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December 17, 2009

ATTN: Document Control Desk
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

BELL BEND NUCLEAR POWER PLANT
REVISION OF RESPONSE TO
ENVIRONMENTAL
REQUEST FOR ADDITIONAL
INFORMATION H 5.3-1
BNP-2009-418 Docket No. 52-039

Reference: Letter from R.R. Sgarro (PPL) to U.S. NRC Document Control Desk, "Response to Environmental Requests for Additional Information, Seventh Submittal," dated November 30, 2009

The purpose of this letter is to update the response to Request for Additional Information (RAI) H 5.3-1. One minor error was discovered subsequent to submittal of the RAI H 5.3-1 response in the referenced letter. The second paragraph of the response to Item 2 incorrectly indicated a temperature rise of 31.0°F, which should have been 33.8°F, consistent with the information presented in Tables 2 and 3 of the response. The revised response to Item 2 is enclosed. The rest of the response to RAI H 5.3-1, as submitted in the referenced letter, remains unchanged.

There are no regulatory commitments identified in this letter.

If you have any questions, please contact the undersigned at 570-802-8102.

I declare under penalty of perjury that the foregoing is true and correct.

Executed on December 17, 2009

Respectfully,

Rocco R. Sgarro

Rocco R. Sgarro

Enclosure: Revised Response to RAI H 5.3-1, Item 2, Bell Bend Nuclear Power Plant, Luzerne County Pennsylvania

RRS/kw

D079
NRO

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Enclosure

Revised Response to H 5.3-1, Item 2
Bell Bend Nuclear Power Plant
Luzerne County Pennsylvania

H 5.3-1 Item 2

ESRP 5.3.2.1

Summary: *Provide information related to the calculation of thermal and chemical effluent plumes from the BBNPP and SSES diffusers:*

2) Sensitivity study, needed especially for the low flow, winter case. Adjustments to ΔT (discharge vs. ambient river) for both SSES and BBNPP, bathymetry differences, adjustment of discharges from SSES and BBNPP, low Susquehanna River discharge.

Full Text: This information was developed through several discussions with the applicant's consultant Ed Buchak (ERM Inc).

Revised Response:

Note: Enclosures cited in this response item have not been revised and are located in the letter from R.R. Sgarro (PPL) to U.S. NRC Document Control Desk, "Response to Environmental Requests for Additional Information, Seventh Submittal," dated November 30, 2009.

2. Sensitivity study, needed especially for the low flow, winter case. Adjustments to ΔT (discharge vs. ambient river) for both SSES and BBNPP, bathymetry differences, adjustment of discharges from SSES and BBNPP, low Susquehanna River discharge.

Because CORMIX is incapable of computing the effects of overlapping thermal plumes, this response addresses GEMSS, the far-field model.

Providing sensitivity information requires comparing the results of the sensitivity simulations with the specified base case, which is the winter (January) low flow case, identified in the ER Table 5.3-3 (Scenario 4). This case yielded the largest combined thermal plume because of the relatively low Susquehanna River flow (2,848 cfs) and large BBNPP temperature rise (ΔT) of 33.8~~31.0~~°F. Also required for the sensitivity tests is a quantitative and representative metric for comparing the results. The metric adopted is the combined SSES and BBNPP surface and bottom areas for the 0.5°F, 1.0°F, and 5.0°F isotherms. The area metric is the most comprehensive with respect to plume size and is readily computed with the GEMSS post-processor.

The sensitivity runs consisted of decreasing Susquehanna River flows in steps to the value of the summer low flow and increasing the SSES and BBNPP ΔT's and discharge rates by 10% and 20%. The conditions and isotherm areas for the base case and seven sensitivity runs are shown in Tables 2 and 3. (Note: The increases in SSES and BBNPP discharge flows and temperatures were assumed for purposes of the sensitivity analysis and do not represent realistic or attainable values.)

Table 2: Low Susquehanna River flow sensitivity tests

Parameter	Scenario 4	Sensitivity Test 1	Sensitivity Test 2	Sensitivity Test 2a
Description	Winter low flow	Midway between winter and summer low flow	Summer low flow	Intermediate low flow
Susquehanna River flow, cfs	2,848	2,047	1,246	1,994
Susquehanna River net, cfs	2,727	1,926	1,125	1,854
Water surface elevation, ft	486.8	486.6	486.0	486.4
Susquehanna River Temperature, F	32	32	32	32
SSES				
Temperature rise, °F	31.0	31.0	31.0	34.1
Intake rate, gpm	42,300	42,300	42,300	48,645
Discharge rate, gpm	11,200	11,200	11,200	12,880
BBNPP				
Temperature rise, °F	33.8	33.8	33.8	37.2
Intake rate, gpm	34,458	34,458	34,458	39,627
Discharge rate, gpm	11,172	11,172	11,172	12,848
Area of the 0.5°F isotherm				
At the surface, acre	71.8	91.7	97.1	95.0
At the bottom, acre	98.0	110.7	110.2	113.4
Area of the 1.0°F isotherm				
At the surface, acre	0.0	63.1	91.0	82.7
At the bottom, acre	70.7	97.8	107.1	106.6
Area of the 5.0°F isotherm				
At the surface, acre	0.0	0.0	0.0	0.0
At the bottom, acre	6.2	8.0	13.5	10.7

Table 3: High heat rejection sensitivity tests

Parameter	Scenario 4	Sensitivity Test 3	Sensitivity Test 4	Sensitivity Test 5	Sensitivity Test 6
Description	Winter low flow	10% higher rates	20% higher rates	10% higher ΔT's	20% higher ΔT's
Susquehanna River flow, cfs	2,848	2,848	2,848	2,848	2,848
Susquehanna River net, cfs	2,727	2,715	2,703	2,727	2,727
Water surface elevation, ft	486.8	486.8	486.8	486.8	486.8
Susquehanna River Temperature, F	32	32	32	32	32
SSES					
Temperature rise, °F	31.0	31.0	31.0	34.1	37.2
Intake rate, gpm	42,300	46,530	50,760	42,300	42,300
Discharge rate, gpm	11,200	12,320	13,440	11,200	11,200
BBNPP					
Temperature rise, °F	33.8	33.8	33.8	37.2	40.6
Intake rate, gpm	34,458	37,904	41,350	34,458	34,458
Discharge rate, gpm	11,172	12,289	13,406	11,172	11,172
Area of the 0.5°F isotherm					
At the surface, acre	71.8	76.9	81.9	75.9	79.4
At the bottom, acre	98.0	101.2	104.3	100.5	102.6
Area of the 1.0°F isotherm					
At the surface, acre	0.0	24.1	40.4	24.3	39.8
At the bottom, acre	70.7	78.6	83.7	77.9	82.1
Area of the 5.0°F isotherm					
At the surface, acre	0.0	0.0	0.0	0.0	0.0
At the bottom, acre	6.2	6.7	7.2	6.9	7.6

As expected, the results show surface and bottom area increases as discharge flows and ΔT's increase and Susquehanna River flows decrease.

Although the size of the combined thermal plume in the Susquehanna River is a complex function of a number of interacting variables, the two most important are the amount of heat rejected to the Susquehanna River (the sum of the product of SSES and BBNPP ΔT's and discharge rates) and the flow rate in the Susquehanna River. These variables can be combined by computing the fully-mixed temperature rise for each sensitivity test and plotting the resulting areas (Figure 1 and Figure 2). The fully-mixed temperature rise is computed as follows:

$$\Delta T_{fm} = (\Delta T_{SSES} * Q_{SSES} + \Delta T_{BBNPP} * Q_{BBNPP})/Q_{SR}$$

The plume area is proportional to the heat rejected (numerator) and inversely proportional to the flow in the Susquehanna River (denominator).

Figure 1: Fully-mixed temperature rise vs. surface area

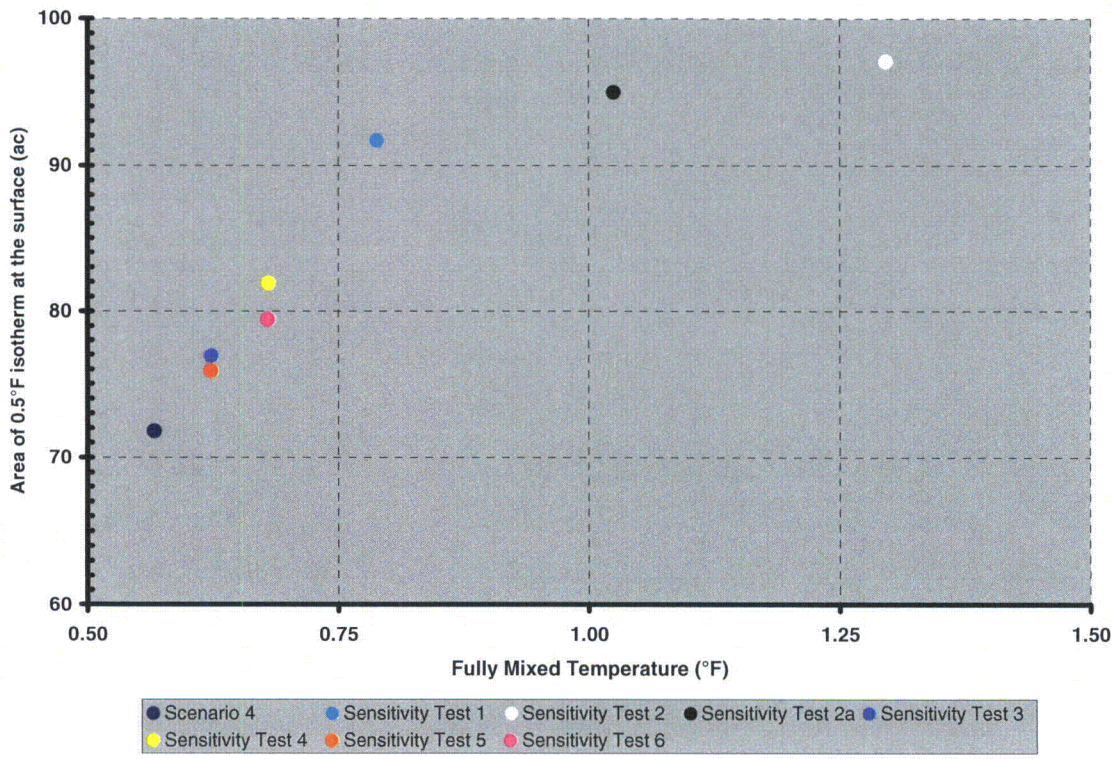
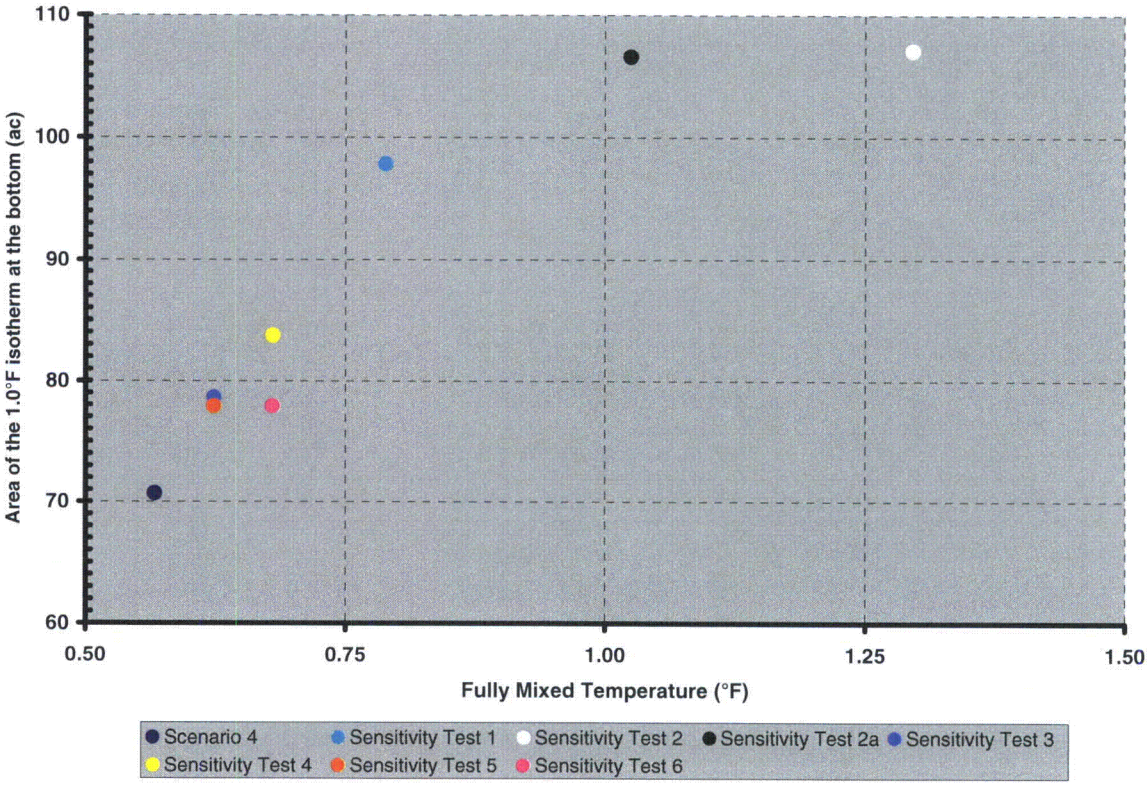


Figure 2: Fully-mixed temperature rise vs. bottom area



The computed plume areas increase with increasing fully-mixed temperature rise as expected, with the rate of increase decreasing at higher values of the fully-mixed temperature rise, likely reflecting the impact of additional factors (e.g. surface heat exchange, lateral and longitudinal dispersion). Furthermore, the plot shows that the amount of heat discharged (the product of the ΔT's and discharge rates) is more important than the value of the individual ΔT and discharge rate. This is shown by the near identical areas for Sensitivity Tests 3 and 5 (see Table 3). This pair represents increases in the heat rejected by 10% but that value is arrived at by increasing either the individual ΔT or the discharge rate by 10%. The same effect can be seen by comparing Sensitivity Tests 4 and 6 (see Table 3).

Enclosure 7 contains the thermal plume GEMSS input files used in the sensitivity analysis discussed above. The GEMSS files on the compact disc (CD) are as follows:

Date/Time	File Name	File Description
8/12/09 2:49p.m.	Verification May 1987_01.txt	GEMSS Input, May 1987 verif. Run
8/12/09 2:49p.m	Verification Sep 2008_01.txt	GEMSS Input, Sept. 2008 verif. Run
8/12/09 2:49p.m	Scenario 04_SR_RQ_01.txt	GEMSS Input, Sensitivity Test 1
8/12/09 2:49p.m	Scenario 04_SR_RQ_02.txt	GEMSS Input, Sensitivity Test 2
8/12/09 2:49p.m	Scenario 04_SR_DQ_01.txt	GEMSS Input, Sensitivity Test 2a
8/12/09 2:49p.m	Scenario 04_SR_DQ_02.txt	GEMSS Input, Sensitivity Test 3
8/12/09 2:49p.m	Scenario 04_SR_DE_01.txt	GEMSS Input, Sensitivity Test 4
8/12/09 2:49p.m	Scenario 04_SR_DE_02.txt	GEMSS Input, Sensitivity Test 5
8/12/09 2:49p.m	Scenario 04_SR_All_01.txt	GEMSS Input, Sensitivity Test 6

Bathymetric differences

The models presented in the ER Section 5.3 relied on two sets of bathymetric data: (1) the US Army Corps of Engineers (USACE) digital terrain maps – transects spaced approximately 500 ft apart and (2) more spatially-detailed bathymetric contours in the immediate vicinity of the SSES intake and discharge (see attached Figure 3, (PPL, 1978)).

The USACE digital terrain bathymetric mapping information for the Susquehanna River is found in Enclosure 8 and a copy of the transmittal letter accompanying the USACE data has been included as Enclosure 9.

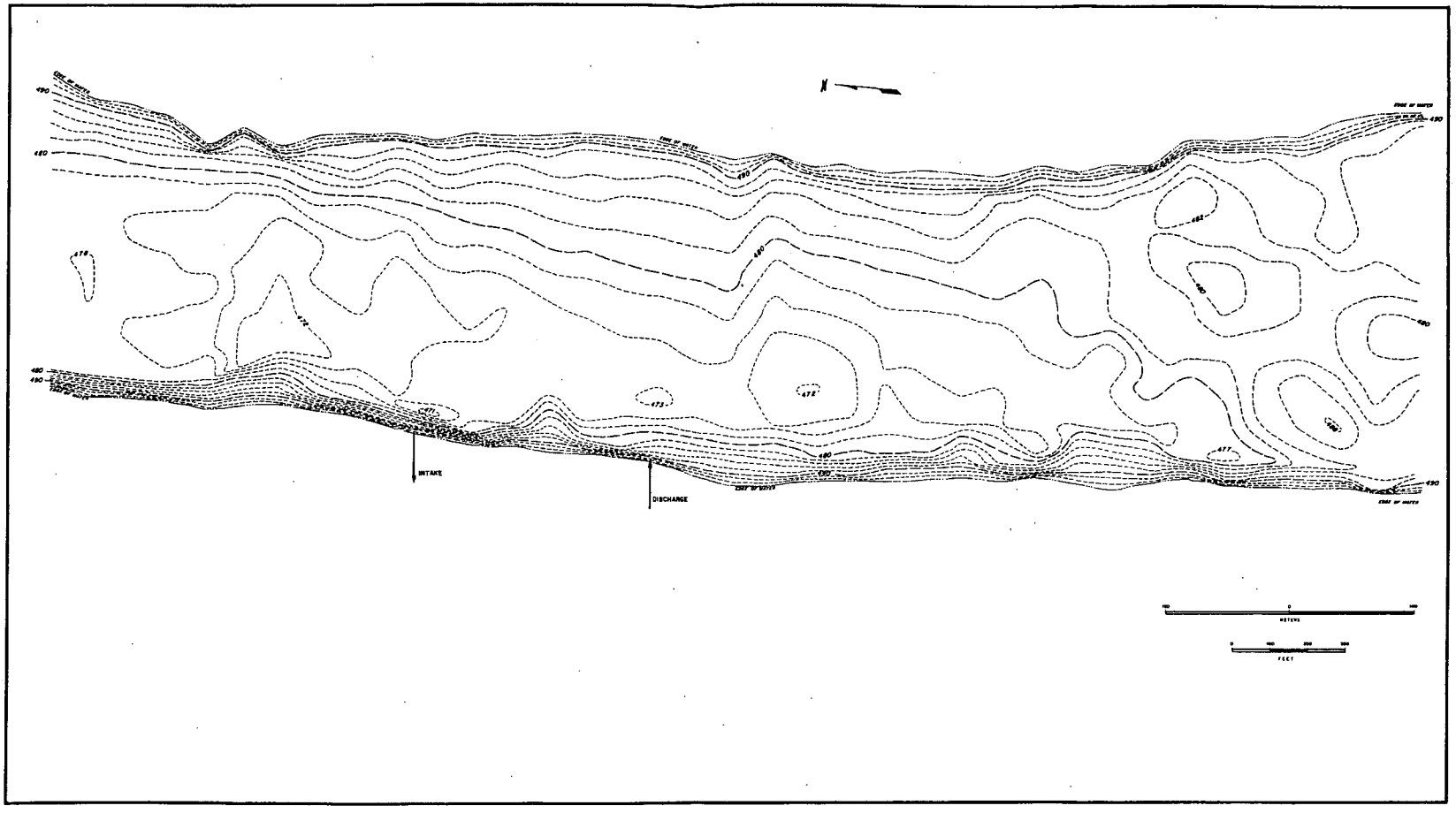
The bathymetric files in Enclosure 8 are as follows:

Date/Time	File Name	File Description
8/12/09 2:50p.m.	XYSusquehanna.dbf	US Army Corps of Engineers bathymetric dataset
8/12/09 2:50p.m.	XYSusquehanna.prj	
8/12/09 2:50p.m.	XYSusquehanna.sbn	
8/12/09 2:50p.m.	XYSusquehanna.sbx	
8/12/09 2:50p.m.	XYSusquehanna.shp	
8/12/09 2:50p.m.	XYSusquehanna.shx	

A third bathymetric dataset available in a report prepared by Ichthyological Associates, contains applicable pages which are included as Enclosure 10 to this RAI response.

The availability of this dataset allows for comparison of the 1978 and 1983 datasets, shown in Figures 3 and 4.

Figure 3: 1978 bathymetric data from Pennsylvania Power and Light Company (1978)

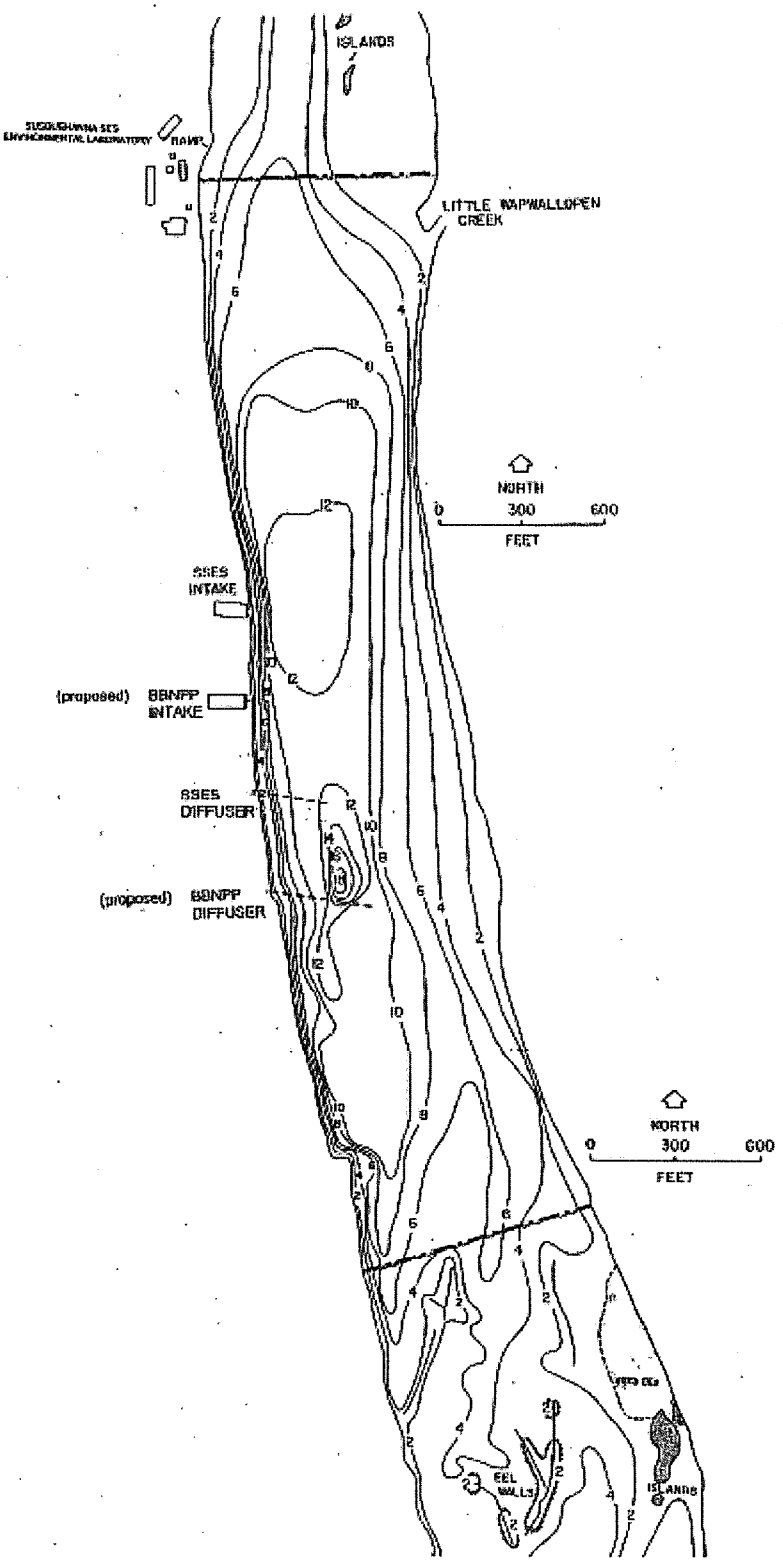


SUSQUEHANNA STEAM ELECTRIC STATION
ER–OPERATING LICENSE STAGE
UNITS 1 AND 2

SUSQUEHANNA RIVER BATHYMETRY.

FIGURE 2.4–3

Figure 4: 1983 depth data (from Fig. 1, Ecology III (1984)). The water surface elevation on the survey date was 486.2 ft MSL.



Note that Figures 3 and 4 are similar qualitatively, but that there is additional detail in the 1983 survey – depth was measured at 607 locations. Each survey shows a deeper area adjacent to the SSES intake and a deeper, but smaller area downstream of the SSES diffuser. These features existed prior to the operation of SSES Units 1 and 2. Based on a comparison of these figures, there was little change over the 5-year period between surveys.

To compare the two surveys, the contours are overlaid in Figures 5 and 6. The contours from each survey are so close to one another (e.g., the 1983 survey shows a depth about 8 in shallower at the BBNPP discharge) that at the level of detail incorporated into the near- and far-field models (overall depth in the former, and depths on a 30 ft by 50 ft grid in the latter), there would be no significant difference in the model results by using the 1983 dataset.

Figure 5: 1978 and 1983 bathymetric data overlain; green is the 1978 data, red the 1983 data.

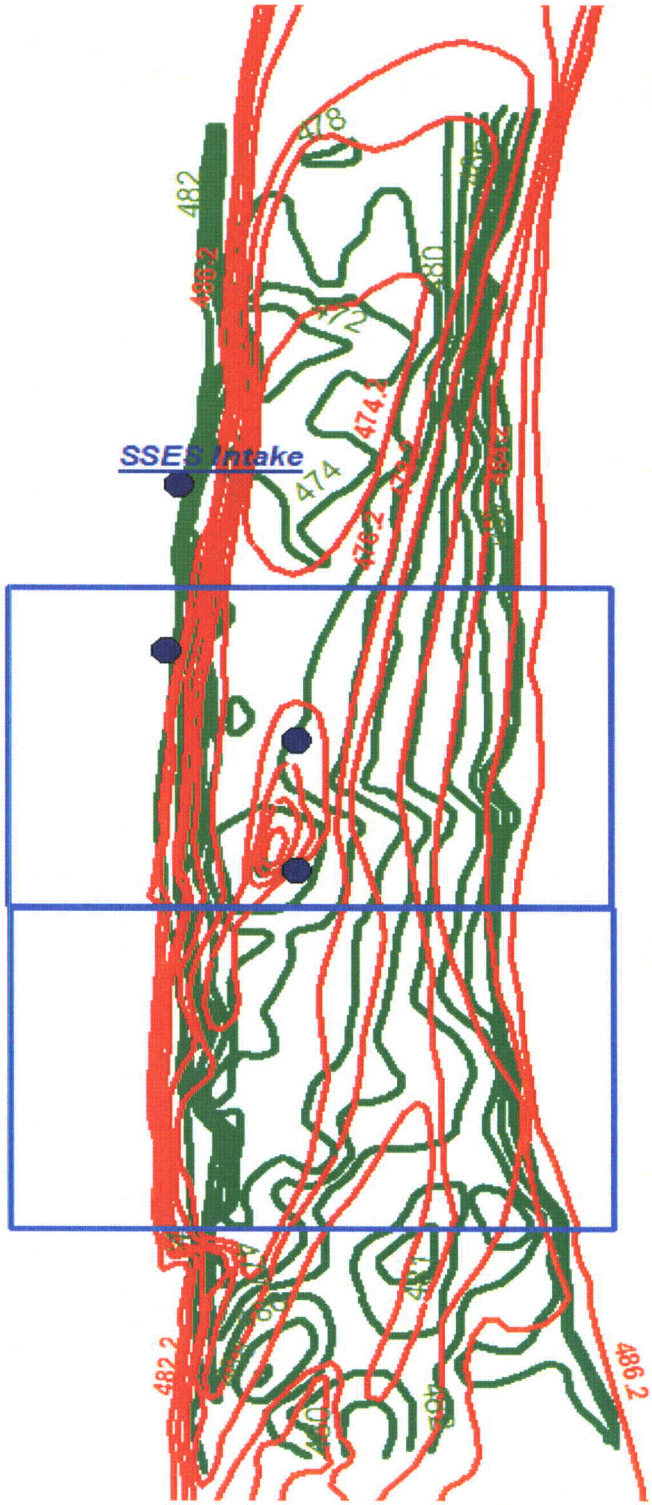
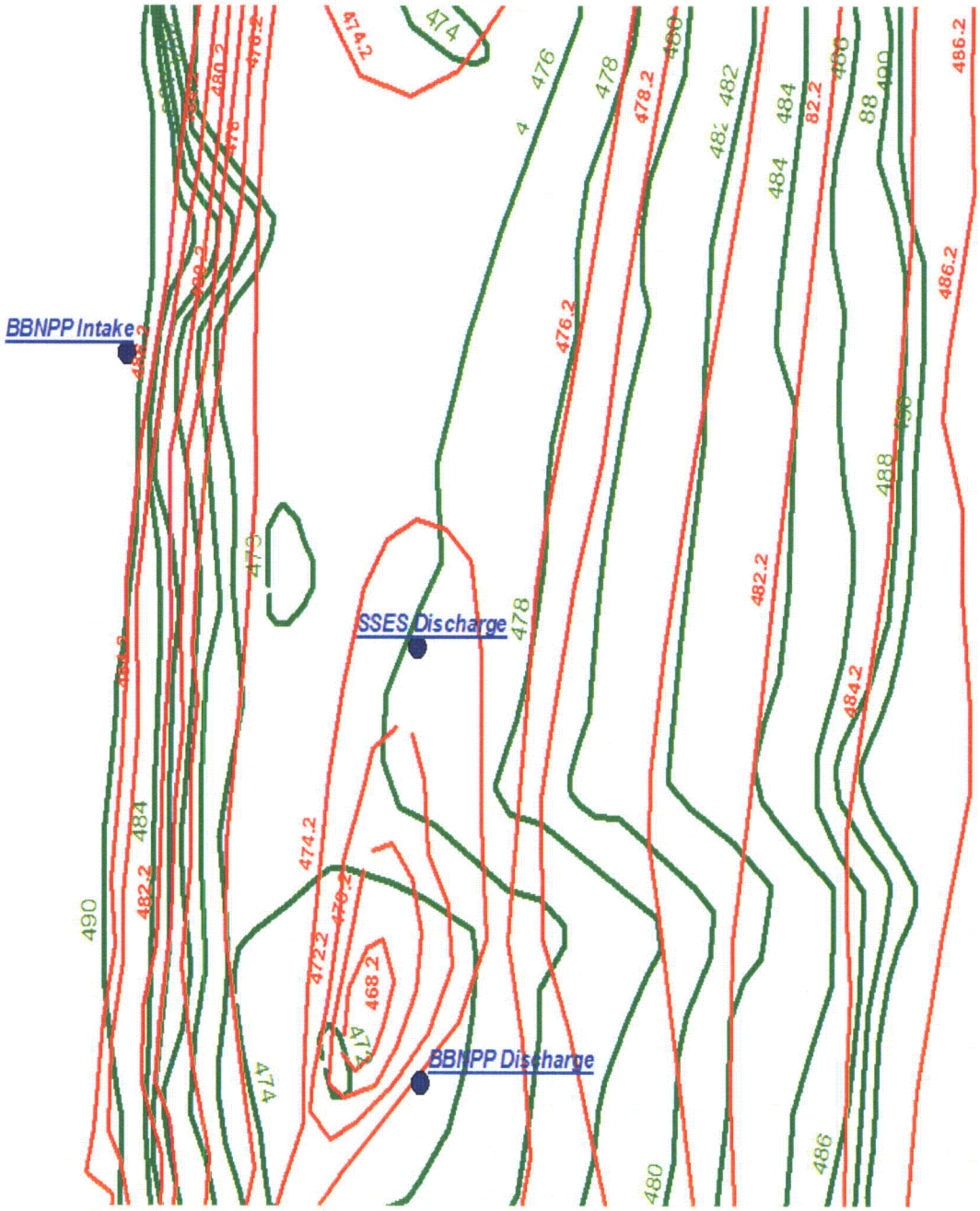


Figure 6: Detail near the BBNPP intake and discharge structures of the 1978 and 1983 bathymetric data; green is the 1978 data, red the 1983 data.



Reference Cited in Item 2 of the Response:

PPL, 1978. Pennsylvania Power and Light Company. 1978. Susquehanna Steam Electric Station, Units 1 & 2 Environmental Report Operating License Stage (Volumes 1, 2, and 3), May 1978.

COLA Impact:
No changes to the BBNPP COLA ER are required as a result of this RAI response.