Docket No.: 50-354

JUL 30 1984

APPLICANT: Public Service Electric & Gas Company (PSE&G)

FACILITY: Hope Creek Generating Station

SUBJECT: SUMMARY OF JUNE 28, 1984 HYDROLOGY MEETING

On June 28, 1984, a meeting was held in the Bethesda, Maryland offices of the NRC to discuss hydrology open items addressed in the Draft SER. A list of attendees is included as Enclosure 1 to this meeting summary.

The items discussed in the meeting are identified in Enclosure 2. The items designated by number (PSE&G open item numbers) are directly from the Draft SER. Those designated by letter are additional topics that the staff wished to discuss. Many of the lettered items correspond to and elaborate on numbered items.

The status of each item is listed in Enclosure 3. All applicant actions identified in Enclosure 3 are to take place by July 31, 1984.

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Division of Licensing

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UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

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Enclosure 1

HYDROLOGY MEETING

JUNE 26, 1984

ATTENDEES

Dave Wagner	NRC
Myron Fliegel	NRC
Robert Jachowski	NRC
R. E. McGough	Bechtel
John Cassidy	Bechtel
Phillip Schuetz	Bechtel
Dave Distel	PSE&G
Ron Drewnowski	PSE&G
Michael Reeser	PSE&G
James Dette	Dames & Moore
David Shen	Dames & Moore
Ralph Campanella	PSE&G

Hope Creek Hydrology Open Items

PSE&G open item 4 (DSER Section 2.4.2.2)

ponding levels on roofs of safety-related structures as a result of the effects of local intense precipitation

PSE&G open item 5 (DSER Section 2.4.5)

a) additional information needed on waves that impact river face of the Service Water Intake Structure

b) design of watertight exterior doors for wave loads

c) floating missle loads

d) flood protection of intake structure to EL. 122'

PSE&G open item 6 (DSER Section 2.4.10)

a) design of watertight doors for wave loads (see item 5b above)

b) structural stability of steel sheet pile caisson and quarrystone revetments

c) detailed information needed on ponding levels (see item 4 above)

PSE&G open item 7 (DSER Section 2.4.11.2)

a) maximum allowable temperature of ultimate heat sink

b) flood protection of intake structure (see item 5d above)

In additon to the above open items, by telecopy of June 25, 1984, PSE&G was informed of the following to be discussed at the June 28 meeting:

A. The PSE&G response to questions 240.6 and 240.7 neglected to provide the details requested regarding the maximum ponding level elevations on roofs of safety-related structures. Discuss the ponding levels as a result of local intense precipitation up to and including Probable Maximum Precipitation as discussed in FSAR references 2.4-20 and 2.4-20a (for 1 square mile PMP). Response should provide sufficient details to verify by an independent analysis that ponding levels do not exceed design roof loading or result in leakage through roof ventilators or hatch seals.

   Details should identify each safety-related building, elevation of each roof level, area of each roof, area of roof that drains to lower roofs, size, number and invert elevation of scuppers for each roof area, length and elevation of parapet walls, and elevation of each hatch opening and ventilator.

B. Clarify FSAR Sections 2.4.1.1 and 3.4.1 (Amendment 5) as they present confusing flood protection levels. For example, Section 2.4.1.1 states "All seismic Category 1 structures are flood-proofed . . . at least to the maximum wave runup elevation of 30.0 feet msl.", whereas Section 3.4.1.1 states "Doors and penetrations in exterior walls of the auxiliary and reactor building are protected against water inflow up to . . . elevation 121 ft (32 ft msl) of other exterior walls" also "water does not enter any safety-related structure, since the structures are watertight up to elevation 121 feet or 127 feet." (32 ft or 38 ft msl).

C. Discuss the consequences of wave runup and overtopping during the PMH on the service water intake structure including the possibility of ingestion of wave overtopping through the air vents. It is noted that the air intake ventilators are at flood protection El 128.5 ft (39.5 ft msl) (FSAR Section 3.4.1.1). The flood protection level is well below the limit of wave runup El 124.4 ft (45.4 ft msl) (FSAR Table 2.4.10a).

D. Provide documentation that all safety-related watertight doors and hatches below the flood protection level are designed to withstand the combined loading effects of both the static water level and the dynamic wave impact associated with hydrologic events up to and including the PMH.

E. Provide documentation to verify that both the steel sheet pile caissons and the quarrystone revetment adjacent to the intake structure are designed for hydrologic events up to and including the design basis PMH flood.

F. A maximum monthly surface water temperature of 30.5°C (86.9°F) has been reported for August 1980 adjacent to the plant for the period 1977 through 1982. Identify the maximum service water intake temperature that will allow the plant to safely shut down under both normal and emergency conditions and discuss the ability of the ultimate heat sink (Delaware River) to supply water below this temperature.

PSE&G Open Item 4

The applicant supplied a response to this open item at the meeting. It is included as Enclosure 4 to this meeting summary. The response is under staff review.

PSE&G Open Item 5

a) The applicant will attempt to supply the staff with detailed calculations of wave overtopping of the intake structure. Additionally, the applicant will address 1) the effect of spray ingestion into the intake structure electrical equipment vent system and, 2) the water tightness of the hatch seals.

b) The applicant is to provide details of wave impact analysis performed for Hope Creek. Additionally, information on wave loading effects on Radwaste Building hatch (north side of building) is to be provided.

c) Response on floating vessels is to be presented to the NRC staff as an Auxiliary Systems Branch open item.

d) See item 5a above.

PSE&G Open Item 6

a) See item 5b above.

b) Information regarding the caissons was discussed at the SGEB audit (1/11/84) meeting, item A.5). Since there are no revetments, PSE&G will remove all references to same. A response to this item was provided at this meeting (see Enclosure 5).

c) see item 4 above.

PSE&G Open Item 7

a) Response to this concern was delayed pending further information from the staff.

b) See item 5a above.

Item A

See item 4 above.

Item B

The applicant indicated that flood proofing has been provided for each building up to the necessary elevation. This will be indicated in the FSAR. PSE&G will clarify FSAR Section 2.4.1.1 and provide a cross-reference to FSAR Section 3.4.

Item C

See item 5a above.

Item D

See item 5b above.

Item E

See item 6b above.

Item F

See item 7a above.

QUESTION 240.13 (Section 2.4.2.3)

Provide your detailed analysis of the PMP ponding levels on roofs of safety-related structures requested in Q240.7. Details should identify and provide information on the roof area of each sub-drainage area for each safety-related structure; the size, number and distance above roof (elevation) of the invert of each scupper (overflow drain) for each drainage system, and the elevation of the curb of each roof hatch within each roof drainage area system. Also provide details used to conclude that the ponding resulting from PMP does not effect safety-related facilities.

RESPONSE

Section 3.4.1.1 has been revised to respond to this question.

b. Waterstops provided in exterior wall construction joints and seismic separation joints below flood level

c. A minimum number of openings in exterior walls and slabs below flood level (these openings are designed to prevent intrusion of flood water.)

d. Water-pressure-tight doors installed in exterior walls below flood level

e. Exposed equipment hatches installed above flood level; those below flood level installed behind exterior walls designed to prevent intrusion of water

f. Continuous waterproofing systems applied to the underside of base slabs and on exterior walls to grade, as discussed below.

Except for the intake structure, the HCGS safety-related structures are provided with roof drainage systems capable of handling a maximum rainfall rate of 4 inches per hour for a period of 20 minutes. In the unlikely event that the roof drains become clogged, redundant overflow drains are provided approximately 6 inches above the main roof drain elevations except for the plant cancelled area, which has no parapets. The roof drainage system disposes water through the yard drainage system. To preclude ponding for significantly greater rainfall intensities segments of the parapets are removed where necessary.

WITH "INSERT A"

The intake structure roof is designed without parapets or other continuous obstructions and is sloped to shed the water. Accordingly, no significant ponding will occur.

To prevent seepage into any Seismic Category I structure all roof openings are watertight and provided with either metal sleeves or concrete curbs of sufficient height to exceed any possible ponding levels.

As an additional margin of safety, all Seismic Category I roofs are designed to withstand a loading of 150 lb/ft², which is greater than the loading resulting from the maximum ponding on the roofs.

Doors and penetrations in exterior walls of the auxiliary and reactor buildings are protected against water inflow up to elevation 127 feet for parts of the south exterior walls and up to elevation 121 feet of other exterior walls. Interior drains from the radwaste areas are independently piped to the liquid waste disposal system and are not connected to the yard drainage system. Wall penetrations above elevations 121 feet and 127 feet

INSERT A

The roof drainage system consists of roof drains and 6-inch diameter scuppers located 6 inches above the roof drain elevations. Supplementing the roof drain system is a series of openings in the parapets of the roofs of the buildings. The 6-hour, local, all-season PMP was used to size these openings. The PMP, which is 27.5 inches, is distributed into 5-minute increments such that the maximum amounts for durations of 1 hour, 30 minutes, 15 minutes and 5 minutes are 18.1, 13.7, 9.5 and 6 inches respectively. Roof elevations, sub-drainage areas, and the dimension of parapet openings are shown in Table 3.4-3. A schematic of the roof drainage is shown on Figure 3.4-4.

The routing of the PMP assumes no losses, the roof drain system to be non-functional, and the ponding is allowed up to the limiting elevation of the top of the curb of each roof hatch within each roof drainage area system. Prior to the PMP, an initial level of ponding at the invert elevation of the parapet openings is assumed (invert elevation is 6 inches above the roof drain elevation).

(A) →

[redacted] rating curve for each rectangular parapet opening was derived using the equation:

$$Q = CLH^{1.5}$$

where:

Q is the discharge in cubic feet per second

C is the discharge coefficient (3.0)

L is the length in feet of the parapet opening

H is the head in feet of water above the invert of the parapet opening

(B) →

The flow capacity of the 8-inch diameter openings is derived using the following short culvert equations:

Inlet control flow for unsubmerged inlets:

$$\frac{H}{D} = \frac{H_c}{D} + k\left(1.273\,\frac{Q}{D^{5/2}}\right)^m$$

Inlet control flow for submerged inlets:

$$\frac{H}{D} = \frac{h_1}{D} + k_1\left(\frac{Q}{D^{5/2}}\right)^2$$

where:

H is the total head above the invert of the opening in feet

H_c is the specific energy

Q is the discharge in cubic feet per second

D is the opening diameter in feet

k, m, $\frac{h_1}{D}$ and k_1 are the inlet control performance coefficients. The experimentally determined values for a square edged entrance are:

$k = 0.0098$

$m = 2.0$

$\frac{h_1}{D} = 0.67$

$k_1 = 0.0645$

Since the limiting water depths are greater than the ponding levels resulting from the PMP (as shown in Table 3.4-3), the ponding levels do not effect safety-related facilities.

TABLE 3.4-3

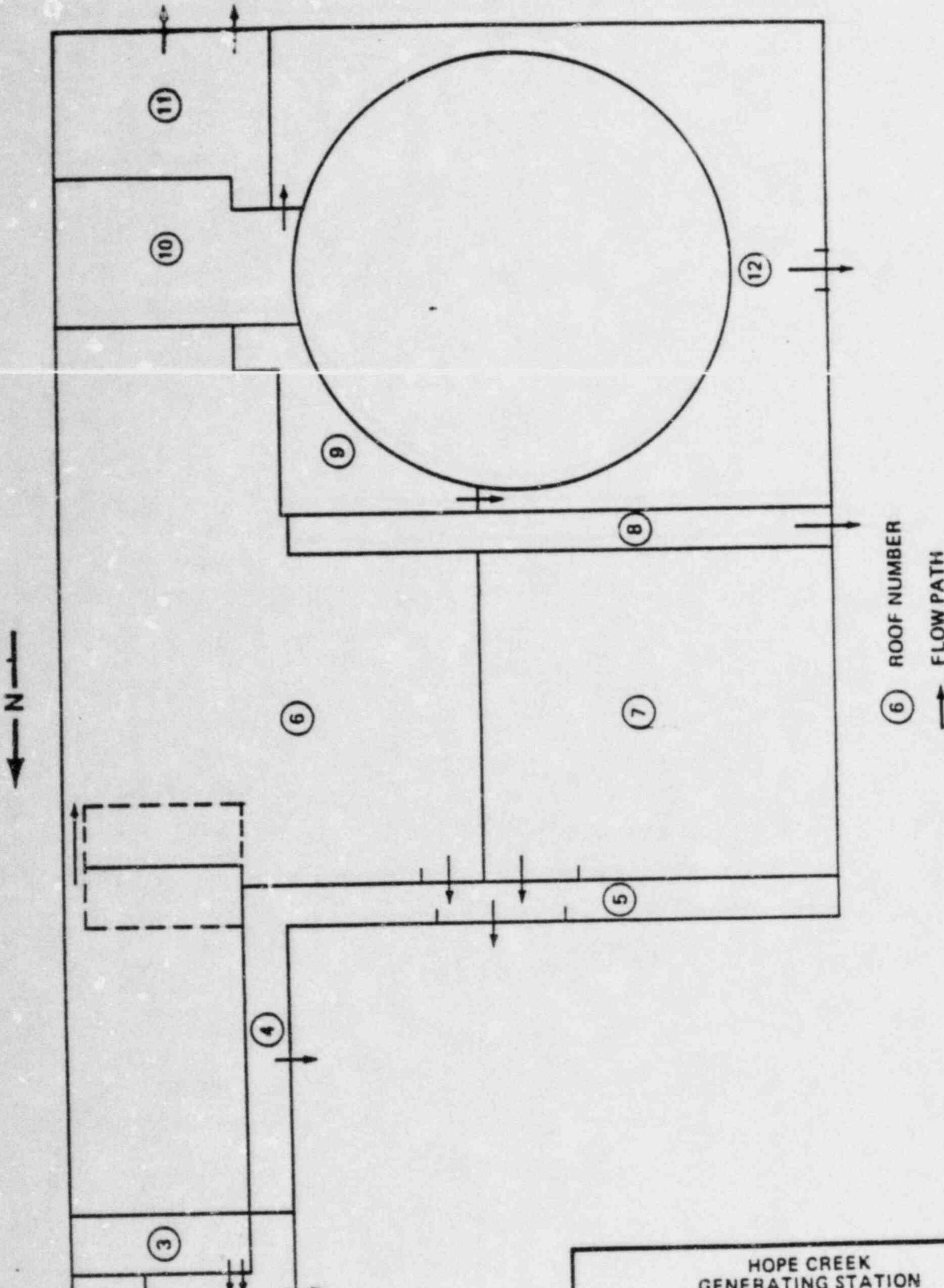
Maximum Ponding Depths on Roofs of Safety-Related Structures for Local 6 Hour PMP

Roof No. (2)	Min. Roof Elevation (ft)	Sub-Drainage Area (ft^2)	Number of 8-inch Diameter Openings	Width of 8-inch High Slot (ft)	Width of Parapet Opening (ft)	Limiting Water Depth Over Roof Drain Elevation (in.)	Max. Water Depth Over Roof Drain Elevation (in.)
1	159	2720	-	2.5	-	12.0	11.5
2	137	2570	2	-	-	28.8	18.0
3	172	1530	2	-	-	15.0	13.6
4	153	1930	1	-	-	28.8	16.1
5	155.25	3700	-	-	50	12.0	11.9
6	172	38850	-	-	25	13.0	12.6
7	198	18420	-	-	35	10.0	9.8
8	155.25	3490	-	3.0	-	12.0	11.7
9	158.33	7380	-	2.5	-	19.0	18.1
10	172	5220	1	0.83	-	18.0	15.8
11	124	5030	2	-	-	18.0	17.5
12	132	33500	-	-	14	18.0	17.6

Notes:

1. The invert elevation of openings and the crest elevation of slots and parapet openings are 6 inches above the roof drain elevation.

2. See Figure 3.4-4.



HOPE CREEK
GENERATING STATION
FINAL SAFETY ANALYSIS REPORT

ROOF DRAINAGE UNDER
PMP CONDITIONS

FIGURE 3.4-4

(A)

Rectangular parapet openings were analyzed as a broad-crested weir for upstream water-surface elevations below the top of the opening. For unsubmerged conditions the

(B) For conditions when the upstream water-surface elevation was higher than the top of the opening, the orifice equation was used:

$$Q = C A \sqrt{2gH}$$

where:

- Q is the discharge in cubic feet per second
- C is the discharge coefficient (taken as 0.6)
- A is the area of the opening in square feet
- H is the head measured from the centerline of the opening in feet
- g is the acceleration of gravity (32.2 feet/second^2)

HCGS

DSER Open Item No. 6b (DSER Section 2.4.10)

STABILITY OF COFFERDAMS

The applicant has also been requested to provide documentation to verify the structural stability of both the steel sheet pile caissons and the quarrystone revetment for hydrologic events up to and including the design basis PMH flood.

Response:

An evaluation has been made of the cellular cofferdams adjacent to the Service Water Intake Structure for hydrologic events up to and including the design basis PMH flood. The resulting combined static and dynamic loading is less than that imposed by postulated seismic events. Accordingly, the loadings due to hydrologic events do not control the design of the cofferdams.

As described in response to NRC Structural Audit Item A.5 from the January 11, 1984 meeting, shore protection is provided by cellular cofferdams without the addition of quarrystone revetment.