PPL NUCLEAR DEVELOPMENT

PPL Bell Bend Nuclear Power Plant

Luzerne County, Salem Township, Pennsylvania

401 Water Quality Supplement

BINDER 4
Correspondence
Item 39

June 2012

Table of Contents

Binder 4:

Other

39. Correspondence (See Correspondence Outline)

Correspondence Outline

Name	Transmittal Date	Subject	Agency
SRBC-2010-074	3/1/2010	Notice of Application Review for PPL Bell Bend, LLC; Bell Bend Nuclear Power Plant, BNP-2009-073; Salem Township, Luzerne County, Pennsylvania	SRBC
BNP-2010-103	4/29/2010	IFIM and Aquatic Impact Studies Workplan **(Includes Enclosures 2 and 3 only)**	SRBC
BNP-2010-165	7/8/2010	SRBC Notice of Application Review Response Seasonal Availability and Water Use	SRBC
PAFBC-2010-283	10/14/2010	Species Impact Review (SIR) - Rare Candidate, Threatened and Endangered Species, BBNPP Update to SIR 27486, Salem Township, Luzerne County, PA	PA FBC
BNP-2010-192	10/21/2010	SRBC Notice of Application Review Response Avoidance of Consumptive Use	SRBC
BNP-2011-049	3/4/2011	SIR #27486, Species Impact Review Freshwater Mussel Survey	PA FBC
BNP-2011-126	6/28/2011	Project Response Status and Filing of Joint Permit Application	SRBC
BNP-2011-118	6/29/2011	Joint Permit Application and Request for Water Quality Certification	PADEP
SRBC-2011-159	8/16/2011	PPL Bell Bend Nuclear Power Plant; Application for Surface Water Withdrawal, and Application for Consumptive Water Use - BNP-2011-005; Salem Township, Luzerne County, Pennsylvania	SRBC
SRBC-2011-162	8/22/2011	PPL Bell Bend Nuclear Power Plant; Avoidance of Consumptive Use - BNP-2010-192; Salem Township, Luzerne County, Pennsylvania	SRBC
SRBC-2011-182	9/23/2011	Re: PPL Bell Bend Nuclear Power Plant; IFIM and Aquatic Studies Workplan Response to SRBC Comments - BNP-2011-071; Salem Township, Luzerne County, Pennsylvania	SRBC
BNP-2011-189	10/4/2011	Application for Surface Water Withdrawal and Application for Consumptive Water Use BNP-2011-005 Response to SRBC Comments	SRBC
BNP-2011-190	10/4/2011	SRBC Notice of Application Review Response Avoidance of Consumptive Use	SRBC
SRBC-2011-200	10/18/2011	Re: PPL Bell Bend Nuclear Power Plant; Project Response Status and Filing of Joint Permit Application - BNP-2011-126; Salem Township, Luzerne County, Pennsylvania	SRBC

BNP-2011-207	11/21/2011	Joint Permit Application and Request for Water Quality Certification, Rev 1	PADEP
SRBC-2011-237	12/21/2011	Re: Bell Bend Nuclear Power Plant; BNP-2011-126; Project Response Status and Filing of Joint Permit Application; Salem Township, Luzerne County, Pennsylvania	SRBC
SRBC-2012-024	1/6/2012	Re: Bell Bend Nuclear Power Plant; BNP-2010-165; Seasonal Availability and Water Use; Salem Township, Luzerne County, Pennsylvania	SRBC
SRBC-2012-063	2/16/2012	Re: Bell Bend Nuclear Power Plant (BBNPP); PPL Pooled Asset Concept Relating to BBNPP; Salem Township, Luzerne County, Pennsylvania	SRBC
BNP-2012-044	2/23/2012	Response to Comments Concerning Seasonal Availability and Water Use	SRBC
BNP-2012-080	3/23/2012	PPL Response to Commission Letters Young of the Year (YOY) Bass 2012 Study Planning	SRBC
ACOE-2012-101	4/16/2012	ACOE-Responses to Public Notice #PN-12-07 (Includes only EPA Comment Section)	ACOE/EPA
ACOE-2012-129	5/21/2012	RE: Application for a Department of the Army Permit - Public Notice PN-12-07 (Application CENAB-OP-RPA-2008-01401-P13); EPA Comments Only	ACOE/EPA

Susquehanna River Basin Commission

a water management agency serving the Susquehanna River Watershed

March 1, 2010

RECEIVED MAR 05 2010

Mr. Terry L. Harpster
VP-Bell Bend Project-Development
PPL Bell Bend, LLC
38 Bomboy Lane, Suite 2
Berwick, PA 18603

Re: Notice of Application Review for PPL Bell Bend, LLC;
Bell Bend Nuclear Power Plant, BNP-2009-073;
Salem Township, Luzerne County, Pennsylvania

Dear Mr. Harpster:

The Susquehanna River Basin Commission (Commission) is reviewing the applications and supporting documents submitted by PPL Bell Bend, LLC (PPL BB) and received by the Commission on May 15, 2009 and an application amendment received on October 15, 2009. The recent submittal of the Plot Plan Change Drawings WBS 1.41, received on February 8, 2010, has not been reviewed and may affect some of the comments herein. The applications and amendment include requests to withdraw 3.300 million gallons per day (mgd) of groundwater (30-day average) from a number of wells for dewatering, withdraw up to 44.000 mgd from the Susquehanna River, and a consumptive water use of up to 31.000 mgd. PPL BB intends to construct a nuclear power plant and initiated the pre-application process with the U.S. Nuclear Regulatory Commission (NRC) on October 8, 2008 to allow sufficient lead time for approvals necessary for commercial operation by December 2018.

As you know, it is the purpose of the Commission to effect comprehensive multiple purpose planning for the conservation, utilization, development, management and control of the water and the related natural resources of the Susquehanna River basin in accordance with the best interest of the people of the basin and the Commission's member jurisdictions. The magnitude of the water withdrawal requests for the Bell Bend Nuclear Power Plant (BBNPP) project require that the Commission assure that all constituencies are given due consideration in the application review, particularly downstream users. The Commission is concerned the consumptive use of water by BBNPP, along with the cumulative consumptive use by others, has the potential to adversely impact the Susquehanna River, not only in the reach of the river where BBNPP is located, but it will also negatively impact the river further downstream. Before any project is approved for water withdrawal and consumptive use of significant magnitude, the project sponsor must demonstrate to the Commission that it has made a good faith effort to develop adequate measures to mitigate the consumptive water use.

The PPL BB applications are being reviewed in accordance with the above issues, and also in accordance with all other applicable provisions of the Compact, considerations in Commission Policy No. 2003-01, and the general standards set forth in Commission regulations, including Regulations 18 CFR §801 (General Policies) and §806 (Review and Approval of Projects). The purpose of this letter is to inform you that based on our review to date the application and amendment do not completely satisfy the informational needs of the Commission. Please refer to the comments below for a description of the application deficiencies.

CONSUMPTIVE WATER USE APPLICATION

Project Sponsors whose consumptive use of water is subject to review and approval shall mitigate such consumptive use [18 CFR §806.22(b)].

The Commission will evaluate the requested quantity of consumptive water use as to the reasonable foreseeable need and proposed conservation measures to minimize water use. The PPL BB application proposes to use payment for mitigation of the consumptive water use; however, due to the magnitude of the BBNPP consumptive use, payment may not be a viable option. The Consumptive Use Mitigation Plan, SRBC Publication No. 253, indicates that consumptive water use in the Middle Susquehanna Subbasin currently exceeds 10 percent of the Q7-10 flow. Therefore, the withdrawal requested by PPL BB will likely require a protective passby flow to protect fish and wildlife and their habitat, as well as downstream uses. The Commission strongly urges PPL BB to research alternate water supply options to mitigate consumptive use during low flow conditions [18 CFR §806.22(b)(1)]. Commission staff will review this request to use payment for mitigation and formulate its recommendations, however please be advised that the Commission will in its sole discretion determine the acceptable manner of mitigation to be provided by a project sponsor under Commission Regulation 18 CFR §806.22(c).

Applicant must include in their application plans for avoiding or mitigating for consumptive use [18 CFR §806.14(a)(2)(ix)].

The information submitted in the application and amendment fails to adequately analyze avoidance of consumptive use. The amendment included an analysis of six different cooling modes, however, consumptive water use was not factored into the cost analysis of the six alternative methods of heat dissipation for BBNPP. The only factors considered were impact on power production, initial cost, and maintenance costs. Because the cost of consumptive water use was not included in the analysis, the alternatives that maximize consumptive use appear to be less costly compared to other alternatives that minimize consumptive use, such as dry cooling systems and hybrid cooling towers. The cost of providing supplemental water to mitigate consumptive use could be significant if reservoirs, pipelines, or other measures are required. All costs need to be considered for a valid analysis. Also, the analysis assumed that the environmental impact of all the alternatives were similar. This assumption is not valid when dry cooling systems and hybrid cooling towers are included in the environmental analysis. The chosen alternative, natural draft cooling towers, require significant blowdown to maintain proper

water chemistry. Blowdown flows returning to the river will be heated and chemicals, including a biocide, will be added, and this may have a negative environmental impact on the river. Dry cooling systems and hybrid cooling towers require significantly less blowdown and may have less environmental impact. The environmental impact of blowdown of all alternatives needs to be analyzed.

The information submitted in the application and amendment fails to include an analysis of the increased evaporation caused by the thermal effects of the blowdown discharge from BBNPP. The thermal effects from the BBNPP blowdown discharge are additive to the thermal effects of the Susquehanna Steam Electric Station (SSES). This analysis should be consistent with the SSES Permanent Water Monitoring Plan, submitted to the Commission by PPL Susquehanna, LLC on January 9, 2008.

The information submitted in the application and amendment fails to describe plans to mitigate consumptive use. As noted above, payment for mitigation of consumptive water use may not be a viable option for the amount of consumptive use proposed by the BBNPP. Not only is the magnitude of the consumptive use a concern, but the timing of the peak usage is coincident with the typical low flow periods of the year. PPL BB should describe plans during low river flows to release water for flow augmentation equal to the projects total consumptive use, or reduce withdrawal from the river equal to the projects total consumptive use in accordance with 18 CFR §806.22(b)(1)(i) and (ii).

SURFACE WATER WITHDRAWAL APPLICATION

The Commission may deny an application, limit or condition an approval to ensure that the withdrawal will not cause significant adverse impacts to the water resources of the basin [18 CFR §806.23(b)(2)].

The Commission has reviewed the submitted surface water withdrawal application and will continue its review based on the PPL BB response to the comments below. The Commission may deny an application, limit or condition an approval to ensure that the withdrawal will not cause significant adverse impacts to the water resources of the basin. To that end, the Commission may consider lowering of stream flow levels; rendering competing supplies unreliable; affecting other water uses; causing water quality degradation that may be injurious to any existing or potential water use; affecting fish, wildlife, or other living resources or their habitat; or affecting low flow of perennial or intermittent streams. The Commission may also limit a withdrawal to the amount (quantity and rate) of the water needed to meet the reasonable foreseeable needs of the project sponsor [18 CFR §806.23(b)(1)].

The Commission utilizes passby flows, conservation releases, and consumptive use compensation to help protect aquatic resources, competing users, and instream flow uses downstream from the point of withdrawal. . . . When the natural flow is equal to, or less than, the prescribed passby flow, no water may be withdrawn from the water source, and the entire natural flow shall be allowed to pass the point of withdrawal (Policy No. 2003-01).

As discussed at the meeting with PPL BB on July 8, 2009, Commission staff has determined that the river withdrawal may exceed the threshold for the Passby Flow Guidance as defined in Commission Policy No. 2003-01. Subsequent to that meeting, the Commission received a proposed Instream Flow Study, submitted on behalf of PPL BB by Normandeau Associates, Inc. on August 7, 2009.. After discussion with the Commission staff, a revised Instream Flow Study Plan was submitted to the Commission on November 19, 2009, on behalf of PPL BB by Normandeau Associates, Inc. and ERM. In the area of the proposed withdrawal, the river is classified as a Warm Water Fishery (WWF) under Title 25, Chapter 93, Pennsylvania Code, and would likely require a 20 percent average daily flow passby condition which would create an interruptible water supply. Commission staff will respond with comments to that proposal in separate correspondence.

Applicant must include in their application plans to implement and properly maintain special monitoring measures [18 CFR §806.23(b)(3)(iii)].

The information submitted in the application and amendment fails to describe plans to establish a permanent water monitoring plan. The plan should be similar in scope and detail to the SSES Permanent Water Monitoring Plan, submitted to the Commission by PPL Susquehanna, LLC on January 9, 2008. The Commission requires that a withdrawal be metered at the intake to within plus or minus 5 percent accuracy of the actual flow (18 CFR §806.30).

Applicant must include in their application a proposed quantity of water to be withdrawn [18 CFR §806.14(a)(2)(iii)]; applicant must include in their application supporting studies, reports, and other information upon which assumptions and assertions have been based [18 CFR §806.14(a)(2)(viii)].

The information submitted in the application and amendment addressed the calculation of the proposed quantity of surface water and groundwater to be withdrawn. The amendment included a determination of the proposed surface water quantity needed; however, the analyses did not include the calculation of the water values used to compute the proposed surface water withdrawal. Any water values taken from manufacturer information sheets should be referenced and included in the application.

The consumptive use application, Form 24C, indicates that trucked-in water would be used for construction if necessary. Page 4-14 of the submission for 18 CFR §806.14(a)(3)(i) also mentions, "The potential sources of water for construction include local municipal water, Susquehanna River water, and offsite water trucked to the construction site." A water source for the water being trucked to the site has not been listed. PPL BB should submit the source of the water trucked to the site. PPL BB cannot use Susquehanna River water for construction purposes prior to receiving a surface water approval from the Commission.

The "Waste Water Retention Basin Discharge" in the water balance diagram "Anticipated Water Use Diagram Peak Day" (Attachment SW-3-A) does not account for rainfall or the evaporation of the 34.3 gallons per minute (gpm) for the "ESWEMS Retention Pond."

The diagram also does not account for the rainfall or 14.1 gpm evaporation for the "Waste Water Retention Basin."

The applicant should assemble a single document outlining all proposed water sources, the quantities of water to be withdrawn, and the determination of those quantities as computed. Any references should be included as part of the single document.

Applicants shall provide copies of any correspondence with member jurisdiction agencies [18 CFR §806.14(a)(1)(x)].

The information submitted with the application and amendment provided copies of correspondence with member jurisdiction agencies, however, given the magnitude of the proposed project and the volume of comments generated during the project review process, the Commission requires that additional, on-going correspondence be provided by PPL BB. Of particular concern for the Commission are correspondence with the NRC pertaining to project schedule, water resources, and environmental impact; and correspondence with the U.S. Army Corp of Engineers (USACE), U.S. Fish and Wildlife Service (USFWS), Pennsylvania Fish and Boat Commission (PFBC), Pennsylvania Department of Environmental Protection (PADEP), Pennsylvania Department of Conservation and Natural Resources, and other appropriate agencies.

Applicant must include in their application a proposed quantity of water to be consumed [18 CFR §806.14(a)(2)(iv)].

The information submitted in the application and amendment fails to adequately address the calculation of the proposed quantity of water to be consumed. While the application and amendment addresses quantities of consumptive use of evaporation and drift from the CWS and ESWEMS cooling towers, evaporation from the ESWEMS retention pond, evaporation from the wastewater retention basin, and power plant consumptive use; it does not address the evaporation from the Susquehanna River due to thermal discharge [refer to comments provided in 18 CFR §806.14(a)(2)(ix)].

The submission for stormwater management [Report No SL-009449 Revision 2, August 14, 2008; response to 18 CFR §806.14(a)(2)(ix)] mentions the area of stormwater ponds at water surface could be 5.8 acres for Pond-1 and 6.2 acres for Pond-2. Water levels at "low water levels" would be 3.8 acres for Pond-1 and 4.86 acres for Pond-2. The evaporation from these ponds could potentially exceed the Commission's regulatory threshold for consumptive use; therefore, PPL BB should submit calculations and, if necessary, computer modeling to determine evaporation rates of these ponds during various climatic conditions.

The "Waste Water Retention Basin Discharge" in the water balance diagram "Anticipated Water Use Diagram Peak Day" (Attachment CU-4) does not account for the rainfall or the evaporation of the 34.3 gpm for the "ESWEMS Retention Pond" or the rainfall or the evaporation of the 14.1 gpm for the "Waste Water Retention Basin." The diagram also does not account for evaporation from the Susquehanna River due to thermal discharge.

The applicant should assemble a single document outlining all consumptive use sources, the quantities of water to be consumed, and the determination of those quantities as computed. Any references should be included as part of the single document.

Applicant must provide a description of the project in terms of water use and availability [18 CFR §806.14(a)(2)(vi)].

The information submitted in the application and amendment fails to adequately describe water use and availability. PPL BB should describe in detail the water usage expected based on seasonal variability and at different operational modes, including full power, reduced power, and periodic maintenance outages. Water use should be compared to seasonal flow variations of the river to determine peak water usage during historical low flow conditions.

Applicant must provide a description of the project in terms of all water sources and the initiation of each source [18 CFR §806.14(a)(2)(vii)].

The information submitted in the application and amendment fails to adequately describe water sources and dates when the water is needed for the project. PPL BB should provide a schedule that depicts when water from the river is required for startup and operation of BBNPP. PPL BB should also submit a proposed plan and schedule for other sources of water that may be required to mitigate consumptive use. The proposed plan and schedule should allow for several different options for consumptive use mitigation and should specify when the preferred option must be identified to fit the overall project schedule.

Applicant must include in their application the anticipated impact of the proposed project on surface water characteristics (quality, quantity, flow regimen, other hydrologic characteristics) [18 CFR §806.14(a)(3)(i)].

The information submitted in the application and amendment fails to address the anticipated impacts of the proposed project on surface water characteristics. The information submitted assumes the PPL BB intake to be between the SSES intake and discharge points and the PPL BB discharge to be downstream of the SSES discharge. No other intake or discharge configuration has been identified or modeled. Page 16 of the submission as a response to 18 CFR §806.14(a)(3)(i) (Susquehanna River Thermal Plume and Dilution Modeling) states, "For the near-field, only the BBNPP was modeled. This approach is satisfactory because in the near-field, the plumes do not overlap due to the 380 foot separation of the SSES and BBNPP discharges." Because the report states the SSES thermal plume would not overlap the BBNPP thermal plume, a configuration should be modeled where the PPL BB discharge is located between the SSES intake and discharge, and the PPL BB intake is located downstream of the SSES discharge.

The thermal modeling submission fails to account for modeling of flows consistent with other plans and submissions, such as the Instream Flow Study Plan (IFIM). The IFIM study references modeling flow at 820 cubic feet per second (cfs) (Q7-10) and at 777 cfs (Q7-10 minus

31.000 mgd consumptive use). Commission Policy No. 2003-01 does not allow for water to be withdrawn when river flows are less than the Q7-10 flow; therefore, the thermal modeling should be run at 820 cfs and at 868 cfs (Q7-10 plus 31.000 mgd consumptive use).

Thermal loading should be modeled at various ambient water temperatures such as minimum, maximum, and average temperatures across all seasons to account for temperature fluctuation and its potential effect on aquatic communities.

The modeling performed fails to account for the evaporation of water due to the thermal loading in the Susquehanna River [refer to comments for 18 CFR §806.14(a)(2)(ix)].

The submission also fails to address the method, if any, of wastewater retention pond cooling such as through a heat exchanger before being discharged through the diffuser into the Susquehanna River. Page 7 of "Report No. SL-009498, Revision 3" indicates a heat exchanger will be utilized, while page 14 of the Susquehanna River Thermal Plume and Dilution Modeling indicates the modeling did not represent an auxiliary heat exchanger. PPL BB should submit designs related to the retention pond, including but not limited to heat exchanger and diffuser criteria. PPL BB also should submit seasonal temperatures of inflow and outflow of retention pond and seasonal temperatures of discharge into the Susquehanna River. If a heat exchanger is to be utilized, PPL BB should model the thermal discharge accordingly.

The information submitted in the application and amendments addressed the concept of the surface water intake design; however, PPL BB did not provide any specific information or plans regarding the design of the intakes or the open channel where the proposed intakes will be located. Information provided by PPL BB, "Report No. SL-009498 Revision 3; November 20, 2008," indicates the location of the pumps and intakes is imperative to the efficiency of the pumps. The location and velocity distribution through the open channel has the potential to create uneven velocity distribution which could ultimately result in the creation of eddy currents or deep-cored vortices. PPL BB should submit dimensions of intakes, dimensions of the intake channel, locations of pumps or intakes within the open intake channel, open areas of the various screening, calculations of velocity through screened areas, schematics or diagrams of the intake design and intake channel, and all methods and designs used to avoid impingement and entrainment of debris and aquatic organisms within the intake channel.

PPL BB should determine a method of sampling the number of aquatic organisms impinged or entrained as a result of the proposed surface water withdrawal. The method should account for impingement and entrainment of organisms throughout the life of the project. Appropriate impingement and entrainment intake system designs should be made to ensure impacts to the local aquatic community are avoided.

Applicant must determine the anticipated impact of the proposed project on existing water withdrawals [18 CFR §806.14(a)(3)(iii)].

The information submitted in the application and amendment did address the effect the proposed project will have on the surrounding area; however, PPL BB did not address whether

discharge of heated water would negatively affect downstream users. PPL BB should submit a determination as to whether the thermal loading of the discharge will affect any existing water users located downstream of the discharge.

The information submitted in the application and amendment fails to address the effect the proposed project will have on the water quality of the Susquehanna River downstream of the project and its potential effect on existing water withdrawals and aquatic communities. PPL BB should determine the effect the proposed consumptive use would have on the dilution of Nescopeck Creek drainage (mine impaired water) as well as any downstream municipal wastewater treatment plant discharges, including, but not limited to, Berwick, Nescopeck, and Briar Creek. PPL BB should determine the effect the thermal loading will have on dissolved oxygen (DO) concentrations downstream of the discharge. PPL BB should evaluate the change and effect of DO concentrations on downstream users and aquatic communities.

Applicant must provide an estimated completion date for the proposed project and an estimated construction schedule [18 CFR §806.14(a)(4)].

The information submitted in the application and amendment provides a detailed project schedule addressing all aspects of the project, including construction activities. Activity SR0330 indicates that SRBC approvals are to be complete by April 11, 2011. The project review required by Commission policies and regulations may not support an April 11, 2011 approval by the Commission. Factors such as the magnitude and timing of the amended application submittal, the complexity of completing an IFIM study to determine passby flows, the time required to design and perform aquifer tests and resubmit the groundwater withdrawal application, and developing consumptive use mitigation options all could extend the Commission's review and approval beyond the April 11, 2011 date. As these activities become better defined, a more appropriate schedule should be developed for Commission activities.

Applicant must determine the compatibility of the proposed project with existing and anticipated uses [18 CFR §806.14(b)(1)(iv)].

The information submitted in the application and amendment fails to adequately describe compatibility of the proposed project to existing and anticipated users of water resources in the mid-Susquehanna River basin. The Commission can provide a list of existing users in this section of the river. PPL BB should consult state water plans and county and municipal comprehensive plans, as well as the Commission Comprehensive Plan, for proposed water users. PPL BB also should evaluate other uses of the river including instream uses and recreation.

Applicant must determine the anticipated impact of the proposed project on flood damage potential considering the location of the project with respect to the flood plain and flood hazard zones [18 CFR §806.14(b)(1)(v)(A)].

The information submitted in the application and amendment fails to address the impact of the project on flood plains and flood hazard zones. The information, as submitted, addresses the potential of the project to be flooded. Although the Commission agrees that inundation of

the project is an important factor, the intent of the regulation is to address the impact of the project on the flood plain and flood hazard zones due to project related buildings or other obstructions causing the flood plain or flood hazard zones to be altered. PPL BB should provide analysis to determine the impact of the proposed project on designated flood plains and flood hazard zones in the vicinity of the project.

Applicant must determine the anticipated impact of the proposed project on recreation potential [18 CFR §806.14(b)(1)(v)(B)].

The information submitted in the application and amendment did address recreational opportunities in the area; however, PPL BB did not commit to providing any additional recreational resources associated with the BBNPP. PPL BB should study the potential of providing the public with recreational opportunities in the vicinity of the project and include development of viable recreational options as part of the project plan.

Applicant must provide a description of the project in terms of anticipated impact of the proposed project on fish, wildlife, and their habitat quality, kind, and number of species. Applicant must demonstrate plans for avoiding any anticipated impacts [18 CFR §806.14(b)(v)(C)].

The information regarding rare species present in the construction zone, as indicated in the document titled "Threatened or Endangered Species and Their Habitats" does not include reference to the presence of trout and therefore is missing potential impacts to these sensitive species. Further detail regarding on-site roosting and maternal den sites for Indiana bat in the upland forest areas needs to be included in the impact assessment.

The information submitted in the document referring to 18 CFR §806.14(b)(1)(v)(C), titled "Fish and wildlife (habitat quality, kind and number of species)" offered a thorough overview of wildlife species that occur in the area of BBNPP and gave a comprehensive listing of rare species impact risk from site disturbance. However, a more thorough document should be submitted that addresses the anticipated impact of specific proposed activities on those species and habitats (including upland habitats) that are identified in the area and have been confirmed on-site through field surveys.

The "Wild Trout Assessment" document is a good overview of the on-site waterbodies and fish communities.

The "Field Survey of Fish and Macroinvertebrates" document is a thorough overview of pond sampling for fish and stream sampling for macroinvertebrates. However, the timing of macroinvertebrate sampling was not consistent between sites. Therefore, any conclusions drawn about the aquatic community between sites must be limited to sampling that occurred at the same time (e.g., July 2008).

The "Preliminary Mussel Survey in the Susquehanna River in the Vicinity of the Proposed Bell Bend Nuclear Power Plant Site" document offers a thorough assessment of

mussels present in the river and near the proposed site. However, proposed or anticipated impacts of the project on aquatic mussel communities are not included in the document. Additional detail regarding impacts must be provided, especially as related to the green floater species found at the site.

The amendment included a copy of correspondence with the USACE regarding the Jurisdictional Determination of on-site wetlands. Commission staff's review of the correspondence and attached "Bell Bend Wetlands Delineation Report" indicate that there are no Exceptional Value wetlands on-site. Walker Run has been identified as a naturally-reproducing, wild trout waterbody. As such, the Commission views all associated and interconnected wetlands with Walker Run as Exceptional Value in terms of resource protection [see PA Code §105.17(1)(iii)]. Additionally, the USFWS indicated, in writing, the site serves as suitable foraging and roosting habitat for the federally endangered Indiana bat. An Indiana bat survey of the site found no occurrences of the species on-site; however, the survey determined that forested areas throughout much of the site provide potential roosting and maternity den sites for Indiana bats in the form of large trees with shaggy, platy or exfoliating bark, crevices and/or cavities (AREVA, 2008c). The wetland report does not identify if the suitable habitat is upland or located within the on-site forested wetlands. Should the suitable habitat exist within the on-site forested wetlands, the Commission would consider those wetlands as Exceptional Value as well [see PA Code §105.17(1)(i)]. The Commission requires an amendment to the Wetlands Delineation Report be submitted that accounts for the Exceptional Value wetlands on-site.

A document was submitted in reference to 18 CFR §806.14(a)(3)(i), titled "Surface Water Characteristics (quality, quantity, flow regimen, other hydrological characteristics)." Section 4.2.1.5 of the document, titled "Construction Impacts," discusses the filling of on-site wetlands and the diversion of Walker Run for the construction of the power block area. This section identifies the possibility of increased sediment loads and channel erosion in downstream reaches of Walker Run. The filling of wetlands, diversion of Walker Run, a trout production stream, and the increased potential for sediment loads and channel scour need to be addressed in terms of anticipated project impacts to fish and wildlife habitat. Additionally, Section 4.3.1.6 is identified as containing information related to proposed wetland mitigation measures; however, Section 4.3.1.6 referenced in the document has not been provided to the Commission as part of the application. The wetlands adjacent to Walker Run have been designated as "exceptional value" by PFBC and PPL BB should take appropriate measures to preserve or mitigate degradation of the wetlands.

A document was submitted titled "Impingement and Entrainment Sampling for the Proposed Bell Bend Nuclear Power Plant at the SSES Circulating Water Supply System Intake Structure." The document fails to account for fall migration of juvenile shad in the study methodology. The applicant would need to demonstrate why it was omitted from the study. Estimations of entrainment of each taxon (Table 7) need explanation. How does the total estimated entrainment of 13+ million fish correlate to the study period and results? How does the estimated entrainment of 13+ million fish correspond to the requirement in 18 CFR §806.14(b)(v)(C)?

A document was submitted titled "A Field Survey of Plant Communities at the Proposed Bell Bend Nuclear Power Plant Site." While the survey was appropriate for baseline plant communities on site, the methodology failed to address the requirements of 18 CFR §806.14(b)(v)(C) regarding potential/anticipated impacts to habitats.

Overall, PPL BB should assemble a single document outlining on-site and adjacent species and habitats and the potential for specific project activities to impact those species and habitats (and mitigation measures for potential impacts). This would replace the assemblage of disparate documents contained in the application at present.

PPL BB should provide the Commission with Geographic Information Systems data layers for all site disturbance and construction footprints.

Applicant must determine the anticipated impact of the proposed project on site development [18 CFR §806.14(b)(1)(v)(E)].

The information submitted in the application and amendment fails to address the impact of the project on the project site and surrounding areas. The Commission requires appropriate studies that determine the impact of the project on geology, topography, soil characteristics, and adjoining and nearby land uses.

Applicant must determine the anticipated impact of the proposed project on historical, cultural and archaeological resources [18 CFR §806.14(b)(1)(v)(F)].

The information submitted in the application and amendment outlined a comprehensive process to determine impacts of the proposed project on historical, cultural, and archaeological resources in the vicinity of the project; however, the analysis of the reports generated is incomplete. In Section 5.1.3 of Part 3 of the Environmental Report, the State Historical Project Office (SHPO) **has not completed their review** of Phase 1b. Also in Section 5.1.3 it states, "the SHPO **will be** consulted to identify measures to avoid, minimize, or mitigate any adverse effects." And finally, in Section 5.1.3 it states, "Based on the results of the cultural resources investigations conducted to date it is likely that there **will be adverse impacts** to cultural resources from construction." PPL BB should complete the analysis of the impact of the proposed project on historical, cultural, and archaeological resources and submit an application amendment specifying the anticipated impacts and what measures are proposed to avoid, minimize or mitigate any adverse effects.

The Commission uses the Comprehensive Plan for the Water Resources of the Susquehanna River Basin (Comprehensive Plan) as a guiding document for all aspects of Commission activities, including project review. Part I.D.7. and Part V.J. of the Comprehensive Plan address the Commission's goal of restoring migratory fish to the Susquehanna watershed.

The information submitted in the application and amendment fails to address the impact of the project on migratory fisheries. The referenced sections of the Comprehensive Plan outline goals to restore migratory fish to the Susquehanna watersheds, specifically American shad.

Although migrating adult American shad do not presently have access to the mid-Susquehanna basin due to downstream obstructions, it is the goal of the Commission and other cooperating agencies to eliminate obstructions over time to allow American shad and other migratory species full access to the waterways of the basin. Currently, part of the American shad restoration process entails stocking shad fry upstream from the proposed project site, requiring juvenile shad to pass by the site during out-migration. PPL BB should perform an impingement and entrainment study to determine the impact of the project on out-migrating juvenile shad. Further studies may be required in the future to determine the impact of the BBNPP and SSES on migrating adult shad.

The Commission shall require that the proposed siting and location in the basin of any type of electric generating facility or any facility located outside the basin having an effect on the waters of the basin, shall be planned in direct consultation with the Commission to enable advance consideration of the possible effects of such installation on the water resources of the basin [801.12(c)(2)]. Additionally, the applicant is required to identify and describe reasonable alternatives, the extent of their economic and technical investigation, and an assessment of their potential environmental impact [18 CFR §806.14(b)(iii)].

The information submitted in the application and amendment fails to address the impact on the environment and water resources in the basin from siting BBNPP at the proposed location. The BBNPP Alternate Site Evaluation, Revision 0, uses screening criteria to establish a list of potential project locations to be evaluated. The most viable locations are then reviewed more extensively. The evaluation process analyzes each site based on 16 criteria and each criterion is weighted based on the perceived importance of that criteria. Each of the 16 criteria is evaluated for each site which results in a score of relative acceptability for each site. The BBNPP Alternate Site Evaluation, submitted in the amended application, does not attribute sufficient worth to water availability. Water availability, which is a subset of the hydrology criteria, is weighted less than 3 percent of the total evaluation. Given the importance of water for operation of nuclear power plants, PPL BB should have provided sufficient weight to water availability to reflect the importance of water resources in the basin.

The evaluation process for the hydrology criteria should consider all relevant factors to assure the siting alternatives are properly evaluated. The hydrology criteria, scored by an expert panel, did not factor cumulative consumptive use into the evaluation process. The cumulative consumptive use at BBNPP site from existing upstream users already exceeds 10 percent of Q7-10. This is a critical omission because additional withdrawals by BBNPP at low river flows would potentially cause ecological damage to aquatic life and other users of the river. The Environmental Scoring Criteria Basis (page A-3) averages water withdrawals over an entire year. Using an annual basis, however, ignores seasonal differences in water availability and water usage that may contribute to significant adverse impact on instream uses. In consideration of these potential seasonal impacts, PPL BB should refocus its analysis on peak water usage during low river flow conditions, not annual averages. The evaluation uses a Q7-10 calculated over the last 10 years (1999 – 2009). However, the correct Q7-10 should use the lowest 7-day average flow with a 10 percent chance of reoccurrence, based on the entire period of record of the referenced gage.

The wetlands criteria appear to be appropriately weighted; however, the evaluation of the wetlands criteria did not acknowledge recent actions by the PFBC to designate the wetlands adjacent to Walker Run as "exceptional value." This designation reduces the BBNPP "wetlands" score from 29.33 to 18.67, and the overall BBNPP score from 370.1 to 359.4. PPL BB should revisit the BBNPP Alternate Site Evaluation and make appropriate revisions.

The Commission requires that the project sponsor demonstrate the ability to fund the project and demonstrate commitment of the government to provide services or financing [18 CFR §806.14(b)(1)(ii) and §806.14(b)(2)(ii)].

The information provided in the application and amendment does not provide sufficient financial information to demonstrate that PPL BB has sufficient funding capability to fund the BBNPP project, including decommissioning costs. The Commission recognizes that the financial information may be confidential; however, PPL BB should take the necessary steps to provide the financial information through procedures established by the Commission for submittal and review of confidential documents. PPL BB should provide details of Department of Energy Loan Guarantees (DOE) related to the Energy Policy Act of 2005 for BBNPP, outlining the loan process and the status of securing the necessary loan. The Commission regards securing the DOE loan as an essential element for funding the BBNPP project.

The Commission requires project sponsors to notify each municipality in which the project is located, the county planning agency of each county in which the project is located, and each contiguous property owner that an application has been submitted to the Commission. The project sponsor shall also publish a notification in a newspaper of general circulation serving the area in which the project is located. All notices shall contain a description of the project, its purpose, requested water withdrawal and consumptive use amounts, location and address, electronic mail address, and phone number of the Commission [18 CFR §806.15].

The information submitted in the application and amendment fails to demonstrate that proper notification of the application was provided as required. The notifications that were performed did not contain the required electronic mail address (e-mail) of the Commission as part of the notification. A significant portion of the interface between the public and the Commission is done through e-mail; therefore, the Commission requires that this omission be corrected by renotifying the appropriate parties. This will include renotification to municipality, county planning agency of each county, newspapers, and contiguous property owners.

Although PPL BB submitted a list of contiguous landowners that were notified, the Commission also requires a map showing the property boundaries with the contiguous property owners. The property parcels depicted on the map should be keyed to the list of property owners.

GROUNDWATER WITHDRAWAL APPLICATION

The Commission has reviewed the materials that PPL BB submitted on May 13, 2009, and October 15, 2009, in support of their application for groundwater withdrawals. The Commission considers the groundwater withdrawal application to be premature and conceptual in nature as it does not comply with standards or procedures set forth in Commission Regulation 18 CFR §806 Subpart B – Application Procedures.

According to Commission Regulation 18 CFR §806.12, prior to the submission of an application pursuant to 18 CFR §806.13, a project sponsor seeking approval to withdraw groundwater shall perform a Commission-approved constant-rate aquifer test.

A constant-rate aquifer testing plan must be submitted to the Commission for each proposed withdrawal well, and reviewed and approved by Commission staff prior to the performance of any testing in support of a groundwater withdrawal application.

The required components of a thorough and approvable constant-rate testing plan are described in the Commission's Aquifer Testing Guidance (Policy No. 2007-01). The Application for Aquifer Test Plan Approval, which is an attachment to the Aquifer Testing Guidance, should be completed and submitted with the constant-rate aquifer testing plan. Please be advised that the Commission will approve an aquifer testing plan only for a completed and fully developed well. The well must be constructed to the final total depth and borehole diameter, with permanent casing set and grouted in place.

An aquifer testing plan submittal is considered to be complete when all items in the Application for Aquifer Test Plan Approval have been completed, including submission of the appropriate aquifer testing plan evaluation fee. The Commission requires that a separate aquifer testing plan evaluation fee be submitted for each proposed groundwater withdrawal well. The Commission staff will review an aquifer testing plan only when it is administratively complete.

The Commission has determined that the most effective way to proceed is to return the groundwater withdrawal application and to credit the associated fee towards the consumptive use and surface water withdrawal application process. PPL BB should request a preliminary consultation with Commission staff for an informal discussion of the Commission requirements for the submission of an approvable constant-rate aquifer testing plan.

Any project withdrawing a consecutive 30-day average of 100,000 gpd or more from a groundwater or surface water source, or a combination of such sources shall require an application to the Commission [18 CFR §806.4(a)(2)(i)]. Project sponsors of projects subject to the review and approval of the Commission shall submit an application and applicable fee to the Commission, in accordance with 18 CFR §806, Subpart B-Application Procedure.

As noted above, the information submitted in the application and amendment fails to address specific requirements of the application process for groundwater withdrawals over 100,000 gallons per day (gpd). The request for groundwater withdrawal should be dependant

upon the results of the Commission-approved constant-rate aquifer tests. The application(s) should include the results of the aquifer testing in a required hydrogeologic report, through a series of graphs and maps, accompanied by supporting and interpretive text. The hydrogeologic report should address any anticipated impact of the proposed withdrawal on, but not limited to, the aquifer, competing water users, and the environment, and provide support upon which assumptions and assertions have been based. Please be advised that the successful completion of an approved aquifer test does not guarantee an approval of the requested withdrawal. The Commission requires that a separate application and fee be submitted for each proposed groundwater withdrawal well.

The Commission recognizes that the purpose of the proposed groundwater withdrawals is to depress the groundwater level to facilitate the excavation and construction of the BBNPP; as such, the groundwater withdrawals are integral to an overall site construction plan. According to the information submitted in the groundwater withdrawal application, PPL BB intends to install a groundwater flow barrier in the form of a vertical soil-bentonite slurry wall to isolate the groundwater depression within the footprint of the proposed construction site. Information submitted to the Commission in the amended application indicates that even with the installation of a slurry wall to mitigate impacts adjacent to the construction site, groundwater drawdown will result from the dewatering process.

Since Walker Run has a reproducing trout population and the PFBC has determined that the wetlands adjacent to Walker Run are "exceptional value," the Commission is sensitive to any groundwater pumping-induced impacts in that area. During the aquifer test planning the selection of groundwater and surface water monitoring points should be based principally on the anticipated pumping-induced area of influence. However, it may be necessary to monitor groundwater and surface water outside the anticipated area of influence due to impact sensitivity.

Although proposed monitoring wells are depicted on GW-2, the Commission staff recommends that PPL BB design its long-term monitoring program in conjunction with the planning and results of the required aquifer testing. The Commission will require detailed information regarding plans for discharge from the dewatering during the aquifer testing and long-term operation. In addition to the dewatering discharge location, the Commission will require details including the anticipated quantity and quality of the discharge water, and specific plans to control the discharge so that water quality of the receiving body of water is not impacted. The Commission may also require additional long-term efforts to monitor or mitigate potential impact of the dewatering process on sensitive ecological areas. However, those conditions will be dependent on the requested withdrawal and the results of the Commission-approved aquifer testing.

CONCLUDING COMMENTS

The above comments were generated during the review performed by the Commission to date. It is the intent of the Commission to provide timely feedback to PPL BB to facilitate approval of the applications. Due to the volume and technical nature of the application and amendment submitted for the proposed project, further review will be required by the

Commission as PPL BB responds to the above comments or submits additional information. The technical review by the Commission would be facilitated if PPL BB includes a narrative as part of the submission outlining the express purpose of the submission, which comment or Commission policy or regulation is being addressed by that particular submission, and, in the case of lengthy reports, which sections of the report are applicable to the technical review by the Commission.

The Commission will respond separately at a later date to other requests raised in the PPL BB applications, including an extension of the terms of approval and an extended time to commence water use at the facility. If you have any questions regarding the above, please contact Paula Ballaron at (717) 238-0423, extension 222.

Sincerely yours,

Michael G. Brownell, Chief
Water Resources Management

cc: Stacey Imboden, NRC
Amy Elliott, USACE
Susan Weaver, PADEP
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April 29, 2010

Mr. Jim Richenderfer
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BELL BEND NUCLEAR POWER PLANT
IFIM AND AQUATIC IMPACT STUDIES WORKPLAN
BNP-2010-103 Docket No. 52-039

References: 1) BNP-2009-073, T. L. Harpster (PPL Bell Bend, LLC) to Paula. B. Ballaron, Susquehanna River Basin Commission, "Bell Bend Nuclear Power Plant Application for Groundwater Withdrawal, Application for Surface Water Withdrawal, Application for Consumptive Water Use", dated May 13, 2009.

2) BNP-2009-309, T. L. Harpster (PPL Bell Bend, LLC) to Paula. B. Ballaron, Susquehanna River Basin Commission, "Bell Bend Nuclear Power Plant Supplemental Information for Application for Surface Water Withdrawal, Application for Consumptive Water Use", dated October 9, 2009.

3) Michael G. Brownell, Susquehanna River Basin Commission, to T.L. Harpster, PPL Bell Bend, LLC, "Notice of Application Review for the PPL Bell Bend, LLC", dated March 1, 2010.

In a March 1, 2010 letter to PPL Bell Bend LLC (PPL), the Susquehanna River Basin Commission (Commission) provided detailed comments on the above referenced application and amendment for the proposed Bell Bend Nuclear Power Plant (BBNPP). This letter provides a response to the comments raised by the Commission in its March 1 letter with respect to the performance of certain aquatic impact studies to address the information needs of the Commission.

This letter transmits the following documents for Commission consideration:

- "Study Plan to Assess the Potential Effects of the Bell Bend Project on Aquatic Resources and Downstream Users" (Enclosure 1).
- PPL response to issues related to intake impingement and entrainment (Enclosure 2).
- PPL response to questions regarding the BBNPP intake and discharge locations (Enclosure 3).

These documents were developed in response to aquatic impact issues raised by the Commission under 18 CFR §806.23(b)(2), 18 CFR §806.14(a)(3)(i), 18 CFR §806.14(a)(3)(iii), 18 CFR §806.14(b)(1)(iv), 18 CFR §806.14(b)(v)(C), and Parts I.D.7 and V.J. of the Commission's Comprehensive Plan.

1The attached study plan (Enclosure 1) proposes certain studies to be undertaken during 2010 to comprehensively evaluate the potential effects that BBNPP's operations might have upon aquatic biota and water quality in the river, namely:

- The potential reduction of suitable aquatic habitat,
- The potential incremental impairment of river water quality below known AMD discharges from Nescopeck Creek,
- Potential impacts due to the thermal discharge from the BBNPP to the river,
- Potential water quality impacts to shallow water areas inhabited by smallmouth bass, and
- Potential impacts to downstream water users.

Enclosure 2 responds to the Commission's request for PPL to clarify certain tabular data contained in the report entitled "Impingement and Entrainment Sampling for the Proposed Bell Bend Nuclear Power Plant at the SSES Circulating Water Supply System Intake Structure, Luzerne County, Pennsylvania, May 2009", and to provide additional information, studies, and monitoring plans as may be necessary to ensure that BBNPP intake designs are adequately protective of the local aquatic community. It is PPL's intent to fully comply with the Track I design and monitoring requirements of 40 CFR §125.80.

Enclosure 3 provides a summary siting analysis of the proposed BBNPP intake and discharge structure locations. PPL has thoroughly evaluated locations for the BBNPP intake and discharge structures along the North Branch of the Susquehanna River and does not believe that a different location would be of value, either in terms of minimizing potential thermal or other environmental impacts, or from a technical or economic perspective.

In-river evaporation is not addressed in this transmittal because it is specifically requested in the March 1 application response letter as part of an analysis of alternative heat dissipation methods.

As discussed at the April 13, 2010 project status meeting with the resource agencies, it is PPL's understanding that the Commission desires an agency meeting to comprehensively review and discuss the Enclosure 1 study plan. PPL would request that such meeting be held as soon as possible so the plan can be finalized on a cooperative and expedited basis and so field work can be initiated and completed in 2010, in accordance with the proposed study schedule.

Should the Commission have any questions regarding the attached, please contact Bradley A. Wise, Environmental Permitting Supervisor, at 610-774-6508. We look forward to resolving all outstanding matters pertaining to the applications with the Commission.

Sincerely,

Terry L. Harpster

TLH/dw

cc: (w/ Enclosures)

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Enclosure 2

BBNPP Impingement and Entrainment Response

BBNPP Impingement and Entrainment Response

Introduction

In a March 1, 2010 letter to PPL Bell Bend, LLC (PPL) the Susquehanna River Basin Commission (SRBC) advised PPL that it "should determine a method of sampling the number of aquatic organisms impinged or entrained as a result of the proposed surface water withdrawal. The method should account for the impingement or entrainment of organisms throughout the life of the project. Appropriate impingement and entrainment intake designs should be made to ensure impacts to the local aquatic community are avoided." The SRBC cited 18 CFR §806.14(a)(3)(i) in connection with this request.

Furthermore, the SRBC advised PPL that it "should perform an impingement and entrainment study to determine the impact of the project on out-migrating juvenile shad..." The SRBC cited Part I.D.7 and Part V.J. of the SRBC Comprehensive Plan in connection with this request and also stated that "Further studies may be required in the future to determine the impact of the BBNPP and Susquehanna Steam Electric Station (SSES) on migrating adult shad."

Lastly, the SRBC noted that the report entitled "Entrainment and Impingement Sampling at the proposed Bell Bend Nuclear Power Plant (BBNPP) at the SSES Circulating Water Supply Intake Structure" submitted by PPL fails to account for, or provide a reason why juvenile American shad were not included as part of the study; that Table 7 requires further clarification; and that the report fails to correlate the entrainment of 13+ million fish to the study period and results, and the requirements of 18 CFR §806.14(b)(v)(C).

This document responds to each of these SRBC comments.

Regulatory Framework

On December 18, 2001 the U. S. Environmental Protection Agency (EPA) published a final rule implementing section 316(b) of the Clean Water Act (CWA) for new facilities that withdraw water from rivers, streams, and lakes, etc. for cooling purposes. The rule was modified by the EPA on June 19, 2003, and is codified in 40 CFR §125 (also referred to as Phase I 316(b) Rule).

40 CFR §125.84 establishes criteria and standards (requirements) applicable to the location, design, construction, and capacity of new cooling water intake structures. "The requirements are administered through NPDES permits issued under section 402 of the CWA. The purpose of these requirements is to establish the best technology available for minimizing adverse environmental impact associated with the use of cooling water intake structures" including impacts with respect to the potential impingement or entrainment of aquatic organisms. The rule establishes a two-track compliance system. Track I establishes national intake capacity, velocity, and other requirements to minimize impingement mortality and entrainment. Track II allows permit applicants to conduct site-specific studies to demonstrate that alternatives to Track I requirements will provide a comparable level of aquatic protections.

For cooling water intake structures drawing more than 10 MGD from a freshwater river or stream, in its NPDES application under Track I, the applicant must:

- Reduce intake flow, at a minimum, to a level commensurate with that which can be attained by a closed-cycle re-circulating cooling water system,

- Design and construct each cooling water intake structure to a maximum through-screen design intake velocity of 0.5 ft/sec,

- Design and construct the cooling water intake structure so that the total intake flow must be no greater than five (5) percent of the source water annual mean flow,

- Select and implement design and construction technologies or operational measures for minimizing impingement mortality and entrainment of fish and shellfish, if there are threatened and endangered or migratory species of concern, within the hydraulic zone of influence of the cooling water intake, or it is determined that the proposed facility, after meeting the technology-based performance standards, would create unacceptable stress to species of concern.

In addition, an applicant may be required to comply with more stringent requirements deemed "reasonably necessary to comply with any provision of state law, including compliance with applicable state water quality standards (including designated uses, criteria, and anti-degradation requirements)."

Under 40 CFR §125.87, as an owner or operator of a new facility, PPL will be required to perform monitoring to demonstrate compliance with the requirements specified in §125.84 as follows:

(a) *Biological monitoring.* The applicant must monitor both impingement and entrainment of the commercial, recreational, and forage base fish and shellfish species identified in the Source Water Baseline Biological Characterization data required by 40 CFR 122.21(r)(3). The monitoring methods used must be consistent with those used for the Source Water Baseline Biological Characterization data required in 40 CFR 122.21(r)(3). The applicant must follow the monitoring frequencies identified below for at least two (2) years after the initial permit issuance. After that time, the applicant may request less frequent sampling in the remaining years of the permit term, and when the permit is reissued, if supporting data show that less frequent monitoring would still allow for the detection of any seasonal and daily variations in the species and numbers of individuals that are impinged or entrained.

(1) *Impingement sampling.* The applicant must collect samples to monitor impingement rates (simple enumeration) for each species over a 24-hour period and no less than once per month when the cooling water intake structure is in operation.

(2) *Entrainment sampling.* The applicant must collect samples to monitor entrainment rates (simple enumeration) for each species over a 24-hour period and no less than biweekly during the primary period of reproduction, larval recruitment, and peak abundance identified during the Source Water Baseline Biological Characterization required by 40 CFR 122.21(r)(3). The applicant must collect samples only when the cooling water intake structure is in operation.

(b) *Velocity monitoring.* If the facility uses surface intake screen systems, the applicant must monitor head loss across the screens and correlate the measured value with the design intake velocity. The head loss across the intake screen must be measured at the minimum ambient source water surface elevation (best professional judgment based on available hydrological data). The maximum head loss across the screen for each cooling water intake structure must be used to determine compliance with the velocity requirement in §125.84(b)(2). If the facility uses devices other than surface intake screens, the applicant must monitor velocity at the point of entry through the device. The applicant must monitor head loss or velocity during initial facility startup, and thereafter, at the frequency specified in the facilities NPDES permit, but no less than once per quarter.

(c) *Visual or remote inspections.* The applicant must either conduct visual inspections (at least weekly) or inspections via remote monitoring devices during the period the cooling water intake structure is in operation to ensure that any design and construction technologies required in §125.84(b)(4) and (5), are functioning as designed.

Finally, under §125.88 as an owner or operator of a new facility the applicant is required to keep records and report information and data as follows:

(a) Records of all the data used to complete the permit application and show compliance with the requirements, any supplemental information developed under §125.86, and any compliance monitoring data submitted under §125.87, for a period of at least three (3) years from the date of permit issuance.

(b) The following must be provided in a yearly status report:

(1) Biological monitoring records for each cooling water intake structure as required by §125.87(a);

(2) Velocity and head loss monitoring records for each cooling water intake structure as required by §125.87(b); and

(3) Records of visual or remote inspections as required in §125.87(c).

Design of the Bell Bend River Intake Structure

The BBNPP cooling water river intake will meet the U.S. EPA Track I requirements as established in 40 CFR §125.84, and summarized above. Specifically:

- Intake flow levels will be reduced to a minimum through the installation of a closed-cycle re-circulating water system (cooling towers),
- The intake structure will be designed to a maximum through-screen velocity of 0.5 ft/sec, and
- The maximum surface water withdrawal applied for (44 mgd or 68 cfs) is less than five percent of the source water annual mean flow at the project (approximately 13,700 cfs based on data from the USGS Gage No. 01536500 at Wilkes-Barre, PA for the period of April 1899 to March 2010).

Furthermore, the design of the BBNPP intake water system will be comparable to that of the adjacent SSES intake, and is therefore expected to create a hydraulic zone of influence similar to that of the existing SSES intake. As discussed below, prior studies of other similarly designed/sized stations in the immediate vicinity of the BBNPP (SSES and Hunlock Creek Power Station) indicate no entrainment or impingement of juvenile American shad, threatened or endangered species, and only minimal entrainment or impingement of other species of concern.

Historical Impingement and Entrainment Studies

Pre-construction impact analyses for new cooling water intakes are normally conducted via a desktop analysis that considers other similarly located and designed facilities in order to derive

an estimate of potential impingement and entrainment at the new intake location. In this instance, the BBNPP intake structure will be similarly located and of a design nearly identical to

the SSES intake. Therefore, impingement and entrainment studies that have been performed at the SSES are believed to the best potential predictor of potential impingement and entrainment at the BBNPP intake. Also instructive are studies done at the Hunlock Creel Power Station which is a 50 MW coal-fired unit that withdraws water from the Susquehanna River through two conventional travelling screens. The station has an open, once-through cooling system. However, the cooling water volumes are similar to those of SSES and the proposed BBNPP.

The following summarizes existing data on impingement and entrainment of aquatic species at the river intakes at SSES, located approximately 300 feet upstream of the proposed BBNPP intake, and at the Hunlock Creek Power Station located approximately 10 miles upstream of the BBNPP site. This data suggests that the potential adverse environmental impact of impingement and entrainment of aquatic species should be minimal at the BBNPP intake, and that additional design and construction technologies or operational measures to further minimize impingement and entrainment are not required beyond the federal Phase I 316(b) Rule. No threatened, endangered or species of concern have been found to be entrained or impinged at either the SSES or at the Hunlock Creek Power Station. In addition, long-term fish sampling of the Susquehanna River, in the vicinity of SSES, has not detected any change to fish or macro-invertebrate or mussel populations due to the operation of the station.

Impingement and Entrainment Sampling at the SSES

A one-year study of entrainment and impingement at the SSES was undertaken by Normandeau Associates between April 2008 and April 2009 in order to characterize the potential impacts at the BBNPP site. The study consisted of weekly sampling to help assure that organisms susceptible to impingement and entrainment at the intake structure, including migratory species such as American shad, would be collected. The results of the study are summarized herein while details relative to the frequency of sampling, number of samples taken, data analysis, and environmental parameters measured concurrently with each sample are provided in Normandeau Associates (2009)

Weekly impingement sampling was conducted from April 2008 through April 2009. The impingement study collected a total of 45, 24-hr samples. Over the entire sampling period a total of 398 fish and crayfish were collected. Crayfish (*Orconectes* sp.) was the dominant organism, with 220 individuals collected representing 55.3% of the total impingement. The remainder of the impingement catch was composed of 178 fish representing 18 species. The most common fish impinged was bluegill (11.1%) followed by rock bass (8.5%), channel catfish (7.8%), tessellated darter (4.5%), and spotfin shiner (4.0%). The total annual estimated impingement at SSES was 3,228 fish and crayfish. This equates to an average of 8.8 fish and crayfish per day. Estimates for fish alone were 3.95 per day, 120 per month and 1,442 per year. Recreationally important species such as smallmouth bass and walleye accounted for less than 1% of the impinged fish.

In addition, impingement sampling has been performed during the fall outmigration period of American shad by PPL at the SSES intake in several years when larval American shad were stocked upriver from the SSES intake and, therefore, could potentially be impinged at the intake. No young-of-year American shad were collected during any of these investigations.

Weekly entrainment sampling was conducted during the fish spawning periods April to August 2008 and March to April 2009.

Thirty-four entrainment samples were collected during 2008 over the 17-week sampling period. A total of 17 species and 3,039 fish were collected in the 34 samples. Quillback (27.2%), Cyprinidae (17.6%), unidentified darter (12.6%), channel catfish (12.1%), common carp (11.4%), and white sucker (9.4%) were the numerically most abundant taxa. Other species that were collected included brown bullhead, chain pickerel, margined madtom, shield darter, rock bass, smallmouth bass, walleye, tessellated darter, banded darter, and yellow perch. Recreationally important species such as smallmouth bass and walleye accounted for only 2.0% and 1.2%, respectively, of the entrained organisms.

A majority (55.9%) of the entrained fish were larvae in the post yolk-sac life stage. Yolk-sac larvae was the second most abundant life stage comprising 17.0% of all individuals with the numbers of young-of-year and the unknown life stage being, 14.1% and 12.9%, respectively. Only four yearling-plus individuals were collected, and no fish eggs were collected in the entrainment samples in 2008.

Cyprinidae was estimated to be the most abundant taxon entrained, comprising 21.5% of the total entrainment estimate. Other common taxa included channel catfish (19.3%), quillback (16.2%), unidentified darter (12.3%), white sucker (9.8%), and common carp (6.7%).

The sampling in 2009 consisted of 10 sampling events which yielded a single egg of the family Catostomidae (likely white sucker or quillback), indicating that earlier than April, entrainment is essentially non-existent.

The Normandeau Associates 2009 report also provides information regarding the theoretical number of fish entrained based on a simplistic but commonly used method of estimating entrainment numbers (see Table 7 in Normandeau Associates 2009). The number of fish potentially entrained, some 13 million in total, is based on the density of organisms collected on the single sampling day per week which is then multiplied by the total volume of river water withdrawn in that entire week. For example, collecting just one organism in the weekly sampling volume of about 56,000 gallons (target volume for two pumped samples) yields a calculated number entrained of approximately 7,000 for the week assuming that SSES withdraws about 58.3 million gallons per day. The high calculated numbers are an artifact of the small sample volume relative to intake withdrawal volume and the assumption that the specimen density in the weekly samples is exactly representative of all of the water being withdrawn by the intake for that week. The results of this commonly used estimation method was presented in Table 7 simply to give a rough idea of potential impingement and is not meant to be a precise estimate or a useful indicator of potential for adverse environmental impact. The method does not take into account such factors as (1) changes in relative abundance and distribution of eggs and larvae, (2) variations in prevailing hydrology, (3) the large numbers of eggs produced per female, (4) strategies of reproduction (nest builders or non-nest builders), and (5) degree of parental protection afforded the young.

A prior entrainment study at the SSES intake structure was completed in 1981 by PPL (1982). This entrainment study included four sampling events; two in May, and once each in June and July. Eight samples were collected at the entrance to the SSES river intake structure during each sampling event. Each sample consisted of three replicate 5-minute samples, at both the surface and bottom of the water column. In all, 48 replicate samples were obtained during each of the four sampling events. The sampling yielded 3,374 larval fish of 18 species. The most common species were: quillback (37%), common carp (22%), tessellated darter (11%), spottail shiner (8%), and spotfin shiner (4%). Recreationally important species such as smallmouth bass, walleye and channel catfish accounted for only 3% of the entrained fish.

Table 7. Estimated number of each taxon entrained and percent composition at the SSES CWIS, April 22 to August 13, 2008.

Taxon	Estimated Number Entrained	Percent Composition
banded darter	13,778	0.1
brown bullhead	13,799	0.1
common carp	894,149	6.7
chain pickerel	13,635	0.1
channel catfish	2,570,361	19.3
Clupeidae	7,042	0.1
Cyprinidae	2,863,110	21.5
Lepomis sp.	42,151	0.3
margined madtom	69,502	0.5
Percidae	312,507	2.3
quillback	2,164,020	16.2
rock bass	285,177	2.1
shield darter	7,042	0.1
smallmouth bass	427,672	3.2
spottail shiner	160,030	1.2
tessellated darter	6,838	0.1
unidentified fish	48,744	0.4
unidentified darter	1,644,738	12.3
walleye	171,869	1.3
white sucker	1,299,692	9.8
yellow perch	308,528	2.3
Total	13,324,384	

Reference: Normandeau Associates, 2009.

Impingement Sampling at Hunlock Creek Power Station

An impingement study performed in 2006 at Hunlock Power Station, which is about 10 miles upriver from BBNPP, provides additional information with which to evaluate the potential impacts of the proposed BBNPP water intake structure on aquatic life of the Susquehanna River (UGI 2006).

The maximum plant intake flow rate during the study sampling events was 58.18 mgd which is greater than, roughly comparable to, the estimated maximum volume for BBNPP. The impingement study performed in 2006 consisted of 37, 24-hour sampling events distributed throughout the year. A total of 282 fish representing 16 species was collected. This equates to 7.6 fish per day or nearly 228 fish per month. Gizzard shad was the numerically dominant species, accounting for 39% of the total impingement catch. Other common species included bluegill (23%), channel catfish (20%), and white crappie (5%). Most of the impingement (53%) occurred during two sampling events in the early fall and was associated with high river flows. No American shad or rare, threatened, or endangered species were collected.

Discussion of Species of Concern

Mussel species of special concern identified in the Susquehanna River in the vicinity of proposed BBNPP river intake structure are the green floater (*Lasmigona subviridis*) and yellow lampmussel (*Lampsilis cariosa).* It is highly unlikely that juveniles or adults of these species will be susceptible to impingement or entrainment. Mussels are burrowing, bottom- oriented species and it is unlikely that these organisms would become entrained in the water column and enter the BBNPP river intake structure. Neither of these species has been collected in impingement studies at the SSES or at the Hunlock Station. However, a small possibility does exist that fish that have been infected with glochidia (mussel larvae) could become entrained or impinged. This occurrence could make the glochidia susceptible to both entrainment and impingement. The host fish species for larvae of green floater are unknown. Yellow lampmussel glochidial hosts include white perch and yellow perch. No white perch were collected during impingement and entrainment sampling at SSES during 2008-2009. Yellow perch was collected in low numbers in both entrainment (n=52) and impingement samples (n=3) at SSES during 2008.

It is also considered highly unlikely that American shad (juvenile or adult) will be susceptible to impingement or entrainment at the BBNPP intake to any significant degree. Juvenile and adult American shad are expected to have ample opportunity to successfully navigate past the planned intake structure. Furthermore, low numbers of recreationally important fish species are likely to be entrained at the BBNPP intake due to expected nest citing in shallow water locations removed from the BBNPP river intake structure.

Conclusions with Respect to Additional Studies and Monitoring

Analyses of the most representative cooling water intake structures have been conducted and presented. Additional analyses of other existing cooling water intakes via additional desktop studies would not be instructive. Furthermore, inasmuch as the BBNPP intake structure is a new facility and is required to be designed to satisfy EPA Track I requirements of 40 CFR §125.84, entrainment or impingement will comply with the performance standards set by the EPA in the rule. Therefore, no additional pre-construction studies are viewed as warranted. Once the facility is placed in service, PPL will be required under 40 CFR §125.87 to perform regular biological, velocity, and visual monitoring to ensure continued compliance with the performance requirements under the rule.

Literature Cited

Normandeau 2009. Impingement and Entrainment Sampling for the Proposed Bell Bend Nuclear Power Plant at the SSES Circulating Water Supply System Intake Structure, Luzerne County, Pennsylvania, May 2009.

PPL 1982. Susquehanna Steam Electric Station 316(b) Entrainment Demonstration Program, July 1982.

UGI 2007. UGI Hunlock Power Station Impingement Sampling Summary Report for sampling Period 01/4/06 to 12/28/06.

Enclosure 3

Rationale for the Location of the Bell Bend Nuclear Power Plant
Intake Structure and Discharge Diffuser

Rationale for the Location of the Bell Bend Nuclear Power Plant Intake Structure and Discharge Diffuser

By
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The discharge of cooling tower blowdown is necessitated by dissolved solids buildup in the cooling water system due to evaporation through the cooling tower. Accepted practice is to place intakes upstream of discharges to avoid recirculation of discharged TDS and heat. Engineering, construction and cost considerations then define locations for intake and discharge structures. Based on the following analysis, it was decided to locate the Bell Bend Nuclear Power Plant (BBNPP) Intake Structure about 300 ft south of the Susquehanna Steam Electric Station (SSES) Intake and about 280 ft north of the SSES Discharge Diffuser. The BBNPP Discharge Diffuser about 380 ft south of the SSES Discharge Diffuser. The following discussion is limited to the North Branch of the Susquehanna River in the vicinity of the SSES.

The starting points in determining where the BBNPP Intake Structure and Discharge Diffuser should be located were the BBNPP power block location, the location of the Susquehanna Steam Electric Station (SSES) and its associated intake structure and discharge diffuser, and the proximity of the Susquehanna River. The BBNPP power block is west and a little south of the SSES. The SSES Intake Structure is located east and a little south of the SSES on the west bank of the North Branch of the Susquehanna River.

A major advantage of the SSES Intake Structure and Discharge Diffuser are the very favorable locations on the Susquehanna River. The Susquehanna River, typically known as a wide-shallow river, is particularly deep in the stretch of the river in front of the SSES Intake. Per the BBNPP Environmental Report (BBNPP ER) Section 2.3.1.1.1.8 and Figure 2.3-11, the Susquehanna River bed elevations in this stretch range from elevation 473 to 484 feet. Normal water level is typically viewed as around elevation 495 feet with the design basis low water level at 484 feet and highest water level recorded as 517 feet. At normal water level the Susquehanna River water depth ranges from 11 to 22 feet. The deepest section of the large pool of water extends about 700 above to 1800 feet below the existing SSES Intake Structure. It is estimated that the pool of water in front of the SSES Intake Structure contains close to 100,000,000 gallons of water even at the design basis low water level.

The intake structure and discharge diffuser have several environmental advantages in this section of the river. These advantages include less impact to the river from dredging, and in general less impact to aquatic habitat and to aquatic life because of the depth and size of the pool. Also less thermal impacts from the heated water discharge occur in the pool. Historical sampling at the SSES Intake structure has shown small impacts from impingement and entrainment. Specific environmental sampling for BBNPP is documented in the BBNPP ER as being a small impact. Aquatic habitat impacts will be quantified in 2010 by performance of the IFIM study described in Enclosure 1.

When the BBNPP Intake Structure and Discharge Diffuser were being sited in the spring of 2008, it was desirable to site the BBNPP Intake and Discharge on land already owned by PPL. The only contiguous land owned by PPL from the river to the BBNPP site without impacting Lake Took-a-while and the Riverlands Recreational Area is land that the existing SSES pipe lines and electrical duct banks (utilities) occupy. This land is just south of Lake Took-a-while and the Riverlands Recreational Area. Running the BBNPP utilities parallel with the existing SSES utilities would also avoid any impact to Lake Took-a-while and the Riverlands Recreational

Area. In addition, paralleling the existing SSES utilities reduces the potential to disturb land that had not been previously disturbed and provides installation feasibility assurance because the SSES installation has already proven successful.

The first option looked at placing the BBNPP Intake Structure north of the existing SSES Intake structure. Going north would increase the length of the various utilities. Also it would mean that the BBNPP utilities would at some point have to cross over or under the existing SSES utilities. Interferences included an existing 230kV transmission line 150 feet right away and known archeological sites on the west bank above the SSES Intake. In addition there is a potential for impact to the Riverlands Recreational Facility and it is desirable to avoid this impact. For these reasons it just did not make sense to try to consider the siting of the BBNPP Intake Structure in this direction.

The next option was to try placing the BBNPP Intake Structure south of the existing SSES Intake. There were two immediate interferences identified. First is the outfall from the SSES Sewage Treatment Plant which is located just south of the SSES Intake Structure. It was decided that this would either have to be relocated or, if SSES should contract for offsite processing like BBNPP, then the line could be abandoned in place. In either case this was not a major obstacle.

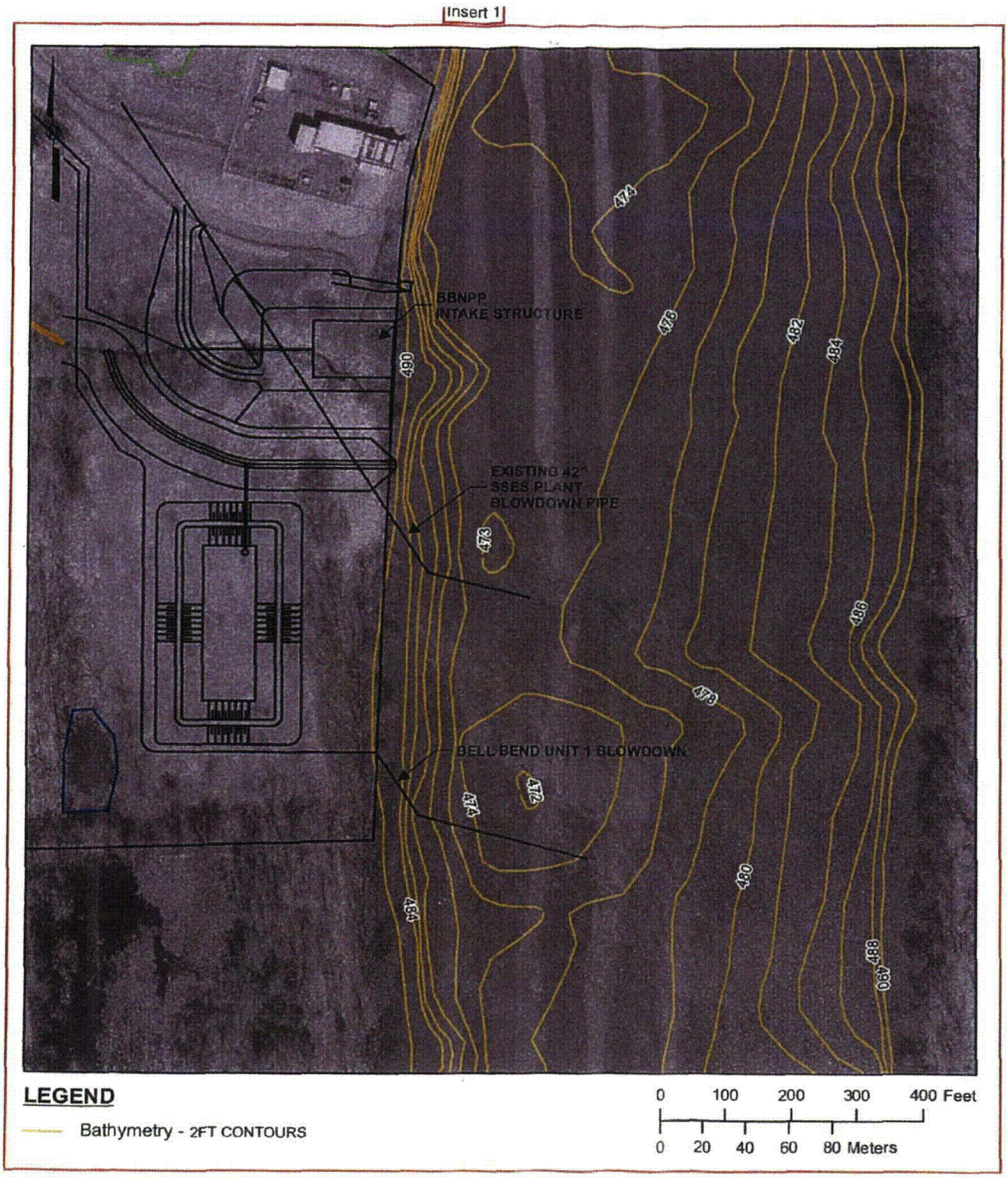
The second interference is the SSES Diffuser or blowdown line. This is a large 42" line that enters the Susquehanna River about 580 feet below the SSES Intake Structure. The problem is the line comes down from SSES to just west of the SSES Intake Structure and then cuts across at a diagonal until it enters the Susquehanna River. This line supports both Susquehanna Steam Electric Station units and is never taken out-of-service. To relocate this line was viewed as not practical due to the impact on the Susquehanna units. This line must remain where it is currently located.

To locate the BBNPP Intake Structure below the SSES blowdown line would increase the impact from installing pipe, electrical duct banks, and roads through wetlands that parallel much of the west bank of the Susquehanna River in this area. In addition, it is desirable to locate both the BBNPP Intake Structure and the Discharge Diffuser within the large pool of water discussed above. To go too far south would eliminate this possibility. Lastly, this would greatly increase the length of the discharge lines and electrical duct banks from the BBNPP. This would be a large cost impact. This option was not viewed as feasible.

The location of the BBNPP Discharge Diffuser needed to be located in the large pool and south of the SSES discharge. The distance between the two discharges needed to be sufficient so the thermal impacts would not be cumulative. The distance between discharges and the design chosen for BBNPP to avoid cumulative thermal impacts was determined by thermal plume modeling performed by ERM. The BBNPP proposed discharge pipe will be at least 24 inches in diameter. The pipe enters the river about 380 feet below the existing blowdown line for Susquehanna SES. This discharge pipe extends approximately 212 feet out into the river. Connected to the discharge pipe is the diffuser section which is 106.5 feet in length. The diffuser has seventy-two 4-inch diameter port holes facing downstream and spaced center-to-center at 1.5 feet intervals. The angle of discharge of the port hole is 45 degrees above horizontal. The diffuser center elevation is approximately 9 feet below the estimated minimum flow river level of 484 ft.

The maximum distance between the two intake structures without interfering with the SSES blowdown line is about 300 feet centerline-to-centerline. Locating the BBNPP Intake Structure close to the SSES Intake Structure assures that many of the reasons for locating the SSES Intake Structure discussed above also apply to the BBNPP Intake Structure making this the

most favorable location for the BBNPP Intake Structure. In addition, by locating the BBNPP intake near the SSES's intake the existing intake access road and laydown area can be shared for routine maintenance. Similarly being able to locate the BBNPP discharge only 380 ft south of the SSES discharge in the pool also makes this a highly favorable location on the North Branch of the Susquehanna River.



Reference: FSAR, Revision 2, Figure 2.4-10, February 12, 2010.

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BELL BEND NUCLEAR POWER PLANT
SRBC NOTICE OF APPLICATION REVIEW RESPONSE
SEASONAL AVAILABILITY AND WATER USE
BNP-2010-165 Docket No. 52-039

References: 1) Michael J. Brownell, Susquehanna River Basin Commission, to T.L. Harpster, PPL Bell Bend LLC., "Notice of Application Review for the PPL Bell Bend, LLC.", dated March 1, 2010.

Please find attached the PPL Bell Bend, LLC (PPL) response to the request for information on seasonal variability of water use in the Susquehanna River Basin Commission's March 1, 2010, "Notice of Application Review for the PPL Bell Bend, LLC" (Reference 1). We are providing detailed information on water usage at different operating modes considering the seasonal flow variation of the river to determine peak water usage during historical low flow conditions.

Should you or your staff have any questions about these notifications please contact Bradley Wise at 610.774.6508 or bawise@pplweb.com.

Respectfully,

Terry L Harpster

TLH/dw

Enclosure 1: Water Use and Seasonal Availability

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Enclosure 1

Water Use and Seasonal Availability

NARRATIVE

Attachment: Water Use and Seasonal Availability

Comment: Applicant must provide a description of the project in terms of water use and availability. [18 CFR 806.14(a)(2)(ix)]

The SRBC commented that the information submitted in the application and amendment fails to adequately describe water use and availability. PPL BB should describe in detail the water usage expected based on seasonal variability and at different operation modes, including full power, reduced power, and periodic maintenance outages. Water use should be compared to seasonal flow variation of the river to determine peak water usage during historical low flow conditions.

Response: PPL BB is providing the following information supportive of BBNPP water use and availability during different operating scenarios.

- Summary of Plant Operations (Operating Modes and Outages)
- Plant Water Use (Description and Quantification)
- Water Supply Availability (River Flow Statistics)
- Water Supply Adequacy (Comparison of Plant Water Use and River Flow)

Review of this information clearly demonstrates the adequacy of the water supply at BBNPP during all seasonal flow variations.

WATER USE AND SEASONAL AVAILABILITY

Summary of Plant Operations

Bell Bend Nuclear Power Plant (BBNPP) will be a base-load power plant. Except for scheduled maintenance outages, it is anticipated that the plant will operate at full power nearly all the time. Nuclear power plants typically can operate at uninterrupted full power for hundreds of days. The expected average annual capacity factor for BBNPP is 95 percent, including scheduled outages; this is equivalent to 347 days of full-power operation each year.

For purposes of assessing water availability, it is reasonable to assume that BBNPP will be at full power. Reduced power (part-load) operation will occur occasionally depending on the status of individual plant components but will not be scheduled and cannot be predicted. Throughout the range of part-load operation, plant water use is approximately proportional to load.

Maintenance outages will be scheduled at 18-month intervals alternating between spring and fall. The expected duration of each outage will be 18 to 30 days. (Scheduled outages at BBNPP will not coincide with scheduled outages at the Susquehanna Steam Electric Station (SSES). SSES outages are currently scheduled in spring, at 24-month intervals for each of the two units in alternating years, so that each spring one unit will have a scheduled outage.)

Plant Water Use

All water to be used at BBNPP when the plant becomes operational will be withdrawn from the Susquehanna River at the BBNPP river intake, except for potable/sanitary water (nominally 100 gpm) to be obtained from the local municipal purveyor. The components of BBNPP water use provided from the river during normal operation are:

- Circulating Water System (CWS) cooling towers
  - Evaporation
  - Drift
  - Blowdown
- Essential Service Water System (ESWS) cooling towers
  - Evaporation
  - Drift
  - Blowdown
- Miscellaneous power plant use (excluding potable/sanitary water)
  - Demineralizer makeup
  - Fire water distribution
  - Floor wash drains
- Other
  - Essential Service Water Emergency Makeup System (ESWEMS) Retention Pond evaporation
  - Waste Water Retention Basin evaporation
  - Potential in-river evaporation induced by heat in the plant discharge

Each of the foregoing uses will be discussed in turn, below.

Components of Plant Water Use

- CWS Cooling Tower Evaporation

  There will be two CWS cooling towers; both are natural draft towers. CWS cooling tower evaporation will account for approximately 97 percent of the plant consumptive use. At full load, the evaporation rate depends upon the ambient wet-bulb temperature (WBT) and relative humidity (RH). Based on the daily meteorological record at Wilkes-Barre from 1949 through 2009, the calculated average full-load, two-tower CWS evaporation is 13,360 gpm (19.24 mgd). The peak-day full-load, two-tower CWS evaporation during this period would have been 16,723 gpm (24.08 mgd) on July 15, 1995, when the daily average WBT was 77.8 deg F and the daily average RH was 66.2 percent.

- CWS Cooling Tower Drift

  The manufacturer estimates drift loss from the CWS cooling towers to be 0.001 percent of the circulating water flow, which is 360,000 gpm per tower during normal operation. The estimated drift loss is thus 4 gpm per tower, or a total of 8 gpm. For the purpose of assessing water availability, a constant loss of 8 gpm is assumed.

- CWS Cooling Tower Blowdown

  Blowdown of an evaporative cooling tower is necessary to prevent excessive build-up of impurities in the circulating cooling water. The rate of blowdown and the rate of CWS makeup flow withdrawn from the river depend upon the "cycles of concentration" (CC), where:

  $$\text{Blowdown} = \{ \text{Evaporation} / (CC - 1) \} - \text{Drift}$$

  or

  $$\text{Blowdown} = \{ \text{River water makeup} / CC \} - \text{Drift}$$

  CC will vary depending upon river water quality and other factors. The expected range of CC is from 3 to 5. Conservatively, CC is assumed to be 3.0 for the purpose of calculating the expected rates of CWS cooling tower blowdown and total river water withdrawal.

- ESWS Cooling Tower Evaporation

  There will be four ESWS cooling towers, all mechanical draft. During normal operation, only two ESWS towers will operate at any time. (Immediately following a postulated accident, all four ESWS towers might be in operation, but this situation would not be critical insofar as plant water use is concerned, since the CWS system would be shut down during an accident.)

  ESWS cooling tower evaporation will account for approximately 2.4 percent of plant consumptive use. At full load, the evaporation rate depends upon the ambient wet-bulb temperature (WBT) and relative humidity (RH). Based on the daily meteorological record at Wilkes-Barre from 1949 through 2009, the calculated average full-load, two-tower ESWS evaporation is 324 gpm (0.47 mgd). The peak-day full-load, two-tower ESWS evaporation during this period would have been 512 gpm (0.73 mgd) on April 27,

2009, when the daily average WBT was 59.4 deg F and the daily average RH was 34.2 percent.

Due to the different performance characteristics of the respective cooling towers, the maximum CWS evaporation rate and maximum ESWS evaporation rate are not expected to coincide.

- ESWS Cooling Tower Drift

  The manufacturer estimates drift loss from the ESWS cooling towers to be less than 0.005 percent of the circulating water flow, which is 19,200 gpm per tower during normal operation. The estimated drift loss is thus less than 1 gpm per tower or less than a total of 2 gpm during normal (two-tower) operation. For purposes of assessing water availability, a constant loss of 2 gpm is assumed.

- ESWS Cooling Tower Blowdown

  Refer to the discussion of blowdown and CC under "CWS Cooling Tower Blowdown," above. The CC at which the ESWS cooling towers will operate will vary depending upon river water quality and other factors. As is the case for the CWS cooling towers, the expected range of CC is from 3 to 5. Conservatively, CC=3.0 is assumed for purposes of calculating the expected rates of ESWS cooling tower blowdown and total river water withdrawal.

- Miscellaneous Power Plant Use

  Miscellaneous power plant uses are expected to require a maximum of 117 gpm, as follows: demineralizer (107 gpm); fire water system (5 gpm); and floor drains (5 gpm). For the purpose of assessing water availability, this 117 gpm is assumed constant.

  The expected maximum consumptive use associated with the miscellaneous power plant systems is 40 gpm, also assumed constant for the purpose of assessing water availability.

- On-Site Pond/Basin Evaporation

  The estimated maximum evaporation from the ESWEMS Retention Pond and the Waste Water Retention Basin is expected to be approximately 48 gpm combined. The surface areas of the ESWEMS Retention Pond and the Waste Water Retention Basin are 5.69 acres and 2.34 acres, respectively. The 30-day maximum evaporation rate for the ESWEMS Retention Pond was calculated to be 34.3 gpm based on very conservative meteorological conditions. The estimated maximum evaporation from the Waste Water Retention Basin was determined in proportion to its surface area relative to the ESWEMS Retention Pond. The 48 gpm is equivalent to approximately 9.5 inches of evaporation per 30 days. For the purpose of assessing water availability, the considerable seasonal variation in surface evaporation rate is disregarded, and 48 gpm is assumed constant.

In consideration of the relatively minor amount of water involved, the effect of direct precipitation on the ESWEMS Retention Pond and the Waste Water Retention Basin is disregarded.

- In-River Evaporation

  A comprehensive discussion of the potential in-river evaporation at BBNPP is presented in the proposed BBNPP Water Monitoring Plan. Potential in-river evaporation at BBNPP is very small compared to total plant water use and does not affect the availability of river water flow to supply the plant. Nevertheless, the estimated maximum rates are presented here for completeness.

  Potential in-river evaporation was determined by a conservative analysis of hypothetical full-power BBNPP operation during the period for which the requisite daily meteorological data and river water temperatures are available (1977-2007). The analysis indicates, for each month of the year, the maximum monthly and the average in-river evaporation rates for 1977-2007 conditions. These values, in mgd, are shown in the two right-hand columns of Table 1 (below).

The estimated BBNPP water use at full power is summarized, by month, in Table 1.

Table 1. BBNPP estimated water use during normal, full-power operation

	River water withdrawal [1]			In-plant consumptive use [2]			In-river evaporation [3]	
	peak day (mgd)	max month (mgd)	average (mgd)	peak day (mgd)	max month (mgd)	average (mgd)	max month (mgd)	average (mgd)
Jan	32.58	26.57	24.07	21.75	17.74	16.07	0.07	0.05
Feb	32.64	26.74	24.67	21.79	17.86	16.47	0.07	0.05
Mar	35.77	28.68	26.93	23.87	19.15	17.98	0.07	0.06
Apr	36.84	31.16	29.98	24.59	20.80	20.02	0.09	0.06
May	36.75	33.52	32.21	24.53	22.37	21.50	0.08	0.05
Jun	37.28	34.77	33.77	24.88	23.21	22.54	0.07	0.03
Jul	37.33	35.67	34.53	24.91	23.81	23.05	0.04	0.02
Aug	37.02	35.24	33.57	24.71	23.52	22.41	0.04	0.02
Sep	36.51	34.07	32.10	24.37	22.74	21.43	0.04	0.03
Oct	35.06	31.96	30.41	23.40	21.34	20.30	0.06	0.05
Nov	34.48	29.77	28.06	23.01	19.88	18.74	0.07	0.06
Dec	32.94	27.57	25.28	21.99	18.41	16.88	0.06	0.05
Aug-Oct [4]	36.19	33.75	32.03	24.16	22.53	21.38	0.05	0.03

[1] Assumptions: 3.0 cycles of concentration; daily wet-bulb temperature and relative humidity at Wilkes-Barre (1949-2009)
[2] Assumption: daily wet-bulb temperature and relative humidity at Wilkes-Barre (1949-2009)
[3] Assumptions: 3.0 cycles of concentration; daily meteorological data at Wilkes-Barre (1977-2007); at-site daily river water temperatures (1977-2007)
[4] Data are weighted averages for August-October (92 days)

Water use during reduced load

Reduced- or part-load operation cannot be predicted or scheduled, and is expected to occur infrequently and for short durations. Water use during reduced-load operation will be approximately proportional to plant power level. The nominal minimum operational power level for nuclear units is approximately 25 percent.

Water use during scheduled outages

During scheduled plant maintenance outages, water usage will consist of potable/sanitary water (supplied by local purveyor) and a minimal amount of power plant water including ESWS. The CWS system will not operate, so that no water will be evaporated in the CWS cooling towers. Withdrawal from the river will be minimal. Evaporation from the ESWEMS Retention Pond and the Waste Water Retention Basin will continue.

Water Supply Availability

The basis for assessing water supply availability at BBNPP is the record of daily flow at the USGS gaging station on the Susquehanna River at Wilkes-Barre (USGS No. 01536500). The record consists of daily flow from April 1899 to the present. For purposes of this assessment, the daily flow record from April 1899 through March 2010 (111 years) was used.

The drainage area of the Wilkes-Barre gaging station is 9,960 square miles. The estimated drainage area at the BBNPP river intake is 10,240 square miles. The small flow contribution from the drainage area between Wilkes-Barre and BBNPP (280 square miles, 2.7 percent) will be disregarded.

Water supply availability at BBNPP is represented by the data presented in Table 2 (next page). Table 2 presents the river flows, annually and by month, at various exceedance percentages, emphasizing low flow (high exceedances). These exceedance data were developed from the Wilkes-Barre gage record, without adjustment. Thus, the following effects and influences are not reflected in Table 2:

- Prospective mitigation for BBNPP consumptive water use via low flow augmentation from upstream reservoirs
- SSES consumptive water use and mitigation via low flow augmentation from Cowanesque Reservoir
- Low flow augmentation from Cowanesque Reservoir to mitigate consumptive use at other generating plants
- Low flow augmentation from Whitney Point Reservoir
- Changes over time in upstream water usage
- Changes over time in flow regulation by other upstream reservoirs
- Additional river flow from the drainage area between the Wilkes-Barre gaging station and BBNPP.

Table 2. Susquehanna River Daily Flow Exceedance at Wilkes-Barre (April 1899-March 2010)

Exceedance (%)	Year (cfs)	Jan (cfs)	Feb (cfs)	Mar (cfs)	Apr (cfs)	May (cfs)	Jun (cfs)	Jul (cfs)	Aug (cfs)	Sep (cfs)	Oct (cfs)	Nov (cfs)	Dec (cfs)	Aug-Oct (cfs)
100	532	1,010	1,060	2,100	5,210	2,000	1,350	787	716	532	658	627	860	532
99.5	787	1,220	1,300	2,628	6,249	2,848	1,570	925	787	626	701	660	1,090	698
99	867	1,390	1,700	3,270	6,586	3,148	1,703	990	815	687	722	860	1,224	732
98	1,010	1,660	2,100	3,920	7,260	3,540	1,836	1,100	855	756	820	1,090	1,490	815
97	1,100	2,000	2,400	4,104	7,919	3,828	1,969	1,180	893	795	907	1,220	1,660	856
96	1,200	2,170	2,600	4,790	8,475	4,120	2,080	1,220	928	828	970	1,340	1,820	899
95	1,290	2,390	2,800	5,210	8,945	4,330	2,200	1,280	970	860	980	1,380	2,060	940
94	1,370	2,540	3,000	5,712	9,400	4,488	2,270	1,304	1,004	899	1,040	1,510	2,308	970
93	1,460	2,800	3,200	6,168	9,860	4,640	2,380	1,340	1,030	935	1,080	1,620	2,560	1,010
92	1,530	2,900	3,400	6,440	10,200	4,836	2,460	1,380	1,080	970	1,110	1,790	2,692	1,050
91	1,610	3,176	3,500	6,736	10,700	5,000	2,520	1,420	1,090	993	1,150	1,840	2,888	1,080
90	1,690	3,300	3,700	7,000	11,000	5,160	2,600	1,450	1,100	1,040	1,180	1,930	3,070	1,100
85	2,140	4,060	4,300	8,590	12,800	5,990	2,930	1,670	1,280	1,164	1,380	2,530	4,040	1,250
80	2,660	4,500	4,758	10,300	14,400	6,690	3,270	1,890	1,410	1,290	1,540	3,260	4,850	1,402
75	3,300	5,000	5,400	12,100	15,800	7,470	3,600	2,080	1,540	1,430	1,700	3,943	5,700	1,550
70	3,980	5,600	5,990	13,900	17,000	8,180	3,930	2,310	1,670	1,580	1,910	4,570	6,400	1,700
65	4,640	6,400	6,500	15,600	18,400	9,040	4,300	2,600	1,820	1,740	2,170	5,160	7,170	1,880
60	5,440	7,100	7,186	17,600	20,200	9,970	4,746	2,860	2,000	1,890	2,490	5,910	8,090	2,080
55	6,380	8,000	7,960	19,600	22,000	10,900	5,190	3,130	2,210	2,080	2,910	6,800	9,030	2,310
50	7,400	9,100	8,800	22,100	24,000	12,000	5,775	3,480	2,440	2,290	3,360	7,540	10,200	2,570
40	10,100	11,500	11,100	27,300	28,400	14,600	7,194	4,240	3,000	2,810	4,500	9,548	12,500	3,320
30	14,100	14,900	14,680	34,200	34,000	18,000	9,172	5,220	3,840	3,700	6,000	12,700	15,700	4,410
20	20,300	21,000	21,120	44,200	42,700	22,500	12,820	7,080	5,310	5,434	9,000	17,000	20,700	6,420
10	32,500	32,500	34,100	64,900	58,520	31,800	19,300	11,100	8,270	9,000	16,000	24,620	30,100	10,900
0	329,000	210,000	179,000	229,000	206,000	206,000	329,000	142,000	95,300	244,000	151,000	123,000	184,000	244,000

Water Supply Adequacy

Because water used at BBNPP will be almost entirely withdrawn from the Susquehanna River, the adequacy of BBNPP water supply is assessed by comparing BBNPP water usage to river flow. Since the BBNPP river discharge is located approximately 680 ft downstream from and in the same river pool as the BBNPP river water intake, the meaningful comparison is between consumptive use (net withdrawal) and river flow. Nonetheless, comparison is provided also between total withdrawal and river flow.

The most critical comparison of water usage to supply would be a comparison of peak-day usage to minimum river flow. This comparison, by month of the year, is presented in Table 3. The monthly comparisons in Table 3 clearly demonstrate the adequacy of supply at BBNPP. Under the most critical condition (peak-day use coinciding with minimum river flow), consumptive use (net withdrawal) by BBNPP would be 7.1 percent of the river flow, disregarding upstream low flow augmentation.

Table 3. Adequacy of water supply – peak day use/minimum river flow

	Minimum daily river flow (cfs)	Peak day BBNPP withdrawal		Maximum % river flow withdrawn at BBNPP	Peak day BBNPP consumptive use [1]		Maximum % river flow consumed at BBNPP [2]
		(mgd)	(cfs)		(mgd)	(cfs)	
Jan	1,010	32.58	50	5.0	21.82	34	3.4
Feb	1,060	32.64	50	4.7	21.86	34	3.2
Mar	2,100	35.77	55	2.6	23.94	37	1.8
Apr	5,210	36.84	57	1.1	24.68	38	0.7
May	2,000	36.75	57	2.9	24.61	38	1.9
Jun	1,350	37.28	58	4.3	24.95	39	2.8
Jul	787	37.33	58	7.4	24.95	39	5.0
Aug	716	37.02	57	8.0	24.75	38	5.3
Sep	532	36.51	56	10.5	24.41	38	7.1
Oct	658	35.06	54	8.2	23.46	36	5.5
Nov	627	34.48	53	8.5	23.08	36	5.7
Dec	860	32.94	51	5.9	22.05	34	4.0
Aug-Oct [3]	636	36.19	56	8.9	24.20	37	6.0

[1] Includes maximum monthly in-river evaporation; see Table 1
[2] Disregards effect of upstream flow augmentation for consumptive use mitigation
[3] Data are weighted averages for August-October (92 days)

Pennsylvania Fish & Boat Commission

established 1866

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Division of Environmental Services
Natural Diversity Section
450 Robinson Lane
Bellefonte, PA 16823-9620
(814) 359-5237 Fax: (814) 359-5175

October 14, 2010

IN REPLY REFER TO
SIR# 35087

BRADLEY WISE
PPL
TWO NORTH NINTH ST
BERWICK, PA 18603

RE: Species Impact Review (SIR) – Rare, Candidate, Threatened and Endangered Species
BELL BEND NUCLEAR POWER PLANT
UPDATE TO SIR 27486
SALEM Township, LUZERNE County, Pennsylvania

Dear Mr. WISE:

I have examined the map accompanying your recent correspondence, which shows the location for the above referenced project. Based on records maintained in the Pennsylvania Natural Diversity Inventory (PNDI) database and our own files, the following rare or protected species are known from the vicinity of the project site:

Common Name	Scientific Name	PA Status
Northern cricket frog	*Acris crepitans*	endangered
Yellow lampmussel	*Lampsilis cariosa*	rare
Green floater	*Lasmigona subviridis*	rare

The Northern cricket frog is a small (less than 2") frog species found in a wide variety of habitats including permanent bodies of water such as slow-moving streams, ponds, lakes, marshes, bogs, and swamps, but also semi-permanent ponds and seasonal forest pools.. Breeding occurs from May to August with metamorphosed froglets emerging July to September. The Northern cricket frog occurs in small, isolated populations in eastern Pennsylvania. These small populations are threatened by pollution, and filling/clearing of wetlands and breeding habitat.

If wetlands, waterways, or vernal pools are to be directly or indirectly impacted by the project activity, we will need to conduct a more thorough evaluation of the potential adverse impacts to the northern cricket frog. Please provide us with the following information to assist us with our review: detailed project plans including a project narrative, identification and delineation of wetlands or streams within the direct and indirect impact area, and color photographs (dated, labeled, and keyed to a map) of wetlands, vernal pools, or waterways expected to be impacted. A habitat assessment or presence/absence survey may be requested for the species of concern.

Freshwater mussels are the most imperiled taxonomic group in North America. Nearly half of the species known to occur in the Commonwealth are now extirpated (locally extinct) from Pennsylvania. We

are concerned about direct and indirect (i.e., runoff) effects that the proposed project may have on the species of concern. Freshwater mussel species are extremely vulnerable to physical (i.e., siltation, dredging, trenching, rip-rap) and chemical (i.e., pH, temperature, dissolved oxygen, organic contaminants, heavy metals) changes to their aquatic environment. Therefore, we recommend construction techniques that eliminate in-stream work, sedimentation and changes to water quality. I recommend that you avoid any in-stream disturbance or water quality degradation in the Susquehanna River during and after the project installation. Storm sewers and retention basins should be designed so as to minimize/remove all silt from the water before it is released into the river. Strict erosion and sedimentation control measures, as well as best management practices should be employed.

If wetlands or water bodies *are not* to be disturbed by the proposed activity, and provided that best management practices are employed and strict erosion and sedimentation control measures are maintained, I do not foresee any adverse impacts to the species of concern listed above or any other rare or protected species under Pennsylvania Fish and Boat Commission jurisdiction.

Note that this office performed no field inspection of the project area. Consequently, comments in this letter are not meant to address other issues or concerns that might arise concerning matters under Pennsylvania Fish and Boat Commission jurisdiction or that of other authorities. If you have any questions regarding this response, please contact Kathy Gipe at 814-359-5186 and **refer to the SIR number at the top of this letter.** Thank you for your cooperation and attention to this matter of nongame species conservation.

Sincerely,

Christopher A. Urban, Chief
Natural Diversity Section

CAU/KDG/mr

T. L. Harpster
VP-Bell Bend Project-Development

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October 21, 2010

Mr. James Richenderfer, Ph.D., P.G.
Acting Chief, Water Resources Management
Susquehanna River Basin Commission
1721 N. Front Street
Harrisburg, PA 17102-2391

BELL BEND NUCLEAR POWER PLANT
SRBC NOTICE OF APPLICATION REVIEW RESPONSE
AVOIDANCE OF CONSUMPTIVE USE
BNP-2010-192 Docket No. 52-039

References: 1) Michael J. Brownell, Susquehanna River Basin Commission, to T.L. Harpster, PPL Bell Bend LLC., "Notice of Application Review for PPL Bell Bend, LLC", dated March 1, 2010.

Please find attached the PPL Bell Bend, LLC (PPL) response to the request for information on avoidance of consumptive use in the Susquehanna River Basin Commission's March 1, 2010, "Notice of Application Review for PPL Bell Bend, LLC" (Reference 1). We have provided detailed information on comparison of cooling tower alternatives including information concerning the technical feasibility of dry air cooling. Also included in this evaluation is consideration of the cost of consumptive use and the environmental impacts of cooling water blowdown for all six heat dissipation alternatives.

Should you or your staff have any questions about this response please contact Bradley Wise at 610.774.6508 or bawise@pplweb.com.

Respectfully,

Terry L Harpster

TLH/kw

Enclosures: 1) NARRATIVE - Avoidance of Consumptive Use
Attachment A – Technical Feasibility and Environmental Impacts - Dry Air Cooling
Attachment B – Technical Feasibility and Environmental Impacts – Hybrid Cooling Towers
Attachment C – Tabular Comparison of Heat Dissipation Alternatives with Respect to Cost and Cooling Tower Blowdown

2) Preface
"Evaluation of Dry Air Cooling for the Bell Bend Nuclear Power Plant", Rev 0, August 25, 2010

cc: (w/ Enclosures)

Ms. Stacey Imboden
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Mr. Thomas W. Beauduy
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Enclosure 1

NARRATIVE – Avoidance of Consumptive Use

Attachment A – Technical Feasibility and Environmental Impacts - Dry Air Cooling

Attachment B – Technical Feasibility and Environmental Impacts – Hybrid Cooling Towers

Attachment C – Tabular Comparison of Heat Dissipation Alternatives with Respect to Cost and Cooling Tower Blowdown

NARRATIVE

Attachment: **Avoidance of Consumptive Use**

Comment: **Applicant must include in their application plans for avoiding or mitigating for consumptive use. [18CFR §806.14(a)(2)(ix)]**

The information submitted in the application and amendment fails to adequately analyze avoidance of consumptive use. The amendment included an analysis of six different cooling modes; however, consumptive water use was not factored into the cost analysis of the six alternative methods of heat dissipation for BBNPP. The only factors considered were impact on power production, initial cost, and maintenance costs. Because the cost of consumptive water use was not included in the analysis, the alternatives that maximize consumptive use appear to be less costly compared to other alternatives that minimize consumptive use, such as dry cooling systems and hybrid cooling towers. The cost of providing supplemental water to mitigate consumptive use could be significant if reservoirs, pipelines, or other measures are required. All costs need to be considered for a valid analysis. Also, the analysis assumed that the environmental impact of all alternatives were similar. This assumption is not valid when dry cooling systems and hybrid cooling towers are included in the environmental analysis. The chosen alternative, natural draft cooling towers, require significant blowdown to maintain proper water chemistry. Blowdown flows returning to the river will be heated and chemicals, including a biocide, will be added, and this may have a negative environmental impact on the river. Dry cooling systems and hybrid cooling towers require significantly less blowdown and may have less environmental impact. The environmental impact of blowdown of all alternatives needs to be analyzed.

The information submitted in the application and amendment fails to include an analysis of the increased evaporation caused by the thermal effects of blowdown discharge from BBNPP. The thermal effects from the BBNPP blowdown discharge are additive to the thermal effects of the Susquehanna Steam Electric Station (SSES). This analysis should be consistent with the SSES Permanent Water Monitoring Plan, submitted to the Commission by PPL Susquehanna, LLC on January 9, 2008.

The information submitted in the application and amendment fails to describe plans to mitigate consumptive use. As noted above, payment for mitigation of consumptive water use may not be a viable option for the amount of consumptive use proposed by the BBNPP. Not only is the magnitude of the consumptive use a concern, but timing of the peak usage is coincident with the typical low flow periods of the year. PPL BB should describe plans during low river flows to release water for flow augmentation equal to the projects total consumptive use, or reduce withdrawal from the river equal to the project's total consumptive use in accordance with 18 CFR §806.22(b)(1)(i) and (ii).

Response:

This response amends the prior Bell Bend heat dissipation alternatives analysis. It considers the cost of consumptive water use mitigation and also includes consideration of both hybrid and dry cooling systems as alternatives to avoid (in whole or in part) water consumption at the Bell Bend Project. It also provides an evaluation of the environmental impacts of cooling water blowdown for each alternative method of heat dissipation. There are two enclosures that are described below.

Enclosure 1
Attachment A provides a summary discussion of the technical aspects of dry air cooling. PPL commissioned a study to evaluate the application of dry air cooling for BBNPP. The study evaluated the feasibility and costs of redesigning the current cooling water system with a dry air cooling system for BBNPP. The study is included as Enclosure 2. The US EPR™ standard design for condenser heat rejection is a wet cooling water system. Dry air cooling has never been previously applied to a project the size of Bell Bend, nor has it been attempted in combination with the US EPR design. Scaling up and design compatibility would be a major risk to the project due to significant technical issues as well as associated major cost increases and uncertainties. PPL is not aware of any large nuclear generating facility (either in operation or in design/licensing phase) that utilizes strictly dry air cooling.

Attachment A also provides a discussion of the environmental impacts of dry air cooling. Although dry air cooling has advantages when it comes to water use and potential aquatic impacts, there are environmental drawbacks that relate to land use and noise.

Attachment B provides a discussion of the technical aspects and potential environmental concerns associated with hybrid cooling alternatives.

Attachment C provides a tabular cost analysis of all six heat dissipation alternatives including hybrid and air cooling (Table 1), and a tabular summary of the potential impacts associated with plant blowdown for each of the six cooling alternatives (Table 2).

The cost analysis in Table 1 includes the cost of water based on current Susquehanna River Basin Commission in-lieu rates which are judged to be representative of possible water mitigation costs[1]. The other costs of the cooling options are based on a US EPR (TM) evaluation and the information was used to revise the BBNPP Environmental Report Table 9.4-1. Due largely to no O&M impacts and no penalty for auxiliary loads, the two planned natural draft cooling tower alternative is clearly the most cost effective alternative even when considering the costs for consumptive use of water.

The environmental impacts of blowdown for the six cooling alternatives are provided in Table 2 in Attachment C and are shown to be small. Included in this Table is consideration of the potential cumulative thermal effects of each cooling option when combined with that of Susquehanna SES. The predicted minimal temperature increase and small areal extent of the blowdown plume is predicted to have no significant impact for each cooling option.

Enclosure 2
Enclosure 2 provides an independent evaluation sponsored by PPL. This study evaluates the use of dry air cooling for the BBNPP in place of the currently planned natural draft cooling

[1] As the Commission is aware, PPL BB is currently investigating consumptive use make-up options to satisfy Commission consumptive use regulations. Final costs associated with expected consumptive use mitigation have not yet been determined, however, final costs are expected to be consistent with the in-lieu payment costs used in this analysis.

towers. A preface page is provided to explain the differences between Table 1 for Dry Air Cooling in Enclosure 1 and the independent evaluation included in Enclosure 2.

The BBNPP plan to mitigate consumptive use is currently in the planning/design phase and will be provided separately as part of the response to the requirements of 18 CFR §806.22(b)(1) cited in the SRBC March 1, 2010 "Notice of Application Review for PPL Bell Bend, LLC" letter to PPL.

Attachment A - Technical Feasibility and Environmental Impacts – Dry Air Cooling

The US EPR™ standard design for condenser heat rejection is a wet cooling water system. The Bell Bend Nuclear Power Plant (BBNPP) application submitted to the Nuclear Regulatory Commission includes this standard design. As a result of the subsequent application for consumptive water use with the Susquehanna River Basin Commission (SRBC), a question was raised concerning the use of a dry air cooling system as an option to avoid or mitigate consumptive water use.

Enclosure 2 provides a summary analysis of the technical feasibility of dry air cooling. The following summarizes the study results.

Direct air cooled condensers are in use in many power plants throughout the world. Many seemingly large plants that use air cooled condensers are combined cycle plants in which only about one third of the power comes from the steam turbine thus requiring reduced condenser cooling. Additionally, even the largest steam plant application, the 4,000 MW Matimba Plant in South Africa consists of multiple 660 MW steam turbine units. An air cooled condenser for BBNPP would be the largest single unit application in the world by a factor of about three (3). Air cooling for a unit of this size has never been designed. Scaling up by this magnitude would be a major risk to the project due to significant technical issues as well as associated cost increases.

In addition, there are other considerations that reduce the attractiveness of installing an air cooled condenser at Bell Bend:

- The use of an air cooled condenser will impose significant changes to the US EPR™ standard design and would impact plant licensing costs and schedule. In fact, the changes would most probably be large enough to endanger the EPR fleet concept, resulting in significantly greater cost impacts that would potentially threaten the project altogether.

- Use of air cooling will bring about a loss of efficiency in plant electrical output. This penalty may be several percent over a year. This loss of generation is not accounted for in Attachment C, Table 1.

The loss of net electrical generation with the air cooled condenser will have to be replaced by electricity from other generating plants, mainly fossil fired units. The benefit of emissions free generation will be lost for the replacement electricity.

Dry air cooling is an alternative cooling method where there is little issue with water availability. The only make-up water is for system losses due to leakage. There are no large evaporative losses and no drift losses such as is experienced when wet systems are utilized. With no evaporative losses, there are no potential issues with blowdown, chemical treatment, fogging, or icing when dry cooling is utilized. Dry air cooling does have some environmental drawbacks when compared to wet systems. Two such drawbacks are addressed in the following paragraphs.

Use of dry air cooling would require a significant increase in land use compared to wet cooling. Wet cooling systems require up to 15 acres. The estimated range for dry air cooling is from 15 to 30 acres to accommodate the number of expected fan cells and steam ducts. The actual size to support a plant the size of BBNPP may actually exceed the 30 acre estimate.

A conceptual dry air cooling design for BBNPP involves 192 fan cells and six steam ducts. Each cell is 43.6 ft wide by 51.1 ft long and they are arranged in an array of 32 cells by 6 cells for a total layout of 1396.3 ft by 306.9 ft. Each cell has a fan with nine blades and a diameter of 36 feet. The fan deck height is 164 feet and the top of the steam distribution duct is 205 feet. The steam ducts are 25 feet in diameter and travel a distance of 1000 feet from the turbine exhaust to the air cooling cells.

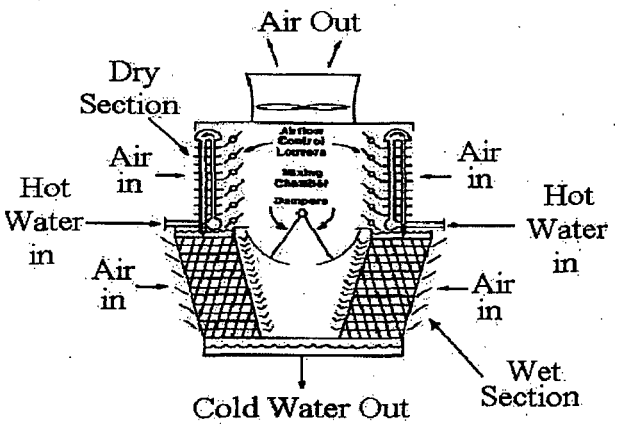
Trying to fit this design to the existing BBNPP plot plan is problematic in two areas. First, any land use needs beyond 15 acres is not available. Second, US EPR™ standard design has an electrical switchgear building located to the north of the turbine building. The electrical switchgear building would have to be relocated to allow for routing the six 25 feet diameter steam ducts. This would represent a major departure from the standard design and result in significant cost increases and uncertainties that would jeopardize the business case for the project.

A second environmental issue is noise. Near field noise for dry air cooling will be < 85 dBA at 3 feet. This is similar for wet cooling systems. The far field noise level for wet cooling systems drops off quickly the further away you go from the source. For a dry air cooling application of 192 fan cells a far field noise level of between 70 and 72 dBA at 400 feet from the fan cells would be expected with standard equipment. The requirement is < 55 dBA. Some form of noise mitigation would most likely be required at a premium cost.

Attachment B - Technical Feasibility and Environmental Impacts – Hybrid Cooling Towers

This section discusses both single-structure hybrid cooling towers and hybrid cooling systems that combine wet and dry cooling components in series or parallel.

A single-structure hybrid cooling tower is on the power generation scene and has options for optimization depending on the desired results. The hybrid cooling tower uses both wet and dry cooling. The bottom section (Wet Section in below diagram) is set up as a typical wet mechanical draft cooling tower. Flow passes through a spray distribution area and then falls down though the fill. Induced air flow travels through the fill and evaporative cooling takes place. With low air temperatures, direct cooling also takes place. In the upper dry section, forced draft fans direct outside air flow across the outside surface of air cooled heat exchangers. The inside of the heat exchanger has a portion of the heated water that is returning to the cooling tower. After passing through the heat exchanger the cooled water returns to the wet cooling tower spray distribution area. The heated air then passes through a mixing section and joins the wet air stream exiting the wet section.



Single Tower - Plume Abatement

If the resulting air mixture is below saturated condition, then no visible plume is produced. This was the objective for the first hybrid cooling systems placed into operation. This type of hybrid cooling tower will reduce water consumption to some extent (~5%) from the amount used by a strictly wet cooling tower, but the primary objective is plume abatement. Large towers of this type are in operation today throughout the world, however they are substantially more costly than wet cooling in exchange for only a small improvement in water efficiency.

There are several configurations possible for a hybrid wet and dry cooling system that is intended for water conservation. There could be a single tower or separate wet and dry towers, using series or parallel airflow and series or parallel cooling water flow. One option is a hybrid cooling system with an evaporative cooling tower and an air cooled condenser as separate structures. The air cooled condenser would handle the entire cooling load except for the hottest periods, when part of the cooling load would be handled by the wet cooling tower. These towers are currently being designed and placed in operation in small to mid-size applications.

The largest known application for a power plant is for a 550 MW mine-mouth coal-fire plant. This application offers a 70% reduction in water use over a wet system on an average basis, and less savings during hot summer periods when wet cooling would be required to achieve effluent thermal limits. A hybrid cooling system for water conservation for a unit the size of BBNPP has also never been designed. Scaling up by this magnitude would be a major risk to the project due to significant technical issues as well as associated major cost increases.

In addition, there is one environmental issue that would require mitigation. This additional environmental issue is noise. Near field noise for hybrid cooling will be ~ 96.7 dBA at 3 feet. The township requirement is < 55 dBA. Some form of noise mitigation would be required at a premium cost. This is typical for hybrid cooling towers. The mitigation measures also bring about the need for a larger tower to offset the loss in efficiency caused by the mitigation measures.

Attachment C – Tabular Comparison of Heat Dissipation Alternatives With Respect to Cost and Cooling Tower Blowdown

Table 1 – Cost of Alternative Heat Dissipation Options

Type of Cooling	Footprint per Plant Unit (1,562 MWe)	Noise	Auxiliary Load Difference [a]	Auxiliary Load Present Value [b]	Average Daily Water Makeup [c]	Make-up Water Cost Present Value [d]	Annual O&M Cost [a] [e]	O&M Cost Present Value [b]	Capital Cost [f]	Total Comparative Present Value [g]
	Acres	dBA @ 1 m	MW	10^3 USD	10^3 mgd	10^3 USD	10^3 USD	10^3 USD	10^3 USD	10^3 USD
Natural Draft (2 Hyperbolic Towers)	16	82	0	***0***	19.84	***39,656***	0	***0***	***173,727***	213,383
Rectangular Mechanical Draft (4 Towers)	24	88	6.22	***74,920***	19.84	***39,656***	468	***8,054***	***130,710***	253,340
Round Mechanical Draft (4Towers)	16	88	4.05	***48,782***	19.84	***39,656***	374.4	***6,443***	***143,103***	237,985
One Round Mechanical Draft (aka Fan-assisted Natural Draft)	8	88	8.49	***102,262***	19.84	***39,656***	374.4	***6,443***	***135,429***	283,790
Dry Cooling	7-30	88	13-79	***204,764*** [h]	0.2 [i]	***400***	5,975	***102,826***	***298,727***	606,717
Hybrid Cooling	5-6	96.7	21.85	***263,182***	18.85 [j]	***37,678***	3,791	***65,241***	***189,527***	555,628

Notes:
USD = U. S. Dollars
mgd = million gallons per day
(a) The value shown is the difference between the identified option and the Natural Draft (2 Hyperbolic Towers) option.
(b) The Auxiliary Load Present value was calculated over 40 years starting in 2019 and includes an assumed 8% cost of money, 2.5% escalation per year, 91% plant capacity factor and price of power of $87.80 per MWh.
(c) All water-cooling options are based on the Natural Draft option except as noted.
(d) The Make-up Water Cost Present value was calculated over 40 years starting in 2019, is based on the SRBC current In-lieu payment rate of $280/MG, and includes an assumed 8% cost of money, 2.5% escalation per year, 91% plant capacity factor.
(e) O&M costs are calculated at 1% or 2% of the capital cost, based on vendor input.
(f) The cost includes the initial cost of the cooling tower(s) and construction cost in 2019 dollars.
(g) This is the sum from the row's Auxiliary Load PV, Make-up Water Cost PV, O&M Cost PV, and Capital Cost values that are ***bold/italicized.***
(h) A nominal value of 17 MW was used to determine the present value.
(i) Value is based on a value of 139 gpm provided by a vendor.
(j) This is a plume-abated hybrid tower with an assumed 95% make-up water requirement compared to the other wet towers.

▪ Table 2 – Comparison of Alternative Heat Dissipation Blowdown Impacts

Type of Cooling	Aquatic Impacts	Thermal Effects	Chemical Effects	Physical Effects	Suspended Solids Impacts
Natural Draft (2 Hyperbolic Towers)	No substantial detrimental impacts are expected based on Ecology III studies of Susquehanna Steam Electric Station (SSES) since operation began in 1983. The BBNPP diffuser is similar in design to that of SSES. SSES blowdown flow is on the order of 18 mgd (2 units) while BBNPP will be about 10 mgd. The cooling tower blowdown will meet state water quality standards and will therefore be expected to have no meaningful impact on the Susquehanna River aquatic community in the vicinity of BBNPP.	The BBNPP And SSES diffusers are separated by 380 feet and the combined effects of the two plumes is very small. In-river average monthly evaporation due to BBNPP will range from 0.02 to 0.06 mgd. The surface excess temperatures are < 0.8°F for August and < 0.3°F for January. Based on thermal plume modeling and SSES experience, the minimal temperature increase and small areal extent of the plume are predicted to have no significant impact. The potential for fish kills resulting from attraction of fish to the BBNPP plume are unlikely given that the existing SSES plume temperatures are typically less than 1°F above ambient temperature and no fish kills are known to have occurred as a result of the plume. The BBNPP consumptive use value takes into account in-river evaporations due to the blowdown discharge consistent with the Susquehanna Steam Electric Station's Permanent Water Monitoring Plan.	Concentrations in the BBNPP discharge as allowed by National Pollutant Discharge Elimination System (NPDES) permit issued by the Pennsylvania Department of Environmental Protection will be lower than concentrations that could harm aquatic organisms present in the Susquehanna River.	The BBNPP diffuser design is similar to the SSES design which has limited physical impacts due to turbulence and thermal block across the river. The physical impacts associated with BBNPP blowdown will be small.	➢ The BBNPP Raw Water System removes suspended solids in the water withdrawn from the river and the backwash effluent is sent to the Waste Water Retention Basin. Suspended solids in the cooling tower basin water will settle out to some extent. The cooling tower blowdown discharges to the Waste Water Retention Basin. This basin is designed to allow settling to occur. All settled material is disposed of on land. Taking this settling of suspended solids into consideration, the net impact from BBNPP operation is to reduce the suspended solids in the river. This is true for the full range of 3-5 cycles of concentration and the full range of anticipated evaporation losses in both the Raw Water System and the Circulating Water Supply System. ➢ The concentration of suspended solids in the blowdown water from the Waste Water Retention Basin is quickly dispersed based on the action of the diffuser jets. ➢ The low velocities at which water will be withdrawn from the river and returned to the river as blowdown will not cause any riverbed materials to be drawn into suspension. ➢ There is no negative impact from BBNPP operation on suspended solids in the Susquehanna River.
Rectangular Mechanical Draft (4Towers)	Comparable to Natural Draft	Comparable to Natural Draft	Comparable to Natural Draft	Comparable to Natural Draft	Comparable to Natural Draft
Round Mechanical Draft (4Towers)	Comparable to Natural Draft	Comparable to Natural Draft	Comparable to Natural Draft	Comparable to Natural Draft	Comparable to Natural Draft

Type of Cooling	Aquatic Impacts	Thermal Effects	Chemical Effects	Physical Effects	Suspended Solids Impacts
One Round Mechanical Draft (aka Fan-assisted Natural Draft)	Comparable to Natural Draft	Comparable to Natural Draft	Comparable to Natural Draft	Comparable to Natural Draft	Comparable to Natural Draft
Dry Cooling	Insignificant	Insignificant	Insignificant	Insignificant	No negative impact
Hybrid Cooling	Less than Natural Draft due to reduced blowdown flow rate	Less than Natural Draft due to reduced blowdown flow rate	Less than Natural Draft due to reduced blowdown flow rate	Less than Natural Draft due to reduced blowdown flow rate	Less than Natural Draft due to reduced blowdown flow rate

Enclosure 2

Preface

"Evaluation of Dry Air Cooling for the Bell Bend Nuclear Power Plant", Rev 0,
August 25, 2010

Preface to Evaluation of Dry Air Cooling for PPL Bell Bend Nuclear Power Plant

The attached study evaluates the use of dry air cooling for the Bell Bend Nuclear Power Plant (BBNPP) in place of the currently planned natural draft cooling towers. This evaluation was performed at the request of PPL and is specific to BBNPP. The values in this report are different but are generally comparable to the values used in the preceding Enclosure 1, Attachment C, Table 1. See below comparison. The cost-related values have the greatest difference due to the conceptual nature of the alternative heat dissipation design, as performed by two independent engineering firms. The same conclusions can be drawn from using either set of dry air cooling costs: That dry air cooling is not technically feasible or cost justifiable for the Bell Bend Project.

Type of Cooling	Footprint per Plant Unit (1,562 MWe)	Auxiliary Load Difference	Water Makeup	Noise	Annual O&M Cost Difference	Capital Cost
	Acres	MW	gpm	dBA @1 meter	10^3 USD	10^3 USD
Table 1 Dry Cooling	7-30	13-79	139	88	5,975	298,727
B & R BBNPP Dry Cooling	17	10-45	230-390	85	3,994	462,468

Evaluation of Dry Air Cooling for the Bell Bend Nuclear Power Plant

Final Report

August 25, 2010

Prepared By				8/24/10
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TABLE OF CONTENTS

Evaluation of Dry Air Cooling for PPL Bell Bend Nuclear Power Plant

1.0 Executive Summary

This study evaluates the use of dry air cooling for the Bell Bend Nuclear Power Plant (BBNPP) in place of the currently planned natural draft cooling towers, which take makeup water from the Susquehanna River. The study has been performed to assess whether dry air cooling would be more cost effective than the current wet cooling tower design when the value of water and costs associated with water replacement at low river flow are taken into account. The results of this analysis indicate that the costs for implementing dry air cooling are significant, amounting to a conservative net present value of $431 million in additional capital and operating costs, including the capital costs of offsite water storage for both cases.

The use of dry cooling will save approximately 6,300 million gallons of water per year (see Sections 2.2 and 5.3) expected to be lost by evaporation in the natural draft cooling towers. The Susquehanna River Basin Commission (SRBC) has indicated that a water fee of $0.28 per 1000 gal of water used is sufficient to mitigate the consumption of water from the river. An alternate analysis was performed in which the cost of offsite water storage is eliminated and replaced with an annual payment to SRBC based on the water used and the use fee escalated for future years. The results of this analysis show an increase in cost penalties for dry air cooling to $473 million

In addition to the financial considerations, the use of air cooled condensers poses some design uncertainties as this would be the largest single unit application worldwide and may be considered a First of a Kind for this reason. Many seemingly large plants that use air cooled condensers are combined cycle plants in which only about one third of the power comes from the steam turbine. Additionally, even the largest steam plant application, the 4000 MW Matimba plant in South Africa consists of multiple 660 MW steam turbine units.

Furthermore, the reduction in plant efficiency attributed to dry air cooling will result in the loss of net electric generation which will increase air pollution emissions from other fossil fired plants that will have to make up for the lost electric energy. Based on the above, the use of natural draft cooling towers is the recommended design approach from both a technical and financial perspective for BBNPP.

2.0 Background

2.1 Reason for Re-evaluation of Dry Air Cooling

The Bell Bend Nuclear Power Plant is based on the Areva EPR U.S. design, features two (2) natural draft cooling towers for the dissipation of waste heat from the steam turbine. The cooling tower design at Bell Bend was selected after comparing the cost effectiveness of many cooling tower designs. These included several sizes of natural draft towers as well as several sizes of round and rectangular mechanical draft tower designs. All of the cooling tower designs that were evaluated in detail are of the wet type, which rely on the evaporation of water as the primary means of heat dissipation. Dry air cooling was not considered in detailed evaluation because it is generally accepted that dry air cooling systems

are more costly to build and do not perform as well as wet designs, leading to less efficient power production.

As a result of its application for consumptive water use with the SRBC, PPL developed this analysis comparing wet cooling to dry air cooling for the Bell Bend Nuclear Power Plant to be complete and thorough in its need for and use of water for wet cooling. This study evaluates the feasibility and cost benefits of redesigning the current U.S. EPR plant at Bell Bend with a wet cooling water system (CWS) to a dry air cooling system (ACC).

2.2 Description of Current Cooling System Design

It is important to reiterate that BBNPP uses the EPR design, which is a standard design being shared among several proposed new plants in order to optimize engineering, procurement and licensing costs. The EPR cooling system design incorporates two natural draft cooling towers, each sized to cool 360,000 gallons per minute (gpm) of cooling water from an inlet temperature of 117.5° F to an outlet water temperature of 90° F when the ambient air is 73° F wet bulb temperature and 50% relative humidity. The warm water entering the tower is distributed by a header and sprayed in the tower by nozzles. The water droplets fall by gravity and form thin films on the cooling tower fill material. As the warm water contacts the cooler air in the tower, heat is transferred to the air by evaporation and convection. The transfer of heat and moisture to the air causes its density to decrease and the air rises. The hyperbolic shape of the concrete chimney above the tower fill area induces a natural draft which draws air through the tower.

Only a small portion of the water is evaporated, approximately 2% of the circulating water flow rate, and the bulk of the water is collected in the cooling tower basin below the tower. The EPR design uses a common basin for both towers. The basin drains to a concrete structure which houses four circulating water pumps. The four pumps feed a common header which supplies water to two 11 foot diameter concrete pipes. The pipes convey the water to the main condensers. A small portion of the flow, 10,000 gpm, is diverted to the Closed Cooling Water System which is used for cooling auxiliary equipment.

The main condenser consists of three separate shells which are connected in series with respect to the cooling water flow. The steam turbine has three double flow low pressure (LP) sections, each exhausting into one of the condenser shells. The pressure in a condenser is determined by the temperature at which the steam condenses. Colder water temperature entering a condenser will produce a lower condensing temperature and hence a lower condensing pressure. A lower condensing pressure allows the steam to expand further in the steam turbine producing additional power.

Since the three condenser shells are connected in series, the water temperature entering each section is higher than the previous one resulting in different condensing pressures for each section. Because the performance of a steam turbine is not linear with respect to exhaust pressure, it has been found that this multi-pressure arrangement provides a slight improvement in output as compared to a single pressure arrangement. This is standard industry practice.

The water flow exiting the last condenser shell is routed back to the cooling towers via another two 11 foot diameter concrete pipes, completing the water circuit. This is considered to be a closed cooling water system but it is not completely closed because some of the water is lost to evaporation in the cooling tower. It is planned to draw water from the Susquehanna River to replace the water lost to evaporation and for blowdown, which is returned to the river. The river water, like all natural water bodies, has certain minerals dissolved in it. When water evaporates in the cooling tower, those minerals are left in the remaining water. Over time, the concentration of those minerals in the circulating water will increase until it reaches a point where the water can no longer absorb them and they would begin to

deposit on the equipment causing fouling and corrosion. To avoid this, a small portion of water is constantly drawn from the cooling tower basin and released to a retention pond, which eventually drains back to the river. This flow, commonly called blowdown, will be designed to be about 50% of the amount of water flow lost to evaporation. This will assure that the concentration of minerals in the circulating water does not exceed three times the normal level in the water. The total water drawn from the river will be 1.5 times the evaporation rate but the excess is returned to the river as blowdown.

At the design point of the cooling system, which is at the peak summer wet bulb temperature of 73° F, the makeup water flow rate is estimated to be 23,800 gpm (34.3 million gallons per day (MGD) of which 7900 gpm (11.4 MDG) is returned to the river as blowdown[1]. In the warmer weather most of the heat transferred to the air is by evaporation but in cooler weather, the portion of heat transferred by convection increases and so there is less evaporation. On the average, the makeup water flow rate is about 18,000 gpm (25.9 MGD) with 6,000 gpm (8.6 MGD) being returned as blowdown. The difference between these two values, 12,000 gpm (17.3 MGD), is referred to as consumptive use for the two main cooling towers. Plant consumptive use by the Raw Water Supply System is not changed by this evaluation.

2.3 Differences between Dry Air Cooling and Current Design

There are fundamental differences in the method in which heat is transferred to the air between dry air cooling and wet cooling towers. In the current design, which uses natural draft cooling towers, most of the heat is transferred to the air by evaporating water. The evaporation process takes place at a constant temperature and so a great deal of heat is transferred to the air without raising the air temperature. Of course, there is some increase in the temperature of the air as a portion of the heat is transferred by convection as well. With dry air cooling, all of the heat is transferred to the air by convection resulting in a much larger temperature increase in the airflow. Higher increases in the air temperature rise translate into higher condensing temperatures. As stated previously, the electric output of the steam turbine generally decreases with higher condensing pressures that result from higher condensing temperatures.

One way to compensate for this is to use greater air flow rates with dry cooling. This, however, results in much larger units consuming more auxiliary power to run fans that move the air. Another way is to use a direct air cooled condenser. In the current design, heat is transferred from the condensing steam to the circulating water in the condenser. That heat is then transferred from the circulating water to the air by intimate contact in the cooling tower. With a direct air cooled condenser, the intermediate circulating water system is eliminated and the steam condenses directly in the air cooled condenser. This is possible because without evaporation, there is no need for intimate contact of the water with the air.

Because of this advantage, the direct air cooled condenser was selected as the preferred design for dry air cooling. The direct air cooled condenser is the technology that is currently being used for power applications requiring dry air cooling. An example of this in a similar region of the country is the 600 MW combined cycle plant in Linden, New Jersey, which includes three nominal 90 MW steam turbines. The direct air cooled condenser will still require an airflow rate of about 6 times greater than the proposed BBNPP natural draft cooling tower and will have a significant auxiliary electric power load associated with the fan power. In addition, the condenser pressure, particularly in the warm weather will be significantly higher, resulting in a reduction in electric generator output.

[1] UniStar Nuclear Report, "Engineering and Economic Evaluation of the Integrated Heat Rejections Cycle", February, 2008

There is another inherent disadvantage of the air cooled condenser that limits its effectiveness in colder weather. With the current cooling system design, the surface condenser sits directly below the LP turbine sections and there is virtually no pressure drop from the turbine exhaust to the condenser. The air cooled condenser, by virtue of its size, must be located at a distance from the turbine exhaust, causing a higher pressure drop than the current cooling system. This is further exacerbated by the fact that there will be six separate condensers connecting to each turbine exhaust end. A large steam duct (25 feet in diameter) is required to transfer the steam from each turbine exhaust to the air cooled condenser which will impose a pressure drop. In addition, the steam is condensed in the condenser tubes, which imposes an additional pressure drop, unlike the current design in which the steam condenses on the surface of the tubes. At the design point, which will give a turbine backpressure of 5 inches of mercury (in Hg), the total pressure drop in the steam duct and condenser tubes is estimated to be about 0.3 in Hg. At a turbine backpressure of 2 in Hg, the pressure drop doubles due to the increased specific volume of the steam and at 1 in Hg the pressure drop is about 1 in Hg. Effectively, regardless of the actual pressure in the air cooled condenser, the turbine exhaust will never see a pressure lower than about 2 in Hg. This limits the plants ability to take advantage of low ambient temperatures as is available in the current design, which permits higher generation output at lower ambient temperatures.

3.0 Design Basis of the Dry Air Cooling System

At the outset, it is important to note that much engineering for the EPR cooling system design is well in progress and that changing to air cooled condensers would require a major balance-of-plant redesign, which would significantly affect the current plant configuration. Not only the cooling system but even the steam turbine itself as, currently designed, is not optimized for use with an air cooled condenser. Changing the steam turbine design, even modestly, would be enough to challenge the concept of a standard fleet EPR design causing significant delays and increase in cost. For the purpose of this study, it is assumed that the current steam turbine design is maintained and the air cooled condenser is designed within those constraints. Although this may not be optimal from the standpoint of the air condenser design, it will represent a reasonable design and may be a necessary constraint to keep enough parameters within the framework of the EPR design.

The major steam turbine constraint relates to the maximum turbine backpressure, which is limited to 5 in Hg. Typically, steam turbines designed for use with air cooled condensers are special high backpressure units that allow operation at higher than 5 in Hg. For this analysis, an air cooled condenser was specified to provide a backpressure of 5 in Hg at the turbine exhaust when the ambient dry bulb temperature is 90°F. GEA Power Cooling Systems, a world renowned and major provider of air cooled condensers, has provided a budget cost quotation and performance curves for an air cooled condenser to meet the needs of BBNPP. A unit designed for a higher backpressure would cost less but would have greater performance penalties.

A small mechanical draft wet cooling tower would also be installed to provide 10,000 gpm of cooling water for the Closed Cooling Water System. While it is possible to use air cooling for the auxiliaries as well, this would impose significant changes to the EPR design and the savings in water use would be minimal.

3.1 Design Changes for Using Air Cooled Condensers

Two cost estimates have been prepared in order to assess the capital cost increase for a U.S. EPR using air cooled condensers. One includes the capital costs that will be removed from the current design to account for equipment that will not be required. These include the natural draft cooling towers, the cooling tower basins, the circulating water pumps, the circulating water pump-house, the circulating water

piping and the main steam condensers. In addition, the costs for providing power to the circulating water system are also estimated. The costs include equipment and installation costs but not full engineering costs, much of which have already been spent. The second cost estimate is for the use of an air cooled condenser. It includes the air cooled condensers, piping, ductwork, foundations, installation, power and control to the fans, the auxiliary cooling tower, circulating water pumps and piping. Additional electrical costs associated with larger auxiliary transformers are also evaluated. This represents a major change in the auxiliary electrical system. The current system includes service to (4) circulating water pumps with a nameplate rating of 9600 HP each. The dry air cooled option includes 192 fans with a nameplate rating of 250 HP each plus two additional fans for the auxiliary cooling tower and its circulating water pumps.

These costs include a factor for engineering and, in some cases, re-engineering existing designs. Estimates for licensing and permitting cost are also included. No additional cost for land use is included as explained in Section 5.2.

In addition to these direct plant items, an offsite water storage facility is required to mitigate water use during times of low water flow rate in the Susquehanna River. The Susquehanna River Basin Commission (SRBC) requires the plant to store a quantity of water equal to 90 days of water usage at the maximum consumption rate. For the current U.S. EPR design at Bell Bend, the maximum daily water consumption rate is 31 MGD[2]. Of this, about 25 MGD is attributed to evaporative losses from the cooling towers with the balance (6 MGD) for other plant water uses. With the air cooled condenser design, the storage requirement is reduced to about 6.3 MGD to account for the other plant water uses, which remain the same plus about 0.3 MGD for the auxiliary cooling tower.

3.2 Commercial Experience with Large Air Cooled Condensers

Direct air cooled condensers are in use in many power plants throughout the world. Most applications are much smaller than what is required for BBNPP. Many seemingly large plants that use air cooled condensers are combined cycle plants in which only about one third of the power comes from the steam turbine. Additionally, even the largest steam plant application, the 4000 MW Matimba plant in South Africa consists of multiple 660 MW steam turbine units. An air cooled condenser for the Bell Bend plant would be the largest single unit application in the world by a factor of about three. This is important because the larger the air cooled condenser is, the further the steam has to be piped to get to the far ends of the condenser. This poses logistics and plant configuration problems and will lead to higher piping system pressure increases and increased penalties for electrical generation output. With multiple units, such as in the Matimba plant, the air cooled condensers can be located closer to each of the steam turbines, minimizing the piping losses.

4.0 Comparative Capital Cost Estimates for Dry Air Cooling vs. Current Design

A pre-conceptual cost estimate was developed to identify the potential impact of changing from a closed cycle cooling water system for the Bell Bend Nuclear Plant, incorporating two natural draft cooling towers, with makeup water provided by the Susquehanna River, to an air cooled condenser, minimizing the use of makeup water from the River.

[2] Bell Bend Nuclear power Plant, Application for Consumptive Water Use to the Susquehanna River Basin Commission, May 2009

A budgetary estimate was provided by GEA, an internationally recognized provider of air cooled condensers. The costs for the two natural draft cooling towers were based on budgetary costs provided by UniStar[1]. The remainder of the costs for equipment and construction were developed by Burns and Roe from standard industry available information, as well as proprietary information from its nuclear plant cost data base. Commodity pricing is based upon the Burns and Roe in-house data base.

A positive contingency factor of 30% was allocated to the ACC option. This level of contingency is based on guidance provided by the U.S. Department of Energy in its cost estimating guide[3] for Class 4 and 5 estimates

Class 5 estimates are prepared for any number of strategic business planning purposes, such as but not limited to market studies, assessment of initial viability, evaluation of alternate schemes, project screening, project location studies, evaluation of resource needs and budgeting, long range capital planning, etc. Accuracy for Class 5 estimates ranges from 30% to 100% on the high side.

Class 4 estimates are prepared for a number of purposes, such as but not limited to, detailed strategic planning, business development, project screening at more developed stages, alternative scheme analysis, confirmation of economic and/or technical feasibility, and preliminary budget approval or approval to proceed to next stage. Accuracy for Class 4 estimates range from 20% to 50% on the high side.

Based upon the above descriptions, the limited amount of information available for the ACC for BBNPP, and the significant scale up of the technology, the positive contingency value was set at low end of the Class 5 estimate range, or 30%, which is in the mid-range of a Class 4 estimate.

A positive contingency factor of 15% was allocated to the current design. This level of contingency is based on guidance provided by the U.S. Department of Energy in its cost estimating guides for a class 3 estimate.

Class 3 estimates are generally prepared to form the basis for budget authorization, appropriation, and/or funding. As such, they typically form the initial control estimate against which all actual costs and resources will be monitored. Typically, engineering is from 10% to 40% complete, and would comprise at a minimum the following: process flow diagrams, utility flow diagrams, preliminary piping and instrument diagrams, plot plan, developed layout drawings, and essentially complete engineered process and utility equipment lists. Estimate accuracies for Class 3 estimates range from 10% to 30% on the high side.

The 15% contingency factor was selected since the reactor plant planned for the Bell Bend site is at least in the preliminary design stage, is not a significant scale up of earlier plant designs and is similar to plants, of the same size, currently being designed and constructed in the United States and around the world.

Engineering costs for the ACC were assumed to be 10% of the estimated capital cost of the ACC. Remaining engineering costs for the CWS were estimated at 5% of the estimated capital cost, taking credit for the design effort completed to date.

In addition to the design changes in the plant, the use of an ACC will reduce the size of the offsite water storage required by the SRBC to mitigate water use during periods of low river water flow. The cost for makeup water storage is currently under evaluation. Two methods are being considered, expansion of existing lakes and storage in abandoned mines. The latter method is expected to be the least expensive

[3] DOE 430.1-1X., Cost Estimating Guide for Program and Project Management", April 2004.

alternative but cost estimates for the mine storage method are not yet completed. For the purpose of this evaluation, lake storage will be considered for both designs. The least expensive lake storage option is estimated to cost $105 million for a nominal 30 MGD capacity. An expansion of the same lake for a smaller capacity (10 MGD) is estimated to cost $60 million. Using the same cost scaling factor to go from 30 MGD to 10 MGD, a lake expansion for 6.3 MGD is estimated to be $48 million.

The results of the cost estimating effort are included in Table 1.

TABLE 1

Summary Comparison of Capital Costs of Existing Circulating Water System and an Air Cooled Condenser System

	Existing Circulating Water System	Air Cooled Condenser System
Capital Cost Elements		
Civil	$58,312,112	$27,058,885
Mechanical	$132,428,501	$204,542,370
Electrical	$845,434	$29,473,913
Subtotal	$191,586,047	$261,075,168
Other		
Contractor Indirects	$18,013,693	$39,528,696
Contractor Fee	$20,959,975	$30,060,386
Engineering	$9,579,302	$19,580,640
Licensing	$1,000,000	$2,000,000
Permitting	$3,000,000	$1,500,000
Procurement	$0	$2,000,000
Subtotal	$52,552,970	$94,669,722
Contingency	$36,620,852	$106,723,200
Total Onsite Costs	$280,759,869	$462,468,090
Offsite Water Storage	$105,000,000	$48,000,000
Total Onsite Plus Offsite Costs	$385,760 000	$510,470,000
Capital Cost Difference for ACC system versus existing CWS for the Bell Bend Nuclear Plant		$124,710,000

Note the Contractor Indirects are noticeably higher for the air cooled condenser because the GEA quotation did not include installation, whereas installation was included n the cooling tower cost.

5.0 Impacts of Dry Air Cooling System vs. Current Design

5.1 Performance Penalties for ACC

The air cooled condenser selected for analysis in this study will deliver a turbine backpressure of 5 in Hg when the ambient temperature is 90° F and the turbine is operating at full load. The current cooling system design with the natural draft tower will deliver a backpressure of about 3 in Hg at the same conditions. According to the steam turbine backpressure correction curves presented in the Cooling Tower Study[4], the output penalty for the 5 in Hg case is -2.09% versus a penalty of -0.45% for the 3 inches of Mercury (in Hg) case. These are unusually low penalties. Typically for other steam turbines, the output penalty for a backpressure of 5 in Hg is around 6% or 7% as compared to a base pressure of 2.5 in Hg. It can be lower if the exhaust end is heavily loaded, although a higher penalty than 2%, even for a heavily loaded back end would be expected. Nonetheless, these low backpressure penalties are used in this evaluation, which are conservative and favor the dry air cooling option.

The other penalty for the air cooled condenser stems from the auxiliary power used to run the fans. The GEA proposal indicates that the ACC has 192 cells, each with a fan driven by a 250 hp motor. The operating load for these fans is estimated to be 34,740 kW. A portion of this load is offset by the circulating water pumps, which are no longer required. The operating load for these four pumps is estimated to be 21,600 kW. The air cooled option will also have an additional electric load of about 450 kW for the auxiliary cooling tower and pumps.

At other times of the year, when the ambient conditions are cooler, both cooling systems will perform better and the penalties will be less. In cold weather, both systems are oversized and will probably be operated at reduced capacity to conserve auxiliary power. The only way to reduce the capacity of the natural draft cooling tower would be to turn off one of the four circulating water pumps. The steam turbine backpressure correction curve suggests that there is little to no advantage to operate with a turbine backpressure below 1.5 in Hg. In fact, the net output will increase by saving the auxiliary power of the pump.

For the air cooled condenser, as stated previously, the backpressure at the turbine exhaust will never be below about 2 in Hg, regardless of how low the pressure is in the condenser due to piping losses. In the cold weather, some fans can be turned off to save auxiliary power without affecting the steam turbine performance. The cooling tower vendor has not provided performance estimates with reduced water flow nor has the air cooled condenser vendor provided performance estimates with some fans off. Some approximate estimates have been incorporated in the performance analysis to simulate these conditions.

5.2 Changes in Land Use

Based on preliminary information provided by GEA, the land area required for the air cooled condensers is about 10 acres which is smaller in size than the land area used by the natural draft cooling towers, about 15 acres. It should be noted that GEA has indicated that greater spacing may be needed among the units to minimize recirculation of air flow. For these reasons, the land use for the ACC units is considered to be similar to the space allocated for the natural draft cooling towers.

The location of the area used for the cooling towers, however, is not optimally located for the air condensers, being about 1000 feet away from the turbine exhausts. The air cooled condenser will require

[4] "Engineering and Economic Evaluation of the Integrated Heat Rejection Cycle, Rev 1, April 18, 2008 " by Sargent & Lundy for Unistar

the above ground routing of 6 steam ducts, each 25 feet in diameter, from the turbine exhausts to the air condenser array. The routing of the steam ducts will take up about 7 acres of land, assuming a 50 foot path for each duct. This will require extensive re-design of the plant layout in that area between the turbine exhausts and the air cooled condensers. The actual routing of the steam ducts and the relocation of equipment in their paths has not been laid out for this study effort. When that is done, it is likely that the overall land use for the dry cooling design will increase.

5.3 Reduction in Water Use

On the average with the current wet cooling design, the Bell Bend Plant will consume a net of about 12,000 gpm of water (17.3 MGD) from the Susquehanna River to make up for evaporation losses An additional 6,000 gpm (8.6 MGD) will be drawn from the river but will be returned as blowdown.

While the air cooled condensers have no evaporation losses themselves, their use requires the addition of a small mechanical draft cooling tower to provide for auxiliary cooling loads. The evaporation losses for the auxiliary tower will average around 180 gpm (0.3 MGD). The average blowdown flow will be 60 gpm (0.1 MGD). The use of dry cooling will save approximately 17.1 MDG of water consumption or 6,300 million gallons per year.

During periods of low water flow in the Susquehanna River, the plant may be required to curtail water use for a period of up to 90 days. In order to continue operation during this period, makeup water will either be supplied from onsite storage or else offsite storage will be added to the river flow to compensate for the water removed at the plant. The use of air cooled condensers would greatly reduce the required size of the water storage.

6.0 Economic Comparison of Dry Air Cooling vs. Current Design

It is evident from the capital cost analysis and the performance comparison that the use of air cooled condensers will increase capital costs and maintenance costs and reduce net plant output. All of these components translate to increased costs. The purpose of this economic evaluation is to quantify the magnitude of the cost increases associated with dry air cooling.

The major cost impact (in terms of decreased generation and associated revenue) is the reduced net electric output resulting from high turbine back pressures and higher auxiliary power loads. In order to assess this cost, the performance of the plant is estimated for the current design and the air cooled condenser case on an annual basis. The performance estimates are made for each month of the year using average monthly weather data. This approach has a tendency to underestimate the negative impacts of the air cooled condensers. The reason for this is that the output penalties increase greatly at higher temperatures in a non-linear fashion, so using the average temperature underestimates the penalties. However, for the purpose of this evaluation, the average method is used to simplify the estimating process. It should be noted that this method is conservative and favors the ACC design. In order to understand the penalties for ACC at the higher temperatures, a few hours of performance are shown at the peak summer conditions. The results are shown on Table 2. The annual performance summary is shown on Table 3.

COMPARISON OF NET PLANT OUTPUT WITH COOLING SYSTEM DESIGNS

TABLE 2

	Wet Bulb Temp deg F	Relative Humidity %	Performance with Natural Draft Cooling System					
			CT Water Temp deg F	Cond. Press in Hg	Kilowatt Change* %	Generator Output kW	Cooling System kW	Net** Output kW
Jan	24.1	70.9	51.20	1.19	0.57%	1,773,022	14,309	1,758,713
Feb	25.6	67.9	53.40	1.27	0.56%	1,772,798	14,307	1,758,491
Mar	32.3	64.7	59.70	1.52	0.49%	1,771,624	14,301	1,757,323
Apr	42.3	61.4	68.30	1.95	0.30%	1,768,229	14,289	1,753,939
May	52.0	64.3	73.41	1.91	0.34%	1,768,971	19,036	1,749,935
June	60.5	69.5	79.39	2.27	0.13%	1,765,237	19,020	1,746,217
July	64.5	70.4	82.79	2.50	-0.04%	1,762,380	19,010	1,743,370
Aug	63.5	72.7	81.89	2.44	0.01%	1,763,193	19,013	1,744,180
Sept	57.2	74.4	76.32	2.08	0.25%	1,767,364	19,029	1,748,335
Oct	46.7	71.6	70.00	2.04	0.24%	1,767,304	14,287	1,753,017
Nov	37.6	70.9	62.50	1.65	0.44%	1,770,747	14,298	1,756,449
Dec	27.9	71.6	54.10	1.29	0.55%	1,772,710	14,307	1,758,403
Peak	73.1	44.0	89.63	3.03	-0.45%	1,755,133	18,988	1,736,144

	Dry Bulb Temp deg F	Performance with Air Cooled Condenser						
		Cond. Press in Hg	Exhaust Press in Hg	Kilowatt Change* %	Generator Output kW	Cooling System kW	Net** Output kW	Output Diff.*** kW
Jan	26.8	1.07	2.00	0.35%	1,769,171	19,786	1,749,384	-9,329
Feb	28.7	1.07	2.00	0.35%	1,769,171	20,442	1,748,729	-9,762
Mar	36.4	1.07	2.00	0.35%	1,769,171	25,030	1,744,140	-13,183
Apr	48.2	1.07	2.00	0.35%	1,769,171	35,845	1,733,325	-20,614
May	58.7	1.53	2.29	0.16%	1,765,807	35,190	1,730,617	-19,318
June	66.9	2.13	2.74	-0.18%	1,759,838	35,190	1,724,648	-21,569
July	71.2	2.50	3.03	-0.42%	1,755,678	35,190	1,720,488	-22,882
Aug	69.5	2.35	2.91	-0.31%	1,757,455	35,190	1,722,265	-21,915
Sept	62.2	1.77	2.46	0.03%	1,763,523	35,190	1,728,333	-20,003
Oct	51.3	1.07	2.00	0.35%	1,769,171	35,190	1,733,981	-19,037
Nov	41.4	1.07	2.00	0.35%	1,769,171	28,734	1,740,437	-16,012
Dec	30.8	1.07	2.00	0.35%	1,769,171	21,622	1,747,549	-10,854
Peak	90.5	4.65	4.97	-2.09%	1,726,201	35,190	1,691,011	-45,133

Assumptions and Notes

Expected Generator Output at 2.5 in Hg	1,763,000	kW
Air Condenser Fan Load - kW	34,740	kW
Auxiliary Cooling Tower Fans and Pumps	450	kW
Total Cooling System Load	35,190	kW

* Kilowatt Change is referenced to 2.5 in Hg

** Net Output is Gross output less Cooling Load

*** Output Diff. is from current design with natural draft cooling towers

TABLE 3

ANNUAL PERFORMANCE AND WATER COMSUMPTION COMPARISON

Month	Days Per Month	Capacity Factor %	Average Penalty kW	Electric Energy MWh	Makeup Water			
					CWS gpm	ACC gpm	CWS 1000 gal	ACC 1000 gal
January	31	91%	-9,329	-6,316	15,000	230	609,336	9,343
February	28	91%	-9,762	-5,970	15,600	230	572,383	8,439
March	31	91%	-13,183	-8,925	18,200	270	739,328	10,968
April	30	91%	-20,614	-13,506	20,100	300	790,171	11,794
May	31	91%	-19,318	-13,079	21,800	330	885,568	13,405
June	30	91%	-21,569	-14,132	23,000	350	904,176	13,759
July	30	91%	-22,882	-14,992	23,300	350	915,970	13,759
August	31	91%	-21,915	-14,837	23,000	350	934,315	14,218
September	30	91%	-20,003	-13,106	22,100	330	868,795	12,973
October	31	91%	-19,037	-12,889	20,600	310	836,821	12,593
November	30	91%	-16,012	-10,491	18,900	280	742,997	11,007
December	31	91%	-10,854	-7,349	17,300	260	702,768	10,562
Peak	1	100%	-45,133	-1,083	26,100	390	37,584	562
Annual	365.0	20.0		-136,676	18,151	273	9,540,212	143,382

The annual loss in net electric output for the air cooled condenser case has a value associated with it. This incremental electric energy could otherwise be sold on the market at marginal rates or displace purchases made at the marginal rates. PP&L is a winter peaking utility and has excess capacity in the summer months so it is likely that most of this lost energy will represent loss of marginal sales. PP&L has provided estimates of marginal electricity prices for the year 2019 when the plant is expected to be in full operation. The electricity is evaluated at that price and escalated for future years. All economic values including electricity rates, interest rates and escalation rates are included in Table 4.

TABLE 4

ASSUMPTIONS

Excess Electricity Sales Price (2019$)	$90/MWh
Electric Escalation Rate (beyond 2019)	2.5%
Economic Life of Project	40 years
Property Taxes	0.025%
Insurance Rate for Capital Costs	0.05%
Capital Cost Escalation Rate	3.0%
Interest During Construction	6.0%
Present Worth Discount Factor	7.0%

The evaluation also includes differences in annual maintenance costs. The major component of the difference in maintenance costs is the servicing and maintenance of the cooling tower fans, motors and speed reducers. A value of $5,000 per fan per year was used for this value in the Cooling Tower Study based on a recommendation from the cooling tower vendor. The fans used in the air cooled condensers are similar to those used in mechanical draft wet cooling towers so that value is also used in this study. There are 192 fans in the air cooled condenser plus two additional fans in the auxiliary tower for a total of 194 fans and an annual cost of $970,000. For the current design with natural draft cooling towers, the only mechanical components are the four circulating water pumps. These are large slow speed devices that require very little maintenance and so these costs are neglected.

The current design uses chemicals to control bacterial growth, pH and inhibit corrosion in the circulation water loop. These chemical costs are estimated to be $100,000 per year.[5]

The net increase in annual operating and maintenance costs for the dry air cooled option is $870,000 at today's cost levels. These costs are escalated for future years.

In addition, the increase in capital costs also carries increases in annual property taxes and insurance. The rates for additional taxes and insurance are also shown in Table 4.

The economic evaluation computes year by year costs for marginal electricity sales along with other operating and maintenance cost differences. The evaluation is projected over a period of forty years. The present value of the forty years of operating expenses is calculated.

The capital cost estimates are based on today's cost levels. In order to bring these costs up to the date of commercial operation, they are escalated to a time of 3 years before commercial operation and then 3 years of interest during construction is added to the escalated cost. The present worth of the annual operating costs is added to the total capital cost at the commercial operation date to produce the total net present value of the increase associated with dry air cooling.

The Net Present Value of Operating Costs, $253,850,000, is the present value, in 2019 dollars, of the additional operating costs including the value of lost electricity sales. The Total Net Present Value of Dry Air Cooling Costs of $431,200,000 includes the capital cost at the commercial operation date of $177,360,000 to the Present Value of Operating Costs.

[5] Estimate is based on input from Burns &Roe in-house water treatment subject matter expert

An alternate economic evaluation was also performed in which the offsite water storage capital costs are not included but are replaced by an annual Consumptive Use Mitigation Fee as specified in the SRBC Regulatory Program Fee Schedule published in January, 2010. This fee is currently $0.28 per 1000 gallons of water consumed. Although there is no mechanism in the fee schedule for escalating the mitigation fee, it is assumed that the fee will be adjusted periodically to reflect inflation. An escalation rate of 2.5% per year has been included in the analysis for future price projections.

The Net Present Value of the annual Operating Costs decrease as compared to the base evaluation, to $214,700,000 but the Total Net Present Value increases to $473,100,000 due to the increase in capital cost difference.

7.0 Summary and Conclusions

The study has examined the technical and economic feasibility of replacing the currently planned and in design wet cooling system for the Bell Bend Nuclear Power Plant with a dry air cooled condenser. As a result of its application for consumptive water use with the SRBC, PPL pursued this analysis to be complete and thorough in its need for and use of water for wet cooling. This study clearly shows that there is a significant cost increase to change to a direct air cooled design, even including the expected costs of mitigation under both the air cooled design and the wet cooling design. The air cooled design is not cost effective and may not be technically feasible because it represents a first of a kind in this size for a single steam turbine unit.

This study has evaluated installing a direct air cooled condenser in place of the natural draft cooling towers and other supporting portions of the circulating water system. A conceptual bill of materials has been prepared for the air cooled condenser system and its impacts on capital cost and performance have been estimated. While the design may be feasible from a technical point, the size of the ACC is three times larger than any unit ever constructed for a single steam turbine unit, which creates many uncertainties.

The cost penalties for changing the cooling system design to Air Cooled Condensers are high, including both capital and operating.

The capital cost increases for changing the design to an air cooled condenser, including water mitigation costs, are estimated to be almost $124.7 million in today's costs requiring an investment of $177 million to account for escalation and interest during construction at the commercial operation date. Over 40 years of operation, the net present value of increased operating and maintenance costs plus electricity cost penalties amount to over $253.8 million. The total net present value of the capital and operating cost increases is calculated to be $431 million in 2019 dollars.

On an annual basis, the use of air cooled condensers will save about a net of 6,300, million gallons of water from the river. The Susquehanna River Basin Commission has proposed that a water fee of $0.28 per 1000 gal is sufficient to mitigate the use of water from the river. An alternate economic evaluation was prepared using the SRBC water fee as an annual operating expense and eliminating the offsite water storage. This evaluation shows an even greater cost penalty for dry cooling of $473 million, $42 million greater than the base case with offsite water storage. Clearly, the use of dry cooling cannot be justified on an economic basis, even considering the value of the water saved.

In addition, there are other considerations that reduce the attractiveness of installing air cooled condensers as follows:

- Although there are many applications of dry air cooled condensers throughout the world, this would be the largest unit by far, servicing a single steam turbine. This is significant because it is one of the few cases in which a larger design is more challenging than a smaller one. The larger the steam flow rate, the further it has to travel to reach the far ends of the condenser. This unit will require 6 steam ducts, each 25 feet in diameter, from the turbine exhaust to the air condenser.
- The loss of net electric generation will have to be replaced by electricity from other generating plants, mainly fossil fired units. The benefit of emissions free generation will be lost for the replacement electricity.
- The use of an air cooled condenser will impose significant changes to the EPR design and would impact plant licensing costs and schedule. In fact, the changes would most probably be large enough to endanger the EPR fleet concept, potentially resulting in even greater costs for BBNPP than what are reflected in this analysis.

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March 4, 2011

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BELL BEND NUCLEAR POWER PLANT
SIR #27486, SPECIES IMPACT REVIEW
FRESHWATER MUSSEL SURVEY
BNP-2011-049 Docket No. 52-039

References: 1) PAFBC-2010-283, Christopher Urban, PFBC, to Bradley Wise, "Species Impact Review (SIR) – Rare, Candidate, Threatened and Endangered Species, Update to SIR 27486", October 14, 2010

PPL Bell Bend, LLC is providing herein a response to the Commission's correspondence of October 14, 2010 (Reference 1).

In response to your telephone request of February 14, we have enclosed the "Mussel Survey in the Susquehanna River in the Vicinity of the Proposed Bell Bend Nuclear Power Plant Site, Luzerne County, Pennsylvania" prepared by Normandeau Associates. While the survey was performed in October 2007, the report was revised to incorporate a figure change resulting from the Bell Bend Nuclear Power Plant (BBNPP) Plot Plan Change, hence its July 2010 revision date.

Should you have any questions or require additional information, please don't hesitate to contact Brad Wise of my staff at (610) 774-6508 or bawise@pplweb.com.

Respectfully,

Terry L. Harpster

TLH/kw

Enclosure: Mussel Survey in the Susquehanna River in the Vicinity of the at the Proposed Bell Bend Nuclear Power Plant Site, Luzerne County, Pennsylvania, Rev. 2, July 2010.

cc: (w/ Enclosure)

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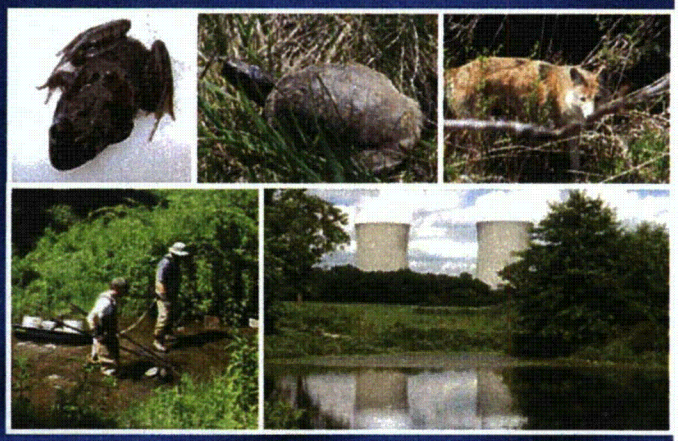
Enclosure

Mussel Survey in the Susquehanna River in the Vicinity of the at the Proposed Bell Bend Nuclear Power Plant Site, Luzerne County, Pennsylvania, Rev. 2, July 2010

Final

Mussel Survey in the Susquehanna River in the Vicinity of the Proposed Bell Bend Nuclear Power Plant Site, Luzerne County, Pennsylvania



Submitted to:
AREVA NP, Inc.
Marlborough, MA

Rev. 2
July 2010

NORMANDEAU ASSOCIATES
ENVIRONMENTAL CONSULTANTS

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

RECORD OF REVISIONS

Revision	Date	Pages/Sections Changed	Brief Description
000	October 2008	All	Initial release
001	June 2010	All	Added report title to header and revision number to footer
001	June 2010	Figure 1	Deleted
001	June 2010	Figure 2	Changed figure number to 1 and removed OCA boundary
002	July 2010	Figure 1	Record of Revisions modified to indicate that the location of BBNPP was moved in Rev 1 as part of the Plot Plan Change Project to reflect the new location

INTRODUCTION

Bell Bend Nuclear Power Plant (BBNPP) is proposed to be sited adjacent to the Susquehanna Steam Electric Station (SSES) in Salem Township, Luzerne County, Pennsylvania (Figure 1). As part of the environmental siting studies, Normandeau Associates, Inc. was contracted by AREVA NP, Inc. to assess the mussel community of the Susquehanna River in the vicinity of the proposed BBNPP intake and discharge structures. At the time of the survey, the exact locations of the proposed intake/discharge structures were unknown, thus sampling effort focused on the approximate locations, which are in the vicinity of the SSES intake and discharge structures.

Several mussel species of interest to the Pennsylvania Fish and Boat Commission (PFBC) are known from the Susquehanna River less than 10 miles downstream of the proposed BBNPP site. Therefore, this survey focused on determining the community composition of mussels inhabiting the Susquehanna River in the general vicinity of the expected location of the proposed intake and discharge structures.

METHODS

Two Normandeau staff members experienced with performing river mussel surveys (William S. Ettinger and Michael K. Mettler) performed this qualitative mussel survey on October 1 and 2, 2007. The site was evaluated by wading and viewing the river bottom with and without the aid of a transparent-bottomed bucket. Therefore, only wadeable sections of the river were surveyed. The survey entailed visually searching the river bottom with some disturbance of substrate materials by hand. No systematic excavation of substrate materials for the purpose of uncovering buried mussels was performed. The survey focused on areas of substrate that would most likely be inhabited by mussels, including sand, gravel, and cobble, although all substrate types including silt, boulders, and bedrock were surveyed.

Five locations within the Susquehanna River were surveyed (Figure 1). Station 1 was located along the east shoreline of the River at Bell Bend, which is approximately 0.6 miles downriver from the existing SSES intake. Station 2 was located along the east shoreline, across from the SSES intake. Station 3 was located along the river shoreline on the opposite (east) side of the river at the confluence of Little Wapwallopen Creek, and approximately 0.3 miles upstream of the SSES intake. Station 4 was located at the downstream end of the island, approximately 1.1 miles upstream of the SSES intake and Station 5 was located along the west shoreline, approximately 0.4 miles upriver of the SSES intake.

All observed mussels were identified to species and subsequently returned to the approximate location of collection. Weather conditions were good with low flows (discharge = 1,780 cubic feet per second at the USGS gage at Danville on October 2) and clear water yielding high visibility.

RESULTS

Live individuals of five species of mussels were observed during the 2-day effort (Table 1). No mussels were observed at Station 4. However, all five species were collected, for the most part, from each of the other four stations. With exception of the eastern elliptio, dozens of individuals of each species were collected. None of the collected species is listed as Threatened or Endangered by the commonwealth of Pennsylvania or the Federal government. However, the Pennsylvania Fish and Boat Commission considers the yellow lampmussel (*Lampsilis cariosa*) to be a species of special concern.

The yellow lampmussel (*Lampsilis cariosa*) is a medium-sized mussel attaining a maximum length of 125 mm. It commonly inhabits medium and large rivers, but is known from lakes and ponds in the northern part of its range. Distribution ranges from Novia Scotia south to Georgia and west to West Virginia. This species occurs in the Susquehanna and Delaware River drainages in Pennsylvania and its populations are

considered to be vulnerable to relatively stable by the Pennsylvania Natural Heritage Program (PNHP 2007a). Though it appears to be relatively abundant within the main stem Susquehanna River, it is less common in tributaries and other river systems. Its preferred substrate includes sand, silt, cobble, and gravel, especially in riffles and flowing portions of rivers. White perch and yellow perch are the only known larval host for this species. The yellow lampmussel is thought to be mildly tolerant of eutrophication and siltation and intolerant of toxins.

In addition to the mussels observed in this survey, a single specimen of another species, green floater (*Lasmigona subviridis*), was identified in a benthic macroinvertebrate sample collected with a dome sampler upstream of the SSES intake on August 15, 2007 (Ecology III 2008). The collection location of this individual was within the vicinity of where the present survey was completed. The green floater is a mussel that is imperiled throughout much of its historic range and is considered imperiled by the Pennsylvania Natural Heritage Program (PNHP 2007b). It occurs throughout the Atlantic Slope from North Carolina to New York, as well as in the Kanawha River basin in West Virginia. This species is not common in Pennsylvania, but is known to occur in the Susquehanna, Delaware, and Ohio River drainages. It is a small mussel that is typically less than 55 mm in length that prefers to inhabit gravel and sand substrate in water depths of 1 to 4 ft. This species inhabits pools and other calm areas of hydrologically stable creeks and rivers and it is intolerant of strong currents (Strayer and Jirka 1997). A decline in population numbers of this species has occurred throughout much of its range. The green floater is hermaphroditic and the hosts for its larval stage (glochidia) are not known.

CONCLUSIONS

This survey will serve to inform discussion and coordination with the PFBC related to any additional investigations that may be necessary as construction plans for BBNPP become more definite. The survey results show the relatively wide distribution and

common occurrence of four species of mussels, including the yellow lampmussel, in the vicinity of the proposed plant. In addition, macroinvertebrate sampling has confirmed the presence of a fifth species, the green floater, in the vicinity of the proposed plant.

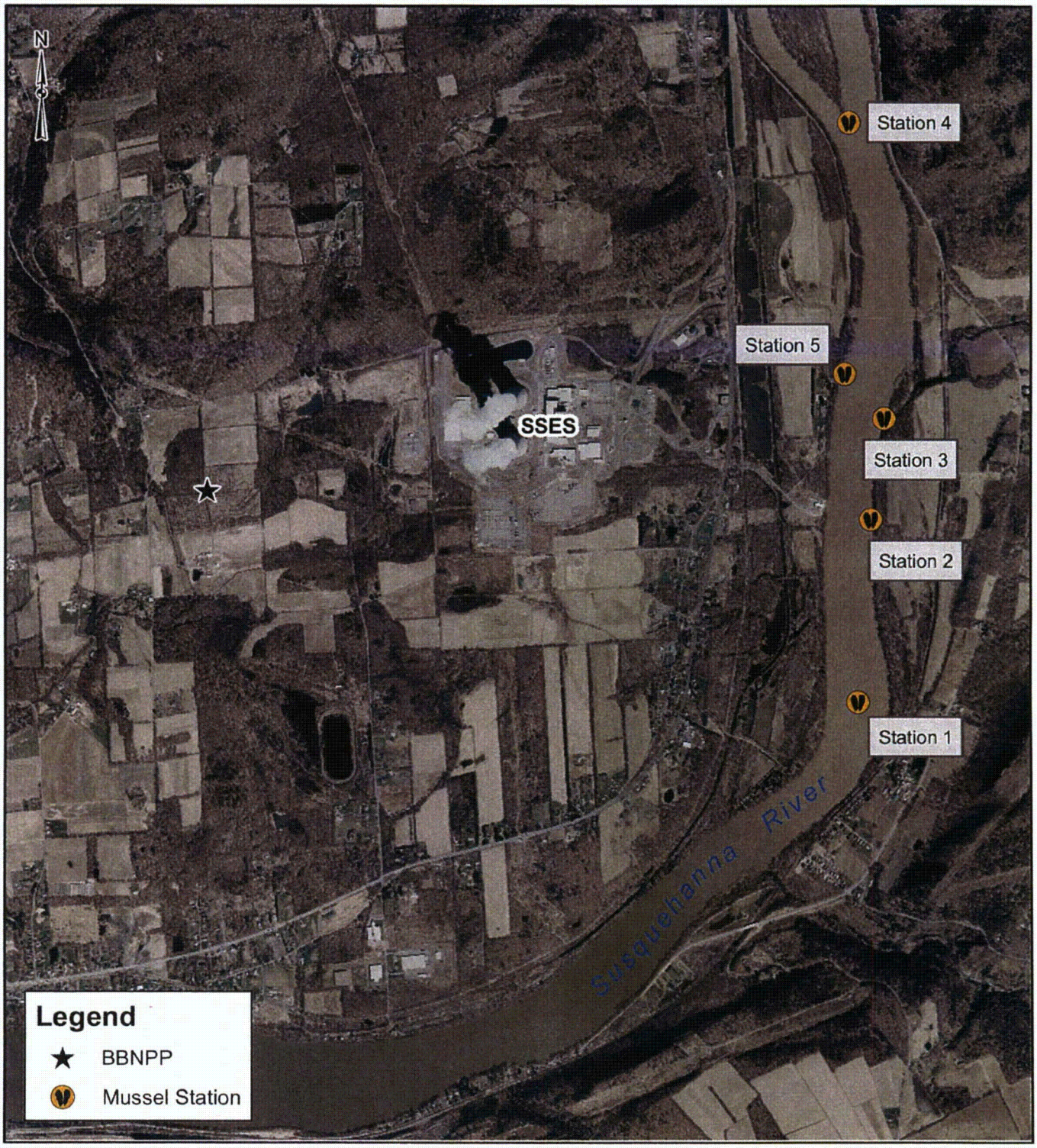
REFERENCES

Ecology III 2008. Environmental Studies in the vicinity of the Susquehanna Steam Electric Station, 2007 water quality, benthic macroinvertebrates, and fishes. Prepared for PPL Susquehanna, LLC.

Strayer, D. L., and K. J. Jirka. 1997. The pearly mussels of New York State. The New York State Education Department, Albany N. Y. 113 pp and plates.

Pennsylvania Natural Heritage Program (PNHP) 2007a, Yellow Lampmussel, Website: http://www.naturalheritage.state.pa.us/factsheets/12214.pdf, date accessed, April 3, 2008.

Pennsylvania Natural Heritage Program 2007b, Green Floater, Website: http://www.naturalheritage.state.pa.us/factsheets/12224.pdf, date accessed, April 10, 2008.



PAMAP Color Orthophoto of PA, 2005

0.5 0.25 0 0.5 Miles

Figure 1.
Location of the proposed BBNPP and mussel survey stations in the Susquehanna River.

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rev. date:
prepared for: b.lees
file name: Figure1_Mussels

Table 1. Species of mussels observed during survey of Susquehanna River completed near the proposed BBNPP site, October 2007.

Common name	Scientific name
Eastern Elliptio	*Elliptio complanata*
Eastern Floater	*Pyganodon cataracta*
Elktoe	*Alasmidonta marginata*
Triangle Floater	*Alasmidonta undulata*
Yellow Lampmussel	*Lampsilis cariosa*
[1]Green Floater	*Lasmigona subviridis*

[1] This species was not collected during the mussel survey. However, a single individual was identified in a macroinvertebrate sample collected by dome sampler upstream of the SSES intake.

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BELL BEND NUCLEAR POWER PLANT
PROJECT RESPONSE STATUS AND FILING
OF JOINT PERMIT APPLICATION
BNP-2011-126 Docket No. 52-039

References: 1) Michael G. Brownell, Susquehanna River Basin Commission, letter to T. L. Harpster, "Notice of Application Review for PPL Bell Bend LLC., Bell Bend Nuclear Power Plant; BNP-2009-073", dated March 1, 2010.

2) James Richenderfer, Susquehanna River Basin Commission, letter to T. L. Harpster, "Re; Bell Bend Nuclear Power Plant; IFIM and Aquatic Impact Studies Consolidated Response to SRBC Study Plan Comments", dated March 16, 2011.

PPL Bell Bend, LLC (PPL) is hereby providing as Enclosure 1 a consolidated summary of PPL responses to the SRBC letter of March 1, 2010 (Reference 1), and is filing for inclusion in the project record the attached Joint Permit Application (JPA) that has been filed on this date with the US Army Corps of Engineers and the PA Department of Environmental Protection.

PPL had previously provided responses to a number of comments and requests for additional information raised in the March 1, 2010 SRBC letter. Enclosure 1 provides a summary reference to these prior responses for the convenience of Commission staff. PPL had also discussed with Commission staff the planned filing of the JPA with the SRBC to complete its response to the March 1 letter. Therefore, Enclosure 1 also provides a cross-reference to content of the JPA that is specifically responsive to the balance of the Commission's information request.

Please note that included in JPA Binder 3, Appendix B, Section 7 is the report "Potential Effects of the Bell Bend Project on Aquatic Resources and Downstream Users (Draft for Agency Review), June 2011". Appendices to the report are provided on the DVD enclosed in Binder 1 of the JPA. This report presents the results of studies undertaken as outlined in the Study Plan submitted to the Commission on April 29, 2010, as amended via subsequent communications with the Commission. PPL is requesting staff review and comments on this report within 60 days, if possible, so that it can be finalized in the third quarter of 2011 for filing with the Nuclear Regulatory Commission and other permitting agencies.

PPL is also providing as Enclosure 2 a response to the SRBC letter of March 16, 2011. This SRBC letter provided additional comments on the aquatics study plan and noted continuing dialog regarding expert panel deliberations of supplemental 2D modeling and mussel studies. The letter also reiterated prior comments regarding the potential impacts of the Bell Bend water withdrawal in areas above the Bell Bend discharge location, and restated the Commission's interest in potential additional PPL analysis of instream thermal and water quality changes due to reduced flow. On the basis of the information and analysis provided in Enclosure 2 and the aquatics study report, PPL does not believe that these matters merit additional consideration.

I trust that the enclosed information will prove responsive to the Commission's letters. Should you have any questions or concerns regarding the attached, please don't hesitate to contact me.

Sincerely,

Gary Petrewski

GP/cw

Enclosures
1) Response Summary and JPA Cross-Reference
2) Response to SRBC letter of March 16, 2011
3) Joint Permit Application

cc: (w/ Enclosures 1 and 2)

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cc: (w/ Enclosures 1, 2 and DVD of JPA)

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Enclosure 1

Response Summary and JPA Cross-Reference

ENCLOSURE 1 - RESPONSE SUMMARY AND JPA CROSS-REFERENCE

This table provides a consolidated summary of PPL responses to comments and information requests contained in SRBC's letter of March 1, 2010.
Where JPA content is specifically responsive to the SRBC comment or information request a cross-reference to the JPA is provided.

Item No.	SRBC Regulation / Policy Reference	Issue / SRBC Comment	Status	JPA Reference Information
CONSUMPTIVE WATER USE APPLICATION				
1	*Project Sponsors whose consumptive use of water is subject to review and approval shall mitigate such consumptive use [18 CFR 806.22(b)].*	PPL Bell Bend proposed in its application to use payment to the Commission as the method of consumptive use mitigation. The SRBC encouraged PPL Bell Bend to investigate other mitigation options.	PPL Bell Bend has been working with Commission staff regarding the potential implementation of a corporate storage asset pool as its proposed method of mitigation for the Bell Bend project. PPL Bell Bend anticipates the development of a comprehensive mitigation plan that will be satisfactory to the Commission prior to the date of Commission action on the Bell Bend Consumptive Use, Water Withdrawal, and Groundwater applications. NOTE: Presented concept to SRBC Commissioners on 6/23/11.	
2	*Applicant must include in their application plans for avoiding or mitigating for consumptive use [18 CFR 806.14.(a)(2)(ix)].*	The information submitted in the application fails to adequately analyze the avoidance of consumptive use.	An Alternative Sites Evaluation Report, Revision 2 (ASER, Rev 2) was filed with the Commission on May 25, 2011. ASER Rev 2 included a sensitivity analysis that evaluated increased weighting being given to project water use and availability at alternative sites. PPL Bell Bend has conducted an extensive analysis of alternatives to the Bell Bend project as summarized in Section Q of the JPA. Alternative site locations and alternative cooling methods have been considered by PPL Bell Bend as a means to avoid consumptive use impacts in the Susquehanna basin.	Binder 1, Section Q.
		Consumptive use was not factored into the cost analysis of the six alternative methods of heat dissipation for BBNPP.	By letter dated October 21, 2010 PPL Bell Bend filed with the Commission an evaluation of alternative methods of heat dissipation at Bell Bend which included consideration of potential consumptive use mitigation costs, and environmental impacts, and also provided further information regarding dry cooling as an option to avoid consumptive use.	Binder 1, Section Q.
		The application fails to include an analysis of the increased evaporation caused by the thermal effects of the blowdown discharge from BBNPP.	By letter dated January 14, 2011 PPL Bell Bend amended its consumptive use application which included an in-stream evaporation component due to thermal discharge.	
		The application fails to describe plans to mitigate consumptive use.	PPL Bell Bend anticipates completion of a consumptive use mitigation plan prior to Commission action on the Bell Bend applications as discussed under item 1 above.	
SURFACE WATER WITHDRAWAL APPLICATION				
3	*The Commission may deny an application, limit or condition an approval to ensure that the withdrawal will not cause significant adverse impacts to the water resources of the basin [18 CFR 806-23(b)(2)].*	None	Commission stated authority acknowledged. No response provided.	
4	*The Commission utilizes passby flows, conservation releases, and consumptive use compensation to help protect aquatic resources, competing users, and instream flow uses downstream from the point of withdrawal.... When the natural flow is equal to, or less than, the prescribed passby flow, no water may be withdrawn from the water source, and the entire natural flow shall be allowed to pass the point of withdrawal (Policy No. 2003-01).*	The Commission staff has determined that the river withdrawal may exceed the threshold for the Passby Flow Guidance as defined in Commission Policy 2003-01. In the area of the proposed withdrawal the river is classified as WWF which would likely require a 20% average daily flow passby condition which would create an interruptible water supply.	PPL has completed an aquatics impacts study in accordance with a study plan submitted to the SRBC on April 29, 2010, as amended by subsequent agreement and correspondence. A report "Potential Effects of the Bell Bend Project on Aquatic Resources and Downstream Users (Draft for Agency Review), June 2011" is included in Appendix B of the Joint Permit Application (JPA). Appendices to the report are included on the DVD of the JPA. A supplemental 2D IFIM modeling analysis is currently underway in accordance with an approved study plan to further validate and refine study analysis. The results of this study will be filed with the SRBC later in 2011.	Binder 3, Appendix B, Section 7, DVD
5	*Applicant must include in their application plans to implement and properly maintain special monitoring measures [18 CFR 806.23(b)(3)(iii).*	PPL Bell Bend should provide a permanent monitoring plan similar in scope and detail to the SSES monitoring plan, and include metering accurate to within 5 percent.	A proposed monitoring plan was filed with the SRBC on July 8, 2010 (BNP-2010-164). SRBC comments on the plan were provided to PPL Bell Bend in a letter of May 17, 2011. A response to comments proposing certain changes to the plan pending SRBC concurrence was filed with the SRBC on June 28, 2011(BNP-2011-124)	

Item No.	SRBC Regulation / Policy Reference	Issue / SRBC Comment	Status	JPA Reference Information
6	*Applicant must include in their application a proposed quantity of water to be withdrawn [18 CFR 806.14 (a)(2)(iii)]; applicant must include in their application supporting studies, reports, and other information upon which assumptions and assertions have been based [18 CFR 806.14(a)(2)(viii)].*	The water withdrawal application as amended did not include the calculation of the water values used to compute the proposed surface water withdrawal. Any water values taken from manufacturer information sheets should be referenced and included in the application. The water balance diagram does not account for rainfall or evaporation for the ESWEMS pond and waste water retention basin. The applicant should assemble a single document outlining all proposed water sources, the quantities of water to be withdrawn, and the determination of those quantities as computed.	On January 14, 2011 PPL Bell Bend filed a request to amend its surface water withdrawal and consumptive use applications (BNP-2011-005). Consolidated calculations in support of these requested amounts, and a revised water balance diagram were appended to the letter.	
		The sources of construction water have not been adequately defined in the application.	All construction water will be provided by PA American Water Company. No construction water will be drawn from any other alternative source. PPL understands that use of PA American Water Company as a source will require Commission Approval by Rule.	
7	*Applicant shall provide copies of any correspondence with member jurisdiction agencies [18 CFR 806.14 (a)(1)(x)].*	The Commission requires that all ongoing correspondence with the NRC, ACOE, and principal resource agencies be provided to the Commission.	The Commission is now being provided with copies of all NRC, ACOE, and principal agency correspondence. PPL Bell Bend formally acknowledged its intent to provide appropriate correspondence in its letter of September 21, 2010 (BNP-2010-177)	
8	*Applicant must include in their application a proposed quantity of water to be consumed [18 CFR 806.14 (a)(2)(iv)].*	The application does not address the evaporation from the Susquehanna River due to thermal discharge.	Instream evaporation has now been included. Calculations have been provided in PPL Bell Bend's January 14, 2011 letter request to amend its applications to the Commission (BNP-2011-005).	
		The evaporation from proposed stormwater ponds 1 and 2 could exceed the Commission's threshold for consumptive use. PPL Bell Bend should submit calculations/modeling for these ponds.	Ponds S-1 and S-2 no longer part of project plan.	
		The water balance provided does not account for rainfall on or evaporation from the ESWEMS pond and the waste water retention basin. Evaporation from the Susquehanna River due to the thermal discharge is also not shown.	See Response to item 6 above.	
		The applicant should assemble a single document outlining all proposed consumptive uses, the quantities of water to be consumed, and the determination of those quantities as computed.	See Response to item 6 above.	
9	*Applicant must provide a description of the project in terms of water use and availability [18 CFR 806.14 (a)(2)(vi)].*	PPL Bell Bend should describe in detail the water usage expected based on seasonal variability and different operational modes. Water usage should be compared to seasonal flow variations.	On July 8, 2010 PPL Bell Bend filed information with the SRBC on seasonal water use and availability (BNP-2010-165). All information contained in this filing is still relevant even though PPL Bell Bend has revised its water withdrawal and consumptive use request via a January 14, 2011 letter (BNP-2011-005).	
10	*Applicant must provide a description of the project in terms of all water sources and the initiation of each source.[18 CFR 806.14 (a)(2)(vii)].*	PPL Bell Bend should provide a schedule depicting when water from the river is required for startup and operation.	JPA Appendix A, Section 7 provides a summary of major project milestones and the current construction schedule. The first use of PA American Water during construction is anticipated in April 2014. The first groundwater withdrawal for construction dewatering is expected in August 2015. The first river water withdrawal and consumptive use is expected in January 2017. This schedule is subject to change.	Binder 2, Appendix A, Section 7.
		PPL Bell Bend should also submit a proposed plan and schedule for other sources of water that may be required to mitigate consumptive use. The plan and schedule should allow for several different options for consumptive use makeup and specify when the preferred option must be identified to fit the overall project schedule.	See response to item 1 above.	

Item No.	SRBC Regulation / Policy Reference	Issue / SRBC Comment	Status	JPA Reference Information
		No other intake or discharge configuration has been identified or modeled. A configuration should be modeled where the Bell Bend discharge is located between the SSES intake and discharge and the Bell Bend intake is located downstream of the SSES discharge.	By letter dated April 29, 2010 (BNP-2010-103) PPL Bell Bend provided to the SRBC its rationale for the selection of the Bell Bend intake and discharge locations. Other alternatives were considered but not viewed as practical.	
		Thermal modeling should be run at a 7Q10 flow plus the project consumptive use. The thermal modeling should be run at various ambient water temperatures.	Based on discussions with Commission staff, in a March 30, 2011 letter (BNP-2011-071) PPL Bell Bend modified its aquatic studies plan to evaluate critical summer and winter temperature and flow conditions in accordance with Commission direction. The results of that analysis are contained in the report "Potential Effects of the Bell Bend Project on Aquatic Resources and Downstream Users (Draft for Agency Review), June 2011" which is included in Appendix B of the Joint Permit Application (JPA).	Binder 3, Appendix B, Section 7, DVD
11	*Applicant must include in their application the anticipated impact of the proposed project on source water characteristics (quality, quantity, flow regimen, other hydrologic characteristics)[18 CFR 806.14(a)(3)(i)].*	PPL Bell Bend should submit designs related to the retention pond, including but not limited to heat exchanger and diffuser criteria. PPL Bell Bend should also submit seasonal temperatures of discharge to the Susquehanna River.	The Bell Bend project will be subject to NPDES permitting by the PA Department of Environmental Protection which will ensure project compliance with appropriate water quality criteria. As noted above, thermal analysis during expected critical periods is included in Appendix B of the JPA. NOTE: The heat exchanger was removed from the design at the retention basin.	Binder 3, Appendix B, Section 7, DVD
		PPL Bell Bend should submit intake dimensions, etc and all designs to avoid impingement and entrainment of debris and aquatic organisms within the intake channel. PPL Bell Bend should determine a method of sampling the number of organisms subject to impingement and entrainment taking into account the life of the project. Intake design should ensure that impacts to the local aquatic community are avoided.	A response to this item was provided by PPL Bell Bend in its letter dated April 29, 2010 (BNP-2010-103) as follows: Analyses of the most representative cooling water intake structures have been conducted and presented. Additional analyses of other existing cooling water intakes via additional desktop studies would not be instructive. Furthermore, inasmuch as the BBNPP intake structure is a new facility and is required to be designed to satisfy EPA Track I requirements of 40 CFR §125.84, entrainment or impingement will comply with the performance standards set by the EPA in the rule. Therefore, no additional pre-construction studies are viewed as warranted. Once the facility is placed in service, PPL will be required under 40 CFR §125.87 to perform regular biological, velocity, and visual monitoring to ensure continued compliance with the performance requirements under the rule.	
12	*Applicant must determine the anticipated impact of the proposed project on existing water withdrawals [18 CFR 806.14(a)(3)(iii)].*	PPL Bell Bend should submit a determination as to whether the thermal loading of the discharge will effect any water users downstream of the discharge.	The results of the thermal analysis are contained in the report "Potential Effects of the Bell Bend Project on Aquatic Resources and Downstream Users (Draft for Agency Review), June 2011" which is included in Appendix B of the Joint Permit Application (JPA). No impacts to downstream users are anticipated as a result of the thermal discharge.	Binder 3, Appendix B, Section 7, DVD
13	*Applicant must provide an estimated completion date for the proposed project and an estimated construction schedule [18 CFR 806.14 (a)(4)].*	An appropriate schedule should be developed for Commission activities.	An initial response to this item was filed with the SRBC via PPL Bell Bend letter dated June 11, 2010 (BNP-2010-131). A revised project schedule was subsequently provided to the SRBC by PPL Bell bend letter of November 29, 2010 (BNP-2010-308). An updated project schedule is included in JPA Appendix A, Section 7. This schedule will be subject to change based on NRC processing of the Combined Operating License Application (COLA), as well as the processing of other required regulatory approvals. PPL will advise the Commission of any future schedule changes.	Binder 2, Appendix A, Section 7.
14	*Applicant must determine the compatibility of the proposed project with existing and anticipated uses [18 CFR 806.23 (b)(1)(iv)].*	PPL Bell Bend should consult state water plans and county and municipal comprehensive plans, as well as the Commission Comprehensive Plan, for proposed water users. PPL Bell Bend should evaluate other uses of the river including instream uses and recreation.	Section J of the JPA provides a characterization of site and adjoining resources (Enclosure C) and a comprehensive assessment of anticipated project impacts including impacts to the aquatic environment, and recreation (Enclosure D). Cumulative impacts are also addressed.	Binder 1B, Section J, Enclosures C and D.
15	*Applicant must determine the anticipated impact of the proposed project on flood damage potential considering the location of the project with respect to the flood plain and flood hazard zones [18 CFR 806.14 (b)(1)(v)(A)].*	PPL Bell Bend should provide analysis to determine the impact of the proposed project on floodplains and flood hazard zones in the vicinity of the project.	Section N of the JPA provides a floodplain management analysis. Flood studies are provided of the Walker Run and its tributary and of the Susquehanna River in the vicinity of the project. The Walker Run analysis illustrates no change to the 100-year floodplain beyond lands controlled by the applicant. The Susquehanna River flood study illustrates no increase in the 100-year floodplain. These analyses have been submitted to Salem Twp and FEMA for approval.	Binder 1, Section N and Sections N1 (Walker Run) and N2 (Susquehanna River).

Item No.	SRBC Regulation / Policy Reference	Issue / SRBC Comment	Status	JPA Reference Information
16	*Applicant must determine the anticipated impact of the proposed project on recreation potential [18 CFR 806.14 (b)(1)(v)(B)].*	PPL Bell Bend should study the potential of providing the public with recreational opportunities in the vicinity of the project and include development of viable recreation options as part of the project plan.	Section R of the JPA addresses PPL Bell Bend's proposed mitigation in association with project development. The proposed wetland mitigation plan for the Riverlands area (Section R4) includes reestablishing the North Branch Canal including plans for recreational trail development.	Binder 1C, Section R
17	*Applicant must provide a description of the project in terms of anticipated impact of the proposed project on fish, wildlife, and their habitat quality, kind, and number of species. Applicant must demonstrate plans for avoiding any anticipated impacts [18 CFR 806.14 (b)(1)(v)(C)].*	Potential impacts to sensitive trout species needs to be addressed. A more through document should be submitted that addresses impacts to fish and wildlife that have been identified in the project area.	JPA Section J Enclosure D summarizes anticipated aquatic and terrestrial impacts due to planned construction features. The report "Potential Effects of the Bell Bend Project on Aquatic Resources and Downstream Users (Draft for Agency Review), June 2011" which is included in Appendix B of the Joint Permit Application (JPA) further evaluates expected Susquehanna River aquatic impacts. PPL is currently in the process of preparing a Biological Evaluation and Management Plan (BEMP) for Indiana bats, a T&E species, subject to USFWS jurisdiction under section 7 of the Endangered Species Act (ESA). The NRC is the lead federal agency responsible for this Section 7 ESA consultation with the USFWS. PPL Bell Bend will file the BEMP with the Commission in 2011 and will keep the Commission advised of subsequent consultation between the NRC and USFWS regarding the Indiana bat.	Binder 3, Appendix B, Sections 11 and 12.
		Additional detail regarding impacts to mussel species must be provided.	By a June 17, 2011 e-mail PPL Bell Bend has forwarded to the Commission a study plan developed in consultation with the SRBC by an expert panel to further investigate sensitive mussel species that may be present in the vicinity of the project. PPL Bell Bend anticipates the completion of this study work in 2011 at which point a study report will be filed with the SRBC for inclusion in the study record.	Binder 3, Appendix B, Section 5.
		The Commission requires an amendment to the Wetlands Delineation Report be submitted that accounts for the Exceptional Value Wetlands on site.	Section J, Enclosure A of the JPA provides a revised wetlands delineation report accounting for on-site EV wetlands.	Binder 1B, Section J, Enclosure A.
		Wetlands adjacent to Walker Run have been designated as exceptional value, and PPL Bell Bend should take appropriate measures to preserve or mitigate degradation of the wetlands.	Section J, Enclosure D of the JPA addresses project impacts on the EV wetlands adjacent to Walker Run, A mitigation plan for Walker Run is included in Section R of the JPA (Subsection R3). A 50 ft riparian buffer will be maintained along all streams and wetlands wherever possible.	Binder 1B, Section J, Enclosure D. Binder 1C, Section R3.
		The impingement and entrainment report fails to account for potential impacts to juvenile American Shad. The plant community survey fails to address potential/anticipated impacts. Overall, PPL Bell Bend should assemble a single document summarizing species and habitat impacts and proposed mitigation.	See response to item 11 above.	
		PPL Bell Bend should provide the Commission with GIS data layers for all site disturbance and construction footprints.	By letter dated October 8,2010 (BNP-2010-236) PPL Bell Bend provided a partial response to SRBC's GIS data layer request. BNP-2010-236 explained that the design files were not developed using GIS software. Therefore, PPL planned to submit files in pdf format as part of the JPA submittal. These files are included on the enclosed DVD	Binder 1, DVD
18	*Applicant must determine the anticipated impact of the proposed project on site development [18 CFR 806.14 (b)(1)(v)(E)].*	The Commission requires appropriate studies that determine the impact of the project on geology, topography, soil characteristics, and adjoining and nearby land uses.	JPA Section J Enclosures C and D characterize land use and associated project impacts.	Binder 1B, Section J, Enclosures C & D.
19	*Applicant must determine the anticipated impact of the proposed project on historical, cultural and archeological resources[18 CFR 806.14 (b)(1)(v)(F)].*	PPL should complete all relevant studies and submit an application amendment specifying the anticipated impacts and proposed avoidance, minimization and mitigation measures.	Studies with respect to historical and cultural resources are summarized in Section D of the JPA. Studies and consultation with the State Historic Preservation Officer are underway. Final studies and the preparation of a criteria of effects analysis are not expected to be complete until early 2012. PPL expects final actions to be complete regarding cultural and archeological resources prior to Commission action on the Bell Bend project.	Binder 1, Section D. Binder 4, Appendix C, Supplemental Cultural Resources Reports.

Item No.	SRBC Regulation / Policy Reference	Issue / SRBC Comment	Status	JPA Reference Information
20	*The Commission uses the Comprehensive Plan for the Water Resources of the Susquehanna River Basin (Comprehensive Plan) as a guiding document for all aspects of Commission activities, including project review. Part I.D.7. and Part V.J. of the Comprehensive Plan address the Commission's goal of restoring migratory fish to the Susquehanna watershed.*	PPL should perform an impingement and entrainment study to determine the impact of the project on out-migrating juvenile shad.	See response to item 11 above.	Binder 3, Appendix B, Section 4.
21	*The Commission shall require that the proposed siting and location in the basin of any type of electric generating facility or any facility located outside the basin having an effect on the waters of the basin, shall be planned in direct consultation with the Commission to enable advance consideration of the possible effects of such installation on the water resources of the basin [18 CFR 801.12(c)(2)]. Additionally, the applicant is required to identify and describe reasonable alternatives, the extent of their economic and technical investigation, and an assessment of their potential environmental impact [18 CFR 14(b)(iii)].*	The Alternative Site Evaluation does not attribute sufficient worth to water availability. The process did not factor in cumulative consumptive use into the evaluation process. 7Q10 should be calculated over the period of record. Wetlands at Bell Bend should account for the exceptional value determination.	The Alternative Sites Evaluation Report, Revision 2 (ASER, Rev 2) was filed with the NRC with copy to the SRBC on May 25, 2011. A sensitivity analysis was included in the document that more thoroughly evaluated water availability and the impact on-site EV wetlands. Section Q of the JPA provides a summary of this analysis.	Binder 1, Section Q.
22	*The Commission requires that the project sponsor demonstrate the ability to fund the project and demonstrate the commitment of the government to provide services or financing [18 CFR 806.14 (b)(1)(ii) and 806.14(b)(2)(ii)].*	PPL should provide required financial information including details and status on the DOE loan guarantee process.	By letter dated April 21, 2010 (BNP-2010-087) PPL Bell Bend provided the requested financial information.	
23	*The Commission requires project sponsors to notify each municipality in which the project is located, the county planning agency in which the project is located, and each contiguous property owner that an application has been submitted to the Commission. The project sponsor shall also publish a notification in a newspaper of general circulation serving the area in which the project is located. All notices shall contain a description of the project, its purpose, requested withdrawal and consumptive use amounts, location and address, electronic mail address, and phone number of the Commission [18 CFR 806.15].*	PPL Bell Bend should renotify parties and include SRBC e-mail in the notification. A map showing contiguous property owners should also be provided.	By letter dated August 6, 2010 (BNP-2010-163) PPL Bell Bend provided documentation of public notice (renotice) of the water withdrawal and consumptive use application. A map of contiguous property owners was provided in this filing, and is also provided in the JPA as an attachment to the application.	Binder 1, Application attachment.
GROUNDWATER WITHDRAWAL APPLICATION				
24	Application returned to PPL		On June 28, 2011 PPL filed with the SRBC an Application for Aquifer Test Plan Waiver in association with the planned submittal of a new groundwater withdrawal application that PPL Bell Bend expects to file with the Commission by the end of 2011. A groundwater application will be required to facilitate temporary dewatering to accommodate the construction of the Essential Service Water Emergency Make-up Supply pond.	

Enclosure 2

Response to SRBC letter of March 16, 2011

Enclosure 2 – Response to SRBC letter of March 16, 2011

COMMENT 1

On page 2 of the referenced correspondence, last paragraph, PPL's understanding of the agreements reached at the October 21, 2010, meeting are listed. The Commission does not agree with item No. 1. Although we agree that Ian Howett asserted that there would be no significant difference in results from 1D modeling versus 2D modeling, Commission staff and consultants did not agree based on our literature research and comments from resource agencies. The Commission did agree to participate in a Delphi Panel to address the issue, as stated in item No. 2. The Delphi Panel did meet on January 19, 2011 and final resolution has not been determined to date.

RESPONSE

PPL has subsequently agreed to perform a 2D hydraulic model in the reach of the Susequehanna River bounded by transects developed and referenced during the 1D study as transects R1 to G3. The work is being performed in accordance with the revised proposal submitted to the SRBC on June 2, 2011. The primary revision was the reduction of survey point density from 1.0 point per meter to 0.4 points per meter as recommended by Mr. Mark Gard of the USFWS as part of the on-going discussion by the 2D Expert Panel in a conference call on May 20, 2011. By A. Dehoff e-mail dated June 14, 2011 PPL was advised that the submitted study plan was acceptable provided that GIS mapping of WUA be included in Task 5. This addition is acceptable to PPL, and work in accordance with the study plan has now commenced.

COMMENT 2

The Commission agrees with item 3 on page 3 of the referenced letter. The Habitat Suitability Curves (HSC) are approved as submitted based on discussions at the January 19, 2011, meeting and incorporation of the agreed upon changes to the shad spawning HSC.

RESPONSE

No response required.

COMMENT 3

In Enclosure 1, Section G1, the Commission acknowledges that the Bell Bend Nuclear Power Plant (BBNPP) intake is in a section of the river characterized as a pool; however, the surface water withdrawal of 44.000 million gallons per day (mgd) requires an appropriate study to identify any potential impacts to the river. The 1D PHABSIM model at transect P1 could model a Q7-10 flow before and after the 44.000 mgd withdrawal to assess the potential impact during low flows.

RESPONSE

The following analysis is provided for additional SRBC consideration.

The change in water surface elevation (wse) at Transect P1 due to a water withdrawal of 44 mgd was first calculated, as suggested, from the stage-discharge relationship developed for Transect P1 as used in the PHABSIM model. The relationship can be summarized as a regression equation that relates flow to elevation. This regression equation is

$$wse = 0.0127Q^{0.6343} + 483.53$$

where

wse water surface elevation, ft MSL
Q Susquehanna River flow, cfs

For upstream and downstream values of Q of 843 cfs and 800 cfs, respectively (the latter value reflecting the consumptive use rate of 43 cfs), the calculated change in water surface elevation is a drop of 0.4 inches. If the withdrawal rate of 44 mgd (68.1 cfs) is used in the Transect P1 calculation, the calculated water surface elevation drop is 0.6 inches.

The stage-discharge relationship was based on field-measured data under existing conditions and does not account for the return flow (Bell Bend discharge) that will occur in the future. This return flow and associated backwater would be expected to alter the stage-discharge relationship at this location. To evaluate the hydraulic conditions of the pool in more detail, the 3-D model that was used to estimate the size of the thermal plume for the COLA Environmental Report was applied to the area of interest. The 3-D model uses measured bathymetry that includes downstream features that act as the hydraulic control. The model also incorporates the SSES and BBNPP withdrawal and discharges at their specified locations (Figure 1).

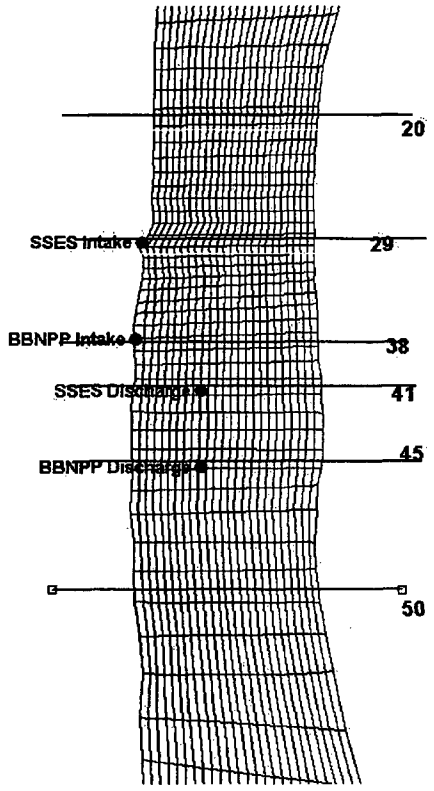

Figure 1 3-D model grid for the Susquehanna River pool adjacent to the BBNPP; also shown are the intake and discharge locations and transect numbers corresponding to those shown in the next figure.

The model results are shown in Figure 2 and illustrate an essentially flat water surface elevation between the BBNPP intake and discharge locations that is 0.3 inches lower when BBNPP is operating. The 0.3 inch incremental drop in water surface elevation applies whether or not SSES is withdrawing and discharging. This predicted 0.3 inch change due to the 44 mgd is less than the 0.4 inch change currently in the PHABSIM model as computed from the stage discharge relationship at Transect P1 for a flow reduction of 28 mgd. Therefore, the modeling using the 28 mgd consumptive use is viewed as conservative and additional analysis of the water withdrawal is considered unwarranted.

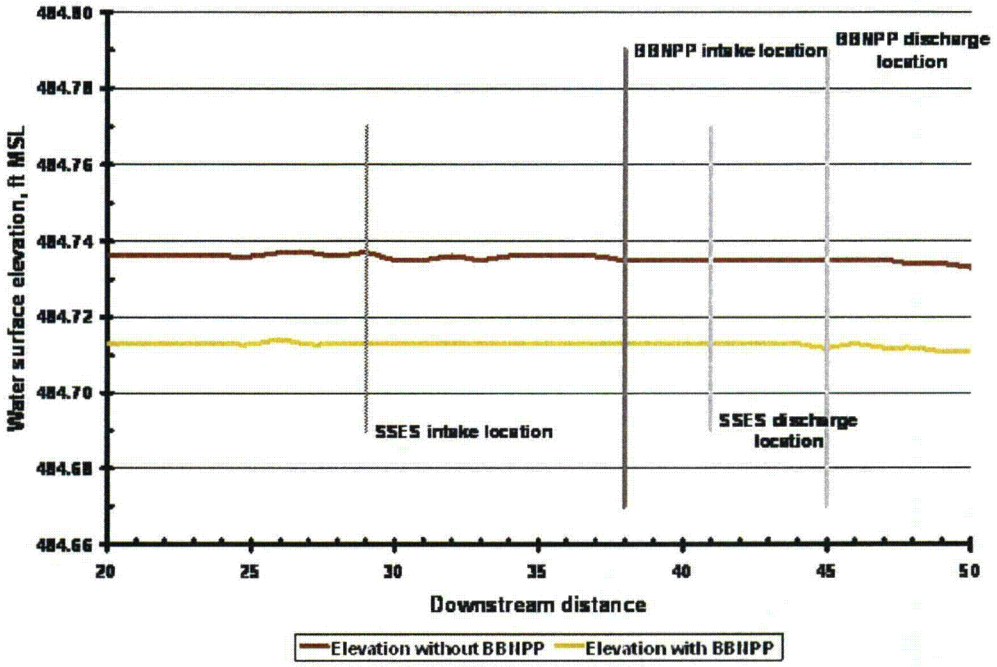

Figure 2 Longitudinal profile of calculated water surface elevations with and without BBNPP operating; the x-axis is distance in terms of model transects, the vertical axis is water surface elevation. Also marked are the locations of the intake and discharge structures.

COMMENT 4

In Enclosure 1, Section G4, the Commission agrees that the extent of 2D modeling for the study plan will be the final resolution of the Delphi Panel. The purpose of the study is to determine potential adverse impacts to aquatic habitat. The use of 2D modeling for this purpose is based on recent peer-reviewed literature on instream studies. Mussel habitat was reviewed by an expert panel that met on February 23, 2011. Although general agreement was achieved at the meeting, the Commission awaits a final proposed study for approval.

RESPONSE

The issues associated with this comment as related to 2D modeling are resolved in accordance with our response to Comment 1.

With regard to mussels, following a May 20, 2011 Expert Panel conference call PPL has provided to the SRBC via a June 17, 2011 e-mail a revised mussel study scope for SRBC/agency review. PPL is ready to proceed with this work, pending agency concurrence.

COMMENT 5

In Enclosure 1, Section G6, second paragraph, the Commission awaits PPL's proposed study plan to address potential increased water temperature caused by increased radiant heating of the streambed due to reduced water depth, reduced capacity to remove heat load due to reduced flow, and thermal discharges. Of particular concern are the shallow areas where increased temperature would stress young-of-the-year smallmouth bass and other organisms.

RESPONSE

PPL has undertaken some initial work regarding this matter that is being filed for additional consideration by the SRBC.

The report "Potential Effects of the Bell Bend Project on Aquatic Resources and Downstream Users Draft for Agency Review", dated June 2011, Section 4.7 (provided in Appendix B of the JPA) shows the calculated increase in river water temperature and DO due to changes in depth. The potential for additional absorption of solar radiation in the streambed is also addressed in the report. Section 5.5.1 of the report provides discussion relative to shallow backwater areas. On the basis of this additional analysis, PPL does not believe that additional study of this matter is warranted.

COMMENT 6

In Enclosure 1, Section S19c, the Commission is not in agreement with the sole use of 1D modeling methods. Again, the extent and purpose of 2D modeling will be determined by the final resolution of the Delphi Panel.

RESPONSE

The issues associated with this comment are resolved in accordance with our response to Comment 1.

Enclosure 3

Joint Permit Application

Enclosure 3 is located on Disc in Hardcopy of letter BNP-2011-126 and also available through FileNet.

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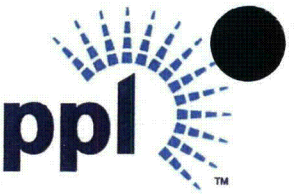

June 29, 2011

Mr. Joseph Buczynski, P.E.
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Ms. Amy Elliott
U.S. Army Corps of Engineers – Baltimore District
State College Field Office
1631 South Atherton Street, Suite 102
State College, PA 16801

BELL BEND NUCLEAR POWER PLANT
JOINT PERMIT APPLICATION AND
REQUEST FOR WATER QUALITY CERTIFICATION
BNP-2011-118 Docket No. 52-039

PPL Bell Bend, LLC is pleased to submit to the Pennsylvania Department of Environmental Protection and the U.S. Army Corps of Engineers a Joint Application for Pennsylvania Water Obstruction and Encroachment Permit and a U.S. Army Corps of Engineers Section 404 Permit for the proposed Bell Bend Nuclear Power Plant in Salem Township, Luzerne County, Pennsylvania. PPL Bell Bend is also requesting state Water Quality Certification under Section 401 of the Clean Water Act.

Please do not hesitate to contact Brad Wise of my staff [610-774-6508 or bawise@pplweb.com] directly with any questions you may have regarding this application.

Respectfully,

Terry L. Harpster

TLH/cw

Enclosure: 1) Joint Application for Pennsylvania Water Obstruction and Encroachment Permit and U.S. Army Corps of Engineers Section 404 Permit
Seven (7) binders and a DVD

cc: w/ Enclosure (Hardcopy and DVD)

Dr. Donald Palmrose
Senior Project Manager
U.S. Nuclear Regulatory Commission
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Rockville, MD 20852

Ms. Stacey Imboden
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Ms. Jamie Davis
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U.S. Environmental Protection Agency
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Ms. Karen J. Karchner
Zoning/Building Code Official
38 Bomboy Lane
Berwick, Pa 18603

Mr. Eugene Trowbridge
Pa Dept Environmental Resources
Northeast Regional Office
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cc: w/ Enclosure (DVD Only)

Mr. Joshua Longmore
Luzerne Conservation District
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Shavertown, PA 1 8708

Susquehanna River Basin Commission

a water management agency serving the Susquehanna River Watershed

August 16, 2011

Mr. Terry L. Harpster
VP-Bell Bend Project-Development
PPL Bell Bend, LLC
38 Bomboy Lane, Suite 2
Berwick, PA 18603

RECEIVED AUG 18 2011

Re: PPL Bell Bend Nuclear Power Plant;
Application for Surface Water Withdrawal, and
Application for Consumptive Water Use – BNP-2011-005;
Salem Township, Luzerne County, Pennsylvania

Dear Mr. Harpster:

The Susquehanna River Basin Commission (Commission) staff has reviewed the "Application for Surface Water Withdrawal, and Application for Consumptive Use" for Bell Bend Nuclear Power Plant (BBNPP) submitted in the referenced correspondence and provides the following comments.

Our comments are as follows:

1. The fourth paragraph of the referenced correspondence states that "there are no certified cooling tower or pump performance curves" because the design and procurement has not been finalized. The proposed method of determining surface water withdrawal is based on pump capacity. The Commission requires performance curves prior to final approval of the surface water withdrawal application.
2. In Section 4, the last paragraph on page 5, the blowdown methodology for the Circulating Water System Makeup Water System (CWSMWS) is described. At the Mussel Expert Panel meeting on February 23, 2011, the blowdown operating procedure for Susquehanna Steam Electric Station (SSES) was described differently. At SSES, the CWSMWS operates at capacity and the blowdown is the difference between the quantity pumped from the river and the quantity lost to evaporation and drift in the cooling towers, and the blowdown is controlled by maintaining a certain level in the cooling tower basin. The Commission requires a description of the operational parameters that determine the quantity of blowdown at BBNPP.
3. The Commission agrees that the surface water withdrawal quantity to be used in the application should be the "maximum instantaneous surface water withdrawal" as stated in the last paragraph of Section 4.4. The withdrawal is based on the capacity of

two CWSMWS pumps and one Raw Water Supply System (RWSS) pump which is 29,100 gallons per minute (gpm).

4. The maximum instantaneous surface water withdrawal is determined by the capacity of two of three CWSMWS pumps and one of three RWSS pumps. These systems have the capacity to pump more than the requested withdrawal. The Commission requires a description of the control mechanism and/or administrative procedures to prevent more than two CWSMWS pumps and one RWSS pump from operating to assure that the requested withdrawal is not exceeded.
5. Attachment A to Enclosure 1, "BBNPP Peak Day Water Use Diagram," does not accurately portray peak flows. For example, the diagram shows the withdrawal for the Circulating Water Supply System to be 25,085 gpm and Section 4.4 indicates the withdrawal to be 26,200 gpm. Similarly, the diagram shows the withdrawal for the Raw Water Supply System to be 952 gpm and Section 4.4 indicates that the withdrawal to be 2,900 gpm. The Commission requires that Attachment A be revised showing water use at the peak water withdrawal requested in Section 4.4 of 29,100 gpm. Additionally, the Commission requires a description of plant operations at peak water withdrawal, including how often the peak withdrawal operating condition will occur.
6. Evaporation from the Essential Service Water Emergency Makeup System (ESWEMS) retention pond is 34.3 gpm. The Commission requires a description of the operation to provide makeup water from the RWSS, including the makeup rate and anticipated cycles of operation.
7. In a letter to the U.S. Nuclear Regulatory Commission, BNP-2011-025 dated January 28, 2011, Figure 3.3-1 on page 3-26 is the "Anticipated Water Use Diagram" which indicates the average and maximum water usage for BBNPP. The flows shown on this diagram are significantly different than those shown on the "BBNPP Peak Day Water Use Diagram." Of particular concern is the difference in the RWSS withdrawal which had an average flow of 1,921 gpm on the "Anticipated Water Use Diagram" and on the "BBNPP Peak Day Water Use Diagram" the same flow was indicated to be 952 gpm. The Commission requires reconciliation of the maximum/peak flows shown on the two diagrams. Consistent definitions and quantities may avoid confusion in the future.

If you have any questions regarding the above, please contact Paula Ballaron at (717) 238-0423, extension 222, or Andrew Dehoff, extension 221.

Sincerely yours,

Andrew D. Dehoff
Manager, Project Review

cc: Michael Canova; USNRC
Donald Palmrose; USNRC
Stacey Imboden; USNRC

Amy Elliott; USACE, Baltimore District
Susan Weaver; PADEP
Eugene Trowbridge; PADEP
Mark Hartle; PFBC
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Larry Miller; USFWS
Jamie Davis; USEPA

Susquehanna River Basin Commission

a water management agency serving the Susquehanna River Watershed

August 22, 2011

RECEIVED AUG 24 2011

Mr. Terry L. Harpster
VP-Bell Bend Project-Development
PPL Bell Bend, LLC
38 Bomboy Lane, Suite 2
Berwick, PA 18603

Re: PPL Bell Bend Nuclear Power Plant;
Avoidance of Consumptive Use – BNP-2010-192;
Salem Township, Luzerne County, Pennsylvania

Dear Mr. Harpster:

The Susquehanna River Basin Commission (Commission) has reviewed the "Avoidance of Consumptive Use" submitted in the referenced correspondence which is a partial response to the Commission's letter dated March 1, 2010, commenting on the surface water withdrawal application submitted on May 15, 2009, by PPL Bell Bend, LLC. As noted in the narrative of the referenced correspondence, the following comments relate to compliance with 18 CFR §806.14(a)(2)(ix).

The Commission appreciates the depth of analysis of the air cooled condensers (ACC) compared to wet cooling systems and the resultant impact of turbine and generator performance. However, as acknowledged in the narrative of the referenced correspondence, there are inconsistencies between Enclosure 1 and Enclosure 2, as well as inconsistencies with the narrative. While acknowledging that some inconsistencies are inherent to different analytical approaches, some inconsistencies require resolution as noted below.

The Commission agrees that utilizing an ACC for Bell Bend Nuclear Power Plant (BBNPP) creates uncertainty and therefore financial risk because ACCs have not previously been used for nuclear power plants or large conventional power plant units, and extrapolation of the technology to the scale required for BBNPP may entail unseen technological problems. The Commission also acknowledges that increased turbine back pressure resulting from utilizing an ACC may impact turbine generator performance beyond the analysis in Enclosure 2 of the referenced correspondence.

The analyses use mitigation fee payments of $0.28 per 1,000 gallons of water as an indication of cost of mitigation makeup water. Although the Commission does allow mitigation fee payments as an option for smaller projects, the water storage controlled by the Commission is

not sufficient to support the mitigation makeup water for a project as large as BBNPP. For that reason, as noted in previous correspondence, consumptive use mitigation fee payments are not a viable option for the BBNPP project. The cost of providing actual mitigation water, perhaps using an analysis of costs related to your proposed pooled asset concept, should be used. Also, PPL should not assume that the $0.28 per 1,000 gallons of water is an appropriate cost figure to provide mitigation makeup water. The Commission increased this fee to $0.29 as of July 1, 2011, one of several increases over the last few years, and will most likely continue these increases during the term of any approval as the costs of providing storage continue to escalate.

There are inconsistencies between Enclosure 1 and Enclosure 2 that should be resolved. In Enclosure 1, Attachment A; there is reference to a power reduction penalty for ACC of several percentage points. The study in Enclosure 2 defines the power reduction penalty as 2% which appears to be more accurate based on the engineering analysis. Also in Attachment A, there is an assertion that ACCs require more space than the 15 acres allocated to the wet cooling design. Enclosure 2 states that ACCs for BBNPP will require 10 acres and 15 acres would be adequate to accommodate an ACC design.

Comments on Enclosure 1, Attachment C, Table 1 are as follows:

1. In the "Footprint per Plan Unit" column, the entry for dry cooling should be 15 acres as stated in the engineering study in Enclosure 2.
2. In the "Auxiliary Load Difference" column, the entry for dry cooling should be 13.5 megawatts (MW) which is the auxiliary load difference cited in Enclosure 2, Section 5.1.
3. In the "Annual O&M Cost" column, the cost for maintaining the natural draft cooling towers is not zero. A cost figure should be generated and subtracted from all the other options to calculate a difference between the natural draft option and the other options, as stated in Note (a).
4. In the "Annual O&M Cost" column, Note (e) asserts that O&M for dry cooling will be 1% or 2% of the capital cost. The relationship between capital costs and O&M costs needs to be validated. Also, the 2% figure was used which is inconsistent with the conservative analytical approach used in the engineering study in Enclosure 2. The 1% figure should be used in Table 1.
5. In Note (b), the 8% cost of money is inconsistent with the 7% discount factor used in the analysis performed in Enclosure 2.
6. In Note (d), use of the $280 per million gallons of water is inappropriate as discussed above.

Enclosure 1, Attachment C, Table 2 presents an acceptable comparison of the cooling options.

In Enclosure 2, Section 1.0, the Commission has not indicated that use of the $0.28 per 1,000 gallons of water is an acceptable method to estimate the cost of makeup water for BBNPP, as discussed above.

In Enclosure 2, Section 3.1, last paragraph, the Commission does not have a requirement to store 90 days of water at the peak consumption rate. The current design consumptively uses up to 28 million gallons per day (MGD), and most likely there will be a requirement to provide water to meet a passby requirement that has not been established. For purposes of this study, reasonable capital costs and annual costs should be established to provide mitigation for the BBNPP makeup water. For the dry air cooling option, for purposes of this study, the $0.29 per 1,000 gallons of water cost plus an escalator figure is appropriate because of the reduced consumption.

Comments on Enclosure 2, Table 1 are as follows:

1. Contractor Indirects and Contractor Fee for the Air Cooled Condenser System (ACC) are considerably higher than the Existing Circulating Water System (ECWS) on a percentage of direct cost basis. What is the rationale for the difference?
2. Although the rationale was provided for the contingency calculation, the amount of contingency for the ACC option ($106,723,200) appears to be too high (30% of total cost).
3. The cost of providing "Offsite Water Storage" for the ACC of $48,000,000 is not consistent with the $400,000 cost in Enclosure 1, Attachment C, Table 1 which used the $0.28 per 1,000 gallons of water cost method. As discussed above, the amount of water required for BBNPP with an ACC system (0.3 MGD) is relatively small and therefore the use of $0.29 per 1,000 gallons of water plus an escalator is appropriate.
4. The "Capital Cost Difference" of $124,710,000 is significantly reduced based on the above comments.

In Enclosure 2, Section 6.0, further detail is required to understand how the present values were calculated for operating costs and capital costs. The $253,850,000 net present value of operating costs should be segregated into maintenance costs, increased auxiliary power, and power reduction opportunity costs with a breakdown of each segregation.

In summary, the Commission requires resolution of the inconsistencies between the two studies submitted in the referenced correspondence, and addresses the above comments. The costs for the two options should be consistent with regard to the time value of money and include all costs.

If you have any questions regarding the above comments, please contact Andrew Dehoff at (717) 238-0423, extension 221.

Sincerely yours,

Andrew D. Dehoff

Andrew D. Dehoff
Manager, Project Review

cc: Bradley A. Wise; PPL, Allentown
Gary Petrewski; PPL, Allentown

Michael Canova; USNRC
Donald Palmrose; USNRC
Stacey Imboden; USNRC
Amy Elliott; USACE, Baltimore District
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Susquehanna River Basin Commission

a water management agency serving the Susquehanna River Watershed

September 23, 2011

Mr. Terry L. Harpster
VP-Bell Bend Project-Development
PPL Bell Bend, LLC
38 Bomboy Lane, Suite 2
Berwick, PA 18603

RECEIVED SEP 26 2011

Re: PPL Bell Bend Nuclear Power Plant;
IFIM and Aquatic Studies Workplan
Response to SRBC Comments – BNP-2011-071;
Salem Township, Luzerne County, Pennsylvania

Dear Mr. Harpster:

The Susquehanna River Basin Commission (Commission) staff has reviewed the "Response to SRBC Comments regarding the IFIM and Aquatic Studies Workplan" for Bell Bend Nuclear Power Plant (BBNPP) submitted in the referenced correspondence and provides the following comments.

Our comments pertain to Enclosure 1 and are as follows:

1. The Response to **Comment 6** states that BBNPP will be operated at a steady rate and therefore "temperature hourly changes are expected to be small." That may be the case during normal operation of BBNPP; however, there will be thermal transients during plant startup and shutdown. The Commission requires that the transient temperatures be analyzed to assure that temperature rises are within the limit of 2°F during a one-hour period. The Commission acknowledges there may be regulatory overlap with the NPDES permitting process. We consider NPDES related issues to be resolved if PPL BBNPP can demonstrate that the issues are properly addressed in the NPDES permitting process. Similarly, **Comment 14,** dealing with chemical additives to the blowdown discharge, can be resolved through the NPDES permitting process.

2. In Response to **Comment 9** Table 2, there are significant discrepancies between results computed by the CORMIX model and the observed results from Ecology III studies. Of particular concern is the comparison in the "Distance to the 0.5°F isotherm." One scenario correlates well, but the other four scenarios do not correlate, with actual observances being higher by a factor of five or more than the CORMIX

model results, and in one case, the actual observance was significantly lower. Because of the lack of correlation, the Commission can not accept studies performed using the CORMIX model. Please advise us of your corrective action in this matter.

3. The Commission requires that the revised study plan be resubmitted after the comments are incorporated. The results of the studies performed as part of the study plan should be submitted for our review.

If you have any questions regarding the above, please contact Paula Ballaron at (717) 238-0423, extension 222, or Andrew Dehoff, extension 221.

Sincerely yours,

Andrew D. Dehoff
Manager, Project Review

cc: Gary Petrewski; PPL
Michael Canova; USNRC
Donald Palmrose; USNRC
Stacey Imboden; USNRC
Amy Elliott; USACE, Baltimore District
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T. L. Harpster
VP-Bell Bend Project-Development

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October 4, 2011

Mr. Andrew D. Dehoff
Manager, Project Review
Susquehanna River Basin Commission
1721 North Front Street
Harrisburg, PA 17102-2391

BELL BEND NUCLEAR POWER PLANT
APPLICATION FOR SURFACE WATER WITHDRAWAL AND
APPLICATION FOR CONSUMPTIVE WATER USE (BNP-2011-005)
RESPONSE TO SRBC COMMENTS
BNP-2011-189 **Docket No. 52-039**

References: 1) T. L. Harpster, PPL Bell Bend, LLC., to James Richenderfer, Susquehanna River Basin Commission, BNP-2011-005, dated January 14, 2011.

2) Andrew D. Dehoff, Susquehanna River Basin Commission, to T. L. Harpster, PPL Bell Bend, LLC., "Application for Surface Water Withdrawal and Application for Consumptive Water Use – BNP-2011-005", dated August 16, 2011.

Enclosed, please find the PPL Bell Bend, LLC. (PPL) response to the Commission's August 16, 2011 letter (Reference 2). No changes have been made to our request (Reference 1) of January 14, 2011 as a result of these comments. However, in the enclosed response, we have clarified numerical calculations and provided additional system descriptions as requested. We are available for a meeting or phone call to provide further clarification as needed.

Should you have further questions or require any additional information on this matter please contact Gary Petrewski at 610-774-5996 or via e-mail at gpetrewski@pplweb.com.

Respectfully,

Terry L Harpster

TLH/kw

Enclosure: PPL Response to SRBC Letter Comments dated August 16, 2011 on PPL Bell Bend Nuclear Power Plant: Application for Surface Water Withdrawal, and Application for Consumptive Water Use

cc: (w/ Enclosure)

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Enclosure

PPL Response to SRBC Letter Comments dated August 16, 2011 on PPL Bell Bend Nuclear Power Plant: Application for Surface Water Withdrawal, and Application for Consumptive Water Use

PPL Response to SRBC Letter Comments dated August 16, 2011 on PPL Bell Bend Nuclear Power Plant: Application for Surface Water Withdrawal, and Application for Consumptive Water Use

SRBC Comment No. 1.

The fourth paragraph of the referenced correspondence states that "there are no certified cooling tower or pump performance curves" because the design and procurement has not been finalized. The proposed method of determining surface water withdrawal is based on pump capacity. The Commission requires performance curves prior to final approval of the surface water withdrawal application.

PPL Response:

It is not correct that PPL's proposed method of determining surface water withdrawal is based on pump capacity as stated in this comment. The actual rate of water withdrawal will be based on metered amounts, not performance curves. The requested peak day water withdrawal is 42 mgd which allows for the estimated peak day calculated water use of 37.5 mgd (See Section 4.1 of Enclosure 1 of the January 14, 2011 PPL letter), plus a contingency to allow for metering error, and the fact that calculated water use has been based on preliminary cooling tower performance curves. Although certified cooling tower curves are not available, the information supplied by cooling tower vendors is based on actual towers that are in operation, and believed to be accurate. PPL has also separately filed with the Commission a proposed metering plan.

The 42 mgd value also corresponds to the planned maximum project instantaneous pump capability as determined in Section 4.4 of Enclosure 1. This value is based upon the combined individual ratings of two Circulating Water System Makeup Water System (CWSMWS) pumps and one Raw Water Supply System (RWSS) pump. This value is very conservative because there is no operating scenario where more pumps would be operating simultaneously or where pump capacities would continue for an entire day. Furthermore, due to system hydraulics, the CWSMWS flow with two pumps operating in parallel will be less than the sum of the individual rated flows of the two pumps.

The final pump selection and design will optimize pump performance and efficiency to operate close to the expected pump flow and pressure requirements. The final pump performance curves will confirm that the 42 mgd withdrawal value will not be exceeded at any time. Plant procedural control including gagging of valves if necessary will assure that the surface water withdrawal value of 42 mgd is not exceeded. Metering will also be installed to ensure that the permitted withdrawal rate will not be exceeded.

PPL is comfortable in making the application for surface water withdrawal and consumptive water use based on available information. When the final design is completed, the requested values will be confirmed and cooling tower and pump performance curves will be provided to the SRBC. However, final design information will not be available prior to the expected date of Commission action on the subject applications. This information will not be available until procurement contracts are let and specific vendor performance data is provided. This will not occur until after the initiation of project construction. This is not an unusual circumstance. The Commission has previously acted, and routinely acts, without the availability of final design information.

SRBC Comment No. 2.

In Section 4, the last paragraph on page 5, the blowdown methodology for the Circulating Water System Makeup Water System (CWSMWS) is described. At the Mussel Expert Panel meeting on February 23, 2011, the blowdown operating procedure for Susquehanna Steam Electric Station (SSES) was described differently. At SSES, the CWSMWS operates at capacity and the blowdown is the difference between the quantity pumped from the river and the quantity lost to evaporation and drift in the cooling towers, and the blowdown is controlled by maintaining a certain level in the cooling tower basin. The Commission requires a description of the operational parameters that determine the quantity of blowdown at BBNPP.

PPL Response:

The operation of the BBNPP cooling towers is different from what is described in the SRBC comment. The cooling tower losses (evaporation and drift) are based on environmental conditions. The blowdown is an operator controlled value based on input from the Chemistry Department. The Chemistry Department will sample cooling tower basin water for Total Dissolved Solids and Total Suspended Solids and will provide to plant operation the cycles of concentration to be maintained in the cooling tower basin water. The operator will manually adjust the blowdown flow to maintain the cycles of concentration. The CWSMWS supplies water to the cooling tower basin to maintain a normal level in making up for the cooling tower losses and blowdown flow. A level control valve automatically adjusts CWSMWS flow to maintain the set cooling tower basin level. The CWSMWS pump flows are NOT constant. The CWSMWS pumps operate along the respective pump flow/pressure curves to adjust the flow in maintaining a constant cooling tower basin level.

As an example, if environmental conditions change such that evaporation decreases, then the basin level control valve will close slightly to account for the smaller loss and to maintain the constant cooling tower basin level. The CWSMWS pumps will operate back on their pump/flow curves to deliver lower flow. With less cooling tower evaporation over time, then the operator can decrease blowdown flow with input from the Chemistry Department to maintain the given cycles of concentration and the basin level control valve will close more to maintain the set basin level. Again, the CWSMWS pumps will operate back on their pump/flow curves to deliver lower flow.

SRBC Comment No. 3.

The Commission agrees that the surface water withdrawal quantity to be used in the application should be the "maximum instantaneous surface water withdrawal" as stated in the last paragraph of Section 4.4. The withdrawal is based on the capacity of two CWSMWS pumps and one Raw Water Supply System (RWSS) pump which is 29,100 gallons per minute (gpm).

PPL Response:

PPL is requesting a peak day water withdrawal limit of 42 mgd as discussed in response to Comment 1 above. This value happens to correspond to the project's planned pump capability. However, PPL is not proposing that Commission action include an instantaneous limit.

SRBC Comment No. 4.

The maximum instantaneous surface water withdrawal is determined by the capacity of two of three CWSMWS pumps and one of three RWSS pumps. These systems have the capacity to pump more than the requested withdrawal. The Commission requires a description of the control mechanism and/or administrative procedures to prevent more than two CWSMWS pumps and one RWSS pump from operating to assure that the requested withdrawal is not exceeded.

PPL Response:

PPL has separately filed with the Commission a proposed metering plan to ensure compliance with expected regulatory limits. Plant procedural controls will also prevent more than two CWSMWS pumps from operating at the same time and will limit only one RWSS pump to operate with two CWSMWS pumps operating near capacity. The one exception for this is when pumps are rotated in and out of service. To rotate pumps in and out of service, the operator will start a standby pump, watch for that pump's pressure and flow to come up and then trip the third pump. This is a brief period of time (seconds) and system flow will not vary to any significant extent. Operating three CWSCMS pumps or two RWSS pumps in parallel during rotation will have a negligible impact on water withdrawal flow during any hour, much less over the period of a day.

In addition, as stated in the PPL response to SRBC Comment No. 1 above, plant procedural control, including gagging of valves if necessary, will assure that the surface water withdrawal value of 42 mgd is not exceeded.

SRBC Comment No. 5.

Attachment A to Enclosure 1, "BBNPP Peak Day Water Use Diagram," does not accurately portray peak flows. For example, the diagram shows the withdrawal for the Circulating Water Supply system to be 25,085 gpm and Section 4.4 indicates the withdrawal to be 26,200 gpm. Similarly, the diagram shows the withdrawal for the Raw Water Supply System to be 952 gpm and Section 4.4 indicates that the withdrawal be 2,900 gpm. The Commission requires that Attachment A be revised showing water use at the peak water withdrawal requested in Section 4.4 of 29,100 gpm. Additionally, the Commission requires a description of plant operations at peak water withdrawal, including how often the peak withdrawal operating condition will occur.

PPL Response:

"BBNPP Peak Day Water Use Diagram" (Attachment A) already provides the expected flows for the peak day where surface water withdrawal and consumptive use is greatest. However, the

diagram does not include contingency amounts associated with potential metering error. The peak day shown in the diagram represents the worst-case meteorological conditions determined from 61 years of daily data and maximum blowdown flow. The peak day surface water withdrawal and consumptive use values of the peak day are a rare occurrence, and will only occur when the plant is operating at full load and when "worst-case" meteorological conditions are occurring. The maximum (peak day) surface water withdrawal is 26,037 gpm from Enclosure 1, Section 4.1.1 of the referenced correspondence. This amount is the total of the CWSMWS withdrawal (25,085 gpm) and the RWSS (which includes the ESWS towers and miscellaneous uses) withdrawal (952 gpm). As discussed in Attachment B the maximum evaporation rates for the ESWS towers do not occur at the same relative humidity and wet bulb temperature as the circulating water system towers. The calculation of maximum peak day withdrawal as shown in the Attachment A diagram is shown in Section 4.1.2 of Enclosure 1, and equals the maximum calculated peak day withdrawal of 37.5 MGD. PPL does not believe that it is practicable to revise Attachment A to reflect the proposed withdrawal limit amount of 42 mgd.

It should be noted that individual system flows such as RWSS may be greater on a different day, but those days do not come close to representing the day where surface water withdrawal and consumptive use is greatest (peak day). A RWSS flow of 2,900 would occur only during shutdown or emergency conditions and will not occur on the day of maximum surface water withdrawal and consumptive use.

SRBC Comment No. 6.

Evaporation from the Essential Service Water Emergency Makeup System (ESWEMS) retention pond is 34.3 gpm. The Commission requires a description of the operation to provide makeup water from the RWSS, including the makeup rate and anticipated cycles of operation.

PPL Response:

The 34.3 gpm makeup rate was calculated based on the worst-case 30-day meteorological conditions that lead to the largest evaporation from the ESWEMS Retention Pond. This is the maximum rate that would be experienced and assumes no make-up to the pond from rain. The RWSS will supply the ESWEMS Pond through a pipe that has a manual valve that is controlled by plant operations. The pond normal water volume is 76.635 acre ft and the minimum water volume to satisfy its safety-related function is 47.308 acre ft. Margin over minimum volume at normal volume is 61.68%. Pond level will be monitored at least on a daily basis. The makeup flow will be adjusted on an as needed basis to maintain normal water level. The actual rate may vary on a daily basis and procedural controls will be implemented to ensure that total river peak day withdrawal rates never exceed the prescribed docket limit of 42 mgd. During winter months when ice has formed on the surface of the ESWEMS Retention Pond, the makeup from the RWSS will most likely be closed.

The pond is required to function for a 27-day period following a design basis accident. No makeup flow from the RWSS is required during this 27-day period. Except for short periods of testing, the pond is not used during normal operation. This testing will not have any affect on overall RWSS flow requirements.

SRBC Comment No. 7.

In a letter to the U.S. Nuclear Regulatory Commission, BNP-2011-025 dated January 28, 2011, Figure 3.3-1 on page 3-26 is the "Anticipated Water Use Diagram" which indicates the average and maximum water usage for BBNPP. The flows shown on this diagram are significantly different than those shown on the "BBNPP Peak Day Water Use Diagram." Of particular concern is the difference in the RWSS withdrawal which had an average flow of 1,921 gpm on the "Anticipated Water Use Diagram" and on the "BBNPP Peak Day Water Use Diagram" the same flow was indicated to be 952 gpm. The Commission requires reconciliation of the maximum/peak flows shown on the two diagrams. Consistent definitions and quantities may avoid confusion in the future.

PPL Response:

The two figures were prepared for different purposes and with different input based on available information at the time when they were prepared. The values for Figure 3.3-1 were derived in 2008 before any cooling towers curves were available and are meant to provide the system values individually. The values provided in PPL's Combined License Application Environmental Report Figure 3.3.-1 satisfied the NRC's need for representative flows for the individual systems. These values (flows) do not satisfy the values needed for SRBC applications for withdrawal and consumptive use. The "BBNPP Peak Day Water Use Diagram" is based on the latest information that is available and provides a snapshot in time to illustrate the peak day use based on the systems that would be in service.

For the RWSS Figure 3.3-1 has the flow 1,921 gpm which has two pumps in service supporting all four UHS towers. The higher evaporation rate then increases the blowdown flow and the makeup flow from RWSS is then greater. The "BBNPP Peak Day Water Use Diagram" has one RWSS pump in service providing 952 gpm supporting two UHS towers which is the number of RWSS pumps that would be in service on the peak day. The evaporation from the UHS towers and blowdown flow are based on the meteorological conditions that cause the largest main cooling tower evaporation. The UHS towers and the main cooling towers have different performance characteristics and will experience maximum evaporation under different meteorological conditions.

For the CWSMWS system Figure 3.3-1 has the flow 23,808 gpm which has two pumps in service supporting the two main cooling towers. This represents the towers operating at a design point which is not bounding. The "BBNPP Peak Day Water Use Diagram" has two CWSMWS pumps in service providing 25,035 gpm supporting the two main cooling towers. The higher evaporation rate is based on worst-case meteorological conditions to provide a bounding value. With the higher cooling tower evaporation rate, the cooling tower blowdown flow is increased and the CWSMWS flow is higher than the design point.

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October 4, 2011

Mr. Andrew D. Dehoff
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BELL BEND NUCLEAR POWER PLANT
SRBC NOTICE OF APPLICATION REVIEW REPONSE
AVOIDANCE OF CONSUMPTIVE USE
BNP-2011-190 Docket No. 52-039

References: 1) Michael J. Brownell, Susquehanna River Basin Commission, to T. L. Harpster, PPL Bell Bend, LLC., "Notice of Application Review for PPL Bell Bend, LLC.", dated March 1, 2010.

2) T. L. Harpster, PPL Bell Bend, LLC., to James Richenderfer, Susquehanna River Basin Commission, BNP-2010-192, dated October 21, 2010.

3) Andrew D. Dehoff, Susquehanna River Basin Commission, to T. L. Harpster, PPL Bell Bend, LLC., "Avoidance of Consumptive Use – BNP-2010-192", dated August 22, 2011.

Enclosed, please find the PPL Bell Bend, LLC. (PPL) response to the Commission's August 22, 2011 letter (Reference 3).

The clarifications of PPL's October 31, 2010 submittal (Reference 2) requested by the Commission, are provided in the enclosed responses. The Commission also suggested a number of potential revisions to Enclosure 1, Attachment C, Table 1 provided in the October 21, 2010 (Reference 2) submittal, stemming from "apparent inconsistencies" between the two independent analyses that were submitted for inclusion in the project record. We do not believe that the suggested revisions to Table 1 are appropriate as noted in the enclosed responses. However, to be responsive to the Commission's needs, we have performed a sensitivity analysis for further Commission consideration. PPL believes that each of the independent consultant analyses provides a reasonable conceptual analysis of dry air cooling, with both independent studies concluding that dry air cooling is not technically feasible or cost justifiable for the Bell Bend Project. We believe this is reinforced by the enclosed sensitivity analysis.

Should you have further questions or require any additional information on this matter please contact Gary Petrewski at 610-774-5996 or via e-mail at gpetrewski@pplweb.com.

Respectfully,

Terry L Harpster

TLH/kw

Enclosure: PPL Response to SRBC letter of August 22, 2010, Avoidance of Consumptive Use

cc: (w/ Enclosure)

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Enclosure

PPL Response to SRBC letter of August 22, 2010, Avoidance of Consumptive Use

Enclosure
PPL Response to SRBC letter of August 22, 2010,
Avoidance of Consumptive Use

Section 1 - Response to Comments

General Response:

In our letter of October 21, 2011 (BNP-2010-192), PPL provided a narrative response (Enclosure 1) and a separate, independent, analyses (Enclosure 2) related to alternative cooling methods. The preface to Enclosure 2 noted certain differences between the analyses, particularly with respect to project costs, and concluded that the same overall conclusion could be drawn from either analysis; i.e., that dry air cooling is not technically feasible or cost justifiable for the Bell Bend Project. In its August 22, 2011 letter the Commission concurs with this conclusion, acknowledges differences that may occur with different analytical approaches, but then suggests certain "inconsistencies" that require resolution. These inconsistencies are further addressed in specific responses below.

Collectively in this response, PPL has chosen not to modify, combine, or resolve analyses independently prepared by its technical consultants both of which conclude that dry air cooling is not technically feasible or cost justifiable for the Bell Bend Project. However, to be responsive to SRBC's concerns a sensitivity analysis has been prepared and is provided in Section 2 below.

SRBC Comment No 1.

The analyses use mitigation fee payments of $0.28 per 1,000 gallons of water as an indication of cost of mitigation make-up water. Although the Commission does allow mitigation fee payments as an option for smaller projects, the water storage controlled by the Commission is not sufficient to support the mitigation makeup water for a project as large as BBNPP. For that reason, as noted in previous correspondence, consumptive use mitigation fee payments are not a viable option for the BBNPP project. The cost of providing actual mitigation water, perhaps using an analysis of costs related to your proposed pooled asset concept, should be used. Also, PPL should not assume that the $0.28 per 1,000 gallons of water is an appropriate cost figure to provide mitigation makeup water. The Commission increased this fee to $0.29 as of July 1, 2011, one of several increases over the last few years, and will most likely continue these increases during the term of any approval as the costs of providing storage continue to escalate.

PPL Response:

The staff position expressed above that mitigation fee payments are (only) an option for small projects appears to be inconsistent with the Commission's regulatory language. However, we understand the Commission's discretion on these matters and, as staff is aware, PPL is working to fully satisfy Commission guidance with regard to providing actual mitigation water in lieu of fee payments.

In response to this comment we direct you to the footnote on Page 2 of Enclosure 1 which notes that PPL expects that final mitigation costs will "be consistent with the in-lieu payment costs used in this analysis." Final PPL costs of mitigation are not known at this time, and may be more - or less - than the in-lieu payment rate when costs are considered on a per million gallon basis. Absent final mitigation costs, using the in-lieu rate represents a reasonable estimate of potential mitigation cost for purposes of these analyses. We note that in the Commission's own analysis in support of Commission Resolution 2008-03 that the established in-lieu payment rate was based on the expected cost of storage development in the basin.

Furthermore, footnote d) of Table 1 of Attachment C also notes that the analysis assumes 2.5% annual escalation, reflecting the fact that costs (including the in-lieu payment rate) will be expected to increase. As a result, the present value analysis in Table 1 already accounts for this potential escalation.

SRBC Comment No. 2

There are inconsistencies between Enclosure 1 and Enclosure 2 that should be resolved. In Enclosure 1, Attachment A, there is reference to a power reduction penalty for ACC of several percentage points. The study in Enclosure 2 defines the power reduction penalty as 2% which appears to be more accurate based on the engineering analysis.

PPL Response:

It should be noted that the Enclosure 2 analysis was not based on a detailed engineering design but rather was prepared at a conceptual level by engineers familiar with both natural draft cooling tower and ACC system design; essentially a pre-feasibility level estimate. Section 5.1 of Enclosure 2 notes that the 0.45% power reduction penalty for natural draft cooling towers, and the 2% power reduction penalty for ACC were derived from a 2008 Sargent and Lundy Cooling Tower Study. The author notes that these penalties are believed to be unusually low for steam turbines which characteristically have penalties associated with steam turbine backpressure of 5 inches Hg in the range of 6 to 7%.

PPL does not believe that refinement of the power reduction penalty would be a worthwhile effort as it would not alter the overall results and conclusions of the analyses. A sensitivity analysis is provided in Section 2 of this response in support of this conclusion.

SRBC Comment No. 3

Also in Attachment A, there is an assertion that ACCs require more space than the 15 acres allocated to the wet cooling design. Enclosure 2 states that ACCs for BBNPP will require 10 acres and 15 acres would be adequate to accommodate an ACC design.

PPL Response:

Section 5.2 of Enclosure 2 notes that the area required for an ACC system would be approximately 10 acres as noted. The analysis in this section goes on to note that steam duct routing would occupy an estimated 7 additional acres of land. Therefore an ACC system design would likely require additional acreage (approximately 17 acres total). Enclosure 1, Attachment 2 at page 5 notes that lands beyond the 15 acres are not available.

SRBC Comment No. 4.

Comments on Enclosure 1, Attachment C, Table 1 are as follows:

1. *In the "Footprint per Plan Unit" column, the entry for dry cooling should be 15 acres as stated in the engineering study in Enclosure 2.*
2. *In the "Auxiliary Load Difference" column, the entry for dry cooling should be 13.5 megawatts (MW) which is the auxiliary load difference cited in Enclosure 2, Section 5.1.*
3. *In the "Annual O&M Cost" column, the cost for maintaining the natural draft cooling tower is not zero. A cost figure should be generated and subtracted from all the other options to calculate a difference between the natural draft options, as stated in Note (a).*
4. *In the "Annual O&M Cost" column, Note (e) asserts that O&M for dry cooling will be 1% or 2% of the capital cost. The relationship between capital costs and O&M costs needs to be validated. Also, the 2% figure was used which is inconsistent with the conservative analytical approach used in the engineering study in Enclosure 2. The 1% figure should be used in Table 1.*
5. *In Note (b) the 8% cost of money is inconsistent with the 7% discount factor used in the analysis performed in Enclosure 2.*
6. *In Note (d) use of the $280 per million gallons of water is inappropriate as discussed above.*

PPL Response:

Enclosure 1, Attachment C, Table 1 was principally derived from PPL's Combined License Application (COLA) Table 9.4-1 and analysis developed by Unistar Nuclear Services, LLC and its consultants for PPL. The footprint, auxiliary load difference, O&M and Capital cost numbers in Table 1 were derived from this source. Enclosure 2 was a separate and independent Burns and Roe analysis commissioned by PPL to further validate COLA Table 9.4-1 information, specifically with respect to a dry cooling alternative. Both analyses were based on generic or conceptual information, and engineering experience as opposed to a detailed design. As noted in the preface to Enclosure 2 the same conclusions can be drawn from either analysis with regard to the feasibility of dry cooling.

In Table 1 PPL expanded the COLA Table 9.4-1 data analysis to derive a comparative present value cost estimate. As noted in footnote (h) of Table 1 PPL assumed a 17 MW auxiliary load difference for dry air cooling in the present value cost analysis, due to the range provided in the Unistar analysis. The 17 MW was

derived from a reasonable interpretation of the Burns & Roe Enclosure 2 report, and is considered potentially conservative and favorable to the dry cooling alternative.

PPL response to SRBC numerical comments follows:

1. As discussed in response to SRBC Comment No. 3 the expected footprint of dry air cooling, taking into account steam duct routing is estimated to be in the range of 17 acres. This is not inconsistent with the general footprint range 7-30 acres shown in Table 1 as developed by Unistar. Our preference is not to begin mixing these analyses by inserting 17 acres in Table 1.

2. As noted in footnote (h) to Enclosure 1, Attachment C, Table 1, the Auxiliary Load Present Value for Dry Cooling was based on 17 MW which is low in the range and favors (is conservative to) the Dry Cooling option. The preface to Enclosure 1 states that the Table 1 Dry cooling option Auxiliary Load Difference is 13-79 MW while the Enclosure 2 Report has it as 10-45 MW. The source of Enclosure 2 data comes from Enclosure 2, Table 2 that provides a month-by-month evaluation. PPL is uncertain over staff's derivation of the 13.5 MW. Nevertheless, the Section 2 sensitivity analysis evaluates this suggested revision.

3. Footnote (a) of Table 1 notes that for both Auxiliary Load and O&M that the values contained in the table are differential values. Developing and inserting either auxiliary load loss or O&M for natural draft cooling towers would not alter the analysis. The numbers shown in these columns already represent differences in comparison to the natural draft option.

4. The O&M values used in Table 1 were supplied by various vendors to Unistar Nuclear Services, LLC as part of the Calverts Cliffs Nuclear project. PPL does not have access to the vendor supplied information – it is proprietary. This issue is further addressed in the Section 2 sensitivity analysis of this response.

5. PPL's cost of money or discount rate varies. Timing differences between analyses resulted in different assumptions. The 8% assumption is a reasonable current estimate for purposes of the present value analysis contained in Table 1.

6. Please see PPL response to SRBC Comment No 1.

SRBC Comment No. 5.

Enclosure 1, Attachment C, Table 2 represents an acceptable comparison of cooling options.

PPL Response:

None.

SRBC Comment No. 6.

In Enclosure 2, Section 1.0 the Commission has not indicated that use of the $0.28 per million gallons of water is an acceptable method to estimate the cost of makeup water for BBNPP, as discussed above.

PPL Response:

See PPL response to SRBC Comment No. 1 for our record response to the use of $0.28 per million gallons in this analysis. While the phrasing of this section could be improved it does not affect the analytical results, or the conclusions. Therefore, PPL is not proposing to modify the report at this time.

SRBC Comment No. 7.

In Enclosure 2, Section 3.1 last paragraph, the Commission does not have a requirement to store 90 days of water at the peak consumption rate. The current design consumptively uses up to 28 million gallons per day (MGD), and most likely there will be a requirement to provide water to meet a passby requirement that has not been established. For purposes of this study, reasonable capital costs, and annual costs should be established to provide mitigation for the BBNPP makeup water. For the dry air cooling option, for purposes of this study, the $0.29 per 1000 gallons of water cost plus an escalator figure is appropriate because of the reduced consumption.

PPL Response:

See PPL response to SRBC Comment No. 1. The Commission's regulations at § 806.22 (ii) state that an acceptable form of mitigation is to "Release water for flow augmentation, in an amount equal to the project's total consumptive use, from surface water storage or aquifers, or other underground storage chambers or facilities approved by the Commission, from which water can be withdrawn for a period of 90 days without impact to surface water flows." At the time that the Burns & Roe report was prepared PPL and Commission staff had not yet discussed this regulation, and this was the interpretation derived by Burns & Roe in their analytical report.

The meaning of this regulatory phrasing is still unclear to PPL, but we do understand that Commission staff interprets this regulation in a different way. In that regard we encourage the Commission to issue some clarifying guidance on this matter.

For purposes of the Enclosure 2 report, the statement is not relevant to the analytical results or conclusions, therefore PPL is not proposing to modify the report at this time.

SRBC Comment No. 8.

Comments on Enclosure 2, Table 1 are as follows:

1. *Contractor Indirects and Contractor Fee for the Air Cooled Condensor System (ACC) are considerably higher than the Existing Circulating Water System (ECWS) on a percentage of direct costs basis. What is the rationale for the difference?*
2. *Although the rationale was provided for the contingency calculation, the amount of contingency for the ACC option ($106,723,200) appears to be too high (30% of total cost).*
3. *The costs of providing "Offsite Water Storage" for the ACC of $48,000,000 is not consistent with the $400,000 cost in Enclosure 1, Attachment C, Table 1 which used the $0.28 per 1,000 gallons of water cost method. As discussed above, the amount of water required for BBNPP with an ACC system (0.3 MGD) is relatively small and therefore the use of $0.29 per 1,000 gallons of water plus an escalator is appropriate.*
4. *The "Capital Cost Difference" of $124,710,000 is significant reduced based on the above comments.*

PPL Response:

1. The footnote at the bottom of the Table 1 states: "the contractor indirects are noticeably higher for the air cooled condenser because the GEA quotation did not include installation, whereas installation was included in the cooling tower costs". The Contractor Fee for both options is about 10% - 11% of Capital Costs Elements Subtotal.

2. A 30% contingency is appropriate and common for conceptual feasibility level estimates in plant development cost analyses and are in accordance with generally accepted cost estimating for design and construction. This level of contingency is based on guidance provided by the US Department of Energy in its guidance document "DOE 430-1-1X., Cost Estimating Guide for Program and Project Management", April 2004.

3. At the time that the Burns & Roe report was prepared in August 2010 a consumptive use makeup option for the natural draft cooling towers was being estimated at $105 million dollars based on a nominal 30 MGD consumptive use. As discussed in Section 3.1 of Enclosure 2 consumptive use associated with an ACC was estimated at 6.3 MGD. Derivation of the $48 million is discussed in the paragraph immediately prior to Table 1 of Enclosure 2. To be conservative (i.e., to provide an analysis favorable to ACC) PPL assumed a 139 gpm makeup rate for ACC in Enclosure 1, Attachment C, Table 1, and used the Commission's in-lieu payment rate as discussed in response to SRBC comment 1.

4. See responses 1 through 3 above.

SRBC Comment No. 9.

In Enclosure 2, Section 6.0, further detail is required to understand how the present values were calculated for operating costs and capital costs. The $253,850,000 net present value of operating costs should be segregated into maintenance costs, increased auxiliary power, and power reduction opportunity costs with a breakdown of each segregation.

PPL Response:

The capital cost increase started with a 2010 value of $124,710,000 from Enclosure 2, Table 2. This is the capital cost difference for an ACC system versus the CWS. This value was escalated at 3.0% per year and 6% per year was added for "interest during construction". Total cost at commercial operation (present value) ends up being $177,360,000.

The present value for the operating costs evaluation assumed a 40-year economic life starting from commercial operation and uses a present worth discount value of 7%. The annual increase in energy use is 136,000 MWh from Enclosure 2, Table 3. Electric energy value is $90/MWh with an annual escalation factor of 2.5%. Additional maintenance cost over CWS is $1,135,000 starting in year one and increases by 3% each year. There is an allowance for equipment replacement of $22,775,000 after 20 years of service. This is included as a maintenance cost for that year. Additional property taxes (0.025%) and insurance (0.05%) are taken as a percentage of the total capital cost and are not escalated over the 40-years. The incremental costs that total to the present value for the operating costs of $253,850,000 are segregated as follows:

Electric Energy Losses:	$224,380,000
Additional Maintenance:	$ 22,194,000
Taxes and Insurance:	$ 1,773,000
Replacement Equipment:	$ 5,500,000
Total	$253,847,000 (rounded up to $253,850,000)

Section 2 – Sensitivity Analysis

Table A below provides a sensitivity analysis of several SRBC comments/suggested changes to Enclosure 1, Attachment C, Table 1. Factors analyzed include:

1. Auxiliary Load Difference of 13.5 MW
2. 7% Discount Rate
3. 1% O&M
4. Auxiliary Load Difference of 8.5 MW (50% power reduction penalty)
5. A cumulative analysis of factors 1 to 3, and
6. A cumulative analysis of factors 2 to 4.

A comparison is also provided to Present Value cost differences derived using analysis from the Burns & Roe report.

Table B below provides a side-by side comparison of key parameters from the independent analyses.

Conclusion

Table A illustrates Present Value cost differences between dry cooling and natural draft cooling towers ranging from $255 million to $429 million for factors 1 to 6 above. A comparative Present Value evaluation of the Burns and Roe report suggests a Present Value cost difference of $332 million.

The Table B comparison illustrates reasonable good correlation between the two independent analyses. This in combination with the sensitivity analysis reinforces a conclusion that dry air cooling is not technically feasible or cost justifiable for the Bell Bend Project.

Table A - Sensitivity Analysis

Type of Cooling	Auxilliary Load Difference (MW)	Aux Load Difference PV (10^3$)	Average Daily Water Make-up (10^3 MGD)	Make-up Water Cost PV (10^3 $)	Annual O&M Cost Difference (10^3 $)	O&M Cost Difference PV (10^3 $)	Capital Cost (10^3 $)	Total Comparative PV (10^3 $)	PV Difference (10^3 $)
Table 1 values per BNP-2010-192									
Natural Draft (2 Hyperbolic Towers) (8% discount rate)	0	$0	19.84	$39,656	0	0	$173,727	$213,383	
Dry Cooling	17	$204,764	0.2	$400	$5,975	$102,826	$298,727	$606,717	$393,334
Dry Cooling Sensitivity									
Individual Factor Analysis									
Natural Draft (2 Hyperbolic Towers) (7% discount rate)	0	$0	19.84	$44,970	0	0	$173,727	$218,697	
(1) 13.5 MW Load Difference	13.5	$162,607	0.2	$400	$5,975	$102,826	$298,727	$564,560	$351,177
(2) 7% Discount Rate	17	$232,188	0.2	$453	$5,975	$116,597	$298,727	$647,966	$429,269
(3) 1% O&M	17	$204,764	0.2	$400	$2,987	$51,409	$298,727	$555,300	$341,917
(4) 50% diff in Power Red. Penalty	8.5	$102,382	0.2	$400	$5,975	$102,826	$298,727	$504,335	$290,952
Cumulative Analysis									
Cumulative Analysis of (1) to (3)	13.5	$184,384	0.2	$453	$2,987	$58,294	$298,727	$541,859	$323,162
Cumulative Analysis of (2) to (4)	8.5	$116,094	0.2	$453	$2,987	$58,294	$298,727	$473,568	$254,872
Analysis for Comparison									
Natural Draft (2 Hyperbolic Towers) (8% discount rate)	0	$0	19.84	$39,659	0	0	$280,760	$320,419	
Analysis of Burns & Roe Evaluation for Comparison(2)	10 (3)	$120,450	0.33 (3)	$660	$3,994	$68,734	$462,468	$652,312	$331,893

(1) From B& R Report without off-site water storage

(2) Analysis uses 8% discount rate

(3) Minimum of range used

Table B - Key Comparison of Independent Analyses

Item	Units	Bechtel Dry Cooling	B&R BBNPP Dry Cooling	Notes
Footprint per plant Unit (1562 MWe)	Acres	7 to 30	17	
Auxilliary Load Difference	MW	13 to 79	10 to 45	
Water make-up	gpm	139	230 to 390	The Bechtel values do not include make-up for the essential service water system.
Annual O&M Cost	10^3 $	$5,975	$3,994	Both are estimated values.
Capital Cost	10^3 $	$298,727	$462,468	Bechtel value is reported as a representative value +/- 20%. B&R value is a vendor quoted value for BBNPP.

Susquehanna River Basin Commission

a water management agency serving the Susquehanna River Watershed

October 18, 2011

Mr. Terry L. Harpster
VP-Bell Bend Project-Development
PPL Bell Bend, LLC
38 Bomboy Lane, Suite 2
Berwick, PA 18603

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

Dear Mr. Harpster:

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 1, 2, and 7. We will respond to the remaining subsections under separate cover. 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 1, the first question in the Summary is "What is the relationship between aquatic habitat and river flows . . . ?" The response was "PHABSIM analysis of aquatic habitat for eight fish species indicates that negative impacts on habitat due to the requested BBNPP water use are generally small and infrequent, and would not contribute to habitat-related population limitations." The Physical Habitat Simulation (PHABSIM) analysis is incomplete, as it does not focus on the area of the river where impacts to aquatic life are most likely to occur, specifically the island and riffle area between transects G2 and R1. The Commission requires additional PHABSIM analysis of this stretch of the river, similar to the analysis submitted in an e-mail from Gary Petrewski, dated May 19, 2011.

   Additionally, to more accurately assess the relationship between aquatic habitat and river flows, the study should focus on low flows in the range of Q7-10 and 20 percent average daily flow (ADF). Unlike most Instream Flow Incremental Methodology (IFIM) studies that typically analyze a broader range of flow regimes based on hydroelectric power operations, the purpose of the BBNPP study is to address impacts on aquatic life at low flows to determine an appropriate passby requirement,

and it may provide information useful in establishing a requirement for mitigation makeup water for the consumptive water use at BBNPP.

Lastly, the Commission notes that several aquatic studies have not been completed, and studies that have been completed have not been reviewed and accepted by the Commission, which renders the statement, "negative impacts on habitat due to the requested BBNPP water use are small and infrequent . . .", premature and cannot be fully evaluated at this time. Comments on the studies that have been submitted must be resolved and other agreed upon studies, including the 2D flow analysis and Mussel Survey, need to be completed, reviewed, and accepted before valid conclusions about the impacts on aquatic life can be drawn.

2. In Section 1, the summary related to the impact of reduced river flow and stage on smallmouth bass indicates, "Once water temperatures consistently exceed 84-85°F, juveniles migrate from the shoreline backwater habitat into deeper river water." This statement is not supported by the study presented in Section 5. The study does not adequately evaluate if the juvenile bass are migrating at a smaller size due to water temperature, and if their natural preference would be to remain in these areas longer to achieve a larger size and thereby reduce predation pressure.

3. In Section 2, second paragraph, the conclusion that there is no negative impact on 7 of 23 species and life stage combinations may not be supported pending final review of the study. For example, historical flows in that section of the river have been considerably lower than the low flow of 800 cubic feet per second (cfs) in the study, and therefore, the conclusion cannot be made without some qualification. Absent an analysis on flows less than 800 cfs, the Commission could not support a passby flow requirement at less than this amount.

   On pages 12 and 13, a paragraph should be added to discuss the margin of error for this IFIM study. There are areas of statistical analysis within the study where errors may be introduced, particularly extrapolation of flows at BBNPP from the Wilkes-Barre stream gage and in the extrapolation of various flows at each transect from one set of flow measurements. Other parameters in the study may also generate a margin of error. A better understanding of the study results will be provided by generating an overall margin of error for the study.

4. Figure 2-1 depicting the "Generalized IFIM sequence" does not show steps for consultation with stakeholders to determine goals of the study, and does not include a step for stakeholders to reach a consensus regarding study conclusions. Due to time constraints and the way the IFIM study was conducted, some of the consultative steps were skipped and had to be retrofitted. In any case, the steps are essential to producing a viable IFIM study and should be included on Figure 2-1.

5. In Section 2.4, for the two transects that were added "during an agency visit," further explanation is needed to demonstrate what data were collected at what flow and how those data were extrapolated to other flows.

6. In Section 2.5, the daily discharge data from 1899 to 2010 cover too large a time frame and dampen impact from development in the watershed. We recommend a period from 1960 to 2008 to develop the time series of daily river flow. Additionally, to adequately analyze low flows, scenarios should be developed using time series of daily river flow experience from 1999 to 2002.

   In addition, known upstream consumptive use should be used in the flow scenarios. For example, the Susquehanna Steam Electric Station (SSES) consumptive use is permitted at 48.000 million gallons per day (mgd). Another flow scenario should be developed subtracting the maximum daily BBNPP consumptive use and all the upstream consumptive use to the Wilkes-Barre gage, including the maximum SSES consumptive use less mitigation releases from Cowanesque Reservoir, from the adjusted flow at the Wilkes-Barre gage.

   In footnote 3 on page 21, what is the rationale for stating that these figures are conservative?

7. In Section 2.6, in addition to the data provided, a graphic of the Weighted Usable Area (WUA) results over time would add another level of analysis to help visualize the change in WUA during the course of the year and where problem areas could occur. This graphic should include current conditions and then the various scenarios.

   In the second paragraph, we agree that the slope of the curve is critical and the focus of the study is to analyze flows in consideration of a passby flow requirement. Accordingly, the x-axis on Figure 2-6 should display lower flows in the Q7-10 to 20 percent ADF range. This will provide better visualization of WUA at the lower flows. In addition, timing and duration of low flows are also critical and, as requested above, WUA plotted against time for each species and life stage would provide data for more specific analysis.

   On page 24, first full paragraph, the Commission regards the relationship between WUA and higher flows to be irrelevant for the purpose of analyzing the need for a passby flow requirement and/or mitigation of the BBNPP consumptive use of water. Although the PHABSIM model shows reduced WUA at higher flows, other factors such as water temperature and dissolved oxygen levels are less critical to aquatic life at high flows. The high flows may temporarily displace some species as they seek more suitable habitat; however, any mortality due to temporary loss of habitat is natural and cannot be attributed to consumptive use of water by BBNPP. At low flows, the consumptive use of water by BBNPP does negatively impact WUA, as well as water temperature and dissolved oxygen, which is the rationale for the study

to focus on low river flows. The above statement also applies to the second to last paragraph of page 29.

In addition, the fifth sentence of the first full paragraph on page 24, the statement that, ". . . any flow reduction due to BBNPP consumptive use can never have a negative effect on the available suitable habitat" cannot be supported because flows less than 800 cfs were not evaluated. Absent analysis focused on flows less than 800 cfs, the Commission will follow established policy and require a passby flow at the Q7-10 river flow or higher.

8. In Section 2.7, the riffle areas within the study area are the areas of most concern, and an analysis of WUA for those areas is essential to fully evaluate any potential effects due to consumptive use at BBNPP. The PHABSIM analysis is incomplete and does not include an analysis on the area of the river where impacts to aquatic life are most likely to occur: the island and riffle area between transects G2 and R1. Further analysis is required that provides the proper focus on this reach of the river. The agreed upon 2D analysis may provide a better understanding of the dynamics of the river in this area.

   In the first paragraph of Section 2.7 on page 25, linear extrapolation to estimate daily WUA for flow values less than 800 cfs is inappropriate because at flows that low, the relationship between WUA and flow is curvilinear. A best-fit curvilinear formula should be used to extrapolate WUA values at flows less than 800 cfs.

   The depiction of WUA versus flow was normalized (nWUA); however, the Commission requires the raw numbers for each species and life stage to assess potential bottlenecks and overall scale of changes in an area for each species.

   In the second paragraph on page 28, the Commission acknowledges that the negative impact to WUA occurs primarily at low flows that may not occur frequently, and this is the relationship portrayed in the WUA versus percent time graphs. For some species and life stages like juvenile smallmouth bass, the low flows are coincident with higher temperatures and low dissolved oxygen. These conditions have been observed to cause mortality of juvenile smallmouth bass. In this case, the percent of time is not relevant; however, the length of time and magnitude of the negative impact on WUA is critical to the survival of the juvenile smallmouth bass. As requested above, a graph of WUA versus time would provide data for a more in-depth analysis.

   In the last paragraph on page 28, the Commission does not agree with the stated conclusion that there is no substantial difference in habitat availability when flows are reduced by BBNPP consumptive water use. Based on comments above, the analysis must be focused on low flows, appropriate sections of the river, and time of the year before reaching this conclusion.

On page 29, first full paragraph, a more robust assessment of WUA should be conducted in conjunction with seasonality constraints. The timing of the low flows makes a difference and analysis should be focused on each species and life cycle that coincides with low flow events.

9. In Section 2.8, conclusions resulting from the PHABSIM study are premature pending resolution of the above comments. The focus of the study should be on low flows, particularly in the riffle area of the river. Additionally, conclusions from the PHABSIM analysis should be integrated with the results of other studies on this section of the river. For example, analyses from Sections 4.0 and 5.0 should be incorporated to more fully assess potential changes in water temperature and dissolved oxygen levels and effects on fish species, especially those dependent on shallow water areas during the summer. Finally, two studies were not included in the JPA submission, the 2D analysis of the riffle area of the river and the Mussel Survey. The results of these studies also need to be integrated into conclusions of the impact of BBNPP on aquatic life.

   The above comment also applies to Section 7.0.

If you have any questions regarding the above, please 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
Stacey Imboden; USNRC
Amy Elliott; USACE, Baltimore District
Susan Weaver; PADEP
Eugene Trowbridge; PADEP
Mark Hartle; PFBC
Tom Shervinskie; PFBC
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November 21, 2011

Mr. Joseph Buczynski, P.E.
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Bureau of Watershed Management
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Ms. Amy Elliott
U.S. Army Corps of Engineers - Baltimore District
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BELL BEND NUCLEAR POWER PLANT
JOINT PERMIT APPLICATION AND REQUEST
FOR WATER QUALITY CERTIFICATION, REV 1
BNP-2011-207 Docket No. 52-039

References:
1) T. L. Harpster to J. Buczynski, PADEP, and A. Elliott, USACE, "Joint Permit Application and Request for Water Quality Certification" BNP-2011-118, June 29, 2011

2) J. Dresch, PADEP, to T. L. Harpster, "Acknowledgement Letter/Administrative Incompleteness Notification, DEP Application No. E40-720", October 25, 2011

PPL Bell Bend, LLC (PPL) is pleased to submit to the Pennsylvania Department of Environmental Protection (PADEP) and the U.S. Army Corps of Engineers a revised Joint Application for Pennsylvania Water Obstruction and Encroachment Permit and a U.S. Army Corps of Engineers Section 404 Permit for the proposed Bell Bend Nuclear Power Plant in Salem Township, Luzerne County, Pennsylvania. PPL is also requesting state Water Quality Certification under Section 401 of the Clean Water Act.

Changes to this application are provided on a revision sheet attached to the submittal. The most significant changes are the updating of the Erosion & Sedimentation Control Plan, Stormwater Management section, and the Hydraulics and Hydrology Analysis. We have also addressed the PADEP changes requested in their Administrative Incompleteness Notification.

Please do not hesitate to contact Brad Wise of my staff [610-774-6508 or bawise@pplweb.com] directly with any questions you may have regarding this application.

Respectfully,

Rocco R. Sgarro

RRS/kw

Enclosure: Joint Application for Pennsylvania Water Obstruction and Encroachment Permit and U.S. Army Corps of Engineers Section 404 Permit Application and a DVD

cc: (W/ Enclosure on DVD)

Ms. Jamie Davis
Office of Environmental Programs (3EA30)
U.S. Environmental Protection Agency
1650 Arch Street
Philadelphia, PA 19103-2029

Mr. Tom Shervinskie
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Ms. Jennifer Kagel
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Ms. Paula B. Ballaron
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Mr. Thomas W. Beauduy
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Mr. Joshua Longmore
Luzerne Conservation District
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Ms. Karen J. Karchner
Zoning/Building Code Official
38 Bomboy Lane
Berwick, Pa 18603

(W/O Enclosure) (To be provided under separate cover Hardcopy and DVD)

Ms. Stacey Imboden
Senior Project Manager
U.S. Nuclear Regulatory Commission
11545 Rockville Pike
Rockville, MD 20852

Susquehanna River Basin Commission

a water management agency serving the Susquehanna River Watershed

December 21, 2011

RECEIVED DEC 29 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

Susquehanna River Basin Commission

a water management agency serving the Susquehanna River Watershed

January 6, 2012

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

RECEIVED JAN 10 2012

Re: Bell Bend Nuclear Power Plant; BNP-2010-165;
Seasonal Availability and Water Use;
Salem Township, Luzerne County, Pennsylvania

Dear Mr. Caverly:

Susquehanna River Basin Commission (Commission) staff has reviewed the "Seasonal Availability and Water Use" for the Bell Bend Nuclear Power Plant (BBNPP) submitted in the referenced correspondence and provides the following comments.

Our comments are as follows:

1. In the last bullet on page 2, titled "ESWS Cooling Tower Evaporation," the evaporation from simultaneous operation of two Essential Service Water System (ESWS) towers is indicated as 324 gallons per minute (gpm) average evaporation and 512 gpm peak evaporation. In BNP-2011-005, page 4 of 8, the peak evaporation is indicated as slightly less at 480 gpm. Additionally, in BNP-2011-025 sent to the Nuclear Regulatory Commission on January 28, 2011, the average evaporation rate for two ESWS towers is indicated as 1,142 gpm, and the peak evaporation is related to four-tower operation and is not relevant. These evaporation rates should be consistently defined and quantified for each operating mode.

2. The Commission does not agree with the conclusion in the second paragraph on page 7 that "The monthly comparisons in Table 3 clearly demonstrate the adequacy of supply at BBNPP." The adequacy of water supply will be determined by careful review of aquatic studies, plans for consumptive water use mitigation, and compliance to Commission policies and regulations.

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

Sincerely yours,

Andrew D. Dehoff, P.E.
Manager, Project Review

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
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Larry Miller; USFWS
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Susquehanna River Basin Commission

a water management agency serving the Susquehanna River Watershed

February 16, 2012

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 (BBNPP);
PPL Pooled Asset Concept Relating to BBNPP;
Salem Township, Luzerne County, Pennsylvania

Dear Mr. Caverly:

Susquehanna River Basin Commission (SRBC) staff has received numerous inquiries from other agencies requesting clarification of the PPL Pooled Asset concept (Pooled Assets) as it relates to the Bell Bend Nuclear Power Plant (BBNPP). The purpose of this letter is to clarify what the SRBC staff believes will be necessary to support a request to utilize a Pooled Assets approach to address consumptive water use by BBNPP.

As part of its consumptive water use application for BBNPP, PPL must propose (and the SRBC commissioners must approve) mitigation for its requested consumptive water use of 28 million gallons of water per day (mgd). As you are aware, staff believes mitigation for a proposed consumptive use by a new facility of this magnitude and at this location must be in the form of compensatory water or discontinuance of use during designated low flow periods rather than monetary payment. The purpose of mitigation is to ensure no net reduction of flow in the river during such periods. Any proposed mitigation water must flow past BBNPP to satisfy the requirement.

PPL is proposing an innovative approach of pooling its various water storage "assets" to meet its consumptive use mitigation requirements at several existing projects and at the proposed BBNPP facility. This approach, as presented to the Commission in the form of a general concept and not a specific plan on June 23, 2011, may potentially allow for the more effective utilization of PPL's water storage assets in the Susquehanna River basin.

No formal action has been taken to date by the commissioners regarding PPL's pooled asset concept, nor has PPL made a formal submission of its request. To develop this concept into an acceptable submission for review and possible approval by the SRBC, PPL must establish a suite of storage options and operational alternatives, and designate which generation facilities and other PPL projects are to be included in the plan. At a minimum, the plan must

identify how it proposes to modify the existing approved mitigation methods at each of the facilities addressed by the plan, include applications for any new and increased withdrawals that might initially be added to the asset pool, and have information to demonstrate that proposed releases are feasible and adequate to meet its mitigation obligations. PPL also will need to provide information to address numerous details involved in plan implementation. SRBC staff's role will be to technically evaluate the merits of any future pooled asset plan to ensure it meets the consumptive use mitigation goals and requirements as described in the SRBC's Comprehensive Plan and regulations. Location and quantity of available storage, as well as acceptable water quality, and timing of operations will be critical factors in staff's review of the plan.

The SRBC requests a list of specific water supply assets upstream of BBNPP that are being considered as part of the Pooled Assets proposal, including the proposed amount of mitigation and expected licensing/permitting or contractual actions for each asset. The list would allow the SRBC to be responsive to inquiries from other agencies and presumably would support a more tangible Pooled Asset proposal. Please note, in addition to sources of storage being identified, all necessary agreements among the different legal entities, both within the PPL corporate structure and any other project sponsors, must be resolved prior to approval of an "asset" into the plan. Neither the commissioners nor staff of SRBC will act as advocate for the plan before any third parties.

Based upon the outcome of the technical evaluation, SRBC staff will make a recommendation to the commissioners regarding acceptance, modification or rejection of the plan. PPL has discussed phased implementation of components of consumptive use mitigation for BBNPP with SRBC staff, and we are willing to suggest to our commissioners that they entertain such an approach.

Lastly, from SRBC's perspective, PPL chose to pursue alternative analyses (using Instream Flow Incremental Methodology [IFIM]) in hopes of supporting its contention that the routine passby requirement (20% average daily flow [ADF]) is not needed to protect aquatic resources and downstream water uses. Because a passby flow is commonly the "trigger" for projects to cease their withdrawal during low flows, upstream storage is typically necessary to allow continued operations during all flow conditions. Should SRBC determine that the requested surface water withdrawal cannot be approved without a passby condition, water storage upstream of BBNPP would be needed to assure that all sections of the Susquehanna River are protected.

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

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February 23, 2012

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BELL BEND NUCLEAR POWER PLANT
RESPONSE TO COMMENTS CONCERNING SEASONAL AVAILABILITY AND WATER USE
BNP-2012-044 Docket No. 52-039

References:
1) Terry L. Harpster, PPL Bell Bend, LLC to James Richenderfer, Susquehanna River Basin Commission, SRBC Notice of Application Review response – Seasonal Availability and Water Use, dated July 8, 2010 [BNP-2010-165].

2) Terry L. Harpster, PPL Bell Bend, LLC to James Richenderfer, Susquehanna River Basin Commission, Application for Surface Water Withdrawal Application for Consumptive Water Use, dated January 14, 2011 [BNP-2011-005].

3) Andrew D. Dehoff, Susquehanna River Basin Commission, to M. J. Caverly, PPL Bell Bend LLC., "Re: Bell Bend Nuclear Power Plant; BNP-2010-165; Seasonal Availability and Water Use; Salem Township, Luzerne County, Pennsylvania", dated January 6, 2012.

As Enclosure 1 please find the PPL Bell Bend, LLC (PPL) response to the Commission's letter (Reference 2).

Should you have any questions please feel free to contact me.

Respectfully,

Gary Petrewski

Gary Petrewski

GP/kw

Enclosure: 1) PPL Response to SRBC Letter Comments dated January 6, 2012

cc: (w/ Enclosure)

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Enclosure

PPL Response to SRBC Letter Comments dated January 6, 2012

SRBC Comment #1:

In the last bullet on page 2, titled "ESWS Cooling Tower Evaporation," the evaporation from simultaneous operation of two Essential Service Water System (ESWS) towers is indicated as 324 gallons per minute (gpm) average evaporation and 512 gpm peak evaporation. In BNP-2011-005, page 4 of 8, the peak evaporation is indicated as slightly less at 480 gpm. Additionally, in BNP-2011-025 sent to the Nuclear Regulatory Commission on January 28, 2011, the average evaporation rate for two ESWS towers is indicated as 1,142 gpm, and the peak evaporation is related to four-tower operation and is not relevant. These evaporation rates should be consistently defined and quantified for each operating mode.

PPL Response:

The approach used by PPL to determine the Maximum Daily (Peak Day) Surface Water Withdrawal and Maximum Daily (Peak Day) Surface Water Consumptive Use was to calculate the maximum expected daily evaporation rate from the entire Bell Bend Nuclear Power Plant. The primary sources of evaporation for the plant are the two natural draft Circulating Water System (CWS) cooling towers operating with the unit at 100% power. Additionally, with the unit at 100% power, two mechanical draft Emergency Service Water System (ESWS) cooling towers will also be in service. The evaporation rate from the two natural draft CWS cooling towers is the dominant factor in determining the maximum expected daily evaporation rate.

Therefore, to determine a maximum expected daily evaporation rate, the worst case meteorological conditions that result in the maximum evaporation rate for the two natural draft CWS cooling towers was determined from meteorological records from Wilkes-Barre from 1949 through 2009. That day was determined to be July 15, 1995 when the daily average wet bulb temperature was 66.2 ^{o}F and the daily average relative humidity was 77.8%. On this day with these meteorological conditions an ESWS two tower evaporation rate was calculated to be 480 gpm as described in BNP-2011-005.

To determine a maximum expected daily evaporation rate for use in ultimately determining the Maximum Daily (Peak Use) Surface Water Consumptive Use for our permit application the value of 480 gpm for the ESWS two tower evaporation rate was added to the 16,723 gpm for the CWS two tower evaporation to obtain the maximum expected daily evaporation rate of 17,203 gpm.

The other three evaporation rates for the ESWS Cooling Towers referenced in your question were calculated for other reasons and were not used to serve as a basis for the surface water consumptive use values presented in our permit application. Each of these three values is explained as follows:

- 324 gpm identified in BNP-2010-165 is an average daily ESWS two tower evaporation rate with the plant at full load. The ESWS two tower evaporation rate was calculated for each day from meteorological records from Wilkes-Barre from 1949 through 2009, the values summed and then divided by the number of days to derive the value of 324 gpm. This is a reference value and is not used to determine any SRBC-related limiting values.

- 512 gpm identified in BNP-2010-165 is the peak day ESWS two tower evaporation rate with the plant at full load. The ESWS two tower evaporation rate was calculated for each day from meteorological records from Wilkes-Barre from 1949 through 2009 and the worst day was determined to be April 27, 2009 when the daily average wet bulb temperature was 59.4 °F and the daily average relative humidity was 34.2%. This is a reference value and is not used to determine any SRBC-related limiting values.

- 1142 gpm identified in BNP-2011-025 is the ESWS two tower evaporation rate used in the BBNPP COLA and actually comes from the US EPR™ FSAR Table 9.2.5-2. This ESWS evaporation value represents the maximum evaporation loss from two ESWS cooling towers at peak heat load and design ambient conditions during the 72 hour period after the Design Basis Accident (DBA). The evaluation assumes that only two of the four normally available ESWS towers are available. The US EPR™ design concept is only two ESWS towers are available for post accident cooling. The assumptions during the accident scenario apply this principle of a loss of two towers based on a combination of a single failure along with a tower being unavailable due to maintenance. This ESWS evaporation rate of 1142 gpm is a bounding value of maximum ESWS evaporation rate for DBA conditions, generic for all US EPR plants and is used in all US EPR™ COLA applications. Other than specification in the BBNPP COLA as a generic EPR maximum design ESWS evaporation rate for DBA conditions, this ESWS value is not utilized in any SRBC-related applications or PPL BBNPP calculations.

The above information is summarized in the following table.

ESWS TWO TOWER VALUE	BASIS	SRBC-RELATED USE
480 gpm	Evaporation rate with the plant at full load that coincides with the peak day natural draft cooling tower maximum evaporation rate	BBNPP design value used to determine Maximum Daily (Peak Day) Surface Water Withdrawal and Maximum Daily (Peak Day) Surface Water Consumptive Use
324 gpm	Average daily ESWS evaporation rate with the plant at full load.	BBNPP reference value - not used to determine any SRBC-related limiting values.
512 gom	Peak-day ESWS evaporation rate with the plant at full load.	BBNPP reference value - not used to determine any SRBC-related limiting values.
1142 gpm	U.S. EPR™ evaporation rate during a accident scenario	US EPR™ generic design bounding value applied to all US plants - not used to determine any SRBC-related limiting values.

In conclusion:

- All three PPL calculated values are correct and consistent for the BBNPP site meteorological conditions for which they are calculated. These values are realistic operating range values based on historical meteorological data.

- The US EPR™ generic maximum ESWS evaporation rate for DBA conditions is correct and is not inconsistent with the other values given the meteorological conditions for which it is calculated.
- NRC-related values are often generic or site-specific bounding values. PPL will continue to provide applicable values for permitting application review and approval that meet SRBC regulations and requests.

SRBC Comment #2:

The commission does not agree with the conclusion in the second paragraph on page 7 that "The monthly comparisons in Table 3 clearly demonstrate the adequacy of supply at BBNPP". The adequacy of water supply will be determined by careful review of aquatic studies, plans for consumptive use mitigation, and compliance to Commission policies and regulations.

PPL Response:

We acknowledge that the Commission will arrive at its own conclusion with respect to the adequacy of water supply. In BNP-2010-165, Enclosure 1, Page 7 PPL was drawing a conclusion based on our evaluation of the studies and data presented to date. We will be more careful in the future so as not to appear to be trying to draw a conclusion for the SRBC.

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March 23, 2012

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BELL BEND NUCLEAR POWER PLANT
PPL RESPONSE TO COMMISION LETTERS
YOUNG OF THE YEAR (YOY) BASS 2012 STUDY PLANNING
BNP-2012-080 NRC Docket No. 52-039

References: 1) J. Richenderfer, SRBC letter to T. L. Harpster dated October 18, 2011, Project Response Status and Filing of Joint Permit Application - BNP-2011-126.

2) J. Richenderfer, SRBC letter to M. J. Caverly dated December 21, 2011, BNP-2011-126 - Project Response Status and Filing of Joint Permit Application.

The attached as Enclosures 1 and 2 provide a PPL response to the above SRBC referenced SRBC letters, respectively. Enclosure 2 includes as attachments a draft amended Aquatic Studies Report Section 5, and a straw 2012 Study Plan related to potential additional YOY bass study work. The amended Section 5 is being provided in advance of the final Aquatic Studies Report to facilitate discussion regarding additional 2012 work planning.

As has been discussed with the SRBC, PPL desires a meeting with staff and involved resource agencies in early to mid April (tentatively during the week of April 9) to review the Section 5 report analysis, and to discuss and finalize expected 2012 study efforts.

Should you or your Staff have any questions, please contact Gary Petrewski at 610.774.5996 or gpetrewski@pplweb.com.

Sincerely,

George J. Kuczynski for

Gary Petrewski

GP/cw

Enclosures:
1) PPL Response to SRBC letter dated October 18, 2011
2) PPL Response to SRBC letter dated December 21, 2011 including
   a. DRAFT AMENDED SECTION 5 – WATER QUALITY ASSESSMENT OF SHALLOW AREAS USED BY FRY AND YOUNG-OF-THE-YEAR SMALLMOUTH BASS
      i. Appendix 5A – Chronology of Observations on Smallmouth Bass
      ii. Appendix 5B – Thermal Response Data - Tabular
      iii. Appendix 5C – Thermal Response Data - Graphic
   b. STUDY PLAN TO COLLECT SUPPLEMENTAL DATA TO ASSESS THE POTENTIAL EFFECTS OF THE BELL BEND PROJECT ON WATER QUALITY OF BACKWATER AREAS USED BY FRY AND YOUNG-OF-THE-YEAR SMALLMOUTH BASS

cc: (w/ Enclosures 2a and 2b on disc)

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Enclosure 1

PPL Response to SRBC letter dated October 18, 2011

PPL RESPONSE TO SRBC COMMENT LETTER DATED OCTOBER 18, 2011

SRBC comments below pertain to the Joint Permit Application (JPA) Binder 3, Appendix B, Section 7, Subsections 1, 2, and 7. SRBC comments are shown in italics and are followed by a PPL response. PPL has sub-numbered paragraphs of SRBC numbered comments as (a), (b), (c) etc.

1. *(a) In Section 1, the first question in the Summary is "What is the relationship between aquatic habitat and river flows . . . ?" The response was "PHABSIM analysis of aquatic habitat for eight fish species indicates that negative impacts on habitat due to the requested BBNPP water use are generally small and infrequent, and would not contribute to habitat-related population limitations." The Physical Habitat Simulation (PHABSIM) analysis is incomplete, as it does not focus on the area of the river where impacts to aquatic life are most likely to occur, specifically the island and riffle area between transects G2 and R1. The Commission requires additional PHABSIM analysis of this stretch of the river, similar to the analysis submitted in an e-mail from Gary Petrewski, dated May 19, 2011.*

PPL Response:

Section 2 of the Aquatic Studies Report describing the PHABSIM analysis is being amended to include the 2-dimensional modeling as a result of consultation with the SRBC for its area of interest. The area that is being evaluated by the 2D modeling effort is transects G3 to R1 and was also agreed upon during consultation. The report will be submitted once the re-analysis is complete. Report submission is expected by the end of March 2012.

1. *(b) Additionally, to more accurately assess the relationship between aquatic habitat and river flows, the study should focus on low flows in the range of Q7-10 and 20 percent average daily flow (ADF). Unlike most Instream Flow Incremental Methodology (IFIM) studies that typically analyze a broader range of flow regimes based on hydroelectric power operations, the purpose of the BBNPP study is to address impacts on aquatic life at low flows to determine an appropriate passby requirement, and it may provide information useful in establishing a requirement for mitigation makeup water for the consumptive water use at BBNPP.*

PPL Response:

Flows in this range (7Q10 - 20%ADF), and habitat impacts associated with them, are inherently included in the analysis as presented, and are represented in graphs of impact vs. flow in the appendices of the draft report. Nevertheless, this information will be provided in the amended Aquatic Studies Report.

1. *(c) Lastly, the Commission notes that several aquatic studies have not been completed, and studies that have been completed have not been reviewed and accepted by the Commission, which renders the statement, "negative impacts on*

habitat due to the requested BBNPP water use are small and infrequent . . ." premature and cannot be fully evaluated at this time. Comments on the studies that have been submitted must be resolved and other agreed upon studies, including the 2D flow analysis and Mussel Survey, need to be completed, reviewed, and accepted before valid conclusions about the impacts on aquatic life can be drawn.

PPL Response:

As noted above, the two-dimensional hydraulic modeling and the mussel study are still outstanding. The 2D effort is almost complete and an amended report will be provided shortly. The mussel study was deferred last year by extremely high flows associated with large storms moving through the study area during the proposed study period. The mussel study will be performed as soon as flow and weather-related conditions allow in 2012. The statement in the draft report was intended to refer specifically to fishery habitat that was the agreed-to subject of the study. It also represents the opinion of experienced PPL biologists that were tasked with conducting the study. We will be more careful with the phrasing of conclusions in the amended report. PPL recognizes that the SRBC and resource agencies may interpret study results differently.

It should be noted that with respect to overall aquatic habitat that the planned mussel studies will only be relevant if specifies of concern are found in areas of potential impact. If no mussel species of concern are found during the planned field work effort in 2012, then mussels will have no impact on any conclusions drawn regarding aquatic impacts.

2. *In Section 1, the summary related to the impact of reduced river flow and stage on smallmouth bass indicates, "Once water temperatures consistently exceed 84-85°F, juveniles migrate from the shoreline backwater habitat into deeper river water." This statement is not supported by the study presented in Section 5. The study does not adequately evaluate if the juvenile bass are migrating at a smaller size due to water temperature and if their natural preference would be to remain in these areas longer to achieve a larger size and thereby reduce predation pressure.*

PPL Response:

The statement in Section 5 was based on documented behavioral observations, between May and July 2010, during the 10 weekly surveys by Ted Jacobsen (Ecology III) of habitat occupied by smallmouth bass for spawning, nesting, and rearing. Several spawning sites were observed during these surveys. These observations characterized inshore habitat utilized by various life stages of smallmouth bass at prevailing water temperatures. Jacobsen recorded that when water temperatures consistently exceeded 84-85°F (in July 2010) juvenile smallmouth moved away from shallower, inshore areas to deeper, offshore areas. The chronology of Ted Jacobsen's observations was attached as Appendix OSMB titled "Chronology of observations on smallmouth bass" of the draft report.

Although rising water temperature through the summer in 2010 was identified as a possible

cause of movement from shallower to deeper areas, the observed behavior may also be innate in young bass. Shoreline seining data collected by Ecology III in recent years (2006-2010) showed very few young smallmouth bass collected in August relative to the number observed in June. According to Chaplin, *et al.*(2009), smallmouth bass (SMB) in the Susquehanna River spawn in late April to early June and that once eggs are deposited, they hatch in 2 to 9 days depending on water temperature. Fry are ready to leave the nest (swim up) in 5 to 6 days. Subsequently, SMB fry (< 25mm) spend 2 to 3 months in the microhabitat in which they were born as a predation avoidance measure and due to the fact that they cannot withstand the higher mid-channel velocities. This is the "critical period" referred to in the Chaplin study which was defined for the purpose of that report as May through July. Simply put, natural variability associated with meteorological conditions, flow, and other factors affects the duration of fry and YOY SMB residency in their respective microhabitats by as much as 30%. It was not the objective of the study to evaluate the variability in YOY SMB size prior to dispersal. Given the negligible impact to temperature and or DO associated with a maximum one half inch change in water depth due to consumptive use, it would be almost impossible to extract or assign statistical significance to these small changes given the natural variability that is inherent in the fry and YOY SMB life-cycle.

See also PPL's separate response to the SRBC's comment letter dated December 21, 2011 with respect to potential additional field studies and analysis to be undertaken in 2012.

3. *(a) In Section 2, second paragraph, the conclusion that there is no negative impact on 7 of 23 species and life stage combinations may not be supported pending final review of the study. For example, historical flows in that section of the river have been considerably lower than the low flow of 800 cubic feet per second (cfs) in the study, and therefore, the conclusion cannot be made without some qualification. Absent an analysis on flows less than 800 cfs, the Commission could not support a passby flow requirement at less than this amount.*

PPL Response:

The amended report will address the Commission's requirement to evaluate flows to 500 cfs.

3. *(b) On pages 12 and 13, a paragraph should be added to discuss the margin of error for this IFIM study. There are areas of statistical analysis within the study where errors may be introduced, particularly extrapolation of flows at BBNPP from the Wilkes-Barre stream gage and in the extrapolation of various flows at each transect from one set of flow measurements. Other parameters in the study may also generate a margin of error. A better understanding of the study results will be provided by generating an overall margin of error for the study.*

PPL Response:

We agree that there are numerous milestones in the process where uncertainty may be introduced in the PHABSIM model, including ones noted in these comments as well as previously submitted comments. We also agree that an overall "margin of error" would be useful in better understanding the results. However, in the long history of PHABSIM there has never been a successful effort to quantify overall uncertainty or even partial errors associated

with the sub-components of PHABSIM. Even knowing this, results from this model are routinely evaluated and accepted at face value. This inability to quantify the uncertainty of the model is a major reason for the conventional limits on extrapolation of the hydraulic simulation as well as the WUA response curves. Accordingly, our report considered the calculated effects of consumptive use down to river flows of about 800 cfs (less than the 7Q10). For both the 1D and 2D analysis, we can extend the flow extrapolations down to 500 cfs, even though those flows are exceedingly rare, and the unquantifiable uncertainty of the model can be expected to increase.

Some attempts have been made to compute confidence intervals in which a fixed sample of observations is repeatedly re-sampled to quantify the variation inherent within the sample but these cannot be applied to the two hydraulic modeling approaches in the Bell Bend studies. A direct comparison of 1D and 2D habitat index results for the G3 to R1 reach will provide the best indication of potential variability in the results.

Furthermore, while the IFIM methodology represents best practice, and is intended and used by resource planners to assess potential changes to species population density, it is not a precise model that would permit a margin of error to be calculated for population effects.

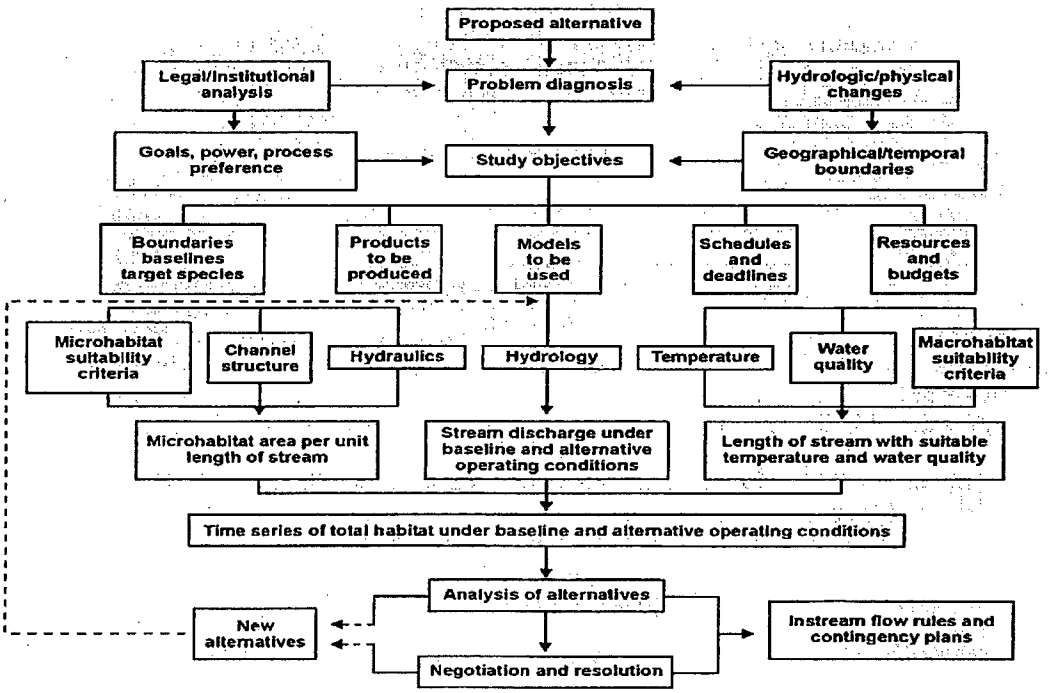
Estimation of BBNPP flows from the stream gage at Wilkes-Barre follows common and accepted hydrology methods (e.g. –proportional drainage area). The intent of the time-series analysis is to use past experience (the flow record) as an estimate of what flows (and thus habitat impacts) might be observed in the future. As such, there is obvious uncertainty in this effort, and that is why it is generally presented in a statistical frequency, or duration, analysis. Small adjustments to the historical flow record will not have an observable effect on the frequency analysis, other than perhaps at the extreme values, which are exceedingly rare. For this reason, reasonable analyses will use a statistical endpoint, such as the 7Q10 flow, or the 99th percentile flow.

4. *Figure 2-1 depicting the "Generalized IFIM sequence" does not show steps for consultation with stakeholders to determine goals of the study, and does not include a step for stakeholders to reach a consensus regarding study conclusions. Due to time constraints and the way the IFIM study was conducted, some of the consultative steps were skipped and had to be retrofitted. In any case, the steps are essential to producing a viable IFIM study and should be included on Figure 2-1.*

PPL Response:

The flow chart contained in Figure 2-1 is actually a flow chart of the habitat model development within the IFIM process. This figure was not intended to illustrate a broader consultation process. The IFIM process is implemented in five sequential phases: problem identification, study planning, study implementation, alternatives analysis, and problem resolution (see figure below).[1] A more complete description of the IFIM process will be included in the amended report to be provided shortly.

[1] http://www.fort.usgs.gov/Products/Software/ifim/5phases.asp



5. *In Section 2.4, for the two transects that were added "during an agency visit," further explanation is needed to demonstrate what data were collected at what flow and how those data were extrapolated to other flows.*

PPL Response:

Further explanation of the treatment of these two transects can be found in Appendix HYD, a detailed description of the hydraulic model development. The information is consolidated below.

Since the transects were added at low flow, subsequent to middle or high flow measurements, only low flow measurements were available. The water surface elevations were simulated by using the rating curves and measured WSEL's from adjacent transects. All WSEL's were converted to a true elevation, allowing for the selection of appropriate middle and high flow WSEL's at the added transects, based on measured elevations at the adjacent transects. The close proximity of adjacent transects, low gradient, and general similarity of the rating curves ensured a very good fit.

Velocity measurements were conducted at low flow. Velocity measurements at high flow are preferred for modeling the velocities over the entire range of flows; however, low flow velocities work well for modeling lower flows. In order to model the higher flows adequately, maximum and minimum roughness coefficients were stipulated. The ADCP measures near-zero velocities poorly unless the entire transect is shallow and slow. The near-zero measured velocities oscillate around zero and the oscillations are amplified into unreasonable positive/negative velocity patterns at high flows. Specifying maximum and minimum roughness coefficients mitigates this problem while maintaining the reasonable velocity patterns.

6. *(a) In Section 2.5, the daily discharge data from 1899 to 2010 cover too large a time frame and dampen impact from development in the watershed. We recommend a period from 1960 to 2008 to develop the time series of daily river flow. Additionally, to adequately analyze low flows, scenarios should be developed using time series of daily river flow experience from 1999 to 2002.*

PPL Response:

The comment regarding the period of record to be used in this analysis was previously raised by the PFBC during development of the study plan. As noted in Footnote 2 of the study plan dated April 2010 the SRBC requested that daily river flows for the entire period of record be used for this study. We believe the PFBC was notified of this decision at that time, but apologize if this was a PPL oversight.

Generally a longer time span encompasses more of the natural variability within the hydrologic record. Additional analysis on specific time periods can be performed; however, care must be taken to consider all habitat impacts with respect to the variations in habitat over a sufficient time frame. Analyzing a drought period exclusive of normal and wet periods may produce erroneous results since habitat may be limited by both high and low flows. Again, the historic flow record is used in this analysis as an estimation or projection of future flow expectations. Nevertheless, PPL will provide an evaluation of the additional recommended time series in the amended report.

6. *(b) In addition, known upstream consumptive use should be used in the flow scenarios. For example, the Susquehanna Steam Electric Station (SSES) consumptive use is permitted at 48.000 million gallons per day (mgd). Another flow scenario should be developed subtracting the maximum daily BBNPP consumptive use and all the upstream consumptive use to the Wilkes-Barre gage, including the maximum SSES consumptive use less mitigation releases from Cowanesque Reservoir, from the adjusted flow at the Wilkes-Barre gage.*

   In footnote 3 on page 21, what is the rationale for stating that these figures are conservative?

PPL Response:

The purpose of this analysis is to examine the potential incremental impact of the Bell Bend project on downstream habitat. As noted on page 13 of the April 2010 Study Plan PPL proposed to use the flow record as measured and recorded at the Wilkes-Barre gage as representative of flows above the Nescopeck Creek. No comments were previously raised on the flow data set to be used.

Any flow adjustments due to unmitigated SSES consumptive use would be included in a base case and also in each of the scenarios investigated in the study. Such an adjustment for assumed upstream consumptive uses will therefore not have a noticeable effect on the flow frequencies or incremental impacts identified in this study. In particular, as SSES consumptive use is mitigated by water releases from Cowanesque Reservoir at flows below the 7Q10, it has

no net effect on the daily flow record during those periods of low flow.

With respect to footnote 3 on page 21 of the study report, the consumptive use values for Bell Bend under scenario B are conservative for the following reasons:

1). The consumptive use assumes that Bell Bend is operating at a 100 percent capacity factor (full load),
2). The maximum average consumptive use values represent the worst month of record maximum as derived based on an analysis of daily cooling tower evaporation corresponding to daily meteorological data from 1949 through 2009, and
3). The values include allowances for other plant losses and for instream evaporation. Instream evaporation is at best speculative given that the Bell Bend thermal plume, as evidenced in the CORMIX modeling analysis, remains submerged (surface heat exchange is unlikely to occur).

Therefore, collectively, habitat impact when expressed vs. percent of time exceeded would be expected to be marginally conservative.

7. *(a) In Section 2.6, in addition to the data provided, a graphic of the Weighted Usable Area (WUA) results over time would add another level of analysis to help visualize the change in WUA during the course of the year and where problem areas could occur. This graphic should include current conditions and then the various scenarios.*

PPL Response:

PPL has provided to the Commission sample graphics that illustrate time-series data on a twelve-month axis, showing the median and range of WUA experienced each week of the year over the multi-year period of record. PPL intends to provide comparable graphics in the amended report. PPL is amenable to providing additional time-series graphics in an alternative form as a future supplement to the report; however, due to the length of the time-series record we request that the Commission be specific in its request. Daily graphics over the full period of record, and for each species and life stage are impractical.

7. *(b) In the second paragraph, we agree that the slope of the curve is critical and the focus of the study is to analyze flows in consideration of a passby flow requirement. Accordingly, the x-axis on Figure 2-6 should display lower flows in the Q7-10 to 20 percent ADF range. This will provide better visualization of WUA at the lower flows. In addition, timing and duration of low flows are also critical and, as requested above, WUA plotted against time for each species and life stage would provide data for more specific analysis.*

PPL Response:

Figure 2-6, as an example, and the similar Appendix plots (Appendix WUA) for each species and life stage, do display flows in the requested range. Tabular data is also provided in Appendix WUA. Plots expressing extreme low flows will be provided in the amended report.

See also response to 7 (a) regarding time-series plots.

7. *(c) On page 24, first full paragraph, the Commission regards the relationship between WUA and higher flows to be irrelevant for the purpose of analyzing the need for a passby flow requirement and/or mitigation of the BBNPP consumptive use of water. Although the PHABSIM model shows reduced WUA at higher flows, other factors such as water temperature and dissolved oxygen levels are less critical to aquatic life at high flows. The high flows may temporarily displace some species as they seek more suitable habitat; however, any mortality due to temporary loss of habitat is natural and cannot be attributed to consumptive use of water by BBNPP. At low flows, the consumptive use of water by BBNPP does negatively impact WUA, as well as water temperature and dissolved oxygen, which is the rationale for the study to focus on low river flows. The above statement also applies to the second to last paragraph of page 29.*

PPL Response:

As noted in response to Comment 5 above, analyzing a drought period, exclusive of normal and wet periods, may produce erroneous results since habitat may be limited by both high and low flows. Another important consideration is that according to Chaplin *et al.* (2009), Susquehanna River streamflow conditions during the 2008 critical period were not extremely low when compared to historical streamflows. The study found that, "...the occurrence of the disease does not seem to be limited to exceptionally low streamflow summers. Moderate or near-normal streamflows and associated water-quality conditions seem to be conducive to widespread occurrence of *F. columnare* infection." Chaplin points to an increase in submerged aquatic vegetation (SAV) and excessive algal growth as a potential factor in increased *F. columnare* infections. That increase is most likely triggered by recent increased concentrations of dissolved inorganic phosphate (DIP) even though the previous historical trend for DIP has been generally downward in the Susquehanna River Basin. Chaplin suggests that increased periphyton growth may be contributing to stressful levels of dissolved oxygen that could explain why YOY SMB are only recently being infected by *F. columnare*.

7. *(d) In addition, the fifth sentence of the first full paragraph on page 24, the statement that, ". . . any flow reduction due to BBNPP consumptive use can never have a negative effect on the available suitable habitat" cannot be supported because flows less than 800 cfs were not evaluated. Absent analysis focused on flows less than 800 cfs, the Commission will follow established policy and require a passby flow at the Q7-10 river flow or higher.*

PPL Response:

We refer the SRBC back to our response to Comment #3 (a).

8. *(a) In Section 2.7, the riffle areas within the study area are the areas of most concern, and an analysis of WUA for those areas is essential to fully evaluate any potential effects due to consumptive use at BBNPP. The PHABSIM analysis is incomplete and does not include an analysis on the area of the river where impacts to aquatic life are most likely to occur: the island and riffle area between*

transects G2 and R1. Further analysis is required that provides the proper focus on this reach of the river. The agreed upon 2D analysis may provide a better understanding of the dynamics of the river in this area.

PPL Response:

SRBC requested that PPL perform an additional, more focused review of the riffle section utilizing a 2-dimensional hydraulic model for the riffle section of the river. The results of the additional analysis are being finalized and will be provided to the SRBC for its consideration and review.

8. (b) *In the first paragraph of Section 2.7 on page 25, linear extrapolation to estimate daily WUA for flow values less than 800 cfs is inappropriate because at flows that low, the relationship between WUA and flow is curvilinear. A best-fit curvilinear formula should be used to extrapolate WUA values at flows less than 800 cfs.*

PPL Response:

The WUA response curve in that flow range is curvilinear for some (not all) of the study species and life stages. The linear extrapolation was considered satisfactory because the range (500-800 cfs) is small, the curvature is slight, and the extrapolations are beyond recommended distances from measured flows, and thus not reported in the time-series summaries. Nevertheless, PPL has performed additional hydraulic modeling down to the flows of interest and will incorporate those in the amended report.

8. *(c) The depiction of WUA versus flow was normalized (nWUA); however, the Commission requires the raw numbers for each species and life stage to assess potential bottlenecks and overall scale of changes in an area for each species.*

PPL Response:

The desired raw numbers for total WUA (sq.ft./1000ft) are tabulated and graphed for each species and life stage in Appendix WUA.

8. *(d) In the second paragraph on page 28, the Commission acknowledges that the negative impact to WUA occurs primarily at low flows that may not occur frequently, and this is the relationship portrayed in the WUA versus percent time graphs. For some species and life stages like juvenile smallmouth bass, the low flows are coincident with higher temperatures and low dissolved oxygen. These conditions have been observed to cause mortality of juvenile smallmouth bass. In this case, the percent of time is not relevant; however, the length of time and magnitude of the negative impact on WUA is critical to the survival of the juvenile smallmouth bass. As requested above, a graph of WUA versus time would provide data for a more in-depth analysis.*

PPL Response:

This kind of graphing will be included in the amended report. We would caution the SRBC in drawing specific conclusions that low DO and higher temperatures are the only causative variables for juvenile SMB mortality in the Susquehanna River. As referenced in Chaplin *et al.* (2009), there are other stressors including but not limited to carbon dioxide, endocrine disruptors, pesticides, and other viral and bacterial pathogens and that those other factors could play as large or larger role in YOY SMB mortality. Chaplin concluded by stating, "At this time, the YOY smallmouth bass mortalities cannot be linked to any one water-quality factor or environmental condition...".

8. *(e) In the last paragraph on page 28, the Commission does not agree with the stated conclusion that there is no substantial difference in habitat availability when flows are reduced by BBNPP consumptive water use. Based on comments above, the analysis must be focused on low flows, appropriate sections of the river, and time of the year before reaching this conclusion.*

   On page 29, first full paragraph, a more robust assessment of WUA should be conducted in conjunction with seasonality constraints. The timing of the low flows makes a difference and analysis should be focused on each species and life cycle that coincides with low flow events.

PPL Response:

Time-series analyses as reported do consider seasonality. The results indicate the seasonal presence of each species and life stage. In particular, some life stages are not present during seasonal periods of low flow, and the habitat time-series accounts for that. The amended report will include seasonality constraints for each species and life cycle.

9. *In Section 2.8, conclusions resulting from the PHABSIM study are premature pending resolution of the above comments. The focus of the study should be on low flows, particularly in the riffle area of the river. Additionally, conclusions from the PHABSIM analysis should be integrated with the results of other studies on this section of the river. For example, analyses from Sections 4.0 and 5.0 should be incorporated to more fully assess potential changes in water temperature and dissolved oxygen levels and effects on fish species, especially those dependent on shallow water areas during the summer. Finally, two studies were not included in the JPA submission, the 2D analysis of the riffle area of the river and the Mussel Survey. The results of these studies also need to be integrated into conclusions of the impact of BBNPP on aquatic life.*

   The above comment also applies to Section 7.0.

PPL Response:

Refer above to PPL's response to Comment 1 (c).