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September 10, 1982

Docket No. 50-213
LS05-82-09-035

Mr. W. G. Counsil, Vice President
Nuclear Engineering and Operations
Connecticut Yankee Atomic Power Co.
Post Office Box 270
Hartford, Connecticut 06101

Dear Mr. Counsil:

SUBJECT: SEP HYDROLOGY TOPICS II-3.A, II-3.B, II-3.B.1, II-3.C, AND III-3.B - HADDAM NECK PLANT

Enclosure 1 is a copy of our draft evaluation of SEP Hydrology Topics II-3.A, Hydrology Description; II-3.B, Flooding Potential and Protective Requirements; II-3.B.1, Capability of Operating Plants to Cope with Design Basis Flood Conditions; II-3.C, Safety-Related Water Supply (Ultimate Heat Sink); and III-3.B, Structural and Other Consequences of Failure of Underdrain Systems. These evaluations are based on review of our contractor's Technical Evaluation Report which is provided as Enclosure 2. Our conclusion regarding these topics are summarized as follows:

Topic II-3.A - Complete. No. differences identified.

Topic II-3.B - Three differences are identified:

(1) The design live load for the service building roof will be exceeded by the PMP.

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(2) The licensee has proposed to make equipment and procedural changes which will provide protection against flooding up to 30 feet msl. The staff finds the licensee's proposed changes acceptable for protection to that level. However, analyses performed to current licensing criteria result in a maximum flooding level occurs at 39.5 feet msl (PMF). The need to provide protection to this level will be evaluated in the Integrated Assessment.

DSU WSE (02)

ADD: G. Staley

(3) Groundwater level should be assumed at grade elevation.

Topic II-3.B.1 - The licensee's proposed emergency flood procedures do not meet current NRC licensing criteria. Technical Specifications which require a flood alert and initiate emergency flood protection procedures are recommended for occurrences of flood water above 15 feet msl.

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Topic II-3.C - The UHS is susceptible to low river level which could cause a loss of the intake structure function. Therefore, the staff has concluded that the UHS does not meet the requirements of Regulatory Guide 1.27.

Topic III-3.B - The mat sump system is not safety grade, thus the groundwater level should be assumed at grade elevation.

You are requested to examine the facts upon which the staff has based its evaluation and respond either by confirming that the facts are correct, or by identifying errors and supplying corrected information. We encourage you to supply any other material that might affect the staff's evaluation of this topic or be significant in the Integrated Assessment of your facility. Your response is requested within 30 days of receipt of this letter. If no response is received within that time, we will assume that you have no comments or corrections.

Sincerely,

Original signed by:

Dennis M. Crutchfield, Chief
Operating Reactors Branch No. 5
Division of Licensing

Enclosures:
As stated

cc w/enclosures:
See next page

* SEE PREVIOUS CONCURRENCE

OFFICE	SEPB *	SEPB *	SEPB	SEPB	ORB#5	ORB#5	AD:OR/DL
SURNAME	AWang:bl	SBrown	CGrimes	WRussell	CTropf	DCrutchfield	TIppolito
DATE	8/30/82	8/31/82	9/2/82	9/2/82	9/3/82	9/7/82	9/ /82

9/9/82

- Topic II-3.B.1 - The licensee's proposed emergency flood procedures do not meet current NRC licensing criteria. The Technical Specifications which require a flood alert and initiate emergency flood protection prodedures are recommended for occurrences of flood water above 15 feet msl.

- Topic II-3.C - The UHS is susceptible to low river level which causes a loss of the intake structure function. Therefore, the staff has concluded that the UHS does not meet the requirements of Regulatory Guide 1.27.

- Topic III-3.B - The mat sump system is not safety grade, thus the grounwater level should be assumed at grade elevation.

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DATE	8/30/82	8/ /82	/ /82	/ /82	/ /82	/ /82	9/9/82

Mr. W. G. Counsil

cc
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State of Connecticut
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Enclosure 1

DRAFT

HYDROLOGIC ENGINEERING SAFETY EVALUATION FOR SYSTEMATIC EVALUATION PROGRAM

Topic II-3.A, Hydrologic Description
Topic II-3.B, Flooding Potential and Protection Requirements
Topic II-3.B.1, Capability of Operating Plants to Cope with Design Basis Flood Conditions
Topic II-3.C, Safety-Related Water Supply (Ultimate Heat Sink)
Topic III-3.B, Structural and Other Consequences of Failure of Underdrain Systems

Plant Name: Haddam Neck
Owner: Connecticut Yankee Atomic Power Company (CYAPCO)
Docket Numbers: 50-213

I. INTRODUCTION

The Systematic Evaluation Program (SEP) was established by the Nuclear Regulatory Commission (NRC) to evaluate the safety of 10 older nuclear power plants. The program evaluates the plants against current licensing criteria with respect to 137 selected topics.

The hydrologic topics provide:

- A brief description of the hydrologic features of the site and surrounding area, plant facilities and the design bases used for construction. Additionally both surface and groundwater and their interfaces with plant safety-related buildings and systems are described.

- Design bases floods for the plant are developed, using current criteria, and compared to the design bases events used when the plant was built. Deviations and their safety significance are discussed. Acceptability of current features are noted where applicable.

- Where physical protection is used to prevent plant flooding, the design and design bases are reviewed and compared to current criteria. The variations, if any, and their safety significance with respect to structural and equipment distress are discussed.

- The design basis groundwater level for hydrostatic loadings are determined in accordance with current criteria and compared to the values used for design.

- Existing emergency plans or procedures and technical specifications related to flooding or safety-related water supply are reviewed and compared to current criteria. Deficiencies are noted and, where possible, acceptable fixes are recommended. Where emergency plans or technical specifications do not exist but are a potential solution to a problem, they are discussed and recommendations made, if appropriate.

- As reviewed here, the Ultimate Heat Sink (UHS) consists of water sources for the cooling water system, necessary retaining structures (e.g., a pond with its dam or a cooling tower supply basin), and the canals or conduits connecting the sources with (but not including) the cooling water system intake structures. The existing UHS is compared to current criteria with respect to available supply and maximum temperature, and if deficiencies exist, they are discussed and acceptable solutions recommended, if possible.

The information used to perform the reviews was gathered from the licensee's files, NRC files, other agencies, and the site visit. In some cases, detailed information was not available. In such cases, the staff and its consultants conservatively estimated these parameters required for analysis. For this evaluation the staff consultant was the Franklin Research Center.

II. REVIEW CRITERIA

Current licensing criteria for nuclear power plants, related to the SEP topics addressed in this report, were developed from the Code of Federal Regulations: 10 CFR Part 50, "Licensing of Production and Utilization Facilities," and General Design Criterion 2, 4, 5, and 44 of Appendix A, "General Design Criteria"; 10 CFR Part 100, "Reactor Site Criteria" and Appendix A, "Seismic and Geologic Siting Criteria for Nuclear Power Plants".

The criteria which are applicable are (1) Standard Review Plans 2.4.1, 2.4.2, 2.4.3, 2.4.4, 2.4.5, 2.4.6, 2.4.7, 2.4.8, 2.4.9, 2.4.10, 2.4.11, 2.4.12, 2.4.14, 3.4.1, and 9.2.5 (Ref. 1); (2) Regulatory Guides 1.102, 1.127, 1.27, 1.59 and 1.70 (Ref. 2); and (3) American National Standards Institute (ANSI) Standard N170-1976 (Ref. 3).

III. RELATED SAFETY TOPICS AND INTERFACES

The effects of high surface water and ground water (pertaining to structural strength of building walls, loss of important equipment and its effect on the plants' ability to safely shutdown, etc) are outside the scope of the hydrologic evaluation. However, the levels of flood and ground water are determined in this evaluation and given to the structural and system reviewers for their use.

SEP interface topics are:

II-4.D - Stability of Slopes

II-4.E - Dam Integrity

II-4.F - Settlement of Foundations and Buried Equipment

III-1 - Classification of Structures, Components and Systems

III-3.A - Effects of High Water Level on Structures

III-3.B - Structural and Other Consequences of Failure of Underdrain Systems

III-3.C - Inservice Inspection of Water Control Structures

III-6 - Seismic Design Considerations

VII-3 - Systems Required for Safe Shutdown

VIII-2 - On-Site Emergency Power Systems - Diesel Generator

IX-3 - Station Service and Cooling Water Systems

XVI - Technical Specifications

IV. REVIEW GUIDELINES

The hydrologic issues identified in the Introduction are developed from design information for the nuclear power plant and from many sources containing hydrologic information for the site. Design bases (elevation of floods, depths of precipitation flooding, elevation of ground water and amounts of available cooling water) are determined and their conformance with or degree of departure from the current criteria is assessed. The Standard Review Plans and Regulatory Guides identified in Section II direct a complete evaluation of all issues and suggest or reference appropriate technical evaluation methods.

Regulatory Guides 1.27, 1.59 and 1.102 have been specifically identified as needing consideration for backfit on operating reactors. These guides are used in determining whether the facility design complies with current criteria or has some equivalent alternatives acceptable to the staff. The acceptability or nonacceptability of any deviations identified in this evaluation and the need for further action will be judged during the integrated assessment for this facility.

V. EVALUATION

The staff's consultant, Franklin Research Center (FRC), has reviewed the submittals from the Licensee (Ref 4 through 12) and available background information and made independent analyses necessary to prepare a Technical Evaluation Report (TER) (Appendix A) titled, "Hydrological Considerations (SEP, II-3.A, B, B.1, C; III-3.B) Connecticut Yankee Atomic Power Company, Haddam Neck Plant" dated June 25, 1982 (revised). This work was performed under NRC Contract No. 03-79-118 and provides the assessment for Systematic Evaluation Program (SEP) Topics: II-3.A Hydrologic Description; II-3.B, Flooding Potential and Protection Requirements; II-3.B.1, Capability of Operating Plants to Cope with Design Basis Flood Conditions II-3.C Safety Related Water Supply (Ultimate Heat Sink (UHS)), and III-3.B Structural and Other Consequences of Failure of Underdrain systems.

The staff has reviewed the TER and generally concurs with the evaluations, conclusions and recommendations. The following summary evaluation describes significant features addressed, any staff differences of opinion with the TER and any independent staff judgements.

Hydrologic Description (Topic II-3.A)

Site and Facilities - The Haddam Neck Nuclear Power Plant went into commercial operation in January 1968 producing 575 MWe of electricity with a pressurized water reactor. The plant is located in the Town of Haddam,

Middlesex County, Connecticut. The plant is situated on the east bank of the Connecticut river about 21 miles south-southeast of Hartford, Connecticut, and approximately 19.5 river miles north of Saybrook Breakwater Light.

The site area is approximately 525 acres located immediately upstream from the confluence of the Salmon and Connecticut Rivers. The general plant area was filled and graded from an initial elevation of about 12 ft to a final plant grade elevation of 21 ft. At the back, or east side, of the plant, wooded slopes rise steeply above the perpendicular rock cut.

The plant draws once through cooling water from the Connecticut River through an intake structure situated at the edge of the river and discharges into a canal that returns the water to the river about 5,500 ft downstream from the intake.

The plant has a dewatering system that consists of "popcorn" concrete, sumps, and sump pumps.

Hydrosphere - The potential sources of flooding at the Haddam Neck site are runoff from precipitation events, such as local site area runoff, and runoff from the Connecticut River Basin in the Connecticut River

that flows past the southwest side of the plant site. The river watershed, extends from the Canada-New Hampshire border to Long Island Sound. The river's source is 375 miles upstream, and the area drained upstream of the plant is approximately 10,900 square miles. The total Connecticut River drainage basin area is approximately 11,250 square miles. Many dams have been constructed on the Connecticut River and its tributaries upstream from the plant site. The Quabbin Reservoir, located on a tributary to the Connecticut River and about 90 miles upstream from the site, is the largest reservoir in the Connecticut River Basin with 1,235,000 acre-feet of storage.

Hurricane surges, seiches, and tsunamis are not controlling at this site. Further detail about the potential flooding sources is given in appended TER.

Design Bases - The design basis (protection requirements) as originally used prior to January 1968, to design the plant and those that would be required under current NRC criteria are summarized in Table 1.

Table 1. Summary of Design Bases (Protection Requirements) for the Haddam Neck Nuclear Power Plant

Event	Original Bases 1968 Criteria	Original Bases 1968 Value	NRC Current Bases 1982 Criteria	NRC Current Bases 1982 Value
1. Flooding				
Roof	unknown	40 psf 7.7 inches ponded water	PMP[1/]	31.46 in/24 hr
Local Plant	unknown	unknown	PMP RO[2/]	21.88 ft msl
Connecticut River (without dam failure)	1.5 ft above highest recorded stage	21.0	PMF[3/]	39.5 ft msl[4/]
2. Groundwater Short Duration (maximum level)	unknown	unknown	PMF	39.5 ft msl[5/]
Normal high level[6/]	unknown	unknown	Gd level	21.0 ft msl
3. Low water Connecticut River	unknown	-2.0 ft msl	PMME[7/]	-5 ft msl

[1/] Probable maximum precipitation

[2/] PMP routed to surface runoff

[3/] Probable maximum flood

[4/] Potential failure of upstream dams not included.

[5/] For purposes of hydrostatic pressures and uplift forces the total submergence before flooding of the structure is used.

[6/] For dynamic analysis.

[7/] Probable maximum meteorological event.

Flooding Potential and Protection Requirements (Topic II-3.B)

This topic identifies all potential external flooding sources and levels that could endanger the plant structures. Flood levels (elevations or depths) are determined using current NRC criteria.

Flood History - The historical flood of record occurred in March 1936 and had a flood elevation of about 19.5 ft msl at the site. Since 1936, a number of reservoirs have been constructed in the river basin and are used to some extent for flood control. Offsetting this increase in flood control storage has been a reduction in channel storage due to urbanization, highway construction, and the construction of flood protection dikes on the flood plain.

In the fourteen years since the plant began operation, no floods have exceeded the levels of the 1936 flood at the plant site.

Roof Flooding - The Licensee has shown, and the consultant's review confirms, that the diesel generator building, the PAB, the containment, the control room, and the auxiliary bay are not subject to roof ponding which would exceed the design basis live loading from the probable maximum precipitation (PMP). The consultant's review of information provided by the Licensee has shown that the design basis live loading for the screenwell and turbine building roofs can be exceeded but only by a maximum of 1.6 psf, or 4% due to height of parapets. This is a small deviation from current NRC standards. but is within the computational limits of staff's criteria.

For any event greater than the 100-year precipitation the service building roof design live loading could be exceeded by a factor of more than 2. This loading greatly exceeds the loading acceptable by current NRC standards.

In the conclusions on roof loading, our consultant has suggested that inservice inspection under Regulatory Guide 1.127 may be an acceptable method to insure full capacity of roof drains. The NRC staff does not agree with this suggestion. The inspection frequency necessary to insure drain capacity will preclude this as a feasible solution.

Local Flooding - The flood level resulting from the local PMP was analyzed by our consultant who concluded that the maximum level would be below elevation 21.5 ft msl at the site.

The Licensee states that the lowest door elevation for the turbine, primary auxiliary, and screenwell buildings is 21.5 ft msl, and for the diesel generator building protection is provided to 21.7 ft msl.

We concur with our consultant's conclusion that the local PMP will not flood safety-related equipment or structures.

Connecticut River Flooding - The elevation of the Probable Maximum Flood (PMF) on the Connecticut River was estimated to be 39.5 ft msl at the site. The Standard Project Flood (SPF) was estimated to have an elevation of 23.2 ft msl. The potential for overtopping and failing upstream dams was not included in the PMF and SPF analysis due to lack of necessary information. Additionally, information was not provided on the flooding effects of non-hydrologic failures of upstream dams. Current criteria would require protection to at least 39.5 ft msl with the possibility of dam failure raising this level. Further, the effects of wave run up would need to be considered.

The intake structure, primary auxiliary building, reactor containment, and fuel oil tank can at most be protected to elevation 30.0 ft msl, because of limiting heights of those sections of their walls that might withstand the hydrodynamic loads associated with floods. To further assess this proposed level of protection, the hydrodynamic loadings and their consequences on the walls of these structures need to be evaluated in SEP Topic III-3.A, Effects of High Water Level on Structures.

Table 2 provides a summary of information on flood discharges and elevations at the site. The Licensee's proposed protection level of 30 ft msl is 6.8 ft above the SPF Level but 9.5 ft below that of the PMF level. Current criteria would require protection to the PMF level.

Groundwater - Since the site can be inundated during severe floods, the maximum level for evaluating hydrostatic and bouyancy effects is controlled by the PMF and thus would be 39.5 ft msl. The normal h groundwater elevation for use in combination with appropriate seismic conditions should be plant grade (21.0 ft msl), since the Licensee has provided no conclusive information which would enable any other conclusion. No credit is given for control of groundwater levels by the underdrain system. See Topic III-3.B for the evaluation of the underdrain system.

Table 2. Range of flood levels and associated description and discharge for the Connecticut River at the Haddam Neck Nuclear Power Plant

Flood Level (ft msl)	Description	Discharge (cfs)
10.0	10 yr	120,900
13.2	50 yr	166,600
15.1	100 yr	186.700
17.6	500 yr	230,800
21.0	Plant Grade	323,200
23.2	SPF	383,000 (51% PMF)
30.0	Proposed Protection[1/]	510,000 (68% PMF)
39.5	PMF[2/]	752,000

[1/] Protection by emergency procedures

[2/] Without dam failures

Capability of Operating Plants to Cope with Design Basis Flood Conditions (Topic II-3.B.1)

Protection against floods can be accomplished by implementing emergency procedures and technical specifications. This topic focuses on the adequacy of the emergency procedures to provide for safe shutdown and cooldown of the reactor during and after flooding on the Connecticut River.

The Licensee's proposed emergency flood procedure would not provide protection to the current NRC licensing flood level (PMF - elevation 39.5 ft msl). The procedure, if upgraded, can provide protection to at most 30 ft msl. Section 3.3.3 of the appended TER discusses technical problems with this procedure that must be corrected before we can conclude that it will provide flood protection to elevation 30 ft msl.

Technical specifications which require a flood alert and initiation of the emergency flood protection procedure are recommended for occurrences of flood water above 15 ft msl (100-year flood elevation).

Safety-Related Water Supply (UHS) (Topic II-3.C)

This topic reviews the acceptability (supply and temperature) of water source(s) with respect to providing safety-related water during emergency shutdown and maintenance of safe shutdown. Additionally, the ability to supply this water during severe floods is discussed in Topic II-3.B.

The Ultimate Heat Sink (UHS) for Haddam Neck Nuclear Power Plant is the Connecticut River, from which water is drawn by an intake structure at the river's edge and returned by a discharge canal.

In the appended TER, our consultant has evaluated the vulnerability of the UHS complex to 1) single failure of man made structural features, 2) missiles, 3) sedimentation, 4) low water, and 5) combination of events. Some of the topic evaluation in the TER is outside the scope of the hydrologic review and needs to be complemented by SEP evaluation. As noted in the TER, the licensee has not addressed some necessary technical specification issues. Refer to Section 3.3.4.1 of the attached TER for the complete evaluation.

A significant concern with respect to low water is that water supply from the UHS can be lost during two possible situations:

- A maximum storm induced setdown in Long Island Sound that will decrease the river level below that required for the safety related pumps.

- Low river flows in conjunction with low tide could also decrease the level below that required for safety related pumps.

Our consultant extrapolated a probable maximum set down in Long Island Sound of -6.3 ft msl up the Connecticut River to the plant site and obtained a set down there of approximately -5 ft msl. They also evaluated historical data and estimated that the river level dropped below the stated design low water level for pump submergency on at least 11 occasions in the past 13 years. The Licensee states, however, that no adverse impacts on plant operation have been experienced due to low water during the period of operation.

Since the Haddam Neck UHS does not fully comply with several criteria of Regulatory Guide 1.27 as described in the TER, it cannot be concluded that the UHS is capable of providing sufficient cooling for safe shutdown and cooldown of the reactor that it serves and of maintaining it in a safe shutdown condition for 30 days.

Regulatory Guide 1.27 also requires that the plant technical specifications include provisions for actions to be taken in the event that conditions threaten partial loss of the UHS. Examples of such a condition might be the prediction of a severe hurricane off-shore which may cause a setdown to occur, or a low river discharge in combination with predicted neap tide, both jeopardizing access to the UHS.

In each of these situations, technical specifications requiring the plant to be placed in a safe shutdown condition or implementation of procedures to mitigate the consequences of a threatened partial loss of the UHS

are needed. The Licensee has not addressed this criterion and does not have technical specifications which include provisions for actions to be taken in the event that the plant requires protection from low water during severe hurricane conditions.

Cur contractor has also suggested some long term modifications that would correct the low water problem.

Structural and Other Consequences of Failure of Underdrain Systems (Topic III-3.B)

The dewatering system at the Haddam Neck site consists of a collector system, drain system, and a discharge system that was originally used to dewater the site during construction.

The collector system is a 6-inch layer of "popcorn' concrete, which drains into a cistern south of the containment building. Water is removed from the cistern by two sump pumps, running alternately, discharging into an open drainage ditch which runs east/west toward the service building. This discharge water empties into a site drain which drains to the discharge canal further south.

The final discharge system (originally not considered safety-grade) was designed to maintain the groundwater level below the mat, minimizing uplift pressures. Consideration for pump failure was made by designing the containment for groundwater levels of 12 ft msl under normal conditions.

The system would not be able to dewater the site during floods above plant grade. Not enough information has been supplied by the Licensee to enable the staff to give credit to the system for lowering groundwater in other circumstances. Therefore, an evaluation under SEP Topic III-3.A using a groundwater elevation (21 ft msl) in combination with the appropriate seismic load is recommended.

VI. CONCLUSIONS

The following conclusions identify those site features, protection structures, or procedures which meet or do not meet present licensing criteria. Those issues which are unresolved or will be resolved in interface topics are identified.

Hydrologic Description (Topic II-3.A)

For the purpose of this review, the hydrologic environment has been adequately described. There are no outstanding issues within this topic.

Flooding Potential and Protection Requirements (Topic II-3.B)

Roofs - Based on the information provided by the Licensee, the design live load for the service building roof will be exceeded by rainfalls less than the PMP. Roofs of all other buildings are sufficient to support rainfall resulting from the PMP event since in all cases the loading would be less than or very near to the design basis live load.

Local Flooding - The Haddam Neck site is protected from local flooding resulting from a PMP event.

Connecticut River Flooding - The original Haddam Neck site design basis flood was 19.5 ft msl and plant grade was made 1.5 ft above this level (21.0 ft msl) with floor levels set at 21.5 ft msl. The probable maximum flood (PMF) on the Connecticut River is estimated to have flood elevation of 39.5 ft msl at the site and a standard project flood (SPF) is estimated to have an elevation of approximately 23.2 ft msl. Failure of upstream dams either during a PMF or as a separate flood producing event has not been addressed by the Licensee.

Hydrodynamic loads, and protection against them, have not been determined for water elevations above the original design basis. SEP Topic III-3.A, Effects of High Water Level on Structures, should address combinations of hydrodynamic and hydrostatic loads.

However protection to 39.5 ft msl is not practical and thus the Licensee has proposed protection to 30 ft msl which is the highest protection possible if building walls are able to structurally withstand the flood waters. This level is 6.8 ft greater than the SPF but 9.5 ft less than the PMF. Protection to only 30 ft msl would not meet current NRC criteria.

Groundwater - The maximum groundwater elevation for hydrostatic load will be the PMF level (39.5 ft. msl). The normal high groundwater elevation for use in combination with appropriate seismic conditions is plant grade. No credit is given for control of groundwater levels by the underdrain system.

Capability of Operating Plants to Cope with Design Basis Flood Conditions (Topic II-3.B.1)

Emergency Procedures - The licensee has proposed to upgrade the emergency procedures to provide flood protection to 30 feet msl. Current NRC licensing criteria would require that the emergency flood procedures provide protection to 39.5 feet msl. Further, Section 3.3.3 of the TER identifies other areas where this procedure is deficient with specific recommendations to the procedure in Section 4.3.

Technical Specifications - Technical Specifications which require a flood alert and initiate an emergency flood protection procedure are recommended for occurrences of flood water above 15 feet msl (100-year flood elevation).

Safety-Related Water Supply (SEP Topic II-3.C)

The Haddam Neck ultimate heat sink complex could not function during two postulated low water events in the Connecticut River. Full compliance with Regulatory Guide 1.27 has not been demonstrated.

Technical specifications which limit operation of the plant when water level drops below a predetermined elevation (-1.5 ft msl) are recommended for the short term. Modifications and equipment changes are recommended for the long term.

Structural and Other Consequences of Failure of Underdrain Systems (SEP Topic III-3.B)

The mat sump system is not safety grade, and failure could enable groundwater to rise to plant grade (see SEP Topic II-3.B). An evaluation under SEP Topic III-3.A using new groundwater elevation at plant grade is recommended.

VII. REFERENCES

1. Standard Review Plans, NUREG 0800 (formerly NUREG 75/087), U.S. Nuclear Regulatory Commission, Office of Nuclear Reactor Regulation.

   a. 2.4.1 - Hydrologic Description

   b. 2.4.2 - Floods

   c. 2.4.3 - Probable Maximum Flood (PMF) on Streams and Rivers

   d. 2.4.4 - Potential Dam Failures

   e. 2.4.7 - Ice Effects

   f. 2.4.8 - Cooling Water Canals and Reservoirs

   g. 2.4.10 - Flooding Protection Requirements

   h. 2.4.11 - Low Water Considerations

   i. 2.4.12 - Ground water

   j. 2.4.14 - Technical Specifications and Emergency Operation Requirements

   k. 2.4.1 - Flood Protection

   l. 9.2.5 - Ultimate Heat Sink

2. Regulatory Guides, U.S. Nuclear Regulatory Commission, Office of Standards Development.

   a. 1.102 - Flood Protection for Nuclear Power Plants

   b. 1.127 - Inspection of Water Control Structures Associated with Nuclear Power Plants

   c. 1.135 - Normal Water Level and Discharge of Nuclear Power Plants

   d. 1.27 - Ultimate Heat Sink for Nuclear Power Plants

e. 1.59 - Design Basis Floods for Nuclear Power Plants

f. 1.70 - Standard Format and Content of Safety Analysis Reports for Nuclear Power Plants, NUREG-75/094.

3. American National Standard N170-1976, "Standards for Determining Design Basis Flooding at Power Reactor Sites," Published by the American Nuclear Society (ANS-2.8).

4. W. G. Counsil (CYAPCO), Letter to D. M. Crutchfield (NRC) Subject: SEP Topic II-3.A, December 14, 1981.

5. W. G. Counsil (CYAPCO), Letter to D. M. Crutchfield (NRC) Subject: SEP Topic II-3.B, December 14, 1981.

6. W. G. Counsil (CYAPCO), Letter to D. M. Crutchfield (NRC), Subject: SEP Topic II-3.C, December 14, 1981.

7. W. G. Counsil (CYAPCO), Letter to D. M. Crutchfield (NRC) Subject: SEP Topic II-3.B, February 19, 1982.

8. W. G. Counsil (CYAPCO), Letter to D. M. Crutchfield (NRC) Subject: SEP Topic II-3.B, April 1, 1982

9. W. G. Counsil (CYAPCO), Letter to D. M. Crutchfield (NRC) Subject: SEP Topics II-3.A and II-3.C, March 22, 1982.

10. W. G. Counsil (CYAPCO), Letter to D. M. Crutchfield (NRC)
Subject: SEP Topic III-3.B, April 7, 1982.

11. W. G. Counsil (CYAPCO), Letter to D. M. Crutchfield (NRC)
SEP Topic III-3.A, August 31, 1981.

12. W. G. Counsil (CYAPCO), Letter to D. M. Crutchfield (NRC)
SEP Topic III-3.A, Addcnsum, November 23, 1981.