Appendix A - Item 34

PPL Bell Bend Nuclear Power Plant
Salem Township, Luzerne County, PA

ACOE Information Requirement:

"Describe potential issues with return water into the Susquehanna River, such as thermal pollution, water quality, bottom scouring at outlet, etc."

Applicant Response:

Thermal Pollution

Discharges from BBNPP will be permitted under the NPDES program, which regulates the discharge of pollutants into waters of the Commonwealth. In this context, waste heat is regarded as a thermal pollutant and is regulated differently than chemical pollutants since limits based on concentration cannot be used for heat. Thermal discharges are regulated under the Clean Water Act §316(a) and Pennsylvania Code, 25 Chapter 93, Water Quality Standards (PA, 2007).

The BBNPP multi-port diffuser discharge system is designed to minimize the potential impact of the thermal plume as it enters the Susquehanna River. The subsurface diffusers create rapid mixing of the thermal effluent with ambient river currents. The volume of river discharge largely determines plume size and shape. Modeling of the BBNPP plume under proposed operating conditions was completed to determine the type and extent of thermal impacts to the river under summer and winter mean and low flow conditions (ERM, 2008). Both the GEMSS and CORMIX models were employed in the evaluation. This study determined that both the areal extent and temperature difference (from ambient conditions) of the plume would be minimal under all potential operating conditions, and will be in compliance with applicable regulations.

The BBNPP thermal plume is predicted to be similar to the existing SSES thermal plume. While the two plumes are unlikely to significantly interact given their locations within the river (380 feet apart), modeling was completed under both combined (cumulative plume, using GEMSS) and single (BBNPP plume only, using GEMSS and CORMIX) conditions. The plume's small cross-

sectional area is unlikely to create a barrier to fish migration and the small area of thermal enhancement is expected to limit attraction of fish such that they will not become acclimated and entrapped there, particularly during winter when fish are susceptible to cold shock from plant shutdown. It should be noted that fish congregation and cold shock impacts have not been observed to occur at the existing SSES discharge.

An additional study of the blowdown plume has been implemented at the request of the SRBC. The study modeled increases in NBSR temperature and decreases in dissolved oxygen resulting from the plume at various River flow scenarios, taking into account the consumptive use of BBNPP. Results from an EPA model were compared to actual observed field plume measurements for the SSES. The model results were field verified. The EPA model demonstrated similar small plumes for BBNPP blowdown under normal circumstances and extreme flow conditions. Complete study results are included in "Potential Effects of the Bell Bend Project on Aquatic Resources and Downstream Users" (Normandeau, 2011, draft) provided in Appendix B of the JPA.

Both the minimal temperature increase and the small areal extent of the plume are predicted to have no significant impact on the benthic macroinvertebrate, mussel, or fish community. The increase in Susquehanna River temperature from the plume is within the range of natural temperature variability in lotic systems, well within the 2 degree per hour regulatory limit (mean 0.5 degrees, max 1.75 degrees), and will conform with applicable Clean Water Act and Commonwealth of Pennsylvania regulatory standards. Impacts to the aquatic community from the BBNPP thermal discharge are expected to be small.

Water Quality

Because cooling towers concentrate solids (minerals and salts) and organics that enter the system in makeup water, cooling tower water chemistry must be maintained with anti-scaling compounds and corrosion inhibitors. Similarly, because conditions in cooling towers are conducive to the growth of fouling bacteria and algae, biocides must be added to the system. Biocides are normally chlorine or bromine-based compounds, but occasionally non-oxidizing biocides are used as well. Table 1 provides details on the various water treatment systems and chemical additives proposed to be used during BBNPP operation. The combined effects that both discharges (SSES and BBNPP) will have on the Susquehanna River will be considered in developing the National Pollutant Discharge Elimination System (NPDES) Permit for BBNPP.

Limited treatment of raw water to prevent biofouling in the intake structures and makeup water piping may be required. Additional water treatment will take place in the cooling tower basin, and may include the addition of biocides, acid for alkalinity and pH control, anti-scaling compounds, corrosion inhibitors, and foam dispersants, as shown in Table 1. Sodium hypochlorite is expected to be used to control biological growth in the circulating water system (CWS), essential service water system (ESWS), and raw water supply system (RWSS).

A NPDES permit will be acquired prior to the startup of BBNPP. It is expected that the BBNPP NPDES permit will contain discharge limits that are similar to SSES.

Based on Susquehanna River chemistry, three cycles of concentration were conservatively selected for cooling tower operation. This is consistent with typical cooling tower operation of three to five cycles of concentration when using surface water makeup. As a result, levels of solids and organics in cooling tower blowdown will be approximately three times as high as ambient concentrations in the Susquehanna River. Blowdown wastewater from the cooling towers will discharge to a retention basin to allow time for settling of suspended solids and to allow additional chemical treatment of the wastewater to adjust pH, if required, prior to discharge to the river. The final discharge from the retention basin will consist of the cooling tower blowdown, filter backwash discharge, miscellaneous low volume wastes, and other plant effluents.

Chemical effects of the discharge include the addition of biocides to limit fouling within the cooling water systems and other chemical agents to limit scaling. Discharge concentrations of these constituents will be limited by the NPDES permit issued by the Pennsylvania Department of Environmental Protection. These concentration limits will be set to protect the designated water use of the receiving water body. In addition, the NPDES permit will account for the combined impacts of both the BBNPP and SSES discharges. The existing SSES discharge which is similar in volume to the proposed BBNPP discharge, operates under an NPDES permit for these discharges.

Water Intake Screen Cleaning

The BBNPP Intake Structure is divided into three bays. Water from the river flows into each bay through fixed bar grating and then a traveling screen. Debris collected by the bar grating and the traveling screens will be collected in a debris basin for cleanout and disposal as solid waste. The screen mesh is mechanically rotated above the water for cleaning via spray water. The

screen wash system consists of three wash pumps that provide a pressurized spray to remove debris from the water screens. The screen cleaning water is directly discharged to the Susquehanna River.

Bottom Scouring at Outlet

Physical effects from the discharge will be limited to the turbulence created by the diffuser jets. These jets will direct the water downstream at a 45-degree angle toward the surface of the river. Riprap will be placed around the discharge diffuser to resist potential erosion. No loss or alteration of unique habitat is expected or reduction in density, species composition or community structure of the aquatic community.

References

UniStar Nuclear Services, LLC. 2010. Bell Bend Nuclear Power Plant Combined License Application Part 3: Environmental Report, Revision 2. Chapters 2, 3 and 5.

ERM, 2008. Susquehanna River Thermal Plume and Dilution Modeling Bell Bend Nuclear Power Plant. Areva NP Inc. Document 38-9083598-000.

Potential Effects of the Bell Bend Project on Aquatic Resources and Downstream Users, Proposed Bell Bend Nuclear Power Plant Site, Luzerne County, Pennsylvania. June 2011. Normandeau Associates, Inc. (Draft)

Table 1 - BBNPP Water Treatment Systems				
System	**Operating Cycle(s)**	**Points of Addition**	**Chemical Processed**	**Estimated Total Amount Used per Year[b]**
Circulating Water Treatment System [a]	Normal Operating Conditions and Normal Shutdown/ Cooldown	CWS Makeup/Water Intake CWS Piping CWS Blowdown/ Retention Basin Outlet	Oxidizing Biocide (Sodium Hypochlorite)	248,033 gal
			Deposit Control Agents (organic phosphonate and acrylate copolymer)	172,929 lbs
			Biofilm Control Agent	172,929 lbs
			Sulfuric Acid	3.43 million lbs
			Dechlorinator (Sodium Bisulfite)	86,464 lbs
ESWS Water Treatment System (ESWS System) [c]	Normal Operating Conditions and Normal Shutdown/ Cooldown	ESWS Piping ESWS Blowdown/ Retention Basin Outlet	Oxidizing Biocide (Sodium Hypochlorite)	17,855 gal
			Deposit Control Agents (organic phosphonate and acrylate copolymer)	12,411 lbs
			Biofilm Control Agent	12,411 lbs
			Sulfuric Acid	246,740 lbs
			Dechlorinator (Sodium Bisulfite)	6,205 lbs
RWSS Water Treatment System [d]	Normal Operating Conditions and Normal Shutdown/ Cooldown	RWSS Makeup/Water Intake RWSS Filters	Oxidizing Biocide (Sodium Hypochlorite)	2,190 gal
Liquid Waste Storage System and Liquid Waste Processing System [e, f]	Normal Operating Conditions and Normal Shutdown/ Cooldown	Influent Waste Water	Sulfuric Acid Sodium Hydroxide	22,900 gal 2,400 gal
Demineralized Water Treatment System [g]	Normal Operating Conditions and Normal Shutdown/ Cooldown	Demineralized Water Distribution System Makeup	Sulfuric Acid Sodium Hydroxide	2,650 gal 2,400 gal

Notes:

a. The Circulating Water Treatment System has no safe shutdown or accident mitigation functions. Sodium hypochlorite will typically be added to makeup water. Sodium hypochlorite and dispersant may be added to piping. Chlorine may also be added to piping for prevention of Legionella. The estimated quantities of chemical additives are totals used throughout the Circulating Water Treatment System.

b. The estimated dosage rates were calculated as described in Section 3.6 of the BBNPP COLA ER.

c. During a Design Basis Accident, the ESWS Water Treatment System is assumed to be non-operational. The estimated quantity of chemical additives is a combined total for the chemicals used in the ESWS.

d. RWSS has no safe shutdown or accident mitigation functions. Sodium hypochlorite will typically be added to makeup water. Sodium hypochlorite and dispersant may be added to piping. The estimated quantity of chemical additives is a combined total for the chemicals used in the RWSS.

e. Types and estimated quantities of chemical additives are based on those used at an existing plant.

f. An anti-foaming agent, complexing agent and/or precipitant may also be used to promote settling of precipitates.

g. The estimated quantities of chemical additives are based on the existing Calvert Cliffs Nuclear Power Plant Units 1 and 2 Demineralized Water Treatment System which uses the indicated chemicals for the regeneration of condensate demineralizers.