PSEG Public Service Electric and Gas Company

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Robert L. Mittl General Manager
Nuclear Assurance and Regulation

August 1, 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.

In addition, enclosed for your review and approval (see Attachment 4) are the resolutions to the Draft SER open items and the resolution of comments received during the April 17 and 18, 1984, Power Systems Branch (Mechanical) meeting on the 430 questions series, listed in Attachment 3. A signed original of the required affidavit is provided to document the submittal of these DSER open item and FSAR question responses.

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

Very truly yours,

R L Mittl

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Attachments

C D. H. Wagner
USNRC Licensing Project Manager

W. H. Bateman
USNRC Senior Resident Inspector

FM05 1/2

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 Hope Creek Generating Station Draft Safety Evaluation Report open item responses and FSAR Question responses.

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 1st day of August 1984.

David K. Burd

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

GJ02

DATE: 8/1/84

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	Open	
2a	2.3.3	Accuracies of meteorological measurements	Complete	7/27/84
2b	2.3.3	Accuracies of meteorological measurements	Complete	7/27/84
2c	2.3.3	Accuracies of meteorological measurements	Complete	7/27/84
2d	2.3.3	Accuracies of meteorological measurements	Open	
3a	2.3.3	Upgrading of onsite meteorological measurements program (III.A.2)	Complete	8/1/84
3b	2.3.3	Upgrading of onsite meteorological measurements program (III.A.2)	Complete	8/1/84 (Rev. 1)
3c	2.3.3	Upgrading of onsite meteorological measurements program (III.A.2)	Open	
4	2.4.2.2	Ponding levels	Open	
5a	2.4.5	Wave impact and runup on service Water Intake Structure	Complete	6/1/84
5b	2.4.5	Wave impact and runup on service water intake structure	Open	
5c	2.4.5	Wave impact and runup on service water intake structure		
5d	2.4.5	Wave impact and runup on service water intake structure	Complete	6/1/84
6a	2.4.10	Stability of erosion protection structures	Open	
6b	2.4.10	Stability of erosion protection structures	Open	
6c	2.4.10	Stability of erosion protection structures	Open	

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	Open	
7b	2.4.11.2	Thermal aspects of ultimate heat sink	Complete	6/1/84
8	2.5.2.2	Choice of maximum earthquake for New England - Piedmont Tectonic Province	Open	
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
23	2.5.4	Clarification of FSAR Tables 2.5.13 and 2.5.14	Complete	6/1/84

ATTACHMENT 1 (Cont'd)

OPEN ITEM	DSER SECTION NUMBER	SUBJECT	STATUS	R. L. MITTL TO A. SCHWENCER LETTER DATED
24	2.5.4	Soil depth models for intake structure	Complete	6/1/84
25	2.5.4	Intake structure soil modeling	Open	
26	2.5.4.4	Intake structure sliding stability	Open	
27	2.5.5	Slope stability	Complete	6/1/84
28a	3.4.1	Flood protection	Complete	7/27/84
28b	3.4.1	Flood protection	Complete	7/27/84
28c	3.4.1	Flood protection	Complete	7/27/84
28d	3.4.1	Flood protection	Complete	7/27/84
28e	3.4.1	Flood protection	Complete	7/27/84
28f	3.4.1	Flood protection	Open	
28g	3.4.1	Flood protection	Complete	7/27/84
29	3.5.1.1	Internally generated missiles (outside containment)	Complete	7/18/84
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	Open	
33	3.5.2	Structures, systems, and components to be protected from externally generated missiles	Open	
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

ATTACHMENT 1 (Cont'd)

OPEN ITEM	DSER SECTION NUMBER	SUBJECT	STATUS	R. L. MITTL TO A. SCHWENCER LETTER DATED
36	3.6.2	Postulated pipe ruptures	Complete	6/29/84
37	3.6.2	Feedwater isolation check valve operability	Open	
38	3.6.2	Design of pipe rupture restraints	Open	
39	3.7.2.3	SSI analysis results using finite element method and elastic half-space approach for containment structure	Open	
40	3.7.2.3	SSI analysis results using finite element method and elastic half-space approach for intake structure	Open	
41	3.8.2	Steel containment buckling analysis	Complete	6/1/84
42	3.8.2	Steel containment ultimate capacity analysis	Complete	6/1/84
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	6/1/84
46	3.8.5	ACI 349 deviations for foundations	Complete	6/1/84
47	3.8.6	Base mat response spectra	Complete	6/1/84
48	3.8.6	Rocking time histories	Complete	6/1/84
49	3.8.6	Gross concrete section	Complete	6/1/84
50	3.8.6	Vertical floor flexibility response spectra	Complete	6/1/84
51	3.8.6	Comparison of Bechtel independent verification results with the design-basis results	Open	

ATTACHMENT 1 (Cont'd)

OPEN ITEM	DSER SECTION NUMBER	SUBJECT	STATUS	R. L. MITTL TO A. SCHWENCER LETTER DATED
52	3.8.6	Ductility ratios due to pipe break	Open	
53	3.8.6	Design of seismic Category I tanks	Complete	6/1/84
54	3.8.6	Combination of vertical responses	Complete	6/1/84
55	3.8.6	Torsional stiffness calculation	Complete	6/1/84
56	3.8.6	Drywell stick model development	Complete	6/1/84
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	6/1/84
60	3.8.6	BSAP element size limitations	Complete	6/1/84
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
64	3.8.6	SSI analysis 12 Hz cutoff frequency	Complete	6/1/84
65	3.8.6	Intake structure crane heavy load drop	Complete	6/1/84
66	3.8.6	Impedance analysis for the intake structure	Open	
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

ATTACHMENT 1 (Cont'd)

OPEN ITEM	DSER SECTION NUMBER	SUBJECT	STATUS	R. L. MITTL TO A. SCHWENCER LETTER DATED
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	6/1/84
78	3.8.6	Dead load calculations	Complete	6/1/84
79	3.8.6	Post-modification seismic loads for the torus	Complete	6/1/84
80	3.8.6	Torus fluid-structure interactions	Complete	6/1/84
81	3.8.6	Seismic displacement of torus	Complete	6/1/84
82	3.8.6	Review of seismic Category I tank design	Complete	6/1/84
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	6/1/84
85	3.8.6	Load combination consistency	Complete	6/1/84

ATTACHMENT 1 (Cont'd)

OPEN ITEM	DSER SECTION NUMBER	SUBJECT	STATUS	R. L. MITTL TO A. SCHWENCER LETTER DATED
86	3.9.1	Computer code validation	Open	
87	3.9.1	Information on transients	Open	
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
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	6/15/84
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

ATTACHMENT 1 (Cont'd)

OPEN ITEM	DSER SECTION NUMBER	SUBJECT	STATUS	R. L. MITTL TO A. SCHWENCER LETTER DATED
100b	3.9.6	10CFR50.55a paragraph (g)	Open	
101	3.9.6	PSI and ISI programs for pumps and valves	Open	
102	3.9.6	Leak testing of pressure isolation valves	Complete	6/29/84
103a1	3.10	Seismic and dynamic qualification of mechanical and electrical equipment	Open	
103a2	3.10	Seismic and dynamic qualification of mechanical and electrical equipment	Open	
103a3	3.10	Seismic and dynamic qualification of mechanical and electrical equipment	Open	
103a4	3.10	Seismic and dynamic qualification of mechanical and electrical equipment	Open	
103a5	3.10	Seismic and dynamic qualification of mechanical and electrical equipment	Open	
103a6	3.10	Seismic and dynamic qualification of mechanical and electrical equipment	Open	
103a7	3.10	Seismic and dynamic qualification of mechanical and electrical equipment	Open	
103b1	3.10	Seismic and dynamic qualification of mechanical and electrical equipment	Open	
103b2	3.10	Seismic and dynamic qualification of mechanical and electrical equipment	Open	
103b3	3.10	Seismic and dynamic qualification of mechanical and electrical equipment	Open	
103b4	3.10	Seismic and dynamic qualification of mechanical and electrical equipment	Open	
103b5	3.10	Seismic and dynamic qualification of mechanical and electrical equipment	Open	

ATTACHMENT 1 (Cont'd)

OPEN ITEM	DSER SECTION NUMBER	SUBJECT	STATUS	R. L. MITTL TO A. SCHWENCER LETTER DATED
103b6	3.10	Seismic and dynamic qualificat.on of mechanical and electrical equipment	Open	
103c1	3.10	Seismic and dynamic qualification of mechanical and electrical equipment	Open	
103c2	3.10	Seismic and dynamic qualification of mechanical and electrical equipment	Open	
103c3	3.10	Seismic and dynamic qualification of mechanical and electrical equipment	Open	
103c4	3.10	Seismic and dynamic qualification of mechanical and electrical equipment	Open	
104	3.11	Environmental qualification of mechanical and electrical equipment	NRC Action	
105	4.2	Plant-specific mechanical fracturing analysis	Complete	7/18/84
106	4.2	Applicability of seismic andd LOCA loading evaluation	Complete	7/18/84
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	Open	
109b	4.4.7	TMI-2 Item II.F.2	Open	
110a	4.6	Functional design of reactivity control systems	Complete	7/27/84
110b	4.6	Functional design of reactivity control systems	Complete	7/27/84
111a	5.2.4.3	Preservice inspection program (components within reactor pressure boundary)	Complete	6/29/84

ATTACHMENT 1 (Cont'd)

OPEN ITEM	DSER SECTION NUMBER	SUBJECT	STATUS	R. L. MITTL TO A. SCHWENCER LETTER DATED
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	7/27/84
112b	5.2.5	Reactor coolant pressure boundary leakage detection	Complete	7/27/84
112c	5.2.5	Reactor coolant pressure boundary leakage detection	Complete	7/27/84
112d	5.2.5	Reactor coolant pressure boundary leakage detection	Complete	7/27/84
112e	5.2.5	Reactor coolant pressure boundary leakage detection	Complete	7/27/84
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	7/18/84
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	Open	
118	5.3.4	Lead factors and neutron fluence for surveillance capsules	Open	

ATTACHMENT 1 (Cont'd)

OPEN ITEM	DSER SECTION NUMBER	SUBJECT	STATUS	R. L. MITIL TO A. SCHWENCER LETTER DATED
119	6.2	TMI item II.E.4.1	Complete	6/29/84
120a	6.2	TMI Item II.E.4.2	Open	
120b	6.2	TMI Item II.E.4.2	Open	
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
124a	6.2.1.5.1	RPV shield annulus analysis	Complete	6/1/84
124b	6.2.1.5.1	RPV shield annulus analysis	Complete	6/1/84
124c	6.2.1.5.1	RPV shield annulus analysis	Complete	6/1/84
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)	Open	
126b	6.2.1.6	Redundant position indicators for vacuum breakers (and control room alarms)	Open	
127	6.2.1.6	Operability testing of vacuum breakers	Complete	7/18/84
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	6/29/84
131	6.2.3	Administration of secondary containment openings	Complete	7/18/84

ATTACHMENT 1 (Cont'd)

OPEN ITEM	DSER SECTION NUMBER	SUBJECT	STATUS	R. L. MITTL TO A. SCHWENCER LETTER DATED
132	6.2.4	Containment isolation review	Complete	6/15/84
133a	6.2.4.1	Containment purge system	Open	
133b	6.2.4.1	Containment purge system	Open	
133c	6.2.4.1	Containment purge system	Open	
134	6.2.6	Containment leakage testing	Complete	6/15/84
135	6.3.3	LPCS and LPCI injection valve interlocks	Open	
136	6.3.5	Plant-specific LOCA (see Section 15.9.13)	Complete	7/18/84
137a	6.4	Control room habitability	Open	
137b	6.4	Control room habitability	Open	
137c	6.4	Control room habitability	Open	
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	7/27/84
140b	9.1.2	Spent fuel pool storage	Complete	7/27/84
140c	9.1.2	Spent fuel pool storage	Complete	7/27/84
140d	9.1.2	Spent fuel pool storage	Complete	7/27/84
141a	9.1.3	Spent fuel cooling and cleanup system	Complete	8/1/84
141b	9.1.3	Spent fuel cooling and cleanup system	Complete	8/1/84
141c	9.1.3	Spent fuel pool cooling and cleanup system	Complete	8/1/84

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	8/1/84
141e	9.1.3	Spent fuel pool cooling and cleanup system	Complete	8/1/84
141f	9.1.3	Spent fuel pool cooling and cleanup system	Complete	8/1/84
141g	9.1.3	Spent fuel pool cooling and cleanup system	Complete	8/1/84
142a	9.1.4	Light load handling system (related to refueling)	Closed (5/30/84-Aux.Sys.Mtg.)	6/29/84
142b	9.1.4	Light load handling system (related to refueling)	Closed (5/30/84-Aux.Sys.Mtg.)	6/29/84
143a	9.1.5	Overhead heavy load handling	Open	
143b	9.1.5	Overhead heavy load handling	Open	
144a	9.2.1	Station service water system	Open	
144b	9.2.1	Station service water system	Open	
144c	9.2.1	Station service water system	Open	
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
147a	9.3.1	Compressed air systems	Complete	8/1/84
147b	9.3.1	Compressed air systems	Complete	8/1/84

ATTACHMENT 1 (Cont'd)

OPEN ITEM	DSER SECTION NUMBER	SUBJECT	STATUS	R. L. MITTL TO A. SCHWENCER LETTER DATED
147c	9.3.1	Compressed air systems	Complete	8/1/84
147d	9.3.1	Compressed air systems	Complete	8/1/84
148	9.3.2	Post-accident sampling system (II.B.3)	Open	
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	8/1/84
151a	9.4.1	Control structure ventilation system	Complete	7/27/84
151b	9.4.1	Control structure ventilation system	Complete	7/27/84
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	8/1/84 (Rev. 1)
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	
157	9.5.1.4.e	Cable tray protection	Open	
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 detection system	Complete	6/1/84
160	9.5.1.5.b	Fire water pump capacity	Open	

ATTACHMENT 1 (Cont'd)

OPEN ITEM	DSER SECTION NUMBER	SUBJECT	STATUS	R. L. MITTL TO A. SCHWENCER LETTER DATED
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	7/18/84
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
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	Open	

ATTACHMENT 1 (Cont'd)

OPEN ITEM	DSER SECTION NUMBER	SUBJECT	STATUS	R. L. MITTL TO A. SCHWENCER LETTER DATED
176b	14.2	Initial plant test program	Open	
176c	14.2	Initial plant test program	Complete	7/27/84
176d	14.2	Initial plant test program	Complete	7/27/84
176e	14.2	Initial plant test program	Complete	7/27/84
176f	14.2	Initial plant test program	Open	
176g	14.2	Initial plant test program	Open	
176h	14.2	Initial plant test program	Open	
176i	14.2	Initial plant test program	Complete	7/27/84
177	15.1.1	Partial feedwater heating	Complete	7/18/84
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	Open	
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	Open	

ATTACHMENT 1 (Cont'd)

OPEN ITEM	DSER SECTION NUMBER	SUBJECT	STATUS	R. L. MITTL TO A. SCHWENCER LETTER DATED
187	7.2.2.4	Lifting of leads to perform surveillance testing	Open	
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	6/1/84
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)
198	7.3.2.6	TMI Item II.K.3.18-ADS actuation	Open	
199	7.4.2.1	IE Bulletin 79-27-Loss of non-class IE instrumentation and control power system bus during operation	Complete	8/1/84
200	7.4.2.2	Remote shutdown system	Complete	6/1/84
201	7.4.2.3	RCIC/HPCI interactions	Open	
202	7.5.2.1	Level measurement errors as a result of environmental temperature effects on level instrumentation reference leg	Open	

ATTACHMENT 1 (Cont'd)

OPEN ITEM	DSER SECTION NUMBER	SUBJECT	STATUS	R. L. MITTL TO A. SCHWENCER LETTER DATED
203	7.5.2.2	Regulatory Guide 1.97	Open	
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	Open	
208	7.7.2.2	Multiple control system failures	Complete	8/1/84
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	6/1/84
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
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

ATTACHMENT 1 (Cont'd)

OPEN ITEM	DSER SECTION NUMBER	SUBJECT	STATUS	R. L. MITTL TO A. SCHWENCER LETTER DATED
216b	5.3.1	Reactor vessel materials	Complete	7/27/84
217	9.5.1.1	Fire protection organization	Open	
218	9.5.1.1	Fire hazards analysis	Complete	6/1/84
219	9.5.1.2	Fire protection administrative controls	Complete	8/1/84
220	9.5.1.3	Fire brigade and fire brigade training	Complete	8/1/84
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	8/1/84
223	8.2.2.3	Independence of offsite circuits between the switchyard and class IE buses	Complete	8/1/84
224	8.2.2.4	Common failure mode between onsite and offsite power circuits	Complete	8/1/84
225	8.2.3.1	Testability of automatic transfer of power from the normal to preferred power source	Complete	8/1/84
226	8.2.2.5	Grid stability	Complete	8/1/84
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

ATTACHMENT 1 (Cont'd)

OPEN ITEM	DSER SECTION NUMBER	SUBJECT	STATUS	R. L. MITTL TO A. SCHWENCER LETTER DATED
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	8/1/84
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	8/1/84
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	8/1/84
238	8.2.2.7	Sequencing of loads on the offsite power system	Complete	8/1/84
239	8.3.1.8	Testing to verify 80% minimum voltage	Open	
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	Open	
242	8.3.2.1	Compliance with position 1 of Regulatory Guide 1.128	Complete	8/1/84
243	8.3.3.1.3	Protection or qualification of Class 1E equipment from the effects of fire suppression systems	Complete	8/1/84
244	8.3.3.3.1	Analysis and test to demonstrate adequacy of less than specified separation	Complete	8/1/84

ATTACHMENT 1 (Cont'd)

OPEN ITEM	DSER SECTION NUMBER	SUBJECT	STATUS	R. L. MITTL TO A. SCHWENCER LETTER DATED
245	8.3.3.3.2	The use of 18 versus 36 inches of separation between raceways	Complete	8/1/84
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	8/1/84
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
251	8.3.3.5.5	Fault current analysis for all representative penetration circuits	Complete	8/1/84
252	8.3.3.5.6	The use of a single breaker to provide penetration protection	Complete	8/1/84
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	8/1/84
254	8.3.3.1.5	Protection of class 1E power supplies from failure of unqualified class 1E loads	Complete	8/1/84
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	Open	

ATTACHMENT 1 (Cont'd)

OPEN ITEM	DSER SECTION NUMBER	SUBJECT	STATUS	R. L. MITTL TO A. SCHWENCER LETTER DATED
257	8.3.2.5	Justification for a 0 to 13 second load cycle	Complete	8/1/84
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	8/1/84
260	8.3.3.3.5	Use of a single breaker tripped by a LOCA signal used as an isolation device	Complete	8/1/84
261	8.3.3.3.6	Automatic transfer of loads and interconnection between redundant divisions	Complete	8/1/84
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	
TS-10	6.7	MSIV leakage rate		

ATTACHMENT 1 (Cont'd)

OPEN ITEM	DSER SECTION NUMBER	SUBJECT	STATUS	R. L. MITTL TO A. SCHWENCER LETTER DATED
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	

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ATTACHMENT 2 DATE: 8/1/84

DRAFT SER SECTIONS AND DATES PROVIDED

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

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ATTACHMENT 3

OPEN ITEM	DSER SECTION NUMBER	SUBJECT
3a	2.3.3	Upgrading of onsite meteorological measurements program (III.A.2)
3b	2.3.3	Upgrading of onsite meteorological measurements program (III.A.2)
141a	9.1.3	Spent fuel cooling and cleanup system
141b	9.1.3	Spent fuel cooling and cleanup system
141c	9.1.3	Spent fuel pool cooling and cleanup system
141d	9.1.3	Spent fuel pool cooling and cleanup system
141e	9.1.3	Spent fuel pool cooling and cleanup system
141f	9.1.3	Spent fuel pool cooling and cleanup system
141g	9.1.3	Spent fuel pool cooling and cleanup system
147a	9.3.1	Compressed air systems
147b	9.3.1	Compressed air systems
147c	9.3.1	Compressed air systems
147d	9.3.1	Compressed air systems
150	9.3.6	Primary containment instrument gas system
153	9.4.5	Engineered safety features ventilation system

ATTACHMENT 3 CONT'D

OPEN ITEM	DSER SECTION NUMBER	SUBJECT
184	7.2.2.1.e	Failures in reactor vessel level sensing lines
188	7.2.2.5	Setpoint methodology
189	7.2.2.6	Isolation devices
193	7.3.2.1.10	Manual initiation of safety systems
194	7.3.2.2	Standard review plan deviations
195a	7.3.2.3	Freeze-protection/water filled instrument and sampling lines and cabinet temperature control
195b	7.3.2.3	Freeze-protection/water filled instrument and sampling lines and cabinet temperature control
196	7.3.2.4	Sharing of common instrument taps
197	7.3.2.5	Microprocessor, multiplexer and computer systems
199	7.4.2.1	IE Bulletin 79-27-Loss of non-class IE instrumentation and control power system bus during operation
204	7.5.2.3	TMI Item II.F.1 - Accident monitoring
208	7.7.2.2	Multiple control system failures
209	7.7.2.3	Credit for non-safety related systems in Chapter 15 of the FSAR
219	9.5.1.2	Fire protection administrative controls
220	9.5.1.3	Fire brigade and fire brigade training
221	8.2.2.1	Physical separation of offsite transmission lines
222	8.2.2.2	Design provisions for re-establishment of an offsite power source
223	8.2.2.3	Independence of offsite circuits between the switchyard and class IE buses

ATTACHMENT 3 CONT'D

OPEN ITEM	DSER SECTION NUMBER	SUBJECT
224	8.2.2.4	Common failure mode between onsite and offsite power circuits
225	8.2.3.1	Testability of automatic transfer of power from the normal to preferred power source
226	8.2.2.5	Grid stability
227	8.2.2.6	Capacity and capability of offsite circuits
228	8.3.1.1(1)	Voltage drop during transient conditions
229	8.3.1.1(2)	Basis for using bus voltage versus actual connected load voltage in the voltage drop analysis
230	8.3.1.1(3)	Clarification of Table 8.3-11
231	8.3.1.1(4)	Undervoltage trip setpoints
232	8.3.1.1(5)	Load configuration used for the voltage drop analysis
233	8.3.3.4.1	Periodic system testing
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
235	8.3.1.5	Diesel generators load acceptance test
236	8.3.1.6	Compliance with position C.6 of RG 1.9
237	8.3.1.7	Decription of the load sequencer
238	8.2.2.7	Sequencing of loads on the offsite power system
240	8.3.1.9	Compliance with BTP-PSB-2

ATTACHMENT 3 CONT'D

OPEN ITEM	DSER SECTION NUMBER	SUBJECT
242	8.3.2.1	Compliance with position 1 of Regulatory Guide 1.128
243	8.3.3.1.3	Protection or qualification of Class 1E equipment from the effects of fire suppression systems
244	8.3.3.3.1	Analysis and test to demonstrate adequacy of less than specified separation
245	8.3.3.3.2	The use of 18 versus 36 inches of separation between raceways
246	8.3.3.3.3	Specified separation of raceways by analysis and test
247	8.3.3.5.1	Capability of penetrations to withstand long duration short circuits at less than maximum or worst case short circuit
248	8.3.3.5.2	Separation of penetration primary and backup protections
249	8.3.3.5.3	The use of bypassed thermal overload protective devices for penetration protections
250	8.3.3.5.4	Testing of fuses in accordance with R.G. 1.63
251	8.3.3.5.5	Fault current analysis for all representative penetration circuits
252	8.3.3.5.6	The use of a single breaker to provide penetration protection
253	8.3.3.1.4	Commitment to protect all Class 1E equipment from external hazards versus only class 1E equipment in one division
254	8.3.3.1.5	Protection of class 1E power supplies from failure of unqualified class 1E loads
255	8.3.2.2	Battery capacity

ATTACHMENT 3 CONT'D

OPEN ITEM	DSER SECTION NUMBER	SUBJECT
257	8.3.2.5	Justification for a 0 to 13 second load cycle
258	8.3.2.6	Design and qualification of DC system loads to operate between minimum and maximum voltage levels
259	8.3.3.3.4	Use of an inverter as an isolation device
260	8.3.3.3.5	Use of a single breaker tripped by a LOCA signal used as an isolation device
261	8.3.3.3.6	Automatic transfer of loads and interconnection between redundant divisions

ATTACHMENT 3 (cont'd)

OPEN ITEM		DSER SECTION NUMBER	SUBJECT
Question	430.95	9.5.4	-
	430.96	9.5.4	-
	430.100	9.5.5	-
	430.101	9.5.5	-
	430.104	9.5.5	-
	430.112	9.5.5	-
	430.115	9.5.6	-
	430.116	9.5.6	-
	430.117	9.5.6	-
	430.120	9.5.2	-
	430.122	9.5.6	-
	430.125	9.5.7	-
	430.127	9.5.7	-
	430.128	9.5.7	-
	430.131	9.5.7	-
	430.133	9.5.7	-
	430.136	9.5.7, 7.5.5	-
	430.140	9.5.8	-
	430.141	9.5.8	-
	430.142	9.5.8	-
	430.143	9.5.8	-
	430.144	9.5.8	-
	430.148	9.5.8	-
	430.152	10.2	-
	430.164	10.4.1.4	-
	430.166	10.4.4	-
	430.167	10.4.4.4	-

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ATTACHMENT 3 (cont'd)

OPEN ITEM		DSER SECTION NUMBER	SUBJECT
Question	430.61	8.3	-
	430.62	8.3	-
	430.63	8.3	-
	430.64	8.3	-
	430.65	9.5.2	-
	430.66	9.5.2	-
	430.68	9.5.2	-
	430.69	9.5.2	-
	430.70	9.5.3	-
	430.71	9.5.3	-
	430.72	9.5.3	-
	430.73	9.5.3	-
	430.74	9.5.3	-
	430.76	9.5.4	-
	430.78	9.5.4	-
	430.80	9.5.4	-
	430.81	9.5.4	-
	430.82	9.5.4	-
	430.83	3.2	-
	430.86	9.5.4	-
	430.87	9.5.4	-
	430.88	9.5.4	-
	430.90	9.5.4	-
	430.92	9.5.4	-
	430.93	9.5.4	-
	430.94	9.5.4	-

ATTACHMENT 4

Rev 1

DSER Open Item No. 3a&b (Section 2.3.3)

Upgrading of Onsite Meteorological Measurements Program (III.A.2)

To address the meteorological requirements for emergency preparedness planning outlined in 10 CFR 50.47 and Appendix E to 10 CFR 50, the applicant will be required to upgrade the operational meteorological measurements program to meet the criteria in NUREG-0654, Appendix 2, "Criteria for Preparation and Evaluation of Radiological Emergency Response Plans and Preparedness in Support of Nuclear Power Plants." The upgrades must be in accordance with the schedule of NUREG-0737, III.A.2, "Clarification of TMI Action Plan Requirements," or its supplements. The incorporation of current meteorological data into a real-time atmospheric dispersion model for dose assessments will also be considered as part of the upgraded capability.

Response

For the information requested above, see revised Question Response 451.6, FSAR Section 2.3.3.3 and Table 2.3-29a, b and c.

QUESTION 451.6

Section 2.3.2 provides comparisons of meteorological data collected at the Hope Creek site with data collected at the National Weather Service station at Wilmington, Delaware to determine the representativeness of "the key meteorological parameters crucial to the safety, operation, and construction of Hope Creek Generating Station." Additional meteorological data have also been collected on Artificial Island since 1969 in support of construction and operation of the Salem Nuclear Power Plant. These data can also be compared to data for Hope Creek if different meteorological measurements programs are in use for each Nuclear Power Plant.

a) Provide comparisons of annual wind direction frequencies at the 33-ft, 150-ft, and 300-ft for both the Salem and Hope Creek facilities for the available period of record. Include the number of valid observations and the total possible observations for each period of record.

b) Provide comparisons of annual atmospheric stability distributions (Pasquill stability classes A-G) based on the measurement of vertical temperature gradient between the 300-ft and 33-ft levels and between the 150-ft and 33-ft levels for both the Salem and Hope Creek facilities for the available period or record. Include the number of valid observations and the total possible observations for each period of record.

RESPONSE

a) Annual wind direction frequencies at the 33 ft, 150 ft, and 300 ft levels observed during June 1969 to May 1971 (SGS preoperational data) are shown in Table 451.6-1. The 150 ft wind distribution was derived from January 1970 to May 1971 data. Annual wind direction distribution for the same three levels for the period January 1977 to December 1981 are presented in Tables 451.6-2, 451.6-3 and 451.6-4, respectively.

INSERT A

COMPARISONS

33 feet

Highest wind direction frequencies from the period 1969 to 1971 (SGS) compare favorably with those from 1977 to 1981 (HCGS). The site has a bimodal distribution. SGS data shows the highest frequency of wind directions are SE-SSE-S and W-WNW-NW. HCGS data shows the same pattern. Frequencies other than these modes are evenly distributed throughout the compass points. For all individual years, the data recovery rates are above 90 percent.

INSERT A

Data collection for the period of 1969 to 1971 was from a tower located 1400 feet north of the Hope Creek Reactor Building at a latitude of 39 degrees, 28 minutes, 13 seconds north, and a longitude of 75 degrees, 32 minutes, 12 seconds west. This tower was originally located to support preoperational data collection for the Salem Stations. The tower was relocated to the existing location to facilitate the construction of the Hope Creek Station and the cooling tower.

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Monthly and annual joint frequency distributions of wind speed and direction, based on atmospheric stability classes, are referenced in Section 2.3.2.1.1. The 5-year data base containing hourly site meteorological data from January 1977 to December 1981 was used as input in the analysis.

2.3.3.3 Operational Data Display

The meteorological parameters required by Regulatory Guide 1.97 will be incorporated in the data base to be included on the control room integrated display system (CRIDs) computer. The display of those parameters will be available as part of the display function along with all other related Regulatory Guide 1.97 variables.

The radiation monitoring system central radiation processor (CRP) computer will provide 15-minute average meteorological monitoring system parameters. The parameters available for display are 33-ft wind speed and wind direction, 150-ft wind speed and wind direction, 300-ft wind speed and wind direction, delta-temperature stability indicators between 300- and 33-ft and 150- and 33-ft, as well as precipitation, barometric pressure, solar radiation, and ambient temperature at 33 ft.

Atmospheric transport and diffusion during normal operation will be calculated by the CRP. A method for determining atmospheric transport and diffusion throughout the plume exposure emergency planning zone during emergency conditions is being developed.

INSERT B

2.3.4 SHORT-TERM DIFFUSION ESTIMATES

2.3.4.1 Objective

The objective is to provide conservative and realistic short-term estimates of relative concentration (X/Q), at both the site boundary and the outer boundary of the low population zone (LPZ) following a hypothetical release of radioactivity from HCGS. The assessment is based on the results of atmospheric diffusion modeling and onsite meteorological data.

A ground-level accidental radionuclide release from HCGS is analyzed at various distances. Conservative and realistic X/Q values at the exclusion area boundary (EAB) are derived for the

INSERT B

The postoperational data collection program will consist of an enhancement to the preoperational program. The enhancement consists of a primary and backup data acquisition system (DAS) and a communication computer. A diagram of the system configuration is provided in Figure 2.3-6. A list of the system hardware components is tabulated on Table 2.3-29a. There are no changes to the meterological tower, sensors, power supply. strip chart recorders, or translator cards. The rain gauge has been changed from a weighing bucket to a tipping bucket which meets the NRC criteria of measuring .01 inches of precipitation. This change has been incorporated in Table 2.3-29.

The primary and backup DAS are configured with identical hardware. Each DAS consists of a Hewlett-Packard 9826a Computer, 3497A Data Acquisition/Control Unit, and a Dames & Moore transient protection system. Each DAS is provides with two communication ports, one as a link to the communications computer, and the other for direct dial-up capability. Each DAS provides for up to seven days of fifteen minute averages. The primary DAS collects data from the meterological parameters listed in Table 2.3-29. The backup DAS collects wind speed and direction from the the three tower elevations and two delta T's, as well as the backup meterological tower. The data acquisition system calculate a sigma theta for each of the three level wind directions.

The communications computer which consists of a DEC PDP 11/23 computer and RX02 dual disk drive. The communications computer is configured with nine I/O ports. The I/O ports support data transfer/interrogation with the Salem Control Room the Hope Creek Radiation Monitoring System via a meteorological system link (which incorporates a HP9915 computer) as well as three dial up ports. The communication computer also supports a display unit in the the Hope Creek EOF as well as communication to the primary and backup DAS.

System accuracy is presented on Tables 2.3-29b and 2.3-29c.

INSERT B
(CONTINUED)

The postoperational data collection program also includes an additional meterological tower identifies as a backup meterological tower, consisting of a 10 meter telephone poll. The backup tower is located aproximately 500 feet south of the primary meterological monitoring tower. Backup meterological data provides wind speed, wind direction, and a computed sigma theta. Backup meteorological data provides wind speed and wind direction and a computer sigma theta.

The CRP display of meteorological parameters will be provided by "menu" driven access.

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DSER OPEN ITEM 3

TABLE 2.3-29 (cont)

Height Above Tower Base, ft	Sensed Parameter	Recorded Parameter	Instrument and Characteristic	Strip Recorders
33	Wind speed	Wind speed	Climet - Model 011, 3 cup anemometer. Threshold 0.6 mph, distance constant <5 ft, operating range 0 to 110 mph, accuracy ±1% or 0.15 mph, whichever is greater	Esterline - Angus Model L825
	Wind direction	Wind direction	Climet - Model 012-10 wind vane. Threshold 0.75 mph, distance constant <3.3 ft, damping ratio 0.4	Esterline - Angus Model L825
	Temperature-differential $T_{300}-T_{33}$ (1) $T_{150}-T_{33}$ (2)			
	Dew point	Dew point	EG&G Model SM 110 accuracy ±0.5°F	Westronics M11E
	Temperature-ambient	Temperature	Climet - Model 016-1 Motor-aspirated temperature shield with Climet 015-3 thermistor accuracy ±0.15°C	Leeds & Northrup Speedomax Multi-Point
6	Barometric pressure	Barometric pressure	Climet - Model 014-90 pressure transducer. Range 28-32 in. Hg	Esterline - Angus Model A
3	Rainfall	Rainfall	~~Model 0501 weighing rain gage~~ MRI MODEL 302 TIPPING BUCKET ACCURACY 0.01 INCHES	Esterline - Angus Model A

(1) Temperature taken as part of temperature differential measurement $T_{300} - T_{33}$.
(2) Temperature taken as part of temperature differential measurement $T_{150} - T_{33}$.
(3) Paired Climet 015-3 thermistor. Accuracy ±0.1°C.

DSER OPEN ITEM 3

TABLE 2.3-29a

DATA ACQUISITION SYSTEM HARDWARE

MANUFACTURER	MODEL	QUALITY	DESCRIPTION
Hewlett Packard	9826A	2	Computer
Hewlett Packard	98256A	2	256K-Byte Memory Expansion
Hewlett Packard	98626A	4	Serial Ports
Hewlett Packard	3497	2	Data Acquisition/ Control Unit
Hewlett Packard	44421A	2	20-Channel Analog Multiplexor
Hewlett Packard	44425A	2	16-Bit Status Input
Dames & Moore	--	2	Transient Protection Modules (analog, status, voltage reference)
Hewlett Packard	9915	1	Computer
DEC	11/23	1	Computer
DEC	RX02	1	Disk Drive
DEC	VT 103BA	1	CRT
DEC		1	Serial Ports
Bell	212A	5	Modem (1)
Bell	202T	6	Modem (1)

(1) Or equivalent modem

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TABLE 2.3-29b

SYSTEM MEASUREMENT ERROR

COMPONENT ERROR	WIND SPEED (10MPH)	WIND SPEED (30 MPH)	WIND SPEED (100 MPH)	WIND DIRECTION (DEGREES)	DELTA TEMPERATURE (300-33) (DEGREES CELSIUS)	DELTA TEMPERATURE (150-33) (DEGREES CELSIUS)	TEMPERATURE (DEGREES CELSIUS)	DEWPOINT (DEGREES CELSIUS)	PRECIPITATION (INCHES)
Sensor	± 0.15	± .30	± 1.00	± 3	± 0.10	± 0.10	± 0.10	± 0.5	.01
Translator	± 0.21	± 0.21	± 0.21	0	-	-	-	0.022	-
DVM	± 0.0035	± 0.0065	± 0.017	± 0.092	± 0.0026	± 0.0026	± 0.013	-	-
Software	0	0	0	0.00	0	0	0	0	-
Other	-	-	-	-	-	-	-	-	-
Total Maximum Error	0.3635	0.5165	1.227	± 3.092	± 0.1026	± 0.1026	± 0.113	± 0.522	.01
Root Sum Square Error	0.21	0.37	1.02	3.00	± 0.103	± 0.103	± 0.101	± 0.50	.01
R.G. 1.23 Specification	0.5	0.5	-	5.0	± 0.15	± 0.15	± 0.5	± 1.5	.01

(1) Instrumentation type and specification provided on Table 2.3-29 and 2.3-29a.

(2) The instantaneous error for wind speed measurements, assuming the individual component errors are additive and independent (root sum square error), is within the R.G. 1.23 specifications for all wind speeds less than 45 mph. The error of time averaged wind speeds will be less than the instantaneous root sum square error (this statement is applicable for all other parameters in this discussion). Therefore, for wind speeds considered to be most critical for dispersion calculations, the estimated error is well within the R.G. 1.23 specification.

RFY:gs
M P84 80/11 1-gs

Table 3.3 - 29c

ARTIFICIAL ISLAND DIGITAL DATA ACQUISITION SYSTEM ACCURACIES

The following system accuracies are based upon VENDOR accuracy specifications and the following conditions:

- 1 year calibration interval
- 5-1/2 digits displayed on DVM
- Auto Zero ON

VOLTMETER ACCURACY

RANGE (V)	ERROR PERCENT OF READING	PLUS RESOLUTION ERROR (MV)
.119999	.015	.003
1.19999	.015	.02
11.9999	.015	.1

PARAMETER ERROR

PARAMETER	DVM RANGE	DAS INPUT VOLTAGE	DAS INPUT ENGINEERING UNITS	ERROR CALCULATION POINT	MAXIMUM[a] DAS ERROR
Temperature	1.19999V	0-1.0V	-30-+45°C	45°C	0.013°C
Delta-Temperature	1.19999V	0-1.0V	-5-+10°C	10°C	0.0026°C
Dew Point	11.9999V	0-5.0	-40-+100°F	100°F	0.022°F
Wind Speed	1.19999V	0-1.0V	0-100 mph	50 mph	0.0095 mph
Wind Speed	1.19999V	0-1.0V	0-100 mph	10 mph	0.0035 mph
Wind Speed	1.19999V	0-1.0V	0-100 mph	30 mph	0.0065 mph
Wind Direction	1.19999V	0-1.0V	0-540°	540°	0.092°
Precipitation	1.19999V	0-1.0V	0-1"	-	0.00"[b]
Pressure	1.19999V	0-1.0V	28-32"Hg	32Hg	0.00068"Hg
Solar Radiation	1.19999V	0-1.0V	0-2Ly/min	2Ly/min	0.00034Ly/min

[a] The data acquisition system error is due entirely to HP-3497A instrument error. Software calculations are computed to 12 significant digits. Therefore, software error is negligible.

[b] Precipitation is calculated using a step-function conversion technique with sufficient noise margin that an error of 0.00" is achievable over an entire calibration period interval.

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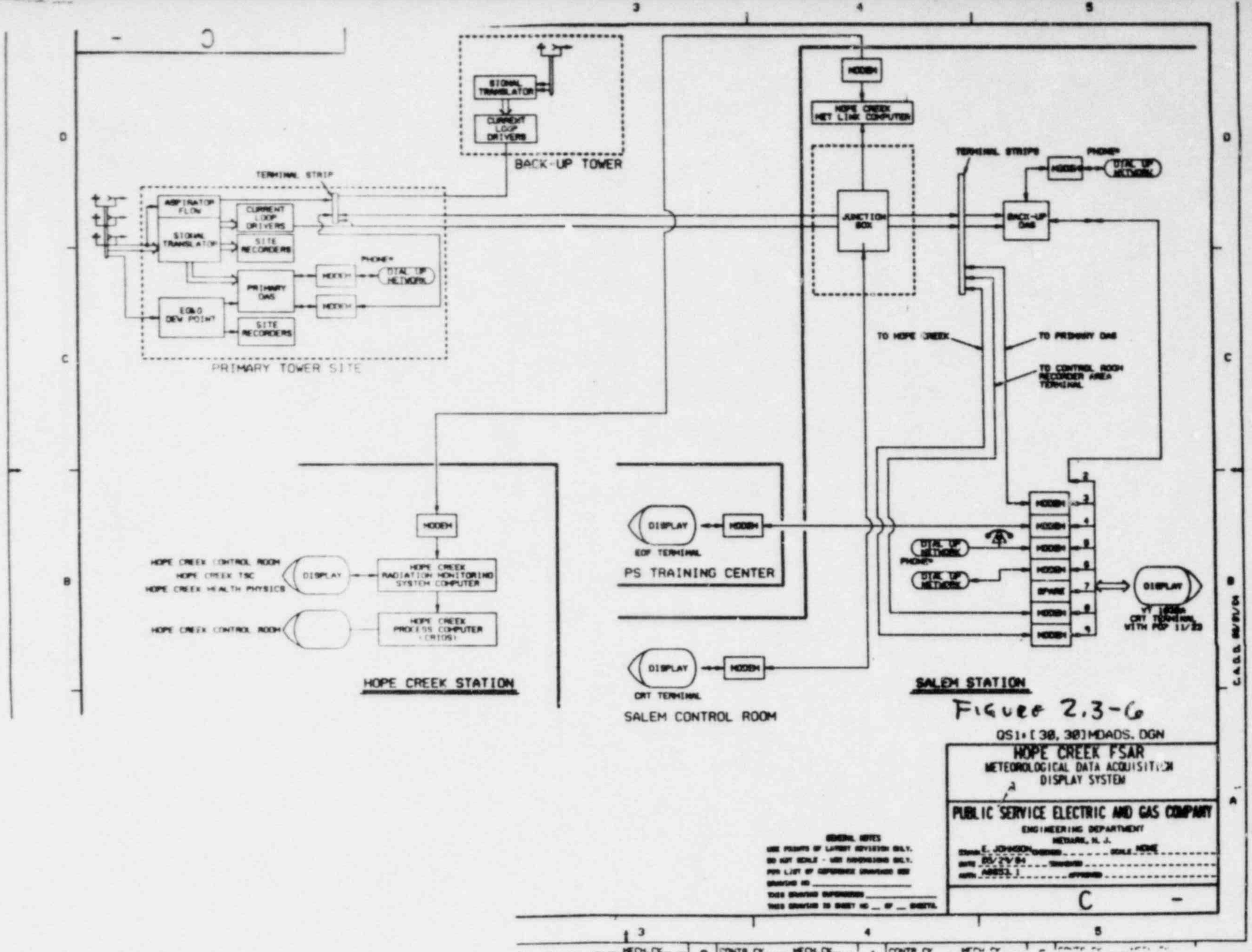

New Figure

DSER Open Item No. 141 (DSER Section 9.1.3)

SPENT FUEL POOL COOLING AND CLEANUP SYSTEM

The applicant has not provided a discussion of the means to provide cooling to the spent fuel pool after a safe shutdown earthquake which fails the non-seismic Category I skimmer tanks in such a manner as to plug the tank drains. Therefore, we cannot conclude that this design satisfies the requirements of General Design Criterion 2, "Design Bases for Protection Against Natural Phenomena," and the guidelines of Regulatory Guides 1.13, "Spent Fuel Storage Facility Design Basis," Positions C.1, C.7 and C.8, and 1.29, "Seismic Design Classification," Positions C.1 and C.2.

The applicant has not adequately addressed the concern of high- and moderate-energy piping system failures and the means to protect these systems (refer to Section 3.6.1 of this SER.) Thus, we cannot conclude that the requirements of General Design Criterion 4, "Environmental and Missile Design Bases," and the guidelines of Regulatory Guide 1.13, Positions C.2, are satisfied.

The system is accessible for routine visual inspection of the system components. Both fuel pool cooling pumps are required to operate at all times to remove the maximum normal heat load. Thus, the cooling system does not meet the single failure criterion. The applicant has not committed to include the portions of the cooling and cleanup systems which are not normally operating in the inservice inspection and periodic functional testing programs as described in Sections 6.6 and 3.6.6 of the SRP. The applicant has not specified the frequency of the testing. Thus, the requirements of General Design Criterion 45, "Inspection of Cooling Water Systems," and 46, "Testing of Cooling Water Systems," are not satisfied.

The spent fuel pool cooling system will maintain the fuel pool water temperature at 135°F, with a heat load of 16.0 MBtu/hour based on decay heat generation from 3,668 fuel bundles (maximum storage) and both cooling trains in operation. This is the normal discharge from 15 fuel cycles. The spent fuel pool cooling system consists of two pumps with a common suction line and a common discharge line, which feeds two heat exchangers with a common inlet line and a common outlet line. Each pump and each heat exchanger have a manual isolation valve on the inlet and manual isolation valve on the outlet; thus, each component can be independently isolated. If one pump or one pump and heat exchanger were not available under these conditions, the pool temperature would exceed the 140°F specified in the Standard Review Plan. The pool cooling must maintain a pool temperature of less than 140°F with any single active failure.

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it can be concluded that the systems design meets the requirements of GDC No. 4, "Environmental and Missile Design Bases", and the guidelines of Regulatory Guide 1.13, Position C.2. For discussion on moderate energy leakage in the common spent fuel pool cooling pump discharge line, see response to Question 410.48.

The spent fuel cooling system does not perform a specific function in shutting down the reactor or in mitigating the consequences of an accident; therefore, does not meet the criteria for being included in ASME B&PV Code Section XI testing requirements.

As discussed below, there is no single active failure within the FPCC system which will result in the loss of a FPCC heat exchanger. However, two system configurations (one FPCC Pump and two FPCC heat exchangers and one FPCC pump and one FPCC heat exchanger) have been evaluated as requested. The results are provided in Table 141-1.

The evaluation indicates that in the event of a single active failure of one FPCC pump, the spent fuel pool temperature could reach 152°F, which exceeds the SRP 9.1.3 limit of 140°F. It is conservatively estimated that the fuel pool temperature could exceed 140°F for 26 days under these conditions. This is based on worst-case assumptions. A maximum SACS water temperature of 95°F is assumed. In addition, a maximum accumulation of spent fuel is assumed stored in the fuel pool, i.e., 16 consecutive refuelings at 18 month intervals, to fill the high density racks to their maximum capacity of 4084 spent fuel assemblies (which exceeds the SRP 9.1.3 requirements). It is also assumed that the last 1/3 core is placed in the spent fuel pool as quickly as practical after shutdown, i.e. 8 days. This is slightly longer than the 150 hours recommended by SRP 9.1.3 and is based on the BWR servicing and refueling improvement program - Phase 1 Summary Report prepared by GE (NEDG-21860).

Review of Figure 9.1-5, Sheet 1 of 2, confirms that there is no single active failure mechanism within the FPCC system which will render one heat exchanger unavailable (e.g., inadvertent valve actuation.). In addition, preventive maintenance on the FPCC heat exchangers can be scheduled prior to the refueling outage to ensure the availability of both heat exchangers to remove the calculated maximum normal heat load. The plate type

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heat exchanger is a low maintenance component with long life gaskets that are expected to be replaced about every 5 years. In addition, the manufacturer has performed a reliability and maintainability analysis on the plate-type heat exchangers which indicates that failures are extremely unlikely. Therefore, failure of one FPCC heat exchanger is not considered to be a credible event. Table 141-1 also provides the maximum pool heatup rate for these postulated events. The time to reach the maximum temperature is conservatively based on a constant heatup rate.

A single active failure of one of the SACS cooling loop inlet valves to the FPCC system heat exchangers has also been evaluated. This could render the FPCC system heat exchangers unavailable for a short period of time. However, the fuel pool cooling is re-established in a short period of time by either manually re-opening the affected valve or providing cooling from the standby SACS loop. It is anticipated that the fuel pool heat-up rate during this short period will not cause the fuel pool temperature to exceed 140°F.

During normal operation, the offsite doses from the fuel pool are negligible. Elevating the fuel pool temperature to 152°F or 174°F would result in a slight increase in the evaporation rate. This slight increase would result in a slight increase in the offsite doses, however, the doses would still be negligible and well below the 10CFR20 limits.

Elevated pool temperature will not significantly affect the performance of the fuel pool filter demineralizer. The only adverse factor is a slightly reduced capacity for ion exchange. Up to 175°F, approximately a 10% reduction in run length of the demineralization cycle is expected with no change in the filter capacity.

The response to Question 410.46 has been revised to address the failure of one FPCC pump. As stated in Section 9.1.3.1.j, normal makeup capability is provided to makeup evaporation losses and to ensure that fuel pool cooling is maintained.

FSAR Figure 9.1-5, Sheet 1 of 2, identifies the full flow by-pass lines around the non safety-related filter-demineralizer system (10"-HBC-062, 6"-HBC-062, 6"-HCC-015). This mode of operation is discussed in Section 9.1.3.2.3, and meets the requirements of General Design Criterion 44, "Cooling Water".

FSAR Section 9.1.3.2.2.4 has been revised to provide the requested information on spent fuel pool sampling.

TABLE 141-1

Single Active Failure Analysis for FPCC System

Description of Parameter	System Configuration	
	1 FPCC Pump and 2 HX	1 FPCC Pump and 1 HX
1. Normal Max. heat load	16.1×10^6 BTU/hr	16.1×10^6 BTU/hr
2. Cooling Water (SACS) Temperature	95°F	95°F
3. Maximum Fuel Pool Temperature	152°F	174°F
4. Heat-up Rate	1.02°F/hr	2.26°F/hr
5. Evaporation Rate	2.13 gpm	5.99 gpm
6. Time to reach the Maximum Temperature assuming the Fuel Pool Temperature at 135°F.	16.7 hrs	17.3 hrs

b. The FPCC system cooling loop (consisting of skimmers, surge tanks, fuel pool cooling pumps, fuel pool heat exchangers, and interconnecting loop piping) and the emergency fuel pool water makeup piping are designed to meet Seismic Category I requirements, except for the surge tanks. The surge tanks are of non-Seismic Category I design, but are embedded in a Seismic Category I concrete structure that provides the pressure boundary for this part of the FPCC system cooling loop. The FPCC system purification loop, consisting of the filter-demineralizers, their interconnecting piping, and associated equipment, is non-Seismic Category I.

c. The FPCC system is designed to handle the decay heat released by all anticipated combinations of spent fuel that could be stored in the fuel pool. The pool water temperature is maintained at a maximum of 135°F under
16.1 the design load of ~~16.0~~ x 10^6 Btu/h. This heat load is
16 based on ~~15~~ consecutive refuelings with one-third of the core removed during each refueling, and on a refueling frequency of 18 months.

d. The FPCC system is designed to permit the residual heat removal (RHR) system to be operated in parallel with the FPCC system through a crosstie, to remove the maximum heat load and to maintain the bulk water temperature in the spent fuel pool at or below 150°F, with a maximum anticipated heat load of
34.2 ~~31.0~~ x 10^6 Btu/h. This is based on one full core load of fuel at the end of a fuel cycle, plus the decay heat of the spent fuel discharged at the ~~two~~ thirteen previous refuelings.

e. The FPCC system is designed with additional capability to provide a source of makeup water to ensure against loss of fuel pool cooling, in compliance with Regulatory Guide 1.13.

f. The FPCC system is designed to monitor fuel pool water level and potential leakage paths and maintain a sufficient level above the spent fuel elements to provide radiation shielding for normal building occupancy.

9.1.3.2.2.2 Fuel Pool Cooling Pumps

Two single-stage, horizontal, motor-driven, centrifugal, half-capacity recirculation pumps circulate water through the FPCC system. The pumps are piped in parallel and take suction from the skimmer surge tanks through a common header. The pump motors, pump control circuits, and power supplies are Class 1E. Each pump is provided with controls for starting and stopping the motor as follows: For normal and accident operation, the primary control in the MCR is used. If it is necessary to start or stop either pump when the MCR is inaccessible, the control in the remote shutdown panel (RSP) is used. Each pump is automatically stopped by skimmer surge tank low-low level, low suction pressure, or low discharge flow.

9.1.3.2.2.3 Fuel Pool Heat Exchangers

Two half-capacity, plate-type heat exchangers are provided for the FPCC system. They are designed to transfer the system design 16.1 heat load of ~~16.0~~x10^6 Btu/h from 135°F pool water, flowing at the system design flow rate of 1400 gpm, to the safety auxiliaries cooling system (SACS) at its maximum temperature of 95°F.

The heat exchangers are arranged in parallel. Fuel pool heat exchanger inlet and outlet temperatures are monitored and recorded by the control room integrated display system (CRIDS).

9.1.3.2.2.4 Fuel Pool Filter-Demineralizer System

The cleanup loop of the FPCC system includes a filter-demineralizer system located in the auxiliary building. The filter-demineralizer system consists of two vessels, located separately in shielded cells, and two holding pumps. One of the vessels, including its holding pump, normally serves as a spare. The holding pumps and the equipment common to the two vessels, including the resin tank with agitator, dust evacuator, and resin eductor, and the associated piping, valves, and instrumentation, are located in a separate room adjacent to the vessel cells.

The filter-demineralizer system also services the torus water cleanup system for the purification of suppression pool water.

The stainless steel filter-demineralizer vessels are of the pressure precoat type. A tube nest assembly consisting of the tube sheet, clamping plate, filter elements, and support grid is inserted as a unit between the flanges of the vessel. The filter elements are stainless steel and are mounted vertically in the vessel. Air scour connections are provided below the tube sheet, and vents are provided in the upper head of each vessel. The filter elements are installed and removed through the top of each vessel. The holding elements are designed to be coated with powdered ion exchange resin as the filtering medium.

The fuel pool filter-demineralizers maintain the following effluent water quality specifications:

Specific conductivity at 25°C, micromho/cm	≤0.1
pH at 25°C	6.0 to 7.5
Heavy elements (Fe, Hg, Cu, Ni), ppm	0.05
Silica (as SiO_2), ppm	<0.05
Chloride (as Cl-), ppm	<0.02
Total insolubles, ppm	90% removal to a minimum of 0.01 ppm

insert A →

The filter-demineralizers are designed to be backwashed periodically with water to remove resin and accumulated sludge from the holding elements. Service air pressure loosens the material from the holding elements and the backwash slurry drains through the gravity drainline to the waste sludge phase separator in the solid waste management system.

The resin tank provides adequate volume for one precoating of one filter demineralizer vessel.

The resin eductor transfers the precoat mixture of resin to the holding pump suction line at a flow rate of 4 gpm.

The holding pumps are designed to recirculate a uniform mixture of resin through the filter-demineralizer vessel being precoated at a flow rate of 1.5 gpm/ft² of filter element surface area, and to automatically start and maintain the precoat material on the filter elements when the system flow rate falls below the value necessary to keep the precoat on the elements.

Insert A

The influent and effluent water of the FPCC system is continuously monitored by on line PH and conductivity instrumentation. In addition, grab samples of the influent H_2O will be analyzed once per week for chloride and for gamma isotopic and once per month for heavy metals (Fe, Cu, Hg, Ni). Grab samples of effluent water will be analyzed weekly for chloride, silica, suspended solids, tritium and for gamma isotopes.

Decontamination factors (df) of greater than 10 are expected for any chloride present and greater than 5 for isotopes of Iodine and Cobalt. Resin bed(s) will be ~~regenerated and/or~~ replaced when these dfs are not achieved.

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Insert A

The influent and effluent water of the Spent Fuel Pool Demineralizer is continuously monitored by on-line pH and conductivity instrumentation. In addition grab samples of the influent water will be analyzed 1/week for Cl and for gamma isotopic and 1/month for heavy metals, and the effluent water will be analyzed weekly for Cl, SiO_2, suspended solids, H-3 and for gamma isotopic, when the cleanup system is in operation.

Decontamination factors (df) of > 10 are expected for any Cl present and > 5 for isotopes of I and Co. Resin beds will be regenerated and/or replaced when these df's are not achieved.

INSERT B →

The pressure drop across the Demineralizer is continously monitored and when the DP increases to a predetermined level the ion exchange media will be replaced. Typically this level is 30 PSID.

Insert B

The Spent Fuel Pool Demineralizer will be operated as required to maintain radiation levels on the refueling platform less than 2 mrem/hr.

Figure 9.2-13 shows the refueling water transfer pumps. Manual valves are aligned to establish the fill flow path, and the pumps are manually started. Provision is made to permit filling the cask pool or the reactor well independently.

A or B

After refueling or spent fuel shipping activities are completed, either the reactor well and the dryer and separator storage pool, or the cask pool are drained via gravity drain lines to the refueling water transfer pumps' suction header from which the water is pumped through the ~~spare~~ condensate demineralizer and back to the CST. Alternately, the reactor well, dryer and separator storage pool, and cask pool can be drained via gravity drain lines to the fuel pool pumps' suction header from which the water is pumped through the fuel pool filter-demineralizers and back to the CST. During refueling operations, a portion of the cooling system flow is diverted from the fuel pool return line to the reactor well via the reactor well diffusers. The recirculation pattern established by the diverted flow allows the heated water that rises above the reactor core to be cooled in the fuel pool heat exchangers. This supplements the parallel RHR system (operating in the shutdown cooling mode) decay heat removal from the core region. When the shipping cask contains spent fuel and is in the cask pool, a portion of the FPCC system flow is diverted from the fuel pool diffusers to the cask pool via the cask pool diffuser. When the RHR system is operated in parallel with the FPCC system to provide fuel pool cooling during the full core unload case, one RHR pump takes the suction from the skimmer surge tanks, circulates the water through one RHR heat exchanger, and returns it to the spent fuel pool via the two RHR intertie return diffusers.

The cask pool is filled via the refueling fill line and drained through a condensate demineralizer or the fuel pool filter-demineralizers in the same manner as the refueling volume is filled and drained. Filling of the cask pool is normally done prior to spent fuel loading into the cask, and draining is normally accomplished after cask loading.

The FPCC system design heat load is 16.0 x 10^6 Btu/h. This is the decay heat expected from ~~15~~ 16 consecutive refuelings ~~rounded upward to the nearest million Btu/h~~. The FPCC system's maximum heat load is ~~31.0~~ 34.2 x 10^6 Btu/h. This is the decay heat expected if it becomes necessary to unload the entire core from the reactor and store it in the pool, which already contains spent fuel from ~~two~~ thirteen previous refuelings. For this core unload design condition, an RHR heat exchanger is operated in parallel with the FPCC system. The RHR system is only interconnected when the reactor is shut down, and larger-than-normal batches of spent fuel, such draining the suppression pool if it is ever necessary. In this mode of operation, the torus water cleanup pump takes suction from the torus and circulates the water through a fuel pool filter-demineralizer and to the CST. Operator action is necessary to terminate torus water cleanup operation, except on low pump suction flow.

9.1.3.3 Safety Evaluation

The FPCC system cooling loop (skimmers, skimmer surge tanks, fuel pool cooling pumps, fuel pool heat exchangers, interconnecting loop piping), and the emergency fuel pool water makeup system are designed to the requirements of Seismic Category I, except for the surge tanks. The surge tanks are of non-Seismic Category I design, but are embedded in a Seismic Category I concrete structure that provides the pressure boundary for this part of the FPCC system cooling loop. The interconnecting piping between RHR and the FPCC system is designed to Seismic Category I requirements. insert 1

The cooling water return lines to the spent fuel pool, associated with both the FPCC and the RHR systems, penetrate the walls of the spent fuel pool horizontally above the normal pool water level. Each of these cooling water return lines is provided with two vacuum breakers to prevent the water from being siphoned out of the pool. No piping connections are made to the pool below the normal water level to prevent any accidental lowering of the water level. Therefore, there is no operator error or FPCC system malfunction that could result in draining the spent fuel pool and uncovering the stored spent fuel. The fuel pool structures are also designed to Seismic Category I requirements. If a line break occurs in the non-Seismic Category I purification loop, the remotely operated purification loop isolation valves close automatically on surge tank low-low level or by operator action.

Any leakage between the fuel pool gates, cask pool gates, or through the vessel to drywell seal or drywell to reactor well seal is alarmed in the MCR. A segmented leak channel system behind the liner weld seams is provided to detect fuel pool, cask pool, reactor well, and dryer and separator pool leakage.

The torus water cleanup system suction and return piping from the torus, out through and including the primary containment isolation valves on each line, is designed to Seismic Category I requirements. The torus water cleanup system piping to and from

Insert 1

during construction

The surge tanks were designed to withstand an external loading of 690 lb/ft^2 during construction. The actual concrete loading (approximately 300 lb/ft^2) was lower than the design value due to the use of a slower pour rate. This external loading induced a stress level less than one half of the design stress level in the tank shell.

An analysis has been performed to determine the effect of seismic loads on the skimmer surge tanks. This analysis indicates that the induced stresses resulting from the seismic loads are insignificant (approximately 1% of the stresses due to concrete placement) and that the skimmer surge tanks will not fail in such a manner as to plug the tank drains.

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The combined use of the techniques mentioned allows an accurate assessment of the SFPFD and permits the determination of when a specific unit should be changed.

Reactor well water level is monitored in the CRIDS, and an annunciator alarm is provided in the MCR to indicate a low reactor well water level during refueling. An interlock trips the refueling water transfer pumps on low reactor well level when the well is draining back to the CST after fuel transfer.

The torus water cleanup pump is started and stopped from the FPCC filter-demineralizer panel and the pump is stopped automatically by low suction flow. Low suction flow is alarmed on the FPCC filter-demineralizer panel. A pressure indicator is located in the pump discharge line.

9.1.3.6 SRP Rule Review

Acceptance Criterion II.1.d.(4) of SRP 9.1.3 limits the water temperature in the fuel pool to 140°F at the maximum heat load with the normal cooling system operating in a single active failure condition.

Insert B

The bulk water temperature in the fuel pool ~~may exceed 140°F with only one heat exchanger in service after the first refueling cycle.~~ However, the RHR system can be manually aligned to provide supplemental cooling in order to avoid bulk water temperatures in excess of 140°F.

9.1.4 FUEL HANDLING SYSTEM

9.1.4.1 Design Bases

The fuel handling system is designed to provide a safe and effective means for transporting and handling fuel from the time it reaches the plant until the time it leaves the plant after post-irradiation cooling. Safe handling of fuel includes design considerations for maintaining occupational radiation exposures as low as reasonably achievable (ALARA) during transportation and handling.

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INSERT #B Section 9.1.3.6

... could reach 152°F for the worst case single active
failure of one FPCC pump with the maximum
16.1 normal heat load of ~~16.0~~ $\times 10^6$ Btu/hr. The
radiological consequences of the fuel pool temper-
ature reaching 152°F have been evaluated.
The resultant doses will not exceed 10CFR20
limits at the site boundary.

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TABLE 9.1-2

FUEL POOL COOLING AND CLEANUP SYSTEM HEAT REMOVAL CAPACITY AND MAKEUP REQUIREMENTS

Parameter	Value at Normal Heat Load	Value at Maximum Heat Load
Quantity of fuel	1/3 of core: 4-1/2 yr irradiation time 8 days decay time	1/3 of core: 4-1/2 yr irradiation time 10 days decay time
	1/3 of core: 4-1/2 yr irradiation time 556 days decay time	1/3 of core: 3 yr irradiation time 10 days decay time
	1/3 of core: 4-1/2 yr irradiation time 1104 days decay time	1/3 of core: 1-1/2 yr irradiation time 10 days decay time
	1/3 of core: 4-1/2 yr irradiation time 1652 days decay time	1/3 of core: 4-1/2 yr irradiation time 558 days decay time
	1/3 of core: 4-1/2 yr irradiation time 2200 days decay time	1/3 of core: 4-1/2 yr irradiation time 1105 days decay time
	1/3 of core: 4-1/2 yr irradiation time 2748 days decay time	1/3 of core: 4-1/2 yr irradiation time 1652 days decay time
	1/3 of core: 4-1/2 yr irradiation time 3296 days decay time	1/3 of core: 4-1/2 yr irradiation time 2200 days decay time
	1/3 of core: 4-1/2 yr irradiation time 3844 days decay time	1/3 of core: 4-1/2 yr irradiation time 2748 days decay time
	1/3 of core: 4-1/2 yr irradiation time 4392 days decay time	1/3 of core: 4-1/2 yr irradiation time 3296 days decay time
	1/3 of core: 4-1/2 yr irradiation time 4940 days decay time	1/3 of core: 4-1/2 yr irradiation time 3844 days decay time
	1/3 of core: 4-1/2 yr irradiation time 5488 days decay time	1/3 of core: 4-1/2 yr irradiation time 4392 days decay time
	1/3 of core: 4-1/2 yr irradiation time 6036 days decay time	1/3 of core: 4-1/2 yr irradiation time 4940 days decay time
	1/3 of core: 4-1/2 yr irradiation time 6584 days decay time	1/3 of core: 4-1/2 yr irradiation time 5488 days decay time
	1/3 of core: 4-1/2 yr irradiation time 7132 days decay time	1/3 of core: 4-1/2 yr irradiation time 6036 days decay time
	1/3 of core: 4-1/2 yr irradiation time 7680 days decay time	1/3 of core: 4-1/2 yr irradiation time 6584 days decay time
	1/3 of core: 4-1/2 yr irradiation time 8228 days decay time	1/3 of core: 4-1/2 yr irradiation time 7132 days decay time
		1/3 of core: 4-1/2 yr irradiation time 7680 days decay time
		1/3 of core: 4-1/2 yr irradiation time 8228 decay time
Normal design heat load	16.1 ~~20~~ x 10^6 Btu/h	
Number of pumps required	2	
Number of heat exchangers required	2	RHR system
Maximum design heat load		~~34.0~~ 54.2 x 10^6 Btu/h
Water makeup requirements due to evaporation losses:		
Makeup during normal operation	2 gpm	
Makeup rate for refueling	5 gpm	

TABLE 9.1-18

DECAY HEAT AND EVAPORATION RATES FOR LOSS OF SPENT FUEL POOL COOLING

Description of the event		Normal heat load in the spent fuel pool (16.1×10^6 BTU/hr)	Maximum heat load in the spent fuel pool (~~31.~~ 34.2 $\times 10^6$ BTU/hr) (4)
A	Time to reach 212°F	17.2 hrs(5)	~~8.9~~ 8.03 hrs
B	Evaporation rate	34.4 gpm	~~66.7~~ 73.5 gpm
C	Time required to initiate makeup water	2 hrs(1) 1/2 hr(2) 20 hrs(3)	~~1/2 hr(4)~~ 2 hrs (1) ½ hr (2)

Notes:

(1) An estimated time of 2 hrs would be required to couple the fire hose fill connections to the Seismic Category I SSWS loops to provide fresh water makeup to the fuel pool.

(2) It has been conservatively estimated that the SSWS can be initiated within 1/2 hr by operator action in the MCR to provide makeup to the fuel pool.

(3) It has been conservatively estimated that after 20 hrs one RHR pump loop and the associated heat exchanger can be used for fuel pool cooling. ~~RHR cooling can be initiated from the MCR.~~

(4) Since the entire core is in the fuel pool, the RHR system can be made availabe ~~within approximately 1/2 hr~~ for fuel pool cooling. ~~by operator action in the MCR.~~

(5) This assumes a normal maximum heat load after ~~15~~ 16 consecutive refuelings.

DSER OPEN ITEM 141

QUESTION 410.46 (SECTION 9.1.3)

Verify that the normal heat load after refueling can be removed by using one spent fuel pool cooling system pump and both heat exchangers. With this system configuration, verify that the pool water temperature will remain less than 140°F and specify the length of time that that (SIC) second heat exchanger is required. If this cannot be verified, justify this deviation from the Standard Review Plan.

RESPONSE

The fuel pool temperature could ~~exceed 140°F~~ reach 152°F with normal maximum heat load in the fuel pool, one spent fuel pool cooling pump and both heat exchangers operating for fuel pool cooling. Insert C

With the above system configuration it has been conservatively estimated that after 90 days the fuel pool heat load will be such that only one fuel pool heat exchanger is required for fuel pool cooling.

Insert C.
Section 9.1.3.6 has been revised to reflect the above and to address the radiological consequences of a pool temperature of 152°F

DSER OPEN ITEM 141

QUESTION 410.55 (SECTION 9.1.3)

Provide a discussion of the means to provide cooling to the spent fuel pool after a safe shutdown earthquake which fails the skimmer surge tanks and plugs the tank drains. The results will be the loss of the spent fuel pool cooling system pumps due to cavitation from an isolated suction line, loss of offsite power from the earthquake, and the unavailability of the RHR system from the loss of the common suction with the spent fuel pool cooling pumps. The worst single active failure should be considered as part of the discussion. If the pool is allowed to boil, then consideration must be given to the time required to clear the skimmer tank drains as compared to the minimum time required to achieve boiling; the continued reduction in worker efficiency as the ambient air temperature, humidity, and radioactivity increases; and the time required to bring the reactor to cold shutdown and thereby have an RHR cooling loop available to cool the pool.

RESPONSE

Consideration of multiple failures of non-Seismic Category I components following a safe shutdown earthquake is beyond the design basis for HCGS. In particular, the postulated failure of both skimmer surge tanks is not considered credible because these "tanks" are, in fact, steel-lined voids in the Seismic Category I spent fuel pool wall.

Section 9.1.3.2 discusses the backup sources of makeup water available to supply the pool in the event normal cooling is lost and RHR cooling is not available.

section 9.1.3.3 has been revised to respond to this question.

DSER Open Item No. 147~~a, b, c, d~~ e (DSER Section 9.3.1)

COMPRESSED AIR SYSTEMS

The service air system consists of two 100 percent capacity trains of compressors, aftercoolers, moisture separators, receivers, and associated piping and valves. Cooling is provided by the turbine auxiliary cooling system. One compressor runs automatically with the other compressor on standby. The standby compressor starts automatically on failure of the first system or failure of the first system to meet the demand for compressed air. This system maintains a constand pressure in the instrument air system. [The applicant has not provided an FSAR figure which identifies each air user, the location of each user, and all accumulators, check valves, and other appurtenances associated with safety related components, systems, and equipment, such as the ADS. The applicant has not provided readable figures in the FSAR, due to the drawing scale factor.] The service air compressor supplies air for the instrument air system by means of an intertie between the service air system and the instrument air system before the instrument air dryer package. The isolation between the two air systems is supplied air from the emergency air supply system (consisting of one compressor, filter, aftercooler, moisture separator, and receiver) for all accidents except a LOCA. Cooling is provided by the reacotr auxiliaries cooling system.

[The applicant has not identified the location of the equipment and the component classifications on the FSAR figures. Therefore, we cannot conclude that air systems satisfy the requirements of General Design Criterion 2, "Design Basis for Protection Against Natural Phenomena," and the guidelines of Regulatory Guide 1.29, Positions C.1 and C.2, "Seismic Design Classification.]

A scheduled program of testing and inspection of the system will be provided to ensure operability of the system components and control systems. For compliance with the requirements of GDC 1, see Section 3.2 of this SER.

The service air system has no functions necessary for achieving safe reactor shutdown condition nor for accident prevention or mitigation. [The applicant has not identified and demonstrated that all instruments, controls and services required for safe shutdown of the plant such as the MSIV and ADS valves are provided with seismic Category I passive air accumulators to assure their proper function in a loss of the air system.] All other air-operated valves including the scram discharge inlet and outlet valves and other devices are designed to move to a safe position on loss of instrument air and do not require a continuous air supply under emergency or abnormal conditions.

[Additionally, the applicant has not verified that all station air system containment penetrations are provided with redundant seismic Category I, Quality Group B isolation valves. Therefore, we cannot conclude the requirements of General Design Criterion 2 and the guidelines of Regulatory Guide 1.29, Position C.2, are satisfied.]

The service instrument air systems will initially meet the requirements of American National Standards Institute (ANSI) MC11.1-1976, using non-oil-lubricated air compressors. [The applicant has not committed to perform periodic air quality testing of the air systems to assure compliance with the requirements of ANSI-MC11.1-1976.]

[Based on the above, we cannot conclude that the safety-related and non safety-related compressed air systems meet the requirements of General Design Criterion 2 regarding the protection against natural phenomena and the guidelines of Regulatory Guide 1.29, Positions C.1 and C.2. We will report resolution of this item in a supplement to this SER. The compressed air system does not meet the applicable acceptance criteria of SRP Section 9.3.1.]

RESPONSE

The information for each air user, and all accumulators, check valves and other appurtenances associated with safety-related components, systems and equipment is provided in the response to Question 410.89

The ADS valve actuators are supplied with nitrogen (air) from the primary containment instrument gas system (see Section 9.3.6 for details of nitrogen (air) supply to ADS valves).

As described in FSAR Section 9.3.1.3 except for the containment isolation valves and penetration, whose location and classification is shown in Table 3.2-1 (Item XVII.a.3) the service air system is not safety related. Therefore, General Design Criteria 2 and Regulatory Guide 1.29, positions C.1 and C.2 do not apply.

As described in Section 6.2.4.3.2.4, "Containment Isolation System the Compressed Service Air Line" and Table 3.2-1 (Item XVII.a.3) the contaiment penetration is provided with redundant Seismic Category I, Quality Group B isolation valves.

As described in revised Section 9.3.1.2, the quality of air supplied to the instrument air system will be periodically tested to see that it meets the requirements of ANSI MC11.1-1976 "Quality Standard for Instrument Air".

The instrument air system afterfilter is designed to remove 0.4 micrometre particles with a 98 per cent efficiency. The system is designed to permit preventive or corrective maintenance on one air dryer and afterfilter train without effecting system operability. Therefore, quarterly inspection of ~~the~~ afterfilter assures that the maximum particle size in the air stream at the instrument is 3.0 micrometres. This satisfies requirement 4.2 of ANSI MC 11.1-1975.

e. The seismic category, quality group classification, and corresponding codes and standards that apply to the design of the compressed air systems are discussed in Section 3.2.

9.3.1.2 System Description

The instrument and service air systems are shown schematically on Figures 9.3-1 through 9.3-3. Major equipment design parameters are listed in Table 9.3-1. The system is designed to take air from outside the building, which ranges from a minimum temperature of 5°F to a maximum temperature of 94°F dry bulb, 78°F wet bulb and compressed air to 110 psig for plant use. The minimum temperature in the compressor area is 40°F dry bulb. the maximum temperature is 104°F dry bulb. Some of the distribution piping pass through areas whose maximum design temperature is 120°F. The system is equipped with air dryers that are capable of drying the air to a -100°F dew point temperature at line pressure.

The compressed air system includes two service air compressors and one emergency instrument air compressor. The two service air compressors discharge oil-free compressed air into a single header with one air receiver common to both compressors. Each compressor has an air intake filter/silencer, an intercooler, and an aftercooler with a built-in moisture separator.

The emergency instrument air system includes one 100%-capacity air compressing train consisting of an air intake filter/silencer, a compressor unit with intercooler, an aftercooler with a built-in moisture separator, and an air receiver.

The service air and the instrument air are normally supplied from a single header and air receiver. The instrument air passes through a dryer package consisting of a prefilter, heatless desiccant type air dryer, and an afterfilter before distribution. Two 100%-capacity instrument air dryer packages are provided in the instrument air system. Two air receivers for the instrument air are also provided downstream of the dryers. The ~~quality of the~~ instrument air ~~exceeds the requirements of ANSI MC11.1-1976, Air Quality For Instrument Air~~. SEE INSERT A

During normal plant operation, one of the two 100%-capacity service compressors is selected as the lead compressor.

DSER OPEN ITEM NO. 147

INSERT "A"

instrument air dew point will be tested in accordance with ANSI MC11.1-1975, Quality Standard For Instrument Air, at a frequency of once per quarter as specified in the air dryer technical manual.

DSER Open Item No. 150 (DSER Section 9.3)

PRIMARY CONTAINMENT INSTRUMENT GAS SYSTEM

The applicant has committed to have the PCIG and instrument air systems meet the requirements of ANSI MC11.1-1976, using non-oil-lubricated air compressors as part of the preoperational startup tests. The applicant has not committed to perform air quality testing in accordance with ANSI MC11.1-1976. On failure to meet acceptable air quality, branch lines are to be tested to determine the extent of problems and corrective action needed.

The safety-related portions of the PCIG and instrument air systems are tested in accordance with the guidelines in RG 1.68.3, "Preoperational Testing of Instrument Air Systems" (refer to Section 14 of this SER).

We cannot conclude that the design conforms to the guidelines of ANSI MC 11.1-1976. We will report resolution of this item in a supplement to this SER. The compressed air system does not meet the applicable acceptance criteria of SRP Section 9.3.1.

RESPONSE

Testing of the PCIGS gas quality can be performed in accordance with ANSI MC 11.1-1975 by taking samples through the various vents, drains or test connections downstream of the PCIGS receivers. FSAR section 9.3.6.4 has been revised to provide the requested information

In addition, the PCIGS outlet filter removes 0.3 micrometre particles with a 98 per cent efficiency. The system is designed to permit preventive or corrective maintenance on one compressor, dryer and filter train without effecting system operability. Therefore, quarterly inspection of the filter assures that the maximum particle size in the air stream at the instrument is 3.0 micrometre. This satisfies requirement 4.2 of ANSI - MC 11.1-1975.

DSER OPEN ITEM NO. 150

preclude damage from missiles generated by the other compressing train.

d. Protection against dynamic effects associated with pipe ruptures - Section 3.6.

e. Environmental design considerations are discussed in Section 3.11.

Failure of a single component will not interrupt the operation of the PCIGS because of the redundant trains provided with separate sources of electric power fed from independent Class 1E sources.

9.3.6.4 Tests and Inspections

The PCIGS components are tested and inspected before leaving the supplier's shop to ensure that the system will meet the design criteria. The system is preoperationally tested in accordance with the requirements of Chapter 14.

Operability of the system is demonstrated by actual use during normal operation.

INSERT "A"

9.3.6.5 Instrumentation Applications

Instrumentation is provided for each train of the PCIGS to monitor and automatically control the system's operation. Further information on the system control and logic is discussed in Section 7.3.

The compressor is instrumented to shut down under the following conditions:

a. Low lubricating oil pressure

b. High lubricating oil temperature

c. High discharge gas temperature

DSER OPEN ITEM 150

DSER OPEN ITEM NO. 150

INSERT "A"

PCIGS dew point will be tested in accordance with ANSI MC11.1-1975, Quality Standard For Instrument Air, at a frequency of once per quarter as specified in the air dryer technical manual.

DSER Open Item No. 153 (DSER Section 9.4.5)

ENGINEERED SAFETY FEATURES VENTILATION SYSTEM

The safety related systems are designed to Seismic Category I, Quality Group C requirements and are housed in the seismic Category I, flood and tornado protected auxiliary building, thereby satisfying the requirements of GDC 2 and the guidelines of RG 1.29, Positions C.1 and C.2. The applicant has provided tornado missile protection for the inlet and outlet louvers. The system is separated from high-energy piping systems and internally generated missiles. [The applicant has not specified the maximum temperature inside the structure with all equipment running during a 102°F summer day. The 102°F day is the maximum summer temperature recorded between 1948 and 1981 (refer to FSAR Table 2.3-13). Therefore, we cannot conclude that the requirements of General Design Criterion 4 are satisfied.] The inlet louvers have tornado-missle-protected barriers and are more than 30 ft above plant grade; thus, the staff concludes that the guidance of Item 2, Subsection A, of NUREG-0660, "Enhancement of Onsite Emergency Diesel Generator Reliability," and therefore, the pertinent requirements of GDC 17, "Electric Power System," relating to the protection of essential electrical components from failure due to the accumulation of dust and particulate material, are satisfied.

RESPONSE

A. Service Water Intake Structure (SWIS)

With an extreme outdoor air temperature of 102°F, the SWIS room ambient temperature will rise (from 104°F with design outdoor air temperature of 94°F) to approximately 113°F. The manufacturer's design information and/or the equipment environmental qualification reports for all active, safety-related equipment and instrumentation in the service water intake structure which could be affected by temperature has been reviewed. A temperature of 113°F will not cause the failure of any of this equipment or instrumentation. This temperature persisting for a total of 180 hours (i.e., 6 hours per day for 30 days) will not have a signifcant impact on the life of this equipment or instrumentation.

B. Standby Diesel Generator (SDG) Area

Section 9.4.6.1 has been revised to indicate maximum space design temperatures. An extreme outdoor air temperature of

102°F would have little or no effect on SDG area HVAC systems or safety-related equipment. Individual HVAC systems within the SDG area are discussed below:

1. IE Panel Room Supply

The IE panel room supply unit mixes 7000 cfm outside air with 34000 cfm return air and further cools this mixture using cooling coils before it is distributed. A rise in outdoor temperature from 94°F to 102°F would result in less than a 1.5°F rise in the mixed air temperature entering the cooling coil. Because of reserve capacity in the cooling coil space, temperatures will rise less than 1.5°F.

2. SDG Air Recirculation

The SDG air recirculation system recirculates 100 percent room air and is designed to maintain a space maximum of 120°F; thus, the system would be unaffected by a rise in outside air temperature to 102°F.

3. Switchgear Room Cooling

The switchgear room cooling units each mix 1840 cfm outside air with 9360 cfm return air and further cool this mixture using cooling coils before it is distributed. A rise in outdoor temperature from 94°F to 102°F would result in less than a 1.5°F rise in the mixed air temperature entering the cooling coil. Because of reserve capacity in the cooling coil space temperatures will rise less than 1.5°F.

4. Safety-Related Battery Room Exhaust

Air is supplied to safety-related battery rooms by either the IE panel room supply system or the switchgear room cooling system and is then exhausted by this system. Based on discussions above, the temperature in the safety-related battery rooms will rise no more than 1.5°F above the design maximum temperature.

Temperature increases of less than 1.5°F for short periods would have no effect on safety-related equipment operation or environmental qualification.

Refer to DSER Open Item No. 1.

INSERT A

INSERT TO FSAR SEC 9.4.6.1

The heating, cooling and ventilation systems for the stand-by diesel generator area is designed to maintain the following space temperatures during normal plant operations, based on outside design temperature of 94°F dry bulb / 78°F wet bulb:

a. 104°F maximum in the H & V equipment rooms, corridors, electrical chases, diesel fuel tank rooms and the diesel generator recirculation fan rooms.

b. 120°F maximum in the diesel generator rooms when the diesel generators are energized.

c. 85°F maximum in the control equipment rooms, inverter rooms, battery charger rooms and the diesel generator control rooms.

d. 90°F maximum in the switchgear rooms.

e. 77°F ± 3°F in the battery rooms.

DSER OPEN ITEM 153

The discharge shutoff damper automatically opens when the fan starts. The fans are started by handswitches located on the local panel.

The two safety-related battery rooms at elevation 163 feet 6 inches are provided with two 100%-capacity exhaust fans. Makeup air to these battery rooms is provided by the diesel area Class 1E panel room supply system. Each fan is provided with a manual inlet shutoff damper and an automatic discharge shutoff damper, and a tornado protection damper. During LOP, the fans are automatically connected to emergency Class 1E power from the SDG. The automatic discharge shutoff damper opens when the fan starts. A low flow computer input actuates an alarm in the main control room upon loss of airflow, and starts the redundant fan automatically. The fans are started by handswitches located on the local panel.

d. Diesel area nonsafety-related battery room exhaust system - The two nonsafety-related battery rooms at elevation 163 feet 6 inches are provided with two 100%-capacity exhaust fans. Each fan has a manual inlet shutoff damper, and an automatic discharge shutoff damper, and a tornado protection damper. Makeup air to these battery rooms is provided by the diesel area Class 1E panel room supply system. During LOP, the fans can be manually connected to SDG-backed non-Class 1E power from the SDG. A low flow computer input actuates an alarm in the main control room upon loss of airflow, and automatically starts the redundant fan. The automatic discharge damper opens when the fan starts. The fans are started by handswitches located on the local panel.

e. Switchgear room cooling systems - These are safety-related systems. Each of the four switchgear rooms is provided with one Seismic Category I, full-capacity air cooling unit that has a centrifugal supply fan, a tornado projection check damper at its outside air louver, a low efficiency filter, and two 100%-capacity chilled water cooling coils. The air cooling unit can be isolated by the automatic outside air shutoff damper and by manual dampers located in the discharge and return ducts. A mixture of outside air and return air enters the switchgear room unit cooler for processing. The conditioned air is supplied to the switchgear room, battery charger room, battery room, and SDG control room of each respective SDG. Cooling coils are supplied with chilled water from the safety-related control area chilled water system. Chilled water piping is arranged so that one coil in each unit receives chilled water from loop A, and the other coil receives chilled water from loop B. During LOP, the cooling units are automatically connected to Class 1E power from the respective SDG that they serve. Each unit cooler can be started by a handswitch located at the local panel.

The low-flow switch for each fan actuates an alarm at the local panel, and in the main control room upon loss of airflow, and stops the operating fan. Alarms are also provided for high-pressure differential across the filter and for high or low return air temperature.

f. Diesel area Class 1E panel room supply system - This system is safety-related and supplies conditioned air to the four battery rooms, ~~eight~~ nine inverter rooms, and two heating, ventilating and air conditioning (HVAC) rooms at elevation 163 feet, and the elevator machine room at elevation 178 feet. It is composed of two 100%-capacity HVAC units. One unit runs while the other is on standby. The standby unit will automatically start upon failure of the operating unit. Outside air for each unit is taken from a separate Seismic Category I plenum. Each unit has a low and a high efficiency filter, an electric heating coil, a chilled water coil, and a centrifugal supply fan provided with automatic inlet vanes. The outside air return duct and discharge air ducts are provided with automatic shutoff dampers. The outside air duct is also provided with a tornado protection check damper. A flow controller is provided that ensures a constant air volume. The cooling coil is supplied with chilled water from the auxiliary building control area chilled water system. Water piping is arranged so that the coil of one unit receives chilled water from loop A and the coil of the other unit receives chilled water from loop B. During LOP, the units are automatically connected to emergency Class 1E power from the SDG. Each unit cooler can be started by a handswitch located at the local panel.

The low-flow switch actuates a local alarm upon loss of airflow and starts the standby units. Local alarms are also provided for high-pressure differential across the

Rev 1

DSER Open Item No. 184 (Section 7.2.2.1)

FAILURE IN REACTOR VESSEL LEVEL SENSING LINES

The applicant is required to submit the results of the analysis concerning failures in reactor vessel level sensing lines to the NRC for review and provide a description of the proposed modifications or justify why modifictions are not necessary.

RESPONSE

For the information requested above, see the response to Question 421.23.

QUESTION 421.23 (SECTIONS 7.2, 7.3, 7.4)

Operating reactor experience indicates that a number of failures have occurred in BWR reactor vessel level sensing lines and that in most cases the failures have resulted in erroneously high reactor vessel level indication. For BWRs, common sensing lines are used for feedwater control and as the basis for establishing vessel level channel trips for one or more of the protective functions (reactor scram, MSIV closure, RCIC, LPCI, ADS or HPCS initiation). Failures in such sensing lines may cause a reduction in feedwater flow and consequential defeat of a trip within the related protective channel.

If an additional failure, perhaps of electrical nature, is assumed in a protective channel not dependent on the failed sensing line, protective action may not occur or may be delayed long enough to result in unacceptable consequences. This depends on the logic for combining channel trips to achieve protective actions.

Identify each case where a reactor vessel water level tap or sensing line failure concurrent with an additional random single electrical failure induces a transient and precludes the automatic operation of reactor scram and/or engineered safety feature system. For each case identified provide an evaluation which demonstrates how the redundancy or diversity of the plant design provides for reactor scram or safety system operation within acceptable limits. Where manual action is required by the operators discuss the instrumentation and time available for the operator to take such corrective action.

To reduce the consequences of sensing line failures in combination with a single failure in a protection channel not dependent on the failed sensing line, a modification of the protection system logic may be required.

BWROG generic report SLI-8211 indicates that early operator action would be required to initiate either HPCI or RCIC in the event of a loss of the reference leg connected to the level sensor which is controlling feedwater combined with the failure of a level sensor, control component or power supply bus associated with the intact reference leg instruments. The specific level sensors are N091, A, B, C, D (Figure 5.1-4) and the buses are 125 Vdc A and B. Provide a description of the modifications implemented at Hope Creek as a result of this concern or provide justifications why the modifications discussed in the generic report are not necessary to reduce the consequence of sensing line failures.

DSER OPEN ITEM 184

RESPONSE

~~The concerns addressed above are being evaluated against the HCGS design. A justification why modifications are not necessary or a description of proposed modifications will be provided by July 1984.~~

An analysis was conducted based on the following assumption that simultaneously:

1. An instrument reference line fails (breaks),

2. A single electrical device also fails (but there is no power supply failure), and

3. There is no operator action.

These postulated multifailures are beyond the design basis for the HCGS; however, an assessment of the plant responses to these types of events was provided.

The instrument reference lines common to feedwater control and to protective system sensors were identified. All the various failure combinations were examined. Two failure combinations that represent the worst postulated failure paths were identified. These two failure combinations are described in what follows.

Failure Combination 1 would be the failure of the division 1* instrument reference line connected to condensing chamber B21-D004A combined with a failure such that ~~it~~ level transmitter B21-N080C indicates a high water level. In the analysis of this combination, it was assumed that the manual selection switch for feedwater control is on the failed instrument line (division 1) and that the operator does not switch the control to the other instrument line (division 2) as would be expected. This would cause the feedwater controller to respond to the erroneous high-level signal by reducing the feedwater flow.

Following the loss of feedwater flow, the decrease of the water level to level 4 would initiate a low water level alarm. After the water level decreased to level 3, a second low water level alarm would be initiated, but a reactor scram would not occur due to the assumed failures.

* ie channel A

When the water level decreased to level 2, a reactor scram would occur due to the alternate rod insertion system, and a third low water level alarm would be initiated. The RCIC system would then automatically start, and both recirculation pumps would trip. However, HPCI system would be unavailable (tripped) due to the assumed failures.

Core uncovery analyses were performed using the REDY program and simulations that represent the beginning-of-cycle (BOC) and end-of-cycle (EOC) void-reactivity coefficients.

The case with the EOC void-reactivity coefficient showed that the minimum water level would be between level 1 and level 2. Figures 421.23-1 and 421.23-2 show the REDY plots for the cases with the BOC void-reactivity coefficient and the EOC void-reactivity coefficient, respectively. The case with the BOC void-reactivity coefficient showed that the minimum water level would be below level 1 outside the shroud and would trigger the closure of the MSIVs.

For the BOC void-reactivity case, a further analysis, based on realistic assumptions, was performed to evaluate the potential for core heatup. This analysis applied the power history that resulted from the core uncovery analysis until the level-2 scram signal occurred at approximately 42 seconds. After 42 seconds, the ANS 1979 best-estimate decay-heat values were used.

Figures 421.23-3 through 421.23-5 show the system pressure, water level inside the shroud, and peak cladding temperature (PCT), respectively, calculated from the core-heatup analysis. The minimum water level in the core would be 2.5 feet below the top of the active fuel (inside the shroud). This uncovery level would result in a PCT of 450°F. Since this PCT is less than the initial cladding temperature of 644°F and well below the 2200°F limit, these results are acceptable from an ECCS viewpoint.

Failure Combination 2 would be the failure of the division 2* instrument reference line connected to condensing chamber B21-D004B combined with a B21-N097 D- or H-level transmitter failure such that it indicates a high water level. In the analysis of this combination, it was assumed that the manual selection switch for feedwater control is on the failed instrument line (division 2) and that the operator does not switch the control to the other instrument line (division 1) as would be expected. This would cause the feedwater controller to respond to the erroneous high-level signal by reducing the feedwater flow. Following the loss of feedwater flow, the water level would decrease to level 4, initiating a low water level alarm. After the water level decreased to level 3, a second low water level alarm would be initiated, and reactor scram would occur. After the water level decreased to level 2, a third low water level alarm would initiate, the HPCI system would automatically start, and both recirculation pumps would trip. The RCIC system would be unavailable (tripped) due to the assumed failures.

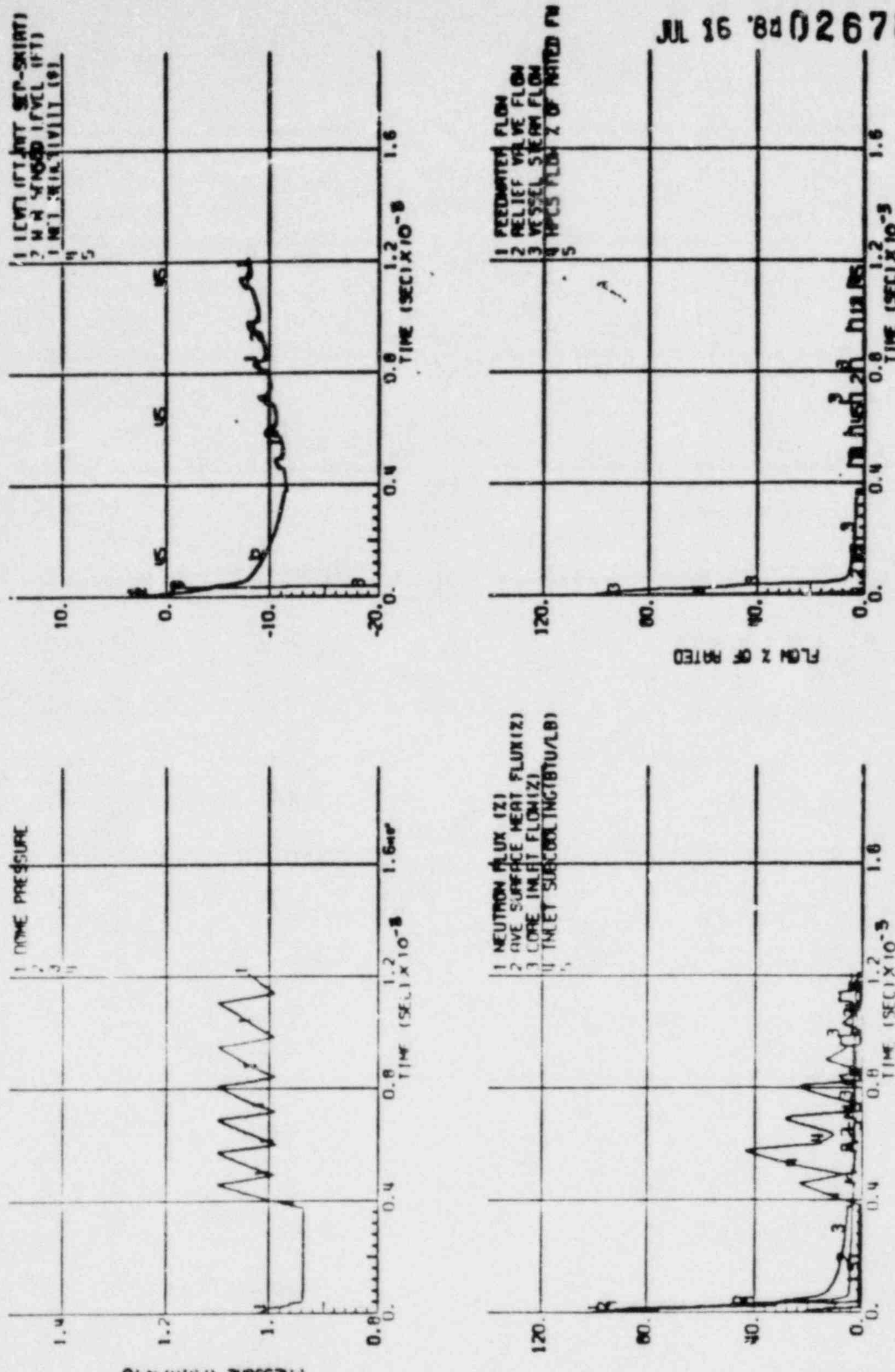
A core uncovery analysis was performed using the REDY program, and simulating the BOC void-reactivity coefficient only, since it presents the worse reactor condition for this scenario.

Figure 421.23-6 shows the REDY plot for this case. It can be seen that the minimum water level outside the shroud would be about 10 feet above the top of the active fuel. No core uncovery was found.

DSER OPEN ITEM 184

* ie channel B

JUL 16 '84 0267810



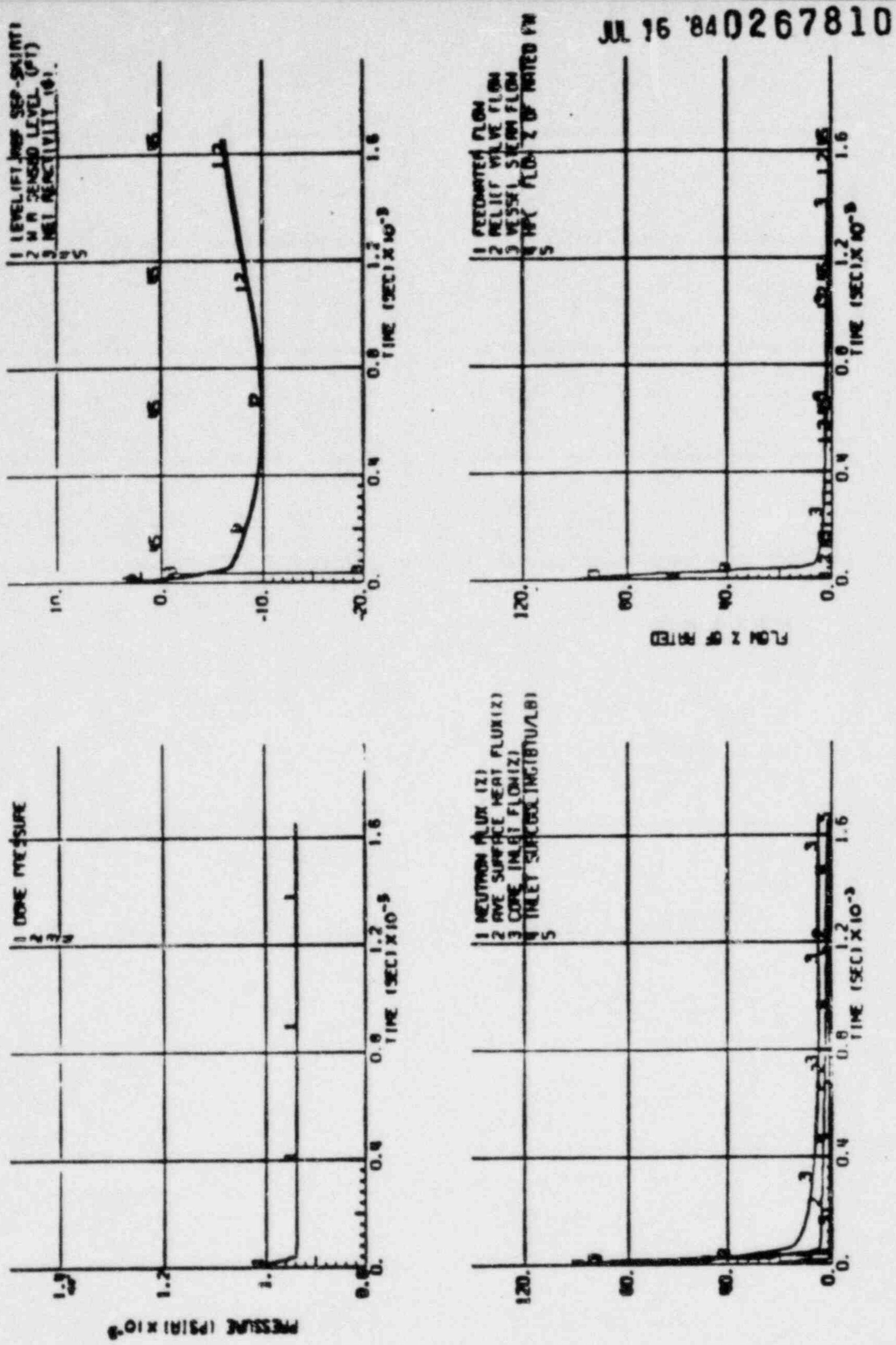
DSER OPEN ITEM 184

HOPE CREEK
GENERATING STATION
FINAL SAFETY ANALYSIS REPORT

INSTRUMENT LINE BREAK
ANALYSIS, BOC; NO HPCI;
RCIC AVAILABLE WITH ARI

FIGURE 421.23-1 AMENDMENT 7, 08/84

JUL 16 '84 0267810



HOPE CREEK
GENERATING STATION

FINAL SAFETY ANALYSIS REPORT

INSTRUMENT LINE BREAK ANALYSIS, EOC; NO HPCI; RCIC AVAILABLE WITH ARI

FIGURE 421.23-2 AMENDMENT 7, 08/84

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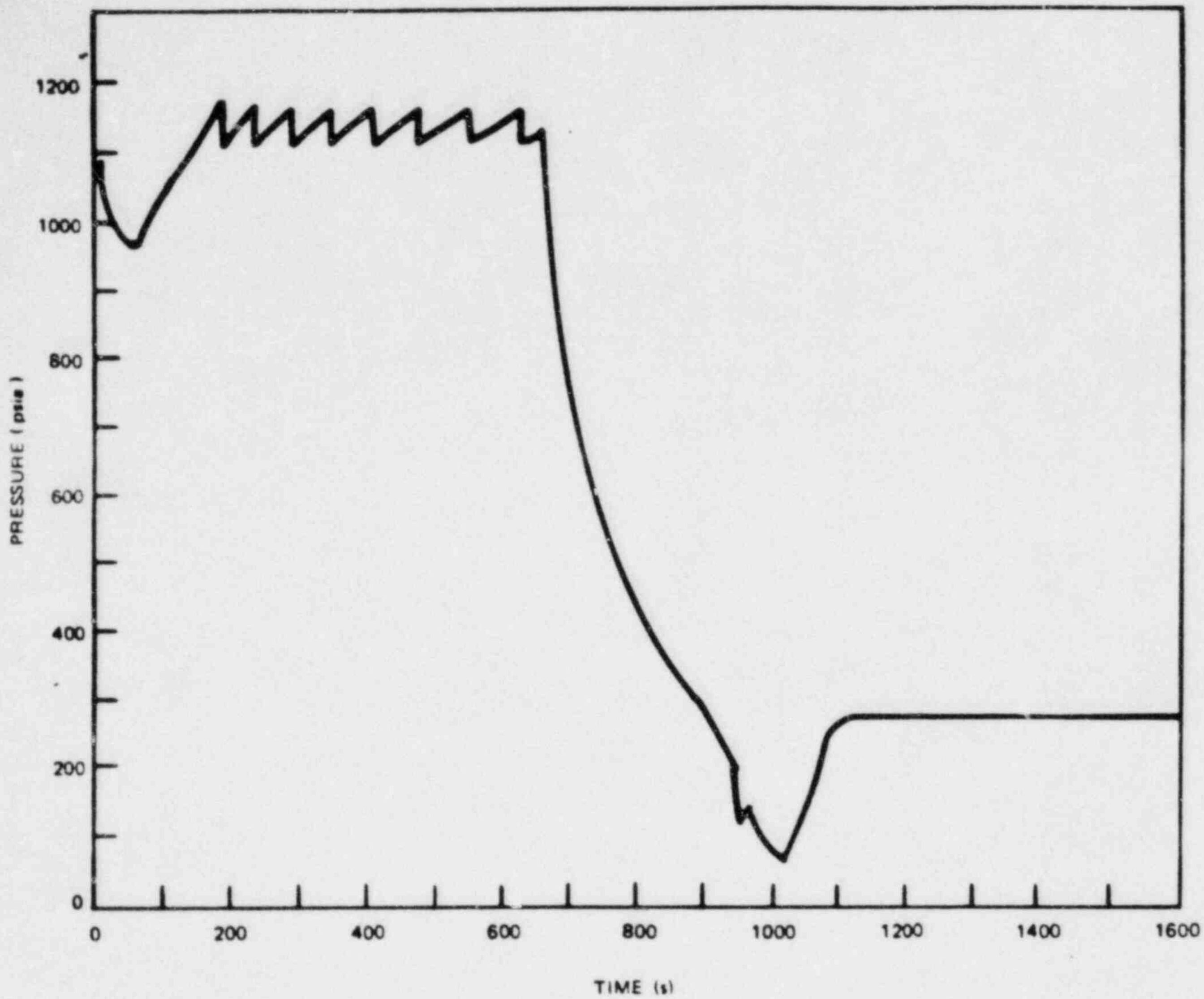


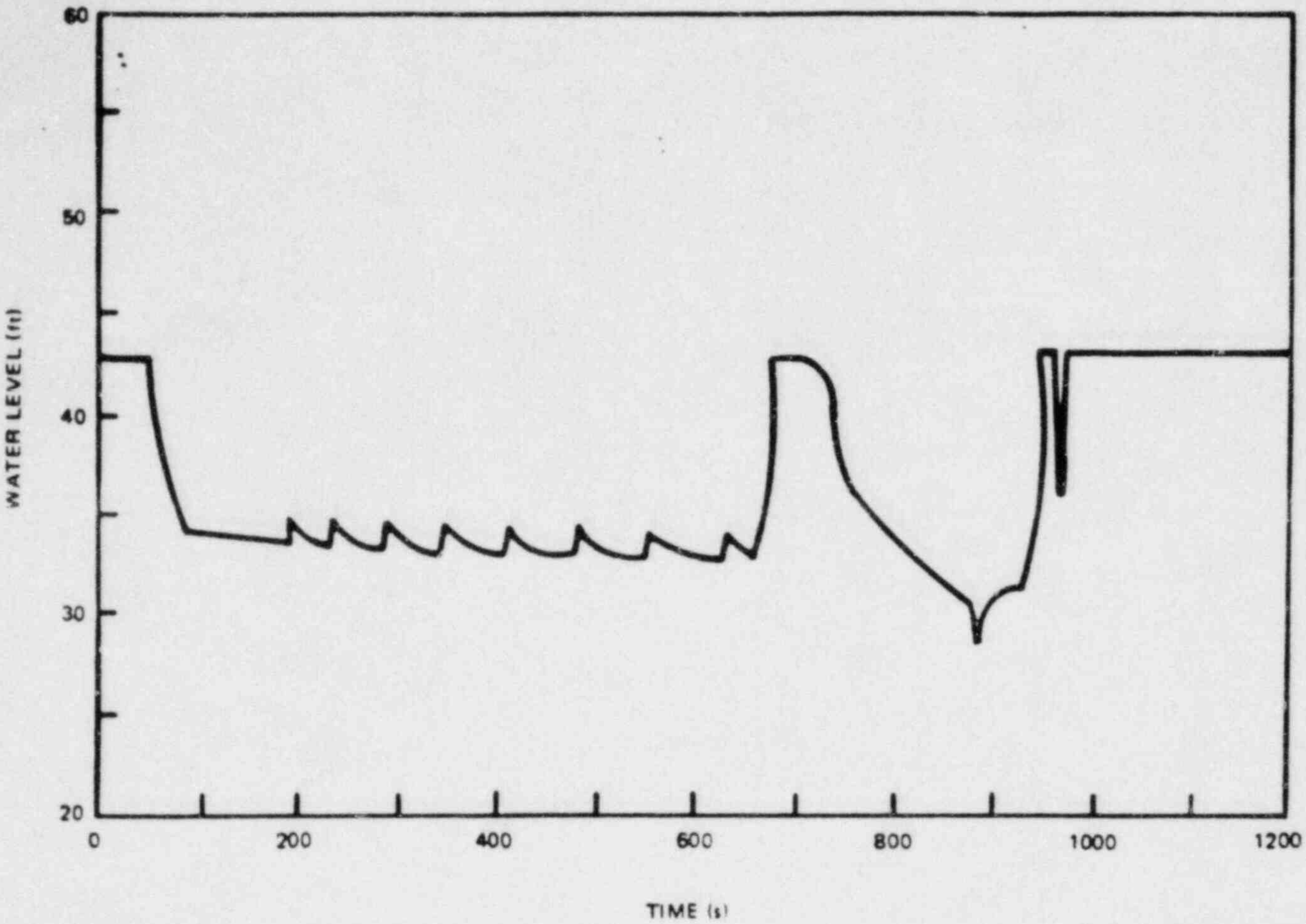
DSER OPEN ITEM 184

HOPE CREEK
GENERATING STATION
FINAL SAFETY ANALYSIS REPORT

VESSEL PRESSURE CALCULATED FROM THE CORE - HEATUP ANALYSIS

FIGURE 421.23-3 AMENDMENT 7, 08/84

JUL 16 '84 0267810



DSER OPEN ITEM 184

HOPE CREEK
GENERATING STATION
FINAL SAFETY ANALYSIS REPORT

WATER LEVEL CALCULATED FROM THE CORE - HEATUP ANALYSIS

FIGURE 421.23-4 AMENDMENT 7, 08/84

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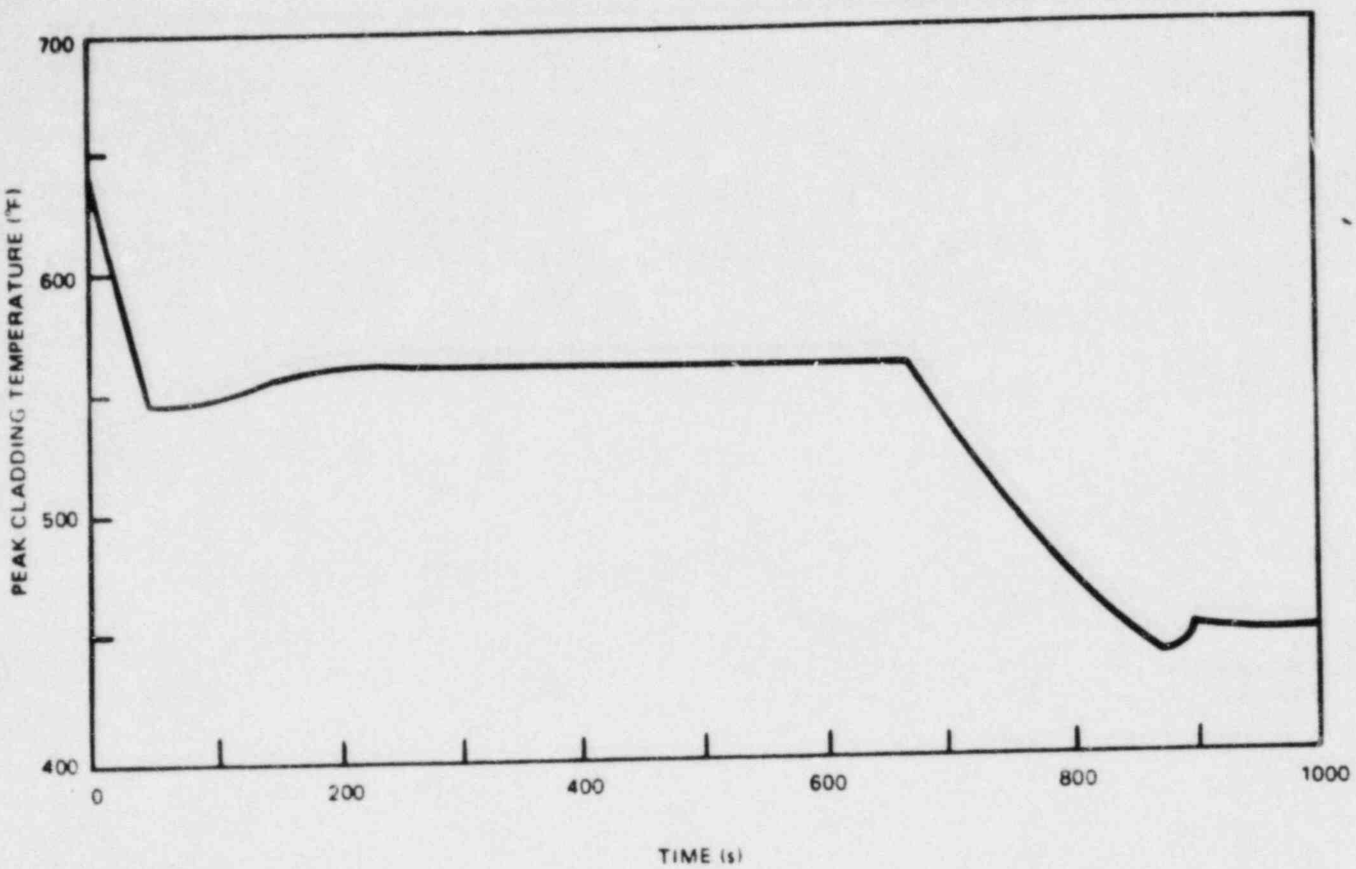

HOPE CREEK
GENERATING STATION
FINAL SAFETY ANALYSIS REPORT

PEAK CLADDING TEMPERATURE CALCULATED FROM THE CORE - HEATUP ANALYSIS

FIGURE 421.23-5 AMENDMENT 7, 08/84

DSER OPEN ITEM 184

DSER Open Item No. 188 (DSER Section 7.2.2.5)

SETPOINT METHODOLOGY

This will be an open item until the staff completes its review of the generic resolution of the setpoint methodology issue.

RESPONSE

For the information requested above, see the response to Question 421.18.

DSER Open Item No. 189 (DSER Section 7.2.2.6)

ISOLATION DEVICES

Pending the submittal of the following additional information:

1. Qualification requirements of Allen-Bradley relays.
2. Justification for EMI immunity of CPI isolators.
3. Justification for EMI immunity of TEL analog signal isolators.
4. Test results for 5-kv breakdown. Voltage testing of isolators by General Electric.
5. Results of the qualification testing of equipment in accordance with IEEE 472.

RESPONSE

The response to Question 421.13 addresses qualification testing of electrical isolation devices. This response will be revised to indicate results of qualification testing once it is completed. This is estimated to be by September 1984.

QUESTION 421.13 (SECTION 7.1, 7.3, 7.4, 7.5 & 7.6)

Various instrumentation and control system circuits in the plant rely on certain devices to provide electrical isolation capability in order to maintain the independence between redundant safety-related circuits and between safety-related circuits and nonsafety-related circuits. Provide the following information:

1. Identify the types of isolation devices which are used as boundaries to isolate nonsafety-related circuits from the safety-related circuits or to isolate redundant safety-related circuits.

2. Provide a summary of the purchase specifications for each isolation device identified in response to part (1) above.

3. Describe the type of testing that was conducted on the isolation devices to ensure adequate protection against the effects of electromagnetic interference, short-circuit failures (line to line and line to ground), voltage faults, and/or surges.

RESPONSE

Non-NSSS:

For part (2) of this question, "summary of purchase specifications" has been inferred as requiring qualification requirements (seismic and environmental) for each isolation system listed below. For each isolation system discussion on seismic qualification, individual isolation devices are qualified to Required Response Spectra (RRS) curves generated for the device location(s). Environmental qualification is discussed for each isolation device in succeeding paragraphs.

Electrical isolation between redundant non-NSSS safety-related circuits and between non-NSSS safety-related circuits and non-safety-related circuits is provided by the following:

a. Bailey Solid State Interposing Logic System (SSILS) and Analog Instrumentation System (AIS) - these two systems utilize the Bailey 890 system for 1E to non-1E, and non-1E to 1E isolation. The basic components of the 890 system are input/output multiplexing modules and transmitter/receiver modules. Transmission is by fiberoptic cable. The transmitter module provides 1E to non-1E isolation; the receiver module provides non-1E to 1E isolation. The fiberoptic cable provides additional electrical isolation although it itself is not formally qualified.

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Seismic qualification for this isolation system is in accordance with qualification procedures and acceptance criteria defined in IEEE Standard 344-1975, and implemented by Regulatory Guide 1.100, Revision 1.

This isolation system is located in and qualified for a mild environment as defined in Sections 3.11.2.4 and 3.11.2.5. The worst-case specified environmental conditions in which this isolation system is designed to operate are as follows:

Pressure: Atmospheric plus fractional inch of H_2O

Temperature:	104°F maximum 40°F minimum 83°F ± 2°F	these conditions may exist 24 hours per year
Relative Humidity:	50% maximum (summertime) 20% minimum (wintertime)	
Nuclear Radiation:	175 Rads Carbon (40 year TID) 88 Rads Carbon - Beta (180 day TID) 2.5 Rads Carbon - Gamma (180 day TID)	

(TID = Total Integrated Dose)

Testing performed in accordance with SAMA Standard PMC 33.1-1978 ~~will be completed by June, 1984, to~~ ensures that this isolation system is adequately protected against the effects of electromagnetic interference (EMI).

Testing performed in accordance with IEEE Standard 472-1974 ~~will be completed by June, 1984, to~~ ensures that this isolation system is adequately protected against the effects of short-circuit failures, voltage faults and/or surges.

b. Computer Products Inc. (CPI) Emergency Response Facilities Data Acquisition System (ERFDAS) - this system utilizes the CPI real time peripheral (RTP) system for 1E to non-1E isolation. The basic components of the RTP system are analog and digital surge cards (qualified to IEEE Standard 472-1974 requirements), analog input cards and optically isolated digital input cards, distributed input/output controllers (DIOC) and transformer-coupled multi-drop limited distance modems (MDLDM). The MDLDMs provided the 1E to non-1E isolation. Data transmission to receiving MDLDMs is by twisted-shielded pairs.

Seismic qualification for this isolation system is in accordance with qualification procedures and acceptance criteria defined in IEEE Standard 344-1975, and implemented by Regulatory Guide 1.100, Revision 1.

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This isolation system is located in and qualified for a mild environment as defined in Sections 3.11.2.4 and 3.11.2.5. The worst-case specified environmental conditions in which this isolation system is designed to operate are as follows:

Pressure: Atmospheric plus fractional inch of H_2O

Temperature:	104°F maximum 40°F minimum	these conditions may exist 24 hours per year
	83°F ± 2°F	

Relative Humidity: 50% maximum (summertime)
20% minimum (wintertime)

Nuclear Radiation: 175 Rads Carbon (40 year TID)
88 Rads Carbon - Beta (180 day TID)
2.5 Rads Carbon - Gamma (180 day TID)

Testing performed in accordance with SAMA Standard PMC 33.1-1978 ~~will be completed by August, 1984, to~~ ensures that this isolation system is adequately protected against the effects of electromagnetic interference (EMI).

Testing performed in accordance with IEEE Standard 472-1974, ~~will be completed by February, 1984, to~~ ensures that this isolation system is adequately protected against the effects of short-circuit failures, voltage faults and/or surges. These tests will be performed on the analog and digital surge cards and the transmit/receive circuits of the MDLDMs.

c. Technology for Energy Corporation (TEC) Radiation Monitoring System (RMS) - this system utilizes three separate isolation methods depending upon the type of isolation required:

1) 1E to 1E isolation - for this type of isolation, Hewlett Packard HFBR 1000 and HFBR 2001 isolators are used. Optical coupling is used to provide the isolation.

2) 1E to non-1E annunciator outputs - for this type of isolation, Agastat Model EGP isolation relays are used. Relay coil to contact separation provides the isolation.

3) 1E to non-1E communication - for data transmission between the TEC 1E microprocessor and the non-1E host computer, TEC Synchronous Data Link Control, serial communications modules 600-1200 are used. Transformer coupling provides the isolation for the transmit circuits. Optical coupling provides the isolation for the receive circuits.

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Seismic qualifiction for these isolation systems is in accordance with qualification procedures and acceptance criteria defined in IEEE Standard 344-1975, and implemented by Regulatory Guide 1.100, Revision 1.

These isolation systems are located in and qualified for a mild environment as defined in Sections 3.11.2.4 and 3.11.2.5. The worst-case specified environmental conditions in which these isolation systems are designed to operate are as follows:

Temperature:	104°F maximum 40°F minimum 76°F ± 2°f	these conditions may exist 24 hours per year
Relative Humidity:	50% maximum 20% minimum	

Testing performed in conformance with Military Standards 461B and 462 on the effects of EMI ~~will be completed by July, 1984 e~~ ensures that these isolation systems are adequately protected against the effects of EMI.

Testing performed in accordance with IEEE Standard 472-1974, ~~will be completed by July, 1984, to~~ ensures that these isolation systems are adequately protected against the effects of short-circuit failures, voltage faults and/or surges.

d. Remote control panels - two isolation methods are provided for remote control panels requiring 1E to non-1E isolation.

1) Digital 1E to non-1E isolation - for this type of isolation, Struthers Dunn type 219, Allen Bradley model 700-200A12P, and General Electric model HEA99 isolation relays are used. Relay coil to contact separation provides the isolation.

2) Analog 1E to non-1E isolation - for this type of isolation, TEC analog isolators, model 156, are used. Transformer coupling is used to provide the isolation.

Seismic qualification for these isolation systems is in accordance with qualification procedures and acceptance criteria defined in IEEE Standard 344-1975, and implemented by Regulatory Guide 1.100, Revision 1.

The Struthers Dunn type 219 and General Electric model HEA99 isolation relays are located in and qualified for a mild environment as defined in Sections 3.11.2.4 and 3.11.2.5. The worst-case specified environmental conditions in which these isolation relays are designed to operate are as follows:

<u>Struther Dunn Type 219</u>

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Temperature: 104°F ± 2°F maximum
40°F ± 2°F minimum

Relative Humidity: 90% maximum
20% minimum

Nuclear Radiation: 200 Rads (40 year TID)

GE HEA99
Temperature: 104°F maximum
60°F minimum

Relative Humidity: 90% maximum
20% minimum

Nuclear Radiation: 200 Rads Gamma (40.5 year TID)

Environmental qualification as defined in IEEE Standard 323-1974, and implemented by Regulatory Guide 1.89, Revision 0, is required for the Allen Bradley model 700P-200A12P isolation relay. The worst-case specified environmental conditions in which this isolation relay is designed to operate are as follows:

		Normal	Abnormal	Accident
Temperature,	Minimum	40°F	110°F	148°F
	Maximum	80°F		
	Average	69°F		
Pressure,	Minimum	-0.25 in. H_2O		-3 psig
	Maximum	1.0 in. H_2O	0 psig	1.0 in. H_2O
Relative Humidity,	Minimum	20%		
	Maximum	90%	100%	100%
Radiation,	Total dose	8.8×10^2 rads		1.7×10^5 rads gamma
Duration		40 yr		180 days

The TEC model 156 analog isolators are located in and qualified for a mild environment as defined in Sections 3.11.2.4 and 3.11.2.5. The worst-case specified environmental conditions in which these isolators are designed to operate are as follows:

Temperature: 104°F ±2°F maximum
40°F ±2°F minimum

Relative humidity: 90% maximum
20% minimum

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Nuclear radiation: 200 Rads (40 year TID)

No testing was conducted on the effects of EMI on the Struthers Dunn type 219, Allen Bradley model 700-200A12P, or General Electric model HEA99 isolation relays. By design, these relays should be immune to the effects of EMI.

Generic EMI susceptibility and emissions test were conducted on the TEC model 156 analog isolators following procedure 156-QP-04, "Electromagnetic Interference (EMI) Test for TEC Model 156 Analog Signal Isolator Module," which is Appendix B to test report 31041-QP-01, "Qualification Test Report for Environmental and Seismic Testing of the TEC Model 158 Analog Isolation System." Results of these tests are available for review at Technology for Energy Corporation, Knoxville, Tennessee.

Testing performed in accordance with IEEE Standard 472-1974 ~~will be performed to~~ ensures that the Struthers Dunn Type 219 ~~and General Electric model HEA99~~ isolation relays are adequately protected against the effects of short-circuit failures, voltage faults and/or surges. — INSERT D —

The following test was performed on the Allen Bradley model 700P-200A12P isolation relay to ensure adequate protection against the effects of short circuit failures, voltage faults and/or surges:

1) Test type - 100% high potential test

2) Test characteristics - 2700 V applied for one second between points of opposite polarity and to ground.

Testing performed in accordance with IEEE Standard 472-1974 ~~will be performed to~~ ensures that the TEC model 156 analog isolators are adequately protected against the effects of short circuit failures, voltage faults and/or surges.

e. Equipment air lock isolation dampers HD-9450A and B interlock with receiving bay door #4323A - Potter Brumfield model MDR isolation relays are utilized to provide both non-1E to 1E and 1E to non-1E isolation as shown below:

1) Non-1E to 1E - receiving bay door #4323A (non-1E coil) permissive to equipment air lock isolation dampers HD-9450A and B (1E contact)

2) 1E to non-1E - equipment air lock isolation dampers HD-9450A and B (1E coil) permissive to receiving bay door #4323A (non-1E contact)

These two relays were purchased from General Electric.

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—INSERT D—

Testing performed in accordance with General Electric Power Systems Management Business Department document MIL 82-12, dated July 24, 1982, ensures that the General Electric model HEA99 isolation relays are adequately protected against the effects of short-circuit failures, voltage faults and/or surges.

f. Startup Transient Monitoring System (STMS) - The qualification requirements of isolation devices, used by the STMS are described in Section 7.5.1.3.5.

— INSERT C —

NSSS:

The isolation devices use to electrically separate nonessential and essential circuits are pursuant to the guidelines of IEEE Standard 384. Both relay and optical isolation devices are employed. The optical isolators utilize a fiber-optic light pipe to electrically separate the input from the output. For example, an essential logic signal activates a light emitting diode, the light is transmitted through the light pipe to a photo switch and the switch changes state on receipt of the light signal and either blocks or transmits.

The relay isolation devices provide the same degree of separation and are used typically for control voltage separation applications, i.e., 120-Vac and 125-Vdc essential-to-nonessential and redundant-essential circuits. The relays are mounted so that a metal barrier separates the coil from the contacts with a minimum distance of one inch between the coil and barrier and between the contact and barrier.

INSERT A

Summary of Purchase Specification:

a. RELAY

1. Design Specification
   a) MIL-R-19523
   b) Contact Specification
   c) Coil Specification
   d) Insulation Specification
   e) Design Life
   f) Reliability

2. Class 1E Safety Function
   a) Functional Specification
   b) Reliability

3. Qualification Testing
   a) Ambient and Design Environments
   b) Application Configuration

b. ISOLATOR

1. Application data specification ~~Bill of Material~~

2. Performance specification ~~Purchase part drawings 204[illegible]6186 and 204B6188~~

3. Qualification Testing
   a) Tested as a panel subassembly

—INSERT C—

¶ Qualification testing for the isolation systems identified in parts a through e is ongoing. Reports documenting the results of this testing will be made available for review by the NRC when received. This is anticipated to be September, 1984, for equipment identified in parts a, b, d and e, and January, 1985, for equipment identified in part c. ~~[illegible]~~ Information concerning the qualification testing of the Validyne equipment identified in part f has been submitted to the NRC.

¶ The isolators are designed and applied in instrumentation and control circuits such that the maximum credible voltage or current transient applied to the isolators' non-Class 1E side will not degrade the operation of the circuit connected to the Class 1E side. The capability of the isolators to withstand the transients is demonstrated by high potential dielectric withstand test and surge withstand test as discussed above. This testing requires a minimum voltage of 1500 volts ac (Reference: ANSI/IEEE C37.90-1978 and IEEE 472-1974). The test voltages ensure that transient voltages resulting from "hot shorts" on the non-Class 1E side will not affect the isolator. This is because the non-Class 1E circuits are not routed with or exposed to circuits with voltages higher than 120 volts ac or 125 volts dc; consequently, the maximum credible transient voltage will be significantly less than the test values.

INSERT A (Q421.13)

Additionally, the redundant reactivity control system (RRCS) uses isolated lamp drivers (card-mounted relays) to isolate class 1E signals from certain non-class 1E loads (e.g., indicators). The RRCS panel qualification used a 200-Vdc line-to-line test across the output contacts to verify no degradation could be propogated back to the input circuit on the card.

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The optical isolator is comprised of semiconductors, resistors and capacitors mounted on a printed circuit board. As designed, this device satisfies electrical isolation requirements.

Both isolation devices satisfy the concern of susceptibility to noise, shorts, surges, and faults. Adverse conditions affecting the coil or the semiconductor device cannot propagate through the isolation barrier (i.e., metal enclosure or fiber-optic light pipe). Conversely, adverse conditions affecting the contacts or receiving semiconductor cannot propagate through the isolation barrier and affect the coil or transmitting semiconductor. Therefore, essential systems or circuits are electrically isolated from nonessential and/or redundant systems or circuits.

Optical isolators were tested as part of the redundant reactivity control system (RRCS) panel qualification tests. The capability of the optical isolators to prevent propagation of a faulure to other circuits was demonstrated as follows:

> The isolators were exposed to a maximum switch-voltage of 140-Vdc or 132-Vac, at approximately 200 mA, during the RRCS panel functional testing. Monitoring of other panel functions during these switching activities showed no detrimental effects on other circuitry. Test results are documented in GE files. An additional 5-kV breakdown-voltage test will be completed by September 1984.

INSERT B

INSERT B (Q421.13)

Where the isolation/separation between divisional circuits and between divisional and nondivisional circuits is achieved with optical isolators, the input and output cards are comprised of semiconductors, resistors, and capacitors and are separated by a 1-inch-long quartz rod through a metal barrier. The optical isolators for the RRCS also have current-limiting resistors on the input circuits.

The ~~isolator~~ enclosures for both types of isolators are designed to hold either four or eight isolator cards; only cards for circuits from the same

INSERT B Continued (Q421.13)

division are contained in the same enclosure. A worst-case failure would cause loss of function to only one division; safety function would not be lost because of the redundancy of the other divisions.

Specifications control the type of testing and qualification for the isolators. Line-to line tests (140-Vdc for two minutes and 400-V, one-millisecond pulses) have been successfully performed on the RRCS isolators. A 5-KV line-to-ground test will be peformed on the input circuit of the non-RRCS isolators. The results of the 5-KV test will be reported in an amendment to this response by September 1984.

No degradation of the card on the other side of the barrier will be used as a criterion for a successful test. Since the same type of enclosures are used for both types of isolators and since 5 KV far exceeds both the voltage of the RRCS isolator tests and the maximum postulated credible "hot short" voltage for all NSSS applications, the 5-KV test will confirm

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INSERT B continued (Q421.13)

the capabilities of the barrier and enclosure to prohibit detriment to the cards on the other side of the barrier.

The test plans, procedures, and reports will be available on file for audit at GE.

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DSER Open Item No. 193 (DSER Section 7.3.1.1)

MANUAL INITIATION OF SAFETY SYSTEMS

The staff is concerned regarding the commonality permissive logic for the LPCI and core spray manual and automatic initiation. In addition, the staff is concerned that a failure of the Bailey 862 logic could disable both the automatic and manual actuation modes for certain ESF systems. The applicant is required to provide additional details regarding the permissive logic for LPCI and core spray and to discuss the design of the Bailey 862 logic and its compliance with Reg. Guide 1.62.

RESPONSE

The response to Question 421.35 addresses the concern regarding commonality of permissive logic for manual and automatic initiation of LPCI and core spray. The question response also addresses the concern of Bailey 862 logic design compliance with Regulatory Guide 1.62.

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DSER Open Item No. 194 (DSER Section 7.3.2.2)

STANDARD REVIEW PLAN DEVIATIONS

The staff has reviewed the applicant's response concerning SRP deviations and has concluded that they are acceptable with the exception of the ESF equipment area cooling system and the SSEAVS. For these systems, the applicant is required to provide additional justification or show system applicability to the Standard Review Plan Table 7.1.

RESPONSE

The response to Question 421.2 provides the justification for any deviations between HCGS control systems design and SRP Table 7-1 requirements. Table 7.1-3 has been revised in accordance with the agreement reached in the June 26, 1984 meeting with the Instrumentation and Control Systems Branch.

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HOPE CREEK GENERATING STATION
FINAL SAFETY ANALYSIS REPORT
TABLE 7.1-3

CODES AND STANDARDS APPLICABILITY MATRIX FOR NON NSSS CONTROL AND INSTRUMENTATION EQUIPMENT (1)

	PRIMARY CONTAINMENT ISOLATION SYSTEM	CONTAINMENT ATMOSPHERIC CONTROL SYSTEM	MAIN CONTROL ROOM HABITABILITY AND ISO SYSTEM	MAIN STEAM ISOLATION VALVE SEALING SYSTEM	FILTRATION, RECIRCULATION, AND VENTILATION SYSTEM	REACTOR BUILDING VENTILATION ISOLATION SYSTEM (9)	STATION SERVICE WATER SYSTEM	SAFETY AUXILIARIES COOLING SYSTEM	CLASS 1E POWER (3)	PRIMARY CONTAINMENT INSTRUMENT GAS SYSTEM	CONTROL AREA CHILLED WATER SYSTEM	ESF EQUIPMENT AREA COOLING SYSTEMS		REMOTE SHUTDOWN SYSTEMS	SAFE SHUTDOWN EQUIPMENT AREA VENTILATION SYSTEMS (12)			BYPASSED AND INOPERABLE STATUS INDICATION SYSTEM	PLANT COMPUTER SYSTEMS (8)	POST ACCIDENT MONITORING INSTRUMENTATION	STARTUP AND TRANSIENT MONITORING SYSTEM	SAFETY RELIEF VALVE POSITION INDICATION SYSTEM	LOOSE PARTS MONITORING SYSTEM		PROCESS RADIATION MONITORING SYSTEM	SAFETY SYSTEM/NON SAFETY SYSTEM ISOLATION (9)
GDC 1	X	X	X	X	X		X	X		X	X	X		X	X			X		X	X (10)				X	
GDC 2	X	X	X	X	X		X	X		X	X	X		X	X			X		X	X (10)				X	
GDC 4	X	X	X	X	X		X	X		X	X	X		X	X			X	X	X	X (10)				X	
GDC 13	X	X	X	X	X		X	X		X	X	X		X	X			X	X	X	X	X	X		X	
GDC 19	X	X	X	X	X		X	X		X	X	X		X				X		X		X	X		X	
GDC 20	X	X	X	X	X		X	X		X	X	X													X	
GDC 21	X	X	X	X	X		X	X		X	X	X													X	
GDC 22	X	X	X	X	X		X	X		X	X	X													X	
GDC 23	X	X	X	X	X		X	X		X	X	X													X	
GDC 24	X	X	X	X	X		X	X		X	X	X													X	
GDC 29	X	X	X	X	X		X	X		X	X	X														
GDC 34							X	X						X											X	
GDC 35							X	X																		
GDC 41		X																								
IEEE 279 1971	X	X	X	X	X		X	X		X	X	X		X				X (11)		X					X	
RG 1.11		X								X															X	
RG 1.22	X	X	X	X	X		X	X		X	X	X		X				X		X					X	
RG 1.29	X	X	X	X	X		X	X		X	X	X		X											X	
RG 1.30 (7)																									X	
RG 1.40 (2)																										
RG 1.47		X	X		X		X	X		X	X			X				X		X					X	
RG 1.53	X	X	X	X	X		X	X		X	X	X		X				X		X					X	
RG 1.62	X	X	X	X	X		X	X		X	X	X		X												
RG 1.63 (4)			X																							
RG 1.80 (5)																										
RG 1.73 (6)																										

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HOPE CREEK GENERATING STATION
FINAL SAFETY ANALYSIS REPORT

TABLE 7.1-3

CODES AND STANDARDS APPLICABILITY MATRIX FOR NON NSSS CONTROL AND INSTRUMENTATION EQUIPMENT (1)

	PRIMARY CONTAINMENT ISOLATION SYSTEM	CONTAINMENT ATMOSPHERIC CONTROL SYSTEM	MAIN CONTROL ROOM HABITABILITY AND ISO SYSTEM	MAIN STEAM ISOLATION VALVE SEALING SYSTEM	FILTRATION RECIRCULATION AND VENTILATION SYSTEM	REACTOR BUILDING VENTILATION ISOLATION SYSTEM (9)	STATION SERVICE WATER SYSTEM	SAFETY AUXILIARIES COOLING SYSTEM	CLASS 1E POWER (3)	PRIMARY CONTAINMENT INSTRUMENT GAS SYSTEM	CONTROL AREA CHILLED WATER SYSTEM	ESF EQUIPMENT AREA COOLING SYSTEMS		REMOTE SHUTDOWN SYSTEMS	SAFE SHUTDOWN EQUIPMENT AREA VENTILATION SYSTEMS			BYPASSED AND INOPERABLE STATUS INDICATION SYSTEM	PLANT COMPUTER SYSTEMS (8)	POST ACCIDENT MONITORING INSTRUMENTATION	STARTUP AND TRANSIENT MONITORING SYSTEM	SAFETY RELIEF VALVE POSITION INDICATION SYSTEM	LOOSE PARTS MONITORING SYSTEM		PROCESS RADIATION MONITORING SYSTEM	SAFETY SYSTEM/NONSAFETY SYSTEM ISOLATION (9)
RG 1.75	X	X	X	X	X		X	X		X	X	X		X				X		X	X (10)				X	
RG 1.89 (5)																										
RG 1.89	X	X	X	X	X		X	X		X	X	X		X							X (10)				X	
RG 1.97																		X	X	X		X			X	
RG 1.100	X	X	X	X	X		X	X		X	X	X		X							X (10)				X	
RG 1.105	X	X	X	X	X		X	X		X	X	X		X				X		X					X	
RG 1.118	X	X	X	X	X		X	X		X	X	X		X				X		X					X	

NOTES

(1) The letter X on the table indicates the applicability of a code or standard to a system described in subsequent sections of Chapter 7. The extent to which the HCGS design conforms is as stated in Section 1.8 for Regulatory Guides and Section 3.1.2 for GDCs.

(2) Regulatory Guide 1.40 is not applicable to HCGS. See Section 1.8.

(3) Refer to Section 8.1 for Class 1E power codes and standards applicability.

(4) Electrical penetrations are non NSSS design responsibility. See Table 7.1.2 (RG 1.63) for NSSS systems requiring electrical penetrations.

(5) See Section 14.2 for applicability of Regulatory Guide 1.68, 1.80.

(6) See Sections 3.10/3.11 for applicability of Regulatory Guide 1.73.

(7) See Sections 17.1/17.2 for applicability of Regulatory Guide 1.30.

(8) The safety parameters display system and emergency response facilities information systems are provided by the plant computer systems.

(9) Subsystem of the primary containment isolation system.

(10) Applies only to the qualified portions of the startup and transient monitoring system (see Section 7.5.1.3.5).

(11) Bypassed and inoperable status indication system meets the requirements of IEEE Standard 279-1971 with the exception that the indicators themselves are not seismically qualified.

(12) The SSEAVS consists of the RSP room HVAC System and the RBEACS. The RBEACS is also part of the ESF Equipment Area Cooling System and satisfies the design requirements of that system.

DSER Open Item No. 195 (DSER Section 7.3.2.3)

FREEZE-PROTECTION/WATER FILLED INSTRUMENT AND SAMPLE LINES AND CABINET TEMPERATURE CONTROL

Another staff concern has been the use of unqualified heaters to control temperature and humidity within cabinets housing electrical transmitters that provide signals to the reactor protection system.

The applicant is required to submit, for staff review, information in response to our concern regarding freeze-protection.

RESPONSE

The response to Question 421.39 addresses the concerns of cold weather protection of safety-related instrument sensing lines.

QUESTION 421.39 (SECTION 7.4)

Section 7.4.1.1.2 of the FSAR provides a discussion regarding RCIC automatic suction source switchover from the condensate storage tank (CST) to the suppression pool yet FSAR Section 9.4 indicates that automatic switchover from the CST to the suppression pool is only provided for HPCI. Correct this discrepancy and provide a detailed discussion of the automatic switchover design including the independence between RCIC and HPCI and the precautions taken for the inoperability of these instruments due to cold weather.

RESPONSE

Automatic switchover of the HPCI/RCIC pump suctions is discussed in Section 9.2.6.5.1.

Section 9.2.6.5.1 has been revised to provide information on HPCI/RCIC pump suction automatic switchover independence and cold weather design precautions and to show that CST low-low level indication has been provided at the remote shutdown panel (RSP).

Section 7.3.1.1.1.1 has been revised to include a reference to the HPCI valve logics.

Sections 5.4.6.1 and 7.4.1.1.2 have been revised to provide a description of the RCIC pump suction automatic switchover function.

Section 7.4.1.4.5.2 has been revised to clarify the description of the CST low-low level indication at the RSP and to clarify the requirements for manually shifting the RCIC pump suction when operating at the RSP.

The only heat tracing required to be installed on safety-related instrument sensing lines at HCGS for the purpose of protecting the sensing line from freezing in cold weather is that heat tracing installed on the level sensing line from the condensate storage tank to the reactor building. This heat tracing is powered from a highly reliable battery-backed non-1E power source and is equipped with an alarm monitoring circuit which detects loss of power to the heat tracing or loss of thermostat. The non-1E battery-backed power supply for the alarm circuit is separate from the heat tracing power supply. The sensing line will also be supplied with an RTD to monitor the temperature of the process fluid in the sensing line where the sensing line is exposed to the severe weather conditions. This temperature indication and associated alarm will be available in the main control room via the plant computer.

--INSERT A -

- INSERT A - 421.39

¶ In the unlikely event that the analog output of the installed RTD becomes unavailable, administrative procedures will provide for verification that the sensing line is not in danger of freezing.

¶ The technical specifications will include surveillance requirements for testing the environmental control and monitoring systems at least once per year prior to the onset of freezing weather.

¶ Heaters are not used in any HCGS safety-related panel to control humidity and/or temperature.

HCGS

DSER Open Item No. 196 (DSER Section 7.3.2.4)

SHARING OF COMMON INSTRUMENT TAPS

The applicant is required to augment the previous response to this concern to address all common instrument taps that have been identified and, in addition, verify that for the examples cited the required protection system redundancy will not be defeated.

RESPONSE

For the information requested above, see the response to Question 421.19.

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DSER Open Item No. 197 (DSER Section 7.3.2.5)

MICROPROCESSOR, MULTIPLEXER AND COMPUTER SYSTEMS

We require the applicant to expand the response regarding the Bailey 862 modules and to provide a typical set of drawings and the instruction manuals for the Bailey Model 862.

RESPONSE

The response to Question 421.6 provides the requested information concerning the reliability of the Bailey 862 equipment. Typical drawings and Bailey 862 instruction manuals were provided to the NRC as additional documents during the January 13 ICSB meetings

QUESTION 421.6 (SECTIONS 7.1 - 7.6)

Identify any "first-of-kind" instruments used in or providing inputs to safety-related systems. Identify each application of a microprocessor, multiplexer or computer system where they are in or interface with safety-related systems.

RESPONSE

There are no "first-of-kind" instruments used in or providing inputs to NSSS safety-related systems. Microprocessors are used in the redundant reactivity control system (RRCS). While the RRCS does not perform any reactor control functions, it does provide signals to trip the recirculation system, to runback the feedwater system, to initiate the standby liquid control system, and to initiate alternate rod insertion for mitigation of an ATWS event (see Section 15.8). The performance monitoring system (PMS) is nonsafety-related, and isolation of safety-related inputs to the PMS is shown functionally in the logic diagrams and elementary diagrams provided to the NRC and listed in Table 1.7-3.

1. The non-NSSS safety-related, "first-of-kind" equipment used at HCGS consists of the following:

   a. Bailey 862 solid state logic modules - provide common signal levels, interfaces, and common logic arrays to provide the interface between the engineered safety features (ESF) systems (identified in Section 7.3) and the main control room controls and displays (identified in Section 7.5).

      High system reliability is achieved through the use of auctioneered redundant power supplies for the three different dc voltages utilized by the 862 logic modules:

      1) 125-Vdc for interrogation of field contacts

      2) 24-Vdc for interrogation of main control room controls; for powering main control room status lights; for powering output driver relays

      3) 9-Vdc for powering the 862 logic modules (onboard voltage regulators control this at 5-Vdc for the logic and buffer circuitry).

      The integrity of each power supply is continuously monitored and any failure is annunciated in the main control room and indicated at the summary alarm panel of the affected logic assembly (cabinet). This summary

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alarm panel also provides indication of fuse module fuse failure, cooling fan failuare, and in which bay (of the 12 bay assembly) the failure occurred.

A digital logic assembly trouble summary alarm is annunciated in the main control room whenever any of the following conditions exist in a Class 1E logic assembly:

1) Door open

2) Fuse module fuse failure

3) Fuse module interlock (fuse module withdrawn)

4) Power bus failure

5) Power supply failure

6) Cooling fan failure

7) Optic link failure (optical isolation system trouble).

High system reliability is achieved by segregating control of field devices (e.g., switchgear, MCC, etc.) into different circuits within a logic assembly. Each circuit is composed of a single fuse module and as many logic modules and output driver relays as required to control a field device. Several related field devices may be controlled from the same circuit. The fuse module protects the logic assembly power supplies from individual circuit faults.

Testing of a system circuit from its control switch through the output(s) of the associated logic modules is made possible by a switch on the fuse module which, when operated, disables the output driver relays. This disabling is continuously indicated in the main control room. Light emitting diodes on the face of the logic module indicate the presence or lack of input signals from the associated control switch and the presence or lack of signals to the output driver relays.

INSERT (A) →

The Bailey 862 equipment is functionally described in the logic diagrams provided to the NRC and listed in Table 1.7-3.

Equipment qualification reports are referenced in Sections 3.10 and 3.11.

The reliability of the 862 Logic Module may also be evaluated by reviewing three facets of the design and manufacturing process. The first facet deals with the application of proven design methods which have been used in other Bailey products or within the I&C industry. Part of this first phase is the evaluation of the design via methods prescribed in Mil Std. 217C. The second area concerns the verification of the 862 Logic Modules ability to perform under various environmental stresses via qualification testing. The third facet deals with the in-plant maintenance of the Logic Modules ability to perform by use of surveillance.

Bailey has employed conservative methods in the design of the 862 Logic Module via the use of proven circuitry schemes. Examples of this is found in the voltage regulator circuitry which provides power for the module. Another example ~~would be~~ is the input buffer circuitry. The most prominent feature with regards to the reliability of the module can be found in the analysis performed on the component items of the module which insure the components are not overstressed. This analysis is accomplished by using Bailey derating factors in conjunction with the Mil Std. 217C. This analysis results in conservative stress ratio calculations demonstrating that each component is not overstressed. All calculations are maintained in auditable files at the Bailey Controls Company in Wickliffe, Ohio. This analysis also provides MTBF values. In the case of the 862 Logic Module, the MTBF is analyzed to be 11.6 years. This value takes into consideration all components including those which are not essential to the 1E function such as test switches and capacitors. It is expected that disabling failures would occur less frequently.

The second area which establishes confidence in the 862 Logic Modules design is the testing performed during the qualification program. The results of these tests demonstrate the designs capability to perform under abnormal and normal environments including seismic events, the effects of RFI/EMI, and voltage spikes. All data is documented in accordance with Appendix B to 10CFR50 and is available for audit at the Bailey Controls Test Lab in Wickliffe, Ohio. Buffers driving the control output relays are usually only momentarily energized, thus resulting in less stress on these components.

The third area for consideration includes the testability or the recognition of failure. Although there is no in-service testing of the module, some failures are self-evident. As an example, the failure of an output buffer in indicating applications would result in the loss of the indication at the main control console. ~~Also, the indicating modules are equipped with an LED indicator to alert the operator to a loss of the 9V or 24V power supplies.~~ In addition, during operation logic module LEDs can be observed to check module functionability and memory status.

One area not previously mentioned is the operating experience of this module in similar applications. This module is presently being used at three facilities. As a result, the 862 Logic Module has five years of operating experience without significant failures.

In summary, these points show the concise and deliberate actions the Bailey 862 Logic Module (and system) employ to obtain and maintain high reliability in its operating capability as is evidenced by its successful operating history to date. The use of existing design tailored to replace relay logic simplifies and enhances the motor control system. The result is a testable, secure system of proven design performing its task in a sound and reliable manner.

b. Bailey 890 system - provides the interface and isolation between the main control room, safety-related instrumentation and the plant computer (control room integrated display system), and the plant annunciator system. The Bailey 890 system is also used to provide isolation between the Class 1E indicating lamp circuits and initiating logic circuits provided for lamp test.

The equipment is functionally described in the logic diagrams provided to the NRC and listed in Table 1.7-3.

Equipment qualification reports are referenced in Sections 3.10 and 3.11.

The Bailey 890 system isolation capabilities are discussed in the response to Question 421.13.

c. Technology for Energy Corporation (TEC) Model 600 equipment - provides equipment to monitor, perform calculations, provide outputs to operator displays, and provide signal isolation (where required) for the following systems:

1) Suppression pool temperature monitoring system - described in Section 6.2.1.1.10.3,

2) Reactor building exhaust radiation monitoring system - described in Section 11.5.2.1.3,

3) Refueling floor exhaust radiation monitoring system - described in Section 11.5.2.1.2.

Equipment qualification reports are referenced in Sections 3.10 and 3.11.

The TEC Model 600 equipment isolation capabilities are discussed in the response to Question 421.13.

2. The following non-NSSS systems at HCGS interface with safety-related systems using microprocessors, multiplexers, or computers:

a. Radiation monitoring systems (RMSs) - discussed in Sections 11.5.2.1.3 and 11.5.2.1.2, the Class 1E reactor building exhaust and refueling floor exhaust RMSs utilize TEC Model 600 equipment to provide radiation monitoring and isolation initiation functions.

The TEC Model 600 system is a microprocessor based system using Motorola 68000 microprocessors to provide data acquisition, signal processing, and signal isolation (where required). See item 1.c. above.

The TEC Model 600 system isolation capabilities are discussed in the response to Question 421.13.

b. Suppression pool temperature monitoring system (SPTMS) - discussed in Section 6.2.1.1.10.3, the SPTMS utilizes TEC Model 600 equipment to provide reliable indication of suppression pool temperature to meet the requirements of a Regulatory Guide 1.97 (type A, Category 1) variable.

The TEC Model 600 system is a microprocessor based system using Motorola 68000 microprocessors. In the SPTMS, redundant, dedicated microprocessors are used to provide data acquisition, signal processing, operator displays, and signal isolation (where required). See item 1.c. above.

The TEC Model 600 system isolation capabilities are discussed in the response to Question 421.13.

c. Control room integrated display system (CRIDS) - part of the plant computer systems discussed in Section 7.5.1.3.3, the CRIDS computer interfaces with safety-related systems to provide information to the control room operator in the form of graphic displays and alarming functions. The CRIDS computer is also used to meet emergency reponse facility requirements (see Section 7.5.1.3.3).

The CRIDS is nonsafety-related and isolation of safety-related inputs is shown functionally in the logic diagrams and elementary diagrams provided to the NRC and listed in Table 1.7-3. See item 1.b. above and the response to Question 421.13 which discusses isolation capabilities of the Bailey 890 system.

d. Emergency response facility data acquisition system (ERFDAS) - the data acquisition system for the HCGS emergency response facilities (ERF). The CRIDS computer is used to process this information as discussed in Section 7.5.1.3.3.

The ERFDAS uses the "Real Time Peripheral" (RTP) system supplied by Computer Products Inc. (CPI). The RTP uses multiplexers to provide data acquisition and signal isolation.

The CPI RTP system isolation capabilities are discussed in the response to Question 421.13.

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e. Startup transient monitoring system (STMS) - discussed in Section 7.5.1.3.5, the STMS uses Validyne Model MC370AD-Q2 remote multiplexers to provide data acquisition and signal isolation of those safety-related signals needed to support plant startup testing.

Isolation capabilities of the Validyne Model MC370AD-Q2 multiplexers are discussed in the response to Question 421.49.

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DSER Open Item No. 199 (DSER Section 7.4.2.1)

IE BULLETIN 79-27 - LOSS OF NON-CLASS 1E INSTRUMENTATION AND CONTROL POWER SYSTEM BUS DURING OPERATION.

We will require the applicant to document the results of the analysis, providing recommendation of hardware or procedural changes as appropriate in response to IEB 79-27. This is presently scheduled for submittal during the fourth quarter of 1984.

RESPONSE

The response to Question 421.42 will be revised by December 1984 to identify any necessary HCGS design changes as a result of analysis of the HCGS design to the concerns of IE Bulletin 79-27.

QUESTION 421.42 (SECTION 7.5)

If reactor controls and vital instruments derive power form common electrical distribution systems, the failure of such electrical distribution systems may result in an event requiring operator action concurrent with failure of important instrumentation upon which these operator actions should be based. IE Bulletin 79-27 addresses several concerns related to the above subject. You are requested to provide information and a discussion based on each IE Bulletin 79-27 concern. Also, you are to:

1) Confirm that all a.c. and d.c. instrument buses that could affect the ability to achieve a cold shutdown condition were reviewed. Identify these buses.

2) Confirm that all instrumentation and controls required by emergency shutdown procedures were considered in review. Identify these instruments and controls at the system level of detail.

3) Confirm that clear, simple unambiguous annunciation of loss of power is provided in the control room for each bus addressed in item 1 above. Identify any exceptions.

4) Confirm that the effect of loss of power to each load on each bus identified in item 1 above including ability to reach cold shutdown, was considered in the review.

5) Confirm that the re-review of IE Circular No. 79-02 which is required by Action Item 3 of Bulletin 79-27 was extended to include both Class 1E and non-Class 1E inverter supplied instrument or control buses. Identify these buses or confirm that they are included in the listing required by Item 1 above.

RESPONSE

An analysis will be conducted based on the ~~General Electric methodology~~ [Limerick Generating Station approach] for answering the concerns raised in IE Bulletin 79-27. This methodology has been reviewed ~~and approved~~ by the NRC ~~via a report written~~ for the ~~WNP-2~~ [Limerick] project. The methodology provides for a systematic and comprehensive analysis to ensure that, in the event of a single power bus failure, sufficient control room indicators, instruments, and controls exist to achieve a cold shutdown.

An outline of the methodology follows:

1. Review the Class 1E and non-Class 1E busses including inverters supplying power to instrumentation and controls in

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Use plant emergency operating procedures to

systems used in attaining the cold shutdown under emergency conditions. Identify busses that could affect the ability to achieve cold shutdown. ~~Use plant operating procedures and procedures developed for certain power bus failures to ensure the identification of all critical power busses.~~

2. Identify the instrumentation of these and control devices connected to each identified power bus. Evaluate the effects of a loss of power to each load, including the limiting effects on the ability to achieve cold shutdown.

~~3. Create bus trees denoting the bus hierarchy and the cascading bus configuration of all busses that power instrumentation and controls the operator would manipulate in going to cold shutdown.~~

3 ~~4~~. Determine the annunciators and alarms that would alert the operator to a failure of any of the identified busses.

4 ~~5~~. ~~Determine the effects of any single power bus loss on the ability to continue in each particular shutdown path being used at the time the bus loss occurs. Include the cascading effects of any bus loss, and consider alternate indications and controls powered by unaffected busses that may aid the operator in the event of a bus loss. Identify alternative shutdown paths available and existing procedures for restoration of the affected bus.~~

insert: The Emergency Operating Procedures will be reviewed to verify that sufficient instrumentation and controls exist to achieve cold shutdown by identifying alternative shutdown paths and instrumentation.

5 ~~6~~. Document the results of the analysis, providing recommendations of hardware or procedural changes as appropriate.

The programs described in the responses to this question and to Questions 421.51 and 421.52 will be conducted as a combined effort that will be completed by December, 1984. STET

DSER Open Item No. 204 (DSER Section 7.5.2.3)

TMI ITEM II.F.1 - ACCIDENT MONITORING

Pending submittal of a revised FSAR Table 7.5-1

RESPONSE

Table 7.5-1 was revised in response to Question 421.41.

DSER Open Item No. 207 (DSER Section 7.7.2.1)

HELBs AND CONSEQUENTIAL CONTROL SYSTEM FAILURES

The applicant is required to submit the analysis and its conclusions concerning HELBs and consequential control system failures to the NRC for staff review. This is scheduled for submittal during the fourth quarter of 1984.

RESPONSE

The response to FSAR Question 421.52 will be revised by December 1984 to provide the requested analysis results.

DSER Open Item No. 208 (DSER Section 7.7.2.2)

MULTIPLE CONTROL SYSTEM FAILURES

The applicant is required to submit the analysis and its conclusions concerning multiple control system failures to the NRC for staff review. This is scheduled for submittal during the fourth quarter of 1984.

RESPONSE

The response to FSAR Question 421.51 will be revised by December 1984 to provide the requested analysis results.

QUESTION 421.51 (SECTION 7.7)

The transient and accident analyses included in the FSAR are intended to demonstrate the adequacy of safety systems in mitigating anticipated operational occurrences and accidents.

Based on the conservative assumptions made in defining these "design bases" events and the detailed review of the analyses by the staff, it is likely that they adequately bound the consequences of single control system failures. To provide assurance that the design basis event analysis for Hope Creek adequately bounds other more fundamental credible failures, provide the following:

(1) Identify those control systems whose failure or malfunction could seriously impact plant safety.

(2) Indicate which, if any, of the control systems identified in (1) receive power from common power sources. The power sources considered should include all power sources whose failure or malfunction could lead to failure or malfunction of more than one control system and should extend to the effects of cascading power losses due to the failure of higher level distribution panels and load centers.

(3) Indicate which, if any, of the control system identified in (1) receive input signals from common sensors. The sensors considered should include common taps, hydraulic headers and impulse lines feeding pressure, temperature, level or other signals to two or more control systems.

(4) Provide justification that any malfunctions of the control systems identified in (2) and (3) resulting from failures or malfunctions of the applicable common power source or sensor including hydraulic components are bounded by the analyses in Chapter 15 and would not require action or response beyond the capability of operators or safety systems.

RESPONSE

An analysis will be conducted based on the General Electric methodology for answering NRC concerns for common power source failures and common sensor or sensing line failures. This methodology, which received NRC concurrance via reports for the Grand Gulf, Shoreham, and WNP-2 projects, will be used for the Hope Creek project. The methodology is systematic and comprehensive and examines control systems interations iterations to establish the limiting-case events. The consequences of single power-source or sensing-line failures will be evaluated with respect to control-grade systems and will ensure the limiting-case events are bounded by the events analyzed in Chapter 15.

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A. Common Power Source Failure

An outline of the methodology for the common power source failure analysis follows:

1. Identify all nonsafety-grade control systems that have the potential of affecting the critical reactor parameters of water level, pressure, or power.

2. Review these control systems at the component level; identifying the effects of the loss of power to each system component and the sebsequent interactions with other components and systems.

3. Generate bus trees denoting the bus hierarchy and cascading configuration of all power busses that supply components of control systems under study.

4. Perform a combined effects analysis. Evaluate the failure of each power bus (load center, motor control center, etc.) starting with the lowest-level source common to multiple control systems and working up each bus tree to the highest common power level. At each level examine the effects of the single bus failure and the consequences of cascading bus failures on all control systems' components.

5. Postulate the limiting transient events as a result of the combined effects analysis and compare these events to those analyzed in Chapter 15.

6. Perform any additional transient calculations or analyses necessary to ensure the postulated limiting events are bounded by those analyzed in Chapter 15.

7. Document the results of the analyses of common power source failure, providing recommendations as appropriate.

B. Common Sensor or Sensing Line Failure

An outline of the methodology for the common sensor or sensing line failure analysis follows:

1. Identify the nonsafety-grade control systems that have the potential of affecting the critical reactor parameters of water level, pressure, or power.

2. Identify all instrument sensing lines and sensors utilized by two or more of these control systems.

INSERT B

WITH the assumption there is a single active failure in a safety system required to mitigate effects of the event.

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3. Analyze the effects of failure of a common sensor of a complete plug or a guillotine break in each of these common instrument lines. Examine the effects of erroneous signals on each instrument and on each function (scrams, trips, permissive signals, etc.) that could be actuated or rendered inoperative.

4. Examine the interactive effects among all systems affected by the common sensing line or sensor failure and the consequential combined effects on the critical reactor parameters.

5. Compare the consequences of these postulated events with those analyzed in Chapter 15 to ensure the consequences of the postulated events are bounded by the results of the Chapter 15 events and to ensure the postulated events would not require actions or responses beyond the capabilities of the operators or the safety systems. Perform any additional transient calculations or analyses necessary to ensure the WORST-CASE ~~postulated~~ limiting event ~~are~~ IS bounded(1) by those analyzed in Chapter 15 (INSERT A).

6. Document the results of the analyses of common sensing line or sensor failures and provide recommendations as appropriate.

The programs described in the responses to this question and to questions 421.42 and 421.52 will be conducted as a combined effort that will be completed by December, 1984.

INSERT A: WITH THE ASSUMPTION THERE IS A SINGLE ACTIVE FAILURE IN A SAFETY SYSTEM REQUIRED TO MITIGATE EFFECTS OF THE EVENT

ADD FOOT NOTE (1)

(1) As it is used in items ~~4~~ A5 AND B5 ABOVE, "bounded" means within the consequence limits for abnormal operational transients given in Section 15.0.3.1.2 of the FSAR or, if the combined probability of occurrence of both the initiating event and the single active failure is similar to the occurrence probabilities of limiting faults (see Section 15.0.3.1), "bounded" means within the consequence limits for limiting the faults given in Section 15.0.3.1.3.

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DSER Open Item No. 209 (DSER Section 7.7.2.3)

CREDIT FOR NON-SAFETY RELATED SYSTEMS IN CHAPTER 15 OF THE FSAR

The peak vessel pressures resulting from the analyses of the transients without taking credit for nonsafety-related structures, systems, and components are bounded by the peak pressure limit of the overpressure protection system as described in the Hope Creek FSAR.

The staff is reviewing the applicant's response relating to this concern and will report its finding in a future SER.

RESPONSE

The response to Question 421.54 identifies which of the nonsafety-grade systems/components that may be actuated during the course of anticipated operational occurrences (transients) are included in the Technical Specifications.

QUESTION 421.54 (SECTION 7.7)

Table 7.1-1 of the FSAR lists the safety-related instrumentation and control systems. Nonsafety-related systems are identified in Table 7.7-1. From a review of Chapter 15 of the FSAR the staff has determined that the analysis of certain anticipated operational occurrences (i.e., the feedwater controller failure-maximum demand) and design basis accidents (i.e., recirculation pump seizure) take credit for the operation of nonsafety-related instrumentation and control systems. It is the staff's position that for events classified as anticipated operational occurrences, credit can be taken for nonsafety-related systems to mitigate the event provided only high availability nonsafety-related systems are being relied upon. Therefore, identify each instrumentation and control system/component which is not classified as safety-related but assumed in the FSAR analysed to mitigate the consequences of transients. Provide a justification for the assumption of operability of this equipment based upon system design, equipment quality, and proposed technical specifications. In addition, provide a discussion on the interfaces with the safety-related portions of the Hope Creek design.

It is the staff's position that no credit may be taken for nonsafety-related instrumentation and control systems/components in mitigating the consequences of design bases accidents. Therefore, identify each instrumentation and control system/component which is classified as nonsafety-related but assumed in the FSAR analyses to mitigate the consequences of accidents. Either redo the analysis assuming no credit for the operation of this equipment, or propose modifications to upgrade the equipment to safety-related status.

RESPONSE

The following nonsafety-grade systems/components may be actuated during the course of anticipated operational occurrences (transients) shown in Chapter 15:

a. Level 8 turbine trip

b. Level 8 feedwater trip

c. Turbine bypass

d. Recirculation runback

e. Rod sequence control system

f. Rod block monitor

g. The relief function of the safety relief valves.

None of these systems are required to mitigate the accidents discussed in Chapter 15.

Table 440.33-1 provided in response to Question 440.33 lists transients where nonsafety-grade systems/components are actuated during the course of the event. The analyses for each of the transients are based on the single-failure criterion associated with the abnormal transients (abnormal transients are defined as events that occur as a result of equipment malfunctions as a result of a single active component failure or operator error). Following this single failure, the resulting transient is simulated in a conservative fashion to show the response of primary system variables and how the various plant systems would interact and function.

Although the analyses of certain transient events assume the operation of specific nonsafety-grade equipment to provide a realistic transient signature, failures of such equipment would not make these events more thermally or pressure limiting than the limiting accidents already addressed in Chapter 15. Periodic testing is prescribed by the NRC's Standard Technical Specifications for Level 8 turbine trip, Level 8 feedwater trip, turbine bypass, the rod sequence control system, the rod block monitor, and the relief function of the safety relief valves.

— INSERT A —

-INSERT A-

The recirculation runback feature of the HCGS is primarily an operational device to increase plant availability. It reduces the incidence of scrams from low vessel water level due to misoperations of the feedwater system. Although the recirculation-runback feature is simulated in the analyses of a complete loss of feedwater flow, as described in Section 15.2.7 ~~of the FSAR~~, the analyses shows it does not make a significant contribution to the mitigation of this event.

The analysis confirms that the reactor power would begin decreasing at the initiation of the feedwater loss because the reduced inlet subcooling would increase the voids. This would tend to increase the MCPR and to decrease reactor pressure. Therefore, in the absence of recirculation runback there would be no challenge to the core thermal margin or vessel pressure boundary before scram, and it would be inappropriate to prescribe surveillance of the recirculation-runback feature in the technical specifications.

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DSER Open Item No. 221 (DSER Section 8.2.2.1)

PHYSICAL SEPARATION OF OFFSITE TRANSMISSION LINES

The description and analysis contained in the FSAR relating to physical independence of the offsite transmission lines between the Public Service Electric & Gas Company transmission grid system and the Hope Creek switchyard, is not sufficient for the staff to conclude that the transmission lines are adequately separated in accordance with the requirements of Criterion 17 of Appendix A to 10 CFR 50.

By Amendment 4 to the FSAR, the applicant in response to a request for information, revised Section 8.2.1.1 of the FSAR to indicate that transmission lines are on separate towers and terminate at widely separated switching stations. This response does not provide the requested description and analysis of physical separation between transmission lines in the vicinity of the Hope Creek switchyard and between transmission line routed from the Hope Creek switchyard and remote switching stations.

RESPONSE

FSAR section 8.2.1.1 and Figure 8.2-1 has been revised to provide the requested information.

8.2 OFFSITE POWER SYSTEMS

8.2.1 DESCRIPTION

8.2.1.1 Transmission Systems

The bulk power transmission system at Hope Creek Generating Station (HCGS) operates at 500 kV. The station supplies power to the 500-kV system through three single-phase power transformers. These transformers step the voltage up from 25 to 500 kV. The offsite power for the plant is fed through the 500-kV system via the 13.8-kV yard.

Figure 8.2-1 shows the 500/13.8-kV yard and the 500-kV transmission lines in the vicinity of the plant. All HCGS lines are on separate towers and terminate at widely separated switching stations. The 13.8-kV and 500-kV sections of the yard are physically tied together through two sets of two station power transformers, T1, T2, T3, and T4, located in the 13.8-kV yard.

Three independent offsite power sources supply the Hope Creek plant. One source is the Salem-Hope Creek 500-kV tie line. This tie feeds the 500/13.8-kV yard via main bus section 20X. The Salem tie and bus section 20X are protected by primary and backup pilot wire relays. Primary and backup pilot wire supervisory and transfer trip relays are provided for transmitting and receiving the dc pilot wire trip signal. The transfer trip is initiated by associated 500-kV and 13.8-kV breaker failure relays, CT module and ground relays, and station transformer T2 and T4 differential relays.

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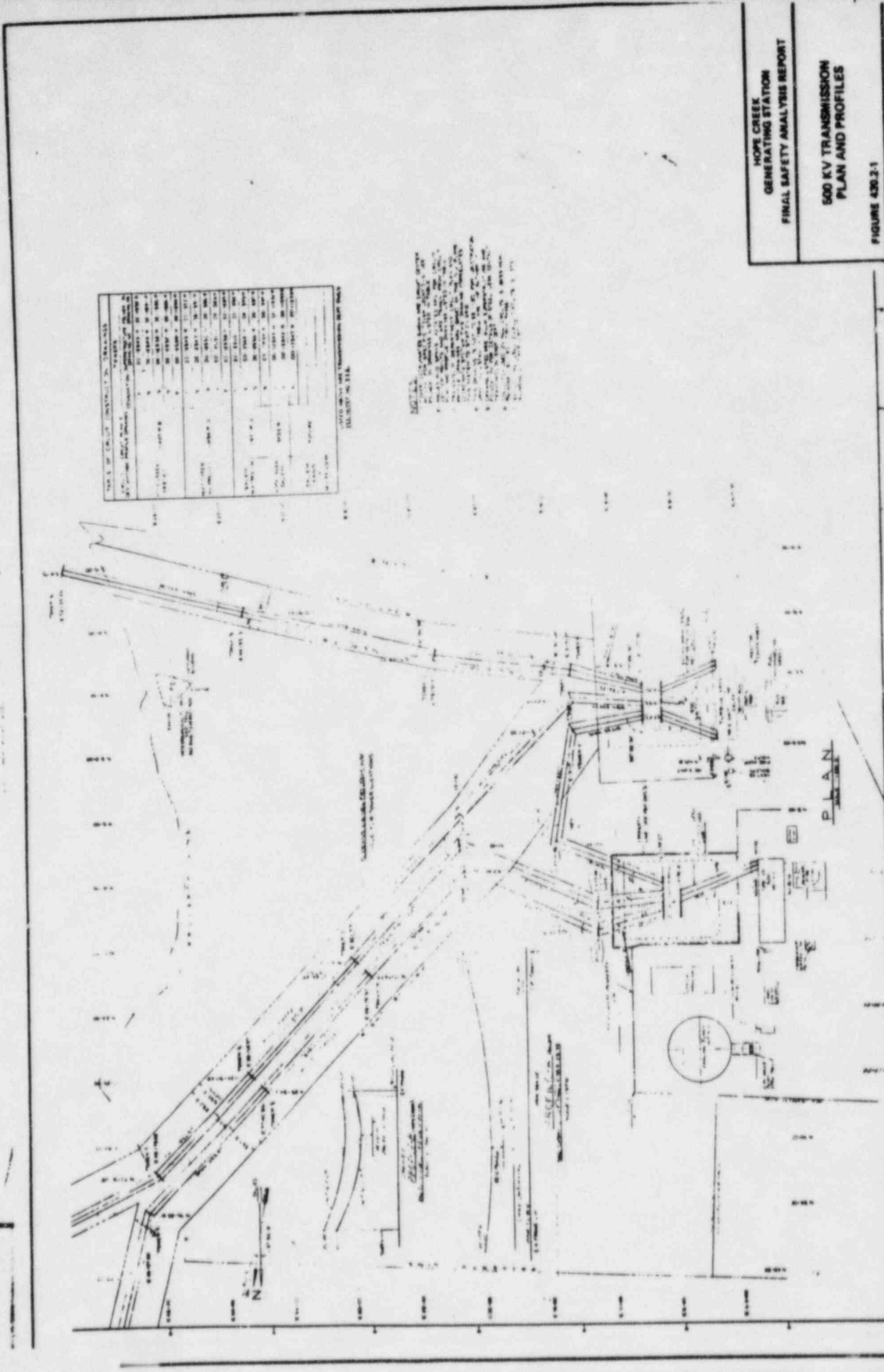
The other sources are a 30.1-mile tie to the Keeney Switching Station Ⓐ which feeds section 3 of the 500-kV bus, and a 42.9-mile tie to the New Freedom Switching Station Ⓑ which feeds section 5 of the bus. Ⓒ Both lines have identical protection schemes. Primary protection is achieved through the use of solid-state phase and ground mho distance relays with a directional comparison carrier blocking system. Backup relay protection is provided by electro-mechanical phase mho distance relays and a directional overcurrent ground relay with a directional comparison continuous carrier blocking system. Both primary and backup relay schemes make use of a carrier transmitter receiver and are also equipped with dual-channel transfer trip equipment.

Ⓐ ..., LOCATED NORTHWEST OF HOPE CREEK NEAR NEWARK, DELAWARE, ...

Ⓑ ..., LOCATED NORTHEAST OF HOPE CREEK IN CAMDEN COUNTY, N.J. ...

Ⓒ KEENEY AND NEW FREEDOM ARE 500/230 KV SWITCHING STATIONS APPROXIMATELY 43 MILES APART.



HOPE CREEK
GENERATING STATION
FINAL SAFETY ANALYSIS REPORT

500 KV TRANSMISSION
PLAN AND PROFILES

FIGURE 430.2-1

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DSER Open Item No. 222 (DSER Section 8.2.2.2)

DESIGN PROVISIONS FOR REESTABLISHMENT OF AN OFFSITE POWER SOURCE

GDC 17 requires, in part, that each of the offsite circuits be designed to be available in sufficient time following a loss of all onsite alternating current power supplies and the other offsite electric power circuit, to assure that specified acceptable fuel design limits and design conditions of the reactor coolant pressure boundary are not exceeded. The description in the FSAR as to compliance with this part of GDC 17 is not sufficient to reach a conclusion of acceptability.

By Amendment 4 to the FSAR the applicant in response to a request for information, stated that in the event of relay operation, the relays can be reset and the equipment returned to service within one hour. This design provision description for reset of relays may be related to design provisions used for reestablishing an offsite circuit from the transmission system through the switchyard to the Class 1E system; however, the description by itself is not sufficient to reach a conclusion of acceptability nor is it responsive to the staff request for information.

RESPONSE

FSAR section 8.2.1.4 and Figure 8.2-2 have been revised to provide the requested information.

provide an auxiliary switch contact for input to generating station computer systems via a data input/output (I/O) cabinet for status indication. For safety reasons, the control switches are provided with a lock-in handle. The generating station control room operator must release keys in his possession to operate these switches.

8.2.1.4 Switchyard

The 500-kV switchyard, located to the east of the Hope Creek plant, is designed with tapered tubular steel structures and rigid aluminum bus work. This yard consists of two breaker-and-a-half bays containing five SF-6 circuit breakers connected to two 500-kV main buses, 10X and 20X, as shown on Figure 8.2-2. Bus 10X is protected by primary and backup differential relays. Breaker failure relaying detects a failure-to-trip or failure-to-interrupt condition at the line terminal and trips associated breakers necessary to isolate the line. (A)

Generating station auxiliary services are supplied via two 13.8-breaker bays by four 500/14.4 kV, 42/56/70-MVA, oil-immersed, self-cooled/forced-air-forced-oil-cooled (OA/FOA/FOA) three-phase transformers connected to the 500-kV busses 10X and 20X, as shown on Figure 8.2-2. Station power transformers T1 and T4 each supply two 13.8/4.16-kV and one 13.8/7.2-kV station service transformers. The remaining two transformers, T2 and T3, each supply one 13.8/4.16-kV station service transformer and one 14.4-kV/208V station light and power transformer. Each 13.8-kV breaker bay consists of three breakers in series. To prevent paralleling of the transformers, one of the breakers is normally open. This breaker is closed in case one of the transformers is out of service.

As shown on Figure 8.2-2, there are six 13.8-kV, 1500-MVA oil circuit breakers. Breaker failure protection detects the failure to trip or failure to interrupt conditions at the line terminals and electrically isolates faulty equipment. Primary and backup relay protection on the 500/14.4-kV station power transformers is provided by the use of harmonic restraint differential relays.

The 13.8-kV system is ungrounded and connected to the delta side of all station power and station service transformers. To detect a phase-to-ground fault in the system, a 13.8-kV/208-V grounded-wye grounding transformer is installed on the secondary side of each station transformer. The neutral of the grounding

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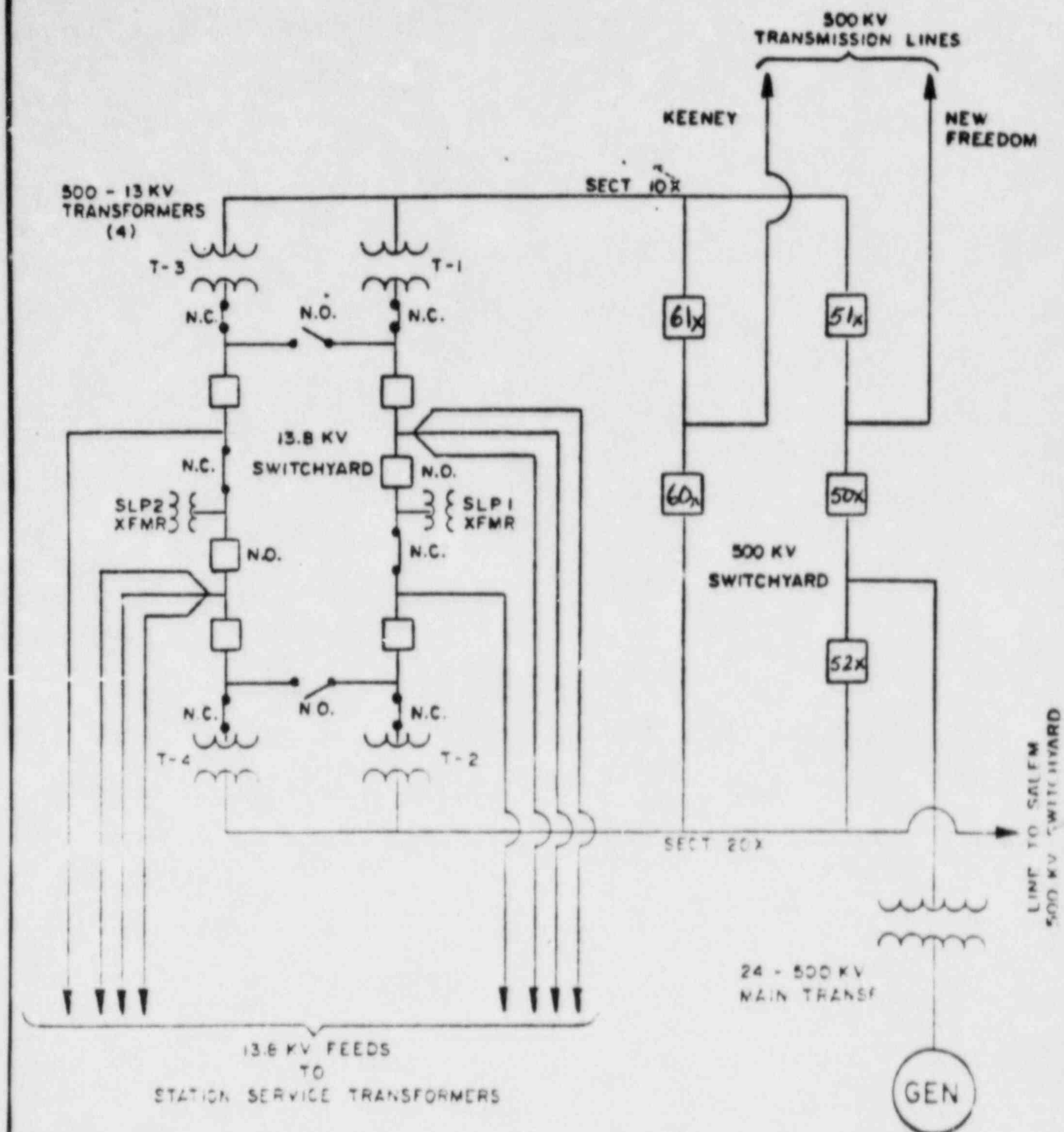
INSERT 'A'

THE 500 KV CIRCUIT BREAKERS ARE PNEUMATICALLY OPERATED AND EACH BREAKER HAS SUFFICIENT STORED AIR FOR A MINIMUM OF THREE OPERATIONS WITHOUT COMPRESSOR ACTUATION. THE COMPRESSOR MOTOR IS FED FROM THE BREAKER A.C. DISTRIBUTION PANEL, WHICH IS PROVIDED WITH TWO INDEPENDENT A.C. CIRCUITS FROM THE SWITCHYARD CONTROL HOUSE.

THE [illegible] HOUSE HAVE INDEPENDENT AND SIMULTANEOUS CONTROL OF THE 500 KV CIRCUIT BREAKERS. THE ELECTRIC SYSTEM OPERATION CENTER, LOCATED IN NEWARK, N.J., HAS LIMITED CONTROL OF THE LINE BREAKERS 51X, 60X, AND 61X AND THE TIE BREAKER 50X, AND NO CONTROL OF THE GENERATOR BREAKER 52X.

DSER OPEN ITEM 222



HOPE CREEK
GENERATING STATION
FINAL SAFETY ANALYSIS REPORT

ONE-LINE DIAGRAM

FIGURE 8.2-2

DSER OPEN ITEM 222

DSER Open Item No. 223 (DSER Section 8.2.2.3)

INDEPENDENCE OF OFFSITE CIRCUITS BETWEEN THE SWITCHYARD AND THE CLASS 1E BUSSES

The Hope Creek design provides two immediate access offsite circuits between the switchyard and the 4.16 kv Class 1E busses. It is the staff position that these two circuits be physically separate and independent such that no single event can simultaneously affect both circuits in such a way that neither can be returned to service in time to prevent fuel design limits or design conditions of the reactor coolant pressure boundary from being exceeded. The physical separation and independence of these two circuits from and including station service transformers 1AX501 and 1BX501 to the 4.16 kv Class 1E busses has not been described or analyzed in the FSAR.

By Amendment 4 to the FSAR, the applicant implied, in response to a request for information, that the offsite circuits are non-Class 1E and thus do not have to be physically separated in accordance with the requirements of Criterion 17 of Appendix A to 10CFR50. The staff finds this interpretation to be unacceptable.

RESPONSE

The response to Question 430.4 has been revised to provide a drawing showing the physical routing of the two offsite circuits between the transformers and the Class 1E busses.

QUESTION 430.4 (SECTION 8.2)

The Hope Creek design provides two immediate access offsite circuits between the switchyard and the 4.16 kV Class 1E buses. It is the staff position that these two circuits be physically separate and independent such that no single event can simultaneously affect both circuits in such a way that neither can be returned to service in time to prevent fuel design limits or design conditions of the reactor coolant pressure boundary from being exceeded. The physical separation and independence of transformers 1AX501 and 1BX501 to the 4.16 kV Class 1E buses has not been described or analysed in the FSAR. Provide the description and analysis and justify areas of noncompliance with the above staff position. The analysis should include separation and independence of control and protective relaying circuits as well as the power circuits.

RESPONSE

Power to the station service transformers comes from separate and opposite sides of the 13.8 kV ring bus. These are run in separate duct bank manholes to each respective transformer. In each duct bank the lines are enclosed in PVC conduit and encased in concrete.

Figure 8.3-5 shows that each of the four 4.16 kV Class 1E switchgear buses is supplied from two offsite (preferred) power sources and one onsite standby diesel generator (SDG). The offsite power to these buses is supplied from station service transformers 1AX501 and 1BX501 by non-segregated phase buses that are insulated and enclosed in metallic ducts. The non-segregated phase buses from the station service transformers to 4.16 kV Class 1E switchgear are designated as non-Class 1E.* The onsite power to the 4.16 kV class 1E bus is supplied from its associated SDG. The cables and the raceways associated with it are designated as Class 1E.

The non-Class 1E, non-segregated phase buses carrying the offsite power to 4.16 kV Class 1E switchgear buses are separated from Class 1E raceways of the onsite SDG power supply in accordance with the requirements of Regulatory Guide 1.75.

INSERT 'A' (NEXT PG) ~~Station service transformers 1AX501 and 1BX501 are separated and protected by concrete walls.~~

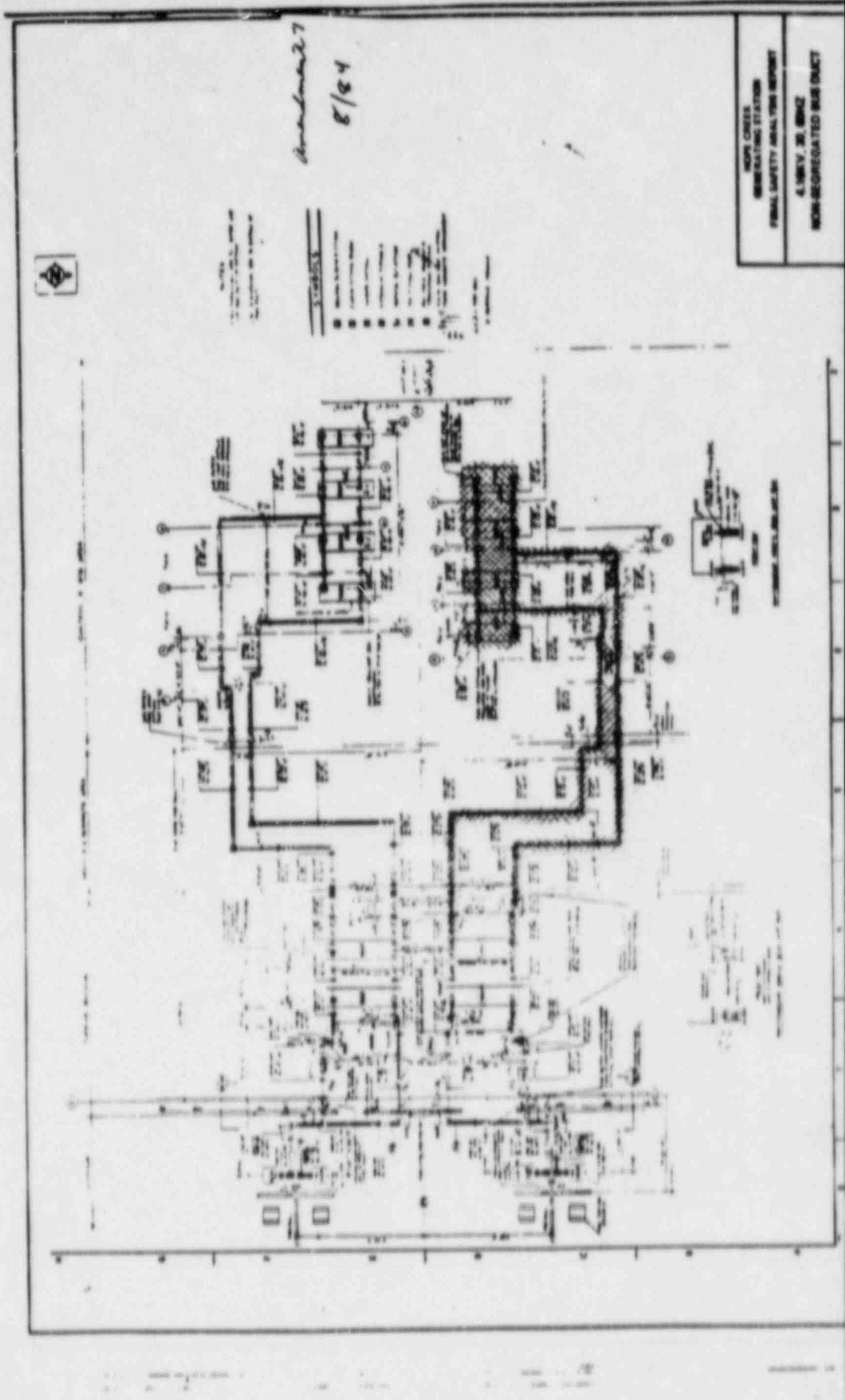
Analysis of circuitry independence and common mode failures are discussed in the response to Question 430.5.

INSERT * THE TWO NON-SEGREGATED BUSES ARE SEPARATED FROM EACH OTHER AS SHOWN ON FIGURE 430.4-1

INSERT 'A'

STATION SERVICE TRANSFORMERS 1AX501 AND 1BX501 ARE PROVIDED WITH INDIVIDUAL WATER SPRAY SYSTEMS AND ARE SEPARATED FROM EACH OTHER BY A 1-HOUR FIRE BARRIER. EACH TRANSFORMER HAS A COLLECTION DIKE AND DRAINAGE OUTLET FOR COLLECTING TRANSFORMER OIL SPILLS AND FIRE SUPPRESSION SYSTEM WATER AND DRAINING IT TO THE OILY WASTE DRAINAGE SYSTEM

DSEP OPEN ITEM 223



DSER OPEN ITEM 223

DSER Open Item No. 224 (DSER Section 8.2.2.4)

COMMON FAILURE MODE BETWEEN ONSITE AND OFFSITE POWER CIRCUITS

Each of the 4.16 kv Class 1E busses at Hope Creek is supplied power from preferred offsite ad standby onsite circuits. It is the staff position that these circuits should not have common failure modes. Physical separation and independence of these circuits has not been described or analyzed in the FSAR. By Amend. 4 to the FSAR, the applicant, in response to a request for information, indicated that a single event can not cause common failure of both onsite and offsite power source circuits because they are separated in accordance with the requirements of Regulatory Guide 1.75. The staff disagrees. Separation in accordance with Regulatory Guide 1.75 by itself is not sufficient for the staff to conclude that these are no common failure modes or to conclude that the probability of coincident loss of both onsite and offsite power sources has been minimized in accordance with the requirements of Criterion 17 of Appendix A to 10 CFR 50.

RESPONSE

The response to Question 430.5 has been revised to provide additional analysis and discussion on separation between onsite and offsite power circuits.

QUESTION 430.5 (SECTION 8.2)

Each of the 4.16 kV Class 1E busses at Hope Creek is supplied power from preferred offsite and standby onsite circuits. It is the staff position that these circuits should not have common failure modes. Physical separation and independence of these circuits has not been described or analyzed in the FSAR. Provide a description and analysis in accordance with Section 5.2.1(5) of IEEE Standard 308-1974.

RESPONSE

PHYSICAL SEPARATION AND INDEPENDENCE OF OFFSITE AND STANDBY ONSITE CIRCUITS SUPPLYING 4.16 KV CLASS 1E SWITCHGEAR BUSES.

Figure 8.3-5 shows that each of the four 4.16 kV Class 1E switchgear buses is supplied from two offsite (Preferred) power sources and one onsite standby diesel generator (SDG). The offsite power to these buses is supplied from station service transformers 1Ax501 and 1Bx501 by non-segregated phase buses that are enclosed in metallic ducts. The non-segregated phase buses from the station service transformers to the 4.16 kV Class 1E switchgear are designated as non-Class 1E. (A) ~~The onsite power to the 4.16 kV Class 1E bus is supplied from its associated SDG. The cables and the raceways associated with it are designated as Class 1E.~~ INSERT A

The non-Class 1E non-segregated phase buses carrying the offsite power to 4.16 kV Class 1E switchgear buses are separated from Class 1E raceways of the onsite (SDG) power ~~supply in accordance with the requirements of Regulatory Guide 1.75.~~ SUPPLIES.

ANALYSIS FOR COMMON FAILURE MODE BETWEEN ONSITE AND OFFSITE POWER SUPPLIES TO 4.16 KV CLASS 1E SWITCHGEAR PER IEEE-308-1974, SECTION 5.2.1.5

The following discussion demonstrates that there are no common failure modes in the HCGS design:

a. Between onsite and offsite power supplies to 4.16 kV Class 1E switchgear.

b. Among the four redundant onsite power sources of the standby power supply to 4.16 kV Class 1E switchgear.

1. As stated above the raceways carrying onsite and offsite power supplies to 4.16 kV Class 1E switchgear are separated ~~in accordance with the requirements of Regulatory Guide 1.75.~~ FROM ONE ANOTHER.

2. The circuit breakers that connect a 4.16 kV Class 1E switchgear bus to the two offsite power supplies and its associated onsite standby power supply are Class 1E and are qualified to the HCGS seismic and environmental parameters for any design basis event.

3. Electrical interlocks are provided to prevent the automatic paralleling of the onsite and offsite power supplies.

4. Each of the four SDGs are located in separate rooms of a seismic Class 1 structure. The SDGs and the associated control panels are qualified for HCGS seismic and environmental parameter for all design basis events. The control panels, power and control cables for all the four SDGs are separated to comply with Regulatory Guide 1.75 requirements.

5. INSERT B

DSER OPEN ITEM 224

pg 2

(A)

FIGURE 430.4-1 SHOWS THE ROUTING OF THESE NON-SEGREGATED PHASE BUS DUCTS FROM STATION SERVICE TRANSFORMERS 1AX501 and 1BX501 TO 4.16 KV SWITCHGEAR. THESE NON-SEGREGATED BUSES ARE PHYSICALLY ROUTED SEPARATELY. HOWEVER, THEY SHARE COMMON PLANT AREAS (HALLWAYS, ROOMS etc.), BUT ARE ALWAYS ~~MAINTAIN PHYSICAL~~ SEPARATED ~~SEPARATION~~ FROM EACH OTHER.

DSER OPEN ITEM 224

INSERT (B.)

THERE ARE FOUR REDUNDANT CLASS IE 4.16 KV SWITCHGEAR ASSEMBLIES. EACH OF THE FOUR CLASS IE 4.16 KV SWITCHGEAR ASSEMBLIES IS POWERED FROM THE TWO OFFSITE POWER SOURCES AND A DEDICATED STANDBY DIESEL GENERATOR. INDEPENDENT CIRCUIT BREAKERS CONNECT THE ONSITE AND OFFSITE POWER SUPPLIES TO THE FOUR CLASS IE 4.16 KV SWITCHGEAR BUSES. THE CONTROL POWER SUPPLY FOR THESE INCOMING CLASS IE 4.16 KV CIRCUIT BREAKERS IS SUPPLIED FROM A 125 V DC DISTRIBUTION PANEL OF ~~IN~~ THE SAME SEPARATION CHANNEL. THE CONTROL CABLES FOR THESE CIRCUIT BREAKERS FOR ONE SWITCHGEAR ASSEMBLY SHARE COMMON RACEWAYS IN CONTROL ROOM, CABLE SPREADING ROOM AND CONTROL EQUIPMENT ROOM. However ~~BUT~~ THESE CABLES ARE SEPARATED FROM CABLES FROM THE REDUNDANT SWITCHGEAR ASSEMBLIES. EACH OF THE FOUR CLASS IE 4.16 KV SWITCHGEAR BUSES HAS ITS OWN INDEPENDENT PROTECTIVE RELAYING SCHEMES. ~~ALSO~~ THE FAILURE OF A PROTECTIVE RELAY IN THE 13.8 kV AND/or 500 kV SYSTEMS DOES NOT IMPACT ANY OF THE FOUR ONSITE POWER SOURCES.

DSER OPEN ITEM 224

DSER Open Item No. 225 (DSER Section 8.2.3.1)

TESTABILITY OF AUTOMATIC TRANSFER OF POWER FROM THE NORMAL TO PREFERRED POWER SOURCE

Each Class 1E bus is supplied with a normal and alternate off-site power source. On loss of the normal source, the bus is automatically transferred to the alternate power source. The capability to test this transfer of power has not been specifically addressed in the FSAR.

Inclusion of the test capability in the FSAR and justification for not testing while the plant is operating at power will be pursued with the applicant.

RESPONSE

The response to Question 430.6 has been revised to provide the requested information.

QUESTION 430.6 (SECTION 8.2)

Each Class 1E bus is supplied with a normal and alternate offsite power source. On loss of the normal source, the bus is automatically transferred to the alternate power source. The capability to test this transfer of power has not been specifically addressed in the FSAR. Describe the transfer circuitry, how it is tested during normal plant operation, and its compliance with GDC 18.

RESPONSE

On the Class 1E 4 kV buses the transfer circuit has two functions. One is to transfer the bus to the alternate source if the normal source is lost due to transformer fault. The other function is to transfer the bus to the alternate source if the normal source has an undervoltage condition. The transfer circuit is shown in each of the main circuit breaker schematic diagram. The applicable diagrams were submitted under separate cover in accordance with Regulatory Guide 1.70, Revision 3, Section 1.7 and consist of Drawing Numbers E-0068-0 thru E-0075-0 and Sheets 3 and 4 of E-0106-0 together with other drawings referenced thereon.

There are eight main circuit breakers, two for each bus, and the transfer circuit is typical for each breaker. The transfer circuits is described as follows, using Bus 10A401 as an example:

a. [illegible]

Bus 10A401 is normally supplied from station service transformer 1AX501 through main circuit breaker (1)52-40108. Drawing Number E-0068-0 shows this breaker's schematic diagram. In the event transformer protective relay operation (differential, ground overcurrent or overcurrent relay), lockout relay (3)86TR-AX501 or (3)86TB1-AX501, shown on Drawing Number E-0112-0, will trip breaker (1)52-40108 and close the alternate feeder breaker (1)52-40101, shown on Drawing Number E-0069-0.

b. Undervoltage of Normal Source Voltage

Undervoltage relays (1)27-40108(A-B) and (1)27-40108(B-C) will pickup auxiliary relays (1)27X-40108(A-B) and (1)27X-40108(B-C) when the normal source voltage is 92% or less of normal bus voltage as shown on Sheet 3 of Drawing Number E-0106-0. Contacts 7-8 of the two auxiliary relays are connected in series to provide a trip signal to breaker (1)52-40108 upon relay actuation - shown as wire number 31 in Drawing Number E-0068-0. The bus is now deenergized

DSER OPEN ITEM 225

since the normal source feeder breaker is tripped. Bus undervoltage relays (1)27A1-401(A-B), (1)27A1-401(B-C), (1)27A2-401(A-B) and (1)27A2-401(B-C) will operate auxiliary relays (1)27AX1-401(A-B), (1)27AY1-401(A-B), (1)27AX1-401(B-C), (1)27AY1-401(B-C), (1)27AX2-401(A-B), (1)27AY2-401(A-b), (1)27AX2-401(B-C), and (1)27AY2-401(B-C) - all shown on Sheet 3 of Drawing Number E-0106-0.

Of the eight auxiliary relays, contacts 9-10 of (1)27AY1-401(A-B), (1)27AY1-401(B-C), (1)27AY2-401(A-B) and (1)27AY2-401(B-C) are connected in a two-out-of-four, twice arrangement to close the alternate source feeder breaker (1)52-40101 - shown as wire number 52 on Drawing Number E-0069-0.

The transfer circuit will be tested during the preoperational test of the Class 1E 4.16 kV ac power system as indicated in Section 14.2.12.1.32. This test will include actual loads on the bus if the loads are ready for preoperational test; otherwise the complete bus transfer test will be performed during the ECCS integrated initiation during loss of offsite power preoperational test described in Section 14.2.12.1.47. The protective relays of the transfer circuit are designed for testing during normal plant operation by use of test plugs or test switches to isolate their actuating function. Class 1E bus transfer circuitry will not be tested during normal plant operations. Testing of the transfer circuitry, as required by GDC 18, will be accomplished as deliniated by the Surveillance Requirements section of Standard Technical Specification [illegible]

However, power source transfer testing from the normal source to the alternate source, as required by GDC 18, will be performed in accordance with Surveillance Requirement 4.8.1.1.1 of the Standard Technical Specification. Power source transfer testing is not performed during power operation in order to preclude an [illegible] transient which [illegible] result due to the interruption of normal AC power to an individual bus should the transfer sequence fail.

DSER OPEN ITEM 225

DSER Open Item No. 226 (DSER Section 8.2.2.5)

GRID STABILITY

In regard to the grid stability analysis presented in Section 8.2.2 of the FSAR, it is the staff concern, due to the close proximity of the Salem and Hope Creek Generating Station, that simultaneous trip of Hope Creek Unit 1, Salem Unit 1 and Salem Unit 2, should be considered.

In response to this concern, the applicant by Amendment 4 to the FSAR stated that the Hope Creek Station will remain stable with the loss of both Salem Units 1 and 2, clarification and basis for this statement will be pursued with the applicant.

RESPONSE

In accordance with these "Reliability Principles and Standards for Planning Bulk Electric Supply Systems of the Mid-Atlantic Area Coordination Group" (MAAC), grid stability analyses have been performed as indicated in Section 8.2.2. Additionally, analysis of the most severe multi-phase fault with delayed clearing (stuck 500KV Breaker 60X) on the Hope Creek - Keeney 500KV line at HOpe Creek, shows that Salem No. 1 and 2, and Hope Creek No. 1 Units will lose synchronism and trip. However, the 500KV system remains stable.

DSER Open Item No. 227 (DSER Section 8.2.2.6)

CAPACITY AND CAPABILITY OF OFFSITE CIRCUITS

Section 8.3.1.1.2.1 of the FSAR indicates that each of the four Class 1E 4.16 kv busses, is energized by one of the two preferred offsite power circuits. On loss of power from one of the offsite circuits automatic fast transfer to the other offsite circuit occurs. Similarly, a number of large non-Class 1E loads are transferred automatically from one to the other preferred offsite power circuit. It is the staff concern that these transfers of Class 1E and non-Class 1E loads may result in degraded voltage condition or overload of offsite power transformers with the possible consequence of loss of both offsite circuits.

By Amendment 4 to the FSAR, the applicant stated that a voltage analysis indicates that each offsite circuit path is of sufficient capacity and capability to supply all station loads. Based on this statement and discussions with the applicant, the staff concludes that each offsite circuit meets the capacity and capability requirements of GDC 17, and is acceptable.

RESPONSE

Item was resolved in the June 6, 1984 meeting in Bethesda.

DSER Open Item No. 228 thru 232 (DSER Section 8.3.1.1)

VOLTAGE DROP ANALYSIS

The voltage levels at the safety related loads should be optimized for the maximum and minimum load conditions that are expected throughout the anticipated range of voltage variations of the offsite power sources for all modes of plant opera ion. By Amendment 4 to the FSAR, the applicant provided the results of a voltage analysis that was requested to be performed in accordance with the guidelines of position 3 of branch technical position PSB-1 (NUREG-0800, Appendix 8A). Based on these results and clarification provided by the applicant during a June 6, 1984 meeting, the staff concludes that there is reasonable assurance that all Class 1E loads will operate at or within design voltage limits under all conditions of plant operation and is acceptable.

RESPONSE

Item(s) was resolved as indicated above.

DSER Open Item No. 233 (DSER Section 8.3.3.4.1)

PERIODIC SYSTEM TESTING

Description of compliance to Section 6.4, Periodic System Tests, of IEEE Standard 308-1974, had not beeen included in Section 8.1.4.6 of the FSAR. By Amendment 4 to the FSAR, the applicant provided the following description of compliance: "Periodic system tests shall be performed using written procedures which will be designed to demonstrate system performance. The frequency of testing shall be governed by the frequencies specified in the Technical Specifications."

The following periodic system tests are required by Section 6.4 of IEEE Standard 308-1974 in order to demonstrate:

(1) The Class 1E loads can operate on the preferred power supply.

(2) The loss of the preferred power supply can be detected.

(3) The standby power supply can be started and can accept design load within the design basis time.

(4) The standby power supply is independent of the preferred power supply.

Pending inclusion of each of these tests in the Hope Creek Technical Specifications, the staff concludes that periodic system testing will comply with the guidelines of Section 6.4 of IEEE Standard 308-1774. This testing meets the requirements of GDC 17 and 18 and is acceptable.

RESPONSE

This item is considered as closed since the Standard Technical Specification Section 4.8.1.1.2e includes the above tests as part of the diesel generator testing every 18 months during shutdown. (The Hope Creek Technical Specification, when issued, is based on the Standard Technical Specification.)

DSER Open Item No. 234 (DSER Section 8.3.1.3)

CAPACITY AND CAPABILITY OF ONSITE AC POWER SUPPLIES

The applicant, in response to a request for information, stated that Table 8.3-1 of the FSAR shows that in no case does the load demand exceed the continuous rated capacity for any of the four diesel generators at Hope Creek. Based on a review of information presented in Table 8.3-1 of the FSAR, it appears, in contradiction to the above statement, that the continuous rated capacity is exceeded when loads are automatically sequenced onto this diesel generator during a loss of offsite power. This item will be pursued with the applicant.

RESPONSE

The response to Question 430.14 has been revised to provide additional clarification.

QUESTION 430.14 (SECTION 8.3.1)

In Section 8.3.1.1.3.10 of the FSAR you state that additional loads may be manually added to Class 1E system after automatic sequencing. It is further stated that the application of these additional loads does not exceed the diesel generators capacity. Provide additional information or results of analysis that demonstrates that diesel generator capacity (continuous rating) is not exceeded when all loads that can be connected are connected to the diesel generator. If the continuous rating can be exceeded, describe design provisions that will preclude overload of the diesel generator.

RESPONSE

Tables 8.3-1 through 8.3-6 tabulate the Class 1E and non-Class 1E load demands for the four standby diesel generators (SDGs) for various scenarios. These tables show that in no case does the load demand exceed the SDG continuous rated capacity for any of the four SDGs.

Upon the completion of the automatic loading sequence, the operator trips the Class 1E loads that are no longer required to mitigate the consequences of the emergency that initiated the starting and loading of the SDGs. Having tripped the Class 1E loads described above, the operator can apply the non-Class 1E loads manually.* The four SDG wattmeters, one for each of the four SDGs, located in the control room, aid the operator to avoid the overloading of the SDGs. No unique one-step loads could push the diesel significantly over 104 percent of its continuous rating.

In the remote event, the operator starts overloading a SDG in excess of 104 percent of its continuous rating, an alarm in the control room is sounded to alert the operator to the SDG overload condition. This condition is detected by an overcurrent relay as shown on Figure 8.3-7. However, a temporary overload of an SDG up to 110% of its related capacity for two hours is within its design capability.

The control room indicators and overload alarms will be used in conjunction with administrative controls for loading SDGs manually.

* THE SDG CONTINUOUS RATING IS NOT EXCEEDED DURING THE AUTOMATIC APPLICATION OF LOADS BY TH SEQUENCER. THE MANUAL APPLICATION OF LOADS IS GOVERNED BY ADMINISTRATIVE CONTROLS TO ENSURE THAT the SDG CONTINUOUS RATING IS NOT EXCEEDE

DSER OPEN ITEM 234

~~Amendment 1~~

DSER Open Item No. 235 (DSER Section 8.3.1.5)

DIESEL GENERATOR LOAD ACCEPTANCE TEST

Position C.2.a(2), of Regulatory Guide 1.108, requires that the preoperational and periodic tests demonstrate proper operation of the diesel generator for design accident loading sequence to design load requirements. Section 1.8.1.9 of the FSAR states that for preoperational testing actual loads are started but may not duplicate their design basis condition. This statement implies exception to the above position. Justification for non-compliance with the guidelines of Regulatory Guide 1.108 will be pursued with the applicant, and the results of the stuff review will be reported in a supplement to this report.

RESPONSE

The response to Question 430.15 has been revised to clarify compliance with Regulatory Guide 1.108.

F70(8)

due to the excitation current inrush while the transformers are energized and lasts for approximately six cycles. The first motor load applied is the RHR motor, after closure of the SDG circuit breaker. The RHR motor circuit breaker has a closing permissive from the bus undervoltage relays. With the current setting of these relays (set to dropout at 70 percent and to pickup at 78 percent) the RHR motor circuit breaker will close when permitted. It takes 4.5 cycles for this circuit breaker to close. During this interval the generator has recovered its voltage in excess of 90 percent. This will be verified during the preoperational tests described in Section 14.2.12.1.30.

DELETE ~~Compliance with Position C.6 of Regulatory Guide 1.9 is discussed in Section 1.8.1.1.100~~
1.8.1.108

For further discussion of onsite power systems, see Section 8.3.

1.8.1.10 <u>Conformance to Regulatory Guide 1.10, Revision 1, January 2, 1973: Mechanical (Cadweld) Splices in Reinforcing Bars of Category I Concrete Structures</u>

Although Regulatory Guide 1.10 was withdrawn by the NRC on July 21, 1981, HCGS complies with it.

The original Cadweld testing program in the preliminary safety analysis report (PSAR) was based on using only sister splices. The program was later revised before the start of construction to conform with the Regulatory Guide using a combination of production and sister splices. When newer technical criteria for Cadwelding developed, the architect-engineer revised the program to delete the tensile test frequency requirements for each splicing crew. The new criteria conformed to the requirements of ANSI N45.2.5, 1978, as endorsed by Regulatory Guide 1.94. However, the letter dated August 5, 1981, NRC to PSE&G, from R. L. Tedesco to R. L. Mittl, requested that the sample frequency requirements of this guide be implemented. Since November 30, 1981, HCGS has been in complete compliance with this Regulatory Guide.

For further discussion, see Section 3.8.6.

DSER OPEN ITEM 235

QUESTION 430.15 (SECTION 8.3.1)

In Sections 1.8.1.9 and 8.1.4.2 of the FSAR. You state (1) that preoperational testing at Hope Creek does not meet the guidelines of position C3 of Regulatory Guide 1.9 (revision 1), (2) predicted loads are verified by testing; however, loads that cannot be tested are verified by analysis or by comparison, and (3) for preoperational testing, actual design loads are started but may not duplicate their design basis condition. The above statement imply (1) that the diesel generators at Hope Creek will not be preoperationally or periodically tested to demonstrate their capacity and capability to operate properly when subject to design load, (2) that the guidelines of position C.2.a(2) of Regulatory Guide 1.108 (revision 1) will not be followed, and (3) that the design does not meet the requirements of criterion 17 of Appendix A to 10 CFR 50. In Section 8.1.4.20 of the FSAR provide justification for noncompliance

RESPONSE

Section 1.8.1.9 has been revised to delete the clarification to position C.3 of Regulatory Guide 1.9, Revision 1. The preoperational test program at HCGS for diesel generator testing will follow the guideline of Regulatory Guides 1.9 and 1.108, as shown in Sections 14.2.12.1.30 and 14.2.12.1.47. ~~One exception to Regulatory Guide 1.108 has been taken as stated in Section 1.8.1.108 and discussed in response to Question 640.10~~

Periodic testing of the SDGs, at the required 18 month intervals, will be performed using written procedures in accordance with the requirements of the Hope Creek Technical Specifications. Sections 1.8.1.108 and 8.1.4.20 have been revised to reflect this response.

Position C.2.a(2) of Regulatory Guide 1.108 is met with no exception as discussed below:

1. During the preoperational test phase, proper design accident loading sequence will be demonstrated by the test described in Section 14.2.12.1.47. This test will verify the ability of the SDG to start and accept the sequenced design loads as specified in Table 8.3-1 while maintaining voltage and frequency within specified limits.

2. For periodic testing required by the Hope Creek Technical Specification, the test per this regulatory position will be performed during shutdown. This test will simulate separately a loss of offsite power and a loss of offsite power plus a LOCA condition to verify the SDG's ability to start and accept the sequenced design loads.

DSER OPEN ITEM 235

DSER Open Item No. 236 (DSER Section 8.3.1.6)

COMPLIANCE WITH POSITION C6 OF REGULATORY GUIDE 1.9

Sections 1.8.1.9 and 8.1.4.20 of the FSAR implies that the Hope Creek design for preoperational and periodic testing of the diesel generator does not follow the guidelines of position C6 of Regulatory Guide 1.9 (Revision 2). By Amendment 4 to the FSAR, the applicant further implied that exceptions have been taken to position C6.

Identification and justification for each exception will be pursued with the applicant.

RESPONSE

Sections 1.8.1.9 and 8.1.4.20 have been revised to clarify compliance with Regulatory Guide 1.9.

8.1.4.16 Regulatory Guide 1.89, Qualification of Class 1E Equipment for Nuclear Power Plants, November 1974

See Section 1.8 for discussion of compliance.

8.1.4.17 Regulatory Guide 1.93, Availability of Electric Power Sources, December 1974

HCGS complies with Regulatory Guide 1.93 as discussed in Section 1.8.

8.1.4.18 Regulatory Guide 1.100, Seismic Qualification of Electric Equipment for Nuclear Power Plants, August 1977

HCGS complies with Regulatory Guide 1.100 as discussed in Section 1.8.

8.1.4.19 Regulatory Guide 1.106, Thermal Overload Protection for Electric Motors on Motor-Operated Valves, March 1977

Design of electrical circuits for MOVs for HCGS complies with Regulatory Guide 1.106, Revision 1, as discussed in Section 1.8.

8.1.4.20 Regulatory Guide 1.108, Periodic Testing of Diesel Generator Units Used as Onsite Electric Power Systems at Nuclear Power Plants, August 1977

HCGS complies with Regulatory Guide 1.108 as discussed in Section 1.8. Chapter 14 discusses compliance with Regulatory Guide 1.108, Revision 1. The design of the SDG and its associated equipment and circuitry permits the unit to be tested during the normal operation of the plant. Periodic tests are developed to:

a. Verify that the components of the SDG units required for automatic startup are operable

b. Verify proper startup of the diesel engine

DSER OPEN ITEM 236

c. Verify that the required voltage and frequency are automatically attained within acceptable limits and time

d. Verify that the full load carrying capability for an interval is not less than 1 hour (this is accomplished by synchronizing the generator with the preferred power supply and assuming a load at the maximum practicable rate.)

e. Verify that the cooling system functions within design limits

f. Test trip setpoints - Overspeed, lube oil pressure, frequency variation, and high jacket water temperature.

Each of the above tests can also be performed when the plant is shut down. Periodic testing of the SDG's, at the required 18 month intervals, will be performed using written procedures in accordance with the requirements of the Hope Creek Technical Specifications.

8.1.4.21 Regulatory Guide 1.118, Periodic Testing of Electric Power and Protection Systems, June 1978

HCGS complies with Regulatory Guide 1.118 as discussed in Section 1.8.

The design of the electrical power system permits its periodic testing during the normal plant operation. Redundant power channels can be tested one at a time. 4.16-kV and 480-V unit substation breakers have a test position. All the signals that are required to open or close the breaker automatically can be simulated. Proper operation of the breakers in response to these signals can be verified. Relays on the switchgear are accessible and installed in such a way that their calibration can be verified in place.

For the loads that are supplied from MCCs, testing of the electrical apparatus is performed in conjunction with testing of mechanical, control, and instrumentation systems.

The preoperational testing program is described in Chapter 14.

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g. Appendix A, Paragraph 1.b (3) concerns standby liquid control system tests. Comment:

Verification of proper mixing of the solution is not performed as part of the preoperational test program. Just prior to fuel load, the solution is mixed and sampled using the station operation procedures.

h. Appendix A, Paragraph 1.c, of Regulatory Guide 1.68 references Regulatory Guide 1.118. Compliance with Regulatory Guide 1.118, Periodic Testing of Electric Power and Protection Systems, is addressed in Section 1.8.120. Regulatory Guide 1.118 will be used as guidance for preoperational tests.

i. Appendix A, Paragraph 1.g (2), concerns testing the emergency ac power distribution system. Comment:

Emergency loads are tested with nominal voltage available at the Emergency AC Power Distribution System buses. The power source to these buses is either from offsite (normal) or onsite (standby). When the bus is supplied from the onsite source, the available voltage is maintained within specified limits to verify proper functioning and loading of the onsite source. Test abstracts are presented in Section 14.2.12.1.30, 14.2.12.1.32 and 14.2.12.1.33. Testing of emergency loads with maximum and minimum design voltage available is not considered necessary became the station distribution system is designed to maintain voltages to support starting and operating of loads within their design limits. The station distribution system has been analyzed in accordance with BTP PSB-1 to establish minimum and maximum voltages under several operating conditions with only the offsite source considered available. Actual test voltages at selected points on the station distribution system will be taken and compared with the calculated voltages to validate the analysis performed.

Appendix A, Paragraph 1.g (3) references Regulatory Guide 1.9. HCGS complies with Regulatory Guide 1.9 ~~subject to clarifications added below:~~ AS DISCUSSED IN SECTION 1.8.

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Although Revision 2 of Regulatory Guide 1.9 is not applicable to HCGS, per its implementation section, HCGS complies with it subject to the clarifications stated below.

1. Position C.3: Insofar as possible, predicted loads are verified by testing. Loads that cannot be tested are verified by analysis or comparison with similar units

2. Position C.5: The suitability of each diesel generator is confirmed by qualification testing and preoperational testing. For qualification testing, actual equipment loads, where practical, or equal resistive loads are connected as shown on the load sequence chart to simulate conditions during a design basis accident (DBA). For preoperational testing, actual loads are started but may not duplicate their design basis conditions.

j. Appendix A, Paragraph 1.h 10) concerns engineered safety features (ESFs). Comment:

There is no practical way to verify the maximum heat removal capability of the ultimate heat sink (UHS). Flow paths are demonstrated to show the proper operation of equipment and structures used to transport the water to and from the ultimate heat sink.

k. Appendix A, Paragraphs 1.k (2) and (3) concerns radiation protection systems. Comment:

Preoperational testing of personnel radiation monitoring and survey equipment or laboratory equipment is not performed. Calibration tests are performed prior to core load in accordance with station procedures.

l. Appendix A, Paragraph 1, states that spiked samples should be used where necessary to verify the operability of radioactive waste handling and storage systems. The functional testing of these systems is accomplished without the use of spiked samples of calibration completed prior to performing the preoperational test.

14.2.13.5 SRP II.e, Regulatory Guide 1.108, Revision 1, August 1977: Periodic Testing of Diesel Generator Units Used as Onsite Electric Power Systems at Nuclear Power Plants

delete

Although Regulatory Guide 1.108 is not applicable to HCGS, per its implementation section, HCGS complies with it, with the following clarifications:

a. Position C.2.a (5) requires that the accident loading sequence to design load requirements be performed directly after the 24 hour run. This does not test the sequencing controls under a more severe condition than if sequentially loaded at an earlier or later period. A restart simulating loss of ac can be performed directly after the 24-hour run.

Sequencing, however, will be performed when the loads can be lined up for operation and all four diesels are available.

HCGS complies with Regulatory Guide 1.108 as discussed in Section 1.8

DSER OPEN ITEM 236

DSER Open Item No. 237 (DSER Section 8.3.1.7)

DESCRIPTION OF THE LOAD SEQUENCER

By Amendment 4 to the FSAR, the applicant in response to a request for information, provided a description of the Hope Creek load sequencer. Based on a review of this description, it appears that provisions for shedding of safety loads has not been considered in the design of the load sequencer. Load shedding capacity and inclusion of the description in Section 8.3 of the FSAR will be pursued with the applicant.

RESPONSE

Item was resolved in the June 6, 1984 meeting in Bethesda.

DSER Open Item No. 238 (DSER Section 8.2.2.7)

SEQUENCING OF LOADS ON THE OFFSITE POWER SYSTEM

It is the staff's position that the offsite power system should have sufficient capacity to supply all required loads without sequencing of loads. By Amendment 4 to the FSAR, the applicant indicated that the Hope Creek design includes provision for sequencing of loads on the offsite as well as the onsite power supply. Thus, the Hope Creek offsite power system may not have sufficient capacity to supply all loads without sequencing. Sequencing of loads on the offsite power system represents an additional source of unreliability and because the same sequencer is used for both onsite and offsite power sources, independence between sources may be compromised. Therefore, it is the staff position that the applicant must perform an analysis with results documented in the FSAR, to demonstrate (1) (1) that there are no credible circuits or common failure modes in the sequencer design that could render both the onsite and offsite power sources unavailable and, (2) that the combined reliability of onsite and offsite power sources has not been compromised. This item will be pursued with the applicant.

RESPONSE

Attached, per your request, is a copy of the ELS system reliability analysis. The response to Question 430.19 has been revised to reflect the submittal of this analysis.

f. LOP AFTER LOCA SEQUENCING COMPLETED

If a LOCA signal is still present when the SDG circuit breaker is closed, the LOCA signal overrides the LOP sequencer and starts the LOCA sequencer to apply LOCA loads in the predetermined sequence.

For scenarios '2a' through '2f' above, the PSIS signals are present to prevent the inadvertant starting of equipment before its predetermined sequenced time.

ELS TESTING:

Provisions exist at each of the sequencer cabinets to test the ELSs for 2a through 2f scenarios described above. An alarm is provided in the main control room to indicate that an ELS is being tested. If an actual LOP or LOCA occurs during the testing of an ELS, the sequencer resets automatically and responds to LOP and/or LOCA event.

The ELS system reliability analysis ~~IS FURNISHED UNDER A SEPARATE COVER.~~ has been provided as part of the response to Draft Safety Evaluation Open Item No. 238 submitted on August 1, 1984 (R.L. Mittl - PSEG to A. Schwencer - NRC, letter) THE ELS SYSTEM RELIABILITY IS ENHANCED BY THE USE OF TWO REDUNDANT MICROPROCESSORS IN EACH OF THE FOUR ELS SYSTEMS.

DSER OPEN ITEM 238

REVISIONS			
LTR	DESCRIPTION	DATE	APPROVED
—	RELEASE ON ᴬ/N 57222	2-6-84	FJM

Reliability Analysis
of
Emergency Load Sequencer
9N90

for
Public Service Electric and Gas Company
Newark, New Jersey
Hope Creek Generating Station

SHEET											
REV	—	—	—	—	—	—	—	—	—	—	—
SHEET	22	23	24	25	26	27	28	29	30	31	32

REV STATUS OF SHEETS																						
	REV	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	SHEET	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21

DSER OPEN ITEM 238

CONDEC Consolidated Controls
Bethel, CT 06801

DRAWN kec 2/4/84
CHECKED F.M. V 2/6/84
ENGR [illegible] 2/6/84
RELEASED KBT 2-6-84

ENGINEERING RELIABILITY REPORT FOR
EMERGENCY LOAD SEQUENCER, 9N90

JUN 1 1 1984

NEXT ASSY	USED ON
	9N90

APPLICATION

SIZE	FSCM NO.	DWG NO.
A	02750	ER7188

SCALE — WT. CALC ACT — SHEET 1 OF 32

ENGINEERING REPORT

Reliability Analysis

Emergency Load Sequencer, 9N90

for

Public Service Electric and Gas Company

Newark, New Jersey

Hope Creek Generating Station

Prepared for

Bechtel Power Company

San Francisco, CA

Bechtel Contract No. 10855-J-810(Q)-AC

Prepared by:

L. Arnell, PhD

Approved by: [signature] Project Engineer

Consolidated Controls Corporation

Bethel, CT

DSER OPEN ITEM 238

REVISION RECORD

Rev.	Page	Paragraph	Description	Appvl/Date

DSER OPEN ITEM 238

1.0 INTRODUCTION

1.1 Scope of Analysis

This Reliability Analysis was performed in accordance with Bechtel Specification No. 10855-J-810 (Q). This analysis provides a prediction of the "Probability of Success in Responding to A Loss of Coolant (LOCA) or a Loss of Power (LOP) Signal for the Emergency Load Sequencer System." This is then used to calculate system reliability, system failure rate and system mean time between failures (MTBF).

The estimates of component failure rates were obtained using the data and procedures of MIL-HBK-217D. Wherever an uncertainty existed in deciding which value to use, a conservative approach was used and the worst case value was selected and used. Where results have been used from previous programs, an ambient temperature of 50°C was used for the calculations.

This report contains the following information:

a. Figure 1 - Functional Block Diagram

b. Figure 2 - Reliability Block Diagram

c. Figure 3 - Simplified Reliability Block Diagram

d. Table 1 - Failure Rate Data Summary

e. Appendix A - Probability Computations

f. Appendix B - Stress Analysis - Reliability Prediction Work Sheets for each Module

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1.2 Definitions

The definitions of IEEE 352-1975 were used throughout this report.

$$Av = \text{Availability} = \frac{\text{average time in the good state per test interval}}{\text{average time per test interval}}$$

or

$$Av = \frac{\text{Uptime}}{\text{Uptime \& Downtime}}$$

or

Av = average reliability during a given test interval = Ra

$$\text{Unavailability} = \overline{Av} = 1\text{-}Av = \frac{\text{Downtime}}{\text{Uptime \& Downtime}}$$

$$\overline{Av} = \overline{Ra} = 1\text{-}Ra$$

Allowing for repair time.

$$\overline{Av} = \lambda\,(\theta t/2 + \theta r)$$

Where θt = test interval = 720 hours
θr = repair interval = 8 hours
λ = failure rate

Then $Av = 1-\overline{Av} = 1-\lambda$ (368 hours)

Where 368 hours represents the "average" of the test interval.

The above equations apply when the repair time is short compared to the test interval. This will be the only case considered in the analysis.

1.3 Assumption

1.3.1 Any failure is repaired within 8 hours.

1.3.2 The manual test interval is 30 days (720 hours).

1.3.3 Success is defined as proper operation, upon demand, of the output relays to a LOCA and/or LOP signals.

1.3.4 Customer provided input and output devices are outside the scope of this analysis.

1.3.5 Failure of ancillary circuits which provide only indication and annunciation functions are not considered system failures.

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1.3.5 Failure of ancillary circuits which provide only indication and annunciation functions are not considered system failures.

1.4 Procedure Used for Calculations

Figure 1 is a Functional Block Diagram of the Emergency Load Sequencer System. From this figure a Reliability Block Diagram (Figure 2) was developed. This diagram shows shows the power supply system, the modules, output relays, and miscellaneous elements. The failure rates for each module are shown. These rates are tabulated from the work sheets for each module. These sheets are attached at the end of the report as part of Appendix B. The failure rates were computed in accordance with MIL-HBK-217D.

This diagram (Figure 2) is simplified further in Figure 3, where A4 and A5 show the redundancy of the power supplies, power transformers, and circuit breakers; A2 and A3 show the redundancy of the input field signals and logic circuitry; A1 depicts the components which are not redundant, namely the miscellaneous items for input and output, the fanout module, the relay drivers, and the output relays. The failure rate shown for A1 in Figure 3 combines all the failure rates for all the items noted for A1. The same applies for A2 and A3, and A4 and A5 in Figure 3.

Prior to summarizing the failure rates for the entire system, an effective failure rate was calculated for the redundant circuits A4 and A5, and for the redundant circuits A2 and A3 (Figure 3). These failure rates were then added to the failure rate of A1 to obtain a total system failure rate. From this value a system MTBF was obtained.

1.5 Summary of Computation

System failure rate:

$$\lambda_T = 902.38 \times 10^{-6} \text{ (failures/hour)}$$

System MTBF = 1110.5 hours

System Availability:

$$Av = 0.66792$$

Using the exact equation results in a slightly higher value of 0.71743.

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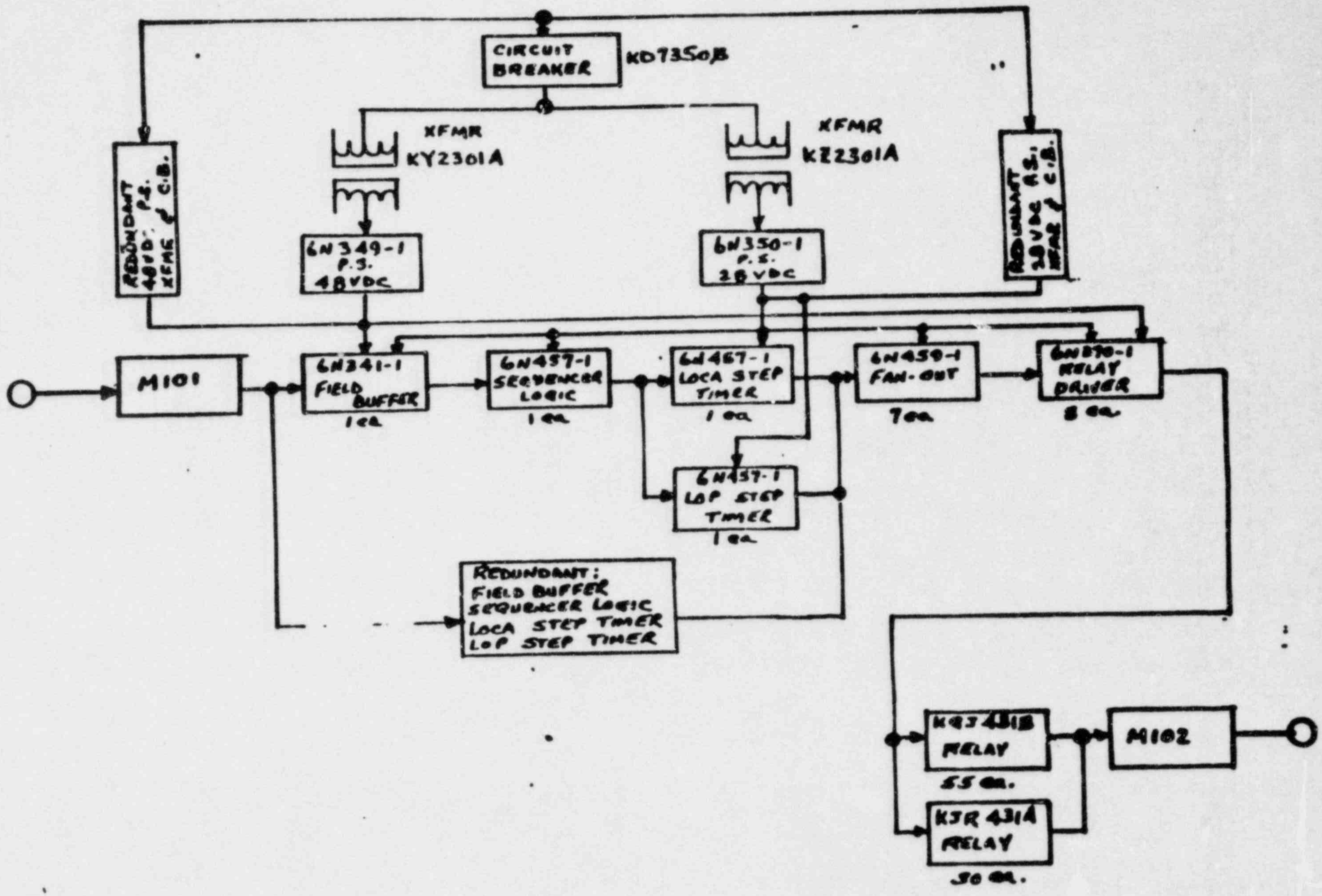

FIGURE 1: FUNCTIONAL BLOCK DIAGRAM

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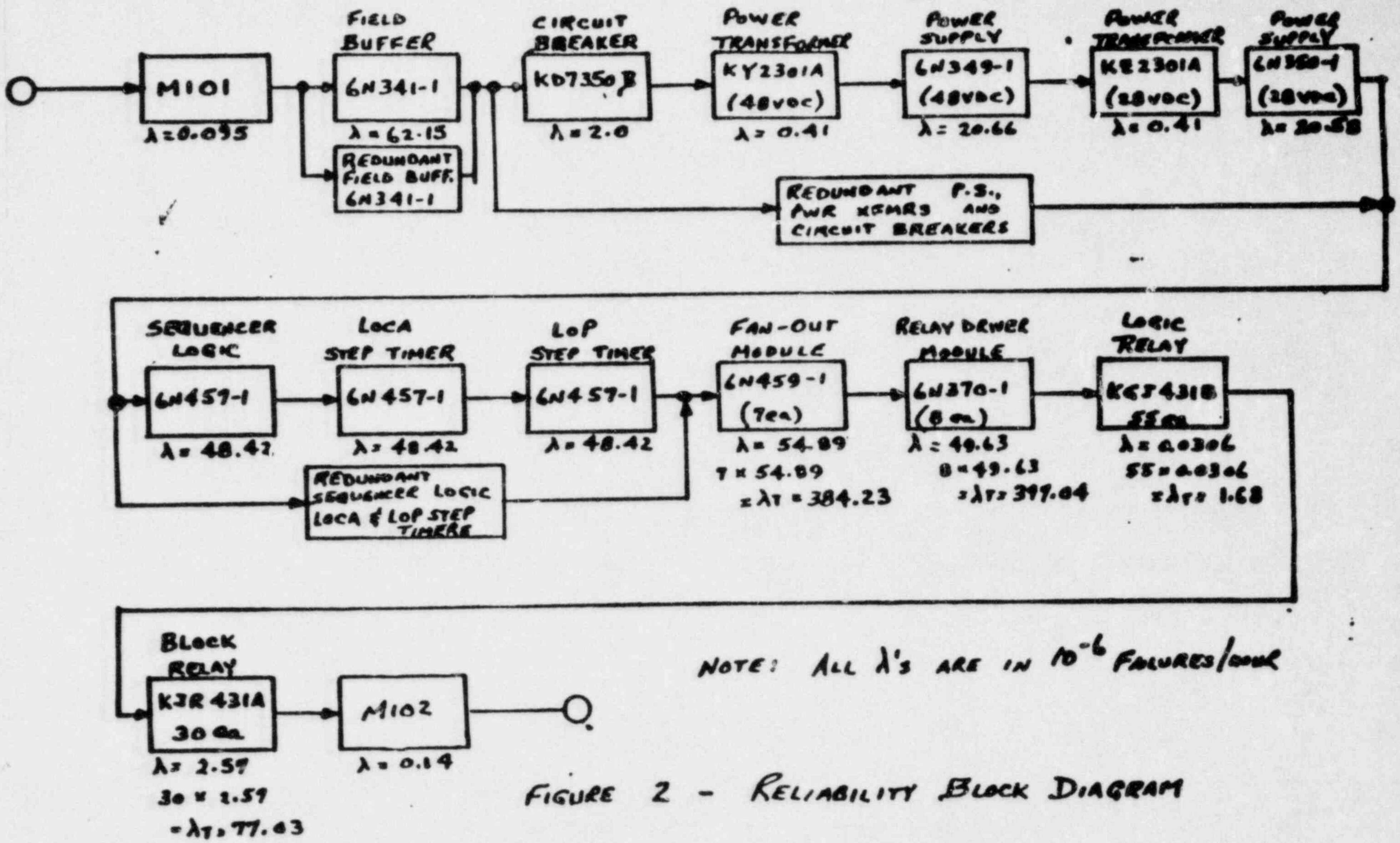

NOTE: All λ's are in 10^{-6} failures/hour

FIGURE 2 - RELIABILITY BLOCK DIAGRAM

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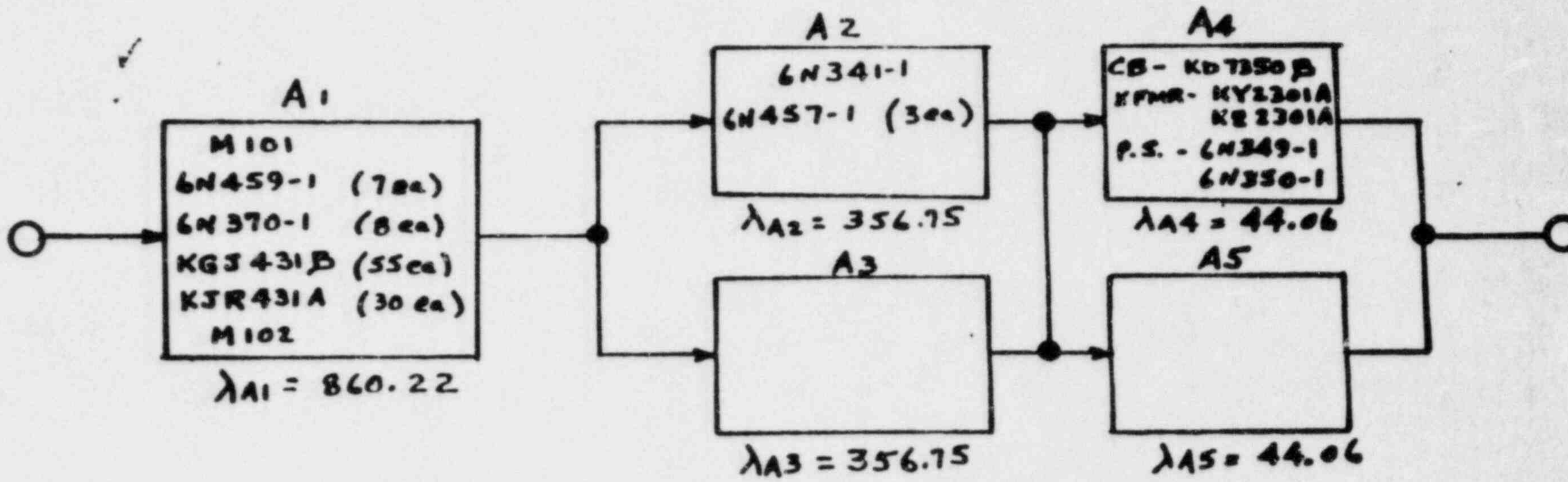

NOTE: ALL λ's ARE IN 10^{-6} FAILURES/HOUR

FIGURE 3: SIMPLIFIED RELIABILITY BLOCK DIAGRAM

TABLE 1

Failure Rate Data Summary

MODULE	FAILURES/MILLION HOURS
6N341-1, Field Buffer Module	62.15
6N370-1, Relay Driver Module	49.63
KZ2301A, Power Transformer (28V)	0.41
KY2301A, Power Transformer (48V)	0.41
6N349-1, Power Supply (48VDC)	20.66
6N350-1, Power Supply (28VDC)	20.58
6N459-1, Fanout Module	54.89
6N457-1, Programmable Plum Module	98.42
KGJ431B, Output Relay	0.0306
KJR431A, Output Relay	2.57
M101, Miscellaneous (Input)	0.095
M102, Miscellaneous (Output)	0.14
KD7350, Circuit Breaker	2.0

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APPENDIX A

Probability Computation.

1. Calculating the failure rate for the power supply redundant configuration, shown as A4 and A5 in Figure 3.

$$\lambda_{A4} = 44.06 \times 10^{-6} \text{ failures/hour}$$

$$\lambda_{A5} = \lambda_{A4}$$

The availability for a 1 out of 2 configuration (redundancy) is:

$$Av = 2e^{-(\lambda_{A4} \cdot T)} - e^{-(2\lambda_{A4} \cdot T)}$$

Where: $T = \frac{\theta t}{2} + \theta r$

$$T = \frac{720 \text{ hours}}{2} + 8 \text{ hours}$$

$$T = 368 \text{ hours}$$

$$Av = 2e^{-(44.06 \times 10^{-6} \times 368)} - e^{-2(44.06 \times 10^{-6} \times 368)}$$

$$= 1.96783 - .968092$$

$$Av = 0.99974$$

$Av = Ra =$ average reliability

$$Ra = e^{-\lambda_1 T}$$

$$\lambda_1 = -\frac{\ln Ra}{T}$$

$$\lambda_1 = -\frac{\ln .99974}{368}$$

$$\lambda_1 = 0.712050 \times 10^{-6}$$

SIZE	FSCM NO.	DWG NO.
A	02750	ER7188

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2. Repeating the above calculation for the redundant field buffer and logic configuration:

$$\lambda_{A2} = 356.75 \times 10^{-6} \text{ failures/hour}$$

$$\lambda_{A2} = \lambda_{A3}$$

$$Av = 2e^{-(356.75 \times 10^{-6} \times 368)} - e^{-2(356.75 \times 10^{-6} \times 368)}$$

$$= 1.75394 - .769074$$

$$Av = .98486$$

$$Av = Ra = e^{-\lambda_2 T}$$

$$\lambda_2 = -\frac{\ln Ra}{T}$$

$$\lambda_2 = -\frac{\ln .98486}{368}$$

$$\lambda_2 = 41.4468 \times 10^{-6}$$

3. Let $\lambda_{A1} = \lambda_3 = 860.22 \times 10^{-6}$

4. Calculating the sum of the 's:

$$\lambda_T = \lambda_1 + \lambda_2 + \lambda_3$$

$$= (.71205 + 41.4468 + 860.22) \times 10^{-6}$$

$$\lambda_T = 902.379 \times 10^{-6}$$

5. System failure rate:

$$\lambda_T = 902.38 \times 10^{-6} \text{ failures/hour}$$

$$\text{System MTBF} = \frac{1}{\lambda_T}$$

System MTBF = 1110.5 hours

System Availability:

$$\overline{Av} = \lambda_T x\ 368$$

$$\overline{Av} = 902.38 \times 10^{-6} \times 368$$

$$= 0.33208$$

$$Av = 1 - \overline{Av} = 1 - 0.33208$$

$$Av = 0.66792$$

Using the exact equations results in a slightly higher value:

$$Av = e^{-(902.38 \times 10^{-6} \times 368)}$$

$$Av = .71743$$

STRESS ANALYSIS—RELIABILITY PREDICTION WORKSHEET

SYSTEM MODULE 6N457 REPORT NO. ______ P 1 OF 3

AMB. TEMP. 25 °C ENGINEER A. NELL

			ENGINEERING DATA									RELIABILITY ANALYSIS							
LINE	REF. DES.	PART DESCRIPTION	LOAD, VOLTAGE, DISSIPATION ACTUAL I	ACTUAL V	ACTUAL W	RATED V	RATED W	STRESS RATIO OR HOT SPOT VALUE	COMPLEXITY VALUE C1	COMPLEXITY VALUE C2	CONTACT QTY, SIZE FORM, OR CKT.	λ_b BASE FAILURE RATE X 10^{-6} HRS.	π_V π_{S2} π_L	π_E	λ_T π_T π_R π_{SR}	π_Q π_{CYC}	π_{CS} π_F π_P π_{TAP} π_A	π_C π_{CV} π_{T2}	λ_p COMPONENT FAILURE RATE X 10^{-6} HOURS
1		KET7361-1									1912	.000041		2.3		1	18.4	1	.18030
2		KP7354BG									82	.00037		6.8					.04619
3		KAB8918A							.014	.0035	1		1	2.5	.66	17.5			.32795
4		KB7350A									1								.1
5		KD7351B									1								.016
6		KA7309J			.003		.25				1	.0004		3.6		2.0		1.0	.0288
7		KU7431A									1	.03101		4.6		1	18	1.5	3.8508
8		KBG165F		28	.004	250	15				1	.00079	.3	5.8	2	12	1.5	1.0	.04949
9		KA7357H									1								.4
10		KA7357G									1								.4
11		KAD8918G							.014	.0035	3		1.0	2.5	2.9	13			2.54865
12		KAF8918X04S							.0094	.0004	1		1.2	2.5	2.9	17.5			.47719
13		KAD8918D-2							.041	.0018	2		1.0	2.5	.49	17.5			1.42066
14		KAP8918B							.100	.0042	1		1.0	2.5	.49	35	3.4		6.9990
15		KAM8918A							.042	.0015	1		1.0	2.5	.38	35			2.0024
16		KAF8918M04S							.0078	.0006	1		1.2	2.5	2.9	17.5			.74627
17		KAF8918C02S							.0123	.0008	1		1.0	2.5	.49	17.5			.38405
18		KAF8918G26S							.0041	.0004	1		1.0	2.5	.49	17.5			.42453
19		KAF8918G13S							.0041	.0004	1		1.0	2.5	.49	17.5			.42453

APPROVED BY ______ TOTAL FAILURES PER 10^6 HRS ______

ER7188
REV.— SHT. 14

DSER OPEN ITEM 238

STRESS ANALYSIS – RELIABILITY PREDICTION WORKSHEET

SYSTEM MODULE 6N457-1 REPORT NO. ______ P 2 OF 3

AMB. TEMP. 25 °C ENGINEER ARNELL

LINE	REF. DES.	PART DESCRIPTION	LOAD, VOLTAGE, DISSIPATION: ACTUAL I	ACTUAL V	ACTUAL W	RATED V	RATED W	STRESS RATIO OR HOT SPOT VALUE	COMPLEXITY VALUE C1	COMPLEXITY VALUE C2	CONTACT QTY, SIZE, FORM, OR CKT.	λ_b BASE FAILURE RATE X 10^{-6} HRS.	π_V π_{S2} π_L	π_E	λ_T π_T π_R π_{SR}	π_Q π_{CYC}	π_{CS} π_F π_P π_{TAP} π_A	π_C π_{CV} π_{T2}	λ_p COMPONENT FAILURE RATE X 10^{-6} HOURS
1		KAF 8918 G21S							.0036	.0004	1		1.0	2.5	.49	17.5			.25837
2		KAF 8918 F13S							.010	.0007	3		1.0	2.5	.49	17.5			1.08414
3		KAF 8918 M01S							.0084	.0086	9		1.0	2.5	.49	17.5			3.08952
4		KAF 8918 F12S							.0113	.0007	1		1.0	2.5	.49	17.5			.52162
5		KDT 1918C							.023	.0051	13		1.0	2.5	.66	35			18.1688
6		KF7311AT		12		50					7			.78		60	1.25		14.64162
7		KAE 8918A									7			.78		60	1.25		12.971
8		KLF 311B-2		12		50					1	.0013		1.6		3.0		1.13	.00705
9		KLF 311D-2		12		100					9	.00085		1.6		3.0		1.45	.05340
10		KB 7311C-2									2	.0019		2.4		15		.77	.10552
11		KT 7311B		35		50					3	.055		2.4		10		.5	1.96257
12		KN 7311D		35		200					1	.0013		1.9		10		.90	.02234
13		KU 7311A		12		100					1	.0013		1.9		10		.85	.02095
14		KU 7311J		12		100					2	.0013		1.9		10		1.03	.05096
15		KF 7327B		35		200					4	.00033	0.7	3.9	1.0	7.5	1.0	1.0	.02703
16		KFW 327B									1	.00025	0.7	3.9	1.0	1.5	1.0	1.0	.00102
17		KA 1327K			<.001		5				1	.00060		3.9		15	1.0		.0351
18		KA7327M			<.001		5				1	.00060		3.9		15	1.0		.0351
19		KB 7327AB			.122		.4				1	.00075		3.9		15	1.0		.04388

APPROVED BY ______ TOTAL FAILURES PER 10^6 HRS. ______ ER7188

REV. – SHT. 15

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DSER OPEN ITEM 238

STRESS ANALYSIS – RELIABILITY PREDICTION WORKSHEET

SYSTEM MODULE 6N957-1 REPORT NO. ______ P 3 OF 3

AMB. TEMP. 25 °C ENGINEER ARNELL

LINE	REF. DES.	PART DESCRIPTION	ENGINEERING DATA: LOAD, VOLTAGE, DISSIPATION – ACTUAL I	ACTUAL V	ACTUAL W	RATED V	RATED W	STRESS RATIO OR HOT SPOT VALUE	COMPLEXITY VALUE C1	COMPLEXITY VALUE C2	CONTACT QTY, SIZE, FORM, OR CKT	RELIABILITY ANALYSIS: λ_b BASE FAILURE RATE X 10^{-6} HRS.	π_V π_{S2} π_L	π_E	λ_T π_T π_R π_{SR}	π_Q π_{CYC}	π_{CS} π_F π_P π_{TAP} π_A	π_C π_{CV} π_{T2}	λ_p COMPONENT FAILURE RATE X 10^{-6} HOURS
1		KB7327Z			.374		1.5				1	.00075		3.9		15	1.0		.04388
2		KPL310-392									1			.78		60			1.4406
3		KMT310-103									6			.78		60	1.25		6.58182
4		KMT310-223									7			.78		60	1.25		7.67879
5		KAG7310C									1			.78		60	1.25		.56801
6		KAG7310A									7			.78		60	1.25		3.97607
7		KAG7310R									7			.78		60	1.25		3.97607
8		KMK310FD									4	.00031		2.9	1.1	1.0			.00396
9		KMK310BF									1	.00031		2.9	1.0	1.0			.00090
10		KMK310DH									8	.00031		2.9	1.0	1.0			.00719
11		KMK310FZ									1	.00031		2.9	1.6	1.0			.00144
12		KMK310A									2	.00031		2.9	1.0	1.0			.00180
13		KNG310AK			.55		2				1	.0089		1.5	1.0	15			.20025
14		KNU310-1300F			.377		3				1	.0071		1.5	1.0	1.0			.01065
15		KMK310EK									1	.00031		2.9	1.0	1.0			.00090
16		KMK310BY									2	.00031		2.9	1.0	1.0			.00180
17																			
18																			
19																			

APPROVED BY ______ TOTAL FAILURES PER 10^6 HRS 98.421

ER7188
REV. – SHT. 16

11.

DSER OPEN ITEM 238

STRESS ANALYSIS – RELIABILITY PREDICTION WORKSHEET

SYSTEM MODULE 6N459-1 REPORT NO. ______ P 1 OF 2

AMB. TEMP. 25 °C ENGINEER ARNELL

LINE	REF. DES.	PART DESCRIPTION	LOAD, VOLTAGE, DISSIPATION – ACTUAL I	ACTUAL V	ACTUAL W	RATED V	RATED W	STRESS RATIO OR HOT SPOT VALUE	COMPLEXITY VALUE C1	COMPLEXITY VALUE C2	CONTACT QTY, SIZE, FORM, OR CKT.	λ_b BASE FAILURE RATE X 10^{-6} HRS.	π_V π_{S2} π_L	π_E	λ_T π_T π_R π_{SR}	π_Q π_{CYC}	π_{CS} π_F π_P π_{TAP} π_A	π_C π_{CV} π_{T2}	λ_p COMPONENT FAILURE RATE X 10^{-6} HOURS
1		KGE7361-1									990	.000041		2.3		1		1	.0924
2		KP7354BH									82	.00037		6.8			18.36		.04619
3		KB7327K			0.1		0.4				1	.00082		3.9		15	1.0		.04797
4		KF7327B		35		200					2	.00033	0.7	3.9	1.0	7.5	1	1	.01351
5		KFK1918-G12S							.0041	.0004	4		1.2	2.5	2.9	17.5			1.90876
6		KFK1918-G19S							.0028	.0014	1		1.2	2.5	2.9	17.5			.39802
7		KFK1918-M04S							.0078	.0006	4		1.2	2.5	2.9	17.5			2.98508
8		KFK1919-G10S							.0036	.0004	7		1.2	2.5	2.9	17.5			3.12718
9		KFK1918-G01S							.0036	.0004	1		1.2	2.5	2.9	17.5			.44674
10		KFK1918-G09S							.0036	.0004	8		1.2	2.5	2.9	17.5			3.57392
11		KFK1918-X04S							.0041	.0004	8		1.2	2.5	2.9	17.5			3.81752
12		KAD8918G							.014	.0035	4		1.0	2.5	2.9	13			3.3982
13		KF7311RT		12		50					4			.78		60	1.25		9.86664
14		KAG7310D									4			.78		60	1.25		2.27204
15		KMT310-104			<.001		.140				1			.78		60	1.25		1.09697
16		KMT310-512			<.001		.140				4			.78		60	1.25		4.38788
17		KMT310-103			<.001		.140				4			.78		60	1.25		4.38788
18		KKP311AJ		12		35					2	.01		2.4	0.5	10		1.1	.26392
19		KKP311AR		12		35					6	.01		2.4	1.0	10		1.45	2.08668

APPROVED BY ______ TOTAL FAILURES PER 10^6 HRS ______

DSER OPEN ITEM 238

STRESS ANALYSIS – RELIABILITY PREDICTION WORKSHEET

SYSTEM MODULE 6N454-1 REPORT NO. ________ P 2 OF 2

AMB. TEMP. 25 °C ENGINEER ARNELL

LINE	REF. DES.	PART DESCRIPTION	ENGINEERING DATA: LOAD, VOLTAGE, DISSIPATION – ACTUAL I	ACTUAL V	ACTUAL W	RATED V	RATED W	STRESS RATIO OR HOT SPOT VALUE	COMPLEXITY VALUE C1	COMPLEXITY VALUE C2	CONTACT QTY, SIZE, FORM, OR CKT	RELIABILITY ANALYSIS: λ_b BASE FAILURE RATE X 10^{-6} HRS.	π_V π_{S2} π_L	π_E	λ_T π_T π_R π_{SR}	π_Q π_{CYC}	π_{CS} π_F π_P π_{TAP} π_A	π_C π_{CV} π_{T2}	λ_p COMPONENT FAILURE RATE X 10^{-6} HOURS
1		KLF 311E-2		12		50					2	.0013		1.6		3.0		1.72	.02152
2		KAE 8918A									4			.78		60	1.25		7.412
3		KLF 311B-2		12		50					13	.0013		1.6		3.0		1.13	.09161
4		KLF 311J-2		12		50					1	.0013		1.6		3.0		1.87	.01167
5		KKL 311Q		35		75					1	.016		2.4	.6	1.5		1.26	.0435
6		KMK 310FF									1	.00031		2.9	1.1	1			.00099
7		KMK 310BP									2	.00031		2.9	1.0	1			.00180
8		KMK 310DZ									2	.00031		2.9	1.0	1			.00180
9		KD 7338T									8	.032	1.0	2.9	1.4	4	1		4.15744
10		KFZ 310EH									1	.00031		2.9	1.0	5			.00449
11		KMK 310DH			.014		.25				3	.00031		2.9	1.0	1			.00270
12		KD 7351B									1								.016
13		KB 7350C									1								.1
14		KB 7165							.0079	.0024	1		1.0	2.5	.87	17.5			.23840
15		KA 7309J			.003		.25				1	.0004		3.6		20		1.0	.0288
16		KA 7327A			<.001		5				1	.00065		3.9		15	1		.03803
17																			
18																			
19																			

APPROVED BY ____________ TOTAL FAILURES PER 10^6 HRS. 54.888

ER718
REV. – SHT. 18

DSER OPEN ITEM 238

STRESS ANALYSIS – RELIABILITY PREDICTION WORKSHEET

SYSTEM MODULE 6N349-1 REPORT NO. ______ P 1 OF 1

AMB. TEMP. 50 °C ENGINEER ARNELL

LINE	REF. DES.	PART DESCRIPTION	Actual I	Actual V	Actual W	Rated V	Rated W	STRESS RATIO OR HOT SPOT VALUE	COMPLEXITY VALUE C1	COMPLEXITY VALUE C2	CONTACT QTY, SIZE, FORM, OR CKT.	λ_b BASE FAILURE RATE X 10^{-6} HRS.	π_V π_{S2} π_L	π_E	λ_T π_T π_R π_{SR}	π_Q π_{CYC}	π_{CS} π_F π_P π_{TAP} π_A	π_C π_{CV} π_{T2}	λ_p COMPONENT FAILURE RATE X 10^{-6} HOURS
1		KVT1900-1									1								.71575
2		KKN311A		62		85					3	.11		2.4		10	-	2.2	17.424
3		KY351B									1	.016							.016
4		KW350R									1	.10							.10
5		KFE327C		62		200					3	.0013	0.7	3.9	10	15	1.5	1.0	2.3956
6		KAD7354									8	.00094		4.7		1.0	2.3		.01016
7																			
8																			
9																			
10																			
11																			
12																			
13																			
14																			
15																			
16																			
17																			
18																			
19																			

APPROVED BY ______ TOTAL FAILURES PER 10^6 HRS. 20.66

DSER OPEN ITEM 238

STRESS ANALYSIS — RELIABILITY PREDICTION WORKSHEET

SYSTEM MODULE 6N350-1 REPORT NO. ______ P 1 OF 1

AMB. TEMP. 50° °C ENGINEER ARNELL

LINE	REF. DES.	PART DESCRIPTION	ENGINEERING DATA: LOAD, VOLTAGE, DISSIPATION — ACTUAL I	ACTUAL V	ACTUAL W	RATED V	RATED W	STRESS RATIO OR HOT SPOT VALUE	COMPLEXITY VALUE C1	COMPLEXITY VALUE C2	CONTACT QTY, SIZE, FORM, OR CKT	RELIABILITY ANALYSIS: λ_b BASE FAILURE RATE X 10^{-6} HRS.	π_V π_{S2} π_L	π_E	λ_T π_T π_R π_{SR}	π_Q π_{CYC}	π_{CS} π_F π_P π_{TAP} π_A	π_C π_{CV} π_{T2}	λ_p COMPONENT FAILURE RATE X 10^{-6} HOURS
1		KVT1900-2									1								0.63529
2		KKN 311C		36		50					3	.11		2.4		10	-	2.2	17.424
3		KY351B									1	.016							.016
4		KW350R									1	.10							.10
5		KFZ327B		36		100					3	.0013	0.7	3.9	10	15	1.5	1.0	2.3956
6		KAD7354									8	.00094		4.7		1.0	2.3		.01016
7																			
8																			
9																			
10																			
11																			
12																			
13																			
14																			
15																			
16																			
17																			
18																			
19																			

APPROVED BY ______

TOTAL FAILURES PER 10^6 HRS 20.58

ER7188
REV. — SHT. 20

DSER OPEN ITEM 238

STRESS ANALYSIS — RELIABILITY PREDICTION WORKSHEET

SYSTEM MODULE KVT1900-1 REPORT NO. ______ P 1 OF 1

AMB. TEMP. 50 °C ENGINEER ______

ENGINEERING DATA / RELIABILITY ANALYSIS

LINE	REF. DES.	PART DESCRIPTION	LOAD, VOLTAGE, DISSIPATION — ACTUAL I	ACTUAL V	ACTUAL W	RATED V	RATED W	STRESS RATIO OR HOT SPOT VALUE	COMPLEXITY VALUE C1	COMPLEXITY VALUE C2	CONTACT QTY, SIZE, FORM, OR CKT	λ_b BASE FAILURE RATE X 10^{-6} HRS.	π_V π_{S2} π_L	π_E	λ_T π_T π_R π_{SR}	π_Q π_{CYC}	π_{CS} π_F π_P π_{TAP} π_A	π_C π_{CV} π_{T2}	λ_p COMPONENT FAILURE RATE X 10^{-6} HOURS
1		KHA 431 (or KHB 431)									1	.01267		2.3		1.0	18	1.0	.52462
2		KFW 327A			0		1				1	.00031	0.7		1.0		0.6	1	.00762
3		KMD 310DH			1.33		3				1	.016		1.5	1.0	1.0			.024
4		KMK 310DH			0		.25				3	.00044		2.9	1.0	1			.00383
5		KMM 310BV			.42		1.0				1	.00098		2.9	1.0	1.0			.00284
6		KMP 310DK			2.5		3				1	.04		1.5	1.4	1.0			.084
7		KMR 310DR			3.06		6.5				1	.016		1.5	1.1	1.0			.0264
8		KFU 1361									45	.000041		2.3		10		1	.04844
9																			
10																			
11																			
12																			
13																			
14																			
15																			
16																			
17																			
18																			
19																			

TOTAL FAILURES PER 10^6 HRS. 0.71575

APPROVED BY ______

ER7188
REV. - SHT. 21

DSER OPEN ITEM 238

STRESS ANALYSIS – RELIABILITY PREDICTION WORKSHEET

SYSTEM MODULE KVT1900-2 REPORT NO. ________ P 1 OF 1

AMB. TEMP. 50 °C ENGINEER ARNELL

		ENGINEERING DATA										RELIABILITY ANALYSIS							
LINE	REF. DES.	PART DESCRIPTION	LOAD, VOLTAGE, DISSIPATION					STRESS RATIO OR HOT SPOT VALUE	COMPLEX-ITY VALUE		CONTACT QTY, SIZE, FORM, OR CKT. %	λ_b BASE FAILURE RATE X 10^{-6} HRS.	π_V π_{S2} π_L	π_E	λ_T π_T π_R π_{SR}	π_Q π_{CYC}	π_{CS} π_F π_P π_{DIP} π_A	π_C π_{CV} π_{T2}	λ_p COMPONENT FAILURE RATE X 10^{-6} HOURS
			ACTUAL			RATED													
			I	V	W	V	W		C1	C2									
1		KHA431(OR KHB 431)									1	.01267		2.3		1.0	1.8	1.0	.52462
2		KFV 327A			0		1				1	.00031	0.7		1.0		0.6	1	.00762
3		KMK 310A			.021		.25				1	.00044		2.9	1.0	1.0			.00128
4		KMK 310DH			0		.25				3	.00044		2.9	1.0	1.0			.00383
5		KMP 310DA			1.21		3.0				1	.012		1.5	1.0	1.0			.018
6		KMP 310DH			1.86		8.0				1	.025		1.5	1.0	1.0			.0375
7		KFU 1361									45	.000041		2.3		10		1	.04244
8																			
9																			
10																			
11																			
12																			
13																			
14																			
15																			
16																			
17																			
18																			
19																			

APPROVED BY ________ TOTAL FAILURES PER 10^6 HRS 0.63529

P871AA

DSER OPEN ITEM 238

STRESS ANALYSIS – RELIABILITY PREDICTION WORKSHEET

SYSTEM MODULE KY2301A REPORT NO. ______ P 1 OF 1.

AMB. TEMP. 50 °C ENGINEER ARNELL

ENGINEERING DATA												RELIABILITY ANALYSIS						
LINE	REF. DES.	PART DESCRIPTION	LOAD, VOLTAGE, DISSIPATION ACTUAL I	ACTUAL V	ACTUAL W	RATED V	RATED W	STRESS RATIO OR HOT SPOT VALUE	COMPLEX-ITY VALUE C1	C2	CONTACT QTY, SIZE, FORM, OR CKT	λ_b BASE FAILURE RATE X 10^{-6} HRS.	π_V π_{S2} π_L	π_E	λ_T π_T π_R π_{SR}	π_Q π_{CYC}	π_{CS} π_F π_P π_{DIP} π_A	π_C π_{CV} π_{T2}	λ_p COMPONENT FAILURE RATE X 10^{-6} HOURS
1		KY2301A						15°C			1	.0018		5.7		30			.3078
2		CRIMP CONN									6	.00026		2.1	2	10			.0655
3		HAND SOLDER									6	.0026		2.1	6	1			.0328
4																			
5																			
6																			
7																			
8																			
9																			
10																			
11																			
12																			
13																			
14																			
15																			
16																			
17																			
18																			
19																			

APPROVED BY ______

TOTAL FAILURES PER 10^6 HRS 0.4061

ER7188

DSER OPEN ITEM 238

STRESS ANALYSIS – RELIABILITY PREDICTION WORKSHEET

SYSTEM MODULE KZ2301A REPORT NO. ______ P 1 OF 1

AMB. TEMP. 50°C °C ENGINEER ARNELL

ENGINEERING DATA												RELIABILITY ANALYSIS							
LINE	REF. DES.	PART DESCRIPTION	LOAD, VOLTAGE, DISSIPATION ACTUAL I	ACTUAL V	ACTUAL W	RATED V	RATED W	STRESS RATIO OR HOT SPOT VALUE	COMPLEXITY VALUE C1	COMPLEXITY VALUE C2	CONTACT QTY, SIZE, FORM, OR CKT	λ_b BASE FAILURE RATE X 10^{-6} HRS.	π_V π_{S2} π_L	π_E	λ_T π_T π_R π_{SR}	π_Q π_{CYC}	π_{CS} π_F π_P π_{TAP} π_A	π_C π_{CV} π_{T2}	λ_p COMPONENT FAILURE RATE X 10^{-6} HOURS
1		KZ2301 A						15°C			1	.0018		5.7		30			.3078
2		CRIMP CNN.									6	.00026		2.1	2	10			.0655
3		HAND SLDER									6	.0026		2.1	1.0	1.0			.0328
4																			
5																			
6																			
7																			
8																			
9																			
10																			
11																			
12																			
13																			
14																			
15																			
16																			
17																			
18																			
19																			

APPROVED BY ______ TOTAL FAILURES PER 10^6 HRS. 0.4061

ER7188

STRESS ANALYSIS – RELIABILITY PREDICTION WORKSHEET

P 1 OF 2

SYSTEM MODULE 6N341-1 REPORT NO. ER

AMB. TEMP. 50 °C ENGINEER ARNEIL

LINE	REF DES	PART DESCRIPTION	Actual I	Actual V	Actual W	Rated V	Rated W	STRESS RATIO OR HOT SPOT VALUE	COMPLEXITY VALUE C1	COMPLEXITY VALUE C2	CONTACT QTY, SIZE, FORM, OR CKT	λ_b BASE FAILURE RATE X 10^{-6} HRS.	π_V π_{S2} π_L	π_E	λ_T π_T π_R π_{SR}	π_Q π_{CYC}	π_{CS} π_F π_P π_{TAP} π_A	π_C π_{CV} π_{T2}	λ_p COMPONENT FAILURE RATE X 10^{-6} HOURS
1		KBF7361									767	.000041		2.3		1.0		1.0	.0723
2		KKM311GC		59		100					20	.0067		1.6		3.0	–	1.45	.9324
3		KKM311AA		33		1000					10	.00077		1.6		3.0		.81	.0300
4		KKM311DD		3		12					10	.0015		1.6		3.0		1.59	.1142
5		KKL311J		28		3.5					10	.05		2.4	0.6	1.6		1.3	1.36
6		KFW327A			.013		1				20	.00031	0.7	3.9	1.0	15.0	0.6	1.0	.1523
7		KG7327	.107		.107		3				4	.00031	0.7	3.9	1.0	15.0	1.0	1.0	.03045
8		KEU1918			.02		0.4				10	.0055		2.4	430	1.0			56.760
9		KMM310BQ			.515		1.0				10	.00098		2.9	1.0	1.0			.02842
10		KMM310BL			.411		1.0				10	.00030		2.9	1.0	1.0			.0232
11		KML310DJ		1	.236		0.5				10	.00098		2.9	1.0	1.0			.02842
12		KMK310DH			.015		0.25				10	.00044		2.9	1.0	1.0			.01276
13		KMK310BM			.021		0.25				10	.00044		2.9	1.0	1.0			.01276
14		KMK310BP			.001		0.25				10	.00044		2.9	1.0	1.0			.01276
15		KMS310-203			.022		0.140				20	.00066		2.4	4.2	3.0			.4191
16		KMS310-153			.089		0.140				20	.00066		2.4	9.8	3.0			.9778
17		KMT310-104			.036		0.140				14	.0066		2.4	5.0	3.0			.57
18		KBL165C		5	.021	30	0.50				20	.00088	0.3	5.8	1.0	12.0	1.5	1.0	.5512
19		KMK310A			.009		0.25				10	.00044		2.9	1.0	1.0			.01276

TOTAL FAILURES PER 10^6 HRS. ______

APPROVED BY ______

ER7188
REV.— SHT. 25

DSER OPEN ITEM 238

STRESS ANALYSIS – RELIABILITY PREDICTION WORKSHEET

SYSTEM MODULE 6N341-1 REPORT NO. ER P 2 OF 2

AMB. TEMP. 50 °C ENGINEER ______

LINE	REF. DES.	PART DESCRIPTION	LOAD, VOLTAGE, DISSIPATION ACTUAL I	ACTUAL V	ACTUAL W	RATED V	RATED W	STRESS RATIO OR HOT SPOT VALUE	COMPLEXITY VALUE C1	COMPLEXITY VALUE C2	CONTACT QTY, SIZE, FORM, OR CKT.	λ_b BASE FAILURE RATE X 10^{-6} HRS.	π_V π_{S2} π_L	π_E	λ_T π_T π_R π_{SR}	π_Q π_{CYC}	π_{CS} π_F π_P π_{TAP} π_A	π_C π_{CV} π_{T2}	λ_p COMPONENT FAILURE RATE X 10^{-6} HOURS
1		KY7310Y			1.1		3				1	.012		1.5	1.0	1.0			.018
2		KP7354Y (CONNECTOR)									1	.00047		6.8		1.0	8.63		.02759
3																			
4																			
5																			
6																			
7																			
8																			
9																			
10																			
11																			
12																			
13																			
14																			
15																			
16																			
17																			
18																			
19																			

APPROVED BY ______ TOTAL FAILURES PER 10^6 HRS. 62.146 = 62.15

ER7188

DSER OPEN ITEM 238

STRESS ANALYSIS — RELIABILITY PREDICTION WORKSHEET

SYSTEM MODULE 6N370-1 REPORT NO. ______ P 1 OF 2

AMB. TEMP. 52 °C ENGINEER ARNELL

LINE	REF. DES.	PART DESCRIPTION	LOAD, VOLTAGE, DISSIPATION: ACTUAL I	ACTUAL V	ACTUAL W	RATED V	RATED W	STRESS RATIO OR HOT SPOT VALUE	COMPLEXITY VALUE C1	C2	CONTACT QTY, SIZE, FORM, OR CKT	λ_b BASE FAILURE RATE X 10^{-6} HRS.	π_V π_{S2} π_L	π_E	λ_T π_T π_R π_{SR}	π_Q π_{CYC}	π_{CS} π_F π_P π_{BP} π_A	π_C π_{CV} π_{T2}	λ_p COMPONENT FAILURE RATE X 10^{-6} HOURS
1		KBJ7361-1									502	.000041		2.3		1.0		1.0	.04734
2		KAL310DV			.296		.50				8	.0012		2.9	1.0	1.0			.02784
3		KMK310BZ			.087		.25				8	.00080		2.9	1.0	1.0			.01856
4		KMK 310BG			.022		.25				8	.00044		2.9	1.0	1.0			.01021
5		KMK 310BP			.013		.25				16	.00044		2.9	1.0	1.0			.02042
6		KMK 310AT			.0041		.25				8	.00044		2.9	1.0	1.0			.01021
7		KMK 310BM			.001		.25				8	.00044		2.9	1.0	1.0			.01021
8		KAB7310-750R0F			4		7				8	.020		1.5	1.0	1.0			.24000
9		KMK 310ED			.024		.25				1	.00044		2.9	1.0				.00128
10		KMT 310-104			.001		.140				16	.00066		2.4	2.9	3.0			.22049
11		KMS 310-563			.024		.140				8	.00066		2.4	4.2	3.0			.15967
12		KFW327A			.001		1.0				16	.00031	0.7	3.9	1.0	15.0	0.6	1.0	.12187
13		KHM 327			.375		1.0				8	.00094		3.9		30	1.0		.87884
14		KEU 1918			.02		.4				8	.0055		2.4	430	1.0			45.408
15		KKM 311BB		2		100					8	.00077		1.6		3.0		1.13	.03341
16		KKM 311AA		5		1000					8	.00077		1.6		3.0		.91	.024
17		2N5872	.06		.375		7				8	.0013	1.4	5.8	2.0	6.0	0.7	1.0	.70936
18		KBL165C		5	.071	30	.5				16	.0010	0.3	5.8	1.0	12	1.5	1.0	.50112
19		KJ7350E-2	(FUSE)								1								0.1

APPROVED BY ______ TOTAL FAILURES PER 10^6 HRS. ______

ER7188

DSER OPEN ITEM 238

STRESS ANALYSIS – RELIABILITY PREDICTION WORKSHEET

SYSTEM MODULE 6N370-1 REPORT NO. ________ P 2 OF 2

AMB. TEMP. 50 °C ENGINEER ________

ENGINEERING DATA												RELIABILITY ANALYSIS							
LINE	REF. DES.	PART DESCRIPTION	LOAD, VOLTAGE, DISSIPATION					STRESS RATIO OR HOT SPOT VALUE	COMPLEX-ITY VALUE		CONTACT QTY, SIZE, FORM, OR CKT.	λ_b BASE FAILURE RATE X 10^{-6}HRS.	π_V π_{S2} π_L	π_E	λ_T π_T π_R π_{SR}	π_Q π_{CYC}	π_{CS} π_F π_P π_{TAP} π_A	π_C π_{CV} π_{T2}	λ_p COMPONENT FAILURE RATE X 10^{-6} HOURS
			ACTUAL			RATED													
			I	V	W	V	W		C1	C2									
											8								0.8.
1		KN7350L-2 (FUSE)									4	.00070	0.7	3.9	1.5	15	1.5	1.0	.258
2		KG 7327	1.124		1.124		3				4	.00054		2.9	1.0	1.0			.00626
3		KMK 310EK			.036		.25				1	.00047		6.8		1.0	7.42		.02371
4		KP7354 (CONNECTOR)																	
5																			
6																			
7																			
8																			
9																			
10																			
11																			
12																			
13																			
14																			
15																			
16																			
17																			
18																			
19																			

APPROVED BY ________ TOTAL FAILURES PER 10^6 HRS 49.63

ER7188
REV. – SHT. 28

DSER OPEN ITEM 238

STRESS ANALYSIS — RELIABILITY PREDICTION WORKSHEET

SYSTEM MODULE M101-INPUT REPORT NO. ________ P 1 OF 1

AMB. TEMP. 25 °C ENGINEER ARNELL

ENGINEERING DATA												RELIABILITY ANALYSIS							
LINE	REF. DES.	PART DESCRIPTION	LOAD, VOLTAGE, DISSIPATION					STRESS RATIO OR HOT SPOT VALUE	COMPLEX-ITY VALUE		CONTACT QTY, SIZE, FORM, % OR CKT	λ_b BASE FAILURE RATE X 10^{-6} HRS.	π_V π_{S2} π_L	π_E	λ_T π_T π_R π_{SR}	π_Q π_{CYC}	π_{CS} π_F π_P π_{DP} π_A	π_C π_{CV} π_{T2}	λ_p COMPONENT FAILURE RATE X 10^{-6} HOURS
			ACTUAL			RATED													
			I	V	W	V	W		C1	C2									
1		KAL-7300E	8	CRIMPED		CONNECTION				5	8	.00026		2.1	2.0	10			.08736
2				ON TERMINAL					BLOCK.										
3		KMK 354									8	.00075		47			2.3		.00811
4																			
5																			
6																			
7																			
8																			
9																			
10																			
11																			
12																			
13																			
14																			
15																			
16																			
17																			
18																			
19																			

APPROVED BY ________

TOTAL FAILURES PER 10^6 HRS. 0.095

DSER OPEN ITEM 238

STRESS ANALYSIS — RELIABILITY PREDICTION WORKSHEET

SYSTEM MODULE Micz-OUTPUT REPORT NO. ________ P 1 OF 1

AMB. TEMP. 25 °C ENGINEER ARNELL

		ENGINEERING DATA										RELIABILITY ANALYSIS							
LINE	REF. DES.	PART DESCRIPTION	LOAD, VOLTAGE, DISSIPATION: ACTUAL I	ACTUAL V	ACTUAL W	RATED V	RATED W	STRESS RATIO OR HOT SPOT VALUE	COMPLEXITY VALUE C1	COMPLEXITY VALUE C2	CONTACT QTY, SIZE, FORM, CKT	λ_b BASE FAILURE RATE X 10^{-6} HRS.	π_V π_{S2} π_L	π_E	λ_T π_T π_R π_{SR}	π_Q π_{CYC}	π_{CS} π_F π_P π_{TAP} π_A	π_C π_{CV} π_{T2}	λ_p COMPONENT FAILURE RATE X 10^{-6} HOURS
1		KMK334									130	.00075		4.7			40.02		.14107
2																			
3																			
4																			
5																			
6																			
7																			
8																			
9																			
10																			
11																			
12																			
13																			
14																			
15																			
16																			
17																			
18																			
19																			

APPROVED BY ________

TOTAL FAILURES PER 10^6 HRS 0.141

ER7188
REV. – SHT. 30

FORM 0064A REV. A

DSER OPEN ITEM 238

STRESS ANALYSIS – RELIABILITY PREDICTION WORKSHEET

SYSTEM MODULE 9N90-1 REPORT NO. ______ P 1 OF 1

AMB. TEMP. 25 °C ENGINEER ARNELL

			ENGINEERING DATA									RELIABILITY ANALYSIS							
LINE	REF. DES.	PART DESCRIPTION	LOAD, VOLTAGE, DISSIPATION: ACTUAL I	ACTUAL V	ACTUAL W	RATED V	RATED W	STRESS RATIO OR HOT SPOT VALUE	COMPLEX-ITY VALUE C1	COMPLEX-ITY VALUE C2	CONTACT QTY, SIZE, FORM, % OR CKT	λ_b BASE FAILURE RATE X 10^{-6} HRS.	π_V π_{S2} π_L	π_E	λ_T π_T π_R π_{SR}	π_Q π_{CYC}	π_{CS} π_F π_P π_{TAP} π_A	π_C π_{CV} π_{T2}	λ_p COMPONENT FAILURE RATE X 10^{-6} HOURS
1		KD7350B (CIRCUIT BREAKER)									1								2.0
2																			
3																			
4																			
5																			
6																			
7																			
8																			
9																			
10																			
11																			
12																			
13																			
14																			
15																			
16																			
17																			
18																			
19																			

APPROVED BY ______

TOTAL FAILURES PER 10^6 HRS 2.0

ER7188
REV – AUG. 11

DSER OPEN ITEM 238

STRESS ANALYSIS – RELIABILITY PREDICTION WORKSHEET

SYSTEM MODULE 9N90-2 REPORT NO. ______ P 1 OF 1

AMB. TEMP. 25 °C ENGINEER ABNELL

LINE	REF. DES.	PART DESCRIPTION	LOAD, VOLTAGE, DISSIPATION – ACTUAL I	ACTUAL V	ACTUAL W	RATED V	RATED W	STRESS RATIO OR HOT SPOT VALUE	COMPLEXITY VALUE C1	COMPLEXITY VALUE C2	CONTACT QTY, SIZE, FORM, OR CKT	λ_b BASE FAILURE RATE X 10^{-6} HRS.	π_V π_{S2} π_L	π_E	λ_T π_T π_R π_{SR}	π_Q π_{CYC}	π_{CS} π_F π_P π_{SP} π_A	π_C π_{CV} π_{T2}	λ_p COMPONENT FAILURE RATE X 10^{-6} HOURS
1		KJR 431A	1								30	.03161	4.77	4.6	.0065	1.6 1.0	6	3.0	77.039
2		KGJ 431B									55	.00888	1.48	2.3	.006	1.0 0.1	5	3.0	1.683
3																			
4																			
5																			
6																			
7																			
8																			
9																			
10																			
11																			
12																			
13																			
14																			
15																			
16																			
17																			
18																			
19																			

KJR 431A – 2.5676 PER RELAY

TOTAL FAILURES PER 10^6 HRS. KJR 431B – 0.0306 PER RELAY

APPROVED BY ______

DSER Open Item No. 240 (DSER Section 8.3.1.9)

COMPLIANCE WITH BTP-PSB-2

By Amendment 4 to the FSAR, the applicant, in response to a request for information, indicated that Section 8.3.1 of the FSAR has been expanded to include a description of compliance of the Hope Creek design to the guidelines of Branch Technical Position PSB-2 (NUREG-0800, Appendix 8A). A review of Section 8.3.1 of the FSAR indicates that the requested information has not been provided. This item will be pursued with the applicant.

RESPONSE

This item is considered closed because the requested information was provided in the response to Question 430.21, published in Amendment 5.

DSER Open Item No. 242 (DSER Section 8.3.2.1)

COMPLIANCE WITH POSITION 1 OF REGULATORY GUIDE 1.128

Sections 1.8.28 and 8.1.4.22 of the FSAR indicates that the battery room ventilation system has the capability to limit hydrogen concentrations to less than 2 percent by volume within the battery room area but does not have the capability to limit hydrogen concentration to less than 2 percent by volume at any location within the battery area in accordance with the guidelines of position C1 of Regulatory Guide 1.128.

By Amendment 4 to the FSAR, the applicant, in response to a request for information, indicated that even though the ventilation exhaust duct is located just below the ceiling, there is sufficient air mixing within the battery area to limit hydrogen accumulation. Clarification of this item will be pursued with the applicant.

RESPONSE

FSAR section 9.4-5 has been revised to provide the requested information

b. Meet the specified cooling and ventilation requirements during normal, shutdown, and accident conditions without loss of function

c. Provide redundancy for active and passive components to meet the single failure criteria

d. Operate the redundant active components from separate Class 1E power sources

e. Provide missile protection for the equipment, ducts, and accessories

f. Provide tornado protection for redundant and separate fresh air intake ducts that penetrate to the outdoors

g. Meet Seismic Category I requirements.

9.4.1.1.5 Control Area Battery Exhaust System

The CABE system exhausts air from the battery rooms to ensure that hydrogen concentrations remain within acceptable limits.

The CABE system is safety-related and is designed to accomplish the following objectives during normal plant operation, as well as during abnormal conditions:

a. Maintain hydrogen concentrations for all battery rooms below a ~~safe~~ 1% level. This is done in conjunction with the CERS system

2% INSERT

b. Provide redundancy for active components to meet the single failure criteria

c. Operate the redundant active components from separate Class 1E power sources

d. Meet Seismic Category I requirements

DSER OPEN ITEM 242

DSER Open Item No. 243 (DSER Section 8.3.3.1.3)

PROTECTION OR QUALIFICATION OF CLASS 1E EQUIPMENT FROM THE EFFECTS OF FIRE SUPPRESSION SYSTEM

For the design basis event "Fire protection system operation," it is the staff position that Class 1E systems and components located in areas with fire suppression systems should be capable and qualified to perform their function when subject to the effects of the subject design basis event (Sections 4.2 and 4.7 of IEEE Standard 308-1974).

By Amendment 4 to the FSAR, the applicant implied that the only Class 1E equipment located in a zone of influence for which automatic water sprinkling systems are installed in the lower cable spreading area. The only electrical equipment installed in this room are electrical cables that are qualified for water submergence. When the effluent from the fire suppression system is water, the staff concludes, based on the above information, that Class 1E systems are adequately protected or qualified for the subject design basis event. Protection or qualification of Class 1E equipment from effluents other than water will be pursued with the applicant.

RESPONSE

The response to Question 430.59 has been revised to provide discussion on effects of CO_2 effluent on electrical equipment.

QUESTION 430.59 (SECTION 8.3.1 and 8.3.2)

For the design basis event "Fire protection system operation", it is the staff position that Class 1E systems and components located in areas with fire suppression systems should be capable and qualified to perform their function when subject to the effects of the subject design basis event (Sections 4.2 and 4.7 of IEEE Standard 308-1974). Either provide a positive statement of compliance to this position in the FSAR or justify non-compliance.

RESPONSE

HCGS Class 1E power system complies with Sections 4.2 and 4.7 of IEEE-308-1974.

The Class 1E 4.16 kv switchgear, unit sub-stations, motor control centers, uninterruptible power supplies, distribution panels, etc, are located in zones of influence for which automatic water sprinkling systems are not installed. INSERT B Preaction water sprinkler system is installed in the lower cable spreading room. INSERT C The only electrical component installed in this room are electrical cables that are qualified to operate for any design basis event parameters for HCGS, including water submergence.

INSERT A >

The class 1E equipment is qualified to the environmental parameters for any design basis event as described in Section 3.11.

INSERT A

A carbon dioxide system protects the upper cable spreading room and diesel generator rooms. In the upper cable spreading room (Control Equipment Room Mezzanine), electrical cables will be subjected to the CO_2 system effluent if there is a fire or inadvertent actuation; however; cable performance is not affected by the effluent. In the diesel generator rooms, an inadvertent actuation of the CO_2 system will also close the fire dampers in the intake ventilation and exhaust duct of each room. However, the operator will be alerted by an alarm upon this inadvertent actuation and ventilation can be reestablished without affect D/G performance. Section 9.5.1.6.30 provides additional discussion on diesel generator fire suppression system.

INSERT B

HOWEVER, SEVERAL AUTOMATIC PREACTION SPRINKLER SYSTEMS ARE BEING ADDED OVER HIGH CABLE CONCENTRATION AREAS IN RESPONSE TO MEETINGS HELD WITH THE NRC CHEMICAL ENGINEERING BRANCH REVIEWERS. 1E SYSTEMS AND COMPONENTS LOCATED THEREIN ARE DESIGNED TO OPERATE FOLLOWING ACTUATION OF THESE FIRE PROTECTION SYSTEMS.

INSERT C

AND A MANUAL WATER SPRAY BACKUP TO THE CO_2 IS BEING ADDED IN THE UPPER CABLE SPREAD ROOM.

DSER Open Item No. 244 (DSER Section 8.3.3.3.1)

ANALYSIS AND TEST TO DEMONSTRATE ADEQUACY OF LESS THAN SPECIFIED SEPARATION

The applicant, by Amendment 4 to the FSAR, provided a description of physical separation between redundant enclosed raceways (covered trays and open top raceways, and between non-Class 1E trays and Class 1E conduit, as follows:

1. In the cable spreading rooms, the main control room, relay room, and control equipment room, the separation is twelve inches (12") horizontal, and eighteen inches (18") vertical.

2. In all other plant areas, the separation is three feet horizontal and five feet vertical.

The applicant further stated that where the separation distances specified above can not be maintained, cable trays shall either be covered with metal tray covers or an analysis, based on test results, will be performed.

The staff concludes that the above separation meets the guidelines of Regulatory Guide 1.75 and is acceptable except for the following.

(1) The use of 18 versus 36 inches of separation between raceways is evaluated in Section 8.3.3.3.2 of this report, and

(2) The use of an analysis to justify less than specified separation will be pursued with the applicant.

RESPONSE

The response to Question 430.52 has been revised to provide the requested analysis.

DSER OPEN ITEM 244

QUESTION 430.52 (SECTION 8.3.1 and 8.3.2)

Provide a description of separation between redundant ~~endosed~~ enclosed ~~raceways~~ raceways or conduit and open top raceways and between Non Class 1E trays and Class 1E conduit.

RESPONSE

Physical separation between raceways for the configurations requested in the above question are described below:

1. Redundant enclosed raceways (covered trays and flexible metallic conduits or rigid conduits) are separated from open top raceways by:

   a. Twelve inches (12") horizontally and eighteen inches (18") vertically in the cable spreading room, ~~the main~~ control equipment room, ~~relay room,~~ and control equipment room mezzanine.

   b. Three feet (3') horizontally and five feet (5') vertically in all other plant areas.

2. Class 1E conduits are separated from non-Class 1E trays by:

   a. Twelve inches (12") horizontally and eighteen inches (18") vertically in the cable spreading room, ~~the main~~ control room, ~~the relay room,~~ and the control equipment room mezzanine.

   b. Three feet (3') horizontally and five feet (5') vertically in all other plant areas.

In cases where the separation distances specified above can not be maintained, cable trays shall either be covered with metal tray covers or an analysis, based on test results, ~~will be~~ is performed to demonstrate compliance with the intent of Regulatory Guide 1.75. There are only two generic cases where analysis is used to justify lesser separation distances. These are identified and analyzed as follows:

- Conduit-to-conduit less than one (1) inch apart

Because of space limitations in some areas of the plant, the minimum separation distance of one inch between rigid steel conduits can not be maintained. The use of the conduits is limited to instrumentation to instrumentation, control to control, instrumentation to control, and control and instrumentation to power feeder with maximum

120 Vac or 125 Vdc cables only. Wyle Test Report No. 56719, prepared for Susquehanna Steam Electric Station, showed that rigid steel conduits in contact with each other are acceptable barriers. The testing demonstrated that shorting of conductors in one conduit until failure did not affect the performance of the conductors in the other conduit or damage the conduit. In addition, Franklin Institute Research Laboratories (FIRL) performed similar testing for the Toledo Edison Company in 1977 with successful results. The test configuration and cables used conservatively bound the HCGS conditions; therefore, the limited cases where the HCGS separation has not been met in the installation are justified.

- Non-Class 1E conduit separation from Class 1E tray

  In safety related areas of the plant there are non-Class 1E rigid steel conduits within one inch of Class 1E tray. The non-Class 1E conduit contains only control, instrumentation or 120 Vac/125 Vdc power cables. The testing performed for the above projects demonstrated that the rigid steel conduit is an effective barrier for protection of any cabling within distance of it. Therefore, the HCGS cases where the non-Class 1E conduit is not installed as required is justified by the previous testing.

The above analysis identifies the cases on a generic level. The installation and inspection of raceways are ongoing and the specific cases where the analysis apply are documented on nonconformance reports that are part of the QA/QC program.

DSER Open Item No. 245 (DSER Section 8.3.3.3.2)

THE USE OF 18 VERSUS 36 INCHES OF SEPARATION BETWEEN RACEWAYS

In Sections 1.8.1.75 and 8.1.4.14.3.1 of the FSAR it is stated that separation between redundant cable trays in the cable spreading area, control equipment room,, relay room, and main control room are separated by 18 inches vertically as opposed to the recommended 36 inches of separation required by IEEE Standard 384-1974.

The applicant, by Amendment 4 to the FSAR, indicated that this 18 inches of separation was approved by the staff during the preliminary design review of the Hope Creek plant. The staff's preliminary safety evaluation report for this item states that:

> "The applicant claims these separation distances are adequate because a high grade type cabling will be specified and results of extensive testing show that no cable degradation or flame propagation occurs when the lower tray, separated by 12 inches from the upper tray, is exposed to a gas flame for 15 minutes."

The results of these tests, that demonstrate no degradation to cables located in the trays 12 inches above the tray exposed to the gas flame, will be pursued with the applicant.

RESPONSE

Section 8.1.4.14.3.1 and the response to Question 43[illegible] have been revised to provide additional justification for the separation distance.

DH/em
F70(8)

QUESTION 430.51 (SECTION 8.3.1 and 8.3.2)

In Sections 1.8.1.75 and 8.1.4.14.3.1 of the FSAR you state that separation between redundant cable trays in the cable spreading area, control equipment room, relay room, and main control room are separated by 18 inches vertically as opposed to the recommended 36 inches of separation required by IEEE Standard 384-1974. Provide analysis substantiated by test that demonstrate the adequacy of 18 inches of separation.

RESPONSE

The HCGS PSAR was approved with 18 inch vertical separation between redundant cable trays. ~~For further discussion refer to Section 8.1.6.~~

A copy of the test report that substantiated the use of this vertical separation will be submitted under separate cover, PSE&G, letter to NRC

Revised Section 8.1.4.14.3.1 provides the analysis based on this test to demonstrate the adequacy of 18 inches separation

DSER OPEN ITEM 245

8.1.4.14.3.1 Cable Spreading Area, Control Equipment Room, and ~~Relay Room~~ Mezzanine, and Main Control Room

The cable spreading area, control equipment room and mezzanine, ~~relay room~~, and main control room do not contain high energy equipment such as switchgear, transformer, rotating equipment, or potential sources of missiles or pipe whip, and are not used for storing flammable materials. Power supply circuits are limited to those serving these areas and their instrument systems. These 208/120-V power cables are installed in conduits. Conduits containing redundant cables are separated by a minimum of 1 inch. Conduit couplings, clamps, locknuts, bushings, etc, shall not be considered in determining the required separation distances. For conduits carrying redundant neutron monitoring cables, boxes also shall not be considered in determining the required separation. Redundant cable trays are separated by at least 18 inches vertically and 12 inches horizontally. The configurations, for which the redundant ~~cable trays~~ raceways can not be separated by distances specified above, will either be analyzed or tested to demonstrate the compliance with the intent of Regulatory Guide 1.75. Separation distance requirements between Class 1E and non-Class 1E raceways are the same as for the separation among redundant channels.

> INSERT A

Strict administrative control of operations and maintenance activities is developed to control and limit the introduction of potential hazards into these areas.

8.1.4.14.3.2 Limited Hazard Areas

Limited hazard areas are the general plant areas from which potential nonelectrical hazards such as missiles, pipe whip, and exposure fires are excluded. The hazards in this area are limited to failures or faults internal to the electrical equipment or cables. These areas include elevations 77, 102, 124, 130, and 137 feet in the auxiliary building wing areas and elevation 87 feet in the radwaste area. Minimum separation in these ~~nonhazardous~~ areas is as follows:

a. Conduits containing redundant cables are separated by a minimum of 1 inch, unless consideration of hazards indicates greater separation is required. Conduit couplings, clamps, locknuts, bushings, etc, shall not be considered in determining the required separation distances. For conduits carrying redundant neutron

INSERT A TO 8.1.4.14.3.1

IEEE 384-1974 requires a minimum vertical separation of 3 feet between trays. The HCGS minimum vertical separation distance is 18 inches. The following analysis provides the justification for the lesser separation distance:

A. All cables are flame retardant and meet or exceed the flame test specified in IEEE 383-1974 as demonstrated by tests. Cable test reports are on file and available for audit.

B. As indicated in the above paragraph, high energy equipment and potential sources of missiles or pipe whip are excluded from the areas. Power circuits in the areas are installed in conduits that qualify as barriers; the maximum potential of the power circuits is limited to 208/120 volts ac or 125 volts dc. There are no power cables of higher potential serving equipment in the areas.

C. The cable tray test report performed for Salem showed that a fire in a cable tray located 12" directly below another tray did not propagate to the upper cable tray nor degrade the cables in the upper cable tray. The test configuration and cables were representative of the HCGS design and installation except that the test configuration used a 12 inch vertical separation. Because the Salem test demonstrated that the 12 inch vertical separation was adequate, the HCGS separation distance is justified.

DSER OPEN ITEM 245

DSER Open Item No. 246 (DSER Section 8.3.3.3.3)

SPECIFIED SEPARATION OF RACEWAYS BY ANALYSIS AND TEST

The applicant by Section 8.1.4.14.3 of the FSAR stated that if redundant cable trays cannot be separated by the distances specified, solid covers for the trays are provided as designated in Section 6.1.3.3 or 6.1.4 of IEEE 384-1981. Section 6.1.3.3 or 6.1.4 of IEEE 384-1981 refers to barriers and enclosed raceways, solid covers are not designed as an acceptable arrangement. The applicant by Amendment 4 to the FSAR revised Section 8.1.4.14.3 to indicate that configurations for which cable trays cannot be separated by the distances specified they will either be analyzed or tested. Indentification of each case where analysis or testing will be used, inclusion in the FSAR of the analysis for each specific case identified, and the test plan and results will be pursued with the applicant.

RESPONSE

The response to Question 430.50 has been revised to provide the requested information.

QUESTION 430.50 (SECTION 8.3.1 and 8.3.2)

In Section 8.1.4.14.3 of the FSAR you state that if redundant cable trays cannot be separated by the distances specified, solid covers for the trays are provided as designated in Section 6.1.3.3 or 6.1.4 of IEEE 384-1981. Section 6.1.3.3 or 6.1.4 of IEEE 384-1981 refers to barriers and enclosed raceways, solid covers are not designated as an acceptable arrangement. Clarify and provide a positive statement that the Hope Creek design meets Sections 6.1.3.3 and 6.1.4 of IEEE Standard 384-1981 or justify non compliance.

RESPONSE

Section 8.1.4.14.3 has been revised to state that, the configurations for which the redundant trays can not be separated by distances specified in this section, will either be analyzed or tested to demonstrate compliance with the intent of Regulatory Guide 1.75.

HCGS is committed to meet the specified separation distances
between redundant trays as defined in Sections 8.1.4.14.3.1
and 8.1.4.14.3.2. In cases where the specified distances have
not been met in the installation, barriers between trays are used
or the trays are totally enclosed with tray covers to justify the
lesser separation. Barrier installation conforms to IEEE 384
requirements. The special cases where barriers are used is identified
on the raceway drawings. It is necessary to refer to the raceway
drawings for identification and location of barriers or tray covers
that are used.

DSER OPEN ITEM 246

DSER Open Item No. 247 (DSER Section 8.3.3.5.1)

CAPABILITY OF PENETRATIONS TO WITHSTAND LONG DURATION SHORT CIRCUITS AT LESS THAN MAXIMUM OR WORST-CASE SHORT CIRCUITS

Section 8.1.4.12 (Item a) of the FSAR indicates that the time-current capability of the 1000 Kcmil conductor penetration is greater than the maximum short circuit current and its duration. The maximum short circuit current and its duration does not equate to Regulatory Guide 1.63 requirement for maximum short-circuit current versus time condition that could occur.

A positive statement in the FSAR to the effect that the time-current capability of the subject penetration is greater than any versus only maximum short circuit current and results of tests that demonstrates this time-current capability will be pursued with the applicant.

RESPONSE

The response to Question 430.44 has been revised to provide the requested information.

DH/em
F70(8)

QUESTION 430.44 (SECTION 8.3.1 and 8.3.2)

Section 8.1.4.12 (Item a) of the FSAR indicates that the time-current capability of the 1000 Kc mil conduction penetration is greater than the calculated worst-case short circuit current and its duration. The worst-case short circuit current and its duration does not equate to Regulatory Guide 1.63 requirement for maximum short-circuit current vs. time condition that could occur.

Provide a positive statement in the FSAR to the effect that the time-current capability of the subject penetration is greater than any versus only-worst case - short circuit current and its duration. Provide results of tests that demonstrates the time-current capability of each penetrative to maintain containment integrity when subject to any short circuit current for its duration worst case design basis event environment.

RESPONSE

Section 8.1.4.12 (Item a) has been revised to read, "The time-current capability of the 1000 kcmil conductor penetration is greater than the maximum short circuit current and its duration." The maximum available fault current for HCGS 1000 kcmil penetration circuit configuration is 11,000 amperes symmetrical. A short current of this magnitude is cleared within 5 cycles. The penetrations were successfully tested for 45,800 amperes for 19 cycles for the HCGS design basis environmental parameters (Table 3.11-1).

THE TIME - CURRENT CAPABILITY OF THE 1000 kcmil PENETRATION IS GREATER THAN ANY MAXIMUM SHORT CIRCUIT CURRENT VS TIME CONDITION THAT COULD OCCUR. SECTION 8.1.4.12 HAS BEEN REVISED TO INCLUDE THE ABOVE RESPONSE.

Extracts of WESTINGHOUSE TEST REPORT PEN-TR-79-05, TECHNICAL REPORTS AND QUALIFICATION DATA FOR MEDIUM VOLTAGE MODULAR ELECTRICAL PENETRATIONS, ~~IS~~ has been FORWARDED UNDER A SEPARATE COVER.

DSER OPEN ITEM 247

f. 120-V ac lighting circuits

g. Motor differential relay current transformer circuits

h. Low voltage instrumentation circuits

i. Communication circuits.

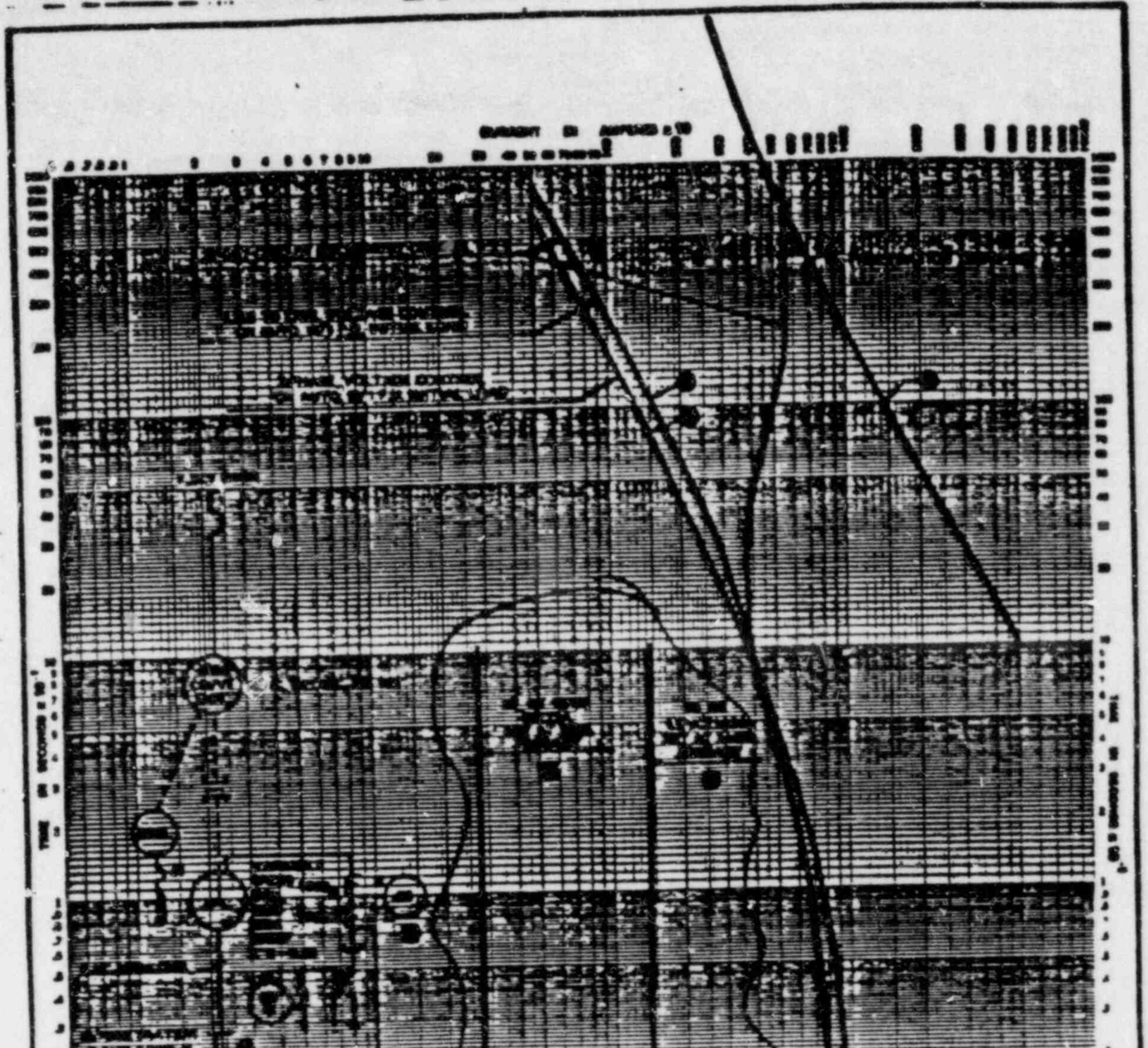
The following system features are provided to ensure compliance with the Regulatory Guide position on single random failures of circuit overload protection devices:

a. Medium voltage penetration assemblies: The only medium voltage circuits routed through the penetration are the 3.92-kV circuits for the two reactor recirculation pump motors. Each motor is supplied from a variable frequency motor-generator set. The maximum fault current available for a fault inside the containment is limited by the generator contribution and the circuit resistance. PRIMARY AND BACKUP PROTECTION FOR THE 1000 kcmil PENETRATION IS PROVIDED BY TWO CLASS 1E CIRCUIT BREAKERS IN SERIES AS SHOWN IN FSAR FIG. 8.3-4. EACH CIRCUIT BREAKER IS PROVIDED WITH AN OVERCURRENT RELAY. THESE RELAYS ARE SET TO TRIP THEIR RESPECTIVE CIRCUIT-BREAKERS. FIG. 430.46 SHEET 11 SHOWS THAT THE TIME-CURRENT CAPABILITY OF THE 1000 kcmil PENETRATION IS GREATER THAN ANY MAXIMUM SHORT CIRCUIT CURRENT VS. TIME CONDITION THAT COULD OCCUR.

b. 480-V ac motor feeder circuits: The 480-V ac loads inside the containment consist of Class 1E and non-Class 1E motor-operated valves and non-Class 1E continuous-duty motors. All these loads are supplied from 480-V motor control centers (MCCs).

The magnetic-only circuit breaker used in the combination starter for the motor provides primary tion for penetration conductors. A thermal-

THE EXISTING FIGURE SHOWS COORDINATION CURVES
DO NOT SHOW THE PROTECTIVE RELAY
CURVES, THAT WERE ADDED RECENTLY.

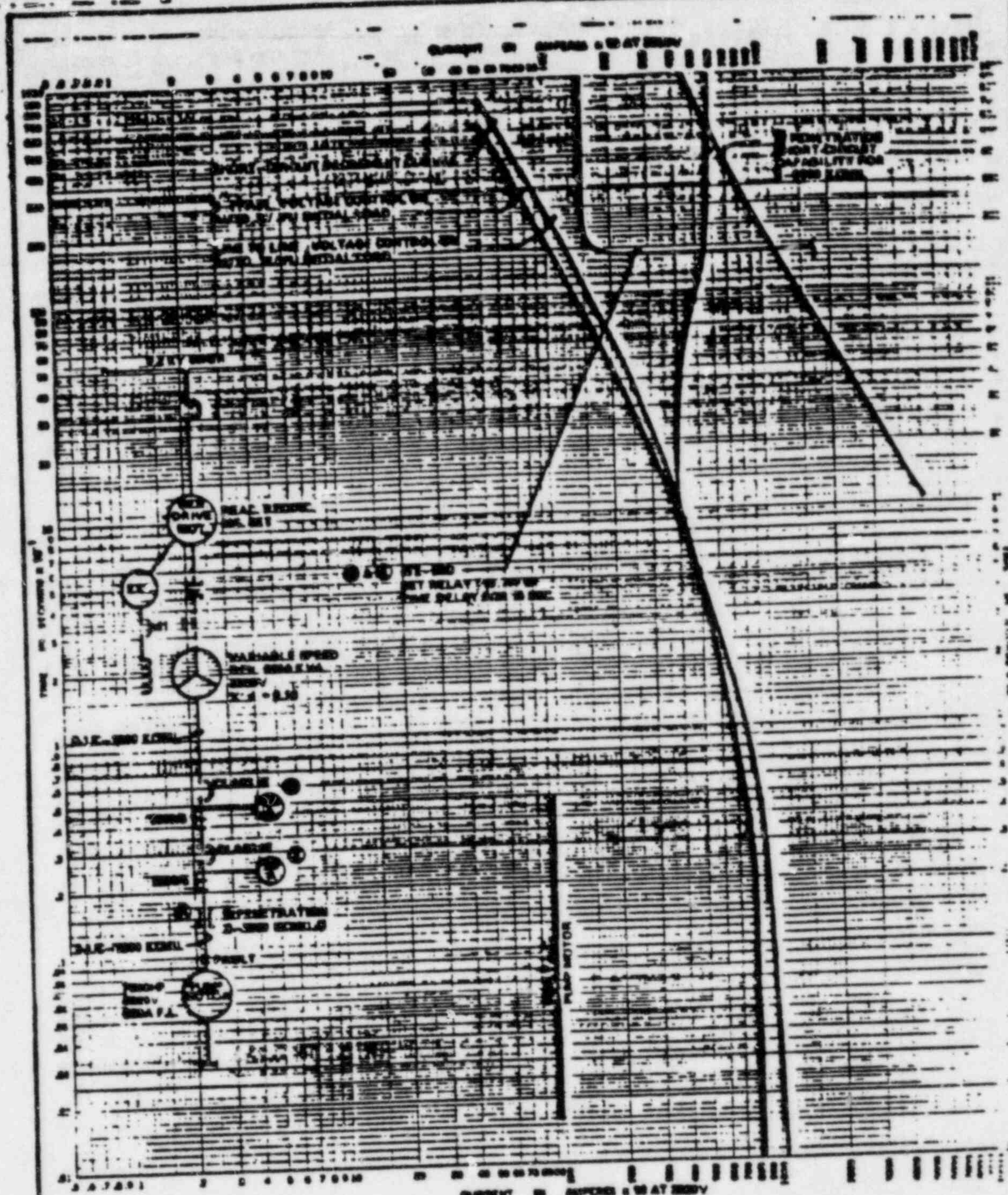


DELETE THESE TWO CURVES. THE NEW SHEET 11 INCORPORATES THE TIME-CURRENT CHARACTERISTICS OF THE CLASS 1E PROTECTIVE RELAYS ADDED TO THE RPT CIRCUIT BREAKERS.

REPLACED BY NEW SHEET 11 (ATTACHED)

CN391

DSER OPEN ITEM 247



NEW SHEET 11.

HOPE CREEK GENERATING STATION
FINAL SAFETY ANALYSIS REPORT

PENETRATION CONDUCTOR OVERCURRENT PROTECTION

FIGURE 8.3-[illegible]
SHEET 11 OF [illegible]

Amendment [illegible]

CN 391

DSER OPEN ITEM 247

DSER Open Item No. 248 (DSER Section 8.3.3.5.2)

SEPARATION OF PENETRATION PRIMARY AND BACKUP PROTECTION

Section 8.1.4.12 (Item b) in the FSAR indicates that primary and backup protective devices, provided 480 v ac motor feeder circuits, are located in the same cubicle of the motor control center. Position 1 of Regulatory Guide 1.63 requires that these protective devices should conform to the criteria of IEEE Standard 279-1971. Thus, the primary and backup protective devices should be physically separated and located in separate versus the same cubicle.

The applicant, by Amendment 4 of the FSAR, indicated that this location is justified because both the primary and backup protective devices are qualified for seismic and environmental parameters.

Both the primary and backup protective devices are molded case type breakers. The staff considers this justification to be unresponsive and therefore, unacceptable. This item will be pursued with the applicant.

RESPONSE

The response to Question 430.45 has been revised to provide additional justification.

QUESTION 430.45 (SECTION 8.3.1 and 8.3.2)

Section 8.1.4.12 (Item b) in the FSAR indicates that primary and backup protective devices, provided 480 V ac motor feeder circuits, are located in the same cubicle of the motor control center. Position 1 of Regulatory Guide 1.63 requires that these protective devices should conform to the criteria of IEEE Standard 279-1971. Thus, the primary and backup protective devices should be physically separated. The devices should preferably be located in separate versus the same cubicle. Justify non compliance.

RESPONSE

Location of the primary and backup protective devices in the same cubicle of a motor control center for a 480 V feeder for loads inside the primary containment is justified as follows:

a. Both the primary and backup protective devices are qualified for HCGS seismic and environmental parameters for any design basis event as described in Sections 3.10, and 3.11.

b. Both the primary and backup circuit breakers are molded case type. These circuit breakers trip directly in response to an overcurrent condition and do not require external control power supply for tripping function.

c. For non-Class 1E 480 V circuits that penetrate into containment, the non-Class 1E circuit breakers are identical in design and construction to that of Class 1E circuit breakers, thereby assuring high reliability.

With the ~~two~~ three provisions described above, the configuration of the primary and backup protective devices located in the same cubicle, meets the intent of IEEE-279-1971. There is no credible single event that will cause both the primary and backup protective circuit breakers to fail in the close position.

DSER Open Item No. 249 (DSER Section 8.3.3.5.3)

THE USE OF BYPASSED THERMAL OVERLOADS PROTECTIVE DEVICES FOR PENETRATION PROTECTION

The applicant by Amendment 0 to Section 8.1.4.12 (Item b) to the FSAR, stated that the overload relay for Class 1 motor operated valves is bypassed for emergency plant operation in accordance with Regulatory Guide 1.106. With respect to Position 1 of Regulatory Guide 1.63, the applicant further stated that Class 1E motor operated valves would burn long before 1000 seconds resulting in a short circuit. Once there is a short circuit, the primary and backup protective devices would operate to provide the required electrical penetration protection. Subsequently, by Amendment 4, the applicant revised the FSAR to state that the backup breakers are selected to allow for sustained locked rotor current and penetration conductors are selected to ensure that the thermal limits of the penetration are not exceeded during this condition.

It is the staff concern:

(1) that the bypassed thermal overload devices is used as part of either the primary or backup long duration penetration protection required by Regulatory Guide 1.63, and

(2) that penetrations are not adequately protected for long duration faults beyond 1000 seconds. These items will be pursued with the applicant.

RESPONSE

The response to Question 430.47 has been revised to provide additional fault current versus time curves for motor operated valve protective devices.

QUESTION 430.47 (SECTION 8.3.1 and 8.3.2)

In Section 8.1.4.12 (Item b) of the FSAR you state that Class 1E motor operated valves would burn long before 1000 seconds resulting in a short circuit. Once there is a short circuit, the primary and backup protective devices would operate to provide the required electrical penetration protection. Provide test that demonstrate that low fault current for long duration of time will always cause a short circuit in time for the primary or backup breakers to operate to protect the penetration.

RESPONSE

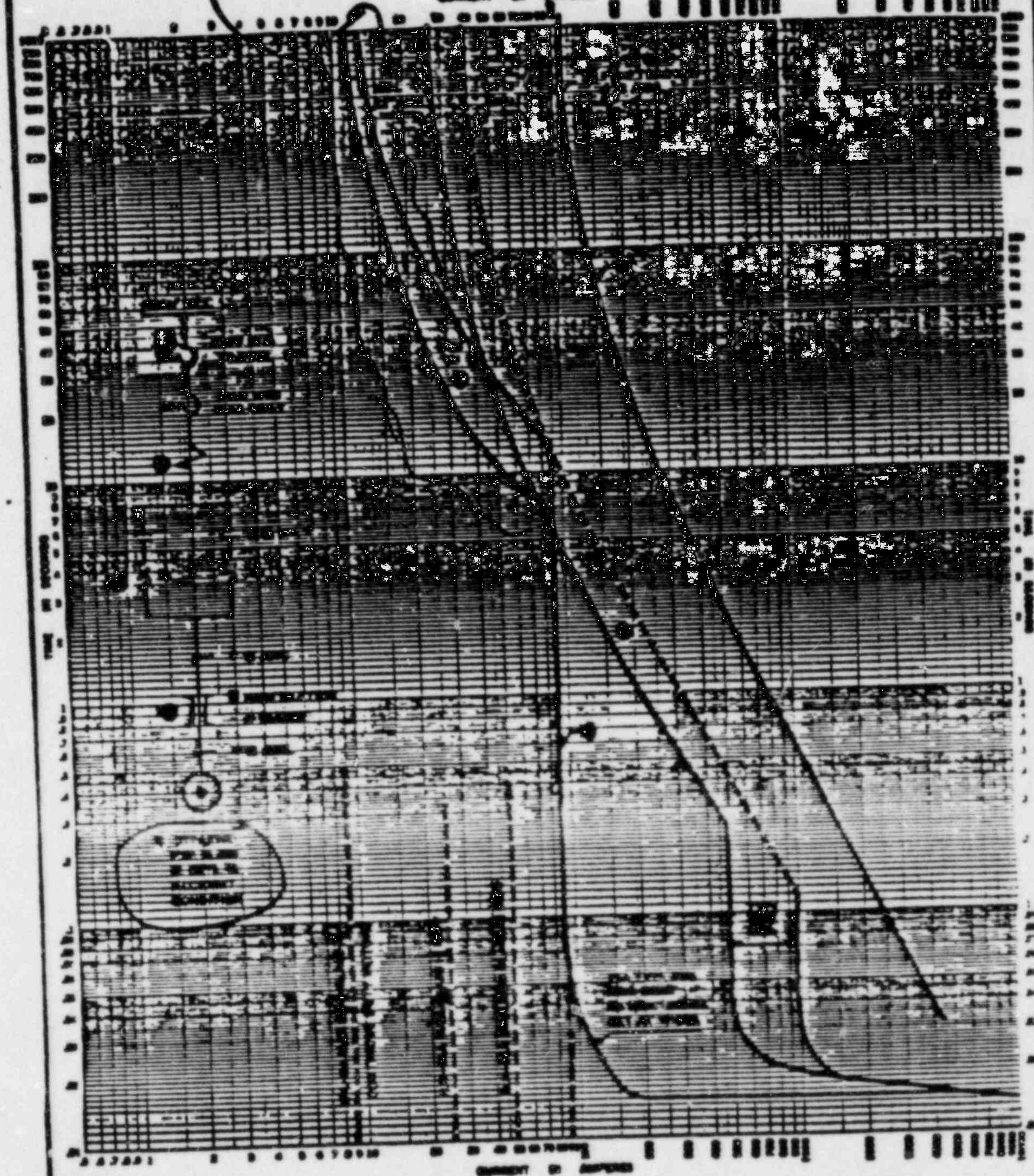
Section 8.1.4.12 (item b) has been revised to delete the statement concerning possibility of Class 1E MOV motor burning and to clarify compliance with Regulatory Guide 1.63.

REVISED FIGURE 430.46 SHEETS 2, 4, 6, AND 8 SHOW THAT FOR A CLASS 1E MOV, THE THERMAL OVERLOAD IS BYPASSED AND IS NOT RELIED ON TO PROVIDE PROTECTION FOR THE ELECTRICAL PENETRATION. THE PRIMARY AND BACKUP PROTECTION FOR THE ELECTRICAL PENETRATION IS PROVIDED BY MAGNETIC ONLY AND THERMAL-MAGNETIC CIRCUIT BREAKERS RESPECTIVELY.

DSER OPEN ITEM 249

THE EXISTING CURVES ARE FOR BOTH CLASS IE & NON-CLASS IE MOVS.

DELETED FOR CLASS IE VALVES.

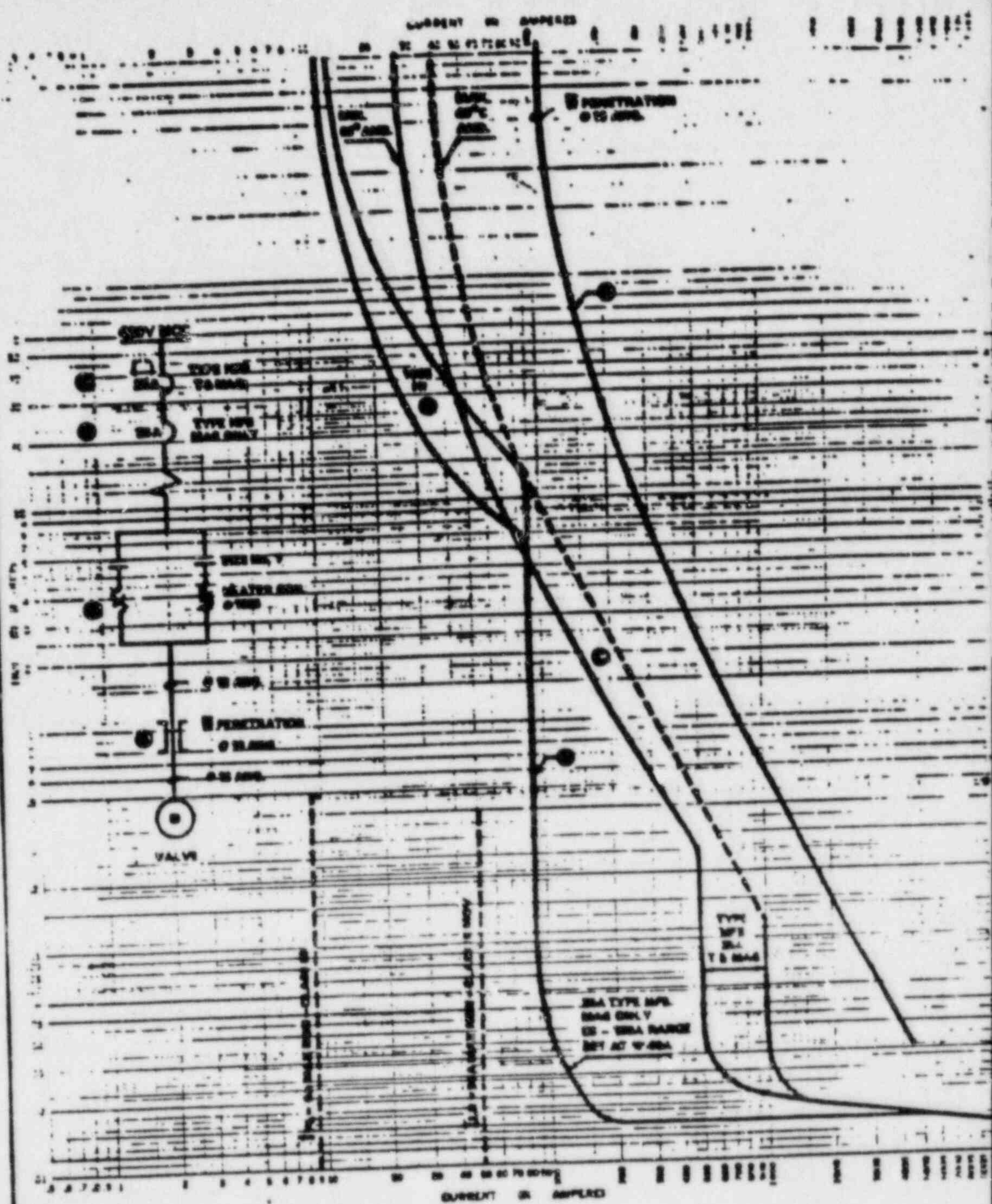


THIS SHEET IS BEING SUPERCEDED BY SHEETS 1 & 2. THE REVISED SHEET 1 SHOWS THE CURVES FOR NON-CLASS IE VALVES & THE NEW SHEET 2 SHOWS THE CURVES FOR CLASS IE MOVS.

SEE ATTACHED SHEETS 1 & 2

REPLACED BY SHEETS 1 and 2 of 20. (ATTACHED)

DSER OPEN ITEM 249



NEW SHEET 1

HOPE CREEK GENERATING STATION
FINAL SAFETY ANALYSIS REPORT

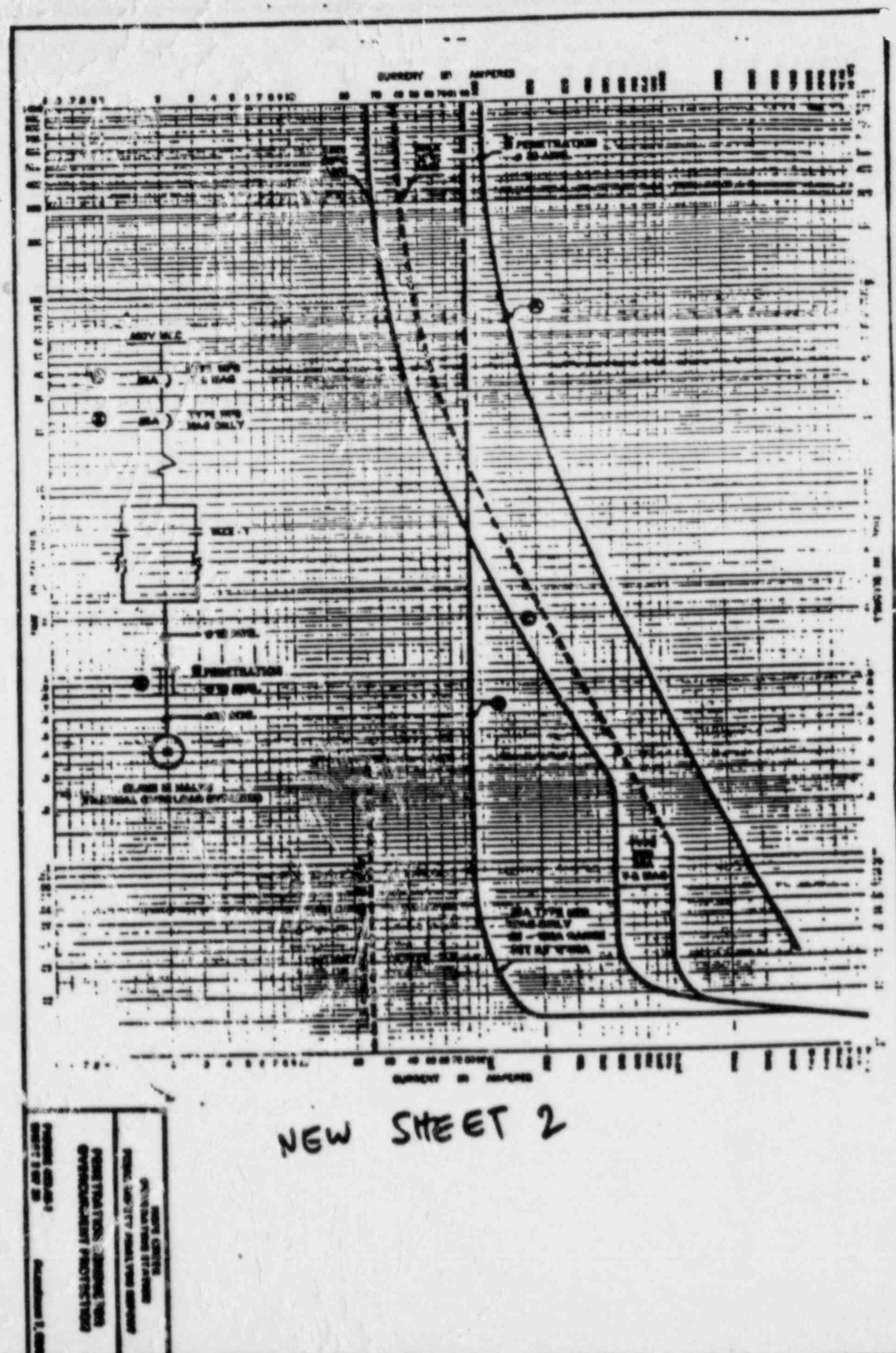
PENETRATION CONDUCTOR OVERCURRENT PROTECTION

FIGURE [illegible]
SHEET 1 OF [illegible]

Amendment [illegible]

DSER OPEN ITEM 249

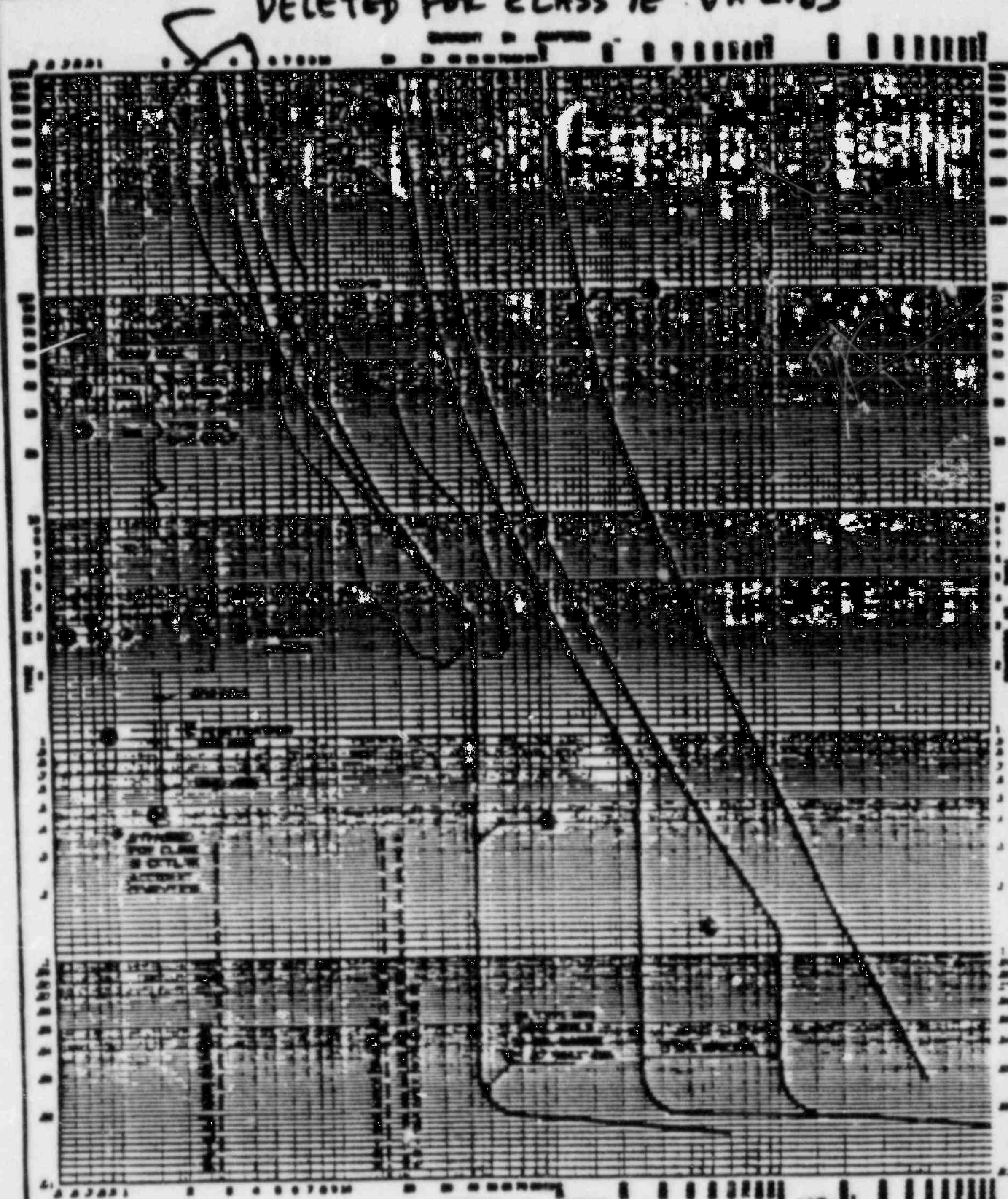
DSER OPEN ITEM 249



NEW SHEET 2

THE EXISTING COORDINATION CURVES ARE BOTH FOR CLASS IE & NON-CLASS IE - MOVS.

DELETED FOR CLASS IE VALVES



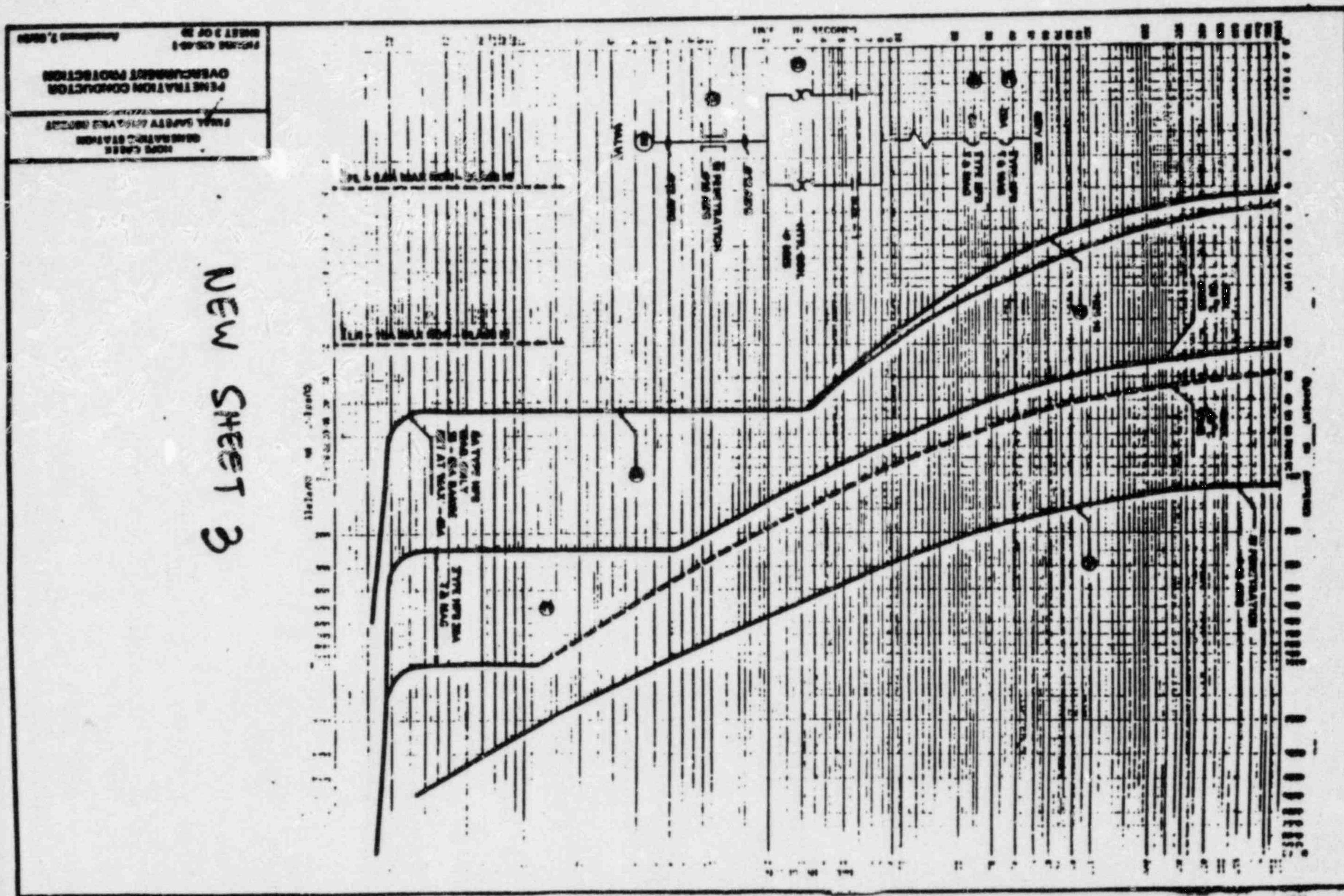
THIS SHEET IS SUPERCEDED BY 2 NEW SHEETS 3 AND 4. THE NEW SHEET 3 SHOWS COORDINATION CURVES FOR NON-CLASS IE MOVS AND NEW SHEET 4 SHOWS THE COORDINATION CURVES FOR CLASS IE MOVS. SEE ATTACHED NEW SHEETS 3 & 4

FINAL SAFETY ANALYSIS REPORT

REPLACED BY NEW SHEETS 3 & 4 of 20 (ATTACHED)

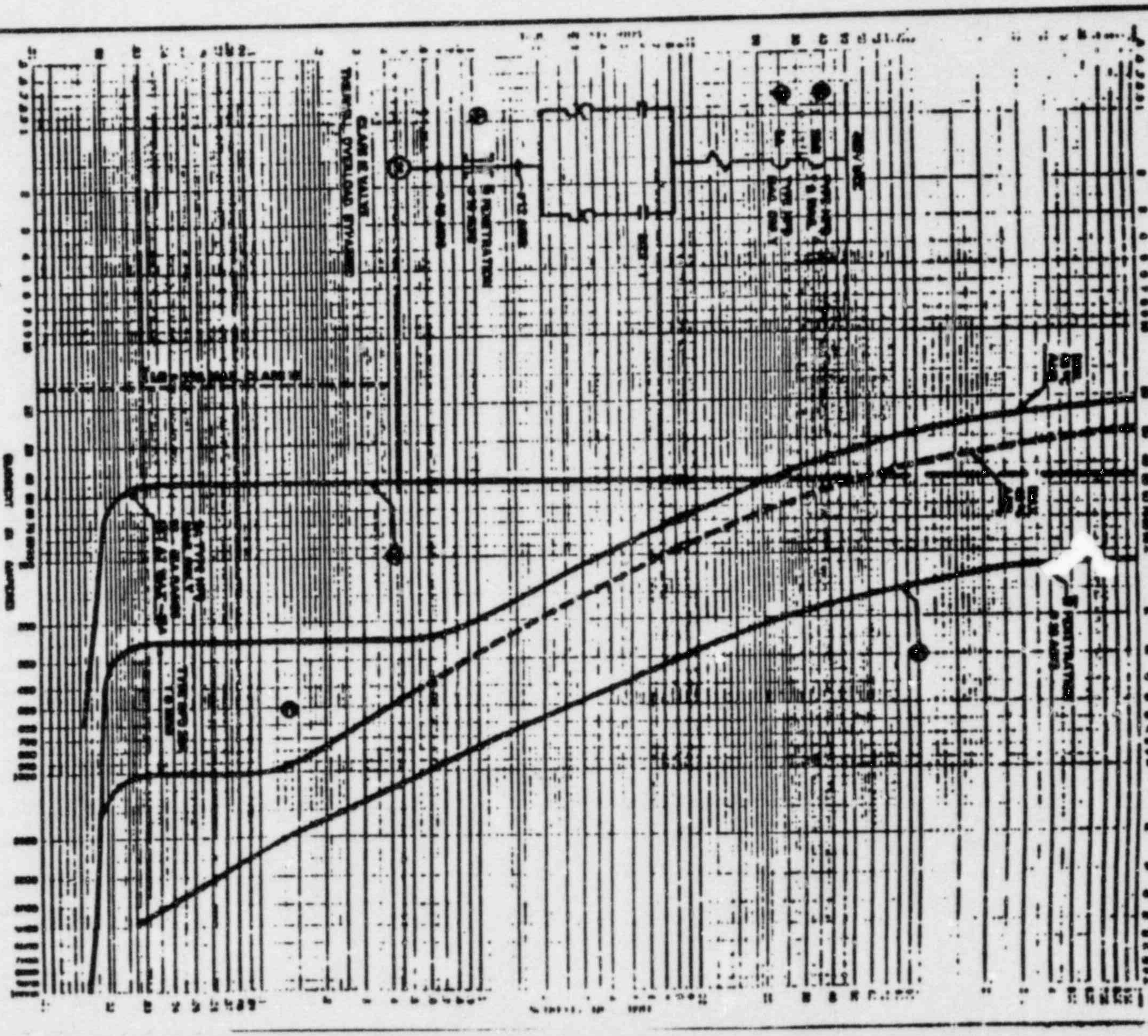
DSER OPEN ITEM 249

DSER OPEN ITEM 249.



NEW SHEET 3

DSER OPEN ITEM 249



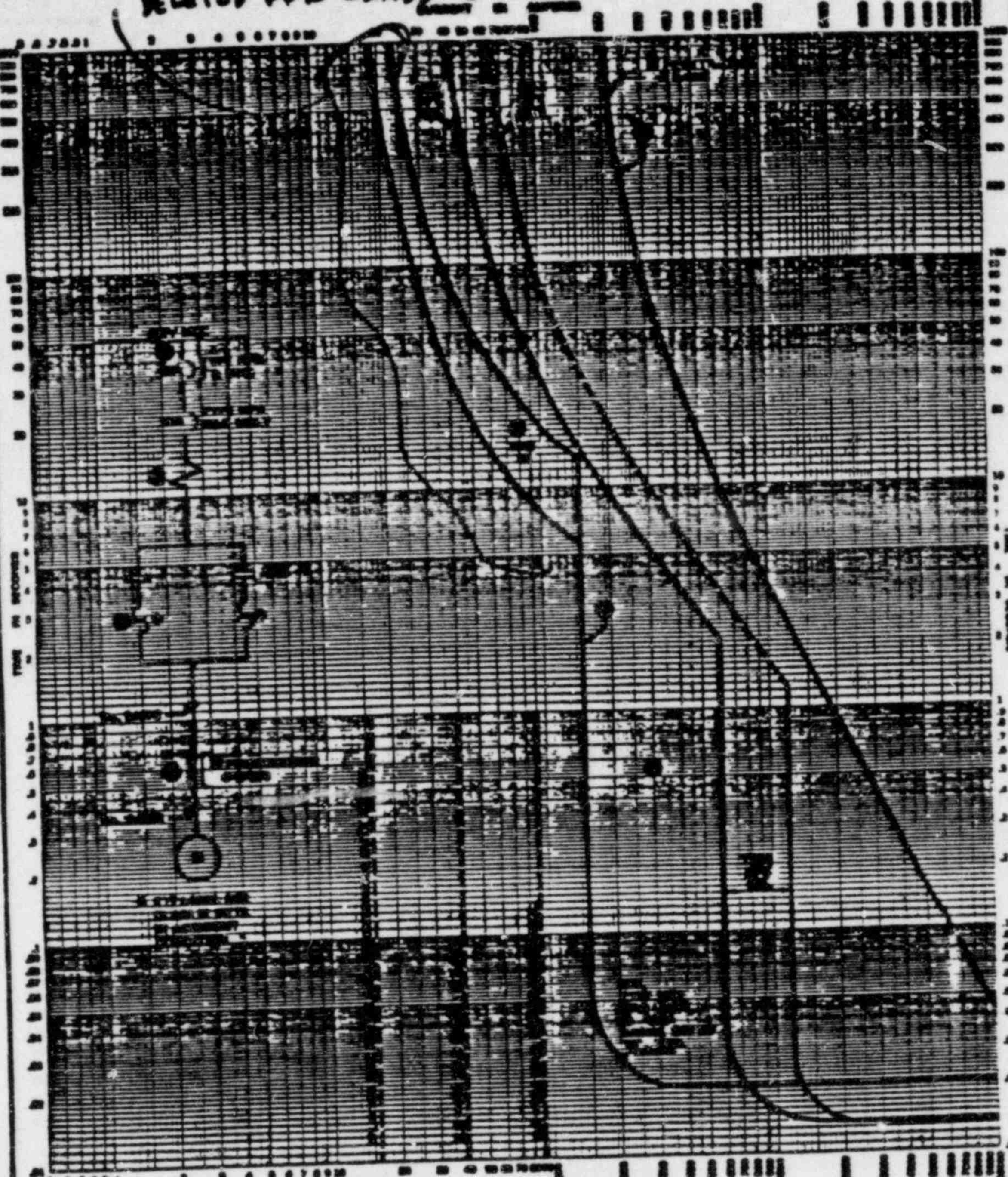
NEW SHEET 4

HOPE CREEK GENERATING STATION
FINAL SAFETY ANALYSIS REPORT

PENETRATION CONDUCTOR OVERCURRENT PROTECTION

THE EXISTING COORDINATION CURVES ARE FOR BOTH CLASS 1E & NON-CLASS 1E VALVES.

DELETED FOR CLASS 1E MOVS

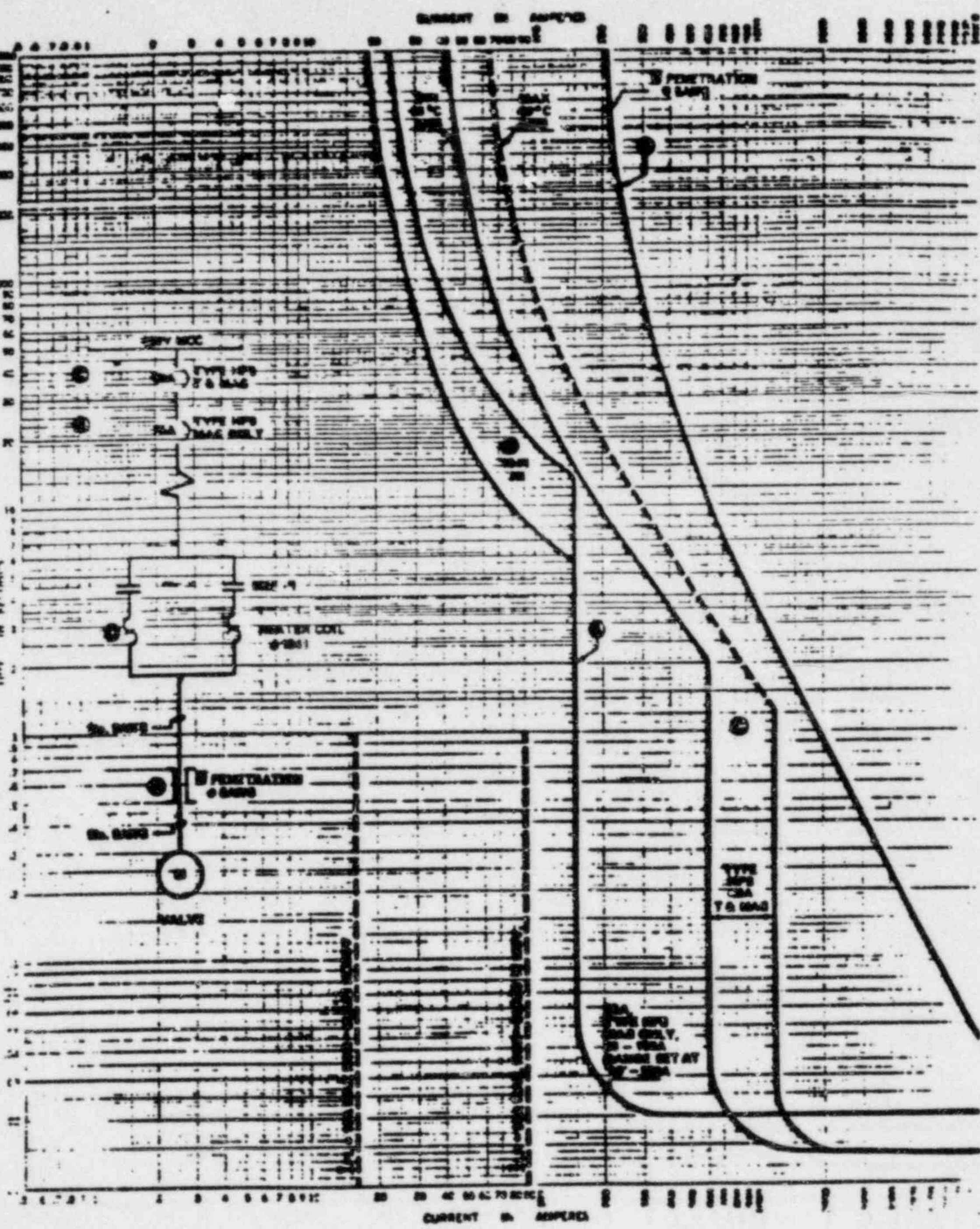


THIS SHEET IS SUPERCEDED BY NEW SHEETS 5 & 6. THE NEW SHEET 5 SHOWS THE COORDINATION CURVES FOR NON-CLASS 1E MOVS. THE NEW SHEET 6 SHOWS THE COORDINATION CURVES FOR CLASS 1E MOVS.

REPLACED BY NEW SHEETS 5 & 6 of 20 (ATTACHED)

DSER OPEN ITEM 249

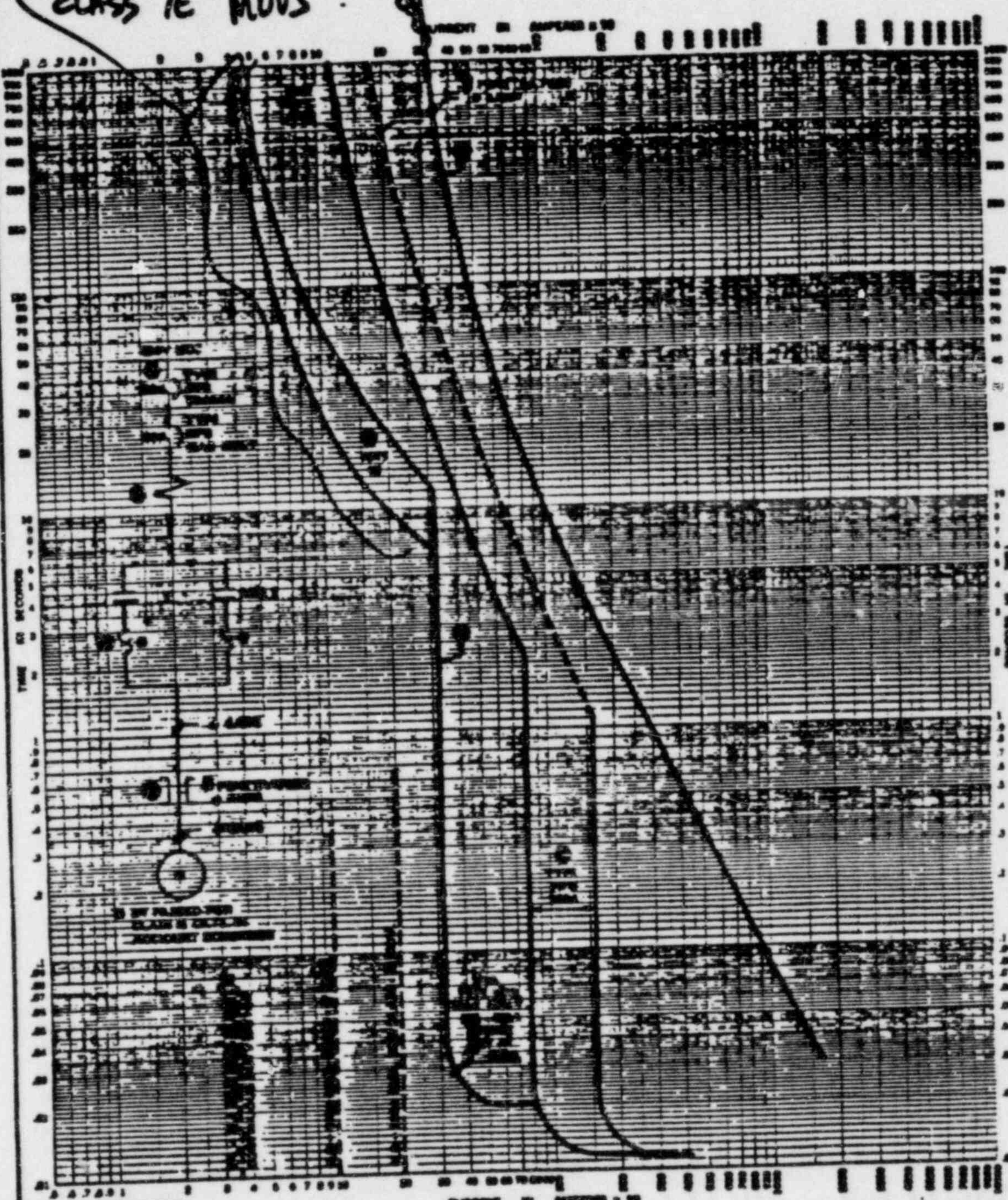
DSER OPEN ITEM 249



NEW SHEET 5

THE EXISTING CURVES ARE FOR BOTH CLASS IE &
NON-CLASS IE MOVS.

DELETED FOR CLASS IE MOVS.



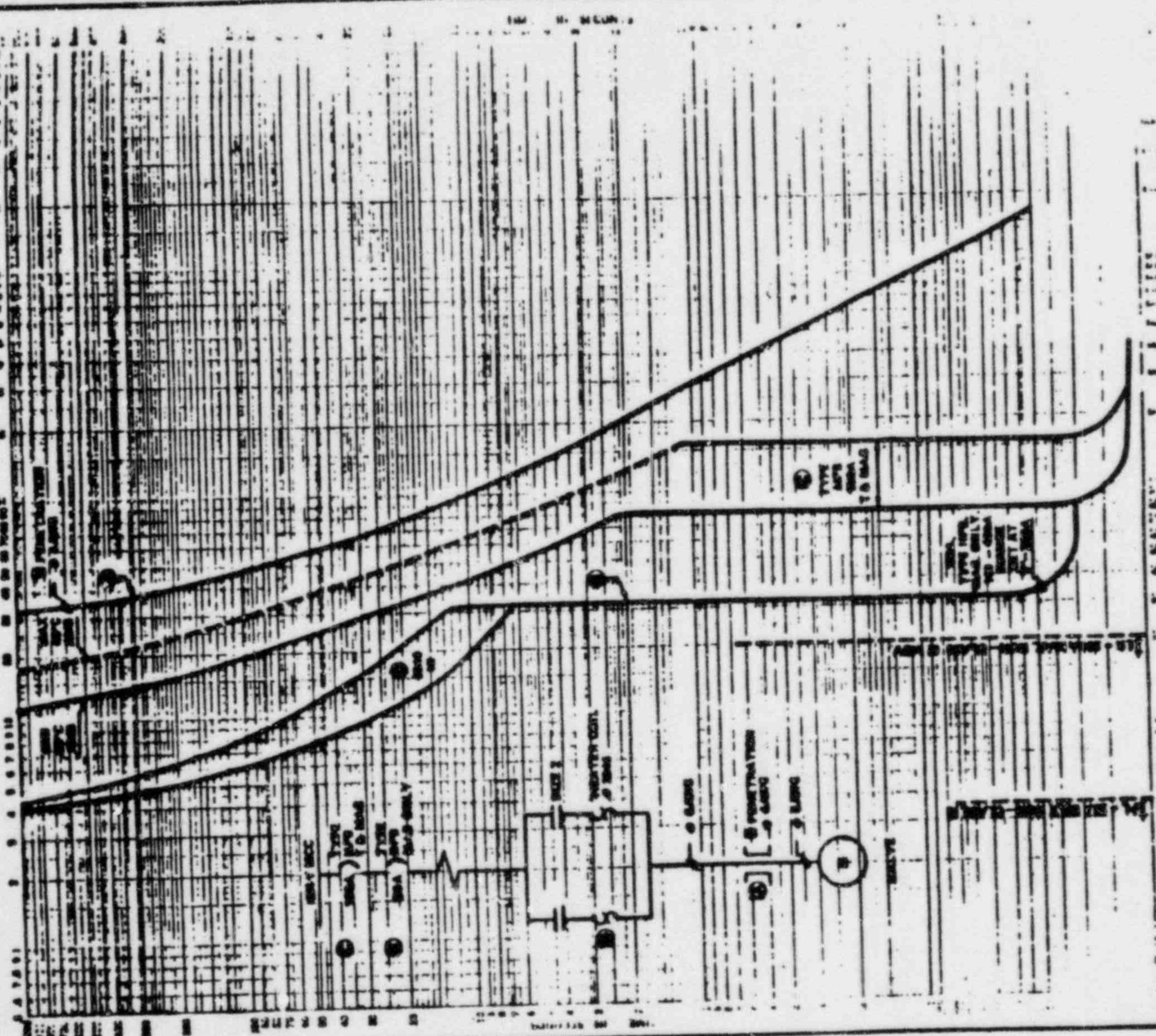
THIS SHEET IS SUPERCEDED BY NEW SHEETS 7 & 8. THE NEW SHEET 7 SHOWS THE COORDINATION CURVES FOR NON-CLASS IE MOV & THE NEW SHEET 8 SHOWS THE COORDINATION CURVE FOR CLASS IE MOV.

REPLACED BY NEW SHEETS 7 & 8.
(ATTACHED)

PENETRATION CONDUCTOR OVERCURRENT PROTECTION

DSER OPEN ITEM 249

DSER OPEN ITEM 249



NEW SHEET 7

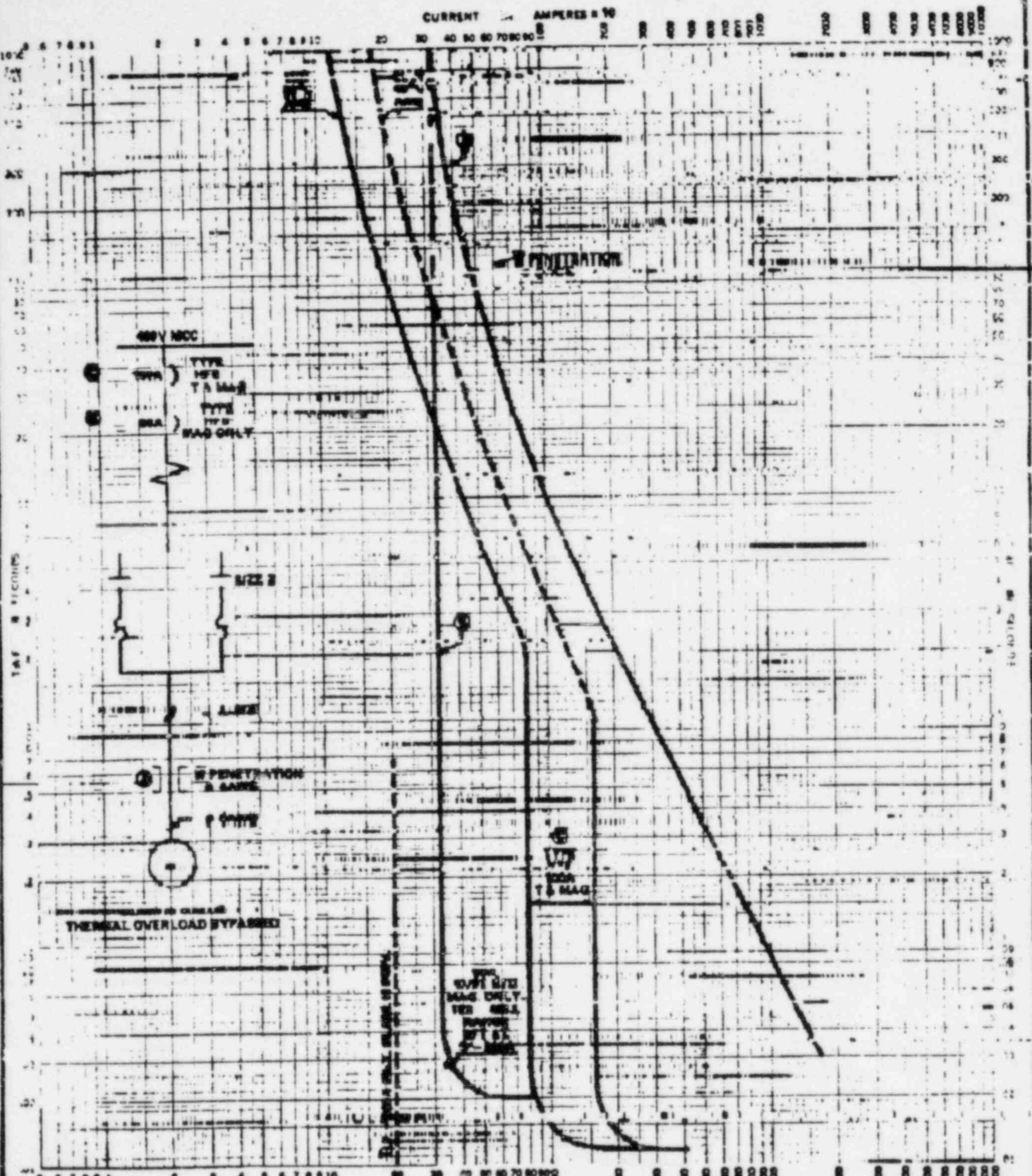
HOPE CREEK
GENERATING STATION
FINAL SAFETY ANALYSIS REPORT

PENETRATION CONDUCTOR
OVERCURRENT PROTECTION

FIGURE 430.40-1
SHEET 7 OF 20

Amendment 7, 08/84

3/3



HOPE CREEK GENERATING STATION
FINAL SAFETY ANALYSIS REPORT

PENETRATION CONDUCTOR OVERCURRENT PROTECTION

FIGURE [illegible]
SHEET [illegible]

Amendment 7, [illegible]

DSER OPEN ITEM 249

DSER Open Item No. 250 (DSER Section 8.3.3.5.4)

TESTING OF FUSES IN ACCORDANCE WITH REGULATORY GUIDE 1.63

Position 1 of Regulatory Guide 1.63 requires testing of both the primary and backup penetration protective devices. By Amendment 4 to the FSAR, the applicant indicated that testing is not required for the following fused circuits:

1. 120 V ac control circuits,
2. 125 V dc control circuits,
3. Motor differential relay current transformer circuits,
4. Low voltage instrumentation circuits, and
5. Communication circuits.

Justification for not meeting the test requirement of position 1 of Regulatory Guide 1.63 will be pursued with the applicant.

RESPONSE

The response to Q 430.48 has been revised To provide the requested information.

QUESTION 430.48 (SECTION 8.3.1 and 8.3.2)

Position 1 of Regulatory Guide 1.63 requires testing of both the primary and backup penetration protective devices. Describe the capability and how these protective device will be tested in Section 8.1.2.12 of the FSAR.

RESPONSE

Testing frequencies and the percentage of affected equipment will be identified in the HCGS Technical Specifications. Test periods should be long enough to allow testing during refueling outages. Redundancy of equipment will facilitate testing when fuel cycle exceeds the test period. HCGS Maintenance procedures will be used to test the affected breakers as follows:

1. 4.16 kV Circuit Breakers
   a. Protective relays - verify proper setting and operation.
   b. Circuit breaker - verify time response
2. Molded case circuit breakers
   a. Trip test at 300% of rated current

~~No testing is required for the following fused circuits:~~

~~1. 120 V ac control circuits.~~
~~2. 125 V dc control circuits (except molded case circuit breakers in General Electric control panels).~~
~~3. Motor differential relay current transformer circuits~~
~~4. Low voltage instrumentation circuits~~
~~5. Communication circuits.~~

Testing of fuses in accordance with Reg. Guide 1.63 will be done at least once per 18 months using the provisions specified in Standard Technical Specification Surveillance Requirement 4.8.4.2, Item a.3. That is, each representative sample of fuses tested will include at least 10% of all fuses of that type. Testing will consist of resistance measurements and will be performed on a rotating basis.

DSER OPEN ITEM 25-0

DSER Open Item No. 251 (DSER Section 8.3.3.5.5)

FAULT CURRENT ANALYSIS FOR ALL REPRESENTATIVE PENETRATION CIRCUITS

By Amendment 4 to the FSAR, the applicant indicated that coordinated fault-current versus time curves for representative penetration conductors and their protective devices are included in Figures 420.46-1 of the FSAR. Based on a review of these figures, the staff concludes that representative curves for motor differential relay, current transformer, and instrumentation circuits were not included in Figure 430.46-1. Inclusion of these circuits as well as other circuits such that the coordinated fault-current versus time curves is representative of all penetration circuits will be pursued with the applicant.

RESPONSE

The response to Question 430.46 has been revised to provide additional fault current versus time curves.

larger than the circuit conductor. The remainder of the requested information is as follows:

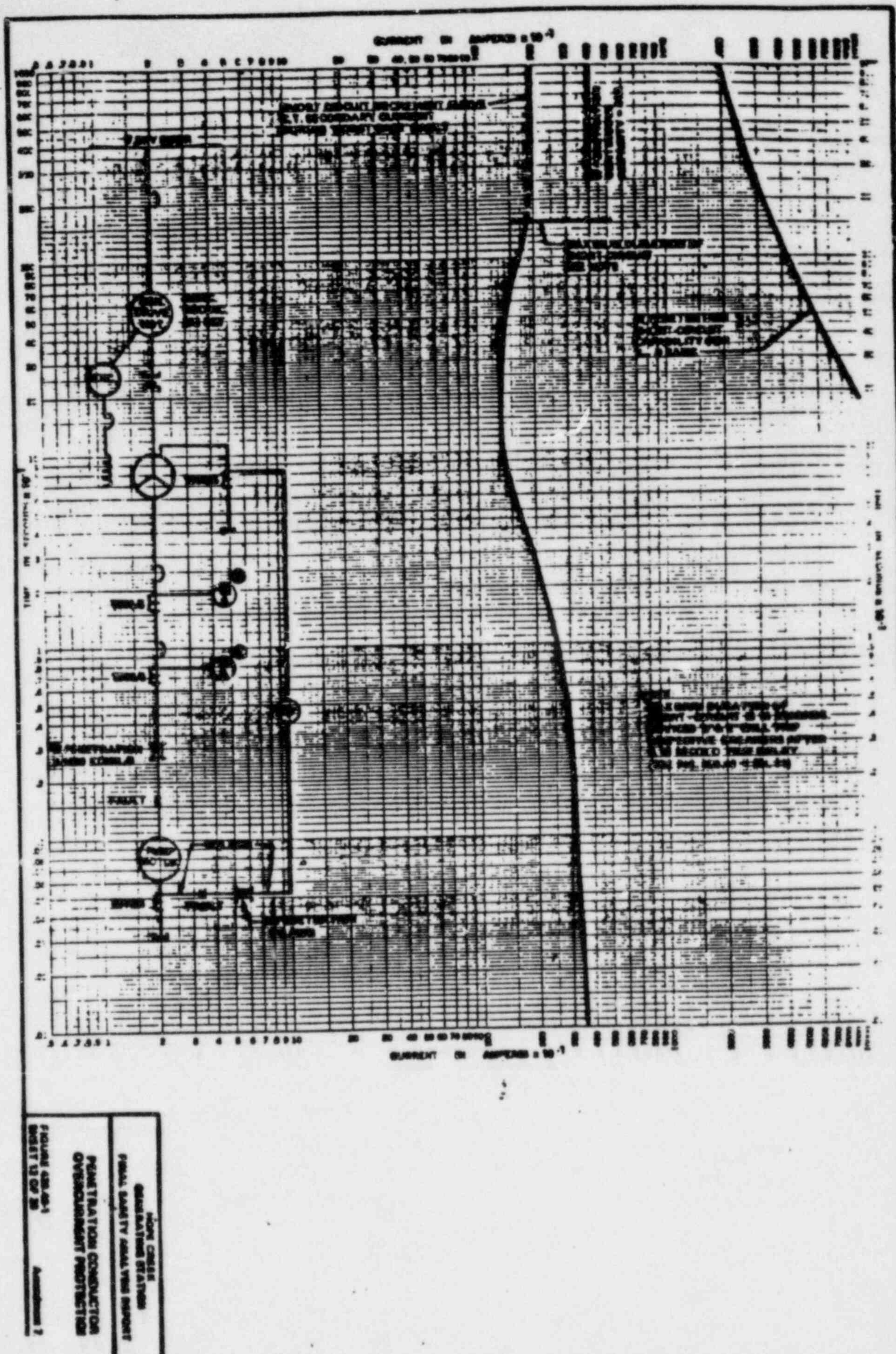
a. HCGS complies with position 1 of Regulatory Guide 1.63 as stated in Section 8.1.4.12. In addition, the penetration assemblies are designed to withstand, without loss of mechanical integrity, the maximum short-circuit current vs. time conditions that could occur, given single random failures of circuit overload protection devices. Time current characteristic curves, based on tests, of the penetration conductors have been established by the penetration supplier; these curves show the maximum duration of symmetrical short circuit current. Based on these curves the primary and backup protective devices are selected to ensure that the mechanical integrity of the penetrations is maintained. This is further demonstrated in Part b, below. The testability of the primary and backup protective devices is addressed in the response to Question 430.48.

b. Coordinated fault-current versus time curves for representative penetration conductors and the protective devices are included in attached Figures 430.46-1.

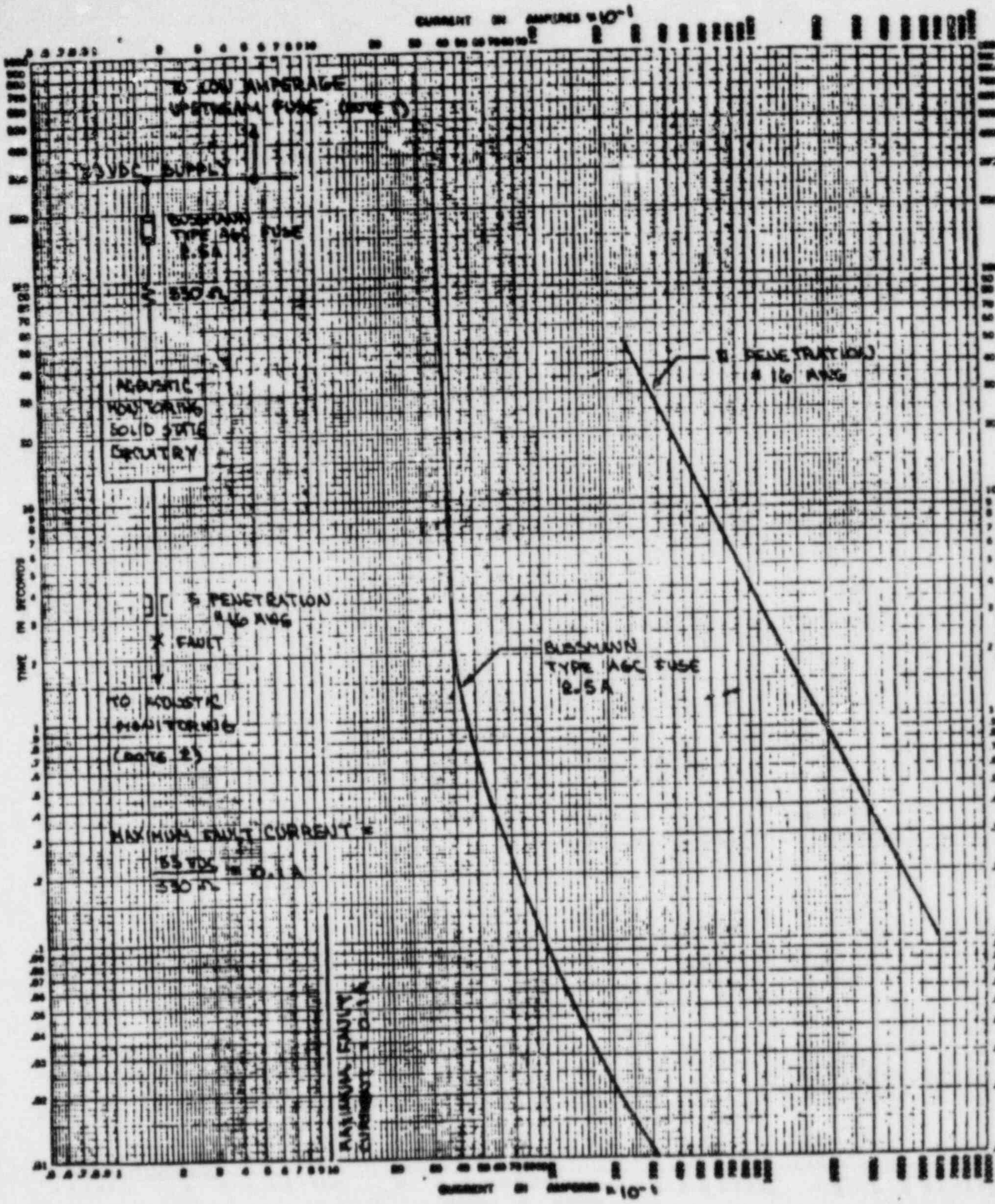
c. The test report that substantiates the capability of the electrical penetration to withstand fault current without seal failure for worst case environmental conditions has been submitted under a separate cover.

THE 1000 kcmil MEDIUM VOLTAGE PENETRATIONS ASSOCIATED WITH REACTOR RECIRCULATION PUMP MOTORS, ARE PROTECTED BY TWO CLASS 1E CIRCUIT BREAKERS IN SERIES AS SHOWN ON REVISED FSAR FIG. 8.3-4. SECTION 8.1.4.12 HAS BEEN REVISED TO INCLUDE THIS RESPONSE.

DSER OPEN ITEM 251



DSER OPEN ITEM 251



NOTES:

1) THE UPSTREAM FUSE PROVIDES OVERCURRENT PROTECTION OF THIS POWER SUPPLY AND OTHER POWER SUPPLIES OF THIS SYSTEM.
2) THIS CIRCUIT IS SIMILAR TO OTHER INSTRUMENTATION CIRCUITS THAT HAVE LOW ENERGY POWER SUPPLIES AND LOW SIGNAL LEVELS.

DSER OPEN ITEM 251

f. 120-V ac lighting circuits

g. Motor differential relay current transformer circuits

h. Low voltage instrumentation circuits

i. Communication circuits.

The following system features are provided to ensure compliance with the Regulatory Guide position on single random failures of circuit overload protection devices:

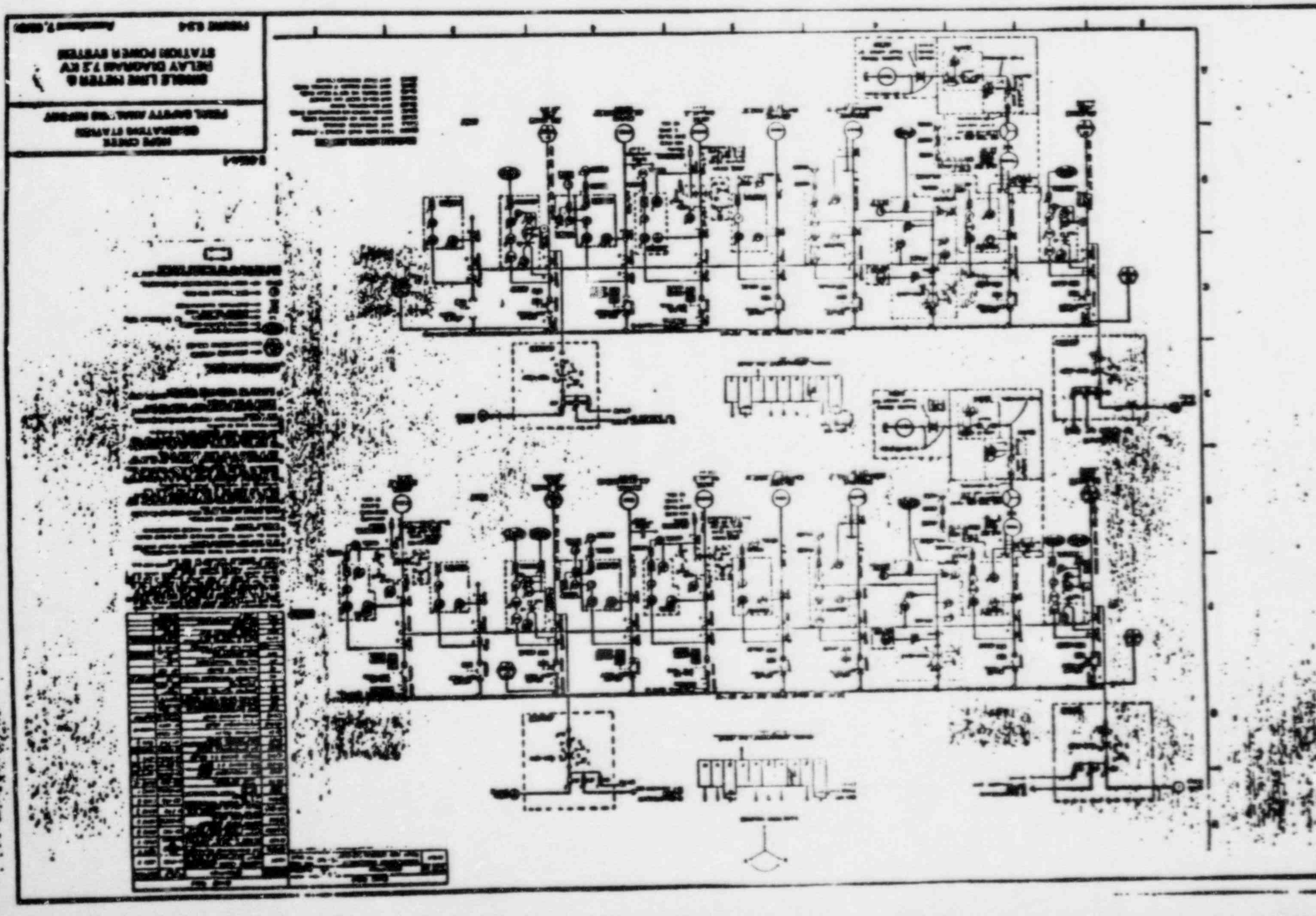
a. Medium voltage penetration assemblies: The only medium voltage circuits routed through the penetration are the 3.92-kV circuits for the two reactor recirculation pump motors. Each motor is supplied from a variable frequency motor-generator set. The maximum fault current available for a fault inside the containment is limited by the generator contribution and the circuit resistance. PRIMARY AND BACKUP PROTECTION FOR THE 1000 Kcmil PENETRATION IS PROVIDED BY TWO CLASS 1E CIRCUIT BREAKERS IN SERIES AS SHOWN IN FSAR FIG. 8.3-4. EACH CIRCUIT BREAKER IS PROVIDED WITH AN OVERCURRENT RELAY. THESE RELAYS ARE SET TO TRIP THEIR RESPECTIVE CIRCUIT-BREAKERS. FIG. 430.46 SHEET 11 SHOWS THAT THE TIME-CURRENT CAPABILITY OF THE 1000 Kcmil PENETRATION IS GREATER THAN ANY MAXIMUM SHORT CIRCUIT CURRENT VS. TIME CONDITION THAT COULD OCCUR.

b. 480-V ac motor feeder circuits: The 480-V ac loads inside the containment consist of Class 1E and non-Class 1E motor-operated valves and non-Class 1E continuous-duty motors. All these loads are supplied from 480-V motor control centers (MCCs).

The magnetic-only circuit breaker used in the combination starter for the motor provides primary protection for penetration conductors. A thermal-

DSER OPEN ITEM 251

DSER OPEN ITEM 251



DSER Open Item No. 252 (DSER Section 8.3.3.5.6)

THE USE OF A SINGLE BREAKER TO PROVIDE PENETRATION PROTECTION

By Amendment 4 to the FSAR, the applicant has indicated that penetration protection for the two reactor recirculation pump motor circuits is provided by a single breaker that is tripped by primary and backup relaying. This design does not meet the requirements of position 1 of Regulatory Guide 1.63. Justification for noncompliance will be pursued with the applicant.

RESPONSE

Figure 430.46-1, Sheet 7, of Amendment 4, has been revised to show two breakers.

[redacted]rger than the circuit conductor. The remainder of the [redacted]equested information is as follows:

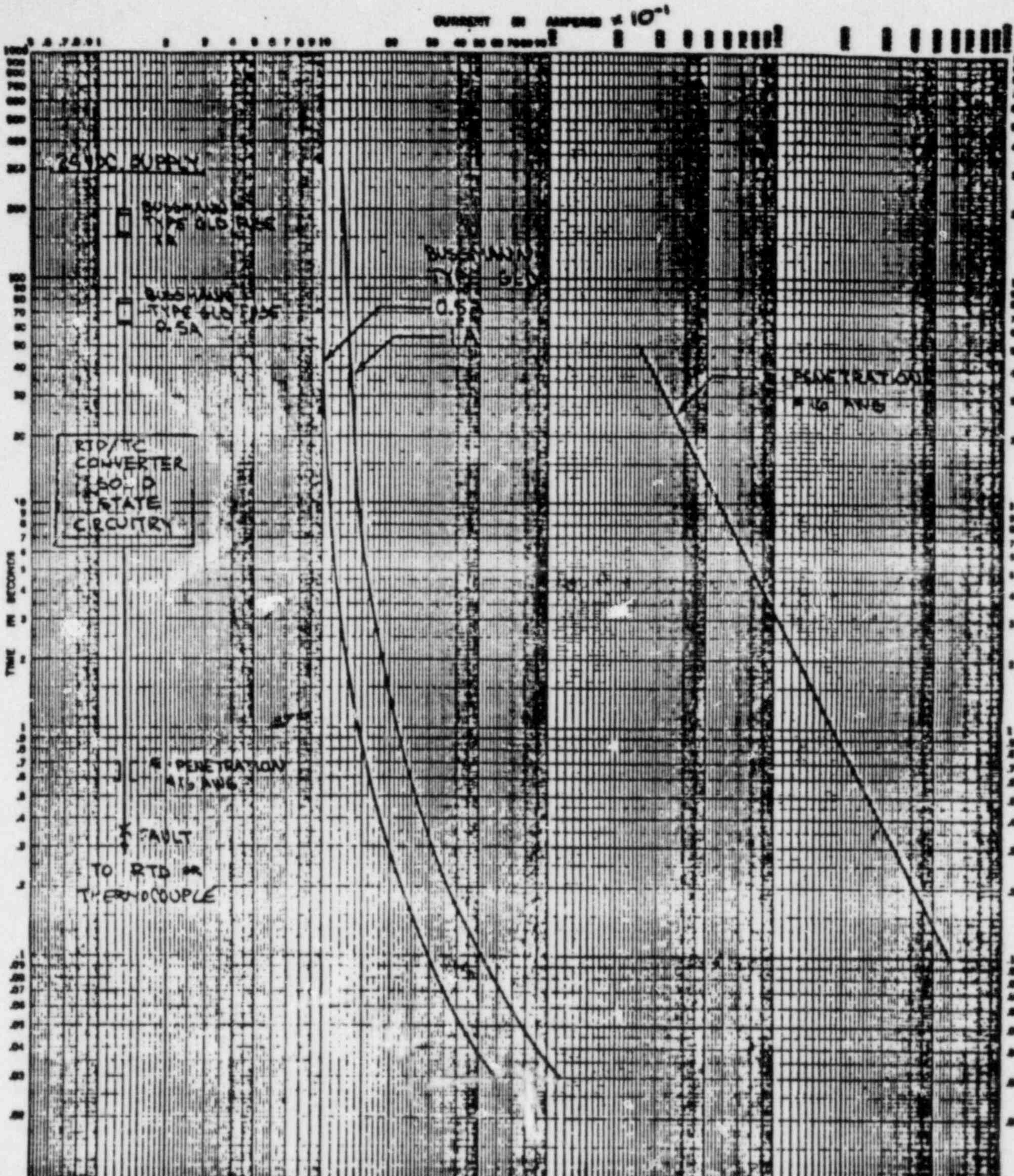
- HCGS complies with position 1 of Regulatory Guide 1.63 as stated in Section 8.1.4.12. In addition, the penetration assemblies are designed to withstand, without loss of mechanical integrity, the maximum short-circuit current vs. time conditions that could occur, given single random failures of circuit overload protection devices. Time current characteristic curves, based on tests, of the penetration conductors have been established by the penetration supplier; these curves show the maximum duration of symmetrical short circuit current. Based on these curves the primary and backup protective devices are selected to ensure that the mechanical integrity of the penetrations is maintained. This is further demonstrated in Part b, below. The testability of the primary and backup protective devices is addressed in the response to Question 430.48.

- Coordinated fault-current versus time curves for representative penetration conductors and the protective devices are included in attached Figures 430.46-1.

- The test report that substantiates the capability of the electrical penetration to withstand fault current without seal failure for worst case environmental conditions has been submitted under a separate cover.

FIGURE 430.46-1 SHEET 21 IS A TYPICAL COORDINATION CURVE FOR A # 16 AWG PENETRATION FOR RTD AND THERMOCOUPLE CIRCUITS. THE CURVES SHOW THAT THE INSTRUMENTATION PENETRATION IS PROTECTED for the maximum short-circuit current.

DSER OPEN ITEM 252



DSER OPEN ITEM 252

DSER Open Item No. 253 (DSER Section 8.3.3.1.4)

COMMITMENT TO PROTECT ALL CLASS 1E EQUIPMENT FROM EXTERNAL HAZARDS VERSUS ONLY CLASS 1E EQUIPMENT IN ONE DIVISION

In Section 8.1.14.3.3 of the FSAR, it is stated that where neither compartmentalization nor the construction of barriers is possible (to protect Class 1E circuits or equipment from hazards such as pipe break, flooding, missiles, and fires) an analysis is performed to demonstrate that none of the hazards disables redundant equipment, conduits, or trays. Based on this statement, the staff concludes that at least one of the redundant Class 1E systems and components at Hope Creek need not be protected from external hazards. The design, thus, does not meet the protection requirement of Criteria 2 and 4, nor the single failure requirement of Criterion 17 of Appendix A to 10 CFR 50. Justification for non-compliance with Criteria 2, 4, and 17 will be pursued with the applicant.

RESPONSE

The response to Question 430.38 has been revised to delete the cited statement from Section 8.1.14.3.3 and to provide discussion of protection against hazards.

QUESTION 430.38 (SECTION 8.3.1 and 8.3.2)

In Sections 8.1.4.14.3.3 of the FSAR you state that where neither compartmentalization nor the construction of barriers is possible (to protect Class 1E circuits or equipment from hazards such as pipe break, flooding, missiles, and fires) an analysis is performed to demonstrate that none of the hazards disables redundant equipment, conduits, or trays. Based on this statement it appears that at least one of the redundant Class 1E systems and components at Hope Creek may not be protected from external hazards. The design, thus, does not meet the protection requirement of Criteria 2 and 4 nor the single failure requirement of Criterion 17 of Appendix A to 10CFR50. Justify non-compliance with Criteria 2, 4, and 17.

RESPONSE

The design of the Class 1E onsite power systems complies with the requirements of General Design Criteria (GDC) 2, 4 and 17 of Appendix A to 10 CFR 50. Section 8.1.4.14.3.3 discusses the general provisions taken to protect Class 1E equipment located in hazardous areas to comply with GDC 2 and 4; the detailed provisions are presented in Chapter 3. Compliance with GDC 17 is discussed in Sections 8.3.1.2 and 8.3.2.2. In all cases the physical protective measures taken and/or analysis conducted ensure that safe shutdown capability is maintained.

Section 3.5 indicates that Class 1E equipment is protected from postulated missiles by use of plant arrangement or suitable physical barriers such that a single missile cannot simultaneous damage a critical system component and its backup system. This is accomplished by locating redundant systems in different areas of the plant or separation by missile-proof walls.

Section 3.6.1.1 indicates that, as part of the design basis for protection against dynamic effects associated with the postulated rupture of piping, a single active component failure is assumed to occur in systems used to mitigate the consequences of the postulated piping rupture and to shut down the reactor. A thorough review of the plant using the design bases provided in Section 3.6.1.1 was conducted and no cases were found where the piping failure would prevent safe shutdown (Reference: Question/Response 410.23).

Section 8.1.4.14.3.3 has been revised to replace the statement on compartments and barriers with one that references Sections 3.5 and 3.6.

monitoring cables, boxes also shall not be considered in determing the required separation.

b. In case of open ventilated trays, redundant trays are separated by 3 feet horizontally and 5 feet vertically, respectively. If the redundant trays cannot be separated by the distances specified above, solid covers for trays are provided as designated in Section 6.1.4 of IEEE 384-1981.

Separation requirements between Class 1E and non-Class 1E circuits are the same as those required between redundant circuits.

8.1.4.14.3.3 Hazardous Areas

These are areas where one or more of hazards such as pipe break, flooding, missile, and fire can be postulated.

Routing of redundant Class 1E circuits or the locating of redundant Class 1E equipment in hazardous areas is avoided. The preferred separation between redundant Class 1E circuits or equipment in these areas is by a wall, floor, or barrier that is structurally adequate to shield redundant raceways from potential hazards in the area.

~~Where neither compartmentalization nor the construction of barriers is possible, an analysis is performed to demonstrate that no missile, fire, jet stream impingement, or pipe whip hazard disables redundant equipment, conduits, or trays. In no case, regardless of the distance of physical separation, are redundant equipment cable trays located in the direct line of sight of the same potential missile source.~~

The plant design for fire protection separation of electrical cables and equipment is reviewed against 10 CFR 50, Appendix R, which is discussed in Section 9.5.1.

Sections 3.5 and 3.6 describe the methods of protection against missiles and pipe ruptures.

DSER Open Item No. 254 (DSER Section 8.3.3.1.5)

PROTECTION OF CLASS 1E POWER SUPPLIES FROM FAILURE OF UNQUALIFIED CLASS 1E LOADS

In Section 8.1.4.6 of the FSAR, it is stated that Class 1E equipment is qualified to perform its function during applicable design basis accidents. The terminology "applicable design basis accidents" is of concern Sections 4.2 and 4.7 of IEEE standard 308-1974 requires that Class 1E equipment be designed and qualified to perform their function during <u>any</u> design basis event. If a Class 1E component is subject to the effects of a design basis event environment, that co[illegible]ponent must be designed and qualified to function in that environment irrespective of the fact that the component may not be directl[illegible] required to mitigate the design basis event.

By Amendment 4 to the FSAR, the applicant indicated that safety-related equipment that is not qualified (because it does not have to perform a safety function to mitigate the design basis event condition to which it is being subjected) are identified in Table 3.11-6 of the FSAR.

In justification of this design, the applicant further indicated that this identified equipment is connected to its power supply by a Class 1E circuit breaker. The circuit breaker will operate to clear any fault caused by the failure of unqualified equipment. Thus, under the single failure criterion only one Class 1E circuit breaker is postulated to sail. The failure of this one circuit breaker can degrade only its associated power supply bus. The redundant power supply and load will be available to perform the safety load.

Further justification or assurance that Class 1E power supplies will not fail as a result of failure of unqualified equipment and results of analysis that provide a positive statement to the effect that the unqualified equipment failure position will not affect station shutdown capability will be pursued with the applicant.

<u>RESPONSE</u>

Additional justification has been provided in the revised response to Question 430.~~36~~.
.37

QUESTION 430.37 (SECTION 8.3.1 and 8.3.2)

In Sections 8.1.4.6 of the FSAR you state that Class 1E equipment is qualified to perform its function during applicable design basis accidents. The terminology "applicable design basis accidents" is not clear. Section 4.2 and 4.7 of IEEE standard 308-1974 requires that Class 1E equipment be designed and qualified to perform their function during any design basis event. If a Class 1E component is subject to the effects of a design basis event environment, that component must be designed and qualified to function in that environment irrespective of the fact that the component may not be directly required to mitigate the design basis event. For each design basis event defined in Table 1 of IEEE standard 308-1974:

a. Identify each Class 1E component that does not meet the design and qualification guidelines of Sections 4.2 and 4.7 of IEEE Standard 308-1974, and

b. Provide an analysis that demonstrates compliance with the single failure criterion assuming simultaneous failure of all components identified above with their associated power supplies.

RESPONSE

a. The term "applicable design basis accident", in compliance is used to more precisely describe the postulated DBE which the safety-related components needed to mitigate that DBE will be required to operate in, and thus describe the conditions the equipment must be qualified to. This is ~~ian complaince~~ with NUREG-0588, Part 2.1(3)(a) which states in part, "should be qualified by test to demonstrate its operability for the time required in the environmental conditions resulting from <u>that</u> accident." It is PSE&G's position to comply with this requirement for each piece of safety-related (Class 1E) equipment.

PSE&G agrees that safety-related components (Class 1E) should be designed and qualified to function for each applicable DBA. However, function in the case of components not required to mitigate a DBA is the requirement not to fail in a manner detrimental to plant safety as specified in NUREG-0588, Part 2.1(3)(b). This is interpreted to mean that if the component is not required to operate during the DBE, the qualification requirement for such components is to demonstrate that they will not fail in a manner which would prevent safe shutdown under the postulated DBA environmental condition.

~~The specific design basis events considered for HCGS are discussed in Chapter 15. These events are comparable to the generic postulated events of Table I of IEEE-308-1974.~~

~~Safety-related equipment that does not have to be qualified as determined by functionality reviews and/or DBA conditions have been identified in Table 3.11-6 of the FSAR.~~

~~The equipment identified above is connected to its power supply bus by a Class 1E circuit breaker. The power supply bus and the circuit breaker are qualified for the DBE environment in which they are located. The Class 1E circuit breaker will operate to clear any fault caused by the failure of the equipment identified above. Under the single failure criteria application, only one Class 1E circuit breaker is postulated to fail. The failure of this circuit breaker can degrade only its associated power supply bus. In this event, a combination of the redundant power supply bus and load is available to perform the safety function.~~

All Class 1E equipment is designed and qualified, as stated in Section 8.1.4.6, to meet the requirements of Sections 4.2 and 4.7 of IEEE Standard 308-1974 with one clarification as identified on revised Table 3.11-6.

Table 3.11-6 now shows that equipment tag numbers 1AN205, 1BN205, 1CN205 and 1DN205 are exempt from harsh environment qualification. This exemption is justified because of the following:

1. Each equipment is designed and qualified as Class 1E equipment to perform its function under applicable design basis events defined for the equipment locations, including seismic and normal environmental parameters,

2. The equipment safety function is to trip the Reactor Recirculation Syst pump motors upon receipt of a trip signal (RPS and ATWS). The equipment is 4.16 kV circuit breakers. The equipment accomplishes its safety function before significant environmental parameter changes are experience.

3. There are two circuit breakers in series in the circuit of each pump motor as shown on Figure 8.3-4. Specifically, 1AN205 and 1CN205 are connected to one circuit and 1BN205 and 1DN205 to the other. Therefore, single failure criterion is met. In addition, the motor circuits are not powered from Class 1E sources so that failure of the circuit breakers does not affect Class 1E power supplies.

THE COMMON MODE CHALLENGES (SEISMIC, ELECTRICAL FAULTS, ETC.) FROM THE SUBJECT EQUIPMENT TO THEIR ASSOCIATED CLASS 1E POWER SUPPLIES ARE MINIMIZED BECAUSE THE EQUIPMENT IS SEISMICALLY QUALIFIED, ELECTRICALLY ISOLATED BY QUALIFIED CLASS 1E CIRCUIT BREAKER, AND ANY CREDIBLE FAILURE IS BOUNDED BY THE SINGLE FAILURE CRITERIA. THE COMMON MODE CHALLENGE IS NOT A DESIGN BASIS WHICH HAS BEEN DEFINED; HOWEVER IT IS ENCOMPASSED BY THE EXISTING SINGLE FAILURE CRITERIA.

DSER OPEN ITEM 254

DSER OPEN ITEM 254

TABLE 3.11-6

SAFETY-RELATED EQUIPMENT LOCATED IN A HARSH ENVIRONMENT EXEMPTED FROM ENVIRONMENTAL QUALIFICATION REQUIREMENTS

EQUIPMENT TAG NO.	DESCRIPTION	REASON
1 AVE 261 1 BVE 261 10 VE 259 10 VE 260	Electric Duct Heater, SLC Electric Duct Heater, SLC Electric Duct Heater, RCIC Electric Duct Heater, HPCI	Due to reactor building temperature increase during a DBA, the duct heaters will not function due to the temperature control settings, which is below DBA building temperature.
1 AN 205 1 BN 205 1 CN 205 1 DN 205	4.16 KV Breaker - RRS Pump Motor 4.16 KV Breaker - RRS Pump Motor 4.16 KV Breaker - RRS Pump Motor 4.16 KV Breaker - RRS Pump Motor	The RRS pump motor breakers trip upon receipt of a LOCA signal shutting down the pumps. The breakers are no longer required to perform a safety-related function. The breakers are not connected to Class IE buses and are qualified for mild environment.
10 Y 201 10 Y 202 10 Y 203 10 Y 204 10 X 201 10 X 202 10 X 203 10 X 204	Panel Panel Panel Panel Transformer Transformer Transformer Transformer	These panels and transformers are located in the reactor building and feed non-critical class 1E Loads.

DSER Open Item No. 255 (DSER Section 8.3.2.2)

BATTERY CAPACITY MARGIN FOR AGING AND LESS THAN OPTIMUM OPERATING CONDITIONS

Section 8.3.2.1.2.2 of the FSAR states that the initial battery capacity is 25 percent greater than required and is consistent with the 80 percent replacement criterion. Section 6.2.2 of IEEE standard 485-1978 states that it is prudent design practice to provide a capacity margin of 10-15 percent to allow for less than optimum operating conditions of the battery. The statement of 25 percent greater capacity implies no design margin.

Subsequently, by Amendment 4 to the FSAR, the applicant stated that the batteries are sized with a design margin of 10 percent of capacity which is in addition to the 25 percent allowed for battery replacement. The staff concludes that this design capacity meets the requirements of GDC 17 and is acceptable pending incorporation of the 10 percent capacity margin in Section 8.3.2 of the FSAR.

RESPONSE

Section 8.3.2.1.2.2 has been revised to incorporate the above design margin.

4. MCC

(a) Bus

(1) Main horizontal bus: 600 A continuous rating, 10,000 A short-circuit bracing

(2) Vertical bus: 300 A continuous rating, 10,000 A short-circuit bracing

(b) Breakers

Molded-case breakers: 100 A frame size, 10,000 A interrupting capacity

(c) Air circuit breakers: 800 A frame size, 25,000 A interrupting capacity.

8.3.2.1.2.2 Class 1E Batteries

A 125-V battery consists of a set of 60 shock-absorbing, clear-plastic cells of the lead-calcium type. Four of the six batteries are rated at 1854 ampere hour and the remaining two at 560 ampere hour at an 8-hour discharge rate based on the end terminal voltage of 1.75 V per cell at 77±5°F.

Each Class 1E battery bank has sufficient capacity to independently supply the required loads except Class 1E ac instrument power supply and balance of plant (BOP) computer power supply, for 4 hours without support from battery chargers. Class 1E ac instrument power supply and BOP computer can be supplied for 40 and 60 minutes respectively from the time that battery chargers are lost. These time intervals are sufficient to ensure that the Class 1E instrument ac power supply is uninterrupted during a loss of offsite power, because the battery chargers will be reenergized from Class 1E 480 V motor control centers once the standby diesel generators are started.

The initial battery capacity is 25% greater than required. This margin is consistent with the battery replacement criterion of 80% rated capacity given in IEEE 450-1975 and is in addition to a 10% design margin allowed for load growth and for less than optimum operating condition of the battery.

DSER Open Item No. 257 (DSER Section 8.3.2.5)

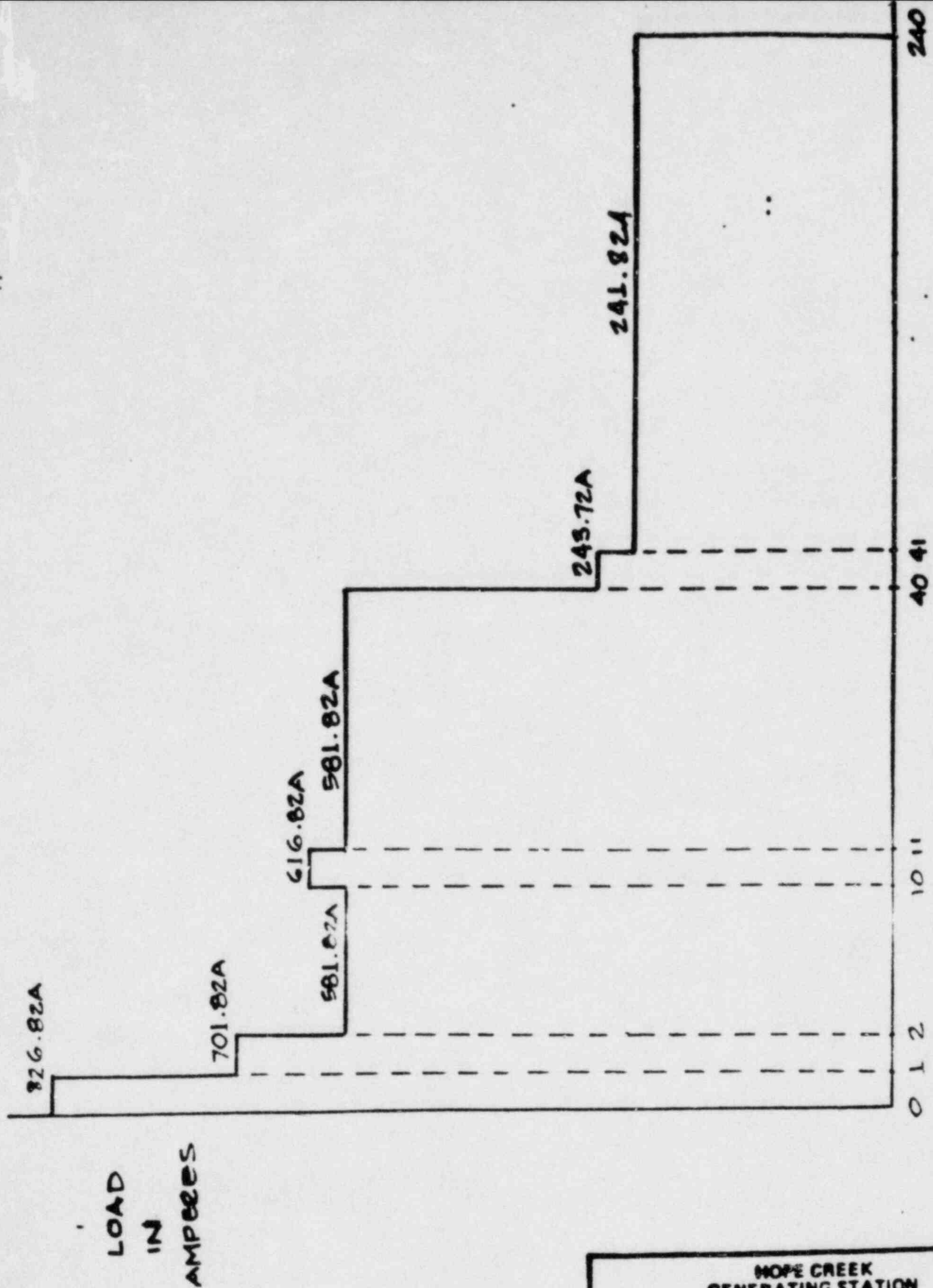
JUSTIFICATION FOR A 0 TO 13 SECOND LOAD CYCLE

Table 8.3-7 of the FSAR indicates that each of the station battery duty cycle consist, in part, of a 0 to 13 seconds and a 13 to 120 second load periods. The basis and justification for separating loads into these two time periods for all modes of plant operation will be pursued with the applicant.

RESPONSE

Tables 8.3-7a,b,c, and d, have been revised to change the 13 seconds to 1 minute.

F70(10)



HOPE CREEK GENERATING STATION
FINAL SAFETY ANALYSIS REPORT

CLASS 1E 125 VDC BATTERY 1AD411 LOAD PROFILE

FIGURE 8.3-16
SHEET 1 OF 8

DSER OPEN ITEM 257

DSER OPEN ITEM 257

TABLE 8.3-7a

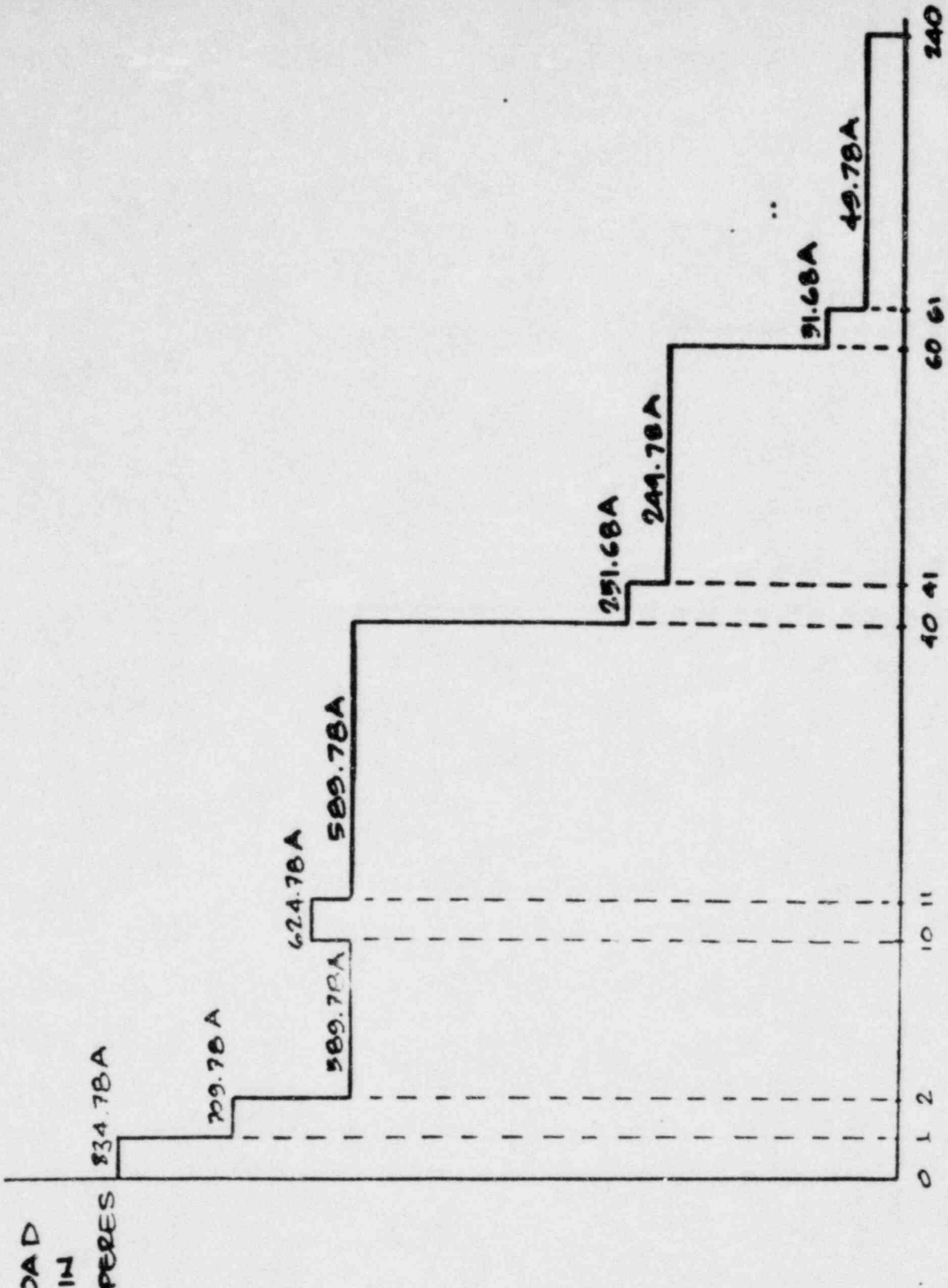
CHANNEL A 125-V DC LOADS
BATTERY 1AD411
DC SWITCHGEAR 10D410

Item	Load Description	Equipment Number	Equipment Rating: KVA	Equipment Rating: Full Load (Amps)	Equipment Rating: Load Inrush (Amps)	MIN Load Cycle (Amperes): 0 to 1 MIN(1)	1 MIN to 2 min	2 min to 10 min	10 min to 11 min	11 min to 40 min	40 min to 41 min	41 min to 240 min
1.	Plant PA system ac power supply inverter	10D496	20	200	-	180	180	180	180	180	200	200
2.	Class 1E instrument ac power supply inverter	1AD481	20	200	-	180	180	180	180	180	-	-
3.	Class 1E instrument ac power supply inverter	1AD482	20	200	-	180	180	180	180	180	-	-
4.	125-V dc distribution panel	1AD417	-	-	-	-	-	-	-	-	-	-
	a. 4.16-kV Class 1E swgr control power	10A401	-	1.2	130	131.2	61.2	1.2	1.2	1.2	1.2	1.2
	b. Standby diesel generator field flashing power	1AC420, 421, 422, & 423	-	-	50	50	-	-	-	-	-	-
	c. 480-V Class 1E unit substation control power	10B410 10B450	-	2.4	105	107.4	62.4	2.8	37.8	2.8	2.8	2.8
	d. Div I RHR & core spray vertical board	10C617	-	9.92	9.92	9.92	9.92	9.92	9.92	9.92	9.92	9.92
	e. Main steam inboard isolation valve relay vertical board	10C622	-	4	4	4	4	4	4	4	4	4
	f. RPS trip system vertical board	10C609	-	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
	g. 250-V dc HPCI system MCC	10D251	-	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3
	h. Reactor recirc pump breaker trip	1AN205 1BN205	-	.2	10	10.2	.2	.2	.2	.2	.2	.2
	i. HPCI relay vertical board	10C620	-	3.12	3.12	3.12	3.12	3.12	3.12	3.12	3.12	3.12
	j. Standby diesel generator control power	1ACL120, 421, 422, & 423	-	5	5	5	5	5	5	5	5	5

DSER OPEN ITEM 257

Item	Load Description	Equipment Number	KVA	Equipment Rating: Full Load (Amps)	Equipment Rating: Load Inrush (Amps)	Load Cycle (Amperes): 0 to ~~30 s~~ 1 min (1)	~~30 s~~ 1 min to ~~5 min~~ 2	~~5 min~~ 2 min to 10 min	10 min to 11 min	11 min to 40 min	40 min to 41 min	41 min to 240 min
k.	Reactor bldg exhaust room and pipe chase isolation dampers terminal box	1AC281	-	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08
l.	125-V dc swgr control power	10D410	-	.7	1.9	.7	.7	.7	.7	.7	2.6	.7
Total (amperes)						826.82 ~~[illegible]~~	701.82 ~~[illegible]~~	581.82 ~~573.82~~	616.82 ~~[illegible]~~	581.72 ~~[illegible]~~	243.72 ~~[illegible]~~	241.72 ~~[illegible]~~
M.	REDUNDANT REACTIVITY CONTROL SYSTEM	10C602	-	4	8	8	8	8	8	8	8	8

(1) BATTERY IS SIZED FOR THE TOTAL MAXIMUM CONCURRENT LOAD AT ANY INSTANT DURING THE FIRST MINUTE



HOPE CREEK
GENERATING STATION
FINAL SAFETY ANALYSIS REPORT

CLASS 1E 125 VDC
BATTERY 1BD411
LOAD PROFILE

FIGURE 8.3-16
SHEET 2 OF 8

DSER OPEN ITEM 257

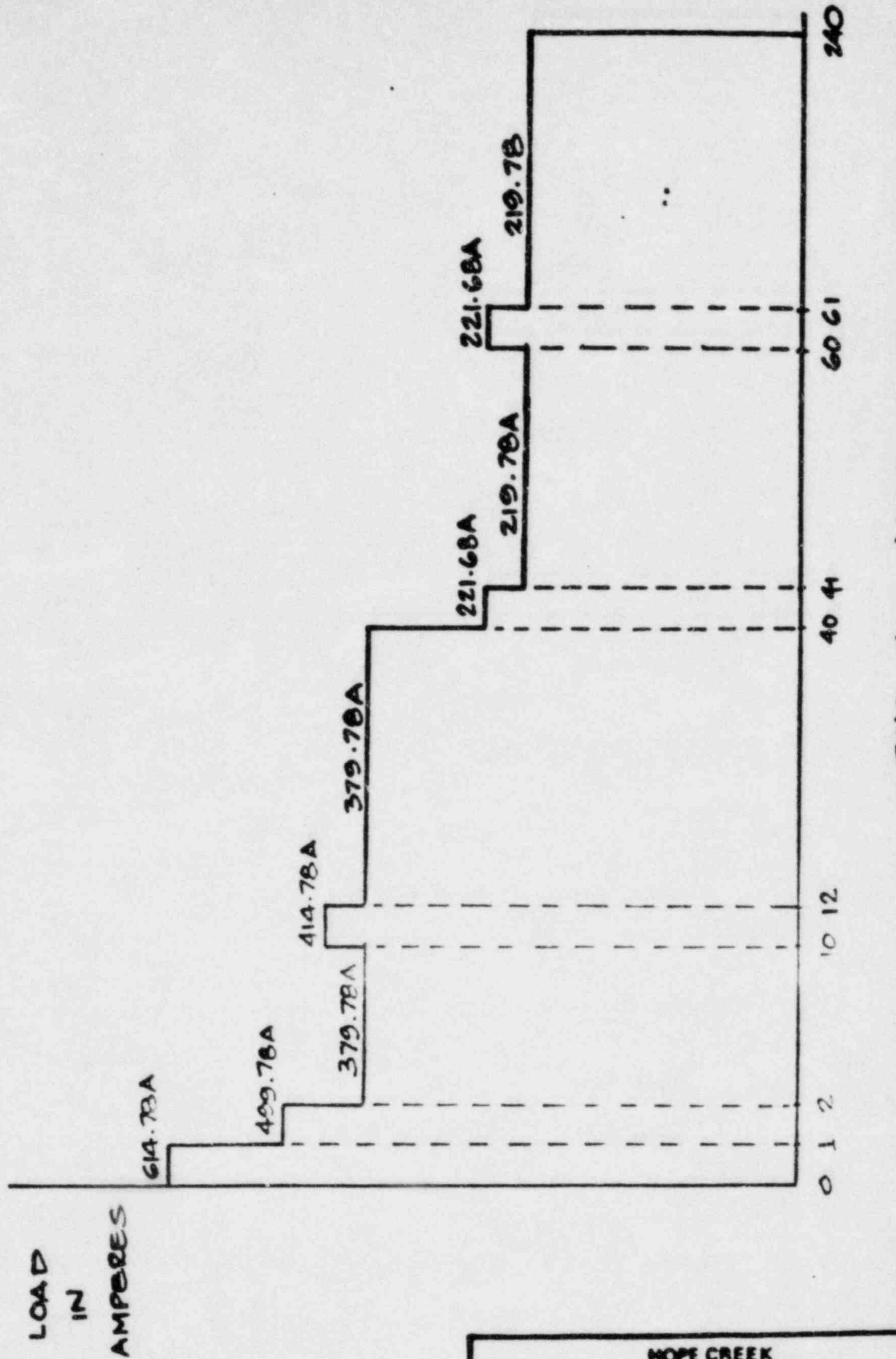
DSER OPEN ITEM 257

TABLE 8.3-7b

CHANNEL B 125-V DC LOADS
BATTERY 1BD411
DC SWITCHGEAR 10D420

Item	Load Description	Equipment Number	Equipment Rating: KVA	Equipment Rating: Full Load (Amps)	Equipment Rating: Load Inrush (Amps)	Load Cycle (Amperes): 0 to 1 min (1)	1 min to 2 min	2 min to 10 min	10 min to 11 min	11 min to 40 min	40 min to 41 min	41 min to 60 min	60 min to 61 min	61 min to 240 min
1.	BOP computer ac power supply inverter	1AD492	20	200		180	180	180	180	180	200	200	-	-
2.	Class 1E instrument ac power supply inverter	1BD481	20	200		180	180	180	180	180	-	-	-	-
3.	Class 1E instrument ac power supply inverter	1BD482	20	200		180	180	180	180	180	-	-	-	-
4.	125-V dc Class 1E distribution panel	1BD417	-	-	-	-	-	-	-	-	-	-	-	-
a.	4.16-kV Class 1E swgr control power	10A402	-	1.2	130	131.2	61.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
b.	Standby diesel generator field flashing power	1BC420, 421, 422 & 423	-	-	50	50	-	-	-	-	-	-	-	-
c.	480-V Class 1E unit substations control power	10B420, 10B460	-	2.4	105	107.4	62.4	2.4	37.4	2.4	2.4	2.4	2.4	2.4
d.	Reactor recirc pump breakers trip	1CN205 1DN205	-	.2	10	10.2	.2	.2	.2	.2	.2	.2	.2	.2
e.	Division II RHR & core spray vertical board	10C618	-	8	8	8	8	8	8	8	8	8	8	8
f.	250-V dc RCIC system MCC	10D261	-	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3

Item	Load Description	Equipment Number	KVA	Equipment Rating: Full Load (Amps)	Equipment Rating: Load Inrush (Amps)	Load Cycle (Amperes): 0 to (1) ~~15 s~~ 1 MIN	1 MIN ~~15 s~~ to 2 ~~[illegible]~~ min	2 min to 10 min	10 min to 11 min	11 min to 40 min	40 min to 41 min	41 min to 60 min	60 min to 61 min	61 min to 240 min
g.	RPS trip system vertical board	10C611	-	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
h.	Remote shutdown panel	10C399	-	8	8	8	8	8	8	8	8	8	8	8
i.	RCIC relay vertical board	10C621	-	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
j.	Auto depress relay vertical board	10C628	-	3	3	3	3	3	3	3	3	3	3	3
k.	Reactor bldg exhaust room isolation dampers terminal box	1BC281	-	4.48	4.48	4.48	4.48	4.48	4.48	4.48	4.48	4.48	4.48	4.48
l.	Standby diesel generator control power	1BC420, 421, 422 & 423	-	5	5	5	5	5	5	5	5	5	5	5
m.	125-V ac swgr control power	10BD411	-	.7	1.9	.7	.7	.7	.7	.7	2.6	.7	2.6	.7
Total						~~[illegible]~~ 834.78	~~[illegible]~~ 709.78	~~[illegible]~~ 584.78	~~[illegible]~~ 624.78	~~[illegible]~~ 584.78	~~[illegible]~~ 251.68	~~[illegible]~~ 249.78	~~[illegible]~~ 51.68	~~[illegible]~~ 49.78
n.	REDUNDANT REACTIVITY CONTROL SYSTEM	10C602	–	4	8	8	8	8	8	8	8	8	8	8
													1.5	1.5
o.	RCIC MIN FLOW BYPASS TO SUPPR POOL VLV	1BD-SV-F019		1.5	–	1.5	1.5	1.5	1.5	1.5	1.5	1.5		



HOPE CREEK GENERATING STATION

FINAL SAFETY ANALYSIS REPORT

CLASS IE 125 VDC BATTERY 1CD411 LOAD PROFILE

FIGURE 8.3-16

SHEET 3 OF 8

DSER OPEN ITEM 257

TABLE 8.3-7c

CHANNEL C 125-V DC LOADS
BATTERY 1CD411
DC SWITCHGEAR 10D430

Item	Load Description	Equipment Number	Equipment Rating: KVA	Equipment Rating: Full Load (Amps)	Equipment Rating: Load Inrush (Amps)	Load Cycle (Amperes): 0 to ~~43 s~~ 1 min(1)	~~43 s~~ 1 min to 2 min	2 min to 10 min	10 min to 12 min	12 min to 40 min	40 min to 41 min	41 min to 60 min	60 min to 61 min	61 min to 240 min
1.	Plant security system ac power supply inverter	0AD495	20	200	-	180	180	180	180	180	200	200	200	200
2.	Class 1E instrument ac power supply inverter	1CD481	20	200	-	180	180	180	180	180	-	-	-	-
3.	Deleted ~~BOP computer ac power supply inverter~~	~~1CD492~~	~~20~~	~~200~~	~~-~~	~~180~~	~~180~~	~~180~~	~~180~~	~~180~~	~~200~~	~~200~~	~~-~~	~~-~~
4.	125-V dc distribution panel	1CD417	-	-	-	-	-	-	-	-	-	-	-	-
a.	4.16-kV Class 1E swgr control power	10A403	-	1.2	130	134.2 ~~21.6~~	61.2 ~~131.2~~	1.2	1.2	1.2	1.2	1.2	1.2	1.2
b.	Standby diesel generator field flashing power	1CC420, 421, 422 & 423	-	-	50	50	-	-	-	-	-	-	-	-
c.	480-V unit substation control power	10B430 10B470	-	2.4	105	107.4 ~~17.6~~	62.4 ~~105.6~~	2.4	37.4	2.4	2.4	2.4	2.4	2.4
d.	125-V swgr control power	10D430	-	.7	1.9	.7	.7	.7	.7	.7	2.6	.7	2.6	.7
e.	Division III RHR and core spray vertical board	10C641	-	6	6	6	6	6	6	6	6	6	6	6
f.	Standby diesel generator control power	1CC420, 421, 422 & 423	-	5	5	5	5	5	5	5	5	5	5	5

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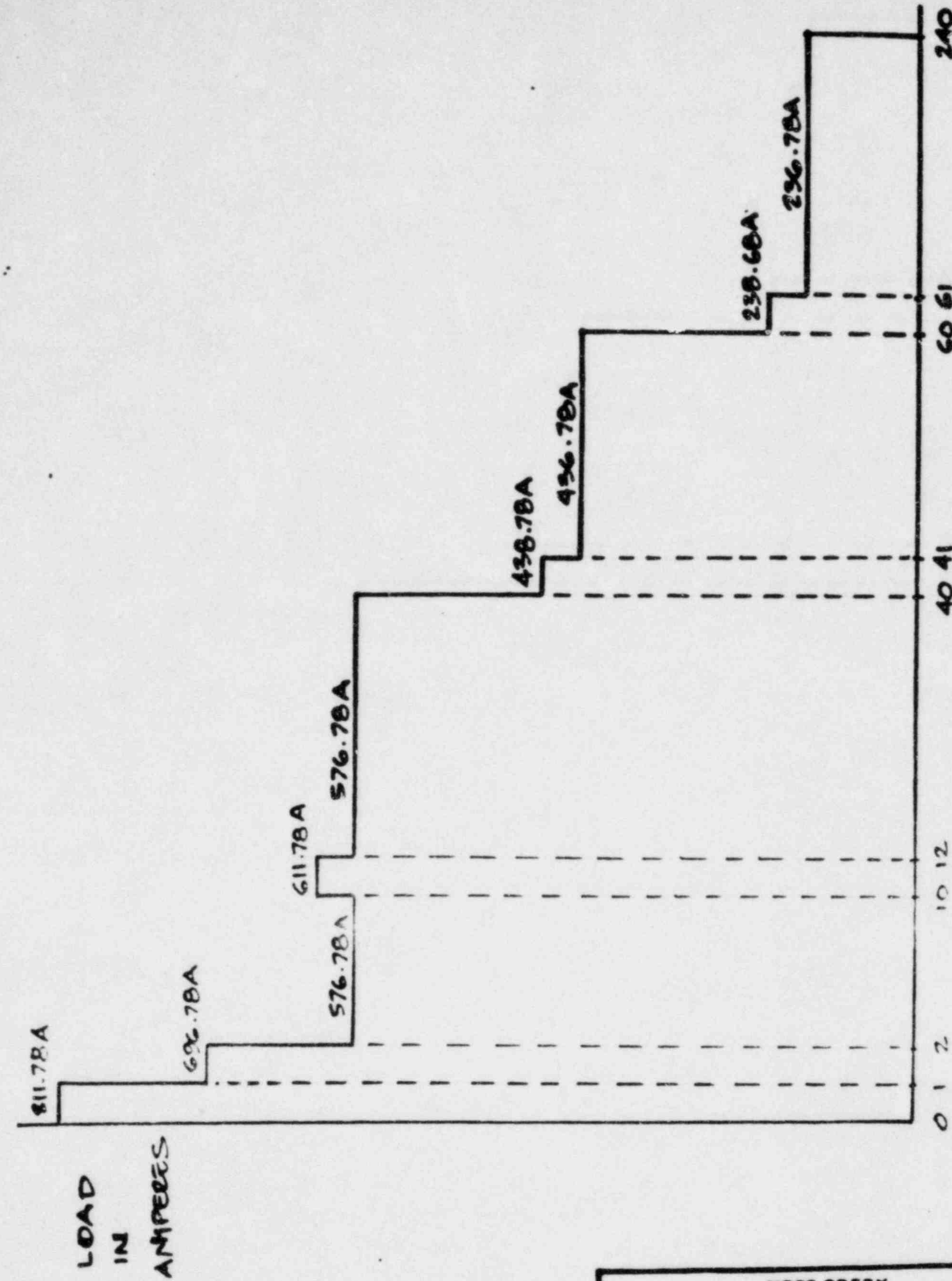
TABLE 8.3-7c (cont)

Item	Load Description	Equipment Number	KVA	Equipment Rating: Full Load (Amps)	Equipment Rating: Load Inrush (Amps)	Load Cycle (Amperes): 0 to ~~13.8~~ 1 min (1)	~~13.5~~ 1 min to 2 min	2 min to 10 min	10 min to 12 min	12 min to 40 min	40 min to 41 min	41 min to 60 min	60 min to 61 min	61 min to 240 min
q.	Reactor bldg exhaust room and pipe chase isolation damper term box	1CC281	-	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total (amperes)						614.78 ~~[illegible]~~	499.78 ~~[illegible]~~	379.78 ~~[illegible]~~	414.78 ~~[illegible]~~	379.78 ~~[illegible]~~	221.68 ~~[illegible]~~	219.78 ~~[illegible]~~	221.68	219.78

NO CHANGE.

(1) BATTERY IS SIZED FOR THE TOTAL MAXIMUM CONCURRENT LOAD AT ANY INSTANT DURING THE FIRST MINUTE



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FINAL SAFETY ANALYSIS REPORT

CLASS 1E 125 VDC
BATTERY 1DD411
LOAD PROFILE

FIGURE 8.3-16
SHEET 4 OF 8

DSER OPEN ITEM 257

DSER OPEN ITEM 257

TABLE 8.3-7d

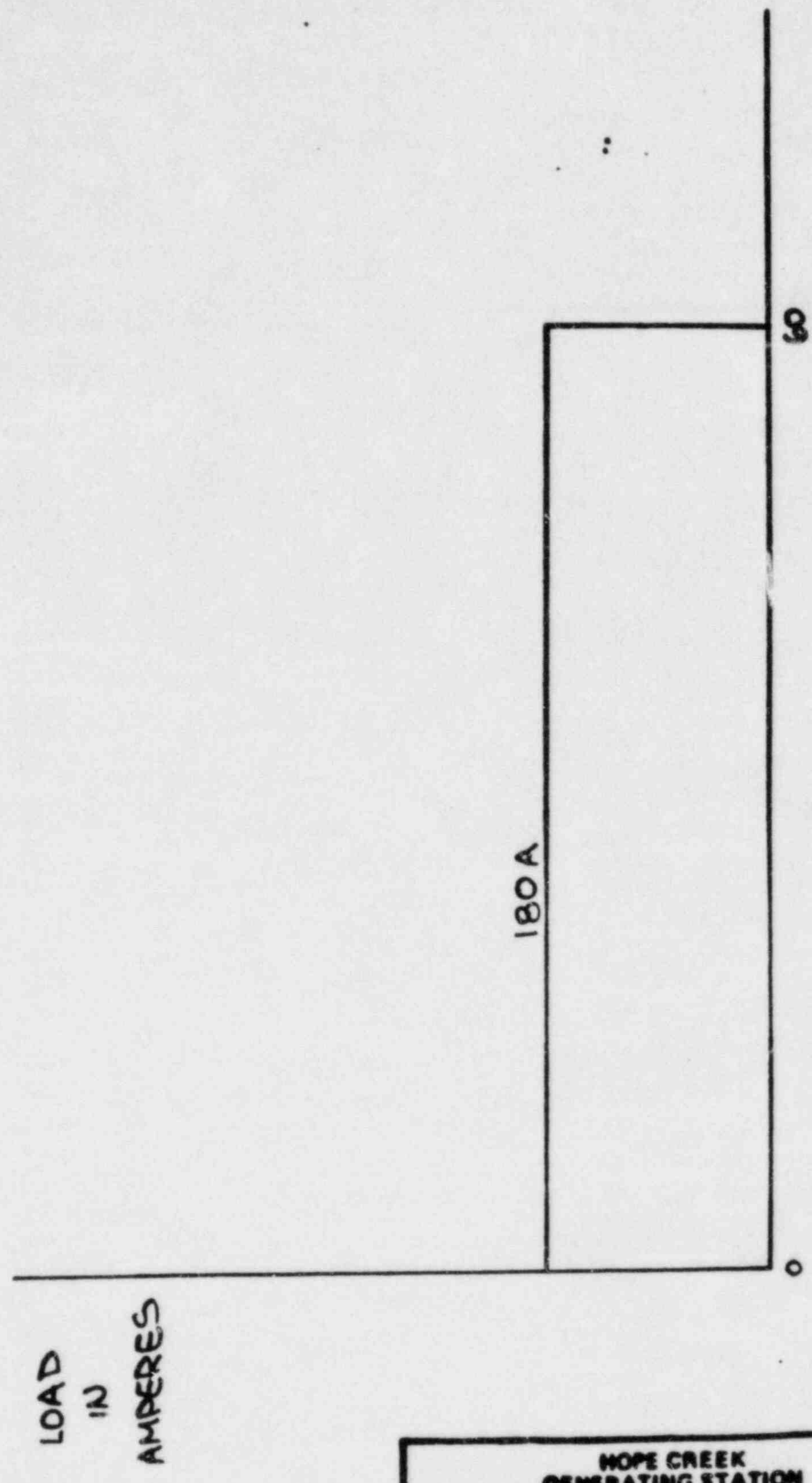
CHANNEL D 125-V DC LOADS
BATTERY 1DD411
DC SWITCHGEAR 10D440

Item	Load Description	Equipment Number	Equipment Rating: KVA	Equipment Rating: Full Load (Amps)	Equipment Rating: Load Inrush (Amps)	Load Cycle (Amperes): 0 to ~~15 s~~ 1 min (1)	~~15 s~~ 1 min to 2 min	2 min to 10 min	10 min to 12 min	12 min to 40 min	40 min to 41 min	41 min to 60 min	60 min to 61 min	61 min to 240 min
1.	BCP computer ac power supply inverter	1BD492	20	200	-	180	180	180	180	180	200	200	-	-
2.	Class 1E instrument ac power supply inverter	1DD481	20	200	-	180	180	180	180	180	-	-	-	-
3.	NSSS computer ac power supply inverter	10D485	20	200	-	180	180	180	180	180	200	200	200	200
4.	125-V dc distribution panel	1DD417	-	-	-	-	-	-	-	-	-	-	-	-
a.	4.16-kV Class 1E swgr control power	10A404	-	1.2	130	~~21.2~~ 131.2	~~131.2~~ 61.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
b.	Standby diesel generator field flashing power	1DC420, 421, 422 & 423	-	-	50	50	-	-	-	-	-	-	-	-
c.	480-V unit substation control power	10B440 10B480	-	2.4	105	~~17.6~~ 107.4	~~107.4~~ 62.4	2.4	37.4	2.4	2.4	2.4	2.4	2.4
d.	Remote shutdown panel	10C399	-	8	0	8	8	8	8	8	8	8	8	8
e.	Div IV RHR & core spray vertical board	10C640	-	8	0	8	8	8	8	8	8	8	8	8
f.	Main steam outboard isolation valve relay vertical board	10C623	-	6	0	6	6	6	6	6	6	6	6	6

DSER OPEN ITEM 257

Item	Load Description	Equipment Number	Equipment Rating: KVA	Equipment Rating: Full Load (Amps)	Equipment Rating: Load Inrush (Amps)	Load Cycle (Amperes): 0 to ~~[illegible]~~ 1 MIN (1)	~~[illegible]~~ 1 MIN to 2 min	2 min to 10 min	10 min to 12 min	12 min to 30 min	40 min to 41 min	41 min to 60 min	60 min to 61 min	61 min to 240 min
g.	Auto depress. relay vertical board	10C631	-	3	3	3	3	3	3	3	3	3	3	3
h.	125-V dc swgr control power	10D440	-	.7	1.9	.7	.7	.7	.7	.7	2.6	.7	2.6	.7
i.	Standby diesel generator control power	10DC420, 421, 422 & 423	-	5	5	5	5	5	5	5	5	5	5	5
j.	Reactor bldg exhaust room isolation dampers terminal box	1DC281	-	4.48	4.48	4.48	4.48	4.48	4.48	4.48	4.43	4.48	4.48	4.48
Total (amperes)						~~[illegible]~~ 811.78	~~[illegible]~~ 696.78	576.78	611.78	576.78	430.68	436.78	230.68	236.78

(1) BATTERY IS SIZED FOR THE TOTAL MAXIMUM CONCURRENT LOAD AT ANY INSTANT DURING THE FIRST MINUTE.



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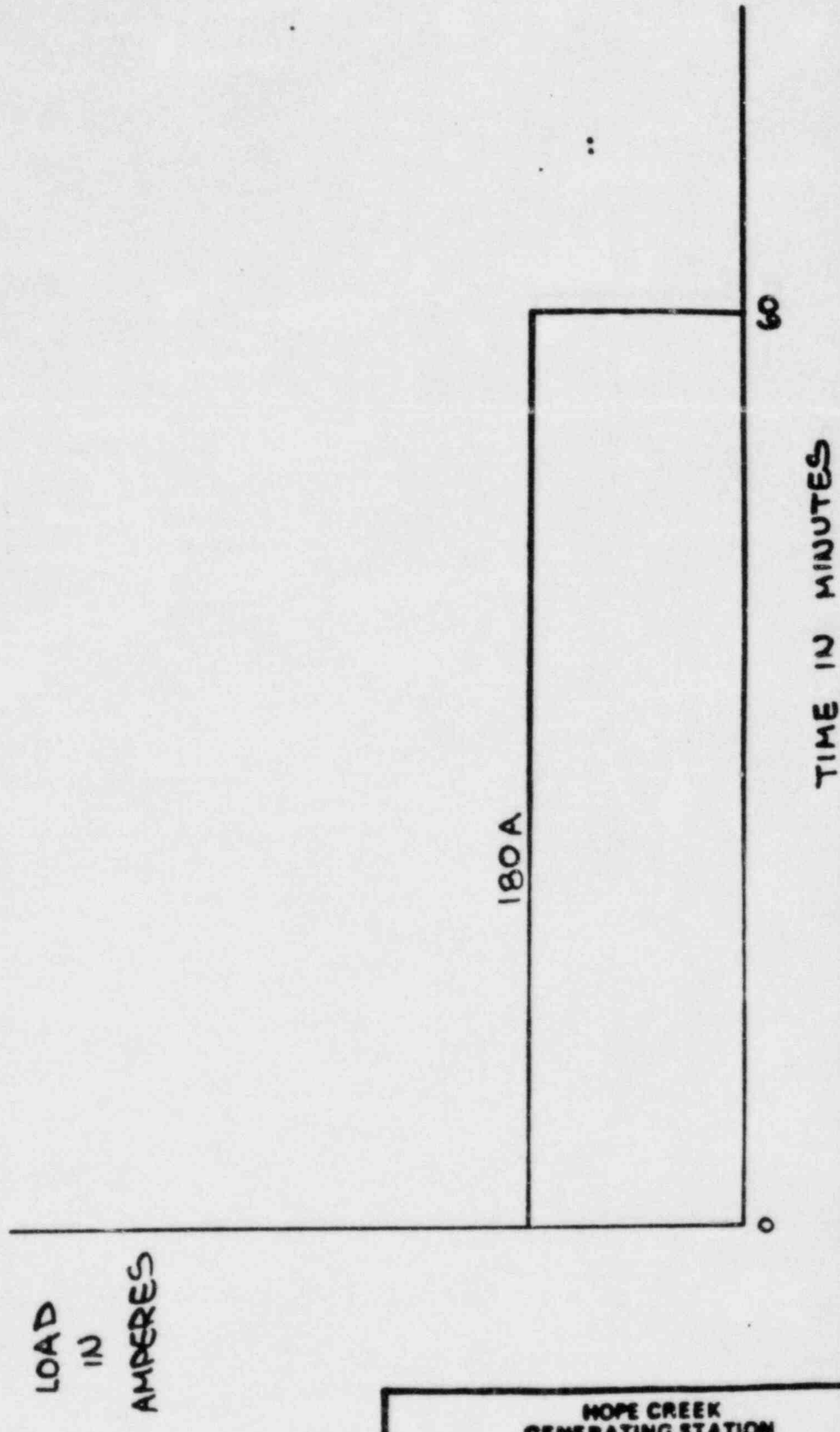
CLASS 1E 125 VDC
BATTERY 1CD447
LOAD PROFILE
FIGURE 8.3-16
SHEET 5 OF 8

DSER OPEN ITEM 257



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FINAL SAFETY ANALYSIS REPORT

CLASS 1E 125 VDC
BATTERY 1DD447
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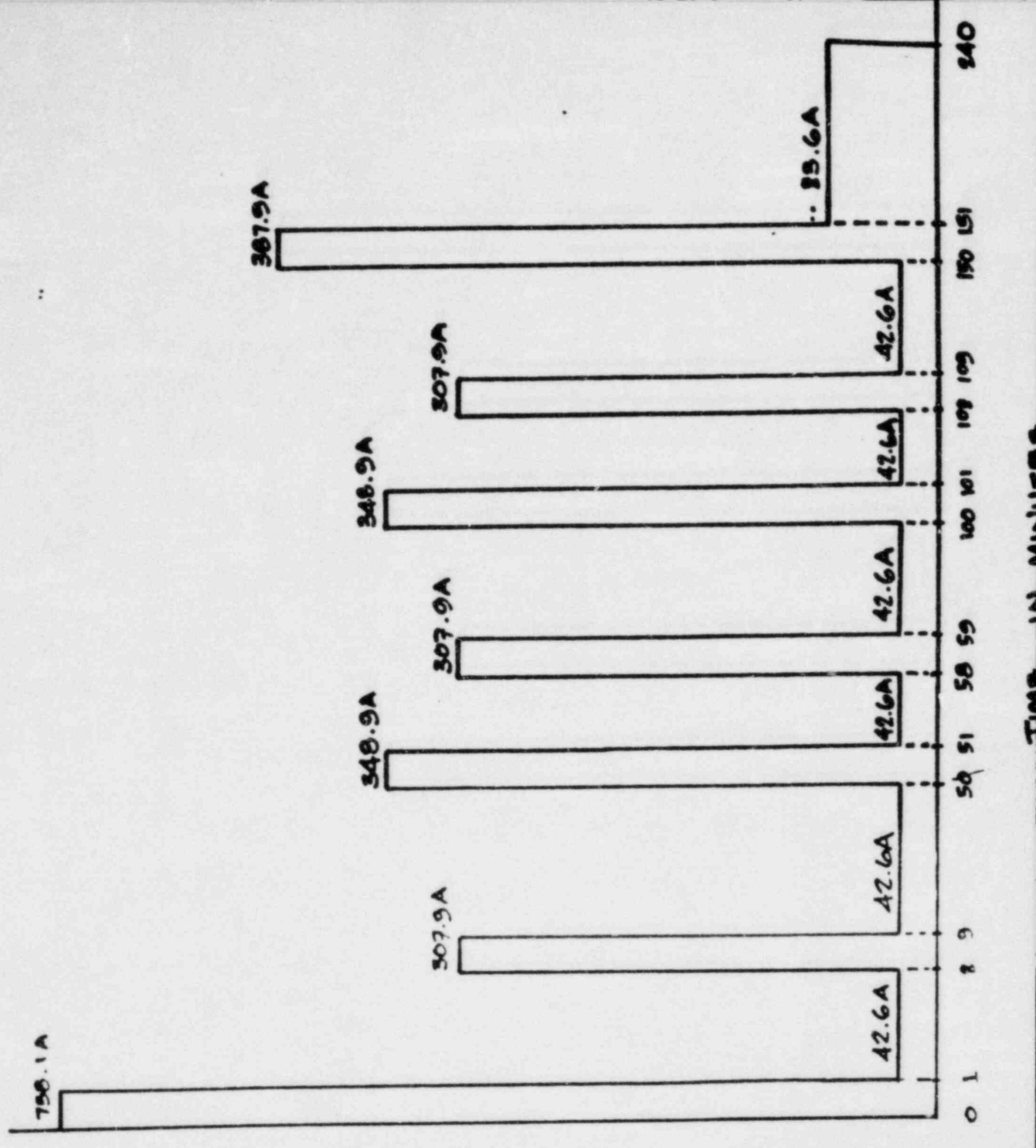
FIGURE 8.3-16
SHEET 6 OF 8

DSER OPEN ITEM 257



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CLASS IE 250 VDC
BATTERY 10D421
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FIGURE 8.3-16
SHEET 7 OF 8

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TABLE 8.3-8

CHANNEL A 250-V DC LOADS
BATTERY 10D421
MOTOR CONTROL CENTER 10D251

		Equipment Rating		Amperes		Load Cycle				
Item	Load Description	Equipment Number	HP	Full Load	Inrush	0 to 1 min	1 to 8 min	8 to 9 min	9 to 50 min	50 to 51 min
1.	HPCI gland seal cond vac pump	10P216	1.5	5.8	17.5	~~5.8~~ 17.5	5.8	5.8	5.8	5.8
2.	HPCI turb aux oil pump	10P213	7.5	25.8	78	78	25.8	25.8	25.8	25.8
3.	HPCI vacuum tank cond pump	10P215	3	11	33	33	11	11	11	11
4.	HPCI test bypass to cond str tank	BJ-HV-F008	5.8	20	~~98~~ 131	-	-	-	-	-
5.	HPCI test bypass to cond str tank	AP-HV-F011	1.8	7.8	41	-	-	-	-	-
6.	HPCI min flow bypass to supp pool	BJ-HV-F012	1.8	7.8	41	41	-	-	-	41
7.	HPCI barom cond clg water sply valve	BJ-HV-F059	.33	2	11.3	11.3	-	-	-	-
8.	HPCI turb exhaust to supp pool	FB-HV-F071	1.8	7.8	41	-	-	-	-	-
9.	HPCI steam supply line to turbine	FD-HV-F001	4.3	17	87	87	-	-	-	-
10.	HPCI pump suction from cond str tank	BJ-HV-F004	.75	3	19.5	-	-	-	-	-
11.	HPCI pump suction from supp pool	BJ-HV-F042	.75	3	19.5	-	-	-	-	-
12.	HPCI pump discharge to RPV	BJ-HV-F007	10.8	40	~~250~~ 225	~~250~~ 225 (3)	-	-	-	-
13.	HPCI pump discharge to RPV	BJ-HV-F006	10.8	40	~~250~~ 225	~~250~~ 225	-	~~250~~ 225	-	~~250~~ 225
TOTAL						~~[illegible]~~ 758.1	82.6	~~[illegible]~~ 307.9	82.6	~~[illegible]~~ 348.9
14.	HPCI PUMP DISCHARGE TO FEEDWATER LINE	BJ-HV-8278	1.6	7	40.3	40.3		40.3		40.3

(1) The MOV can be jogged at any time.
(2) Suction to HPCI pump is assumed to change over from condensate storage tank to suppression pool at the end of 2 1/2 hours.
(3) Valve under test.

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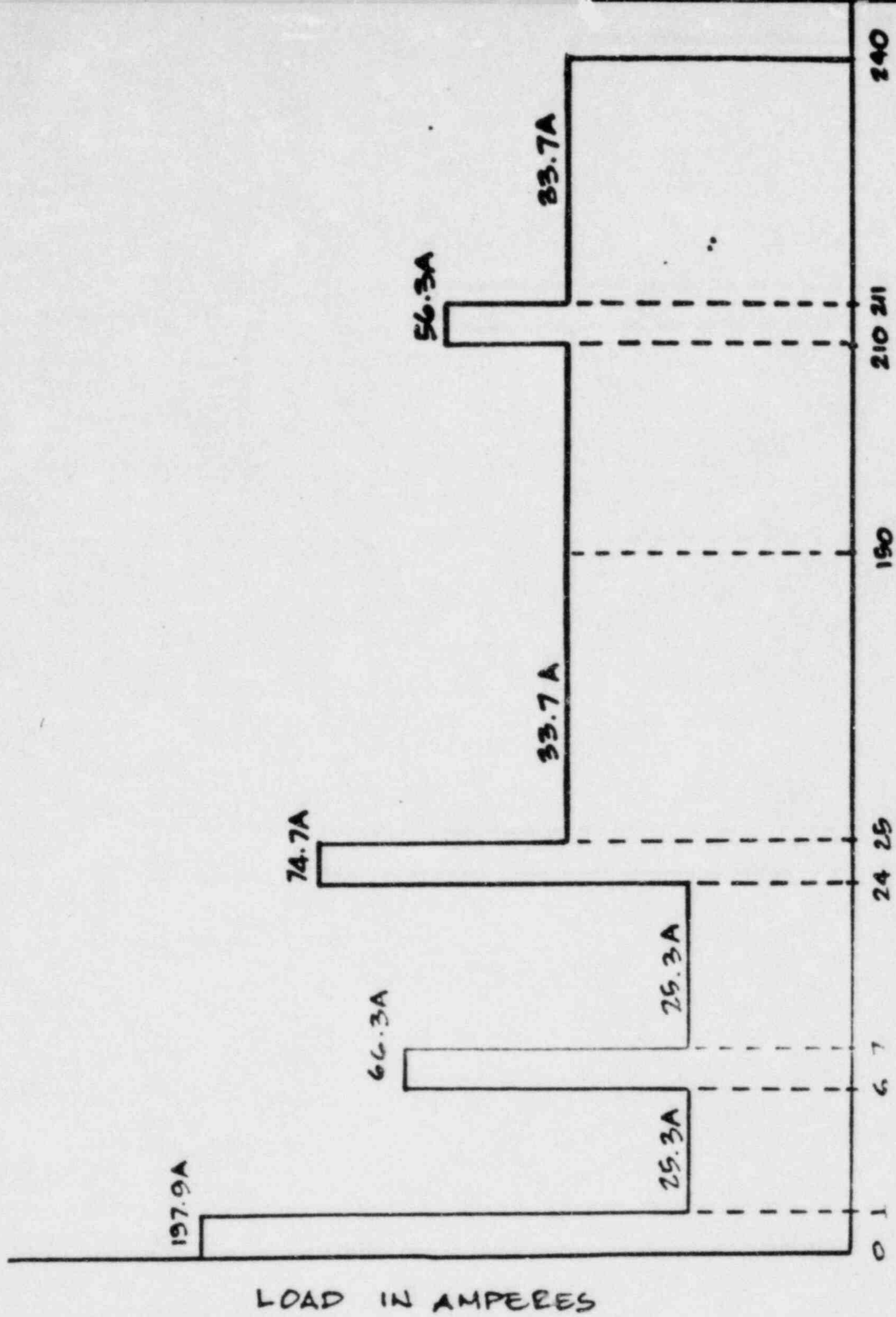
TABLE 8.3-8 (cont)

Item	Load Description	Equipment Rating: Equipment Number	Amperes / Load Cycle: 51 to 58 min	58 to 59 min	59 to 100 min	100 to 101 min	101 to 108 min	108 to 109 min	109 to 150 min	150 to 151 min	151 to 240 min
1.	HPCI gland seal cond vac pump	10P216	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8
2.	HPCI turb aux oil pump	10P213	25.8	25.8	25.8	23.8	25.8	25.8	25.8	25.8	25.8
3.	HPCI vacuum tank cond pump	10P215	11	11	11	11	11	11	11	11	11
4.	HPCI test bypass to cond str tank	BJ-HV-F008	-	-	-	-	-	-	-	-	-
5.	HPCI test bypass to cond str tank	AP-HV-F011	-	-	-	-	-	-	-	-	-
6.	HPCI min flow bypass to supp pool	BJ-HV-F012	-	-	-	41	-	-	-	41(a)	41(a)
7.	HPCI barom cond clg water sply valve	BJ-HV-F059	-	-	-	-	-	-	-	-	-
8.	HPCI turb exhaust to supp pool	FB-HV-F071	-	-	-	-	-	-	-	-	-
9.	HPCI steam supply line to turbine	FD-HV-F001	-	-	-	-	-	-	-	-	-
10.	HPCI pump suction from cond str tank	BJ-HV-F004	-	-	-	-	-	-	-	19.5(a)	-
11.	HPCI pump suction from supp pool	BJ-HV-F042	-	-	-	-	-	-	-	19.5(a)	-
12.	HPCI pump discharge to RPV	BJ-HV-F007	-	-	-	-	-	-	-	-	-
13.	HPCI pump discharge to RPV	BJ-HV-F006	-	~~250~~ 225	-	~~250~~ 225	-	~~250~~ 225	-	~~250~~ 225	-
14.	HPCI PUMP DISCHARGE TO FEEDWATER LINE	BJ-HV-8278	-	40.3	-	40.3	-	40.3	-	40.3	-
	Total (amperes)		42.6 ✓	~~[illegible]~~ 307.9	42.6 ✓	~~[illegible]~~ 348.9	42.6 ✓	~~[illegible]~~ 307.9	42.6	~~[illegible]~~ 387.9	83.6 ✓



HOPE CREEK
GENERATING STATION
FINAL SAFETY ANALYSIS REPORT

CLASS 1E 250 VDC
BATTERY 10D431
LOAD PROFILE
FIGURE 8.3-16
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TABLE 8.3-9

CHANNEL B 250-V DC LOADS
BATTERY 10D431
MOTOR CONTROL CENTER 10D261

Item	Load Description	Equipment Number	Equipment Rating: HP	Amperes: Full Load	Amperes: Inrush	Load Cycle: 0 to 1 min	1 to 6 min	6 to 7 min	7 to 24 min	24 to 25 min	25 to 150 min	150 to 210 min	210 to 211 min	211 to 240 min
1.	RCIC gland seal vac pump	10P219	3	14.3	42.5	42.5	14.3	14.3	14.3	14.3	14.3	14.3	14.3	14.3
2.	RCIC vac tank cond pump	10P220	3	11	33	33	11	11	11	11	11	11	11	11
3.	RCIC turb exhaust to supp pool	FC-HV-F059	0.33	~~4~~ 1.9	11.3	-	-	-	-	-	-	-	-	-
4.	RCIC test line to cond storage tank	BD-HV-F022	0.75	3	19.5	-	-	-	-	-	-	-	-	-
5	~~RCIC min flow bypass to suppression pool~~ Deleted	~~BD-HV-F019~~	~~0.14~~	~~2~~	~~10.3~~	~~10.3~~	~~-~~	~~-~~	~~-~~	~~10.3~~	~~-~~	~~10.3 (2)~~	~~10.3 (2)~~	~~10.3 (2)~~
6.	RCIC stm supply to turbine	FC-HV-F045	1.00	4	30	30	-	-	-	-	-	-	11.3 (2)	-
7.	RCIC pump inlet from cond storage tank	BD-HV-F010	0.33	~~4~~ 1.9	11.3	-	-	-	-	-	-	-	11.3 (2)	-
8.	RCIC pump inlet from supp pool	BD-HV-F031	0.33	2	11.3	-	-	-	-	-	-	-	-	
9.	RCIC pump outlet to RPV	BD-HV-F012	1.8	7.4	41	41 (2)	-	-	-	-	-	-	-	
10.	RCIC pump outlet to RPV	BD-HV-F013	1.8	7.4	41	41	-	41	-	41	-	-	-	-
11.	RCIC vac pump disch to suppression pool	FC-HV-F0~~66~~ 60	0.14	~~1.4~~ 0.76	14	-	-	-	-	-	-	-	-	-
12.	RCIC barom cond cooling water supply	BD-HC-F046	0.33	~~1.3~~ 2.17	10.~~9~~ 4	10.~~9~~ 4	-	-	-	-	-	-	-	-
13.	RCIC turb trip & throttle valve	FV-HV-4282	0.09	0.7	8.4	-	-	-	-	8.4 (1)	8.4 (1)	8.4 (1)	8.4 (1)	8.4 (1)
	Total (amperes)					~~200.1~~ 197.9	25.3 ✓	66.30 ✓	~~38.2~~ 25.3	~~85~~ 74.7	23.70 ✓	~~98~~ 33.70	~~56.3~~ 56.30	~~48~~ 33.7

STET

(1) MOV can be jogged any time.
(2) ... the RCIC pump is assumed to change from condensate storage tank to suppression

DSER Open Item No. 258 (DSER Section 8.3.2.6)

DESIGN AND QUALIFICATION OF DC SYSTEM LOADS TO OPERATE BETWEEN MINIMUM AND MAXIMUM VOLTAGE

By Amendment 4 to the FSAR, the applicant defined the maximum and minimum voltage range over which the DC system may be expected to operate. The operating voltages were defined as 105 or 210 volts minimum to 140 or 280 volts maximum depending on whether the system is a 125 or 250 volts nominal system.

A positive commitment as to the design and qualification of DC system loads to operate between minimum and maximum voltage levels will be pursued with the applicant.

RESPONSE

Response to Question 430.32 has been revised to provide a positive statement.

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QUESTION 430.32 (SECTION 8.3.2)

Define the maximum and minimum voltage range over which the dc system may operate. Indicate the design and qualification capability of each equipment and component of the dc system to operate over this range of voltage.

RESPONSE

The Class 1E dc system is designed to operate under a range of voltages which are dependent on the status of the battery charger/battery. Under normal operating condition with the battery charger supplying the operating loads and a float charge to the battery, the dc system voltage will be 130 V for the 125 V system (260 V for the 250 V system). While the battery is being equalize charged, the dc system voltage will be 140 V for the 125 V system (280 V for the 250 V system). And when the battery is the sole source for supplying the loads, the dc system voltage which is initially at 130 or 260 V will eventually decrease to 105 or 210 V for the 125 or 250 V nominal system, respectively at the end of the discharge period. The operating voltage can then be defined as 105 or 210 V minimum to 140 or 280 V maximum, depending on whether the system is 125 or 250 V nominal system.

The equipment and components of the power supply portion, i.e., battery, battery charger and switchgear assembly are designed and qualified to operate over this voltage range.

The equipment and components of the load portion are required by the equipment specifications to function in the voltage range of 105 to 140 or 210 to 280 V as applicable. Inverters are designed and qualified to operate in the required voltage range. [A review program is underway to reconfirm the adequacy of the remaining equipment/components' design and qualification capability. This review includes verification of suppliers' conformance to equipment specifications and consideration of operability requirements. Necessary corrective actions will be taken to resolve any deficiency. This review will be completed in September 1984.]

The equipment and components of the load portion are designed and qualified or being qualified to operate over the applicable voltage range expected at the loads based on system voltages defined above.

DSER Open Item No. 259 (DSER Section 8.3.3.3.4)

USE OF AN INVERTER AS AN ISOLATION DEVICE

By Amendment 4 to the FSAR, the applicant indicated that the non-Class 1E public address system distribution panel shown on Sheet 2 of Figure 8.3-11 of the FSAR is supplied power from the Class 1E dc system through an inverter. The applicant further stated that this inverter is an acceptable isolation device per IEEE-384-1981, Section 7.1.2.3. The staff does not agree. Test and analysis to demonstrate the adequacy of a inverter as an isolation device will be pursued with the applicant.

RESPONSE

Response to Question 430.33 has been revised to state that the inverter will be tested as an isolation device.

ANALYSIS FOR SUPPLYING NON-CLASS 1E LOADS FROM CLASS 1E DC SYSTEMS

Figure 8.3-11 shows non-Class 1E public address system distribution panel 10J496 supplied from a Class 1E dc power bus 10D410 through a Class 1E inverter in UPS unit 10D496. The inverter is an acceptable isolation device per IEEE-384-1981, Section 7.1.2.3. Therefore, a failure in the non-Class 1E distribution panel 10J496 will not degrade Class 1E dc system bus 10D410.

THE HCGS UPS SYSTEM ~~ON HOPE CREEK PROJECT~~ WILL BE TESTED TO DEMONSTRATE THE ADEQUACY OF AN INVERTER BEING APPLIED AS AN ISOLATION DEVICE. THE TEST WILL DEMONSTRATE THAT VOLTAGE, CURRENT, AND FREQUENCY ON THE CLASS 1E SIDE OF THE INVERTER ARE NOT DEGRADED BELOW ACCEPTABLE LEVELS WHEN MAXIMUM CREDIBLE VOLTAGE OR CURRENT TRANSIENT IS APPLIED ON THE NON-CLASS 1E SIDE OF THE UPS SYSTEM. THE TESTS TO BE PERFORMED WILL SIMULATE ALL OPERATING MODES FOR WHICH HCGS UPS SYSTEM IS DESIGNED. THE TESTS WILL INCLUDE THE FOLLOWING TYPES OF FAULTS AT THE INVERTER OUTPUT LOCATION:

a. PHASE TO GROUND.

b. NEUTRAL TO GROUND.

c. PHASE TO NEUTRAL WITHOUT GROUND.

ANALYSIS SUPPORTED BY TEST RESULTS WILL BE SUBMITTED ~~BY AUGUST~~ in September 1984.

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DSER Open Item No. 260 (DSER Section 8.3.3.3.5)

THE USE OF A SINGLE BREAKER TRIPPED BY A LOCA SIGNAL AS AN ISOLATION DEVICE

Section 8.3.1.1.2 of the FSAR indicates that the Class 1E system provides power to non-Class 1E loads. Non-Class 1E loads are connected to the Class 1E system through a single breaker that is tripped automatically by a LOCA signal. The single breaker tripped by a LOCA signal provides acceptable isolation between Class 1E and non-Class 1E circuits for the design basis accident--LOCA. However, for other design basis accidents or operating occurrences that do not generate a LOCA signal (such as loss of offsite power, design basis exposure fire, seismic events, etc.), it is the staff concern that a single breaker may not provide acceptable isolation.

By Amendment 4 to the FSAR, the applicant indicated that protect-tive device coordination studies show that the single breaker time overcurrent trip characteristics will trip to clear a fault prior to initiation of a trip of a upstream breaker. Identifi-cation of all non-Class 1E circuits being isolated using a single breaker trip by LOCA signal, periodic testing of breaker coordi-nation, and capability of breaker to trip prior to any versus only upstream breaker and for all versus only circuit faults, will be pursued with the applicant.

RESPONSE

Response to Question 430.33 has been revised to provide the requested information.

QUESTION 430.33 (SECTION 8.3.1 and 8.3.2)

Section 8.3.1.1.2 of the FSAR indicates that the Class 1E system provides power to non-Class 1E loads. Non-Class 1E loads are connected to the Class 1E system through a single breaker that is tripped automatically by a LOCA signal. The single breaker tripped by a LOCA signal provides acceptable isolation between Class 1E and Non-Class 1E circuits for the design basis accident - LOCA. However, for other design basis accident[illegible] operating occurrances that do not generate a LOCA signal (su[illegible]s loss of offsite power, design basis exposure fire, seismic events, etc), it is the staff concern that a single breaker may not provide acceptable isolation. Provide an analysis, in accordance with the guidelines of Section 4.9 of IEEE Standard 308-1974, that demonstrates that failure of anyone or simultanous combined failure of all non Class 1E loads will not prevent any of the four channels of Class 1E power from performing its safety function. The analysis should consider, but not be limited to, (1) capacity and capability of onsite and offsite power supplies and their associated distribution system to supply power to Class 1E loads within their design ratings for all modes of plant operation, (2) the guidelines of Section 7.1.2.1 of IEEE standard 384-1981, (3) an analysis of diesel generator loadings for loss of offsite power similiar to that presented in Tables 8.3-2 through 8.3-6 of the FSAR, (4) the failure of the Non Class 1E dc system that supplies control power to the subject non Class 1E loads, and (5) a similiar analysis of the Class 1E dc system if non-Class 1E loads are connected.

RESPONSE

The following discussion demonstrates the adequacy of employing a single circuit breaker tripped by a LOCA signal as an isolation device between a Class 1E power bus and a non-Class 1E load for design base event that do not generate LOCA signals.

Figure 430.33-1 shows the two configurations that employ a circuit breaker tripped by a LOCA signal as an isolation device. The two configurations are:

a. A Class 1E unit substation supplies a non-Class 1E motor control center (MCC) or a motor load through Class 1E circuit breaker B.

b. A Class 1E motor control center supplies through Class 1E circuit breaker D, a non-Class 1E distribution panel.

The Class 1E circuit breakers B and D are qualified to operate for HCGS seismic and environmental parameters for all design basis events. These circuit breakers will trip to isolate their

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respective Class 1E power supply buses from the non-Class 1E loads in the event the non-Class 1E loads fail. This applies whether the plant is supplied from an offsite source or an onsite source. Thus, the failure of the non-Class 1E loads supplied from Class 1E power supply buses will not prevent any of the four channels of Class 1E power supplies from performing its safety function. INSERT A FROM PAGE 430.33-2A

COMPLIANCE WITH GUIDELINES OF SECTION 7.1.2.1 OF IEEE 384-1981

Protective device coordination studies for devices shown in Figure 430.33-1 have shown that the time-overcurrent trip characteristics of circuit breakers A, B, C, and D are such that:

a. Circuit breaker B will trip to clear a fault current prior to initiation of a trip of circuit breaker A.

b. Circuit breaker D will trip to clear a fault current prior to initiation of a trip of circuit breaker C.

X Both the onsite and offsite powers supply sources are separately capable of supplying the necessary fault current for sufficient time to ensure the proper protective device coordination without loss of function of Class 1E loads. INSERT B FROM PAGE 430.33-2A

STANDBY DIESEL GENERATOR LOADINGS FOR LOSS OF OFFSITE POWER

Table 8.3-1 tabulates the loads, their KW ratings, and loading sequences for design basis accident (DBA) and loss of offsite power (LOP) scenarios. It can be verified by inspecting Table 8.3-1 that DBA loading of the SDGs is the limiting case with respect to the loading capability of the SDGs.

FAILURE OF THE NON-CLASS 1E DC SYSTEM THAT SUPPLIES CONTROL POWER TO THE SUBJECT NON-CLASS 1E LOADS

For configuration (a) (described above) the circuit breaker B supplying a Non-Class 1E MCC or a motor load is controlled by Class 1E 125 V dc control power supply. For a non-Class 1E motor load, a non-Class 1E circuit breaker is provided downstream of circuit breaker B. This non-Class 1E circuit breaker (GE-AKR type) is controlled by a non-Class 1E 125 V dc control power. GE-AKR type circuit breakers are directing acting trip devices and do not require external control power supply for tripping for electrical fault conditions. Therefore, the failure of the dc control power supply does not prevent the circuit breaker ~~to~~ trip(ping) in response to the failure of non-Class 1E motor load. from

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The Class IE onsite ac sources and the offsite power sources and their distribution system are of sufficient capacity and capability to supply power to both Class IE and non-Class IE loads during all plant conditions. In the event of a LOCA the non-Class IE loads are automatically tripped from the Class IE buses in accordance with Position C.1 of Regulatory Guide 1.75. IN ADDITION, CABLES FROM THE CLASS IE BUSES TO THE NON-CLASS IE LOADS ARE ROUTED IN RIGID STEEL CONDUITS OR TRAYS. WHERE TRAY ROUTING IS USED, NON-CLASS IE CABLES ASSOCIATED WITH OTHER IE CHANNELS ARE NOT RUN TOGETHER IN THE SAME TRAY

INSERT B

Periodic testing of the breaker time-overcurrent trip characteristics will be performed to demonstrate that the circuit breaker trip function remains within required limits. Table 430.33-1 identifies the non-Class IE loads that are supplied through circuit breakers B and D of Figure 430.33-1.

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TABLE 430.33-1

NON-CLASS 1E LOADS CONNECTED TO CLASS 1E BUSES THROUGH CIRCUIT BREAKER TRIPPED BY LOCA SIGNAL

LOAD NO.	NON-CLASS 1E LOAD DESCRIPTION	CLASS 1E BUS	CLASS 1E CIRCUIT BREAKER NO.
1	Reactor Auxiliary Cooling System Pump 1AP209	10B410	52-41011
2	Radwaste and Service Area MCC 10B313	10B410	52-41014
3	Reactor Building Supply Air Handling Unit 1BVH300	10B410	52-41024
4	Reactor Auxiliary Cooling System Pump 1BP209	10B420	52-42011
5	Radwaste and Service Area MCC 10B323	10B420	52-42014
6	Reactor Building Exhaust Fan 1BV301	10B420	52-42024
7	Reactor Building Supply Air Handling Unit 1CVH300	10B430	52-43024
8	Control Rod Drive Pump 1AP207	10B430	52-43014
9	Control Rod Drive Pump 1BP207	10B440	52-44014
10	Reactor Building Supply Air Handling Unit 1AVH300	10B440	52-44024
11	Radwaste Area Supply Fan 0BV316	10B440	52-44034
12	Reactor Area MCC 10B252	10B450	52-45011
13	Radwaste Area Exhaust Fan 0AV305	10B450	52-45014
14	Emergency Instrument Air Compressor 10K100	10B450	52-45024
15	Reactor Building Exhaust Fan 1CV301	[illegible]50	52-45034
16	Reactor Area MCC 10B262	[illegible]	52-46011
17	Radwaste Area Exhaust Fan 0BV305	10B460	52-46014
18	Reactor Area MCC 10B272	10B470	52-47011
19	Radwaste Area Exhaust Fan 0CV305	10B470	52-47014
20	Radwaste Area Supply Fan 0AV316	10B470	52-47024
21	Technical Support Center MCC 00B479	10B470	52-47031

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TABLE

CONTINUED

22	Reactor Area MCC 10B282	10B480	52-48011
23	Reactor Building Exhaust Fan 1AV301	10B480	52-48029
24	NSSS Computer Inverter 10D485	10B441	52-441043
25	Public Address System Inverter 10D496	10B451	52-451023
26	BOP Computer Inverter 1AD492	10B461	52-461023
27	Security System Inverter 0AD495	10B471	52-471023
28	BOP Computer Inverter 1BD492	10B481	52-481023

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DSER Open Item No. 261 (DSER Section 8.3.3.3.6)

AUTOMATIC TRANSFER OF LOADS AND INTERCONNECTION BETWEEN REDUNDANT DIVISIONS

In Sections 8.1.4.1, 8.3.1.1.2.4, and 8.3.2.2 of the FSAR, it is stated that no provision exists for either automatic or manual transfer of loads between redundant load groups. The design depicted by this statement, meets the requirements of criterion 17 of Appendix A to 10 CFR 50, the guidelines of Regulatory Guide 1.6 and is therefore, ac eptable. However, based on staff review of single line diagrams presented in Section 8.3 of the FSAR, provision for both automatic and manual transfer of loads have been identified. Sheet 2 of Figure 8.?-11 (E-0012-1) of the FSAR shows the non Class 1E BCP computer load normally connected to Class 1E division "D" with provision for automatic transfer to divisions "B" or "C". In addition, Sheet 5 of Figure 8.3-8 (E-0009-1) of the FSAR shows the non Class 1E loads on 125 v DC bus 10D486 having provision for manual transfer between Class 1E division "A" and "B" and the capability for simultaneous connection of this same load to both division "A" and "B." Similar provisions for load transfer also exists between division "C" and "D".

By Amendment 4 to the FSAR, the applicant indicated that a BOP computer load powered from Class 1E, Channel B is automatically transferred to Class 1E Channel C on loss of its Class 1E power supply. The applicant further indicated that this automatic transfer design does not violate the requirements of GDC 17 nor does it fall under guidelines of Regulatory Guide 1.6 because the BOP computer load is not safety-related. The staff disagrees. The automatic transfer does not meet position 4c of Regulatory Guide 1.6. In addition, this automatic transfer or interconnection between redundant divisions does not meet the independence requirements of GDC 17. The applicant has been requested to provide this results of an analysis that identifies and justifies use of all physical and electrical interconnections between redundant ac and dc divisions and between redundant associated divisions. This items will be pursued with the applicant.

RESPONSE

The automatic/manual transfer feature has been deleted as indicated in the revised response to Question 430.34.

QUESTION 430.34 (SECTION 8.3.2)

In Sections 8.1.4.1, 8.3.1.1.2.4 and 8.3.2.2 of the FSAR you state that no provision exists for either automatic or manual transfer of loads between redundant load groups. The design depicted by this statement meets the requirements of Criterion 1 of Appendix A to 10 CFR 50, the guidelines of Regulatory Guide 1.6 and is, therefore, acceptable. However, based on staf review of single line diagrams presented in Secition 8.3 of the FSAR, provision for both automatic and manual transfer of loads have been identified. Sheet 2 of Figure 8.3-11 (E-0012-1) of th FSAR shows the non Class 1E BOP computer load normally connected to Class 1E division "D" with provision for automatic transfer t divisions "B" or "C". In addition, Sheet 5 of Figure 8.3-8 (E-0009-1) of the FSAR shows the non Class 1E loads on 125 v DC bus 10D486 having provision for manual transfer between Class 1E divisions "A" and "B" and the capability for simultaneous connection of this same load to both division "A" and "B". Similiar provisions for load transfer also exists between division "C" and "D".

a. Correct the above identified inconsistency so that the Hope Creek design is consistent with design commitment contained in the FSAR. Describe how one can conclude in the future with reasonable assurance that the actua Hope Creek electrical desing meets design commitments documented in the FSAR.

b. Provide the results of an analysis that demonstrates that the physical and electrical independence of the four independent electrical divisions have not been compromized by the connection of Non Class 1E loads on the Class 1E AC and DC system. The results of the analysis should include but not be limited to (1) identification and justification of all electrical interconnections, (2) description with electrical schematic diagrams for each non Class 1E load, (3) description of the physical routing of circuits associated with each Class 1E load group with respect to other non-Class 1E loads connected to redundant Class 1E load groups, and (4) where separation between redundant associated circuits or between associated circuits and non Class 1E circuits is less than the separation required by IEEE standard 384, justificatio should be provided.

RESPONSE

~~The designs referred to do not violate the requirements of GDC 1 or the guidelines of Regulatory Guide 1.6 with respect to~~

automatic or manual transfer of loads between redundant load group.

Figure 8.3-11, Sheet 2, shows the BOP computer power supplies. The basic operation of the three power supplies is that when all power supplies are available (no internal or external failures), distribution panels 1AJ492 and 1CJ492 are supplied from 1AD492 (Channel B) and distribution panels 1BJ492 and 1DJ492 are supplied from 1BD492 (Channel D). If either of power supplies 1AD492 or 1BD492, fails completely, but not both, then the common transfer switch will automatically transfer distribution panel 1CJ492 or 1DF492 to power supply 1CD492 (Channel C); in this event distribution panels 1AJ492 and 1BJ492 are not transferred because only one of them is needed for computer operation. Retransfer is a manual operation. The analysis and justification of this design are presented below.

The BOP computer loads are non-Class 1E and non-redundant except for distribution panels 1AJ492 and 1BJ492 which do not have any means for power supply transfer. Although the panels are redundant, they do not fall under the Regulatory Guide 1.6 definition of redundant loads because the panel loads are not safety related. The BOP computer power supplies, and their upstream feeders, are designated Class 1E in order to preserve the independence of the upstream circuits which are connected to Class 1E 480 V MCCs and 125 V dc switchgear.

The preservation of the physical independence of redundant power supplies and load groups is accomplished and maintained in the present design of the BOP computer power distribution system by:

a. Tripping the Class 1E 480 V MCC feeder circuit breakers supplying backup power to the BOP computer power supply (CB301 connection on the FSAR figure) upon receipt of a LOCA signal.

b. Isolating the non-Class 1E BOP computer loads from the Class 1E 480 V MCC and 125 V dc power sources by use of acceptable isolation devices which are the inverters within the BOP computer power supplies 1AD492, 1BD492 and 1CD492.

c. Routing the cables between the 480 V MCC and dc switchgear and their respective BOP computer power supplies in Class 1E raceways of the designated channels. Routing of BOP computer power supplies load cables in non-Class 1E raceways.

d. Preventing paralleling of redundant power sources (480 V ac and 125 V dc) and redundant (safety) load groups by use of two static transfer switches, one in the BOP computer power supply and one in the common

DSER OPEN ITEM 261

~~transfer switch cabinet, so that a failure of one static transfer switch does not cause connection of the power sources. The static transfer switch contacts are also break before make type so that there can be no parallelling of power sources during the transfer. The computer loads are not redundant (safety) loads.~~

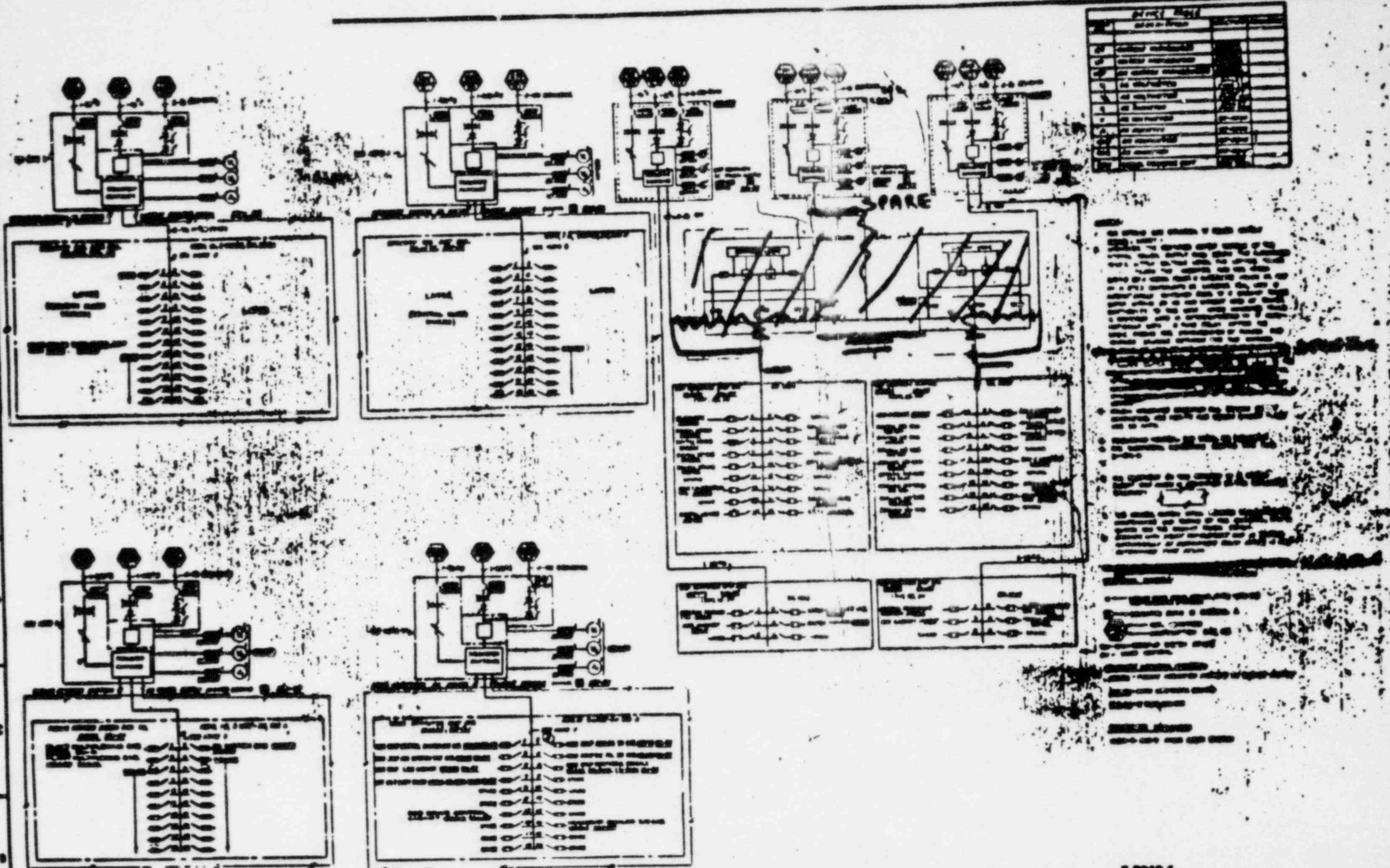
Figure 8.3-8, Sheet 5, shows only non-Class 1E equipment as indicated on this sheet in the area immediately above the title block; therefore, the concerns expressed are not applicable.

The above analysis indicate that the HCGS commitments on GDC 17 and Regulatory Guide 1.6 are incorporated in the actual electrical design.

FIGURE 8.3-11 SHEET 2 HAS BEEN REVISED TO DELETE THE AUTOMATIC TRANSFER FEATURE BETWEEN CHANNELS B AND C, AND BETWEEN CHANNELS C AND D. BOP COMPUTER PANELS 1CJ492 and 1DJ492 ARE SUPPLIED FROM UPS SYSTEMS 1AD492 and 1BD492, RESPECTIVELY.

DSER OPEN ITEM 261

JUL 16 '84 0267611



E-0012-1

HOPE CREEK GENERATING STATION

FINAL SAFETY ANALYSIS REPORT

SINGLE LINE METER & RELAY DIAGRAM 120 V AC INSTRUMENTATION & MISC SYST

FIGURE 8.3-11

QUESTION 430.61 (SECTION 8.3)

Provide a detail discussion (or plan) of the level of training proposed for your operators, maintenance crew, quality assurance, and supervisory personnel responsible for the operation and maintenance of the emergency diesel generators. Identify the number and type of personnel that will be dedicated to the operations and maintenance of the emergency diesel generators and the number and type that will be assigned from your general plant operations and maintenance groups to assist when needed.

In your discussion identify the amount and kind of training that will be received by each of the above categories and the type of ongoing training program planned to assure optimum availability of the emergency generators.

Also discuss the level of education and minimum experience requirements for the various categories of operations and maintenance personnel associated with the emergency diesel generators (SRP 8.3.1, Parts II & III).

RESPONSE

The mechanical and electrical discipline of the Safety and Skills Department will implement a complete, formal training program covering the preventative maintenance, inspection, repair, trouble shooting and general operation of the standby diesel generator at HCGS. The program will be given to all mechanical and electrical maintenance, quality control, operating and maintenance supervisiory personnel. The depth and quality of this training program will be at least equivalent to that of the training programs normally conducted by the manufacturer. ~~The program will be implemented by December 1985.~~

Insert A

~~Continuing training will be implemented thereafter to maintain the skills and incorporate the necessary updates.~~

~~In addition to the above training, operations personnel will have training covering the normal and emergency procedures of diesel operation both from the main control room and from the local operating panels.~~

~~There will be no operations and maintenance personnel specifically dedicated to the operation and maintenance of the diesel generators.~~

All personnel associated with the operation and maintenance of the diesel generators will meet the education and minimum experience requirements of ANSI/ANS 3.1-1981 for the functional level of their respective title/discipline.

Further clarification of education and minimum experience requirements is defined in Station Administrative Procedure SA-AP.ZZ-07(Q), Station Personnel Qualification Requirements.

A Insert A 430.61

A formal training program has been implemented in April 1984 and will have been presented to all designated mechanical, electrical, quality assurance, and maintenance supervisory personnel associated with the emergency diesel by December 1985. This course is five days in length and covers preventative maintenance, inspection, trouble-shooting, repair, and general operation of the standby diesel generator set at HCGS. The portion of this course dealing with the diesel engine will be given to mechanical maintenance personnel and lasts about three days. The portion of this course dealing with the generator will be given to electrical maintenance personnel and lasts about two days. The depth and quality of the maintenance training program and following replacement training programs will be at least equivalent to that of training programs conducted by the manufacturer. Continuing training will be implemented thereafter to maintain necessary skills and incorporate a review of industry publications, manufacturer's change notices and lessons learned at HCGS concerning the diesel generator.

All licensed operating personnel will be given an overview of theory and operation of the combined diesel generator set and the support systems necessary for its operation during system training. This training will last about four or five hours and will include normal and emergency procedures for both local and remote operating station. Additional detailed training using normal and emergency procedures as they apply to the control room will be covered in the Hope Creek plant referenced simulator when it becomes available in late 1984. Re-occuring classroom and simulator training will be included in the licensed operator requalification program and will include applicable events from other plants as well as lessons learned at Hope Creek. Replacement training for operators will be at the same level as presented in systems training.

There will be no operations and maintenance personnel solely dedicated to the operation and maintenance of the diesel generators.

QUESTION 430.62 (SECTION 8.3)

Periodic testing and test loading of an emergency diesel generator in a nuclear power plant is a necessary function to demonstrate the operability, capability and availability of the unit on demand. Periodic testing coupled with good preventive maintenance practices will assure optimum equipment readiness and availability on demand. This is the desired goal.

To achieve this optimum equipment readiness status the following requirements should be met:

1. The equipment should be tested with a minimum loading of 25 percent of rated load. No load or light load operation will cause incomplete combustion of fuel resulting in the formation of gum and varnish deposits on the cylinder walls, intake and exhaust valves, pistons and piston rings, etc., and accumulation of unburned fuel in the turbocharger and exhaust system. The consequences of no load or light load operation are potential equipment failure due to the gum and varnish deposits and fire in the engine exhaust system.

2. Periodic surveillance testing should be performed in accordance with the applicable NRC guidelines (R.G. 1.108), and with the recommendations of the engine manufacturer. Conflicts between any such recommendations and the NRC guidelines, particularly with respect to test frequency, loading and duration, should be identified and justified.

3. Preventive maintenance should go beyond the normal routine adjustments, servicing and repair of components when a malfunction occurs. Preventive maintenance should encompass investigative testing of components which have a history of repeated malfunctioning and require constant attention and repair. In such cases consideration should be given to replacement of those components with other products which have a record of demonstrated reliability, rather than repetitive repair and maintenance of the existing components. Testing of the unit after adjustments or repairs have been made only confirms that the equipment is operable and does not necessarily mean that the root cause of the problem has been eliminated or alleviated.

4. Upon completion of repairs or maintenance and prior to an actual start, run, and load test a final equipment check should be made to assure that all electrical circuits are functional, i.e., fuses are in place, switches and circuit breakers are in their proper position, no loose wires, all test leads have been removed, and all valves are in the proper position to permit a manual start of the equipment. After the unit has been satisfactorily started and load

2/2

tested, return the unit to ready automatic standby service and under the control of the control room operator.

Provide a discussion of how the above requirements have been implemented in the emergency diesel generator system design and how they will be considered when the plant is in commercial operation, i.e., buy what means will the above requirements be enforced. (SRP 8.3.1, Parts II & III).

RESPONSE

Loading requirements will incorporate the diesel engine manufacturers' recommendations to preclude gum and varnish deposits on engine components or the engine exhaust system.

1. Minimum load requirements for SDG testing will be identified in OP-SO.KJ-001, Diesel Generator Operation.

2. See response to Question 430.15.

3. A comprehensive preventive maintenance (PM) program (for the SDG) ~~is currently being developed and this program will consist of~~ incorporates the latest vendor recommendations and the requirements of Chapter 16. One SDG can be taken out of service, in accordance with 8.3.1.1.3, enabling periodic maintenance and/or rework to be performed in a timely manner. ~~Additionally, a reliability monitoring program will be implemented to monitor and trend repetivive equipment and/or component failures.~~ In this manner, the root causes of system (or component) malfunctions can be more readily identified and corrective actions taken as necessary.

4. The supervisor in charge of the work will verify for completeness, and administrative controls will be implemented to ensure the system is restored to its operable condition prior to any start, run, or load test on the SDG.

The following procedures will reference this topic:

MD-PM.KJ-001(Q)	Diesel Engine PM
MD-PM.KJ-002(Q)	Starting Air System PM
MD-PM.KJ-003(Q)	Generator PM
MD-CM.KJ-001(Q)	Diesel Engine Overhaul and Repair
MD-CM.KJ-002(Q)	Starting Air Compressor Overhaul, Repair and Replacement
MD-CM.KJ-003(Q)	Generator Overhaul and Repair

Station Administrative Procedures 17, 21, 22, 23, and 26, as discussed in Section 13.5.

The HCGS reliability program enhances SDG reliability by:

1. Analyzing machinery history record for recurring problems or failures of the SDG or supporting auxiliary systems or components.
2. Tracking operating experience reports, circulars, letters and notices of failure or problems generic to all diesel generators.
3. Use of the NPRDS data base system

1/2

QUESTION 430.63 (SECTION 8.3)

The availability on demand of an emergency diesel generator is dependent upon, among other things, the proper functioning of its controls and monitoring instrumentation. This equipment is generally panel mounted and in some instances the panels are mounted directly on the diesel generator skid. Major diesel engine damage has occurred at some operating plants from vibration induced wear on skid mounted control and monitoring instrumentation. This sensitive instrumentation is not made to withstand and function accurately for prolonged periods under continuous vibrational stresses normally encountered with internal combustion engines. Operation of sensitive instrumentation under this environment rapidly deteriorates calibration, accuracy and control signal output.

Therefore, except for sensors and other equipment that must be directly mounted on the engine or associated piping, the controls and monitoring instrumentation should be installed on a free standing floor mounted panel separate from the engine skids, and located on a vibration free floor area. If the floor is not vibration free, the panel shall be equipped with vibration mounts.

Confirm your compliance with the above requirement or provide justification for noncompliance. (SRP 8.3.1, Parts II & III).

RESPONSE

~~All of the safety related instrumentation for the HCGS diesel generator controls, with the exception of the sensors or equipment that must be directly mounted on the engine or piping, are installed in floor mounted control panels removed from the engine skid.~~

INSERT A

All of the instrumentation and control equipment used in these applications are carefully selected for use by Colt Industries for the expected vibrations associated with diesel equipment. Their use in the HCGS units is based on satisfactory performance proven in other similar nuclear power plants.

In addition, all process and control connections leaving the engine skid have flexible couplings. The diesel manufacturer does vibration testing of all skid units during their break-in shop testing to assure proper rotational balancing measured against response of similar previous skid units.

INSERT A to 430.63

2/2

430.63

430.63
The only sensors on the diesel skid unit are those which must be mounted on the engine or associated piping, as excepted by the second paragraph of ~~the NRC~~ question. These sensors consist of temperature and pressure sensing switches, level and flow switches, and pneumatic transmitters. No vibration sensitive instrumentation is used or provided by Colt. Relays and other control devices are in control panels which are not mounted on the engine.

The instrumentation that is mounted on the skid unit is qualified per Colt's 1E Qualification Program.

Colt Industries has confirmed that

QUESTION 430.64 (SECTION 8.3)

Operating experience at two nuclear power plants has shown that during periodic surveillance testing of a standby diesel generator, initiation of an emergency start signal (LOCA or LOOP) resulted in the diesel failing to start and perform its function due to depletion of the starting air supply from repeated activation of the starting relay. This event occurred as the result of inadequate procedures and from a hang-up in engine starting and control circuit logic failing to address a built-in time delay relay to assure the engine comes to a complete stop before attempting a restart. During the period that the relay was timing out fuel to the engine was blocked while the starting air was uninhibited. This condition with repeated start attempts depleted stating air and rendered the diesel generator unavailable until the air system could be repressurized.

Review procedures and control system logic to assure this event will not occur at your plant. Provide a detail discussion of how your system design, supplemented by procedures, precludes the occurrence of this event. Should the diesel generator starting and control circuit logic, and procedures require changes, provide a description of the proposed modifications. (Refer to Request 430.123 for control air requirements) (SRP 8.3.1 Part II & III).

RESPONSE

The HCGS diesel generator control design has a time delay relay which holds the fuel racks closed for ~~2 minutes~~ 140 seconds to allow the unit to come to a complete stop. However, in the event of an emergency start signal during this count-down time this relay is functionally overridden and the fuel racks open to allow the diesel to continue to run or restart through the normal starting air sequence described in Section 9.5.6. Therefore, this concern is not applicable to the HCGS design.

→ INSERT

~~Description of the functional control override of fuel rack time down relay (8.3) to prevent D/G failure to start is not provided~~

1/5

Figure 430.64-1 is the schematic of the time delay and shutdown circuit. ~~With reference to figure 430.64-1~~, the time delay relay is designated as "Stopping Timer 5A". For a normal stop function, actuation of control switch "CS-1" to the stop position (switch located on the local engine control panel), the stop pushbutton (located in the main control room), or the stop switch at the remote engine control panel will energize the 5A timer. The relay coil 5AX is energized when either the stop pushbutton or the stop switch is actuated. Once the 5A timer is

2/5

....64 (cont) energized its contact, SA, will close for 140 seconds to energize the "shutdown solenoid SDS". The shutdown solenoid will supply air pressure to the engine stop tank which also supplies air to the fuel rack solenoid valve to drive the fuel racks to the zero fuel position. Figure 9.5-26 shows the fuel rack solenoid as item 3.

In the event that an emergency start signal is received during the normal stop sequence, the "shutdown solenoids SDS" will be deenergized by contacts ESA or ESB, and the engine will

.64 (cont) restart and run in the emergency mode.

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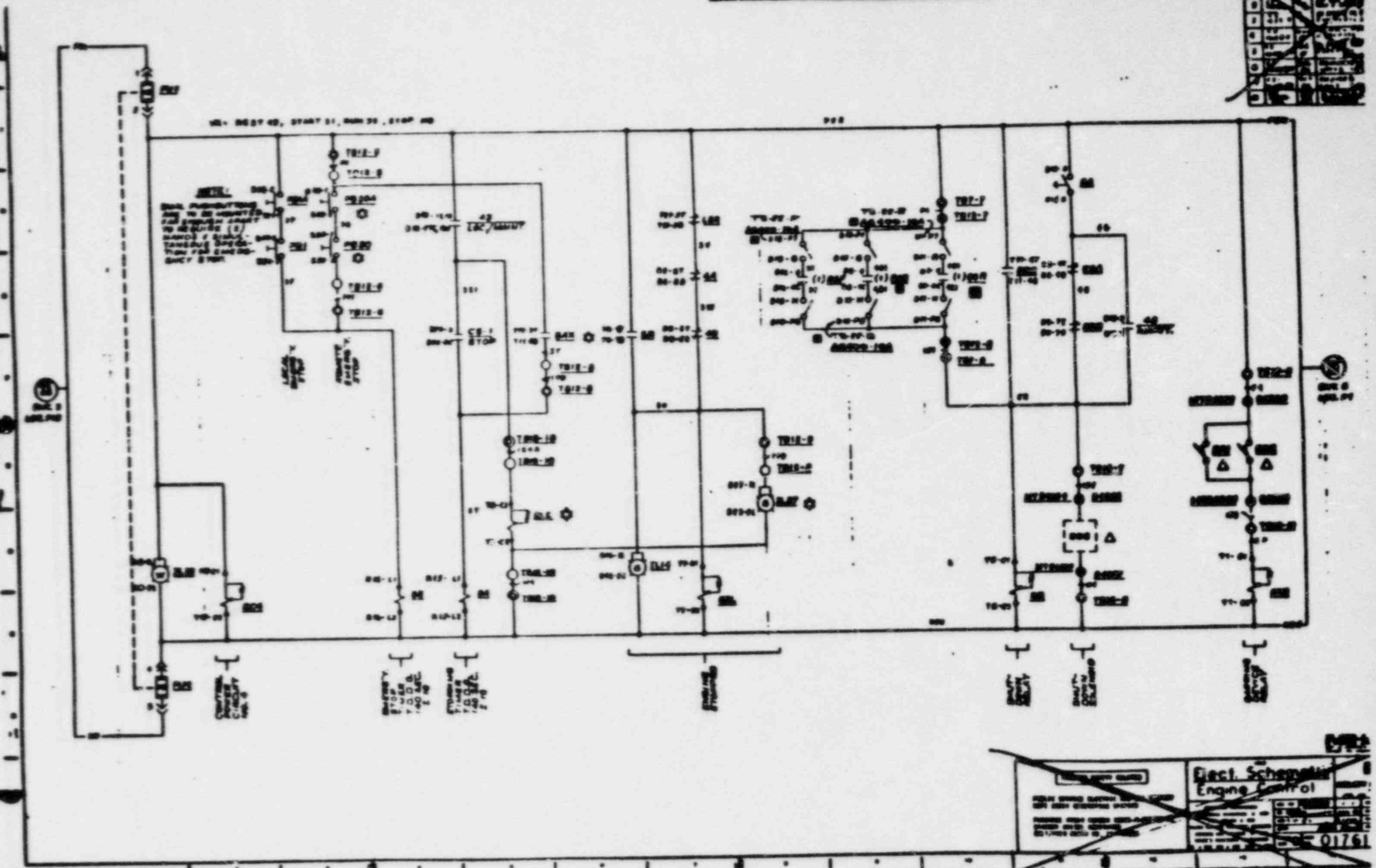
LOCAL ENGINE CONTROL PANEL



Elect. Schematic Engine Control

01761

430.64-1

5/5

QUESTION 430.65 (SECTION 9.5.2)

The information regarding the onsite communications system (Section 9.5.2) does not adequately cover the system capabilitie during transients and accidents. Provide the following information:

a. Identify all working stations on the plant site where it may be necessary for plant personnel to communicate with the control room or the emergency shutdown panel during and/or following transients and/or accidents (including fires) in order to mitigate the consequence of the event and to attain a safe cold plant shutdown.

b. Indicate the maximum sound levels that could exist at each of the above identified working stations for all transients and accident conditions.

c. Indicate the types of communication systems available at each of the above identified working stations.

d. Indicate the maximum background noise level that coul exist at each working station and yet reliably expect effective communication with the control room using:

1. the page party communiations systems, and

2. any other additional communication system provid that working station.

e. Describe the performance requirements and tests that the above onsite working stations communication syste will be required to pass in order to be assured that effective communication with the control room or emergency shutdown panel is possible under all conditions.

f. Identify and describe the power source(s) provided fo each of the communications systems. (SRP 9.5.2; Parts II & III).

RESPONSE

Insert A

a. The identification of all working stations where it m be necessary for plant personnel to communicate with the control room during and/or following transients and/or accidents is not provided because all necessa plant shutdown controls and indications are located within the control room which precludes necessity of having plant personnel located at any particular station. If, however, plant shutdown is controlled from the emergency shutdown panel, then it may be necessary to have plant personnel able to communicate from three working stations which have backup controls and indications. These three stations are at the diesel generator remote control panels rooms (4 total), the Class 1E switchgear rooms (4 total), and at the reactor protection system (RPS) motor-generator set area. In the event of fires, the fire brigade reports to the affected area(s) and the areas are listed in Section 9.5.1.2.15.

b. Maximum sound levels have not been defined for the above working stations. The effectiveness of the communication system(s) will be demonstrated during the preoperational and power ascension test programs of Chapter 14. Insert B

c. The page party communication system is available at or nearby the above working stations. In addition, a two-way radio communication system is available as a backup system. Insert C

d. ~~The maximum background noise level that could exist at the stations for communicating with the control room has not been established.~~ The communications systems provided on HCGS are of proven design as used in previously approved plants. In addition, the communication system will be tested as described in Part (e) of this response. Insert D

e. See response to Question 430.68, communication systems performance requirements and tests. In-plant communication tests are also described in Section 14.2.12.1.38. The test method states that communication is checked between the control room and the remote shutdown panel. Insert E

f. The power source to the page party communication system is from an uninterruptible power supply feeding the public address system distribution panel 10D496 which in turn supplies the public address system cabinet 10C685, as shown on Sheet 2 of Figure 8.3-11. Insert F

Response ...

Insert A

Table 9.5-17 identifies all necessary working stations where it may be necessary for plant personnel to communicate with the control room o the emergency shutdown panel during and/or following transients and/or accidents (including fires) in order to mitigate the consequences of the event and to attain a safe cold plant shutdown. The identified working stations or areas in this table are selected from the Fire Hazard Analysis presented in Appendix 9A wherein all areas containing safe shutdown equipment and cable are evaluated for effect of fire on the ability to achieve and maintain cold shutdown. The areas shown on Table 9.5-17 are those which contain equipment required for shutdown, areas containing only raceways and cables are not shown.

Insert B

The locations of public address loudspeakers and handset/speaker amplifier are selected to provide effective communications and to accomodate areas with high noise levels during normal plant operation and accident condition, including fire. The design of these public address components include provisions for volume control of the loudspeakers, adjustment in loudspeaker mounti.. to provide maximum coverage, and special noise-cancelling handse.. which are effective in high ambient noise areas without use of acoustic booths. As indicated in Section 14.2.12.1.38, the public address system will b.. tested with area equipment running. Any relocation and adjustment o.. the public address components will be provided as necessary as result the testing. Estimates of maximum sound levels are provided as indicated on Table 9.5-17. These estimates are based on equipment being energized or running and based on no sound level attenuation which would result from accounting for room constant and distance and location of the noise source(s).

Insert C

Table 9.5-17 also shows for each of the working stations the typ.. of communication system components available.

Insert D

the maximum noise levels are estimated for t
As part of Table 9.5-17, the maximum noise levels are estimated for t communicating with the control room or
areas where personnel will be communicating with the control room or PA handsets and telephones ar
remote shutdown panel room. Generally, PA handsets and telephones ar The maximum noise levels are
not located in areas with high noise levels. The maximum noise levels are in the area with the sound l
estimated based on the type of operating equipment in the area with the sound l NEMA Publication MG 1 AND IEEE standards
defined by industry standards, such as NEMA Publication MG 1 AND IEEE standards the noise level associated with the noi
several types of equipment are in the area, then the noise level associated with the noi
equipment is shown on this table.

Insert E

preoperationally tested with the
The communication systems are preoperationally tested with the public address system is effective
objectives of demonstrating that the public address system is effective other communication systems
in areas with high noise levels and that other communication systems emergency shutdown panel
are effective between the control room or emergency shutdown panel
and working stations identified in Table 9.5-17.

Insert F

is fed from Class 1E, Channel A
This uninterruptible power supply (UPS) is fed from Class 1E, Channel A
distribution buses. The radio system is also supplied with
uninterruptible power; however, non-Class 1E distribution buses
are used to power this UPS subsystem. The design of each UPS,
as shown on Figure 8.3-11, is such that there are three input power
feeders - two from 480V ac motor control centers and one from a 125V
dc switchgear. In the case of the radio system the non-class 1E 480V ac
motor control centers which are connected to Class 1E 480V load centers are
stripped on a ~~LOCA signal~~ loss of station normal AC power.
In the event of loss of offsite power, the public address system will hav
uninterrupted power because Class 1E onsite power source(s) will power
the input feeders of the UPS subsubsystem. The radio system will also
have uninterrupted power supplied through the dc distribution system for
4 hours; however, the 480V ac feeders can be powered from a standby
diesel generator by manual reconnection of the 480V motor center
center buses to the Class 1E 480V load centers. Therefore, a prolonged
loss of offsite power event does not affect the two communication
systems. Station operating procedures will be developed prior to fuel
loading to cover the manual reconnection of non-class 1E motor control
centers to Class 1E load centers.

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QUESTION 430.66 (SECTION 9.5.2)

Discuss the protective measures taken to assure a functionally operable onsite and offsite communiation system. The discussion should include the considerations given to component failures, loss of power and the severing of communication lines or trunks as a result of an accident or fire. (SRP 9.5.2, Part II)

RESPONSE

Protective measures provided to assure a functionally operable onsite and offsite communication system include:

a. Powering each communication system from a separate and independent power source so that a loss of one power source only affects one communication system. (Additional discussion on the power sources is provided in response to Question 430.~~69~~ 65)

b. Locating central components of the communication system in different areas of the plant so that a fire cannot damage more than one system.

c. Providing separate and dedicated raceways for each of the communication system's wiring so that each communication system circuit is physically separated from the other.

d. Immediate detection of component failures for the onsite communication systems of page party public address, telephone and two-way radio systems because of their regular use in the day-to-day plant operation. ~~The offsite communication system will be periodically tested to ensure operability.~~

Although the onsite and offsite communication systems are independent of each other, there are cases where individual components of each system are located in the same area, e.g., control room, because of operational consideration. In the event of severing of communication lines as a result of an accident or fire, the two-way radio system serves as the backup communication system to the hard-wired communication systems. Insert A

Section 15.0, Exercises and Drills, of The HCGS Emergency Plan, specifies frequency of emergency planning drills. Use of the offsite communication system(s) during these drills constitutes testing of the same.

Insert A

The onsite handheld radios (transceivers) have provision for transmitting and receiving independent of the base station such that communications can be maintained in the event that the base station or remote control consoles are lost due to a fire or to loss of power. In addition for the hard-wired public address and telephone communication systems, a fire in a single room can not cause a total loss of these two systems because their major components including power supplies are not located in the same room. A partial loss of the hard-wired communication systems may result from a fire in a single room if there are common components located therein such as wiring, telephone handsets and loudspeaker, but because the communication circuits are designed and routed in branches, a loss of one branch only affects the fire area and other areas served by this branch.

QUESTION 430.68 (SECTION 9.5.2)

In Section 9.5.2.4 of the FSAR you state that inservice inspection tests, preventative maintenance, and operability checks are performed periodically to prove the availability of the communication systems. Provide the frequency of these tests. (SRP 9.5.2, Part II and III).

RESPONSE

The conventional special page and phone systems surveillance are in frequent use and will require no periodic maintenance or testing. The HCGS Maintenance Department will replace and/or repair components that fail during normal use.

Periodic tests and operability checks of infrequently used communications system will be performed in accordance with the frequencies specified in Section ~~13.3~~. 15.0, Exercise and Drills, of the HCGS Emergency Plan.

QUESTION 430.69 (SECTION 9.5.2)

Section 9.5.2 of the FSAR describes the intraplant communication system at Hope Creek which is composed of three subsystems. They are Public Address (PA), Telephone, and Two-Way Radio Systems. A number of areas in the plant are served by one or more of these systems. All these systems are classified non-Class 1E. The PA system is powered from Division A of the Vital Class 1E station batteries; the power sources for the other systems are undefined. Assuming a failure, non-availability due to loss of power, or in ability to use a system due to its interference with control instrumentation or equipment such as the radio system of any or all of these systems following a seismic event, it is possible that portions of the plant may be without adequate communications for an extended period of time during the design basis event. This is unacceptable, it is our position that adequate communications be provide to all vital, hazardous and safety related areas needed for the safe shutdown of the reactor and the evacuation of personnel in the event of a design basis event. Modify your design to provide the necessary communication for postulated conditions above or justify the present design. (SRP 9.5.2, Parts I & II)

RESPONSE

Section 9.5.2.3 has been revised to provide evaluation of seismic event on the communication systems. The power sources for the other systems are discussed in the response to Question 430.~~67~~ 65. and revised Section 9.5.2.

"Merge-Isolate" capability for the plant and refueling platform PA systems is provided at the communication cabinet located in the main control room.

The telephone system of Section 9.5.2.2.2 can be patched into the PA system page channel to enable communications to be conducted between telephone and PA handset locations.

The radiation alert signal and the fire alarm signal are transmitted over the paging channel of the PA system, overriding its normal use. The PA system is fed from an uninterruptible power source, ~~as~~ shown on Figure 8.3-11, Sheet 2, as power supply 1CD496.

new IP

9.5.2.2.2 Telephone System

The automatic telephone system is furnished and maintained by the New Jersey Bell Telephone Company. The system has a capacity of approximately 300 lines. The power supply for this system consists of an independent charger and battery with a capability of operating the entire plant telephone system for a minimum of 8 hours after a loss of the normal ac supply. Direct lines, including the emergency notification system (ENS) to the Nuclear Regulatory Commission offices, are powered from a station inverter to ensure continued direct communications during loss of offsite power (LOP). Drawing Number E-1467-0 (drawing referenced in Section 1.7) illustrates the location of the components in a riser diagrammatic form.

9.5.2.2.3 Two-Way Radio Communications System

Two radio communication systems are provided. One System is for security personnel use and it is described in Section 13.6. The other system is for station personnel use as described herein. This radio communication system serves as an alternate communication system to the public address and the telephone systems. This system consists of three remote control consoles, a primary and a backup base repeater stations with manual switchover provision, handheld transceivers (radios) and antenna divider network with antennas and transmission lines distributed throughout the power block. Drawing Number E-1475-1 (drawing referenced in Section 1.7) illustrates the location of the fixed components in a riser diagrammatic form.
The radio system is used by the fire brigade, described in Section 9.5.1.5.2, and by other station personnel. However, during the preoperational testing phase of the plant, the radio system is used by startup personnel. The radio system also has interface capability for connection with the Salem radio system.

One of the remote control consoles is located in the main control room for operators use and another is located in the fire brigade room. The third remote control console is available as a spare unit. The repeater stations are located within the Auxiliary Building. Antenna networks are located throughout the power block in order to achieve maximum coverage.

The instrumentation power source is an uninterruptible source. This supply is the ~~security system~~ ac power supply ~~OAD105~~ 1BJ484 as shown on sheet 4 of Figure 8.3-11.

9.5.2.2.4 Remote Shutdown Panel

The remote shutdown panel room has both a telephone and a PA handset station for communication link with other plant locations.

9.5.2.3 System Evaluation

System design considerations include diversity and operational reliability. The inplant communication systems are provided with reliable, uninterruptible power supply for uninterrupted communications between all areas of the plant.

The PA system is the primary means of intraplant communication for plant operations. The telephone system is used as a backup in the event of a failure of the public address system. The telephone system is also used for special communication requirements and normal offsite communications. A two-way radio communication system provides backup to intraplant communication in the event of total loss of both systems.

The communication systems have adequate flexibility to keep the plant personnel informed of plant operational status at all times.

The integrated design of the system provides effective communication between plant personnel in all vital areas during startup, normal plant operation, and during the full spectrum of accident or incident conditions (including fire), under maximum potential noise levels. Effective plant-to-offsite communication has also been provided.

The communication systems have been evaluated to ensure that adequate communications are maintained following a seismic event such that safe shutdown capability is not affected. This assurance is provided by the design and locations of major components of the three intraplant communication systems as discussed below:

a. Power Sources

Although the communication systems are classified non-Class 1E, Class 1E sources are provided for the PA and ~~radio systems,~~ and a non-Class 1E sources for the telephone systems. The Class 1E sources are designed to withstand seismic events and are located within a Seismic Category I structure to prevent a loss of power occurrence. The Class 1E sources are physically separated and independent of each other so that a single failure can only affect one communication system. The non-Class 1E communication loads are isolated from the Class 1E power supplies by use of solid state inverters and shunt trip of the backup source circuit breakers upon LOCA signal to prevent degradation of the Class 1E power sources. A loss of the non-Class 1E power source to the telephone system affects only that system.

Insert A >

b. Equipment Locations

The locations of the communications equipment are widely dispersed throughout the power block. The majority of the telephone components are located in non-safety related areas, including the central equipment. In safety related areas, the telephone components are comprised only of telephones and their dedicated conduits and are located away from safety related equipment. The major components of the PA and radio systems are located within a Seismic Category I structure; however, they are physically separated from each other and from safety related equipment.

Insert B > Therefore, it is unlikely that there will be a total

5/7

Insert A to Page 9.5-67 Q430.69

The power sources referred to in this subsubsection are those which supply input power to the static inverters from which the PA and radio systems receive ac power. Figure 8.3-11 depicts the design of each uninterruptible power supply (UPS). The static inverter is one component of each UPS, others are voltage regulator, rectifiers, and transfer switch; all components collectively form an UPS system. The UPS system for the PA system has Class IE, Channel A, ac and dc input power sources; the UPS components are seismically qualified, and its distribution panel's construction, configuration and components are similar or nearly identical to those of the Class IE distribution panels shown on Figure 8.3-11. The UPS system for the radio system has input ac power supplied from Class IE, Channel B, power sources through non-Class IE motor control centers (MCC a), and its dc input power is from a non-Class IE power source. Similarly, the radio system UPS components, distribution panel and input power MCC a are considered seismically qualified because the components are of Class IE design and construction. Therefore, power to the PA and radio systems will not be interrupted following a seismic event.

Insert B to Page 9.5-67 Q430.69

The communications equipment are not classified as Class IE; however, because of their inherent design and construction features, such as solid state components, hand-held radios and securing cabinets and handsets to floors and walls, some communications equipment are expected to remain functional following a seismic event.

loss of all communications equipment following a seismic event.

c. Raceways

Insert A

Each of the communication system wiring is enclosed in its own dedicated conduits and/or with metallic sheathing and is physically separated from each other and from safety related raceways. Because of the dispersed locations of the communications components, it is unlikely that there will be a total loss of all communications due to failure of the wiring following a seismic event.

d. Communications Following a Seismic Event

Safe shutdown of the plant from the control room or the remote shutdown panel room can be achieved without the need for intraplant communication systems because all necessary shutdown controls and indications are located therein. The operator also can initiate evacuation instructions/alarm from the control room, if necessary, by use of any one of the three communication systems since the total loss of all three systems is considered unlikely. (it is also unlikely that the radio system will cause interferences with control instrumentation and equipment because this type of system has been widely used in previously approved plants and preoperational testing of all safety related systems together with the radio system will demonstrate that interferences are not caused.)

Insert B>

9.5.2.4 Inspection and Testing Requirements

The systems described above are conventional and have a history of successful operation at similar, existing plants. Most of these systems will be in routine use and maintenance, ensuring their availability. Infrequently used systems will be tested on a scheduled basis to ensure operability.

The radiation alert and fire alarm systems are periodically tested. These tests include adequacy of signal level, availability of power sources, and proper function of all circuits. See Section 14.2 for preoperational testing. ~~and Section 16.0 for periodic testing.~~

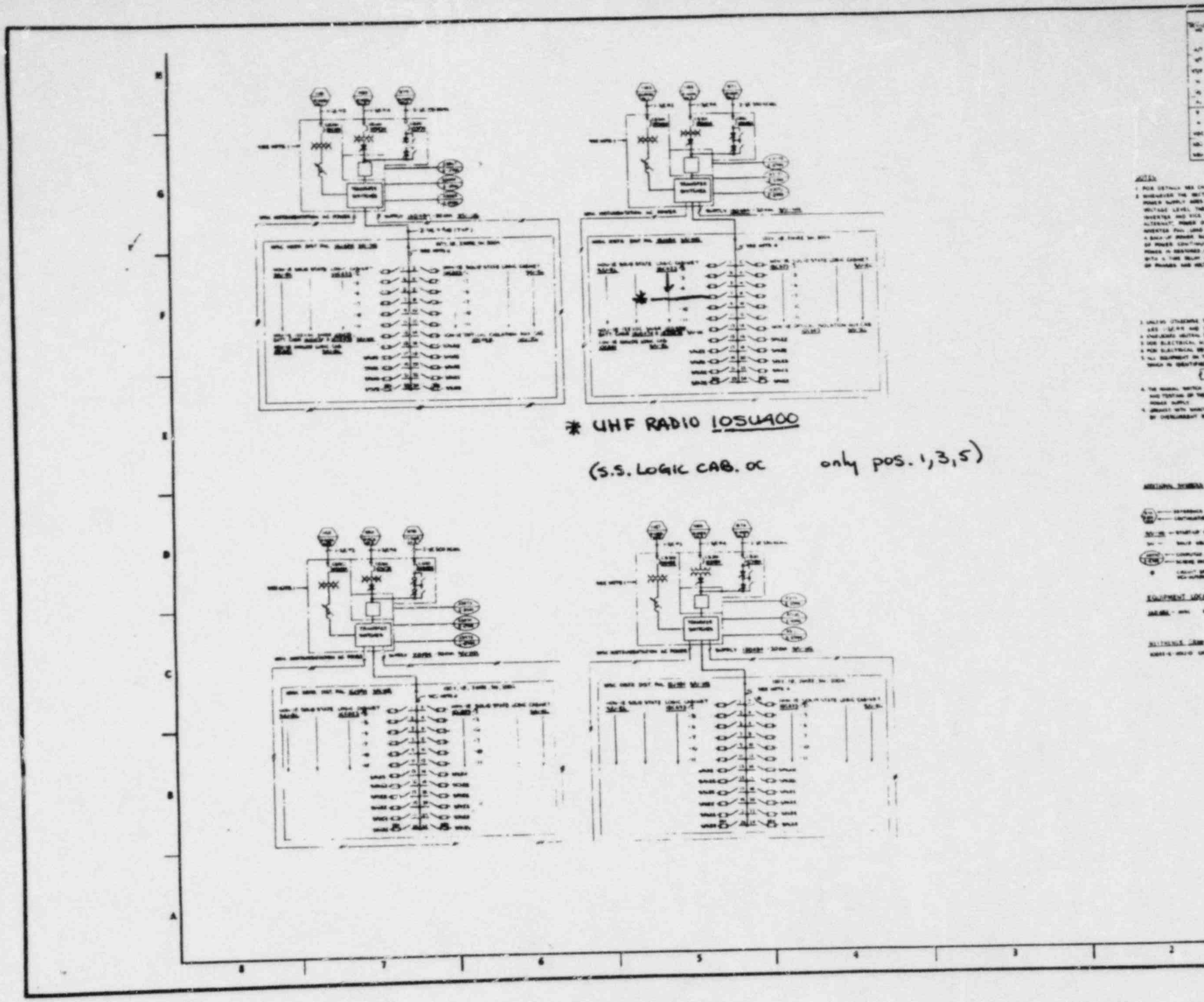
(BECHTEL NOTE: STANDARD TECHNICAL SPECIFICATION DOES NOT HAVE REQUIREMENT FOR TESTING OF EVACUATION ALARM TESTING.)

Insert A to Page 9.5-68 Q 430.69

and of the communication circuits' design and routing as branches which are independent of each other,

Insert B to Page 9.5-68 Q 430.69

In the event that communications need to be established between the control room or Remote Shutdown Panel room and other plant areas to achieve safe shutdown, an evaluation of communication systems available at each area revealed that at least one communication system component is located within or nearby each area. Table 9.5-17 lists the areas evaluated; the selected areas are based on the Fire Hazards Analysis presented in Appendix 9A which identifies areas containing safe shutdown equipment. Thus, assuming that there is a total loss of power to the communications system central equipment plus loss of the central equipment, communications can be maintained by use of hand-held radios (transceivers).



* UHF RADIO 10SU400
(S.S. LOGIC CAB. α only pos. 1,3,5)

QUESTION 430.70 (SECTION 9.5.3)

Identify the vital hazardous, and safety related areas where emergency lighting is needed for safe shutdown of the reactor and the evacuation of personnel in the event of an accident. Tabulate the lighting system provided in your design to accommodate those areas so identified. Include the degree of compliance to Standard Review Plan 9.5.1 regarding emergency lignting requirements in the event of a fire. (SRP 9.5.3, Parts I & II)

RESPONSE

Table 9.5-17 has been added to provide the requested information, reference response to question 430.71)

The areas identified in this table are those areas where operators and other station personnel are needed to perform, safe shutdown duties in the event of an accident. Access routes to the same areas are also included. The emergency lighting system for these routes are designed to comply with SRP Section 9.5.1 requirement for fixed self-contained lighting units.

1/1

QUESTION 430.71 (SECTION 9.5.3)

Expand the lighting section of the FSAR to include a discussion of how lighting will be provided for those areas listed in requests 430.65 and 430.70 above and illuminated by the dc emergency lighting system only, in the event of a prolonged loss of offsite ac power or provide the rationale why lighting is not required in these areas. Include in your discussion what, if any, other areas would require lighting during a sustained loss of ac power, and how it would be provided. (SRP 9.3.3, Parts I & II)

RESPONSE

Sections 9.5.3.2.2 and 9.5.3.3 have ~~has~~ been revised to describe lighting for areas described in Questions 430.65 and 430.70.

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safety-related equipment, and access routes to and between and egress routes from these areas.

may illuminance level

Table 9.5-17 lists the emergency lighting subsystems provided for areas where operators and other station personnel are needed to perform safe shutdown duties in the event of an accident. In the event of a prolonged loss of offsite power, each area will be illuminated by the self-contained, 8-hour battery pack units until the essential ac subsystem is manually reconnected to the standby diesel generator. For all other areas not listed on this table, at least one of the emergency lighting subsystems is provided in each area required for personnel safety and for access/egress purpose during an evacuation or fire. ← Insert A

9.5.3.3 Safety Evaluation

The lighting systems are not safety-related and are classified as non-Class 1E. However, components of lighting systems located above or adjacent to safety-related equipment are supported by Seismic Category II/I supports to protect safety-related equipment from damage during a seismic event. ← Insert B

The normal lighting system is designed such that offsite power supplies station lighting for normal plant operation, control and maintenance of equipment, and plant access routes.

> Insert C

The integrated design of the emergency lighting systems uses onsite power and/or self-contained battery packs to provide adequate emergency station lighting in all areas required for control and maintenance of safety-related equipment, firefighting, and the access routes to and between and egress routes from these areas.

Figure 9.5-20 is the single line drawing for the lighting distribution system.

Illumination levels provided in various areas either conform to or exceed those required in the IES handbook. ← Insert D

9.5.4 STANDBY DIESEL GENERATOR FUEL OIL STORAGE AND TRANSFER

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Insert A to Page 9.5-72

The manual reconnection of the essential ac lighting loads to the diesel generator sources are performed under administrative control in accordance with station operating procedures. Hand-held portable lighting units will also be available to station personnel to provide supplemental lighting when necessary during a prolonged loss of offsite power condition.

Insert B to Page 9.5-72

In addition the control room lighting system is seismically qualified as part of the ceiling design.

Insert C to Page 9.5-72

The essential ac lighting system is designed to provide lighting from standby diesel generator sources through Class IE unit substations and non-Class IE MCCs. Although the non-Class IE MCC are shed upon the occurrence of a LOCA, station operating procedures will require reconnection of the MCCs within 8 hours after the shedding. The non-Class IE MCCs are designed and constructed the same as for Class IE MCCs.

Insert D to Page 9.5-72

Station personnel will have access to hand-held portable lighting units when necessary for supplemental lighting.

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REPLACE EXISTING
TABLE 9.5-17 (AMEND. 4)
WITH THIS

TABLE 9.5 - 17

COMMUNICATIONS AND EMERGENCY LIGHTING SYSTEMS FOR SAFE SHUTDOWN AREAS

AREA / EQUIPMENT	COMMUNICATION FEATURES		EMERGENCY LIGHTING SYSTEM FEATURES	
	COMPONENTS AVAILABLE AT AREA	ESTIMATED MAXIMUM NOISE LEVEL AT AREA, dBA	APPROXIMATE FOOTCANDLES AT EQUIPMENT FROM- ESSENTIAL AC	8-HOUR BATTERY PACK
	LEGEND 1 = PA HANDSET 2 = PA SPEAKER 3 = TELEPHONE 4 = RADIO	LEGEND dBA = DECIBEL, A-WEIGHTED < = LESS THAN		
AUXILIARY BUILDING				
ROOM 3576, EL. 137 REMOTE SHUTDOWN PANEL	1, 2, 3, 4	<60	30	6
ROOM 5104, EL. 54 HPCI BATTERIES	2, 4	<30	3	1
ROOM 5105, EL. 54 RPS MG SET	1, 2, 4	< 80	3	1
ROOM 5106, EL. 54 CORRIDOR	2, 4	< 50	5	3
ROOM 5107, EL. 54 DIESEL FUEL OIL STORAGE TANKS AND PUMPS	2, 4	< 80	3	1
ROOM 5108, EL. 54 DIESEL FUEL OIL STORAGE TANKS AND PUMPS	2, 4	< 50	3	1

TABLE 9.5 - 17

COMMUNICATIONS AND EMERGENCY LIGHTING SYSTEMS FOR SAFE SHUTDOWN AREAS

	COMMUNICATION FEATURES		EMERGENCY LIGHTING SYSTEM FEATURES	
			APPROXIMATE FOOTCANDLES AT EQUIPMENT FROM-	
AREA / EQUIPMENT	COMPONENTS AVAILABLE AT AREA	ESTIMATED MAXIMUM NOISE LEVEL AT AREA, dBA	ESSENTIAL AC	8-HOUR BATTERY PACK
AUXILIARY BUILDING - CONTINUED	LEGEND 1 = PA HANDSET 2 = PA SPEAKER 3 = TELEPHONE 4 = RADIO	LEGEND dBA = DECIBEL, A-WEIGHTED < = LESS THAN		
ROOM 5109, EL. 54 DIESEL FUEL OIL STORAGE TANKS AND PUMPS	2, 4	<80	3	1
ROOM 5110, EL. 54 DIESEL FUEL OIL STORAGE TANKS AND PUMPS	2, 4	<80	3	1
ROOM 5111, EL. 54 CORRIDOR	4	<50	3	1
ROOM 5112, EL. 54 CORRIDOR	1 (IN AJACENT VESTIBULE), 2, 4	<50	5	1
ROOM 5128, EL. 54 RCIC BATTERIES	2, 4	<50	3	1
ROOM 5129, EL. 54 HPCI BATTERY CHARGER AND DC SWITCHGEAR	4.	<70	10	1

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TABLE 9.5 - 17

COMMUNICATIONS AND EMERGENCY LIGHTING SYSTEMS FOR SAFE SHUTDOWN AREAS

AREA / EQUIPMENT	COMMUNICATION FEATURES: COMPONENTS AVAILABLE AT AREA	COMMUNICATION FEATURES: ESTIMATED MAXIMUM NOISE LEVEL AT AREA, dBA	EMERGENCY LIGHTING SYSTEM FEATURES: APPROXIMATE FOOTCANDLES AT EQUIPMENT FROM - ESSENTIAL AC	EMERGENCY LIGHTING SYSTEM FEATURES: APPROXIMATE FOOTCANDLES AT EQUIPMENT FROM - 8-HOUR BATTERY PACK
AUXILIARY BUILDING - CONTINUED	LEGEND 1 = PA HANDSET 2 = PA SPEAKER 3 = TELEPHONE 4 = RADIO	LEGEND dBA = DECIBEL, A-WEIGHTED < = LESS THAN		
ROOM 5130, EL. 54 RCIC BATTERY CHARGER AND DC SWITCHGEAR	2, 4	< 70	3	1
ROOM 5208, EL. 77 D/G ROOM HVAC COOLER AND RECIRCULATION FAN	2, 4	< 100	3	1
ROOM 5209, EL. 77 D/G ROOM HVAC COOLER AND RECIRCULATION FAN	2, 4	< 100	3	1
ROOM 5210, EL. 77 D/G ROOM HVAC COOLER AND RECIRCULATION FAN	2, 4	< 100	3	1
ROOM 5211, EL. 77 D/G ROOM HVAC COOLER AND RECIRCULATION FAN	2, 4	< 100	3	1
ROOM 5217, EL. 77 CORRIDOR	1 (IN ADJACENT VESTIBULE), 2, 4	< 50	5	1

TABLE 9.5 - 17

COMMUNICATIONS AND EMERGENCY LIGHTING SYSTEMS FOR SAFE SHUTDOWN AREAS

AREA / EQUIPMENT	COMMUNICATION FEATURES: COMPONENTS AVAILABLE AT AREA	COMMUNICATION FEATURES: ESTIMATED MAXIMUM NOISE LEVEL AT AREA, dBA	EMERGENCY LIGHTING SYSTEM FEATURES: APPROXIMATE FOOTCANDLES AT EQUIPMENT FROM - ESSENTIAL AC	EMERGENCY LIGHTING SYSTEM FEATURES: APPROXIMATE FOOTCANDLES AT EQUIPMENT FROM - 8-HOUR BATTERY PACK
AUXILIARY BUILDING - CONTINUED	LEGEND 1 = PA HANDSET 2 = PA SPEAKER 3 = TELEPHONE 4 = RADIO	LEGEND dBA = DECIBEL, A-WEIGHTED < = LESS THAN		
ROOM 5301, EL. 102 CORRIDOR	2, 4	<50	5	1
ROOM 5302, EL. 102 CONTROL PANELS	2, 4	<65	3	1
ROOM 5304, EL. 102 D/G AND CONTROL PANELS	2, 4	<110	3	2
ROOM 5305, EL. 102 D/G AND CONTROL PANELS	2, 4	<110	3	2
ROOM 5306, EL. 102 D/G AND CONTROL PANELS	2, 4	<110	3	2
ROOM 5307, EL. 102 D/G AND CONTROL PANELS	2, 4	<110	3	2
ROOM 5313, EL. 102 CORRIDOR	1 (IN ADJACENT VESTIBULE), 2, 4	<50	4	4

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TABLE 9.5 - 17

COMMUNICATIONS AND EMERGENCY LIGHTING SYSTEMS FOR SAFE SHUTDOWN AREAS

AREA / EQUIPMENT	COMMUNICATION FEATURES: COMPONENTS AVAILABLE AT AREA	COMMUNICATION FEATURES: ESTIMATED MAXIMUM NOISE LEVEL AT AREA, dBA	EMERGENCY LIGHTING SYSTEM FEATURES: APPROXIMATE FOOTCANDLES AT EQUIPMENT FROM - ESSENTIAL AC	EMERGENCY LIGHTING SYSTEM FEATURES: APPROXIMATE FOOTCANDLES AT EQUIPMENT FROM - 8-HOUR BATTERY PACK
AUXILIARY BUILDING - CONTINUED	LEGEND 1 = PA HANDSET 2 = PA SPEAKER 3 = TELEPHONE 4 = RADIO	LEGEND dBA = DECIBEL, A-WEIGHTED < = LESS THAN		
ROOM 5401, EL. 124 CORRIDOR/ACCESS AREA	2, 4	<50	3	2
ROOM 5403, EL. 117-6 CONTROL PANELS	1, 2, 4	<65	3	2
ROOM 5404, EL. 124 CORRIDOR	1, 2, 4	<50	3	2
ROOM 5409, EL. 124 CORRIDOR	1, 2, 4	<50	3	2
ROOM 5410, EL. 124 D/G REMOTE CONTROL PANELS AND SEQUENCER	2, 4	<65	3	2
ROOM 5411, EL. 124 SWITCHGEAR, LOAD CENTERS, MCCs AND DIST. PANELS	2, 4	<70	3	1
ROOM 5412, EL. 124 D/G REMOTE CONTROL PANELS AND SEQUENCER	2, 4	<65	3	1
ROOM 5413, EL. 124 SWITCHGEAR, LOAD CENTERS, MCCs AND DIST. PANELS	2, 4	<70	3	1

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TABLE 9.5-17

COMMUNICATIONS AND EMERGENCY LIGHTING SYSTEMS FOR SAFE SHUTDOWN AREAS

AREA/EQUIPMENT	COMMUNICATION FEATURES: COMPONENTS AVAILABLE AT AREA	COMMUNICATION FEATURES: ESTIMATED MAXIMUM NOISE LEVEL AT AREA, dBA	EMERGENCY LIGHTING SYSTEM FEATURES: APPROXIMATE FOOTCANDLES AT EQUIPMENT FROM ESSENTIAL AC	EMERGENCY LIGHTING SYSTEM FEATURES: APPROXIMATE FOOTCANDLES AT EQUIPMENT FROM 8-HOUR BATTERY PACK
AUXILIARY BUILDING - CONTINUED	LEGEND 1 = PA HANDSET 2 = PA SPEAKER 3 = TELEPHONE 4 = RADIO	LEGEND dBA = DECIBEL, A-WEIGHTED < = LESS THAN		
ROOM 5914, EL. 124 D/G REMOTE CONTROL PANELS AND SEQUENCER	2, 4	<65	3	1
ROOM 5915, EL. 124 SWITCHGEAR, LOAD CENTERS, MCCs AND DIST. PANELS	2, 4	<70	3	1
ROOM 5916, EL. 124 D/G REMOTE CONTROL PANELS AND SEQUENCER	2, 4	<65	3	1
ROOM 5917, EL. 124 SWITCHGEAR, LOAD CENTERS, MCCs AND DIST. PANELS	2, 4	<70	3	1
ROOM 5447, EL. 124 FRVS CONTROL PANELS	2, 4	<65	3	1
ROOM 5448, EL. 124 INVERTERS AND DIST. PANELS	1 (IN ADJACENT VESTIBULE), 2, 4	<70	3	1
ROOM 5501, EL. 137 INVERTERS AND DIST. PANELS	2, 3 (IN ADJACENT ROOM), 4	<70	3	2

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TABLE 9.5-17

COMMUNICATIONS AND EMERGENCY LIGHTING SYSTEMS FOR SAFE SHUTDOWN AREAS

	COMMUNICATION FEATURES		EMERGENCY LIGHTING SYSTEM FEATURES	
			APPROXIMATE FOOTCANDLES AT EQUIPMENT FROM-	
AREA/EQUIPMENT	COMPONENTS AVAILABLE AT AREA	ESTIMATED MAXIMUM NOISE LEVEL AT AREA, dBA	ESSENTIAL AC	8-HOUR BATTERY PACK
AUXILIARY BUILDING - CONTINUED	LEGEND 1 = PA HANDSET 2 = PA SPEAKER 3 = TELEPHONE 4 = RADIO	LEGEND dBA = DECIBEL, A-WEIGHTED < = LESS THAN		
ROOM 5502, EL. 137 CORRIDOR	2, 3 (IN ADJACENT ROOM), 4	<50	8	2
ROOM 5510, EL. 137 CONTROL ROOM BOARDS AND CONSOLES	1, 2, 3, 4	<85	30	15
ROOM 5537, EL. 137 CORRIDOR	1 (IN AJACENT VESTIBULE), 2, 4	<50	3	2
ROOM 5538, EL. 137 BATTERY CHARGERS, FUSE BOX AND BATT. MONITOR	4	<65	3	2
ROOM 5539, EL. 137 BATTERIES	2, 4	<50	3	2
ROOM 5540, EL. 137 BATTERY CHARGERS, FUSE BOX AND BATT. MONITOR	4	<65	3	2
ROOM 5541, EL. 137 BATTERIES	4.	<50	3	2
ROOM 5542, EL. 137 [illegible]	2, 4	[illegible]	[illegible]	

TABLE 9.5 - 17

COMMUNICATIONS AND EMERGENCY LIGHTING SYSTEMS FOR SAFE SHUTDOWN AREAS

AREA / EQUIPMENT	COMMUNICATION FEATURES: COMPONENTS AVAILABLE AT AREA	COMMUNICATION FEATURES: ESTIMATED MAXIMUM NOISE LEVEL AT AREA, dBA	EMERGENCY LIGHTING SYSTEM FEATURES: APPROXIMATE FOOTCANDLES AT EQUIPMENT FROM - ESSENTIAL AC	EMERGENCY LIGHTING SYSTEM FEATURES: APPROXIMATE FOOTCANDLES AT EQUIPMENT FROM - 8-HOUR BATTERY PACK
AUXILIARY BUILDING - CONTINUED	LEGEND 1 = PA HANDSET 2 = PA SPEAKER 3 = TELEPHONE 4 = RADIO	LEGEND dBA = DECIBEL, A-WEIGHTED < = LESS THAN		
ROOM 5543, EL. 137 BATTERIES	2, 4	< 50	3	2
ROOM 5544, EL. 137 BATTERY CHARGERS, FUSE BOX AND BATT. MONITOR	2, 4	<65	3	2
ROOM 5545, EL. 137 BATTERIES	4	<50	3	2
ROOM 5602, EL. 155-3 CONTROL AREA WATER CHILLER, CONTROL ROOM AIR HANDLING UNIT AND RETURN AIR FAN, AND HVAC CONTROL PANEL	1 (LOCATED AWAY FROM LARGEST NOISE SOURCE), 2, 4	<110	3	2
ROOM 5604, EL. 163-6 CORRIDOR	1, 2, 4	<50	3	2
ROOM 5605, EL. 163-6 CONTROL PANELS	4	<65	3	2
ROOM 5611, EL. 163-6 CORRIDOR	2, 4	<50	3	1

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TABLE 9.5 - 17

COMMUNICATIONS AND EMERGENCY LIGHTING SYSTEMS FOR SAFE SHUTDOWN AREAS

AREA / EQUIPMENT	COMMUNICATION FEATURES: COMPONENTS AVAILABLE AT AREA	COMMUNICATION FEATURES: ESTIMATED MAXIMUM NOISE LEVEL AT AREA, dBA	EMERGENCY LIGHTING SYSTEM FEATURES: APPROXIMATE FOOTCANDLES AT EQUIPMENT FROM - ESSENTIAL AC	EMERGENCY LIGHTING SYSTEM FEATURES: APPROXIMATE FOOTCANDLES AT EQUIPMENT FROM - 8-HOUR BATTERY PACK
AUXILIARY BUILDING - CONTINUED	LEGEND 1 = PA HANDSET 2 = PA SPEAKER 3 = TELEPHONE 4 = RADIO	LEGEND dBA = DECIBEL, A-WEIGHTED < = LESS THAN		
ROOM 5606, EL. 163-6 SWITCHGEAR ROOM COOLERS AND D/G BATTERY ROOM EXHAUST FANS	2, 4	<90	5	2
ROOM 5607, EL. 163-6 INVERTER, DC SWITCHGEAR, BATTERY CHARGER AND FUSE BOX	4	<70	3	1
ROOM 5608, EL. 163-6 CORRIDOR	2 (IN AJACENT CORRIDOR), 4	<50	5	2
ROOM 5609, EL. 163-6 BATTERIES	4	<50	4	2
ROOM 5610, EL. 163-6 CORRIDOR	4	<50	9	1
ROOM 5612, EL. 163-6 CORRIDOR	4	<50	8	1
ROOM 5629, EL. 163-6 SWITCHGEAR ROOM COOLERS AND D/G BATTERY ROOM EXHAUST FANS	1, 2, 4	<90	5	2
ROOM 5630, EL. 163-6 CONTROL AREA WATER CHILLER, CONTROL ROOM AIR HANDLING	2, 4	<110	3	2

COMMUNICATIONS AND EMERGENCY LIGHTING SYSTEMS FOR SAFE SHUTDOWN AREAS

AREA / EQUIPMENT	COMMUNICATION FEATURES: COMPONENTS AVAILABLE AT AREA	COMMUNICATION FEATURES: ESTIMATED MAXIMUM NOISE LEVEL AT AREA, dBA	EMERGENCY LIGHTING SYSTEM FEATURES: APPROXIMATE FOOTCANDLES AT EQUIPMENT FROM - ESSENTIAL AC	EMERGENCY LIGHTING SYSTEM FEATURES: APPROXIMATE FOOTCANDLES AT EQUIPMENT FROM - 8-HOUR BATTERY PACK
AUXILIARY BUILDING - CONTINUED	LEGEND 1 = PA HANDSET 2 = PA SPEAKER 3 = TELEPHONE 4 = RADIO	LEGEND dBA = DECIBEL, A-WEIGHTED < = LESS THAN		
ROOM 5702, EL. 178 CORRIDOR	2 (IN AJACENT ROOM), 4	<70	5	2
ROOM 5709, EL. 178 CONTROL AND DIESEL AREA HVAC EQUIPMENT	1 (LOCATED AWAY FROM NOISEST EQUIPMENT), 2, 4	<105	3	2
REACTOR BUILDING				
ROOM 4104, EL. 54 CORE SPRAY PUMP AND UNIT COOLERS	1 (IN ADJACENT VESTIBULE), 2, 4	<106	15	2
ROOM 4102, EL. 54 TO 101 VALVES	2, 4	<70	3	1
ROOM 4105, EL. 54 CORE SPRAY PUMP AND UNIT COOLERS	1 (IN ADJACENT VESTIBULE), 2, 4	<106	15	2
ROOM 4107, EL. 54 RHR PUMP, JOCKEY PUMP, UNIT COOLERS, AND INSTRUMENT RACK	1 (IN ADJACENT ELECTRICAL ROOM), 2, 4	<108	3	1

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TABLE 9.5-17

COMMUNICATIONS AND EMERGENCY LIGHTING SYSTEMS FOR SAFE SHUTDOWN AREAS

AREA/EQUIPMENT	COMMUNICATION FEATURES: COMPONENTS AVAILABLE AT AREA	COMMUNICATION FEATURES: ESTIMATED MAXIMUM NOISE LEVEL AT AREA, dBA	EMERGENCY LIGHTING SYSTEM FEATURES: APPROXIMATE FOOTCANDLES AT EQUIPMENT FROM: ESSENTIAL AC	EMERGENCY LIGHTING SYSTEM FEATURES: APPROXIMATE FOOTCANDLES AT EQUIPMENT FROM: 8-HOUR BATTERY PACK
REACTOR BUILDING - CONTINUED	LEGEND 1 = PA HANDSET 2 = PA SPEAKER 3 = TELEPHONE 4 = RADIO	LEGEND dBA = DECIBEL, A-WEIGHTED < = LESS THAN		
ROOM 4108, EL. 54 RCIC-MCC AND INSTRUMENT RACKS	1, 2, 4	<65	10	2
ROOM 4109, EL. 54 RHR PUMP, HX AND UNIT COOLER	1 (IN ADJACENT ELECTRICAL ROOM), 2, 4	<108	3	2
ROOM 4110, EL. 54 RCIC PUMP, TURBINE, GLAND STEAM CONDENSER, VACUUM PUMP, CONDENSATE PUMP, JOCKEY PUMP AND UNIT COOLERS	2, 4	<110	3	2
ROOM 4111, EL. 54 HPCI PUMP, TURBINE, GLAND STEAM CONDENSER, VACUUM PUMP, JOCKEY PUMP, VALVES AND UNIT COOLERS	2, 4	<110	3	1
ROOM 4112, EL. 54 HPCI-MCC AND	1, 2, 4	<65	3	2

TABLE 9.5-17

COMMUNICATIONS AND EMERGENCY LIGHTING SYSTEMS FOR SAFE SHUTDOWN AREAS

	COMMUNICATION FEATURES		EMERGENCY LIGHTING SYSTEM FEATURES	
			APPROXIMATE FOOTCANDLES AT EQUIPMENT FROM-	
AREA/EQUIPMENT	COMPONENTS AVAILABLE AT AREA	ESTIMATED MAXIMUM NOISE LEVEL AT AREA, dBA	ESSENTIAL AC	8-HOUR BATTERY PACK
REACTOR BUILDING - CONTINUED	LEGEND 1 = PA HANDSET 2 = PA SPEAKER 3 = TELEPHONE 4 = RADIO	LEGEND dBA = DECIBEL, A-WEIGHTED < = LESS THAN		
ROOM 4113, EL. 54 RHR PUMP, HX AND UNIT COOLER	1 (IN ADJACENT ELECTRICAL ROOM), 2, 4	<108	3	2
ROOM 4114, EL. 54 RHR PUMP, JOCKEY PUMP, INSTRUMENT RACK, UNIT COOLERS	1 (IN ADJACENT ELECTRICAL ROOM), 2, 4	<108	5	2
ROOM 4116, EL. 54 CORE SPRAY PUMP AND UNIT COOLERS	1 (IN ADJACENT VESTIBULE), 2, 4	<106	25	2
ROOM 4118, EL. 54 CORE SPRAY PUMP AND UNIT COOLERS	1 (IN ADJACENT VESTIBULE), 2, 4	<106	5	2
ROOM 4201, EL. 77 MCCs	1 (IN ADJACENT ROOM), 2, 4	<65	3	2
ROOM 4202, EL. 77 INSTRUMENT RACKS	1, 2, 4	<100	3	2
ROOM 4203, EL. 77 INSTRUMENT RACK	2, 4	<65	3	2

TABLE 9.5-17

COMMUNICATIONS AND EMERGENCY LIGHTING SYSTEMS FOR SAFE SHUTDOWN AREAS

AREA/EQUIPMENT	COMMUNICATION FEATURES: COMPONENTS AVAILABLE AT AREA	COMMUNICATION FEATURES: ESTIMATED MAXIMUM NOISE LEVEL AT AREA, dBA	EMERGENCY LIGHTING SYSTEM FEATURES: APPROXIMATE FOOTCANDLES AT EQUIPMENT FROM ESSENTIAL AC	EMERGENCY LIGHTING SYSTEM FEATURES: APPROXIMATE FOOTCANDLES AT EQUIPMENT FROM 8-HOUR BATTERY PACK
REACTOR BUILDING-CONTINUED	LEGEND 1 = PA HANDSET 2 = PA SPEAKER 3 = TELEPHONE 4 = RADIO	LEGEND dBA = DECIBEL, A-WEIGHTED < = LESS THAN		
ROOM 4208, EL.77 RHR HX AND UNIT COOLER	2, 4	<85	3	2
ROOM 4209, EL. 77 VALVES AND INSTRUMENTS	1 (IN ADJACENT VESTIBULE), 2, 4	<100	3	1
ROOM 4210, EL.77 INSTRUMENTS	2, 4	<65	3	2
ROOM 4214, EL. 77 RHR HX	2, 4	<85	3	2
ROOM 4215, EL. 77 INSTRUMENT RACK	2, 4	<65	3	2
ROOM 4216, EL. 77 CORRIDOR	2, 4	<50	3	1
ROOM 4218, EL. 77 INSTRUMENT RACK	1, 2, 4	<65	3	2
ROOM 4219, EL. 77 INSTRUMENTS	2, 4	<65	3	2

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TABLE 9.5 - 17

COMMUNICATIONS AND EMERGENCY LIGHTING SYSTEMS FOR SAFE SHUTDOWN AREAS

AREA / EQUIPMENT	COMMUNICATION FEATURES: COMPONENTS AVAILABLE AT AREA	COMMUNICATION FEATURES: ESTIMATED MAXIMUM NOISE LEVEL AT AREA, dBA	EMERGENCY LIGHTING SYSTEM FEATURES: APPROXIMATE FOOTCANDLES AT EQUIPMENT FROM - ESSENTIAL AC	EMERGENCY LIGHTING SYSTEM FEATURES: APPROXIMATE FOOTCANDLES AT EQUIPMENT FROM - 8-HOUR BATTERY PACK
REACTOR BUILDING - CONTINUED	LEGEND 1 = PA HANDSET 2 = PA SPEAKER 3 = TELEPHONE 4 = RADIO	LEGEND dBA = DECIBEL, A-WEIGHTED < = LESS THAN		
ROOM 4301, EL. 102 CORRIDOR	1, 2, 4	<65	3	2
ROOM 4303, EL. 102 MCC	1, 2, 4	<65	3	2
ROOM 4307, EL. 102 SACS PUMPS AND HXs, CONTROL PANELS, VALVES AND UNIT COOLERS	2, 4	<106	3	2
ROOM 4309, EL. 102 SACS PUMPS AND HXs, CONTROL PANELS, VALVES AND UNIT COOLERS	1 (LOCATED AWAY FROM NOISIEST EQUIPMENT), 2, 4	<106	3	1
ROOM 4315, EL. 102 CORRIDOR	2 (NEARBY), 4	<65	3	2
ROOM 4327, EL. 102 HPCI VALVES	2, 4	<80	3	2
ROOM 4329, EL. 102 RHR VALVES	2, 4	<80	3	2
ROOM 4319, EL. 102 RCIC VALVE	2, 4	<80	3	2

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TABLE 9.5 - 17

COMMUNICATIONS AND EMERGENCY LIGHTING SYSTEMS FOR SAFE SHUTDOWN AREAS

AREA / EQUIPMENT	COMMUNICATION FEATURES: COMPONENTS AVAILABLE AT AREA	COMMUNICATION FEATURES: ESTIMATED MAXIMUM NOISE LEVEL AT AREA, dBA	EMERGENCY LIGHTING SYSTEM FEATURES: APPROXIMATE FOOTCANDLES AT EQUIPMENT FROM - ESSENTIAL AC	EMERGENCY LIGHTING SYSTEM FEATURES: APPROXIMATE FOOTCANDLES AT EQUIPMENT FROM - 8-HOUR BATTERY PACK
INTAKE STRUCTURE	LEGEND 1 = PA HANDSET 2 = PA SPEAKER 3 = TELEPHONE 4 = RADIO	LEGEND dBA = DECIBEL, A-WEIGHTED < = LESS THAN		
ROOM 107, EL. 79-8 VALVES	2, 4	< 80	3	2
ROOM 110, EL. 79-8 VALVES	2, 4	< 80	3	2
ROOM 203, EL. 93 MCCs	1 (IN ADJACENT ROOM), 2, 4	< 65	10	2
ROOM 204, EL. 93 PUMPS, VALVES AND CONTROL PANELS	1 (IN ADJACENT ROOM), 2, 4	< 108	5	2
ROOM 207, EL. 93 MCCs	1, 2 (IN ADJACENT ROOM), 3, 4	< 65	10	2
ROOM 208, EL. 93 PUMPS, VALVES AND CONTROL PANELS	1, 2 (IN ADJACENT ROOM), 4	< 108	5	2
EL. 107 TRAVELING SCREEN CONTROL PANELS	2, 4	< 80	10	1
EL. 114 TRAVELING SCREEN [illegible]	2, 4	< 70	10	2

TABLE 9.5 - 17

COMMUNICATIONS AND EMERGENCY LIGHTING SYSTEMS FOR SAFE SHUTDOWN AREAS

AREA / EQUIPMENT	COMMUNICATION FEATURES		EMERGENCY LIGHTING SYSTEM FEATURES	
	COMPONENTS AVAILABLE AT AREA	ESTIMATED MAXIMUM NOISE LEVEL AT AREA, dBA	APPROXIMATE FOOTCANDLES AT EQUIPMENT FROM - ESSENTIAL AC	8-HOUR BATTERY PACK
INTAKE STRUCTURE - CONTINUED	LEGEND 1 = PA HANDSET 2 = PA SPEAKER 3 = TELEPHONE 4 = RADIO	LEGEND dBA = DECIBEL, A-WEIGHTED < = LESS THAN		
ROOM 305, 306, EL. 122 FANS	1, 2, 4	< 90	10	1
ROOM 311, 312, EL. 122 FANS	1, 2, 4	<90	10	1

QUESTION 430.72 (SECTION 9.5.3)

Provide a discussion on the protective measures taken to assure a functionally operable lighting system, including considerations given to component failures, loss of ac power, and the severing of lighting cables as a result of a accident or fire. (SRP 9.5.3, Parts I & II)

RESPONSE

The protective measures taken to ensure a functionally operable lighting system include:

a. Diversity in power sources such that a loss of one source does not disable more than one lighting subsystem.

b. Provision for emergency lighting as backup to the normal ac lighting system such that sufficient illumination is maintained during a loss of the normal lighting system due to component failure or loss of ac power.

c. Use of dedicated raceways and/or embedded conduits for branch circuits such that a severing of lighting cables as a result of a accident or fire affects only a portion of the lighting system. In the event the power supply cables in a particular area are severed instead of branch circuit cables, only a portion of the the lighting system is affected because of the diversity provided in power sourxces, lighting subsystems and lighting components. ← Insert C from below

d. Periodic testing and maintenance of the emergency lighting system to ensure functional operability. The frequency of testing will be specified in the station preventive maintenance procedure which will be developed prior to fuel load.

Insert to C.

Should branch circuits be severed as a result of a fire, the 8-hour battery pack units will function to provide lighting

QUESTION 430.73 (SECTION 9.5.3)

You state in Sections 9.5.3.1 and 9.5.3.3 of the FSAR that illumination levels provided in the various areas of the plant either conform to or exceed the required in the Illumination Engineering Society Handbook. This statement is too general particularly for emergency lighting. The staff has determined that a minimum of 10 foot candles at the work station is required to adequately control, monitor and/or maintain safety related equipment during accident and transient conditions and a minimum of 5 foot candles in the corridors which provide access to and egress from these areas. For those safety related areas listed in requests 430.65 and 430.70 above and illuminated by the dc lighting systems only verify that the minimum of 10 foot candles at the work station is being met. Also verify that the 10 foot candles minimum at the work station is being met by those safety related areas illuminated by the ac emergency system. Verify that the access and egress corridors are illuminated by a minimum of 5 foot candles. Modify your design as necessary. (SRP 9.5.3, Parts I & II).

RESPONSE

The Illuminating Engineering Society (IES) lighting handbook, 1981, does not specifically recommend illuminance levels under emergency lighting condition but it does state that "Because of the very low illuminances provided by emergency lighting and because only escape routes need to be lighted, lux (footcandle) and watts per square meter (foot) are not suitable measuring criteria; adequate visibility is really the only suitable [illegible] design does conform to or exceed the IES handbook design requirements with regard to escape route identification, illumination of exit signs, egress route illumination and power supply systems. Thus, the HCGS "emergency lighting" design does provide adequate illumination to ensure that escape routes can be effectively identified and used when the normal lighting system is unavailable, all in accordance with IES recommendations.

With regard to the staff position on illuminance levels for performing tasks under emergency lighting condition, Table 9.5-17 (see Question 430.70) identifies the illuminance levels, footcandles, available in the safe shutdown areas depending on the availability of the lighting subsystems. At least 10 footcandles are provided in the control room with either the essential ac or the 8-hour battery pack subsystem functional and at least 10 foot candles are provided in the remote shutdown panel room during the emergency lighting condition. The remaining two areas, diesel generator remote control panel rooms and the Class 1E switchgear rooms, contain backup electrical controls and indicators for the remote shutdown panel (RSP) and these areas are not required to be manned for

Replace with insert A

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safe shutdown. However, in the event that the controls and indicators need to be verified during safe shutdown from the RSR sufficient illumination is provided in these areas.

Response 430.73

Insert A

For all other areas listed on this table where the illuminance ~~levels~~ does not meet or exceed the staff levels,

lighting units be available to personnel performing tasks during the emergency lighting condition. The illuminance levels shown are approximate levels that can be expected at the equipment.

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QUESTION 430.74 (SECTION 9.5.3)

Section 9.5.3.2 of the FSAR describes the emergency lighting system which is composed of three subsystems. They are the 125 V dc, essential ac and eight hour battery lighting systems. A number of areas in the plant are served by one or more of these systems. All these systems are classified non-Class 1E and receive power from non-Class 1E sources, i.e., non-Class 1E station batteries for the dc lighting and the non-Class 1E MCC's fed from the emergency diesel generator for the ac lighting. Even though the essential ac lighting system may be powered from the diesel generators, it must be manually connected in the event of a LOCA. Assuming a failure or non-availability of any or all of these systems following a design basis event or a LOCA it is possible that portions of the plant particularly the control room may be without sufficient lighting or without lighting for an extended period of time during this design basis event. This is unacceptable. It is our position that adequate lighting be provided to all vital, hazardous, and safety-related areas needed for the safe shutdown of the reactor and the evacuation of personnel in the event of an accident. Modify your design to provide this necessary lighting. (SRP 9.5.3, Parts I and II)

RESPONSE

Although the power sources to the emergency lighting subsystem are non-Class 1E, except for the diesel generator source, it is unlikely that portions of the plant will be without sufficient lighting or without lighting for an extended period of time during a design basis event of seismic or LOCA. This assessment is justified as follows:

a. Control Room Lighting

The control room is served by three lighting systems-normal ac, essential ac and 8-hour battery pack systems. All the lighting components in this room are seismically analyzed and/or mounted to meet the Seismic Category II/I requirement (see Table 3.2-1). In the event that the essential ac system cannot be reconnected manually from the control room to the diesel generator source after the DBE, the self-contained 8-hour battery packs on selected lighting fixtures will automatically function to provide sufficient lighting. These self-contained power supplies have individual test feature and status indicating lights such that the operator can easily observe the operational status of each lighting fixture. Because periodic testing and maintenance ~~is~~ A performed on these 8-hour battery packs, it is unlikely

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that there will be a complete failure of this emergency lighting subsystem.

b. Lighting for Other Areas

The lighting system for areas other than the control room is comprised of normal ac and one or more of the emergency lighting subsystems. The lighting components in safety related areas are mounted to meet the Seismic Category II/I requirement (see Table 3.2-1) and the self-contained 8-hour battery pack units have been seismically qualified. Areas required for safe shutdown have essential ac and 8-hour battery pack subsystems and areas for evacuation of personnel have as a minimum, the 8-hour battery pack subsystem for emergency lighting. Because the 8-hour battery pack units are subject to periodic testing and maintenance, this lighting subsystem will function to provide sufficient illumination until normal or other emergency lighting subsystem(s) is restored. In addition, the lighting system components are diverse in location and are powered from different power sources such that the possibility of insufficient lighting for an extended period of time is unlikely.

c. Lighting Following Seismic or LOCA Event

The non-Class 1E motor control centers (MCCs) which supply power to the essential ac lighting system are designed and constructed the same as for Class 1E MCCs. Therefore they are capable of withstanding a seismic event. After the LOCA event the manual reconnection of the essential ac lighting loads to the diesel generator sources will be performed ~~under administrative control~~ in accordance with station operating procedures which will require the reconnection be made no later than 8 hours after the MCC disconnection. Because the lighting system can be supplied from onsite power sources and ~~the~~ some lighting components are seismically analyzed or mounted, it is concluded that there will not be a total loss of lighting. However, in the event of loss of or insufficent lighting in some areas, station personnel will have access to hand-held portable lighting units.

(the 8 hour battery pack has successfully been seismically tested)

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safety-related equipment, and access routes to and between and egress routes from these areas.

may — illuminance level

Table 9.5-17 lists the emergency lighting subsystems provided for areas where operators and other station personnel are needed to perform safe shutdown duties in the event of an accident. In the event of a prolonged loss of offsite power, each area will be illuminated by the self-contained, 8-hour battery pack units until the essential ac subsystem is manually reconnected to the standby diesel generator. For all other areas not listed on this table, at least one of the emergency lighting subsystems is provided in each area required for personnel safety and for access/egress purpose during an evacuation or fire. ← Insert A

9.5.3.3 Safety Evaluation

The lighting systems are not safety-related and are classified as non-Class 1E. However, components of lighting systems located above or adjacent to safety-related equipment are supported by Seismic Category II/I supports to protect safety-related equipment from damage during a seismic event. ← Insert B

The normal lighting system is designed such that offsite power supplies station lighting for normal plant operation, control and maintenance of equipment, and plant access routes.

> Insert C

The integrated design of the emergency lighting systems uses onsite power and/or self-contained battery packs to provide adequate emergency station lighting in all areas required for control and maintenance of safety-related equipment, firefighting, and the access routes to and between and egress routes from these areas.

Figure 9.5-20 is the single line drawing for the lighting distribution system.

Illumination levels provided in various areas either conform to or exceed those required in the IES handbook. ← Insert D

9.5.4 STANDBY DIESEL GENERATOR FUEL OIL STORAGE AND TRANSFER

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Insert [illegible]

The manual reconnection of the essential ac lighting loads to the diesel generator sources are performed ~~under administrative control~~ in accordance with station operating procedures. Hand-held portable lighting units will also be available to station personnel to provide supplemental lighting when necessary during a prolonged loss of offsite power condition.

Insert B to Page 9.5-72

In addition the control room lighting system is seismically qualified as part of the ceiling design.

Insert C to Page 9.5-72

The essential ac lighting system is designed to provide lighting from standby diesel generator sources through Class 1E unit substations and non-Class 1E MCCs. Although the non-Class 1E MCC are shed upon the ~~occurrence~~ loss of ~~a LOCA~~ normal ~~and~~ station ~~auxiliary~~ AC power, station operating procedures will require reconnection of the MCCs within 8 hours after the shedding. The non-Class 1E MCCs are designed and constructed the same as for Class 1E MCCs.

Insert D to Page 9.5-72

Station personnel will have access to hand-held portable lighting units when necessary for supplemental lighting.

REPLACE EXISTING
TABLE 9.5-17 (AMEND. 4)
WITH THIS

TABLE 9.5-17

COMMUNICATIONS AND EMERGENCY LIGHTING SYSTEMS FOR SAFE SHUTDOWN AREAS

AREA / EQUIPMENT	COMMUNICATION FEATURES: COMPONENTS AVAILABLE AT AREA	COMMUNICATION FEATURES: ESTIMATED MAXIMUM NOISE LEVEL AT AREA, dBA	EMERGENCY LIGHTING SYSTEM FEATURES: APPROXIMATE FOOTCANDLES AT EQUIPMENT FROM ESSENTIAL AC	EMERGENCY LIGHTING SYSTEM FEATURES: APPROXIMATE FOOTCANDLES AT EQUIPMENT FROM 8-HOUR BATTERY PACK
	LEGEND 1 = PA HANDSET 2 = PA SPEAKER 3 = TELEPHONE 4 = RADIO	LEGEND dBA = DECIBEL, A-WEIGHTED < = LESS THAN		
AUXILIARY BUILDING				
ROOM 3576, EL. 137 REMOTE SHUTDOWN PANEL	1, 2, 3, 4	<60	30	6
ROOM 5104, EL. 54 HPCI BATTERIES	2, 4	<30	3	1
ROOM 5105, EL. 54 RPS MG SET	1, 2, 4	<80	3	1
ROOM 5106, EL. 54 CORRIDOR	2, 4	<50	5	3
ROOM 5107, EL. 54 DIESEL FUEL OIL STORAGE TANKS AND PUMPS	2, 4	<80	3	1
ROOM 5108, EL. 54 DIESEL FUEL OIL STORAGE TANKS AND PUMPS	2, 4	<50	3	1

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TABLE 9.5-17

COMMUNICATIONS AND EMERGENCY LIGHTING SYSTEMS FOR SAFE SHUTDOWN AREAS

AREA / EQUIPMENT	COMMUNICATION FEATURES: COMPONENTS AVAILABLE AT AREA	COMMUNICATION FEATURES: ESTIMATED MAXIMUM NOISE LEVEL AT AREA, dBA	EMERGENCY LIGHTING SYSTEM FEATURES: APPROXIMATE FOOTCANDLES AT EQUIPMENT FROM ESSENTIAL AC	EMERGENCY LIGHTING SYSTEM FEATURES: APPROXIMATE FOOTCANDLES AT EQUIPMENT FROM 8-HOUR BATTERY PACK
AUXILIARY BUILDING - CONTINUED	LEGEND 1 = PA HANDSET 2 = PA SPEAKER 3 = TELEPHONE 4 = RADIO	LEGEND dBA = DECIBEL, A-WEIGHTED < = LESS THAN		
ROOM 5109, EL. 54 DIESEL FUEL OIL STORAGE TANKS AND PUMPS	2, 4	<80	3	1
ROOM 5110, EL. 54 DIESEL FUEL OIL STORAGE TANKS AND PUMPS	2, 4	<80	3	1
ROOM 5111, EL. 54 CORRIDOR	4	<50	3	1
ROOM 5112, EL. 54 CORRIDOR	1 (IN AJACENT VESTIBULE), 2, 4	<50	5	1
ROOM 5128, EL. 54 RCIC BATTERIES	2, 4	<50	3	1
ROOM 5129, EL. 54 HPCI BATTERY CHARGER AND DC SWITCHGEAR	4.	<70	10	1

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TABLE 9.5-17

COMMUNICATIONS AND EMERGENCY LIGHTING SYSTEMS FOR SAFE SHUTDOWN AREAS

AREA / EQUIPMENT	COMMUNICATION FEATURES: COMPONENTS AVAILABLE AT AREA	COMMUNICATION FEATURES: ESTIMATED MAXIMUM NOISE LEVEL AT AREA, dBA	EMERGENCY LIGHTING SYSTEM FEATURES: APPROXIMATE FOOTCANDLES AT EQUIPMENT FROM ESSENTIAL AC	EMERGENCY LIGHTING SYSTEM FEATURES: APPROXIMATE FOOTCANDLES AT EQUIPMENT FROM 8-HOUR BATTERY PACK
AUXILIARY BUILDING - CONTINUED	LEGEND 1 = PA HANDSET 2 = PA SPEAKER 3 = TELEPHONE 4 = RADIO	LEGEND dBA = DECIBEL, A-WEIGHTED < = LESS THAN		
ROOM 5130, EL. 54 RCIC BATTERY CHARGER AND DC SWITCHGEAR	2, 4	< 70	3	1
ROOM 5208, EL. 77 D/G ROOM HVAC COOLER AND RECIRCULATION FAN	2, 4	< 100	3	1
ROOM 5209, EL. 77 D/G ROOM HVAC COOLER AND RECIRCULATION FAN	2, 4	< 100	3	1
ROOM 5210, EL. 77 D/G ROOM HVAC COOLER AND RECIRCULATION FAN	2, 4	< 100	3	1
ROOM 5211, EL. 77 D/G ROOM HVAC COOLER AND RECIRCULATION FAN	2, 4	< 100	3	1
ROOM 5217, EL. 77 CORRIDOR	1 (IN ADJACENT VESTIBULE), 2, 4	< 50	5	1

TABLE 9.5-17

COMMUNICATIONS AND EMERGENCY LIGHTING SYSTEMS FOR SAFE SHUTDOWN AREAS

AREA / EQUIPMENT	COMMUNICATION FEATURES: COMPONENTS AVAILABLE AT AREA	COMMUNICATION FEATURES: ESTIMATED MAXIMUM NOISE LEVEL AT AREA, dBA	EMERGENCY LIGHTING SYSTEM FEATURES: APPROXIMATE FOOTCANDLES AT EQUIPMENT FROM - ESSENTIAL AC	EMERGENCY LIGHTING SYSTEM FEATURES: APPROXIMATE FOOTCANDLES AT EQUIPMENT FROM - 8-HOUR BATTERY PACK
AUXILIARY BUILDING - CONTINUED	LEGEND 1 = PA HANDSET 2 = PA SPEAKER 3 = TELEPHONE 4 = RADIO	LEGEND dBA = DECIBEL, A-WEIGHTED < = LESS THAN		
ROOM 5301, EL. 102 CORRIDOR	2, 4	<50	5	1
ROOM 5302, EL. 102 CONTROL PANELS	2, 4	<65	3	1
ROOM 5304, EL. 102 D/G AND CONTROL PANELS	2, 4	<110	3	2
ROOM 5305, EL. 102 D/G AND CONTROL PANELS	2, 4	<110	3	2
ROOM 5306, EL. 102 D/G AND CONTROL PANELS	2, 4	<110	3	2
ROOM 5307, EL. 102 D/G AND CONTROL PANELS	2, 4	<110	3	2
ROOM 5315, EL. 102 CORRIDOR	1 (IN ADJACENT VESTIBULE), 2, 4	<50	4	4

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TABLE 9.5 - 17

COMMUNICATIONS AND EMERGENCY LIGHTING SYSTEMS FOR SAFE SHUTDOWN AREAS

AREA/EQUIPMENT	COMMUNICATION FEATURES: COMPONENTS AVAILABLE AT AREA	COMMUNICATION FEATURES: ESTIMATED MAXIMUM NOISE LEVEL AT AREA, dBA	EMERGENCY LIGHTING SYSTEM FEATURES: APPROXIMATE FOOTCANDLES AT EQUIPMENT FROM - ESSENTIAL AC	EMERGENCY LIGHTING SYSTEM FEATURES: APPROXIMATE FOOTCANDLES AT EQUIPMENT FROM - 8-HOUR BATTERY PACK
AUXILIARY BUILDING - CONTINUED	LEGEND 1 = PA HANDSET 2 = PA SPEAKER 3 = TELEPHONE 4 = RADIO	LEGEND dBA = DECIBEL, A-WEIGHTED < = LESS THAN		
ROOM 5401, EL. 124 CORRIDOR/ACCESS AREA	2, 4	<50	3	2
ROOM 5403, EL. 117-6 CONTROL PANELS	1, 2, 4	<65	3	2
ROOM 5404, EL. 124 CORRIDOR	1, 2, 4	<50	3	2
ROOM 5409, EL. 124 CORRIDOR	1, 2, 4	<50	3	2
ROOM 5410, EL. 124 D/G REMOTE CONTROL PANELS AND SEQUENCER	2, 4	<65	3	2
ROOM 5411, EL. 124 SWITCHGEAR, LOAD CENTERS, MCCs AND DIST. PANELS	2, 4	<70	3	1
ROOM 5412, EL. 124 D/G REMOTE CONTROL PANELS AND SEQUENCER	2, 4	<65	3	1
ROOM 5413, EL. 124 SWITCHGEAR, LOAD CENTERS,	2, 4	<70	3	1

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TABLE 9.5 - 17

COMMUNICATIONS AND EMERGENCY LIGHTING SYSTEMS FOR SAFE SHUTDOWN AREAS

AREA / EQUIPMENT	COMMUNICATION FEATURES		EMERGENCY LIGHTING SYSTEM FEATURES: APPROXIMATE FOOTCANDLES AT EQUIPMENT FROM-	
	COMPONENTS AVAILABLE AT AREA	ESTIMATED MAXIMUM NOISE LEVEL AT AREA, dBA	ESSENTIAL AC	8-HOUR BATTERY PACK
AUXILIARY BUILDING - CONTINUED	LEGEND 1 = PA HANDSET 2 = PA SPEAKER 3 = TELEPHONE 4 = RADIO	LEGEND dBA = DECIBEL, A-WEIGHTED < = LESS THAN		
ROOM 5414, EL. 124 D/G REMOTE CONTROL PANELS AND SEQUENCER	2, 4	<65	3	1
ROOM 5415, EL. 124 SWITCHGEAR, LOAD CENTERS, MCCs AND DIST. PANELS	2, 4	<70	3	1
ROOM 5416, EL. 124 D/G REMOTE CONTROL PANELS AND SEQUENCER	2, 4	<65	3	1
ROOM 5417, EL. 124 SWITCHGEAR, LOAD CENTERS, MCCs AND DIST. PANELS	2, 4	<70	3	1
ROOM 5447, EL. 124 FRVS CONTROL PANELS	2, 4	<65	3	1
ROOM 5448, EL. 124 INVERTERS AND DIST. PANELS	1 (IN ADJACENT VESTIBULE), 2, 4	<70	3	1
ROOM 5501, EL. 137 INVERTERS AND DIST. PANELS	2, 3 (IN ADJACENT ROOM), 4	<70	3	2

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TABLE 9.5-17

COMMUNICATIONS AND EMERGENCY LIGHTING SYSTEMS FOR SAFE SHUTDOWN AREAS

	COMMUNICATION FEATURES		EMERGENCY LIGHTING SYSTEM FEATURES	
			APPROXIMATE FOOTCANDLES AT EQUIPMENT FROM-	
AREA / EQUIPMENT	COMPONENTS AVAILABLE AT AREA	ESTIMATED MAXIMUM NOISE LEVEL AT AREA, dBA	ESSENTIAL AC	8-HOUR BATTERY PACK
AUXILIARY BUILDING - CONTINUED	LEGEND 1 = PA HANDSET 2 = PA SPEAKER 3 = TELEPHONE 4 = RADIO	LEGEND dBA = DECIBEL, A-WEIGHTED < = LESS THAN		
ROOM 5502, EL. 137 CORRIDOR	2, 3 (IN ADJACENT ROOM), 4	<50	8	2
ROOM 5510, EL. 137 CONTROL ROOM BOARDS AND CONSOLES	1, 2, 3, 4	<85	30	15
ROOM 5537, EL. 137 CORRIDOR	1 (IN AJACENT VESTIBULE), 2, 4	<50	3	2
ROOM 5538, EL. 137 BATTERY CHARGERS, FUSE BOX AND BATT. MONITOR	4	<65	3	2
ROOM 5539, EL. 137 BATTERIES	2, 4	<50	3	2
ROOM 5540, EL. 137 BATTERY CHARGERS, FUSE BOX AND BATT. MONITOR	4	<65	3	2
ROOM 5541, EL. 137 BATTERIES	4.	<50	3	2
ROOM 5542, EL. 137	2, 4	[illegible]	3	[illegible]

TABLE 9.5 - 17

COMMUNICATIONS AND EMERGENCY LIGHTING SYSTEMS FOR SAFE SHUTDOWN AREAS

AREA / EQUIPMENT	COMMUNICATION FEATURES: COMPONENTS AVAILABLE AT AREA	COMMUNICATION FEATURES: ESTIMATED MAXIMUM NOISE LEVEL AT AREA, dBA	EMERGENCY LIGHTING SYSTEM FEATURES: APPROXIMATE FOOTCANDLES AT EQUIPMENT FROM: ESSENTIAL AC	EMERGENCY LIGHTING SYSTEM FEATURES: APPROXIMATE FOOTCANDLES AT EQUIPMENT FROM: 8-HOUR BATTERY PACK
AUXILIARY BUILDING - CONTINUED	LEGEND 1 = PA HANDSET 2 = PA SPEAKER 3 = TELEPHONE 4 = RADIO	LEGEND dBA = DECIBEL, A-WEIGHTED < = LESS THAN		
ROOM 5543, EL. 137 BATTERIES	2, 4	<50	3	2
ROOM 5544, EL. 137 BATTERY CHARGERS, FUSE BOX AND BATT. MONITOR	2, 4	<65	3	2
ROOM 5545, EL. 137 BATTERIES	4	<50	3	2
ROOM 5602, EL. 155-3 CONTROL AREA WATER CHILLER, CONTROL ROOM AIR HANDLING UNIT AND RETURN AIR FAN, AND HVAC CONTROL PANEL	1 (LOCATED AWAY FROM LARGEST NOISE SOURCE), 2, 4	<110	3	2
ROOM 5604, EL. 163-6 CORRIDOR	1, 2, 4	<50	3	2
ROOM 5605, EL. 163-6 CONTROL PANELS	4	<65	3	2
ROOM 5611, EL. 163-6 CORRIDOR	2, 4	<50	3	1

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TABLE 9.5-17

COMMUNICATIONS AND EMERGENCY LIGHTING SYSTEMS FOR SAFE SHUTDOWN AREAS

AREA/EQUIPMENT	COMMUNICATION FEATURES: COMPONENTS AVAILABLE AT AREA	COMMUNICATION FEATURES: ESTIMATED MAXIMUM NOISE LEVEL AT AREA, dBA	EMERGENCY LIGHTING SYSTEM FEATURES: APPROXIMATE FOOTCANDLES AT EQUIPMENT FROM ESSENTIAL AC	EMERGENCY LIGHTING SYSTEM FEATURES: APPROXIMATE FOOTCANDLES AT EQUIPMENT FROM 8-HOUR BATTERY PACK
AUXILIARY BUILDING - CONTINUED	LEGEND 1 = PA HANDSET 2 = PA SPEAKER 3 = TELEPHONE 4 = RADIO	LEGEND dBA = DECIBEL, A-WEIGHTED < = LESS THAN		
ROOM 5606, EL. 163-6 SWITCHGEAR ROOM COOLERS AND D/G BATTERY ROOM EXHAUST FANS	2, 4	<90	5	2
ROOM 5607, EL. 163-6 INVERTER, DC SWITCHGEAR, BATTERY CHARGER AND FUSE BOX	4	<70	3	1
ROOM 5608, EL. 163-6 CORRIDOR	2 (IN AJACENT CORRIDOR), 4	<50	5	2
ROOM 5609, EL. 163-6 BATTERIES	4	<50	4	2
ROOM 5610, EL. 163-6 CORRIDOR	4	<50	9	1
ROOM 5612, EL. 163-6 CORRIDOR	4	<50	8	1
ROOM 5629, EL. 163-6 SWITCHGEAR ROOM COOLERS AND D/G BATTERY ROOM EXHAUST FANS	1, 2, 4	<90	5	2
ROOM 5630, EL. 163-6	2, 4			

TABLE 9.5-17

COMMUNICATIONS AND EMERGENCY LIGHTING SYSTEMS FOR SAFE SHUTDOWN AREAS

AREA/EQUIPMENT	COMMUNICATION FEATURES: COMPONENTS AVAILABLE AT AREA	COMMUNICATION FEATURES: ESTIMATED MAXIMUM NOISE LEVEL AT AREA, dBA	EMERGENCY LIGHTING SYSTEM FEATURES: APPROXIMATE FOOTCANDLES AT EQUIPMENT FROM: ESSENTIAL AC	EMERGENCY LIGHTING SYSTEM FEATURES: APPROXIMATE FOOTCANDLES AT EQUIPMENT FROM: 8-HOUR BATTERY PACK
AUXILIARY BUILDING - CONTINUED	LEGEND 1 = PA HANDSET 2 = PA SPEAKER 3 = TELEPHONE 4 = RADIO	LEGEND dBA = DECIBEL, A-WEIGHTED < = LESS THAN		
ROOM 5702, EL. 178 CORRIDOR	2 (IN AJACENT ROOM), 4	<70	5	2
ROOM 5709, EL. 178 CONTROL AND DIESEL AREA HVAC EQUIPMENT	1 (LOCATED AWAY FROM NOISEST EQUIPMENT), 2, 4	<105	3	2
REACTOR BUILDING				
ROOM 4104, EL. 54 CORE SPRAY PUMP AND UNIT COOLERS	1 (IN ADJACENT VESTIBULE), 2, 4	<106	15	2
ROOM 4102, EL. 54 TO 101 VALVES	2, 4	<70	3	1
ROOM 4105, EL. 54 CORE SPRAY PUMP AND UNIT COOLERS	1 (IN ADJACENT VESTIBULE), 2, 4	<106	15	2
ROOM 4107, EL. 54 RHR PUMP, JOCKEY PUMP, UNIT COOLERS, AND [illegible]	1 (IN ADJACENT ELECTRICAL ROOM), 2, 4	<108	3	1

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TABLE 9.5-17

COMMUNICATIONS AND EMERGENCY LIGHTING SYSTEMS FOR SAFE SHUTDOWN AREAS

AREA / EQUIPMENT	COMMUNICATION FEATURES: COMPONENTS AVAILABLE AT AREA	COMMUNICATION FEATURES: ESTIMATED MAXIMUM NOISE LEVEL AT AREA, dBA	EMERGENCY LIGHTING SYSTEM FEATURES: APPROXIMATE FOOTCANDLES AT EQUIPMENT FROM ESSENTIAL AC	EMERGENCY LIGHTING SYSTEM FEATURES: APPROXIMATE FOOTCANDLES AT EQUIPMENT FROM 8-HOUR BATTERY PACK
REACTOR BUILDING - CONTINUED	LEGEND 1 = PA HANDSET 2 = PA SPEAKER 3 = TELEPHONE 4 = RADIO	LEGEND dBA = DECIBEL, A-WEIGHTED < = LESS THAN		
ROOM 4108, EL. 54 RCIC-MCC AND INSTRUMENT RACKS	1, 2, 4	<65	10	2
ROOM 4109, EL. 54 RHR PUMP, HX AND UNIT COOLER	1 (IN ADJACENT ELECTRICAL ROOM), 2, 4	<108	3	2
ROOM 4110, EL. 54 RCIC PUMP, TURBINE, GLAND STEAM CONDENSER, VACUUM PUMP, CONDENSATE PUMP, JOCKEY PUMP AND UNIT COOLERS	2, 4	<110	3	2
ROOM 4111, EL. 54 HPCI PUMP, TURBINE, GLAND STEAM CONDENSER, VACUUM PUMP, JOCKEY PUMP, VALVES AND UNIT COOLERS	2, 4	<110	3	1
ROOM 4112, EL. 54 HPCI-MCC AND INSTRUMENT RACKS	1, 2, 4	<65	3	2

TABLE 9.5-17

COMMUNICATIONS AND EMERGENCY LIGHTING SYSTEMS FOR SAFE SHUTDOWN AREAS

AREA/EQUIPMENT	COMMUNICATION FEATURES: COMPONENTS AVAILABLE AT AREA	COMMUNICATION FEATURES: ESTIMATED MAXIMUM NOISE LEVEL AT AREA, dBA	EMERGENCY LIGHTING SYSTEM FEATURES: APPROXIMATE FOOTCANDLES AT EQUIPMENT FROM - ESSENTIAL AC	EMERGENCY LIGHTING SYSTEM FEATURES: APPROXIMATE FOOTCANDLES AT EQUIPMENT FROM - 8-HOUR BATTERY PACK
REACTOR BUILDING - CONTINUED	LEGEND 1 = PA HANDSET 2 = PA SPEAKER 3 = TELEPHONE 4 = RADIO	LEGEND dBA = DECIBEL, A-WEIGHTED < = LESS THAN		
ROOM 4113, EL. 54 RHR PUMP, HX AND UNIT COOLER	1 (IN ADJACENT ELECTRICAL ROOM), 2, 4	<108	3	2
ROOM 4114, EL. 54 RHR PUMP, JOCKEY PUMP, INSTRUMENT RACK, UNIT COOLERS	1 (IN ADJACENT ELECTRICAL ROOM), 2, 4	<108	5	2
ROOM 4116, EL. 54 CORE SPRAY PUMP AND UNIT COOLERS	1 (IN ADJACENT VESTIBULE), 2, 4	<106	25	2
ROOM 4118, EL. 54 CORE SPRAY PUMP AND UNIT COOLERS	1 (IN ADJACENT VESTIBULE), 2, 4	<106	5	2
ROOM 4201, EL. 77 MCCs	1 (IN ADJACENT ROOM), 2, 4	<65	3	2
ROOM 4202, EL. 77 INSTRUMENT RACKS	1, 2, 4	<100	3	2
ROOM 4203, EL. 77 INSTRUMENT RACK	2, 4	<65	3	2

TABLE 9.5-17

COMMUNICATIONS AND EMERGENCY LIGHTING SYSTEMS FOR SAFE SHUTDOWN AREAS

AREA / EQUIPMENT	COMMUNICATION FEATURES		EMERGENCY LIGHTING SYSTEM FEATURES	
	COMPONENTS AVAILABLE AT AREA	ESTIMATED MAXIMUM NOISE LEVEL AT AREA, dBA	APPROXIMATE FOOTCANDLES AT EQUIPMENT FROM- ESSENTIAL AC	8-HOUR BATTERY PACK
REACTOR BUILDING-CONTINUED	LEGEND 1 = PA HANDSET 2 = PA SPEAKER 3 = TELEPHONE 4 = RADIO	LEGEND dBA = DECIBEL, A-WEIGHTED < = LESS THAN		
ROOM 4208, EL. 77 RHR HX AND UNIT COOLER	2, 4	<85	3	2
ROOM 4209, EL. 77 VALVES AND INSTRUMENTS	1 (IN ADJACENT VESTIBULE), 2, 4	<100	3	1
ROOM 4210, EL. 77 INSTRUMENTS	2, 4	<65	3	2
ROOM 4214, EL. 77 RHR HX	2, 4	<85	3	2
ROOM 4215, EL. 77 INSTRUMENT RACK	2, 4	<65	3	2
ROOM 4216, EL. 77 CORRIDOR	2, 4	<50	3	1
ROOM 4218, EL. 77 INSTRUMENT RACK	1, 2, 4	<65	3	2
ROOM 4219, EL. 77 INSTRUMENTS	2, 4	<65	3	2

TABLE 9.5 - 17

COMMUNICATIONS AND EMERGENCY LIGHTING SYSTEMS FOR SAFE SHUTDOWN AREAS

AREA / EQUIPMENT	COMMUNICATION FEATURES: COMPONENTS AVAILABLE AT AREA	COMMUNICATION FEATURES: ESTIMATED MAXIMUM NOISE LEVEL AT AREA, dBA	EMERGENCY LIGHTING SYSTEM FEATURES: APPROXIMATE FOOTCANDLES AT EQUIPMENT FROM - ESSENTIAL AC	EMERGENCY LIGHTING SYSTEM FEATURES: APPROXIMATE FOOTCANDLES AT EQUIPMENT FROM - 8-HOUR BATTERY PACK
REACTOR BUILDING - CONTINUED	LEGEND 1 = PA HANDSET 2 = PA SPEAKER 3 = TELEPHONE 4 = RADIO	LEGEND dBA = DECIBEL, A-WEIGHTED < = LESS THAN		
ROOM 4301, EL. 102 CORRIDOR	1, 2, 4	<65	3	2
ROOM 4303, EL. 102 MCC	1, 2, 4	<65	3	2
ROOM 4307, EL. 102 SACS PUMPS AND HXs, CONTROL PANELS, VALVES AND UNIT COOLERS	2, 4	<106	3	2
ROOM 4309, EL. 102 SACS PUMPS AND HXs, CONTROL PANELS, VALVES AND UNIT COOLERS	1 (LOCATED AWAY FROM NOISEST EQUIPMENT), 2, 4	<106	3	1
ROOM 4315, EL. 102 CORRIDOR	2 (NEARBY), 4	<65	3	2
ROOM 4327, EL. 102 HPCI VALVES	2, 4	<80	3	2
ROOM 4329, EL. 102 RHR VALVES	2, 4	<80	3	2
(ROOM 4319, EL. 102	2, 4	<80	[illegible]	[illegible]

TABLE 9.5 - 17

COMMUNICATIONS AND EMERGENCY LIGHTING SYSTEMS FOR SAFE SHUTDOWN AREAS

	COMMUNICATION FEATURES		EMERGENCY LIGHTING SYSTEM FEATURES	
			APPROXIMATE FOOTCANDLES AT EQUIPMENT FROM-	
AREA / EQUIPMENT	COMPONENTS AVAILABLE AT AREA	ESTIMATED MAXIMUM NOISE LEVEL AT AREA, dBA	ESSENTIAL AC	8-HOUR BATTERY PACK
INTAKE STRUCTURE	LEGEND 1 = PA HANDSET 2 = PA SPEAKER 3 = TELEPHONE 4 = RADIO	LEGEND dBA = DECIBEL, A-WEIGHTED < = LESS THAN		
ROOM 107, EL. 79-8 VALVES	2, 4	< 80	3	2
ROOM 110, EL. 79-8 VALVES	2, 4	< 80	3	2
ROOM 203, EL. 93 MCCs	1 (IN ADJACENT ROOM), 2, 4	< 65	10	2
ROOM 204, EL. 93 PUMPS, VALVES AND CONTROL PANELS	1 (IN ADJACENT ROOM), 2, 4	< 108	5	2
ROOM 207, EL. 93 MCCs	1, 2 (IN ADJACENT ROOM), 3, 4	< 65	10	2
ROOM 208, EL. 93 PUMPS, VALVES AND CONTROL PANELS	1, 2 (IN ADJACENT ROOM), 4	< 108	5	2
EL. 107 TRAVELING SCREEN CONTROL PANELS	2, 4	< 80	10	1
EL. 114 TRAVELING SCREEN	2, 4	< 70	10	

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TABLE 9.5-17

COMMUNICATIONS AND EMERGENCY LIGHTING SYSTEMS FOR SAFE SHUTDOWN AREAS

	COMMUNICATION FEATURES		EMERGENCY LIGHTING SYSTEM FEATURES	
			APPROXIMATE FOOTCANDLES AT EQUIPMENT FROM-	
AREA/EQUIPMENT	COMPONENTS AVAILABLE AT AREA	ESTIMATED MAXIMUM NOISE LEVEL AT AREA, dBA	ESSENTIAL AC	8-HOUR BATTERY PACK
INTAKE STRUCTURE - CONTINUED	LEGEND 1 = PA HANDSET 2 = PA SPEAKER 3 = TELEPHONE 4 = RADIO	LEGEND dBA = DECIBEL, A-WEIGHTED < = LESS THAN		
ROOM 305, 306, EL. 122 FANS	1, 2, 4	<90	10	1
ROOM 311, 312, EL. 122 FANS	1, 2, 4	<90	10	1

QUESTION 430.76 (SECTION 9.5.4)

In Section 9.5.4.5 of the FSAR you describe the instruments, controls, sensors and alarms provided for monitoring the diesel engine fuel oil storage and transfer system and their function which alert the operator when these parameters are exceed the ranges recommended by the engine manufacturer. Discuss the testing and the frequency of testing necessary to maintain and assure a highly reliable instrumentation, controls, sensors and alarm system. Describe what operator actions are required during alarm conditions to prevent harmful effects to the diesel engine. Discuss the system interlocks provided. (SRP 9.5.4, Part III)

RESPONSE

The testing of diesel generator instrumentation and control will be performed using written procedures and in accordance with the frequencies specified in the Hope Creek Technical Specifications. Those items not covered in that section will be tested in accordance with other written procedures. Available January 1985.

Operator actions during alarm conditions will be addressed in the appropriate alarm response procedure, OP-AR.JE-XXX series. Available January 1985.

The diesel fuel oil storage tank and diesel fuel oil day tank are interlocked as described in Section 9.5.4.2.3. The diesel fuel oil storage tank is interlocked with the diesel fuel oil fill station as described in Section 9.5.4.2.6.

Insert A here

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RESPONSE

INSERT A page 1
to Q 430.76

The Instrumentation and Control Department will calibrate the instruments, controls, sensors and alarms required to assure operability of the diesel engine fuel oil transfer system. Table 430.76-1 provides an equipment summary and surveillance frequency. Calibration checks and calibration of the instruments, controls, sensors and alarms will be performed using written procedures.

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Operator actions to preclude loss or conditions harmful to the diesel engine are provided in table 430.76-2.

The fill portion of the diesel engine fuel oil tranfer system is controled from one of four control stations. Interlocks are provided to prevent more than one control station from opening fill valve HV-7534. Additional interlocks close fill valve HV-7534 when the selected fuel oil storage tank has reached a high level setpoint and the control mode selection switch is in automatic. Soleniod valve SV-7534 and air operated fill valve HV-7534 are configured to automatically close the fill valve on either a loss of solenoid electrical power or a loss of control air. All interlocks provide protection against inadvertent fuel oil storage tank overfill.

The fuel oil transfer system is provided with the capability to automatically transfer fuel oil from a storage tank to a diesel engine fuel oil day tank. Two storage tanks are provided for each diesel engine. Each storage tank is provided with a fuel oil transfer pump. When the diesel engine day tank level is sensed low the selected fuel oil transfer pump automatically starts to supply fuel oil from the storage tank to the day tank. This control scheme assures continuous supply of fuel oil to the diesel engines.

TABLE 430.76-1

Diesel Engine Fuel Oil Transfer System

Instruments, Controls and Sensors

Sys...

Inst no.		Function	Surveillance Frequency*
11·7817	A-D	DAY TANK LVL	P
11·7507	A-D	DAY TANK TEMP	P
AHL·7501	A-D	F.O. DAY TANK	F
AHL·7530	A-D	F.O. DAY TANK LVL CONT	F
1S·7505	A-D	F.O. SUCTION STRAINER ΔP	P
1S·7506	A-D	F.O. FILTER ΔP	P
DSH·6804	A-D	F.O. STRAINER ΔP	F
DSH 6805	A-D	F.O. FILTER ΔP	F
PL·7508	A-D	F.O. HEADER	F
11·7819	A-D	F.O. PUMP DISCH	P
11·7820	A-D	F.O. HEADER PRESS.	P
11·7507	A-D	F.O. TEMP	P
1·6501	A-D	F.O. FILTER IN/OUT (RECP)	P
1·6502	A-D	F.O. PMP DISCH	F
·7821	A-H	F.O. STORAGE TANK LVL P/B	F
1·7822	A-H	F.O. STORAGE TANK LVL (RECP)/2	F
·7824	A-H	F.O. TRANSFER PMP PRESS	F

*Surveillance

P = 36 MONTH Frequency

F = 18 MONTH FREQUENCY

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~~Response to Question 430.~~

TABLE 430.76-2

Summary of Operator Actions in Response to Diesel Engine Fuel Oil Storage and Transfer System Alarms

High Priority Alarms

a) FUEL OIL PRESSURE LOW

Check	Action
Operating pressures (locally)	If normal. Attempt to clear alarm If low. Proceed to next check
Suction valve open	Open valve in pump suction line if closed
Filter and strainer diff. pressure	If high - see applicable response summary.
Day tank level	If low - see applicable response summary
Motor driven pump auto start	If not confirm - Control switch CS-33 in AUTO. Power is available Take manual control at CS-33 if necessary
Valve lineup to instrumentation and alarm switches	Open valves found in closed position
Piping System integrity from day tank to injectors	

b) FUEL OIL DAY TANK LEVEL LOW

Check	Action
Tank level locally	If normal. Attempt to clear alarm If low: Proceed to next check
Verify transfer pump auto start	If not: check for proper operation of LSHL 7530 control pump manually if required If running: Confirm valve lineup to day tank
Piping integrity	If piping is breached or restricted: Notify Shift Supervisor Crosstie and fill from f.o storage tank of another diesel if required

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Low Priority Alarms

a) FUEL OIL DAY TANK LEVEL HIGH

Check	Action
Tank level (locally)	If normal: Attempt to clear alarm If high: Proceed to next check
Confirm transfer pump shutoff	If running: Stop pump manually Monitor day tank level Prevent low level alarm Notify I&C to repair level control

b) FUEL OIL STORAGE TANK NO. 1 LEVEL LOW

Check	Action
Tank level	If normal: Attempt to clear alarm If low: Proceed to next check
Tank and piping integrity	If leaks or obstructions are found: Isolate if possible Notify Shift Supervisor
Transfer pump running	Ensure fuel oil is not being pumped to main fuel oil storage tank

c) FUEL OIL STORAGE TANK NO. 2 LEVEL LOW

Check	Action
Same as response b	

d) FUEL OIL STORAGE TANK NO.1 LEVEL HIGH

Check	Action
Tank level	If normal: Attempt to clear alarm If high: Proceed to next check
Storage tanks [redacted] being filled - level high	Ensure: alarming tank is not selected for fill proper operation of LSHH 7535 and HV 7534 Manually operate HV 7534 if required
Storage tanks ~~Tanks~~ not being filled - level high	If transfer pump(s) are running, ensure crossties are not open Confirm valve lineup to main fuel oil storage tank.

e) FUEL OIL STORAGE TANK NO.2 LEVEL HIGH

Check	Action
Same as response d	

f) FUEL OIL FILTER DIFFERENTIAL PRESSURE HIGH

Check	Action
Confirm high filter dP	If normal: Attempt to clear alarm If high: Confirm instrumentation valve lineup Swap and clean filter

g) FUEL OIL STRAINER DIFFERENTIAL PRESSURE HIGH

Check	Action
Confirm high strainer dP	If normal: Attempt to clear alarm If high: Confirm instrumentation valve lineup Swap and clean filter

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h) FUEL OIL TRANSFER PUMP NO. 1 MALFUNCTION

Check	Action
Confirm: Alarming pump is running Discharge pressure is low	If pump has not received a run signal Attempt to clear alarm If pump is running and pressure is normal: Notify I&C to repair alarm If pump has failed to run: Confirm CS-35 is in AUTO Attempt to control pump manually If discharge pressure is low: Confirm valve lineup to pump Notify I&C and Maintenance as required

i) FUEL OIL TRANSFER PUMP NO. 2 MALFUNCTION

Check	Action
Same as response h	

j) FUEL OIL TRANSFER SYSTEM NOT IN AUTOMATIC

Check	Action
Position of CS34 and CS-35 Fuel Oil Transfer pump control switches	If both switches are in AUTO: Attempt to clear alarm If either switch is not in AUTO: Confirm reason for switch position Return to AUTO when possible

QUESTION 430.78 (SECTION 9.5.4)

Describe your design provisions made to protect the fuel oil storage tank fill and vent lines from damage by tornado missiles. (SRP 9.5.4, Part II).

RESPONSE

The standby diesel generator lines are protected from tornado missiles as described in revised Sections 9.5.4.3, 3.3, and 3.5.

The standby diesel generator fuel oil storage tank vents are located in the standby diesel generator area of the auxiliary building except for the conservation vent and flame arrestor. The portions of the vent lines that are located in the diesel generator area of the auxiliary building are protected from tornado missiles as described in revised Sections 9.5.4.3, 3.3, and 3.5. The section of piping that is located outside of the standby diesel generator area of the auxiliary building, as shown on Figure 430.78-1 are not missile protected. ~~If the vent line should become damaged by a tornado missile, appropriate actions will be taken to establish an alternate vent path until the normal vent path is returned to its operable condition.~~

INSERT

~~430.78 TORNADO MISSILE PROTECTION OF FUEL OIL STORAGE AND DAY~~
~~9.5.4 TANK VENTS IS INADEQUATE.~~

1/3

Insert to 430.78

430.78 If the vent line should become damaged by a tornado missile, then an alternate vent path will be established to allow venting of the diesel fuel oil storage tanks and the diesel fuel oil day tanks by opening a spare 4" flanged connection or the 30" manhole located on the diesel fuel oil storage tanks. This vent path will be maintained until the normal vent for the diesel fuel oil storage tanks and the diesel fuel oil day tank can be reestablished.

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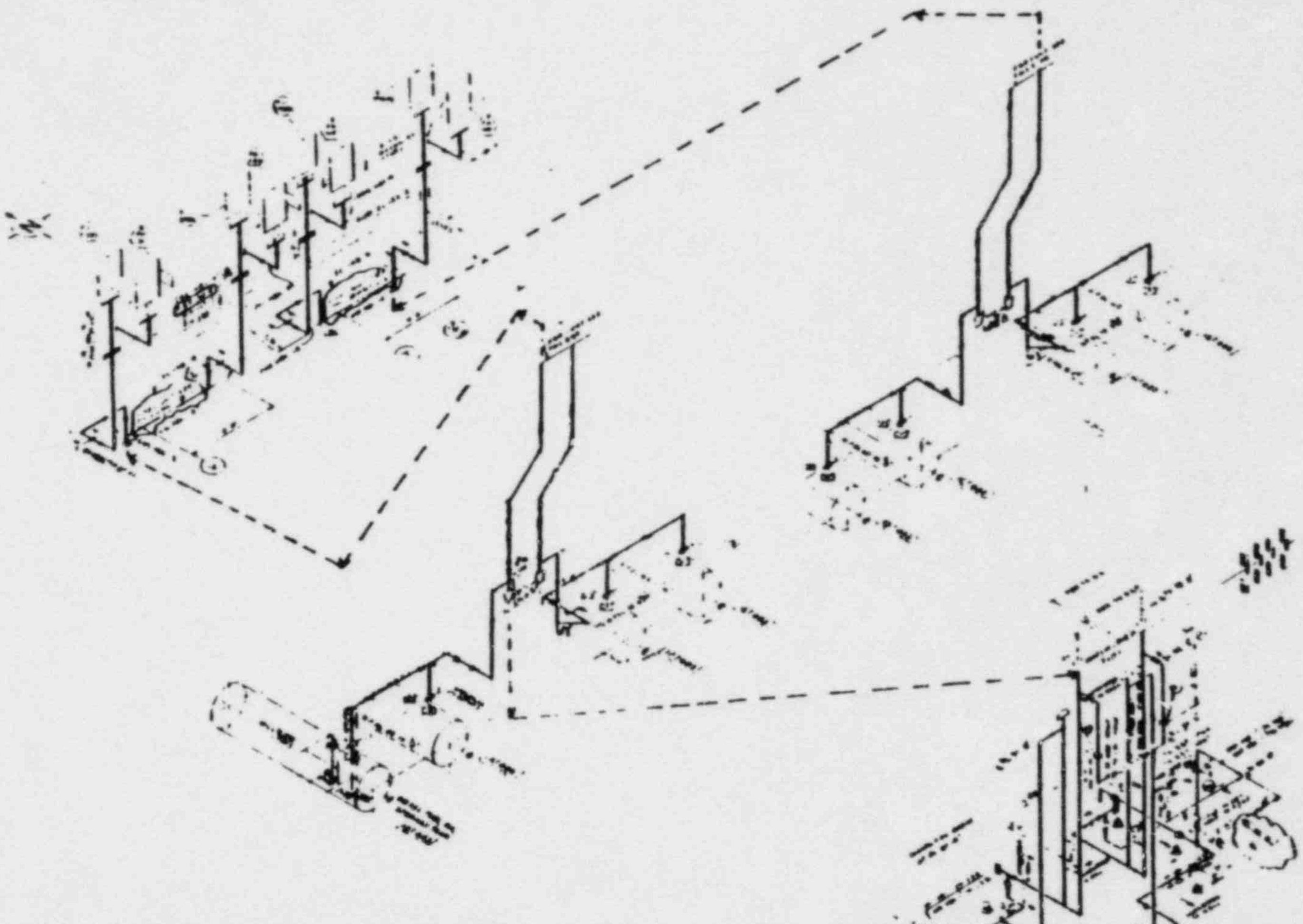

HOPE CREEK
GENERATING STATION
FINAL SAFETY ANALYSIS REPORT

DIESEL GENERATOR FUEL OIL
STORAGE AND DAY TANK VENTS

FIGURE 430 76 1 AMENDMENT 4

QUESTION 430.80 (SECTION 9.5.4)

In Section 9.5.4.2.1 you discuss the corrosion protection both internal and external for the fuel oil storage tank. No discussion is provided on the corrosion protection provided for the fuel oil fill piping. Expand the FSAR to include a more explicit description of proposed protection of underground piping. Where corrosion protective coatings are being considered (piping and tanks) include the industry standards which will be used in their application. Also discuss what provisions will be made in the design of the fuel oil storage and transfer system in the use of a impressed current type cathodic protection system, in addition to water proof protective coatings, to minimize corrosion of burried piping or equipment. If cathodic protection is not being considered, provide your justification. (SRP 9.5.4, Part II)

RESPONSE

The diesel fuel oil transfer piping that is buried is primed and wrapped, in accordance with industry standards, AWWA-C-203 including Appendix A1.5 and/or A2.0. The buried diesel fuel oil transfer piping is also cathodically protected.

The emergency fill line and connection is provided inside the diesel generator building. The buried fuel oil fill line is separated from the emergency fill line by a normally closed isolation valve, which is located inside the building, as shown on Figure 9.5-22.

430.80 (9.5.4) Installation inspection program for the fuel oil system cathodic protection system is not described.

SEE ATTACHED

1/5

Response 430.80

430.80 The diesel fuel oil transfer piping that is buried is primed and wrapped, in accordance with industry standards AWWA-C-203 including appendix A1.5 and/or A2.0. The buried portions of the diesel fuel oil transfer piping ~~is~~ are cathodically protected by an impressed current cathodic protection system. ~~and is considered as non safety related piping.~~ The impressed current cathodic protection system is also considered as a non safety related system. ~~The site impressed current cathodic protection system will be tested in accordance with plant~~

2/5

(1)

430.80 (cont)

See Insert A

A The buried portion of the diesel fuel oil transfer piping is not considered safety related piping since an emergency fill connection is provided inside the diesel generator building, which can be isolated from the buried portion of the fill piping by an isolation valve which is located inside the building, as shown on Figure 9.5-2. This emergency fill connection provides a protected fill path to the diesel fuel oil storage

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430.80 (cont) tanks, none of which is buried piping.

430.80 (Insert A)

The diesel engine fuel oil transfer piping cathodic protection system will be tested every six months in accordance with the manufacturer's testing recommendations.

QUESTION 430.81 (SECTION 9.5.4)

In Section 9.5.4.2.1 of the FSAR you state that "The interior and exterior surfaces of the [fuel oil storage] tank are corrosion protected by carboline carbo zinc 11 coatings. I&E circular 77-15 discusses the incompatibility between diesel fuel oil and zinc. The reaction results in a substance resembling soap which when heated becomes insoluble and this substance could render diesel generators inoperable due to blocked fuel lines, injectors, etc. This is not acceptable. It is our position that fuel oil storage tanks be provided with internal corrosion protection. Therefore provide the results of tests which show that over the lifetime of the plant that the carboline carbo zinc 11 coating used is compatible with the type of diesel fuel oil that will be used at your plant and that the condition described in the circular will not occur or replace the internal coating with a non-zinc base type that is compatible with diesel fuel oil. (SRP 9.5.4, Part II)

RESPONSE

Bechtel is presently reviewing the use of Carboline Carbo Zinc 11 in diesel fuel oil storage tanks. A complete response will be submitted in May 1984.

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①

430.81

As stated in Section 9.5.4.2.1 H.C.G.S.

diesel fuel oil storage tanks are coated with carboline carbo zinc 11, on the interior and exterior surfaces, for corrosion protection.

Coating of diesel fuel oil tanks with inorganic zinc, for corrosion purposes, has been a standard practice in the diesel fuel oil storage and transfer industry. It has been recorded, however, that there is a problem with the storage of

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430.81 cont

diesel fuel oil in storage tanks lined with inorganic zinc if the diesel fuel oil has been processed from naphthenic based crude.

Inorganic zinc linings in the presence of diesel fuel oil refined from naphthenic based crude forms zinc naphthenate. Zinc naphthenate accelerates the oxidation of diesel fuel oil and promotes the formation of insoluable gels or gums, which ~~will~~ can clog fuel filters and foul injectors in diesel engines.

3/6

430.B1 cont

Napthenic based crude is the primary source of naphthenic acid in diesel fuel oil. However, naphthenic based crude represents a small percentage of the available crude supplies. The two major suppliers of naphthenic based crude are California and Venezuela.

Refineries that do not process naphthenic based crude oils do not have restrictions against the use of inorganic zinc lined tanks to store and transport No 1 and

430.81 cont

No 2 grade diesel fuel oil. Power plants have used inorganic zinc lined tanks to store diesel fuel oil and have not reported adverse effects on diesel fuel oil or the standby diesel engines.

Fuel oil procurement specifications ~~[illegible]~~ will require ~~[illegible]~~ diesel fuel oil with a neutralization number of 0.10 or less and/or that diesel fuel oil refined from napthenic based crude not be used. The limit of a neutralization number of 0.10 or less is recommended to minimize the

430.81 cont

probability of fuel oil degradation in the event that a naphthenic based diesel fuel oil is accidently delivered to the station.

~~[illegible]~~ These requirements will ensure that diesel fuel oil degradation will not occur from the use of zinc linings in the diesel fuel oil storage tanks.

QUESTION 430.82 (SECTION 9.5.4)

You state in the FSAR that protection from high and moderate energy pipe breaks is provided for the emergency diesel generators and discussed in Section 3.6. The emergency diesel generator air start and combustion air and exhaust systems are for your design high energy systems, but Section 3.6 does not provide any analysis for these systems. This is unacceptable. Identify all high and moderate energy lines and systems that will be installed in the diesel generator room. Discuss the measures that will be taken in the design of the diesel generator facility to protect the safety related systems, piping and components from the effects of high and moderate energy line failure to assure availability of the diesel generators when needed. (See request 430.120 and 430.149 for additional concerns on high energy line breaks with regard to the air start system and diesel engine exhaust system) (SRPs 9.5.4 - 9.5.8, Parts II and III)

RESPONSE

The standby diesel generator (SDG) combustion air exhaust system is not classified as high energy system because the SDG do not operate during normal plant conditions. According to the definitions provided in Section 3.6.3, the identification of the high and moderate energy systems is based on the normal plant conditions which are the plant operating conditions during reactor startup, power operation, hot standby, and reactor cooldown to cold shutdown condition. The SDGs do not operate during any of these plant conditions. They only operate during plant upset condition or during the SDG system testing. Therefore, the SDG engine exhaust system is not classified as a high energy system.

* Insert → Further description of the air starting system is given in the response to 430.120.

The air starting system is a high energy system. A discussion of the pipe break location, compartment pressure-temperature transients and verification of reactor shutdown capability is provided in Section 3.6.1.2.1.19.

There are no other high energy lines in the diesel generator rooms. However, a moderate energy line, the SACS cooling water to the combustion air-water heat exchanger is located in the diesel generator rooms. The facility response, as discussed in revised Section 3.6.1.2.1.19, is applicable to a failure of this moderate energy line in the diesel generator room.

1/3

Insert

430.82

the potential for a leak in the system has been considered since the exhaust piping is routed through areas which contain safety-related equipment or panels. From elevation 130'-0", where the exhaust stack exits the exhaust silencer and is routed directly to the roof, to elevation 199'-0" the stack is enclosed in an

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430.82 (cont) air tight three hour fire proof enclosure. A local smoke detector is located at the upper elevation of the stack enclosure. The smoke detector will detect any exhaust leakage in the enclosure from elevation 130'-0" up to elevation 199'-0". Only one smoke detector is required since, provisions have been made to ventilate the enclosure through the roof opening, creating a natural stack effect.

See additional response to question 430.149.

QUESTION 430.83 (SECTION 3.2)

The FSAR text and Table 3.2-1 indicates that the components and piping systems for the diesel generator auxiliaries (fuel oil system, cooling water, lubrication, air starting, and intake and combustion system) that are mounted on the auxiliary skids are designed seismic Category I and are ASME Section III, Class 3. The engine mounted components and piping and certain other components listed in the various Sections of 9.5 and Table 3.2-1 are designed and manufactured to DEMA standards and/or manufacturer's standards and are seismic Category I. This is not in accordance with Regulatory Guide 1.26 which requires the entire diesel generator auxiliary systems be designed to ASME Section III Class 3 or Quality Group C. You also state that the figures in Section 9.5 show where quality group classification changes are. The figures do not provide this information. Provide the following: (a) the industry standards that were used in the design, manufacture, and inspection of the engine mounted piping and components, (b) show on the appropriate P&ID's where the Quality Group Classification changes from Quality Group C, and where the Seismic Category I portions of the system are located. Sections 9.5.4 through 9.5.8 and Table 3.2-1 define certain pumps, filters, strainers, valves, and subsystems in the diesel generator auxiliary systems as Quality Group D or not applicable with regards to Quality Group Classification. It is our position that all components and piping in the diesel generator auxiliary systems be designed to Seismic Category I ASME Section III Class 3 requirements. Comply with this position or justify noncompliance. (SRPs 9.5.4 - 9.5.8, Part III)

RESPONSE

a. The engine mounted piping systems (such as the lube oil headers, water headers, cylinder heads, etc) are manufactured to the manufacturer's proprietary design requirements which do not necessarily meet the requirements of ASME Section III or ANSI B.31. The components used are pressure tested and the manufacturing processes are monitored as part of the supplier's approved QA program. The major components are included in the seismic analysis.

   (It should be noted that the DEMA standard is not a design specification, but gives guidance as to what should be included in a performance type specification.)

b. The figure in Section 9.5 can be used to determine quality group classification and seismic boundaries. The diesel engine auxiliary system P&IDs (Figures 9.5-22, 25, and 28) indicate the piping line classes and the piping specification changes as defined on Figure 1.13-1, sheet 1 (P&ID legend). The third letter of the three-letter piping

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line class code indicates the code to which the piping and components are built. Tables 3.2-2 and 3.2-3 can then be used to determine the quality group classification based on the applicable code. The Seismic Category I boundaries are indicated by the Q-flags as indicated in Section 3.2.1.

Section 1.8.1.26 has been revised to include a clarification of Regulatory Guide 1.26, Revision 3, Position C.2.b with regard to engine-mounted components and piping.

The following concerns will be addressed by July, 1984:

a. The EDG air start system is a high energy system. All portions of the system which are high energy during standby and operations need to be ASME III, Class 3.b.

b. Verify or analyze that a pipe break in the air start system does not damage any other piping on the engine (of equal or less diameter).

c. Analysis or justification for parts that are not ASME is required.

d. Engine mounted piping generally meets the requirements of ANSI B31.1.

e. Verify compliance or indicate why equivalent.

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system (RACS) cooling water to the seal coolers are quality group D.

Additionally, Position C.2.b of Regulatory Guide 1.26 requires that cooling water systems important to the safety function of the standby diesel generators be Quality Group C. HCGS's diesel generator cooling water systems are classified as Quality Group C except for the engine mounted piping systems (such as the lube oil headers, water headers, cylinder heads, etc). The engine mounted piping systems are part of the diesel engine and its auxiliary support sytems which, as stated in Section B of the Regulatory Guide, are not covered by this guide. These systems are manufactured to the manufacturer's proprietary design requirements which do not necessarily meet the requirements of ASME Section III or ANSI B.31. However, the components used are pressure tested and the manufacturing processes are monitored as a part of the suppliers approved QA program, which addresses the 18 criteria contained within 10 CFR 50, Appendix B.

Additional quality assurance requirements invoked by the applicant include:

a. periodic documented subsupplier audits (including plant visits),

b. review and approval of subsupplier QA programs and manuals,

c. test and inspection audits,

d. calibration of test gauges before and after use, and

e. control of calibration records and acceptance devices.

With the imposition of the above design, manufacturing, and testing controls, the on-skid and off-skid piping and components have been made to be equivalent to Quality Group C. This meets the requirements in Section B of the guide to design, fabricate, erect and test the diesel engine and its auxiliary support systems to quality standards commensurate with the safety function to be performed.

NUREG-0737, Item II.k.3.25 extends the requirements of Position C.2.b by requiring demonstration that the consequences stemming from a loss of cooling water to the reactor recirculation pump seal coolers is acceptable following a loss of power for at least 2 hours. NEDO-24951 (Reference 5.4-4) confirms that the HCGS design meets the requirements of NUREG-0737, Item II.k.3.25.

See Section 3.2.2 for further discussion and Section 1.8.2 for NSSS assessment of this Regulatory Guide.

1.8.1.27 Conformance to Regulatory Guide 1.27, Revision 2, January 1976: Ultimate Heat Sink For Nuclear Power Plants

HCGS complies with Regulatory Guide 1.27. The ultimate heat sink (UHS) is the Delaware River, which is a large, single water source as defined by the Regulatory Guide. The service water equipment required for the dissipation of residual heat is all safety-related and redundant, with the exception of the service water discharge piping outside of the reactor building. This piping normally discharges into the circulation water system (CWS). However, if some natural or site-related event occurs and blocks the flow, there are rupture discs in the safety-related portion of the service water discharge piping that allow the water to be safely diverted onto and across the lower yard surface area, thus completing the cooling loop between the UHS and the plant.

For further discussion of the station service water system (SSWS) and the UHS, see Sections 9.2.1 and 9.2.5.

1.8.1.28 Conformance to Regulatory Guide 1.28, Revision 2, February 1979: Quality Assurance Program Requirements (Design and Construction)

Although Regulatory Guide 1.28, Revision 2, is not applicable to HCGS, per its implementation section, HCGS complies with ANSI N45.2-1977 as modified and interpreted by Regulatory Guide 1.28. The architect-engineer quality program for the design and construction of safety-related items meets the requirements of

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1.8.1.23 Conformance to Regulatory Guide 1.23 (Safety Guide 8), Revision 0, February 17, 1972: Onsite Meteorological Programs

HCGS complies with Regulatory Guide 1.23.

1.8.1.24 Conformance to Regulatory Guide 1.24 (Safety Guide 24), Revision 0, March 23, 1972: Assumptions Used for Evaluating the Potential Radiological Consequences of a Pressurized Water Reactor Radioactive Gas Storage Tank Failure

Regulatory Guide 1.24 is not applicable to HCGS.

1.8.1.25 Conformance to Regulatory Guide 1.25 (Safety Guide 25), Revision 0, March 23, 1972: Assumptions Used for Evaluating the Potential Radiological Consequences of a Fuel Handling Accident in the Fuel Handling and Storage Facility for Boiling and Pressurized Water Reactors

HCGS complies with Regulatory Guide 1.25.

1.8.1.26 Conformance to Regulatory Guide 1.26, Revision 3, February 1976: Quality Group Classifications and Standards for Water-, Steam-, and Radioactive-Waste-Containing Components of Nuclear Power Plants

HCGS complies with Regulatory Guide 1.26, with the clarifications outlined below.

PSE&G's position is that equipment that is important to safety is safety-related and therefore does not distinguish between these terms. PSE&G does recognize the need for the assurance of the specified operation of certain non-safety-related structures, systems and components, such as fire protection systems, radioactive waste treatment, handling and storage systems, and Seismic Category II/I items. Such assurance is documented through the specification of limited quality assurance programs (described in Table 3.2-1, footnotes (22), (50) and (52). In addition, items designated "D+" in Table 3.2-1 will be included in the QA program during operations.

The exception to Position C.2.b is that since the reactor recirculation pumps do not perform any safety function and since failure of the reactor coolant pumps due to seal or cooling water failure does not have serious safety implications, the control rod drive (CRD) seal purge supply and reactor auxiliaries cooling

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Principal Components	FSAR Section	Source of Supply (1)	Location (2)	Quality Group Classification (3)	Principal Construction Codes and Standards (5)	Seismic Category (6)	QA Requirements (7)	Comments
g. Auxiliary building control area chilled water system:	9.2.7.2							
1. Chillers		P	B,G	C	III-3	I	Y	
2. Cooling coils		P	B,C,G	C	III-3/ARI-410	I	Y	
3. Pumps		P	B,G	C	III-3	I	Y	
4. Motors		P	B,G	NA	IEEE-323/344	I	Y	
5. Piping and valves		P	B,G,C	C	III-3	I	Y	(14)(48)
6. Tank, head		P	G	C	VIII-1	I	Y	
h. Potable & sanitary water system:	9.2.4							
1. Pumps		P	O,G,B,R	D	B31.1.0/ Hyd.I	NA	N	(24)
2. Motors		P	O,G,B,R	NA	NEMA MG-1	NA	N	
3. Piping and valves		P	O,G,B,R	D	B31.1.0/NSPC	NA	N	
i. Demineralized water makeup storage & transfer system:	9.2.3							
1. Tanks		P	T	D	API-620	NA	N	
2. Pumps		P	T	D	Hyd.I	NA	N	(24)
3. Motors		P	T	NA	NEMA MG-1	NA	N	
4. Piping and valves, reactor building penetration & isolation		P	C	C	III-3	I	Y	(48)
5. Piping and valves, other		P	All	D	B31.1.0	NA	N	
XII. Standby Diesel Generator and Auxiliary Systems								
a. Fuel oil storage and transfer system:	9.5.4							
1. Storage tanks		P	G	C	III-3, N195	I	Y	
2. Day tanks		P	G	C	III-3, N195	I	Y	
3. Piping and valves, fuel oil system		P	G	C	III-3, N195	I	Y	(48)
4. Pumps, motor-driven fuel oil transfer		P	G	C	III-3, N195	I	Y	

Principal Components	FSAR Section	Source of Supply (1)	Location (2)	Quality Group Classification (3)	Principal Construction Codes and Standards (5)	Seismic Category (6)	QA Requirements (7)	Comments
5. Motors, motor-driven fuel oil transfer pump and standby fuel oil pump		P	G	NA	IEEE-323/344	I	Y	
6. Pump, motor-driven standby fuel oil		P	G	C	III-3	I	Y	
7. Strainers, fuel oil		P	G	C	III-3	I	Y	
8. Pump, engine-driven fuel oil		P	G	NA	Hyd.I	I	Y	
b. Diesel generators		P	G	NA	IEEE-387/(44)	I	Y	
c. Electrical modules with safety functions (27)		P	G	NA	IEEE-279/323	I	Y	
d. Cable with safety functions		P	G	NA	IEEE-279/323	NA	Y	(15)
e. Lubrication system:	9.5.7							
1. Piping and valves		P	G	C	III-3	I	Y	(48)
2. Heat exchangers		P	G	C	III-3	I	Y	
3. Lube oil filter housing		P	G	C	III-3	I	Y	
4. Lube oil strainer housing		P	G	C	III-3	I	Y	
5. Heater		P	G	C	III-3	I	Y	
6. Lube oil makeup tanks		P	G	C	III-3	I	Y	
7. Pump, motor-driven prelube keepwarm		P	G	C	III-3	I	Y	
8. Pump motor-driven prelube		P	G	C	III-3	I	y	
9. Pump, engine-driven lube oil		P	G	NA	(44)	I	Y	
10. Suction strainer, engine-driven lube oil pumps		P	G	NA	(44)	I	Y	
11. Motors, prelube/keepwarm and prelube pumps		P	G	NA	IEEE-323/344	I	Y	
f. Starting and control air system:	9.5.6							
1. Piping and valves from receiver to diesel and from receiver to receiver inlet check valve		P	G	C	III-3	I	Y	(48)
2. Piping and valves, other		P	G	D	B31.1.0	NA	N	

QUESTION 430.86 (SECTION 9.5.4)

In the FSAR you state the fire protection systems for the diesel generator fuel oil storage vaults are a manual deluge system and an automatic CO_2 systems. Both system as well as their associated detection, alarm, and actuation systems are nonsafety related systems and are not qualified for seismic events. The systems are seismically supported. Show that spurious actuation of the CO_2 fire protection system will not affect diesel generator availability and operability and describe the procedures that will be used to preclude the inadvertant operation of the manual deluge system from affecting diesel generator availability and operability during accident conditions.

RESPONSE

Even though the CO_2 system is not safety related, the CO_2 systems serving the diesel generator fuel oil storage vaults have seismically qualified components, such as the control panel, master and selector valves, thermal detectors, electro-manual pilot cabinets, and pushbutton stations, to avoid inadvertent discharge of CO_2 during a seismic event. (Reference Section 9.5.1.1.4 and Figure 9.5-17)

To prevent inadvertent discharge of water from the manual deluge systems during a seismic event, the outside screw and yoke gate valve for each system is kept closed. Since the gate valve is closed, the system can not discharge water unless the operator manually opens the gate valve and the deluge valve. ~~The operator will not actuate the system unless there is a fire.~~ INS In addition, if the system has been actuated, the other three tank vaults and equipment are available for use by the diesel generators.

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INSERT

430.86 The fire protection in each of the diesel generator fuel oil storage tank rooms consists of an early warning smoke and fire detection system, an automatic CO_2 total flooding system, a manual deluge system (which serves as a backup to the CO_2 system), fire water hose stations and portable extinguishers.

The early warning smoke and fire detection system consists of two (2) infared flame detectors and two (2) photo electric smoke detectors mounted ~~at~~ on the

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430.86 (cont)

ceilings. If a fire occurs, the early warning detection system will detect fire, by either the smoke or flame detectors, and will register an alarm at the local detection control panel and in the main control room.

Thermal detectors are utilized to actuate the automatic CO_2 total flooding system. There are seven (7) thermal detectors per room, which actuate at 160°F. A warning alarm will be initiated in the diesel fuel oil storage tank room and on the local CO_2 system control panel and in control room prior to the release of CO_2. The

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30.86 (cont) alarm will allow personnel in the area sufficient time to evacuate the room prior to the release of the CO_2.

The CO_2 system in the rooms can also be manually actuated from a push button station located outside the respective diesel fuel oil storage tank room adjacent to its associated door.

There are two (2) water hose stations located in the corridor outside of the diesel fuel oil storage tank rooms, Each station is equiped with a hose capable of reaching into the diesel fuel oil storage tank room with at least one hose stream

cont 4/7

420.86(cont) to combat fires.

The final permanently installed system to combat fires in the diesel fuel oil storage tank room is the deluge system. This system is actuated by manually opening a gate valve and actuating a pushbutton on the local control panel or a pushbutton station located next to the entrance door.

#1 The fire alarms for the early warning fire and smoke detection system and the thermal detection for the CO_2 flooding systems are registered locally and in the control room

430.86 (cont) on the fire protection status panel (10C671).

The location of the detector registering an alarm ~~and location of the alarm are~~ is printed out at the fire protection status panel in the order that the alarms are received. The receipt of an alarm, indicating fire, without first the receipt of an early warning alarm would indicate a possible spurious actuation of the CO_2 system. This information would be passed to the fire brigade dispatched to investigate the cause of the alarm.

Fire brigade personel dispatched to investigate fire alarms will be briefed in the

430.86 (cont) ~~in the~~ methods to be utilized to determine if an alarm is spurious or if there is an actual fire condition.

Design features of the fire protection system and personnel training programs, in response to fire alarms, will prevent the inadvertent actuation of the deluge system, in the diesel fuel oil storage tank rooms, if the CO_2 system is inadvertently actuated and/or a spurious alarm is received.

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QUESTION 430.87 (SECTION 9.5.4)

Assume an unlikely event has occurred requiring operation of a diesel generator for a prolonged period that would require replenishment of fuel oil without interrupting operation of the diesel generator. What provision will be made in the design of the fuel oil storage fill system to minimuze the creation of turbulence of the sediment in the bottom of the storage tank. Stirring of this sediment during addition of new fuel has the potential of causing the overall quality of the fuel to become unacceptable and could potentially lead to the degradation or failure of the diesl generator. (SRP 9.5.4, Parts I, II, and III)

RESPONSE

As shown in Figure 9.5-22, Diesel Engine Auxiliary Systems Fuel Oil, and described in Sections 9.5.4.2, 9.5.4.2.3, 9.5.4.2.4, 9.5.4.2.5, 9.5.4.2.6, and 9.5.4.3 there is a duplex fuel oil filter in the barge and truck fill line, and in the emergency fill connection line. The filter prevents solid particles or debris from entering the diesel fuel oil storage tanks.

The diesel fuel oil storage tank design minimizes the possibility of sediment being drawn into the pumps by a six inch projection of the pump suction nozzle into the tank. The six inch projection of the nozzle into the tank allows for approximatly 55 ft³ of sediment before reaching the top of the inlet nozzle. Disturbances of the sediment will be minimal in the vacinity of the pump suction nozzle since the diesel fuel oil storage tank fill nozzle is approximatly thirty feet from the pump suction nozzle.

Insert

The combined effect of the duplex fuel oil filters, pump suction nozzle projection, and separation of fill and outlet nozzles and administrative controls is such that turbulance of the sediment, during fill operation, will not cause sediment to be drawn into the fuel oil system, leading to degradation or failure of the diesel generator.

Filling of the diesel fuel oil tanks will be administratively controlled. For each diesel engine one fuel oil storage tank will be designated as a fill tank and the other fuel oil storage tank will be designated as the diesel engine supply tank. A minimum of 10 hours shall elapse before switching tank designations. This will provide adequate time for sediment to settle after the last fuel oil delivery.

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.

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HCGS has a multi-demensional approach toward assurring diesel engine fuel oil availability. Before, during and after catastrophic environmental conditions require utilization of the Standby Diesel Generators (SDG) any of the following concepts may be used in combination to provide a continuous fuel supply:

1. Conservation of available diesel fuel inventory.
2. Emergency fuel procurement
3. Utilization of alternate available fuels

<u>Conservation of available diesel fuel inventory</u>

HCGS diesel fuel inventory will permit continuous operation of all four diesel engines at full load for a at least seven day time period. During a simultaneous trip of the HCGS generator and a loss of off-site AC power the SDG will automatically start to supply AC. power. This power is directed ~~of~~ to equipment and equipment auxiliaries required to:

1. reflood or maintain reactor water level
2. decrease reactor temperature in a controlled manner
3. remove fission product decay heat
4. remove energy from and therefore safeguard the integrity of the primary containment

Once these goals have been acheived the AC power requirements for the station can be greatly reduced. 2/5

As station power requirements are reduced to only essential equipment, the need for emergency fuel oil delivery is greatly reduced, and the time available to restore normal AC power is expanded proportionally.

Emergency Fuel Procurement

FSAR Section 2.4 describes the hydrolgical study for the HCGS site. This study provides an analysis of the impact of the station due to riverine flooding, postulated dam failures up stream of the site, tsunamis and the probable maximum hurricane (PMH). The maximum wave runup expected at the site is summarized in FSAR table 2.4-6.

The accident having the greatest potential for requiring SDG operation and widespread impact on diesel fuel suppliers and the normal diesel fuel oil truck delivery routes is the PMH. Modern weather forecasting techniques provide a minimum of 24 hours warning time for plant preparation and protection. This time period allows management to order and receive fuel. Filling the available diesel engine fuel oil storage tanks to capacity before the onset of the PMH permits all diesel engines to operate fully loaded continuously for 30 days.

During the PMH flooding above site grade may occur for 48 hours. Post storm analysis of current fuel inventory, fuel consumption, offsite AC power availability, fuel supplier operability and fuel delivery path availability will determine the fuel supplier, delivery method and degree of urgency.

Any of following suppliers may be utilized to provide diesel fuel during normal and emergency conditions:

Fuel Supplier	Approximate Distance to HCGS
Crouse Fuel Service Newark, Delaware	40 mi
Fogg Ross Oil Co. Salem, New Jersey	12 mi
Trenton Oil Co. Trenton, New Jersey	80 mi
Reco, Petrolium Co. Reading, Pennsylvania	80 mi
ASCO Fuel Allentown, Pennsylvania	90 mi

In addition to the diesel fuel oil distributors listed above, Getty, Texaco and the Sun Oil Company have refineries within a 75 mile radius of the site.

<u>Utilization of Alternate Available Fuels</u>

In the unlikely event that all fuel oil delivery methods fail, diesel generators are still required for use as the integrity of the fuel cladding or containment structure is in jeopardy fuel may be transfered from the auxiliary boiler 1,000,000 gal. fuel oil supply tank.

The combination of conservation, pre-storm planning, emergency procurement and the availability of alternate fuels assures a fuel oil supply for the SDG.

Due to the seven day required fuel inventory, proximity to more than one supplier of diesel fuel and the sites meteorological history snow accumulation will not impact continuous operation of the diesel engines.

QUESTION 430.90 (SECTION 9.5.4)

Provide the source of power for the solenoid valve in the fuel oil storage tank fill line, diesel engine motor driven fuel oil booster pump and the motor characteristics, i.e., motor hp., operating voltage, phase(s) and frequency. Also include pump capacity and discharge head. Revise the FSAR accordingly. (SRP 9.5.4, Part III)

RESPONSE

The source of power for solenoid valve (SV-7534) is Non-Class IE. However, valve HV-7534 has a manual override capability which allows manual operation for emergency diesel fuel oil tanks during an emergency condition. The motor driven fuel oil pump and the fuel oil transfer pumps are powered from a Class IE power source. INSERT Table 9.5-4 has been revised to include operating voltage, phase(s) and frequency of diesel fuel oil transfer pump and motor driven fuel oil pump motors. Table 9.5-4 provides the diesel fuel oil transfer pump horsepower and capacity at rated discharge pressure, and the capacity at rated discharge pressure for the motor driven fuel oil pump.

3.4.90 POWER SOURCES FOR MOTOR DRIVEN FUEL OIL PUMPS AND FUEL OIL
3.5.4 TRANSFER PUMPS HAVE NOT BEEN IDENTIFIED.

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INSERT

430.90 ... which receives its power from the ~~associated~~ respective Class 1E diesel generator channel I.

Sections 9.5.4.2.2 and 9.5.4.2.4 have been revised to incorporate this.

e. One ac motor-driven standby fuel oil pump

f. One duplex fuel oil pump suction strainer

g. One duplex fuel oil pump discharge filter

h. One conservation vent with flame arrestor

i. One emergency relief vent

j. One fill connection duplex fuel oil filter

k. One emergency fill station duplex fuel oil filter.

All equipment is mounted on the SDG skid, except for the storage tanks, the fuel oil transfer pumps, and the fuel oil day tank.

9.5.4.2.1 Diesel Fuel Oil Storage Tanks

Each set of two storage tanks is located below its corresponding SDG unit in a separate concrete enclosure at elevation 54 feet. Each tank has connections for filling, venting, transfer pump suction, overflow return from the day tank, instrumentation, drain/sampling, and a manhole. The interior and exterior surfaces of the tank are corrosion-protected by Carboline Carbo Zinc 11 coatings. An elevated platform is provided over the tank for easy access to the instruments and the manhole.

Each set of storage tanks can store a quantity of diesel fuel oil that is sufficient for 7 days of continuous operation of one SDG unit under rated full operating load.

9.5.4.2.2 Diesel Fuel Oil Transfer Pumps

One diesel fuel oil transfer pump is provided for each fuel oil storage tank. The diesel fuel oil transfer pumps receive their power from their 1E diesel generator channel. Each pump can transfer fuel oil to the day tank through its own discharge line. This pump, mounted outside the [illegible] suction head (NPSH) that is [illegible] located below the bottom of the storage tank so that the pump impeller remains continuously flooded. Operation of the transfer pumps is automatically controlled by a high-low level switch on the fuel oil day tank. Either transfer pump can refill the day tank, and operation is automatically alternated for even pump wear. Because the capacity of the transfer pump is greater than the fuel consumption of the diesel engine, it can supply fuel oil to the engine and simultaneously increase the inventory of the day tank.

9.5.4.2.3 Standby Diesel Generator Fuel Oil Day Tanks

Each day tank contains sufficient fuel oil for 1-3/4 hours of continuous operation of the diesel engine at rated full load. Under normal conditions, fuel oil in the day tank is automatically replenished by either fuel oil transfer pump from either fuel oil storage tank. The day tank is located in the SDG room so that fuel oil flows by gravity to the fuel oil pumps to maintain a flooded pump suction. The day tank has connections for filling, overflow to the storage tanks, recirculation from the fuel injection system, venting, instrumentation, drain to the storage tanks, a drain for drawing off accumulated water, and an inspection, and sampling port.

9.5.4.2.4 Standby Diesel Generator Fuel Oil Pumps

Each SDG is provided with an engine-driven fuel oil pump and an ac motor-driven fuel oil pump. [The motor-driven fuel oil pump motor receives it power from its ~~associated~~ respective Class 1E diesel generator channel.] These pumps take suction from a common header. Since fuel oil flows through this header by gravity, both pumps stay continuously primed. A shutoff valve, locked open, is provided on the suction header to allow for maintenance or repair of the fuel oil pumps. Since the fuel oil pumps operate in parallel, a check valve is provided on the discharge line of the motor-driven pump to prevent recirculation when this pump is not in operation. The motor-driven fuel oil pump is automatically energized by low pressure in the fuel oil supply header and deenergized when pressure has returned to normal.

9.5.4.2.5 Filters

The system includes a 40-micron particle retention duplex strainer on the pump suction header, and a 5-micron-particle retention duplex filter on the pump discharge header.

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QUESTION 430.92 (SECTION 9.5.4)

In Section 9.5.4.2.2 of the FSAR you state that "Either transfer pump can refill the day tank, and that operation is automatically alternated for even pump wear". Provide the following:

a. Provide a detailed description with the aid of system schematics and logic diagrams of the automatic alternations control system for the fuel oil transfer pumps.

b. If tank standing time for sediment control during refilling is to be used to resolve the concern of Request 430.87. Discuss how the automatic alternation control system for the transfer pumps will be bypassed to allow for sediment settling. The discussion should include the necessary procedures for the manual and/or automatic operations of the pumps. (SRP 9.5.4, Parts I, II & III)

RESPONSE

a. The electrical schematic and control logic diagram for ~~the~~ the diesel fuel oil transfer pump controls are shown on Figures 430.92-1 and 430.92-2. The relays and ~~contacts~~ devices listed below perform the following functions:

FTC = Day Tank Level Control
FLA = Day Tank Back Up Level Control
5EX = Diesel Generator Emergency Stop

INSERT →

~~CR4, CR5, CR6 } relays and contacts which perform the automatic alternating function.~~

~~Manual (HAND) operation bypasses the alternating function which allows both pumps to be operated simultaneously or out of sequence.~~

b. Provisions for tank standing time for sediment control are considered in response to Question 430.87.

~~Identification of Diesel Fuel Oil Transfer Pump Control Logic is not provided~~

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130.92

CR4 = pump No.1 control relay

CR5 = pump No.2 control relay

CR6 = pump No.1 and 2 control relay

CS-34 = pump No.1 control switch

CS-35 = pump No 2 control switch

Automatic Operation

The fuel oil day tank level control provides start and stop interlocks, FTC, for the fuel oil transfer pump controls. When both pump control switches, CS-34 and CS-35, are in the auto position and both pumps are off, a low diesel fuel oil day tank level condition will start pump No.1. This pump will stop automatically when the diesel fuel oil day

30.92 (cont) tank is filled. During the period when pump No. 1 is running, CR6 relay will be sealed-in and will remain sealed-in after the pump has stopped. On the next tank refill cycle, pump No. 2 will start and also deenergize CR6 to repeat the tank filling cycle beginning with pump No. 1.

Manual Operation

The diesel fuel oil day tank may be filled manually at the remote engine control panel by use of one or both transfer pumps by operating control switches CS-34 and/or CS-35. The switches

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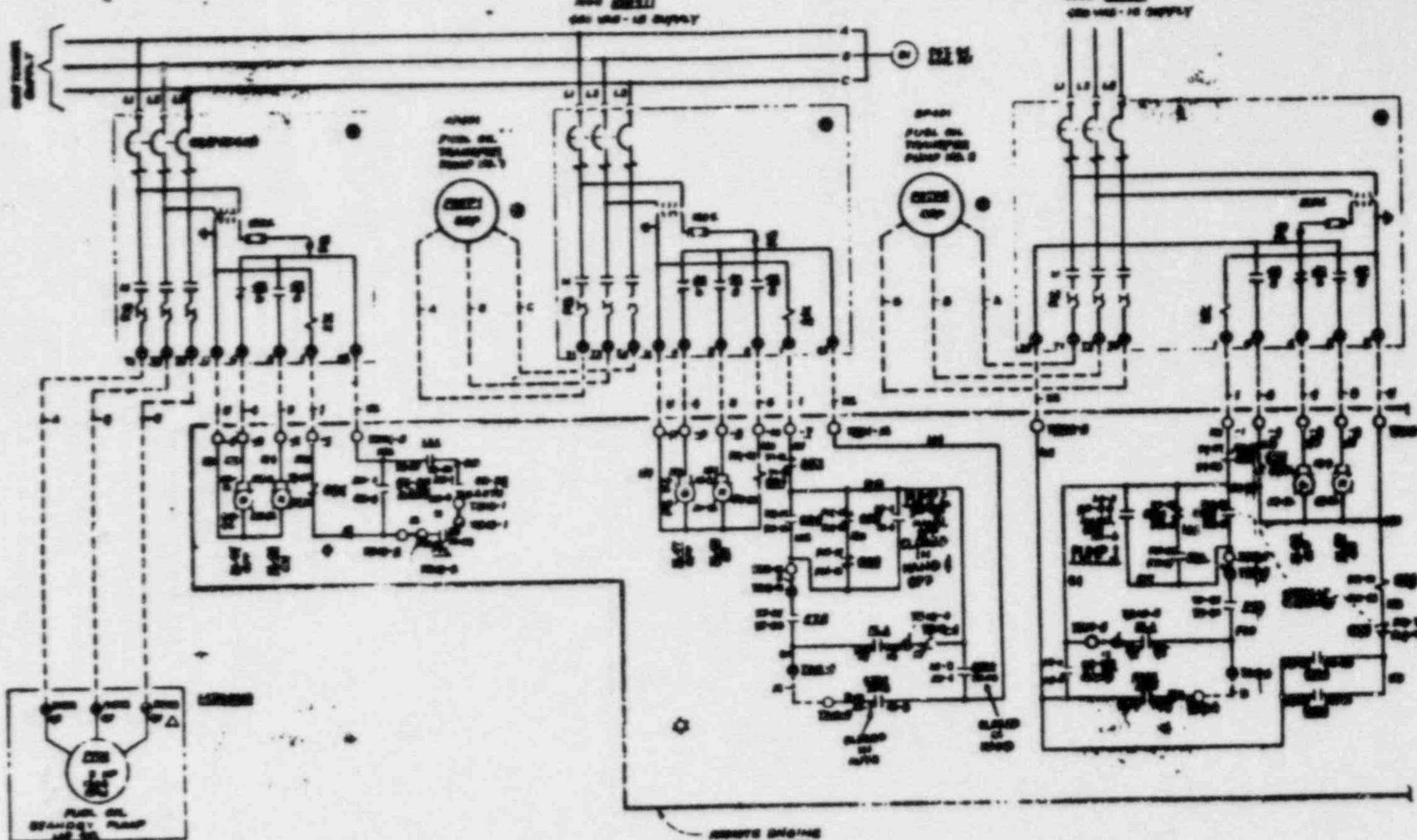
0.92(cont) have three maintained positions - hand, off and auto. The "Hand" position will bypass the tank level control interlock used for automatic pump start. If the tank is filled to capacity under the manual filling operation, a high tank level alarm located at this panel will be initiated. The "Off" position will permit automatic filling of the day tank by the second pump under the tank control interlock while bypassing the pump cycling feature if one switch is in the "Off" position. If one or both switches are in the "Hand" or "Off" position, a fuel oil transfer system 4/7

30.92 (cont) not in automatic alarm, also located on this panel, will be initiated.

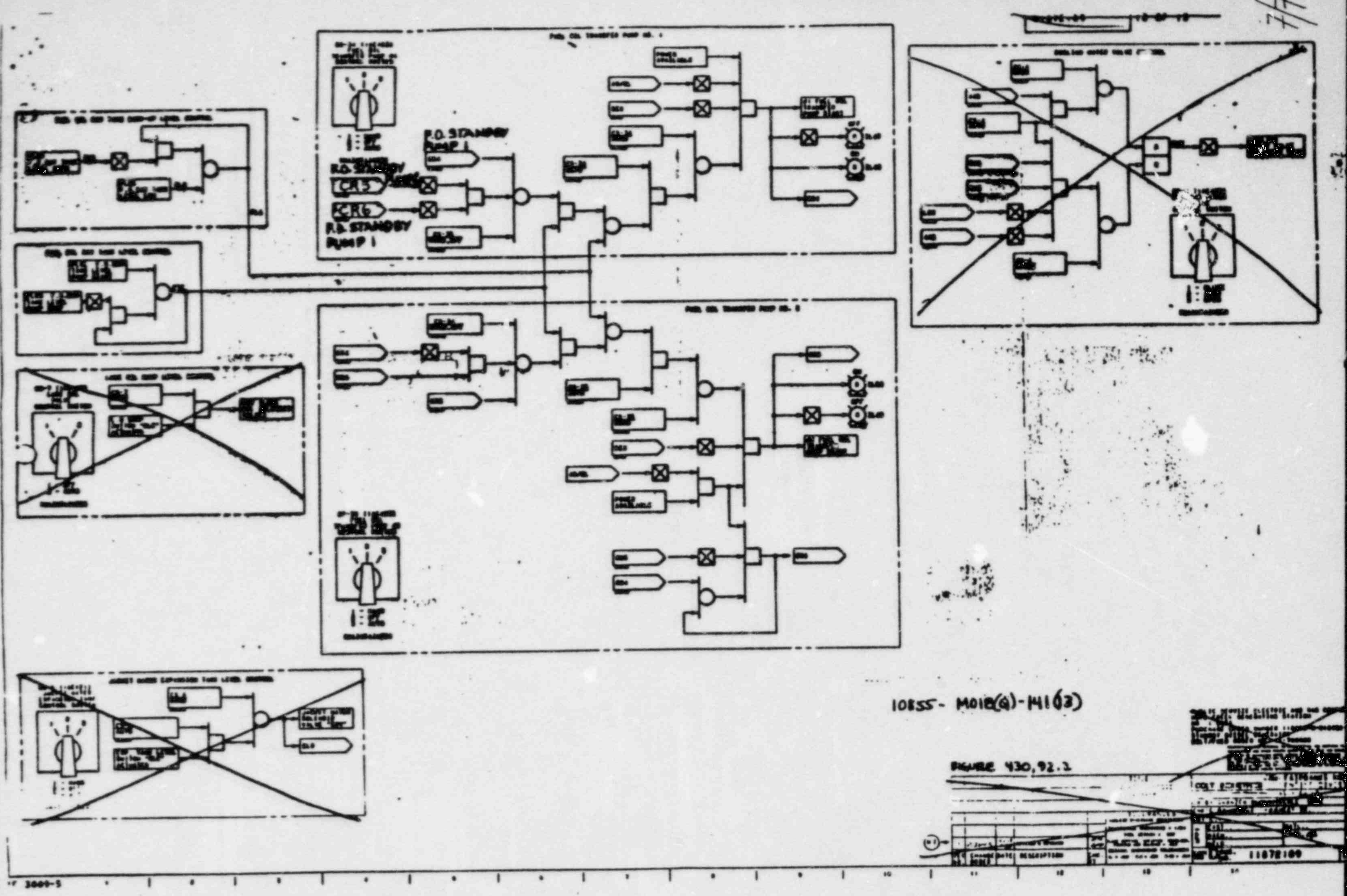


	480V - 1E MCC			
DIESEL	UNIT 1	UNIT 2	UNIT 1	UNIT 2
A	[illegible]	[illegible]	[illegible]	[illegible]
B	[illegible]	[illegible]	[illegible]	[illegible]
C	[illegible]	[illegible]	[illegible]	[illegible]
D	[illegible]	[illegible]	[illegible]	[illegible]

HOPE CREEK GENERATING STATION
FINAL SAFETY ANALYSIS REPORT

ELECTRICAL SCHEMATIC
ENGINE CONTROL

FIGURE 430.82-1



F.O. STANDBY PUMP 1
F.O. STANDBY
CR5
CR6
F.O. STANDBY PUMP 1
10855- M018(Q)-H1(3)
FIGURE 430.92.2
11072100

QUESTION 430.93 (SECTION 9.5.4)

You state in FSAR Section 9.5.4.2.6 and show in Figure 9.5-22 that a common normal and emergency fill line for all the fuel oil storage tanks is provided. This is acceptable as stated in Section 7.5 of ANSI N-195 provided that the requirements of Seciton 7.3 of the standard are met. Section 7.3 requires that "provisions shall be made to allow refilling the supply tanks after a design basis accident." The common truck fill connectin does not meet this requirement since a design basis accident such as a tornado missile or pipe break could damage the connection thus preventing refilling the tanks. Also a fire in one D/G storage tank room would result in the inability to refill the other storage tanks or result in flooding the damaged tank room with fuel oil during refilling. This is unacceptable. We require the following:

a. An alternate means of refilling each of the diesel generator fuel oil storage tanks following a design basis event.

b. Since the common fill line appears to cross all the fuel oil storage tank room provide isolation valves on the common fill line on both sides of the fuel oil storage tank room walls to isolate all the tanks. Revise your design accordingly. (SRP 9.5.4, Parts II & III)

RESPONSE

a. The diesel fuel oil storage tank fill lines are provided with an emergency fill connection, as described in Section 9.5.4.2.6. The emergency fill connection and the associated diesel fuel oil transfer piping downstream of the normally closed valve 0-V-010, as shown on revised Figure 9.5-22, are seismically analyzed. This piping is also located in the SDG area of the auxiliary building, which is designed to Seismic Category I requirements, reference Section 9.5.4.3. The piping, including the emergency fill connection is protected from tornado missiles and pipe breaks as described in Sections 3.3, 3.5 and 3.6 respectively.

INSERT

b. The common fill line and individual fuel oil storage tank manually-operated fill valves are located outside the diesel fuel oil storage tank enclosures. The location of the common header and the individual tank fill valves in the corridor outside the diesel storage tank enclosure is 3 feet 6 inches from the wall of the enclosure. The enclosure is designed as a fire barrier in accordance with Section 9.5.1.1.10. The diesel fuel oil storage tank enclosures are provided with fire protection in accordance with Section 9.5.1.1.13. The system design normally has all of the tanks isolated through normally closed fill valves. Fire protection boundaries are shown on Figures 9.5-1, 9.5-2, and 9.5-3.

430.93 Ability to refill the fuel oil storage tanks following (9.5.4) damage to the common fuel fill line is not addressed.

2/4

Insert

430.93 If the diesel fuel oil storage tank fill line is unable to deliver diesel fuel oil to the diesel fuel oil storage tanks, after a design basis event, an alternate path for filling the tanks will be established. The alternate flow path will be a hose which will be temporarily routed inside the area of the diesel generator auxiliary building from the source to the diesel fuel oil storage tanks. The tank(s) can then be filled through the #-4 inch spare flanged connection or the manhole opening, both of which are located on the top of the tanks

430.93 (cont) and are accessible for this purpose.

When filling the diesel fuel oil storage tanks by this method, proper hose routing will be enforced to ensure that the hose is not crimped or damaged. Fire watches will be utilized along the length of the hose, as necessary, when this operation is in progress.

QUESTION 430.94 (SECTION 9.5.4)

In Section 9.5.4.2.6 of the FSAR you state that the emergency flood protected truck fill connection for the fuel oil storage tanks is located inside the auxiliary building at Elevation 102 feet (plant grade level). In Section 3.4, Table 3.4-1 you state that the design flood elevation for the D/G building is 120.4 feet with the still water height at 113.8 feet. Provide the following:

a. Describe or provide adequate drawings to show the location of the emergency fuel oil storage tank fill connection.

b. Assuming the emergency fill connection must be used to refill the fuel oil storage tanks. Describe how fuel oil will be delivered to the site during flood conditions and describe the procedures that will be used in refilling the storage tanks during flood conditions and non-flood conditions. The procedures should include fuel hose routing and fire watcher.

c. Describe how flood water is prevented from entering the building during refueling operations. (SRP 9.5.4, Parts I, II & III)

RESPONSE

The diesel fuel oil emergency fill line is located in the auxiliary building at floor elevation 102 feet-0 inches and a center line elevation of 106 feet-6 inches. The emergency diesel fuel oil fill connection is located in an area which is flood protected by the auxiliary building main service entry doors. The location of the diesel fuel oil connection is shown on Figure 430.94-1, reference Figure 1.2-35 for location relative to watertight door.

The diesel fuel oil tanks are designed for a seven day supply with the diesel generators operating at full capacity, reference Section 9.5.4.3. It is not anticipated that localized flooding will prevent refueling from occuring at some time during this period. System operating procedures (SOP) will address the refilling of the storage tanks from any fill connection and include proper fuel hose routing and the establishment of a fire watch, when necessary. Abnormal operating procedure, acts of nature, shall provide direction to the operator as to which SOP is to be used, dependent upon environmental conditions. These procedures will be in place by January 1985. Additionally refer to response to question 430.88 for information pertaining to fuel oil delivery to HCGS durring flood conditions

Leakage through the door seals is removed by drainage systems in the building. The flood doors are capable of withstanding the flood height as described in Section 3.4 and Table 3.4-1.

1/1

QUESTION 430.95 (SECTION 9.5.4)

In Section 9.5.4.2.6 of the FSAR you state that "Diesel fuel oil can be transferred to the auxiliary boiler fuel storage tank through a one-way common line that is connected by a normally closed manual valve branched off of each fuel oil transfer pump discharge line." Insufficient information is provided in the FSAR on the line connecting to the auxiliary boiler. However from the information provided, a failure of this line or the inadvertent opening of the isolation valve could contaminate the diesel fuel oil by siphoning action from the auxiliary boiler storage tank which appears to be at grade elevation 102' (fuel oil storage tanks are at elevation 54') or jeopardize the availability of the diesel generators by depleting the seven day fuel oil storage capacity. These are unacceptable conditions. It is our position that the connection to the auxiliary boiler fuel oil storage tank be either removed from the diesel generator fuel oil transfer system or justify the necessity of this connection between the auxiliary boiler and D/G fuel oil system (SRP 9.5.4, Part III).

RESPONSE

The diesel fuel oil transfer line from the diesel fuel oil storage tanks to the auxiliary boiler fuel oil storage tank is required for the following reasons:

a. regulatory requirements require the complete drainage of the diesel fuel oil storage tanks periodically,

b. provide capability of draining the diesel fuel oil storage tanks for maintenance and/or inspection,

c. provide capability to drain possibly contaminated diesel fuel oil.

The piping for transfering diesel fuel oil to the auxiliary boiler fuel oil storage tank has a minimum of 6 valves in the line from the transfer line of the diesel fuel oil storage tanks to the auxiliary boiler fuel oil storage tank.

The number of three (3) normally closed valves, are one (1) locked closed valve and two (2) check valves in the transfer line will prevent siphoning of the auxiliary boiler fuel oil back to the diesel fuel oil storage tanks if one of the valves is inadvertantly opened, and will minimize the possibility of fuel oil being inadvertently transferred away from the standby diesel generator fuel oil day tanks.

see attached

430.95 Description of common F.O. oil transfer line does not conform (9.5.4) to figures. Response inadequate.

1/3

430.95 Three of the valves are normally closed valves, two of the valves are check valves allowing flow from the diesel fuel oil storage tanks to the auxiliary boiler fuel storage tank, and one valve is a normally locked closed valve, reference figures 9.5-22 and 9.5-31, sheet 1 of 2. The combination of normally closed valves, check valves and a locked closed valve will prevent inadvertant siphoning of the auxiliary boiler fuel oil back to the diesel fuel oil storage tanks if one of the manually operated valves is inadvertantly

430.95 (cont) opened. The combination of a normally locked closed valve and three normally closed valves minimizes the possibility of diesel fuel oil being inadvertantly transfered away from the diesel fuel oil storage tanks to the auxiliary boiler fuel oil tank if one of the valves is inadvertantly left open.

QUESTION 430.96 (SECTION 9.5.4)

The same line described in Request 430.95 above is used as a means of replenishing the day tanks of any diesel generator from the other D/G fuel oil storage tanks. This is an acceptable design. The figures provided inthe FSAR do not show whether this is located in the diesel generator rooms or the fuel oil storage tank vaults. In either event damage to this line could result in flooding of any one of the rooms with fuel oil, thus creating a fire hazard and possible loss of more than one diesel generator. This is unacceptable. It is our position that isolation valves similar to the ones required in Request 430.93b be provided in this line. (SRP 9.5.4, Part II & III)

RESPONSE

The portion of the diesel fuel oil transfer piping, in the diesel generator area, used to transfer diesel fuel oil to the auxiliary boiler fuel oil storage tanks or another diesel's fuel oil day tank is seismically analyzed. The piping is routed through compartments that are separated by fire boundaries. The consequences of a pipe break in any one of these compartments would only affect one diesel generator unit. The rooms are provided with oily waste drains to minimize the effects of spillage.

The piping outside the diesel generator room is located in areas covered by fire protection, in the auxiliary building diesel generator area, as discussed in Section 9.5.1.1.10 and response to Question 430.99 which references figures covering these areas.

INSERT

Diesel fuel oil transfer piping from the diesel fuel oil storage tanks to the auxiliary boiler fuel oil storage tank is not normally pressurized piping and has the capability of being drained after use. The piping is also isolated from the line from the diesel fuel oil storage tank to the fuel oil day tank by a normally locked closed isolation valve.

Addition of another isolation valve for this case would not increase the reliability of the system and in fact would decrease the flexibility of the design to cross-transfer fuel to other tanks when any of the tank vaults become inaccessible.

[redacted]

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Insert

430.96 The common portion of the diesel fuel oil transfer piping, to the auxiliary boiler fuel oil storage tank, is located outside of the diesel generator ventilation rooms (El. 77'-0") in a common corridor. The corridor is bounded by three hour fire barriers as discussed in Section 9.5.1.1.10. The failure of the common portion of the diesel fuel oil transfer piping to the auxiliary boiler fuel oil day tank will not cause the loss of a diesel generator.

QUESTION 430.100 (SECTION 9.5.5)

Section 9.5.5 indicates that the function of the diesel generator cooling water system is to dissipate the heat transferred through the: 1) engine water jacket, 2) turbo-charger 3) engine air water coolers, 4) bearings, and 5) governor lube oil cooler. Provide information on the individual component heat removal rates (But/hr), flow (lbs/hr), temperature differentials (°F), inlet and outlet temperatures (°F) and the total heat removal rate required. Also provide the design margin (excess heat removal capacity) included in the design of major components and subsystems. (SRP 9.5.5, Parts II & III).

RESPONSE

As described in Section 9.5.5, the diesel generator cooling water system is comprised of the following two subsystem:

a. Jacket water cooling loop
b. Intercooler and injector cooling loop (provides cooling to turbo-charger, bearings, and combustion air)

generator outboard

Tables 9.5-6 and 9.5-7 have been revised to include the requested information on the respective heat exchangers. Total design heat removal rate for these heat exchangers is 8,530,000 Btu/hr. Both of these heat exchangers and the safety auxiliaries cooling system are designed to remove 110% of the design rating heat load.

A summary of the heat loads, flow rates and differential temperatures for the above components is as follows:

Insert I

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430.100 Insert I

	OPERATING CONDITION	DESIGN CONDITION
Intercooler Water Heat Exchanger		
Heat load (BTU/HR)	3,118,000	3,732,000
Raw water flow (GPM)	1176	1176
R.W. inlet temp. (°F)	< 95	95
R.W. temp. diff. (°F)	5.3	6.5

The intercooler water heat exchanger is designed to dissipate the heat from the combustion air coolers and the generator bearing.

	OPERATING CONDITION	DESIGN CONDITION
Jacket Water Heat Exchanger		
Heat load (BTU/HR)	5,412,000	5,953,000
Raw water flow (GPM)	1176	1176
R.W. inlet temp. (°F)	< 100.3	101.5
R.W. temp. diff. (°F)	9.2	10.2

The jacket water heat exchanger is designed to dissipate the heat from the engine water jackets, turbocharger and governor lube oil cooler.

QUESTION 430.101 (SECTION 9.5.5)

Provide the results of a failure mode and effects analysis to show that failure of a piping connection between subsystems (engine water jacket, lube oil cooler, governor lube oil cooler, and engine air inter-cooler) will not degrade engine performance or cause engine failure. (SRP 9.5.5, Parts II & III)

RESPONSE

The interconnecting piping (SACS water side) between the intercooler heat exchanger, jacket water heat exchanger, and lube oil heat exchanger, is moderate energy piping and is designed to Seismic Category I Criteria. As discussed in Section 9.2.2, during an LOP/LOCA each of the two SACS loops provide cooling to the two diesel engines dedicated to each loop. However, if one of the loops is inoperative, the two diesel engines dedicated to this loop will be re-aligned to the operating loop by manually opening the valves in the intertie lines. If a pipe break occurs in the interconnecting piping between the cooling subsystems of a diesel engine which results in leakage exceeding the makeup supply capability, the low-low switch in the expansion tank will ultimately activate an alarm in the main control room. This diesel engine will then be isolated from the SACS by manually closing the isolation valves (shown on Figure 9.2-5). Therefore, failure of the cooling water piping will cause loss of cooling water supply to only one diesel engine. Loss of cooling water will result in shutdown of this diesel engine. However, as stated in Section 7.5.5.3, since only three of the four SDGs are required for safety loads, failure of the SDG does not preclude safe shutdown of the plant following LOCA/LOP.

[redacted]

See attached for additional response.
Insert

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Insert

430.101

The design basis for the safety auxiliary cooling system (SACS) is that no single active failure can disable an entire loop. The SACS is also designed to prevent a complete loss of function due to a passive failure during the long term containment cooling mode following a LOCA. Leakage from a passive failure is assumed equivalent to that resulting from pump seal failure. The rate of leakage is such that after receipt of a Low-Low 2/3

(cont)

(c)

430.101 cont

SACS expansion tank alarm sufficient operator action time, approximately 30 minutes, is available to realign the diesel generator cooling to the remaining SACS loop.

QUESTION 430.104 (SECTION 9.5.5)

Describe the instrumentation, controls, sensors and alarms provided for monitoring of the diesel engine cooling water system and describe their function. Discuss the testing necessary to maintain and assure a highly reliable instrumentation, controls, sensors, and alarm system, and where the alarms are annunciated. Identify the temperature, pressure, level, and flow (where applicable) sensors which alert the operator when these parameters exceed the ranges recommended by the engine manufacturer and describe what operator actions are required during alarm conditions to prevent harmful effects to the diesel engine. Discuss the systems interlocks provided. (SRP 9.5.6, Part III)

RESPONSE

The instrumentation, controls, sensors and alarms are described in Section 9.5.5. The testing of diesel engine instrumentation and control will be performed using written procedures and in accordance with the frequencies specified in the Hope Creek Technical Specifications. Those items not covered in that section will be tested in accordance with other written procedures. Alarm locations are discussed in Section 8.3.1.1.3. Section 9.5.5.5 has been revised to identify the temperature, pressure, and level parameters which alert the operator when the manufacturer's recommended ranges are exceeded, and also, to include the system interlock. Operator action during alarm conditions will be addressed by the appropriate alarm response procedure, OP-AR.EG-XXX series. Available January 1985.

Insert A here

1/8

RESPONSE

2/8

INSERT A page 1

The instrumentation controls, sensors and alarms are described in section 9.5.5. The Instrumentation and Controls Department will perform the calibration checks and calibration of instrumentation, controls, sensors and alarm necessary to maintain and assure operability of the diesel engine cooling water system. The equipment, function and surveillance frequency is provided in Table 430.104-1. Equipment testing will be performed in accordance with written procedures. Alarm locations are discussed in Section

Insert A (Cont'd) page 2

8.3.1.1.3. Section 9.5.5.5 has been revised to identify the temperature, pressure and level parameters which alert the operator when the manufacturer's recommended ranges are exceeded. Operator response to alarm conditions is summarized in Table 430.104-2.

The diesel generator cooling water system is provided with automatic refill of the jacket cooling water expansion tank from the demineralized water system. Heaters prewarm the jacket cooling water when water temperature decreases below a preset temperature limit. These automatic controls maintain the diesel engine cooling water system in standby readiness.

The diesel engine starting logic does not require permis signals from the diesel engine cooling water system. Norn and emergency starts of the diesel engine will not be inhibited. The diesel engine trip and stopping circuits cann be activated by cooling water system malfunctions or related instrument failures.

TABLE 430 104-11

DIESEL GENERATOR JACKET WATER SYSTEM.

System ID	INST NO		~~MANUFACTURER~~	~~MODEL NO.~~	FUNCTION	~~PROC TYPE~~	Surveillance frequency* ~~INTERVAL~~ E/P	
KJ	LSHL-3887	A-D	MAGNETROL	A-103-F	JACKET WATER EXPANSION TANK	DC	F	F
KJ	PSL-6612	A-D	ASCO	SB-11	J.W PRESS / DETECTS ENG SPEED.	DC	F	F
KJ	PSL-6613	A-D	ASCO	SB-11	JACKET WATER PRESS	DC	F	F
KJ	PT-7789	A-D	FAIRCHILD	MODEL 20	JACKET WATER PRESS	CC	P	P
KJ	TI-7840	A-D	ASHCROFT	EI	J.W. HX OUT	DC	P	P
KJ	TI-7841	A-D	"	"	J.W. HX IN	DC	P	P
KJ	TI-7842	A-D	"	"	J.W KEEPWARM HX OUT	DC	P	P
KJ	TI-7843	A-D	"	"	J.W PUMP OUT	DC	P	P
KJ	TS-6611	A-D	ASCO	SB-11	J.W HEATER THERMOS.	DC	F	F
KJ	TSH-6609	A-D	"	"	J.W. TEMP	DC	F	F
KJ	TSH-6610	A-D	"	"	J.W KEEPWARM TEMP	DC	F	F
KJ	TSL-6607	A-D	"	"	J.W. TEMP	DC	F	F
KJ	TSL-6608	A-D	"		J.W KEEPWARM TEMP.	DC	F	F
KJ	PI-7799	A-D	ASHCROFT	1377AS	J.W PMP DISCH (RECP)	CC	P	P
KJ	TI-6614	A1-D1	Honeywell	DIALATROL	J.W TEMP	DC	F	F
KJ	TI-6614	A2-D2	"	"	" "	DC	F	F

* [redacted]

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TABLE 430.104-1

INTERCOOLER WATER SYSTEM

System ID	INST NO		[illegible]		FUNCTION	~~[illegible]~~ TYPE	Surveillance Frequency* E/R	
KJ	PSL-6621	A-D	ASCO	SB-11	INTERCOOLER WATER PRESS	DC	F	F
KJ	DT-6631	A-D	FAIRCHILD	MODEL 3D	INTERCOOLER PUMP DISCH.	CC	P	P
KJ	TI-6624	A-D	ASHCROFT	EI	INTERCOOLER PUMP OUT	DC	P	P
KJ	TI-6625	A-D	"	"	INTERCOOLER HX OUT	DC	P	P
KJ	TI-6626	A-D	"	"	INTERCOOLER HX IN	DC	P	P
KJ	TI-6627	A-D	"	"	DG. WATER OUT TEMP.	DC	P	P
KJ	TSH-6620	A-D	ASCO	SB-11	INTERCOOLER WATER TEMP.	DC	F	F

* Surveillance Frequency

F = 18 months

P = 36 months

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TABLE 430.104-2

~~Response to Question 430.104~~

Summary of Operator Actions in Response to Diesel Engine Cooling Water System Alarms

High Priority Alarms:

a) JACKET WATER PRESSURE LOW

Check	Action
Instrument valve lineup	Open valves to switch and gauge if closed
Pressure indication	If normal: Attempt to clear alarm
Piping and Slex coupling integrity	If leaks or obstructions exist
Engine driven pump operability	

b) JACKET WATER TEMPERATURE HIGH

Check	Action
Operating Temperature indications	If normal: Attempt to clear alarm
Operation of temp control valve	
Engine driven pump operability	
Flow of SACS cooling water	Open SV2395 if closed

c) JACKET WATER TEMPERATURE LOW

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Check	Action
Operating temperature indications	If normal: Attempt to clear alarm
Operation of temp. control valve	Fail open design may cause this condition Notify Maintenance to repair when possible.

c) JACKET WATER EXPANSION TANK LEVEL HIGH

Check	Action
LSHL 7527 operating properly	If normal: Attempt to clear alarm
SV6615 is closed	Manually close SV6615 if open
Tank overflow	If overflowing, drain tank to clear alarm

d) JACKET WATER EXPANSION TANK FILLING

Check	Action
SV6615 is open	If not: If low level alarm occurs, manually open SV6615 to clear alarm If open: Confirm SV6615 closes before high level alarm is initiated

d) JACKET WATER EXPANSION TANK LEVEL LOW

Check	Action
LSHL 7527 operating properly	If normal: Attempt to clear alarm
	If switch has failed, operate SV6015 manually until alarm condition is cleared
Makeup demin water is available	Ensure pump is running and proper valve lineup
Drain valve position	Close drain valve and cap discharge pipe if leak exists.
Piping and flex coupling integrity	

Low Priority Alarms

a) JACKET WATER KEEP WARM TEMPERATURE HIGH

Check	Action
J.W. heater outlet temperature	If normal. Attempt to clear alarm
J.W keepwarm pump operating	Confirm power is available to the pump pump control switch is in AUTO Notify Maintenance if required
Heater thermostat operating	If not: manually control heater to clear alarm Notify I&C to repair thermostat

b) JACKET WATER KEEP WARM TEMPERATURE LOW

Check	Action
JW heater outlet temperature	If normal. Attempt to clear alarm
Position of pump and heater controls	Place switches CS 39 and CS 40 in AUTO
keepwarm pump and heater operating	Confirm. power is available to both components heater thermostat is operating Notify maintenance if required

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QUESTION 430.112 (SECTIONS 9.5.5)

Figure 9.5-24 of the FSAR shows a 1-inch overflow line off of the expansion tank. A description is provided as to its routing, its classification (Seismic and quality group) and its connection to any other systems in the diesel generator room (drain system, sump, etc.,). Provide the Seismic and quality group classification and the routing of the overflow line from the expansion tank to its end point. Discuss the effects of a line break on the operation of the diesel generator or on any D/G auxiliary equipment. (SRP 9.5.5 Parts II and III).

RESPONSE

INSERT 1

The expansion tank overflow line is seismic Category I, ASME B&PV Code, Section III, Class 3. Routing from the expansion tank to the equipment drain is all within the related diesel generator compartment. Water from the overflow line flows into an equipment drain which leads to the plant oily water waste collection system. ~~The equipment drain and the oily water waste system are non safety related~~. A line break in the expansion tank overflow line will have no effect on the operation of the corresponding diesel generator or on any diesel generator auxiliary equipment. Any water accumulated in a ruptured overflow line will be routed to one of two floor drains present in each diesel generator room. Both floor drains, which are adequately sized to handle any water accumulated in the overflow line, are routed to the oily waste system. ~~Since~~ there is no 1E equipment located in the area between the overflow line and the floor drains, therefore, no 1E equipment ~~will~~ would be affected by a line break.

INSERT 2

[redacted]

1/7

CN 327
430.112

430.112 Insert 1

The jacket water expansion tank has a high-low level alarm which would indicate a problem in the system prior to overflowing of the expansion tank.

Insert 2

The drainage system for the standby diesel generator areas is a non-safety related system. However the drainage system is embedded in seismic category I concrete flooring and walls. The standby diesel generator room drainage

130.112 (cont) system consists of two floor drains and six equipment drains. The drains in each standby diesel generator room are headered together to a common line. The drain line is provided with a normally closed isolation valve which will isolate that diesel generator room from the other diesel generator rooms, and the remaining portions of the system. Each standby diesel generator room drain header is routed vertically down to elevation 54'-0", in a seismic category I concrete wall, to a common horizontal drain header which is routed to an oily waste sump. The horizontal drain

430.112 (cont) header also accepts drains from the standby diesel generator ventilation rooms, which are located on elevation 77'-0", and from the diesel fuel oil storage tank rooms at elevation 54'-0". The drain header from each of the diesel fuel oil storage tank rooms is provided with a normally closed isolation valve, providing isolation capability for each diesel generator fuel oil storage tank room. The ventilation room and fuel oil storage tank room drainage lines are routed separatly to the common horizontal drain header.

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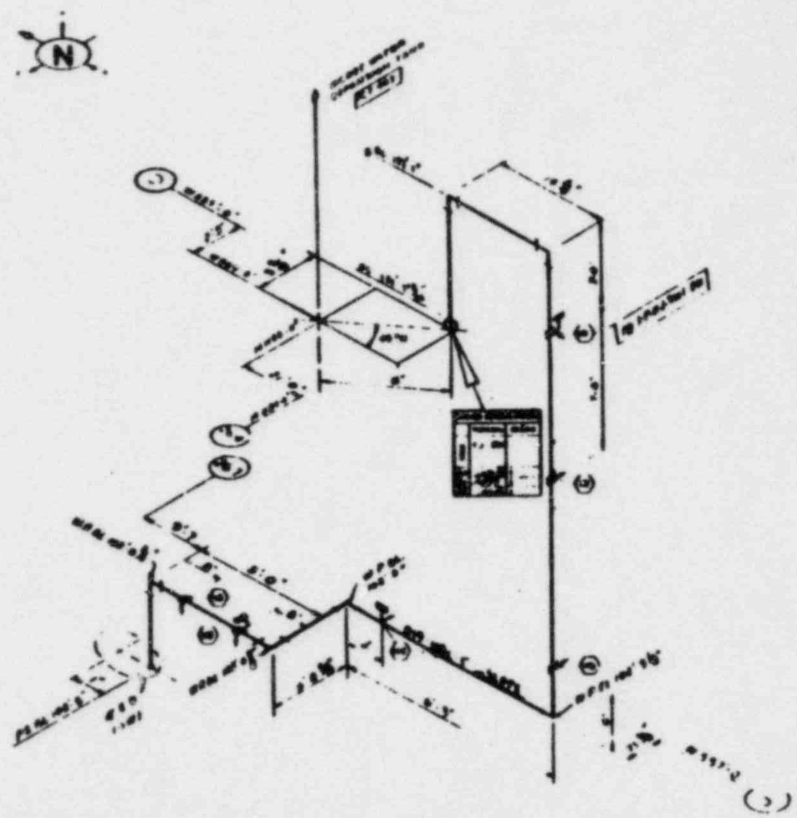
430.112 (cont) The vertical drain header from each of the standby diesel generator rooms and the common horizontal drain header are four inch cast iron piping which are provided with clean out connections. The drains from the diesel generator ventilation rooms and fuel oil storage rooms are ~~also~~ four inch cast iron pipe provided with clean out connections.

The drainage sump, which accepts drains from the common horizontal header, is provided with two 100% sump pumps, which pump the oily waste to the oily waste

5/7

430.112 (cont) processing system, level controls, and high level alarm. The pumping system is provided with a back flow preventor to prevent fluids from flowing back to the sump from the oily waste processing system.

Failure of a drainage system from any diesel generator room will not affect the operation of the other diesel generator rooms.



HOPE CREEK
GENERATING STATION
FINAL SAFETY ANALYSIS REPORT

ENGINEERED SMALL PIPING/
AUXILIARY BLDG OVERFLOW
FROM EXPANSION TANK [illegible]

FIGURE [illegible] AMENDMENT 4

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QUESTION 430.115 (SECTION 9.5.6)

Describe the instrumentation, controls, sensors and alarms provided for monitoring the diesel engine air starting system, and describe their function. Describe the testing necessary to maintain a highly reliable instrumentation, control, sensores and alarm system and where the alarms are annunciated. Identify the temperature, pressure and level sensors which alert the operator when these parameters exceed the ranges recommended by the engine manufacturer and describe any operator actions required during alarm conditions to prevent harmful effects to the diesel engine. Discuss system interlocks provided. Revise your FSAR accordingly. (SRP 9.5.6, Part III)

RESPONSE

The instrumentation controls, sensors and alarms are described in Sections 9.5.6.3 and 9.5.6.5.

For the testing frequency and where the alarms are annunciated see response to Question 430.104.

Only pressure controls are utilized in the starting air system; temperature and level sensors are not applicable.

As described in Section 9.5.6.3 a low pressure alarm on each of the air trains alerts the operator of system trouble in the control room. Safety relief valves on the receivers/air trains protect the system from overpressurization and operator action is not required to protect the engine during a trouble alarm (Reference Section 9.5.6.3). The system is interlocked with the engine barring gear to prevent inadvertent start attempts while the unit is under maintenance.

Insert A here

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Only pressure controls and instrumentation are utilized in the starting air system; temperature and level sensors are not applicable. A summary of the equipment and surveillance frequency is provided on Table 430.115-1.

As described in section 9.5.6.3 a low pressure alarm on each of the air trains alerts the operator of system trouble in the control room. Operator response to diesel engine starting air system alarms is summarized in Table 430.115-2. Safety relief valves on the receivers/air trains protect the system from over pressurization.

The diesel engine air starting system air compressor starts automatically when air accumulator pressure decreases to 280 psi and stops the compressor at 425 psi increasing. The system is disabled by the barring gear interlock which is used to prevent diesel engine operation during maintenance

BECHTEL

Diesel Engine

Starting & Control Air System

System ID	Inst No		Manufacturer & Model No.		Function		Type	Surveillance Frequency*	
KJ	PI-7528	A-H	Ashcroft	1279	Air Start Receiver Tanks		DC	P	P
KJ	PIC-7543	A-D	Circle Seal	[illegible]	Cont Air Press		CC	P	P
KJ	PSHL-6825	A-H	ASCO	SB-11	Start Air Comp. Control		DC	P	P
KJ	PI-7554	A1-D2	Ashcroft	1339A	Start. Air Press.	(@ LCP)	DC	P	P
KJ	PSL-7555	A1-D2	ASCO	SB-11	Start Air Press		DC	F	F

* Surveillance Frequency

F = 18 months
P = 36 months

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TABLE 430.115-$2

~~Response to Question 430.115~~

Summary of Operator Actions in Response to Diesel Engine Air Starting System Alarms.

<u>High Priority</u>

a) STARTING AIR PRESSURE LOW

Check	Action
Air header pressure	If normal: Check valve lineup to sensor Attempt to clear alarm If low: Proceed to next step
Receiver pressure	If normal: Check valve lineup to air start distributor If low: Proceed to next step
Valve lineup to receivers	Open valves if closed
Compressor running	If stopped: Confirm valve lineup to start switch Ensure power to compressor
Piping and flex coupling	If leaks or obstructions exist: Isolate leak if possible Notify Shift Supervisor

b) START FAILURE CRANKSHAFT NOT ROTATING

Check	Action
Barring device	If engaged: Check reason for engagement Disengage when possible
Engine trouble shutdown	Ensure shutdown has been reset
Control power available	Ensure circuit #3 is energized Notify Maintenance if repairs are required
Maintenance switch position	If 43 switch is not in REMOTE: Check reason for position Return to REMOTE when possible
Hand switch position	If HSS switch is not in NORMAL: Check reason for position Return to NORMAL when possible
If the diesel still fails to start, manually start at:	Control room panel remote engine panel local engine panel Air start solenoid valve

c) START FAILURE CRANKSHAFT ROTATING

Check	Action
Fuel system	If fuel system problems exist, respond in accordance with applicable alarm respon
Air intake system	Check condition of air intake filters, piping, flex connectors, and intake manifolds.

Low Priority

a) ENGINE LOCKED OUT FOR MAINTENANCE

Check	Action
Position of maintenance switch (83)	If switch is in MAINTENANCE position: Check reason for switch position Return to REMOTE when possible If switch is in REMOTE position: Attempt to clear alarm

b) DIESEL ENGINE IN LOCAL CONTROL

Check	Action
Position of maintenance switch (83)	If switch is in LOCAL position: Check reason for switch position Return to REMOTE when possible If switch is in REMOTE position: Attempt to clear alarm

c) REMOTE EMERGENCY TAKEOVER

Check	Action
Position of control switch (HSS)	If switch is in EMERGENCY TAKEOVER Check reason for switch position Return to NORMAL when possible If switch is in NORMAL: Attempt to clear alarm

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QUESTION 430.116 (SECTION 9.5.6)

Expand your description of the diesel engine starting system. The FSAR text should provide a detail system description of what is shown on Figure 9.5-26. The FSAR text should also describe: 1) components and their function, 2) instrumentation, controls, sensors, and alarms, and 3) a diesel engine starting sequence. In describing the diesel engine starting sequence include the number of air start valves used and whether one or both air start systems are used. (SRP 9.5.6, Part III)

RESPONSE

Section 9.5.6.2 has been revised to provide the requested information.

Section 9.5.6.2 has been revised to provide additional information.

the compressor when normal pressure is reached. When the SDG is on the barring gear, an interlock prevents an inadvertent start of the engine. An alarm and light, indicating that the SDG is locked out for maintenance are provided on the local and remote engine control panels and it also alarms in the control room. When the engine is locked out for maintenance the starting air headers are pneumatically and electrically locked out to prevent inadvertent starting attempts. The normal diesel air start utilizes both air start headers and both air receivers.

The starting and control air system is designed such that one receiver supplies starting air to one bank of cylinders, and the other receiver supplies starting air to the other bank of cylinders. The air headers are normally not connected together. The SDG can be started using only one receiver and one bank of cylinders. Therefore, if one receiver or the piping from the receiver to the cylinder bank should fail, the operation of the SDG would not be affected.

The starting air system is also connected to the air shutdown tank. The tank is actually an enlarged 6 inch section of ASME pipe in the air start supply piping on the engine skid which serves the sole purpose of closing the fuel racks to shutdown the engine on a stop signal.

9.5.6.3 Safety Evaluation

Safety-related components of the SDG starting and control air system, including supporting structures, are designed to Seismic Category I requirements as defined in Section 3.7. The system is located in the SDG area of the auxiliary building, which is designed to Seismic Category I requirements as discussed in Section 3.8.4.

The SDG starting and control air system is designed so that failure of any one active component does not result in the loss of starting air to any SDG. Therefore, failure of any one component of the SDG starting and control air system does not preclude safe shutdown of the plant following a loss-of-coolant accident (LOCA) and/or loss of offsite power (LOP). See Table 9.5-10 for the failure modes and effects analysis of the system.

Each SDG set is located in the auxiliary building, which is protected against the effects of natural phenomena such as tornadoes, hurricanes, and floods. Evaluation of the SDG

2/2

QUESTION 430.117 (SECTION 9.5.6)

Discuss the procedures that will be followed to ensure the air dryers are working properly and the frequency of checking/testing. (SRP 9.5.6, Parts II & III).

RESPONSE

Periodic (preventive) maintenance will be performed on the diesel engine air start system to ensure proper operation. System testing will be performed in accordance with Chapter 16, Technical Specifications.

Insert A here

~~Response~~

INSERT A

Procedure MD-PM.KJ-002(Q), Starting Air System Preventive Maintenance procedure provides instructions for maintaining a high degree of ~~operable~~ reliability for the air dryers in the diesel engine starting air system. The air dryers used in this application are refrigerant type. ~~The~~ Preventive maintenance ~~procedure~~ ~~listed above~~ ~~requires~~ includes a daily check of the compressor oil level and draining the starting air storage tanks ~~on a~~ bi-weekly. ~~bas frequency.~~

1/2

QUESTION 430.120 (SECTION 9.5.6)

Section 9.5.6.2 of the FSAR defines the air starting system for your plant as a high energy system. A high energy line pipe break in the air starting system of one diesel generator, plus any single active failure in any auxiliary system of any other diesel generator will result in loss of sufficient onsite AC power so that the plant cannot safely shutdown. This is unacceptable. Provide the following information:

a. Assuming a pipe break at any location in the high energy portion of the air start system, demonstrate that no damage from the resulting pipe whip, jet impingement, or missiles (air receivers, or enginer mounted air tanks) will occur on any of the four diesel generators or their auxiliary systems.

b. Section 9.5.6.2 states that the air receivers, valves, and piping to the engine are designed in accordance with ASME Section III Class 3 (Quality Group C) requirements. This is partially acceptable. We require the entire air starting system from the compressor discharge up to and including all engine mounted air start piping, valves and components be designed to Seismic Category I, ASME Section III Class 3 (Quality Group C) requirements. Show that you comply with this position. (SRP 9.5.6, Part II and III)

RESPONSE

See response to Question 430.82 (Section 3.6.1.2.1.19) for a discussion on the affects of a pipe break in the high energy portion of the air start system.

Insert 1

All of the air start piping, valves and receivers from the check valve on the air receiver inlet (including the check valve) to the air start solenoid valve on the engine are designed to Seismic Category I ASME Section III, Class 3 requirements. Refer to Figure 9.5-26 for component descriptions.

The compressor, air dryer, and piping up to the air receiver inlet check valve are not built to meet ASME code requirements because they do not serve a safety-related function. The air start valves, air distributors and the diesel engine cylinders are all pressure retaining parts, downstream of the air start solenoid valves, which do serve a safety-related function and are not ASME code items built to Seismic Category I requirements. These are specialty items that are not available as ASME components but which are built to the SDG manufacturers own critical specifications (see Table 3.2-1, Item XII.b.)

1/3

Insert 2

INSERT 1

For the purposes of pipe break and jet impingement analysis the emergency generator and its associated auxiliaries are considered a single system. As a single system a single failure is only required to be postulated in one system. A pipe break in any one of the diesel generator rooms will not affect the remaining diesel generator units and their associated auxiliaries

2/3

Separation of the diesel generator rooms by 18 inch ~~[illegible]~~ reinforced concrete walls protects other diesel generator units and auxiliaries from damage of pipe break in adjacent diesel generator rooms. Therefore

Insert 2

A break in ~~any of~~ the ~~non-~~safety-related compressor air dryer ~~AA~~ piping up to the ASME air inlet check valve would not cause any pipe whip damage ~~due~~ to the connecting ASME piping because the non-safety-related piping is 3/4" in nominal diameter and

~~have~~ is the same size

and has less than or equal wall thickn as the connecting ASME piping, therefore, damage from pipe whip is not considered as stated in SRP 3.6.2.

3/3

QUESTION 430.122 (SECTION 9.5.6)

You state in Section 9.5.6.2 of the FSAR that each independent starting system is designed to be capable of starting the engine five times from a pressure greater than 320 psig without recharging the starting air tanks. No information has been provided on system pressure alarms, compressor cut-in or cut-out. Provide the following.

a. Expand Section 9.5.6 of your FSAR to clarify the statement regarding the capability of the air start system of five starting cycles without recharging the air receivers. A successful diesel generator start is defined as the ability of the air start system to crank the diesel engine to the manufacturer's recommended RPM, to enable the generator to reach voltage, frequency and begin load sequencing in 10 seconds or less. With the receiver at the low pressure alarm setpoint and without recharging provide a tabulation of receiver pressure and diesel engine starting times for each of the five consecutive starts. In addition, describe the sequence of events when an emergency start signal exists. State whether the diesel engine cranks until all compressed air is exhausted, or cranking stops after a preset time to conserve the diesel starting air supply. Describe the electrical features (including interlocks) of this system in Section 8.0 of the FSAR (in the appropriate subsection).

b. Provide the pressures at which the following alarms and controls actuate: low pressure alarm, low low pressure alarm, high pressure alarm, air compressor cut-in and cut-out pressures, and all relief valve settings.

c. Verify that the low pressure alarm setpoint indicates to the operator that the compressor is not maintaining system pressure and that at this setpoint the system pressure and capacity is sufficient to start within 10 seconds the diesel generator five (5) times. (SRP 9.5.6, Part II)

RESPONSE

Section 9.5.6.2 has been revised to define the starting sequence, starting cranking cycles, system interlocks, controls setpoints, and alarms.

The basic control sequence is that the compressor cycles on at 380 psi, decreasing pressure, and off at 425 psi, increasing pressure. The low pressure alarm, to the remote panels and the control room is set at 325 psi decreasing pressure and there is no low-low pressure alarms. There is no high pressure alarm; however, the receiver safety relief valves relieve pressure at 475 psi.

The five starts, each in under 10 seconds at the low alarm set point condition (325 psi) was not verified in the shop performance tests. However, sufficient data exists from these tests to show an adequate air supply exists for five starts in under 10 seconds. Using the shop performance test data for the first D/G test unit (equipment No. 1DG400) which is typical of all the units, two tests were performed to demonstrate receiver capacity.

The first test verified the normal starting air sequence of both receivers and both air header banks to start the engine from a fully charged condition (425 psi) for five successful (each under 10 second) starts without recharging the receivers.

The second test simulated a failure of either one of the receivers and it's associated air header bank. The engine was started as often as possible using only one receiver and it's associated air header bank without recharging the receiver. The results of both of these tests are tabulated in Table 430.122-1. From the results of the five normal starts test only two of the starts occurred under the low alarm setpoint (325 psi) but each of these starts were well under 10 seconds. Taking the other test data for the "degraded" condition (only 1/2 of the starting air capacity case) we see nine consecutive successful starts were made below the low alarm setpoint using either the right air bank or left air bank. As indicated by the tabulated data in Table 430.122-1 two or three of the starts for either bank were in 10 seconds or less.

The test data also shows that ~~each of the~~ in each bank four starts ~~was~~ were achieved in under 10 seconds using the "compressor on" set point (380 psi). We can conclude that with both receivers in service, which is the normal design condition, the total number of starts would easily meet the five starts each in under 10 seconds criteria. This conclusion is further demonstrated by extrapolating the data of the first test from table 430.122-1. The first data point at or below the 325 psi set point is start point 4. Therefore, starts 4 and 5 provide valid data and 3 extrapolated points are necessary to demonstrate 5 start capability. From the data, a worst case 10 percent drop in starting air pressure results in an approximate 0.10 of a second increase in starting time. Based on this criteria

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the following data could be extrapolated

*START No.	START (PSI)	FINISH (PSI)		START TIME (SEC)
6	255 (-Δ 10%)	229	(+0.4)	8.8
7	229 (-Δ 10%)	206	(+0.5)	9.3
8	206 (-Δ 10%)	185	(+0.6)	9.9

This extrapolated data is conservative since the percent starting air pressure drop is decreasing by 10% as shown in the data and that the incremental time increase of 1/10 of a second is less than that indicated by test "B" data for the pressure ranges used.

Actual testing of the diesel generators to demonstrate five start capability is under evaluation by PSE&G due to the potential detrimental effects on overall diesel generator reliability.

TABLE 430.122-1

DATA EXTRACTED FROM COLT INDUSTRIES TEST REPORT DATED 2/82

Test	Start No	Start PSI	Finish PSI	Start Time
A) Normal Sequence	1	425 psi	380 psi	7.6 sec.
	2	380 psi	340 psi	7.8 sec.
	3	340 psi	305 psi	8.0 sec.
	4	305 psi	275 psi	8.1 sec.
	5	275 psi	255 psi	8.4 sec.
B) 1 Receiver Out 2 Cases: A Header (B Header)				
	1	425 psi (425 psi)	365 psi (365 psi)	8.9 sec (8.7 sec)
	2	365 psi (365 psi)	320 psi (325 psi)	9.2 sec (9.2 sec)
	3	320 psi (325 psi)	285 psi (290 psi)	9.6 sec (9.1 sec)
	4	285 psi (290 psi)	250 psi (260 psi)	9.9 sec (9.6 sec)
	5	250 psi (260 psi)	225 psi (235 psi)	10.3 sec (9.8 sec)
	6	225 psi (235 psi)	205 psi (215 psi)	10.8 sec (10.3 sec)
	7	205 psi (215 psi)	180 psi (190 psi)	11.3 sec (10.7 sec)
	8	180 psi (190 psi)	160 psi (170 psi)	11.9 sec (11.1 sec
	9	160 psi (170 psi)	145 psi (155 psi)	12.6 sec (11.3 sec
	10	145 psi (155 psi)	130 psi (140 psi)	14.2 sec (12.3 sec)
	11	130 psi (140 psi)	115 psi (125 psi)	15.6 sec (13.6 sec)
	12	115 psi (125 psi)	- -	Failed (Failed)

QUESTION 430.125 (SECTION 9.5.7)

For the diesel engine lubrication system in Section 9.5.7 provide the following information: 1) define the temperature differentials, flow rate, and heat removal rate of the interface cooling system external to the engine and verify that these are in accordance with recommendations of the engine manufacturer; 2) discuss the measures that will be taken to maintain the required quality of the oil, including the inspection, frequency of inspection, and replacement when oil quality is degraded; 3) describe the protective features (such as blowout panels) provided to prevent unacceptable crankcase explosion and to mitigate the consequences of such an event; and 4) describe the capability for detection and control of system leakage and the frequency it will be checked. (SRP 9.5.7, Parts II & III)

RESPONSE

1) Flow rate and heat removal rate of the safety auxiliaries cooling system (SACS) is provided in Table 9.2-4. The maximum cooling water inlet temperature to the diesel generator skid is 95°F as given in Table 9.2-3. The outlet temperature will vary with the actual heat load and actual inlet temperature of the cooling water. It has been verified that these parameters are in accordance with the recommendations of the diesel generator manufacturer.

2) The quality of the diesel generator lube oil will be maintained by complying with the surveillance standards set by the manufacturer. While the diesels are running the oil level will be checked in the lube oil sump, make-up tank, and rocker arm lube oil tank, in accordance with the plant operating procedures. When the level is checked the oil will also be checked for water and fuel contamination. Dilution can be suspected when low oil pressure exists, and blue-grey exhaust smoke may indicate excessive lube oil consumption. Degradation of lube oil quality will necessitate lube oil replacement. Periodically samples of lube oil will be sent to an oil company for analysis.

Insert A

3) See response to Question 430.134.

4) Lube oil system leakage is detected by decreasing level in the lube oil makeup tank. Low level in the makeup tank is annunciated at the remote engine control panel. External leakage would be visibly evident. Internal leakage would be evident in the diesel generator exhaust. Lube oil seepage from the crankcase is prevented by the crankcase vacuum system as described in Section 9.5.7.2. Lube oil system leakage will be controlled by proper maintenance at

1/3

Insert A to 430.125

2) Procurement specifications for diesel engine lubricating oil will incorporate the engine manufacturer's recommendations for quality, purity and lubrication properties. Sampling will be performed quarterly or after 750 hours of engine operation. Oil samples will be analyzed — to assure that:

1. oil degradation has not occurred
2. the oil continues to meet the specifications of MIL-L-2104B

The analysis report will determine the need for replacement of the lubricating oil.

In addition, surveillance testing demonstrates diesel engine operability and will include performance monitoring of the diesel engine lubricating oil system. The installed strainer and filter will remove sediment or other deleterious material. Strainer or filter cleaning will be performed at the onset of increased differential pressure across the strainer or filter. Residue will be analyzed to determine:

1. the source of lube oil contamination
2. the need for lube oil replacement
3. the need for cleaning the engine lube oil sump

intervals recommended in the manufacturers operation and maintenance manuals.

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QUESTION 430.127 (SECTION 9.5.7)

In Section 9.5.7.5 of the FSAR you describe the instrumentation, controls, sensors and alarms provided for monitoring the diesel engine lubrication oil system and their function which alert the operator when these parameters exceed the ranges recommended by the engine manufacturer. Describe the testing and the frequency of testing necessary to maintain a highly reliable instrumentation, control, sensors and alarm system. Describe any operator action required during alarm conditions to prevent harmful effects to the diesel engine. Discuss systems interlocks provided. Revise your FSAR accordingly. (SRP 9.5.7, Part III)

RESPONSE

Insert A here

Diesel engine instrumentation and control testing will be performed using written procedures in accordance with the frequencies specified in the Technical Specifications. Those instruments not covered in this section will be tested in accordance with written procedures. Available January 1985.

Operator action during alarm conditions will be addressed by the appropriate alarm response procedure, OP-AR.CF-XXX series. Available January 1985.

FSAR Section 9.5.7.5 has been revised to include system interlocks.

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Response

space → The Instrumentation and Control Department will perform calibration checks and calibrations on the instrumentation, controls, sensors and alarms of the diesel engine lubrication oil system. The calibration checks and calibrations will be performed in accordance with written procedures. The Equipment and surveillance frequency is summarized in Table 430.127-1.

A

Diesel engine lubrication system operator alarm responses are summarized in Table 430.127-2.

[redacted]

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TABLE 430.127-1

DIESEL GENERATOR LUBE OIL SYSTEM

System ID	INST NO.	~~MANUFACTURER~~ MODEL #	FUNCTION (LUBE OIL (typical for all))	~~TYPE~~	Surveillance Frequency* ~~100% Test~~ E/P	~~[illegible]~~
KJ	LI-7557 A-D	PNEUMERCATOR P-5	DG LO MAKE UP TANK	DC	P	P
KJ	LSH-7563 A-D	GEMS M/N 35676	DG ROCKER ARM LO LEVEL	DC	F	F
KJ	LSHL-7556 A-D	MAGNETROL A-153-F	DG CRANK CASE LO LEVEL CONT	DC	F	F
KJ	LSHL 7558 A-D	" "	DG CRANK CASE LO LEVEL	DC	F	F
KJ	LSL-7544 A-D	" "	DG LO MAKE UP TANK	DC	E	F
KJ	PDI-7783 A-D	ORANGE RESEARCH M/N 1201PG-1	DG LO FILTER ΔP	DC	P	P
KJ	PDI-7784 A-D	" "	DG LO STRAINER ΔP	DC	P	P
KJ	PDSH-7400 A-D	U.E. J27KB	DG LO FILTER ΔP	DC	F	F
KJ	PDSH-7514 A-D	"	DG LO STRAINER ΔP	DC	F	F
KJ	PSL-7542 A1-D1	ASCO SB-11	DG LO PRESS LOW	DC	F	F
KJ	PSL-7542 A2-D2	" "	" "	DC	E	F
KJ	PSL-7542 A3-D3	" "	" "	DC	E	F
KJ	PSL-7542 A4-D4	" "	" "	DC	E	F
KJ	PSL-7560 A-D	" "	DG ROCKER ARM LO PRESS LOW	DC	F	F
KJ	PT-7780 A-D	FAIRCHILD MODEL 20	DG LO PRESS	CC	P	P
KJ	TI-6796 A-D	ASHCROFT EI	DG LO KEEPWARM PMP DISCH.	DC	P	P
KJ	TI-6797 A-D	" "	DG LO HEATER OUT	DC	P	P
KJ	TI-6798 A-D	" "	DG ENG LE. LO PMP DISCH	DC	P	P
KJ	TI-6799 A-D	[illegible]	DG LO HX IN	DC	P	P
KJ	TI-6800 A-D	[illegible]	DG LO HX OUT	DC	P	P
KJ	TS-7539 A-D	ASCO SB-11	DG LO HEATER THERMOSTAT	DC	F	F
KJ	TSH-7550 A-D	" "	DG LO KEEPWARM TEMP	DC	F	F
KJ	TSH-8579 A-D	" "	DG LO ENG TEMP	DC	F	F
KJ	TSL-7561 A-D	" "	DG LO KEEPWARM TEMP	DC	F	F
KJ	TSL-7562 A-D	" "	DG LO ENG TEMP	DC	F	F

~~[illegible]~~

KJ	PI-7780 A1-D1	~~ASHCROFT 1279~~	LO ENGINE MANIFOLD	~~DC~~	P	~~X~~
KJ	TI-7548 A1-D2	~~HONEYWELL DIALATEMP~~	LO TEMP (REMOTE)	~~DC~~	F	~~X~~

* Surveillance Frequency
F = 18 months
P = 36 months

Table 430.127-2

~~Response to question 430.127~~

Summary of Operator Actions in Response to Diesel Engine Lubricating Oil System Alarms

<u>High Priority</u>

a) LUBE OIL TEMPERATURE HIGH

Check	Action
Lube oil temperature	If normal: Attempt to clear alarm
	If high, proceed to next step
SACS flow through cooler	Open SV 2395 if closed
Proper operation of temperature control valve	

b) LUBE OIL MAKEUP TANK LEVEL LOW

Check	Action
Tank level	If normal: Attempt to clear alarm
	If low, proceed to next step
Drain valve	Close valve if open or leaking
Proper operation of crankcase fill solenoid valve	If crankcase level is high: Close valve using control switch CS-1. Manually close valve if required
Piping and flex coupling integrity	If leaks or obstructions are present: Isolate leaks or clear obstructions if possible. Notify Shift Supervisor

c) CRANKCASE LUBE OIL LEVEL HIGH.

Check	Action
Crankcase level	If normal: Attempt to clear alarm
	If high, proceed to next step
Confirm solenoid makeup valve is closed	If open: Close valve using CS-7. Manually close if required
Crankcase level trend	Manually drain if required

d) CRANKCASE LUBE OIL LEVEL [redacted] LOW

Check	Action
Crankcase level	If normal. Attempt to clear alarm
	If low. proceed to next check
Confirm CS-7 is in AUTO	If not; Determine reason for switch out of AUTO. Return switch to AUTO when possible
	With CS-7 in AUTO, Confirm solenoid valve is open, manually open if required to maintain crankcase level
Lube oil makeup system operable	If not: Gravity fill crankcase to clear alarm

e) LUBE OIL PRESSURE LOW PRE-TRIP

Check	Action
Operating pressure	If normal: Attempt to clear alarm
	If low: proceed to next check
Strainer and filter dP	If high, refer to applicable response
Piping integrity	If breaks or obstructions are found:
	attempt to isolate leak or free obstruction
	Notify Shift Supervisor
Valve lineup to instrumentation	Open valves if closed
Pump operation	

f) LUBE OIL PRESSURE LOW SHUTDOWN

Check	Action
Operating pressure	If greater than 60 psi:
	Attempt to clear alarm
	If below 60 psi:
	Confirm diesel has shutdown.
	Manually shutdown if required
	Determine cause of low pressure

Low Priority

a) LUBE OIL TEMPERATURE LOW

Check	Action
Lube oil temperature	If normal: Attempt to clear alarm
	If low: proceed to next check
Operation of temperature control valve	Valve fails open, may cause low temp. under certain conditions.

b) LUBE OIL KEEP WARM TEMPERATURE HIGH

Check	Action
Heater outlet temperature	If normal. Attempt to clear alarm
	If high proceed to next check
Control switch positions	Heater switch (CS-36) and pump switch (CS-37) should be in AUTO, if not: Determine reason for switch position. Return to AUTO when possible
Pump operating properly	
Heater thermostat operating	If thermostat has failed, Notify I&C and: pump running: Control temp. by cycling CS-36 to control heater. pump not running: Place CS-36 in OFF to prevent heater damage

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4/

c) LUBE OIL KEEP WARM TEMPERATURE LOW

Check	Action
Heater outlet temperature	If normal: Attempt to clear alarm
	If low proceed to next check
Control switch positions	Heater switch (CS-36) and pump switch (CS37) should be in AUTO, if not:
	Determine reason for switch position
	Return to AUTO when possible
Heater thermostat operation	If thermostat has failed, Notify I&C
Operation of temp control valve	Valve fails full open

d) ROCKER ARM LUBE OIL TANK LEVEL HIGH

Check	Action
Operation of tank level control valve	Confirm linkage and valve actuator are not bound
Tank overflow	If overflow occurs, manually control tank level

e) ROCKER ARM LUBE OIL PRESSURE LOW

Check	Action
Instrumentation valve lineup → Duplex RO filter	Open high pressure switch isolation valve if closed swap and clean filter
Confirm motor driven pump start	If prelube pump has not started, manually start to clear alarm. 8/9
Pressure relief valve	Confirm PSV is not stuck open

f) LUBE OIL STRAINER DIFFERENTIAL PRESSURE HIGH

Check	Action
Differential pressure indicator	If normal: Attempt to clear alarm
	If high: proceed to next Check
Lube oil pressure	Confirm adequate L.O pressure is available and clean strainer when possible

g) LUBE OIL FILTER DIFFERENTIAL PRESSURE HIGH

Check	Action
Differential pressure indicator	If normal. Attempt to clear alarm
	If high filter may be isolated and cleaned if keepwarm system is shutdown.

h) CRANKCASE PRESSURE HIGH

Check	Action
Crankcase manometer	If normal: Attempt to clear alarm
	If high. proceed to next check
Vacuum ejector piping and flex coupling integrity	Notify Shift Supervisor of any leaks or obstructions

QUESTION 430.128 (SECTION 9.5.7)

Provide the source of power for the diesel engine keep warm lube oil pump, rocker arm prelube oil pump, and keep warm heater, and motor characteristics, i.e, motor hp, operating voltage, phase(s) and frequency. Revise your FSAR accordingly. (SRP 9.5.7, Part III)

RESPONSE

Table 9.5-11 and Section 9.5.7.2 have been revised to include this information. The IE power source is also included in revised section 9.5.7.2.

[redacted]

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e. Withstand wind, tornadoes, floods, and missiles

f. Permit testing of active system components during plant operation.

The SDG lubrication system is designed to Seismic Category I requirements and complies with IEEE Standard 387. The quality group classification and corresponding codes and standards that apply to the design of the system are discussed in Section 3.2. Compliance with Regulatory Guides 1.9, 1.115, and 1.117 is discussed in Section 1.8. Compliance with GDC 2, 4, 5, and 17 is discussed in Section 3.1. The SDG lubrication system is in compliance with the recommendations of NUREG CR-0660.

9.5.7.2 System Description

The SDG lubrication system consists of two subsystems, the engine lube oil system and the rocker arm lube oil system. The engine lube oil system consists of an engine-driven lube oil pump, a suction strainer, a lube oil heat exchanger, a Class 1E motor-driven prelube/keep-warm pump, a Class 1E immersion heater, a wye strainer at the motor-driven pump suction, a simplex strainer, a simplex filter, and a lube oil makeup tank. The rocker arm lube oil system consists of an engine-driven rocker arm lube oil pump, a Class 1E motor-driven rocker arm prelube pump, a rocker arm lube oil reservoir, and a duplex rocker arm lube oil filter. A Class 1E ac power source of the same channel as the SDG is used to supply power to the immersion heater and prelube pump. Major component design parameters for these two systems are shown in Table 9.5-11. The SDG general arrangement is shown on Figures 1.2-33 and 1.2-35. A schematic diagram of the lubrication system is shown on Figures 9.5-27 and 9.5-28.

Each SDG crankcase is the main source of lube oil for the engine and rocker arm lube oil systems. If the lube oil level drops below set limits, a solenoid valve actuated by a low level switch in the crankcase opens, and lube oil flows by gravity from the makeup tank into the crankcase. A high level switch actuates valve closure. Degraded oil from the engine crankcase can be drained for reclaiming by the motor-driven pump of the engine lube oil system via a three-way valve on the pump discharge and a drain header. Lubricating oil quality is maintained through the use of full flow filters and strainers and is verified by periodic laboratory testing.

Each crankcase is provided with a built-in crankcase evacuation system using an ejector to maintain a negative pressure in the

QUESTION 430.131 (SECTION 9.5.7)

You state in Section 9.5.7 of the FSAR that the lube oil used to lubricate the engine is stored in a lube oil sump tank and a 250 gallon make-up lube oil tank. During diesel engine operation a certain amount of lube oil is consumed as part of the combustion process. Since the diesel generator may be required to operate for a minimum seven days during a loss of offsite power or accident condition, sufficient lube oil should be stored in the sump and/or site to preclude diesel generator unavailability due to lack of lube oil. You state that the sump and its make-up tank contains an adequate supply of lube oil for the diesel generator to operate for a minimum of 7 days at maximum rated load. Provide the following:

a. Provide the normal lube oil usage rate for each diesel engine under full load conditions. Also provide the lube oil usage rates which would be considered excessive.

b. Show with the lube oil in the sump and the make-up tank at the minimum recommended level (low level alarm settings) that the diesel engine can operate without refilling the lube oil sump and make-up tank for a minimum of seven days at maximum rated load. If the sump and make-up tank capacity is insufficient for this condition, show that adequate lube oil will be stored onsite for each engine to assure seven days of operation at rated load.

c. Show with the lube oil in the sump at the minimum recommended level (low level alarm setting) and assuming a failure (in the closed position) of the solenoid operated valve between the make-up tank and the sump, that the diesel engine can operate without refilling the lube oil sump for a minimum of seven days at maximum rated load. If the sump capacity is insufficient for this condition, show that adequate lube oil will be stored on site for each engine to assure seven days of operation at rated load. Discuss operator action on failure of the solenoid valve to assure continued engine operation and how fuel would be added to the engine sump under this condition.

d. If the lube oil consumption rate becomes excessive, discuss the provisions for determining when to overhaul the engine. The discussion should include the procedures used and the quality of operator training provided to enable determination of excessive L.O. consumption rate. (Refer to requests 430.62.3 and 430.61 for additional requirements on procedures and training). (SRP 9.5.7, Parts II & III)

RESPONSE

a. The lube oil consumption rate for the standby diesel generator at the rated 4430 KW (6186 BHP) is 1.12 to 1.55 gallons per hour. The engine manufacturer, Colt Industries, indicates that the lube oil consumption rate does not vary appreciably with the engine load level.

The engine manufacturer indicates that a lube oil consumption rate of 3 gallons per hour would be considered excessive and should be investigated and remedied.

b. The diesel engine manufacturer recommends that the diesel engine sump be kept "topped off" in the standby condition and not allowed to be at the "minimum level" condition so that it is always ready to operate for the maximum duration required.

To raise the lube oil level in the diesel engine sump from the minimum level to the full running depth, approximatly 220 gallons of lube oil is required, is the capacity of four 55 gallon storage drums or At a consumption rate of 1.55 gallons per hour the engine can operate for 142 hours. To operate for 1 hours, an average consumption rate of 1.31 gallons pe hour should not be exceeded, which is in the expected consumption range. The lube oil make up tank contains 250 gallons of oil, therefore, the make up tank can raise the sump level from minimum level to full with an additional 30 gallon in reserve. The lube oil make up tank can therefore maintain the diesel engine in the operating lube oil range for 161 hours at a consumption rate of 1.55 gallons per hour.

On site lube oil storage, for the diesel generators, will consist of twenty 55 gallon drums, which will be sufficient to maintain the diesel engines lube oil sump in the operating range for 7 days at rated power.

INSERT A

Operator action on failure of the solenoid valve to provide adequate engine lube oil sump makeup capability will be specified in the appropriate alarm response procedure. This procedure shall also provide direction to the operator as to the alternate methods of adding lube oil to the engine sump. The preferred method of alternate engine sump lube oil addition is currently being evaluated through discussions between PSE&G and the engine manufacturer. ~~Further detail will be provided by July 1984.~~

move to "C"

430.131

INSERT A

a minimum of 275 gallons of lube oil per diesel generator (twenty 55 gallon drums, total) will be stored on site for emergency makeup. The 275 gallon storage of lube oil exceeds the required lube oil make up for a seven day supply at a maximum, worst case, consumption rate of 1.55 gallons per hour.

Therefore, with the onsite storage of twenty 55 gallon drums of lube oil there will be sufficient lube oil to operate the diesel engines for seven days from the low level sump indication.

FROM "b"

c. Refer to response (b) above for lube oil on site storage and vendor recommenced standby lube oil levels.

d. If during the course of routine SDG operation, it becomes apparent that the lube oil consumption rate is excessive, engineering and vendor services will be drawn-on to assist in identifying and correcting the abnormal condition.

Operating department shift reading sheets will require the visual verification and logging of the SDG lube oil make-up tank levels on a daily basis when the SDG is in "standby" condition. Additionally, SDG periodic test procedures will require the visual verification of lube oil make-up tank level(s), both before and after such testing is performed. Upon completion of testing, the findings will be compared against the previous months test results and the normal oil usage rates (as defined in responst to item "a"). In this manner, any appreciable changes in engine performance will be immediately identified and corrective measures taken as necessary.

Plant operator training, and subsequent requalification training, adequately stress the importance of proper equipment lubrication, logkeeping and systems training. This training, combined with "in-house" plant experience, suffices to alert operators to any abnormal diesel generator condition.

In addition, the following concerns will be addressed by July, 1984:

a. Assure that a 7 day supply of lube oil is available assuming the initial level is at the low level alarm and the maximum consumption rate, or

b. Assurance that there is a 7 day supply of lube oil on site if the diesel engine does not have sufficient lube oil to operate for 7 days at the maximum consumption rate, at the low level alarm.

c. Assurance that the lube oil sump can be filled assuming a failure of the solenoid operated makeup valve and no makeup tank available.

QUESTION 430.133 (SECTION 9.5.7)

Assume an unlikely event has occurred requiring operation of a diesel generator for a prolonged period that would require replenishment of lube oil without interruption operation of the diesel generator. Provide the following:

a. What provision will be made in the design of the lube oil system to add lube oil to the sump and/or make-up tank. These provisions shall include procedures or instructions available to the operator on the proper addition of lube oil to the diesel generator as follows:

   1. How and where lube oil can be added while the equipment is in operation,

   2. Particular assurance that the wrong kind of oil is not inadvertently added to the lubricating oil system, and

   3. That the expected rise in level occurs and is verified for each unit of lube oil added.

b. Verification that these operating procedures or instructions will be posted locally in the diesel generator rooms.

c. Verification that personnel responsible for the operation and maintenance of the diesel are trained in the use of these procedures. Verification of the ability of the personnel on the use of the procedures shall be demonstrated during preoperational tests and during operator requalification.

d. Verification that the color coded, or otherwise marked, lines associated with the diesel-generator are correctly identified and that the line or point for adding lube oil (when the engine is on standby or in operation) has been clearly identified. (SRP 9.5.7, Parts II & III)

RESPONSE

a. 1. The system has been designed so that oil may be added to the sump. Normally lube oil will be added via the fill line, to the lube oil make-up tank as shown on Figures 9.5-27 and 9.5-28. It would then flow through the solenoid level control valve to the engine sump. Oil may also be added directly to the oil sump via the fill line or if 1/2 required, directly to the engine sump via the gravity fill line on the side of the crankcase.

2. Operations Department Document Control Administrative Procedure will include a distribution list for field approved procedures. The diesel generator rooms will be listed for containing a controlled copy of the procedures required for local diesel operation. (Procedure ID is OP-AP.ZZ-005). Available January 1985.

3. The level will be verified by the level indicator on the lube oil make-up tank or if the oil is added directly to the sump it will be verified by the non-recurrance of the low level alarm after its acknowledgement and a dipstick from the sump.

(Insert)

b. Operations Department Document Control Administrative Procedure will include a distribution list for field approved procedures. The diesel generator rooms will be listed for containing a controlled copy of the procedures required for local diesel operation. Procedure ID is OP-AP.ZZ-005. Available January 1985.

c. Operations personnel will be trained in the use of diesel generator operating procedures during the operator training programs and during the preoperational test program. Operator requalification will require demonstration of the proper use of the procedures.

d. The points for adding lube oil to the diesel generator will be tagged. Also, the diesel-generator area is a "controlled access" area. Access will be limited to authorized plant personnel, trained in maintaining the diesel-generators.

4. Diesel engine lubricating oil fill points will be clearly labeled to identify the fill point, type of lubricating oil required and the number of the applicable operating procedure. A controlled copy of the procedures required for diesel engine operation will be posted in the diesel generator area.

2/2

QUESTION 430.136 (SECTION 7.5.5, 9.5.7)

You state in the FSAR that cooling to the diesel engine cooling water systems and the lube oil system is provided by the Safety Auxiliaries Cooling System (SACS). Figures 9.5-23, 9.5-24 and 9.5-27 of the FSAR show the intercooler heater exchanger, the jacket water heat exchanger and the lube oil heat exchanger connected in series with the SACS providing cooling to the intercooler heater exchanger first and the lube oil heat exchanger last. Other plants with the same type of engine design have the lube oil heat exchanger cooled by the diesel engine jacket water system. Rather than cooled by a service water system or have a separate independing connection to the service water cooling system. Justify that your design of having the lube oil heat exchanger in series with the cooling water heat exchangers, will adequately cool and maintain lube oil temperature within manufacturer's specifications during engine operation. (SRP 9.5.7, Part I, II, and III)

RESPONSE

~~This question is being reviewed by the diesel engine manufacturer and a response will be provided in March 1984.~~

It is the manufacturer's design to have the Intercooler Heat Exchanger, the Jacket Water Heat Exchanger, and the Lube Oil Heat Exchanger cooled by the series arrangement shown in the referred drawings. We are committed to supply inlet cooling water to these Diesel Generator Coolers in accordance with the manufacturer's requirements. these requirements are shown in Table 9.2-4.

Colt confirms that 95°F inlet temperature of cooling water is adequate for proper cooling of this unit. The series system as outlined (intercooler heat exchanger, jacket water heat exchanger, and finally, ~~L.O.~~ lube oil heat exchanger) is the manufacturer's proven standard design.

The ~~L.O.~~ lube oil heat exchanger has been sized for the expected water temperature at the outlet of the jacket water heat exchanger.

Hope Creek Generating Station SDGs is not different than all of the others. ~~Hope Creek~~ HCGS uses ~~our~~ Colt's "standard" design. Some others have been different as a result of either specification requirements or specific site requirements. In all cases, Colt analyzes the specific units requirements and sizes all heat exchanger equipment accordingly.

QUESTION 430.140 (SECTION 9.5.8)

Describe the instrumentation, controls, sensors and alarms provided in the design of the diesel engine combustion air intake and exhaust system and their function which alert the operator when parameters exceed ranges recommended by the engine manufacturer. Describe the testing and frequency of testing necessary to maintain a highly reliable instrumentation, control, sensors, and alarm system and where the alarms are annunciated. Describe any operator action required during alarm conditions to prevent harmful effects to the diesel engine. Discuss systems interlocks provided. Revise your FSAR accordingly. (SRP 9.5.8, Part III)

RESPONSE

Two temperature indicating switches are provided on each diesel generator unit to monitor combustion air intake temperature; a high temperature sensed by both switches will initiate an alarm as described in Section 9.5.8.5. The exhaust gas and engine cylinder temperatures are monitored by thermocouples which are selectively indicated on a pyrometer located on the remote engine control panel by operation of the temperature selector switch; also located on this panel. These devices perform indication and/or alarm function only and no system interlock is provided. The instrumentation, sensors and alarms are described in Section 9.5.8.5.

~~The testing of diesel generator instrumentation and control will be performed using written procedures and in accordance with the frequencies specified in the Hope Creek Technical Specifications. Those items not covered by that section will be tested in accordance with other written procedures. Available January 1985.~~

~~Operator actions during alarm conditions will be addressed by the appropriate alarm response procedures, OP-AR.KJ-XXX series. Available January 1985.~~

Insert A here

1/4

INSERT A

The Instrumentation and Controls Department will perform calibration checks and calibrations or the instrumentation, controls, sensors and alarms of the diesel engine combustion air intake and exhaust system. The calibration checks and calibrations will be performed in accordance with written procedures. The equipment and surveillance frequency is summarized in Table 430.140-1.

Diesel engine combustion air intake and exhaust system operat response to alarm conditions is summarized in Table 430.14

(TABLE [illegible]

CRANK CASE VACUUM, AIR INTAKE & EXHAUST SYSTEMS.

System ID ✓	INST NO		~~MANUFACTURER~~	~~MODEL NO~~	FUNCTION	~~PROC TYPE~~	Surveillance Frequency* ~~INST TOO~~	~~2/P~~
KJ	PSH-6602	A-D	~~GE~~	~~J302~~	CRANK CASE PRESS.	~~DC~~	F	~~F~~
KJ	TS-6600	A-D	~~ASHCROFT~~	~~EI~~	INTAKE AIR TEMP	~~DC~~	P	~~P~~
KJ	TI-8269	A-D	~~"~~	~~"~~	LEFT TURBO OUT	~~DC~~	P	~~P~~
KJ	TI-8270	A-D	~~"~~	~~"~~	RIGHT TURBO OUT	~~D~~	P	~~P~~
KJ	TI-8271	A-D	~~"~~	~~"~~	AIR MANIFOLD LEFT	~~D~~	P	~~P~~
KJ	TS-8272	A-D	~~"~~	~~"~~	AIR MANIFOLD RIGHT	~~DC~~	P	~~P~~
KJ	TSH-6605	A1-D1	~~ASCO~~	~~SB-11~~	COMBUSTION AIR TEMP	~~DC~~	F	~~F~~
KJ	TSH-6605	A2-D2	~~"~~	~~"~~	" " "	~~DC~~	F	~~F~~
KJ	TI-9585	A-D	~~ALNOR~~	~~FA~~	CYLINDER EXHAUST TEMP	~~DC~~	F	~~F~~
KJ	PG-6602	A-D	~~MERIAM~~	~~10AA25FF~~	CRANK CASE VACUUM	~~DC~~	P	—

*Surveillance Frequency

F = 18 months

P = 36 months

3/4

TABLE 430.140-2

~~Response to Question 430.140~~

Summary of Operator Actions in Response to Diesel Engine Combustion Air Intake and Exhaust System Alarms.

High Priority

a.) COMBUSTION AIR TEMPERATURE HIGH

Check	Action
Intercooler cooling water temp and pressure	If abnormal. Check piping for leaks and obstructions Ensure makeup water is available from the jacket water expansion tank Intercooler cooling pump is operable SACS is available to the intercooler heat exchanger

QUESTION 430.141 (SECTION 9.5.8)

Provide the results of an analysis that demonstrates that the function of your diesel engine air intake and exhaust system design will not be degraded to an extent which prevents developing full engine rated power or cause engine shutdown as consequence of any meteorological or accident condition. Incl in your discussion the potential and effect of fire extinguish (gaseous) medium, recirculation of diesel combustion products, other gases that may intentionally or accidentally be releasec site, on the performance of the diesel generator. (SRP 9.5.8, Parts II & III)

RESPONSE

Insert ~~Due to the stragegic location of the SDG air intake in relati to the exhaust gas stack,~~ recirculation of the exhaust gas air intake ~~is minimized~~ and therefore will not pose a hazard the performance of the SDG. This is discussed in Section 9.5.8.3.

As discussed in Section 9.5.1 and indicated in Table 9A-1, a water hose is provided in the SDG combustion air intake areas and portable fire extinguishers (CO_2 or dry chemicals) are al available for limited use. This possibility of limited use c CO_2 or dry chemical fire extinguishers does not pose a potent threat to the diesel engine since the area is vented to the outside via air inlet louvers, as shown on Figures 1.2-11 and 1.2-36.

A potential fire in or near the SDG area is discussed in resp to Question 430.143.

Other gases that may intentionally or accidentally be release site are either located remote to the diesel generator enclos or are small enough in volume to not pose a hazard to the performance of the diesel generators. Refer also to Section 9.5.1.1.11.

A safety evaluation of the air intake and exhaust system whic discusses meteorological and accident conditions is provided Section 9.5.8.3, with further discussion in Section 3.3, 3.4 3.5, 3.6, and 3.11. Additionally, onsite wind direction frequency distributions, Tables 2.3-5 and 2.3-6, indicate tha the normal or prevailing winds disburse diesel exhaust gases any other onsite gaseous releases away from the SDG air intak louvers. The equipment is designed to remain operable for th range of design conditions given in Section 3.3.2.1.a and b.

From the above, no circumstances as a consequence of meteorological or accident conditions could be postulated th would degrade system design to an extent which prevents developing full rated engine power or causes engine shutdown.

[redacted].

As discussed in Section 9.5.8.3 and shown
in Figure 1.2-11 the combustion air for
SDG is outside air drawn through lou
openings in the south wall of the A
building at elevation 130 ft. ~~The~~ Each exhau
duct discharges above the auxiliary buildin
at elevation 198 ft and is about 75 ft
north from each of the associated air intake ~~openings~~ openings. T
combination of much higher elevation hot temperature exhaust
lower elevation cold air intake and the general
separation of ~~components~~ these lines will inhibit any
recirculation — back to text

3/3

QUESTION 430.142 (SECTION 9.5.8)

Discuss the provisions made in your design of the diesel engine combustion air intake and exhaust system to prevent possible clogging, during standby and in operation, from abnormal climatic conditions (heavy rain, freezing rain, dust storms, ice snow and drifting snow) that could prevent operation of the diesel generator on demand. (SRP 9.5.8, Parts II & III)

RESPONSE

The standby diesel generator intake system is [Insert 1] protected from rain ice, and snow, by a louvered Seismic Category I enclosure as discussed in Sections 9.5.8.2 and 9.5.8.3. The air filter is capable of removing 95% of 25-micron particles and 70% of 5-micron particles as indicated in Table 9.5-13.

INSERT 2 ~~The standby diesel generator exhaust duct is provided with a hood cover and screen to prevent possible clogging from abnormal climatic conditions.~~ Section 9.5.8.3 has been revised to clarify the system design.

[redacted]

1/5

1

430.142

INSERT 1 Each missile proof opening is covered by a 5 ft wide by 10 ft high framed louver as shown in figure 430.142-1. The spacing between the storm blading allows for a free flow area of at least 38 percent, based on manufacturers information. Since the opening is 50 square feet then 38 percent of this area is 19 square feet, which is 6 times greater than the area of the intake piping, which is 3.14 square feet. The louver design is designed to exceed the icing weather conditions described in Section 2.3.1.2.1.6.

2/5

430.142 (cont)

INSERT 2

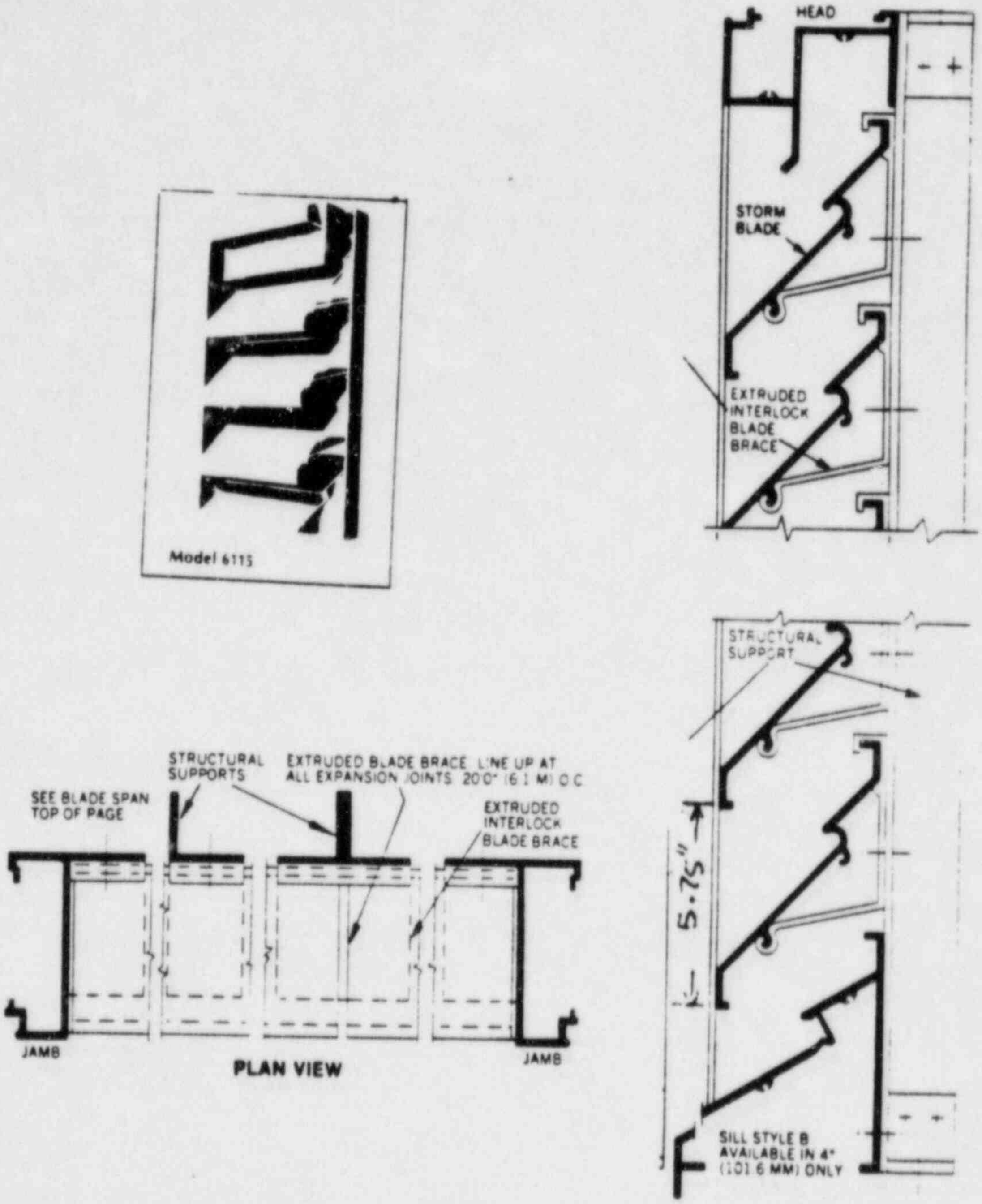
: Missile protection for the standby diesel generator exhaust stack is discussed in the response to question 430.150.

The standby diesel generator exhaust stack penetrates the roof at the 198 foot elevation of the auxiliary building. The missile enclosure above the stack outlet has a continuous circumferential opening approximatly five feet above the roof elevation. The opening is protected from rain, snow and ice by a pyramid

430.142 (cont)

shaped hood, which has a minimum two foot overhang.

Figure 430.142-1



QUESTION 430.143 (SECTION 9.5.8)

Show by analysis that a potential fire in the diesel generator building or any of the other surrounding buildings (reactor building, control building, etc.) together with a single failure of the fire protection system for that area will not degrade the quality of the diesel combustion air so that the remaining diesels will be able to provide full rated power. (SRP 9.5.8, Parts II & III)

RESPONSE

A 3-hour-fire-barrier has been added to separate the diesel combustion air intakes by safe shutdown division. Since the divisionalized intakes are in separate rooms, a fire in one zone, and an automatic closure of the fire door will not affect the remaining diesels combustion air. Therefore, the remaining two diesels will be able to provide full rated power. This analysis was performed as part of the Appendix R fire hazard analysis (see revised Appendix 9A).

The Appendix R analysis shows that a fire in any one fire area of the control, diesel or reactor buildings will affect no more than one division of the diesel generator intakes. The Appendix R analysis assumes a failure of any automatic fire protection systems for that area.

The SDG HVAC systems exhaust from missile protected areas located at elevation 198'-0".

The possibility of significant quantities of smoke or other combustion by-products bypassing dampers or failed dampers from any of the areas and exiting at the 198 ft. elevation and consequently being drawn down to other diesel generator intakes at the 130 ft elevation is not credible.

QUESTION 430.144 (SECTION 9.5.8)

Experience at some operating plants has shown that diesel engines have failed to start due to accumulation of dust and other deleterious material on electrical equipment associated with starting of the diesel generators (e.g., auxiliary relay contacts, control switches - etc.). Describe the provisions that have been made in your diesel generator building design, electrical starting system, and combustion air and ventilation air intake design(s) to preclude this condition to assure availability of the diesel generator on demand.

Also describe under normal plant operation what procedure(s) will be used to minimuze accumulation of dust in the diesel generator rooms; specifically address concrete dust control. (SRP 9.5.8, Parts II & III)

RESPONSE

Section 9.4.6.2, discusses how dust intake to the SDG control panel area is minimized.

Control panels associated with starting the standby diesel engines are located in areas which are provided with dust control provisions. The standby diesel generator rooms and the remote control panel areas have epoxy surfaces applied to the floors. The standby diesel generator rooms are also provided with metal grating walkways above the floor.

The electrical relays and switches associated with engine start are housed in dust-tight and drip-tight panels (NEMA type 12 indoor enclosure).

INSERT → A

In addition to the design features that minimize the impact of dust on the SDG operation, the preventive maintenance program for the control cabinets includes requirements for cleaning out ^abnormal amount dust accumulation.

Periodic testing of the SDG units ensures their availability on demand.

Provisions made to protect combustion air from dust are discussed in Section 9.5.8.2.

Therefore the problem of concrete dust generation, dust and other deleterious material generation is minimized.

The standby diesel generator air intakes are located in the corridor, reference Figure 1.2-36. The air enters the corridor through the air intake and missile barriers, it then enters the diesel air intake system through ~~intel~~ inlet filters 1AF-413 (1BF-413, 1CF-413, 1DF-413).

The air is drawn from the corridor through the filters at the 130 ft. elevatio Since this is an area where there is little foot traffic and no other equipment, and the intakes are off of the ground away from sources of dust the generation of dust should be minimal.

All of the control panel areas are supplied by HVAC units which are equiped with filters to ~~trap~~ REMOVE AIRBORNE dust and dirt. Since these areas are SUPPLIES WITH FILTER OUTBOARD OR RO RETURN ~~closed~~ and there are no other potential sources of dust it is not anticipated that accumulation of dust will be a problem.

Insert A (for P430.144-1)

Preventive maintenance procedure, MD-PM.ZZ-006(Q) describes the method for cleaning switchboards, panels and switchgear. This procedure will be performed quarterly on electrical panels associated with the SDG.

QUESTION 430.148 (SECTION 9.5.8)

In Section 9.5.8.3 of the FSAR you state that a missile shield is provided in the combustion air intake area to protect against tornado missiles. The drawings provided in Section 1.2 of the FSAR do not give a clear and detailed layout of the diesel generator equipment in the diesel generator area, including the intake area. Provide a clear plan, elevation and sectional drawings of the diesel generator area showing the location and identification of equipment, the location and details of the exhaust stack above elevation 198', and details of the combustion air intake structure and missile shield. (SRP 9.5.8, Parts I, II, & III)

RESPONSE

Details of the missile shield protection for the SDG combustion air intake area is shown on Figure 3.5-23 in response to Question 410.17. Details of the intake louvers are given in figure 430.142-1. ~~of Question 430.142~~
Also refer to Figures 1.2-11, 1.2-35 to 1.2-39 and 3.5-26 for the sectional/elevation and plan drawings of the SDG area.
A complete description of the missile protected exhaust stack is given in Question 430.150.

[redacted]

[redacted]

QUESTION 430.152 (SECTION 10.2)

In the turbine generator section discuss: 1) the valve closure times and the arrangement for the main steam stop and control and the reheat stop and intercept valves in relation to the effect of a failure of a single valve on the overspeed control functions; 2) the valve closure times and extraction steam valve arrangements in relation to stable turbine operation after a turbine generator system trip; 3) effects of missile from a possible turbine generator failure on safety-related systems or components. (SRP 10.2, Parts II & III).

RESPONSE

Section 10.2.2.6 has been revised to include the valve closure times and the arrangement for the main steam stop and control and combined intercept valves in relation to the effect of a failure of a single valve on the overspeed control functions.

Section 10.2.2.6 has been revised to include the valve closure times and extraction steam valve arrangements in relation to stable turbine operation after a turbine generator system trip.

The effects of turbine missiles are discussed in Section 3.5.1.3.

[redacted]

AF 5/22/84

trip solenoid (MTS) and de-energizes the master trip solenoid valves MTSV-A and MTSV-B which removes the emergency trip system pressure causing the turbine valves to close. Loss of either [illegible] signal or hydraulic function of this trip results in a main st[illegible] valve closure.

When the mechanical overspeed trip is being tested, using the overspeed governor lockout device, the electrical overspeed trip protects the turbine against overspeed.

An additional feature of the protective system that will minimize the likelihood of an overspeed condition is the power/load unbalance circuitry (Figure 10.2-12). Generator load is sensed by means of three current transformers and is compared with the turbine power input which is sensed by the turbine intermediate pressure sensor. Control valve action will occur only when the power load unbalance is approximately 40 percent or greater while the generator current (load) is lost at a rate equivalent to going from rated to zero in approximately 35 msec. or less.

There are four steam lines at the high pressure stage. Each line is provide with one stop valve in series with one control valve. Steam from the high pressure stage flows to the moisture separators and then to the three low pressure stages. Each of the six low pressure lines has a combined intercept valve that consists of a stop valve in series with a control valve, in one housing. All of the above valves close within 0.2 seconds on turbine trip. Assuming a single failure within the above system of 20 valves in case of a turbine overspeed trip signal, the turbine will be successfully tripped.

The diversity of devices shown on Table 10.2-1 ensures that stable operation following a turbine trip proceeds from the requirement that both the stop valves and the combined intercept valves close in a turbine trip, thereby preventing steam from the main steam line from entering the turbine and preventing the expansion of steam already in the high pressure stage and in the moisture separator. An additional provision is made to automatically isolate the major steam extraction lines from the turbine by power-assisted check valves. Closure times of the check valves ~~will be~~ in accordance with the turbine manufacturer's recommendations.

have been calculated at less than two seconds, and are

Any postulated accident, including the effects of high or moderate energy pipe failures, that results in a loss of [illegible]

QUESTION 430.164 (SECTION 10.4)

In Section 10.4.1.4 you have discussed tests and initial field inspection but not the frequency and extent of inservice inspection of the main condenser. Provide this information in the FSAR. (SRP 10.4.1, Part III).

RESPONSE

The HCGS Maintenance department is in the process of identifying the frequency for inspection of the main condenser. This information will be provided by August 1984. The main condenser inspection will include periodic sampling (Eddy Current) of condenser tubes.

Insert A here

~~Response~~ / INSERT A

Procedure MD-PM.AD-002 (Z), Main Condenser Inspection shall be performed every 18 months during a refuelling or maintenance outage. The inspection shall include:

visual inspection of the condenser tube sheets.
visual inspection of condenser anodes.
eddy current testing of a sample of condenser tubes
visual inspection of condenser shell side structures and piping.

1/2

QUESTION 430.166 (SECTION 10.4.4)

Provide additional description (with the aid of drawings) of the turbine bypass valves and associated controls. In your discussion include the number, size, principle of operation, construction, setpoints, and capacity of each valve and the malfunctions and/or modes of failure considered in the design of the turbine bypass system. (SRP 10.4.4, Part III).

RESPONSE

The size of the inlet and outlet of the bypass valves is shown on Figure 10.3-1. The number, principal of operation, construction, and capacity of the bypass valves are discussed in revised Section 10.4.4.2. The operation of the bypass system is discussed in Sections 10.4.4.2 and 7.7.1.6, and shown on Figure 7.7-8. The only setpoint associated with this system is the bypass valve closure on loss of condenser vacuum as given in Table 15.2-8. Section 7.7.1.6.3.3 discusses the control of the bypass valves.

The bypass valves fail closed upon loss of hydraulic fluid system pressure. In this case a turbine trip will result. Hydraulic fluid in accumulators at the bypass valves will hold them open for approximately one minute following the turbine trip. During this time reactor steam will be bypassed to the condenser.

1/3

10.4.4 TURBINE BYPASS SYSTEM

The turbine bypass system dissipates the energy of the main st produced by the reactor that cannot be used by the turbine.

10.4.4.1 Design Bases

The turbine bypass system has no safety-related functions.

The turbine bypass system is designed to discharge main steam directly to the condenser to control the pressure in the react pressure vessel (RPV) during the following modes of operation:

a. RPV heatup to rated pressure

b. Bringing the turbine up to speed and synchronizing i

c. Power operation when the quantity of steam generatec the reactor exceeds that required by the turbine (Re to section 10.4.4.2 for the turbine bypass system capacity).

d. RPV cooldown.

The piping that connects the main steam lines to the inlet of bypass valve chest is described in Section 10.3. The piping connecting the discharge of the bypass valves to the condense designed to ANSI B31.1 requirements.

10.4.4.2 System Description

The turbine bypass system is shown on Figure 10.3-1 and consi of the:

a. Bypass valve chest assembly

b. Piping downstream of the bypass valves to the condensers

2/3

c. **Pressure reducer assemblies.**

The bypass valve chest consists of nine separate bypass control valves mounted in individual compartments of a common valve chest. The valves are globe-type, with the stems arranged so that they extend to the outside of the chest through the discharge chamber of the respective valve. This stem arrangement minimizes leakage when the valves are closed, since it is necessary to seal the stem only against condenser vacuum.

Each bypass valve has a discharge line routed directly to the condenser. To reduce the pressure at which the bypassed steam enters the respective condenser, a pressure reducer assembly is installed in each bypass valve discharge line.

The valves open sequentially. When used during normal startup and shutdown, only the number 1 and number 2 bypass valves are used. However, in the event of a full load rejection, such as would occur if the generator circuit breakers were opened, it is necessary that all nine valves open to bypass 25% of the turbine valves wide open (VWO) flow, which is the maximum design flow of the bypass valves. Each individual bypass valve has a capacity to pass 2.78% of the VWO flow.

10.4.4.3 Safety Evaluation

The turbine bypass system has no safety-related function. Failure of the system does not compromise any safety-related system or component or prevent a safe shutdown of the plant.

Failure of the bypass valves to open for any reason, such as a mechanical malfunction or insufficient vacuum in the condenser, causes the pressure in the reactor to increase, ultimately shutting down the reactor and lifting the main steam safety/relief valves (SRVs) that discharge the excess steam to the suppression pool.

There are no safety-related components in the vicinity of the bypass system piping. A high-energy line failure in the turbine bypass system could cause a turbine trip due either to high condenser pressure caused by increased air inleakage at the condenser or to a possible break in the turbine's electrohydraulic control (EHC) system piping caused by steam

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QUESTION 430.167 (SECTION 10.4)

In Section 10.4.4.4 you have discussed tests and initial field inspection but not the frequency and extent of inservice testing and inspection of the turbine bypass system. Provide this information in the FSAR. (SRP 10.4.4, Part I)

RESPONSE

INSERT A

Inservice testing of the turbine bypass valves will be performed on a weekly basis.

Periodic inspection of the turbine bypass valves will be performed using written preventive maintenance procedures. The scope and frequency of inspection will be termined by August 1984.

Insert A

In service testing of the turbine bypass valves is performed in accordance with Technical Specifications requirement 4.7.10. Turbine bypass valves will be tested weekly and every 18 months a system functional test wh[illegible] includes a simulated automatic actuation and ve[illegible]ion that each automatic valve actuates to its correct position.

Maintenance procedure MD-CM.AC-007 (Z), Turbine Bypass Valve Overhaul and Inspection requires visual inspection of the turbine bypass valve internals. This inspection includes the valve seat, disk and stem. One turbine bypass valve will be inspected every 40 months.