PSE&G Public Service Electric and Gas Company

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Robert L. Mittl General Manager
Nuclear Assurance and Regulation

October 15, 1984

Director of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
7920 Norfolk Avenue
Bethesda, MD 20814

Attention: Mr. Albert Schwencer, Chief
Licensing Branch 2
Division of Licensing

Gentlemen:

HOPE CREEK GENERATING STATION
DOCKET NO. 50-354
DRAFT SAFETY EVALUATION REPORT
OPEN ITEM STATUS

Attachment 1 is a current list which provides a status of the open items identified in Section 1.7 of the Draft Safety Evaluation Report (SER). Items identified as "complete" are those for which PSE&G has provided responses and no confirmation of status has been received from the staff. We will consider these items closed unless notified otherwise. In order to permit timely resolution of items identified as "complete" which may not be resolved to the staff's satisfaction, please provide a specific description of the issue which remains to be resolved.

Attachment 2 is a current list which identifies Draft SER Sections not yet provided.

Enclosed for your review and approval (see Attachment 4) are the resolutions to the Draft SER open items listed in Attachment 3.

A signed original of the required affidavit is provided to document the submittal of these items.

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1/1

Should you have any questions or require any additional information on these items, please contact us.

Very truly yours,

Attachments/Enclosure

C D. H. Wagner
USNRC Licensing Project Manager (w/attach.)

W. H. Bateman
USNRC Senior Resident Inspector (w/attach.)

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION
DOCKET NO. 50-354

PUBLIC SERVICE ELECTRIC AND GAS COMPANY

Public Service Electric and Gas Company hereby submits the enclosed responses to DSER open items and FSAR Questions for the Hope Creek Generating Station.

The matters set forth in this submittal are true to the best of my knowledge, information, and belief.

Respectfully submitted,

Public Service Electric
and Gas Company

By: Thomas J. Martin
Thomas J. Martin
Vice President -
Engineering and Construction

Sworn to and subscribed before me, a Notary Public of New Jersey, this 15th day of October 1984.

David K. Burd

DAVID K. BURD
NOTARY PUBLIC OF NEW JERSEY
My Comm. Expires 10-23-85

MC 28 02

DATE: 10/15/84

ATTACHMENT 1

OPEN ITEM	DSER SECTION NUMBER	SUBJECT	STATUS	R. L. MITTL TO A. SCHWENCER LETTER DATED
1	2.3.1	Design-basis temperatures for safety-related auxiliary systems	Complete	8/15/84
2a	2.3.3	Accuracies of meteorological measurements	Complete	8/15/84 (Rev. 1)
2b	2.3.3	Accuracies of meteorological measurements	Complete	8/15/84 (Rev. 1)
2c	2.3.3	Accuracies of meteorological measurements	Complete	8/15/84 (Rev. 2)
2d	2.3.3	Accuracies of meteorological measurements	Complete	8/15/84 (Rev. 2)
3a	2.3.3	Upgrading of onsite meteorological measurements program (III.A.2)	Complete	8/15/84 (Rev. 2)
3b	2.3.3	Upgrading of onsite meteorological measurements program (III.A.2)	Complete	8/15/84 (Rev. 2)
3c	2.3.3	Upgrading of onsite meteorological measurements program (III.A.2)	NRC Action	
4	2.4.2.2	Ponding levels	Complete	8/03/84
5a	2.4.5	Wave impact and runup on service water intake structure	Complete	10/15/84 (Rev. 4)
5b	2.4.5	Wave impact and runup on service water intake structure	Complete	10/15/84 (Rev. 4)
5c	2.4.5	Wave impact and runup on service water intake structure	Complete	7/27/84
5d	2.4.5	Wave impact and runup on service water intake structure	Complete	10/15/84 (Rev. 4)
6a	2.4.10	Stability of erosion protection structures	Complete	8/20/84
6b	2.4.10	Stability of erosion protection structures	Complete	8/20/84
6c	2.4.10	Stability of erosion protection structures	Complete	8/03/84

ATTACHMENT 1 (Cont'd)

OPEN ITEM	DSER SECTION NUMBER	SUBJECT	STATUS	R. L. MITTL TO A. SCHWENCER LETTER DATED
7a	2.4.11.2	Thermal aspects of ultimate heat sink	Complete	8/3/84
7b	2.4.11.2	Thermal aspects of ultimate heat sink	Complete	8/3/84
8	2.5.2.2	Choice of maximum earthquake for New England - Piedmont Tectonic Province	Complete	8/15/84
9	2.5.4	Soil damping values	Complete	6/1/84
10	2.5.4	Foundation level response spectra	Complete	6/1/84
11	2.5.4	Soil shear moduli variation	Complete	6/1/84
12	2.5.4	Combination of soil layer properties	Complete	6/1/84
13	2.5.4	Lab test shear moduli values	Complete	6/1/84
14	2.5.4	Liquefaction analysis of river bottom sands	Complete	6/1/84
15	2.5.4	Tabulations of shear moduli	Complete	6/1/84
16	2.5.4	Drying and wetting effect on Vincentown	Complete	6/1/84
17	2.5.4	Power block settlement monitoring	Complete	6/1/84
18	2.5.4	Maximum earth at rest pressure coefficient	Complete	6/1/84
19	2.5.4	Liquefaction analysis for service water piping	Complete	6/1/84
20	2.5.4	Explanation of observed power block settlement	Complete	6/1/84
21	2.5.4	Service water pipe settlement records	Complete	6/1/84
22	2.5.4	Cofferdam stability	Complete	6/1/84

ATTACHMENT 1 (Cont'd)

OPEN ITEM	DSER SECTION NUMBER	SUBJECT	STATUS	R. L. MITTL TO A. SCHWENCER LETTER DATED
23	2.5.4	Clarification of FSAR Tables 2.5.13 and 2.5.14	Complete	6/1/84
24	2.5.4	Soil depth models for intake structure	Complete	6/1/84
25	2.5.4	Intake structure soil modeling	Complete	8/10/84
26	2.5.4.4	Intake structure sliding stability	Complete	8/20/84
27	2.5.5	Slope stability	Complete	6/1/84
28a	3.4.1	Flood protection	Complete	8/30/84 (Rev. 1)
28b	3.4.1	Flood protection	Complete	8/30/84 (Rev. 1)
28c	3.4.1	Flood protection	Complete	8/30/84 (Rev. 1)
28d	3.4.1	Flood protection	Complete	8/30/84 (Rev. 1)
28e	3.4.1	Flood protection	Complete	8/30/84 (Rev. 1)
28f	3.4.1	Flood protection	Complete	7/27/84
28g	3.4.1	Flood protection	Complete	7/27/84
29	3.5.1.1	Internally generated missiles (outside containment)	Complete	8/3/84 (Rev. 1)
30	3.5.1.2	Internally generated missiles (inside containment)	Closed (5/30/84-Aux.Sys.Mtg.)	6/1/84
31	3.5.1.3	Turbine missiles	Complete	7/18/84
32	3.5.1.4	Missiles generated by natural phenomena	Complete	7/27/84
33	3.5.2	Structures, systems, and components to be protected from externally generated missiles	Complete	7/27/84

ATTACHMENT 1 (Cont'd)

OPEN ITEM	DSER SECTION NUMBER	SUBJECT	STATUS	R. L. MITTL TO A. SCHWENCER LETTER DATED
34	3.6.2	Unrestrained whipping pipe inside containment	Complete	7/18/84
35	3.6.2	ISI program for pipe welds in break exclusion zone	Complete	6/29/84
36	3.6.2	Postulated pipe ruptures	Complete	6/29/84
37	3.6.2	Feedwater isolation check valve operability	Complete	8/20/84
38	3.6.2	Design of pipe rupture restraints	Complete	8/20/84
39	3.7.2.3	SSI analysis results using finite element method and elastic half-space approach for containment structure	Complete	8/3/84
40	3.7.2.3	SSI analysis results using finite element method and elastic half-space approach for intake structure	Complete	8/3/84
41	3.8.2	Steel containment buckling analysis	Complete	6/1/84
42	3.8.2	Steel containment ultimate capacity analysis	Complete	8/20/84 (Rev. 1)
43	3.8.2	SRV/LOCA pool dynamic loads	Complete	6/1/84
44	3.8.3	ACI 349 deviations for internal structures	Complete	6/1/84
45	3.8.4	ACI 349 deviations for Category I structures	Complete	8/20/84 (Rev. 1)
46	3.8.5	ACI 349 deviations for foundations	Complete	8/20/84 (Rev. 1)
47	3.8.6	Base mat response spectra	Complete	8/10/84 (Rev. 1)
48	3.8.6	Rocking time histories	Complete	8/20/84 (Rev. 1)

ATTACHMENT 1 (Cont'd)

OPEN ITEM	DSER SECTION NUMBER	SUBJECT	STATUS	R. L. MITTL TO A. SCHWENCER LETTER DATED
49	3.8.6	Gross concrete section	Complete	8/20/84 (Rev. 1)
50	3.8.6	Vertical floor flexibility response spectra	Complete	8/20/84 (Rev. 1)
51	3.8.6	Comparison of Bechtel independent verification results with the design-basis results	Complete	8/20/84 (Rev. 2)
52	3.8.6	Ductility ratios due to pipe break	Complete	8/3/84
53	3.8.6	Design of seismic Category I tanks	Complete	8/20/84 (Rev. 1)
54	3.8.6	Combination of vertical responses	Complete	8/10/84 (Rev. 1)
55	3.8.6	Torsional stiffness calculation	Complete	6/1/84
56	3.8.6	Drywell stick model development	Complete	8/20/84 (Rev. 1)
57	3.8.6	Rotational time history inputs	Complete	6/1/84
58	3.8.6	"O" reference point for auxiliary building model	Complete	6/1/84
59	3.8.6	Overturning moment of reactor building foundation mat	Complete	8/20/84 (Rev. 1)
60	3.8.6	BSAP element size limitations	Complete	8/20/84 (Rev. 1)
61	3.8.6	Seismic modeling of drywell shield wall	Complete	6/1/84
62	3.8.6	Drywell shield wall boundary conditions	Complete	6/1/84
63	3.8.6	Reactor building dome boundary conditions	Complete	6/1/84

ATTACHMENT 1 (Cont'd)

OPEN ITEM	DSER SECTION NUMBER	SUBJECT	STATUS	R. L. MITTL TO A. SCHWENCER LETTER DATED
64	3.8.6	SSI analysis 12 Hz cutoff frequency	Complete	8/20/84 (Rev. 1)
65	3.8.6	Intake structure crane heavy load drop	Complete	6/1/84
66	3.8.6	Impedance analysis for the intake structure	Complete	8/10/84 (Rev. 1)
67	3.8.6	Critical loads calculation for reactor building dome	Complete	6/1/84
68	3.8.6	Reactor building foundation mat contact pressures	Complete	6/1/84
69	3.8.6	Factors of safety against sliding and overturning of drywell shield wall	Complete	6/1/84
70	3.8.6	Seismic shear force distribution in cylinder wall	Complete	6/1/84
71	3.8.6	Overturning of cylinder wall	Complete	6/1/84
72	3.8.6	Deep beam design of fuel pool walls	Complete	6/1/84
73	3.8.6	ASHSD dome model load inputs	Complete	6/1/84
74	3.8.6	Tornado depressurization	Complete	6/1/84
75	3.8.6	Auxiliary building abnormal pressure	Complete	6/1/84
76	3.8.6	Tangential shear stresses in drywell shield wall and the cylinder wall	Complete	6/1/84
77	3.8.6	Factor of safety against overturning of intake structure	Complete	8/20/84 (Rev. 1)
78	3.8.6	Dead load calculations	Complete	6/1/84
79	3.8.6	Post-modification seismic loads for the torus	Complete	8/20/84 (Rev. 1)

ATTACHMENT 1 (Cont'd)

OPEN ITEM	DSER SECTION NUMBER	SUBJECT	STATUS	R. L. MITTL TO A. SCHWENCER LETTER DATED
80	3.8.6	Torus fluid-structure interactions	Complete	6/1/84
81	3.8.6	Seismic displacement of torus	Complete	8/20/84 (Rev. 1)
82	3.8.6	Review of seismic Category I tank design	Complete	8/20/84 (Rev. 1)
83	3.8.6	Factors of safety for drywell buckling evaluation	Complete	6/1/84
84	3.8.6	Ultimate capacity of containment (materials)	Complete	8/20/84 (Rev. 1)
85	3.8.6	Load combination consistency	Complete	6/1/84
86	3.9.1	Computer code validation	Complete	8/20/84
87	3.9.1	Information on transients	Complete	8/20/84
88	3.9.1	Stress analysis and elastic-plastic analysis	Complete	6/29/84
89	3.9.2.1	Vibration levels for NSSS piping systems	Complete	6/29/84
90	3.9.2.1	Vibration monitoring program during testing	Complete	7/18/84
91	3.9.2.2	Piping supports and anchors	Complete	6/29/84
92	3.9.2.2	Triple flued-head containment penetrations	Complete	6/15/84
93	3.9.3.1	Load combinations and allowable stress limits	Complete	6/29/84
94	3.9.3.2	Design of SRVs and SRV discharge piping	Complete	6/29/84

ATTACHMENT 1 (Cont'd)

OPEN ITEM	DSER SECTION NUMBER	SUBJECT	STATUS	R. L. MITTL TO A. SCHWENCER LETTER DATED
95	3.9.3.2	Fatigue evaluation on SRV piping and LOCA downcomers	Complete	6/15/84
96	3.9.3.3	IE Information Notice 83-80	Complete	8/20/84 (Rev. 1)
97	3.9.3.3	Buckling criteria used for component supports	Complete	6/29/84
98	3.9.3.3	Design of bolts	Complete	6/15/84
99a	3.9.5	Stress categories and limits for core support structures	Complete	6/15/84
99b	3.9.5	Stress categories and limits for core support structures	Complete	6/15/84
100a	3.9.6	10CFR50.55a paragraph (g)	Complete	6/29/84
100b	3.9.6	10CFR50.55a paragraph (g)	Complete	9/12/84 (Rev. 1)
101	3.9.6	PSI and ISI programs for pumps and valves	Complete	9/12/84 (Rev. 1)
102	3.9.6	Leak testing of pressure isolation valves	Complete	9/12/84 (Rev. 1)
103a1	3.10	Seismic and dynamic qualification of mechanical and electrical equipment	Complete	8/20/84
103a2	3.10	Seismic and dynamic qualification of mechanical and electrical equipment	Complete	8/20/84
103a3	3.10	Seismic and dynamic qualification of mechanical and electrical equipment	Complete	8/20/84
103a4	3.10	Seismic and dynamic qualification of mechanical and electrical equipment	Complete	8/20/84

ATTACHMENT 1 (Cont'd)

OPEN ITEM	DSER SECTION NUMBER	SUBJECT	STATUS	R. L. MITTL TO A. SCHWENCER LETTER DATED
103a5	3.10	Seismic and dynamic qualification of mechanical and electrical equipment	Complete	8/20/84
103a6	3.10	Seismic and dynamic qualification of mechanical and electrical equipment	Complete	8/20/84
103a7	3.10	Seismic and dynamic qualification of mechanical and electrical equipment	Complete	8/20/84
103b1	3.10	Seismic and dynamic qualification of mechanical and electrical equipment	Complete	8/20/84
103b2	3.10	Seismic and dynamic qualification of mechanical and electrical equipment	Complete	8/20/84
103b3	3.10	Seismic and dynamic qualification of mechanical and electrical equipment	Complete	8/20/84
103b4	3.10	Seismic and dynamic qualification of mechanical and electrical equipment	Complete	8/20/84
103b5	3.10	Seismic and dynamic qualification of mechanical and electrical equipment	Complete	8/20/84
103b6	3.10	Seismic and dynamic qualification of mechanical and electrical equipment	Complete	8/20/84
103c1	3.10	Seismic and dynamic qualification of mechanical and electrical equipment	Complete	8/20/84
103c2	3.10	Seismic and dynamic qualification of mechanical and electrical equipment	Complete	8/20/84
103c3	3.10	Seismic and dynamic qualification of mechanical and electrical equipment	Complete	8/20/84
103c4	3.10	Seismic and dynamic qualification of mechanical and electrical equipment	Complete	8/20/84
104	3.11	Environmental qualification of mechanical and electrical equipment	NRC Action	

ATTACHMENT 1 (Cont'd)

OPEN ITEM	DSER SECTION NUMBER	SUBJECT	STATUS	R. L. MITTL TO A. SCHWENCER LETTER DATED
105	4.2	Plant-specific mechanical fracturing analysis	Complete	8/20/84 (Rev. 1)
106	4.2	Applicability of seismic andd LOCA loading evaluation	Complete	8/20/84 (Rev. 1)
107	4.2	Minimal post-irradiation fuel surveillance program	Complete	6/29/84
108	4.2	Gadolina thermal conductivity equation	Complete	6/29/84
109a	4.4.7	TMI-2 Item II.F.2	Complete	8/20/84
109b	4.4.7	TMI-2 Item II.F.2	Complete	8/20/84
110a	4.6	Functional design of reactivity control systems	Complete	8/30/84 (Rev. 1)
110b	4.6	Functional design of reactivity control systems	Complete	8/30/84 (Rev. 1)
111a	5.2.4.3	Preservice inspection program (components within reactor pressure boundary)	Complete	6/29/84
111b	5.2.4.3	Preservice inspection program (components within reactor pressure boundary)	Complete	6/29/84
111c	5.2.4.3	Preservice inspection program (components within reactor pressure boundary)	Complete	6/29/84
112a	5.2.5	Reactor coolant pressure boundary leakage detection	Complete	8/30/84 (Rev. 1)
112b	5.2.5	Reactor coolant pressure boundary leakage detection	Complete	8/30/84 (Rev. 1)

ATTACHMENT 1 (Cont'd)

OPEN ITEM	DSER SECTION NUMBER	SUBJECT	STATUS	R. L. MITTL TO A. SCHWENCER LETTER DATED
112c	5.2.5	Reactor coolant pressure boundary leakage detection	Complete	8/30/84 (Rev. 1)
112d	5.2.5	Reactor coolant pressure boundary leakage detection	Complete	8/30/84 (Rev. 1)
112e	5.2.5	Reactor coolant pressure boundary leakage detection	Complete	8/30/84 (Rev. 1)
113	5.3.4	GE procedure applicability	Complete	7/18/84
114	5.3.4	Compliance with NB 2360 of the Summer 1972 Addenda to the 1971 ASME Code	Complete	7/18/84
115	5.3.4	Drop weight and Charpy v-notch tests for closure flange materials	Complete	9/5/84 (Rev. 1)
116	5.3.4	Charpy v-notch test data for base materials as used in shell course No. 1	Complete	7/18/84
117	5.3.4	Compliance with NB 2332 of Winter 1972 Addenda of the ASME Code	Complete	8/20/84
118	5.3.4	Lead factors and neutron fluence for surveillance capsules	Complete	8/20/84
119	6.2	TMI item II.E.4.1	Complete	6/29/84
120a	6.2	TMI Item II.E.4.2	Complete	8/20/84
120b	6.2	TMI Item II.E.4.2	Complete	8/20/84
121	6.2.1.3.3	Use of NUREG-0588	Complete	7/27/84
122	6.2.1.3.3	Temperature profile	Complete	7/27/84
123	6.2.1.4	Butterfly valve operation (post accident)	Complete	6/29/84

ATTACHMENT 1 (Cont'd)

OPEN ITEM	DSER SECTION NUMBER	SUBJECT	STATUS	R. L. MITTL TO A. SCHWENCER LETTER DATED
124a	6.2.1.5.1	RPV shield annulus analysis	Complete	8/20/84 (Rev. 1)
124b	6.2.1.5.1	RPV shield annulus analysis	Complete	8/20/84 (Rev. 1)
124c	6.2.1.5.1	RPV shield annulus analysis	Complete	8/20/84 (Rev. 1)
125	6.2.1.5.2	Design drywell head differential pressure	Complete	6/15/84
126a	6.2.1.6	Redundant position indicators for vacuum breakers (and control room alarms)	Complete	8/20/84
126b	6.2.1.6	Redundant position indicators for vacuum breakers (and control room alarms)	Complete	8/20/84
127	6.2.1.6	Operability testing of vacuum breakers	Complete	8/20/84 (Rev. 1)
128	6.2.2	Air ingestion	Complete	7/27/84
129	6.2.2	Insulation ingestion	Complete	6/1/84
130	6.2.3	Potential bypass leakage paths	Complete	9/13/84 (Rev. 1)
131	6.2.3	Administration of secondary containment openings	Complete	7/18/84
132	6.2.4	Containment isolation review	Complete	6/15/84
133a	6.2.4.1	Containment purge system	Complete	8/20/84
133b	6.2.4.1	Containment purge system	Complete	8/20/84
133c	6.2.4.1	Containment purge system	Complete	8/20/84

ATTACHMENT 1 (Cont'd)

OPEN ITEM	DSER SECTION NUMBER	SUBJECT	STATUS	R. L. MITTL TO A. SCHWENCER LETTER DATED
134	6.2.6	Containment leakage testing	Complete	6/15/84
135	6.3.3	LPCS and LPCI injection valve interlocks	Complete	8/20/84
136	6.3.5	Plant-specific LOCA (see Section 15.9.13)	Complete	8/20/84 (Rev. 1)
137a	6.4	Control room habitability	Complete	8/20/84
137b	6.4	Control room habitability	Complete	8/20/84
137c	6.4	Control room habitability	Complete	8/20/84
138	6.6	Preservice inspection program for Class 2 and 3 components	Complete	6/29/84
139	6.7	MSIV leakage control system	Complete	6/29/84
140a	9.1.2	Spent fuel pool storage	Complete	9/7/84 (Rev. 2)
140b	9.1.2	Spent fuel pool storage	Complete	9/7/84 (Rev. 2)
140c	9.1.2	Spent fuel pool storage	Complete	9/7/84 (Rev. 2)
140d	9.1.2	Spent fuel pool storage	Complete	9/7/84 (Rev. 2)
141a	9.1.3	Spent fuel cooling and cleanup system	Complete	8/30/84 (Rev. 1)
141b	9.1.3	Spent fuel cooling and cleanup system	Complete	8/30/84 (Rev. 1)
141c	9.1.3	Spent fuel pool cooling and cleanup system	Complete	8/30/84 (Rev. 1)

ATTACHMENT 1 (Cont'd)

OPEN ITEM	DSER SECTION NUMBER	SUBJECT	STATUS	R. L. MITTL TO A. SCHWENCER LETTER DATED
141d	9.1.3	Spent fuel pool cooling and cleanup system	Complete	8/30/84 (Rev. 1)
141e	9.1.3	Spent fuel pool cooling and cleanup system	Complete	8/30/84 (Rev. 1)
141f	9.1.3	Spent fuel pool cooling and cleanup system	Complete	8/30/84 (Rev. 1)
141g	9.1.3	Spent fuel pool cooling and cleanup system	Complete	8/30/84 (Rev. 1)
142a	9.1.4	Light load handling system (related to refueling)	Complete	8/15/84 (Rev. 1)
142b	9.1.4	Light load handling system (related to refueling)	Complete	8/15/84 (Rev. 1)
143a	9.1.5	Overhead heavy load handling	Complete	9/7/84
143b	9.1.5	Overhead heavy load handling	Complete	9/13/84
144a	9.2.1	Station service water system	Complete	8/15/84 (Rev. 1)
144b	9.2.1	Station service water system	Complete	8/15/84 (Rev. 1)
144c	9.2.1	Station service water system	Complete	8/15/84 (Rev. 1)
145	9.2.2	ISI program and functional testing of safety and turbine auxiliaries cooling systems	Closed (5/30/84-Aux.Sys.Mtg.)	6/15/84
146	9.2.6	Switches and wiring associated with HPCI/RCIC torus suction	Closed (5/30/84-Aux.Sys.Mtg.)	6/15/84

ATTACHMENT 1 (Cont'd)

OPEN ITEM	DSER SECTION NUMBER	SUBJECT	STATUS	R. L. MITTL TO A. SCHWENCER LETTER DATED
147a	9.3.1	Compressed air systems	Complete	9/21/84 (Rev. 2)
147b	9.3.1	Compressed air systems	Complete	9/21/84 (Rev. 2)
147c	9.3.1	Compressed air systems	Complete	9/21/84 (Rev. 2)
147d	9.3.1	Compressed air systems	Complete	9/21/84 (Rev. 2)
148	9.3.2	Post-accident sampling system (II.B.3)	Complete	9/12/84 (Rev. 1)
149a	9.3.3	Equipment and floor drainage system	Complete	7/27/84
149b	9.3.3	Equipment and floor drainage system	Complete	7/27/84
150	9.3.6	Primary containment instrument gas system	Complete	8/3/84 (Rev. 1)
151a	9.4.1	Control structure ventilation system	Complete	8/30/84 (Rev. 1)
151b	9.4.1	Control structure ventilation system	Complete	8/30/84 (Rev. 1)
152	9.4.4	Radioactivity monitoring elements	Closed (5/30/84- Aux.Sys.Mtg.)	6/1/84
153	9.4.5	Engineered safety features ventilation system	Complete	8/30/84 (Rev 2)
154	9.5.1.4.a	Metal roof deck construction classificiation	Complete	6/1/84
155	9.5.1.4.b	Ongoing review of safe shutdown capability	NRC Action	
156	9.5.1.4.c	Ongoing review of alternate shutdown capability	NRC Action	

ATTACHMENT 1 (Cont'd)

OPEN ITEM	DSER SECTION NUMBER	SUBJECT	STATUS	R. L. MITTL TO A. SCHWENCER LETTER DATED
157	9.5.1.4.e	Cable tray protection	Complete	8/20/84
158	9.5.1.5.a	Class B fire detection system	Complete	6/15/84
159	9.5.1.5.a	Primary and secondary power supplies for fire cetection system	Complete	6/1/84
160	9.5.1.5.b	Fire water pump capacity	Complete	8/13/84
161	9.5.1.5.b	Fire water valve supervision	Complete	6/1/84
162	9.5.1.5.c	Deluge valves	Complete	6/1/84
163	9.5.1.5.c	Manual hose station pipe sizing	Complete	6/1/84
164	9.5.1.6.e	Remote shutdown panel ventilation	Complete	6/1/84
165	9.5.1.6.g	Emergency diesel generator day tank protection	Complete	6/1/84
166	12.3.4.2	Airborne radioactivity monitor positioning	Complete	9/13/84 (Rev. 2)
167	12.3.4.2	Portable continuous air monitors	Complete	7/18/84
168	12.5.2	Equipment, training, and procedures for inplant iodine instrumentation	Complete	6/29/84
169	12.5.3	Guidance of Division B Regulatory Guides	Complete	7/18/84
170	13.5.2	Procedures generation package submittal	Complete	6/29/84
171	13.5.2	TMI Item I.C.1	Complete	6/29/84
172	13.5.2	PGP Commitment	Complete	6/29/84
173	13.5.2	Procedures covering abnormal releases of radioactivity	Complete	6/29/84

ATTACHMENT 1 (Cont'd)

OPEN ITEM	DSER SECTION NUMBER	SUBJECT	STATUS	R. L. MITTL TO A. SCHWENCER LETTER DATED
174	13.5.2	Resolution explanation in FSAR of TMI Items I.C.7 and I.C.8	Complete	6/15/84
175	13.6	Physical security	Open	
176a	14.2	Initial plant test program	Complete	8/13/84
176b	14.2	Initial plant test program	Complete	8/13/84
176c	14.2	Initial plant test program	Complete	7/27/84
176d	14.2	Initial plant test program	Complete	8/24/84 (Rev. 2)
176e	14.2	Initial plant test program	Complete	7/27/84
176f	14.2	Initial plant test program	Complete	8/13/84
176g	14.2	Initial plant test program	Complete	8/20/84
176h	14.2	Initial plant test program	Complete	8/13/84
176i	14.2	Initial plant test program	Complete	7/27/84
177	15.1.1	Partial feedwater heating	Complete	8/20/84 (Rev. 1)
178	15.6.5	LOCA resulting from spectrum of postulated piping breaks within RCP	NRC Action	
179	15.7.4	Radiological consequences of fuel handling accidents	NRC Action	
180	15.7.5	Spent fuel cask drop accidents	NRC Action	
181	15.9.5	TMI-2 Item II.K.3.3	Complete	6/29/84
182	15.9.10	TMI-2 Item II.K.3.18	Complete	6/1/84
183	18	Hope Creek DCRDR	Complete	8/15/84

ATTACHMENT 1 (Cont'd)

OPEN ITEM	DSER SECTION NUMBER	SUBJECT	STATUS	R. L. MITTL TO A. SCHWENCER LETTER DATED
184	7.2.2.1.e	Failures in reactor vessel level sensing lines	Complete	8/1/84 (Rev 1)
185	7.2.2.2	Trip system sensors and cabling in turbine building	Complete	6/1/84
186	7.2.2.3	Testability of plant protection systems at power	Complete	8/13/84 (Rev. 1)
187	7.2.2.4	Lifting of leads to perform surveillance testing	Complete	8/3/84
188	7.2.2.5	Setpoint methodology	Complete	8/1/84
189	7.2.2.6	Isolation devices	Complete	8/1/84
190	7.2.2.7	Regulatory Guide 1.75	Complete	6/1/84
191	7.2.2.8	Scram discharge volume	Complete	6/29/84
192	7.2.2.9	Reactor mode switch	Complete	8/15/84 (Rev. 1)
193	7.3.2.1.10	Manual initiation of safety systems	Complete	8/1/84
194	7.3.2.2	Standard review plan deviations	Complete	8/1/84 (Rev 1)
195a	7.3.2.3	Freeze-protection/water filled instrument and sampling lines and cabinet temperature control	Complete	8/1/84
195b	7.3.2.3	Freeze-protection/water filled instrument and sampling lines and cabinet temperature control	Complete	8/1/84
196	7.3.2.4	Sharing of common instrument taps	Complete	8/1/84
197	7.3.2.5	Microprocessor, multiplexer and computer systems	Complete	8/1/84 (Rev 1)

ATTACHMENT 1 (Cont'd)

OPEN ITEM	DSER SECTION NUMBER	SUBJECT	STATUS	R. L. MITTL TO A. SCHWENCER LETTER DATED
198	7.3.2.6	TMI Item II.K.3.18-ADS actuation	Complete	8/20/84
199	7.4.2.1	IE Bulletin 79-27-Loss of non-class IE instrumentation and control power system bus during operation	Complete	8/24/84 (Rev. 1)
200	7.4.2.2	Remote shutdown system	Complete	8/15/84 (Rev 1)
201	7.4.2.3	RCIC/HPCI interactions	Complete	8/3/84
202	7.5.2.1	Level measurement errors as a result of environmental temperature effects on level instrumentation reference leg	Complete	8/3/84
203	7.5.2.2	Regulatory Guide 1.97	Complete	8/3/84
204	7.5.2.3	TMI Item II.F.1 - Accident monitoring	Complete	8/1/84
205	7.5.2.4	Plant process computer system	Complete	6/1/84
206	7.6.2.1	High pressure/low pressure interlocks	Complete	7/27/84
207	7.7.2.1	HELBs and consequential control system failures	Complete	8/24/84 (Rev. 1)
208	7.7.2.2	Multiple control system failures	Complete	8/24/84 (Rev. 1)
209	7.7.2.3	Credit for non-safety related systems in Chapter 15 of the FSAR	Complete	8/1/84 (Rev 1)
210	7.7.2.4	Transient analysis recording system	Complete	7/27/84
211a	4.5.1	Control rod drive structural materials	Complete	7/27/84
211b	4.5.1	Control rod drive structural materials	Complete	7/27/84
211c	4.5.1	Control rod drive structural materials	Complete	7/27/84

ATTACHMENT 1 (Cont'd)

OPEN ITEM	DSER SECTION NUMBER	SUBJECT	STATUS	R. L. MITTL - A. SCHWENCER LETTER DATED
211d	4.5.1	Control rod drive structural materials	Complete	7/27/84
211e	4.5.1	Control rod drive structural materials	Complete	7/27/84
212	4.5.2	Reactor internals materials	Complete	7/27/84
213	5.2.3	Reactor coolant pressure boundary material	Complete	7/27/84
214	6.1.1	Engineered safety features materials	Complete	7/27/84
215	10.3.6	Main steam and feedwater system materials	Complete	7/27/84
216a	5.3.1	Reactor vessel materials	Complete	7/27/84
216b	5.3.1	Reactor vessel materials	Complete	7/27/84
217	9.5.1.1	Fire protection organization	Complete	8/15/84
218	9.5.1.1	Fire hazards analysis	Complete	6/1/84
219	9.5.1.2	Fire protection administrative controls	Complete	8/15/84
220	9.5.1.3	Fire brigade and fire brigade training	Complete	8/15/84
221	8.2.2.1	Physical separation of offsite transmission lines	Complete	8/1/84
222	8.2.2.2	Design provisions for re-establishment of an offsite power source	Complete	9/14/84 (Rev. 1)
223	8.2.2.3	Independence of offsite circuits between the switchyard and class IE buses	Complete	9/26/84 (Rev. 3)
224	8.2.2.4	Common failure mode between onsite and offsite power circuits	Complete	9/26/84 (Rev. 2)

ATTACHMENT 1 (Cont'd)

OPEN ITEM	DSER SECTION NUMBER	SUBJECT	STATUS	R. L. MITTL TO A. SCHWENCER LETTER DATED
225	8.2.3.1	Testability of automatic transfer of power from the normal to preferred power source	Complete	9/21/84 (Rev. 1)
226	8.2.2.5	Grid stability	Complete	8/13/84 (Rev. 1)
227	8.2.2.6	Capacity and capability of offsite circuits	Complete	8/1/84
228	8.3.1.1(1)	Voltage drop during transient conditions	Complete	8/1/84
229	8.3.1.1(2)	Basis for using bus voltage versus actual connected load voltage in the voltage drop analysis	Complete	8/1/84
230	8.3.1.1(3)	Clarification of Table 8.3-11	Complete	8/1/84
231	8.3.1.1(4)	Undervoltage trip setpoints	Complete	8/1/84
232	8.3.1.1(5)	Load configuration used for the voltage drop analysis	Complete	8/1/84
233	8.3.3.4.1	Periodic system testing	Complete	9/21/84 (Rev. 1)
234	8.3.1.3	Capacity and capability of onsite AC power supplies and use of administrative controls to prevent overloading of the diesel generators	Complete	8/1/84
235	8.3.1.5	Diesel generators load acceptance test	Complete	9/21/84 (Rev. 1)
236	8.3.1.6	Compliance with position C.6 of RG 1.9	Complete	8/1/84
237	8.3.1.7	Decription of the load sequencer	Complete	9/21/84 (Rev. 1)
238	8.2.2.7	Sequencing of loads on the offsite power system	Complete	9/21/84 (Rev. 1)

ATTACHMENT 1 (Cont'd)

OPEN ITEM	DSER SECTION NUMBER	SUBJECT	STATUS	R. L. MITTL TO A. SCHWENCER LETTER DATED
239	8.3.1.8	Testing to verify 30% minimum voltage	Complete	8/15/84
240	8.3.1.9	Compliance with BTP-PSB-2	Complete	8/1/84
241	8.3.1.10	Load acceptance test after prolonged no load operation of the diesel generator	Complete	9/21/84 (Rev. 3)
242	8.3.2.1	Compliance with position 1 of Regulatory Guide 1.128	Complete	9/13/84 (Rev. 1)
243	8.3.3.1.3	Protection or qualification of Class 1E equipment from the effects of fire suppression systems	Complete	9/13/84 (Rev. 1)
244	8.3.3.3.1	Analysis and test to demonstrate adequacy of less than specified separation	Complete	9/28/84 (Rev. 2A)
245	8.3.3.3.2	The use of 18 versus 36 inches of separation between raceways	Complete	9/28/84 (Rev. 2B)
246	8.3.3.3.3	Specified separation of raceways by analysis and test	Complete	8/1/84
247	8.3.3.5.1	Capability of penetrations to withstand long duration short circuits at less than maximum or worst case short circuit	Complete	9/13/84 (Rev. 1)
248	8.3.3.5.2	Separation of penetration primary and backup protections	Complete	8/1/84
249	8.3.3.5.3	The use of bypassed thermal overload protective devices for penetration protections	Complete	8/1/84
250	8.3.3.5.4	Testing of fuses in accordance with R.G. 1.63	Complete	8/1/84

ATTACHMENT 1 (Cont'd)

OPEN ITEM	DSER SECTION NUMBER	SUBJECT	STATUS	R. L. MITTL T A. SCHWENCER LETTER DATED
251	8.3.3.5.5	Fault current analysis for all representative penetration circuits	Complete	9/24/84 (Rev. 3)
252	8.3.3.5.6	The use of a single breaker to provide penetration protection	Complete	9/21/84 (Rev. 2)
253	8.3.3.1.4	Commitment to protect all Class 1E equipment from external hazards versus only class 1E equipment in one division	Complete	9/28/84 (Rev. 3A)
254	8.3.3.1.5	Protection of class 1E power supplies from failure of unqualified class 1E loads	Complete	9/14/84 (Rev. 1)
255	8.3.2.2	Battery capacity	Complete	8/1/84
256	8.3.2.3	Automatic trip of loads to maintain sufficient battery capacity	Complete	9/13/84 (Rev. 1)
257	8.3.2.5	Justification for a 0 to 13 second load cycle	Complete	9/13/83 (Rev. 1)
258	8.3.2.6	Design and qualification of DC system loads to operate between minimum and maximum voltage levels	Complete	8/1/84
259	8.3.3.3.4	Use of an inverter as an isolation device	Complete	10/3/84 (Rev. 3)
260	8.3.3.3.5	Use of a single breaker tripped by a LOCA signal used as an isolation device	Complete	10/3/84 (Rev. 2)
261	8.3.3.3.6	Automatic transfer of loads and interconnection between redundant divisions	Complete	9/13/84 (Rev. 1)
262	11.4.2.d	Solid waste control program	Complete	8/20/84

ATTACHMENT 1 (Cont'd)

OPEN ITEM	DSER SECTION NUMBER	SUBJECT	STATUS	R. L. MITTL T A. SCHWENCER LETTER DATED
263	11.4.2.e	Fire protection for solid radwaste storage area	Complete	8/13/84
264	6.2.5	Sources of oxygen	Complete	8/20/84
265	6.8.1.4	ESF Filter Testing	Complete	8/13/84
266	6.8.1.4	Field leak tests	Complete	8/13/84
267	6.4.1	Control room toxic chemical detectors	Complete	8/13/84
268		Air filtration unit drains	Complete	9/13/84 (Rev. 1)
269	5.2.2	Code cases N-242 and N-242-1	Complete	8/20/84
270	5.2.2	Code case N-252	Complete	8/20/84
TS-1	2.4.14	Closure of watertight doors to safety-related structures	Open	
TS-2	4.4.4	Single recirculation loop operation	Open	
TS-3	4.4.5	Core flow monitoring for crud effects	Complete	6/1/84
TS-4	4.4.6	Loose parts monitoring system	Open	
TS-5	4.4.9	Natural circulation in normal operation	Open	
TS-6	6.2.3	Secondary containment negative pressure	Open	
TS-7	6.2.3	Inleakage and drawdown time in secondary containment	Open	
TS-8	6.2.4.1	Leakage integrity testing	Open	
TS-9	6.3.4.2	ECCS subsystem periodic component testing	Open	

ATTACHMENT 1 (Cont'd)

OPEN ITEM	DSER SECTION NUMBER	SUBJECT	STATUS	R. L. MITTL T A. SCHWENCER LETTER DATED
TS-10	6.7	MSIV leakage rate		
TS-11	15.2.2	Availability, setpoints, and testing of turbine bypass system	Open	
TS-12	15.6.4	Primary coolant activity		
LC-1	4.2	Fuel rod internal pressure criteria	Complete	6/1/84
LC-2	4.4.4	Stability analysis submitted before second-cycle operation	Open	

ATTACHMENT 2 DATE: 10/15/84

DRAFT SER SECTIONS AND DATES PROVIDED

SECTION	DATE	SECTION	DATE
3.1			
3.2.1		11.4.1	See Notes 1&5
3.2.2		11.4.2	See Notes 1&5
5.1		11.5.1	See Notes 1&5
5.2.1		11.5.2	See Notes 1&5
6.5.1	See Notes 1&5	13.1.1	See Note 4
8.1	See Note 2	13.1.2	See Note 4
8.2.1	See Note 2	13.2.1	See Note 4
8.2.2	See Note 2	13.2.2	See Note 4
8.2.3	See Note 2	13.3.1	See Note 4
8.2.4	See Note 2	13.3.2	See Note 4
8.3.1	See Note 2	13.3.3	See Note 4
8.3.2	See Note 2	13.3.4	See Note 4
8.4.1	See Note 2	13.4	See Note 4
8.4.2	See Note 2	13.5.1	See Note 4
8.4.3	See Note 2	15.2.3	
8.4.5	See Note 2	15.2.4	
8.4.6	See Note 2	15.2.5	
8.4.7	See Note 2	15.2.6	
8.4.8	See Note 2	15.2.7	
9.5.2	See Note 3	15.2.8	
9.5.3	See Note 3	15.7.3	See Notes 1&5
9.5.7	See Note 3	17.1	8/3/84
9.5.8	See Note 3	17.2	8/3/84
10.1	See Note 3	17.3	8/3/84
10.2	See Note 3	17.4	8/3/84
10.2.3	See Note 3		
10.3.2	See Note 3		
10.4.1	See Note 3		
10.4.2	See Notes 3&5		
10.4.3	See Notes 3&5		
10.4.4	See Note 3		
11.1.1	See Notes 1&5		
11.1.2	See Notes 1&5		
11.2.1	See Notes 1&5		
11.2.2	See Notes 1&5		
11.3.1	See Notes 1&5		
11.3.2	See Notes 1&5		

Notes:

1. Open items provided in letter dated July 24, 1984 (Schwencer to Mittl)
2. Open items provided in June 6, 1984 meeting
3. Open items provided in April 17-18, 1984 meeting
4. Open items provided in May 2, 1984 meting
5. Draft SER Section provided in letter dated August 7, 1984 (Schwencer to Mittl)

CT:db

ATTACHMENT 3

DSER OPEN ITEMS

5a, 5b, 5d	2.4.5	Wave impact and runup on Service Water Intake Structure

QUESTION/RESPONSE

230.8

430.88

ATTACHMENT 4

DSER Open Item No. 5 a, b and d (DSER Section 2.4.5)

WAVE IMPACT AND RUNUP ON SERVICE WATER INTAKE STRUCTURE

The applicant has analyzed the wind waves that would traverse plant grade coincident with the PMH surge hydrograph and runup on safety-related facilities. These calculations were based on the assumption that wind waves would be generated in the Delaware Estuary and progress to the site. As the surge level would begin to rise, resulting from the approaching eye of the postulated hurricane, the wind speed would progressively change direction from the southeast clockwise to the west. Waves encroaching on the southern end of the Island would be depth-limited (i.e., the waves would "feel" bottom and thus become shallow water waves) by plant grade elevation on both the Salem and Hope Creek sites. These depth-limited (shallow water) waves will impact and runup on the southern and western faces of the safety-related structures in the power block. The applicant has stated that the southern face of the Reactor Building and the Auxiliary Building are designed for a flood protection level of 38.0 ft msl or 3.2 ft above the maximum calculated wave runup height of 34.8 ft msl and the other exposures of safety-related structures have a flood protection level of 32.0 ft msl or 1 ft above the maximum calculated wave runup height of 31.0 ft msl.

The staff has requested the applicant to provide additional information on the waves that impact on the river face of service water intake structure. The waves impacting on this face of the structure are not reduced in height (depth-limited) as those that traverse plant grade.

As indicated in Section 2.4.1, the applicant states that all accesses to safety-related structures (doors and hatches) are provided with water-tight seals designed to withstand the head of water associated with the flood protection levels. But, the applicant has not indicated whether the water-tight doors are designed to withstand either the combined loading effects of both static water level and the dynamic wave impact or, as cited in Sections 3.4.1 and 3.5.1.4 of this report, the impact of a barge propelled by winds and waves associated with a hydrologic event that floods plant grade.

Based upon its analysis according to SRP 2.4.5, the staff concludes that the flood protection level of El. 38.0 ft msl for the southern face of the Reactor Buidling and Auxiliary Building and El. 32.0 ft msl for the remaining safety-related structures within the power block meets the requirements of Regulatory Guide 1.59. Until additional information and analysis

DSER Open Item No. 5 a, b and d (Cont'd)

are available, the staff cannot conclude that the flood protection level of El. 32.0 ft msl for the Service Water Intake Structure meets the requirements of Regulatory Guide 1.59. Based on its analysis, the staff cannot conclude that the plant meets the requirements of GDC 2 with respect to the hydrologic aspects of Probable Maximum Surges and Seiche Flooding.

Response

The requested information for the service water intake structure has been provided in the responses to the following NRC questions:

QUESTION NO.	INFORMATION PROVIDED
240.8	Wave runup elevations
240.9	Wave impact loads
240.8 & 410.69	Flood protection

As a result of discussions with the NRC staff, the response to Question No. 410.69 has been revised and the following summary calculations have been revised and are attached:

1. Analysis of overtopping of Service Water Intake Structure

2. Runup on the East Face of the Service Water Intake Structure

QUESTION 410.69 (Section 9.2.1)

Provide a figure(s) in the FSAR which shows the protection of the station service water system from the flood water (including wave effects) of the design basis flood.

RESPONSE

The general arrangement of the intake structure is provided in Figures 1.2-40 and 1.2-41. Section AA of Figure 1.2-41 is reproduced here as Figure 410.69-1 which identifies the watertight areas and the walls and slabs designed to accommodate flood loads. As described in Sections 2.4.2 and 2.4.5, the south and west exterior walls of the intake structure are subject to a maximum wave run-up elevation of 134.4 feet due to the probable maximum hurricane (PMH). Such waves could overtop the roof of the western portion of the structure at elevation 128 feet. However, a rigorous analysis has been performed to determine the depth of water in the low area (elevation 122.0 feet) after wave impact and to confirm that water does not enter the building through the air intake control dampers (bottom elevation 128.5 feet). Therefore, flood water will not enter into the dry area of the intake structure. On the north side of the intake structure, the maximum water level will be only slightly higher than the still water elevation (113.8 feet) during the PMH. According to Table 2.4.6, the maximum wave elevation for the north side of the intake structure is 26.3 feet MSL (elevation 115.3 feet) due to a postulated multiple dam break. Therefore, flood protection of the north exterior wall to elevation 121.0 feet is adequate.

On the east side of the intake structure, the maximum wave run-up elevation due to the PMH equals 121.97feet. This elevation is due to a 1% wave traveling in the direction of Fetch "A". Fetch A, which is rotated about 15 degrees from Fetch 1 (as shown in Figures 410.69-2 and 410.69-3), is chosen to maximize the wave run-up elevation. Since this elevation is lower than the bottom of the HVAC exhaust opening, flood water will not enter the intake structure from the east side of the building.

In addition the following assessments have been made to confirm the adequacy of the structure and interior components for the overtopping wave:

a. The exterior walls are designed to withstand the flood loads including the dynamic wave action effects.

b. The roof hatches at both elevations 122.0 and 128.0 feet have been sealed (caulking, gaskets, etc.) to prevent any intrusion of water. The hatch covers are keyed into

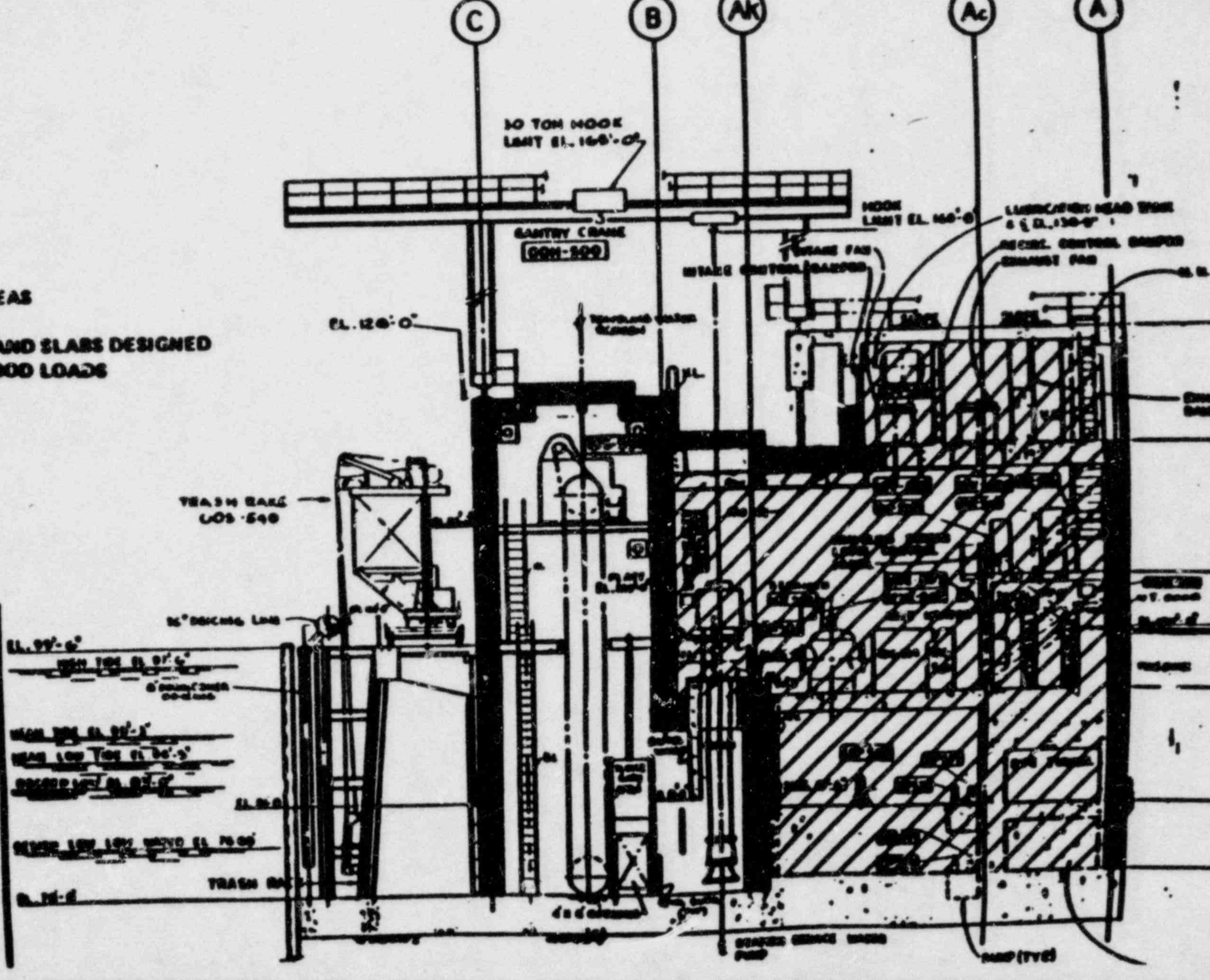
the openings to prevent any adverse slippage due to wave induced loadings.

c. All Seismic Category I components except for the traveling water screens are located within the dry areas of the structure.

d. The traveling water-screens, located in the "wet" area between column lines B and C have electric motors which are fully protected against the flood water level.

e. A condition was postulated where suspended moisture enters the dry areas of the structure through the air intake control dampers. It has been assessed that all of the Seismic Category I components subjected to this environment will continue to function as required.

Section 3.4.1 and Table 3.4-1 have been revised for clarification.



LEGEND:

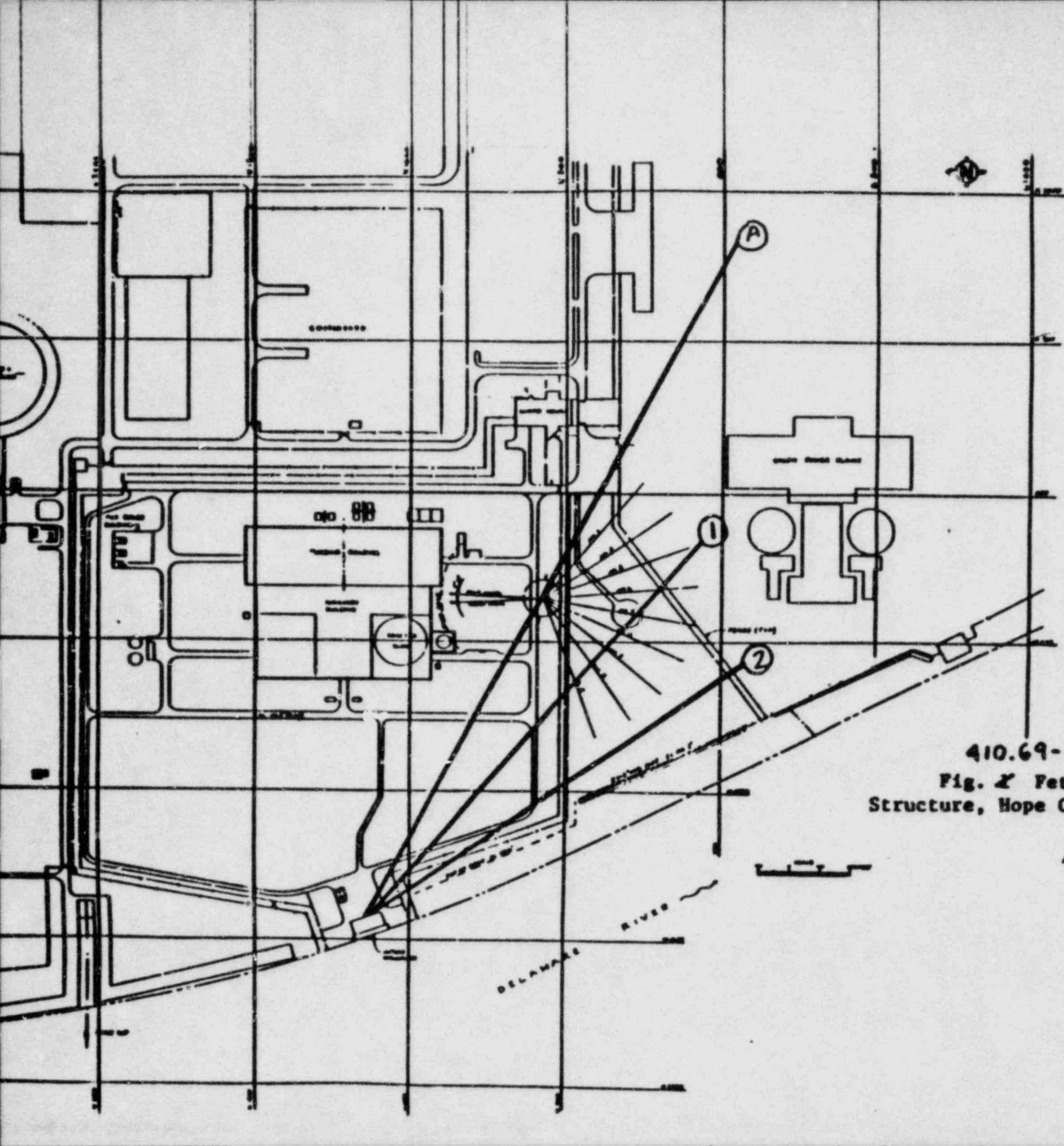
DRY AREAS

WALLS AND SLABS DESIGNED FOR FLOOD LOADS

HOPE CREEK GENERATING STATION

FINAL SAFETY ANALYSIS REPORT

SERVICE WATER INTAKE STRUCTURE — FLOOD PROTECTION



410.69-2

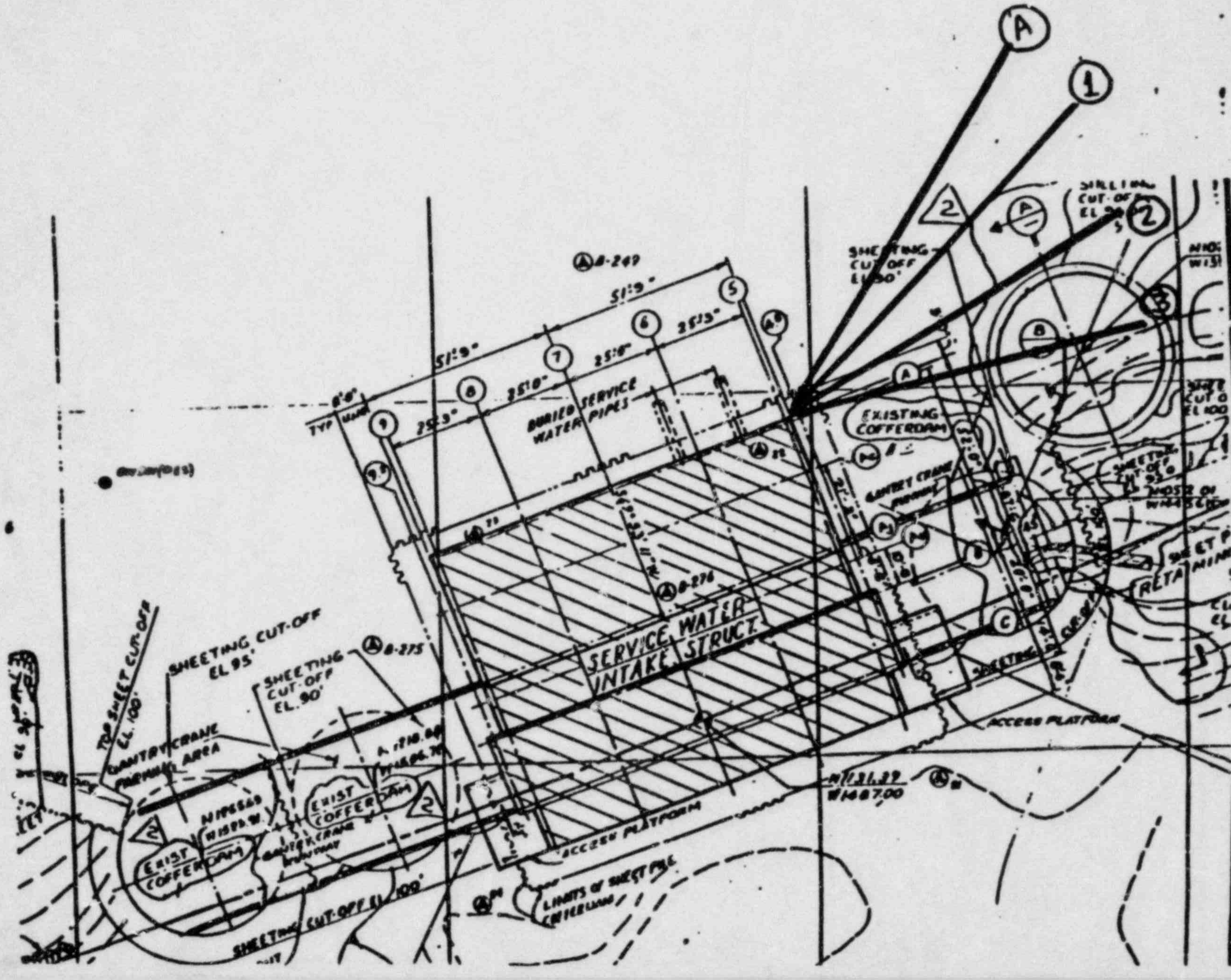
Fig. 2 Fetches for Service Water Intake Structure, Hope Creek Generating Station.

REV. 4

410.69-3

Fig. 2 Fetches for Service Water Intake Structure, Hope Creek Generating Station

REV. 4



August 6, 1984

Hope Creek Generating Station

Analysis of Overtopping of Service Water Intake Structure

I. Wave Calculations

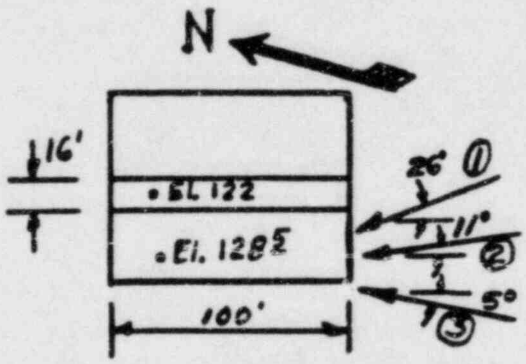
- Wave heights and periods as well as still-water levels and runup elevations are as given in Table 2.4-10a of FSAR (Amendment 5, April 1984).

II. Overtopping Calculations

- Overtopping rates were calculated for west face and south face where top of wall elevations are 128.5 and 122.0, respectively.
- Equations from Weggel (1976) were used for the overtopping calculations.

$$Q = (g Q_0^* H_0'^3) \exp\left(-\frac{0.217}{2\alpha} \log_e\left(\frac{R+h-d_s}{R-h+d_s}\right)\right)$$

$$Q_0^* = \frac{\left(\frac{\epsilon}{2\pi}\right)^2 \left(\frac{H}{H_0'}\right)^2 \tanh\left(\frac{2\pi d_s}{L}\right)}{\frac{H_0'}{gT^2}}$$



- where ε was taken as $1/2\pi$ in order to maximize the value of Q_0^* (see Figure 6 of Weggel's paper)
- α was taken as 0.06 in order to maximize Q (see Equation 4 of Weggel's paper).
- Conservative assumptions in calculating overtopping rates were:
  - It was assumed that waves attacked normal to the wall of the structure.
  - It was assumed that the train of waves was made up of all 1% waves.
  - It was assumed that wave height was constant along the crest.
- Calculated overtopping rate was increased to allow for wind speed using Equation (7-11) of the 1977 edition of the U. S. Army Corps of Engineers Shore Protection Manual.

$$K' = 1.0 + W_f\left(\frac{h-d_s}{R} + 0.1\right)\sin\theta$$

- In making the wind adjustment the factor W_f was assumed to be 2.0 for onshore winds greater than 60 mph. The angle 0 was 90°.

o After adjustment for wind the overtopping rates were adjusted for angle of attack by multiplying the overtopping rate by the sin of the angle between the fetch vector and the wall.

III. Maximum water surface elevations were calculated by backwater calculation starting from the north end of the roof.

o The separate overtopping rates were added and the total was assumed to flow off the top of the structure at the north end.

o Critical depth was assumed to occur at the downstream end of the channel and was calculated as:

$$y_c = \left[\frac{(Q_{TOT}/16)^2}{32.2}\right]^{1/3}$$

where Q is the rate of flow from the west side in cfs/ft.

o The backwater calculation assumes a gradually varied steady flow.

$$y_{x+\Delta x} = \sqrt{\frac{2\Delta Q \cdot \Delta x \cdot Q_x}{16 \cdot 32.2 \cdot y_x} + y_x^2}$$

o Calculations were performed moving upstream starting with the depth at the north end.

o The calculations showed that fetch 3 was the critical case. The total flow rate for fetch 3 was 0.5 cfs/ft from the west and 14.7 cfs/ft from the south end.

o The maximum water surface elevation reached was 126.9 for the fetch 3 condition which is well below the critical 128.5 elevation at which flow could enter the air intakes.

IV. A separate calculation was made considering a surge generated by flow coming over the south end of the building. The depth of flow and velocity of flow ahead of the surge resulting from the previous surge had to be assumed. Velocity ahead of the surge was assumed to be zero, since that condition maximizes the surge height. Depth ahead of the surge was assumed to be 1.0' and does not have a really significant affect on the height of the following surge. The resulting elevation of the crest of the generated surge was 126.9 which is below the 128.5 elevation at which water can flow into the air intake.

V. A check was made to see if flow could surge into the air intakes as a result of plunging from the roof at elevation 128.5.

- Loss coefficients of 0.5 at the entrance to the air intake opening and 0.5 at the bend (see attached sketch were assumed).

- Velocity at the edge of the 128.5 elevation roof section was calculated assuming critical depth there and was increased by 50% for reasons of conservancy.

- The velocity approaching the entrance to the air intake chamber was calculated using the energy equation and neglecting losses.

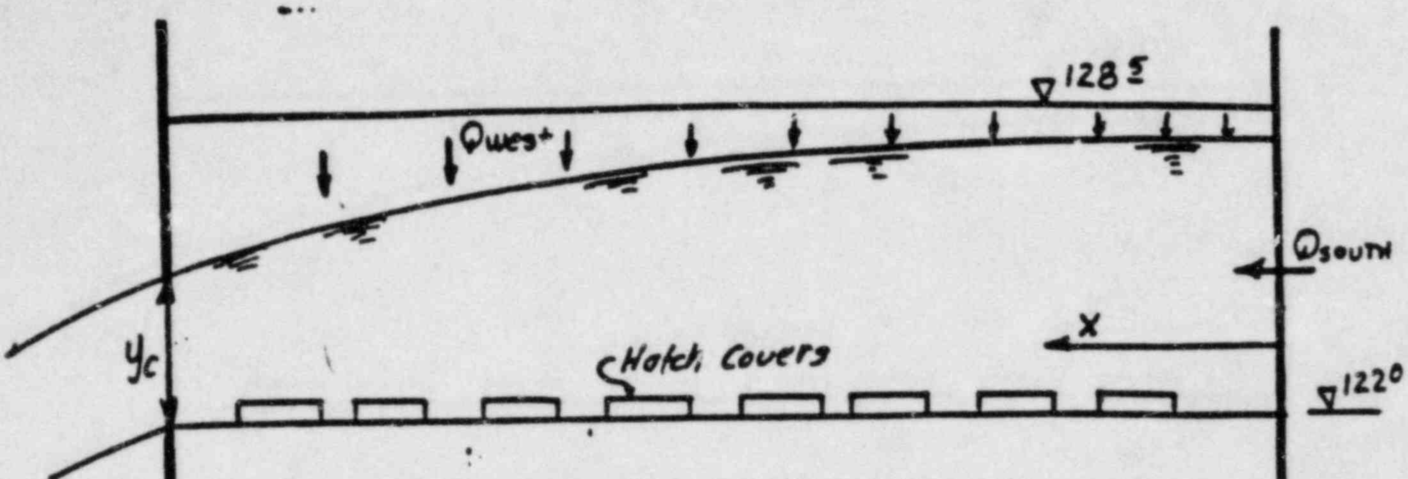
- Losses incurred by turbulence and impact of the jet entering water ponded on top of elevation 122.0 were neglected.

- Headloss through the screens was neglected.

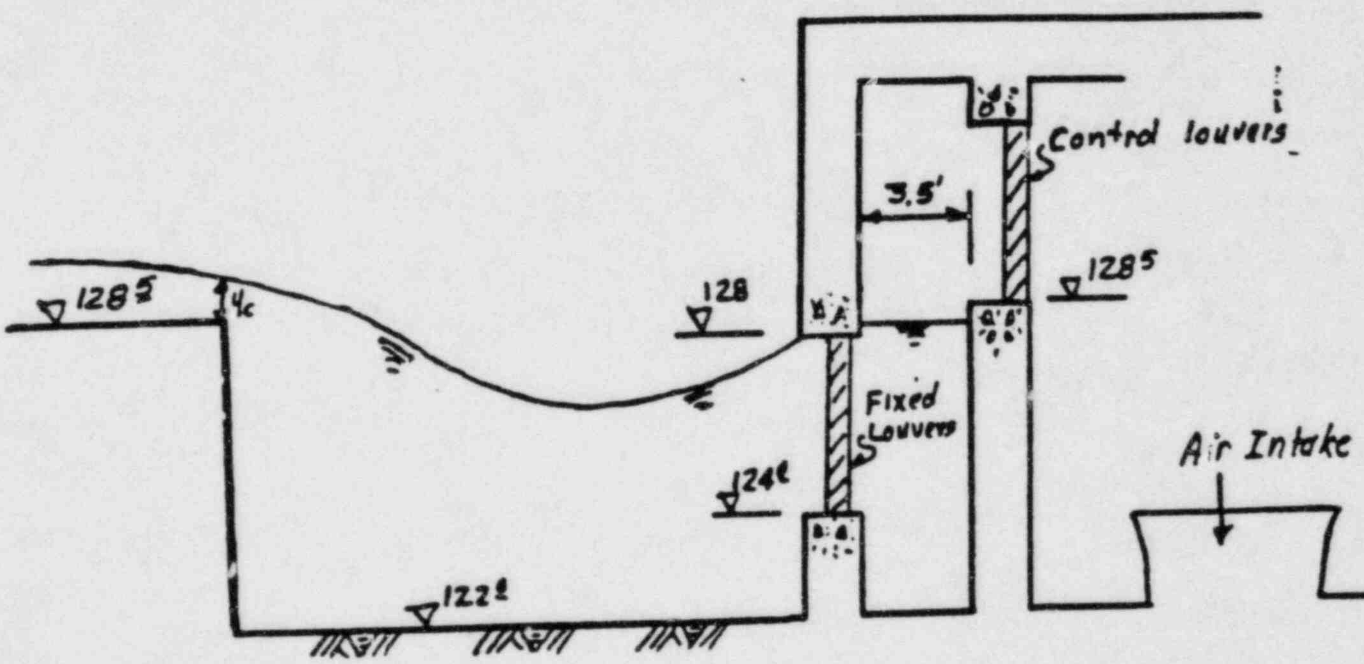
- The maximum elevation achieved was calculated to be 126.3 or well below the 128.5 elevation at which water could flow into the building.

- A separate analysis was made using a one-dimensional momentum approach. The presence of the louver on top of the outer wall was neglected. A velocity of 26 feet per second was assumed to occur over the top of the lower outer wall whose top elevation is at 124.0. This velocity was calculated assuming that the total potential energy in a wave runup to 134.4 would be converted to kinetic energy at elevation 124 without energy loss. The one-dimensional energy analysis, assuming a flow rate of 5.75 cfs/foot indicates that the water surface within the intake could rise to elevation 127.0 which is below the 128.5 elevation at which water could flow into the service-water intake structure. The assumption of a flow rate of 5.75 cfs/foot is very conservative since that is the total overtopping rate from the west side of the structure for the critical fetch conditions assuming the wave strikes normal to the structure wall.

- The total pressure of the air intake fans equals 4.5 inches of water. The maximum elevations of 126.3 feet and 127.0 feet given above result in margins of 2.2 and 1.5 feet respectively with respect to the 128.5 feet elevation at which water could flow into the building. Therefore, there is sufficient margin to accommodate a rise in water level due to fan suction pressure.



Flow along center of building



Sketch of flow conditions at entrance to air intakes

References

1. Weggel, J. R., "Wave Overtopping Equation" Proceedings of the 1976 Coastal Engineering Conference.

2. Jackowski, R. A. (Editor) Shore Protection Manual, U. S. Army Corps of Engineers, Coastal Engineering Research Center, 1977.

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Calculation Summary
Runup on the East Face of the
Service Water Intake Structure
Hope Creek Generating Station

The attached Figure 1 shows the fetches considered for wave runup on the service water intake structure (SWIS). Fetch A, which has an azimuth of 119°, is 4800 feet long over the island and passes between the Salem Plant and the Hope Creek Generating Station. The wave front from Fetch A approaches the east wall of the service water intake structure at an oblique angle equal to 55° (see Figure 1).

Under design conditions, hurricane generated waves approaching the SWIS would be tripped by passage over the dike at the edge of the island. The top of this dike is at elevation 108 feet (PSE&G Datum).

Incident wave heights, wave lengths, and still water levels are assumed as given in Table 2.4-10A of the FSAR. For Fetch A conditions, we have assumed that the incident wave characteristics, still water level, and wind speed are the same as for Fetch 1. Thus, the incident wave has a significant wave height of 10.8 feet, period of 6.4 seconds, and a length of 180 feet. The corresponding wind speed is 108.6 mph and the still water level is 112.1 feet (PSE&G Datum). The ground elevation of the island is 101 feet (PSE&G Datum), which makes the water depth equal to 11.1 feet (112.1 - 101.0 feet).

Because the dike at the edge of the island would trip all large waves and because the water depth is shallow over the island, it is reasonable to assume that the wave approaching the SWIS along Fetch A would have a significant height equal to the one generated by a 108.6 mph wind over an unlimited fetch and for a water depth of 11.1 feet. Thus, the significant wave height at the east wall of the SWIS would be 4.7 feet according to Figure 3-21 of Reference 1. The one percent wave height is 7.05 feet (1.5 * 4.7 feet). The ratio of maximum (1%) waves to the significant wave height is taken to be 1.5 and was obtained from Reference 2, for shallow water wave generation approaching steady state conditions, including a 30% increase to account for data scatter.

To determine the runup of this wave on the east wall of the SWIS, a wave runup coefficient of 2.0 was chosen in accordance with the results presented in Reference 3 and shown in Figure 2, for a wave approach normal to the structure. This runup coefficient was further modified, taking into consideration the oblique wave approach for the wave propagation along Fetch A. For a wave approach angle of 55°, a wave runup reduction of 30% was estimated based on the results presented in Reference 4 (see Figure 3). This reference was cited by Mr. John Ahrens of the Coastal Engineering Research Center, U.S. Army Corps of Engineers as applicable to the conditions under investigation (Reference 5).

Thus, the 1% wave runup would be 9.87 feet (2.0 * 0.70 * 7.05 feet) and the runup elevation would be 121.97 feet (PSE&G Datum) (112.1 + 9.87 feet).

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REFERENCES

1. U. S. Army Corps of Engineers, Shore Protection Manual, Coastal Engineering Research Center, Fort Belvoir, Virginia, 3rd Edition, 1977.

2. Bretschneider, C. L., "Field Investigation of Wave Energy Loss of Shallow Water Ocean Waves", Technical Memorandum No. 46 , Beach Erosion Board, U.S. Army Corps of Engineers, September 1954.

3. Losada, M. A., and L. A. Gimenez - Curto, "Mound Breakwaters Under Wave Attack", Proceedings of the International Seminar on Criteria For Design and Construction of Breakwaters and Coastal Structures, Department of the Oceanographical and Ports Engineering of the University of Santander, Spain, 1980, p. 127-238.

4. Tautenhain, E., S. Kohlhase and H. W. Partenscky, "Wave Run-up at Sea Dike Under Oblique Wave Approach", Proceedings of the Eighteenth Coastal Engineering Conference, Volume I, November 14 to 19, 1982, Cape Town, Republic of South Africa, published by the American Society of Civil Engineers, New York.

5. Personal Communication between J. P. Ahrens of U.S. Army Corps of Engineers, Coastal Engineering Research Center and S. L. Hui of Bechtel Civil and Minerals Incorporated, dated October 9, 1984.

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Fig. 1 Fetches for Service Water Intake Structure, Hope Creek Generating Station

(Revised)
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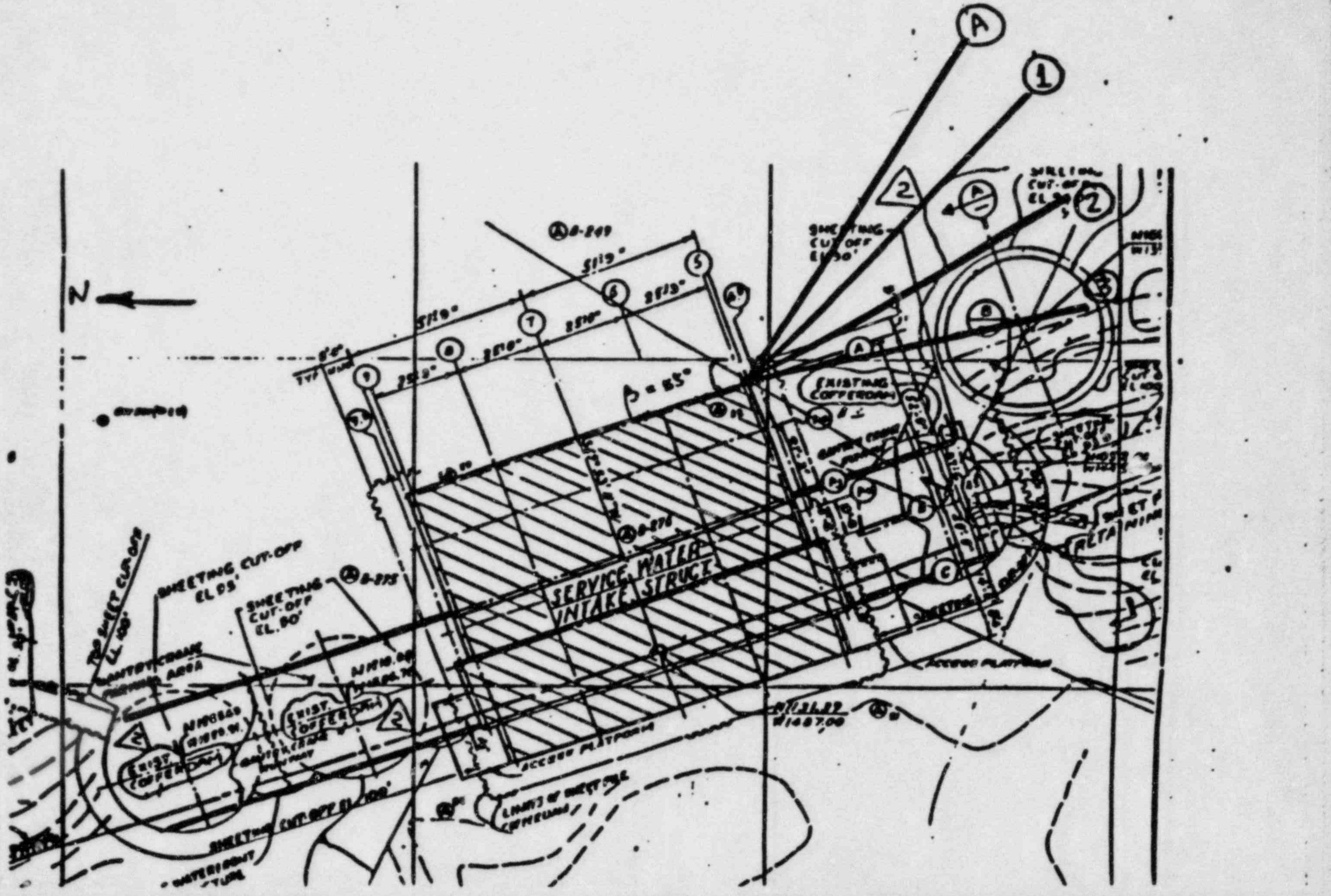

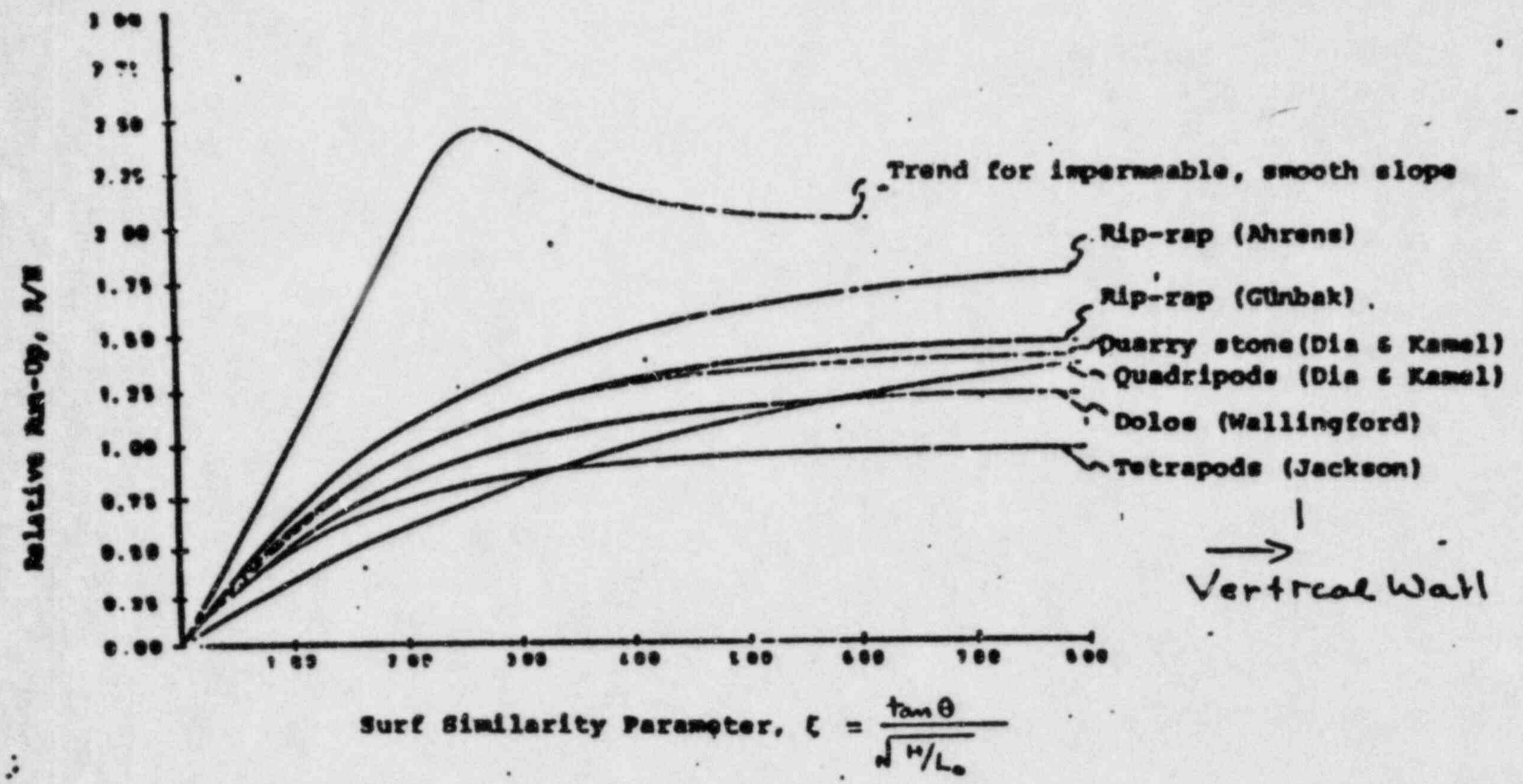

Fig..2 Relative Run-Up Versus ξ For Various Breakwater Armor Units. (From Losada and Gimenez-Curto, 1980).

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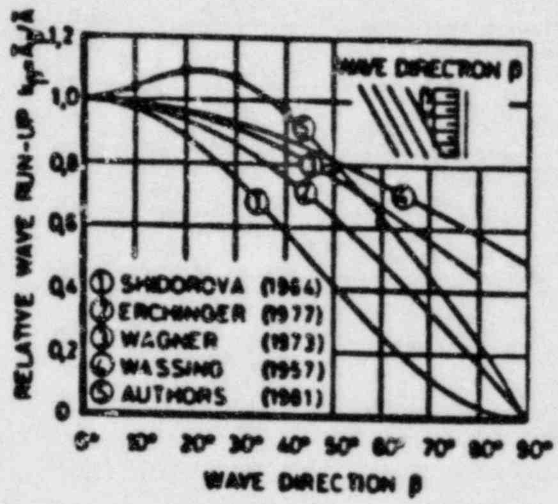

Fig. 3 Relative Wave Run-up For Wave Direction β (From Tautenhain, et al, 1982)

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(2)

Question 230.8: Question 230.6 addressed the January 9, 1982 magnitude 5-3/4 New Brunswick, Canada earthquake and the effect of the New Brunswick earthquake on the Hope Creek site. The revised FSAR discusses the 1982 New Brunswick earthquake sequence and states "the 1982 Miramichi earthquake sequence was not out of character with the region's previous earthquake history" (FSAR, p. 2.5-80). Is the New Brunswick region more seismically active than the Hope Creek site area? Compare seismic activity rates and recurrence models derived for alternative size regions around both of these areas. (See, for example, the Shearon Harris SER, NUREG-1038 or the Millstone Meeting Summary contained in a February 1, 1984 letter from W. Counsil to B. Youngblood).

<u>Response:</u> The seismic activity rates and recurrence models for several alternative sized regions surrounding the Hope Creek site and the epicentral region of the January 1982 Miramichi, New Brunswick earthquake have been compared. This comparison was done in the following manner:

1) earthquakes listed in Table 2.5-1 of the FSAR for which no magnitudes were available (i.e. historical events prior to about 1950) were converted from Intensity to magnitude using Nuttli and Herrmann's (1978) relationship

$$m_b = 1.75 + 0.5\, I_o \qquad (1)$$

2) other seismicity data (i.e. events listed in Earth Physics Branch Files or North Eastern U.S. Seismic Network Bulletins) where magnitude scales other than m_b were used to characterize seismic events, were considered to be numerically equivalent for purposes of this analysis.

3) a recurrence model was constructed for both the Hope Creek region and the area surrounding the New Brunswick magnitude 5.7 event of the form:

$$\text{Log } N(\geq M) = a - bM$$

and normalized to $10^4 mi^2$ for direct comparison of earthquake density in a $5^\circ x 5^\circ$ area centered about both the Hope Creek site and the New Brunswick event (see Figure 1 and Table 2).

4) a qualitative comparison of a $1^\circ x 1^\circ$ area about both areas was also made to reflect the relative numbers of instrumentally recorded earthquakes of varying magnitudes over equivalent recording periods at both sites (see Tables 3 and 3A).

Discussion: A $5^\circ x 5^\circ$ area surrounding the Hope Creek site and the Miramichi, New Brunswick magnitude 5.7 earthquake epicenter was selected as being broad enough to represent seismicity on a regional level. Events $\geq M_L = 4.0$ were compiled from Table 2.5-1 of the FSAR for Hope Creek and from data files of the Earth Physics Branch, Dominion Observatory, (see Table 1) for the Miramichi region (Adams, 1984, personal communication), not including the January 9, 1982 Miramichi event or its aftershocks. Table 2 provides a summary of the recurrence parameters for both areas and the recurrence curves are shown on Figure 1.

The fact that the population density in central New Brunswick is low and that earthquakes have only been routinely recorded in that region for the last decade or so may reflect an even greater difference in seismicity between Miramichi and the Hope Creek site.

As a further comparison between the two areas, a $1^\circ x 1^\circ$ area, centered on the Hope Creek site and the Miramichi 1982 epicenter, was selected and earthquakes occurring within both the areas were determined. A earthquakes have been instrumentally recorded since about 1930 in eastern Canada, this date was used as the low cut off in both data sets available. Table 3 shows the comparison; for the Hope Creek area, there has been a total of 8 events since 1930-2 events between magnitudes 2.0-2.9; 5 events between magnitudes 3.0-3.9 and one event between magnitude 4.0 and 4.4. The $1^\circ x 1^\circ$ region

surrounding the 1982 Miramichi epicenter, on the other hand, shows a greater number of events (25) than Hope Creek, not including the 1982 Magnitude 5.7 event and aftershocks. There have been recorded (since 1930) 14 events of magnitude 2.0-2.9 (Shearon-Harris SER); 4 between magnitudes 3.0-3.4; 5 events between 3.5-3.9; 1 earthquake between magnitude 4.0 and 4.4 and 1 event between magnitude 4.5 and 4.9. Table 3A list those events used in this comparison for both areas.

It appears that the Hope Creek site is within an area of significantly lower seismicity than for the Miramichi, New Brunswick Region.

TABLE 1

Earthquakes ≥ M_L = 4.0 Used in a 5^{o}x 5^{o} Comparison Between the Hope Creek Site and Miramichi, N.B.

Hope Creek

(See Table 2.5-1 of the FSAR)

Miramichi, N.B.

Date	N. Lat.	W.Long	Magnitude (M_L)
22 May 1817	46.0	69.0	5.0
09 Jul 1824	46.5	66.5	4.5
08 Feb 1855	46.0	64.5	4.5
22 Oct 1869	45.0	66.2	5.0
27 Feb 1874	44.8	68.7	4.0
31 Dec 1882	45.0	67.0	4.5
22 Mar 1896	45.2	67.2	4.0
21 Mar 1904	45.0	67.2	5.0
15 Jul 1905	44.3	69.8	4.5
14 May 1908	44.0	65.8	4.0
08 Aug 1908	46.3	67.6	4.5
11 Dec 1912	45.0	68.0	4.0
13 Jan 1914	45.1	67.2	4.5
27 Jul 1915	44.0	65.0	4.0
12 Jun 1917	49.0	68.0	4.0
02 Jul 1922	46.5	66.6	4.5
08 Feb 1928	45.3	69.0	4.5
04 Jan 1930	46.7	65.8	4.5
30 Sep 1937	45.5	65.8	4.5
17 May 1938	49.0	68.0	4.0
22 Aug 1938	44.7	68.8	4.0
23 Jun 1944	49.4	67.8	5.0
29 Jun 1950	49.5	67.4	4.5
28 Jun 1951	49.5	67.0	4.0
19 Sep 1951	49.3	66.3	4.5
24 Jan 1953	49.4	66.0	4.5
14 Sep 1953	49.4	65.3	4.5
21 Oct 1958	49.2	68.5	4.0
25 Mar 1962	47.5	66.0	4.0
14 Jan 1966	48.9	67.7	4.0
30 Sep 1967	49.3	65.9	4.5

TABLE 2

RECURRENCE PARAMETERS

Region	Area (mi^2)	$N/10^4 mi^2$: $M_L = \geq 4.0$	4.5	5.0	5.5	"b"
Hope Creek ($5^o x 5^o$)	9.2×10^4	0.03	0.01	0.002	-	0.67
New Brunswick ($5^o x 5^o$) (w/o Miramichi Events)	8.1×10^4	0.02	0.01	0.003	0.0007	0.85

TABLE 3

SEISMIC EVENTS WITHIN A $1^o x 1^o$ AREA CENTERED ABOUT THE HOPE CREEK SITE AND THE MIRAMICHI MAGNITUDE 5.7 EPICENTER

Magnitude	Hope Creek (1930-1980)	New Brunswick (1930-1981)
2.0 - 2.9	2	14
3.0 - 3.9	5	9
4.0 - 4.4	1	1
4.5 - 4.9	0	1
TOTAL	8	25

TABLE 3A

Earthquakes Used in a $1^{o} x 1^{o}$ Comparison Between the Hope Creek Site and Miramichi, New Brunswick

Hope Creek

Date	North Lat.	West Long	Intensity	Magnitude*
15 Nov 1939	39.6	75.2	V	4.2
11 Aug 1954	40.3	76.0	IV	3.6
20 Jan 1955	40.3	76.0	IV	3.6
23 Jan 1962	39.8	75.9	I-II	2.5
11 Feb 1972	39.7	75.7	II	2.7
28 Feb 1973	37.7	75.4	VI	3.8 m_n
10 Jul 1973	Near Willmington		IV	3.7
02 May 1980	40.2	75.0	IV	3.7

Miramichi, New Brunswick

(14 events between M_L = 2.0-2.9 are taken from the Shearon-Harris SER, 1983)

Date	Lat.	Long	Magnitude (M_L)
04 Jan 1930	46.7	65.8	4.6
15 Jun 1938	46.5	66.8	3.3
04 Aug 1957	46.5	67.0	3.7
29 Jan 1961	46.3	66.9	3.8
31 Jan 1962	47.5	67.1	3.5
25 Mar 1962	47.5	66.0	4.0
01 Aug 1963	46.8	66.5	3.0
17 Oct 1964	47.6	67.2	3.9
27 May 1965	46.9	66.6	3.3
24 Oct 1977	47.0	67.0	3.0
28 Nov 1981	47.0	66.6	3.7

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* converted from MM Intentisy to magnitude using $m_b = 1.75 + 0.5I_o$ (Nuttli and Herrmann, 1978)

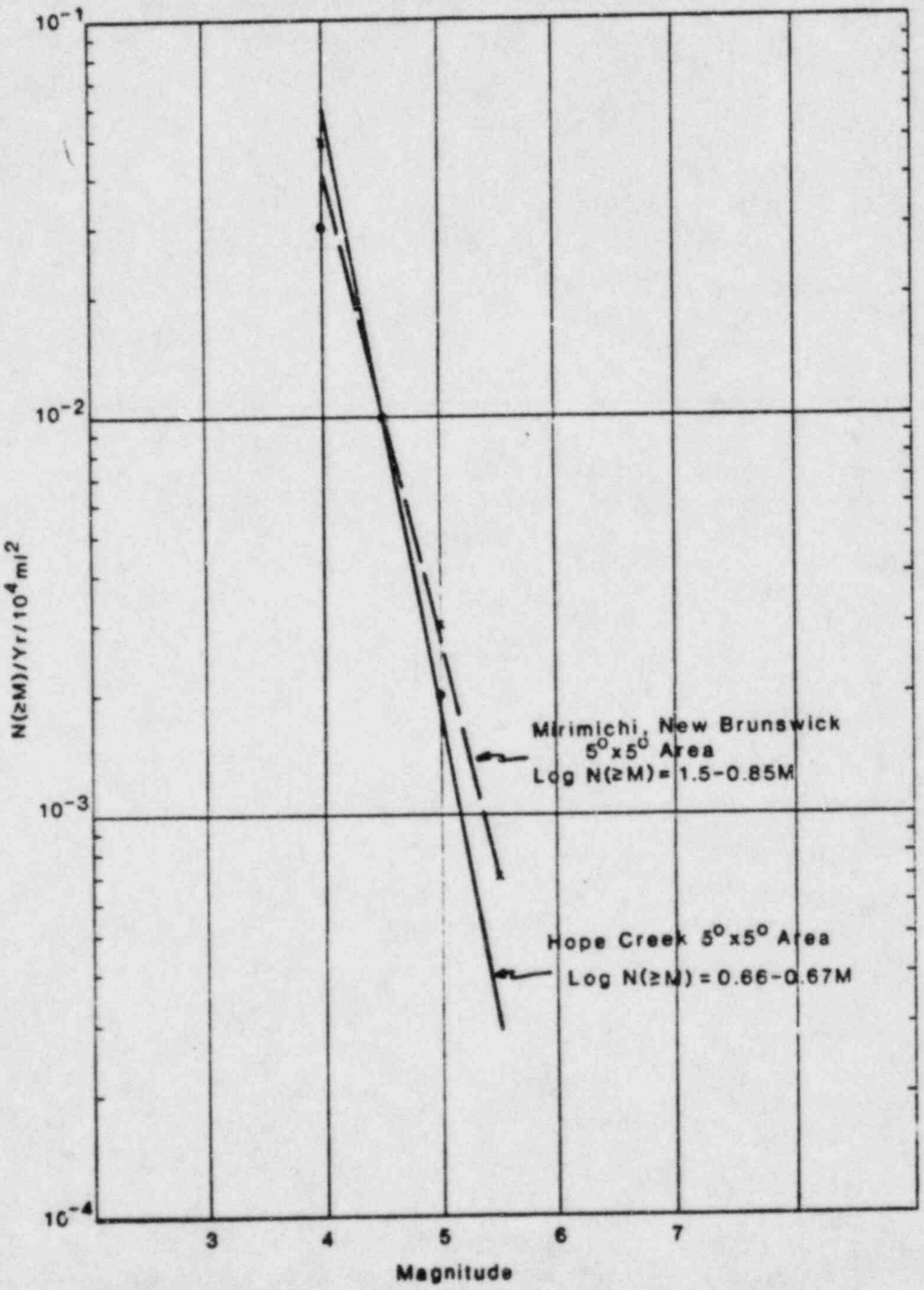
REFERNCES

Adams, J.; May 17, 1984; Personal Communication.

Basham, P.W., Weichert, D.H. and Berry, M.J., 1979; Regional Assessment of Seismic Risk in Eastern Canada; BSSA, Vol 69, No. 5, pp. 1567-1602.

U.S.N.R.C., Shearon Harris Safety Evaluation Report; 1983; NUREG-1038.

Nuttli, O.W. and Herrmann, R.B., 1978; Credible Earthquakes for the Central United States; Report 12, Misc. Paper S-73-1, U.S. Corps of Engineers, Waterways Exp. Station (Vicksburg).



Recurrence Curves

Figure 1

Rev. 3

QUESTION 430.88 (SECTION 9.5.4)

Provide additional justification to support your statement in Section 9.5.4.3 that sufficient additional fuel can be delivered to the plant site by truck, or barge. In your discussion include sources where diesel quality fuel oil is available and distances travelled from the source to the plant. Also discuss how fuel oil will be delivered onsite under extremely unfavorable environmental conditions. (SRP 9.5.4, Part I)

RESPONSE

Standby diesel generator fuel oil storage tank fill connections are discussed in Section 9.5.4.2.6. The total capacity of the SDG fuel oil storage tanks and day tanks is sufficient for seven days of SDG operation at the rated full load indicated in Section 8.3 for a DBA and LOP. Within this period, additional fuel can be delivered to the plant site by truck or barge. The supply depot is located about 44 miles from the plant in Pensauken, N.J. Under extremely unfavorable environmental conditions, deliveries would be made by truck.

(INSERT "A")

1/4

INSERT "A" TO 430.88

¶ Site flooding (i.e. flooding above plant grade elevation) is a highly unlikely event. The highest historical high water was 97.5 feet (PS Datum), recorded November 1950, 4 feet below plant grade. As an estuarine, site flooding is primarily a result of the effects of tide combined with severe storms. The tidal cycle being approximately 12 hours in duration would reasonably be expected to contribute to site or local flooding for only a few hours. This would afford the opportunity to refuel the fuel oil storage tanks within a few hours of any scheduled refueling.

Severe site flooding to the design flood level is due to the PMH as defined in Regulatory Guide 1.59. Precise track position and forward speed (27 knots) as well as other assumptions are necessary to develop the flood levels calculated for the design basis event. A description of the analysis is presented in Section 2.4.5. A forward speed of 27 knots would cause the hurricane to move over 300 miles past the site in 10 hours. The maximum winds are assumed to extend 39 nautical miles. The forward travel speed is a critical parameter in the calculation, as this is what causes the large volume of water to be first forced into the Delaware and then carried up the estuary past the site. Even in the event that the storm should stall, flood water will tend to drain out the bay as the forcing function is no longer available to push water into the bay. There would also be a further reduction of flood waters due to the tidal change. It would be unrealistic as to expect site flooding to persist for more than 24 hours. Upon continuous operation of the diesel generators for any 2 day period, a new fuel oil shipment will be delivered.

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Question 430.88 con't

While extremely adverse wind, weather and tidal conditions at the Hope Creek Site could interfere with diesel oil delivery for approximately 24-36 hours, it would be a very improbable situation that would preclude delivery by all of the possible avenues (truck, barge or helicopter) for as long as 60 hours.

There are three key factors which support this conclusion. First, while any storm can remain stationary for an extended period, one in an adverse position (onshore) will lose its energy source and be eroded by surface friction. Secondly, any storm remaining offshore where it can retain all or some of its energy source will be in a position either to cause unusually low tides following the initial surge, or at least to provide shelter from the maximum winds because of the long fetch over the lower Jersey peninsula. Thirdly, the storm surge capable of seriously flooding the area is an enormous wave and it will not maintain site area flooding condition for prolonged periods (24-36 hours) even if the driving force continues.

The following is a brief description of three storm variations:

A. Hurricane stationary in the least favorable position (see Figure 430.88-1)
   A hurricane in this position is largely cut off from oceanic moisture and it is subject to frictional erosion of its wind speeds. It will decay into a wet, showery situation with modest wind speeds within 12-24 hours.

B. Hurricane stationary off the coast (see Figure 430.88-2)
   A hurricane anywhere off the coast would continue to receive a substantial portion of its energy and it would not be affected by friction of the land surface. However, its location would preclude the fetch necessary to drive water directly into the bay, and the flow over the peninsula would moderate the winds at the site. The initial surge should drop within 12 hours and would probably be followed by an abnormally low tide. The clouds and showers associated with the storm might last 24-36 hours.

   If the PMH were to stall directly south of the Delaware Bay Inlet, westerly winds could cause high water build-up at the entrance to the bay. It would require a continuous wall of water approximately 12 feet high to maintain flooding conditions at the site. A prolonged event (24-36 hours) of this type would be highly improbable.

Question 430.88 cont'd

C. Extra-tropical storms

These storms are much larger than hurricanes, and at times they do remain stationary for very long periods. However, much of the above reasoning remains valid for them also. A stationary storm in the unfavorable position needed to generate strong southeasterly winds would be subject to surface friction, and it would lose much of its energy, although in a different way. The sharp contrast between the cold polar air and the tropical maritime air from which such storms are generated would gradually disappear and the air would become homogenous around the circumference of the low pressure area. Such storms weaken slowly over a period of 24-36 hours.

Storms off the coast can maintain their energy source very well, and they may remain vigorous for three or four days. However, if the storm produced a major surge while reaching the vicintiy of the site. it would then generate a period of very low water. Adverse weather could last for several days, in the sense that the winds might be high and precipitation could continue, but transportation of fuel or lube oil should not be a problem.

Based upon previous discussions (i.e., 2 days of diesel generator operation prior to PMH), the probable maximum flood would conservatively pass after one day. This would leave 3.5 days of fuel supply in the tanks after providing for a conservative half day to permit settlement of postulated sediment in the tanks.

The normal method of fuel transport would be by tank truck. Should any event preclude delivery by truck, the 3.5 days of remaining fuel will provide ample time to arrange an alternate delivery method. These could include barge or helicopter delivery. The refill line extends to the station barge slip. There are sufficient refineries and military installations within a reasonable distance of the station to assure the credibility of these methods of delivery. Among the available privately owned helicopters, a Sikorski 561 has a minimum lift capacity of 7500 pounds. This equates to 918 gallons of diesel fuel in drums. This quantity of fuel would permit two fully loaded diesels to operate for approximately 85 minutes. Military helicopters with greater lifting capacity would also be available.

Similarly, the commitment to refuel with a remaining five day fuel supply provides ample time to clear roads of any credible snowfall or to arrange an alternate delivery method. Getty, Texaco and the Sun Oil Company have refineries within a 75 mile radius of the site.

Comprehensive emergency plans are required by federal agencies ie FEMA and NRC. These plans require documentation in the form of letters of agreement and memornadum of understanding between the

nuclear utility and state and federal governments which provide the use of resources of the various agencies involved. The availability of these resources provides additional assurance that accidents and acts of nature beyond design basis can be addressed.

The SDG fuel oil storage tanks are sized in accordance with the requirements of SRP 9.5.4 and Regulatory Guide 1.137 for a seven day supply of fuel oil to each redundant SDG following a LOCA or LOP.

Each pair of SDG fuel oil storage tanks contains sufficient fuel to operate a diesel engine for approximately seven days, six hours, based on the time dependent generator loading shown in FSAR Table 8.3-3.

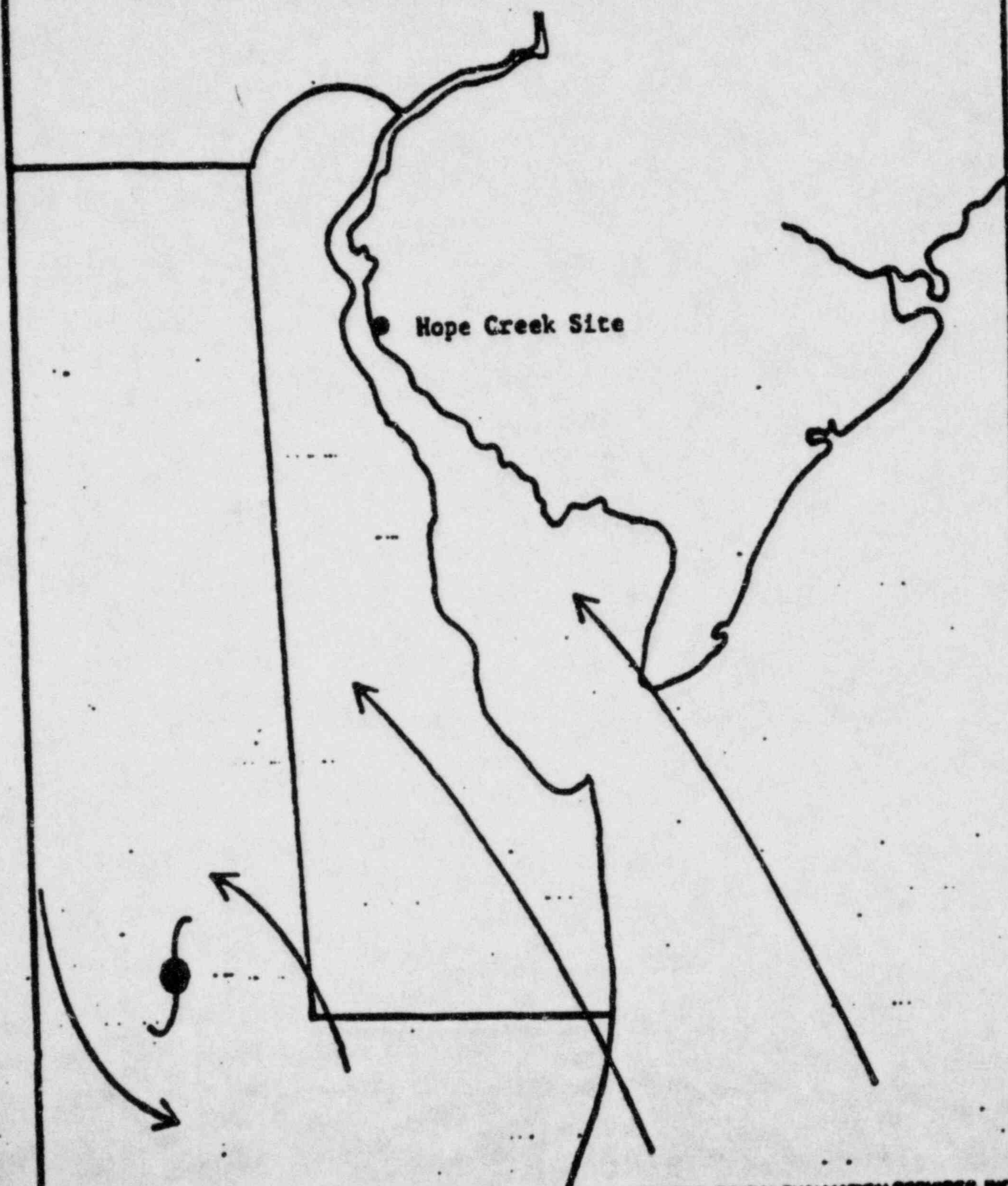
During an actual shutdown under these conditions, i.e. LOP and flood, all four diesels would not be required to achieve and maintain cold shutdown. Thus, for a realistic shutdown scenario there in fact would be approximately 14 days fuel oil available for required diesel operation.

FIGURE 430.88-1

HOPE CREEK

GENERATING STATION

Onshore Hurricane - Wind Flows



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