QUESTION 371.1

Several flood elevations in the text and tables are inconsistent. For example, the June 24, 1972 flood level at Danville is given as 435.5 feet above Mean Sea Level, while in the text it is stated that the level was 1.6 feet above that of the March 9, 1904 event (458.8 feet above MSL). Also, the text states that the estimated flood level at the site during the June 1972 event was about 518 feet MSL, while the table gives it as 516.6 feet MSL. Correct these and any other inconsistencies in the text.

RESPONSE:

See revised Subsections 2.4.2.1.2 and 2.4.3.3, Section 2.4.3 and Table 2.4-4.

QUESTION 371.2

Justify the statement (FSAR p. 2.4-9) that the buried conduit, that is part of the site drainage system required to pass the PMP runoff, cannot be blocked:

(1) Consider debris that can be carried by the PMP runoff and show that the conduit and all entrances to it cannot be blocked.

(2) Are there provisions to regularly check the conduit to ensure that it has not failed or become blocked? If so, discuss them.

(3) If your response to either of the above indicate that the conduit may not be available to pass the runoff from a PMP, discuss the consequences in terms of site flooding.

RESPONSE:

Subsection 2.4.2.3 has been revised to provide the response to this question.

QUESTION 371.3

A discussion of flood effects on the river intake system is necessary. Is this system designed to withstand the probable Maximum Flood on the Susquehanna River? If not, what is the maximum river stage the system is designed for and how is it that stage characterized (e.g., how does it compare with the flood of record)?

RESPONSE

The river intake structure is not required to be designed to withstand the Probable Maximum Flood (PMF) since it serves no safety related function. The intake structure is designed for the Project Standard Flood which would reach an elevation of 525 feet (msl). The PMS elevation is 548 feet (msl). The flood of record occurred on June 24,1972 (Table 2.4-4) and reached an elevation of 516.6 feet (msl). A description of the intake structure's non-safety related function is presented in Section 9.2.

QUESTION 371.4

Discuss the effects of blockages of the river intake or discharge system by ice. Include a discussion of the frequency of such occurrences.

RESPONSE:

FSAR Subsection 2.4.7 has been revised to include this information.

QUESTION 371.5

Provide a discussion of the low river stage in relation to the requirements of the intake and discharge systems. Include figures showing the locations of the major components of these systems and cross-sections showing their relationship to various river levels.

RESPONSE:

Subsection 2.4.11.2 has been revised and Figures 2.4-52 and 2.4-53 have been added to the FSAR to supply this information.

QUESTION 371.6

Discuss the implications of the September 30, 1976 amendment to 18 CFR Part 803, that requires compensation for water withdrawn from the Susquehanna River during periods of low flow.

(a) How do you intend to comply with the regulation?

(b) Will the plant have to be shut down during low river flow? How often will the UHS pond have to be used to comply with the regulation?

RESPONSE:

A discussion of compliance with 18CFR303 is found in Subsection 2.4.11.4.

The Ultimate Heat Sink (UHS) will not be used to comply with this regulation.

TABLE 371.6-1

IMPACT OF LOW FLOW ON SUSQUEHANNA OPERATION

	4 day outage (Average Annual)			28 day outage (Once in 30 years)			96 day outage (Maximum recorded)		
	60% CF	70% CF	80% CF	60% CF	70% CF	80% CF	60% CF	70% CF	80% CF
Energy Reduction [1] (Million KWH)	142	165	189	991	1156	1322	3398	3965	4531
Capacity Factor Reduction (percentage points)	0.8	0.9	1.0	5.4	6.3	7.2	18.5	21.6	24.6

(1) Based on station capacity of 2100 MW and a scheduled outage rate of approximately 15% (1977 PJM GUS Report) with forced outage rates adjusted to give the indicated capacity factors.

QUESTION 371.7

Discuss the low level alarms in the river intake structure. At what river level do the alarms go off? What happens if the alarm is activated?

RESPONSE:

FSAR Subsection 2.4.11.6 has been revised to include this information.

QUESTION 371.8

Is the 665 foot MSL groundwater level that is referred to in the first paragraph a measured or a design level?

RESPONSE:

Response: It is a design level.

QUESTION 371.9

Provide descriptions, including figures and cross-sections, of the Ultimate Heat Sink pond and its components. Figures showing intakes, discharges, pumps, sprays, etc. are needed

RESPONSE:

The Ultimate Heat Sink Pond and the ESSW Pumphouse are described in Subsection 3.8.4.1 of the FSAR.

QUESTION 371.10

How is the buildup of concentration of dissolved solids in the UHS pond prevented? Is there provision for monitoring the water chemistry in the pond?

RESPONSE:

Please see revised Subsections 9.2.7.2 and 9.2.7.3.

QUESTION 371.11

Discuss the consequences of an emergency shutdown immediately following a period when cooling tower blowdown is diverted to the UHS pond. Did your analysis of the pond's thermal performance consider this additional heat input and the resulting higher initial pond temperature?

RESPONSE:

Please see revised Subsections 9.2.7.2 and 9.2.7.3.

QUESTION 371.12

Identify (manufacturer, type) and provide diagrams of the spray nozzles and their arrangement in the pond. Discuss the consequences of a freezing rain or waves from the pond covering the nozzles with ice.

RESPONSE:

The required information is contained in revised FSAR Subsection 9.2.7.2.2.

QUESTION 371.13

Discuss the meteorological data used to satisfy the criteria of Regulatory Guide 1.27. What data base was used, how were the values given in FSAR Tables 9.2-9 and 9.2-10 chosen, and why were only averages for the first day and the next 29 chosen? Justify the conservatism of meteorological conditions used.

RESPONSE:

FSAR Subsection 9.2.7.3.7.1 has been revised to include this information.

QUESTION 371.14

Provide a detailed description of the models used to analyze pond performance. Provide figures showing heat input to the pond with time, integrated heat, and calculated pond temperature and volume with time for the case of maximum water loss and maximum pond temperature.

RESPONSE:

The required model descriptions are contained in revised Subsection 9.2.7.3.3.

QUESTION 371.15

Discuss the origin of FSAR Figures 9.2-15 and 9.2-16. Are they from your model, from measurements made at operating spray ponds or from another source?

RESPONSE:

This discussion is contained in revised FSAR Subsection 9.2.7.3.7.

QUESTION 371.16

Indicate where those items, identified in amendment 17 of the PSAR to be responded to or discussed further in the FSAR, are discussed.

RESPONSE:

Indicated below are those items identified in Amendment 17 of the PSAR for which further response in the FSAR was indicated. References to our responses are also provided.

NRC Letter dated February 15, 1974.

Item 1(c). Discuss short-circuiting from wind blown spray.
Response: Refer to Subsection 9.2.7.3.7.1

Item 1(f). Account for recirculation in your performance system model.
Response: Refer to Subsection 9.2.7.3.3

NRC Letter dated January 15, 1975

Question 1. Provide plan drawings of the spray pond, pump intake area and location of the ESSW pumphouse.

Response: See Dwgs. M-274, Sh. 1, C-795, Sh. 1, and Figures C-795, Sh. 1 and Figures 3.8-96, 3.8-97 and 9.2-24.

Question 3. Provide foundation sections necessary to evaluate the stability of the pumphouse and service water piping.

Response: See figures 2.5-42, Dwg. C-63, Sh. 1, and Figures 3.8-96, 3.8-97, 3.8-98 and 3.8-104.

Question 5. Discuss dewatering for the spray pond and ESSW pumphouse.

Response: Refer to subsection 2.5.4.10.2.

Question 7. Discuss fill material beneath the ESSW pumphouse.

Response: Refer to subsection 3.8.5.1.

QUESTION 371.17

Describe the pre-operational tests and the analysis of the resulting data to be used to confirm the UHS pond will perform as predicted.

RESPONSE:

This description is contained in revised FSAR Subsection 9.2.7.4.

QUESTION 371.18

Provide a list of references used for this section.

RESPONSE:

The references used for this section are included below:

1) W. E. Ranz and W. R. Marshall, "Evaporation from Drops", Chemical Engineering Process Vol. 48, Nos. 3 & 4 (March, April 1952).

2) V. E. Schrock and G. J. Trezek, "Rancho Seco Nuclear Service Spray Pond Performance Evaluation," unpublished report submitted to Sacramento Municiple Utility district (July 1, 1973).

3) Spray Engineering Company for Pennsylvania Power and Light Company, "Drops Size Spectrum Test Report", unpublished (April 1974).

4) G.P. Williams, "Probability Charts for Predicting Ice Thickness, The Engineering Journal, EIC (June 1963).

5) Kays, W.M. and London, A.L., "Compact Heat Exchangers", (Palo Alto, CA: National press, 1955).

QUESTION 371.19

Provide a map of the site clearly showing the topography as altered by the plant. Note that FSAR Figure 2.4-1 is inadequate because it is very difficult to see the contours in the vicinity of the plant.

RESPONSE:

Figure 2.5-24 has been revised and shows all the present roads and finished grading for both Units 1 and 2.

QUESTION 371.20

Describe the "pressure resisting doors" used to prevent water from reaching safety-related equipment. Document that they are water tight for the maximum water level they must withstand. Indicate that procedures will be used to ensure that the door will be properly closed during a flood. Alternately, if you can document that the maximum water level will be below the sill level of the doors to all safety-related buildings, it may not be necessary to keep the doors shut.

RESPONSE:

A description of the "pressure resisting doors" used to prevent water from reaching safety-related equipment has been included in subsection 2.4.2.3 of the FSAR.

QUESTION 371.21

You state, on page 2.4-29 of the FSAR, that "...all safety-related equipment (in the ESSW pumphouse) are located at higher elevation (than the 684.7 feet MSL you calculated as the maximum wind wave runup) and has suitable protection."

What is the elevation of the safety-related equipment and what is the suitable protection?

RESPONSE:

See revised Subsection 2.4.8.4.1 for response.

QUESTION 371.22

Please provide a copy of, or a better reference to the TAMS report referred to in your response to Q371.6.

RESPONSE:

The referenced TAMS report is attached.

AVAILABILITY OF SUSQUEHANNA RIVER FLOW

The availability of Susquehanna River flows for use consumptively at the Susquehanna Steam Electric Station was examined. The analysis, based on the Susquehanna River Basin Commission regulations governing consumptive uses and a repetition of the historical flows, shows there would be 4 days of shortage per year on the average. There would be 12 years out of 71 in which shortages would occur, ranging from 2 days to 96 days. The following table summarizes the results of the analysis, and provides estimated return periods for various durations of shortages.

Days of Shortages	Order Number	Return Period[1]
96	1	158
31	2	34
28	3	30
25	4	28
14	5	15
12	6	13
10	7	12
7	8	9
4	9-10	8
3	11	7
2	12	6
0	13-71	

The basic studies were made as a part of the ongoing hydrologic work Tippetts-Abbett-McCarthy-Stratton is doing for Pennsylvania Power & Light Company concerning an alternative water supply for the SSES. These studies are reviewed and summarized below.

[1] Based on a Log-Pearson Type III Distribution, as given in U.S. Water Resources Council, "Guidelines in Determining Flood Flow Frequency," Bulletin 17, March 1976.

Requirements of the SRBC

The Susquehanna River Basin Commission regulations concerning consumptive uses of Susquehanna River flow were published in 18 CFR 803, September 14, 1976. Those parts of the regulation which are pertinent to the study follows:

"S803.61 Consumptive Uses of Water

(a) Definitions. For purposes of this section the words listed below are defined as follows:

(1) Consumptive Use. Water withdrawn from its source, via a man-made conveyance system, but not directly returned thereto making it unavailable for other water users.

(2) Dedicated Augmentation. Release from an upstream storage facility which is intended for another instream or withdrawal use.

(b) Requirements.

(1) Compensation shall be required for consumptive uses of water during periods of low flow. Compensation is required during periods of low flow for the purposes of protection of public health; stream quality control; economic development; protection of fisheries; recreation; dilution and abatement of pollution; the prevention of undue salinity; protection of the Chesapeake Bay; and other purposes as determined by the Commission.

(2) Consumptive uses by a project not exceeding 20,000 gpd from a total withdrawal of less than 100,000 gpd from surface or groundwaters are exempt from the requirement unless such uses adversely affect the purposes outlined in (1).

(c) Method of Compensation.

(1) Methods of compensation acceptable to the Commission will depend upon the character of the project's source of water supply and other factors noted below.

(i) Stream source. Compensation in an amount equal to the project's total consumptive use shall be required when the stream flow at the point of taking equals or is anticipated to equal the low flow criterion which is the 7-day 10-year low flow plus the project's total consumptive use and dedicated augmentation. The commission reserves the right to apply a

higher low flow criterion for a particular stream reach when it finds, as the result of evidence presented at a public hearing, that it is needed to serve the purposes outlined in (b)(1). . . .

(f) Effective Date. This section shall apply to all consumptive uses initiated since January 23, 1971. Any project that has initiated consumptive use after the effective date is subject to this requirement. Such users or projects which will begin consumptive uses in the near future must comply with the requirement within a time period to be set by the Commission for individual projects."

The periods when compensation would be required are the same as the times when the Susquehanna flow would not be available for consumptive use at the SSES. At all other times, the river flow would be available.

Estimate of the 7-day 10-year (Q7-10) low flow

The USGS gaging station near Wilkes-Barre is about 20 miles upriver from the SSES and is the closest location where river flows are recorded. The historic flow at this gage was used to indicate requirements at the SSES.

The USGS estimated the value of the !7-10 at this gage to be 770 cfs.[2] The value was used as a basis for determining the availability of the Susquehanna River flow at the SSES.

Other Factors

Two other factors were considered as possibly affecting the estimate of the availability of Susquehanna River water for consumptive purposes. However, it was determined that these factors did not have an appreciable effect on the estimate. The factors evaluated were:

1. Past and future consumptive uses by others.

2. Releases from existing reservoir.

TAMS evaluation considered a number of effects of consumptive uses and upstream reservoir releases which are discussed below.

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[2] Bulletin No. 12, "Low Flow Characteristics of Pennsylvania Streams," published by the Department of Environmental Resources, Commonwealth of Pennsylvania in Cooperation with the U.S. Department of Interior, Geological Survey, October 1977.

According to the SRBC regulations, consumptive uses of substantial amounts initiated after January 23, 1971, must be compensated for. Flows released from storage could not be considered as a part of the normal flow when estimating the need for compensation unless allocated.

The SRBC[3] estimated that consumptive use above the Wilkes-Barre gage will increase from 91 cfs in 1971 to 155 in 1990. A review of the water supply needs above Wilkes-Barre as summarized in the Susquehanna Study Report[4] indicates that about 40 percent of this consumptive use would result from domestic and industrial needs and 60 percent from irrigation. TAMS estimated that less than 2 percent of these future consumptive uses would be for farm and urban domestic needs and they would not require compensation under Section 803.61-b-2 of the regulations.

The effects of past consumptive uses on the estimate of the Q7-10 were reviewed. If the historical records were corrected to reflect consumptive uses as of January 1971, the Q7-10 flow might be slightly less. The overall results of such corrections would probably be to increase the number of days when the river flow would be below the minimum value. However, a preliminary computation indicated that such a correction would not significantly change the USGS estimate of the Q7-10. Because of inadequate historical records of past consumptive uses and the insignificant changes, no detailed corrections to the records are considered to be warranted.

There are two Corps of Engineers reservoir projects under construction and six existing reservoirs above SSES. The existing projects are mainly for flood control. Several have secondary purposes, none of which impound sufficient water for SSES augmentation needs. However, the two projects under construction do have storage space which could be allocated for low flow augmentation. At this time, no detailed information has been disclosed on future releases, so TAMS has made the conservative assumption in this paper that any releases from upstream reservoirs would not be available for consumptive use at the SSES unless so specified.

Estimate of Non-Availability of Consumptive Water Supply

The estimated number of days each year based on the historic record at Wilkes-Barre when Susquehanna River flow would not be available for consumptive use at the SSES is tabulated in the enclosed Tables. These are the days during the period 1905-1975 when the recorded flow at the Wilkes-Barre gage would be less than Q7-10 (770 cfs) plus the consumptive use of the SSES (50 cfs) or 820 cfs.

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3 "Information on Flow Criteria and Make Up for Consumptive Withdrawals," Susquehanna River Basin Commission, March 1976.

4 "Susquehanna River Basin Study," Appendix F. Susquehanna River Basin Coordinating Committee, June 1970.

**DAYS DURING THE PERIOD 1905-1975
THAT SUSQUEHANNA RIVER FLOWS
COULD NOT BE USED CONSUMPTIVELY AT THE SSES**

	July**	Aug.	Sept.	Oct.	Nov.	Total
1905	-	-	-	-	-	0
06	-	-	-	-	-	0
07	-	-	-	-	-	0
08	-	-	12	-	-	12
09	-	-	-	-	-	0
1910	-	-	-	-	-	0
11	-	3	-	-	-	3
12	-	-	-	-	-	0
13	-	-	4	-	-	4
14	-	-	-	-	-	0
15	-	-	-	-	-	0
16	-	-	-	-	-	0
17	-	-	-	-	-	0
18	-	-	-	-	-	0
19	-	-	-	-	-	0
1920	-	-	-	-	-	0
21	-	-	-	-	-	0
22	-	-	-	-	-	0
23	-	-	-	-	-	0
24	-	-	-	-	-	0
25	-	-	-	-	-	0
26	-	-	-	-	-	0
27	-	-	-	-	-	0
28	-	-	-	-	-	0
29	-	-	-	-	-	0
1930	-	-	-	-	-	-
31	-	-	-	-	-	-
32	-	-	-	-	-	-
33	-	-	-	-	-	-
34	-	-	-	-	-	-
35	-	-	-	-	-	-
36	-	-	-	-	-	-
37	-	-	-	-	-	-
38	-	-	-	-	-	-
39	-	6	22	-	-	28

	July**	Aug.	Sept.	Oct.	Nov.	Total
1940	-	-	-	-	-	0
41	-	-	5	9	-	14
42	-	-	-	-	-	0
43	-	-	-	-	-	0
44	-	-	-	-	-	0
45	-	-	-	-	-	0
46	-	-	-	-	-	0
47	-	-	-	-	-	0
48	-	-	-	-	-	0
49	-	-	-	-	-	0
1950	-	-	-	-	-	0
51	-	-	-	-	-	0
52	-	-	-	-	-	0
53	-	-	1	3	-	4
54	-	-	-	-	-	0
55	1	9	-	-	-	10
56	-	-	-	-	-	0
57	-	-	-	-	-	0
58	-	-	-	-	-	0
59	-	-	7	-	-	7
1960	-	-	-	-	-	0
61	-	-	-	-	-	0
62	-	8	23	-	-	31
63	-	-	-	19	6	25
64	-	12	28	31	25	96
65	2	-	-	-	-	2
66	-	-	-	-	-	0
67	-	-	-	-	-	0
68	-	-	-	-	-	0
69	-	-	-	-	-	0
1970	-	-	-	-	-	0
71	-	-	-	-	-	0
72	-	-	-	-	-	0
73	-	-	-	-	-	0
74	-	-	-	-	-	0
75	-	-	-		-	0
Total	3	38	102	62	31	236

* Based on reservoir releases when flow was equal to or less than 820 cfs at the Susquehanna Gage at Wilkes Barre.

** Based on historical record, augmentation releases would never be required in the months December through June.

QUESTION 371.23

You state, on page 2.4-39 of the FSAR, that the river low level alarm is set at 488.5 feet MSL. From the stage discharge curve, FSAR Figure 2.4.6, that level corresponds to a discharge of about 5000 cfs. From the discharge-duration curve, FSAR Figure 2.4-30, the river discharge is below 5000 cfs about 40 percent of the time at Wilkes-Barre. Since the discharge-duration relationship at the site would not be very different than at Wilkes-Barre, it appears that the low level alarm would be activated quite often. What is the purpose of the alarm and what happens when it is activated?

RESPONSE:

Subsection 2.4.11.6 has been revised to supply this information.

QUESTION 371.24

Indicate how you intend to ensure spray pond cooling capability beyond 30 days, especially if:

(1) the Susquehanna River flow is below the level at which you can withdraw water in compliance with 18 CFR Part 803.

(2) the river stage is below that needed for the intake system to operate.

We note that on page 9.2-26 of the FSAR, you refer to Section 13.3 which in turn refers to your emergency plan. We were unable to find a discussion of makeup water to the spray ponds in that document.

RESPONSE:

Subsection 9.2.7.1 has been revised to include this information.

QUESTION 371.25

You state on FSAR page 9.2-26, that at times of subfreezing temperatures, return flow to the spray pond will be first discharged directly into the pond, through a by-pass line, without passing through the spray network. Please indicate, on a diagram of the pond, the location of the by-pass line and document that its location precludes short circuiting of hot water to the intake without significantly thawing the pond. Document that the return temperature will remain below the design maximum temperature at all times.

RESPONSE:

Subsection 9.2.7.2.3 of the FSAR has been revised to address this question.

QUESTION 371.26

On page 9.2-34 of the FSAR you refer to an Appendix D, which we have not been able to find in the FSAR. Please either direct us to its location in the FSAR, or if not in the FSAR, provide the document.

RESPONSE:

Appendix D is provided as Subsection 9.2.7.6.

QUESTION 371.27

Model studies, performed during the Construction Permit (CP) review, indicated that the spray ponds, as designed, would be capable of providing cooling water at a temperature below the design maximum for the shutdown of both units during conditions specified in Regulatory Guide 1.27. The ability of the as built spray ponds to meet the design bases adopted at the CP must be confirmed by actual performance tests. Specifically, tests to confirm that the pond responds in a manner consistent with the model studies previously used to estimate pond performance, are needed. Commit to provide a detailed description of your test plan, procedures and analyses techniques for NRC staff review and approval prior to operation of Unit 1. The plan should recognize the availability of heat from Unit 1. Your schedule for the tests and analyses should allow for NRC staff review and approval prior to loading fuel for Unit 2.

RESPONSE:

FSAR Subsection 9.2.7.4 has been revised in response to this question.

QUESTION 371.28

You have not documented that the pressure resisting doors described on page 2.4-10 will prevent water from reaching safety-related equipment, nor have you indicated what procedures will be used to ensure that the doors will be properly closed during a flood event. You state that "prototype assemblies are tested to insure their conformance to specified performance criteria ..." Describe the performance criteria relevant to flood protection. Identify and locate on appropriate maps and figures those doors that provide flood protection. Identify the practices, technical specifications or other procedures that will insure that the doors will be properly closed during a flood event.

Alternately, if you can document that the maximum water level will be below the sill level of the doors to all safety related buildings, it may not be necessary to keep the doors shut.

RESPONSE:

See revised Subsection 2.4.2.3. The effects of flooding on the ESW pumphouse are discussed in the response to Question 371.21.

QUESTION 371.29

Determine if a groundwater dewatering system is installed, being constructed or planned at the site. Responses to items (1) through (3) are necessary only if a dewatering system is, or will be, built.

(1) Provide a description of the dewatering system, including as-built drawings showing the locations of structures, components and features of the system. Provide available information related to the design of all system components such as pumps, lateral interceptors, drainage blankets, and previous fills.

(2) Determine the extent that the dewatering system is relied upon to reduce inleakage into safety-related buildings. Document the internal water levels that cause failure of safety-related equipment.

(3) Determine if credit is given to the system for reduction of active and/or passive loads on safety-related structures or components, or on any non-safety component whose failure could affect safety-related features.

RESPONSE:

No groundwater dewatering system is installed, being constructed, or is planned at the Susquehanna SES site.

A temporary drainage system was installed for use during construction but has been abandoned and is not required for plant operation. Plant design has been based upon the assumption that there is no groundwater dewatering system around any of the Susquehanna SES structures.

QUESTION 371.30

You state on page 2.5-120 that seepage from the spray pond will be monitored using observation wells and refer to subsection 2.4.13.4. That subsection, however, does not contain the referenced discussion. It is our position that the possibility of groundwater levels above your design elevation of 665 feet MSL be addressed by a monitoring program and technical specifications. Therefore, provide the following information:

1. Provide a description of your proposed monitoring program, including maps and cross-sections showing the locations and depths of the observation wells in relation to the spray pond. Discuss the data collection program you propose, including methods of collection, schedules, and documentation. Provide details of your proposed program (described in FSAR Section 2.5.5.2.2.1) to measure actual seepage by measuring pond levels, precipitation and evaporation.

2. Discuss technical specifications and limiting conditions of operation necessary to ensure that the general health and safety of the public is not endangered if the design groundwater level below the spray pond is exceeded.

RESPONSE:

See new Subsection 2.5.5.2.2.1.1.