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

PPL Bell Bend, LLC
38 Bomboy Lane, Suite 2
Berwick, PA 18603
Tel. 570.802.8111 FAX 570.802.8119
tlharpster@pplweb.com

ppl™

July 8, 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
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

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

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

Mr. Tom Shervinskie
Pa Fish & Boat Commission
450 Robinson Lane
Bellefonte, PA 16823

Ms. Jennifer Kagel
United States Fish & Wildlife Service
Pennsylvania Field Office
315 S. Allen St. #322
State College, PA 16801

Mr. Eugene Trowbridge
Pa Dept Environmental Resources
Northeast Regional Office
2 Public Square
Wilkes-Barre, PA 18711

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

Ms. Paula B. Ballaron
Susquehanna River Basin Commission
1721 North Front Street
Harrisburg, PA 17102-0425

Mr. Thomas W. Beauduy
Susquehanna River Basin Commission
1721 North Front Street
Harrisburg, PA 17102-0425

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:

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

  or

  Blowdown = { River water makeup / CC } - 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)