AMERICAN ELECTRIC POWER SERVICE CORPORATION
INDIANA & MICHIGAN ELECTRIC COMPANY
D. C. COOK NUCLEAR PLANT

SAFE SHUTDOWN CAPABILITY ASSESSMENT, PROPOSED MODIFICATIONS, AND EVALUATIONS
10 CFR 50, Appendix R, Section III.G

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1. INTRODUCTION

1.1 Purpose of Report

The purpose of this report is to identify the safe shutdown system requirements of the Donald C. Cook Nuclear Plant, Units 1 and 2, relative to the fire protection guidelines of 10 CFR 50 Appendix R. For those plant areas where fire protection of the safe shutdown systems and their associated circuits are not in compliance, analyses are presented and modifications are proposed for the purpose of meeting the Nuclear Regulatory Commission's (NRC) requirements. In a few areas, exemptions are requested from the specific requirements of Section III.G where compliance with the regulation would not significantly enhance fire protection above that of present commitments.

The NRC management has established that the reporting process regarding Appendix R is one of "Management by Exception". This process suggests that the contents of this Appendix R submittal need not exhaustively address every instance of compliance by including the details of the supporting analyses. Rather, it should focus on the methods by which Indiana and Michigan Electric Company has determined that either:

(1) The Donald C. Cook design complies with or will comply with the specific requirements of Appendix R, Section III.G; or

(2) Exemptions are requested from the specific requirements of Appendix R Section III.G. By analysis and implementation of proposed modifications, the level of fire protection will provide assurance that at least one train of redundant safe shutdown systems would be free of fire damage.

1.2 Executive Summary

In accordance with the guidance given in Appendix R, "...that licensees should re-examine those previously approved configurations of fire protection that do not meet the requirements as specified in Section III.G to Appendix R...", a detailed, re-examination and re-analysis of the Donald C. Cook Nuclear Plant's safe shutdown capability has been performed. The results of that re-examination and re-analysis, included in this report, build upon the previous fire protection activities performed under the guidelines of Branch Technical Position (BTP) APCSB 9.5-1, the response to which was submitted in 1977. The re-analysis also considers other subsequent fire protection improvements incorporated into the D.C. Cook facility.

This report reviews Indiana and Michigan Electric Company's Donald C. Cook Nuclear Plant, Units 1 and 2 (Docket Nos. 50-315 and 50-316) safe shutdown systems and their associated circuits for compliance with 10 CFR 50 Appendix R, Section III.G. This report also includes the descriptions of proposed alternative shutdown systems and provides sufficient technical information to permit NRC Staff review and approval of proposed plant modifications. Finally, those areas of noncompliance with the provisions of Appendix R are identified, and a subsequent, substantive basis for equivalent protection to the public health and safety is demonstrated through detailed analysis.

This report was prepared in the following manner. First, a process of selection and documentation of limiting safety consequences and safe shutdown system performance goals was conducted for the Donald C. Cook Nuclear Plant. An analysis was then performed to identify a minimal set of primary and auxiliary safe shutdown systems necessary to support safe shutdown in the event of a postulated exposure fire. After the requisite systems were identified, the related components and circuits (including associated circuits) were reviewed for compliance with the specific separation criteria of 10 CFR 50 Appendix R, Section III.G.2. For those areas not in compliance, studies were completed to determine whether:

(1) Modifications or changes to plant fire protection or safe shutdown system features were required to bring the zone into compliance; or

(2) Alternative or dedicated shutdown capability was required to bring the zone into compliance; or

(3) An exemption was justified for the specific fire zone in question.

Subsequent to issuance of the Appendix R March 1983 submittal, the design and implementation of the proposed modifications was begun. Some of the proposed fire protection modifications were reviewed and in some instances it was identified that the modifications could not physically be implemented (e.g., upgrading the access hatches to three-hour fire-rated). During this period, the fire area boundaries had also undergone a reevaluation process. This reevaluation identified additional areas of concern. These concerns were evaluated and other options were identified in order to bring the

D.C. Cook power plant into compliance with the requirements of 10 CFR 50 Appendix R.

The following approaches were taken to resolve the identified areas of concern:

(1) Propose additional modifications (see Section 8).

(2) Provide justifications for existance of unrated barriers, HVAC ducts, doors, hatches and/or openings (see Section 9).

(3) Combine fire areas into a larger fire area. In these cases, systems analyses were performed to ensure one train of safe shutdown systems remains unaffected (see Sections 2 and 9).

(4) Request exemption and provide justification for the exemption (see Section 7).

Portions of D.C. Cook power plant were not identified as fire zones in the March 1983 submittal. These areas do not contain safe shutdown cables or components and were not included in any identified fire areas. During the reevaluation process, these areas were given a fire zone designation and included in the previously identified fire areas.

The results of these activities are listed in Summary Table 1-1. The table identifies the fire areas and fire zones at the D.C. Cook Plant, the applicable Appendix R provisions, and the technical approaches selected to achieve the appropriate levels of protection. Table 1-1 includes the unidentified fire zones and presents the condition/status of each fire zone at the time of the March 1983 submittal. Table 1-1 of this report correlates to Table 1-1 of the March 1983 submittal, but has been reformatted and includes additional information.

The results of this re-analysis and re-examination can be summarized as follows:

(1) Separation between required safe shutdown circuits, which meets the specific requirements of Section III.G.2 of Appendix R to 10 CFR 50, exists or will exist in 147 of the fire zones reviewed.

(2) Alternative shutdown, which meets the requirements of Section III.G.3 and III.L of Appendix R to 10 CFR 50, will exist for 51 fire zones.

(3) Two technical exemption requests were submitted subsequent to the March 1983 submittal. The exemptions were (a) Auxiliary Building HVAC ducts and (b) Containment Building seismic gaps.

(4) Three exemption requests from the specific requirements of Section III.G.2 of Appendix R are requested in fire zones where zone features provide equivalent protection.

(5) Eight exemption requests from the specific requirements of Section III.G.3 of Appendix R are requested in fire zones where zone features provide equivalent protection.

(6) All associated circuits of concern having a separation less than that required by Section III.G.2 of Appendix R to 10 CFR 50, and having a common power source with the shutdown equipment, will be electrically protected from the post-fire shutdown circuit of concern by coordinated circuit breakers, fuses or similar devices.

(7) All associated circuits of concern having a separation less than that required by Section III.G.2 of Appendix R and having a common enclosure, e.g., raceway, panel, junction box, have been adequately resolved by being electrically protected from the post-fire shutdown circuits of concern by circuit breakers, fuses or similar devices.

(8) All associated circuits of concern that have a separation from the fire area less than that required by Section III.G.2 of Appendix R and have a connection to circuits of equipment whose spurious operation could adversely affect the shutdown capability have been adequately resolved by appropriate action pre- or post-fire.

1.2.1 Results of Analysis

The results of the analysis confirm the adequacy of the existing fire protection features in 13 of 57 fire areas when compared against the specific criteria of Appendix R, Section III.G.

For 18 of the 57 fire areas, proposed modifications including upgrading of fire barriers, installation of suppression and detection systems, circuit modifications, cable rerouting, tray and conduit wrapping, and piping modifications will achieve fire zone and area compliance with the specific criteria of Appendix R, Section III.G.

For the remaining 26 fire areas, similar modifications are proposed but verbatim compliance with Appendix R is not achieved. For these areas, exemptions are requested. The exemption requests are made on the basis of detailed fire hazards analyses which conclude that existing features, when combined with additional proposed fire protection modifications, provide functionally equivalent protection of the public health and safety. The exemption requests are contained in Section 7.0 of this report.

1.3 Scope of Report

This report contains nine sections. Section 2.0 identifies the fire areas and fire zones developed to support the Appendix R analyses. This includes a detailed discussion of the detection and suppression systems and identifies the features provided on a zone-by-zone basis. Criteria for establishing fire areas and zones are discussed as well as the process used to determine the associated fire hazard severity. The information contained in Section 2 generally presents the D.C. Cook plant configuration of each fire zone and fire area at the end of the 1986 Unit 2 refueling outage. In addition, the fire protection features include modifications required for compliance with Appendix R Section III.G, and general plant improvements initiated at the time of issue of this report.

Section 3.0 provides a description of the active fire protection features including detection and suppression systems at D.C. Cook. The information contained in Section 3 generally presents the D.C. Cook plant configuration of each fire zone's active fire protection features at the end of the 1986 Unit 2 refueling outage. In addition, the fire protection features include modifications required for compliance with Appendix R Section III.G, and general plant improvements initiated at the time of issue of this report.

Section 4.0 describes the investigatory process used to identify safety functions, safe shutdown systems, components and circuits, and associated circuits of concern. Related assumptions and considerations are also discussed. The information contained in this section presents the D.C. Cook plant status/condition of the safe shutdown systems and components at the end of the 1986 Unit 2 refueling outage.

Section 5.0 provides a discussion of the alternative shutdown systems provided by use of the unaffected unit's safe shutdown systems. In addition, Section 5.0 provides detailed responses to the relevant questions contained in Generic Letter 81-12 as clarified by the NRC Staff's clarifications dated March 22, 1982. The information contained in this section presents the D.C. Cook plant status/condition of the safe shutdown systems, components, and alternative shutdown methods identified at the time of the March 1983 submittal; however, the system flow diagrams included in this section present the D.C. Cook plant piping configuration at the end of the 1986 Unit 2 refueling outage.

Section 6.0 addresses the cold shutdown repairs necessary to achieve long-term safe shutdown. The levels of damage which may occur as a result of hypothesized Appendix R fires, the normal actions and repairs required to assure that cold shutdown can be achieved and maintained within 72 hours, are identified. The information contained in this section presents the D.C. Cook plant status/condition of the safe shutdown systems and components at the end of the 1986 Unit 2 refueling outage.

Section 7.0 contains exemption requests for each fire area/zone identified as not being in compliance with Section III.G of Appendix R, and for areas/zones where a modification would not enhance fire protection safety. Each of the fire areas/zones is described in detail and a fire hazards analysis, including results, is provided. Exemptions for each zone are also formally requested in this section and the detailed technical bases for each request are identified at the conclusion of each analysis. Tables and sketches summarizing significant fire area information are also provided at the end of each subsection. Exemptions requested in Subsections 7.2 through 7.12 utilize the D.C. Cook plant condition/configuration at the time of the March 1983 submittal. The remaining two subsections (7.13 and 7.14) are based on the D.C. Cook plant condition/configuration at the time of June 1984. In some instances, evaluations were performed to justify not implementing proposed modifications. These evaluations are presented in Section 9 of this report and are based on the configuration of the D.C. Cook plant at the end of the 1986 Unit 2 refueling outage. In addition, due to on-going efforts to comply with 10 CFR 50 Appendix R and subsequent generic NRC clarifications, various modifications in conjunction with the performance of engineering evaluations have resulted in revisions to various requested exemptions. These revisions are based on the existing configuration of the D.C. Cook plant at the end of the 1986 Unit 2 refueling outage.

Section 8.0 describes those modifications proposed at D.C. Cook Nuclear Plant which are considered necessary to:

(1) Bring each identified fire zone into compliance with the specific criteria of 10 CFR 50 Appendix R, Section III.G; or,

(2). Satisfy certain assumptions made in Section 7.0 (e.g., installation of barriers, thermal shields, conduit wrappings, etc.).

The information contained in this section presents the D.C. Cook plant configuration/status at the time of the March 1983 submittal.

Section 9.0 provides a compilation of fire area boundary evaluations which have been performed since the issuance of the March 1983 report. The information contained in this section presents the D.C. Cook plant configuration/status at the end of the 1986 Unit 2 refueling outage.

1.4 Definitions, Acronyms and Abbreviations

1.4.1 Definitions

Active Component - a component used to directly control (start, regulate or stop) a shutdown or support function, e.g., a flow control valve, a pump, or a normally closed isolation or stop valve.

Affected Unit - as used in discussions of alternative shutdown, the unit with one or more of its normal safe shutdown systems rendered inoperable, without considering the cross connects in the fire zone under investigation.

Associated Circuit of Concern - safety-related and non-safety-related cables that are associated with equipment which is required for shutdown and which have a separation from the fire area less than that required by Section III.G.2 of Appendix R to 10 CFR 50, and which have either:

(1) A common power source with the shutdown equipment and the power source is not electrically protected from the post-fire shutdown circuit of concern by coordinated circuit breakers, fuses or similar devices; or

(2) A connection of circuits of equipment whose spurious operation will adversely affect the shutdown capability, e.g., RHR/RCS isolation valves; or

(3) A common enclosure, e.g., raceway, panel, junction box, with shutdown cables and are not electrically protected from the post-fire shutdown circuits of concern by circuit breakers, fuses or similar devices or will allow propagation of the fire into the common enclosure.

<u>Automatic Detection</u> - a device located (usually at the ceiling) in a zone or area that transmits a signal to a remote location (usually the Control Room) indicating an excess presence of combustion products. Several types of detection devices are commonly utilized, such as smoke (photoelectric and ionization), heat (fixed temperature, rate of rise, or a combination of both) and flame detectors (ultraviolet, visible, or infrared).

<u>Automatic Suppression</u> - a fixed piping system of water or other fire extinguishing agent automatically actuated when the presence of combustion products or heat exceeds the set point established for the system in the area in which it is installed.

<u>Cold Shutdown</u> - reactor at zero power, K_{eff} less than 0.99 and RCS temperature at or below 200^{o}F.

<u>Fire Area</u> - that portion of a building or plant separated from other areas by boundary fire barriers with the fire hazard in each area evaluated to determine barrier fire rating requirements.

Fire Barrier - a continuous membrane either vertical or horizontal, such as a wall or floor/ceiling assembly, that has a specified fire resistance rating to limit the spread of fire between fire areas or safe shutdown components. The fire barriers are defined to be rated commensurate with the hazard to which the barrier is exposed.

Fire Brigade - the team of plant personnel assigned to fire-fighting and who are equipped for and trained in the fighting of fires.

Fire Rating - the time in minutes or hours that materials or assemblies have withstood a fire exposure as established in accordance with test procedures of nationally recognized testing organizations.

Fire Stop - a feature of construction that prevents fire propagation along the length of cables or prevents spreading of fire to nearby combustibles within a given fire area or fire zone.

Fire Zone - a subdivision of a fire area designated as a potential fire hazard zone for convenience of analysis and design of fire suppression systems.

Fixed Suppression - any water or gaseous suppression system activated either automatically or manually, but excluding manual hose stations and portable fire extinguishers.

Hot Shutdown - reactor at zero power, K_{eff} less than 0.99 and RCS temperature between 350^{o}F and 200^{o}F.

Hot Standby - the initial safe shutdown state with the reactor at zero power, K_{eff} less than 0.99 and RCS average temperature greater than or equal to $350^{\circ}F$.

Manual Suppression - a fixed or portable means of controlling or extinguishing a fire requiring manual actuation and/or application.

Safe Shutdown System - a safe shutdown system includes all components, panels, cables, raceways, conduits, etc., necessary for the system to perform a safe shutdown function. A safe shutdown system is any of the systems (e.g., Auxiliary Feedwater) which are required by 10 CFR 50 Appendix R. Necessary supporting auxiliary systems are included.

Sprinkler System - a network of piping connected to a reliable water supply that will distribute the water throughout the area protected and will discharge the water through sprinklers in sufficient quantity to either control or extinguish a fire. The system, usually activated by heat, includes a controlling valve and a device for actuating an alarm when the system is in operation.

Standpipe and Hose System - a fixed piping system with hose outlets, nozzle and hose connected to reliable water supply to provide effective fire hose streams to specific areas inside the building.

Unaffected Unit - as used in the discussions of alternative shutdown, the unit whose normal safe shutdown systems will be used to provide alternative shutdown in the affected unit.

Water Spray System - a network of piping similar to a sprinkler system except that it utilizes open-head spray nozzles and protects a specific hazard.

1.4.2 Acronyms and Abbreviations

AFW - Auxiliary Feedwater

AOV - Air-Operated Valve

BIT - Boron Injection Tank

CCW - Component Cooling Water

CST - Condensate Storage Tank

CVCS - Chemical and Volume Control System

ECCS - Emergency Core Cooling Systems

EPS - Emergency Power System

ESW - Essential Service Water

LSI - Local Shutdown Indication

MCC - Motor Control Center

MOV - Motor-Operated Valve

MS - Main Steam

PORV - Power-Operated Relief Valve

RCP - Reactor Coolant Pump

RCS - Reactor Coolant System

RHR - Residual Heat Removal

RWST - Refueling Water Storage Tank

SV - Safety Valve

TABLE 1-1

APPENDIX R SUMMARY COMPLIANCE TABLE

FIRE ZONE	SSS EQPT OR CABLE WITHIN ZONE	DETECTION	AUTOMATIC SUPPRESSION	APPLICABLE APPENDIX R PROVISIONS III.G.2	III.G.3	REQUIRED MODIFICATIONS OR EVALUATIONS
FIRE AREA: RHR AND CTS PUMPS AREA - ELEV. 573' 0": 3 HOUR BOUNDARY						
1	1&2	EXISTING	NONE	ER (c)		(1), (2), (6), (9)
1A	NONE	NONE	NONE	EC (*)		(3), (5)
1B	NONE	NONE	NONE	EC (*)		(3), (5)
1C	1	NONE	NONE	ER (a,b)		(2), (3), (5)
1D	1	NONE	NONE	ER (a,b)		(2), (3), (5)
1E	NONE	NONE	NONE	EC (*)		(3), (5)
1F	NONE	NONE	NONE	EC (*)		(3), (5)
1G	2	NONE	NONE	ER (a,b)		(2), (3), (5)
1H	2	NONE	NONE	ER (a,b)		(2), (3), (5)
136	NONE	NONE	NONE	EC (*)		NONE
137	NONE	NONE	NONE	EC (*)		NONE
138A	NONE	NONE	NONE	EC (*)		NONE
138B	NONE	NONE	NONE	EC (*)		(5)
138C	NONE	NONE	NONE	EC (*)		NONE

TABLE 1-1

APPENDIX R SUMMARY COMPLIANCE TABLE
(CONTINUED)

FIRE ZONE	SSS EQPT OR CABLE WITHIN ZONE	DETECTION	AUTOMATIC SUPPRESSION	APPLICABLE APPENDIX R PROVISIONS III.G.2	III.G.3	REQUIRED MODIFICATIONS OR EVALUATIONS
FIRE AREA: TURBINE BUILDING, SCREENHOUSE, SERVICE/OFFICE BUILDINGS AND UNITS 1 AND 2 WEST MAIN STEAM VALVE ENCLOSURES: 1.5 HOUR BOUNDARY						
2	NONE	NONE	NONE	EC (*)		(5)
28	NONE	NONE	EXISTING	EC (*)		(5)
30	NONE	NONE	EXISTING	EC (*)		(5)
77	NONE	NONE	EXISTING	EC (*)		(5)
78	NONE	NONE	EXISTING	EC (*)		(5)
79	1	NONE	EXISTING	PC (b,c)		(1), (3), (4), (5)
80	1	NONE	EXISTING	EC (b)		(5)
81	NONE	NONE	EXISTING	EC (*)		(5)
82	NONE	NONE	EXISTING	EC (*)		(5)
83	NONE	EXISTING	EXISTING	EC (*)		(5)
84	2	NONE	EXISTING	EC (b)		(5)
85	2	NONE	EXISTING	PC (b,c)		(1), (3), (4), (5)
86	NONE	NONE	EXISTING	EC (*)		(5)
87	NONE	NONE	EXISTING	EC (*)		(5)
88	NONE	EXISTING	EXISTING	EC (*)		(5)
89	NONE	NONE	EXISTING	EC (*)		(5)
90	NONE	NONE	EXISTING	EC (*)		(5)
91	1	NONE	EXISTING	EC (b)		(5)
92	NONE	NONE	EXISTING	EC (*)		(5)
93	NONE	NONE	EXISTING	EC (*)		(5)
94	NONE	NONE	EXISTING	EC (*)		(5)

FIRE AREA CONTINUED ON NEXT PAGE

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APPENDIX R SUMMARY COMPLIANCE TABLE
(CONTINUED)

FIRE ZONE	SSS EQPT OR CABLE WITHIN ZONE	DETECTION	AUTOMATIC SUPPRESSION	APPLICABLE APPENDIX R PROVISIONS III.G.2	III.G.3	REQUIRED MODIFICATIONS OR EVALUATIONS
95	NONE	EXISTING	EXISTING	EC (*)		(5)
96	NONE	NONE	EXISTING	EC (*)		(5)
97	NONE	NONE	EXISTING	EC (*)		(5)
98	NONE	NONE	EXISTING	EC (*)		(5)
99	NONE	NONE	EXISTING	EC (*)		(5)
100	NONE	EXISTING	EXISTING	EC (*)		(5)
108	1	NONE	NONE	ER (b)		(5), (6)
109	2	NONE	NONE	ER (b)		(5), (6)
110	1	NONE	NONE	EC (b)		(5)
111	NONE	NONE	NONE	EC (*)		(5)
112	1	NONE	NONE	EC (b)		(5)
113	2	NONE	NONE	EC (b)		(5)
114	1	NONE	NONE	EC (b)		(5)
115	2	NONE	NONE	EC (b)		(5)
124	NONE	EXISTING	EXISTING	EC (*)		(5)
125	NONE	EXISTING	EXISTING	EC (*)		(5)
126	NONE	EXISTING	EXISTING	EC (*)		(5)
127	NONE	EXISTING	EXISTING	EC (*)		(5)
128	NONE	NONE	NONE	EC (*)		(5)
129	NONE	EXISTING	EXISTING	EC (*).		(5)
130	NONE	EXISTING	EXISTING	EC (*)		(5)
131	NONE	EXISTING	EXISTING	EC (*)		(5)

FIRE AREA CONTINUED ON NEXT PAGE

TABLE 1-1

APPENDIX R SUMMARY COMPLIANCE TABLE
(CONTINUED)

FIRE ZONE	SSS EQPT OR CABLE WITHIN ZONE	DETECTION	AUTOMATIC SUPPRESSION	APPLICABLE APPENDIX R PROVISIONS III.G.2	III.G.3	REQUIRED MODIFICATIONS OR EVALUATIONS
139	NONE	NONE	NONE	EC (*)		(5)
140	NONE	NONE	NONE	EC (*)		(5)
141	NONE	NONE	NONE	EC (*)		(5)
142	NONE	NONE	NONE	EC (*)		(5)
143	NONE	NONE	NONE	EC (*)		(5)
FIRE AREA: AUXILIARY BUILDING ELEV. 633' AND 650' AND FUEL HANDLING BUILDING: 1.5 HOUR BOUNDARY						
3	NONE	EXISTING	EXISTING	EC (*)		(5)
31	NONE	NONE	NONE	EC (*)		(5)
32	1	EXISTING	EXISTING	EC (g)		(5)
35	NONE	NONE	NONE	EC (*)		(5)
36	NONE	NONE	NONE	EC (*)		(5)
48	NONE	EXISTING	NONE	EC (*)		(5)
49	OP	EXISTING	NONE	ER (*)		(5), (6)
50	2	EXISTING	NONE	ER (g)		(5), (6)
51	1	EXISTING	NONE	PC (g)		(2), (4), (5)
52	1&2	EXISTING	NONE		PC, ER	(2), (4), (5), (6)
69	1&2	EXISTING	NONE	ER (g)		(5), (6)
106	1	EXISTING	NONE	EC (g)		(5)
107	2	EXISTING	NONE	EC (g)		(5)
146	NONE	NONE	NONE	EC (*)		(5)

TABLE 1-1

APPENDIX R SUMMARY COMPLIANCE TABLE
(CONTINUED)

FIRE ZONE	SSS EQPT OR CABLE WITHIN ZONE	DETECTION	AUTOMATIC SUPPRESSION	APPLICABLE APPENDIX R PROVISIONS III.G.2	III.G.3	REQUIRED MODIFICATIONS OR EVALUATIONS
FIRE AREA: SAMPLING ROOM ELEV. 587' 0": 1.5 HOUR BOUNDARY						
4	1	EXISTING	NONE	EC (g)		NONE
FIRE AREA: AUXILIARY BUILDING EAST AND WEST ELEV. 587' 0": 1.5 HOUR BOUNDARY						
5	1&2	EXISTING	EXISTING	PC (c)		(1), (2), (4), (5) (9)
6A	NONE	NONE	NONE	EC (*)		(5)
6N	1	EXISTING	EXISTING		PC, ER	(1), (2), (4), (5) (6), (7), (9)
6M	1&2	EXISTING	EXISTING	PC, ER (c)		(1), (2), (5), (6)
6S	2	EXISTING	EXISTING		PC, ER	(1), (2), (4), (5) (6), (7), (9)
61	NONE	EXISTING	NONE	EC (*)		(5)
64A	NONE	EXISTING	EXISTING	EC (*)		(5)
64B	NONE	EXISTING	EXISTING	EC (*)		(5)
65A	2	EXISTING	EXISTING	EC (g)		(5)
65B	2	EXISTING	EXISTING	EC (g)		(5)
FIRE AREA: UNIT 1 QUADRANT 1 CABLE TUNNEL ELEV. 596' 3.5": 3 HOUR BOUNDARY						
7	1	EXISTING	EXISTING	PC, ER (g)		(5), (6), (7)
FIRE AREA: UNIT 1 QUADRANT 4 CABLE TUNNEL ELEV. 596' 3.5": 1.5 HOUR BOUNDARY						
8	1	EXISTING	EXISTING	PC, ER (g)		(2), (6)

TABLE 1-1

APPENDIX R SUMMARY COMPLIANCE TABLE
(CONTINUED)

FIRE ZONE	SSS EQPT OR CABLE WITHIN ZONE	DETECTION	AUTOMATIC SUPPRESSION	APPLICABLE APPENDIX R PROVISIONS III.G.2	III.G.3	REQUIRED MODIFICATIONS OR EVALUATIONS
FIRE AREA: UNIT 1 QUADRANT 3N AND 3M CABLE TUNNELS ELEV. 596' 3.5": 1.5 HOUR BOUNDARY						
9	1	EXISTING	EXISTING	EC (g)		(5)
10	1	EXISTING	EXISTING	PC, ER (g)		(5), (6), (7)
FIRE AREA: UNIT 1 QUADRANT 3S CABLE TUNNEL ELEV. 596' 3.5": 1.5 HOUR BOUNDARY						
11	1	EXISTING	EXISTING	ER (g)		(6)
FIRE AREA: UNIT 1 QUADRANT 2 PIPING TUNNEL ELEV. 596' 3.5": 1.5 HOUR BOUNDARY						
12	1	NONE	NONE	PC, ER (g)		(2), (5), (6)
FIRE AREA: UNIT 1 DIESEL OIL PUMP ROOM ELEV. 587' 0": 3 HOUR BOUNDARY						
13	1&2	EXISTING	EXISTING	EC (g)		(5)
FIRE AREA: UNIT 1 TRANSFORMER ROOM ELEV. 591' 0": 1.5 HOUR BOUNDARY						
14	1	NONE	NONE		PC, ER	(3), (5), (7)
FIRE AREA: UNIT 1 CD DIESEL ROOM ELEV. 587' 0": 1.5 HOUR BOUNDARY						
15	1	EXISTING	EXISTING	PC (a)		(1), (7)
FIRE AREA: UNIT 1 AB DIESEL ROOM ELEV. 587' 0": 1.5 HOUR BOUNDARY						
16	1	EXISTING	EXISTING	EC (g)		NONE
FIRE AREA: UNIT 1 WEST AUXILIARY FEEDWATER PUMP ROOM: 3 HOUR BOUNDARY						
17A	1	NONE	NONE	EC (g)		NONE

TABLE 1-1

APPENDIX R SUMMARY COMPLIANCE TABLE
(CONTINUED)

FIRE ZONE	SSS EQPT OR CABLE WITHIN ZONE	DETECTION	AUTOMATIC SUPPRESSION	APPLICABLE APPENDIX R PROVISIONS III.G.2	III.G.3	REQUIRED MODIFICATIONS OR EVALUATIONS
FIRE AREA: UNIT 2 WEST AUXILIARY FEEDWATER PUMP ROOM: 3 HOUR BOUNDARY						
17B	2	NONE	NONE	EC (g)		NONE
FIRE AREA: AUXILIARY FEEDWATER PUMP CORRIDOR: 3 HOUR BOUNDARY						
17C	1&2	NONE	NONE	PC (g)		(1), (3), (4)
FIRE AREA: UNIT 1 EAST AUXILIARY FEEDWATER PUMP ROOM: 3 HOUR BOUNDARY						
17D	1	NONE	NONE	EC (g)		NONE
FIRE AREA: UNIT 1 TURBINE AUXILIARY FEEDWATER PUMP ROOM: 3 HOUR BOUNDARY						
17E	1	NONE	EXISTING	EC (g)		NONE
FIRE AREA: UNIT 2 TURBINE AUXILIARY FEEDWATER PUMP ROOM: 3 HOUR BOUNDARY						
17F	2	NONE	EXISTING	EC (g)		NONE
FIRE AREA: UNIT 2 EAST AUXILIARY FEEDWATER PUMP ROOM: 3 HOUR BOUNDARY						
17G	2	NONE	NONE	EC (g)		NONE
FIRE AREA: UNIT 2 CD DIESEL ROOM ELEV. 587' 0": 1.5 HOUR BOUNDARY						
18	2	EXISTING	EXISTING	PC (g)		(7)
FIRE AREA: UNIT 2 AB DIESEL ROOM ELEV. 587' 0": 1.5 HOUR BOUNDARY						
19	2	EXISTING	EXISTING	PC (a)		(1)

TABLE 1-1

APPENDIX R SUMMARY COMPLIANCE TABLE
(CONTINUED)

FIRE ZONE	SSS EQPT OR CABLE WITHIN ZONE	DETECTION	AUTOMATIC SUPPRESSION	APPLICABLE APPENDIX R PROVISIONS III.G.2	III.G.3	REQUIRED MODIFICATIONS OR EVALUATIONS
FIRE AREA: UNIT 2 TRANSFORMER ROOM ELEV. 591' 0": 1.5 HOUR BOUNDARY						
20	2	NONE	NONE		PC, ER	(3), (5), (7)
FIRE AREA: UNIT 2 DIESEL OIL PUMP ROOM ELEV. 587' 0": 3 HOUR BOUNDARY						
21	1&2	EXISTING	EXISTING	EC (g)		(5)
FIRE AREA: UNIT 2 QUADRANT 2 PIPING TUNNEL ELEV. 596' 3.5": 1.5 HOUR BOUNDARY						
22	2	NONE	NONE	PC, ER (g)		(2), (5), (6)
FIRE AREA: UNIT 2 QUADRANT 3N CABLE TUNNEL ELEV. 596' 3.5": 1.5 HOUR BOUNDARY						
23	2	EXISTING	EXISTING	ER (g)		(6)
FIRE AREA: UNIT 2 QUADRANT 3M AND 3S CABLE TUNNELS ELEV. 596' 3.5": 1.5 HOUR BOUNDARY						
24	2	EXISTING	EXISTING	PC, ER (g)		(5), (6), (7)
25	2	EXISTING	EXISTING	EG (g)		(5)
FIRE AREA: UNIT 2 QUADRANT 4 CABLE TUNNEL ELEV. 596' 3.5": 1.5 HOUR BOUNDARY						
26	2	EXISTING	EXISTING	PC, ER (g)		(2), (6)
FIRE AREA: UNIT 2 QUADRANT 1 CABLE TUNNEL ELEV. 596' 3.5": 1.5 HOUR BOUNDARY						
27	2	EXISTING	EXISTING	PC, ER (g)		(6), (7)

TABLE 1-1

APPENDIX R SUMMARY COMPLIANCE TABLE
(CONTINUED)

FIRE ZONE	SSS EQPT OR CABLE WITHIN ZONE	DETECTION	AUTOMATIC SUPPRESSION	APPLICABLE APPENDIX R PROVISIONS III.G.2	III.G.3	REQUIRED MODIFICATIONS OR EVALUATIONS
FIRE AREA: ESSENTIAL SERVICE WATER PUMPS AREA: 3 HOUR BOUNDARY						
29A	1	NONE	NONE		ER	(3), (5)
29B	1	NONE	NONE		ER	(3), (5)
29E	1	NONE	NONE		ER	(3), (5)
29C	2	NONE	NONE		ER	(2), (3), (5)
29D	2	NONE	NONE		ER	(2), (3), (5)
29F	2	NONE	NONE		ER	(2), (3), (5)
29G	1&2	NONE	NONE	ER (c)		(1), (2), (3), (5)
FIRE AREA: UNIT 1 EAST MAIN STEAM VALVE ENCLOSURE AND CONTRACTOR ACCESS CONTROL AREA: 1.5 HOUR BOUNDARY						
33	1	NONE	NONE		ER	(2), (3), (5)
33A	1	NONE	NONE		ER	(3), (5), (6)
33B	1	NONE	NONE		ER	(3), (5), (6)
105	NONE	NONE	EXISTING	EC (*)		(5)
FIRE AREA: UNIT 2 EAST MAIN STEAM VALVE ENCLOSURE AREA: 1.5 HOUR BOUNDARY						
34	2	NONE	NONE		ER	(2), (3)
34A	2	NONE	NONE		ER	(3), (5), (6)
34B	2	NONE	NONE		ER	(3), (6)

TABLE 1-1

APPENDIX R SUMMARY COMPLIANCE TABLE
(CONTINUED)

FIRE ZONE	SSS EQPT OR CABLE WITHIN ZONE	DETECTION	AUTOMATIC SUPPRESSION	APPLICABLE APPENDIX R PROVISIONS III.G.2	III.G.3	REQUIRED MODIFICATIONS OR EVALUATIONS
FIRE AREA: AUXILIARY BUILDING NORTH AND SOUTH ELEV. 609' 0": 1.5 HOUR BOUNDARY						
37	NONE	EXISTING	NONE	EC (*)		(5)
43	1	EXISTING	NONE		EC	(5)
44N	1&2	EXISTING	EXISTING		PC, ER	(1), (2), (3), (4), (5), (6), (7), (9)
44S	1&2	EXISTING	EXISTING		PC, ER	(1), (2), (3), (4), (5), (6), (7), (8), (9)
44A	NONE	NONE	NONE	EC (*)		(5)
44B	NONE	NONE	NONE	EC (*)		(5)
44C	1	NONE	NONE	EC (h)		(5)
44D	1	NONE	NONE	EC (h)		(5)
44E	SP	NONE	NONE	EC (g)		(5)
44F	2	NONE	NONE	EC (g)		(5)
44G	2	NONE	NONE	EC (h)		(5)
44H	2	NONE	NONE	EC (h)		(5)
FIRE AREA: UNIT 1 QUADRANT 2 CABLE TUNNEL ELEV. 612' 0": 1.5 HOUR BOUNDARY						
38	1	EXISTING	EXISTING		PC, ER	(6), (7)
FIRE AREA: UNIT 2 QUADRANT 2 CABLE TUNNEL ELEV. 612' 0": 1.5 HOUR BOUNDARY						
39	2	EXISTING	EXISTING		PC, ER	(6), (7)

TABLE 1-1

APPENDIX R SUMMARY COMPLIANCE TABLE
(CONTINUED)

FIRE ZONE	SSS EQPT OR CABLE WITHIN ZONE	DETECTION	AUTOMATIC SUPPRESSION	APPLICABLE APPENDIX R PROVISIONS III.G.2	III.G.3	REQUIRED MODIFICATIONS OR EVALUATIONS
FIRE AREA: UNIT 1 SWITCHGEAR ROOMS ELEV. 609' 0": 1.5 HOUR BOUNDARY						
40A	1	EXISTING	EXISTING		EC	NONE
40B	1	EXISTING	EXISTING		PC	(5), (7)
FIRE AREA: UNIT 1 ENGINEERED SAFETY SYSTEMS AND MCC ROOM ELEV. 609' 0": 1.5 HOUR BOUNDARY						
41	1	EXISTING	EXISTING		PC	(5), (7)
FIRE AREA: UNIT 1 EMERGENCY POWER SYSTEMS AREA ELEV. 609' 0": 1.5 HOUR BOUNDARY						
42A	1	EXISTING	EXISTING		PC	(7)
42B	1	EXISTING	EXISTING		PC	(7)
42C	1	EXISTING	EXISTING		PC	(7)
42D	1	EXISTING	EXISTING		PC	(7)
FIRE AREA: UNIT 2 ENGINEERED SAFETY SYSTEMS AND MCC ROOM ELEV. 609' 0": 1.5 HOUR BOUNDARY						
45	2	EXISTING	EXISTING		PC	(5), (7)
FIRE AREA: UNIT 2 EMERGENCY POWER SYSTEMS AREA ELEV. 609' 0": 1.5 HOUR BOUNDARY						
46A	2	EXISTING	EXISTING		PC	(7)
46B	NONE	EXISTING	EXISTING	EC (*)		
46C	2	EXISTING	EXISTING		PC	(7)
46D	2	EXISTING	EXISTING		PC	(7)
FIRE AREA: UNIT 2 SWITCHGEAR ROOMS ELEV. 609' 0": 1.5 HOUR BOUNDARY						
47A	2	EXISTING	EXISTING		EC	NONE
47B	2	EXISTING	EXISTING		PC	(5), (7)

TABLE 1-1

APPENDIX R SUMMARY COMPLIANCE TABLE
(CONTINUED)

FIRE ZONE	SSS EQPT OR CABLE WITHIN ZONE	DETECTION	AUTOMATIC SUPPRESSION	APPLICABLE APPENDIX R PROVISIONS III.G.2	III.G.3	REQUIRED MODIFICATIONS OR EVALUATIONS
FIRE AREA: UNIT 1 CONTROL ROOM: 3 HOUR BOUNDARY						
53	1	EXISTING	NONE		PC, ER	(2), (5), (7)
FIRE AREA: UNIT 2 CONTROL ROOM: 3 HOUR BOUNDARY						
54	2	EXISTING	NONE		PC, ER	(2), (5), (7)
FIRE AREA: UNIT 1 SWITCHGEAR ROOM CABLE VAULT: 3 HOUR BOUNDARY						
55	1	EXISTING	EXISTING		PC	(5), (7)
FIRE AREA: UNIT 1 AUXILIARY CABLE VAULT: 1.5 HOUR BOUNDARY						
56	1	EXISTING	EXISTING		PC	(5), (7)
FIRE AREA: UNIT 1 CONTROL ROOM CABLE VAULT AND HOT SHUTDOWN PANEL AREA: 1.5 HOUR BOUNDARY						
57	1	EXISTING	EXISTING		PC	(5), (7)
144	1	EXISTING	NONE		PC, ER	(2), (7)
FIRE AREA: UNIT 2 CONTROL ROOM CABLE VAULT AND HOT SHUTDOWN PANEL AREA: 3 HOUR BOUNDARY						
58	2	EXISTING	EXISTING		PC	(5), (7)
145	2	EXISTING	NONE		PC, ER	(2), (7)
FIRE AREA: UNIT 2 AUXILIARY CABLE VAULT: 1.5 HOUR BOUNDARY						
59	2	EXISTING	EXISTING		PC	(5), (7)
FIRE AREA: UNIT 2 SWITCHGEAR ROOM CABLE VAULT: 3 HOUR BOUNDARY						
60	2	EXISTING	EXISTING		PC	(5), (7)

TABLE 1-1

APPENDIX R SUMMARY COMPLIANCE TABLE
(CONTINUED)

FIRE ZONE	SSS EQPT OR CABLE WITHIN ZONE	DETECTION	AUTOMATIC SUPPRESSION	APPLICABLE APPENDIX R PROVISIONS III.G.2	III.G.3	REQUIRED MODIFICATIONS OR EVALUATIONS
FIRE AREA: UNIT 1 CHARGING PUMPS AREA ELEV. 587' 0": 1 HOUR BOUNDARY						
62A	1	EXISTING	EXISTING		PC	(2), (5), (7)
62B	1	EXISTING	EXISTING		PC	(2), (5), (7)
62C	1	EXISTING	EXISTING		PC	(2), (5), (7)
FIRE AREA: UNIT 2 CHARGING PUMPS AREA ELEV. 587' 0": 1 HOUR BOUNDARY						
63A	2	EXISTING	EXISTING		PC	(2), (5), (7)
63B	2	EXISTING	EXISTING		PC	(2), (5), (7)
63C	2	EXISTING	EXISTING		PC	(2), (5), (7)
FIRE AREA: UNIT 1 CONTAINMENT: 3 HOUR BOUNDARY						
66	1	NONE	NONE	PC (d)		(7)
67	1	NONE	NONE	PC (d)		(7)
68	1	NONE	NONE	EC (d)		NONE
101	1	NONE	NONE	EC (d)		NONE
103	1	NONE	NONE	EC (d)		NONE
118	SP	NONE	NONE	EC (g)		NONE
120	1	NONE	NONE	PC (d)		(7)
122	1	NONE	NONE	PC (f)		(7)
132	NONE	NONE	NONE	EC (*)		NONE
134	NONE	NONE	NONE	EC (*)		NONE

TABLE 1-1

APPENDIX R SUMMARY COMPLIANCE TABLE
(CONTINUED)

FIRE ZONE	SSS EQPT OR CABLE WITHIN ZONE	DETECTION	AUTOMATIC SUPPRESSION	APPLICABLE APPENDIX R PROVISIONS III.G.2	III.G.3	REQUIRED MODIFICATIONS OR EVALUATIONS
FIRE AREA: CONTROL ROOM HVAC AND COMPUTER AREA: 3 HOUR BOUNDARY						
70	NONE	EXISTING	NONE	EC (*)		(5)
71	NONE	EXISTING	EXISTING	EC (*)		NONE
72	NONE	EXISTING	EXISTING	EC (*)		NONE
73	NONE	EXISTING	NONE	EC (*)		(5)
FIRE AREA: UNIT 2 CONTAINMENT: 3 HOUR BOUNDARY						
74	2	NONE	NONE	PC (d)		(7)
75	2	NONE	NONE	PC (d)		(7)
76	2	NONE	NONE	EC (d)		NONE
102	2	NONE	NONE	EC (d)		NONE
104.	2	NONE	NONE	EC (d)		NONE
119	SP	NONE	NONE	EC (g)		NONE
121	2	NONE	NONE	PC (d)		(7)
123	2	NONE	NONE	PC (f)		(7)
133	NONE	NONE	NONE	EC (*)		NONE
135	NONE	NONE	NONE	EC (*)		NONE
FIRE AREA: UNIT 1 TANK AREA PIPE TUNNEL: 3 HOUR BOUNDARY						
116	NONE	NONE	NONE	EC (*)		(5)
FIRE AREA: UNIT 2 TANK AREA PIPE TUNNEL: 3 HOUR BOUNDARY						
117	NONE	NONE	NONE	EC (*)		(5)

TABLE 1-1

APPENDIX R SUMMARY COMPLIANCE TABLE
(CONTINUED)

LEGEND:

NONE	NO SSS COMPONENTS OR CABLES IN THE ZONE/NO MODIFICATIONS REQUIRED FOR COMPLIANCE
1	UNIT 1 SSS COMPONENTS OR CABLES IN THE ZONE
2	UNIT 2 SSS COMPONENTS OR CABLES IN THE ZONE
1&2	BOTH UNITS SSS COMPONENTS OR CABLES IN THE ZONE
OP	OPTIONAL SHUTDOWN COMPONENTS AND/OR CABLES ONLY IN THE ZONE
EC	EXISTING COMPLIANCE
PC	PROPOSED COMPLIANCE
ER	EXEMPTION REQUEST
SP	SPURIOUS CABLES ONLY. SEE TABLE 4-3

TYPE OF III.G.2 COMPLIANCE STRATEGY

(a)	III.G.2 (a) COMPLIANCE - SEPARATION OF CABLES AND EQUIPMENT AND ASSOCIATED NONSAFETY-RELATED CIRCUITS OF REDUNDANT TRAINS BY A FIRE BARRIER HAVING A THREE-HOUR RATING.
(b)	III.G.2 (b) COMPLIANCE - SEPARATION OF CABLES AND EQUIPMENT AND ASSOCIATED NONSAFETY-RELATED CIRCUITS OF REDUNDANT TRAINS BY A HORIZONTAL DISTANCE OF MORE THAN 20 FEET WITH NO INTERVENING COMBUSTIBLES OR FIRE HAZARDS. IN ADDITION, FIRE DETECTORS AND AN AUTOMATIC FIRE SUPPRESSION SYSTEM SHALL BE INSTALLED IN THE FIRE AREA.
(c)	III.G.2 (c) COMPLIANCE - ENCLOSURE OF CABLE AND EQUIPMENT AND ASSOCIATED NONSAFETY-RELATED CIRCUITS OF ONE REDUNDANT TRAIN IN A FIRE BARRIER HAVING A ONE-HOUR RATING. IN ADDITION, FIRE DETECTORS AND AN AUTOMATIC FIRE SUPPRESSION SYSTEM SHALL BE INSTALLED IN THE FIRE AREA.
(d)	III.G.2 (d) COMPLIANCE - SEPARATION OF CABLES AND EQUIPMENT AND ASSOCIATED NONSAFETY-RELATED CIRCUITS OF REDUNDANT TRAINS BY A HORIZONTAL DISTANCE OF MORE THAN 20 FEET WITH NO INTERVENING COMBUSTIBLES OR FIRE HAZARDS.
(e)	III.G.2 (e) COMPLIANCE - INSTALLATION OF FIRE DETECTORS AND AN AUTOMATIC FIRE SUPPRESSION SYSTEM IN THE FIRE AREA.
(f)	III.G.2 (f) COMPLIANCE - SEPARATION OF CABLES AND EQUIPMENT AND ASSOCIATED NONSAFETY-RELATED CIRCUITS OF REDUNDANT TRAINS BY A NON-COMBUSTIBLE RADIANT ENERGY SHIELD.
(g)	III.G.1 COMPLIANCE IS PROVIDED SINCE NO REDUNDANT SAFE SHUTDOWN EQUIPMENT IS IN THE AREA.
(h)	III.G COMPLIANCE IS PROVIDED SINCE THE SAFE SHUTDOWN EQUIPMENT IN THE AREA IS PASSIVE AND IS NOT REQUIRED TO OPERATE.
(*)	III.G COMPLIANCE IS PROVIDED SINCE NO SAFE SHUTDOWN CABLES OR COMPONENTS ARE IN THE FIRE ZONE.

TABLE 1-1

APPENDIX R SUMMARY COMPLIANCE TABLE
(CONTINUED)

TYPE OF MODIFICATION REQUIRED FOR COMPLIANCE

(1) RACEWAY PROTECTION (i.e., WRAPPING OF CABLE TRAY OR CONDUIT)

(2) AREA BOUNDARY MODIFICATION

(3) DETECTION MODIFICATION

(4) SUPPRESSION MODIFICATION

(5) AREA BOUNDARY EVALUATION

(6) AREA BOUNDARY EXEMPTION

(7) ELECTRICAL CIRCUIT AND/OR MECHANICAL PIPING MODIFICATION

(8) RATED BARRIER ADDITION WITHIN A FIRE ZONE

(9) BOUNDARY MODIFICATION (STAIRWAY SUPPRESSION)

2. IDENTIFICATION OF FIRE AREAS

This section provides detailed information on the criteria and methodologies used to develop fire area and zone definitions for D.C. Cook. In addition, the methodology utilized to develop equivalent fire severities for each fire area are discussed. The results of these activities are presented as Tables 2-1 and 2-2 and Figures 2.1 through 2.11.

The information contained in this section generally presents the D.C. Cook plant configuration of each fire zone and fire area at the end of the 1986 Unit 2 refueling outage. The fire protection features include modifications required for compliance with Appendix R Section III.G, as well as general plant improvements initiated at the time of issue of this report.

2.1 Background

On January 31, 1977, the Indiana and Michigan Electric Company (I&M) responded to Appendix A of Branch Technical Position (BTP) APCSB 9.5-1 for Units 1 and 2 at the D.C. Cook Nuclear Plant. The general guidelines used for the plant layout of fire zones were:

(1) Identify safety-related systems or equipment;

(2) Isolate safety-related systems or equipment from unacceptable fire hazards by spatial separation or by the provision of fire barriers or enclosures;

(3) Provide fire detection and/or suppression equipment to minimize the effects of a fire; and

(4) Employ combinations of the above, acting to complement or back up one another.

These general criteria were incorporated into the March 31, 1977, Fire Hazards Analysis for Units 1 and 2 of the D.C. Cook Plant. A total of 104 fires zones were identified in the 1977 Fire Hazards Analysis for D.C. Cook. In that response, rooms or areas were identified as separate fire zones if they contained combustible materials, safety-related equipment or cables and/or were adjacent to zones containing such equipment.

For each of the 104 fire zones identified in the 1977 Fire Hazards Analysis, the combustible/fuel loading in terms of Btu's per square foot of floor area was determined. The combustible materials considered in the analysis were cable insulation, plastic, liquid hydrocarbons, flammable gases, and carbonaceous products such as wood, paper and charcoal.

The physical barriers separating fire zones identified in the 1977 Fire Hazards Analysis were constructed of heavy reinforced concrete construction having a minimum fire rating of three hours. The only exceptions to this construction are concrete block walls with the minimum rating of 1-1/2 hours, which had been added for compartmentalization. Artificial boundaries, such as open walkways varying from six feet in width to the entire length or width of the zone, separated a number of zones in both the Turbine and Auxiliary Buildings. In the Turbine Building, the boundaries were determined by the location of suppression and/or detection systems. In the Auxiliary

Building, the location was dependent on the physical characteristics of the elevation. The artificial boundaries typically were located where elevator shafts or walls reduced size of the openings between zones to large open walkways.

2.2 Identification of Fire Zones

The general guidelines used for establishing fire zones in the Indiana and Michigan Electric Company's response to Appendix A formed the basis for the fire zone and area activities performed in response to Appendix R. In responding to the separation criteria of Appendix R, Section III.G.2, a study was performed to identify locations within the plant that, if required, could be defined as fire areas or could be used as barriers during the III.G.2(a) separation analysis. The study resulted in subdivisions of certain previously defined zones. These were identified in the subsequent analysis by a letter following the previous zone definition (e.g., 40A). In some cases, these subdivided zones were subsequently found to constitute a valid fire area (e.g., 17A). In other cases, the subzones were combined during the cable separation analysis for analytical convenience (e.g., 62A,B,C).

In general, those Appendix A fire zones that would qualify as a fire area under the criteria of Appendix R without modifications were designated as fire areas. Systems analyses were performed on the fire areas to identify potential conflicts with the separation criteria of Appendix R. Where no conflicts arose, and where no safe shutdown equipment was identified in the area, compliance with Appendix R was identified. No attempts were made to combine the fire areas that do comply with Appendix R with adjacent fire areas or zones in Revision 0 to the March 1983 submittal. However, during the reevaluation effort, some fire areas originally in compliance were combined and evaluated for impact to safe shutdown.

Another study was performed that identified additional plant locations not previously tabulated in the 1977 analysis. These plant areas were incorporated into the fire zone listing in Revision 0 to the March 1983 submittal and are numbered as Fire Zones 105 through 128. Many of these zones were subsequently found to contain no safe shutdown equipment or cables.

Since the previous study did not identify all plant areas, an additional study was performed for this report per the criteria of Generic Letter 83-33 to accurately identify all plant locations. As a result, Fire Zones 129 through 146 were identified, some of which were subdivided by letters into multiple zones (e.g., 138A). These plant areas were also incorporated into the fire zone listing.

The newly identified fire zones, with the exception of Fire Zones 144 and 145, contain no safe shutdown cables or components. These new fire zones were combined with adjacent fire areas to form larger fire areas. Fire hazards analyses and safe shutdown system evaluations were performed to ensure that there would be no impact on compliance for these fire areas (see Sections 7 and 9). Only Fire Zones 144 and 145, which were originally included as part of Fire Zones 54 and 53, respectively, contain safe shutdown equipment or cables. However, these two zones are the Unit 1 and Unit 2 hot shutdown panels, which were proposed to be enclosed by three-hour barriers in Revision 0 to the March 1983 Appendix R submittal.

An artificial fire zone was also identified during the course of this study. This zone, ELSH, is made up of the two elevator shafts (passenger and freight) connecting levels of the Auxiliary Building. The door openings to the shafts are protected by 'B' label fire doors. This artificial zone was created due to the difficulties associated with identifying a vertical shaft in horizontal fire area boundaries. It exists for convenience purposes only and is not identified elsewhere in this report.

Based on these studies, a total of 198 individual and subdivided fire zones (e.g., 40A) have been identified. Table 2-1 is a compilation of all the fire zones identified in this analysis.

2.3 Identification of Fire Areas

A fire area is defined as that portion of a plant separated from other areas by rated boundary fire barriers. The rating of the barriers is determined by the fire hazard within each area and is required to be commensurate with the fire hazard to which the barrier is exposed. Fire barriers, doors, dampers, and penetration seals are not necessarily required to be three-hour-rated. The rating is dependent upon the fire hazards to which they could be exposed. At D. C. Cook, the construction of walls, floors, and ceilings is typically of heavy, reinforced concrete with an inherent fire rating of at least three hours. In addition to this construction, the definition of the fire area boundaries must also address the protection provided for the doors, dampers, stairways, hatches, and other penetrations in the fire area boundary construction.

Doors and dampers at D.C. Cook are typically either 1-1/2 or three-hour fire-rated when they form part of a barrier separating fire areas. Evaluations and/or exemption requests are provided where fire-rated protection does not exist. Ratings also may exist for doors that form zone boundaries within an area or are part of exterior walls. At D.C. Cook, no external fire hazards exist along exterior plant walls that contain unrated doors.

Some conditions exist where ventilation systems exit into rated enclosures and proceed through other areas in the plant to the exterior. Rated dampers do not exist in these situations. These types of ventilation systems exist in Zones 40A, 40B, 41, 42A, 42D, 45, 46A, 46D, 47A and 47B (Emergency Power Systems Area). Section 3 discusses further the acceptable impact of these openings on these zone's gaseous suppression systems.

Stairways connecting fire areas within the Auxiliary Building will be provided with automatic water suppression systems around the perimeter of the stair openings. These systems form water curtains that inhibit the passage of hot gases, flames and products of combustion to the areas above. Based on the low area combustible loading of each level of the Auxiliary Building (less than ten minutes for any fire area), this type of water suppression protection provides an adequate barrier that prevents fire propagation to adjoining levels. This protection permits each level of the Auxiliary Building to be treated as a separate fire area.

Unrated metal hatches, where they form part of a fire area boundary, have been evaluated and found to provide a level of protection appropriate to the area hazard, in conjunction with the existing fire protection features for that area. Large concrete plugs are provided in the floor/ceiling assemblies between fire areas of the Auxiliary Building for equipment removal. When in place, these plugs provide an equivalent level of protection to that required for the barrier.

Other penetrations and openings in barriers separating fire areas that contain safe-shutdown equipment are either sealed to provide a level of fire protection commensurate with the fire hazard in the fire area or evaluations are performed to justify the existing configuration.

Penetrations and openings may not be sealed where area walls form a natural division between plant buildings, the areas do not contain safe shutdown equipment, and the combustible loading in the vicinity of the wall is extremely low. Such unsealed penetrations and openings in barriers typically exist either as natural ventilation flowpaths or to facilitate other aspects of plant and building design (water drainage paths, room pressure relief for hypothesized pipe breaks, seismic gaps, etc.).

In general, artificial boundaries (i.e., large open spaces) do not exist between defined fire areas.. However, this is not always the case. For example, an evaluation is performed to justify the ladder opening connecting each unit's main steam valve enclosure (Fire Zones 33 and 34 for Units 1 and 2, respectively) with the RW, CS and PW tank area pipe tunnel (Fire Areas 116 and 117 for Units 1 and 2, respectively), which then connects with the quadrant 2 piping tunnel (Fire Areas 12 and 22 for Units 1 and 2, respectively) via an open walkway. Artificial boundaries do exist between fire zones or sub-zones within a fire area. These boundaries occur in some cases as a result of the combination of previously defined zones into larger fire areas. In other cases, they were created to facilitate the cable and equipment separation analysis. In all instances, these artificial boundaries were recognized as such, and the separation analysis performed between such zones used the III.G.2 20-ft and/or one-hour barrier provisions.

An inherent feature of the D.C. Cook electrical system design is the extensive use of embedded conduit. Although such embedded conduit principally contains power cabling, some control and instrument circuits may also be routed within embedded conduits. Embedded conduit typically is located in concrete floor fill slabs. These fill slabs, of varying thickness, are poured directly on the floor's structural concrete pads. Embedded conduits also exist in certain vertical wall sections. Such floor and wall conduits are embedded with a minimum of four inches of concrete cover. In some cases, the conduit may exist under two to three feet of concrete. In all cases, due to the inherent fire ratings associated with such construction and the separation available between redundant division conduits within the slabs, cables so embedded are not considered as part of any identified fire zone until they exit the concrete.

Based on these criteria, the March 1983 submittal identified 80 fire areas at D.C. Cook. As a result of identifying previously unidentified plant locations, fire area boundaries have changed. In some cases, fire areas identified separately in the March 1983 submittal were combined into larger fire areas. In other cases, the newly identified fire zones were combined with adjacent fire areas forming larger fire areas. Where penetrations in fire area boundaries were identified as having no impact on redundant safe shutdown capabilities, technical evaluations were performed justifying the configurations (see

Section 9). These fire areas, which may consist of individual fire zones or a consolidation of zones, are listed in Table 2-2 and are shown graphically in Figures 2.1 through 2.11 on a floor-by-floor (plan and sectional views) basis. A total of 57 fire areas have been identified in this manner. The automatic detection and suppression systems, which are described in Section 3, are also listed in Table 2-2. Table 2-2 also identifies floor areas and combustible loadings on a fire zone by fire zone basis, with total floor areas and combustible loadings provided for each fire area. Each solid horizontal line in Table 2-2 delineates one of the 57 fire areas utilized in this analysis. Where zones and sub-zones have been combined into a single fire area, the zones are grouped together in this table and are separated from other fire areas by solid horizontal lines. Unless specifically indicated, the rating of the boundary fire barriers for each fire area indicated in this table describes the minimum fire rating of the components that form the boundaries of the area.

Figures 2.1 through 2.11 identify the location of fire area and fire zone boundaries as they exist at D.C. Cook. Blue lines in these figures identify fire area boundaries, while orange lines identify fire zone boundaries that do not form a portion of fire area boundaries. Figures 2.1 through 2.11 identify the entirety of fire area boundaries; they do not solely identify those barriers that separate interior fire areas. As such, exterior walls and walls below grade that do not abut adjacent interior fire areas have also been identified with blue lines as fire area boundaries. These fire areas are identified for the performance of Appendix R separation analysis. Where only one train of safe shutdown systems is located within a fire area with justifiable barriers, then the criteria of Appendix R Section III.G.1 are met.

Although not specifically identified in either Table 2-2 or Figures 2.1 through 2.11, three-hour-rated barriers separating redundant safe shutdown components located in the same fire area have been identified. These barriers, while not resulting in the creation of separate fire areas, have been utilized to achieve compliance with Section III.G.2(a) of Appendix R. The III.G.2(a) barriers at D.C. Cook that have been utilized are identified as follows:

(1) The T-shaped wall separating the Unit 1 RHR pumps in Fire Zone 1C and Fire Zone 1D on the 573 ft elevation of the Auxiliary Building;

(2) The T-shaped wall separating the Unit 2 RHR pumps in Fire Zone 1G and Fire Zone 1H on the 573 ft elevation of the Auxiliary Building;

(3) The wall separating Unit 1 ESW pumps in Fire Zone 29A and Fire Zone 29B from the Unit 2 ESW pumps in Fire Zone 29C and Fire Zone 29D; and

(4) The barrier separating the Unit 1 CCW pumps from the Unit 2 CCW pumps and the spare CCW pump from the Unit 1 and Unit 2 CCW pumps.

2.4 Procedure for Updating Combustible Loading

Since the submittal of the 1977 Fire Hazards Analysis, additional cabling has been installed at D.C. Cook. In order to address this increase in combustible loading due to additional cable insulation, previously developed zone cable combustible loadings were increased by an average value based on the total amount of additional cable installed at D.C. Cook. A review of documentation revealed that the total number of feet of cable at D.C. Cook increased by approximately 25% between 1977 and 1982. A 25% increase in combustible loading associated with cable insulation was therefore applied to the fire zones identified in the 1977 Fire Hazards Analysis for D.C. Cook. In order to account for additional amounts of cable installed since 1982, an additional 10% increase in total feet of installed cable has been applied to those fire zones containing cable insulation.

Between 1982 and the end of 1985, the actual increase has been less than 5%. The 25% and 10% increases are conservative in nature because the increases include all cables used in the plant, whether in cable trays or conduit.

Since 1977, cables in conduit and trays in some fire areas/zones have been wrapped with a one-hour fire barrier to achieve the appropriate separation criteria. Pilasters in the diesel generator rooms have been protected with a three-hour wrap. As a conservative measure, the wrapped cables have not been deleted from the cable combustible loading in the fire areas/zones where they exist. Area surveys were conducted in 1982 and again in 1986 to determine if any additional substantial combustibles had been added to the various zones.

The equivalent fire severity then was estimated through a strict interpretation of the criteria presented in Table 6-8A of the 14th Edition of the Fire Protection Handbook. This table, which was also utilized to estimate the fire severity in the 1977 Fire Hazards Analysis, relates the Btu/ft^2 of combustible material with the estimated minutes of fire severity based on the area under the standard time-temperature curve. The values contained within this table are based on materials with an average heat of combustion of 8000 Btu/lb. To obtain an accurate equivalent fire severity for materials with heats of combustion greater or less than 8000 Btu/lb, the Btu/ft^2 referenced in Table 6-8A must be multiplied by the ratio of the heat of combustion of the actual materials within the zone (cable insulation, liquid hydrocarbons, plastics, etc.) divided by the heat of combustion (8000 Btu/lb) utilized in the table. This analysis has been performed for each fire area contained within this report with the equivalent fire severities referenced in Table 2-2. Table 2-2 of this report correlates to Table 2-2 of the March 1983 submittal, but has been reformatted and includes additional information.

2.5 Supplemental Information to Support the Contention that Cables in Conduit Embedded in Concrete are not Part of the Fire Area

Section 2.3 states that cables located in conduit embedded in concrete walls, floors, or ceilings were not considered as part of any fire zone until they exited the concrete. The supplemental information contained in this section provides the basis for this technical determination.

The technical basis substantiating that four inches of concrete cover provides adequate protection for embedded cables considers the following:

(1) The fire hazard and level of fire detection and suppression that exist for each of the various areas of concern;

(2) The NFPA ratings for concrete fire barriers;

(3) The difference between the NFPA fire barrier configuration and the wall, floor, ceiling configurations at Donald C. Cook that contain embedded cable;

(4) The difference between the NFPA fire barrier cold side temperature criteria and the temperature failure criteria for typical nuclear plant cables.

In accordance with the NFPA's 14th Edition of the <u>Fire Protection Handbook</u>, Table 6-7G of Section 6 concerning building construction and design criteria indicates that for normal weight concrete, which is the predominant type of concrete at D.C. Cook, a minimum solid thickness of 4.2 to 4.5 inches results in a two-hour fire rating, while a one-hour fire rating requires only 2.8 to 3 inches of concrete. The range of these ratings is based on the two types of concrete aggregate that could potentially be used.

Although this would indicate that a 1-1/2 to 2-hour rating is achieved by a simple four-inch concrete section, direct use of these ratings for the actual configuration of the concrete sections containing embedded cable at D.C. Cook should not be made.

Figure 2.0-a depicts the typical construction for which the NFPA ratings directly apply, while Figure 2.0-b indicates the typical construction of concrete at D.C. Cook containing embedded cables. It immediately becomes apparent, recognizing the typical values for thermal conductivity and heat capacity of concrete, that the additional barrier mass between the embedded cables and the cold side will function as a heat sink, lowering the actual in-wall temperature at the embedded cable to a number substantially lower than the 322°F used for the standard NFPA barrier rating. The 322°F value in the NFPA ratings is based on a limiting factor of 250°F plus an assumed ambient temperature of 72°F on the cold side of the concrete section.

In order to quantify this comparison, a Finite Difference Thermal Computer Model was used that assumed a constant fire side heat flux of three-hour duration and measured the temperature variations at the four-inch embedment for various section thicknesses. As a base case, a four-inch concrete section was used with incident heat fluxes varied until a 322°F cold side temperature was achieved. Once determined, this base case heat flux was applied for 6.0, 8.0 and 12.0 inch concrete sections for a three-hour duration. In all cases, the cold side wall was assumed adiabatic. The model results listed below indicate that, at a distance from the hot side of four inches, the concrete temperatures decrease dramatically as wall thickness increases.

Total Section Thickness (in.)	Temp. at 4 in. at 3 hours (^{O}F)
4.0	322
6.0	216
8.0	197
12.0	196

Further support for the conclusion that embedded cable does not degrade is contained in a report entitled, "A Study of Damageability of Electrical Cable in Simulated Fire Environments," prepared by Factory Mutual Research Corporation in March 1981 for the Electric Power Research Institute. The report indicates that the surface temperature for 11 cable samples (varying from PE/PVC to EPR/Hypalon), at the point where insulation degradation begins, ranges from 567^{O}F to 993^{O}F. The temperature at which insulation degradation begins is higher than the temperatures associated with the failure criteria of 322^{O}F for NFPA-rated fire barriers. When a comparison is made between the onset of insulation degradation (567^{O}F to 993^{O}F) and the likely thermal profiles for concrete sections typical for D.C. Cook barriers, it is evident that no cable insulation degradation should occur for embedded cables.

Indiana and Michigan Electric Company's technical conclusion is that a minimum concrete cover of four inches protecting embedded conduit and cable provides sufficient protection to justify the exclusion of embedded conduit and cable in any fire area until it exits the concrete section.

2.6 Identification of Maximum Allowable Combustible Loading

Justification for some of the exemptions and evaluations is based on the quantity of combustible loading present in the area. For the purpose of controlling the increase of fixed and/or transient combustible loading due to maintenance or future plant modifications, a maximum allowable combustible loading value is identified only for those areas involved in an exemption or evaluation. These values are listed in Table 2-3. The plant locations (areas) identified on this table may consist of a single fire zone, a single fire area, or a group of fire zones that do not make a fire area. Unless specifically listed, the values in Table 2-3 are totals of fixed and transient combustible loadings in the areas. The fire zones in Table 2-3 are grouped together by fire area similar to those listed in Tables 1-1 and 2-2.

TABLE 2-1
FIRE ZONE IDENTIFICATION TABLE

Fire Zone	Identification
1	Auxiliary Building - El 573 ft 0 in. - both units
1A	Containment Spray Pump East, Auxiliary Building - El 573 ft 0 in. - Unit 1
1B	Containment Spray Pump West, Auxiliary Building - El 573 ft 0 in. - Unit 1
1C	Residual Heat Removal Pump East, Auxiliary Building - El 573 ft 0 in. - Unit 1
1D	Residual Heat Removal Pump West, Auxiliary Building - El 573 ft 0 in. - Unit 1
1E	Containment Spray Pump East, Auxiliary Building - El 573 ft 0 in. - Unit 2
1F	Containment Spray Pump West, Auxiliary Building - El 573 ft 0 in. - Unit 2
1G	Residual Heat Removal East, Auxiliary Building - El 573 ft 0 in. - Unit 2
1H	Residual Heat Removal West, Auxiliary Building - El 573 ft 0 in. - Unit 2
2	Pump Bay Turbine Building - El 569 ft 6 in. - both units
3	Drumming/Drum Storage - El 587 ft 0 in.
4	Sampling Room Auxiliary Building - El 587 ft 0 in.
5	Auxiliary Building - El 587 ft 0 in. (East End) - both units
6A*	Auxiliary Building Pipe Tunnel - El 601 ft 0 in. and El 609 ft 0 in. - both units
6N	Auxiliary Building - El 587 ft 0 in. (North section of the West End) - Unit 1

TABLE 2-1
(continued)

Fire Zone	Identification
6M	Auxiliary Building - El 587 ft 0 in. (Middle section of the West End) - both units
6S	Auxiliary Building - El 587 ft 0 in. (South section of the West End) - Unit 2
7	Quadrant 1 Cable Tunnel - El 596 ft 3-1/2 in. - Unit 1
8	Quadrant 4 Cable Tunnel - El 596 ft 3-1/2 in. - Unit 1
9	Quadrant 3N Cable Tunnel - El 596 ft 3-1/2 in. - Unit 1
10	Quadrant 3M Cable Tunnel - El 596 ft 3-1/2 in. - Unit 1
11	Quadrant 3S Cable Tunnel - El 596 ft 3-1/2 in. - Unit 1
12	Quadrant 2 Piping Tunnel - El 591 ft 0 in. - Unit 1
13	Diesel Oil Pump Room - El 587 ft 0 in. - Unit 1
14	Transformer Room - El 591 ft 0 in. - Unit 1
15	1CD Diesel Generator Room - El 587 ft 0 in. - Unit 1
16	1AB Diesel Generator Room - El 587 ft 0 in. - Unit 1
17A	West Aux. Feed Pump Room - El 591 ft 0 in. - Unit 1
17B	West Aux. Feed Pump Room - El 591 ft 0 in. - Unit 2
17C	Corridor to Aux. Feed Pump Rooms - El 591 ft 0 in. - both units
17D	East Aux. Feed Pump Room - El 591 ft 0 in. - Unit 1
17E	Turbine Aux. Feed Pump Room - El 591 ft 0 in. - Unit 1
17F	Turbine Aux. Feed Pump Room - El 591 ft 0 in. - Unit 2
17G	East Aux. Feed Pump Room - El 591 ft 0 in. - Unit 2
18	2CD Diesel Generator Room - El 587 ft 0 in. - Unit 2
19	2AB Diesel Generator Room - El 587 ft 0 in. - Unit 2
20	Transformer Room - El 591 ft 0 in. - Unit 2
21	Diesel Oil Pump Room - El 587 ft 0 in - Unit 2

TABLE 2-1
(continued)

Fire Zone	Identification
22	Quadrant 2 Piping Tunnel - El 591 ft 0 in. - Unit 2
23	Quadrant 3N Cable Tunnel - El 596 ft 3-1/2 in. - Unit 2
24	Quadrant 3M Cable Tunnel - El 596 ft 3-1/2 in. - Unit 2
25	Quadrant 3S Cable Tunnel - El 596 ft 3-1/2 in. - Unit 2
26	Quadrant 4 Cable Tunnel - El 596 ft 3-1/2 in. - Unit 2
27	Quadrant 1 Cable Tunnel - El 596 ft 3-1/2 in. - Unit 2
28	Diesel Fire Pump Room - El 591 ft 0 in. - Unit 1
29A	Essential Service Water Pump PP-1E - El 591 ft 0 in. - Unit 1
29B	Essential Service Water Pump PP-1W - El 591 ft 0 in. - Unit 1
29C	Essential Service Water Pump PP-2E - El 591 ft 0 in. - Unit 2
29D	Essential Service Water Pump PP-2W - El 591 ft 0 in. - Unit 2
29E	Motor Control Center For ESW Pumps - El 591 ft 0 in. - Unit 1
29F	Motor Control Center For ESW Pumps - El 591 ft 0 in. - Unit 2
29G	Screen House Auxiliary MCC Room - El 575 ft 0 in. - both units
30	Unit 2 Diesel Fire Pump Room - El 591 ft 0 in.
31	Concrete Mixing Building/Drumming Area - El 609 ft 0 in.
32	Cask Handling Area - El 609 ft 0 in. - both units
33	Main Steam Valve Enclosure, East - El 612 ft 0 in. - Unit 1
33A	Main Steam Line Area, East - El 612 ft 0 in. - Unit 1
33B	Non Essential Service Water Valve Area, West - El 612 ft 0 in. - Unit 1

TABLE 2-1
(continued)

Fire Zone	Identification
34	Main Steam Valve Enclosure, East - El 612 ft 0 in. - Unit 2
34A	Main Steam Line Area, East - El 612 ft 0 in. - Unit 2
34B	Non Essential Service Water Valve Area, West - El 612 ft 0 in. - Unit 2
35	Instrument Calibration Room - El 609 ft 0 in.
36	Spent Fuel Heat Exchanger Pit Pump Room - El 609 ft 0 in.
37	Valve Gallery - El 617 ft 0 in. - both units
38	Quadrant 2 Penetration Cable Tunnel - El 612 ft 0 in. - Unit 1
39	Quadrant 2 Penetration Cable Tunnel - El 612 ft 0 in. - Unit 2
40A	4kV AB Switchgear Room - El 609 ft 6 in. - Unit 1
40B	4kV CD Switchgear Room - El 609 ft 6 in. - Unit 1
41	Engineered Safety System & MCC Room - El 609 ft 6 in (& Underfloor) - Unit 1
42A	EPS Transformer Room - El 609 ft 6 in. - Unit 1
42B	EPS Control Rod Drive Room - El 609 ft 6 in. - Unit 1
42C	EPS Motor Control Room - El 609 ft 6 in. - Unit 1
42D	EPS (AB) Battery Room - El 609 ft 6 in. - Unit 1
43	Access Control Area - El 609 ft 0 in. - both units
44N	Auxiliary Building North - El 609 ft 0 in. - both units
44S	Auxiliary Building South - El 609 ft 0 in. - both units
44A	Containment Spray Heat Exchanger Room #18E, Auxiliary Building - El 609 ft 0 in. - Unit 1
44B	Containment Spray Heat Exchanger Room #18W, Auxiliary Building - El 609 ft 0 in. - Unit 1

TABLE 2-1
(continued)

Fire Zone	Identification
44C	Residual Heat Removal Heat Exchanger Room #17E, Auxiliary Building - El 609 ft 0 in. - Unit 1
44D	Residual Heat Removal Heat Exchanger Room #17W, Auxiliary Building - El 609 ft 0 in. - Unit 1
44E	Containment Spray Heat Exchanger Room #18E, Auxiliary Building - El 609 ft 0 in. - Unit 2
44F	Containment Spray Heat Exchanger Room #18W, Auxiliary Building - El 609 ft 0 in. - Unit 2
44G	Residual Heat Removal Heat Exchanger Room #17E, Auxiliary Building - El 609 ft 0 in. - Unit 2
44H	Residual Heat Removal Heat Exchanger Room #17W, Auxiliary Building - El 609 ft 0 in. - Unit 2
45	Engineered Safety System & MCC Room - El 609 ft 6 in. (& Underfloor) - Unit 2
46A	EPS Transformer Room - El 609 ft 6 in. - Unit 2
46B	EPS Control Rod Drive Room - El 609 ft 6 in. - Unit 2
46C	EPS Motor Control Room - El 609 ft 6 in. - Unit 2
46D	EPS (AB) Battery Room - El 609 ft 6 in. - Unit 2
47A	4kV AB Switchgear Room - El 609 ft 6 in. - Unit 2
47B	4kV CD Switchgear Room - El 609 ft 6 in. - Unit 2
48	New Fuel Storage Room - El 633 ft 0 in.
49	HVAC Vestibule - El 633 ft 0 in. - Unit 1
50	HVAC Vestibule - El 633 ft 0 in. - Unit 2
51	Auxiliary Building - El 633 ft 0 in. (East End) - both units
52	Auxiliary Building - El 633 ft 0 in. (West End) - both units
53	Unit 1 Control Room - El 633 ft 0 in.
54	Unit 2 Control Room - El 633 ft 0 in.

TABLE 2-1
(continued)

Fire Zone	Identification
55	Switchgear Room Cable Vault - El 625 ft 10 in. - Unit 1
56	Auxiliary Cable Vault - El 620 ft 6 in. - Unit 1
57	Control Room Cable Vault - El 624 ft 0 in. - Unit 1
58	Control Room Cable Vault - El 624 ft 0 in. - Unit 2
59	Auxiliary Cable Vault - El 622 ft 6 in. - Unit 2
60	Switchgear Room Cable Vault - El 625 ft 10 in. - Unit 2
61	Spray Additive Tank Room - El 587 ft 0 in. - both units
62A	Reciprocating Charging Pump - El 587 ft 0 in. - Unit 1
62B	Centrifugal Charging Pump - El 587 ft 0 in. - Unit 1
62C	Centrifugal Charging Pump - El 587 ft 0 in. - Unit 1
63A	Reciprocating Charging Pump - El 587 ft 0 in. - Unit 2
63B	Centrifugal Charging Pump - El 587 ft 0 in. - Unit 2
63C	Centrifugal Charging Pump - El 587 ft 0 in. - Unit 2
64A	Safety Injection Pump North - El 587 ft 0 in. - Unit 1
64B	Safety Injection Pump South - El 587 ft 0 in. - Unit 1
65A	Safety Injection Pump South - El 587 ft 0 in. - Unit 2
65B	Safety Injection Pump North - El 587 ft 0 in. - Unit 2
66	Containment Piping Annulus - El 598 ft 9-3/8 in. - Unit 1
67	Containment Lower Volume - El 598 ft 9-3/8 in. - Unit 1
68	Containment Upper Volume - El 650 ft 0 in. - Unit 1
69	Auxiliary Building - El 633 ft 0 in. and 650 ft 0 in. - both units
70	Control Room HVAC Equipment - El 650 ft 0 in. - Unit 1
71	Unit 1 Computer Room - El 650 ft 0 in.
72	Unit 2 Computer Room - El 650 ft 0 in.

TABLE 2-1
(continued)

Fire Zone	Identification
73	Control Room HVAC Equipment - El 650 ft 0 in. - Unit 2
74	Containment Piping Annulus - El 598 ft 9-3/8 in. - Unit 2
75	Containment Lower Volume - El 598 ft 9-3/8 in. - Unit 2
76	Containment Upper Volume - El 650 ft 0 in. - Unit 2
77	Welding Shop Unit 1 - El 591 ft 0 in. - Turbine Building
78	Heating Boiler Room Unit 1 - El 591 ft 0 in. - Turbine Building
79	Turbine Room Unit 1 (N.E. Portion) - El 591 ft 0 in.
80	Turbine Room Unit 1 (S.E. Portion) - El 591 ft 0 in.
81	Turbine Room Unit 1 (S.W. Portion) - El 591 ft 0 in.
82	Turbine Room Unit 1 (N.W. Portion) - El 591 ft 0 in.
83	Turbine Room Unit 1 Lube Oil Room - El 591 ft 0 in.
84	Turbine Room Unit 2 (N.E. Portion) - El 591 ft 0 in.
85	Turbine Room Unit 2 (S.E. Portion) - El 591 ft 0 in.
86	Turbine Room Unit 2 (S.W. Portion) - El 591 ft 0 in.
87	Turbine Room Unit 2 (N.W. Portion) - El 591 ft 0 in.
88	Turbine Room Unit 2 Lube Oil Room - El 591 ft 0 in.
89	Turbine Room Unit 2 Misc. Oil Room - El 591 ft 0 in.
90	Turbine Room Unit 1 (N.E. Portion) - El 609 ft 0 in.
91	Turbine Room Unit 1 (S.E. Portion) - El 609 ft 0 in.
92	Turbine Room Unit 1 (S.W. Portion) - El 609 ft 0 in.
93	Turbine Room Unit 1 (N.W. Portion) - El 609 ft 0 in.
94	Turbine Room Unit 1 Aux. Heating Boiler - El 609 ft 0 in.

TABLE 2-1
(continued)

Fire Zone	Identification
95	Turbine Room Unit 1 Turbine Oil Tank Room - El 605 ft 11 in.
96	Turbine Room Unit 2 (N.E. Portion) - El 609 ft 0 in.
97	Turbine Room Unit 2 (S.E. Portion) - El 609 ft 0 in.
98	Turbine Room Unit 2 (S.W. Portion) - El 609 ft 0 in.
99	Turbine Room Unit 2 (N.W. Portion) - El 609 ft 0 in.
100	Turbine Room Unit 2 Turbine Oil Tank Room - El 609 ft 0 in.
101	Containment 1 Accumulator Enclosure West - El 612 ft 0 in.
102	Containment 2 Accumulator Enclosure West - El 612 ft 0 in.
103	Reactor Head Enclosure - Unit 1 - El 567 ft 2 in.
104	Reactor Head Enclosure - Unit 2 - El 567 ft 2 in.
105	Contractor Access Control Building - El 612 ft 0 in.
106	Aux. F.W. Battery Room #1 - Auxiliary Building - El 633 ft 0 in. - Unit 1
107	Aux. F.W. Battery Room #2 - El 633 ft 0 in. - Unit 2
108	West Steam Valve Enclosure - Unit 1 - El 635 ft
109	West Steam Valve Enclosure - Unit 2 - El 635 ft
110	Main Steam Accessway - Unit 1 - El 587 ft 0 in.
111	Main Steam Accessway - Unit 2 - El 587 ft 0 in.
112	Essential Service Water Pipe Tunnel - Unit 1 - El 570 ft 6 in.
113	Essential Service Water Pipe Tunnel - Unit 2 - El 570 ft 6 in.
114	Essential Service Water Pipe Tunnel - Unit 1 - El 587 ft 0 in.
115	Essential Service Water Pipe Tunnel - Unit 2 - El 587 ft 0 in.

TABLE 2-1
(continued)

Fire Zone	Identification
116	RW, CS, PW Tank Area Pipe Tunnel - Unit 1 - El 593 ft 0 in.
117	RW, CS, PW Tank Area Pipe Tunnel - Unit 2 - El 593 ft 0 in.
118	Containment Regen Heat Exchanger Room - Unit 1 - El 612 ft 0 in.
119	Containment Regen Heat Exchanger Room - Unit 2 - El 612 ft 0 in.
120	Containment 1 Accumulator Enclosure East - El 612 ft 0 in.
121	Containment 2 Accumulator Enclosure East - El 612 ft 0 in.
122	Containment 1 Instrumentation Room - Unit 1 - El 612 ft 0 in.
123	Containment 2 Instrumentation Room - Unit 2 - El 612 ft 0 in.
124	UPS Inverter Room Security - El 591 ft 0 in.
125	CAS Security - El 633 ft 0 in.
126	Tech Support Center - El 633 ft 0 in. - both units
127	TSC, UPS Inverter and Battery Rooms - El 650 ft 0 in. - both units
128	UPS Battery Room Security - El 591 ft 0 in.
129*	Unit 1 Turbine Deck - El 633 ft 0 in.
130*	Unit 2 Turbine Deck - El 633 ft 0 in.
131*	Service and Office Buildings
132*	Unit 1 Ice Condenser - El 640 ft 0 in.
133*	Unit 2 Ice Condenser - El 640 ft 6 in.
134*	Unit 1 Reactor Vessel Pit - El 567 ft 0 in.
135*	Unit 2 Reactor Vessel Pit - El 567 ft 0 in.

TABLE 2-1
(continued)

Fire Zone	Identification
136*	Unit 1 Pipe Tunnel - El 573 ft 0 in.
137*	Unit 2 Pipe Tunnel - El 573 ft 0 in.
138A*	CVCS Hold-up Tank Area North - El 562 ft 0 in.
138B*	CVCS Hold-up Tank Area Middle - El 562 ft 0 in.
138C*	CVCS Hold-up Tank Area South - El 562 ft 0 in.
139*	Turbine Room Sump - El 570 ft 9 in.
140*	Turbine Caustic Pump and Tank Area - El 569 ft 0 in.
141*	Turbine Pump Pit - El 571 ft 0 in.
142*	Screenhouse - El 591 ft 0 in. - both units
143*	Water Intake and Discharge System - El 546 ft 0 in. - both units
144*	Unit 1 Hot Shutdown Panel Enclosure - El 633 ft 0 in.
145*	Unit 2 Hot Shutdown Panel Enclosure - El 633 ft 0 in.
146*	Auxiliary Building Loading Platform - El 609 ft 0 in.

*Areas of the plant that were previously not identified as fire zones in the 1983 Appendix R submittal

TABLE 2-2

FIRE PROTECTION FEATURES
FOR FIRE AREAS*

FIRE AREA*	EXISTING DETECTION	EXISTING SUPPRESSION	MINIMUM RATING OF FIRE AREA BOUNDARIES	EQUIVALENT FIRE SEVERITY (MINUTES)	FIRE LOAD BTU/FT^2	AREA FT^2	FIGURE NUMBER
RHR AND CTS PUMPS AREA E–. 573′-0" (SEE NOTE 26)							
1	7 IONIZATION	DRY PILOT PREACTION SPRINKLERS (SEE NOTES 1 AND 42)	1-1/2 (SEE NOTES 1, 2, 25, 38, 39, 53 AND 56)	6.0	8,172	5,309	2.2, 2.5, 2.6
1A	2 IONIZATION	NONE (SEE NOTE 42)		1.3	1,790	324	2.5, 2.6
1B	2 IONIZATION	NONE (SEE NOTE 42)		3.6	4,815	324	2.5, 2.6
1C	2 IONIZATION	NONE (SEE NOTE 42)		5.1	6,877	284	2.5, 2.6
1D	2 IONIZATION	NONE (SEE NOTE 42)		9.2	12,309	284	2.2, 2.5, 2.6
1E	2 IONIZATION	NONE (SEE NOTE 42)		3.6	4,774	324	2.6

(THIS FIRE AREA IS CONTINUED ON NEXT PAGE)

* EACH FIRE AREA IS SEPARATED BY A SOLID HORIZONTAL LINE WITH SOME FIRE AREAS CONSISTING OF MULTIPLE FIRE ZONES.

TABLE 2-2

FIRE PROTECTION FEATURES
FOR FIRE AREAS*

FIRE AREA*	EXISTING DETECTION	EXISTING SUPPRESSION	MINIMUM RATING OF FIRE AREA BOUNDARIES	EQUIVALENT FIRE SEVERITY (MINUTES)	FIRE LOAD BTU/FT^2	AREA FT^2	FIGURE NUMBER
1F	2 IONIZATION	NONE (SEE NOTE 42)		3.7	4,913	324	2.6
1G	2 IONIZATION	NONE (SEE NOTE 42)		5.4	7,303	284	2.6
1H	2 IONIZATION	NONE (SEE NOTE 42)		5.6	7,593	284	2.2, 2.6
136	NONE	NONE (SEE NOTE 42)		0.6	804	317	2.2, 2.6
137	NONE	NONE (SEE NOTE 42)		0.9	1,154	317	2.2, 2.6
138A	NONE	NONE (SEE NOTE 42)		0	0	2,025	2.2, 2.5, 2.6
138B	NONE	NONE (SEE NOTE 42)		0	0	2,025	2.2, 2.6
138C	NONE	NONE (SEE NOTE 42)		0	0	2,025	2.2, 2.6
			TOTAL	2.9	4,079	14,450	

* EACH FIRE AREA IS SEPARATED BY A SOLID HORIZONTAL LINE WITH SOME FIRE AREAS CONSISTING OF MULTIPLE FIRE ZONES.

TABLE 2-2

FIRE PROTECTION FEATURES
FOR FIRE AREAS*

FIRE AREA*	EXISTING DETECTION	EXISTING SUPPRESSION	MINIMUM RATING OF FIRE AREA BOUNDARIES	EQUIVALENT FIRE SEVERITY (MINUTES)	FIRE LOAD BTU/FT^2	AREA FT^2	FIGURE NUMBER
TURBINE BUILDING, SCREENHOUSE, SERVICE/OFFICE BUILDINGS AND UNITS 1 AND 2 WEST MAIN STEAM VALVE ENCLOSURES (SEE NOTES 26 & 27)							
2	NONE	NONE	1-1/2 (SEE NOTES 9, 11, 12, 28, 33, 34, 40, 41, 58, 59, 61 AND 62)	2.2	2,913	9,342	2.1, 2.4, 2.5, 2.6
28	NONE	WET PIPE SPRINKLERS		90.2	119,922	400	2.7
30	NONE	WET PIPE SPRINKLERS		90.2	119,922	400	2.7
77	NONE	WET PIPE SPRINKLERS		4.1	5,454	2,088	2.1, 2.7
78	NONE	WET PIPE SPRINKLERS		4.0	5,419	2,160	2.1, 2.7
79	4 IONIZATION FOR D.G. RAMP/CORRIDOR	WET PIPE SPRINKLERS		5.9	7,983	11,140	2.1, 2.4, 2.7
80	NONE	WET PIPE SPRINKLERS		3.0	3,980	14,418	2.1, 2.4, 2.5, 2.7
81	NONE	WET PIPE SPRINKLERS		2.3	3,174	12,812	2.1, 2.4, 2.5, 2.7
		(THIS FIRE AREA IS CONTINUED ON NEXT PAGE)					

* EACH FIRE AREA IS SEPARATED BY A SOLID HORIZONTAL LINE WITH SOME FIRE AREAS CONSISTING OF MULTIPLE FIRE ZONES.

TABLE 2-2

FIRE PROTECTION FEATURES
FOR FIRE AREAS*

FIRE AREA*	EXISTING DETECTION	EXISTING SUPPRESSION	MINIMUM RATING OF FIRE AREA BOUNDARIES	EQUIVALENT FIRE SEVERITY (MINUTES)	FIRE LOAD BTU/FT^2	AREA FT^2	FIGURE NUMBER
82	NONE	WET PIPE SPRINKLERS		8.0	10,651	11,212	2.1, 2.4, 2.7
83	1 THERMISTOR	AUTOMATIC CO_2, WET PIPE SPRINKLERS		>> 3 HR	2,687,458	897	2.1, 2.4, 2.7
84	NONE	WET PIPE SPRINKLERS		2.4	3,257	14,824	2.1, 2.5, 2.7
85	4 IONIZATION FOR D.G. RAMP/CORRIDOR	WET PIPE SPRINKLERS		4.1	5,599	12,549	2.1, 2.7
86	NONE	WET PIPE SPRINKLERS		20.0	26,632	12,833	2.1, 2.7
87	NONE	WET PIPE SPRINKLERS		6.4	8,645	12,834	2.1, 2.5, 2.7
88	1 THERMISTOR	AUTOMATIC CO_2, WET PIPE SPRINKLERS		>> 3 HR	4,252,164	1,072	2.1, 2.5, 2.7
89	NONE	WET PIPE SPRINKLERS		>> 3 HR	602,662	800	2.1, 2.7
90	NONE	WET PIPE SPRINKLERS		5.3	7,038	10,998	2.1, 2.4, 2.8
91	NONE	WET PIPE SPRINKLERS		19.4	25,875	15,400	2.1, 2.4, 2.5, 2.8
92	NONE	WET PIPE SPRINKLERS		12.2	16,386	13,825	2.1, 2.4, 2.5, 2.8
		(THIS FIRE AREA IS CONTINUED ON NEXT PAGE)					

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TABLE 2-2

FIRE PROTECTION FEATURES
FOR FIRE AREAS*

FIRE AREA*	EXISTING DETECTION	EXISTING SUPPRESSION	MINIMUM RATING OF FIRE AREA BOUNDARIES	EQUIVALENT FIRE SEVERITY (MINUTES)	FIRE LOAD BTU/FT^2	AREA FT^2	FIGURE NUMBER
93	NONE	WET PIPE SPRINKLERS		4.9	6,627	12,705	2.1, 2.8
94	NONE	WET PIPE SPRINKLERS		2.3	3,091	890	2.1, 2.8
95	1 THERMISTOR	AUTOMATIC CO_2, WET PIPE SPRINKLERS		>> 3 HR	2,600,084	590	2.1, 2.8
96	NONE	WET PIPE SPRINKLERS		23.7	31,547	15,300	2.1, 2.5, 2.8
97	NONE	WET PIPE SPRINKLERS		2.4	3,207	12,524	2.1, 2.8
98	NONE	WET PIPE SPRINKLERS		8.7	11,572	14,080	2.1, 2.8
99	NONE	WET PIPE SPRINKLERS		28.4	37,713	13,139	2.1, 2.5, 2.8
100	1 THERMISTOR	AUTOMATIC CO_2, WET PIPE SPRINKLERS		>> 3 HR	3,314,428	1,102	2.1, 2.5, 2.8
108	NONE	NONE		7.6	10,187	897	2.2, 2.4, 2.10, 2.11
109	NONE	NONE		11.8	15,872	897	2.2, 2.10, 2.11
110	NONE	NONE		0.6	803	1,776	2.2, 2.4, 2.7, 2.8, 2.9
111	NONE	NONE		0.6	838	1,776	2.2, 2.7, 2.8, 2.9

(THIS FIRE AREA IS CONTINUED ON NEXT PAGE)

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TABLE 2-2

FIRE PROTECTION FEATURES
FOR FIRE AREAS*

FIRE AREA*	EXISTING DETECTION	EXISTING SUPPRESSION	MINIMUM RATING OF FIRE AREA BOUNDARIES	EQUIVALENT FIRE SEVERITY (MINUTES)	FIRE LOAD BTU/FT^2	AREA FT^2	FIGURE NUMBER
112	NONE	NONE		0.2	329	1,229	2.4, 2.5, 2.6
113	NONE	NONE		2.4	3,250	1,229	2.5, 2.6
114	NONE	NONE		0.1	142	539	2.2, 2.7
115	NONE	NONE		0	0	539	2.2, 2.7
124	2 IONIZATION	AUTOMATIC HALON 1301		0	0	400	2.7
125	4 IONIZATION (2 UNDER FLOOR)	AUTOMATIC HALON 1301		0	0	225	2.10
126	COMPUTER ROOM 4 IONIZATION	AUTOMATIC HALON 1301		68.0	90,400	2,450	2.1, 2.10
	CONSOLE ROOM 4 IONIZATION (2 UNDER FLOOR)	AUTOMATIC HALON 1301					
	CONSULTATION ROOMS 4 IONIZATION (2 PER RM)	WET PIPE SPRINKLER SYSTEM					
	REMAINING TECH SUPPORT CENTER 3 IONIZATION	NONE					
127	UPS, INVERTER ROOM 2 IONIZATION	AUTOMATIC HALON 1301		9.8	13,051	1,035	2.2, 2.4, 2.11
	UPS BATTERY ROOM 2 IONIZATION	NONE					

(THIS FIRE AREA IS CONTINUED ON NEXT PAGE)

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TABLE 2-2

FIRE PROTECTION FEATURES
FOR FIRE AREAS*

FIRE AREA*	EXISTING DETECTION	EXISTING SUPPRESSION	MINIMUM RATING OF FIRE AREA BOUNDARIES	EQUIVALENT FIRE SEVERITY (MINUTES)	FIRE LOAD BTU/FT^2	AREA FT^2	FIGURE NUMBER
128	NONE	NONE		31.4	41,837	440	2.7
129	THERMISTORS FOR TURBINE	MANUAL WATER SPRAY FOR TURBINE UNDER LAGGING AND MANUAL DRY CHEMICAL FOR TURBINE BEARING		3.5	4,963	53,279	2.1, 2.4, 2.10, 2.11
	CHEM LAB 4 IONIZATION	NONE					
130	THERMISTORS FOR TURBINE	MANUAL WATER SPRAY FOR TURBINE UNDER LAGGING AND MANUAL DRY CHEMICAL FOR TURBINE BEARING		1.7	2,528	53,135	2.5, 2.10, 2.11
131							2.1, 2.7, 2.8, 2.10
EL. 649'-6" (EXTENSION)	QC VAULT 2 IONIZATION	AUTOMATIC HALON 1301		128	170,302	83,328	
	REMAINING FLOOR AREA 51 IONIZATION	NONE					
EL. 636'-6" (EXTENSION)	44 IONIZATION	WET PIPE SPRINKLERS FOR MECH. EQUIP. RM. ONLY					

(THIS FIRE AREA IS CONTINUED ON NEXT PAGE)

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TABLE 2-2

FIRE PROTECTION FEATURES
FOR FIRE AREAS*

FIRE AREA*	EXISTING DETECTION	EXISTING SUPPRESSION	MINIMUM RATING OF FIRE AREA BOUNDARIES	EQUIVALENT FIRE SEVERITY (MINUTES)	FIRE LOAD BTU/FT^2	AREA FT^2	FIGURE NUMBER
EL. 633'-0"	11 IONIZATION	WET PIPE SPRINKLERS FOR SERVICE BLDG					
EL. 623'-6" (EXTENSION)	28 IONIZATION	WET PIPE SPRINKLERS FOR LOCKER ROOM					
EL. 621'-0"	QA RECORD VAULT 1 IONIZATION	AUTOMATIC CO_2					
	TELEPHONE EQUIP. ROOM 1 IONIZATION	AUTOMATIC CO_2					
	OTHER FLOOR AREAS 10 IONIZATION	WET PIPE SPRINKLERS FOR SERVICE BLDG AND OFFICE BLDG HVAC EQUIP. ROOM					
EL. 609'-0" (EXTENSION)	12 IONIZATION 10 HEAT	WET PIPE SPRINKLERS					
EL. 609'-0"	19 IONIZATION 14 HEAT	WET PIPE SPRINKLERS FOR SERVICE BLDG, MISC OFFICE BLDG AREAS					
EL. 595'-0"	FILE ROOM, CHART AND RECORDS 3 IONIZATION	AUTOMATIC CO_2					

(THIS FIRE AREA IS CONTINUED ON NEXT PAGE)

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TABLE 2-2

FIRE PROTECTION FEATURES
FOR FIRE AREAS*

FIRE AREA*	EXISTING DETECTION	EXISTING SUPPRESSION	MINIMUM RATING OF FIRE AREA BOUNDARIES	EQUIVALENT FIRE SEVERITY (MINUTES)	FIRE LOAD BTU/FT2	AREA FT2	FIGURE NUMBER
EL. 595'-0"	SECURITY EQUIP. ROOM 2 IONIZATION	AUTOMATIC HALON 1301					
	REMAINING FLOOR AREAS 10 IONIZATION 3 HEAT	WET PIPE SPRINKLERS FOR SERVICE BLDG & OFFICE BLDG MECH. EQUIP. ROOMS. DELUGE SYSTEM FOR OFFICE BLDG GAS & BOTTLE STORAGE, & ROADWAY OVERHANG					
ELEVATOR LOBBY (EXTENSION)	3 IONIZATION	NONE					
139	NONE	NONE		0	0	1,164	2.1, 2.5, 2.6
140	NONE	NONE		2.6	3,698	888	2.1, 2.4, 2.6
141	NONE	NONE		1.5	2,196	1,611	2.1, 2.5, 2.6
142	NONE	NONE		19.0	25,652	18,608	2.4, 2.5, 2.7, 2.8
143	NONE	NONE		0	0	99,800	2.1, 2.4, 2.5, 2.6
			TOTAL	41.8	55,776	555,579	

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TABLE 2-2

FIRE PROTECTION FEATURES
FOR FIRE AREAS*

FIRE AREA*	EXISTING DETECTION	EXISTING SUPPRESSION	MINIMUM RATING OF FIRE AREA BOUNDARIES	EQUIVALENT FIRE SEVERITY (MINUTES)	FIRE LOAD BTU/FT^2	AREA FT^2	FIGURE NUMBER
AUXILIARY BLDG EL. 633' & 650' AND FUEL HANDLING BUILDING (SEE NOTES 26 & 27)							
3	2 IONIZATION (SEE NOTE 18)	DRY PILOT PREACTION SPRINKLER SYSTEM (SEE NOTE 18)	1-1/2 (SEE NOTES 1, 2, 19, 30, 31, 37, 39, 40, 53, 57, 60, 61 AND 64)	3.6	4,861	2,657	2.3, 2.5, 2.7
31	NONE	NONE		18.0	24,019	986	2.3, 2.8
32	6 IONIZATION	DRY PILOT PREACTION SPRINKLERS		17.4	23,311	5,523	2.3, 2.5, 2.8, 2.10, 2.11
35	NONE	NONE		38.2	50,792	323	2.8
36	NONE	NONE		2.7	3,719	1,624	2.3, 2.8
48	4 IONIZATION	NONE		0	0	1,650	2.3, 2.10
49	7 IONIZATION, THERMISTORS FOR CHARCOAL FILTER UNITS 12-HV-AFX-1 1-HV-AES-1 1-HV-AES-2	MANUAL WATER SPRAY FOR CHARCOAL FILTER UNITS		65.2	86,725	3,200	2.2, 2.3, 2.10
50	7 IONIZATION, THERMISTORS FOR CHARCOAL FILTER UNITS 2-HV-AES-1 2-HV-AES-2	MANUAL WATER SPRAY FOR CHARCOAL FILTER UNITS		33.2	44,309	3,200	2.2, 2.3, 2.10

(THIS FIRE AREA IS CONTINUED ON NEXT PAGE)

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TABLE 2-2

FIRE PROTECTION FEATURES
FOR FIRE AREAS*

FIRE AREA*	EXISTING DETECTION	EXISTING SUPPRESSION	MINIMUM RATING OF FIRE AREA BOUNDARIES	EQUIVALENT FIRE SEVERITY (MINUTES)	FIRE LOAD BTU/FT^2	AREA FT^2	FIGURE NUMBER
51	9 IONIZATION (SEE NOTE 55)	DRY PILOT PREACTION SPRINKLERS (SEE NOTES 1, 3)		16.2	21,650	5,386	2.2, 2.3, 2.5, 2.10
52	17 IONIZATION	DRY PILOT PREACTION SPRINKLERS (SEE NOTES 1, 3)		7.9	10,717	11,085	2.2, 2.4, 2.5, 2.10
69	28 IONIZATION, THERMISTORS FOR CHARCOAL FILTER UNITS 1-HV-CPR-1 2-HV-CPR-1	MANUAL WATER SPRAY FOR CHARCOAL FILTER UNITS		2.2	2,998	17,914	2.2, 2.3, 2.5, 2.8, 2.9, 2.10, 2.11
106	1 HEAT (FIXED TEMP/RATE OF RISE)	NONE		12.6	16,770	192	2.2, 2.10
107	1 HEAT (FIXED TEMP/RATE OF RISE)	NONE		10.8	14,375	224	2.3, 2:10
146	NONE	NONE		49.1	65,356	626	2.8
			TOTAL	12.9	17,283	54,590	
SAMPLING ROOM EL. 587'-0"							
4	3 IONIZATION	NONE	1-1/2	12.5	16,753	1,025	2.5, 2.7

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TABLE 2-2

FIRE PROTECTION FEATURES
FOR FIRE AREAS*

FIRE AREA*	EXISTING DETECTION	EXISTING SUPPRESSION	MINIMUM RATING OF FIRE AREA BOUNDARIES	EQUIVALENT FIRE SEVERITY (MINUTES)	FIRE LOAD BTU/FT2	AREA FT2	FIGURE NUMBER
AUXILIARY BUILDING EAST AND WEST EL. 587'-0" (SEE NOTES 26 & 27)							
5	14 IONIZATION, 1 THERMISTOR FOR CHARCOAL FILTER UNIT 12-HV-SATFUF (SEE NOTE 55)	DRY PILOT PREACTION SPRINKLERS (SEE NOTES 1, 3) MANUAL WATER SPRAY FOR CHARCOAL FILTER UNIT	1-1/2 (SEE NOTES 1, 2, 4, 35, 39, 53, 56, 57, 60 AND 63)	8.5	11,229	8,635	2.2, 2.3, 2.5, 2.7 2.9
6A	NONE	NONE		0.1	143	10,890	2.2, 2.3, 2.5, 2.9
6M	6 IONIZATION (SEE NOTE 55)	DRY PILOT PREACTION SPRINKLERS (SEE NOTE 3)		8.2	11,022	6,095	2.2, 2.7, 2.9
6N	4 IONIZATION (SEE NOTE 55)	DRY PILOT PREACTION SPRINKLERS (SEE NOTES 1,3)		16.4	21,892	4,212	2.2, 2.5, 2.7, 2.9
6S	4 IONIZATION (SEE NOTE 55)	DRY PILOT PREACTION SPRINKLERS (SEE NOTES 1,3)		6.7	9,034	6,095	2.2, 2.7, 2.9
61	2 IONIZATION	NONE		10.4	13,846	1,000	2.3, 2.5, 2.7
64A	2 IONIZATION	DRY PILOT PREACTION SPRINKLERS		9.4	12,642	309	2.2, 2.7

(THIS FIRE AREA IS CONTINUED ON NEXT PAGE)

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TABLE 2-2

FIRE PROTECTION FEATURES
FOR FIRE AREAS*

FIRE AREA*	EXISTING DETECTION	EXISTING SUPPRESSION	MINIMUM RATING OF FIRE AREA BOUNDARIES	EQUIVALENT FIRE SEVERITY (MINUTES)	FIRE LOAD BTU/FT^2	AREA FT^2	FIGURE NUMBER
64B	2 IONIZATION	DRY PILOT PREACTION SPRINKLERS		8.0	10,739	288	2.2, 2.5, 2.7
65A	2 IONIZATION	DRY PILOT PREACTION SPRINKLERS		8.6	11,518	309	2.2, 2.7
65B	2 IONIZATION	DRY PILOT PREACTION SPRINKLERS		9.7	13,008	288	2.2, 2.7
			TOTAL	6.5	8,947	38,121	
UNIT 1 QUADRANT 1 CABLE TUNNEL EL. 596'-3.5" 7	4 IONIZATION 3 INFRARED	AUTOMATIC CO_2	3 (SEE NOTES 40 AND 63)	87.5	116,629	960	2.3, 2.7, 2.8
UNIT 1 QUADRANT 4 CABLE TUNNEL EL. 596'-3.5" 8	6 IONIZATION 5 INFRARED	AUTOMATIC CO_2	1-1/2 (SEE NOTE 40)	23.1	30,841	2,050	2.3, 2.4, 2.7
UNIT 1 QUADRANT 3N AND 3M CABLE TUNNELS (SEE NOTE 27) 9	4 IONIZATION 3 INFRARED	AUTOMATIC CO_2	1-1/2 (SEE NOTES 23 AND 40)	54.8	72,856	539	2.2, 2.7
10	4 IONIZATION 3 INFRARED	AUTOMATIC CO_2		78.3	104,250	800	2.2, 2.7
			TOTAL	68.9	91,612	1,339	

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TABLE 2-2

FIRE PROTECTION FEATURES
FOR FIRE AREAS*

FIRE AREA*	EXISTING DETECTION	EXISTING SUPPRESSION	MINIMUM RATING OF FIRE AREA BOUNDARIES	EQUIVALENT FIRE SEVERITY (MINUTES)	FIRE LOAD BTU/FT^2	AREA FT^2	FIGURE NUMBER
UNIT 1 QUADRANT 3S CABLE TUNNEL 11	3 IONIZATION 3 INFRARED	AUTOMATIC CO_2	1-1/2 (SEE NOTE 40)	19.7	26,344	840	2.2, 2.7
UNIT 1 QUADRANT 2 PIPING TUNNEL 12	NONE	NONE	1-1/2 (SEE NOTES 2, 5 AND 40)	1.2	1,722	7,812	2.2, 2.3, 2.4, 2.6, 2.7, 2.8, 2.9, 2.10
UNIT 1 DIESEL OIL PUMP ROOM 13	1 THERMISTOR	AUTOMATIC CO_2	3 (SEE NOTE 6)	19.1	25,469	621	2.2, 2.7
UNIT 1 TRANSFORMER ROOM 14	12 IONIZATION	NONE (SEE NOTE 43)	1-1/2 (SEE NOTE 6)	0.8	1,056	2,072	2.2, 2.7
UNIT 1 CD DIESEL ROOM EL. 587'-0" 15	2 THERMISTORS	AUTOMATIC CO_2	1-1/2	127.0	169,014	2,156	2.2, 2.4, 2.7
UNIT 1 AB DIESEL ROOM EL. 587'-0" 16	2 THERMISTORS	AUTOMATIC CO_2	1-1/2	124.0	165,028	2,233	2.2, 2.4, 2.7

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TABLE 2-2

FIRE PROTECTION FEATURES
FOR FIRE AREAS*

FIRE AREA*	EXISTING DETECTION	EXISTING SUPPRESSION	MINIMUM RATING OF FIRE AREA BOUNDARIES	EQUIVALENT FIRE SEVERITY (MINUTES)	FIRE LOAD BTU/FT^2	AREA FT^2	FIGURE NUMBER
UNIT 1 WEST AFW PUMP ROOM 17A	NONE	NONE	3	0.6	887	252	2.5, 2.7
UNIT 2 WEST AFW PUMP ROOM 17B	NONE	NONE	3	0.6	893	252	2.5, 2.7
AFW PUMP CORRIDOR 17C	2 IONIZATION	WET PIPE SPRINKLERS	3	4.9	6,697	328	2.5, 2.7
UNIT 1 EAST AFW PUMP ROOM 17D	NONE	NONE	3	0.8	1,004	219	2.1, 2:5, 2.7
UNIT 1 TURBINE-DRIVEN AFW PUMP ROOM 17E	NONE	WET PIPE SPRINKLERS	3	0.8	1,034	219	2.1, 2.7
UNIT 2 TURBINE-DRIVEN AFW PUMP ROOM 17F	NONE	WET PIPE SPRINKLERS	3 (SEE NOTE 41)	0.8	1,034	219	2.1, 2.5, 2.7
UNIT 2 EAST AFW PUMP ROOM 17G	NONE	NONE	3	0.8	1,004	219	2.1, 2.5, 2.7

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FIRE PROTECTION FEATURES FOR FIRE AREAS*

FIRE AREA*	EXISTING DETECTION	EXISTING SUPPRESSION	MINIMUM RATING OF FIRE AREA BOUNDARIES	EQUIVALENT FIRE SEVERITY (MINUTES)	FIRE LOAD BTU/FT^2	AREA FT^2	FIGURE NUMBER
UNIT 2 CD DIESEL ROOM EL. 587'-0" 18	2 THERMISTORS	AUTOMATIC CO_2	1-1/2	122.2	162,647	2,250	2.2, 2.5, 2.7
UNIT 2 AB DIESEL ROOM EL. 587'-0" 19	2 THERMISTORS	AUTOMATIC CO_2	1-1/2	122.2	162,656	2,250	2.2, 2.7
UNIT 2 TRANSFORMER ROOM 20	12 IONIZATION	NONE (SEE NOTE 44)	1-1/2 (SEE NOTE 7)	1.0	1,503	2,072	2.2, 2.7
UNIT 2 DIESEL OIL PUMP ROOM 21	1 THERMISTOR	AUTOMATIC CO_2	3 (SEE NOTE 7)	21.0	28,063	561	2.2, 2.7
UNIT 2 QUADRANT 2 PIPING TUNNEL 22	NONE	NONE	1-1/2 (SEE NOTES 2, 8 AND 40)	0.6	1,022	8,460	2.2, 2.3, 2.6, 2.7, 2.8, 2.9, 2.10
UNIT 2 QUADRANT 3N CABLE TUNNEL 23	3 IONIZATION 3 INFRARED	AUTOMATIC CO_2	1-1/2 (SEE NOTE 40)	21.5	28,716	840	2.2, 2.7

* EACH FIRE AREA IS SEPARATED BY A SOLID HORIZONTAL LINE WITH SOME FIRE AREAS CONSISTING OF MULTIPLE FIRE ZONES.

TAB[illegible]2-2

FIRE PROTECTION FEATURES
FOR FIRE AREAS*

FIRE AREA*	EXISTING DETECTION	EXISTING SUPPRESSION	MINIMUM RATING OF FIRE AREA BOUNDARIES	EQUIVALENT FIRE SEVERITY (MINUTES)	FIRE LOAD BTU/FT^2	AREA FT^2	FIGURE NUMBER
UNIT 2 QUADRANT 3M AND 3S CABLE TUNNELS (SEE NOTE 27) 24	4 IONIZATION 3 INFRARED	AUTOMATIC CO_2	1-1/2 (SEE NOTES 24 AND 40)	58.7	78,083	800	2.2, 2.7
25	4 IONIZATION 3 INFRARED	AUTOMATIC CO_2		45.9	61,132	567	2.2, 2.7
			TOTAL	53.3	71,051	1,367	
UNIT 2 QUADRANT 4 CABLE TUNNEL EL. 596'-3.5" 26	6 IONIZATION 5 INFRARED	AUTOMATIC CO_2	1-1/2 (SEE NOTE 40)	15.9	21,086	2,746	2.3, 2.7
UNIT 2 QUADRANT 1 CABLE TUNNEL EL. 596'-3.5" 27	4 IONIZATION 3 INFRARED	AUTOMATIC CO_2	3 (SEE NOTE 40)	63.9	85,009	1,056	2.3, 2.7, 2.8

* EACH FIRE AREA IS SEPARATED BY A SOLID HORIZONTAL LINE WITH SOME FIRE AREAS CONSISTING OF MULTIPLE FIRE ZONES.

TABLE 2-2

FIRE PROTECTION FEATURES
FOR FIRE AREAS*

FIRE AREA*	EXISTING DETECTION	EXISTING SUPPRESSION	MINIMUM RATING OF FIRE AREA BOUNDARIES	EQUIVALENT FIRE SEVERITY (MINUTES)	FIRE LOAD BTU/FT^2	AREA FT^2	FIGURE NUMBER
ESSENTIAL SERVICE WATER PUMPS AREA							
29A	4 IONIZATION	NONE (SEE NOTE 45)	3 (SEE NOTES 9 AND 54)	9.7	12,921	332	2.5, 2.7
29B	4 IONIZATION	NONE (SEE NOTE 45)		1.6	2,117	402	2.5, 2.7
29C	4 IONIZATION	NONE (SEE NOTE 46)		8.4	11,267	332	2.7
29D	4 IONIZATION	NONE (SEE NOTE 46)		2.2	2,890	402	2.7
29E	1 IONIZATION	NONE (SEE NOTE 45)		3.0	3,974	92	2.7
29F	1 IONIZATION	NONE (SEE NOTE 46)		3.0	3,974	92	2.7
29G	4 IONIZATION	NONE (SEE NOTE 47)		8.8	11,858	1,544	2.5, 2.6
			TOTAL	6.7	9,098	3,196	

* EACH FIRE AREA IS SEPARATED BY A SOLID HORIZONTAL LINE WITH SOME FIRE AREAS CONSISTING OF MULTIPLE FIRE ZONES.

TABLE 2-2

FIRE PROTECTION FEATURES
FOR FIRE AREAS*

FIRE AREA*	EXISTING DETECTION	EXISTING SUPPRESSION	MINIMUM RATING OF FIRE AREA BOUNDARIES	EQUIVALENT FIRE SEVERITY (MINUTES)	FIRE LOAD BTU/FT^2	AREA FT^2	FIGURE NUMBER
UNIT 1 EAST MAIN STEAM VALVE ENCLOSURE AND CONTRACTORS ACCESS CONTROL AREA (SEE NOTE 27)							
33	24 IONIZATION 4 INFRARED	NONE (SEE NOTE 48)	1-1/2 (SEE NOTES 5, 36, 40 AND 58)	12.0	16,118	1,040	2.4, 2.8, 2.10, 2.11
33A	3 IONIZATION, 10 INFRARED, 1 THERMISTOR FOR CHARCOAL FILTER UNIT 1-HV-CIPX-1	MANUAL WATER SPRAY FOR CHARCOAL FILTER UNIT (SEE NOTE 48)		6.7	9,129	3,216	2.2, 2.3, 2.8
33B	2 IONIZATION	NONE (SEE NOTE 48)		0.2	236	600	2.2, 2.8
105	NONE	WET PIPE SPRINKLERS		11.7	15,619	2,380	2.2, 2.4, 2.8
			TOTAL	8.5	11,530	7,236	

* EACH FIRE AREA IS SEPARATED BY A SOLID HORIZONTAL LINE WITH SOME FIRE AREAS CONSISTING OF MULTIPLE FIRE ZONES.

TABLE 2-2

FIRE PROTECTION FEATURES
FOR FIRE AREAS*

FIRE AREA*	EXISTING DETECTION	EXISTING SUPPRESSION	MINIMUM RATING OF FIRE AREA BOUNDARIES	EQUIVALENT FIRE SEVERITY (MINUTES)	FIRE LOAD BTU/FT²	AREA FT²	FIGURE NUMBER
UNIT 2 EAST MAIN STEAM VALVE ENCLOSURE							
34	24 IONIZATION 4 INFRARED	NONE (SEE NOTE 49)	1-1/2 (SEE NOTES 8, 40 AND 59)	8.3	11,287	1,040	2.8, 2.10, 2.11
34A	3 IONIZATION, 10 INFRARED, 1 THERMISTOR FOR CHARCOAL FILTER UNIT 2-HV-CIPX-1	MANUAL WATER SPRAY FOR CHARCOAL FILTER UNIT (SEE NOTE 49)		3.1	4,204	3,216	2.2, 2.3, 2.8
34B	2 IONIZATION	NONE (SEE NOTE 49)		4.3	5,735	600	2.2, 2.8
			TOTAL	4.3	5,909	4,856	

* EACH FIRE AREA IS SEPARATED BY A SOLID HORIZONTAL LINE WITH SOME FIRE AREAS CONSISTING OF MULTIPLE FIRE ZONES.

TABLE 2-2

FIRE PROTECTION FEATURES
FOR FIRE AREAS*

FIRE AREA*	EXISTING DETECTION	EXISTING SUPPRESSION	MINIMUM RATING OF FIRE AREA BOUNDARIES	EQUIVALENT FIRE SEVERITY (MINUTES)	FIRE LOAD BTU/FT^2	AREA FT^2	FIGURE NUMBER
AUXILIARY BUILDING NORTH AND SOUTH EL. 609'-0" (SEE NOTE 27) 37	3 IONIZATION (SEE NOTE 55)	NONE	1-1/2 (SEE NOTES 1, 2, 4, 11, 12, 13, 25, 28, 30, 32, 38, 39, 50, 53 AND 64)	0	0	2,730	2.3, 2.5, 2.8
43	24 IONIZATION	NONE		55.8	74,361	4,630	2.2, 2.4, 2.8
44A	NONE	NONE		4.4	5,854	220	2.5, 2.8, 2.10
44B	NONE	NONE		4.7	6,269	220	2.5, 2.8, 2.10
44C	NONE	NONE		4.3	5,742	270	2.5, 2.8, 2.10
44D	NONE	NONE		3.4	4,603	270	2.2, 2.8, 2.10
44E	NONE	NONE		4.7	6,269	220	2.8, 2.10
44F	NONE	NONE		5.2	6,999	220	2.8, 2.10
44G	NONE	NONE		10.9	14,571	270	2.8, 2.10
44H	NONE	NONE		1.8	2,360	270	2.8, 2.10
44N	19 IONIZATION (SEE NOTE 55)	DRY PILOT PREACTION SPRINKLERS (SEE NOTES 1, 3)		36.6	48,650	7,580	2.2, 2.5, 2.8, 2.9
44S	20 IONIZATION (SEE NOTE 55)	DRY PILOT PREACTION SPRINKLERS (SEE NOTES 1, 3, 10)		14.2	19,192	9,360	2.2, 2.8
			TOTAL	25.8	34,482	26,261	

* EACH FIRE AREA IS SEPARATED BY A SOLID HORIZONTAL LINE WITH SOME FIRE AREAS CONSISTING OF MULTIPLE FIRE ZONES.

TABLE 2-2

FIRE PROTECTION FEATURES
FOR FIRE AREAS*

FIRE AREA*	EXISTING DETECTION	EXISTING SUPPRESSION	MINIMUM RATING OF FIRE AREA BOUNDARIES	EQUIVALENT FIRE SEVERITY (MINUTES)	FIRE LOAD BTU/FT^2	AREA FT^2	FIGURE NUMBER
UNIT 1 QUADRANT 2 CABLE TUNNEL EL. 612'-0" 38	7 IONIZATION 4 INFRARED	AUTOMATIC CO_2	1-1/2 (SEE NOTE 40)	31.0	41,288	2,650	2.2, 2.3, 2.8, 2.9
UNIT 2 QUADRANT 2 CABLE TUNNEL EL. 612'-0" 39	7 IONIZATION 4 INFRARED	AUTOMATIC CO_2	1-1/2 (SEE NOTE 40)	23.0	30,622	2,667	2.2, 2.3, 2.8, 2.9
UNIT 1 4kV SWITCHGEAR ROOMS EL. 609'-0"							
40A	2 IONIZATION 3 INFRARED	AUTOMATIC CO_2	1-1/2 (SEE NOTE 14)	15.5	20,616	1,476	2.2, 2.8
40B	2 IONIZATION 3 INFRARED	AUTOMATIC CO_2		13.6	18,144	1,440	2.2, 2.8
			TOTAL	14.6	19,394	2,916	
UNIT 1 ENGINEERED SAFETY SYSTEMS AND MCC ROOM EL. 609'-0" 41	9 IONIZATION (3 UNDER FLOOR) 5 INFRARED (2 UNDER FLOOR)	AUTOMATIC CO_2	1-1/2 (SEE NOTE 15)	20.7	27,614	3,096	2.2, 2.4, 2.8

* EACH FIRE AREA IS SEPARATED BY A SOLID HORIZONTAL LINE WITH SOME FIRE AREAS CONSISTING OF MULTIPLE FIRE ZONES.

TABLE 2-2

FIRE PROTECTION FEATURES
FOR FIRE AREAS*

FIRE AREA*	EXISTING DETECTION	EXISTING SUPPRESSION	MINIMUM RATING OF FIRE AREA BOUNDARIES	EQUIVALENT FIRE SEVERITY (MINUTES)	FIRE LOAD BTU/FT^2	AREA FT^2	FIGURE NUMBER
UNIT 1 EMERGENCY POWER SYSTEMS AREA EL. 609'-0"							
42A	2 IONIZATION 2 INFRARED	AUTOMATIC CO_2	1-1/2	3.7	5,080	1,209	2.2, 2.4, 2.8
42B	2 IONIZATION 1 INFRARED	AUTOMATIC CO_2		7.3	9,712	922	2.4, 2.8
42C	3 IONIZATION 2 INFRARED	AUTOMATIC CO_2		1.8	2,392	530	2.2, 2.4, 2.8
42D	2 IONIZATION	NONE		33.5	44,583	503	2.2, 2.4, 2.8
			TOTAL	9.2	12,258	3,164	
UNIT 2 ENGINEERED SAFETY SYSTEMS AND MCC ROOM EL. 609'-0" 45	9 IONIZATION (3 UNDER FLOOR) 5 INFRARED (2 UNDER FLOOR)	AUTOMATIC CO_2	1-1/2 (SEE NOTE 16)	17.6	23,443	2,884	2.2, 2.5, 2.6, 2.8

* EACH FIRE AREA IS SEPARATED BY A SOLID HORIZONTAL LINE WITH SOME FIRE AREAS CONSISTING OF MULTIPLE FIRE ZONES.

TABLE 2-2

FIRE PROTECTION FEATURES
FOR FIRE AREAS*

FIRE AREA*	EXISTING DETECTION	EXISTING SUPPRESSION	MINIMUM RATING OF FIRE AREA BOUNDARIES	EQUIVALENT FIRE SEVERITY (MINUTES)	FIRE LOAD BTU/FT^2	AREA FT^2	FIGURE NUMBER
UNIT 2 EMERGENCY POWER SYSTEMS AREA EL. 609'-0"							
46A	2 IONIZATION 2 INFRARED	AUTOMATIC CO_2	1-1/2	3.5	4,793	1,209	2.2, 2.6, 2.8
46B	2 IONIZATION 1 INFRARED	AUTOMATIC CO_2		8.3	11,150	922	2.5, 2.8
46C	3 IONIZATION 2 INFRARED	AUTOMATIC CO_2		4.0	5,502	530	2.2, 2.5, 2.8
46D	2 IONIZATION	NONE		30.0	39,973	503	2.2, 2.5, 2.8
			TOTAL	9.2	12,356	3,164	
UNIT 2 4kV SWITCHGEAR ROOMS EL. 609'-0"							
47A	2 IONIZATION 3 INFRARED	AUTOMATIC CO_2	1-1/2 (SEE NOTE 17)	14.4	19,158	1,476	2.2, 2.8
47B	2 IONIZATION 3 INFRARED	AUTOMATIC CO_2		12.9	17,136	1,440	2.2, 2.8
			TOTAL	13.6	18,159	2,916	

* EACH FIRE AREA IS SEPARATED BY A SOLID HORIZONTAL LINE WITH SOME FIRE AREAS CONSISTING OF MULTIPLE FIRE ZONES.

TABLE 2-2

FIRE PROTECTION FEATURES
FOR FIRE AREAS*

FIRE AREA*	EXISTING DETECTION	EXISTING SUPPRESSION	MINIMUM RATING OF FIRE AREA BOUNDARIES	EQUIVALENT FIRE SEVERITY (MINUTES)	FIRE LOAD BTU/FT^2	AREA FT^2	FIGURE NUMBER
UNIT 1 CONTROL ROOM 53	45 IONIZATION (20 ABOVE CEILING)	NONE (SEE NOTE 51)	3 (SEE NOTES 20 AND 21)	21.2	28,225	4,410	2.2, 2.5, 2.10
UNIT 2 CONTROL ROOM 54	41 IONIZATION (17 ABOVE CEILING)	NONE (SEE NOTE 52)	3 (SEE NOTES 21, 22 AND 29)	22.6	30,069	4,410	2.2, 2.10
UNIT 1 SWITCHGEAR ROOM CABLE VAULT 55	13 IONIZATION 10 INFRARED	AUTOMATIC CO_2 (NOT IN BATTERY ROOM)	3 (SEE NOTES 14 AND 15)	25.1	33,536	9,086	2.2, 2.4, 2.9
UNIT 1 AUXILIARY CABLE VAULT 56	6 IONIZATION	AUTOMATIC CO_2	1-1/2 (SEE NOTE 13)	51.1	68,120	1,783	2.2, 2.4, 2.9

* EACH FIRE AREA IS SEPARATED BY A SOLID HORIZONTAL LINE WITH SOME FIRE AREAS CONSISTING OF MULTIPLE FIRE ZONES.

TABLE 2-2

FIRE PROTECTION FEATURES
FOR FIRE AREAS*

FIRE AREA*	EXISTING DETECTION	EXISTING SUPPRESSION	MINIMUM RATING OF FIRE AREA BOUNDARIES	EQUIVALENT FIRE SEVERITY (MINUTES)	FIRE LOAD BTU/FT^2	AREA FT^2	FIGURE NUMBER
UNIT 1 CONTROL ROOM CABLE VAULT AND HOT SHUTDOWN PANEL AREA (SEE NOTE 26) 57	65 IONIZATION	AUTOMATIC HALON 1301, MANUAL CO_2	1-1/2 (SEE NOTE 20)	77.8	103,590	4,410	2.2, 2.5, 2.9
144	1 IONIZATION	NONE		0	0	89	2.10
			TOTAL	76.3	101,541	4,499	
UNIT 2 CONTROL ROOM CABLE VAULT AND HOT SHUTDOWN PANEL AREA (SEE NOTE 26) 58	76 IONIZATION	AUTOMATIC HALON 1301, MANUAL CO_2	3 (SEE NOTE 22)	74.7	99,344	4,410	2.2, 2.9
145	1 IONIZATION	NONE		0	0	89	2.10
			TOTAL	73.2	97,379	4,499	

* EACH FIRE AREA IS SEPARATED BY A SOLID HORIZONTAL LINE WITH SOME FIRE AREAS CONSISTING OF MULTIPLE FIRE ZONES.

TABLE 2-2

FIRE PROTECTION FEATURES
FOR FIRE AREAS*

FIRE AREA*	EXISTING DETECTION	EXISTING SUPPRESSION	MINIMUM RATING OF FIRE AREA BOUNDARIES	EQUIVALENT FIRE SEVERITY (MINUTES)	FIRE LOAD BTU/FT^2	AREA FT^2	FIGURE NUMBER
UNIT 2 AUXILIARY CABLE VAULT							
59	6 IONIZATION	AUTOMATIC CO_2	1-1/2 (SEE NOTE 19)	40.7	54,237	1,701	2.2, 2.9
UNIT 2 SWITCHGEAR ROOM CABLE VAULT							
60	13 IONIZATION 10 INFRARED	AUTOMATIC CO_2 (NOT IN BATTERY ROOM)	3 (SEE NOTES 16 AND 17)	19.0	25,487	9,163	2.2, 2.5, 2.9
UNIT 1 CHARGING PUMP ROOMS							
62A	2 IONIZATION	DRY PILOT PREACTION SPRINKLERS	3 (SEE NOTES 2, 4 AND 25)	26.2	35,034	438	2.5, 2.7
62B	2 IONIZATION	DRY PILOT PREACTION SPRINKLERS		22.3	29,790	416	2.5, 2.7
62C	2 IONIZATION	DRY PILOT PREACTION SPRINKLERS		24.5	32,656	416	2.2, 2.5, 2.7
			TOTAL	24.4	32,538	1,270	

* EACH FIRE AREA IS SEPARATED BY A SOLID HORIZONTAL LINE WITH SOME FIRE AREAS CONSISTING OF MULTIPLE FIRE ZONES.

TABLE 2-2

FIRE PROTECTION FEATURES
FOR FIRE AREAS*

FIRE AREA*	EXISTING DETECTION	EXISTING SUPPRESSION	MINIMUM RATING OF FIRE AREA BOUNDARIES	EQUIVALENT FIRE SEVERITY (MINUTES)	FIRE LOAD BTU/FT^2	AREA FT^2	FIGURE NUMBER
UNIT 2 CHARGING PUMP ROOMS							
63A	2 IONIZATION	DRY PILOT PREACTION SPRINKLERS	3 (SEE NOTES 2, 4 AND 38)	25.1	33,426	438	2.7
63B	2 IONIZATION	DRY PILOT PREACTION SPRINKLERS		24.1	32,149	416	2.7
63C	2 IONIZATION	DRY PILOT PREACTION SPRINKLERS		23.2	31,022	416	2.2, 2.7
			TOTAL	24.1	32,217	1,270	

* EACH FIRE AREA IS SEPARATED BY A SOLID HORIZONTAL LINE WITH SOME FIRE AREAS CONSISTING OF MULTIPLE FIRE ZONES.

TABLE 2-2

FIRE PROTECTION FEATURES
FOR FIRE AREAS*

FIRE AREA*	EXISTING DETECTION	EXISTING SUPPRESSION	MINIMUM RATING OF FIRE AREA BOUNDARIES	EQUIVALENT FIRE SEVERITY (MINUTES)	FIRE LOAD BTU/FT^2	AREA FT^2	FIGURE NUMBER
UNIT 1 CONTAINMENT (SEE NOTE 26) 66	THERMISTORS FOR CABLE TRAYS	NONE	3	19.2	25,593	4,166	2.3, 2.4, 2.7
67	THERMISTORS FOR REACTOR COOLANT PUMPS, FOR CABLE TRAYS, AND FOR CHARCOAL FILTER UNITS 1-HV-CFT-1 1-HV-CFT-2	AUTOMATIC WATER SPRAY SYSTEM FOR BOTH CHARCOAL FILTER UNITS, MANUAL WATER SPRAY SYSTEM FOR RCPs		58.4	77,639	3,648	2.3, 2.4, 2.7, 2.8, 2.10, 2.11
68	THERMISTORS FOR CABLE TRAYS	NONE		3.5	4,611	6,316	2.2, 2.3, 2.4, 2.10 2.11
101	THERMISTORS FOR CABLE TRAYS	NONE		28.9	38,483	1,230	2.4, 2.8
103	THERMISTORS FOR CABLE TRAYS	NONE		4.9	6,529	615	2.3, 2.4, 2.7, 2.8
118	NONE	NONE		7.4	9,922	230	2.8
120	NONE	NONE		4.3	5,751	2,580	2.3, 2.4, 2.8
122	NONE	NONE		16.3	21,710	580	2.3, 2.8
132	NONE	NONE		6.8	9,160	3,506	2.3, 2.4, 2.10, 2.11
134	NONE	NONE		0	0	665	2.3, 2.4, 2.6, 2.7
			TOTAL	16.8	22,608	23,536	

* EACH FIRE AREA IS SEPARATED BY A SOLID HORIZONTAL LINE WITH SOME FIRE AREAS CONSISTING OF MULTIPLE FIRE ZONES.

TABLE 2-2

FIRE PROTECTION FEATURES
FOR FIRE AREAS*

FIRE AREA*	EXISTING DETECTION	EXISTING SUPPRESSION	MINIMUM RATING OF FIRE AREA BOUNDARIES	EQUIVALENT FIRE SEVERITY (MINUTES)	FIRE LOAD BTU/FT^2	AREA FT^2	FIGURE NUMBER
HVAC EQUIPMENT AND COMPUTER ROOMS							
70	12 IONIZATION (6 IN DUCTS) 1 THERMISTOR FOR CHARCOAL FILTER UNIT 1-HV-ACRF-1	MANUAL WATER SPRAY FOR CHARCOAL FILTER UNIT	3 (SEE NOTES 21, 29 AND 62)	8.2	11,187	1,715	2.2, 2.5, 2.11
71	ALARM ONLY (HIGH VOLTAGE) 4 IONIZATION (2 UNDER FLOOR)	AUTOMATIC HALON 1301		87.5	116,545	430	2.2, 2.5, 2.11
	HALON ACTUATION (LOW VOLTAGE) 6 IONIZATION (3 UNDER FLOOR)						
72	ALARM ONLY (HIGH VOLTAGE) 4 IONIZATION (2 UNDER FLOOR)	AUTOMATIC HALON 1301					
	HALON ACTUATION (LOW VOLTAGE) 6 IONIZATION (3 UNDER FLOOR)			106.4	141,607	430	2.2, 2.11
73	12 IONIZATION (6 IN DUCTS) 1 THERMISTOR FOR CHARCOAL FILTER UNIT 2-HV-ACRF-1	MANUAL WATER SPRAY FOR CHARCOAL FILTER UNIT		7.1	9,469	1,770	2.2, 2.11
			TOTAL	25.3	33,820	4,345	

* EACH FIRE AREA IS SEPARATED BY A SOLID HORIZONTAL LINE WITH SOME FIRE AREAS CONSISTING OF MULTIPLE FIRE ZONES.

TABLE 2-2

FIRE PROTECTION FEATURES
FOR FIRE AREAS*

FIRE AREA*	EXISTING DETECTION	EXISTING SUPPRESSION	MINIMUM RATING OF FIRE AREA BOUNDARIES	EQUIVALENT FIRE SEVERITY (MINUTES)	FIRE LOAD BTU/FT^2	AREA FT^2	FIGURE NUMBER
UNIT 2 CONTAINMENT (SEE NOTE 26) 74	THERMISTORS FOR CABLE TRAYS	NONE	3	23.1	30,739	4,166	2.3, 2.7
75	THERMISTORS FOR REACTOR COOLANT PUMPS, FOR CABLE TRAYS, AND FOR CHARCOAL FILTER UNITS 2-HV-CFT-1 2-HV-CFT-2	AUTOMATIC WATER SPRAY SYSTEM FOR BOTH CHARCOAL FILTER UNITS, MANUAL WATER SPRAY SYSTEM FOR RCPs		62.1	82,562	3,648	2.3, 2.7, 2.8, 2.10, 2.11
76	THERMISTORS FOR CABLE TRAYS	NONE		3.3	4,467	6,316	2.2, 2.3, 2.10, 2.11
102	THERMISTORS FOR CABLE TRAYS	NONE		20.6	27,414	1,230	2.8
104	THERMISTORS FOR CABLE TRAYS	NONE		5.5	7,328	615	2.3, 2.7, 2.8
119	NONE	NONE		4.9	6,481	230	2.8
121	NONE	NONE		2.2	2,993	2,580	2.3, 2.8
123	NONE	NONE		9.0	12,027	580	2.3, 2.8
133	NONE	NONE		6.8	9,160	3,506	2.3, 2.10, 2.11
135	NONE	NONE		0	0	665	2.3, 2.6
			TOTAL	17.2	23,112	23,536	

* EACH FIRE AREA IS SEPARATED BY A SOLID HORIZONTAL LINE WITH SOME FIRE AREAS CONSISTING OF MULTIPLE FIRE ZONES.

TABLE 2-2

FIRE PROTECTION FEATURES
FOR FIRE AREAS*

FIRE AREA*	EXISTING DETECTION	EXISTING SUPPRESSION	MINIMUM RATING OF FIRE AREA BOUNDARIES	EQUIVALENT FIRE SEVERITY (MINUTES)	FIRE LOAD BTU/FT^2	AREA FT^2	FIGURE NUMBER
UNIT 1 TANK AREA PIPE TUNNEL 116	NONE	NONE	3 (SEE NOTE 5)	0.2	437	1,724	2.2, 2.3, 2.4, 2.7
UNIT 2 TANK AREA PIPE TUNNEL 117	NONE	NONE	3 (SEE NOTE 8)	0.4	515	1,724	2.2, 2.3, 2.7

* EACH FIRE AREA IS SEPARATED BY A SOLID HORIZONTAL LINE WITH SOME FIRE AREAS CONSISTING OF MULTIPLE FIRE ZONES.

TABLE 2-2

FIRE PROTECTION FEATURES
FOR FIRE AREAS

NOTES

(1) CLOSE-SPACED DRY PILOT PREACTION SPRINKLERS AROUND PERIMETER OF STAIR(S) AT CEILING LEVEL

(2) SEE SECTION 9.4 FOR BOUNDARY EVALUATION OF VERTICAL AIR SHAFTS (FIRE AREAS 12 AND 22)

(3) DRY PILOT PREACTION SPRINKLERS IN NORMALLY ACCESSIBLE PORTIONS OF THE FIRE ZONE

(4) SEE SECTION 9.6 FOR BOUNDARY EVALUATION OF 6A PIPE TUNNEL

(5) SEE SECTION 9.23 FOR BOUNDARY EVALUATION OF FIRE AREA 116

(6) SEE SECTION 9.7 FOR BOUNDARY EVALUATION OF FIRE AREAS 13 AND 14

(7) SEE SECTION 9.8 FOR BOUNDARY EVALUATION OF FIRE AREAS 20 AND 21

(8) SEE SECTION 9.24 FOR BOUNDARY EVALUATION OF FIRE AREA 117

(9) SEE SECTION 9.25 FOR BOUNDARY EVALUATION OF ESW PUMPS FIRE AREA AND HATCH EVALUATION BETWEEN FIRE ZONE 29C AND FIRE ZONE 29G

(10) CCW PUMP COVERAGE TO PROTECT BEARINGS

(11) SEE SECTION 9.21 FOR DOOR EVALUATION BETWEEN FIRE ZONE 43 AND FIRE ZONE 110

(12) SEE SECTION 9.22 FOR DOOR EVALUATION BETWEEN FIRE ZONE 44S AND FIRE ZONE 111

(13) SEE SECTION 9.14 FOR HATCH EVALUATION BETWEEN FIRE ZONE 43 AND FIRE AREA 56

(14) SEE SECTION 9.15 FOR HATCH EVALUATION BETWEEN FIRE ZONE 40B AND FIRE AREA 55

(15) SEE SECTION 9.16 FOR HATCH EVALUATION BETWEEN FIRE AREA 41 AND FIRE AREA 55

(16) SEE SECTION 9.19 FOR HATCH EVALUATION BETWEEN FIRE AREA 45 AND FIRE AREA 60

(17) SEE SECTION 9.20 FOR HATCH EVALUATION BETWEEN FIRE ZONE 47B AND FIRE AREA 60

(18) NOT IN DRUM STORAGE

(19) SEE SECTION 9.18 FOR HATCH EVALUATION BETWEEN FIRE ZONE 52 AND FIRE AREA 59

(20) SEE SECTION 9.13 FOR HATCH EVALUATION BETWEEN FIRE AREA 53 AND FIRE AREA 57

TABLE 2-2

FIRE PROTECTION FEATURES
FOR FIRE AREAS

(21) SEE SECTION 9.5 FOR HATCH EVALUATION BETWEEN FIRE AREAS 53 AND 54 AND FIRE ZONES 70 AND 73

(22) SEE SECTION 9.17 FOR HATCH EVALUATION BETWEEN FIRE AREA 54 AND FIRE AREA 58

(23) SEE SECTION 9.26 FOR BOUNDARY EVALUATION OF FIRE AREA 9 AND FIRE AREA 10

(24) SEE SECTION 9.27 FOR BOUNDARY EVALUATION OF FIRE AREA 24 AND FIRE AREA 25

(25) SEE SECTION 9.31 FOR UNIT 1 LEAKAGE DETECTION BOX EVALUATION

(26) THIS FIRE AREA CONTAINS ADDITIONAL FIRE ZONES WHICH WERE PREVIOUSLY UNIDENTIFIED

(27) THIS FIRE AREA CONTAINS ADDITIONAL FIRE ZONES WHICH WERE PREVIOUSLY IDENTIFIED AS SEPARATE FIRE AREA

(28) SEE SECTION 9.1 FOR DUCT EVALUATION BETWEEN FIRE ZONE 43 AND FIRE ZONE 91

(29) SEE SECTION 9.2 FOR DUCT EVALUATION BETWEEN FIRE AREA 54 AND FIRE ZONE 73

(30) SEE SECTION 9.3 FOR DUCT EVALUATION OF CCW PUMPS

(31) SEE SECTION 9.9 FOR BOUNDARY EVALUATION OF FIRE AREA CONTAINING FIRE ZONES 3, 32, 36, 48 AND 69 WITH FIRE AREA CONTAINING FIRE ZONES 49, 50, 51 AND 52

(32) SEE SECTION 9.10 FOR BOUNDARY EVALUATION BETWEEN FIRE ZONE 43 AND FIRE ZONE 44N

(33) SEE SECTION 9.11 FOR BOUNDARY EVALUATION BETWEEN TURBINE BUILDING, SERVICE BUILDING AND MAIN STEAM PIPE TUNNELS

(34) SEE SECTION 9.12 FOR BOUNDARY EVALUATION BETWEEN TURBINE BUILDING AND SCREEN HOUSE

(35) SEE SECTION 9.28 FOR BOUNDARY EVALUATION BETWEEN FIRE AREA 61 AND FIRE ZONE 5

(36) SEE SECTION 9.29 FOR BOUNDARY EVALUATION BETWEEN FIRE AREA 105 AND FIRE ZONE 33A

(37) SEE SECTION 9.30 FOR BOUNDARY EVALUATION BETWEEN FIRE AREA CONTAINING FIRE ZONES 3, 32, 36, 48, 49, 50, 51, 52, 69 AND FIRE AREAS 31, 35, 106, 107 AND 146

(38) SEE SECTION 9.32 FOR UNIT 2 LEAKAGE DETECTION BOX EVALUATION

(39) SEE SECTION 7.13 FOR AUXILIARY BUILDING HVAC DUCT PENETRATION EXEMPTION

(40) SEE SECTION 7.14 FOR SEISMIC GAP EXEMPTION

(41) FLOOR DRAINAGE OPENING FROM FIRE AREA 17F TO FIRE ZONE 2 BELOW

(42) SEE SECTION 7.2 FOR FULL AREA SUPPRESSION EXEMPTION

(43) SEE SECTION 7.3 FOR FIXED SUPPRESSION EXEMPTION

(44) SEE SECTION 7.4 FOR FIXED SUPPRESSION EXEMPTION

TABLE 2-2

FIRE PROTECTION FEATURES
FOR FIRE AREAS

(45) SEE SECTION 7.5 FOR FIXED SUPPRESSION EXEMPTION

(46) SEE SECTION 7.6 FOR FIXED SUPPRESSION EXEMPTION

(47) SEE SECTION 7.7 FOR FULL AREA SUPPRESSION EXEMPTION

(48) SEE SECTION 7.8 FOR FIXED SUPPRESSION EXEMPTION

(49) SEE SECTION 7.9 FOR FIXED SUPPRESSION EXEMPTION

(50) SEE SECTION 7.10 FOR ONE-HOUR BARRIER EXEMPTION

(51) SEE SECTION 7.11 FOR FIXED SUPPRESSION EXEMPTION

(52) SEE SECTION 7.12 FOR FIXED SUPPRESSION EXEMPTION

(53) AUXILIARY BUILDING PASSENGER AND FREIGHT ELEVATOR DOORS ARE CLASS B

(54) CONTROLLED ACCESS TO EACH FIRE ZONE IS VIA LOCKED SCREEN MESH GATE

(55) DETECTION COVERAGE DOES NOT EXTEND INTO ZONE CUBICLES CONTAINING RADIOACTIVE EQUIPMENT LOCATED BEHIND SHIELD WALLS WITH CONTROLLED-ACCESS SCREEN MESH GATES

(56) SEE SECTION 9.33 FOR BOUNDARY EVALUATION OF FIRE ZONE 6A TO FIRE ZONE 138B

(57) SEE SECTION 9.34 FOR BOUNDARY EVALUATION OF FIRE ZONE 36 TO FIRE ZONE 5

(58) SEE SECTION 9.35 FOR BOUNDARY EVALUATION OF FIRE ZONE 33A TO FIRE ZONE 108

(59) SEE SECTION 9.36 FOR BOUNDARY EVALUATION OF FIRE ZONE 34A TO FIRE ZONE 109

(60) SEE SECTION 9.37 FOR BOUNDARY EVALUATION OF FIRE ZONE 5 TO FIRE ZONE 32

(61) SEE SECTION 9.38 FOR BOUNDARY EVALUATION OF FIRE ZONE 69 TO FIRE ZONES 108 AND 109

(62) SEE SECTION 9.39 FOR BOUNDARY EVALUATION OF FIRE ZONE 70 TO FIRE ZONE 129

(63) SEE SECTION 9.40 FOR BOUNDARY EVALUATION OF FIRE ZONE 7 TO FIRE ZONE 61

(64) SEE SECTION 9.41 FOR BOUNDARY EVALUATION OF FIRE ZONES 44N AND 37 TO FIRE ZONE 51

TABLE 2-3

MAXIMUM ALLOWABLE COMBUSTIBLE LOADING
FOR FIRE ZONES INVOLVED IN
EXEMPTION AND/OR EVALUATION

Fire Zone(s)*	Existing Combustible Loading		Maximum Allowable Combustible Loading	
	Btu/ft^2	Minute	Btu/ft^2	Minute
1A	1,790	1.3	20,000	15
1B	4,815	3.6	20,000	15
1E	4,774	3.6	20,000	15
1F	4,913	3.7	20,000	15
138B	0	0	13,000	10
1A,1B,1C and 1D	6,242	5	20,000	15
1E,1F,1G and 1H	6,063	4.5	20,000	15
138A,138B and 138C	0	0	13,000	10
1,1A → 1H, 136,137,138A, 138B and 138C	4,079	2.9	20,000	15

END OF FIRE AREA

*Fire Zone(s) are grouped together by fire area similar to Tables 1-1 and 2-2

TABLE 2-3 (continued)

Fire Zone(s)*	Existing Combustible Loading Btu/ft^2	Existing Combustible Loading Minute	Maximum Allowable Combustible Loading Btu/ft^2	Maximum Allowable Combustible Loading Minute
91	25,875	19.4	53,000	40
108 Fixed	10,187	7.6	27,000	20
108 Transient	-	-	13,000	10
109 Fixed	15,872	11.8	33,000	25
109 Transient	-	-	13,000	10
110 Fixed	803	0.6	27,000	20
110 Transient	-	-	13,000	10
111 Fixed	838	0.6	27,000	20
111 Transient	-	-	13,000	10
139	0	0	13,000	10
140	3,698	2.6	33,000	25
141	2,196	1.5	33,000	25
142	25,652	19	53,000	40
143	0	0	13,000	10

END OF FIRE AREA

*Fire Zone(s) are grouped together by fire area similar to Tables 1-1 and 2-2

TABLE 2-3 (continued)

Fire Zone(s)*	Existing Combustible Loading Btu/ft^2	Existing Combustible Loading Minute	Maximum Allowable Combustible Loading Btu/ft^2	Maximum Allowable Combustible Loading Minute
32	23,311	17.4	40,000	30
36	3,719	2.7	20,000	15
49	86,725	65.2	100,000	75
50	44,309	33.2	60,000	45
52	10,717	7.9	27,000	20
69	2,998	2.2	20,000	15
3,32,36, 48 and 69	6,600	5	20,000	15
49,50 and 52	30,778	23	47,000	35
49,50,51 and 52	28,629	21.4	47,000	35
3,32,36, 48,49,50, 51 and 52	15,000	12	33,000	25
3,31,32,35, 36,48,49,50, 51,52,69, 106,107 and 146	17,283	12.9	33,000	25

END OF FIRE AREA

*Fire Zone(s) are grouped together by fire area similar to Tables 1-1 and 2-2

TABLE 2-3 (continued)

Fire Zone(s)*	Existing Combustible Loading		Maximum Allowable Combustible Loading	
	Btu/ft^2	Minute	Btu/ft^2	Minute
5	11,299	8.5	27,000	20
6A	143	0.1	13,000	10
61	13,846	10.4	27,000	20
64A	12,642	9.4	27,000	20
64B	10,739	8	27,000	20
65A	11,518	8.6	27,000	20
65B	13,008	9.7	27,000	20
5,6N,6M, 6S,61,64A, 64B,65A and 65B	12,420	9.3	27,000	20
5,6A,6N, 6M,6S,61, 64A,64B, 65A and 65B	8,947	6.5	27,000	20

END OF FIRE AREA

*Fire Zone(s) are grouped together by fire area similar to Tables 1-1 and 2-2

TABLE 2-3 (continued)

Fire Zone(s)*	Existing Combustible Loading		Maximum Allowable Combustible Loading	
	Btu/ft^2	Minute	Btu/ft^2	Minute
7	116,629	87.5	133,000	100
END OF FIRE AREA				
8	30,841	23.1	47,000	35
END OF FIRE AREA				
10	104,250	78.3	120,000	90
END OF FIRE AREA				
11	26,344	19.7	40,000	30
END OF FIRE AREA				
12	1,722	1.2	20,000	15
END OF FIRE AREA				

*Fire Zone(s) are grouped together by fire area similar to Tables 1-1 and 2-2

TABLE 2-3 (continued)

Fire Zone(s)*	Existing Combustible Loading Btu/ft^2	Existing Combustible Loading Minute	Maximum Allowable Combustible Loading Btu/ft^2	Maximum Allowable Combustible Loading Minute
13	25,469	19.1	40,000	30
END OF FIRE AREA				
14	1,056	0.8	13,000	10
END OF FIRE AREA				
20	1,503	1	20,000	15
END OF FIRE AREA				
21	28,063	21	47,000	35
END OF FIRE AREA				
22	1,022	0.6	13,000	10
END OF FIRE AREA				

*Fire Zone(s) are grouped together by fire area similar to Tables 1-1 and 2-2

TABLE 2-3 (continued)

Fire Zone(s)*	Existing Combustible Loading		Maximum Allowable Combustible Loading	
	Btu/ft^2	Minute	Btu/ft^2	Minute
23	28,716	21.5	47,000	35
END OF FIRE AREA				
24	78,083	58.7	93,000	70
END OF FIRE AREA				
26	21,086	15.9	33,000	25
END OF FIRE AREA				
27	85,009	63.9	100,000	75
END OF FIRE AREA				

*Fire Zone(s) are grouped together by fire area similar to Tables 1-1 and 2-2

TABLE 2-3 (continued)

Fire Zone(s)*	Existing Combustible Loading		Maximum Allowable Combustible Loading	
	Btu/ft^2	Minute	Btu/ft^2	Minute
29A and 29B	6,842	5.1	20,000	15
29A,29B and 29E	6,667	5	20,000	15
29C and 29D	6,842	5.1	20,000	15
29C,29D and 29F	6,379	4.8	20,000	15
29G	11,858	8.8	13,000	10

END OF FIRE AREA

*Fire Zone(s) are grouped together by fire area similar to Tables 1-1 and 2-2

TABLE 2-3 (continued)

Fire Zone(s)*	Existing Combustible Loading		Maximum Allowable Combustible Loading	
	Btu/ft^2	Minute	Btu/ft^2	Minute
33A	9,129	6.7	27,000	20
33B	236	0.2	13,000	10
105	15,619	11.7	33,000	25
33 and 33A	10,840	8	27,000	20
33,33A and 33B	9,530	7	27,000	20
33,33A, 33B and 105	11,530	8.5	27,000	20
END OF FIRE AREA				
34A	4,204	3.1	20,000	15
34B	5,735	4.3	20,000	15
34 and 34A	5,937	4.5	20,000	15
34,34A and 34B	5,909	4.3	20,000	15
END OF FIRE AREA				

*Fire Zone(s) are grouped together by fire area similar to Tables 1-1 and 2-2

TABLE 2-3 (continued)

Fire Zone(s)*	Existing Combustible Loading Btu/ft^2	Existing Combustible Loading Minute	Maximum Allowable Combustible Loading Btu/ft^2	Maximum Allowable Combustible Loading Minute
43	74,361	55.8	80,000	60
44S	19,192	14.2	33,000	25
44A,44B,44C and 44D	5,573	4	20,000	15
44E,44F,44G and 44H	7,645	5.7	20,000	15
37,44A → 44H, 44N and 44S	25,853	19	40,000	30
37,43, 44A → 44H, 44N and 44S	34,482	25.8	47,000	35

END OF FIRE AREA

*Fire Zone(s) are grouped together by fire area similar to Tables 1-1 and 2-2

TABLE 2-3 (continued)

Fire Zone(s)*	Existing Combustible Loading Btu/ft^2	Existing Combustible Loading Minute	Maximum Allowable Combustible Loading Btu/ft^2	Maximum Allowable Combustible Loading Minute
38	41,288	31	60,000	45
END OF FIRE AREA				
39	30,622	23	47,000	35
END OF FIRE AREA				
40B	18,144	13.6	33,000	25
END OF FIRE AREA				
41	27,614	20.7	40,000	30
END OF FIRE AREA				
45	23,443	17.6	40,000	30
END OF FIRE AREA				

*Fire Zone(s) are grouped together by fire area similar to Tables 1-1 and 2-2

TABLE 2-3 (continued).

Fire Zone(s)*	Existing Combustible Loading Btu/ft^2	Existing Combustible Loading Minute	Maximum Allowable Combustible Loading Btu/ft^2	Maximum Allowable Combustible Loading Minute
47B	17,136	12.9	33,000	25
END OF FIRE AREA				
53	28,225	21.2	47,000	35
END OF FIRE AREA				
54	30,069	22.6	47,000	35
END OF FIRE AREA				
55	33,536	25.1	47,000	35
END OF FIRE AREA				
56	68,120	51.1	80,000	60
END OF FIRE AREA				

*Fire Zone(s) are grouped together by fire area similar to Tables 1-1 and 2-2

TABLE 2-3 (continued)

Fire Zone(s)*	Existing Combustible Loading		Maximum Allowable Combustible Loading	
	Btu/ft^2	Minute	Btu/ft^2	Minute
57	103,590	77.8	120,000	90
END OF FIRE AREA				
58	99,344	74.7	113,000	85
END OF FIRE AREA				
59	54,237	40.7	67,000	50
END OF FIRE AREA				
60	25,487	19	40,000	30
END OF FIRE AREA				
62A, 62B and 62C	32,538	24.4	47,000	35
END OF FIRE AREA				

*Fire Zone(s) are grouped together by fire area similar to Tables 1-1 and 2-2

TABLE 2-3 (continued)

Fire Zone(s)*	Existing Combustible Loading Btu/ft^2	Existing Combustible Loading Minute	Maximum Allowable Combustible Loading Btu/ft^2	Maximum Allowable Combustible Loading Minute
63A,63B and 63C	32,217	24.1	47,000	35
END OF FIRE AREA				
73	9,469	7.1	27,000	20
70,71,72 and 73	33,820	25.3	47,000	35
END OF FIRE AREA				
116	437	0.2	13,000	10
END OF FIRE AREA				
117	515	0.4	13,000	10
END OF FIRE AREA				

*Fire Zone(s) are grouped together by fire area similar to Tables 1-1 and 2-2

TI APERTURE CARD

Also Available On Aperture Card

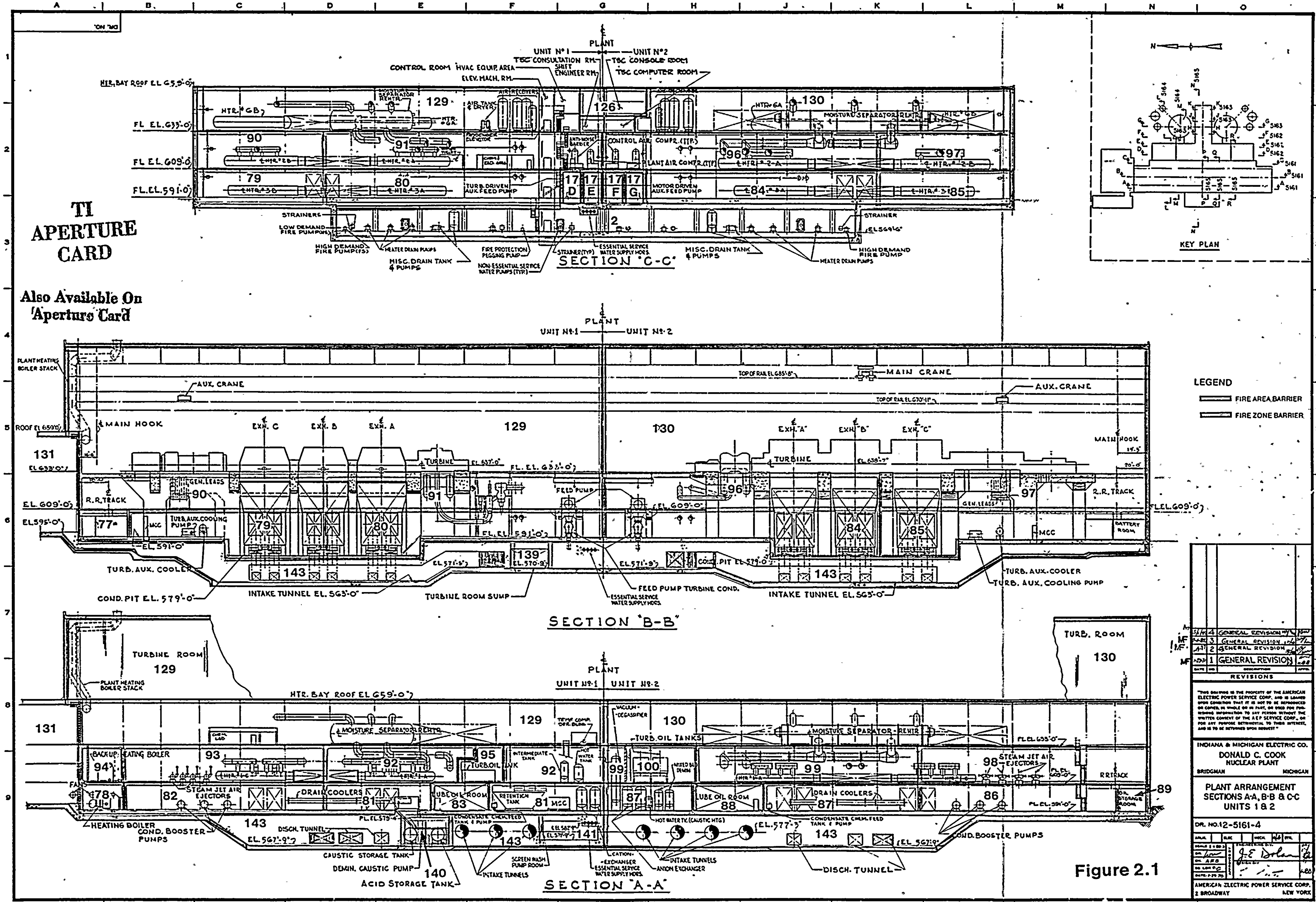
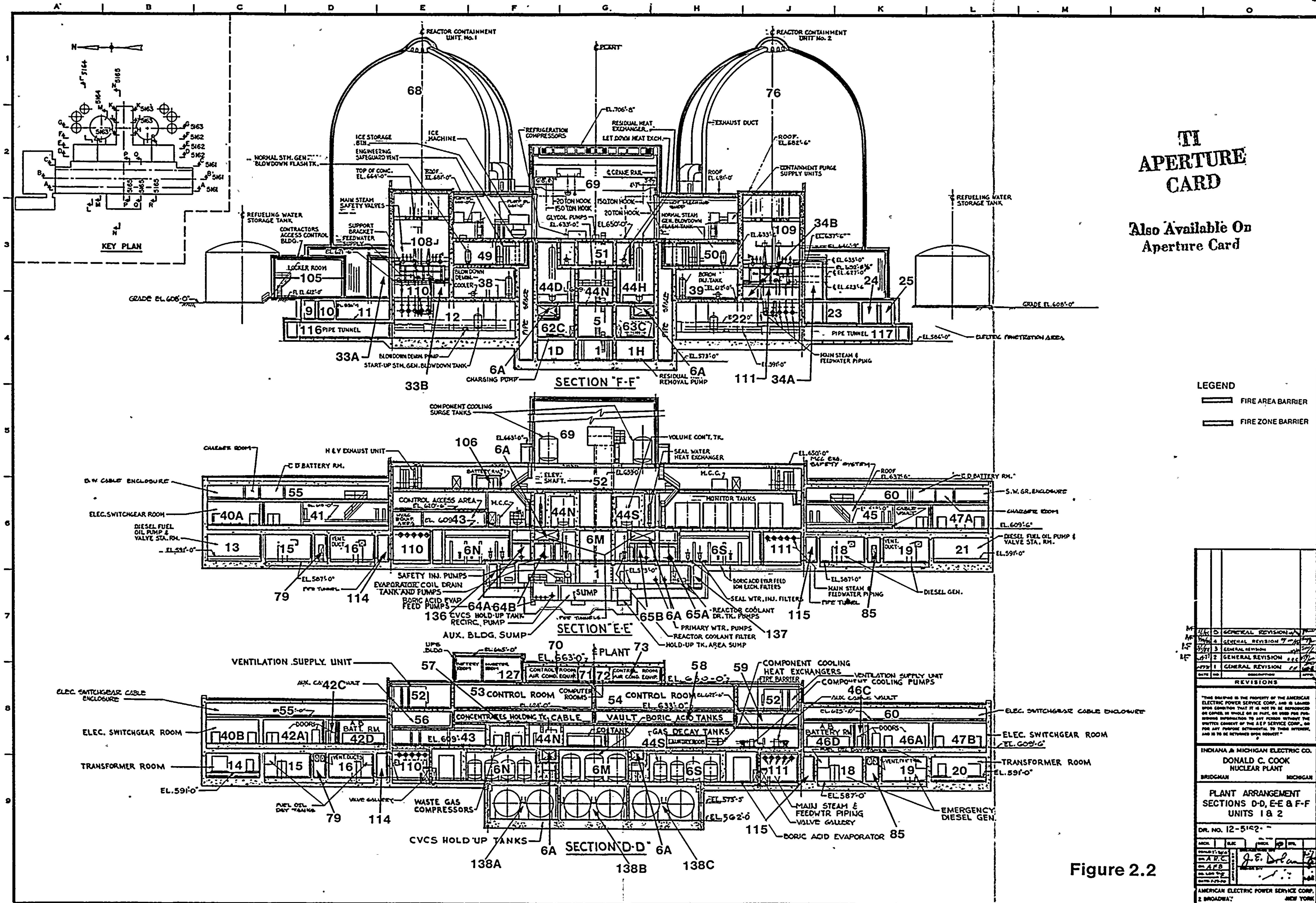


Figure 2.1

8702190215 -01

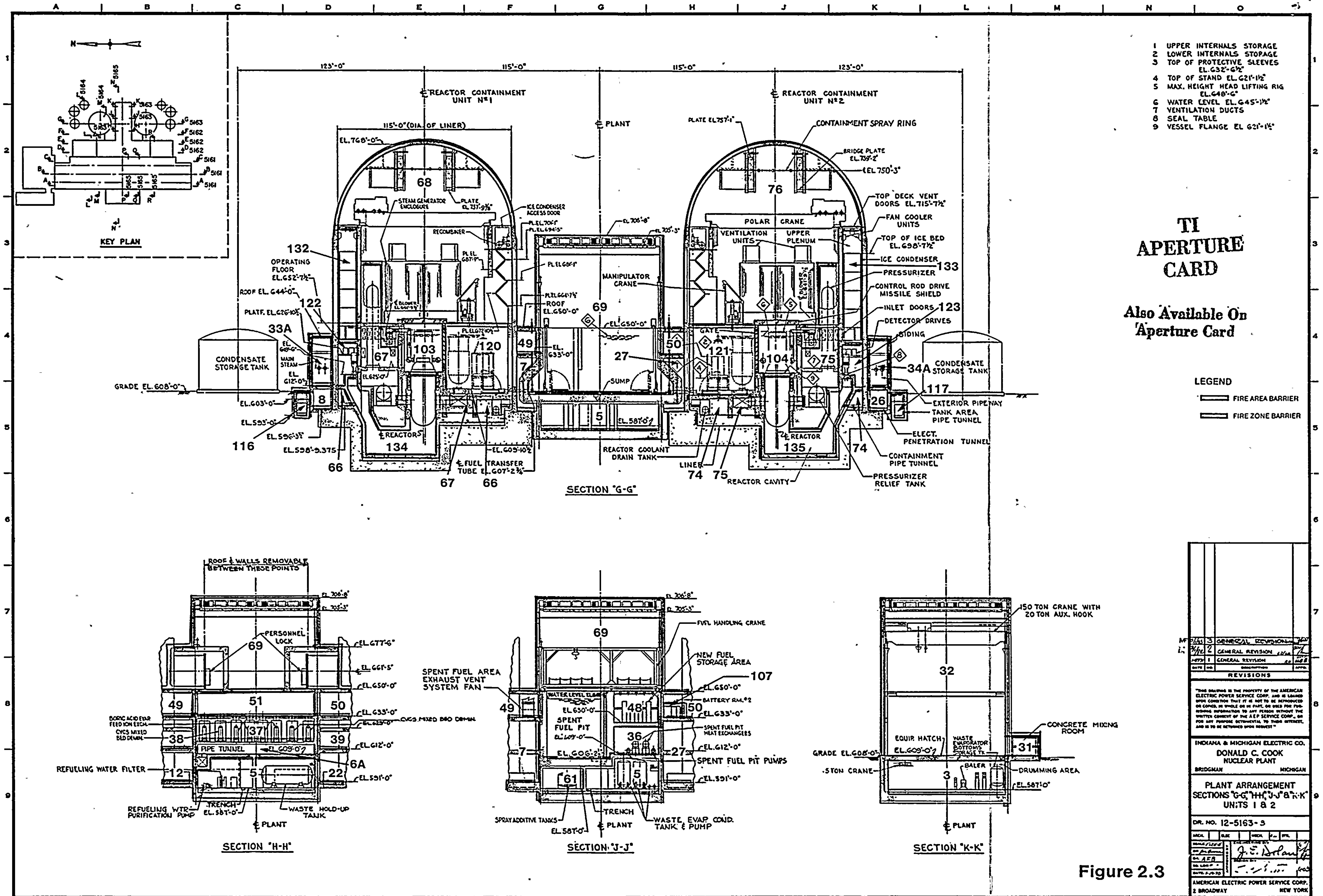


TI APERTURE CARD

Also Available On Aperture Card

Figure 2.2

8702190215-02



TI APERTURE CARD

Also Available On Aperture Card

Figure 2.3

8702190215-03

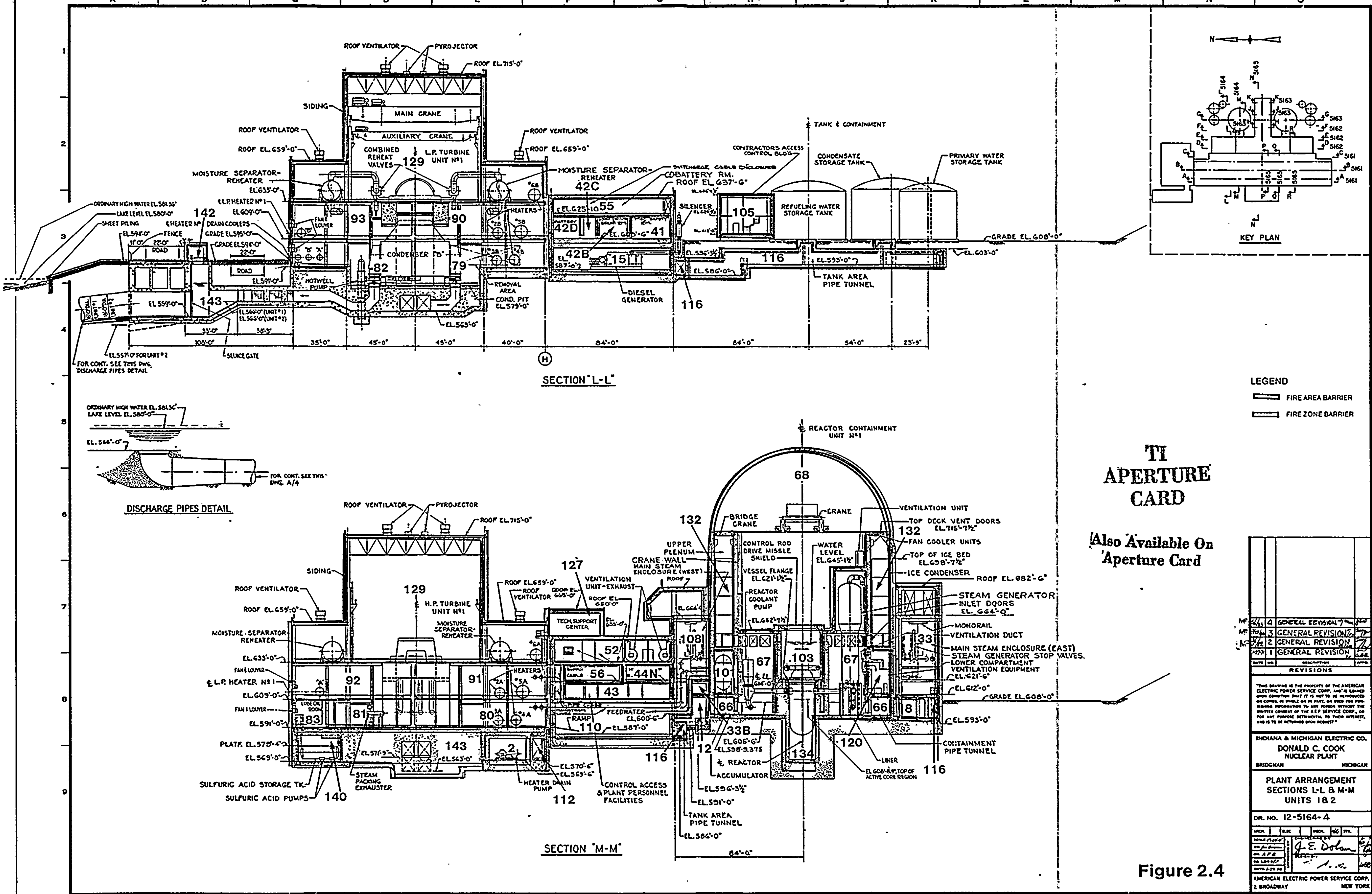


Figure 2.4

8702190215-04

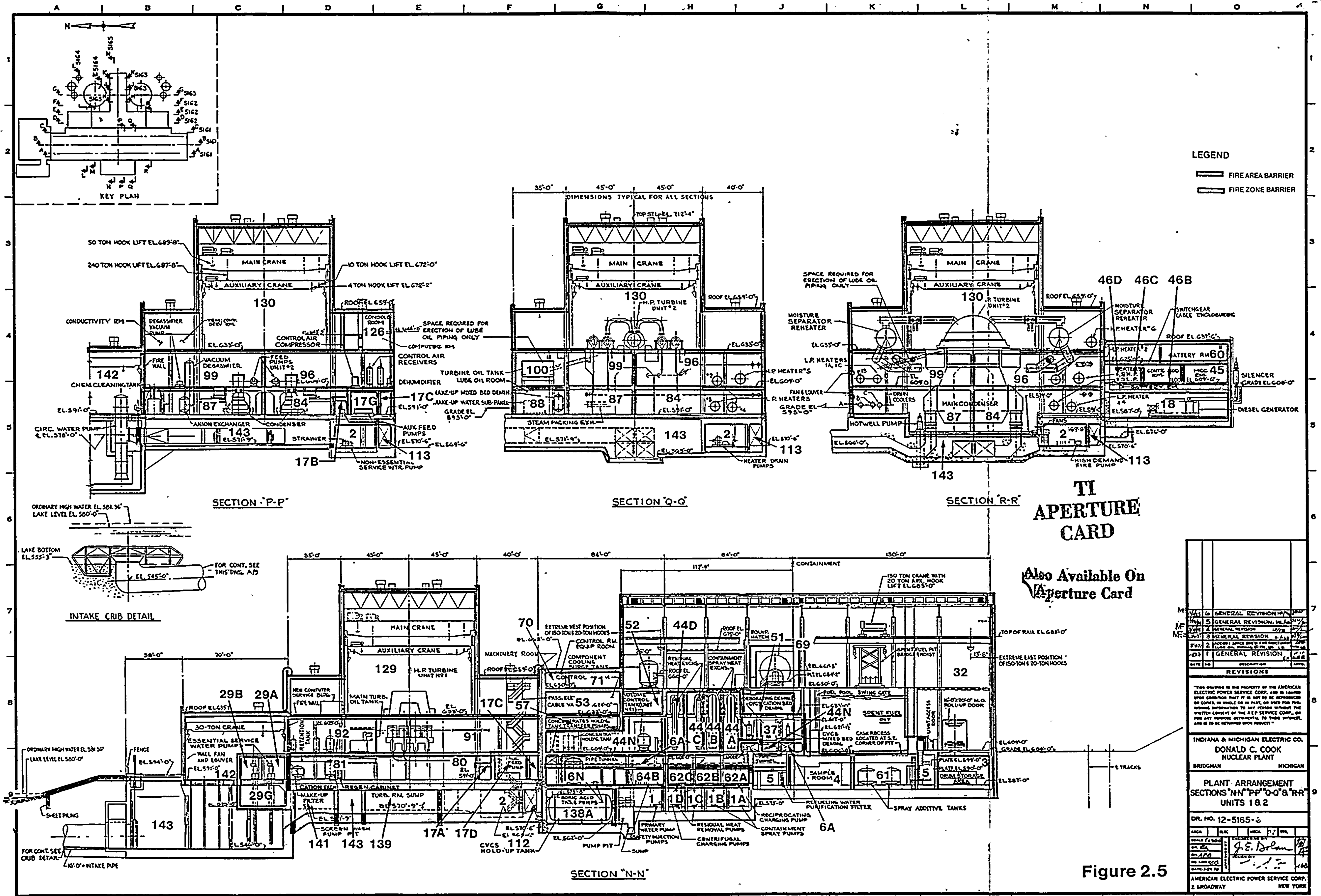


Figure 2.5

8702190215-05

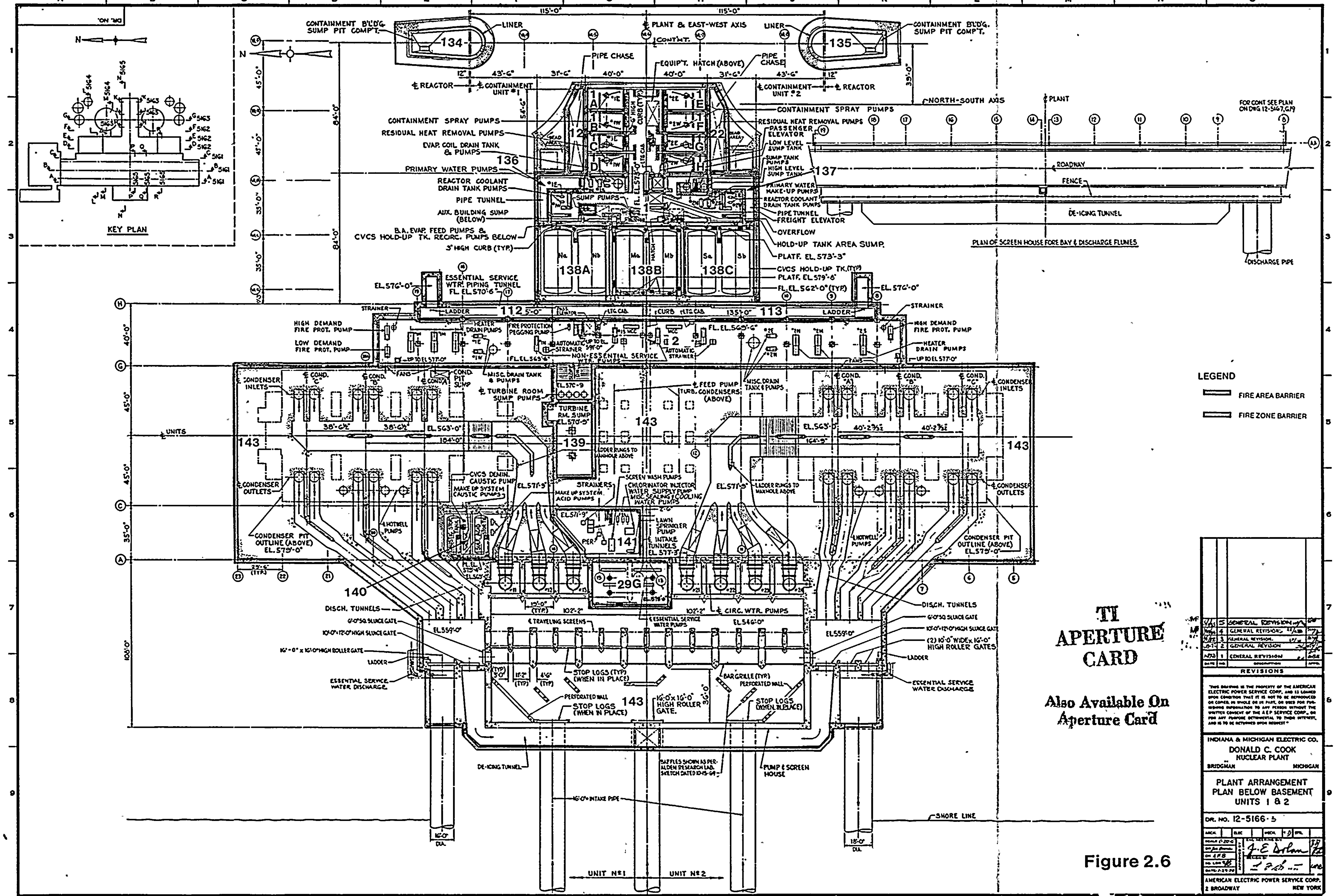


Figure 2.6

TI APERTURE CARD

Also Available On Aperture Card

8702190215-06

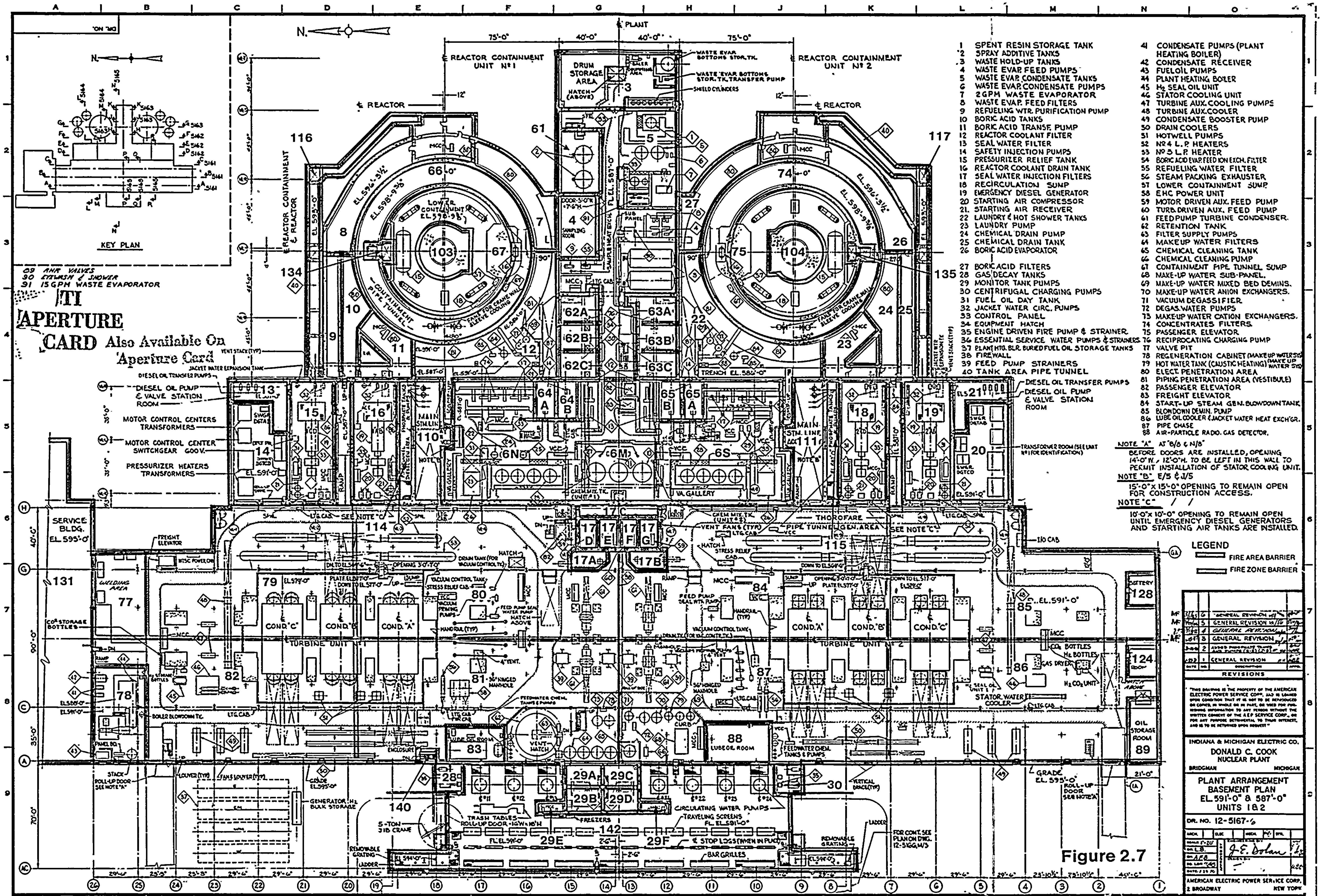


Figure 2.7

APERTURE CARD Also Available On Aperture Card

8702190215-07

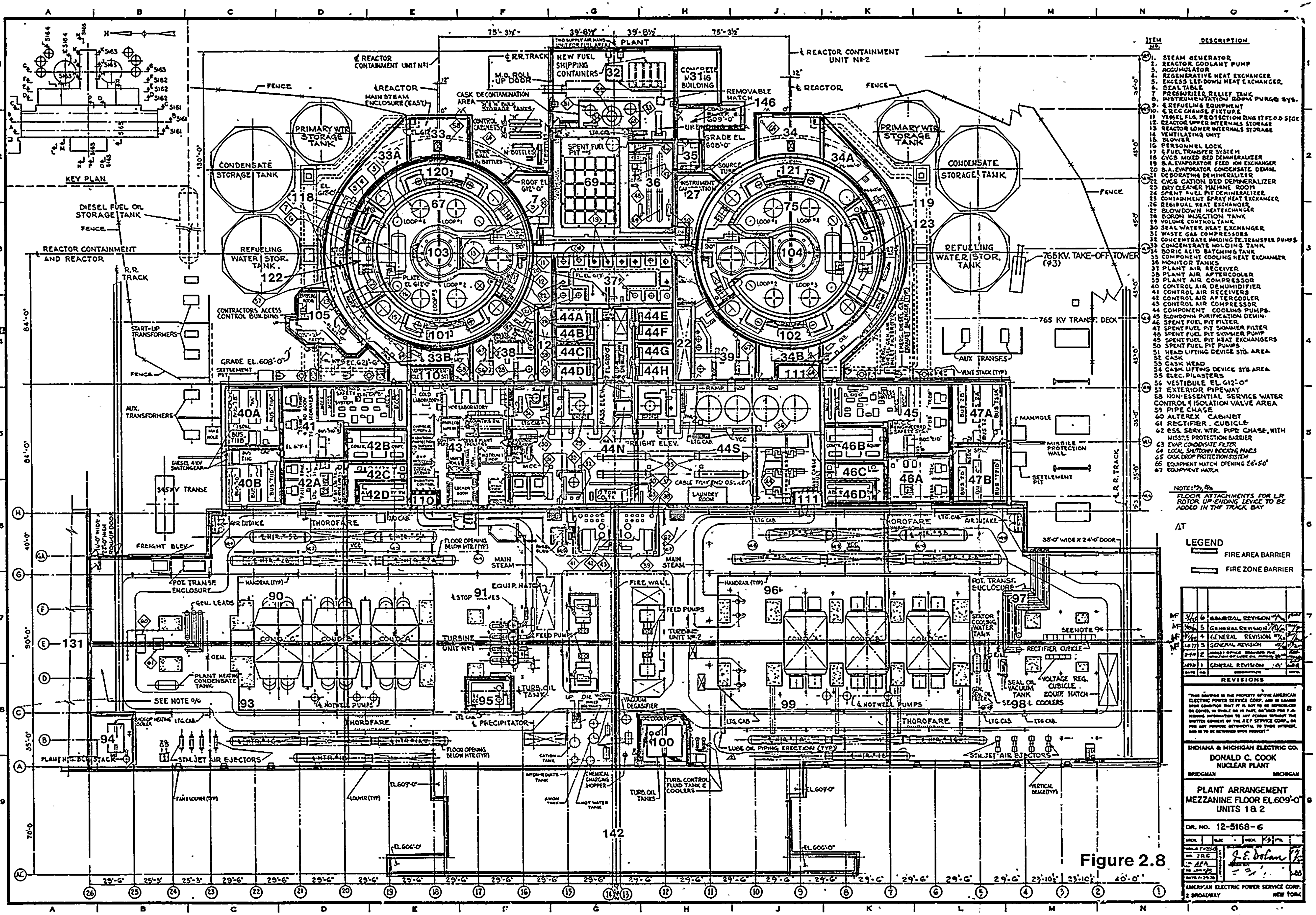


Figure 2.8

8702190215-08

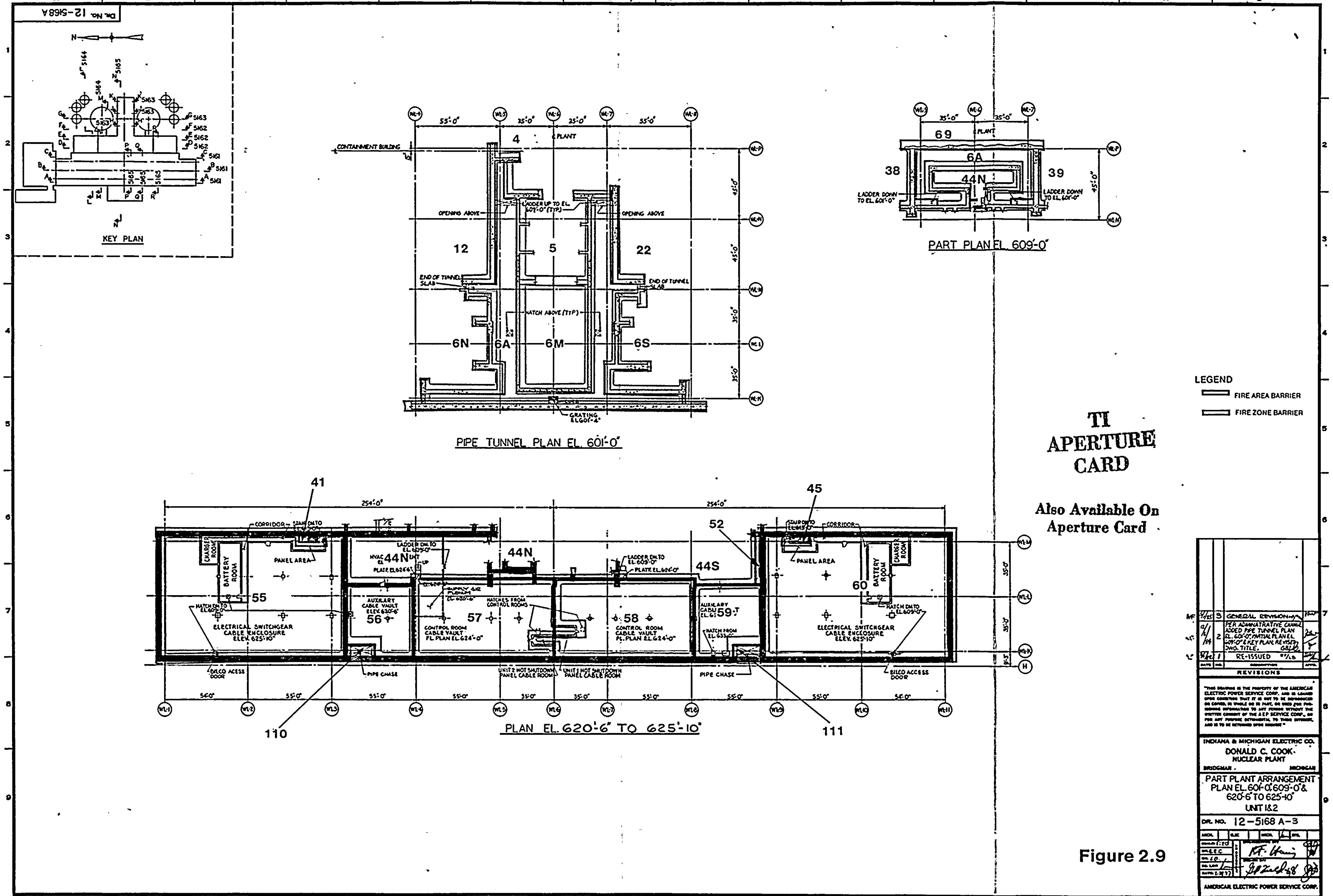


Figure 2.9

8702190215-09

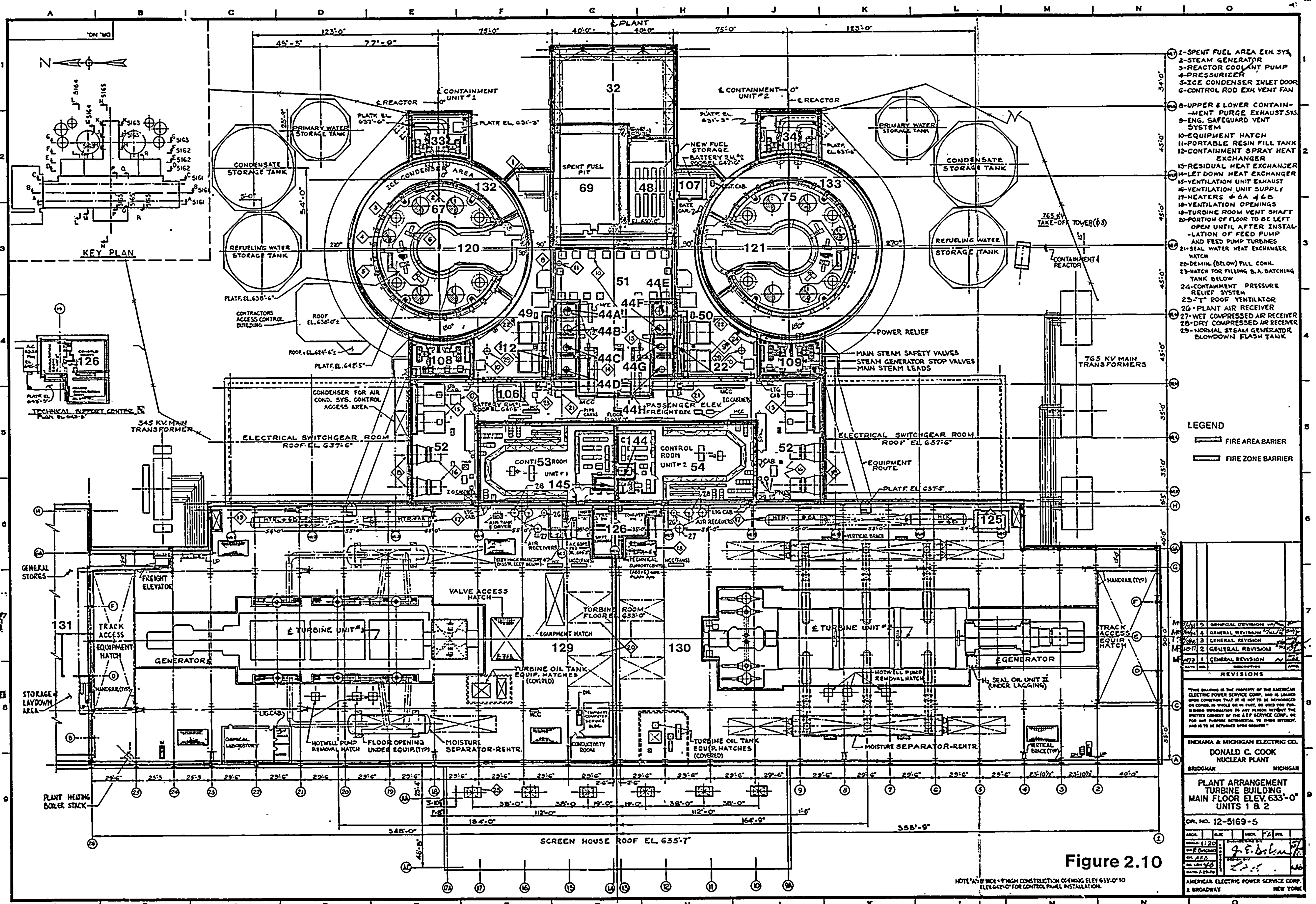


Figure 2.10

TI APERTURE CARD

Also Available On Aperture Card

8702190215-10

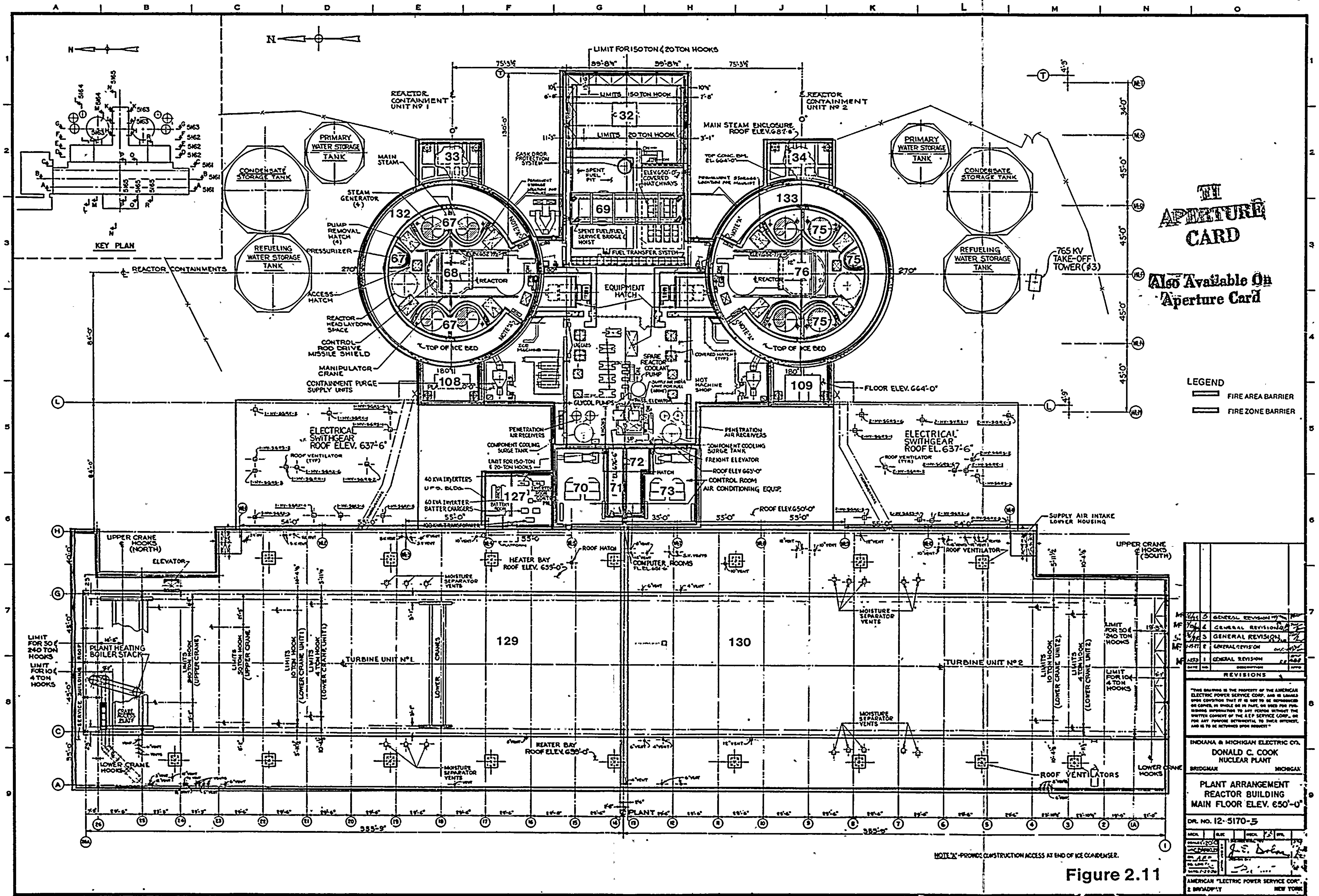


Figure 2.11

8702190215-11

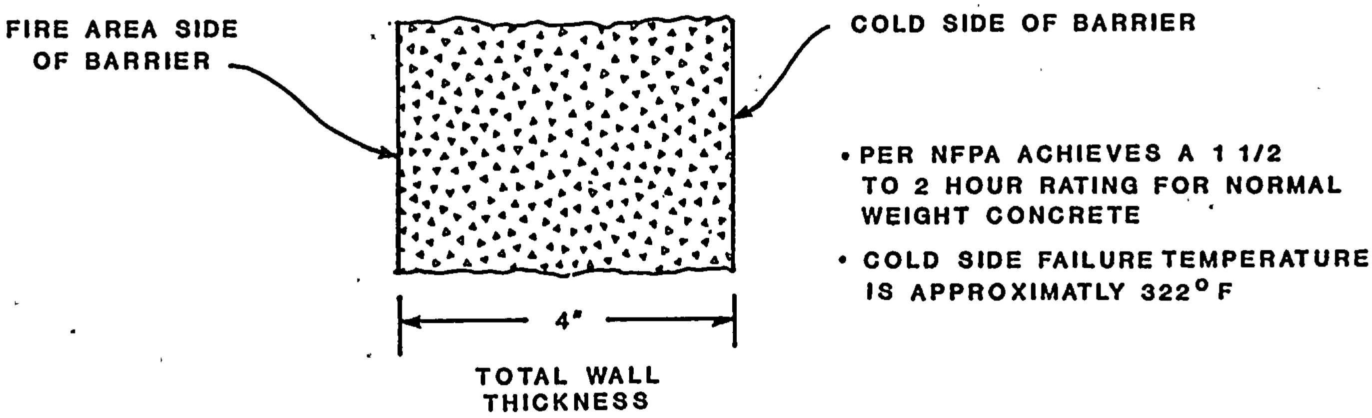


FIGURE 2.0-a

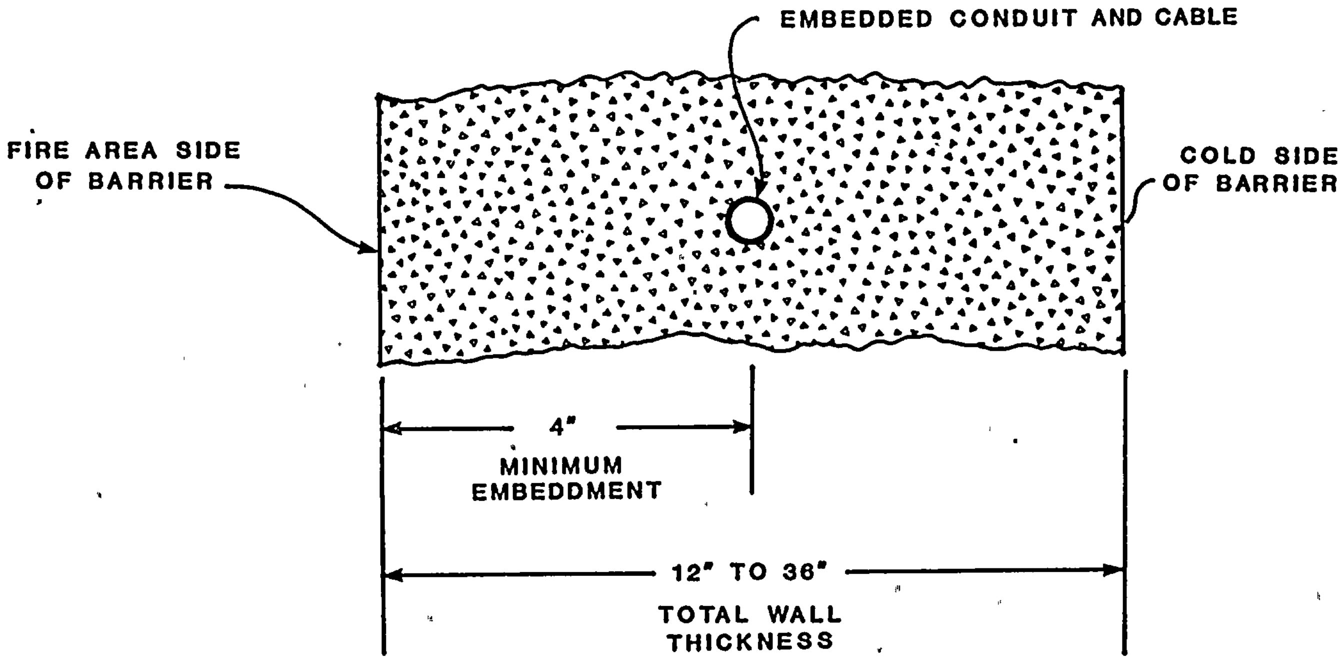


FIGURE 2.0-b

FIGURES 2.0-a AND 2.0-b EMBEDDED CONDUIT

3. DETECTION AND SUPPRESSION SYSTEMS

Section 3 provides detailed information on the detection and suppression systems installed at the D.C. Cook Nuclear Plant. The information contained in this section generally presents the D.C. Cook plant configuration of each fire zone's fire protection features at the end of the 1986 Unit 2 refueling outage. The fire protection features include modifications required for compliance with Appendix R Section III.G, as well as general plant improvements initiated at the time of issue of this report. These active fire protection measures complement the passive protection provided by the area and zone boundaries discussed in Section 2. In conjunction with other complementary features, they provide additional defense-in-depth that ensure that exposure fires will be promptly detected and extinguished. In conjunction with adequate physical separation, they also provide a means of compliance with the provisions of Appendix R Section III.G.2. A tabulation by fire zone of the information contained in this section is provided in Section 2, Table 2-2.

3.1 Fire Detection Systems

3.1.1 General System Information

The Control Rooms of the D.C. Cook Nuclear Plant, which are staffed 24 hours a day by trained personnel, function as the required central supervising station for each unit at the plant.

The Control Rooms are contained within three-hour fire-rated construction with appropriate doors and dampers, thereby meeting the location and separation requirements for the central supervising stations. See Sections 9.2, 9.5, 9.13, and 9.17 for technical evaluations with respect to unrated and/or unprotected boundary openings for the Control Rooms.

Supervisory capability is provided for the detection systems to indicate when maintenance of the system is required for circuit breaks or grounds. All fire detection systems provide both audible and visual alarms on the fire alarm control panel in the respective Control Room. Alarms also sound in areas where either Halon or Carbon Dioxide suppression systems are utilized.

3.1.2 <u>System Descriptions</u>

Three modes of fire detection are provided at the D.C. Cook Nuclear Plant. They are ionization smoke detection, thermistor heat detection, and infrared flame detection. In addition, there are spot locations protected by heat detectors which are electrically connected into the ionization smoke detection systems in specific fire areas. Table 2-2 and Figures 3-1 through 3-6 identify the locations of the detection systems at D.C. Cook.

The ionization smoke detection systems are the primary form of fire detection in the plant. Infrared flame detectors are crossed zoned with the smoke detection systems in some fire zones that are protected by a gaseous suppression system. In these fire zones, activation of both the smoke detection system and the flame detection system are required before actuation of the suppression system. The auxiliary cable vaults have only one zone of fire detection, which also automatically actuates the CO_2 gaseous suppression systems located therein.

Thermistor detection systems are provided in a number of fire zones in the plant. Single zones of detection are provided for alarm purposes only around the turbine generators, reactor coolant pumps, and the in-containment cable trays. Thermistor detection and alarm is used in and around some parts of the main turbines where manual initiation of water spray suppression systems protect the turbines above the operating floor. Thermistor detection and alarm, with manual initiation of water spray suppression, also protect the reactor coolant pumps located inside containment.

Several Carbon Dioxide Suppression Systems are automatically actuated by one zone of thermistor detection. Single zone thermistor detection is provided for alarm and automatic actuation of CO_2 suppression systems for the Diesel Fuel Pump Rooms, Lube Oil Rooms, and Turbine Oil Tank Rooms. Two zones of thermistor detection are provided for alarm and automatic activation of CO_2 suppression systems for the Diesel Generator Rooms of both units.

The charcoal filter units are provided with a single zone thermistor detection system. Each detection system has two high temperature alarms. Upon receipt of the higher temperature fire alarm, the system valve will be automatically opened. However, for those systems located outside of containment, the shut-off valve upstream of the system valve must be manually opened before water will discharge into the water spray system piping.

3.2 Fire Suppression Systems

3.2.1 General System Information

All automatic suppression systems alarm both audibly and visually on the fire alarm control panel in the respective Control Room. Supervisory capacity is built into the water suppression systems in the form of position-indicating tamper switches on all shut-off valves for individual systems. When these valves change from their normal position beyond a specified limit, an alarm sounds both audibly and visually in the respective Control Room. Supervisory capability is provided on relays, isolation switches, and high or low tank pressure for the Carbon Dioxide systems. The solenoid valves for release of the main Halon tanks protecting the Cable Spreading Rooms are also supervised.

3.2.2 Systems Description

Three basic modes of fire suppression are provided at the D.C. Cook Nuclear Plant. They are water, Halon, and carbon dioxide suppression systems. Each is described in detail below, with system locations indicated in Table 2-2 and identified on Figures 3-1 through 3-6.

3.2.2.1 Water Suppression Systems

Water can be applied to any potential fire in protected areas by one or more of four types of water suppression systems. These are:

(1) Automatic wet pipe sprinkler systems

(2) Dry pilot preaction sprinkler systems

(3) Water spray suppression systems (manual and automatic)

(4) Manual hose stations

The water supply for these suppression systems for both units of the plant is through a common supply header. This interior supply header is also interconnected with the yard main header by sealed-open sectionalizing valves. Each interior suppression system, with the exception of the charcoal filter suppression systems outside of containment, is equipped with normally open, manual shut-off valves and is instrumented with water flow indicators to provide audible and visual annunciation in the respective Control Room. Each unit is equipped with a 2000-gpm electric motor-driven fire pump and a 2000-gpm diesel motor-driven fire pump. In addition, a single 500-gpm electric motor-driven fire pump is provided to handle water flow requirements of less than 500-gpm in both units. All five pumps are electrically independent to ensure that failure of any pump will not impair the reliability of the water suppression systems.

With regard to fire pump sequencing, when a high demand system operates, the fire pumps are started through the high demand logic system. The first pump to start will be the high demand electric motor-driven pump in the unit requiring water suppression. If the electric motor-driven pump fails to operate, or if additional capacity is needed, the header pressure will fall below a set point and the diesel-driven pump in the same unit will start through the logic system. If more capacity is still needed, as sensed by header pressure, the electric motor-driven fire pump in the other unit will start. If still more capacity is needed to maintain header pressure, the remaining diesel-driven pump of the other unit will start. If adequate header pressure is still not maintained by the four high demand fire pumps, the electric motor-driven low demand fire pump will start.

Low pressure sensing devices are installed in the main interior supply header to ensure that, if fire-fighting water flows greater than 2000-gpm are required (the maximum single demand is 3700-gpm for the Unit 1 main transformer and Turbine Building wall), additional pumping capacity will automatically be provided to maintain header pressure.

Pump connections to the interior and yard loop headers are widely separated. The diesel-driven pumps are on opposite ends of the intake screenhouse (Fire Zones 28 and 30) and the electric motor-driven pumps are on opposite ends of the pump pit within Fire Zone 2 of the Turbine Building. Power supplies for the pumps are from several sources. The electric pumps are supplied from metal clad switchgear and motor control centers which are supplied from alternate sources. Each diesel-driven pump has two independent starting battery sources, each with its own charging equipment and with automatic and/or manual throwover. Each diesel-driven pump is located in its own three-hour-rated room. Similar isolation of the electric motor-driven pumps is not necessary, due to the lack of fire exposure and spatial separation in the pump pit area.

Both the electric and diesel-driven pumps have available running, electric power, and strainer condition indication alarms in their respective Control Rooms. The diesel-driven pumps, in addition, have engine supervisory information such as coolant over-temperature, failure to start, engine overspeed, and low oil pressure alarm in the respective Control Room.

The wet pipe, preaction and water spray sprinkler systems are the primary forms of automatically applying water on a fire. A dry pilot, preaction sprinkler system differs from a wet pipe system only in that automatic detection by the pilot system is required before water will enter the pipe network in the area.

Both the pilot piping and sprinkler piping heads are normally closed; however, the pilot piping heads require a lower temperature to operate. This will cause the operation of the pneumatically-operated system deluge valve, allowing water to enter sprinkler piping. At this point, the dry pilot sprinkler system functions just like a wet pipe sprinkler system. Upon detection of a higher temperature by sprinkler piping heads, the system discharges water onto the fire through the sprinkler piping heads that have now operated. In addition, specific areas and/or equipment are protected by automatic and/or manual fixed-water spray systems. The outside containment charcoal filter units' fixed-water suppression system has been modified to be equipped with a normally closed manual shut-off valve, located upstream of the system valve. This modification has been initiated at the time of issue of this report. Each automatic preaction sprinkler and fixed-water spray system also can be operated manually.

Manual fire-fighting hose stations are the primary backup to the automatic and/or manual water suppression systems. Hose stations are located in plant areas outside containment (such as the Turbine and Auxiliary Buildings). Additional hose stations are located at access areas to the Control Rooms, Control Room cable vaults, the auxiliary cable vaults, the containment cable tunnels (with hose stations also located within the tunnels), upper and lower access to the containments, the diesel generators and the emergency power system areas.

3.2.2.2 Carbon Dioxide Suppression Systems

Areas indicated in Table 2-2 that are protected by carbon dioxide systems have boundary penetrations (i.e., dampers, seismic gaps, and openings around cables, conduits and pipes) sealed to ensure retention of the carbon dioxide concentrations. In some fire areas, however, dampers have not been provided for duct work that communicates directly with the plant exterior or pass through other areas within rated construction boundaries to the plant exterior. For the CO_2 systems in these fire areas, concentration tests have been performed which demonstrate that the required concentration levels can be maintained without dampers. The affected fire zones in which this situation exists are 40A, 40B, 41, 42A, 45, 46A, 47A and 47B.

A discharge delay time with audible alarm (for automatic system actuation only) is incorporated into each system design to allow personnel time to leave the area. This is necessary due to the health hazards associated with achieving the concentration levels of carbon dioxide required to extinguish the fire.

Carbon dioxide suppression systems can be activated both automatically and manually. The CO_2 suppression systems can be activated automatically by one of the following:

(1) Single zone ionization smoke detection

(2) Single zone thermistor detection

(3) Two zones of thermistor detection

(4) One zone of ionization and one zone of infrared flame detection

Should a loss of power prevent the system from automatically discharging, the four master valves on the 17-ton carbon dioxide storage tank, located in Fire Zone 44N, will fail in the open position, thereby charging the supply headers up to the hazard area selector valves. It is then possible for personnel to go to the specific pilot valve cabinet controlling the operation of these selector valves and manually open them, allowing CO_2 to enter the hazard area. Each of the Control Room cable vaults is provided with a manual CO_2 system back-up to the automatic Halon system.

3.2.2.3 Halon Suppression Systems

The D.C. Cook Nuclear Power Plant has been equipped with Halon 1301 in a number of areas: the Control Room cable vaults (Fire Areas 57 and 58), computer areas, TSC areas, security areas, and guard house areas. Each system has its own set of Halon 1301 cylinders. Penetration seals have been provided to ensure that the required concentration of the agent is maintained. Although the concentrations of Halon required for extinguishment are generally low and would not result in serious health hazards, personnel are advised to leave any area in which Halon has been, or is about to be, discharged.

The Halon suppression systems can be operated both automatically and manually. Both zones of detection provided in these areas must sense a fire before the agent will discharge automatically. Each system can be manually actuated from the appropriate control cabinet or cylinder bank.

3.2.2.4 Partial Zone or Area Coverage

Certain areas or zones in the Auxiliary Building are identified in Table 2-2 as containing partial suppression coverage. The criteria developed to determine the acceptability of partial coverage for these selected zones and areas is as follows:

(1) Automatic fire suppression may not have been provided in those portions of Fire Zones 1, 3, 5, 6N, 6M, 6S, 44N, 44S, 51 and 52 based on one or more of the following criteria:

(a) High or extremely high radiation areas;

(b) Radioactive processing equipment and storage tanks;

(c) Low combustible loads;

(d) Controlled and locked personnel access;

(e) Areas shielded by walls separating equipment from the remainder of the fire area or zone;

(f) Fire rated wall construction;

(g) Containing process piping and heat exchangers;

(h) Presence of detection systems;

(i) Suppression over concentrated combustible loads.

The substantial ALARA considerations associated with the installation of systems in these areas, combined with the extremely low probability of fires in these regions, formed the criteria which justified the entire zone for exclusion of automatic suppression systems from these rooms. In addition, a suppression system is not provided in Fire Zones 1A through 1H, 44A through 44H, and containment for the same reason as stated in a-h.

(2) Automatic fire suppression systems have been excluded from Fire Zones 49 and 50 based on the following criteria:

(a) The existing barrier construction provides adequate isolation and containment of a potential fire;

(b) Full zone detection is already provided with additional detection and suppression provided for the principal combustibles source in the zone (charcoal filters);

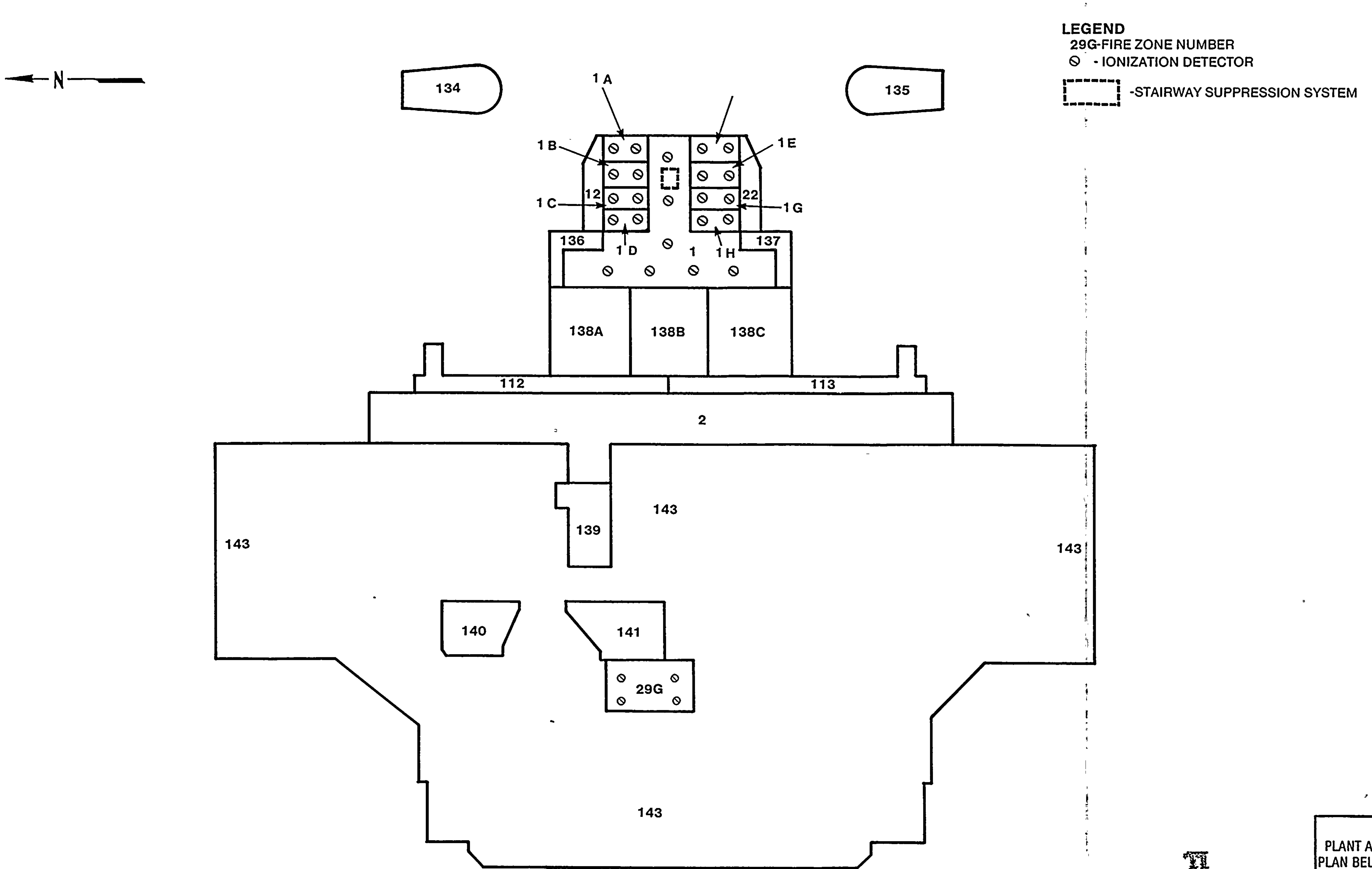
(c) Redundant safe shutdown cables and/or equipment exist outside the zone; therefore, the zone boundary is not required to function as a III.G.2 separation barrier; and

(d) The newly installed preaction sprinkler systems located in Fire Zone 52 adjacent to these zones will inhibit fire spread out of the zone to fire zones of adjacent fire areas.

(3) Automatic fire suppression systems have been excluded from Fire Zones 144 and 145 based on the following criteria:

(a) The existing barrier construction provides adequate isolation and containment of potential fire;

(b) Full zone detection is already provided.



DETECTION AND SUPPRESSION SYSTEMS

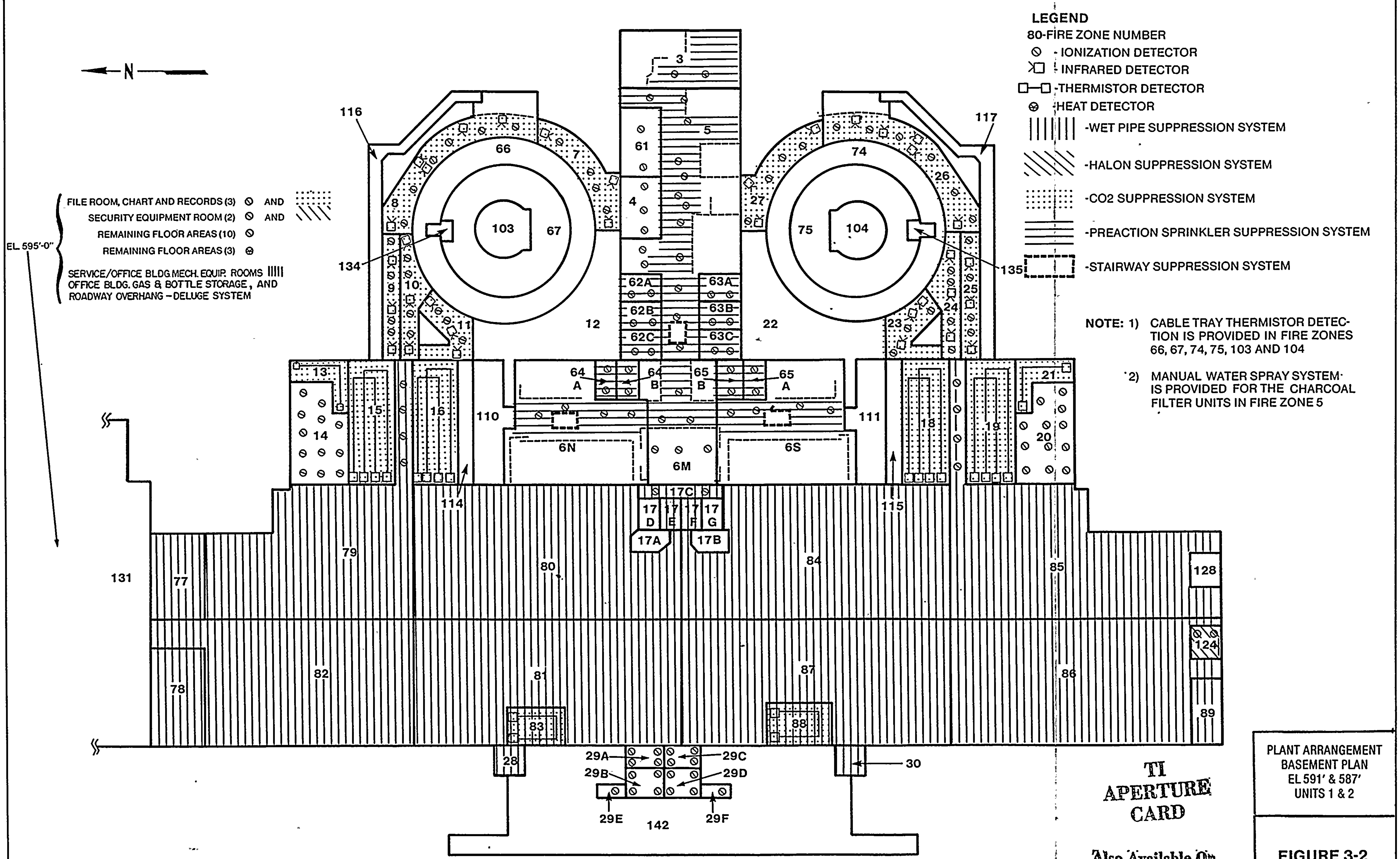
APERTURE CARD

Also Available On Aperture Card

PLANT ARRANGEMENT
PLAN BELOW BASEMENT
UNITS 1 & 2

FIGURE 3-1

8702190215-12



DETECTION AND SUPPRESSION SYSTEMS

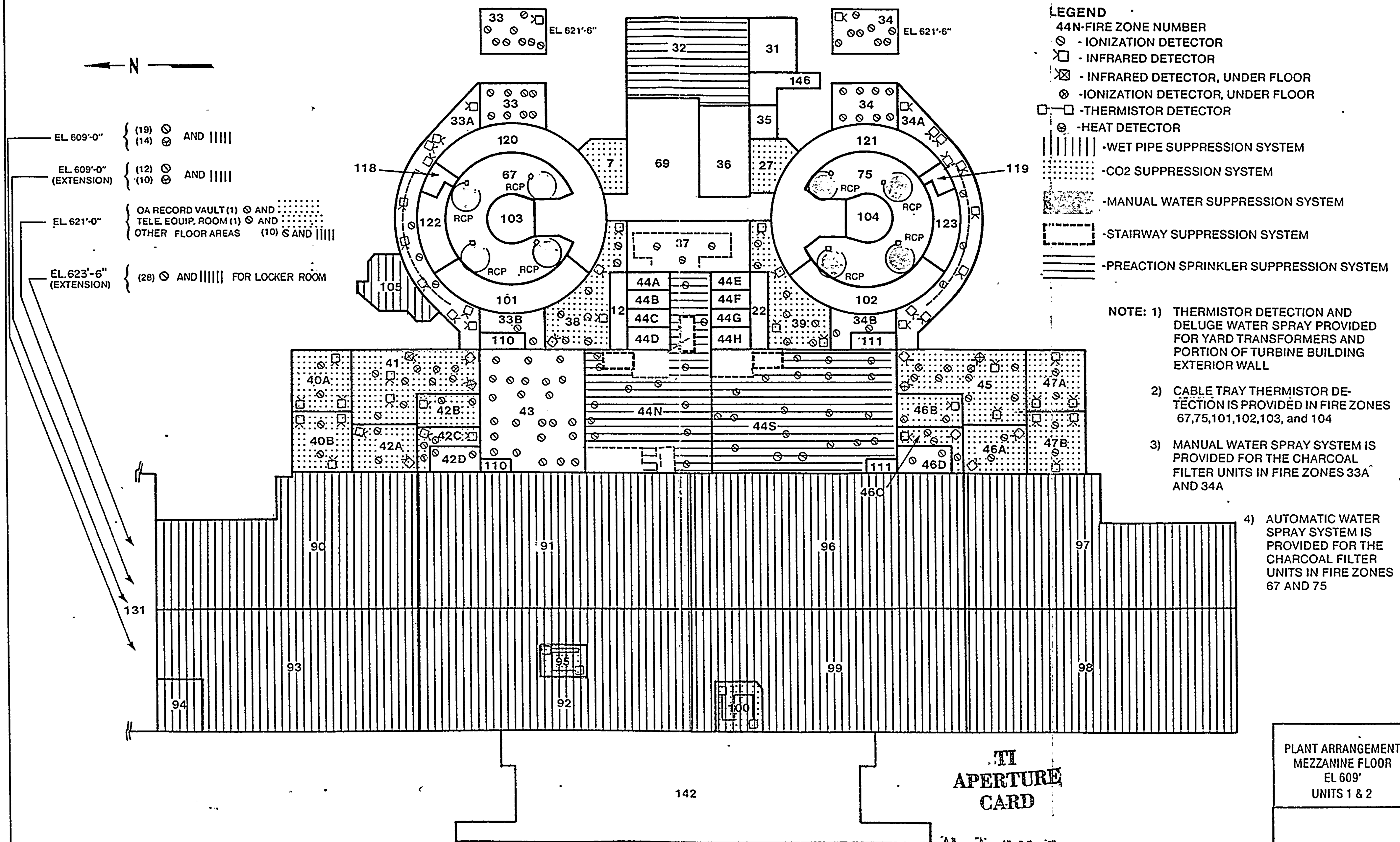
TI APERTURE CARD

Also Available On Aperture Card

PLANT ARRANGEMENT
BASEMENT PLAN
EL 591' & 587'
UNITS 1 & 2

FIGURE 3-2

8702190215-13



DETECTION AND SUPPRESSION SYSTEMS

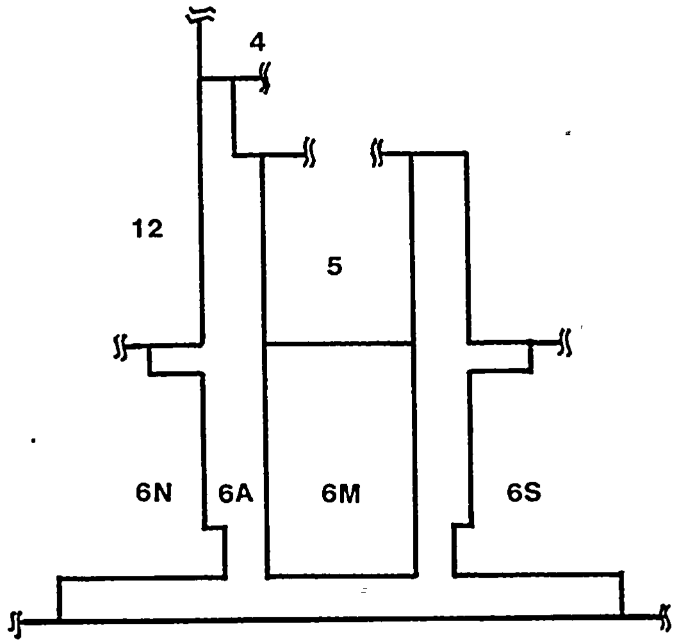
PLANT ARRANGEMENT
MEZZANINE FLOOR
EL 609'
UNITS 1 & 2

FIGURE 3-3

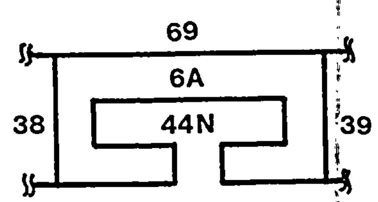
TI
APERTURE
CARD

Also Available On
Aperture Card

8702190215-14



PIPE TUNNEL PLAN EL 601′

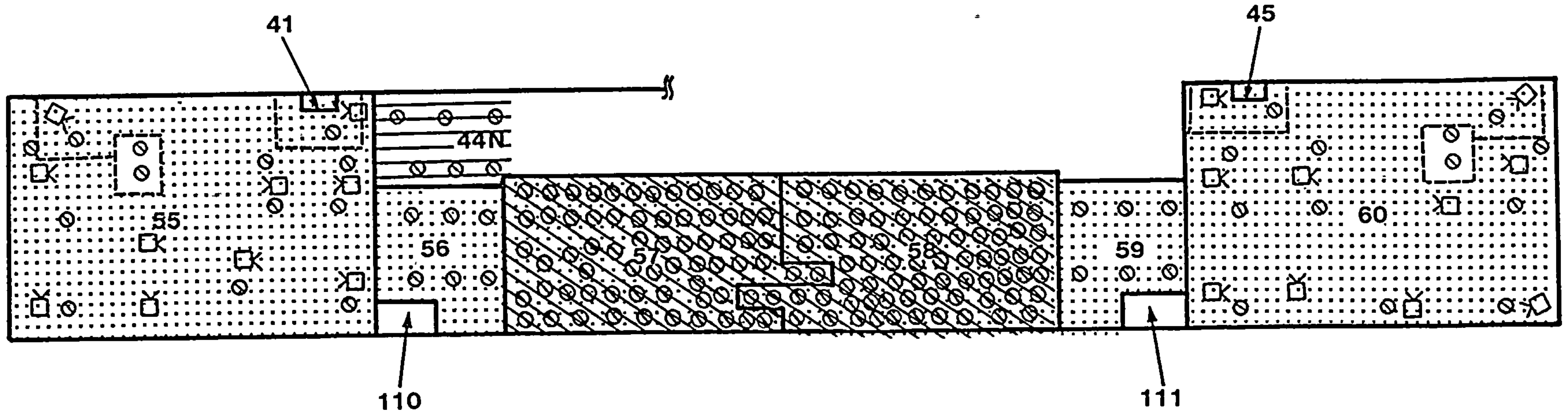


PART PLAN EL 609′

LEGEND

58-FIRE ZONE NUMBER
-IONIZATION DETECTOR
-INFRARED DETECTOR

-PREACTION SPRINKLER SUPPRESSION SYSTEM
-HALON SUPPRESSION SYSTEM
-CO2 SUPPRESSION SYSTEM



PLAN EL 620′-6″ to 625′-10″

DETECTION AND SUPPRESSION SYSTEMS

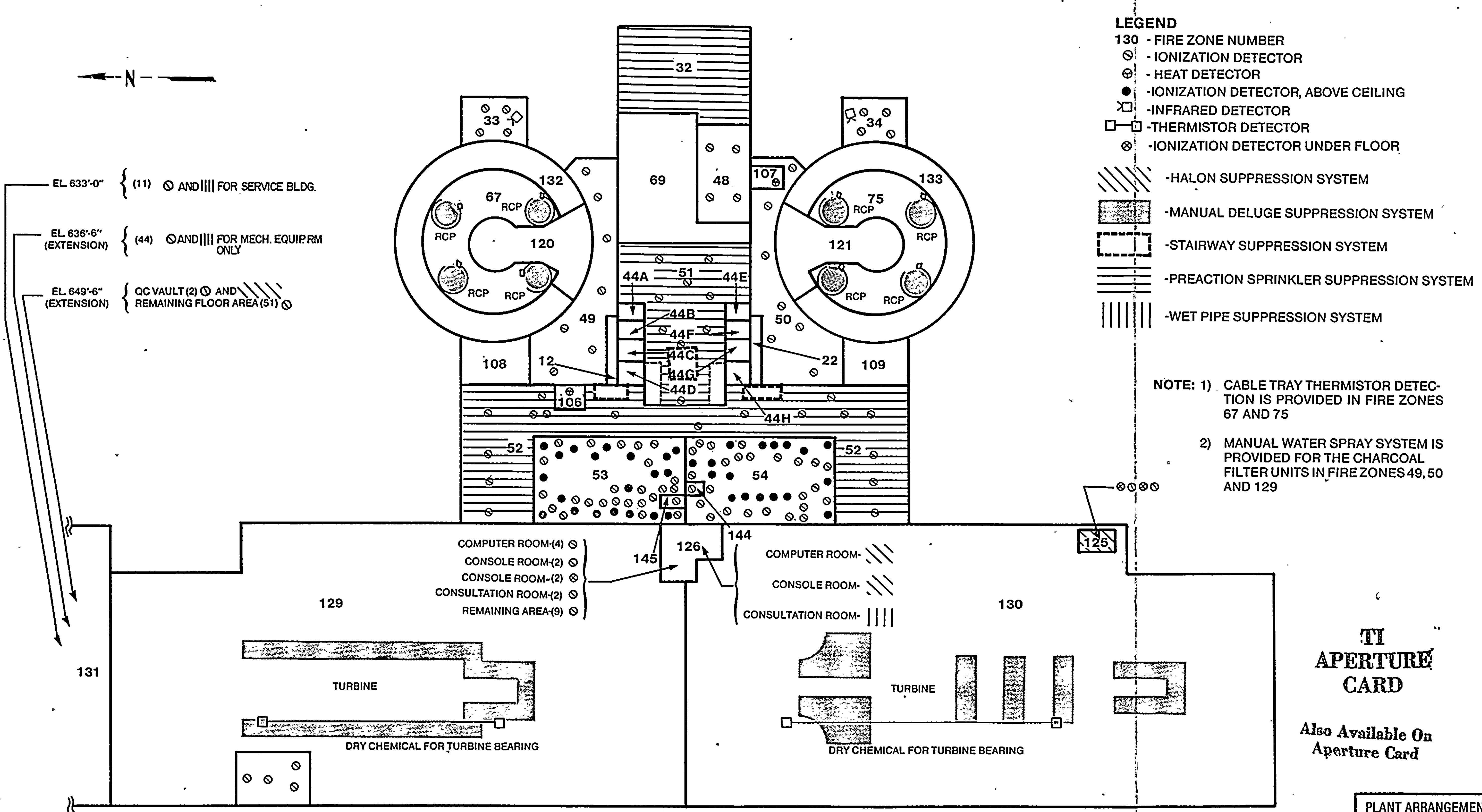
TI APERTURE CARD

Also Available On Aperture Card

PART PLANT ARRANGEMENT
PLAN EL 601′, 609′ & 620′-6″ to 625′-10″
UNITS 1 & 2

FIGURE 3-4

8702190215-15



DETECTION AND SUPPRESSION SYSTEMS

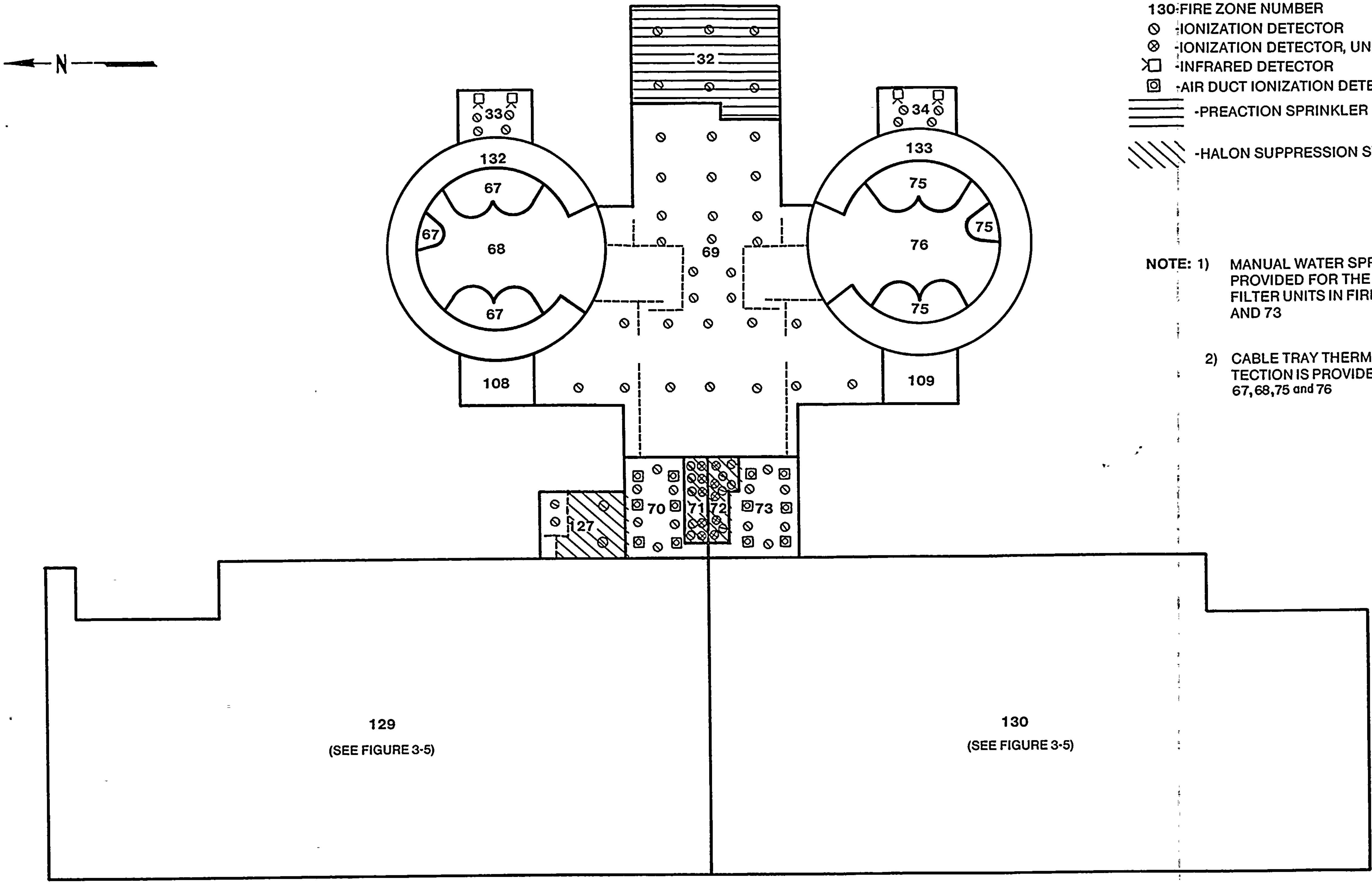
TI APERTURE CARD

Also Available On Aperture Card

PLANT ARRANGEMENT
TURBINE BUILDING
MAIN FLOOR
EL 633'
UNITS 1 & 2

FIGURE 3-5

8702190215-16



LEGEND

130 -FIRE ZONE NUMBER

-IONIZATION DETECTOR

-IONIZATION DETECTOR, UNDER FLOOR

-INFRARED DETECTOR

-AIR DUCT IONIZATION DETECTOR

-PREACTION SPRINKLER SUPPRESSION SYSTEM

-HALON SUPPRESSION SYSTEM

NOTE: 1) MANUAL WATER SPRAY SYSTEM IS PROVIDED FOR THE CHARCOAL FILTER UNITS IN FIRE ZONES 69, 70 AND 73

2) CABLE TRAY THERMISTOR DETECTION IS PROVIDED IN FIRE ZONES 67, 68, 75 and 76

PLANT ARRANGEMENT
REACTOR BUILDING
MAIN FLOOR
EL 650'
UNITS 1 & 2

FIGURE 3-6

DETECTION AND SUPPRESSION SYSTEMS

4. SAFE SHUTDOWN SYSTEMS, COMPONENTS AND CIRCUITS METHOD OF INVESTIGATION

4.1 Introduction

Paragraph 50.48 of 10 CFR 50, which became effective on February 17, 1981, requires all nuclear plants licensed to operate prior to January 1, 1979, to comply with the requirements of Section III of Appendix R to 10 CFR 50 regardless of any previous approvals by the Nuclear Regulatory Commission of other design features. Section III.G.1 requires that fire protection features be provided for those systems, structures and components important to safe shutdown. These features must be capable of limiting fire damage so that:

(1) One train of systems necessary to achieve and maintain hot shutdown conditions from either the Control Room or the Emergency Control Station(s) is free of fire damage; and,

(2) Systems necessary to achieve and maintain cold shutdown from either the Control Room or the Emergency Control Station(s) can be repaired within 72 hours.

Section III.L of Appendix R and Generic Letter 81-12 (February 20, 1981) Enclosure 1 "Staff Position," provides additional guidance on the NRC Staff's requirements for this safe shutdown capability.

4.1.1 Design Basis Events

For the purpose of this review and report for which safe shutdown capability will be demonstrated for D.C. Cook, the spectrum of postulated exposure fires in a given plant area will be analyzed involving either in-situ or transient combustibles which are external to any systems, structures or components located in or adjacent to that area. The effects of such fires may adversely affect those systems, structures or components essential to safe plant shutdown. The most limiting assumption (i.e., worst-case scenario) with respect to the availability of off-site power will be assumed. No concurrent or sequential design basis accidents or transients are assumed to exist. In addition, no random single failures are assumed to occur other than those which occur as a direct result of fire analysis assumptions.

4.2 Safety Functions

The specific safe shutdown functions necessary to satisfy Appendix R acceptance criteria are as follows:

(1) Reactivity Control Function

(2) Reactor Coolant Makeup Control Function

(3) Reactor Coolant Pressure Control Function

(4) Reactor Heat Removal Function

(5) Process Monitoring Function

(6) Miscellaneous Supporting Functions

4.2.1 Reactivity Control

After a reactor trip, the reactivity control function must be capable of achieving and maintaining at least a 1% reactivity shutdown margin from zero power hot standby to cold shutdown. The function must be capable of compensating for any reactivity changes associated with xenon decay and the reactor coolant temperature decrease which occurs during cooldown to cold shutdown conditions.

4.2.2 Reactor Coolant Make-up Control

The reactor coolant make-up control function shall be capable of assuring that sufficient make-up inventory is provided to compensate for Reactor Coolant System fluid losses due to identified leakage from the reactor coolant pressure boundary and shrinkage of the Reactor Coolant System water volume during cooldown from hot standby to cold shutdown conditions. Adequate performance of this function is demonstrated by the maintenance of reactor coolant level within the pressurizer.

4.2.3 Reactor Coolant Pressure Control

Reactor coolant pressure control is required to assure that the Reactor Coolant System is operated:

(1) Within the technical specifications for Reactor Coolant System pressure-temperature requirements;

(2) To prevent peak Reactor Coolant System pressure from exceeding 110% of system design pressure; and

(3) With a sufficient subcooling margin to minimize void formation within the reactor vessel.

4.2.4 Reactor Heat Removal

The reactor heat removal function shall be capable of transferring fission product decay heat from the reactor core at a rate such that specified acceptable fuel design limits and design conditions of the reactor coolant pressure boundary are not exceeded. The function shall be capable of achieving cold shutdown within a 72-hour period and maintaining cold shutdown conditions thereafter.

4.2.5 Process Monitoring

When information on process variables is required by operators to modify safe shutdown system alignments or control safe shutdown equipment, such monitoring information must be available. The process monitoring function shall be capable of providing, if possible, direct readings of those plant process variables necessary for plant operators to perform and/or control the previously identified functions.

4.2.6 Miscellaneous Supporting Functions

The system and equipment used to perform the previous functions may require miscellaneous supporting functions such as process cooling, lubrication and ac/dc power. These supporting functions shall be available and capable of providing the support necessary to assure acceptable performance of the previously identified safe shutdown functions.

4.2.7 Discussion

The selection of safety functions is principally based on those identified in Branch Technical Position (BTP) CMEB 9.5-1 Section C.5.c. Other subfunctions may exist under each of these broad headings. Examples of such subfunctions are steam generator level control and steam generator pressure control which exist as a part of reactor heat removal. Steam generator level and pressure control are required during hot standby. But during certain portions of hot shutdown and all of cold shutdown, the Residual Heat Removal System is operable and these subfunctions are not required. Other subfunctions like emergency power, process cooling, etc., are embraced by the miscellaneous supporting function definition.

In addition to the functions identified in BTP CMEB 9.5-1, a reactor coolant pressure control function has been included. Although this function could be placed within the reactor coolant make-up function and reactor heat removal function, the specific goals achieved by the performance of this function are unique enough to warrant a separate safety function classification.

The safety functions identified adequately assure that the containment pressure boundary will not be threatened. Uncontrolled mass and energy releases to the containment from the primary systems are limited by the achievement of these safety functions and will assure that no rupture of the reactor coolant or containment pressure boundaries will occur.

4.3 Analysis of Safe Shutdown Systems

4.3.1 Introduction

Various analytical approaches could be taken to assure that sufficient plant systems are available to perform the previously identified plant safety functions. Numerous plant systems are available, alone and in combination with other systems, to provide these required functions. Furthermore, the exact location and specific effects of exposure fires cannot be precisely determined. In general, recognizing the confined physical location of such fires and the operational flexibility and physical diversity of systems available to achieve safe shutdown, one can assume that appropriate plant fire protection features will limit fire damage to the extent that unaffected plant systems will be able to attain safe shutdown. An extensive effort would be required to identify the effects of postulated fires in all potential plant locations on all the plant systems which are normally available to support safe shutdown. As a conservative alternative to this approach, a minimum set of plant systems (safe shutdown systems) and components is identified in response to the requirements of Appendix R which can achieve and maintain safe shutdown in spite of the location of the fire event and the most limiting assumed concurrent loss of off-site power. Demonstration of adequate protection of this minimum system set from the effects of postulated fires constitutes an adequate and conservative demonstration of the ability to achieve and maintain safe shutdown for the purpose of fire protection.

The safe shutdown systems selected for D.C. Cook will be capable of achieving and maintaining subcritical conditions in the reactor, maintaining reactor coolant inventory, achieving and maintaining hot conditions for an extended period of time, achieving cold shutdown conditions within 72 hours, and maintaining cold shutdown conditions thereafter.

4.3.2 Initial Assumptions

(1) The unit is operating at 100% power upon the occurrence of a fire and concurrent loss of off-site power.

(2) The reactor is tripped either manually or automatically.

(3) No additional single failures are considered other than the loss of off-site power and those directly attributable to the fire.

(4) No piece of equipment required for safe shutdown is assumed to be out of service.

4.3.3 Definitions

Hot Standby - The initial safe shutdown state with the reactor at zero power, K_{eff} less than 0.99 and RCS average temperature greater than or equal to 350°F.

Hot Shutdown - Reactor at zero power K_{eff} less than 0.99 and RCS temperature between 350°F and 200°F.

Cold Shutdown - Reactor at zero power, K_{eff} less than 0.99 and RCS temperature below or equal to 200°F.

4.3.4 Safe Shutdown Functions

4.3.4.1 Reactivity Control Function

Initial reactivity control will result from an automatic Reactor Protection System (RPS) trip or from operator initiation of a manual trip upon notification of a major fire. This action will deenergize the normally energized RPS to actuate a reactor trip. The effects of fires on the RPS are not considered to preclude the initiation of an automatic trip or control rod insertion.

Following rod insertion, hot subcritical conditions are achieved for approximately 35 hours with no addition of boron, assuming all rods are inserted into the core and the reactor trip occurs at end of life and at 100% power, with xenon at steady-state level. As xenon decays, however, positive reactivity is added, requiring the addition of borated water from the refueling water storage tank (RWST) to maintain the required margin of shutdown reactivity. The cooldown transition from hot standby to hot shutdown, and ultimately to cold shutdown, requires additional boration to compensate for the negative moderator temperature coefficient. The total quantity of borated water from the RWST (a minimum of 1950 ppm) which must be injected into the Reactor Coolant System (RCS) to achieve the required cold shutdown margin is less than the quantity of borated water from the same source required to maintain a constant pressurizer level during cooldown (Reactor Coolant System volume shrinkage compensation). The Chemical and Volume Control System (CVCS) is capable of injecting this quantity of borated water into the Reactor Coolant System and maintaining the required shutdown reactivity margin throughout safe shutdown. Figure 4.1 depicts the RCS Reactivity Control function.

4.3.4.2 Reactor Coolant Make-up Control

For the assumed fire scenario, reactor coolant make-up control can be achieved by isolation of the normal and excess letdown CVCS paths and operation of the charging portion of the

CVCS through the RCP seal injection path. The boron injection tank (BIT) injection path may also be used for added operational flexibility. Reactor coolant make-up will be available within the first 30 minutes post-reactor trip.

Successful maintenance of RCS integrity is also necessary to achieve adequate inventory and pressure control. Inadvertent opening of boundary isolation valves such as the reactor head or pressurizer vent valves, pressurizer power-operated relief valves, and RHR suction isolation valves have been precluded and adequate maintenance of reactor coolant pump seal integrity achieved to assure safe shutdown.

Control of pressurizer water level achieved manually is by controlling CVCS charging flow based on pressurizer level information. Figure 4.2 depicts the RCS makeup control function.

4.3.4.3 Reactor Coolant Pressure Control

Overpressure protection of the RCS prior to a controlled cooldown and depressurization is provided by the pressurizer safety valves. After alignment of the Residual Heat Removal System (RHR), at approximately 350°F and 400 psig, overpressure protection is provided by the RHR safety valves. The pressurizer safety valves and RHR safety valves, in conjunction with a controlled cooldown and a timely transfer to RHR cooling at or around a Reactor Coolant System temperature of 350°F, should ensure that the RCS pressure-temperature limits are not exceeded. For adequate pressure control, isolation of the pressurizer auxiliary spray will occur as the result of operator action.

The establishment and maintenance of a sufficient subcooling margin within the Reactor Coolant System is essential to successful achievement and maintenance of safe shutdown. In order to provide operational flexibility and to enhance the safe shutdown capabilities of the plant, repair provisions will be developed to provide the availability of at least one backup pressurizer heater group. As discussed in Section 6, the pressurizer heaters are not considered necessary for plant safe shutdown. However, the availability of one group of heaters enhances the capability of maintaining sufficient subcooling margin. Figure 4.3 depicts the RCS pressure control function.

4.3.4.4 Reactor Heat Removal Function

Following a reactor trip with an assumed loss of off-site power, decay heat is initially removed by natural circulation within the Reactor Coolant System, heat transfer to the Main Steam System via the steam generators, and operation of the power-operated atmospheric relief valves (PORVs) or the Main Steam System code safety valves. With the steam generator safety valves alone, the RCS maintains itself close to the nominal no-load condition.

For decay heat removal via natural circulation a minimum of two steam generators will be available. This decay heat removal requires the ability to supply sufficient auxiliary feedwater to the steam generators to make up for the inventory discharged as steam by the safety or relief valves. For maintenance of initial hot standby conditions, the secondary make-up flow required to the steam generators is less than 450 gpm and is supplied by the Auxiliary Feedwater System (AFW). Auxiliary feedwater sources are available from the condensate storage tanks, and alternatively, from the Essential Service Water System (ESW). Auxiliary feedwater may be supplied to the steam generators by the auxiliary motor-driven feedwater pumps or by the auxiliary steam turbine-driven feedwater pump.

The further removal of additional heat is achieved by the controlled operation of the steam generator power-operated atmospheric relief valve (PORV) and continued operation of the Auxiliary Feedwater System. During this cooldown phase, an auxiliary feedwater flow of up to 450 gpm is required and can be supplied with an individual motor- or turbine-driven auxiliary feedwater pump. After reduction of Reactor Coolant System temperature below 350^{o}F, the Residual Heat Removal System is used to establish long-term core cooling through the removal of decay heat from the Reactor Coolant System to the environment via the Residual Heat Removal System, Component Cooling Water System, and the Essential Service Water System. Figure 4.4 depicts the reactor heat removal function.

4.3.4.5 Process Monitoring Function

The operator requires knowledge of various plant parameters to perform required system transitions and essential operator actions. A discussion, by safe shutdown function, of the necessary instrumentation is provided below.

For the fire scenarios assumed in this analysis, inventory make-up to the Reactor Coolant System will be from the refueling water storage tank through the reactor coolant pumps' seal injection lines. An alternative path via the BIT injection path. has been analyzed for operational flexibility; however, it is not required for safe shutdown. As previously discussed, sufficient negative reactivity exists in the Reactor Coolant System (after rod insertion) for 35 hours without the need for additional boron addition. Furthermore, the negative reactivity inserted by the control rods and the RWST water injected by the CVCS (to compensate for the RCS volume decrease) will maintain the core subcritical while cooling down from hot full power to a cold shutdown condition, assuming no letdown is available. Administrative and operational procedures for D.C. Cook will ensure that sufficient boron is added in a timely manner to the primary system to achieve the necessary cold shutdown reactivity margin. With boron addition under procedural control, no operator actions are expected or anticipated based on direct-reading neutron monitoring to ensure an adequate safe shutdown negative reactivity margin. However, core source range detectors will be available for core activity monitoring in the Control Room. An additional source range channel will also be added to a local station, LSI-4, to provide this information for areas requiring alternative shutdown.

Various process monitoring functions must be available to adequately achieve and maintain the reactor coolant makeup, pressure control and decay heat removal functions. For the assumed fire scenario, maintenance of hot standby requires that pressurizer level and RCS pressure instrumentation be available. Reactor Coolant System temperature is maintained during hot standby by proper decay heat removal via steam generators and self-actuation of the main steam code safety valves or controlled operation of the steam generator PORVs. In the natural circulation mode of operation, the difference between the hot-leg and cold-leg wide range temperatures (T_h-T_c) provides a direct indication of the existence of a natural circulation condition.

Operating personnel, by monitoring of RCS pressure and hot leg temperature (T_h) instrumentation and, if available, manual control of the pressurizer heaters (not required for safe shutdown), will maintain RCS pressure to assure that appropriate subcooling margin is achieved. Maintenance of pressurizer level control is achieved by monitoring pressurizer level instrumentation and manual control of CVCS charging flow.

Maintenance of hot standby also requires the control of the secondary system to compensate for variations in the primary system performance. Monitoring of steam generator level and pressure are available to assure adequate and controlled decay heat removal. The level control is achieved by operator manipulation of AFW system flow, based on steam generator level indication. Secondary system pressure will be monitored by steam generator pressure indication.

The plant operators will utilize the instrumentation discussed above for monitoring of natural circulation conditions, subcooling margin, heat removal and compliance with the plant's pressure/temperature limits as it pertains to the low temperature overpressure protection of the Reactor Coolant System (cold leg temperature in conjunction with RCS pressure).

4.3.4.6 Supporting Functions

Various systems are required to provide support to safe shutdown equipment or systems. These support systems are:

(1) Emergency Power System

(2) Essential Service Water System

(3) Component Cooling Water System

Figure 4.5 depicts the supporting system interactions with safe shutdown systems.

The following sections discuss each of the required safe shutdown systems and the support systems.

4.4 Safe Shutdown Systems

4.4.1 Chemical and Volume Control System (CVCS)

The charging portion of the Chemical Volume and Control System (CVCS) accomplishes the following safety functions:

(1) Reactivity control by control of soluble chemical neutron absorber (boron) concentration in the RCS, reactor coolant makeup control by maintaining water inventory in the RCS

(2) Maintenance of reactor coolant pump seal integrity

Reactivity control capability for plant shutdown is provided by the control rods, with boric acid injection used to compensate for the xenon transients. Insertion of the control and shutdown rod groups make the reactor at least 1% subcritical ($k_{eff} \leq 0.99$) following trip from any credible operation condition to the hot zero power condition, assuming the most reactive rod remains in the fully withdrawn position. For the assumed fire scenario, no struck-rod condition need be assumed.

When either unit is at power, the quantity of boric acid retained in its refueling water storage tank, ready for injection to the RCS, always exceeds that quantity required to bring the reactor from a full power condition to hot shutdown and then to cold shutdown.

For the assumed post-fire scenario, make-up water to the Reactor Coolant System will be provided by the Chemical and Volume Control System from the refueling water storage tank (borated at a minimum of 1950 ppm).

Numerous CVCS flow paths are normally available for charging to the RCS. Two separate and independent flow paths will provide reactor coolant makeup and boration:

(1) The charging line to the reactor coolant pumps' seals will always be available if at least one of the charging pumps is operational.

(2) Injection via the boron injection tank is an alternative flow path which is not required for safe shutdown; however, it provides plant operational flexibility.

For the assumed event, charging and boration will be accomplished by operating a minimum of one centrifugal charging pump taking suction from the refueling water storage tank and injecting borated water through the RCP seal injection line to the RCS or as an option borated water may be injected via the boron injection tank. Suction to the charging pump can be delivered from the RWST by opening either one of two normally closed motor-operated valves.

Controlled leakage (letdown) from the Reactor Coolant System normally occurs via the seal leak-off return path and the normal and excess letdown paths. For the post-fire operational sequence, the normal and excess letdown paths will be isolated. Isolation of the normal and excess letdown lines will occur as a result of loss of instrument air or will be achieved by operator action to assure adequate inventory control. Furthermore, procedural control for isolation of all potentially spurious RCS boundary paths, including pressurizer PORVs, reactor and pressurizer post-accident vents and auxiliary spray, will be achieved.

Seal leak-off flow need not be available to achieve safe shutdown. The reactor coolant pump No. 1 seal leak-off air-operated valves fail open. In that condition, seal return flow will be available at the suction of the charging pumps (through the seal water heat exchanger) or it may be locally or remotely isolated by a containment isolation motor-operated valve or by the seal water return filters manual valves.

The injection path from the charging pumps to the reactor coolant pump seals contains only one air-operated valve (normally open, fail-open) which is provided with a minimum flow (50 gpm) mechanical stop. Thus, operation of one charging pump will ensure a minimum RCS charging flow of approximately 20 gpm, irrespective of the availability of the BIT injection path.

The injection path through the BIT (containing 900 gallons of 20,000 ppm borated water) is available for operational flexibility. It requires remote or manual opening of two motor-operated valves in series (total of four motor-operated valves arranged in two redundant sets in series), since the RCS cold leg isolation valves are normally open. Inclusion of the BIT injection path as an alternate charging and boration path, although not essential for safe shutdown, will provide added operational flexibility in the post-fire scenario defined for this analysis.

Isolation of the volume control tank (by closure of either one of two motor-operated valves) during emergency makeup from the RWST and isolation of the seal return line to the seal water heat exchanger can be performed by local manual operation.

Pressurizer water level is maintained by operation of one centrifugal charging pump using pressurizer level instrumentation information.

Centrifugal Charging Pumps

The two high-head centrifugal charging pumps per unit are normally aligned for the CVCS charging function. During design basis accidents they are part of the ECCS system. The centrifugal charging pumps are of the horizontal type with a design flow rate of 150 gpm and a discharge pressure at shutoff of 2749 psig. Each pump is designed to provide rated flow against a pressure equal to the sum of the RCS normal maximum pressure (existing when the pressurizer power-operated relief valve is operating) and the piping, valve and equipment pressure losses at the design charging flows. Each of the centrifugal charging pumps has a minimum recirculation flow motor-operated valve to prevent damage to the pump when it is operating at shut-off pressure. The pumps require cooling water (from the CCW) to their mechanical-seal heat exchangers, gear oil coolers, bearing oil coolers and seal housings. The pumps also require operation of external oil pressure pumps in idle conditions.

Boron Injection Tank

The boron injection tank (BIT) is designed to hold sufficient concentrated boric acid solution to shut down the reactor during a worst-case accident (steam line rupture). Design concentration of boric acid is 12% by weight (equivalent to 20,000 ppm) with a usable volume of 900 gallons. Redundant tank heaters and line heat tracing are provided to assure that the solution is maintained during normal operation at a temperature ($\geq$145^{o}F) which is in excess of the solubility limit (approximately 133^{o}F). Recirculation of the contents of the BIT during normal plant operation is accomplished by using the boric acid transfer pumps.

Should the BIT path be utilized, isolation of the BIT recirculation lines' air-operated valves (fail-closed) will occur either as a consequence of the loss of off-site power or by operator procedural control for the post-fire scenario.

<u>Refueling Water Storage Tank</u>

In addition to its normal duty to supply borated water to the refueling cavity for refueling operations, the RWST provides borated water to ECCS pumps.

The capacity of the refueling water storage tank is based on the requirement for filling the refueling cavity. This quantity is in excess of that required for safe shutdown. Technical specification volume of the RWST is 350,000 gallons of borated water at a minimum of 1950 ppm boron. The maximum boric acid concentration is approximately 1.4 weight percent boric acid.

4.4.2 <u>Reactor Coolant System</u>

The Reactor Coolant System (RCS) consists of four similar heat transfer loops connected in parallel to the reactor vessel. Each loop contains a reactor coolant pump and a steam generator.

In addition, the system includes a pressurizer with associated code safety and relief valves (PORVs). Reactor Coolant System instrumentation includes cold-leg, hot-leg temperatures (wide range), pressure (wide range) and pressurizer water level.

The natural circulation capability of the plant provides a means of decay heat removal when the reactor coolant pumps are unavailable. Natural circulation flow rates are governed by the amount of decay heat, component elevations, primary to secondary heat transfer, loop flow resistance and voiding. The conditions during natural circulation relate to maintaining adequate primary to secondary heat transfer, subcooling and inventory.

For this analysis of safe shutdown capability, two of the four RCS loops will be monitored to ensure that natural circulation is established and maintained.

While in natural circulation, adequate heat transfer and coolant flow are dependent on adequate inventory in both the primary and secondary systems. Maintaining water level above the "U" tubes on the secondary side of the steam generators and adequate level within the pressurizer are required for natural circulation. Confirmation of flow while in natural circulation is accomplished through the use of temperature indications. Those indications are cold-leg temperature (T_c) and hot-leg temperature (T_h). T_c should attain a value which is a few degrees higher than the saturation temperature of the secondary inventory. T_h should attain a value which is less than at full power and higher than T_c. When T_c and T_h attain the values described above, flow and heat transfer have been achieved in the associated RCS loops.

Reactor Coolant System inventory control is based on the operation of CVCS charging paths. High pressure seal water from the CVCS system is injected into the reactor coolant pumps lower radial bearing chamber to prevent leakage of high temperature reactor coolant along the pump shaft. The injection flow splits in the bearing chamber with a portion flowing up through the radial bearing and into the shaft seal chamber. The remaining portion flows down the shaft, through the RCP thermal barrier end into the Reactor Coolant System. For added operation flexibility in a post-fire scenario, the reactor coolant pump thermal barrier cooling path from the Component Cooling Water System can be made available for safe shutdown. Maintenance of either seal injection or thermal barrier cooling provides adequate protection of the reactor coolant pump seals. However, components associated with the CCW thermal barrier cooling flow path are not required for safe shutdown.

<u>Pressurizer Heaters</u>

Subcooling within the RCS can be maintained by controlled operation of the pressurizer heaters and monitoring of RCS pressure and loop hot-leg temperature (T_h). However, the pressurizer heaters are not required for safe shutdown. As an optional operator action to enhance the capability of maintaining sufficient subcooling margin, a minimum heater power of 150 kW will be available from any of the back-up heater groups. This additional heat will conservatively cover heat losses from the pressurizer at or below normal operating temperature/pressure with no allowance for continuous spray. Under loss of off-site power conditions, a backup heater group can be repowered from the opposite unit.

Pressurizer Safety Valves

Overpressurization protection of the RCS is assured by three spring-loaded, self-activated pressurizer code safety valves set at a pressure of 2485 psig. The combined capacity of the valves is equal to or greater than the maximum pressure surge resulting from a complete loss of load without reactor trip.

4.4.3 Main Steam Systems

For the post-fire scenario, maintenance of the steam generator inventory and control of steam generator pressure are required for both hot standby and subsequent primary system cooldown to support the decay and sensible heat removal function within the applicable operational limits.

The Main Steam (MS) System consists of four parallel flow paths, one from each steam generator to the main turbine of the unit. The MS system will be isolated either by operation of the turbine stop valve or by the steam generator main steam stop valves.

In accordance with supporting FSAR analysis, inventory control of two steam generators is sufficient to provide the reactor heat removal function during natural circulation conditions.

Maintenance of the steam generator water level during the period of auxiliary feedwater operation (hot standby) involves remote or local manual positioning of the auxiliary feedwater flow control valves and operation of the motor-driven or turbine-driven auxiliary feedwater pumps based on steam generator level information. Steam generator water level and pressure indication are available in the Control Room, on the hot shutdown panels and at the Local Shutdown Indication (LSI) stations (located at the auxiliary feedwater flow control valve stations).

The MS system is also designed to deliver motive steam to the turbine-driven auxiliary feedwater pumps. Steam to these turbines is supplied by branch connections upstream of the steam generator stop valves on two steam lines in each unit (corresponding to steam generators No. 2 and 3). Either line is sufficient to supply steam for the auxiliary feedwater pump turbine, but two are provided for redundancy. These lines are tied together with a normally open motor-operated shut-off valve and a check valve in each line before the cross-tie.

Safety Valves

In the main steam enclosures outside of the containment, a bank of five code safety valves are installed on each steam line.

The five safety valves (two set at 1065 psig, two at 1075 psig, one at 1085 psig) on each line are installed to protect the MS system against overpressure and to provide a combined relieving capacity greater than the maximum steam flow rate.

Power-Operated Relief Valves

A power-operated relief valve (PORV) is provided on each steam line which is capable of releasing the sensible and decay heat to the atmosphere. The PORVs are used for plant cooldown by steam discharge to the atmosphere since the steam dump system is assumed not available. The PORVs have a total combined capacity of approximately 10% of the maximum steam flow. For the assumed fire scenario, a minimum of two PORVs, will be used to provide the Reactor Coolant System controlled cooldown.

Controls for the steam generator PORVs are provided in the Control Room, in the hot shutdown panels, and locally at the shutdown stations. During hot standby conditions, the steam generator PORVs will be used in manual steam pressure control mode. Thus, the RCS temperature is controlled by maintaining the steam generator at the corresponding saturation pressure.

4.4.4 Auxiliary Feedwater System

The Auxiliary Feedwater (AFW) System is required during hot standby to support RCS decay heat removal. For hot standby, secondary system (steam generator) inventory control is provided by the AFW system. Each unit contains two motor-driven pumps and one turbine-driven pump which are dedicated to each unit. In addition, any motor-driven pump can be cross tied to the opposite unit by the opening of one manual cross-connect valve. Thus, each unit has the capability of receiving auxiliary feedwater from five separate pump sources (four motor-driven and one turbine-driven). Each motor-driven pump is rated at 450 gpm and each turbine-driven pump is rated at 900 gpm, with both flow capacities being at 1175 psig discharge pressure. The pumps have the design capability of providing the rated flow against a steam generator pressure of 1065 psig (the lowest steam generator safety valve setpoint).

The AFW system is designed to deliver enough water to maintain sufficient heat transfer in the steam generators in order to prevent loss of primary water through the RCS pressurizer safety or relief valves.

Turbine-Driven Auxiliary Feedwater Pumps

The turbine-driven auxiliary feed pump (TDFP) is designed to deliver a sufficient flow to all four steam generators of the unit with which it is associated and maintain steam generator water levels above the lower limit of the wide range level indicator. Each is a horizontal, six-stage, centrifugal pump driven by a single-stage atmospheric exhaust turbine. On automatic operation mode, the turbine will function as a single speed machine. However, manual speed control is available in the Control Room, on the hot shutdown panels and locally. Loss of control air to the turbine governor will result in the governor reverting to the maximum speed setpoint; however, speed can subsequently be controlled locally. Two overspeed trip devices are provided. The electrical overspeed trip, set at 115% speed, resets automatically after a trip. The mechanical overspeed trip device, set at 125% speed, must be reset manually.

Each auxiliary feedwater pump turbine has its own self-contained lube oil system utilizing sleeve bearings lubricated by a shaft-rotary-type pump driven from the turbine shaft. Water for the cooler is supplied from the auxiliary feed pump discharge line, thus ensuring a cooling water supply whenever the auxiliary feed pump turbine is operating.

Steam generators No. 2 and/or 3 provide motive steam to the turbine-driven auxiliary feedwater pump. The TDFP is capable of operating down to a steam pressure of 125 psia, at which time the Residual Heat Removal System may be placed in service.

Motor-Driven Auxiliary Feedwater Pumps

Each unit is supplied with two motor-driven auxiliary feedwater pumps (MDFP) with only one required for safe shutdown. The other unit's MDFPs are also available by opening cross-tie discharge valves.

Each pump is a horizontal, eight-stage centrifugal pump. The pumps require no external lube oil cooling or other support services other than ac power.

Condensate Storage Tanks

At hot standby, the minimum volume of water required by the plant technical specification for the Condensate Storage Tank (CST) is 175,000 gallons. Should the CST supply become exhausted, the alternate unit's CST is made available through a single cross-tie, normally closed, air-operated valve (fail-closed). As a backup to both these sources of makeup water, cross-ties to the Essential Service Water System (ESW) are provided. Ample time is assumed available post-fire for a local manual realignment of the normally closed valves that isolate ESW from the suction of the auxiliary feedwater pumps.

4.4.5 Residual Heat Removal System

The Residual Heat Removal (RHR) System is designed to remove residual and sensible heat from the core by reducing the temperature of the RCS during the hot and cold shutdown phases of safe shutdown.

The RHR system consists of two RHR heat exchangers, two RHR pumps and the associated piping, valving and instrumentation necessary for operational control. The design residual heat load is based on the residual heat fraction of the full core MW (thermal) power level that exists 20 hours following reactor shutdown from an extended power run near full power.

During cold shutdown operations, reactor coolant flows from the RCS to the RHR pumps through the tube side of the RHR heat exchangers and back to the RCS. The heat load is transferred by the RHR heat exchangers to the Component Cooling Water System which is circulating on the shell side of the heat exchangers. The inlet line to the RHR system is located in the hot leg of the reactor coolant loop No. 2 while the return line is connected to the cold legs of reactor coolant loops Nos. 2 and 3.

Two motor-operated valves in series isolate the inlet line to the Residual Heat Removal System from the Reactor Coolant System. The return lines are isolated by check-valves in series in each line and a common motor-operated valve. To avoid potential RCS boundary leakage at this high/low pressure interface, one of the motor-operated valves in the RHR suction line will be kept closed (pre-fire condition) with the corresponding motor control center breaker in the open position.

A minimum flow return line from the downstream side of each residual heat exchanger to the corresponding pump's suction line is provided to assure that the RHR pumps do not overheat under low flow conditions. A motor-operated valve located in each minimum flow line will be opened if RHR pump flow falls below 500 gpm and will be closed when the flow increases above 1000 gpm.

The cooldown rate of the reactor coolant is controlled by regulating the flow through the tube side of the RHR heat exchangers. A bypass line, which serves both residual heat exchangers, is used to regulate the temperature of the return flow to the RCS as well as to maintain a constant flow through the RHR system.

The RHR system can be placed in operation when the pressure and temperature of the RCS are less than 400 psig and 350^{O}F, respectively. If one of the pumps and/or one of the heat exchangers is not operative, safe operation of the plant is not affected; however, the time for cooldown is extended.

Residual Heat Removal Pumps

Two identical pumps are installed in the Residual Heat Removal System. Each pump is sized to deliver sufficient reactor coolant flow through the residual heat exchangers to meet the plant cooldown requirements.

A seal heat exchanger for each pump is supported by operation of the Component Cooling Water System.

RHR Safety Valves

The RHR system safety valves provide RCS cold overpressure protection whenever the RHR system is in operation. The valves are located inside containment, one each on the RHR system suction and discharge path, and discharge to the pressurizer relief tank. The valves are set at 450 psig and 600 psig, respectively.

Accumulators

The manual isolation of the accumulators is assumed as a post-fire activity. The isolation valve at each accumulator is closed only when the RCS is intentionally depressurized below 1000 psig. If these valves' associated cables were damaged by fires, the isolation is assumed to be performed locally, governed by adequate plant procedures (post-fire).

4.4.6 Component Cooling Water System

The Component Cooling Water (CCW) System is a supporting system to other safe shutdown systems. Two redundant trains are available, each consisting of one pump and heat exchanger and associated valves, piping and local instrumentation.

The CCW system for each unit serves as an intermediate heat transfer loop between the various safe shutdown components and the Essential Service Water System (ultimate heat sink).

The CCW system provides cooling for the following safe shutdown equipment in each unit:

(1) Residual heat removal exchangers

(2) Centrifugal charging pumps

- (a) Mechanical-seal heat exchangers
- (b) Gear oil coolers
- (c) Bearing oil coolers
- (d) Seal housing

(3) Residual heat removal pumps mechanical-seal heat exchangers

(4) Reactor coolant pump thermal barrier heat exchanger

Each unit is served by two component cooling pumps, two component cooling heat exchangers, a surge tank and associated piping and valves. A spare swing pump is available as a replacement for any pump on either units CCW system by valving it into the appropriate CCW headers and by connecting it into the other pump's power supply and control circuitry.

One pump and one component cooling heat exchanger per unit fulfill the heat removal function during normal full load operation for various components located in the Auxiliary and Containment Buildings. During plant cooldown in RHR mode, two pumps and two heat exchangers per unit are normally utilized to remove the residual heat. If one of the loops is not operative, only one RHR loop is effective and cooldown then is at a slower rate.

The two component cooling loops associated with one unit are interconnected downstream from the heat exchangers to effectively form an open loop supply header both for loads which are essential and those that are nonessential. For the present analysis of safe shutdown, no isolation of nonessential loads is assumed to be required. However, in anticipation of a potentially large cooling demand, the operator can isolate the component cooling inlet to nonessential loads or shift to the other units component cooling system by remotely and/or manually operated valves.

The essential loads, other than the residual heat exchangers, are normally valved open to the supply header and they discharge to the suction of the component cooling pump with which they are normally associated, so that component cooling water is circulated continuously through the essential loads during normal operation.

Each of the component cooling outlet lines from the residual heat exchangers has a normally closed motor-operated valve which must be opened during RHR cooldown. The motor-operated valves that isolate the CCW system from the reactor coolant pump thermal barrier coolers are included as safe shutdown components for operational flexibility in a post-fire scenario, since the thermal barriers perform a redundant function to the seal water injection cooling.

By appropriate realignment of pump suction and discharge header cross-tie valves, one of the opposite units CCW pumps may be dedicated to providing flow to the fire-affected unit.

A surge tank is connected to the suction side of the pumps, and makeup to the system is supplied to the surge tank from the demineralized water system.

4.4.7 Essential Service Water System

The Essential Service Water (ESW) System provides cooling for the following safe shutdown heat transfer equipment:

(1) Component cooling heat exchangers

(2) Emergency diesel generator heat exchangers

The system also provides a back-up supply of water to the AFW system in the event that the condensate storage tanks are depleted.

This system, shared by both units, consists of four pumps, each with its associated duplex discharge strainer, and two main headers. Each redundant header is served by two pumps (one for each unit) and each header, in turn, serves the corresponding essential loads in both units. These components, together with the associated heat exchangers, valving, piping local instrumentation, complete the Essential Service Water System.

During normal operation, water is supplied through the circulating water intake pipes from the lake to the pumps suction well located in the screenhouse.

The Essential Service Water System can remove the heat transferred to the Component Cooling Water System from both units, plus the heat loads of the emergency diesel generator engine coolers (i.e., the air aftercoolers, lubricating oil cooler, and jacket water cooler), the Control Room air conditioner condensers, and provide make-up flow to the turbine- and motor-driven auxiliary feedwater pumps.

Essential Service Water Pumps

Four pumps are installed in the center portion of the screenhouse. The pumps are vertical turbine pumps with enclosed shafts. Grease-lubricated line bearings eliminate the need for external water lubrication. Two pumps serve each one of the two main supply headers. No more than three of these pumps are required in any given circumstances to provide necessary flexibility of operation for both units. Two operable pumps are sufficient to carry the heat removal duties of two units at hot or cold shutdown simultaneously (at minimum cooldown rate). Local manual operation of motor-operated valves is credited post-fire.

4.4.8 Emergency Power System

The plant Emergency Power System (EPS) includes an on-site, independent, automatically or manually starting emergency power source that supplies power to essential safe shutdown equipment if the normal off-site power sources are unavailable.

The emergency power source for each unit consists of two 4160V, 3500 kW diesel generators. Each diesel engine is equipped with its own auxiliaries. These include starting air, fuel oil, lube oil, cooling water, intake and exhaust system, speed (RPM) regulator and controls. Cooling water is provided from the Essential Service Water Systems while electric power for each engine's auxiliaries is provided by its own generator.

Cranking power for each diesel is supplied from its respective high pressure starting air system. Energy for starting a diesel is derived from two air receivers each containing enough high pressure compressed air to provide for multiple starting sequences.

There are two diesel fuel oil storage tanks on site, physically separated from each other. The piping is arranged so that each storage tank supplies fuel to one emergency diesel generator in each unit while the other storage tank supplies fuel to the other emergency diesel generator in each unit. Two fuel oil transfer pumps per diesel generator provide transfer capability from the storage tanks to the individual diesel generator day tanks.

The emergency power sources for the two units are similar and are electrically and physically isolated from one another, as are the diesel generator sets for each unit. Each diesel generator is capable of supplying ac power to one path of safe shutdown equipment with one supplying power to 4kV buses T11A and

T11B (T21A and T21B for Unit 2) and the other supplying power to T11C and T11D (T21C and T21D for Unit 2). The diesel generators supply power to 600V buses 11A, 11B, 11C, and 11D through the 4160V buses T11A, T11B, T11C, and T11D, respectively.

Loss of voltage to the 4160V diesel buses above is sensed by undervoltage relays. Upon sensing, master relays automatically start the emergency generators, trip the normal feed circuit breakers for the 4160V diesel buses and trip all motor feeder breakers on the diesel buses, the 600V bus tie breaker, and all nonessential 600V motor feeder breakers. The emergency generator circuit breaker which connects the diesel generator output to the 4160/600V bus system is closed when rated voltage is obtained.

HVAC equipment is available to provide cooling for the rooms containing the diesel generators and other EPS support equipment. Since the HVAC equipment and all associated power and control cabling is contained within these rooms, separation analysis of the HVAC system was not required.

4160V Emergency Power System

Each 4160V diesel bus (T11A and T11B, T11C and T11D) is fed from a 4.16kV diesel generator to supply power to the engineered safety features and other necessary equipment in the event of a loss of off-site power. There are two diesel generators associated with each unit. Each diesel generator is connected to two 4160V buses, one to buses T11A and T11B and one to buses T11C and T11D. Upon loss of power to a 4160V diesel bus, the associated diesel generator starts automatically or manually by operator action. The circuit breaker which normally supplies power to that diesel bus from the main 4160V bus is tripped. A 4.16kV circuit breaker in each bus is automatically closed when its diesel generator is at speed and rated voltage and reenergizes the bus. The diesel generators will then supply all equipment which must operate under emergency conditions for the respective safeguard train.

Low Voltage Power System

The 600V auxiliary system distributes power for all low voltage station service demands other than the pressurizer heaters. The normal source of power for the 600V system is the 4160V system buses via the 4160/600V transformers. The pressurizer heaters are fed from the 4160V system buses via their 4160/480V transformers and individual load centers and motor control centers. The pressurizers heaters can be connected to the diesels.

The switchgear is metal-clad with 250V dc operated air circuit breakers. The 4160/600V transformers are filled with nonflammable liquid. The 600V system is divided into six bus sections, four of which (11A, 11B, 11C and 11D) are safety buses, 11A and 11B for one safety train and 11C and 11D for the other. The power source for each of these buses is 1500kVA, 4160/600V transformer whose primary is connected to buses T11A, T11B, T11C and T11D, respectively. Bus tie-breakers between buses 11A and

11C and buses 11B and 11D are provided so that a 1500kVA transformer can feed two adjacent 600V buses, should one of the transformers fail. Upon signal to start the diesel generators, the 600V bus tie breakers are opened automatically. The bus tie breakers and 600V source breakers are interlocked to eliminate the possibility of inadvertent parallel operation of diesels. A similar 600V system is provided for Unit 2.

Two 480V buses, 11PHA and 11PHC, are fed from two of the 4.16kV buses, T11A and T11D respectively, via two 1000kVA, 4160/480V transformers. These buses supply power to the pressurizer heater loads. An identical 480V system is provided for Unit 2.

<u>120V AC Vital Instrument Bus System</u>

The 120V ac Vital Instrument Bus System consists of four separate vital buses per unit which are supplied by four independent 5.0kVa, single-phase static inverters. Two of the inverters are connected to one of the unit batteries, the other two are connected to the second battery in the same unit. The input to each inverter is from a 600V motor control center, or a 250V unit battery.

The output of each inverter is connected to a distribution cabinet through a normally closed circuit breaker. The distribution cabinets supply all of the required normal safe shutdown instrument channels. Alternative shutdown (LSI) instrumentation is fed directly from 120V ac distribution cabinets in either the fire-affected or unaffected unit.

250V DC System

The 250V dc system supplies power for operation of switchgear, vital bus inverters, power-operated valves and Control Room emergency lighting. The battery system for each unit consists of two separately located sets of lead acid cells. Each cell battery has its own active normal charger and a wired standby charger. Following a loss of unit normal power, the battery chargers are energized from the emergency diesel generators.

The battery distribution switchboard consists of several metal-clad structures, each with a 250V dc, two-wire ungrounded main bus, and two-pole manually-operated fused disconnecting switches.

During normal operation the 250V dc load is fed from the battery chargers, with the batteries floating on the system. Upon loss of ac power, the entire dc load is drawn from the batteries. The loads powered from the battery include the diesel generator circuits, 4kV switchgear, 600V and 480V load centers, electrically-operated valves, Control Room emergency lighting and vital bus inverters. The batteries are sized for three hours of operation after a loss of ac power, predicated upon the continuous operation of all dc emergency equipment. However, upon start-up of the emergency diesel generator, the battery chargers are energized to take over the load and recharge their associated battery.

All direct current loads associated with engineered safeguards equipment are fully redundant. These loads are arranged so that one battery supplies each redundant function.

A circuit is provided to cross-tie the AB and CD train plant batteries and loads on each unit. This circuit has redundant isolating switches, one at each point of connection to the two battery systems. Under normal conditions, both of these switches are kept open and the circuit deenergized.

The trip and close coils for the 4kV, 600V and 480V breakers are electrically independent of one another and must be energized to operate. The breakers will not change position if control power is lost.

<u>250V DC Battery N System</u>

The 250V dc N train battery supplies power for the operation of the turbine-driven auxiliary feedwater pump (TDFP). This battery system (per unit) consists of one battery (one set of lead acid cells) and two battery chargers, each supplied from a separate safety train ac bus. This N battery is physically and electrically isolated from the other unit batteries.

The battery distribution switchboard consists of one metal-clad structure with a 250V dc, two-wire ungrounded main bus, and two-pole manually-operated fused disconnecting switches.

During normal operation, the 250V dc load is fed from one of the battery chargers, with the battery floating on the system. Upon loss of station ac power, the entire dc load is drawn from the battery. The majority of the load consists of the electrically-operated auxiliary feedwater valves serving the steam generators from the turbine-driven auxiliary feedwater pump system, and the steam admission valve to the turbine-driven auxiliary feedwater pump. The auxiliary feedwater to steam generator valves are normally open and the TDFP trip and throttle valve is energized to open. The remaining load consists of the auxiliary feedwater turbine control bus. The AFW turbine control bus encompasses the AFW turbine start and trip circuits, the overspeed monitor, the test valve, and the emergency leak-off valve. The battery is sized to allow anticipated operation of the valves and their control circuits with the battery chargers and backup feed circuits deenergized. The battery is capable of serving the turbine-driven auxiliary feedwater pump for as long as the steam supply to the turbine is available.

4.5 Identification of Safe Shutdown System Components

Subsection 4.4 described the specific systems which will be used to achieve safe shutdown. This subsection discusses the method of selection of safe shutdown components at D.C. Cook.

For each system, plant flow diagram (hereafter referred to as P&IDs, also refer to Figures 4.6 through 4.19.2) system descriptions, and one-line diagrams (refer to Figures 4.20

through 4.23) were used to identify the precise primary flow paths and operational characteristics that must be established to accomplish the desired safe shutdown function. From this information, a list was compiled of the components which participate in the system's performance of its safe shutdown function. These components are:

(1) Active components that need to be powered to establish, or assist in establishing, the primary flow path and/or the system's operation.

(2) Active components in the primary flow path that normally are in the proper position whose power loss will not result in a change of position, but may be affected by open, short or ground faults in control or power cabling.

(3) Power-operated components that need to change position to establish or assist in establishing the primary flow path, whose loss of electrical or air supplies result in the component adopting the required safe shutdown position but which may be affected by open, short or ground faults in control or power cabling.

(4) Major mechanical components that support safe shutdown (heat exchangers and storage tanks).

From the analysis of the safe shutdown system flow paths, those components whose spurious operation would threaten safe shutdown system operability were also identified (see Table 4-3). This identification included those branch flow paths that must be isolated and remain isolated to assure that flow will not be substantially diverted from the primary flow path. See Subsection 4.7 for the detailed discussion of spurious operations.

A list was generated for safe shutdown devices including device identification, normal operating status, operating requirements for the various shutdown stages (hot standby, hot shutdown and cold shutdown), required supporting services, and plant location.

This safe shutdown equipment list for D.C. Cook contains the minimum amount of equipment necessary to safely shut down the units. For reasons of operational flexibility and to further enhance the conservatisms of this analysis, paths such as injection through the boron injection tank (BIT) and thermal barrier coolers for the reactor coolant pumps were identified in Sections 4.3 and 4.4. Optional components are not considered safe shutdown and, therefore, are not included in the safe shutdown component list of this report or in the computerized Safe Shutdown System Analysis report. However, the optional components associated with the BIT flow path are included as safe shutdown components.

The final safe shutdown component list developed for D.C. Cook Units 1 and 2 includes the minimum components required to protect the safe shutdown capability from the exposure fire damage postulated in Appendix R. These lists are provided as Table 4-1 for Unit 1 equipment and Table 4-2 for Unit 2 equipment.

4.6 Identification of Safe Shutdown Circuits and Cables

The computer database developed during the D.C. Cook safe shutdown system analysis (see previous section) was the basic input for the identification of electrical circuits essential to ensure an adequate equipment performance. All the electrically-dependent devices in Table 4-1 were used to identify the corresponding safe shutdown electrical circuits, except for those motor-operated valves for which manual operation was assumed during long-term cooldown (RHR, etc.). The circuits identified included power (4160V ac, 600V ac, 480V ac and 250V dc), control (220V ac, 120V ac and 250V dc) and instrumentation.

The identification and analysis of the above essential electrical circuits were based on one-line diagrams, elementary circuit drawings, and cable block diagrams from which the necessary circuit cables were selected for the later phase of cable routing and separation analysis.

For each electrical circuit, all circuit cables that ensure operability with no detrimental failure of each component were identified as required for safe shutdown. The exceptions to the above criteria included annunciator, computer, motor stator heaters and external monitoring circuits that are electrically isolated form the electrical circuits of concern.

The D.C. Cook conduit and cable raceway schedules were then used to identify the individual cable physical routings. A computer data was developed to contain all essential cables and their associated routings. For each safe shutdown system, a package was also developed that contained the following information:

(1) Safe shutdown component datasheet

(2) Mark-up of cable block diagrams with identified essential cables

(3) Database output with cable routing information

This routing information was extracted and used to color-code and identify the approximate location of these cables on electrical cable tray and conduit layout drawings, by system and by fire areas (see Section 4.8).

4.7 Associated Circuits of Concern

4.7.1 Introduction

The separation of protection requirements of 10 CFR 50, Appendix R apply not only to safe shutdown circuits but also to "associated" circuits that could prevent operation or cause maloperation of shutdown systems and equipment. The identification of these associated circuits of concern was performed for D.C. Cook in accordance with NRC Generic Letter 81-12 and the Staff's Clarification to the Generic Letter. The latter further defined these associated circuits of concern as those which have a physical separation less than that required by Section III.G.2 of Appendix R, and have one of the following:

(1) A common power source with the shutdown equipment and the power source is not electrically protected from the circuit of concern by coordinated breakers, fuses, or similar devices;

(2) A connection to circuits of equipment whose spurious operation would adversely affect the shutdown capability;

(3) A common enclosure with the shutdown cables, and,

(a) are not electrically protected by circuit breakers, fuses or similar devices, or

(b) will allow propagation of the fire into the common enclosure.

4.7.2 <u>Identification of Associated Circuits of Common Power Supply and Common Enclosures</u>

The electrical distribution system was reviewed to assure that acceptable coordination and selective tripping is provided for all circuits on the Emergency Power System. The review was limited to the EPS since there is no equipment powered from the balance of plant distribution systems which is required for, or whose loss of power could prevent, safe shutdown.

The Emergency Power System consists of:

(1) 4160V ac switchgear

(2) 600V ac load centers and motor control centers

(3) 480V ac load centers and motor control centers for the pressurizer backup heaters

(4) 120V ac vital instrumentation buses

(5) 250V dc distribution buses.

Electrical circuit fault protection was originally designed to provide protection for plant electric circuits via protective relaying, circuit breakers and fuses. This protective equipment was designed and applied to ensure adequate protection of all electrical distribution equipment, including cables, from electric faults and overload conditions in the circuits. The selection and application of these devices was in accordance with the American Electric Power design practices. The use of these design practices assures that, for electric fault and overloads, cables have a level of protection which prevents degradation beyond that which would be experienced by continuous operation of these cables at their rated current value. The operation of these protective devices, by limiting cable damage, also prevents the occurrence of cable faults which could cause ignition of these cables.

An integral part of the original electrical system protection was the proper coordination of all these devices. Such coordination assures that the protective device nearest (in an electrical sense) to the fault operates prior to the operation of any "upstream" protective devices, and provides interruption of electrical service to a minimum amount of equipment. The original electrical protection design at D.C. Cook required coordination of such electrical protective devices.

These original D.C. Cook electrical design practices provided confidence that no associated circuits of concern by common power supply or by common enclosure Type 1 exist at D.C. Cook. As an additional check, a review was conducted of the existing electrical protection and coordination at D.C. Cook for the safe shutdown power supplies. As expected, most of the circuit protective devices reviewed had been properly selected and were coordinated. Design changes have been initiated to correct the few remaining deficiencies identified during the review.

For associated circuits of concern by common enclosure Type 2, the design of the fire protection features at D.C. Cook ensures that no such circuits exist. Associated circuits of concern that occur as intervening combustibles are resolved by one or both of the following methods:

(1) Use of nonpropagating cable jacket materials

(2) Use of fire stops at appropriate cable tray sections to prevent damage to hot shutdown system cables

4.7.3 Spurious Operation Analysis

Cables that are not part of safe shutdown circuits may be damaged by the effects of postulated fires. This cable damage may consequently prevent the correct operation of safe shutdown components, or result in the maloperation of equipment which would directly prevent the proper performance of the safe shutdown systems.

The effects of spurious operations may be conceptually divided into two subclasses as follows:

(1) Maloperation of safe shutdown equipment due to control circuit electrical interlocks between safe shutdown circuits and other circuits; for example, the numerous pressurizer heater automatic operation interlocks from process control and instrument circuits

(2) Maloperation of equipment that is not defined as part of the safe shutdown systems, but that could prevent the accomplishment of a shutdown safety function; for example, inadvertent depressurization of the Reactor Coolant System or the Main Steam System by spurious opening of boundary valves

For Subclass I, a detailed review of all safe shutdown circuit elementaries was performed and all interlocks to other circuits were identified. A Failure Modes and Effects Analysis (FMEA) was performed to determine if maloperation of these interlocks (inadvertent opening of closed contacts or closing of open contacts) would prevent the proper operation of the safe shutdown equipment. If such a condition could occur, the safe shutdown circuit and the maloperating interlock were identified.

For Subclass 2, a system engineering review was performed on plant system and equipment that were not part of safe shutdown systems to determine which of these components had the potential to defeat safety functions by their spurious operation. These components, their normal and their unacceptable operating states, along with their associated control circuits, were identified and tabulated. A FMEA was performed for cables of these circuits to determine if conductor-to-conductor shorts, conductor open circuits or conductor grounds could result in a component transition to an unacceptable state. If such a condition could not occur, the component was removed from the potential list.

The above exercise results in a list of potential spurious operation candidates for which a resolution was required to protect safe shutdown capability.

For the purpose of conducting these analyses, the loss of instrument air or off-site power was assumed only for those cases where such a loss could cause unacceptable consequences.

Alternatively, if the existence of instrument air or off-site power resulted in unacceptable consequences, then these were assumed available.

The results of these analyses were tabulated and resolution was achieved by:

(1) Providing a means to isolate the equipment when not normally needed (e.g., remove power cables, open circuit breakers), or

(2) Providing a means to detect spurious operations and then undertaking procedures to defeat the maloperation of equipment (e.g., opening of breakers to remove spurious operation, actuation of a master switch, etc.).

For these potential spurious circuits or components, resolutions are shown in Table 4-3 and, to the extent necessary, will be incorporated into operating procedures.

For the purpose of conducting these spurious operation analyses, the loss of instrument air or off-site power was assumed where such a loss could cause unacceptable consequences. Alternatively, if the existence of instrument air or off-site power results in unacceptable consequences, then they were assumed available.

In order for cable faults that generate spurious operation to occur, various conditions must exist synergistically at the cable fault location:

(1) Sufficient energy must exist due to the fire to create failure of the cable jacket and insulating material.

(2) The failure of the jacket and insulating material must occur in a way that directly exposes the cable conductors.

(3) For each short, two or more specific conductors must come into direct contact causing low impedence conductor-to-conductor connections.

(4) For certain types of spurious operation, multiple electrically independent shorts must occur.

(5) No additional conductors that would cause circuit fault currents and operation of circuit protective devices may participate in the short condition.

(6) No ground faults that would cause operation of circuit protective devices must occur.

The spurious operation analysis performed for Donald C. Cook recognized the extremely low probability of certain types of these faulted conditions. The following cable short conditions causing spurious operation were considered of sufficiently low likelihood that they were assumed not to require additional analysis or modification:

CASE 1) Three phase-ac power circuit cable-to-cable faults (4 kV, 600V and 480V)

CASE 2) Two wire ungrounded-dc power circuit cable-to-cable faults (250V)

CASE 3) Two wire ungrounded-dc control circuit cable-to-cable faults (250V)

CASE 4) Single phase ungrounded-ac control circuit cable-to-cable faults (220V)

With respect to Cases 1) and 2), no conductor-to-conductor faults within the same power cable can cause spurious powering of the associated device. Only power cable-to-cable connections between one deenergized and one energized power circuit could permit operation. For the case of the three-phase-ac circuit, three electrically independent cable-to-cable shorts must occur without grounds in order to power the associated device. Similarly, for the two-wire ungrounded dc power circuit, two electrically independent cable-to-cable shorts without grounds must occur. The likelihood of such occurrences has been acknowledged by the NRC Staff to be sufficiently low to permit excluding such faulted conditions from consideration (Federal Register Vol. 48, No. 86 at 19963).

The fundamental basis for excluding such shorts from consideration is based on the need to provide multiple cable-to-cable electrically independent faults in order for spurious operation to occur. With respect to Cases 3) and 4), Indiana and Michigan Electric Company has excluded such cable-to-cable faults causing spurious operation based on similar technical considerations.

Concerning Case 3), all dc control circuits at D.C. Cook are ungrounded. In order for spurious operation to occur, due to circuit-to-circuit faults between dc circuits supplied from different sources, at a minimum, two electrically independent cable-to-cable shorts without grounds must occur. This is identical to the type of shorted conditions discussed in Case 2).

Furthermore, the same condition, two independent cable-to-cable shorts, must occur even for those dc circuits supplied from the same source. This is due to the Indiana and Michigan Electric Company design standard that, in general, requires that the control switch and relay contacts "double break" the positive and negative control leads for components whose spurious operation could affect safe shutdown (e.g., solenoid and motor-operated valves) (see Figure 4.34). The implementation of this design standard for these control circuits (250V dc and 220V ac) at Donald C. Cook prevents single cable-to-cable faults from initiating spurious operation.

For the ungrounded ac control circuits in Case 4), the identical consideration exists. MCC transformer secondary 220V ac control circuits are ungrounded. Therefore, at a minimum, two cable-to-cable shorts must simultaneously occur in order for spurious operation to result for circuits supplied from different sources. In addition, for circuits supplied from the same source, the "double break" Indiana and Michigan Electric Company design standard would require two cable-to-cable independent shorts to occur prior to device spurious operation.

The control circuit cable construction at D.C. Cook further decreases the probability of any cable-to-cable faults due to the extensive use of asbestos-jacketed control cable. Asbestos-braided cable jacketing prevents the intimate conductor-to-conductor contact required for hot shorts because the jacketing retains its physical integrity for the full spectrum of exposure fires postulated. In those installations where asbestos jacketed cable is not used, only IEEE-383 qualified cable exists. These cabling jacket compounds, although not as structurally impervious to fire effects as asbestos, have extremely high softening temperatures and are not prone to the conductor breakthrough phenomena that occur with lower temperature jacket materials such as PVC.

4.7.4 Supplementary Information Related to Table 4-3

This section provides supplementary information related to Table 4-3, "Potential Spurious Malfunctions That Could Affect Safe Shutdown - Resolution Statements Concerning Procedural Detection and Termination."

The concepts of procedural detection and isolation were used in the Resolution column of Table 4-3 to represent the fact that safe shutdown procedures would contain sufficient information to permit plant operating personnel to:

(1) Assess the performance of safe shutdown functions using the safe shutdown instrumentation available

(2) Identify on a component basis those components whose spurious operation could be causing the safe shutdown instrumentation off-normal indications

(3) Identify on a component basis the specific operator actions that could be taken to mitigate the consequences of the component's spurious operation

The components in Table 4-3 whose resolution requires post-fire operator action can be segregated into five general categories. These are listed below.

Category 1: Potential Spurious Operations That Must Be Resolved for Cold Shutdown Only

The components in this category are ILS-950, ILS-951, IMO-330, IMO-331, IMO-340, IMO-350, ICM-305, and ICM-306. For these components, operator verification of appropriate system alignment and component availability will be procedurally required prior to cold shutdown initiations.

Category 2: Components That Permit Letdown from the Reactor Coolant System

These components include QRV-111, QRV-112, QRV-160, QRV-161, QRV-162, QRV-113, QRV-114, QRV-170, NRV-151, NRV-152, NRV-153, NSO-021 through NSO-064. Spurious operation of selected combinations of these components may cause sufficient uncontrolled letdown to impact the ability of the CVCS charging pumps (150 gpm each) to provide adequate makeup to the Reactor Coolant System. Monitoring of pressurizer level instrumentation will provide the operator with sufficient primary information to determine that spurious operation is causing uncontrolled letdown in excess of available charging flow. Based on this and other backup information that will likely be available, operators will be procedurally directed to initiate certain actions including systematically verifying and isolating all potential letdown paths.

Category 3: Components That May Impact CVCS Makeup

The only components in this category when the BIT injection line is utilized are IRV-251 and IRV-252. The instrumentation to be used and the actions to be taken for these valves are identical to those discussed in Category 2.

Category 4: Components That Affect Maintenance of RCS Pressure

Components in this category are QRV-51, LV-459C and LV-460D.[1] Spurious operation of these components will be detected by monitoring pressurizer presure, pressurizer level and reactor coolant system temperature instrumentation. This instrumentation will provide information to indicate that, via spurious operation of the auxiliary spray line valve or lack of pressurizer heaters, reactor coolant system pressure control may be impacted.[2] Procedures will identify the specific actions to be taken to ensure that, should pressure control be impacted, isolation of the auxiliary spray line or appropriate reenergization of the pressurizer heaters will occur.

1LV-459C and D are the low pressurizer level interlocks in the heater control circuits. Pressurizer heaters are not required for safe shutdown. Heaters are considered only for operational flexibility.

2Indiana and Michigan Electric Company wishes to note that spurious operation of the auxiliary spray line valve may impact safe shutdown only when the normal charging path is utilized to provide reactor coolant system makeup. This path is not credited as providing reactor coolant system makeup to achieve safe shutdown.

Category 5: <u>Components That Affect Heat Removal via the Steam Generators</u>

Components in this category are MRV-213, MRV-223, MRV-233 and MRV-243. Spurious opening of these components may result in an uncontrolled cooldown. Instrumentation available to detect excess cooldown includes steam generator pressure and level and reactor coolant system temperature and pressure. Should such excess cooldown occur, procedures will identify specific methods of isolating and controlling the operation of these valves.

4.8 Identification of Safe Shutdown Equipment, Cables and Raceways within Fire Zone Boundaries

The components and cables required for safe shutdown were identified by the processes described in the preceding sections. The location of all SSS components by fire zone was identified and added to the Safe Shutdown Component List (Table 4-1).

The routing of each SSS cable was obtained from the D.C. Cook Cable and Conduit Schedules. This information was programmed into a database concurrently with the fire zone location of every safe shutdown cable trough in the plant. Individual cable routings were outputted with the fire zone location of all troughs that were applicable for each particular cable. The routing of all conduits was also identified by fire zone. The complete route of each SSS cable and all the fire zones each cable is in were thereby identified. Table 4-4 is an example of the type of printout developed.

This database information was also sorted and printed out by system by fire zone, giving a complete listing of all SSS cables and their raceways within all plant fire zones.

An additional database was generated, identifying by division the equipment, troughs and conduit in each fire zone for every safe shutdown system. This list was the basis for determining which fire zones for each system required a detailed physical separation analysis.

The fire zones for each system which contain cables or equipment of different redundant divisions had all components and raceways (troughs and conduits) identified and were marked on the plant physical location drawings. Any zones that contain cables for both Unit 1 and Unit 2 had the components and raceways marked on the same set of physical location drawings so that the common effects of a single fire on both units would be readily apparent.

These marked-up physical location drawings were used to support the separation evaluation described in the subsequent section

4.9 Evaluation of the Separation of Safe Shutdown System (SSS) Components and Cables

In order to complete an evaluation of the separation of SSS components and cables, safe shutdown functional block diagrams were developed. These diagrams are a functional representation of the P&ID for each of the safe shutdown systems and depicts all of the safe shutdown components. Typical block diagrams are provided as Figures 4.24 through 4.33.

For each system and each fire zone, a functional block diagram was prepared. The location of SSS equipment was identified for every fire zone by a check in the proper box on the block diagram. The locations by fire zone of every cable for each component was also identified by a check on the appropriate block diagram for each fire zone.

In order to ensure that the loss of supporting systems would be properly identified (such as a loss of portions of the electrical power system affecting the required function provided by a component of another system), a third check was indicated for each component on the functional block diagram whenever a support system (e.g., power supply) for a component is unavailable due to a fire in that particular fire zone.

Using the functional block diagrams, the marked-up physical location drawings, the printouts of the components and cables in each fire zone, the fire detection and suppression by fire zone data, and various other plant documents, a detailed fire separation evaluation of each fire area and zone was completed.

Using the functional block diagrams, it was determined whether both redundant divisions were unavailable due to a fire within each fire area. If both redundant divisions are affected, the marked-up physical location drawings were used to determine the separation between the redundant components and/or cables. This was done by fire area and zone for all safe shutdown systems.

With the amount of separation identified and the existence (if any) of detection and suppression in the area, a method of compliance with Appendix R, Section III.G criteria was developed. Any modifications that were required were documented.

4.10 Physical Inspections

Physical inspections were done at the D.C. Cook site to verify the basis for the analysis performed. During these inspections, the safe shutdown component locations were verified to agree with the plant drawings and the component by fire zone list. The location of walls, wall openings and doors and the fire ratings of walls, penetrations, doors, dampers, etc., were noted. The presence of intervening combustible materials or fire hazards was determined. The location, type and quantity of fire detectors in each fire zone were recorded. The existence and type of fire suppression systems were noted.

A survey was made of the actual plant routings for raceway and was compared to the marked-up physical location drawings and any discrepancies were corrected to the as-built arrangement.

The feasibility of any proposed modifications was also checked and noted.

4.11 Identification of Areas of Conformance/Nonconformance with Appendix R, Section III.G

The results of the detailed separation analyses described in the preceding sections indicate:

(1) The fire zones that meet the criteria of Appendix R, Section III.G,

(2) The fire zones requiring modifications to meet the criteria

(3) The fire zones that incorporate equivalent protection and for which exemptions are requested

A summary of the results of that analysis are documented in Table 1-1 of Section 1.

AMERICAN ELECTRIC POWER SERVICE CORPORATION
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TABLE 4-1

SAFE SHUTDOWN COMPONENTS *** CHEMICAL AND VOLUME CONTROL SYSTEM

COMPONENT	DESCRIPTION	FIRE ZONE	POWER SUPPLIES	
TK-33	REFUELING WATER STORAGE TANK	YARD		
ICM-250	BIT OUTLET ISOLATION MOV	38	AM-D	
ICM-251	BIT OUTLET ISOLATION MOV	38	AZV-A	
IMO-255	BIT INLET ISOLATION MOV	38	AM-D	
IMO-256	BIT INLET ISOLATION MOV	38	AZV-A	
TK-11	BORON INJECTION TANK	38		
IMO-910	RWST TO CC PUMPS ISO MOV	62A	AM-D	
QRV-251	CHARGING FLOW CONTROL AOV	62A	CRID-III	
IMO-911	RWST TO CC PUMPS ISO MOV	62B	AZV-A	
PP-50E	CENTRIFUGAL CHARGING PUMP E	62B	T11D	MCCD
PP-50E(LO)	CC PUMP E LUBE OIL PUMP	62B	AB-D	
PP-50W	CENTRIFUGAL CHARGING PUMP W	62C	T11A	MCAB
PP-50W(LO)	CC PUMP W LUBE OIL PUMP	62C	AB-A	
IMO-51	BIT INJECTION LINE MOV	66	EZC-C	
IMO-52	BIT INJECTION LINE MOV	66	EZC-B	
IMO-53	BIT INJECTION LINE MOV	66	EZC-D	
IMO-54	BIT INJECTION LINE MOV	66	EZC-A	
CS-534	BIT INJ FROM CHG PUMP CROSS-TIE HEADER	62C		

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TABLE 4-1 - CONTINUED

SAFE SHUTDOWN COMPONENTS *** CHEMICAL AND VOLUME CONTROL SYSTEM

COMPONENT	DESCRIPTION	FIRE ZONE	POWER SUPPLIES
CS-535	SEAL INJECTION FROM CHG PUMP CROSS-TIE HEADER	62C	
CS-536	CHG PUMP DISCHG TO CROSS-TIE HEADER	62C	
QMO-200	NORMAL CHARGING ISO	62A	AM-D
QMO-201	NORMAL CHARGING ISO	62A	AZV-A
QMO-451	VCT TO CHG PUMP ISO	44N	AM-D
QMO-452	VCT TO CHG PUMP ISO	44N	AZV-A

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TABLE 4-1

SAFE SHUTDOWN COMPONENTS *** REACTOR COOLANT SYSTEM

COMPONENT	DESCRIPTION	FIRE ZONE	POWER SUPPLIES	
N31	SOURCE RANGE MONITORING CHANNEL	103	CRID-I	
N32	SOURCE RANGE MONITORING CHANNEL	103	CRID-II	
NLI-151	PRESSURIZER WATER LEVEL	122	CRID-IV	ELSC
NLP-151	PRESSURIZER WATER LEVEL	122	CRID-I	
NLP-152	PRESSURIZER WATER LEVEL	122	CRID-II	
NLP-153	PRESSURIZER WATER LEVEL	122	CRID-III	
LSI-3	LOCAL SHUTDOWN STATION	5	ELSC	
NPS-121	RCS PRESSURE (W. RANGE)	66	CRID-II	
NPS-122	RCS PRESSURE (W. RANGE)	66	CRID-III	ELSC
NTR-110	LOOP 1 TH TEMPERATURE	67	CRID-III	
NTR-120	LOOP 2 TH TEMPERATURE	67	CRID-I	
NTR-130	LOOP 3 TH TEMPERATURE	67	CRID-II	
NTR-140	LOOP 4 TH TEMPERATURE	67	CRID-I	

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TABLE 4-1 - CONTINUED

SAFE SHUTDOWN COMPONENTS *** REACTOR COOLANT SYSTEM

COMPONENT	DESCRIPTION	FIRE ZONE	POWER SUPPLIES
NTR-210	LOOP 1 TC TEMPERATURE	67	CRID-II
NTR-220	LOOP 2 TC TEMPERATURE	67	CRID-II
NTR-230	LOOP 3 TC TEMPERATURE	67	CRID-II
NTR-240	LOOP 4 TC TEMPERATURE	67	CRID-II
SV-45A	PRESSURIZER SAFETY VALVE	67	
SV-45B	PRESSURIZER SAFETY VALVE	67	
SV-45C	PRESSURIZER SAFETY VALVE	67	
LSI-5	LOCAL SHUTDOWN STATION	33	ELSC
LSI-6	LOCAL SHUTDOWN STATION	12	ELSC

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TABLE 4-1

SAFE SHUTDOWN COMPONENTS *** MAIN STEAM SYSTEM

COMPONENT	DESCRIPTION	FIRE ZONE	POWER SUPPLIES
MCM-221	STEAM SUPPLY (SG 2) TO PP-4	108	AM-A
MCM-231	STEAM SUPPLY (SG 3) TO PP-4	108	AM-D
MPP-220	SG2 PRESSURE	108	CRID-I
MPP-221	SG2 PRESSURE	108	CRID-II
MPP-222	SG2 PRESSURE	108	CRID-III
MPP-230	SG3 PRESSURE	108	CRID-I
MPP-231	SG3 PRESSURE	108	CRID-II
MPP-232	SG3 PRESSURE	108	CRID-III
MRV-223	SG 2 POWER OPERATED ATMOSPH RELIEF VALVE	108	CRID-II
MRV-233	SG 3 POWER OPERATED ATMOSPH RELIEF VALVE	108	CRID-II
SV-1	SG 2&3 SAFETY VALVES	108	
SV-2	SG 2&3 SAFETY VALVES	108	
SV-3	SG 2&3 SAFETY VALVES	108	
MPP-210	SG1 PRESSURE	33	CRID-I
MPP-211	SG1 PRESSURE	33	CRID-II
MPP-212	SG1 PRESSURE	33	CRID-IV
MPP-240	SG4 PRESSURE	33	CRID-I
MPP-241	SG4 PRESSURE	33	CRID-II
MPP-242	SG4 PRESSURE	33	CRID-IV

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TABLE 4-1 - CONTINUED

SAFE SHUTDOWN COMPONENTS *** MAIN STEAM SYSTEM

COMPONENT	DESCRIPTION	FIRE ZONE	POWER SUPPLIES
MRV-213	SG 1 POWER OPERATED ATMOSPH RELIEF VALVE	33	CRID-I
MRV-243	SG 4 POWER OPERATED ATMOSPH RELIEF VALVE	33	CRID-I
SV-1	SG 1,4 SAFETY VALVES	33	
SV-2	SG 1,4 SAFETY VALVES	33	
SV-3	SG 1,4 SAFETY VALVES	33	
MRV-210	MAIN STEAM STOP VALVE	33	
MRV-220	MAIN STEAM STOP VALVE	108	
MRV-230	MAIN STEAM STOP VALVE	108	
MRV-240	MAIN STEAM STOP VALVE	33	
MRV-211	MAIN STEAM STOP VALVE DUMP VALVE	33	CCV-CD
MRV-212	MAIN STEAM STOP VALVE DUMP VALVE	33	CCV-AB
MRV-221	MAIN STEAM STOP VALVE DUMP VALVE	108	CCV-CD
MRV-222	MAIN STEAM STOP VALVE DUMP VALVE	108	CCV-AB
MRV-231	MAIN STEAM STOP VALVE DUMP VALVE	108	CCV-CD
MRV-232	MAIN STEAM STOP VALVE DUMP VALVE	108	CCV-AB
MRV-241	MAIN STEAM STOP VALVE DUMP VALVE	33	CCV-CD
MRV-242	MAIN STEAM STOP VALVE DUMP VALVE	33	CCV-AB

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TABLE 4-1

SAFE SHUTDOWN COMPONENTS *** AUXILIARY FEEDWATER SYSTEM

COMPONENT	DESCRIPTION	FIRE ZONE	POWER SUPPLIES	
BLP-122	SG 2 WATER LEVEL (N. RANGE)	101	CRID-III	
BLP-132	SG 3 WATER LEVEL (N. RANGE)	101	CRID-III	
FMO-221	SG 2 SUPPLY MOV (PP-4)	12	ABN	
FMO-222	SG 2 SUPLY MOV (PP-3E)	12	EZC-D	
FMO-231	SG 3 SUPPLY MOV (PP-4)	12	ABN	
FMO-232	SG 3 SUPPLY MOV (PP-3E)	12	EZC-D	
LSI-2	LOCAL SHUTDOWN STATION	12	ELSC	
BLP-112	SG 1 WATER LEVEL (N. RANGE)	120	CRID-III	
BLP-142	SG 4 WATER LEVEL (N. RANGE)	120	CRID-III	
FRV-247	EMERGENCY LEAK-OFF AOV (PP-3W)	17A	ELSC	
PP-3W	MOTOR DRIVEN AUXILIARY FEED PUMP W	17A	T11A	MCAB
FRV-257	EMERGENCY LEAK-OFF AOV (PP-3E)	17D	AFW	
PP-3E	MOTOR DRIVEN AUXILIARY FEED PUMP E	17D	T11D	MCCD
FRV-258	EMERGENCY LEAK-OFF AOV (PP-4)	17E	DCN	
PP-4	TURBINE DRIVEN AUXILIARY FEED PUMP	17E	DCN	

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TABLE 4-1 - CONTINUED

SAFE SHUTDOWN COMPONENTS *** AUXILIARY FEEDWATER SYSTEM

COMPONENT	DESCRIPTION	FIRE ZONE	POWER SUPPLIES	
PP-4/T-T	PP-4-TRIP & THROTTLE MOV	17E	ABN	
FMO-211	SG 1 SUPPLY MOV (PP-4)	33	ABN	
FMO-212	SG 1 SUPPLY MOV FROM (PP-3W)	33	AZV-A	
FMO-241	SG 4 SUPPLY MOV (PP-4)	33	ABN	
FMO-242	SG 4 SUPPLY MOV (PP-3W)	33	AZV-A	
LSI-1	LOCAL SHUTDOWN STATION	33	ELSC	
TK-32	CONDENSATE STORAGE TANK	YARD		
BLI-110	SG 1 WATER LEVEL (W. RANGE)	66	CRID-IV	ELSC
BLI-120	SG 2 WATER LEVEL (W. RANGE)	66	CRID-IV	ELSC
BLI-130	SG 3 WATER LEVEL (W. RANGE)	66	CRID-IV	ELSC
BLI-140	SG 4 WATER LEVEL (W. RANGE)	66	CRID-IV	ELSC
BLP-110	SG 1 WATER LEVEL (N. RANGE)	66	CRID-IV	
BLP-111	SG 1 WATER LEVEL (N. RANGE)	66	CRID-II	
BLP-120	SG 2 WATER LEVEL (N. RANGE)	66	CRID-IV	
BLP-121	SG 2 WATER LEVEL (N. RANGE)	66	CRID-I	
BLP-130	SG 3 WATER LEVEL (N. RANGE)	66	CRID-IV	
BLP-131	SG 3 WATER LEVEL (N. RANGE)	66	CRID-I	
BLP-140	SG 4 WATER LEVEL (N. RANGE)	66	CRID-IV	
BLP-141	SG 4 WATER LEVEL (N. RANGE)	66	CRID-II	
CRV-51	CONDENSATE STORAGE TANK CROSS-TIE	17C		

SAFE SHUTDOWN COMPONENTS *** AUXILIARY FEEDWATER SYSTEM

COMPONENT	DESCRIPTION	FIRE ZONE	POWER SUPPLIES
ESW-109	SW SUPPLY TO MOTOR DRIVEN AFW PUMP 1E	17D	
ESW-115	SW SUPPLY TO TURBINE DRIVEN AFW PUMP TD	17E	
ESW-243	SW SUPPLY TO MOTOR DRIVEN AFW PUMP 1W	17A	
FW-129	AFW CROSS-TIE	17D	
LSI-4	LOCAL SHUTDOWN STATION	5	ELSC

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TABLE 4-1

SAFE SHUTDOWN COMPONENTS *** COMPONENT COOLING WATER SYSTEM

COMPONENT	DESCRIPTION	FIRE ZONE	POWER SUPPLIES	
CMO-410	CCW HEAT EXCHANGER OUTLET MOV	44N	AM-D	
CMO-415	CCW COMMON SERVICE HEADER ISO MOV	44N	AM-D	
CMO-416	CCW COMON SERVICE HEADER ISO MOV	44N	AM-A	
CMO-419	CCW TO RHR HX ISO MOV	44N	AM-D	
CMO-420	CCW HEAT EXCHANGER OUTLET MOV	44N	AM-A	
HE-15E	CCW HEAT EXCHANGER	44S		
HE-15W	CCW HEAT EXCHANGER	44S		
PP-10E	COMPONENT COOLING PUMP E	44S	T11D	MCCD
PP-10W	COMPONENT COOLING PUMP W	44S	T11A	MCAB
CMO-429	CCW TO RHR HX ISO MOV	52	AM-A	
CCW-167	WEST CCW SUCTION CROSS-TIE	44S		
CCW-172	EAST CCW SUCTION CROSS-TIE	44S		
1-CCW-173	WEST CCW DISCHARGE CROSS-TIE	44S		
1-CCW-214	WEST SURGE TANK ISOLATION VALVE	69		
1-CCW-220	EAST SURGE TANK ISOLATION VALVE	69		
1-CCW-256	WEST CCW SUCTION CROSS-TIE	44S		

AMERICAN ELECTRIC POWER SERVICE CORPORATION
D.C. COOK - UNIT 1
TABLE 4-1

SAFE SHUTDOWN COMPONENTS *** ESSENTIAL SERVICE WATER SYSTEM

COMPONENT	DESCRIPTION	FIRE ZONE	POWER SUPPLIES	
WMO-705	ESW HEADER CROSS-TIE MOV	112	ABD-A	
WMO-707	ESW HEADER CROSS-TIE MOV	112	ABD-D	
WMO-721	ESW SUPPLY TO DGAB	114	ABD-A	
WMO-725	ESW SUPPLY TO DGCD	114	ABD-D	
WMO-744	ALTER MAKEUP TO PP-3W	17A	MAN OPER	
WMO-754	ALTER MAKEUP TO PP-3E	17D	MAN OPER	
WMO-753	ALTER MAKEUP TO PP-4	17E	MAN OPER	
ESWSE	ESW PUMP 1E STRAINER	29A	PS-D	
PP-7E	ESW PUMP	29A	T11D	MCCD
WMO-701	ESW PUMP DISCHARGE ISO MOV	29A	PS-D	
ESWSW	ESW PUMP 1W STRAINER	29B	PS-A	
PP-7W	ESW PUMP	29B	T11A	MCAB
WMO-702	ESW PUMP DISCHARGE ISO MOV	29B	PS-A	
WMO-731	ESW TO CCW HX INLET MOV	44N	AM-D	
WMO-733	ESW TO CCW HX OUTLET MOV	44N	AM-D	
WMO-735	ESW TO CCW HX INLET MOV	44N	AZV-A	
WMO-737	ESW TO CCW HX OUTLET MOV	44N	AZV-A	

AMERICAN ELECTRIC POWER SERVICE CORPORATION
D.C. COOK - UNIT 1
TABLE 4-1

SAFE SHUTDOWN COMPONENTS *** RESIDUAL HEAT REMOVAL SYSTEM

COMPONENT	DESCRIPTION	FIRE ZONE	POWER SUPPLIES	
IMO-310	RHR PUMP SUCTION ISO MOV	1C	ABV-D	
PP-35E	RHR PUMP E	1C	T11D	MCCD
IMO-320	RHR PUMP SUCTION ISO MOV	1D	ABV-A	
PP-35W	RHR PUMP W	1D	T11A	MCAB
IMO-312	RHR PUMP MINIMUM FLOW MOV	44C	AM-D	
IMO-314	RHR PUMPS CROSS-TIE MOV	44C	ABV-D	
IRV-310	RHR HX FLOW CONTROL AOV	44C	CRID-II	
IRV-311	RHR HX BYPASS FLOW CONTROL AOV	44C	CRID-II	
HE-17E	RHR HEAT EXCHANGER	44C		
RH-117	RHR ISO MANUAL VALVE (LC)	44C	MAN OPER	
RH-128E	RHR ISO MANUAL VALVE (LC)	44C	MAN OPER	
IMO-322	RHR PUMP MINIMUM FLOW MOV	44D	AM-A	
IMO-324	RHR PUMPS CROSS-TIE MOV	44D	AZV-A	
IRV-320	RHR HX FLOW CONTROL AOV	44D	CRID-III	
HE-17W	RHR HEAT EXCHANGER	44D		
RH-128W	RHR ISO MANUAL VALVE (LC)	44D	MAN OPER	
ICM-111	RHR OUTLET ISO MOV	66	EZC-C	
ICM-129	RHR INLET ISO MOV	66	EZC-C	
IMO-128	RHR INLET ISO MOV	67	EZC-B	

AMERICAN ELECTRIC POWER SERVICE CORPORATION
D.C. COOK - UNIT 1
TABLE 4-1 - CONTINUED

SAFE SHUTDOWN COMPONENTS *** RESIDUAL HEAT REMOVAL SYSTEM

COMPONENT	DESCRIPTION	FIRE ZONE	POWER SUPPLIES
IMO-110	SI ACCUMULATOR ISO MOV	66	EZC-C
IMO-120	SI ACCUMULATOR ISO MOV	66	EZC-B
IMO-130	SI ACCUMULATOR ISO MOV	66	EZC-D
IMO-140	SI ACCUMULATOR ISO MOV	66	EZC-A

AMERICAN ELECTRIC POWER SERVICE CORPORATION
D.C. COOK - UNIT 1
TABLE 4-1

SAFE SHUTDOWN COMPONENTS *** EMERGENCY POWER SYSTEM

COMPONENT	DESCRIPTION	FIRE ZONE	POWER SUPPLIES	
TK-47	DIESEL FUEL OIL STORAGE TANK CD & AB	YARD		
BN	250 VDC TRN BATTERY	106	N/A	
1CD1	DIESEL FUEL OIL TRANSFER PUMP	13	ABD-C	
1CD2	DIESEL FUEL OIL TRANSFER PUMP	13	ABD-D	
ABD-C	MCC 1-ABD-C	15	11C	
ABD-D	MCC 1-ABD-D	15	11D	
CD1	JACKET WATER PUMP	15	ABD-D	
CD2	JACKET WATER PUMP	15	ABD-C	
DGCD	DIESEL GENERATOR CD	15	TDCD	MCCD
AB1	JACKET WATER PUMP	16	ABD-A	
AB2	JACKET WATER PUMP	16	ABD-B	
ABD-A	MCC 1-ABD-A	16	11A	
ABD-B	MCC 1-ABD-B	16	11B	
DGAB	DIESEL GENERATOR AB	16	TDAB	MCAB

AMERICAN ELECTRIC POWER SERVICE CORPORATION
D.C. COOK - UNIT 1
TABLE 4-1 - CONTINUED

SAFE SHUTDOWN COMPONENTS *** EMERGENCY POWER SYSTEM

COMPONENT	DESCRIPTION	FIRE ZONE	POWER SUPPLIES	
ELSC	120 VAC DISTRIBUTION PNL 1-ELSC	16	ABD-B	
1AB1	DIESEL FUEL OIL TRANSFER PUMP	21	ABD-B	
1AB2	DIESEL FUEL OIL TRANSFER PUMP	21	ABD-A	
PS-A	MCC 1-PS-A	29E	AB-A	
PS-D	MCC 1-PS-D	29E	AB-D	
T11A	4KV BUS T11A	40A	DGAB	MCAB
T11B	4KV BUS T11B	40A	DGAB	MCAB
T11C	4KV BUS T11C	40B	DGCD	MCCD
T11D	4KV BUS T11D	40B	DGCD	MCCD
11B	600V BUS 11B	41	TR11B	MCAB
11D	600V BUS 11D	41	TR11D	MCCD
BCHAB1	250 VDC BATTERY CHARGER 1-AB1	41	EZC-A	
BCHAB2	250 VDC BATTERY CHARGER 1-AB2	41	EZC-B	
EZC-A	MCC 1-EZC-A	41	11A	
EZC-B	MCC 1-EZC-B	41	11B	
EZC-C	MCC 1-EZC-C	41	11C	
EZC-D	MCC 1-EZC-D	41	11D	

AMERICAN ELECTRIC POWER SERVICE CORPORATION
D.C. COOK - UNIT 1
TABLE 4-1 - CONTINUED

SAFE SHUTDOWN COMPONENTS *** EMERGENCY POWER SYSTEM

COMPONENT	DESCRIPTION	FIRE ZONE	POWER SUPPLIES	
TR11B	4KV/600V TRANSFORMER 11B	41	T11B	
TR11D	4KV/600V TRANSFORMER 11D	41	T11D	MCCD
11A	600V BUS 11A	42A	TR11A	MCAB
11C	600V BUS 11C	42A	TR11C	MCCD
CRID-I	120 VAC INSTR DISTR PNL	53	EZC-C	MCCD
CRID-II	120 VAC INSTR DISTR PNL	53	EZC-D	MCCD
CRID-III	120 VAC INSTR DISTR PNL	53	EZC-A	MCAB
CRID-IV	120 VAC INSTR DISTR PNL	53	EZC-B	MCAB
MCAB	TRAIN B 250 VDC DISTRIBUTION CABINET	42C	TDAB	
TDAB	TRAIN B 250 VDC TRANSFER CABINET	42C	AB,BCHAB1	BCHAB2
AB	250 VDC BATTERY AB	42D	N/A	
AZV-A	MCC 1-AZV-A	44N	AB-A	
AM-A	MCC 1-AM-A	52	11A	
AM-D	MCC 1-AM-D	52	11D	
DCN	250 VDC TRN BATTERY DISTR CAB	52	BN	
11AC	BUS TIE BREAKER	42A	MCAB	
11BD	BUS TIE BREAKER	41	MCAB	
TR11A	4KV/600V TRANSFORMER 11A	42A	T11A	MCAB
TR11C	4KV/600V TRANSFORMER 11C	42A	T11C	

AMERICAN ELECTRIC POWER SERVICE CORPORATION
D.C. COOK - UNIT 1
TABLE 4-1 - CONTINUED

SAFE SHUTDOWN COMPONENTS *** EMERGENCY POWER SYSTEM

COMPONENT	DESCRIPTION	FIRE ZONE	POWER SUPPLIES
BCHCD1	250 VDC BATTERY CHARGER 1-CD1	55	EZC-D
BCHCD2	250 VDC BATTERY CHARGER 1-CD2	55	EZC-C
CD	250 VDC BATTERY 1-CD	55	N/A
MCCD	TRAIN A 250 VDC DISTRIBUTION CABINET	55	TDCD
TDCD	TRAIN A 250 VDC TRANSFER CABINET	55	CD,BCHCD1 BCHCD2
AB-A	MCC 1-AB-A	6N	11A
AB-D	MCC 1-AB-D	6N	11D
ABN	250 VDC TRN BATTERY DISTR CAB	6N	DCN

AMERICAN ELECTRIC POWER SERVICE CORPORATION
D.C. COOK - UNIT 2
TABLE 4-2

SAFE SHUTDOWN COMPONENTS *** CHEMICAL AND VOLUME CONTROL SYSTEM

COMPONENT	DESCRIPTION	FIRE ZONE	POWER SUPPLIES	
TK-33	REFUELING WATER STORAGE TANK	YARD		
IMO-256	BIT INLET ISOLATION MOV	39	AZV-A	
IMO-255	BIT INLET ISOLATION MOV	39	AM-D	
ICM-250	BIT OUTLET ISOLATION MOV	39	AM-D	
ICM-251	BIT OUTLET ISOLATION MOV	39	AZV-A	
TK-11	BORON INJECTION TANK	39		
QRV-251	CHARGING FLOW CONTROL AOV	5	CRID-111	
IMO-910	RWST TO CC PUMPS ISO MOV	63A	AM-D	
PP-50E	CENTRIFUGAL CHARGING PUMP E	63B	T21D	MCCD
IMO-911	RWST TO CC PUMPS ISO MOV	63B	AZV-A	
PP-50E(LO)	CC PUMP E LUBE OIL PUMP	63B	AB-D	
PP-50W	CENTRIFUGAL CHARGING PUMP W	63C	T21A	MCAB
PP-50W(LO)	CC PUMP W LUBE OIL PUMP	63C	AB-A	
IMO-51	BIT INJECTION LINE MOV	74	EZC-C	
IMO-52	BIT INJECTION LINE MOV	74	EZC-B	
IMO-53	BIT INJECTION LINE MOV	74	EZC-D	
IMO-54	BIT INJECTION LINE MOV	74	EZC-A	
CS-534	BIT INJECTION FROM CHG PUMP CROSS-TIE HEADER	63C		

AMERICAN ELECTRIC POWER SERVICE CORPORATION
D.C. COOK - UNIT 2
TABLE 4-2 - CONTINUED

SAFE SHUTDOWN COMPONENTS *** CHEMICAL AND VOLUME CONTROL SYSTEM

COMPONENT	DESCRIPTION	FIRE ZONE	POWER SUPPLIES
CS-535	SEAL INJECTION FROM CHG PUMP CROSS-TIE HEADER	63C	
CS-536	CHG PUMP DISCHG TO CROSS-TIE HEADER	63C	
QMO-200	NORMAL CHARGING ISO	63A	AM-D
QMO-201	NORMAL CHARGING ISO	63A	AZV-A
QMO-451	VCT TO CHG PUMP ISO	44S	AM-D
QMO-452	VCT TO CHG PUMP ISO	44S	AZV-A

AMERICAN ELECTRIC POWER SERVICE CORPORATION
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TABLE 4-2

SAFE SHUTDOWN COMPONENTS *** REACTOR COOLANT SYSTEM

COMPONENT	DESCRIPTION	FIRE ZONE	POWER SUPPLIES	
N31	SOURCE RANGE MONITORING CHANNEL	104	CRID-I	
N32	SOURCE RANGE MONITORING CHANNEL	104	CRID-II	
NLP-151	PRESSURIZER WATER LEVEL	123	CRID-I	
NLP-152	PRESSURIZER WATER LEVEL	123	CRID-II	
NLP-153	PRESSURIZER WATER LEVEL	123	CRID-III	
NLI-151	PRESSURIZER WATER LEVEL	123	CRID-IV	ELSC
LSI-3	LOCAL SHUTDOWN STATION	5	ELSC	
NPS-121	RCS PRESSURE (W. RANGE)	74	CRID-II	
NPS-122	RCS PRESSURE (W. RANGE)	74	CRID-III	ELSC
NTR-210	LOOP 1 TC TEMPERATURE	75	CRID-II	
NTR-220	LOOP 2 TC TEMPERATURE	75	CRID-II	
NTR-120	LOOP 2 TH TEMPERATURE	75	CRID-I	
NTR-130	LOOP 3 TH TEMPERATURE	75	CRID-II	
NTR-230	LOOP 3 TC TEMPERATURE	75	CRID-II	
NTR-140	LOOP 4 TH TEMPERATURE	75	CRID-I	
NTR-240	LOOP 4 TC TEMPERATURE	75	CRID-II	
NTR-110	LOOP 1 TH TEMPERATURE	75	CRID-III	

AMERICAN ELECTRIC POWER SERVICE CORPORATION
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TABLE 4-2 - CONTINUED

SAFE SHUTDOWN COMPONENTS *** REACTOR COOLANT SYSTEM

COMPONENT	DESCRIPTION	FIRE ZONE	POWER SUPPLIES
SV-45A	PRESSURIZER SAFETY VALVE	75	
SV-45B	PRESSURIZER SAFETY VALVE	75	
SV-45C	PRESSURIZER SAFETY VALVE	75	
LSI-5	LOCAL SHUTDOWN STATION	34	ELSC
LSI-6	LOCAL SHUTDOWN STATION	22	ELSC

AMERICAN ELECTRIC POWER SERVICE CORPORATION
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TABLE 4-2

SAFE SHUTDOWN COMPONENTS *** MAIN STEAM SYSTEM

COMPONENT	DESCRIPTION	FIRE ZONE	POWER SUPPLIES
MRV-223	SG 2 POWER OPERATED ATMOSPH RELIEF VALVE	109	CRID-II
MRV-233	SG 3 POWER OPERATED ATMOSPH RELIEF VALVE	109	CRID-II
MCM-221	STEAM SUPPLY (SG 2) TO PP-4	109	AM-A
MCM-231	STEAM SUPPLY (SG 3) TO PP-4	109	AM-D
MPP-220	SG2 PRESSURE	109	CRID-I
MPP-230	SG3 PRESSURE	109	CRID-I
MPP-231	SG3 PRESSURE	109	CRID-II
MPP-221	SG2 PRESSURE	109	CRID-II
MPP-222	SG2 PRESSURE	109	CRID-III
MPP-232	SG3 PRESSURE	109	CRID-III
SV-1	SG 2&3 SAFETY VALVES	109	
SV-2	SG 2&3 SAFETY VALVES	109	
SV-3	SG 2&3 SAFETY VALVES	109	
MPP-210	SG1 PRESSURE	34	CRID-I
MPP-240	SG4 PRESSURE	34	CRID-I
MPP-211	SG1 PRESSURE	34	CRID-II
MPP-241	SG4 PRESSURE	34	CRID-II
MPP-212	SG1 PRESSURE	34	CRID-IV
MPP-242	SG4 PRESSURE	34	CRID-IV

AMERICAN ELECTRIC POWER SERVICE CORPORATION
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TABLE 4-2 - CONTINUED

SAFE SHUTDOWN COMPONENTS *** MAIN STEAM SYSTEM

COMPONENT	DESCRIPTION	FIRE ZONE	POWER SUPPLIES
SV-1	SG 1,4 SAFETY VALVES	34	
SV-2	SG 1,4 SAFETY VALVES	34	
SV-3	SG 1,4 SAFETY VALVES	34	
MRV-213	SG 1 POWER OPERATED ATMOSPH RELIEF VALVE	34	CRID-I
MRV-243	SG 4 POWER OPERATED ATMOSPH RELIEF VALVE	34	CRID-I
MRV-210	MAIN STEAM STOP VALVE	34	
MRV-220	MAIN STEAM STOP VALVE	109	
MRV-230	MAIN STEAM STOP VALVE	109	
MRV-240	MAIN STEAM STOP VALVE	34	
MRV-211	MAIN STEAM STOP VALVE DUMP VALVE	34	CCV-CD
MRV-212	MAIN STEAM STOP VALVE DUMP VALVE	34	CCV-AB
MRV-221	MAIN STEAM STOP VALVE DUMP VALVE	109	CCV-CD
MRV-222	MAIN STEAM STOP VALVE DUMP VALVE	109	CCV-AB
MRV-231	MAIN STEAM STOP VALVE DUMP VALVE	109	CCV-CD
MRV-232	MAIN STEAM STOP VALVE DUMP VALVE	109	CCV-AB
MRV-241	MAIN STEAM STOP VALVE DUMP VALVE	34	CCV-CD
MRV-242	MAIN STEAM STOP VALVE DUMP VALVE	34	CCV-AB

AMERICAN ELECTRIC POWER SERVICE CORPORATION
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TABLE 4-2

SAFE SHUTDOWN COMPONENTS *** AUXILIARY FEEDWATER SYSTEM

COMPONENT	DESCRIPTION	FIRE ZONE	POWER SUPPLIES	
TK-32	CONDENSATE STORAGE TANK	YARD		
BLP-122	SG 2 WATER LEVEL (N. RANGE)	102	CRID-III	
BLP-132	SG 3 WATER LEVEL (N. RANGE)	102	CRID-III	
BLP-112	SG 1 WATER LEVEL (N. RANGE)	121	CRID-III	
BLP-142	SG 4 WATER LEVEL (N. RANGE)	121	CRID-III	
PP-3W	MOTOR DRIVEN AUXILIARY FEED PUMP W	17B	T21A	MCAB
FRV-247	EMERGENCY LEAK-OFF AOV (PP-3W)	17B	ELSC	
PP-4	TURBINE DRIVEN AUXILIARY FEED PUMP	17F	DCN	
PP-4/T-T	PP-4-TRIP & THROTTLE MOV	17F	ABN	
FRV-258	EMERGENCY LEAK-OFF AOV (PP-4)	17F	DCN	
PP-3E	MOTOR DRIVEN AUXILIARY FEED PUMP E	17G	T21D	MCCD
FRV-257	EMERGENCY LEAK-OFF AOV (PP-3E)	17G	AFW	
LSI-2	LOCAL SHUTDOWN STATION	22	ELSC	
FMO-221	SG 2 SUPPLY MOV (PP-4)	22	ABN	
FMO-231	SG 3 SUPPLY MOV (PP-4)	22	ABN	

AMERICAN ELECTRIC POWER SERVICE CORPORATION
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TABLE 4-2 - CONTINUED

SAFE SHUTDOWN COMPONENTS *** AUXILIARY FEEDWATER SYSTEM

COMPONENT	DESCRIPTION	FIRE ZONE	POWER SUPPLIES	
FMO-222	SG 2 SUPPLY MOV (PP-3E)	22	EZC-D	
FMO-232	SG 3 SUPPLY MOV (PP-3E)	22	EZC-D	
LSI-1	LOCAL SHUTDOWN STATION	34	ELSC	
FMO-211	SG 1 SUPPLY MOV (PP-4)	34	ABN	
FMO-241	SG 4 SUPPLY MOV (PP-4)	34	ABN	
FMO-212	SG 1 SUPPLY MOV FROM (PP-3W)	34	AZV-A	
FMO-242	SG 4 SUPPLY MOV (PP-3W)	34	AZV-A	
BLI-110	SG 1 WATER LEVEL (W. RANGE)	74	CRID-IV	ELSC
BLI-120	SG 2 WATER LEVEL (W. RANGE)	74	CRID-IV	ELSC
BLI-130	SG 2 WATER LEVEL (W. RANGE)	74	CRID-IV	ELSC
BLI-140	SG 4 WATER LEVEL (W. RANGE)	74	CRID-IV	ELSC
BLP-110	SG 1 WATER LEVEL (N. RANGE)	74	CRID-IV	
BLP-120	SG 2 WATER LEVEL (N. RANGE)	74	CRID-IV	
BLP-130	SG 3 WATER LEVEL (N. RANGE)	74	CRID-IV	
BLP-140	SG 4 WATER LEVEL (N. RANGE)	74	CRID-IV	
BLP-141	SG 4 WATER LEVEL (N. RANGE)	74	CRID-II	
BLP-131	SG 3 WATER LEVEL (N. RANGE)	74	CRID-I	
BLP-121	SG 2 WATER LEVEL (N. RANGE)	74	CRID-I	
BLP-111	SG 1 WATER LEVEL (N. RANGE)	74	CRID-II	
ESW-145	SW SUPPLY TO MOTOR DRIVEN AFW PUMP 1E	17G		

AMERICAN ELECTRIC POWER SERVICE CORPORATION
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TABLE 4-2 - CONTINUED

SAFE SHUTDOWN COMPONENTS *** AUXILIARY FEEDWATER SYSTEM

COMPONENT	DESCRIPTION	FIRE ZONE	POWER SUPPLIES
ESW-240	SW SUPPLY TO TURBINE DRIVEN AFW PUMP	17F	
ESW-243	SW SUPPLY TO MOTOR DRIVEN AFW PUMP 1W	17B	
FW-129	AFW CROSS-TIE	17G	
LSI-4	LOCAL SHUTDOWN STATION	5	ELSC

AMERICAN ELECTRIC POWER SERVICE CORPORATION
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TABLE 4-2

SAFE SHUTDOWN COMPONENTS *** COMPONENT COOLING WATER SYSTEM

COMPONENT	DESCRIPTION	FIRE ZONE	POWER SUPPLIES	
CMO-419	CCW TO RHR HX ISO MOV	44N	AM-D	
PP-10E	COMPONENT COOLING PUMP E	44S	T21D	MCCD
PP-10W	COMPONENT COOLING PUMP W	44S	T21A	MCAB
CMO-410	CCW HEAT EXCHANGER OUTLET MOV	44S	AM-D	
CMO-420	CCW HEAT EXCHANGER OUTLET MOV	44S	AM-A	
CMO-415	CCW COMMON SERVICE HEADER ISO MOV	44S	AM-D	
CMO-416	CCW COMON SERVICE HEADER ISO MOV	44S	AM-A	
HE-15E	CCW HEAT EXCHANGER	44S		
HE-15W	CCW HEAT EXCHANGER	44S		
CMO-429	CCW TO RHR HX ISO MOV	52	AM-A	
CCW-167	WEST CCW SUCTION CROSS-TIE	44S		
CCW-172	EAST CCW SUCTION CROSS-TIE	44S		
CCW-173	WEST CCW DISCHARGE CROSS-TIE	44S		
CCW-214	WEST SURGE TANK ISOLATION VALVE	69		
CCW-220	EAST SURGE TANK ISOLATION VALVE	69		
CCW-256	WEST CCW SUCTION CROSS-TIE	44S		

AMERICAN ELECTRIC POWER SERVICE CORPORATION
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TABLE 4-2

SAFE SHUTDOWN COMPONENTS *** ESSENTIAL SERVICE WATER SYSTEM

COMPONENT	DESCRIPTION	FIRE ZONE	POWER SUPPLIES	
WMO-706	ESW HEADER CROSS-TIE MOV	113	ABD-A	
WMO-708	ESW HEADER CROSS-TIE MOV	113	ABD-D	
WMO-722	ESW SUPPLY TO DGAB	115	ABD-A	
WMO-726	ESW SUPPLY TO DGCD	115	ABD-D	
WMO-744	ALTER MAKEUP TO PP-3W	17B	MAN OPER	
WMO-753	ALTER MAKEUP TO PP-4	17F	MAN OPER	
WMO-754	ALTER MAKEUP TO PP-3E	17G	MAN OPER	
PP-7E	ESW PUMP	29C	T21D	MCCD
WMO-703	ESW PUMP DISCHARGE ISO MOV	29C	PS-D	
ESWSE	ESW PUMP 2E STRAINER	29C	PS-D	
PP-7W	ESW PUMP	29D	T21A	MCAB
WMO-704	ESW PUMP DISCHARGE ISO MOV	29D	PS-A	
ESWSW	ESW PUMP 2W STRAINER	29D	PS-A	
WMO-736	ESW TO CCW HX INLET MOV	44S	AZV-A	
WMO-738	ESW TO CCW HX OUTLET MOV	44S	AZV-A	
WMO-732	ESW TO CCW HX INLET MOV	44S	AM-D	
WMO-734	ESW TO CCW HX OUTLET MOV	44S	AM-D	

AMERICAN ELECTRIC POWER SERVICE CORPORATION
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TABLE 4-2

SAFE SHUTDOWN COMPONENTS *** RESIDUAL HEAT REMOVAL SYSTEM

COMPONENT	DESCRIPTION	FIRE ZONE	POWER SUPPLIES	
IMO-310	RHR PUMP SUCTION ISO MOV	1G	ABV-D	
PP-35E	RHR PUMP E	1G	T21D	MCCD
IMO-320	RHR PUMP SUCTION ISO MOV	1H	ABV-A	
PP-35W	RHR PUMP W	1H	T21A	MCAB
IMO-312	RHR PUMP MINIMUM FLOW MOV	44G	AM-D	
IRV-310	RHR HX FLOW CONTROL AOV	44G	CRID-II	
IRV-311	RHR HX BYPASS FLOW CONTROL AOV	44G	CRID-II	
IMO-314	RHR PUMPS CROSS-TIE MOV	44G	ABV-D	
RH-117	RHR ISO MANUAL VALVE (LC)	44G	MAN OPER	
RH-128E	RHR ISO MANUAL VALVE (LC)	44G	MAN OPER	
HE-17E	RHR HEAT EXCHANGER	44G		
IMO-322	RHR PUMP MINIMUM FLOW MOV	44H	AM-A	
IRV-320	RHR HX FLOW CONTROL AOV	44H	CRID-III	
IMO-324	RHR PUMPS CROSS-TIE MOV	44H	AZV-A	
RH-128W	RHR ISO MANUAL VALVE (LC)	44H	MAN OPER	
HE-17W	RHR HEAT EXCHANGER	44H		
ICM-129	RHR INLET ISO MOV	74	EZC-C	
ICM-111	RHR OUTLET ISO MOV	74	EZC-C	
IMO-128	RHR INLET ISO MOV	75	EZC-B	

AMERICAN ELECTRIC POWER SERVICE CORPORATION
D.C. COOK - UNIT 2
TABLE 4-2 - CONTINUED

SAFE SHUTDOWN COMPONENTS *** RESIDUAL HEAT REMOVAL SYSTEM

COMPONENT	DESCRIPTION	FIRE ZONE	POWER SUPPLIES
IMO-110	SI ACCUMULATOR ISO MOV	74	EZC-C
IMO-120	SI ACCUMULATOR ISO MOV	74	EZC-B
IMO-130	SI ACCUMULATOR ISO MOV	74	EZC-D
IMO-140	SI ACCUMULATOR ISO MOV	74	EZC-A

AMERICAN ELECTRIC POWER SERVICE CORPORATION
D.C. COOK - UNIT 2
TABLE 4-2

SAFE SHUTDOWN COMPONENTS *** EMERGENCY POWER SYSTEM

COMPONENT	DESCRIPTION	FIRE ZONE	POWER SUPPLIES	
BN	250 VDC TRN BATTERY	107	N/A	
2CD1	DIESEL FUEL OIL TRANSFER PUMP	13	ABD-C	
2CD2	DIESEL FUEL OIL TRANSFER PUMP	13	ABD-D	
DGCD	DIESEL GENERATOR CD	18	TDCD	MCCD
ABD-D	MCC 2-ABD-D	18	21D	
CD1	JACKET WATER PUMP	18	ABD-C	
CD2	JACKET WATER PUMP	18	ABD-D	
ABD-C	MCC 2-ABD-C	18	21C	
DGAB	DIESEL GENERATOR AB	19	TDAB	MCAB
ABD-A	MCC 2-ABD-A	19	21A	
ELSC	120 VAC DISTRIBUTION PNL 2-ELSC	19	ABD-B	
AB1	JACKET WATER PUMP	19	ABD-A	
AB2	JACKET WATER PUMP	19	ABD-B	
ABD-B	MCC 2-ABD-B	19	21B	
2AB2	DIESEL FUEL OIL TRANSFER PUMP	21	ABD-A	

AMERICAN ELECTRIC POWER SERVICE CORPORATION
D.C. COOK - UNIT 2
TABLE 4-2 - CONTINUED

SAFE SHUTDOWN COMPONENTS *** EMERGENCY POWER SYSTEM

COMPONENT	DESCRIPTION	FIRE ZONE	POWER SUPPLIES	
2AB1	DIESEL FUEL OIL TRANSFER PUMP	21	ABD-B	
PS-A	MCC 2-PS-A	29F	AB-A	
PS-D	MCC 2-PS-D	29F	AB-D	
AZV-A	MCC 2-AZV-A	44S	AB-A	
EZC-A	MCC 2-EZC-A	45	21A	
TR21B	4KV/600V TRANSFORMER 21B	45	T21B	
21B	600V BUS 21B	45	TR21B	MCAB
EZC-B	MCC 2-EZC-B	45	21B	
EZC-C	MCC 2-EZC-C	45	21C	
TR21D	4KV/600V TRANSFORMER 21D	45	T21D	MCCD
21D	600V BUS 21D	45	TR21D	MCCD
EZC-D	MCC 2-EZC-D	45	21D	
BCHAB1	250 VDC BATTERY CHARGER 2-AB1	45	EZC-A	

AMERICAN ELECTRIC POWER SERVICE CORPORATION
D.C. COOK - UNIT 2
TABLE 4-2 - CONTINUED

SAFE SHUTDOWN COMPONENTS *** EMERGENCY POWER SYSTEM

COMPONENT	DESCRIPTION	FIRE ZONE	POWER SUPPLIES	
BCHAB2	250 VDC BATTERY CHARGER 2-AB2	45	EZC-B	
21A	600V BUS 21A	46A	TR21A	MCAB
21C	600V BUS 21C	46A	TR21C	MCCD
CRID-I	120 VAC INSTR DISTR PNL	54	EZC-C	MCCD
CRID-II	120 VAC INSTR DISTR PNL	54	EZC-D	MCCD
CRID-III	120 VAC INSTR DISTR PNL	54	EZC-A	MCAB
CRID-IV	120 VAC INSTR DISTR PNL	54	EZC-B	MCAB
TDAB	TRAIN B 250 VDC TRANSFER CABINET	46C	AB,BCHAB1	BCHAB2
MCAB	TRAIN B 250 VDC DISTRIBUTION CABINET	46C	TDAB	
AB	250 VDC BATTERY AB	46D	N/A	
T21A	4KV BUS T21A	47A	DGAB	MCAB
T21B	4KV BUS T21B	47A	DGAB	MCAB
T21C	4KV BUS T21C	47B	DGCD	MCCD
T21D	4KV BUS T21D	47B	DGCD	MCCD
DCN	250 VDC TRN BATTERY DISTR CAB	50	BN	
AM-A	MCC 2-AM-A	52	21A	
AM-D	MCC 2-AM-D	52	21D	

AMERICAN ELECTRIC POWER SERVICE CORPORATION
D.C. COOK - UNIT 2
TABLE 4-2 - CONTINUED

SAFE SHUTDOWN COMPONENTS *** EMERGENCY POWER SYSTEM

COMPONENT	DESCRIPTION	FIRE ZONE	POWER SUPPLIES	
BCHCD1	250 VDC BATTERY CHARGER 2-CD1	60	EZC-D	
CD	250 VDC BATTERY 2-CD	60	N/A	
BCHCD2	250 VDC BATTERY CHARGER 2-CD2	60	EZC-C	
TDCD	TRAIN A 250 VDC TRANSFER CABINET	60	CD,BCHCD1	BCHCD2
MCCD	TRAIN A 250 VDC DISTRIBUTION CABINET	60	TDCD	
TK-47	DIESEL FUEL OIL STORAGE TANK CD & AB	YARD		
AB-A	MCC 2-AB-A	6S	21A	
AB-D	MCC 2-AB-D	6S	21D	
ABN	250 VDC TRN BATTERY DISTR CAB	6S	DCN	
21AC	BUS TIE BREAKER	46A	MCAB	
21BD	BUS TIE BREAKER	45	MCAB	
TR21A	4KV/600V TRANSFORMER	46A	T11A	MCAB
TR21C	4KV/600V TRANSFORMER	46A	T11C	

INDIANA & MICHIGAN ELECTRIC COMPANY

D.C. COOK UNITS 1 AND 2

TABLE 4-3

POTENTIAL SPURIOUS MALFUNCTIONS THAT COULD AFFECT SAFE SHUTDOWN

POTENTIAL SPURIOUS COMPONENT	SYSTEM	EFFECT OF MALFUNCTION	RESOLUTION
FRV-245 FRV-255	AF	SPURIOUS OPENING WILL DIVERT AFW FLOW TO THE CST.	CIRCUIT BREAKERS AT DC DISTRIBUTION PANELS CCV-AB AND CCV-CD (CONTROL ROOM) TO BE KEPT OPEN DURING NORMAL OPERATIONS (PRE-FIRE) (EXCEPT DURING TEST), ENSURING NO SPURIOUS VALVE OPENING. (AIR-OPERATED VALVES FAIL CLOSED WITH LOSS OF AIR OR LOSS OF POWER.)
FRV-256	AF	SAME AS ABOVE. COMMON POWER SUPPLY WITH TDFP CONTROL CIRCUITRY. MAY RESULT IN LOSS OF COMMON PROTECTION.	PROVIDE SEPARATE CIRCUIT PROTECTION (FUSE/DISCONNECT SWITCH) AT DC DISTRIBUTION PANEL DCN. DISCONNECT SWITCH TO BE KEPT OPEN DURING NORMAL OPERATION (PRE-FIRE) (EXCEPT DURING TEST), ENSURING NO SPURIOUS VALVE OPENING. (AIR-OPERATED VALVES FAIL CLOSED WITH LOSS OF AIR OR LOSS OF POWER.)
QMO-200 QMO-201 QRV-51	CVCS	SPURIOUS OPENING OF BOTH NORMAL CHARGING VALVES QMO-200 AND QMO-201 AND THE PRESSURIZER AUXILIARY SPRAY AIR-OPERATED VALVE QRV-51 (WITH CVCS PUMPS RUNNING) WILL RESULT IN UN-CONTROLLED RCS PRESSURE REDUCTION.	OPERATOR VALVE ISOLATION AT THE PRESSURIZER PANEL OR BY LOCAL CLOSURE OF CVCS VALVES QMO-200 OR -201 WILL ENSURE VALVE CLOSURE. (AIR-OPERATED VALVE FAILS CLOSED ON LOSS OF AIR OR ELECTRICAL POWER.)
QRV-111 QRV-112 QRV-160 QRV-161 QRV-162	CVCS	SPURIOUS OPENING OF QRV-111 <u>AND</u> QRV-112 <u>AND</u> EITHER ONE OF THE ORIFICE ISO-LATION VALVES WILL RESULT IN UNCON-TROLLED LETDOWN.	PROCEDURAL ISOLATION OF THE LETDOWN PATH BY OPENING CIRCUIT BREAKER AT CONTROL ROOM PANELS CCV-AB OR CCV-CD OR AT DC DISTRI-BUTION PANELS MCAB OR MCCD WILL ENSURE LETDOWN ISOLATION. (AIR-OPERATED VALVES FAIL CLOSED WITH LOSS OF AIR OR LOSS OF POWER.)
QRV-113 QRV-114 QRV-170	CVCS	SPURIOUS OPENING OF <u>ALL</u> VALVES IN SERIES WILL RESULT IN UNCONTROLLED EXCESS LETDOWN.	(SEE ABOVE)
LB459C LB460D	RCS	SPURIOUS OPERATION OF LOW-LOW PRESSUR-IZER LEVEL SWITCHES WILL TRIP PRESSUR-IZER HEATER'S SUPPLY BREAKERS AT 480V LOAD CENTER 11 PHA OR 11 PHC.	HEATERS NOT REQUIRED DURING THE FIRST 3-4 HOURS AFTER TRIP (AT STABLE HOT STANDBY). PROCEDURAL DETECTION AND DEENERGIZATION OF CONTROL GROUP LOGIC CABINETS 1 AND 2 (CONTROL ROOMS).

INDIANA & MICHIGAN ELECTRIC COMPANY

D.C. COOK UNITS 1 AND 2

TABLE 4-3 - CONTINUED

POTENTIAL SPURIOUS MALFUNCTIONS THAT COULD AFFECT SAFE SHUTDOWN

POTENTIAL SPURIOUS COMPONENT	SYSTEM	EFFECT OF MALFUNCTION	RESOLUTION
NRV-151 NRV-152 NRV-153	RCS	SPURIOUS OPENING OF ANY OF THE PRESSURIZER PORVs WILL RESULT IN RCS BOUNDARY BREACH.	PROCEDURAL DETECTION AND CLOSURE OF RESPECTIVE BLOCK VALVES (NMO-151, NMO-152, NMO-153) OR OPENING OF PORV CIRCUIT BREAKERS AT CONTROL ROOM PANELS CCV-AB AND CCV-CD, OR OPENING OF DC DISTRIBUTION PANELS BREAKERS AT MCAB OR MCCD. (AIR-OPERATED PORVs FAIL CLOSED WITH LOSS OF POWER OR LOSS OF AIR.)
NSO-021 NSO-022 NSO-023 NSO-024 NSO-061 NSO-062 NSO-063 NSO-064	RCS	SPURIOUS OPENING OF PRESSURIZER OR REACTOR HEAD VENT VALVES WILL RESULT IN BREACH OF RCS BOUNDARY.	PROCEDURAL DETECTION AND OPENING OF RESPECTIVE SUPPLY BREAKERS AT CONTROL ROOM PANELS CCV-AB AND SSV-A1. (SOLENOID-OPERATED VENT VALVES FAIL CLOSED WITH LOSS OF POWER.)
ICM-129 IMO-128	RHR	SPURIOUS OPENING OF BOTH RHR/RCS BOUNDARY ISOLATION VALVES DURING REACTOR MODES 1, 2, AND 3 WILL RESULT IN BREACH OF THE RCS BOUNDARY.	MOTOR CONTROL CENTER SUPPLY BREAKER FOR EITHER ICM-129 OR IMO-128 WILL BE KEPT OPEN DURING REACTOR MODES 1, 2 AND 3 (PRE-FIRE) WITH VALVE CLOSED.
ILS-950 ILS-951	RHR	SPURIOUS OPERATION OF RWST LOW LEVEL SWITCHES TRIP RHR PUMPS.	OPENING OF TEST SWITCHES AT CONTROL PANEL RHR ISOLATES THE LOW LEVEL TRIP LOGIC (RHR OPERATION ONLY).
IMO-330 IMO-331	RHR	SPURIOUS OPENING OF ANY OF THE CONTAINMENT SPRAY HEADER ISOLATION VALVES DURING REACTOR MODES 4 AND 5 WILL DIVERT RCS WATER TO THE CONTAINMENT.	OPEN MOTOR CONTROL CENTER BREAKERS FOR THESE VALVES (AT AM-A AND AM-D) AND VERIFY LOCAL VALVE ALIGNMENT BEFORE OPERATION OF RHR.
IMO-340 IMO-350	RHR	SPURIOUS OPENING OF ANY OF THE RHR/CVCS AND PUMP SUCTION TIE LINES WILL DIVERT RCS WATER TO THE PRT THROUGH SAFETY VALVE SV-56.	OPEN MOTOR CONTROL CENTER BREAKERS FOR THESE VALVES (AT AM-A AND AM-D) AND VERIFY LOCAL VALVE ALIGNMENT BEFORE OPERATION OF RHR.
ICM-305 ICM-306	RHR	SPURIOUS OPENING OF THE CONTAINMENT SUMP ISOLATION VALVES DURING REACTOR MODES 4 AND 5 (RHR) WILL DIVERT RCS WATER TO THE CONTAINMENT.	CLOSE LOCAL MANUAL VALVES AT THE SUCTION OF THE RHR PUMPS (RH 104 E AND W) BEFORE OPERATION OF RHR.

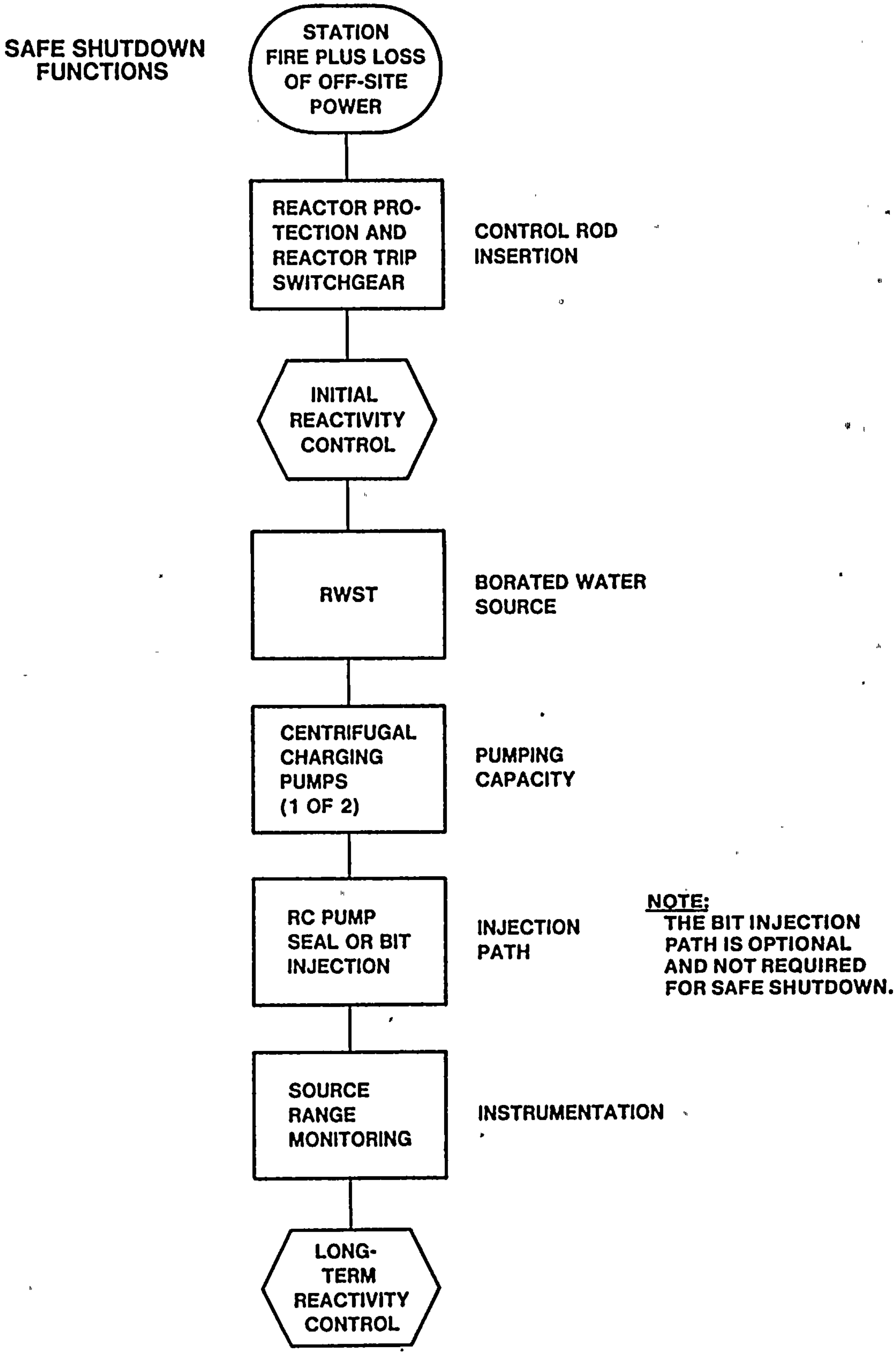
INDIANA & MICHIGAN ELECTRIC COMPANY

D.C. COOK UNITS 1 AND 2

TABLE 4-3 - CONTINUED

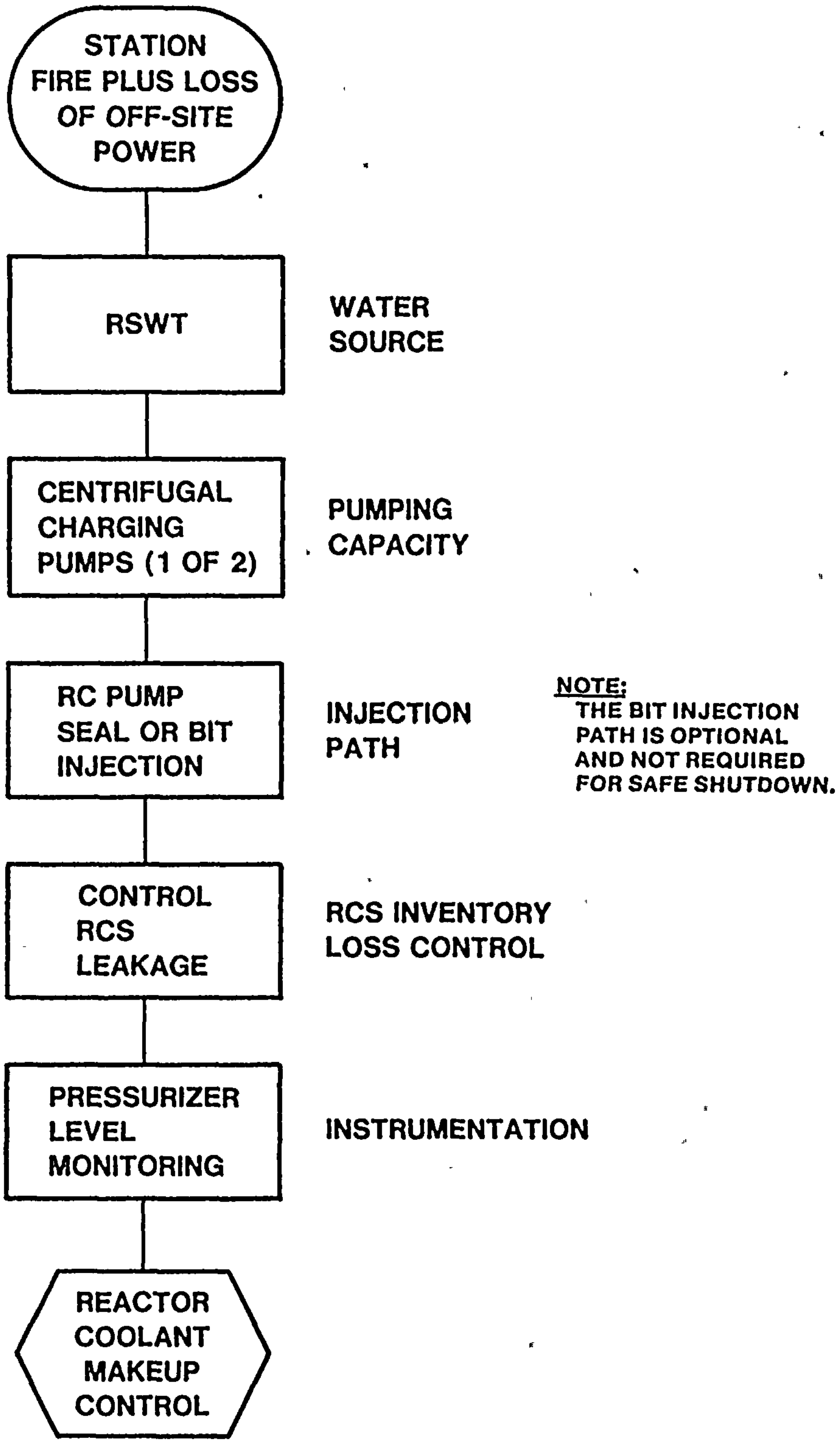
POTENTIAL SPURIOUS MALFUNCTIONS THAT COULD AFFECT SAFE SHUTDOWN

POTENTIAL SPURIOUS COMPONENT	SYSTEM	EFFECT OF MALFUNCTION	RESOLUTION
IRV-251 IRV-252	SIS	SPURIOUS OPENING OF BOTH VALVES DURING CVCS CHARGING THROUGH THE BIT PATH WILL PRESSURIZE THE BAT SYSTEM AND DIVERT CVCS CHARGING.	PROCEDURAL DETECTION AND TERMINATION BY OPENING CIRCUIT BREAKER FOR EITHER VALVE AT DC DISTRIBUTION PANEL CCV-AB OR CCV-CD (CONTROL ROOM) OR AT DC DISTRIBUTION PANEL MCAB OR MCCD (FIRE ZONES 42C OR 55). (AIR-OPERATED VALVES FAIL CLOSED WITH LOSS OF AIR OF LOSS OF POWER.)
1DGTAB 1DGTCD 2DGTAB 2DGTCD	EPS	SPURIOUS CLOSING OF ANY OF THESE BREAKERS WILL RESULT IN LOADING THE DIESEL GENERATOR WITH TEST LOAD BANK.	CIRCUIT BREAKERS AT DIESEL GENERATOR LOAD TEST PANELS TO BE KEPT LOCKED-OPEN DURING NORMAL PLANT OPERATION (PRE-FIRE) (EXCEPT DURING DIESEL TEST).
MRV-213 MRV-223 MRV-233 MRV-243	MS	SPURIOUS OPENING OF THE STEAM GENERATOR PORVs (AS A RESULT OF FIRE-INDUCED CONTROL CIRCUIT FAILURES) WILL RESULT IN UNCONTROLLED COOLDOWN.	PROCEDURAL DETECTION AND ISOLATION BY PLACING THE AUTO/MANUAL CONTROLLER IN MANUAL (AT THE CONTROL ROOM OR HSD PANEL CONTROLLERS) OR IN THE LOCAL CONTROL IN THE RESPECTIVE LSI SHUTDOWN STATIONS. (AIR-OPERATED PORVs FAIL CLOSED WITH LOSS OF AIR OR LOSS OF CURRENT SIGNAL.)

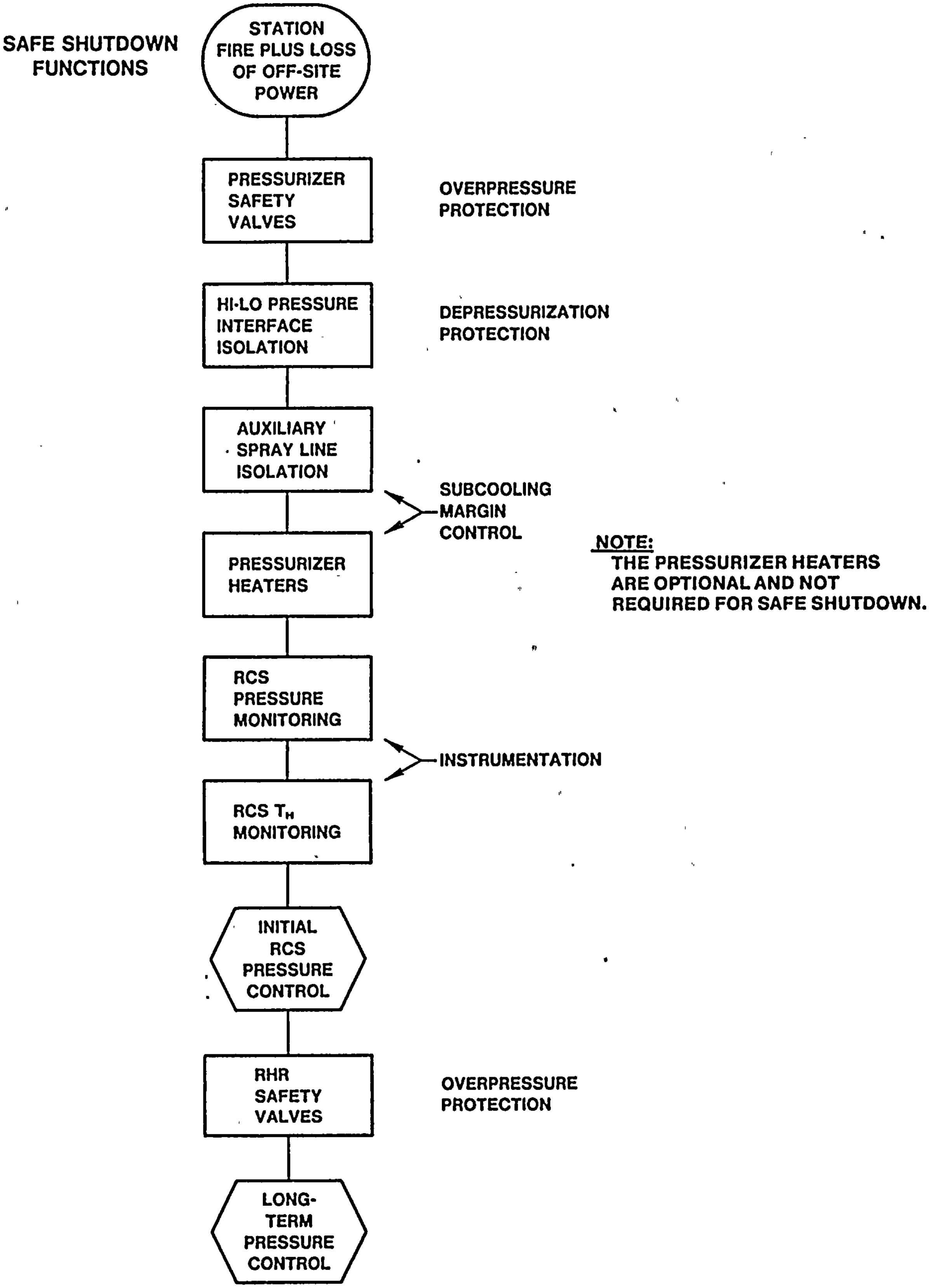


RCS REACTIVITY CONTROL FIGURE 4.1

SAFE SHUTDOWN FUNCTIONS

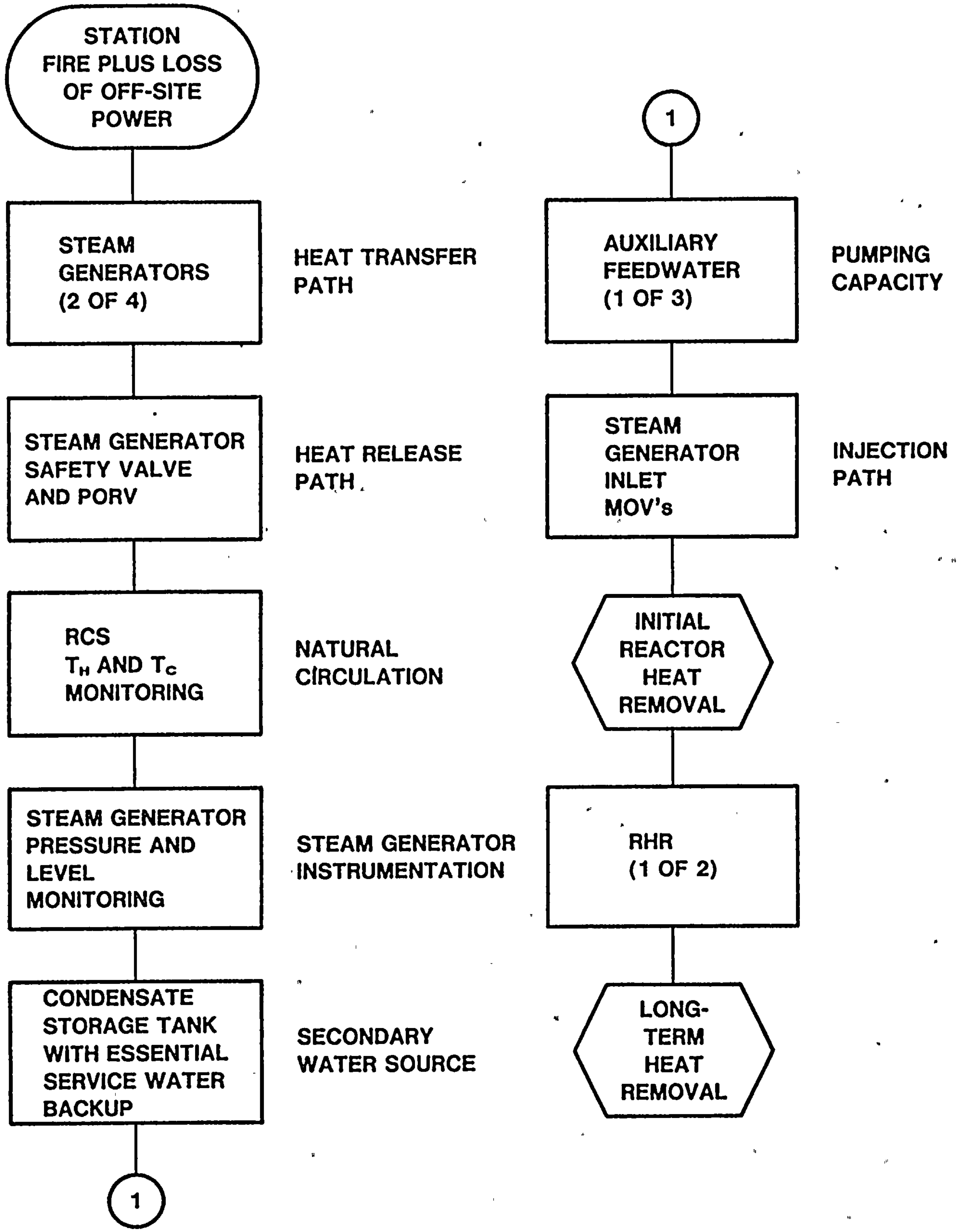


RCS MAKEUP CONTROL FIGURE 4.2



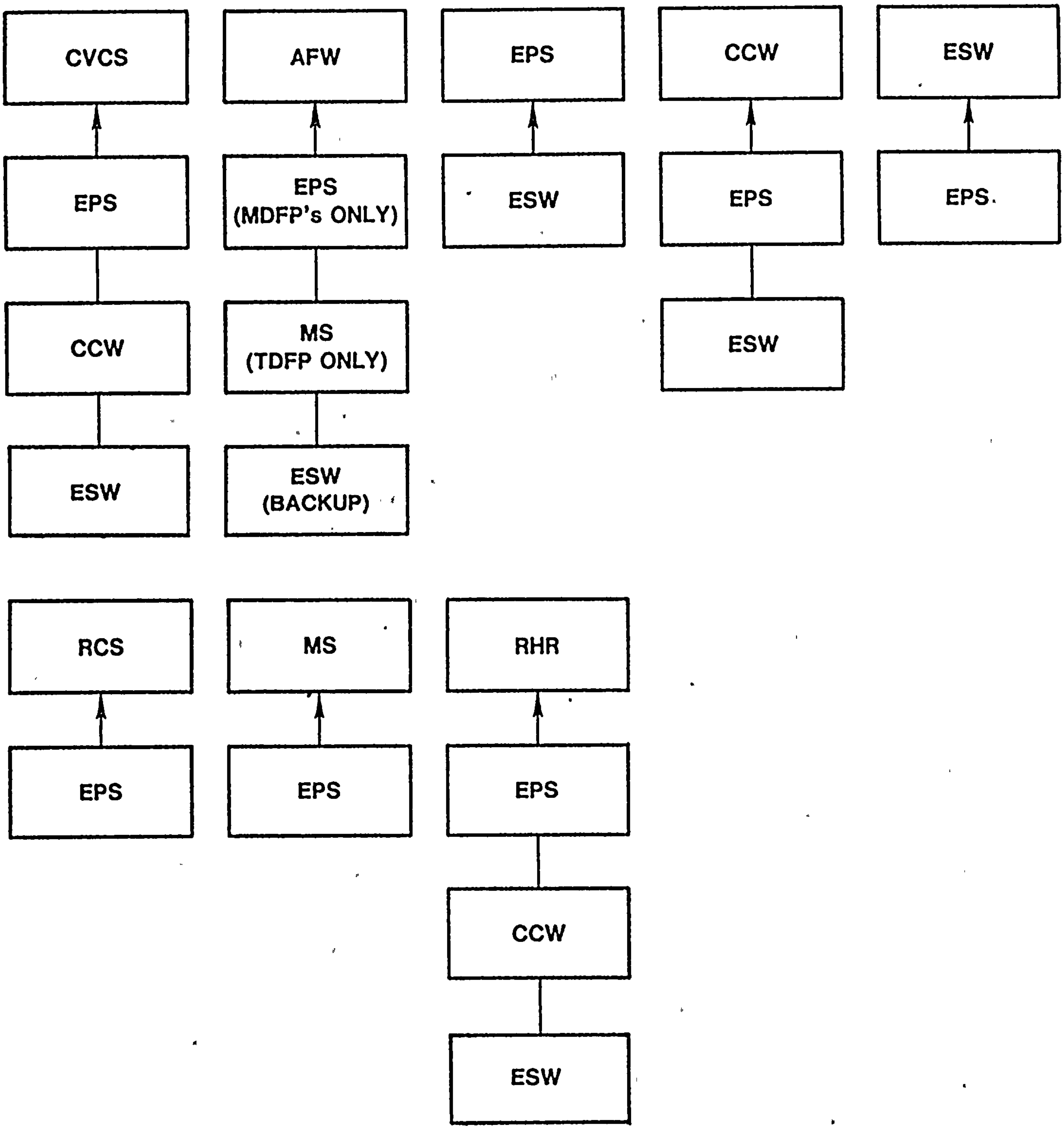
RCS PRESSURE CONTROL FIGURE 4.3

SAFE SHUTDOWN FUNCTIONS



REACTOR HEAT REMOVAL FIGURE 4.4

SAFE SHUTDOWN FUNCTIONS



SUPPORTING SYSTEM INTERACTION DIAGRAM FIGURE 4.5

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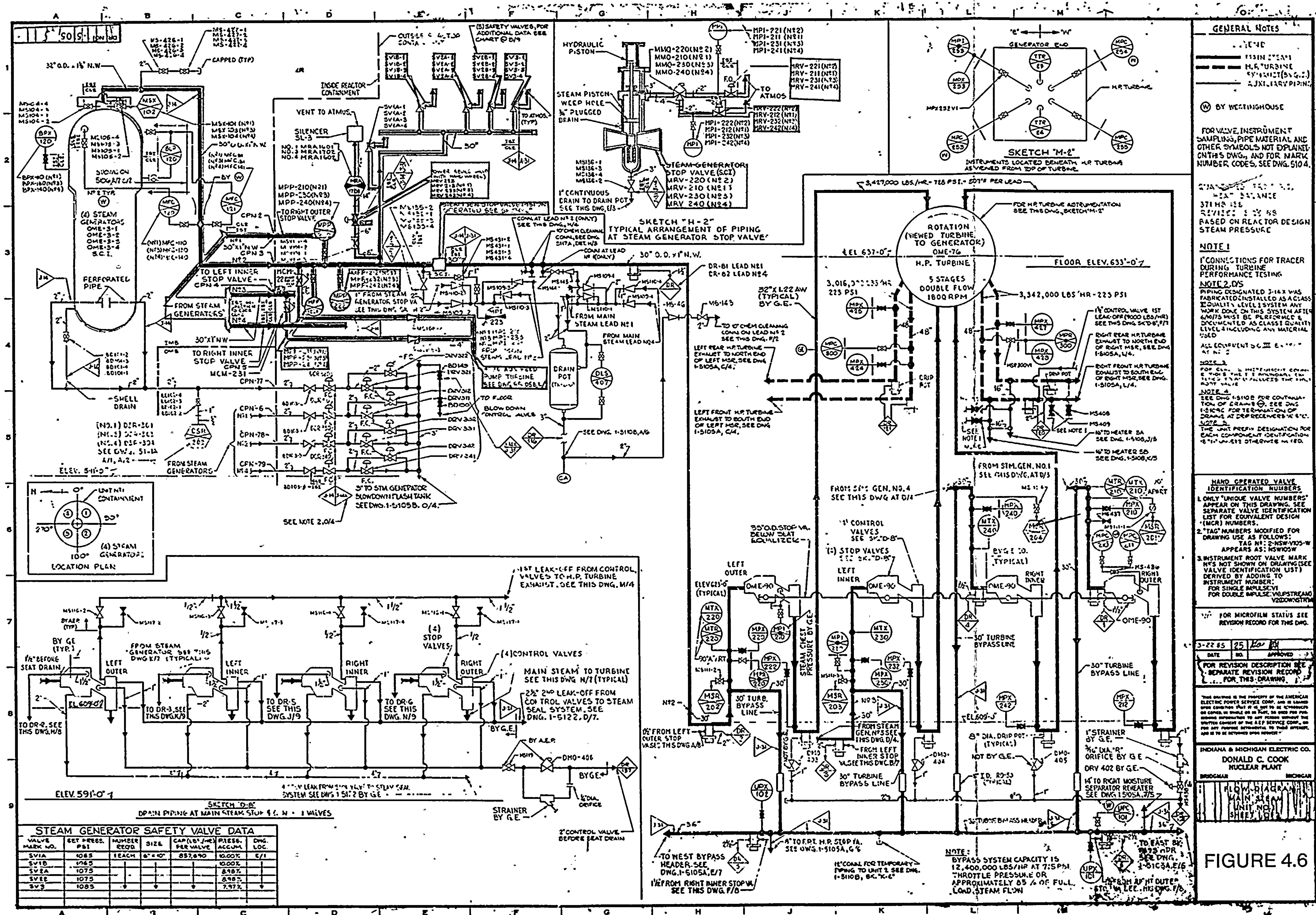

STEAM GENERATOR SAFETY VALVE DATA

VALVE MARK NO.	SET PRESS. PSI	NUMBER REQ'D	SIZE	CAP (LBS/HR) PER VALVE	PRESS. ACCUM.	DWG. LOC.
SV1A	1065	1 EACH	6" x 10"	857,690	10.00%	E/1
SV1B	1065				10.00%	
SV2A	1075				8.98%	
SV2B	1075				8.98%	
SV3	1085				7.97%	

FIGURE 4.6

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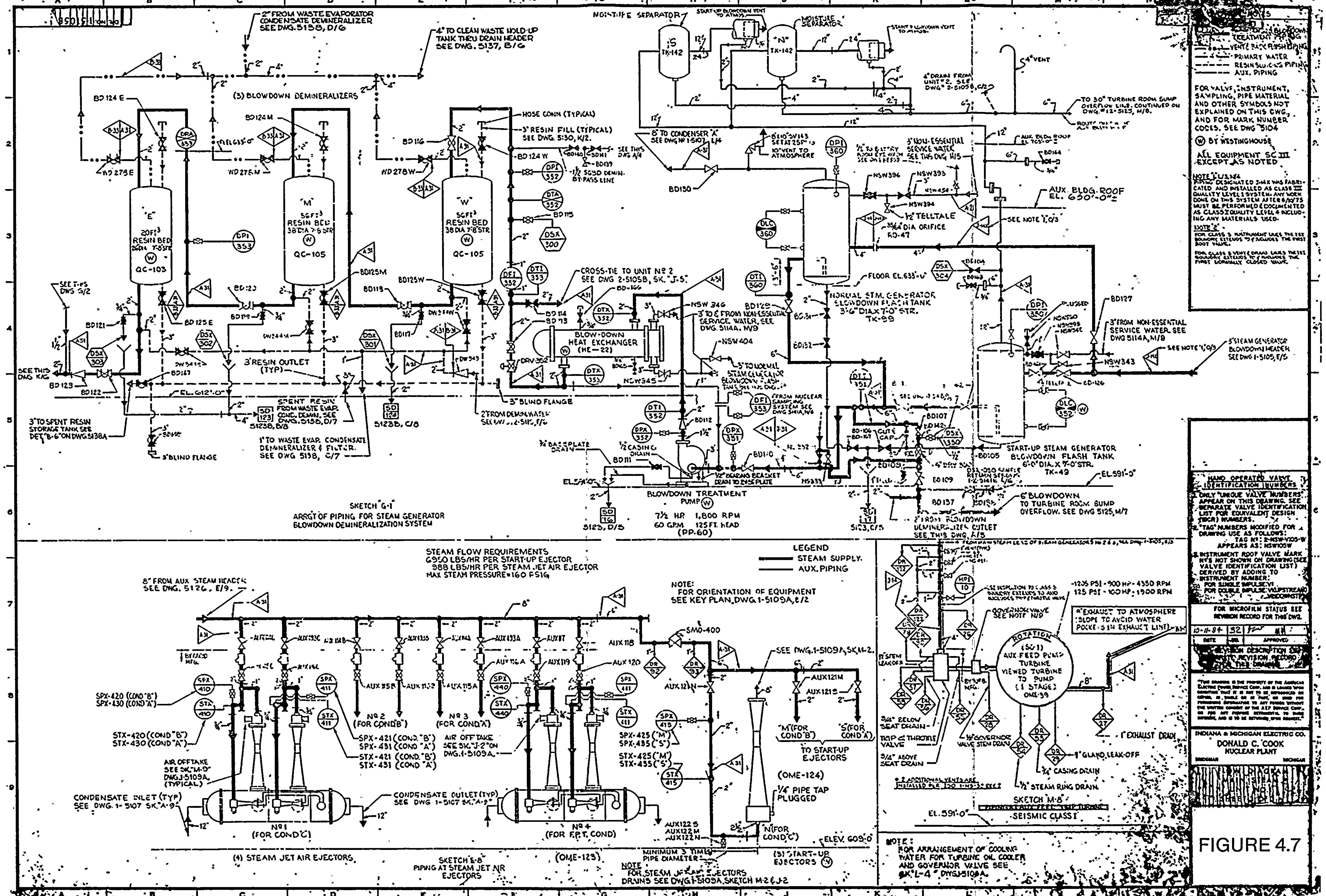

FIGURE 4.7

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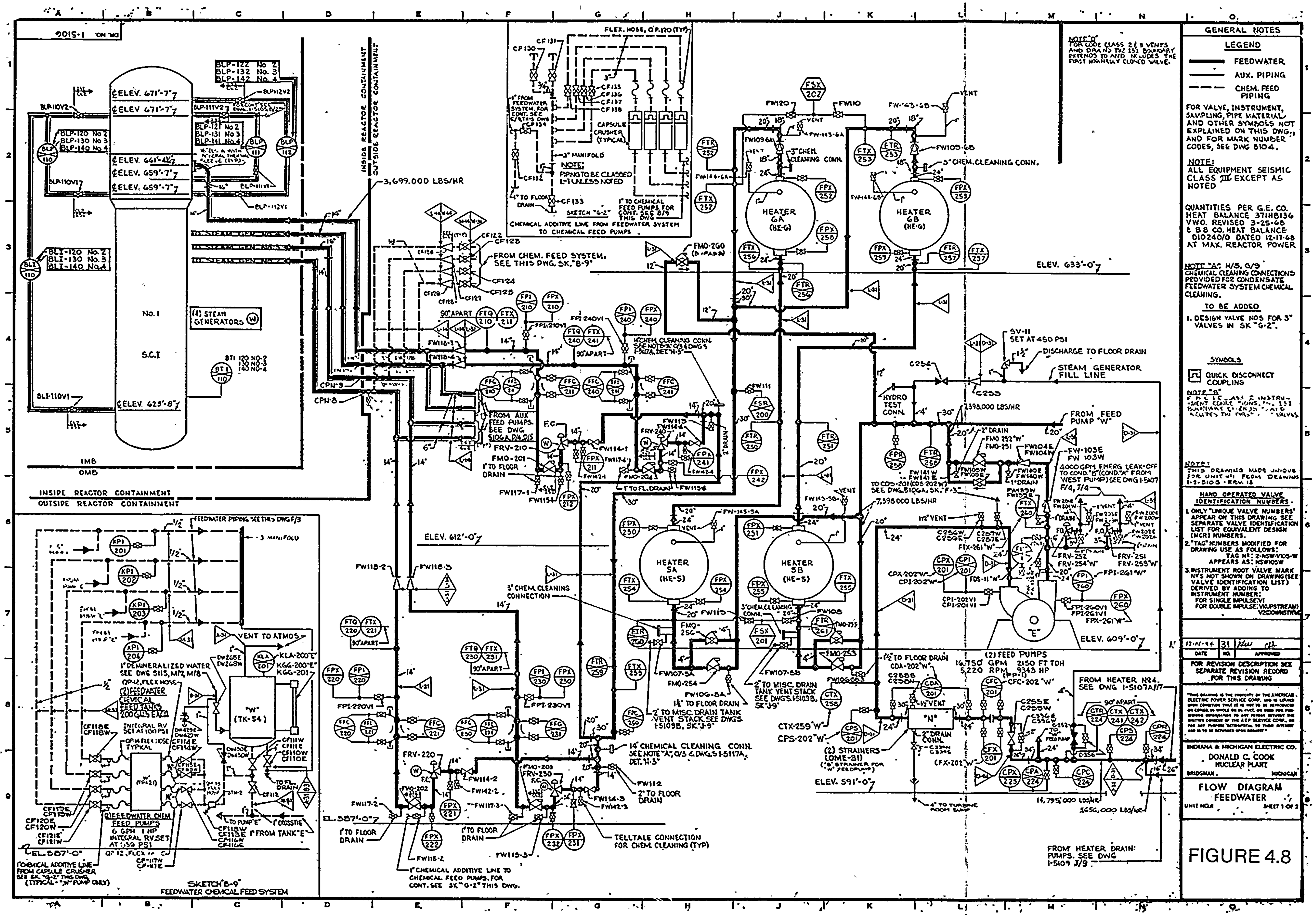

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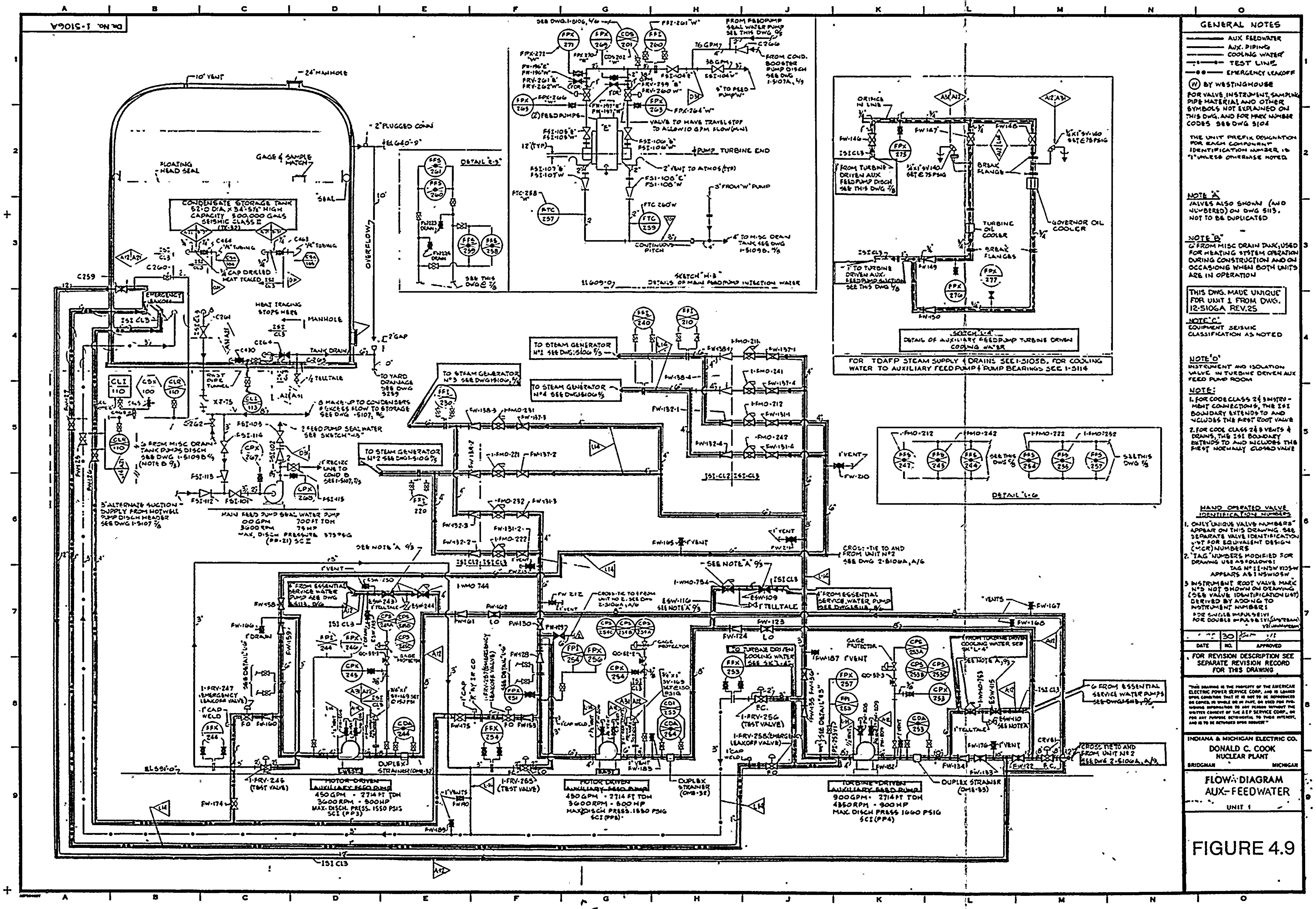

FIGURE 4.9

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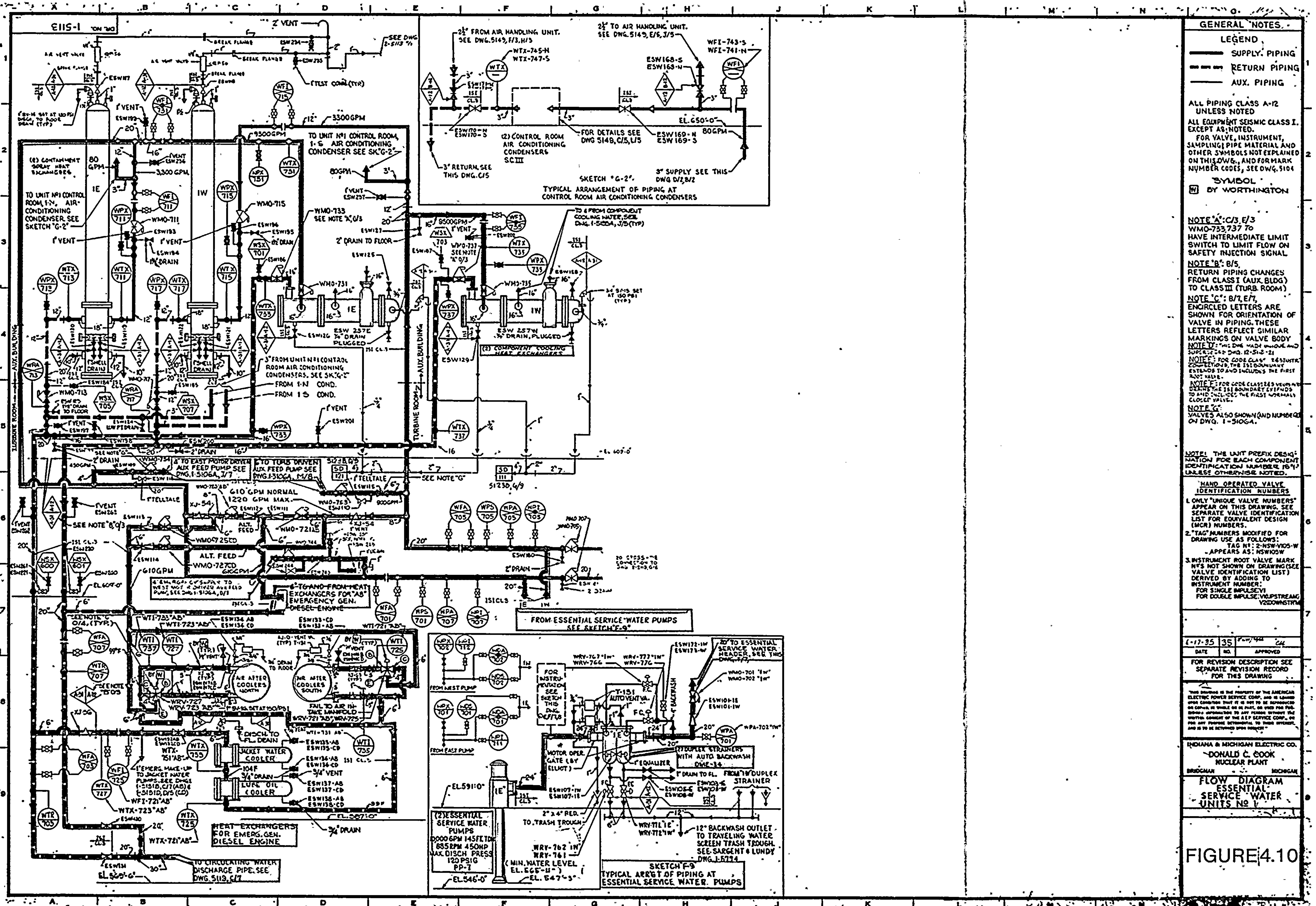

FIGURE 4.10

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TI APERTURE CARD

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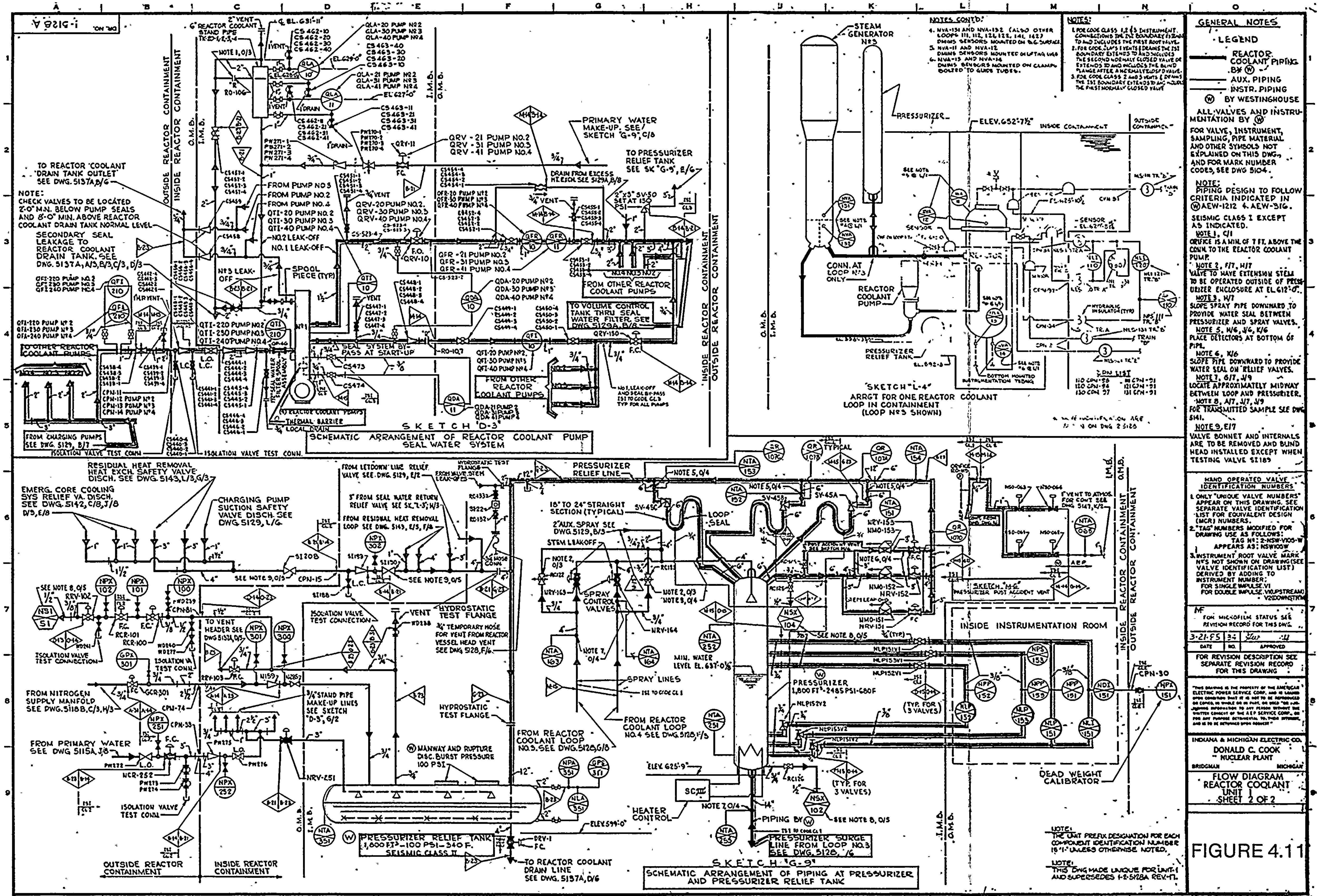

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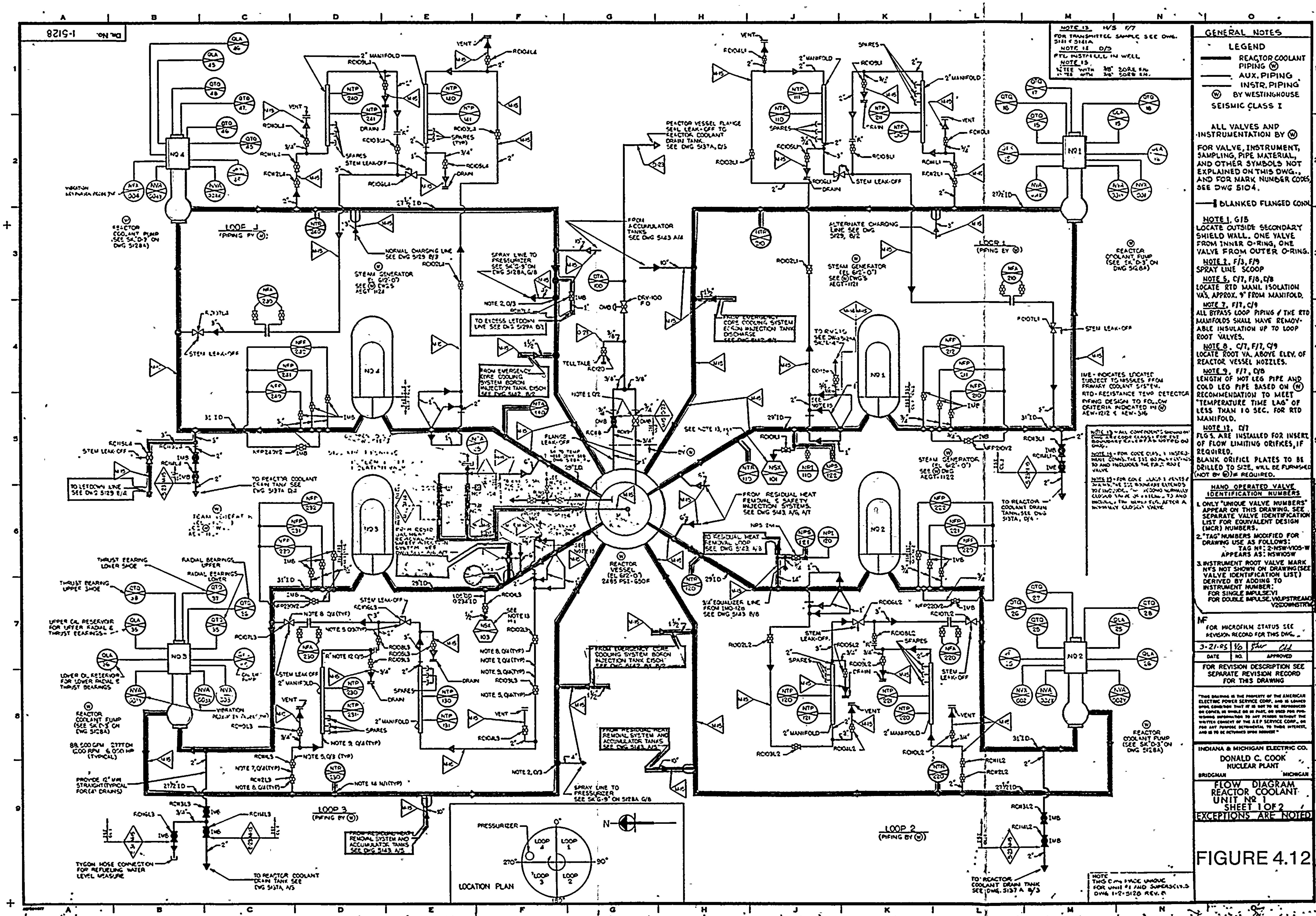

FIGURE 4.12

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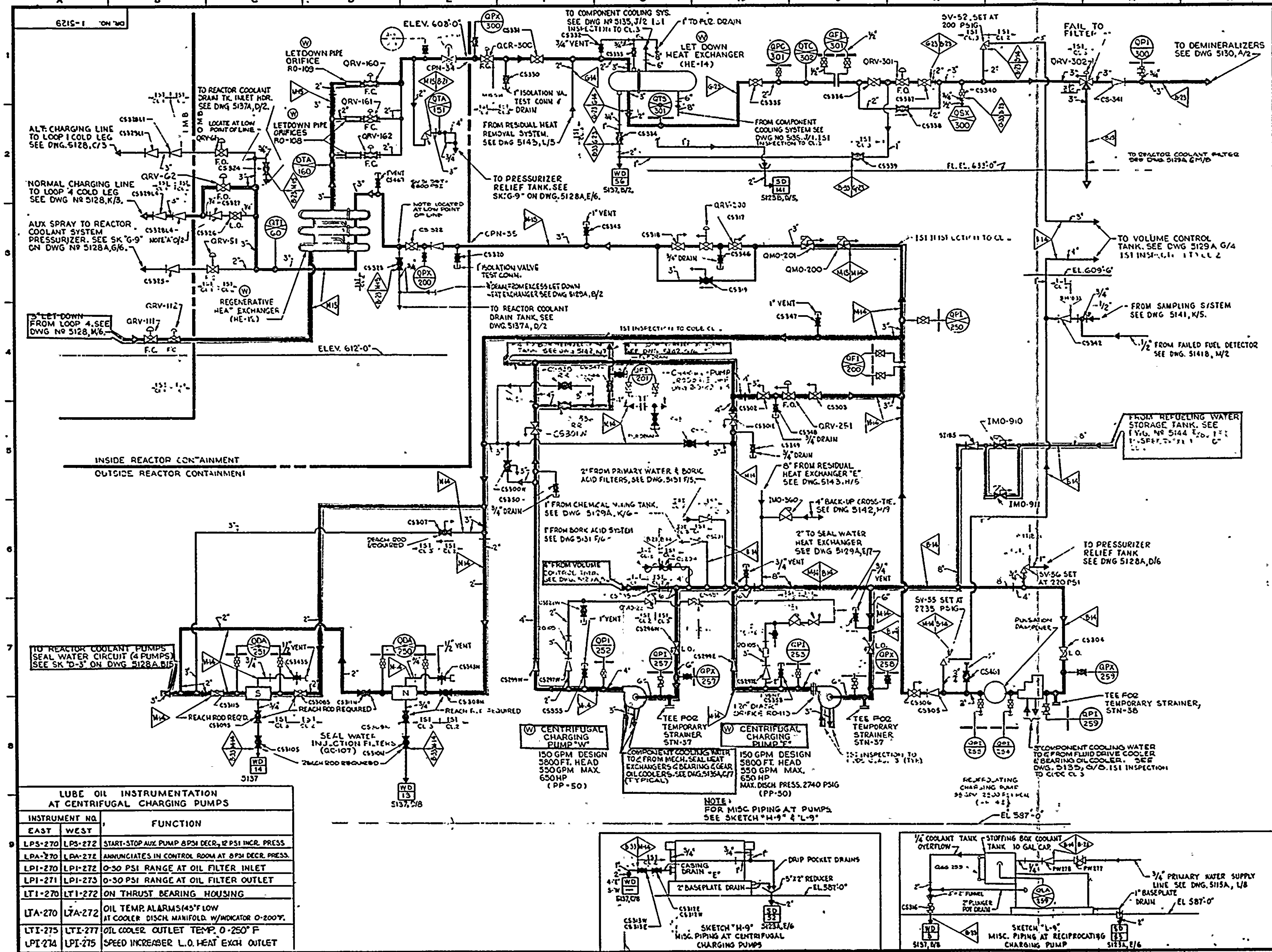

GENERAL NOTES

LEGEND

MAIN FLOW

AUX. FLOW

FOR VALVE, INSTRUMENT, SAMPLING, PIPE MATERIAL AND OTHER SYMBOLS NOT EXPLAINED ON THIS DWG AND FOR MARK NUMBER CODES SEE DWG 5104.

SEISMIC CLASS I, EXCEPT AS NOTED

VALVE NOTED "A" B/3 VALVE OPENS AT 500 PSID

ALL VALVES, EQUIPMENT & INSTRUMENTATION SUPPLIED BY (W) (WESTINGHOUSE) EXCEPT AS NOTED.

HAND OPERATED VALVE IDENTIFICATION NUMBERS

1. ONLY "UNIQUE VALVE NUMBERS" APPEAR ON THIS DRAWING. SEE SEPARATE VALVE IDENTIFICATION LIST FOR EQUIVALENT DESIGN (MCR) NUMBERS.
2. "TAG" NUMBERS MODIFIED FOR DRAWING USE AS FOLLOWS: TAG Nº 2 NSW VC15 W APPEARS AS NSW15W

*INSTRUMENT ROOT VALVE MARK NºS NOT SHOWN ON DRAWING (SEE VALVE IDENTIFICATION LIST) DERIVED BY ADDING TO INSTRUMENT NUMBER: FOR SINGLE IMPULSE: VI FOR DOUBLE IMPULSE: VIUPSTREAM V2DOWNSTREAM

FOR MICROFILM STATUS SEE REVISION RECORD FOR THIS DWG

DATE	NO.	APPROVED
2-21-85	29	KW NE

FOR REVISION DESCRIPTION SEE SEPARATE REVISION RECORD FOR THIS DRAWING

INDIANA & MICHIGAN ELECTRIC CO.

DONALD C. COOK NUCLEAR PLANT

BRIDGMAN MICHIGAN

FLOW DIAGRAM CVCS-REACTOR LETDOWN & CHARGING

UNIT Nº 1 SHEET 1 OF 2

FIGURE 4.13

LUBE OIL INSTRUMENTATION AT CENTRIFUGAL CHARGING PUMPS

INSTRUMENT NO. EAST	INSTRUMENT NO. WEST	FUNCTION
LPS-270	LPS-272	START-STOP AUX PUMP 8 PSI DECR., 12 PSI INCR. PRESS
LPA-270	LPA-272	ANNUNCIATES IN CONTROL ROOM AT 8 PSI DECR. PRESS.
LPI-270	LPI-272	0-30 PSI RANGE AT OIL FILTER INLET
LPI-271	LPI-273	0-30 PSI RANGE AT OIL FILTER OUTLET
LTI-270	LTI-272	ON THRUST BEARING HOUSING
LTA-270	LTA-272	OIL TEMP. ALARMS (45°F LOW AT COOLER DISCH. MANIFOLD. W/INDICATOR 0-200°F.
LTI-275	LTI-277	OIL COOLER OUTLET TEMP. 0-250° F
LPI-274	LPI-275	SPEED INCREASER L.O. HEAT EXCH OUTLET

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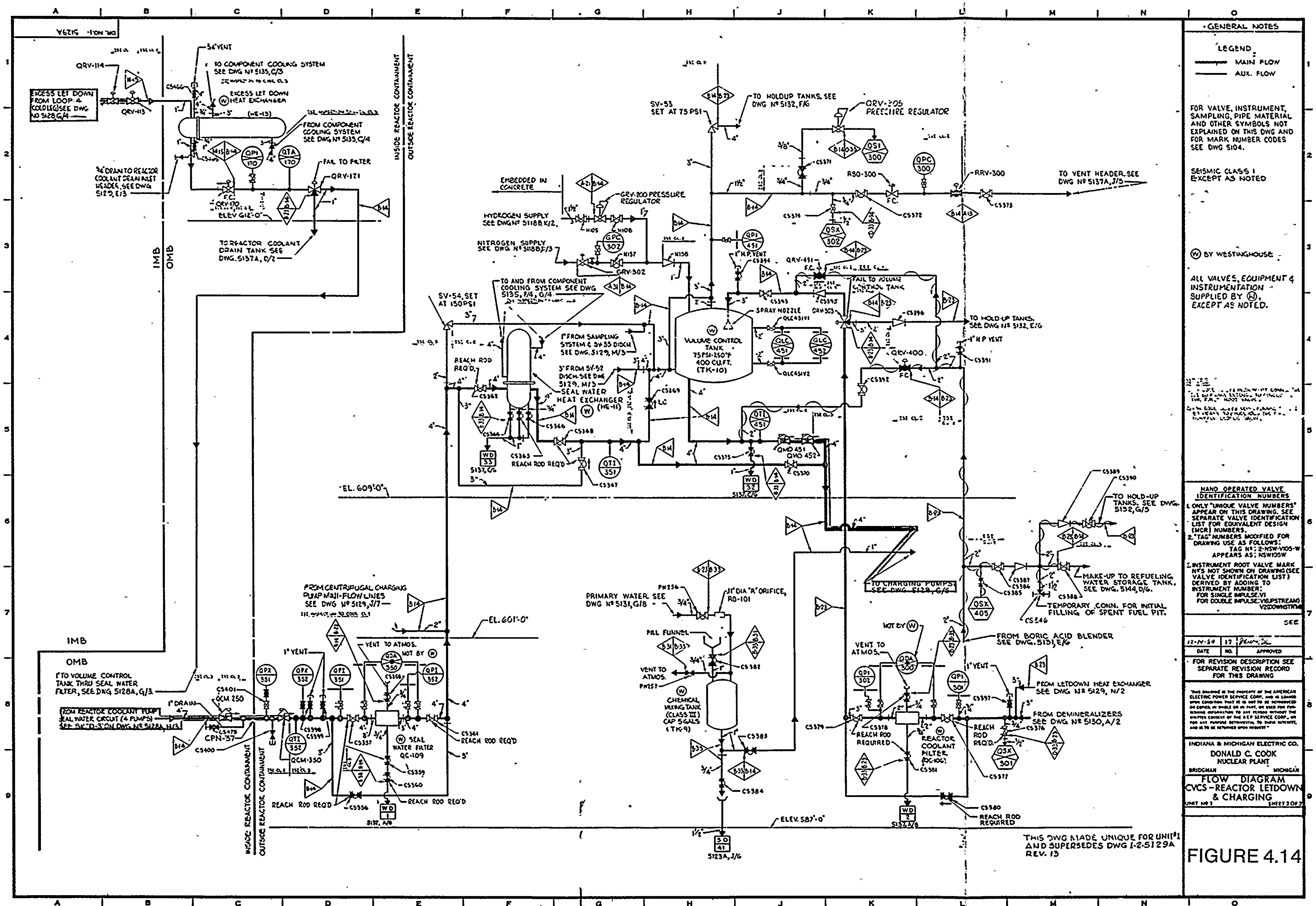

FIGURE 4.14

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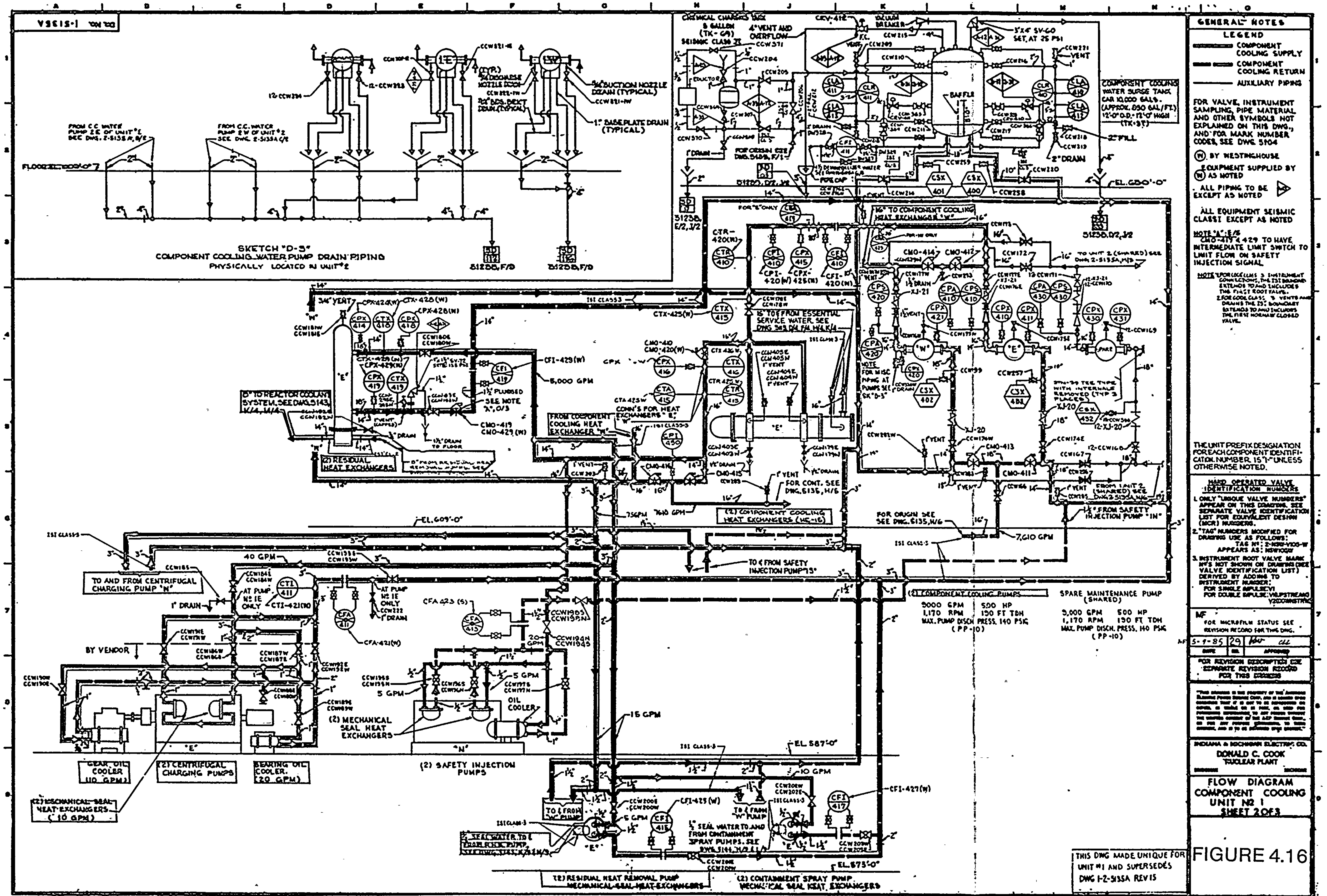

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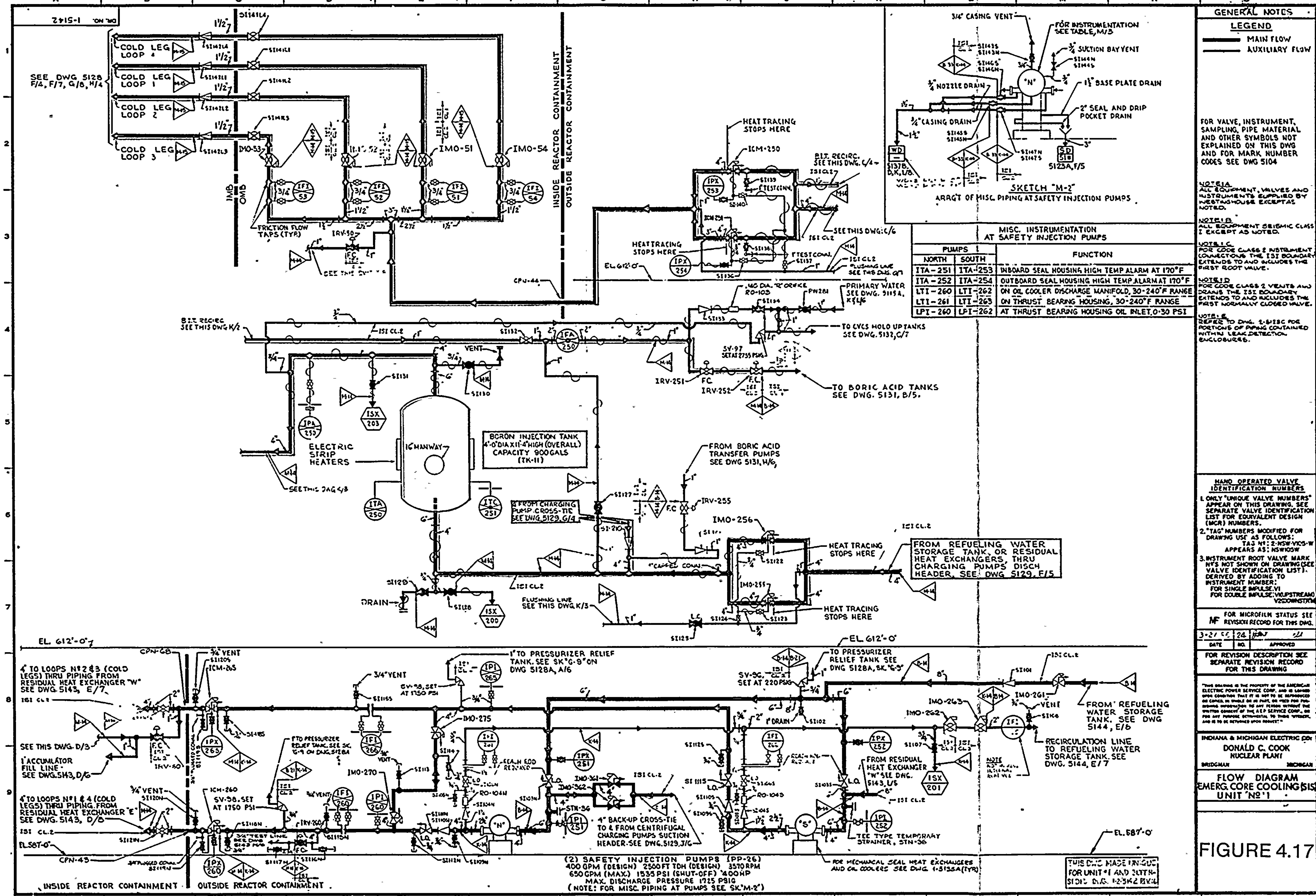

FIGURE 4.17

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[illegible]

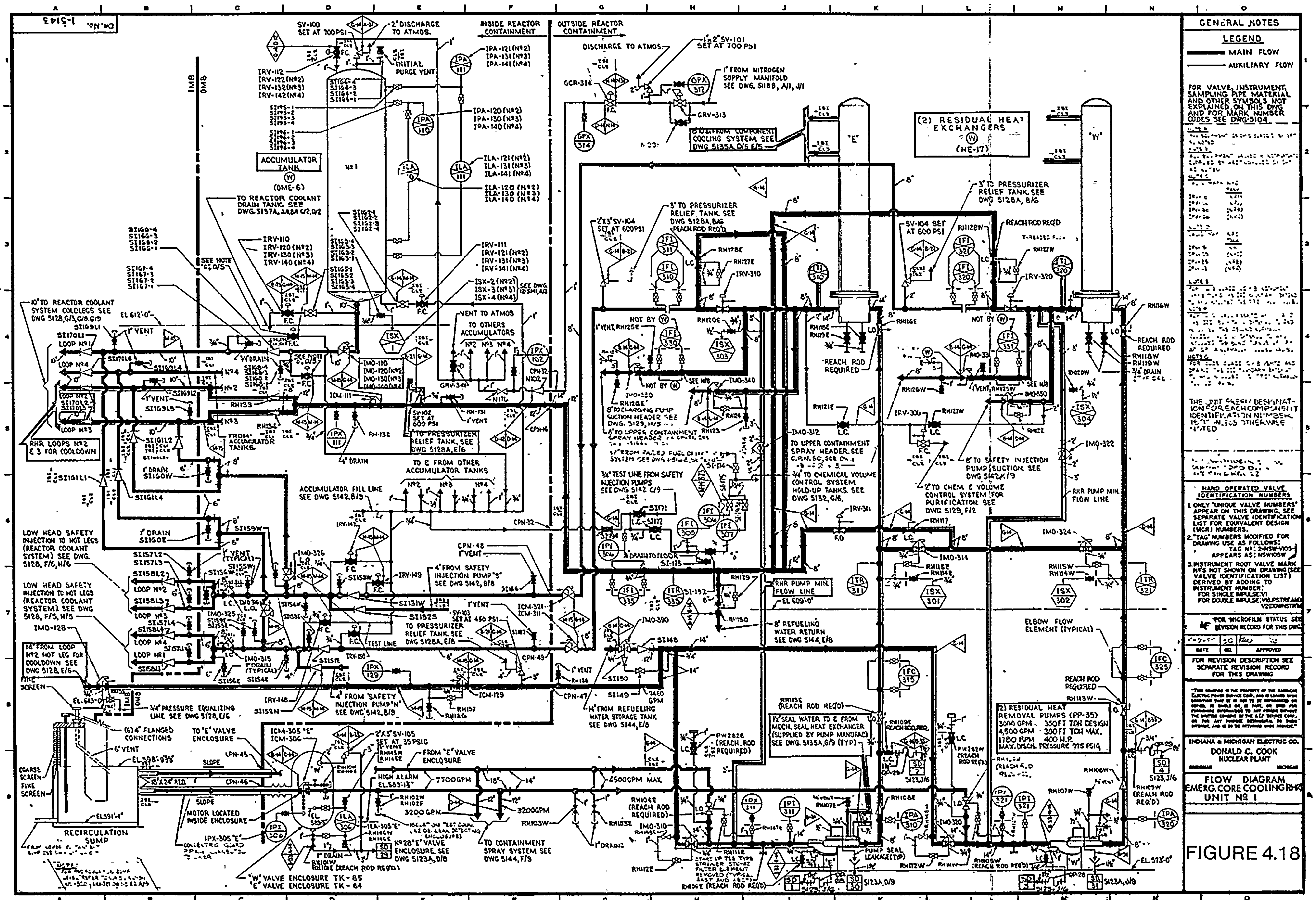

FIGURE 4.18

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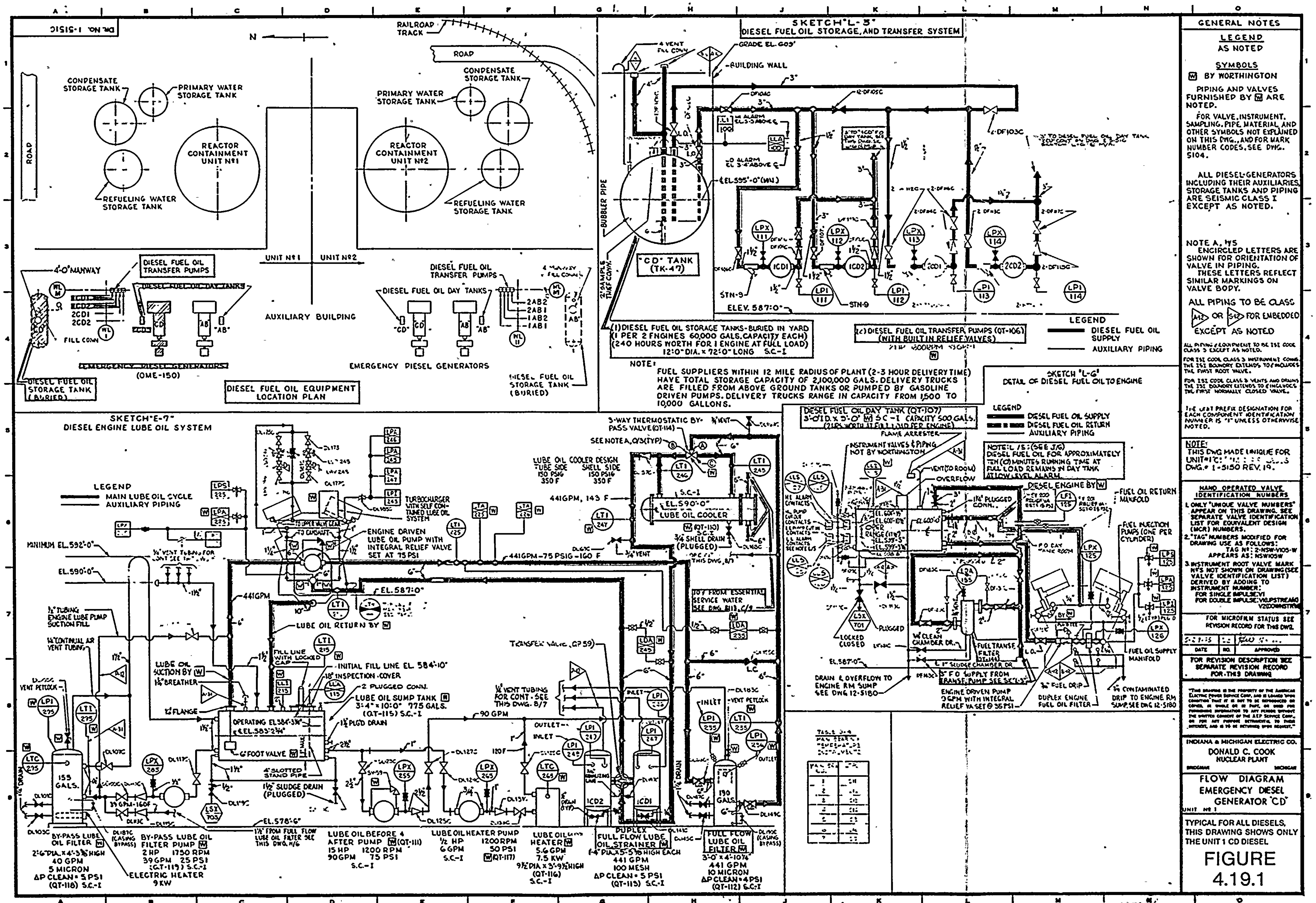

TI APERTURE CARD

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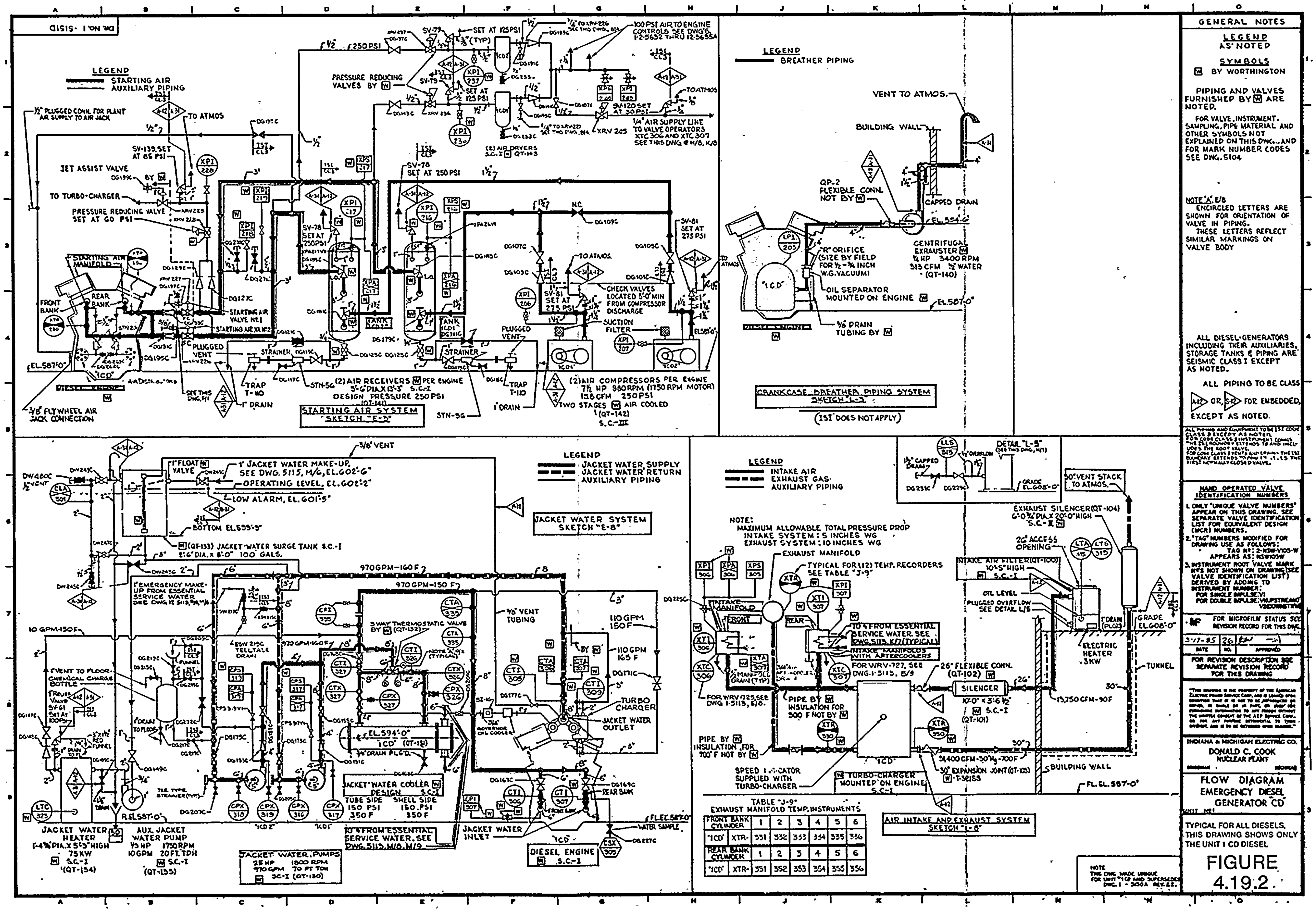

FRONT BANK CYLINDER		1	2	3	4	5	6
"1CD"	XTR-	351	352	353	354	355	356
REAR BANK CYLINDER		1	2	3	4	5	6
"1CD"	XTR-	351	352	353	354	355	356

FIGURE 4.19:2

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TI APERTURE CARD

Also Available On Aperture Card

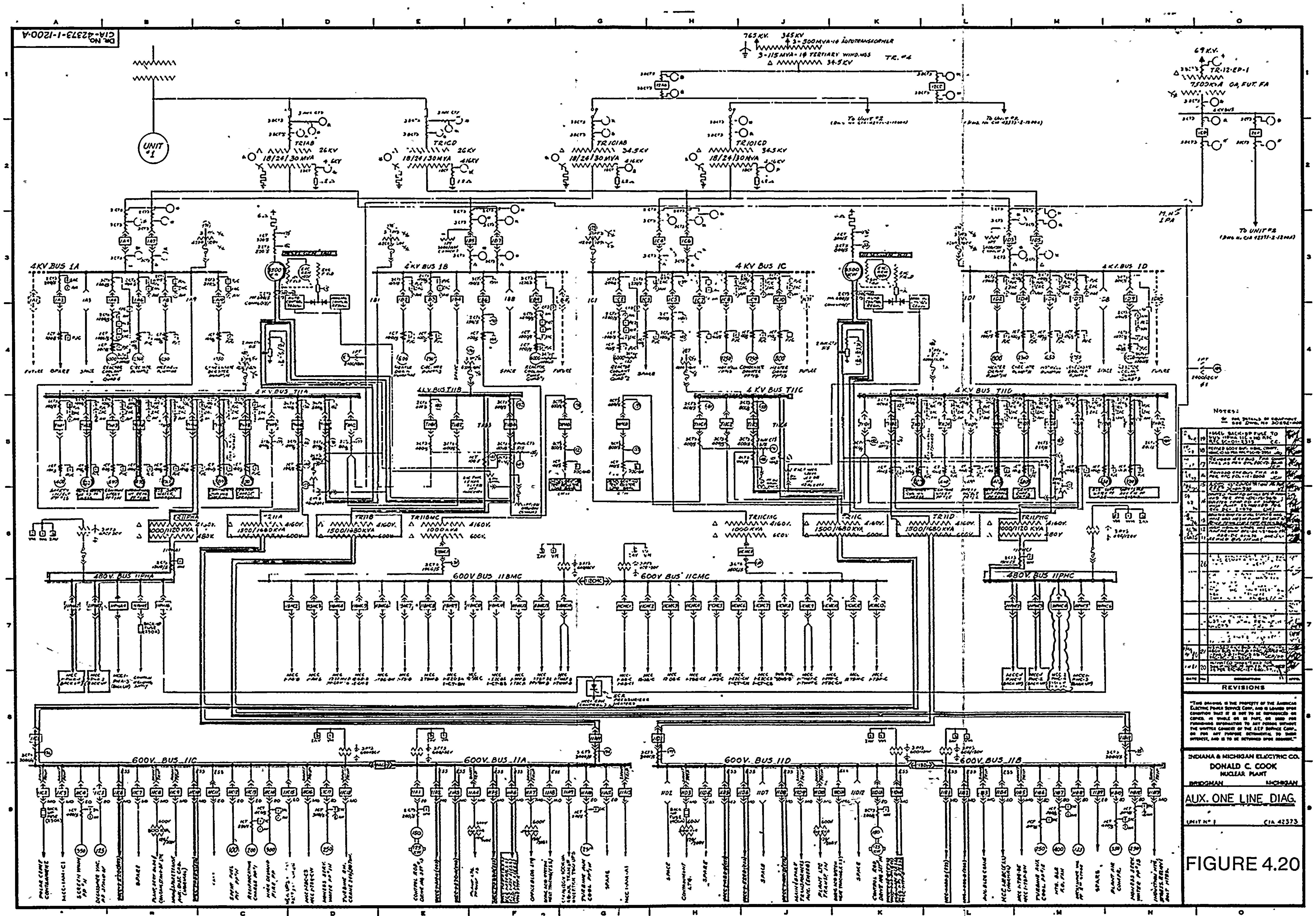
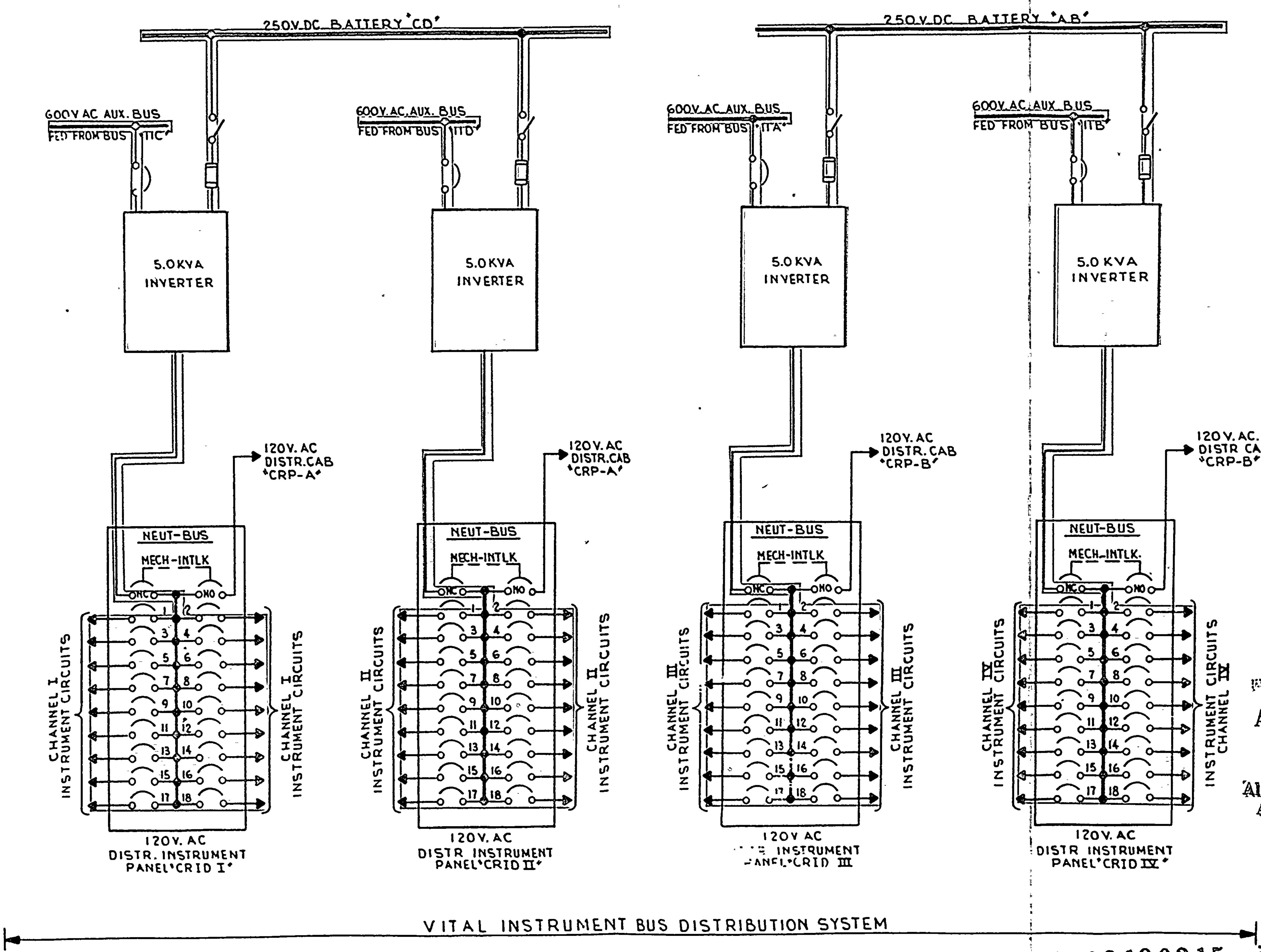


FIGURE 4.20

8702190215-32



TI APERTURE CARD

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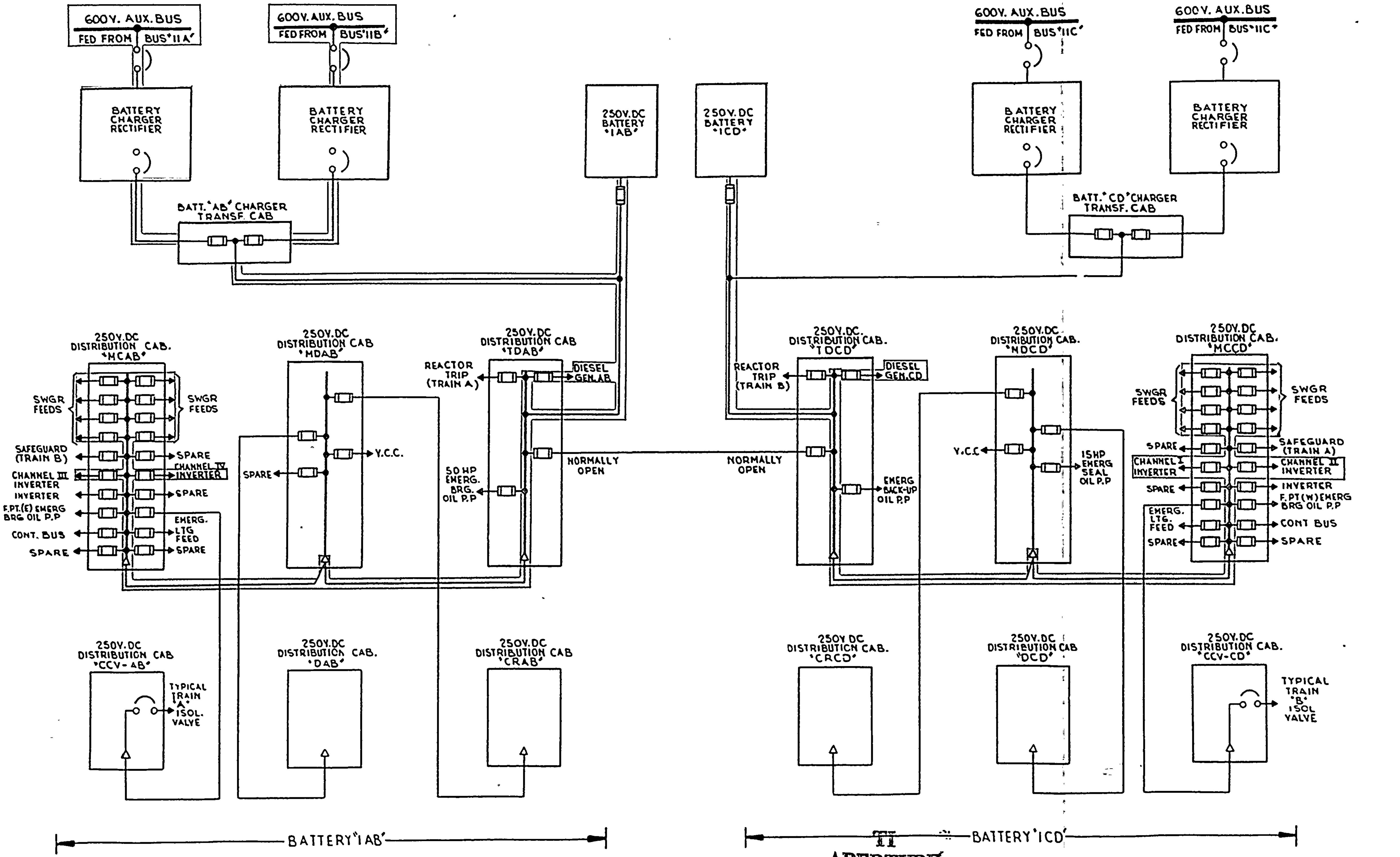
FIGURE 4.21

8702190215-33

FIGURE 8.3-1.



TI APERTURE CARD

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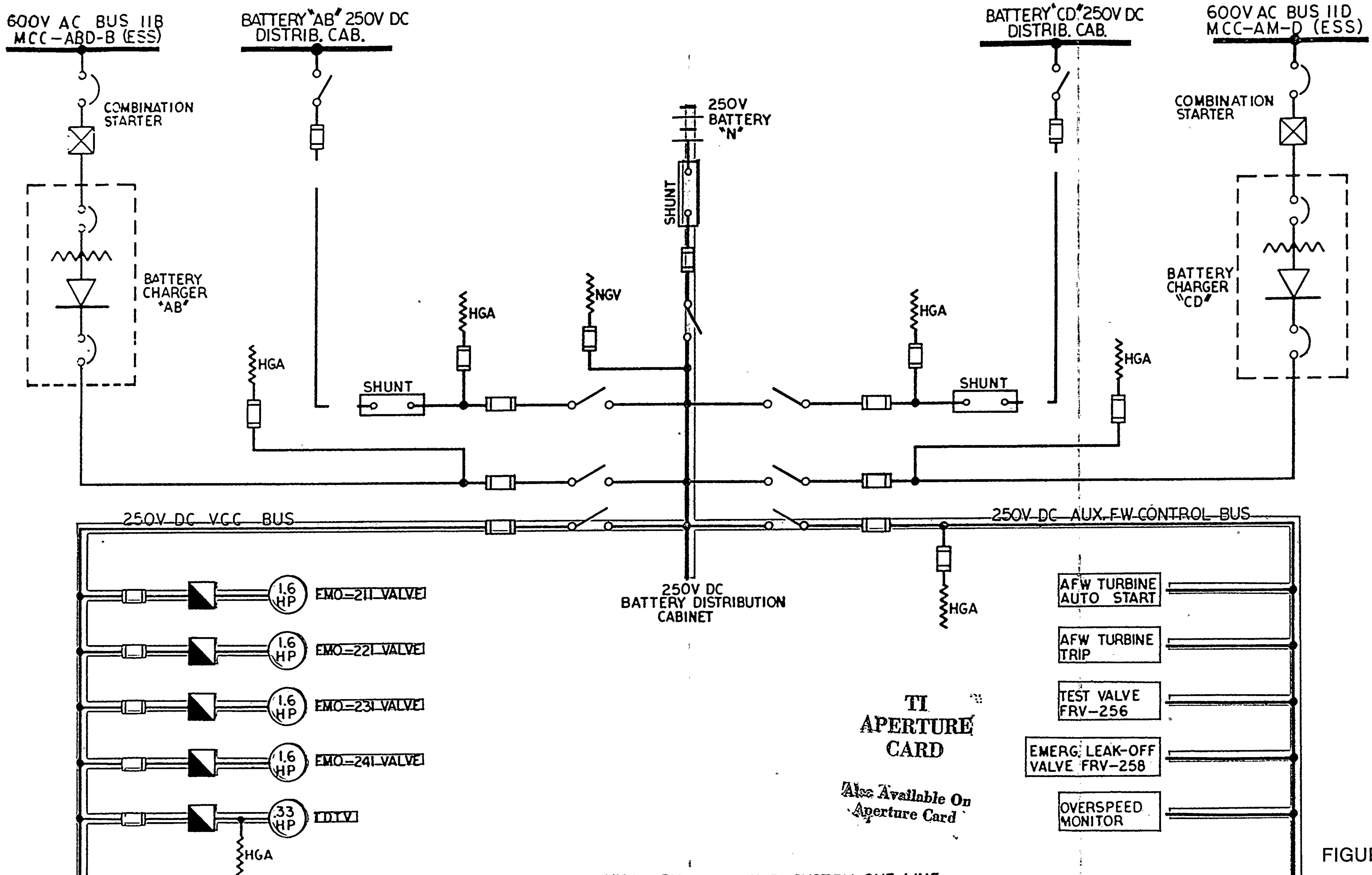
250V DC DISTRIBUTION
FIGURE 8. 3-2
REDRAWN 12-21-81

FIGURE 4.22

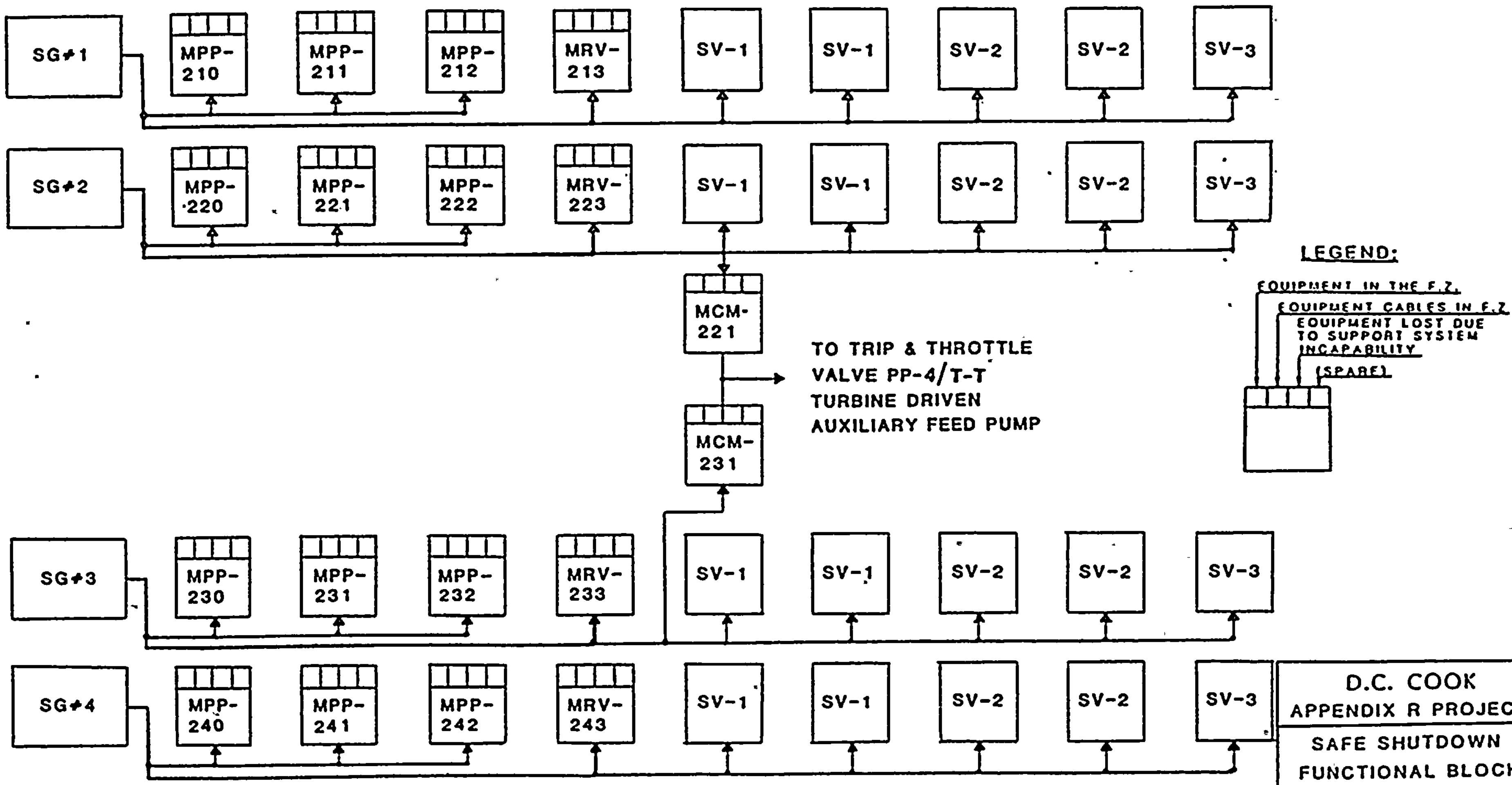
8702190215-34



TURBINE DRIVEN AUXILIARY FEEDWATER SYSTEM ONE-LINE

FIGURE 4.23

FSAR FIG 8.3-3
JUNE 1982



D.C. COOK APPENDIX R PROJECT	
SAFE SHUTDOWN FUNCTIONAL BLOCK DIAGRAM	
SYSTEM MS	FIRE ZONE

FIGURE 4.24

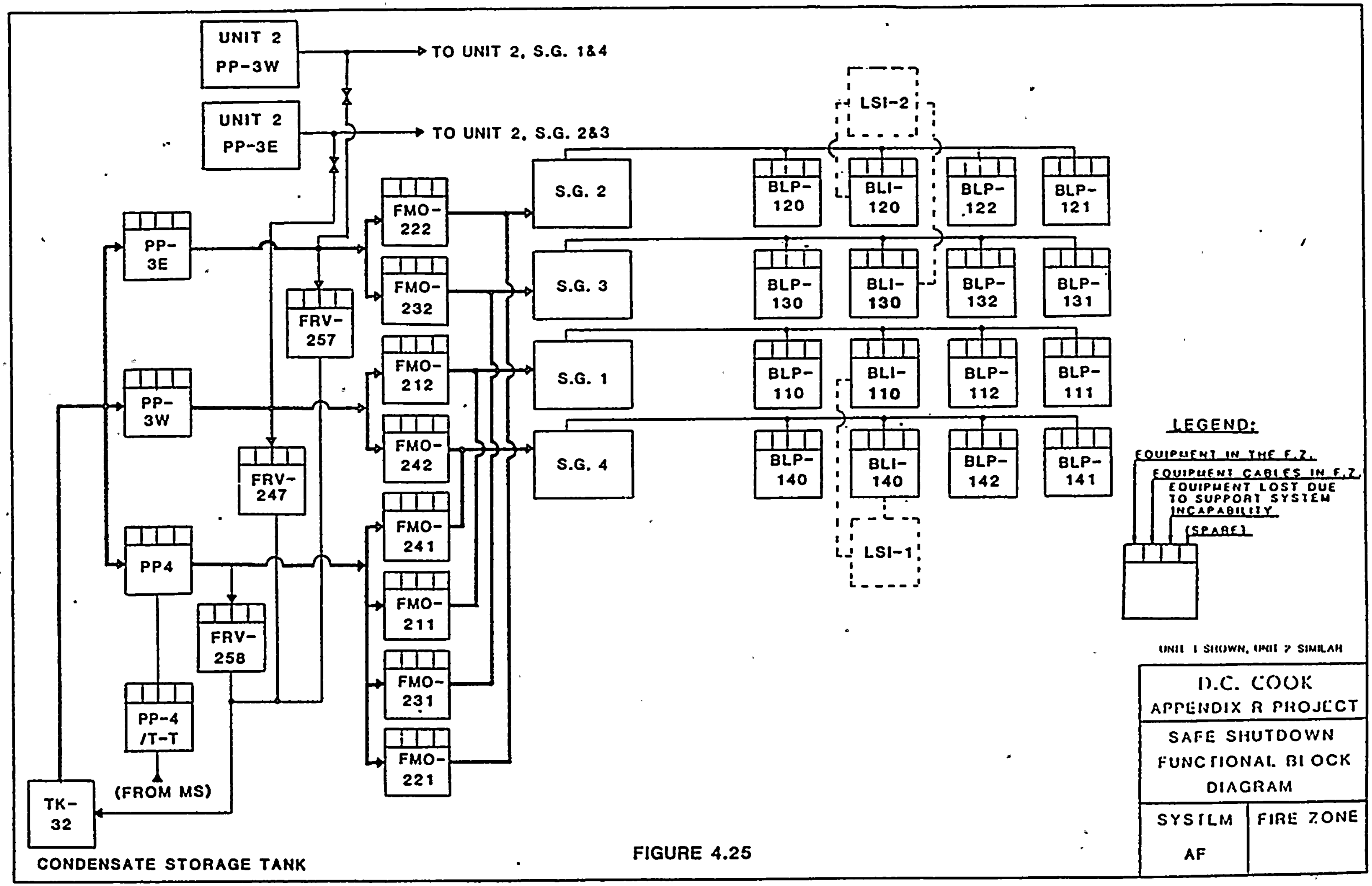

UNIT 2 PP-3W
TO UNIT 2, S.G. 1&4
UNIT 2 PP-3E
TO UNIT 2, S.G. 2&3
PP-3E
PP-3W
PP4
FRV-257
FRV-247
FRV-258
PP-4 /T-T
(FROM MS)
TK-32
CONDENSATE STORAGE TANK
FMO-222
FMO-232
FMO-212
FMO-242
FMO-241
FMO-211
FMO-231
FMO-221
S.G. 2
S.G. 3
S.G. 1
S.G. 4
LSI-2
BLP-120
BLI-120
BLP-122
BLP-121
BLP-130
BLI-130
BLP-132
BLP-131
BLP-110
BLI-110
BLP-112
BLP-111
BLP-140
BLI-140
BLP-142
BLP-141
LSI-1
LEGEND:
EQUIPMENT IN THE F.Z.
EQUIPMENT CABLES IN F.Z.
EQUIPMENT LOST DUE TO SUPPORT SYSTEM INCAPABILITY
(SPARE)
UNIT 1 SHOWN, UNIT 2 SIMILAR
D.C. COOK
APPENDIX R PROJECT
SAFE SHUTDOWN FUNCTIONAL BLOCK DIAGRAM
SYSTEM
AF
FIRE ZONE

FIGURE 4.25

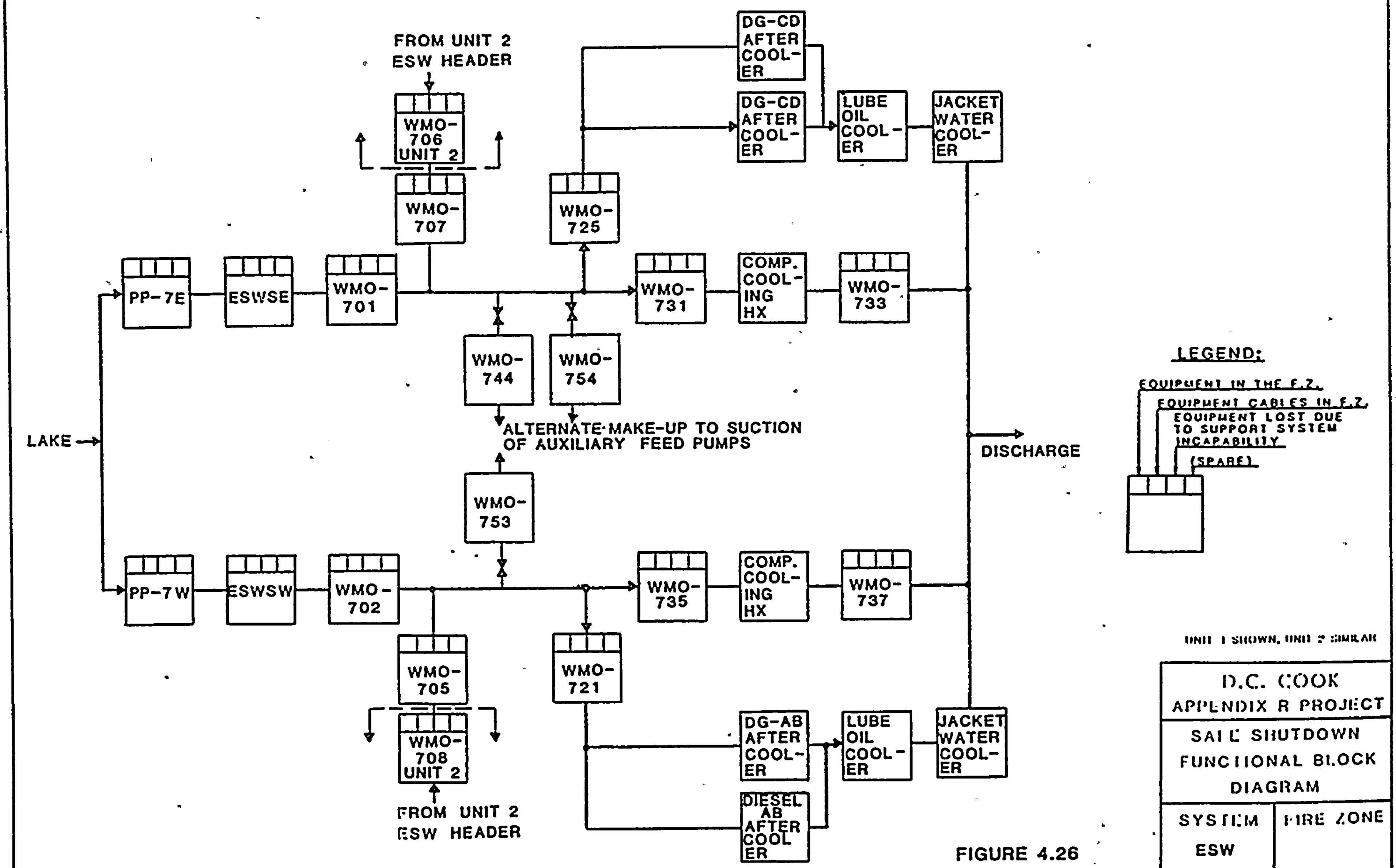
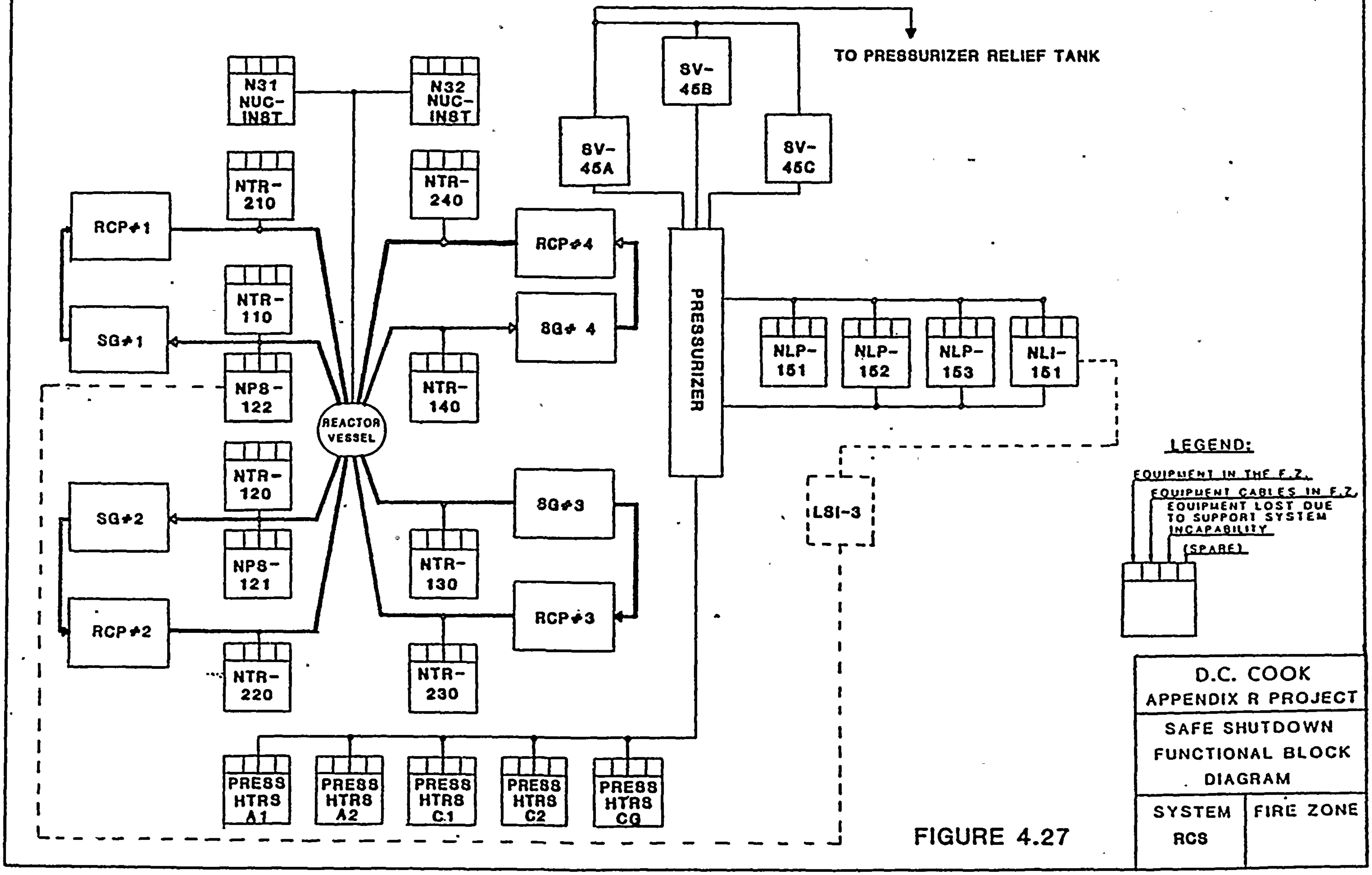


FIGURE 4.26

D.C. COOK APPENDIX R PROJECT	
SAFE SHUTDOWN FUNCTIONAL BLOCK DIAGRAM	
SYSTEM ESW	FIRE ZONE



D.C. COOK
APPENDIX R PROJECT

SAFE SHUTDOWN FUNCTIONAL BLOCK DIAGRAM

SYSTEM	FIRE ZONE
RCS	

FIGURE 4.27

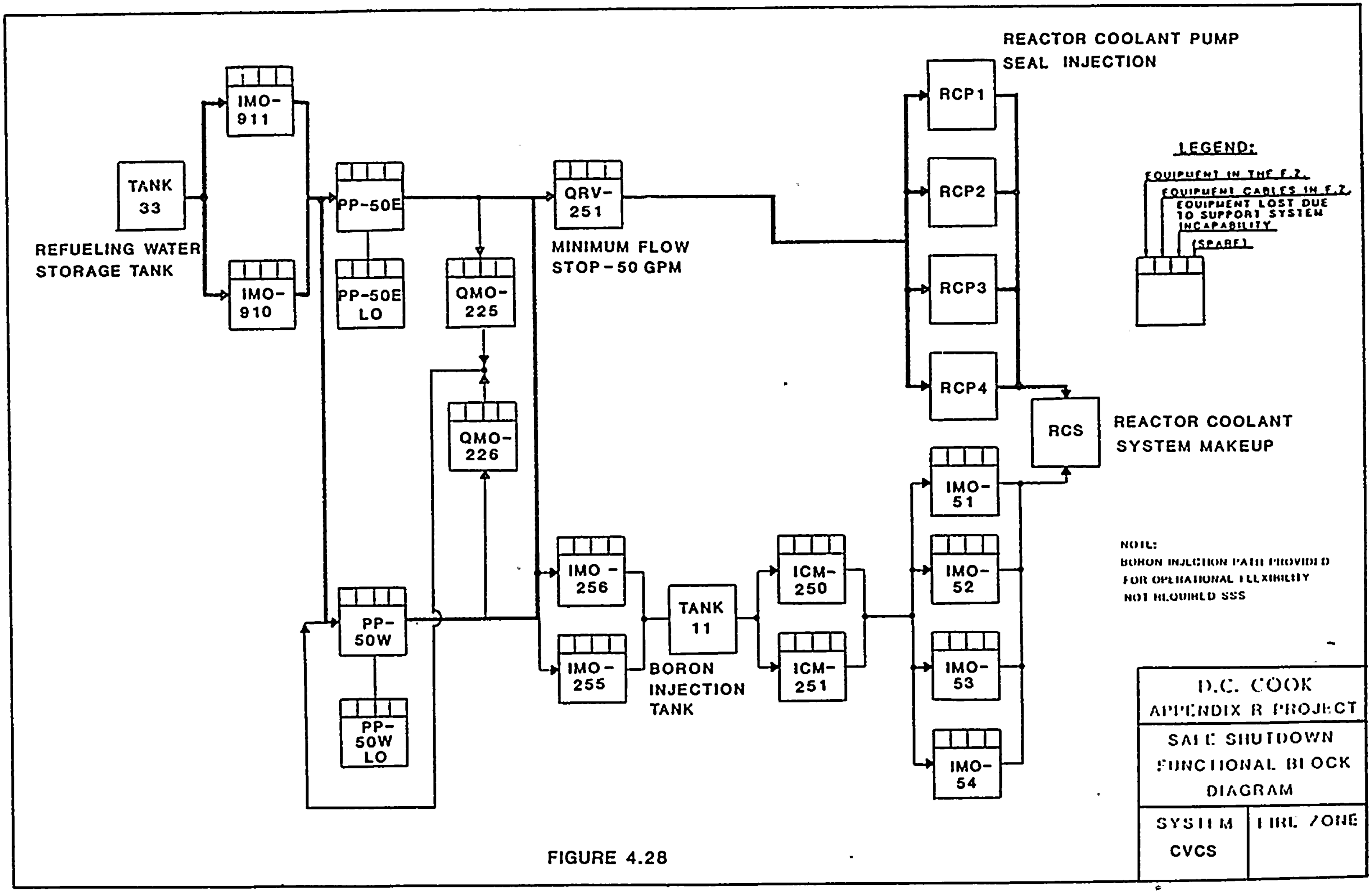

REACTOR COOLANT PUMP SEAL INJECTION
IMO-911
TANK 33
REFUELING WATER STORAGE TANK
IMO-910
PP-50E
PP-50E LO
QRV-251
MINIMUM FLOW STOP-50 GPM
QMO-225
QMO-226
RCP1
RCP2
RCP3
RCP4
LEGEND:
EQUIPMENT IN THE F.Z.
EQUIPMENT CABLES IN F.Z.
EQUIPMENT LOST DUE TO SUPPORT SYSTEM INCAPABILITY
(SPARE)
RCS
REACTOR COOLANT SYSTEM MAKEUP
IMO-51
IMO-52
IMO-53
IMO-54
NOTE:
BORON INJECTION PATH PROVIDED FOR OPERATIONAL FLEXIBILITY NOT REQUIRED SSS
PP-50W
PP-50W LO
IMO-256
IMO-255
TANK 11
BORON INJECTION TANK
ICM-250
ICM-251
D.C. COOK
APPENDIX R PROJECT
SAFE SHUTDOWN FUNCTIONAL BLOCK DIAGRAM
SYSTEM
CVCS
FIRE ZONE

FIGURE 4.28

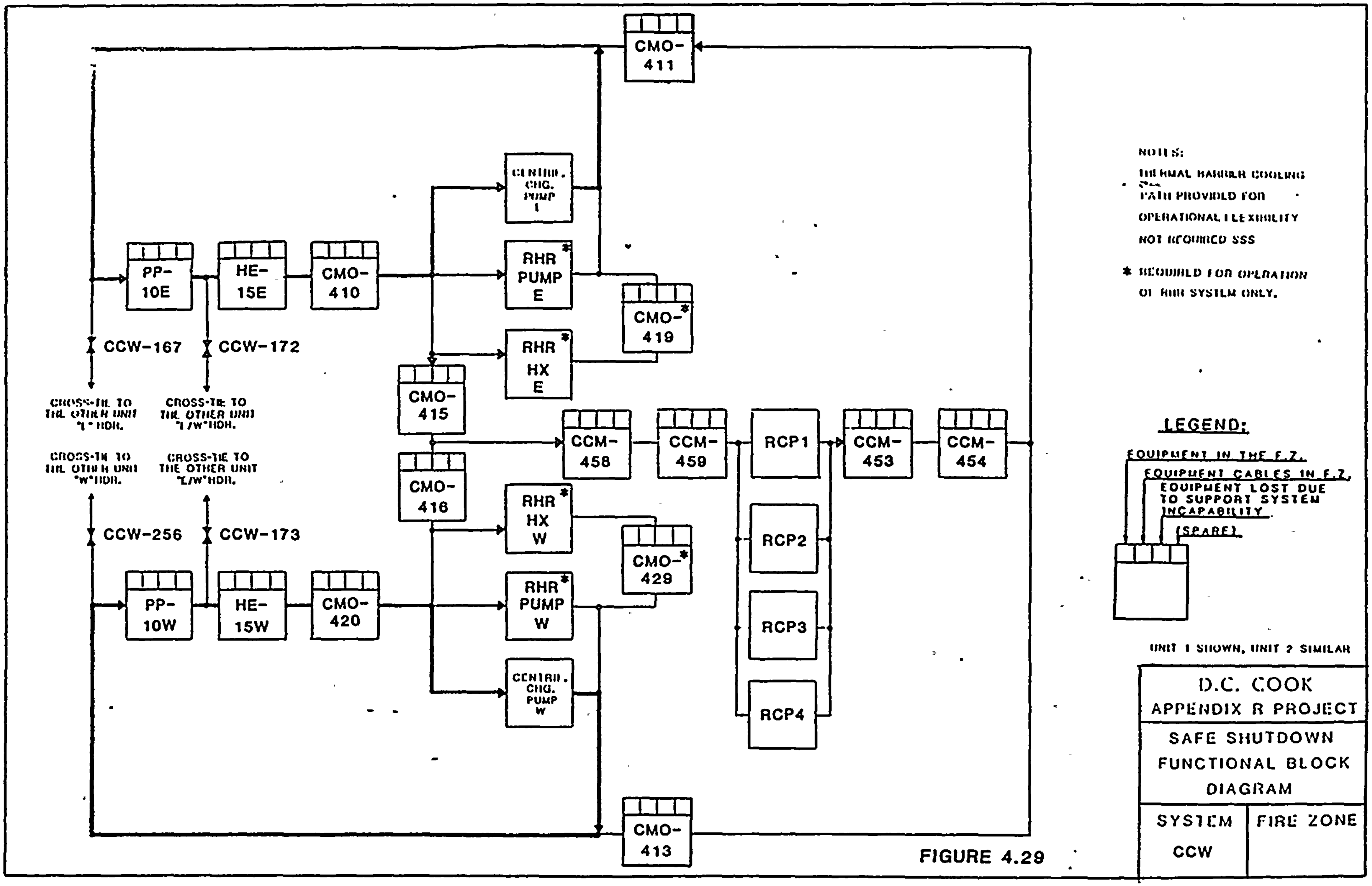

CMO-411
CENTRIF. CHG. PUMP E
RHR PUMP E *
RHR HX E *
CMO-419 *
PP-10E
HE-15E
CMO-410
CCW-167
CCW-172
CROSS-TIE TO THE OTHER UNIT "E" HDR.
CROSS-TIE TO THE OTHER UNIT "E/W" HDR.
CROSS-TIE TO THE OTHER UNIT "W" HDR.
CROSS-TIE TO THE OTHER UNIT "E/W" HDR.
CCW-256
CCW-173
CMO-415
CMO-416
CCM-458
CCM-459
RCP1
RCP2
RCP3
RCP4
CCM-453
CCM-454
RHR HX W *
CMO-429 *
PP-10W
HE-15W
CMO-420
RHR PUMP W *
CENTRIF. CHG. PUMP W
CMO-413
NOTES:
THERMAL BARRIER COOLING PATH PROVIDED FOR OPERATIONAL FLEXIBILITY NOT REQUIRED SSS
* REQUIRED FOR OPERATION OF RHR SYSTEM ONLY.
LEGEND:
EQUIPMENT IN THE F.Z.
EQUIPMENT CABLES IN F.Z.
EQUIPMENT LOST DUE TO SUPPORT SYSTEM INCAPABILITY
(SPARE)
UNIT 1 SHOWN, UNIT 2 SIMILAR
D.C. COOK
APPENDIX R PROJECT
SAFE SHUTDOWN FUNCTIONAL BLOCK DIAGRAM
SYSTEM
CCW
FIRE ZONE

FIGURE 4.29

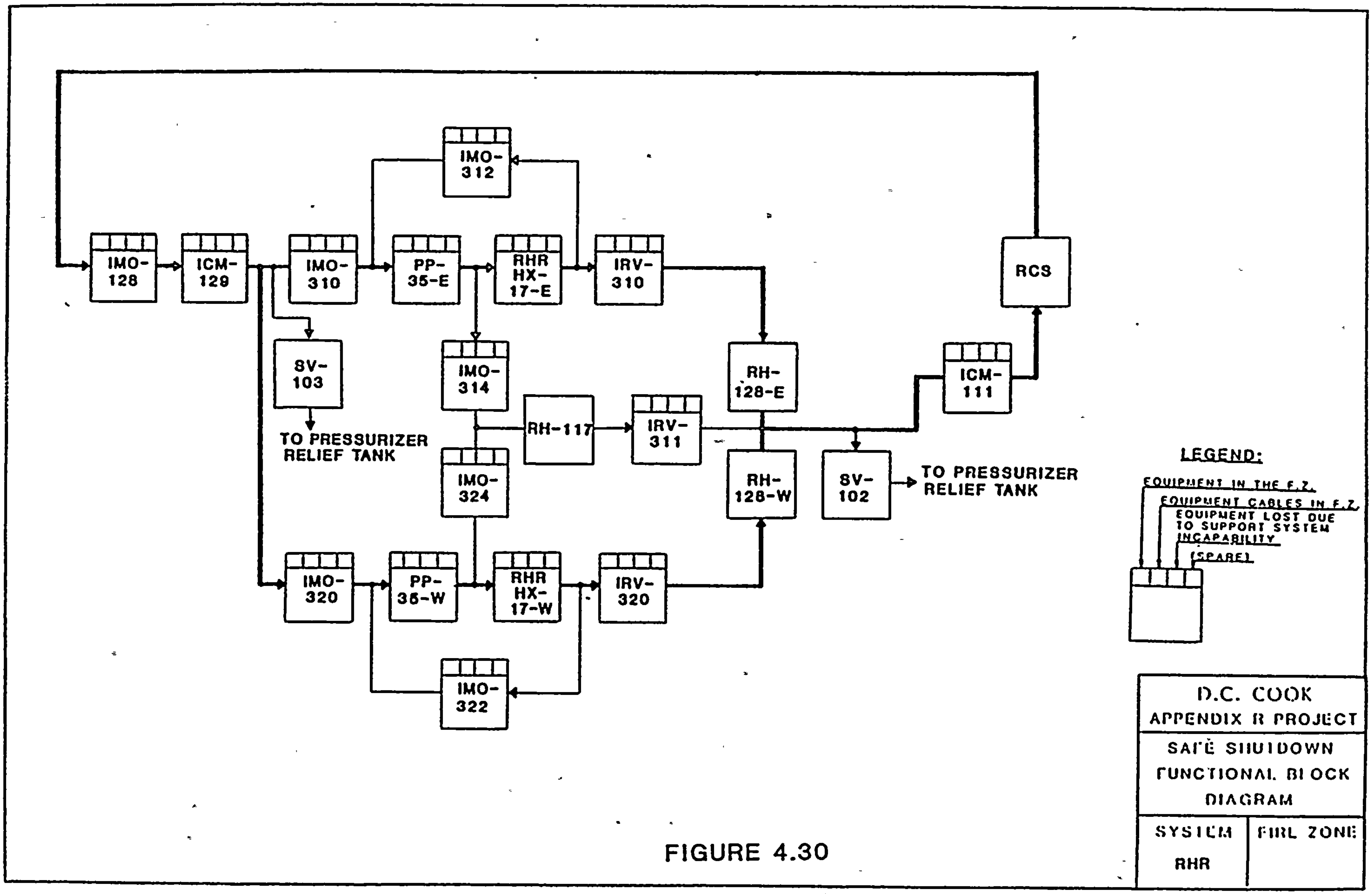

IMO-128
ICM-129
IMO-310
PP-35-E
RHR HX-17-E
IRV-310
IMO-312
SV-103
TO PRESSURIZER RELIEF TANK
IMO-314
RH-117
IRV-311
IMO-324
RH-128-E
RH-128-W
SV-102
TO PRESSURIZER RELIEF TANK
ICM-111
RCS
IMO-320
PP-35-W
RHR HX-17-W
IRV-320
IMO-322
LEGEND:
EQUIPMENT IN THE F.Z.
EQUIPMENT CABLES IN F.Z.
EQUIPMENT LOST DUE TO SUPPORT SYSTEM INCAPABILITY
(SPARE)
D.C. COOK
APPENDIX R PROJECT
SAFE SHUTDOWN FUNCTIONAL BLOCK DIAGRAM
SYSTEM
RHR
FIRE ZONE

FIGURE 4.30

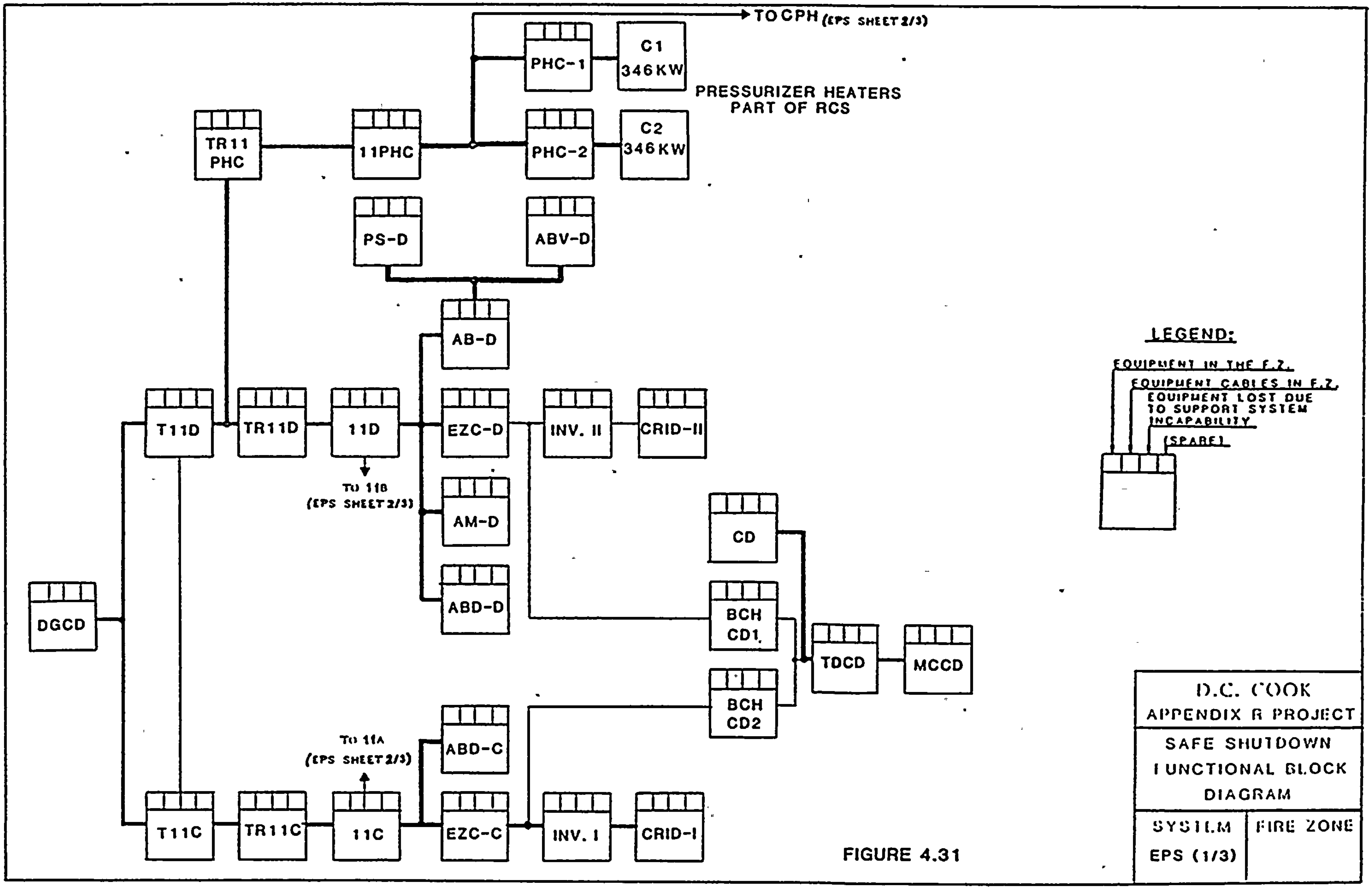


FIGURE 4.31

D.C. COOK APPENDIX R PROJECT	
SAFE SHUTDOWN FUNCTIONAL BLOCK DIAGRAM	
SYSTEM EPS (1/3)	FIRE ZONE

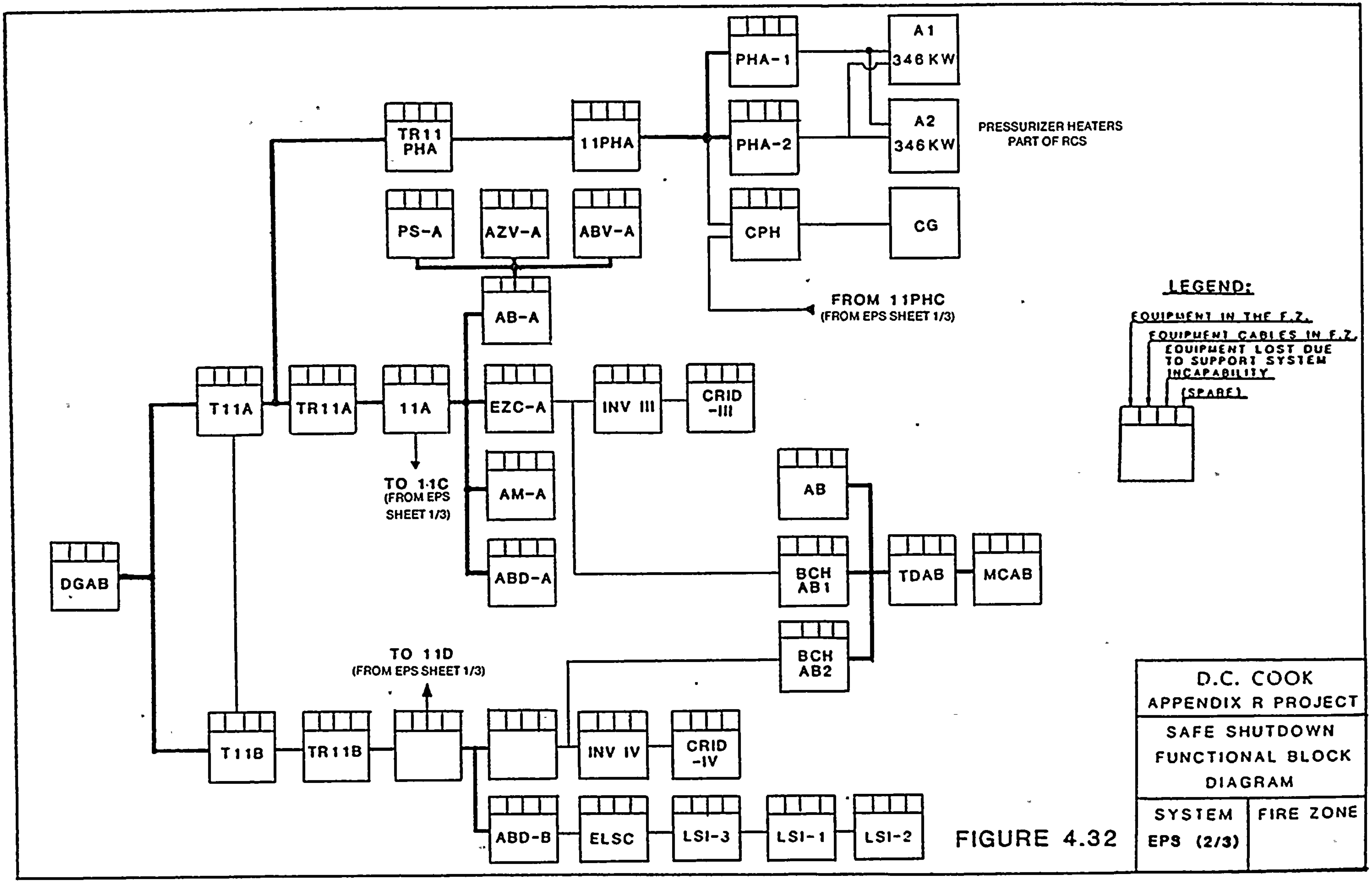
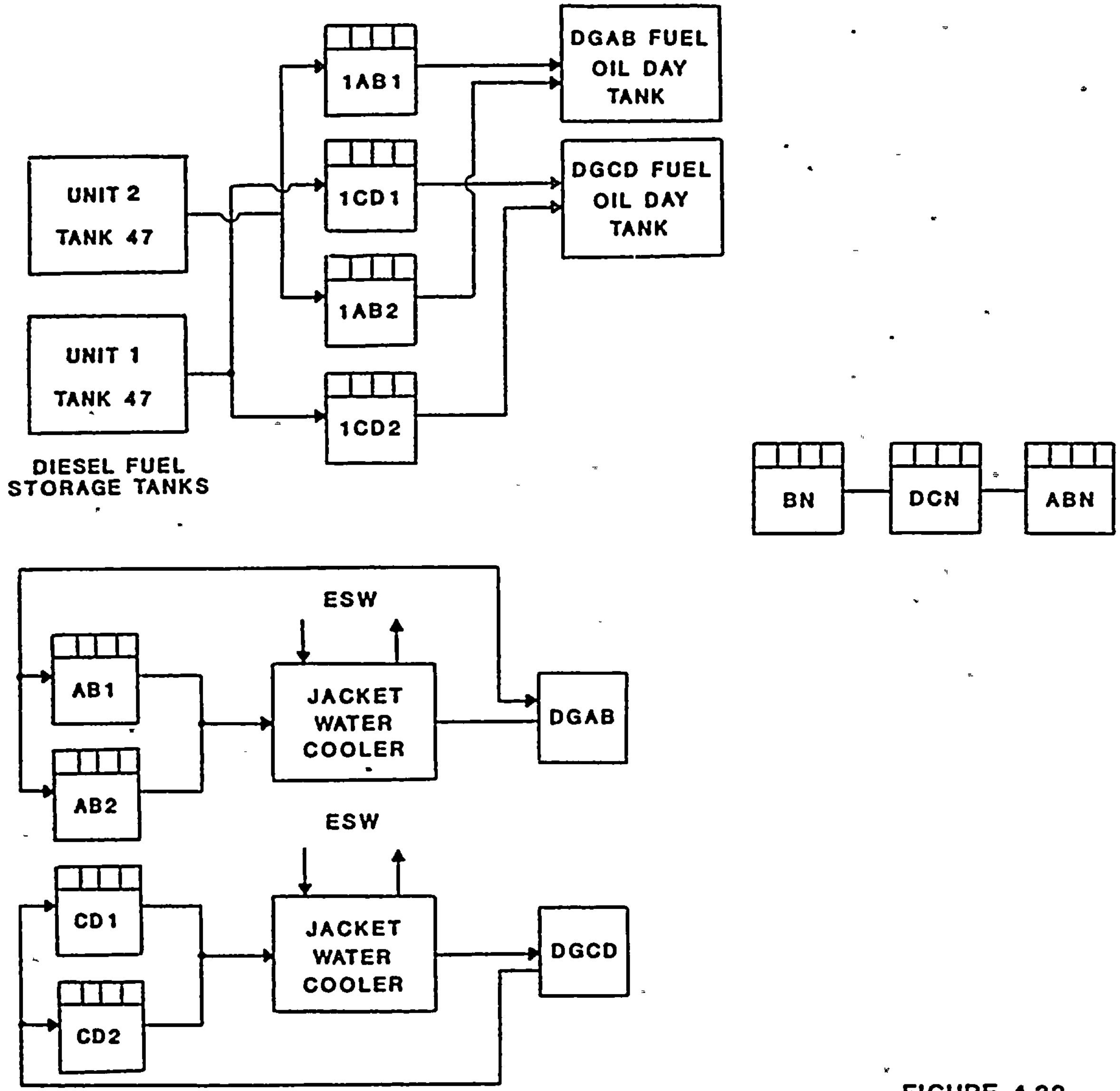


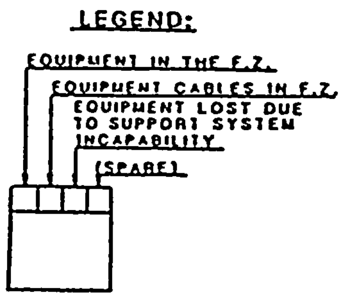
FIGURE 4.32

D.C. COOK
APPENDIX R PROJECT

SAFE SHUTDOWN
FUNCTIONAL BLOCK
DIAGRAM

SYSTEM	FIRE ZONE
EPS (2/3)	

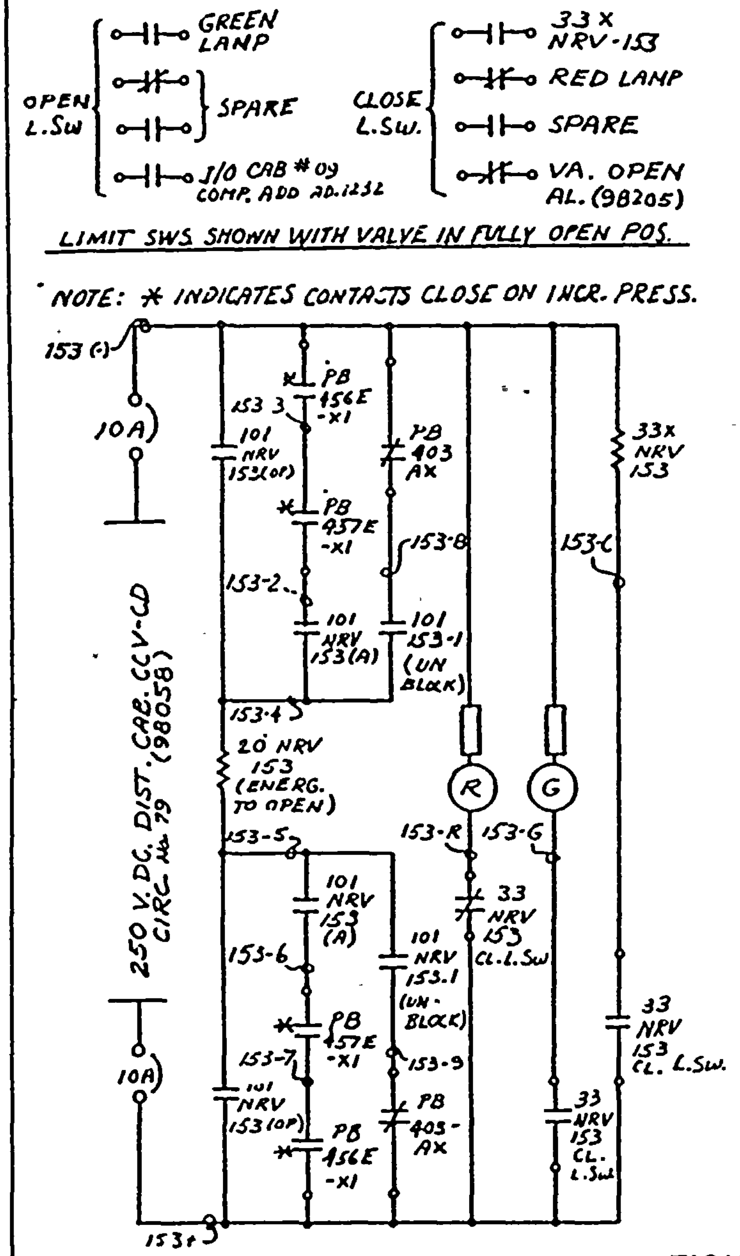


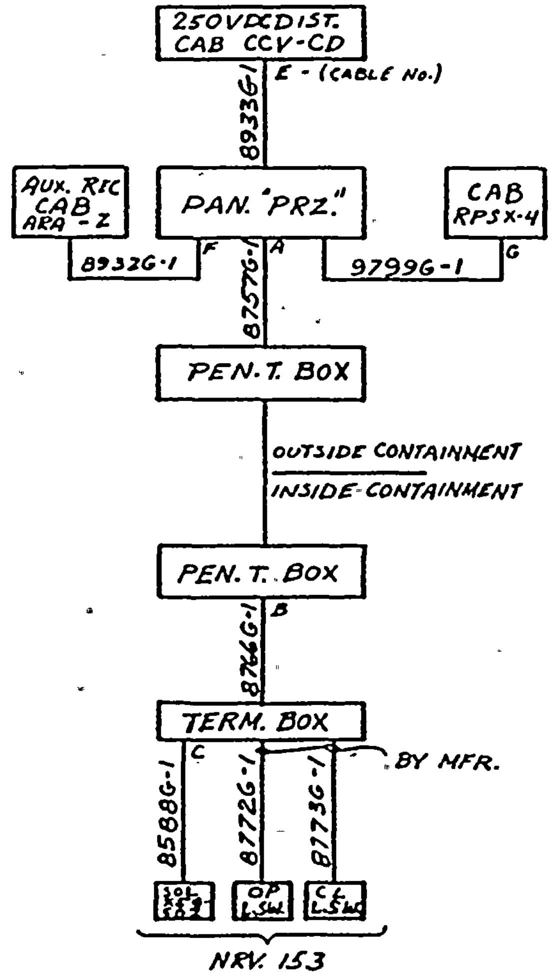


UNIT 1 SHOWN, UNIT 2 SIMILAR

D.C. COOK APPENDIX R PROJECT	
SAFE SHUTDOWN FUNCTIONAL BLOCK DIAGRAM	
SYSTEM EPS (3/3)	FIRE ZONE

FIGURE 4.33





FROM	PAN PRZ	PEN T BOX	TERM BOX	DIST. CAB	AUX REL. CAB URA-Z	CAB RPSX-A
TO	PEN. T. BOX	TERM BOX	SOL.	PAN PRZ	PAN PRZ	PAN PRZ
CABLE	A	B	C	E	F	G
SIZE	12/C	12/C	2/C	2/C	8/CSH	8/CSH
CONDUCTOR ASSIGNMENTS	153+	153+	153-4	153+	–	29A
	153-R	153-R	153-5	153(-)	–	PZAP
	153(-)	153C			153+	153+
	153-6	153-6			153-6	153-9
	–	153-OP			153(-)	153(-)
	153-4	153-4			153-2	153-8
	153-5	153-5			–	54A
	PZAP	PZAP			–	–
	38	38				
	–	10C				
	153+	153+				
	–	–				

NOTE:

2 SHORTS MUST OCCUR IN CIRCUIT IN ORDER TO ENERGIZE SOV FOR NRV 155 (20 NRV 153).

FIGURE 4.34 PRESSURIZER PORV: NRV–153
ELECTRICAL SCHEMATIC, CABLE BLOCK DIAGRAM
AND CABLE CONDUCTOR ASSIGMENTS

5. ALTERNATIVE SHUTDOWN

5.1 Introduction

For various D.C. Cook plant fire zones, compliance with the provisions of Section III.G.2 cannot be effectively or economically achieved due to the configuration and congestion of safe shutdown equipment, cables and associated circuits. For these areas Indiana and Michigan Electric Company has determined that the appropriate technical approach necessary to comply with the provisions of Section III.G of Appendix R is to provide an alternative shutdown capability. This section provides a description of the alternative shutdown system designs to be used to achieve compliance in all these plant areas. This section also provides sufficient information to the NRC for review of the proposed plant modifications necessary to provide these alternative shutdown capabilities. In addition, this section responds to the information requests contained in the NRC Staff's clarifications to Generic Letter 81-12 dated March 22, 1982, SUBJECT: Fire Protection Rule - Appendix R.

The alternative shutdown methods proposed by Indiana and Michigan for each specific fire zone provide the ability to achieve and maintain subcritical activity conditions in the reactor, maintain reactor coolant inventory, achieve and maintain hot standby conditions, and achieve cold shutdown conditions within 72 hours and maintain cold shutdown conditions thereafter.

The alternative shutdown methods selected ensure that no fuel cladding damage, rupture of the primary coolant boundary, or rupture of the containment boundary will occur.

The alternative shutdown methods selected have the capability to:

(1) Achieve and maintain cold shutdown reactivity conditions;

(2) Maintain reactor coolant level within the pressurizer level indication range;

(3) Remove reactor decay heat during hot standby, hot shutdown and cold shutdown;

(4) Provide monitoring of appropriate process variables necessary to control alternative shutdown equipment; and,

(5) Provide the process cooling, lubrication and other associated supporting functions necessary to permit the operation of the equipment used for safe shutdown.

Five alternative shutdown methods have been proposed. Refer to Section 5.3 for a detailed discussion of each method. The methods vary from a complete alternative shutdown method that, with the exception of instrumentation, requires no active SSS equipment in the fire affected unit, to the simple use of local pneumatic loading stations to control steam generator PORVs. The "Complete Alternative Shutdown" method is available to achieve safe shutdown for areas such as the cable vaults and Control Rooms. The various other safe shutdown methods proposed are selected subsets of the "Complete Alternative Shutdown" method.

The equipment and cables for each of the alternative shutdown systems are separated from the fire zones of concern in accordance with Section III.G.2; specific exemptions from the provisions of III.G.2 are identified in Section 7.0.

The selected alternative shutdown methods accommodate both conditions when off-site power is or is not available. The equipment and systems comprising each of the alternative shutdown methods are capable of being powered by both on-site and off-site electrical power systems.

The required equipment and systems for achieving hot standby are capable of maintaining such conditions until hot shutdown actions are commenced. The number of operating shift personnel exclusive of fire brigade members required to operate such equipment and systems shall be on-site at all times.

The equipment and systems comprising the means of achieving and maintaining hot shutdown and cold shutdown conditions will be made operable and cold shutdown achieved for all alternative shutdown methods within 72 hours. The materials and procedures required to achieve the alternative shutdown methods will be available on-site.

5.2 Alternative Shutdown System Description

As stated in the footnote to 10 CFR 50 Appendix R, Section III.G.3:

> Alternative shutdown capability is provided by rerouting, relocating or modification of existing systems; dedicated shutdown capability is provided by installing new structures and systems for the function of post-fire shutdown.

Historically, alternative shutdown systems provided by licensees to comply with the provisions of Appendix R involved:

(1) Electrical isolation, via the use of isolation and transfer switches, of those electrical circuit cables and equipment that can be impacted by the fire, and

(2) Re-establishment of those electrical circuit functions and equipment operation by transfer of circuit control to local control stations.

In some cases this isolation and transfer of control is provided as one alternative system for the areas requiring alternative shutdown (such as Control Rooms and the associated cable vaults). In other cases, this isolation and transfer of control is uniquely provided for each zone requiring alternative shutdown.

Although acceptable as a method of compliance with Appendix R, these modifications to safety-related equipments and circuits are undesirable for various reasons. First, the addition of new equipment and cabling increases the probability of safety circuit malfunctions due to failure or maloperation of the equipment. Second, the addition of alternate control locations outside the Control Room creates the potential for inadvertent or malicious actions that could cause loss of systems control from the Control Room.

Dedicated shutdown systems have also been proposed to achieve compliance with Appendix R. By providing a completely independent means of achieving safe shutdown, such systems do not typically create such adverse impacts on existing safety systems, but do require extensive and costly plant modifications and long project completion times.

During its review of other available alternatives to achieve safe shutdown, Indiana and Michigan recognized that a number of inherent D.C. Cook plant features exist that could be used to achieve safe shutdown via some other alternative means. A few of these important features are:

(1) Each unit has its own Control Room and associated cable spreading area separated by three-hour fire barriers, with the exception of the common connecting door.

(2) The two units are provided with their own independent and redundant on-site emergency power systems that meet Section III.G separation criteria between units. The Unit 1 diesel generators and distribution equipment are located on the north end of the plant, and the Unit 2 diesel generators and distribution equipment are located on the south end of the plant.

(3) The other major safe shutdown systems (ESW, CCW, AFW) are also independent train-oriented redundant systems that presently have cross-ties between units.

(4) In general, good physical Unit 1/Unit 2 separation of equipment, circuits and cables exists, with Unit 1 systems and equipment occupying the north side of the plant's east-west centerline and Unit 2 occupying the south side area.

(5) Few plant fire zones contain both Unit 1 and Unit 2 equipment or cables.

These and other attributes suggested that, in general, hypothesized fires if properly contained would affect the safe shutdown systems of only one of the two D.C. Cook units. The other unit's safe shutdown systems would in general be unaffected, with <u>all</u> redundant trains free of fire damage. This availability of all safe shutdown paths in the unaffected unit, when combined with the existing unit manual cross-ties, suggested that a highly preferred alternative shutdown approach could be developed using the safe shutdown systems of the unaffected unit.

Studies were initiated to review the capability of the safe shutdown systems in the unaffected unit to support Appendix R safe shutdown requirements in the fire-affected unit and to maintain stable plant operating modes in the unaffected unit. The studies confirmed that with minor modifications the safe shutdown systems provided such a capability.

Various alternative shutdown methods were ultimately selected to accommodate the various plant areas under consideration. These are all subsets of the complete alternative shutdown method that was originally selected to accommodate the effects of cable vault and Control Room fires.

The complete alternative shutdown method selected by I&M for safe shutdown is to use the safe shutdown systems of the D.C. Cook unit unaffected by the hypothesized fire to achieve safe shutdown in the fire-affected unit. This alternative shutdown method is technically preferred over other methods requiring extensive circuit isolation and modifications, and can be easily implemented post-fire by the plant operating staff. After incorporation of the various proposed modifications and with the exception of Zone 44S, only the safe shutdown systems used to provide alternative shutdown of either Unit 1 or Unit 2 will exist in any one fire zone that requires alternative shutdown.

Sections 4.2 through 4.4 previously provided the definitions of the safe shutdown functions, primary and support systems, and equipment required to achieve safe shutdown. Figures 4.1 through 4.5 depict the safety sequences used to achieve normal safe shutdown. Modifications to those figures are provided as Figures 5.1 through 5.4. The modifications depict the safety sequences used to achieve complete alternative safe shutdown.

The following is a discussion of the existing plant features and required modifications on a system-by-system basis, which will permit the safe shutdown systems of the unaffected unit to serve as the complete alternative shutdown system for the fire-affected unit.

5.2.1 <u>Chemical and Volume Control System</u>

For those fire zones where hypothesized fires will create a loss of the fire-affected unit's CVCS system, the functions of the system will be achieved by the operation of a proposed four-inch centrifugal charging pump discharge header cross-tie line between Unit 1 and Unit 2. Manual operation of the line's isolation valves, in Zone 5, will achieve immediate RCS make-up via the RCP seal injection path or, with some manual system alignment, boron injection tank path. Figure 5.5 is a highlighted P&ID of this proposed cross-tie modification.

5.2.2 Auxiliary Feedwater System

For those fire zones where the operability of all three trains of auxiliary feedwater can be threatened due to hypothesized fire, the shutdown functions of the AFW system will be achieved by manually opening existing motor-driven AFW pump discharge header cross-tie valves along with initiation and alignment of the associated equipment in one of the unaffected unit's motor-driven auxiliary feedwater trains.

Local indication of the steam generator level and pressure, presently located at local panels LSI-1 and LSI-2, will be upgraded and repowered from the unaffected unit's EPS. Steam generator level control will be achieved by manually throttling the affected unit's steam generator inlet MOVs located directly adjacent to local panels LSI-1 and LSI-2. Figure 5.6 is a highlighted P&ID of this existing cross-tie method.

5.2.3 Essential Service Water System

As discussed in Section 4.4.7, the ESW system as a supporting system is necessary to directly support the cooling needs of the Component Cooling Water and Emergency Power Supply (diesel generator) Systems. For the fire zones requiring complete alternative shutdown, with the exception of Fire Zones 29(A,B,E), 29(C,D,F), the ESW systems of the fire-affected unit are assumed unavailable and are not required to achieve stable hot standby.

For hot shutdown and cold shutdown, operation of the fire-affected unit's RHR system will require manual realignment of certain ESW flow paths. This realignment will divert a portion of the unaffected unit's ESW flow to a CCW heat exchanger in the fire-affected unit. This diversion in combination with a similar realignment of CCW will provide cooling water to one RHR pump and heat exchanger in the fire-affected unit.

For Fire Zones 29(A,B,E) and 29(C,D,F), the only alternative shutdown system required is the unaffected unit's ESW. For these areas the diversion of sufficient ESW flow from the unaffected unit to the affected unit provides the required ESW support for all safe shutdown systems in the fire-affected unit. This diversion is achieved via normally open unit cross-tie MOVs that are free of fire damage for fires within Fire Zones 29(A,B,E) and 29(C,D,F).

As discussed in Section 4.4.7, the ESW system is shared by both units. Two operable pumps are sufficient to carry the heat removal duties of two units simultaneously through hot and cold shutdown (at a minimum cooldown rate). Figures 5.7.1 and 5.7.2 are highlighted P&IDs of this existing cross-tie method.

The control circuits for both units' ESW pumps, strainers and discharge valves currently exist in various zones requiring alternative shutdown. In order to ensure that fires in certain zones will not cause failures in all four ESW trains, circuit modifications are proposed that include the installation of isolation relays and cable rerouting, to ensure that both trains of ESW in the unaffected unit will be available for all areas requiring alternative shutdown.

5.2.4 Component Cooling Water System

As discussed in Section 4.4.6, for hot standby the CCW system as a supporting system is necessary to provide the cooling needs of the centrifugal charging pumps and, for operational flexibility, the cooling needs of the RCP seals. For hot shutdown and cold shutdown, the system also provides cooling for the RHR pumps and RHR heat exchangers.

For all fire zones requiring alternative shutdown, the fire-affected unit's charging pumps and RCP thermal barrier cooling are not required. For these zones (excluding 44S) the use of the unaffected unit's centrifugal charging pumps provides adequate primary system make-up via the seal injection path.

For hot shutdown and cold shutdown in the fire-affected unit, CCW must be provided to a minimum of one of the affected unit's RHR pumps and heat exchangers. This is achieved by manual realignment of existing CCW inter-unit cross-ties to provide CCW flow from the unaffected unit's CCW pumps to the appropriate CCW heat exchanger and RHR heat exchanger in the fire-affected unit. Should re-establishment of RCP thermal barrier cooling be chosen, earlier realignment of the CCW inter-unit cross-tie may be performed but this is optional and not a required operation to achieve safe shutdown. In order to ensure that a fire in various zones requiring alternative shutdown will not cause failures of all four CCW pumps' circuitry, modifications are proposed that will isolate, via control circuit relays, the suspect cable.

Two CCW pumps in the unaffected unit are sufficient to support all required cooling demands for both units when such alternative shutdown is required.

Both Unit 1 and Unit 2 charging pumps exist in Fire Zone 44S. Modifications are proposed to install a one-hour fire barrier between the Unit 1 and Unit 2 CCW pumps. This will ensure the survival of either the Unit 1 or Unit 2 CCW pumps Therefore, for a fire in Fire Zone 44S that disabled the Unit 1 CCW pumps, safe shutdown could be achieved by using the Unit 2, CCW pumps even though this area is a complete alternate shutdown area for Unit 2 according to Table 5-1.

Figure 5.8 is a highlighted P&ID of this existing cross-tie method.

5.2.5 Main Steam

As discussed in Section 4.4.3, initial hot standby heat removal is achieved via the operation of steam generator safety valves. Subsequent heat removal will be achieved via operation of the steam generator power-operated relief valves (PORVs). For alternative shutdown, manual operation of the PORVs from local control stations near LSI-1 and LSI-2 will be achieved via pneumatic valve loading controls with backup motive power provided by the permanent plant N_2 accumulator and distribution header. The PORVs also have the capability to be operated by existing manual handwheels. Figure 5.9 is a sketch of the proposed local pneumatic PORV controls.

5.2.6 Reactor Coolant System

For fire zones requiring complete alternative shutdown and for other zones requiring selective alternative shutdown, RCS instrumentation, which includes source range monitoring, hot leg wide range temperature, cold leg wide range temperature, pressurizer wide range level and pressure, must be available. Local panel LSI-3 presently contains local indication of pressurizer level and pressure. A new Local Shutdown Indication panel LSI-4, located adjacent to LSI-3, will include new source range monitoring along with hot and cold leg temperature monitoring.

The addition of the new dedicated nonsafety-related instrument channels coupled with repowering of the new instrument channels and the existing channels from the unaffected unit's EPS provide the necessary equipment functions in those zones requiring alternative shutdown.

5.2.7 Emergency Power System

As discussed in Section 4.4.8, the EPS provides support to all safe shutdown systems. For all fire zones requiring complete alternative shutdown, the fire-affected unit's EPS are not required for hot or cold shutdown. The EPS of the unit unaffected by the hypothesized fire will provide the necessary electrical, power generation and distribution for the alternative shutdown systems.

Various equipment (pressurizer backup heaters, instrumentation and RHR pumps) in the affected unit cannot be used to support shutdown because of the assumed total loss of EPS in that unit. This equipment in the fire-affected unit will be made available by repowering the equipment from the unaffected unit's electrical power sources.

For initial hot standby, repowering is only required for the various instruments provided on the local panels LSI-1, LSI-2, LSI-3, LSI-4, LSI-5 and LSI-6. Modifications to the existing LSI panels will be made to provide local manual selection of Unit 1 or Unit 2 power sources.

Figures 5.12.1 and 5.12.2 depict in one-line diagram form the new LSI power sources. Figure 5.13 is a typical elementary diagram showing the individual LSI panel power circuit selection.

For extended hot standby, in addition to the instrumentation previously discussed, repowering of one group of pressurizer backup heaters may be necessary. This activity is considered a repair and will use permanently-installed jumper power cables and retermination of the heaters. Figure 5.22 is the one-line diagram showing this repowering. A more detailed discussion of this hot standby repair is provided in Section 6.2.

For hot shutdown and cold shutdown, repowering of one RHR pump from the unaffected unit may also be required. Reference Section 6.3 for a detailed discussion of this repair activity.

5.2.8 Residual Heat Removal

Hot shutdown and cold shutdown require operation of the RHR system. One train of the RHR System in the fire-affected unit will be available by repowering of one RHR pump (see Section 5.2.7), and manual alignment of the associated RHR System valves.

5.3 Alternative Shutdown Methods

Five alternative shutdown methods are required to ensure compliance with the provisions of Appendix R Section III.G. Table 5-1 provides a listing of the fire zones requiring alternative shutdown and the specific alternate shutdown method(s) required to achieve safe shutdown for each fire zone.

5.3.1 Method AS1

Method AS1 is described as "Complete Alternative Shutdown" and may require the use of all the alternative shutdown capabilities discussed in Section 5.2. Section 5.2 provided information and a discussion of the systems and equipment used to provide this complete alternative shutdown capability. The fire zones requiring this form of alternative shutdown have substantial portions of the normal safe shutdown systems located in the zone. The location and congestion of this equipment is such that compliance with Appendix R Section III.G.2 cannot be rationally achieved.

For the purposes of this analysis, in the areas requiring Method AS1, all normal shutdown equipment can be assumed unavailable.

The zones requiring this method can be divided into four general groupings. First, Fire Zones 53, 54, 55, 56, 57, 58, 59, 60, 144 and 145 are the Control Rooms, cable vault and hot shutdown panel areas for both units. Because of the nature of these zones, almost all normal SSS equipment has required cables or components in the area. Second, Fire Zones 6N, 6S, 43, 44N, and 44S are the Auxiliary Building zones that directly interface with the cable vault and Control Room zones. Because of their physical proximity to these areas, many SSS circuits and cables typically exit the Control Room and cable vault areas via these five fire zones to the remaining plant areas. The third group contains Fire Zones 40A, 40B, 41, 42A, 42B, 42C and 42D for Unit 1, and 47A, 47B, 45, 46A, 46B, 46C and 46D for Unit 2. These zones, which house the majority of the on-site emergency power system equipment and share a common gaseous suppression system per unit, have been grouped together for the purpose of this analysis. The final group contains Fire Zones 14 and 20, which are the Unit 1 and Unit 2 Transformer Rooms. These rooms contain cables that can affect operability of the respective unit's redundant diesel generators. These rooms also contain the pressurizer backup heater transformers along with associated primary and secondary cabling. Fires in one of these rooms may cause the loss of all on-site ac power for the associated unit.

Table 5-2 lists the normal shutdown equipment that must be reestablished for all fire zones utilizing complete alternative shutdown. The table was developed by assuming that all normal shutdown equipment has been rendered unavailable due to hypothesized fire. This limiting condition, which is conservative, yields a subset of normal SSS equipment that must be operated to achieve alternative shutdown via Method AS1. That list of equipment by system and the method of operation assumed post-fire are depicted in Table 5-2.

With the exception of Method AS3, the remaining alternative shutdown methods tabulated in Table 5-1 are subsets of this complete alternative shutdown method. As such, they use only portions of the systems and equipment required for the complete alternative shutdown method.

5.3.2 Method AS2

Method AS2, the "Charging Cross-tie and Supporting Systems Only" alternative shutdown method, is required in Fire Zones 62A, 62B and 62C in Unit 1 and 63A, 63B and 63C in Unit 2 only. These areas are the Unit 1 and Unit 2 charging pump areas, respectively. Should a fire occur in these areas, only the ability to provide normal charging system makeup will be affected. All other normal SSS are outside of the area. This alternative shutdown method addresses loss of normal charging flow by providing CVCS makeup via the proposed CVCS cross-tie.

Table 5-3 identifies by system the normal SSS equipment that is lost due to fires in these zones and that must be available to support the CVCS cross-tie method. Note that no normal SSS equipment that is required to support Method AS2 is unavailable due to fires in these areas.

5.3.3 Method AS3

Method AS3, the "Essential Service Water Cross-tie and Support Only" method, is also only required in Fire Zones 29(A,B,E) and 29(C,D,F). These are the Unit 1 and Unit 2 ESW pump areas, respectively. This shutdown method is necessary to address the potential loss of both of the affected units' ESW pumps, discharge valves or strainers for fires in these zones. The method provides for restoration of ESW flow in the fire-affected unit via normally open motorized header cross-tie valves (WMO-705, WMO-706, WMO-707 and WMO-708) that exist outside of these fire zones and are free of fire damage.

Table 5-4 identifies by system the normal SSS equipment that is lost due to fires in these zones and that must be available to support this alternative shutdown method. Note that no SSS equipment that is required to support Method AS3 is unavailable due to a fire in these zones.

5.3.4 Method AS4

Method AS4, the "Local PORV Control Only" method, is required for those areas where loss of necessary PORV control occurs due to loss of supporting EPS or loss of PORV control circuit cables. This method is required in Fire Zones 15, 33, 38 and 52 for Unit 1 and 18, 34, 39 and 52 for Unit 2. In Fire Zones 15 and 18, the loss of the EPS supply to the PORVs requires local control. In the remaining zones, loss of PORV control circuit cables requires local control. Local manual operation of two of the four PORVs at their respective local control stations near the LSI-1 and LSI-2 panels provides the necessary alternative shutdown capability.

Table 5-5 identifies by system the normal SSS equipment that is lost and that must be available to support Method AS4 due to fires in Zones 33, 34 and 52. A similar tabulation for Fire Zones 15, 18, 38 and 39 is provided as Table 5-7. Since these zones also require Method AS5, "T_h and T_c Monitoring," the table reflects the normal equipment that is lost and must be available for both methods.

5.3.5 Method AS5

Method AS5, the "T_h and T_c Monitoring Only" method, is required only for those zones where loss of supporting EPS or associated instrumentation loop cables occurs. This method is required in Fire Zones 15 and 38 for Unit 1, and 18 and 39 for Unit 2.

Table 5-6 identifies by system the normal SSS equipment that is lost due to fires in Zones 15, 18, 38 and 39 and that must be available to support this alternative shutdown method.

Table 5-7 identifies by system the normal SSS equipment that is lost due to fires in Zones 15, 18, 38 and 39 and that must be available to support both Method AS4 and AS5 in these zones.

5.4 Detailed Response to the NRC Clarifications of Generic Letter 81-12

The following information is provided as a detailed response to Enclosure 1 of NRC Memorandum of March 22, 1982, for the fire zones at D.C. Cook Unit 1 and Unit 2 that require alternative shutdown. As stated in Enclosure 1, the information request is merely a rewording of the Section 8 information request contained in Generic Letter 81-12.

The information request contained in Generic Letter 81-12 Section 8, particularly paragraphs (b), (c), (d), (e), (g), (i) and (j), and Clarification Letter Enclosure 1, Paragraphs 1(a) through 1(j), is principally focused on alternative shutdown designs that utilize isolation/transfer and control switches to bypass damaged power or control circuit cabling and equipment. This bypassing of damaged elements by the alternative shutdown system permits restoration of other elements of the safe shutdown systems circuits unaffected by the hypothesized fire. In addition, new circuits and cabling are typically added to reestablish operation and control of necessary normal safe shutdown equipment.

As previously discussed, the principal alternative shutdown approach utilized by Indiana and Michigan, with exception of the repowering of certain instrumentation and isolation of ESW and CCW pump control cables, does not attempt to restore damaged equipment or circuits, but instead provides for the use of the independent safe shutdown systems of the unaffected unit to achieve alternative safe shutdown system functions. To a large degree the use of the unaffected unit's safe shutdown systems to provide safe shutdown in the fire-affected unit could be viewed as dedicated rather than alternative shutdown. Because this approach is in fact a mixture of alternative and dedicated shutdown, much of the information requested by the NRC is related to normal circuits and equipment in the fire area that will be severed or bypassed does not apply. The responses provided below have been tailored to the unique characteristics of the D.C. Cook alternative shutdown approach.

Request 1

> Identify those areas of the plant that will not meet the requirements of Section III.G.2 of Appendix R and, thus alternative shutdown will be provided or an exemption from the requirements of Section III.G.2 of Appendix R will be provided. Additionally provide a statement that all other areas of the plant are or will be in compliance with Section III.G.2 of Appendix R.

Response 1

Table 1-1 provides a concise overview of the status of compliance with Section III.G of Appendix R for all fire zones at the D.C. Cook Nuclear Plant Units 1 and 2. The table clearly identifies which zones are or will be in compliance with III.G.2, which zones require alternative shutdown, and which zones require some form of exemption from certain provisions of Section III.G.

Request 1.a

> List the system(s) or portions thereof used to provide the shutdown capability with the loss of off-site power.

Response 1.a

Refer to Sections 4.1 through 4.4, which describe the normal shutdown systems used by this analysis to achieve safe shutdown for all fire zones. As discussed in these sections, the systems and equipment selected for the purpose of this analysis are a minimum set of plant systems that can be used to achieve safe shutdown. Should a loss of off-site power occur without an assumed plant fire, these systems and others will be available to achieve safe shutdown.

Request 1.b

> For those systems identified in "1a" for which alternative or dedicated shutdown capability must be provided, list the equipment and components of the normal shutdown system in the fire area and identify the functions of the circuits of the normal shutdown system in the fire area (power to what equipment, control of what components and instrumentation). Describe the system(s) or portions thereof used to provide the alternative shutdown capability for the fire area and provide a table that lists the equipment and components of the alternative shutdown system for the fire area.

> For each alternative system identify the function of the new circuits being provided. Identify the location (fire zone) of the alternative shutdown equipment and/or circuits that bypass the fire area and verify that the alternative shutdown equipment and/or circuits are separated from the fire area in accordance with Section III.G.2.

<u>Response 1.b</u>

Sections 5.2, 5.3 and associated Tables 5-1 through 5-7 provide a detailed response to the information required by the first paragraph of the request.

For those circuits requiring bypass and isolation, Figures 5.14.1 through 5.18 identify the cables requiring isolation and the fire zone locations of the alternative shutdown cables that bypass the fire zone of concern. As previously discussed, only the alternative shutdown ESW pump control circuits and certain LSI panel instruments contain cabling that would not be free of fire damage for certain areas requiring alternative shutdown.

Section 5.5 provides detailed information on the modifications proposed to ensure that these alternative shutdown circuits are isolated from the circuit cables that are located in zones requiring alternative shutdown. This section and referenced figures also contain information on all the new circuits to be provided to achieve alternative shutdown.

With the exception of Fire Zone 44S, all alternative shutdown equipment and circuits are separated from the fire zones in accordance with Section III.G.2.

Fire Zone 44S has been identified as requiring alternative shutdown for Unit 2. The fire zone contains all component cooling water pumps for both units and therefore does not comply with the provisions of Section III.G.2. Section 7.10 provides a detailed discussion of the technical basis for requesting an exemption from the provisions of Section III.G.2 for these pumps.

Request 1.c

> Provide drawings of the alternative shutdown system(s) which highlight any connections to the normal shutdown systems (P&IDs for piping and components, elementary wiring diagrams of electrical cabling). Show the electrical location of all breakers for power cables, and isolation devices for control and instrumentation circuits for the alternative shutdown systems for that fire area.

Response 1.c

Figures 5.6 through 5.9 and Figure 5.11 depict the piping and component connections between the normal shutdown and alternative shutdown systems.

Figures 5.10.1 through 5.10.5 identify the location of existing and proposed LSI panels. Figures 5.12.1 and 5.12.2 are the power supply one-line diagrams for the LSI panels. Figure 5.13 is a typical schematic showing the power switching arrangement at the LSI panels. Figure 5.19.1 through 5.19.3 and Figure 5.20 depict in block diagram form the existing and proposed local shutdown instrumentation.

Figures 5.14.1 through 5.18 depict the isolation relays and control circuit and cabling modifications that ensure the CCW and

ESW pumps, ESW strainers and various system valves are free of fire damage and available to support alternative shutdown, as required.

Request 1.d

> Verify that changes to safety systems will not degrade safety systems: (e.g., new isolation switches and control switches should meet design criteria and standards in the FSAR for electrical equipment in the system that the switch is to be installed; cabinets that the switches are to be mounted in should also meet the same criteria (FSAR) as other safety-related cabinets and panels; to avoid inadvertent isolation from the Control Room, the isolation switches should be keylocked or alarmed in the Control Room if in the "local" or "isolated" position; periodic checks should be made to verify that the switch is in the proper position for normal operation; and a single transfer switch or other new device should not be a source of a failure which causes loss or redundant safety systems).

Response 1.d

The only modifications that will involve safety-related equipment are:

(1) Rerouting of ESW pump, discharge valve and strainer cables;

(2) Installation of the CVCS piping cross-tie; and

(3) Rerouting RCS wide range temperature instrumentation cables.

10 CFR 50.59 reviews will be performed for these and all other proposed modifications. Based on preliminary reviews, no changes to the safety systems will degrade their performance for the spectrum of design basis events for which they are required.

Request 1.e

> Verify that licensee procedures have been or will be developed which describe the tasks to be performed to effect the shutdown method. Provide a summary of these procedures outlining operator actions.

Response 1.e

Plant procedures will be developed that will describe the post-fire operations to be performed. A brief summary of these procedures is provided in Section 5.6 for areas requiring complete alternative shutdown. Although the procedures only utilize the minimum set of equipment identified in this analysis, equipment not involved in the fire will be utilized to the extent possible to provide maximum operational flexibility.

Request 1.f

> Verify that the manpower required to perform the shutdown functions using the procedures of e. as well as to provide fire brigade members to fight the fire is available as required by the fire brigade technical specifications.

Response 1.f

For the spectrum of operations required for the initial hot standby period post-fire (approximately two hours), three operations personnel are sufficient to achieve and maintain safe shutdown in addition to the fire brigade members and the alternate unit's Control Room operators.

Request 1.g

> Provide a commitment to perform adequate acceptance tests of the alternative shutdown capability. These tests should verify that:

equipment operates from the local control station when the transfer or isolation switch is placed in the "local" position and that the equipment cannot be operated from the Control Room; and that equipment operates from the Control Room but cannot be operated at the local control station when the transfer isolation switch is in the "remote" position.

Response 1.g

Acceptance tests of all modifications will be performed to ensure alternative shutdown system performance requirements.

Request 1.h

Provide Technical Specifications of the surveillance requirements and limiting conditions for operation for that equipment not already covered by existing Technical Specifications. For example, if new isolation and control switches are added to a shutdown system, the existing Technical Specification surveillance requirements should be supplemented to verify system/equipment functions from the alternate shutdown station at testing intervals consistent with the guidelines Regulatory Guide 1.22 and IEEE 338. Credits may be taken for other existing tests using group overlap test concepts.

Response 1.h

No modifications to the D.C. Cook Technical Specifications are anticipated, but if any are required, these will be made following NRC acceptance of the alternative shutdown systems provided in this section.

Request 1.i

For new equipment comprising the alternative shutdown capability, verify that the systems available are adequate to perform the necessary shutdown function. The functions required should be based on previous analyses, if possible (e.g., in the FSAR), such as a loss of normal ac power or shutdown on Group 1 isolation (BWR). The equipment required for the alternative capability should be the same or equivalent to that relied on in the above analysis.

Response 1.i

The systems and equipment that comprise the alternative shutdown method as previously described are identical in performance capability to the normal shutdown systems.

Request 1.j

Verify that repair procedures for cold shutdown systems are developed and material for repairs is maintained on site. Provide a summary of these procedures and a list of the material needed for repairs.

Response 1.j

As previously outlined, the modification/repairs required to achieve long-term cold shutdown are:

(1) Repowering of pressurizer heaters (optional - not required for safe shutdown); and

(2) Repowering of one RHR pump.

Section 6 contains a discussion of the repairs and lists the material needed to implement the repairs.

5.5 Alternative Shutdown Modifications

The following is a compilation of the proposed equipment and system modifications required to achieve operability of the alternative shutdown system.

5.5.1 CVCS Cross-tie

Installation of a permanent CVCS cross-tie: The four-inch cross-tie with double isolation is depicted on the attached P&ID, Figure 5.5. The line will be installed in accordance with the installation criteria of the CVCS system. Physical routing of the cross-tie, as presently proposed, is outlined in Figure 5.11.

5.5.2 Alternate Power to LSI Panels

Repowering of the LSI panels from the unaffected unit's emergency power sources: Figures 5.12.1 and 5.12.2 depict in one-line diagram form the proposed power supply modifications to the LSI panels. Figure 5.13 is the associated electrical schematic. All the instrumentation located on the panels is nonsafety-related. The power supply cables are also designated as nonsafety-related, although they are powered from either unit's on-site power sources. The routing of the unaffected unit's power cabling to the LSI panels will comply with the separation requirements of Section III.G.2 for those fire zones for which the power cabling is required for alternative shutdown.

5.5.3 ESW Pump Circuit Modifications

Isolation and rerouting of various control cables for the ESW pumps: Isolation relays will be added to the circuits that start the ESW pumps from the discharge header pressure switches as well as from the opposite unit's safety injection (SI) signal.

These relays will be added at the 4kV switchgear for all four ESW pumps. The relays will ensure that electrical open, short and ground faults in the fire zones will not prevent proper operation of the ESW pumps in the unaffected unit. Table 5-8 identifies the cables that will be isolated and their fire zone routing. The redundant ESW pump breaker controls and their associated cables, which presently exist for these pumps in the alternate unit's Control Room, will be relocated to their own unit's hot shutdown panel. In addition, the second ESW pump's breaker control circuitry and associated cables in the alternate unit's hot shutdown panel will be removed. The purpose of this modification is to eliminate the potential for electrical open, short and ground faults in the fire-affected unit affecting the ESW pump controls of the unaffected unit. The relocated controls on the hot shutdown panel are <u>not</u> required for Appendix R safe shutdown. Typical circuitry modifications to ensure isolation of field cabling are shown as Figure 5.14. The cables that will be eliminated are tabulated in Table 5-9 and are also shown on Figure 5.15.

5.5.4 ESW Strainer and Valve Circuit Modifications

Modifications, similar to those described for the ESW pump in 5.5.3 above, will be implemented for the ESW pump discharge valves, strainers and header cross-tie valves. The cables that will be eliminated are tabulated in Table 5-9 and are also shown on Figures 5.16, 5.17 and 5.18.

5.5.5 CCW Pump Circuit Modifications

Isolation of CCW pump pressure switch and associated cabling will be accomplished with isolation relays similar to the method proposed for the ESW pump pressure switches. Table 5-8 identifies the cables to be isolated.

5.5.6 New T_h and T_c for LSI Panels

To ensure that hot leg temperature (T_h) and cold leg temperature (T_c) information is available to monitor safe shutdown at panels LSI-4, LSI-5 and LSI-6, new safety-related instrument circuits will be rerouted. New cabling will be routed from the RTDs via containment penetrations to the local panels. T_h and T_c for RCS loops 1 and 4 will be available at LSI-5. T_h and T_c for RCS loops 2 and 3 will be available at LSI-6. All four coolant loops' T_h and T_c will be made available at the LSI-4 panel. The cable routing will be designed to ensure that sufficient separation and protection exist for all areas requiring alternative shutdown indication of T_h and T_c. As with other instrumentation located on the LSI panels, these temperature loops can be powered from either unit's EPS.

5.5.7 New SG Pressure for LSI Panels

To ensure that steam generator pressure information is available to monitor safe shutdown, pressure transmitters will be installed for steam generators 1, 4 and 2, 3 at panels LSI-5 and LSI-6, respectively. The signals will also be retransmitted to LSI-4 to provide centralized information.

5.5.8 New SRM for LSI Panels

To ensure that source range neutron monitoring information is available to support alternative shutdown, a new SRM channel will be installed. The channel will utilize an existing spare ex-core monitor well and will provide indication at local panel LSI-4. Routing of all cabling required will not violate Section III.G.2 criteria for the zones requiring alternative shutdown. Figure 5.20 is a sketch of the proposed SRM channel.

5.5.9 New Centralized Control Panels - LSI-4

In order to provide a centralized control and communication point for all action outside the Control Room, all required safe shutdown instrumentation that presently exists or is proposed on panels LSI-1, LSI-2, LSI-5 and LSI-6 will be retransmitted to panel LSI-4, which is adjacent to LSI-3.

All instrumentation required for local shutdown indication will be available at panels LSI-3 and LSI-4. Local indication for RCS pressure, pressurizer level, charging and letdown flow are presently located on LSI-3. Local indication for RCS hot and cold leg temperatures, steam generator pressure, steam generator level and source range monitoring will be added on LSI-4. In addition, both LSI panels will have the capability of being powered from the unaffected unit's EPS. Figures 5.21.1, 5.21.2 and 5.21.3 conceptually show panels LSI-1, LSI-2, LSI-3 and LSI-4.

5.5.10 Permanent Cable for Pressurizer Backup Heater Repowering

To ensure that timely repairs can be performed to reenergize one backup group of pressurizer heaters, a 480V MCC will be permanently installed in the fire-affected unit for this repair activity. This MCC will be powered from a 480V switchgear circuit breaker located in the unaffected unit. (Refer to Figure 5.22 for Unit 1 one-line representation.) Permanent power cables with prefabricated terminations will be stored at the MCC. During a fire, these cables will be routed from the MCC to the electrical penetrations for repowering of three banks of pressurizer heaters in a backup heater group. Further discussion of the repair activities is provided in Section 6.2.2.

5.6 Summary of Procedures Used for Alternative Shutdown

5.6.1 Initial Hot Standby

Upon occurrence and notification of a major fire in a zone requiring alternate shutdown, the Control Room operator will initiate reactor and turbine generator trips and actuation of MSIV isolation. Upon loss of major shutdown system controls, transfer of control away from the Control Room to local shutdown operation centers may occur with the operators taking the following immediate actions:

(1) The unaffected unit's Control Room operators are notified of the major fire and initiate measures to utilize cross-tied alternative systems to achieve safe shutdown in the fire-affected unit.

(2) As necessary to minimize inventory loss and prevent inadvertent operation, isolation of various letdown

paths from the RCS is achieved by tripping selective control power breakers. These paths include letdown, excess letdown, head and pressurizer vents, RCP seal letdown, and pressurizer PORVs.

(3) An operator is dispatched to throttle open the Unit 1 - Unit 2 CVCS manual cross-tie valves and RCS make-up is immediately achieved either via the RCP seal water injection lines or via the BIT (optional path).

(4) The same operator transfers various SSS instrumentation at local panel LSI-3 to provide local readout of all SSS instrumentation.

(5) A second operator is dispatched to open one or both of the existing Unit 1/Unit 2 motor-driven auxiliary feedwater pump manual unit cross-tie valves (FW-129).

(6) The second and a third operator verify main steam isolation and operation of the steam generator safety valves.

(7) The same operators manually align the fire-affected unit's steam generator inlet valves (FMO-212, FMO-242, and/or FMO-222, FMO-232) and establish local manual control of the valves.

(8) Operators two and three transfer steam generator instrumentation at local panels LSI-1 and LSI-2.

(9) The unaffected unit's Control Room operators close the unaffected unit's steam generator inlet valves (FMO-212, FMO-242 and/or FMO-222, FMO-232) and start the appropriate unaffected unit's motor-driven auxiliary feedwater pump from the Control Room.

(10) Stable control of the RCS make-up system is achieved by monitoring LSI-3 panel instrumentation and throttling the CVCS cross-tie valves.

(11) Stable control of steam generators inventory and RCS heat removal is achieved by monitoring LSI-1 and LSI-5 and/or LSI-2 and LSI-6 panels instrumentation and manual control of the appropriate steam generator inlet valves and PORVs.

(12) The above four LSI stations are coordinated by using LSI-3 and LSI-4 (located next to each other) indications.

These actions, which should easily be accomplished within a relatively short (30-minute) time frame, are sufficient to achieve and control both primary and secondary make-up and heat removal. Therefore, safe hot standby conditions (the unit subcritical and at temperature and pressure) will be achieved.

5.6.2 Long-Term Hot Standby

Should the extent of fire damage be such that immediate reoccupancy of the Control Room and reestablishment of one train of the fire-affected unit's safe shutdown systems are not feasible, long-term hot standby conditions can be maintained by continued use of the alternative shutdown system previously discussed.

The boration to xenon-free conditions can be achieved by injection via the CVCS cross-tie from the unaffected unit's RWST. Other alternative means of boration include use of the BIT path or injection from the boric acid system if available.

Shrinkage of the RCS will provide sufficient volume reduction to accommodate the makeup during this period. Cooldown will be provided by continued operation of auxiliary feedwater and manual operation of the steam generator PORVs.

At approximately five to six hours post-fire, if pressurizer backup heaters have been lost, ambient heat losses from the pressurizer may cause a decrease in subcooling margin. This margin will be maintained by initiating RCS cooldown or alternatively by repowering three banks of pressurizer heaters in a backup heater group from the unaffected unit.

Other manual system and valve alignments may occur to provide additional operational flexibility and to prepare for initiation of RHR operation (hot shutdown).

5.6.3 Hot Shutdown

In order to achieve hot shutdown, the repair procedure for repowering one RHR pump from the unaffected unit will be implemented. In addition, manual realignment of the unaffected unit's CCW and ESW systems will be performed to provide cooling water to the associated RHR heat exchanger. Other minor manual valve alignments in the RHR system will also be performed.

The SI accumulators will be isolated.

The RHR inlet valves will be manually opened and the RHR system will be started.

5.6.4 Cold Shutdown

Cold shutdown is achieved by continued operation of the RHR system and the other required supporting systems that were previously in operation during hot shutdown.

5.6.5 Alternative Shutdown System Technical Specifications

Indiana and Michigan Electric Company has conducted a review of the technical specifications for Donald C. Cook Nuclear Power Plant to determine the impact on these technical specifications of the proposed Appendix R Alternative Shutdown System Design.

Because the Alternative Shutdown System proposed by Indiana and Michigan Electric Company for D. C. Cook requires the use of various safety-related systems in the unit unaffected by the fire to achieve safe shutdown, this review focused on all the operating modes in the unit unaffected by hypothesized fire.

Based on this review, the existing technical specifications for operating modes 1, 2 and 3 presently appear adequate. The review did indicate that modifications to the technical specifications are required when the unaffected unit is in operating modes 4, 5 or 6. The following information outlines the general approach to be taken by Indiana and Michigan Electric Company in modifying the technical specifications for each of the alternative shutdown systems that would be required during these modes. This form of technical specification modification will be provided for the Chemical and Volume Control System, Essential Service Water System, Component Cooling Water System, and the Motor-Driven Auxiliary Feedwater System.

Limiting Condition for Operation

Sufficient system equipment must be available to permit the system to be operable and capable of supporting this unit's operation in the existing mode (4, 5 or 6) and capable of providing alternative shutdown to the opposite unit while that unit is in operating mode 1, 2 or 3.

ACTION: With insufficient system equipment available to maintain this unit in its existing operating mode <u>and</u> support safe shutdown in the opposite unit, restore such minimum capability within 72 hours or:

(1) Establish a daily fire inspection of the following areas in the opposite unit requiring the alternative shutdown system;

- o Auxiliary Building - elev. 587 ft
- o Auxiliary Building - elev. 609 ft
- o Transformer Room - elev. 591 ft
- o Control Room
- o Switchgear Room
- o Engineering Safety System and MCC Room
- o EPS Equipment Rooms
- o Charging Pump Room
- o ESW Pump Room

(2) Initially verify by inspection the OPERABILITY of fire detection, automatic fire suppression and manual fire fighting equipment for those areas requiring this alternative shutdown system.

If minimum capability cannot be restored within 30 days, submit to the NRC a report outlining the cause of the inoperable equipment, the actions taken, and the plans and schedules for restoring the system to operable status.

TABLE 5-1

ALTERNATIVE SHUTDOWN METHODS/FIRE ZONE MATRIX

	ALTERNATIVE SHUTDOWN METHOD				
FIRE ZONES	METHOD AS1 COMPLETE ALTERNATIVE SHUTDOWN	METHOD AS2 CHARGING CROSSTIE & SUPPORTING SYSTEMS ONLY	METHOD AS3 ESSENTIAL SERVICE WATER CROSSTIE & SUPPORT ONLY	METHOD AS4 LOCAL PORV CONTROL ONLY	METHOD AS5 Th & Tc MONITORING (LSI-3) ONLY
6N	1				
6S	2				
43	1				
44N	1				
44S	2				
14	1				
20	2				
53	1				
55	1				
56	1				
57	1				
54	2				
58	2				
59	2				
60	2				
40A,B	1				
41	1				
42A,B, C,D	1				
47A,B	2				
45	2				
46A, C,D	2				
144	1				
145	2				

NOTES AND LEGEND:

1	Indicates the alternative shutdown method is required in Unit 1.
2	Indicates the alternative shutdown method is required in Unit 2.
1,2	Indicates the alternative shutdown method is required for both units.

TABLE 5-1 (CONT.)

ALTERNATIVE SHUTDOWN METHODS/FIRE ZONE MATRIX

FIRE ZONES	ALTERNATIVE SHUTDOWN METHOD				
	METHOD AS1 COMPLETE ALTERNATIVE SHUTDOWN	METHOD AS2 CHARGING CROSSTIE & SUPPORTING SYSTEMS ONLY	METHOD AS3 ESSENTIAL SERVICE WATER CROSSTIE & SUPPORT ONLY	METHOD AS4 LOCAL PORV CONTROL ONLY	METHOD AS5 Th & Tc MONITORING (LSI-3) ONLY
62A,B,C		1			
63A,B,C		2			
29A,B,E			1		
29C,D,F			2		
33,33A, 33B				1	
38				1	1
34,34A, 34B				2	
39				2	2
52				1,2	

NOTES AND LEGEND:

1 Indicates the alternative shutdown method is required in Unit 1.
2 Indicates the alternative shutdown method is required in Unit 2.
1,2 Indicates the alternative shutdown method is required for both units.

TABLE 5-2

NORMAL SHUTDOWN EQUIPMENT AFFECTED BY A FIRE
WHICH REQUIRES OPERATION POST-FIRE TO SUPPORT METHOD AS1
"COMPLETE ALTERNATIVE SHUTDOWN"

FIRE IN FIRE ZONES 14, 20, 53, 54, 55, 56, 57, 58, 59, 60, 144, 145, 6N, 6S, 43, 44N, 44S, 40A, 40B, 41, 42A, 42B, 42C, 42D, 47A, 47B, 45, 46A, 46B, 46C, 46D

SYSTEM	EQUIPMENT	METHOD OF OPERATION
CVCS	None	No normal shutdown equipment required
AFW*	FMO-212 FMO-242	Manual valve operation near panel LSI-1
	FMO-222 FMO-232	Manual valve operation near panel LSI-2
	BLI-110 BLI-140	Isolation & transfer of indication to panel LSI-1
	BLI-120 BLI-130	Isolation & transfer of indication to panel LSI-2
MS	MRV-213 MRV-243	Manual valve operation near panel LSI-1
	MRV-223 MRV-233	Manual valve operation near panel LSI-2
RCS*	NLI-151 NPS-122	Isolation & transfer of indication to LSI-3
	NTR-110 NTR-210 NTR-120 NTR-220 NTR-130 NTR-230 NTR-140 NTR-240	Routing of new cables will provide indication at LSI-4, LSI-5 and LSI-6**
	PRESS. HTR***	Repowering via repair from unaffected unit

TABLE 5-2 (cont.)

SYSTEM	EQUIPMENT	METHOD OF OPERATION
CCW	CMO-410 CMO-419 CMO-420 CMO-429	Verify alignment of 1 pair prior to RHR initiation
ESW	WMO-705 WMO-708 WMO-707 WMO-706	Verify alignment of 1 pair prior to RHR initiation
	WMO-735 WMO-737 WMO-731 WMO-733	Verify alignment of 1 pair prior to RHR initiation (Unit 1)
	WMO-732 WMO-734 WMO-736 WMO-738	Verify alignment of 1 pair prior to RHR initiation (Unit 2)
EPS	None	No normal shutdown equipment required
RHR	PP-35E PP-35W	Repowering via repair from unaffected unit. In addition, appropriate manual valve alignments will be performed.

* For Zones 14 and 20 loss of all ac power will not affect operability of instrumentation systems or turbine-driven auxiliary feedwater pump due to availability of dc power for some time interval post-fire.

** Not considered as normal shutdown equipment but provides local information from the same RTDs as normal instrument channels.

*** The repowering and use of a single backup group of pressurizer heaters is optional and not required for safe shutdown. This repowering capability is provided for operational flexibility.

TABLE 5-3

NORMAL SHUTDOWN EQUIPMENT AFFECTED BY A FIRE
WHICH REQUIRES OPERATION POST-FIRE TO SUPPORT METHOD AS2
"CHARGING CROSSTIE AND SUPPORTING SYSTEM ONLY"

FIRE IN FIRE ZONES 62 (A,B,C) AND 63 (A,B,C)

SYSTEM	EQUIPMENT	METHOD OF OPERATION
CVCS	None	No normal shutdown equipment required
AFW	None	No equipment or cable in the fire zone
MS	None	No equipment or cable in the fire zone
RCS	None	At least one path free of fire damage
CCW	None	No equipment or cable in the fire zone
ESW	None	No equipment or cable in the fire zone
EPS	None	No equipment or cable in the fire zone
RHR	None	No equipment or cable in the fire zone

TABLE 5-4

NORMAL SHUTDOWN EQUIPMENT AFFECTED BY A FIRE
WHICH REQUIRES OPERATION POST-FIRE TO SUPPORT METHOD AS3
"ESSENTIAL SERVICE WATER CROSSTIE AND SUPPORT ONLY"

FIRE IN FIRE ZONE 29 (A,B,E) AND 29 (C,D,F)

SYSTEM	EQUIPMENT	METHOD OF OPERATION
CVCS	None	No equipment or cable in the fire zone
AFW	None	No equipment or cable in the fire zone
MS	None	No equipment or cable in the fire zone
RCS	None	No equipment or cable in the fire zone
CCW	None	No equipment or cable in the fire zone
EPS	None	No equipment or cable in the fire zone
ESW	None	No equipment in the fire zone required
RHR	None	No equipment or cable in the fire zone

TABLE 5-5

NORMAL SHUTDOWN EQUIPMENT AFFECTED BY A FIRE
WHICH REQUIRES OPERATION POST-FIRE TO SUPPORT METHOD AS4
"LOCAL PORV CONTROL ONLY"

FIRE IN FIRE ZONES 33 AND 34

SYSTEM	EQUIPMENT	METHOD OF OPERATION
CVCS	None	At least one path free of fire damage
AFW	None	At least one path free of fire damage
MS	MRV-223 MRV-233	Manual operation of SG-2 & SG-3 PORV near panel LSI-2
RCS	None	At least one path free of fire damage
CCW	None	At least one path free of fire damage
EPS	None	At least one path free of fire damage
ESW	None	At least one path free of fire damage
RHR	None	At least one path free of fire damage

TABLE 5-5 (cont.)

FIRE ZONE 52

SYSTEM	EQUIPMENT	METHOD OF OPERATION
CVCS	None	At least one path free of fire damage
AFW	None	At least one path free of fire damage
MS	MRV-213 MRV-243 OR MRV-223 MRV-233	Manual operation of PORVs near LSI-1 or LSI-2 respectively
RCS	None	At least one path free of fire damage
CCW	CMO-410 CMO-420	Manual alignment of either valve - hot standby
	CMO-419 CMO-429	Manual alignment of either valve prior to RHR initiation
EPS	None	Both paths free of fire damage (manual valve alignments in other systems due to assumed loss of AM-A and AM-D)
ESW	None	At least one path free of fire damage
RHR	None	At least one path free of fire damage

TABLE 5-6 INTENTIONALLY DELETED

TABLE 5-7

NORMAL SHUTDOWN EQUIPMENT AFFECTED BY A FIRE
WHICH REQUIRES OPERATION POST-FIRE TO SUPPORT METHOD AS4
"LOCAL PORV CONTROL ONLY" & AS5 "T_h & T_c MONITORING ONLY"

FIRE IN FIRE ZONES 38 AND 39

SYSTEM	EQUIPMENT	METHOD OF OPERATION
CVCS	None	At least one path free of fire damage
AFW	None	At least one path free of fire damage
MS	MRV-223 MRV-233 or MRV-213 MRV-243	Local manual control of PORVs near local panels LSI-1 and LSI-2
RCS	NTR-110* NTR-120 NTR-140	Routing of new cables to provide remote indication of T_h and T_c for all four loops at LSI-4, LSI-5, & LSI-6
CCW	None	At least one path free of fire damage
ESW	None	No equipment or cables in the fire zone
EPS	None	At least one path free of fire damage
RHR	IMO-128**	Manual operation of IMO-128

* Fire Zone 38 only
** Fire Zone 39 only

TABLE 5-7 (cont)

FIRE IN FIRE ZONES 15 AND 18

SYSTEM	EQUIPMENT	METHOD OF OPERATION
CVCS	None	At least one path free of fire damage
AFW	None	At least one path free of fire damage
MS	MRV-213 MRV-223 MRV-233 MRV-243	Local operation of steam generator PORVs near panels LSI-1 & LSI-2
RCS	NTR-140 NTR-210 NTR-240 NTR-120 NTR-130 NTR-220 NTR-230	Routing of new cables to provide remote indication at LSI-4, LSI-5, & LSI-6 for all four loops T_h and T_c
CCW	None	At least one path free of fire damage
ESW	None	At least one path free of fire damage
EPS	None	At least one path free of fire damage
RHR	ICM-129 ICM-111	Manual operation required prior to RHR initiation

TABLE 5-8

ESW PUMP SSS CABLES TO BE ISOLATED

PUMP	CABLE	FIRE ZONE ROUTING
1-PP-7E (UNIT 1)	9248G-1 8447G-1	54, 58, 44S, 44N, 56, 55, 41, 40B 112, 15, 79, 41, 55, 40B
1-PP-7W (UNIT 1)	9635R-1 8447R-1	54, 58, 44S, 44N, 57, 56, 55, 40A 112, 16, 79, 55, 40A
2-PP-7E (UNIT 2)	9248G-2 8447G-2	53, 57, 58, 59, 60, 47B 113, 18, 46A, 60, 47B
2-PP-7W (UNIT 2	9635R-2 8447R-2	53, 57, 58, 59, 60, 47A 113, 19, 85, 60, 46A, 45, 47A

CCW PUMP SSS CABLES TO BE ISOLATED

PUMP	CABLE	FIRE ZONE ROUTING
1-PP-10E (UNIT 1)	9425G-1	44S, 44N, 56, 55, 40B, 41
1-PP-10W (UNIT 1)	8690R-1	44S, 44N, 56, 55, 42A, 40A, 41
2-PP-10E (UNIT 2)	9425G-2	44S, 59, 60, 46A, 47B, 45
2-PP-10W (UNIT 2)	8690R-2	44S, 59, 60, 46A, 45, 47A

TABLE 5-9

ESW SYSTEM SSS CABLES TO BE REMOVED

EQUIPMENT	CABLE	FIRE ZONE ROUTING
ESWSE (UNIT 1)	9654G-1	54, 58, 57
	9655G-1	54, 58, 57
	9656G-1	54, 58, 57
ESWSW (UNIT 1)	9654R-1	54, 58, 57
	9655R-1	54, 58, 57
	9656R-1	54, 58, 57
WMO-701 (UNIT 1)	9232G-1*	29E, 29G, 58, 54
WMO-702 (UNIT 1)	8624R-2*	29E, 29G, 58, 54
WMO-705 (UNIT 1)	9235R-1	54, 57, 58, 53
WMO-707 (UNIT 1)	9587G-1	54, 57, 58, 53
1-PP-7E (UNIT 1)	9658G-1	54, 58, 57
	9659G-1	54, 58
	9720G-1	54, 58, 57, 53
1-PP-7W (UNIT 1)	9428R-1	54, 58
	9429R-1	54, 58
	9722R-1	54, 58, 57, 53
ESWSE (UNIT 2)	9654G-2	53, 57, 58
	9655G-2	53, 57, 58
	9656G-2	53, 57, 58

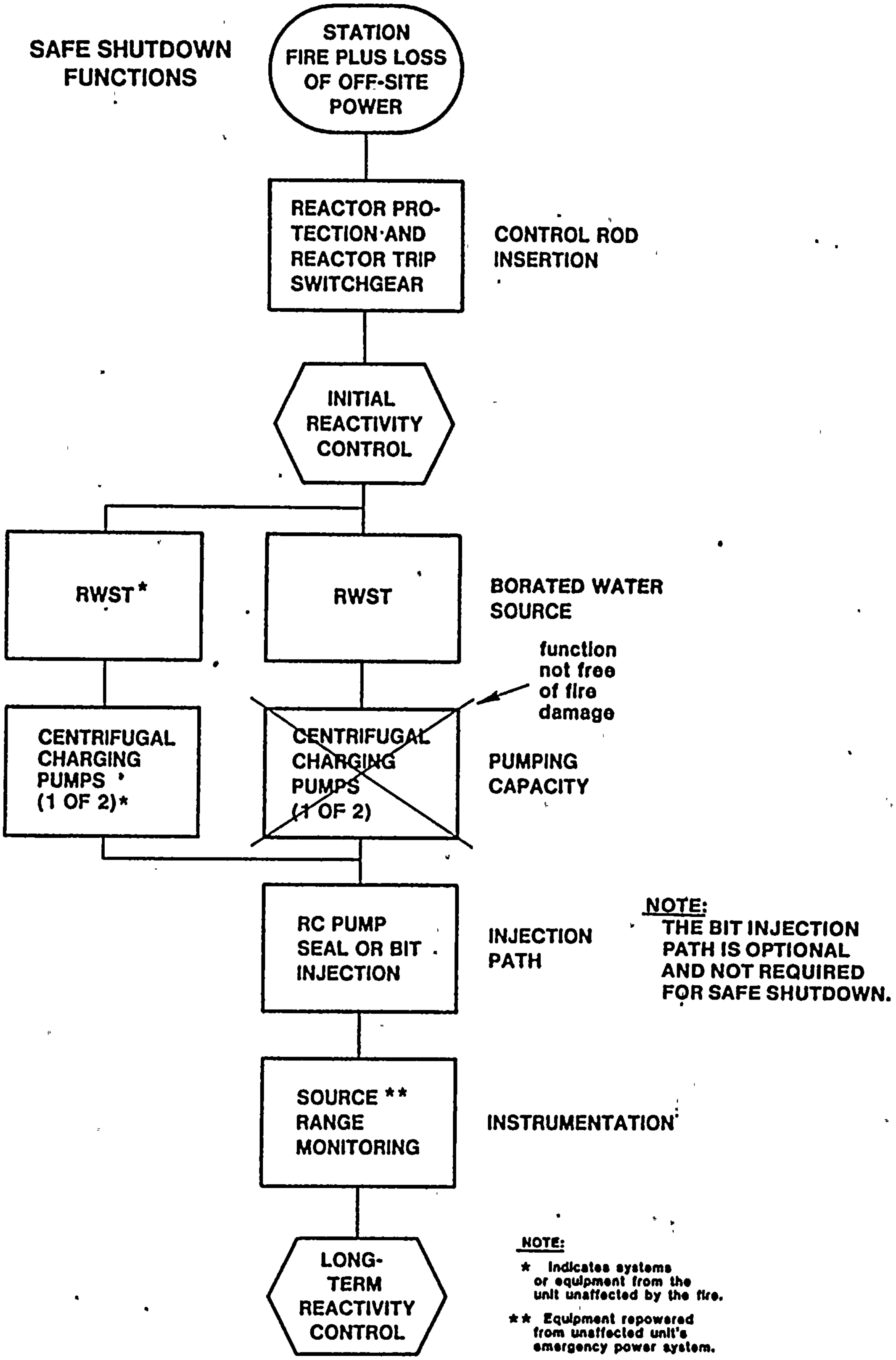
*Cables to be wrapped in Fire Zone 29G and removed from Fire Zones 54 and 58 (see Figure 5.16). Cable 9232G-1 has been re-tagged to 9867G-1, and cable 8624R-2 has been re-tagged to 9967R-1.

TABLE 5-9 (cont.)

ESW SYSTEM SSS CABLES TO BE REMOVED

EQUIPMENT	CABLE	FIRE ZONE ROUTING
ESWSW (UNIT 2)	9654R-2	53, 57, 58
	9655R-2	53, 57, 58
	9656R-2	53, 57, 58
WMO-703 (UNIT 2)	9987G-2*	29F, 29G, 57, 53, 58
WMO-704 (UNIT 2)	8996R-1*	29F, 29G, 58, 57, 53
WMO-706 (UNIT 2)	9235R-2	53, 57, 58, 54
WMO-708 (UNIT 2)	9587G-2	53, 57, 58, 54
2-PP-7E (UNIT 2)	9658G-2	53, 57
	9659G-2	53, 57
	9720G-2	53, 57, 58, 54
2-PP-7W (UNIT 2)	9428R-2	53, 57
	9429R-2	53, 57
	9722R-2	53, 57, 58, 54

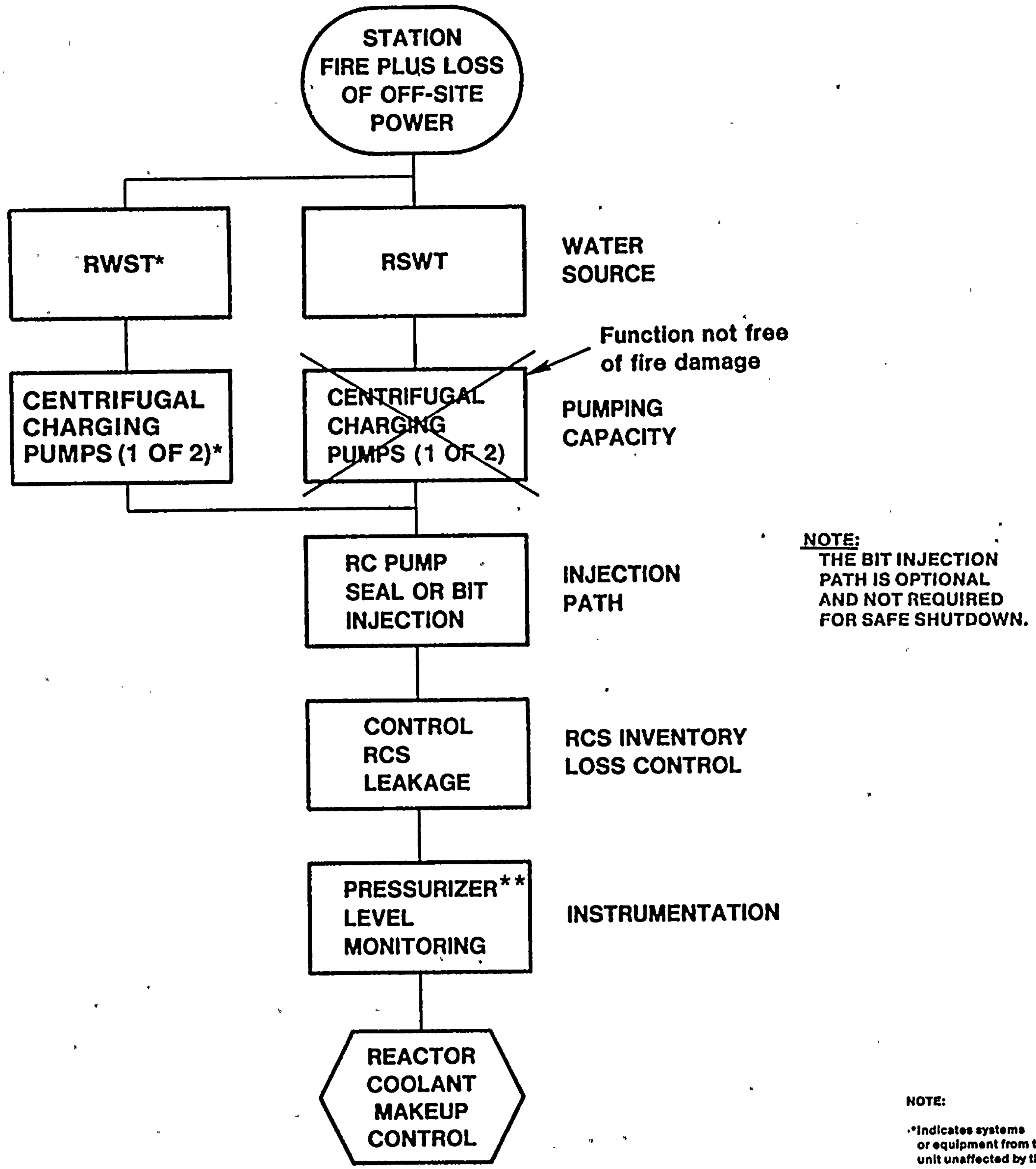
*Cables to be wrapped in Fire Zone 29G and removed from Frie Zones 53 and 57 (see Figure 5.16). Cable 9987G-2 has been re-tagged to 8644G-2, and cable 8996R-1 has been re-tagged to 8979R-2.



ALTERNATIVE SHUTDOWN

RCS REACTIVITY CONTROL FIGURE 5.1

SAFE SHUTDOWN FUNCTIONS



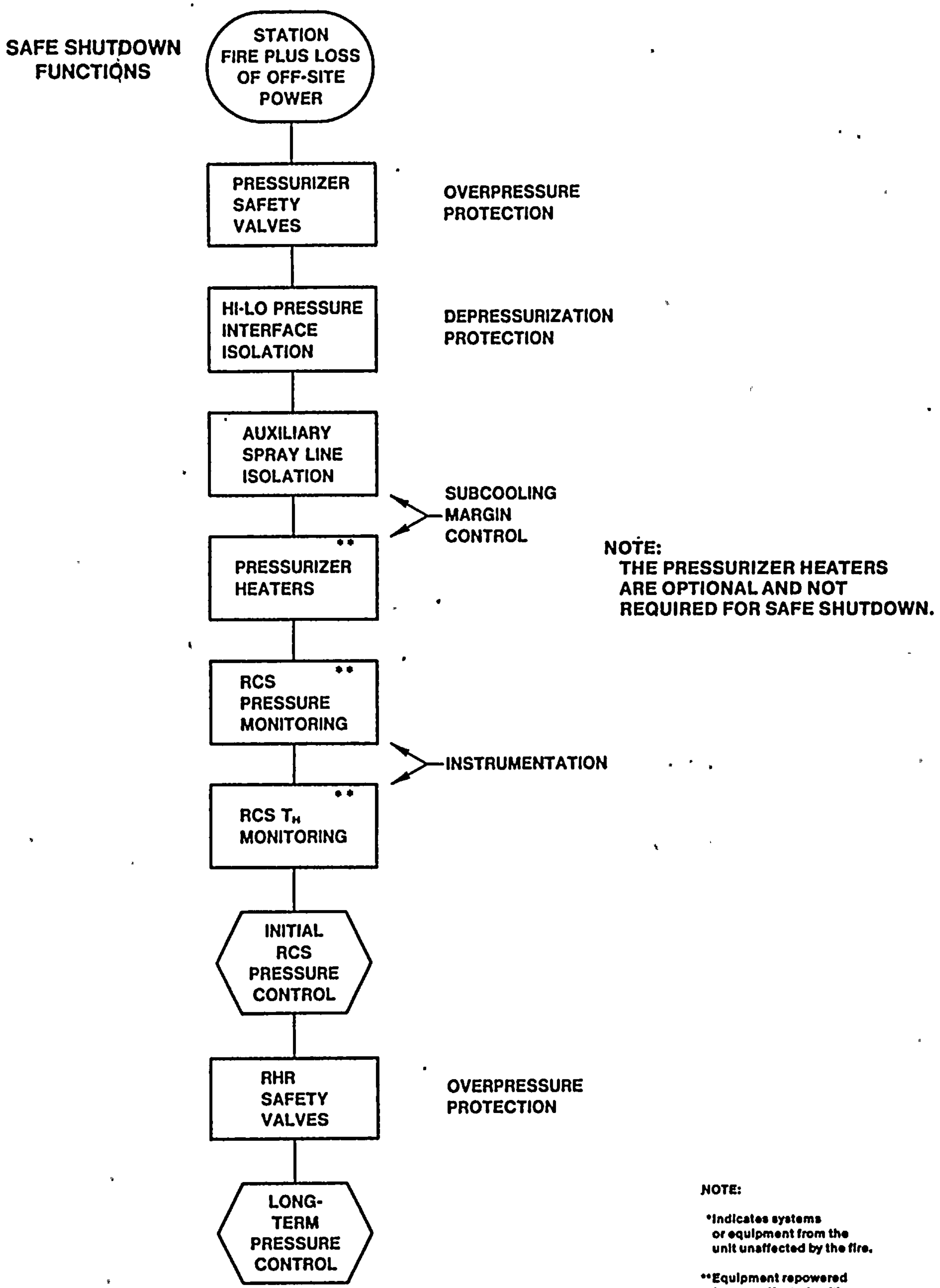
ALTERNATIVE SHUTDOWN

RCS MAKEUP CONTROL FIGURE 5.2

NOTE:

*Indicates systems or equipment from the unit unaffected by the fire.

**Equipment repowered from unaffected unit's emergency power system.



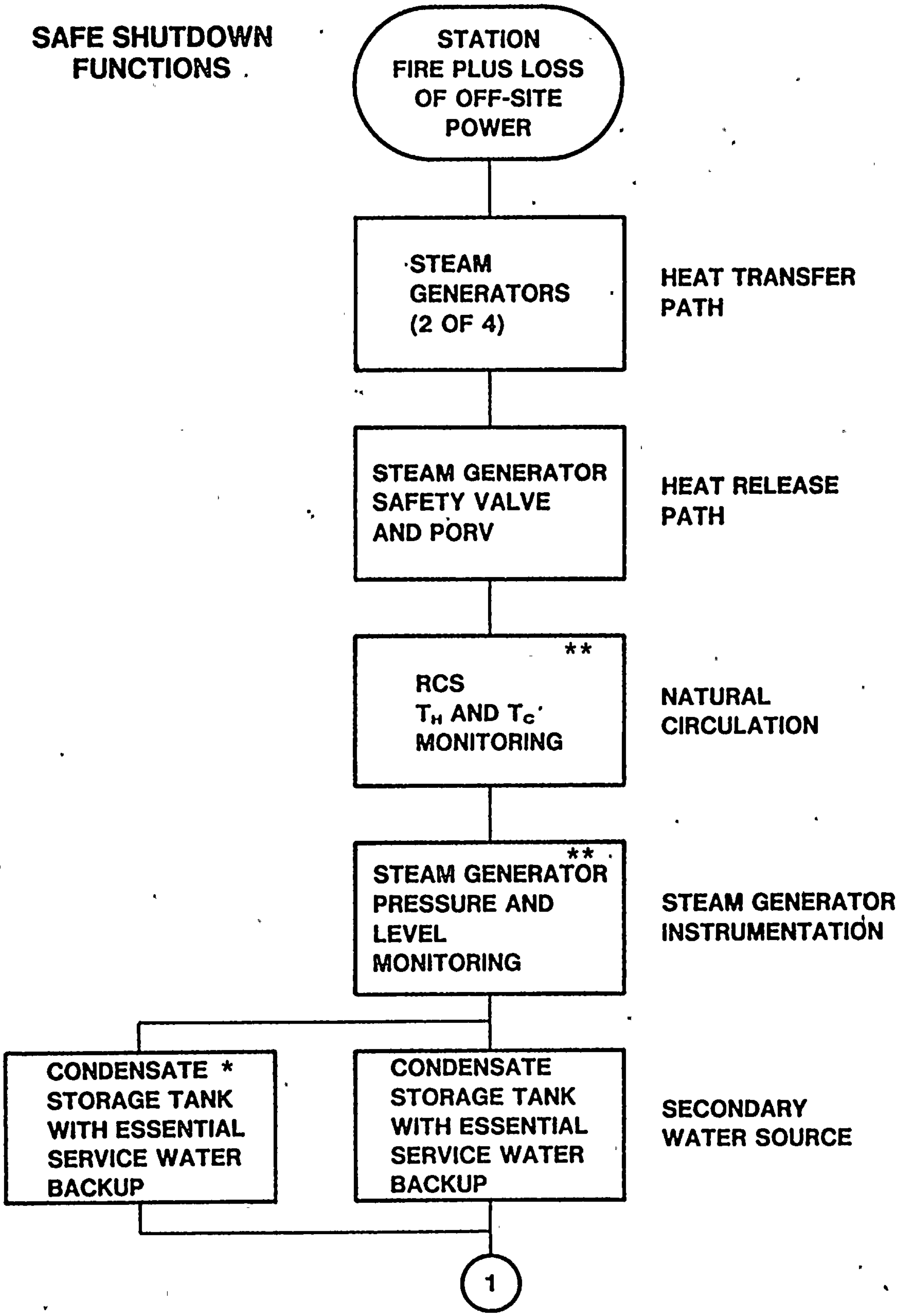
NOTE:

*Indicates systems or equipment from the unit unaffected by the fire.

**Equipment repowered from unaffected unit's emergency power system.

ALTERNATIVE SHUTDOWN

RCS PRESSURE CONTROL FIGURE 5.3



NOTE:

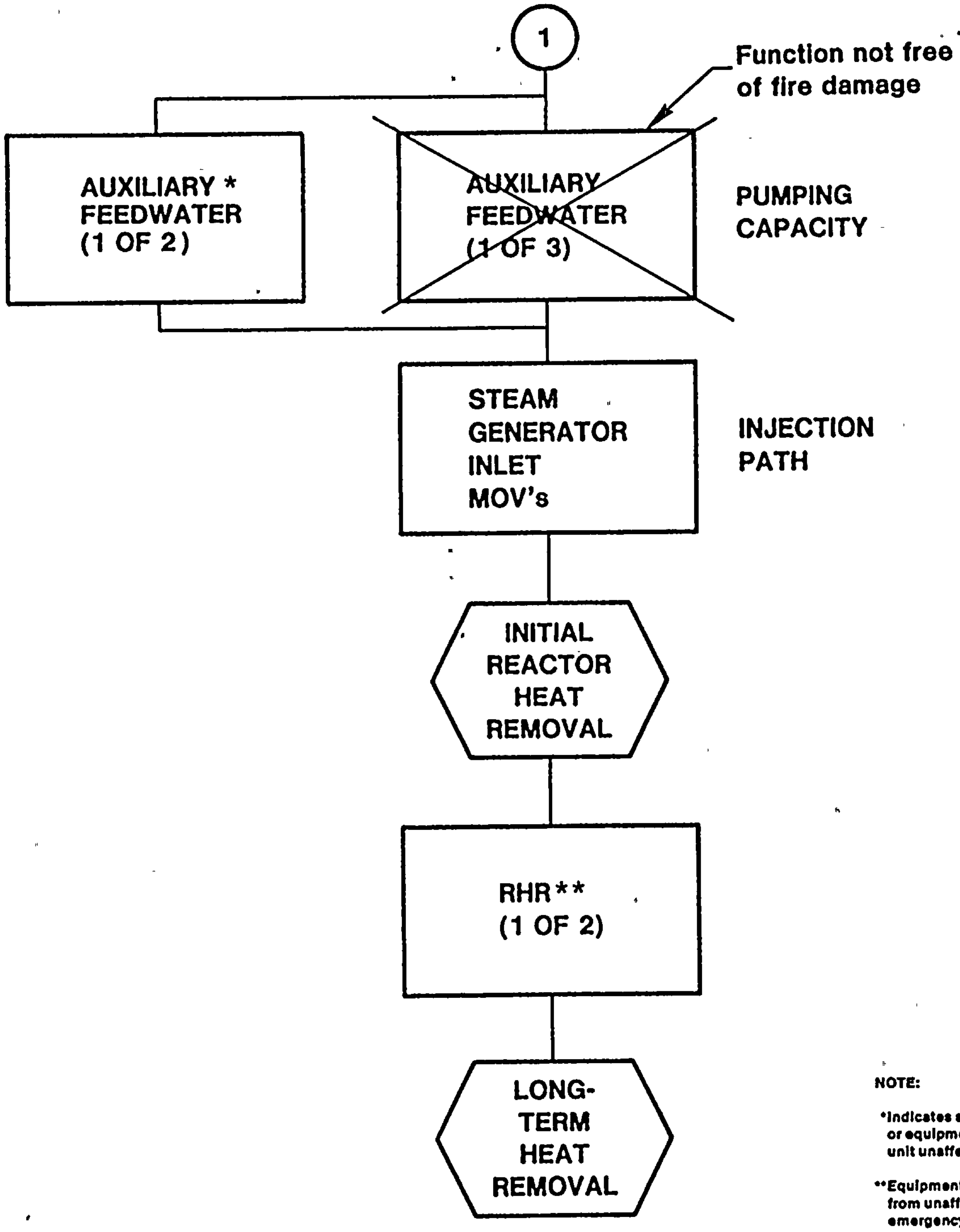
*Indicates systems or equipment from the unit unaffected by the fire.

**Equipment repowered from unaffected unit's emergency power system.

ALTERNATIVE SHUTDOWN

REACTOR HEAT REMOVAL FIGURE 5.4

SAFE SHUTDOWN FUNCTIONS



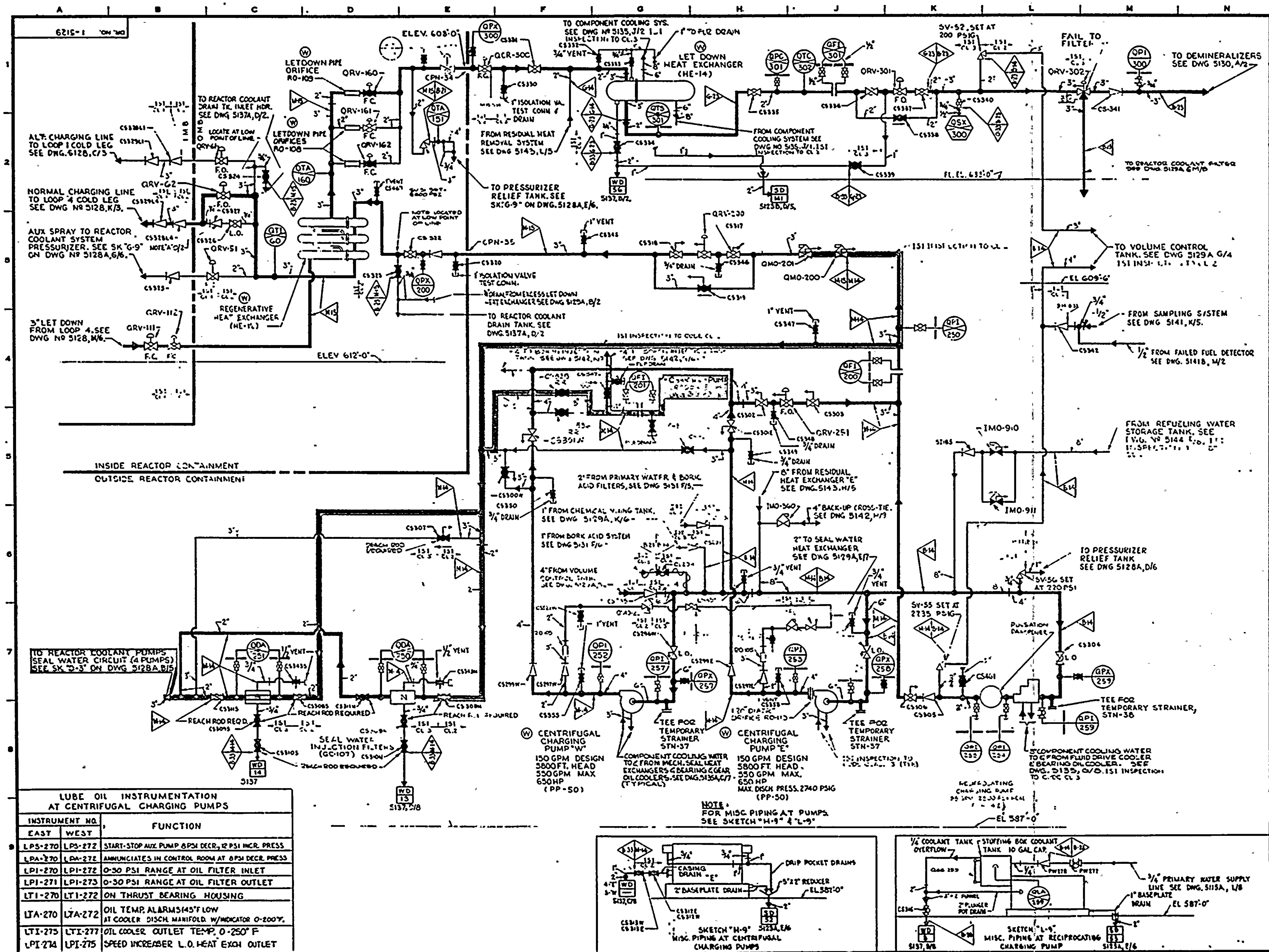
NOTE:

*Indicates systems or equipment from the unit unaffected by the fire.

**Equipment repowered from unaffected unit's emergency power system.

ALTERNATIVE SHUTDOWN

REACTOR HEAT REMOVAL FIGURE 5.4 (CONT)



LUBE OIL INSTRUMENTATION AT CENTRIFUGAL CHARGING PUMPS		
INSTRUMENT NO.		FUNCTION
EAST	WEST	
LPS-270	LPS-272	START-STOP AUX. PUMP 8 PSI DECR., 12 PSI INCR. PRESS
LPA-270	LPA-272	ANNUNCIATES IN CONTROL ROOM AT 8 PSI DECR. PRESS
LPI-270	LPI-272	0-30 PSI RANGE AT OIL FILTER INLET
LPI-271	LPI-273	0-30 PSI RANGE AT OIL FILTER OUTLET
LTI-270	LTI-272	ON THRUST BEARING HOUSING
LTA-270	LTA-272	OIL TEMP. ALARMS 145°F LOW AT COOLER DISCH. MANIFOLD. W/INDICATOR 0-200°F.
LTI-275	LTI-277	OIL COOLER OUTLET TEMP. 0-250° F
LPI-274	LPI-275	SPEED INCREASER L.O. HEAT EXCH OUTLET

GENERAL NOTES

LEGEND

MAIN FLOW

AUX. FLOW

FOR VALVE, INSTRUMENT, SAMPLING, PIPE MATERIAL AND OTHER SYMBOLS NOT EXPLAINED ON THIS DWG AND FOR MARK NUMBER CODES SEE DWG 5104.

SEISMIC CLASS I, EXCEPT AS NOTED

VALVE NOTED "A" B/3 VALVE OPENS AT 500 PSID

ALL VALVES, EQUIPMENT & INSTRUMENTATION SUPPLIED BY (W) WESTINGHOUSE, EXCEPT AS NOTED.

NOTES:
THIS DWG MADE ... FOR UNIT 1 AND ...

HAND OPERATED VALVE IDENTIFICATION NUMBERS

1. ONLY "UNIQUE VALVE NUMBERS" APPEAR ON THIS DRAWING. SEE SEPARATE VALVE IDENTIFICATION LIST FOR EQUIVALENT DESIGN (MCR) NUMBERS.
2. "TAG" NUMBERS MODIFIED FOR DRAWING USE AS FOLLOWS: TAG Nº 2 NSW V125 W APPEARS AS NSW125 V

*INSTRUMENT ROOT VALVE MARK NO'S NOT SHOWN ON DRAWING (SEE VALVE IDENTIFICATION LIST) DERIVED BY ADDING TO INSTRUMENT NUMBER: FOR SINGLE IMPULSE: V1 FOR DOUBLE IMPULSE: V1 (UPSTREAM) V2 (DOWNSTREAM)

FOR MICROFILM STATUS SEE REVISION RECORD FOR THIS DWG

DATE	NO.	APPROVED
3-21-85	29	[illegible]

FOR REVISION DESCRIPTION SEE SEPARATE REVISION RECORD FOR THIS DRAWING

INDIANA & MICHIGAN ELECTRIC CO.
DONALD C. COOK NUCLEAR PLANT
BRIDGMAN MICHIGAN

FLOW DIAGRAM CVCS-REACTOR LETDOWN & CHARGING
UNIT NO 1 SHEET 1 OF 2

FIGURE 5.5

TI APERTURE CARD

Also Available On Aperture Card

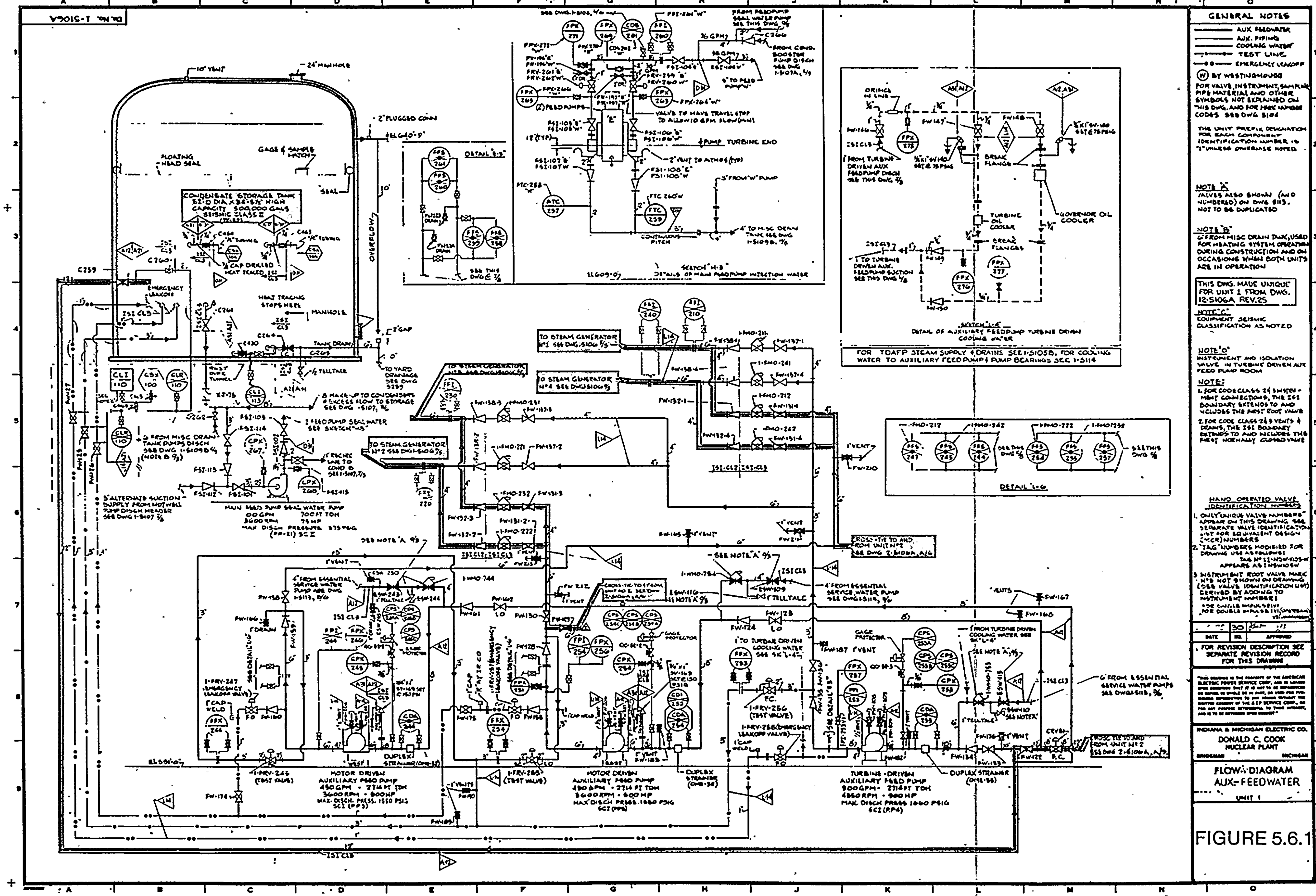
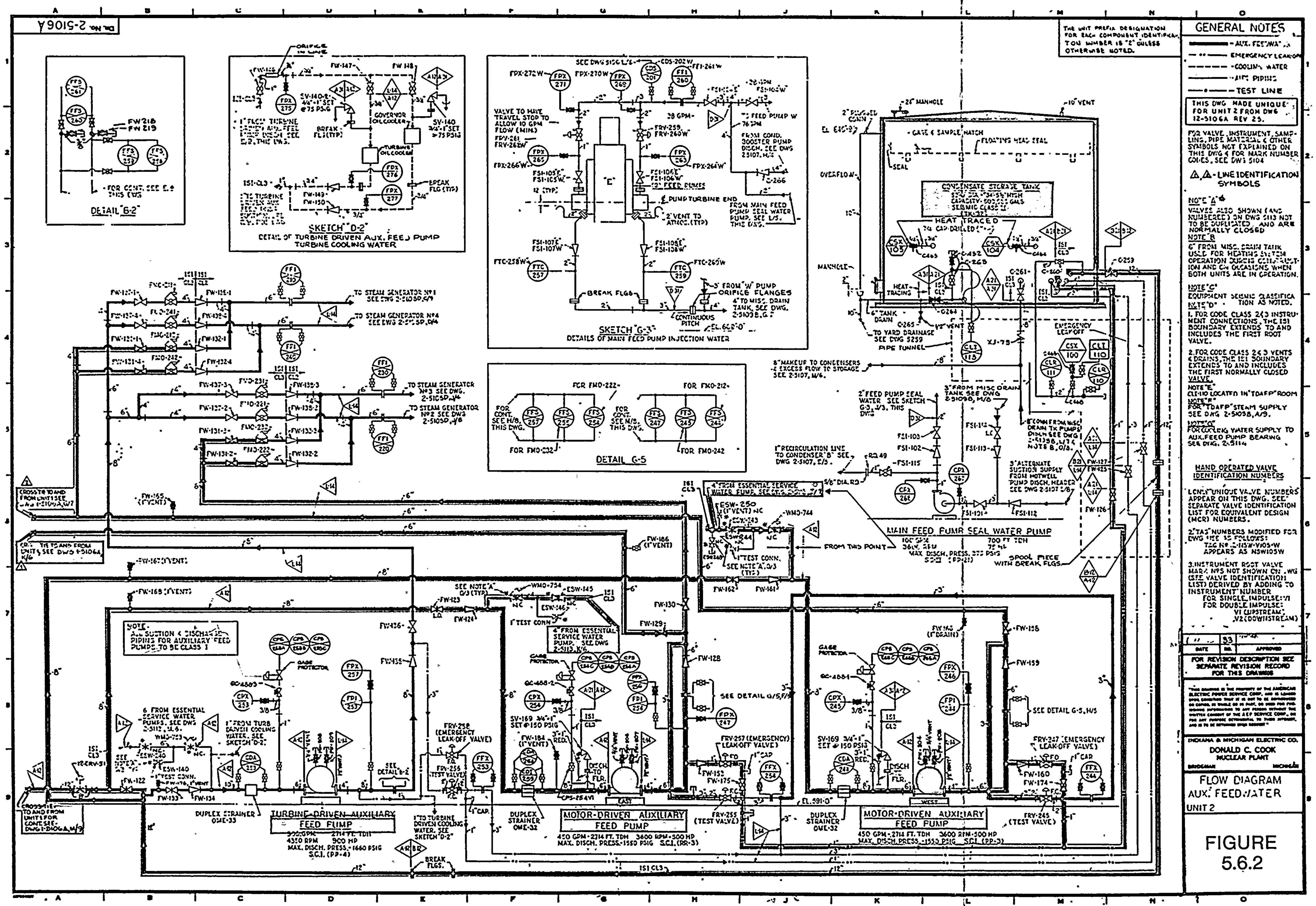


FIGURE 5.6.1

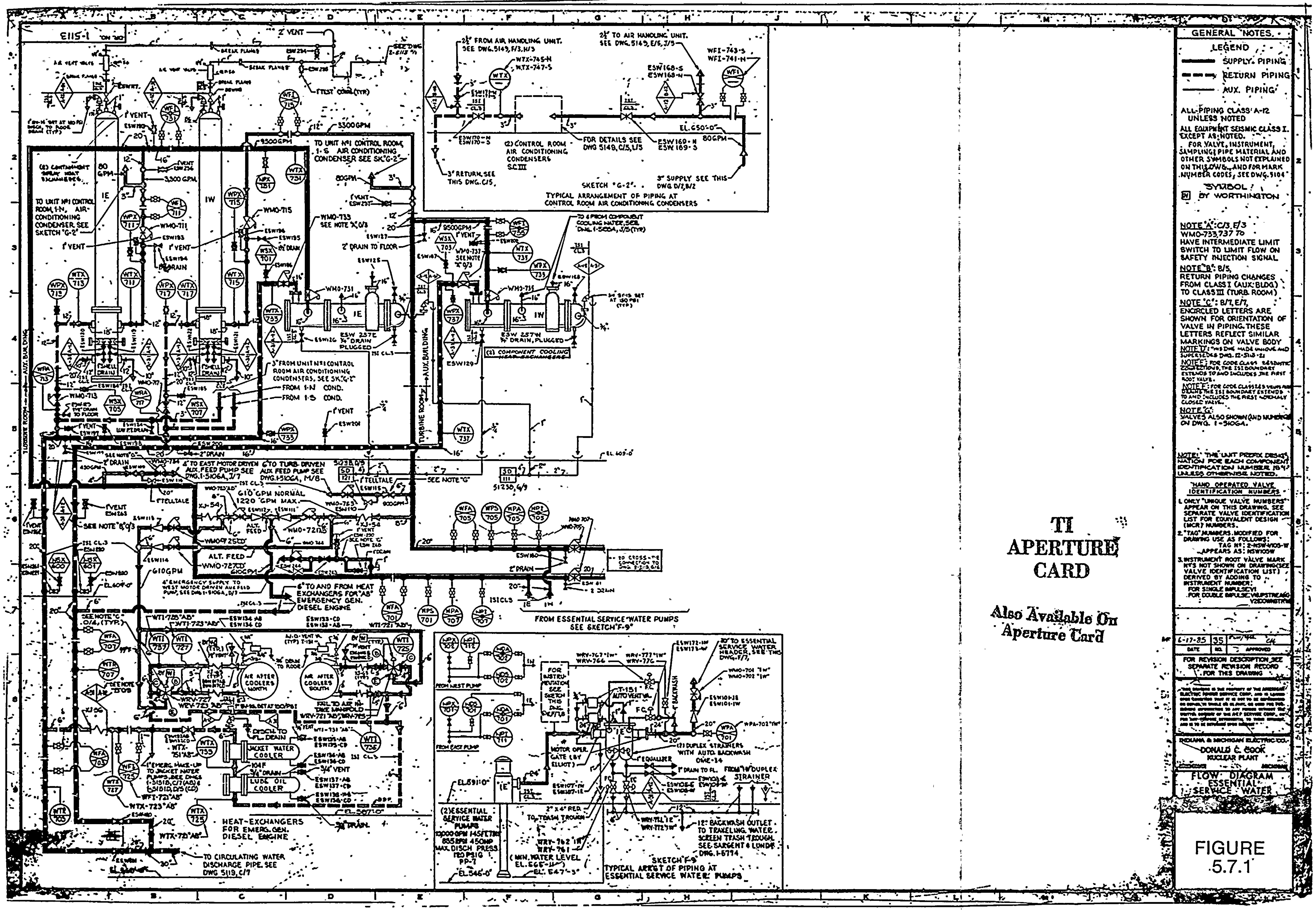
8702190215-37

TI APERTURE CARD

Also Available On Aperture Card



8702190215-38



TI APERTURE CARD

Also Available On Aperture Card

8702190215-39

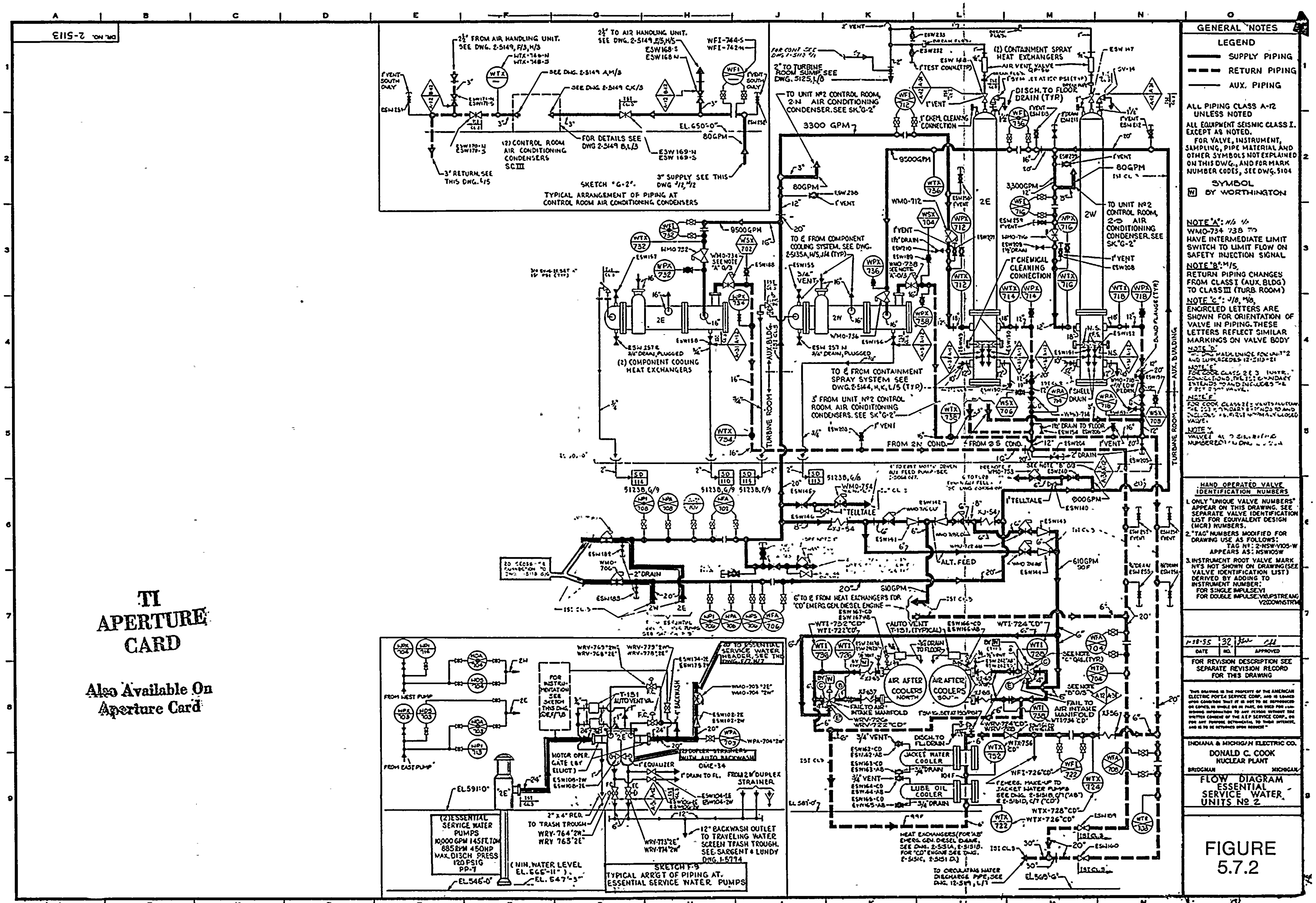
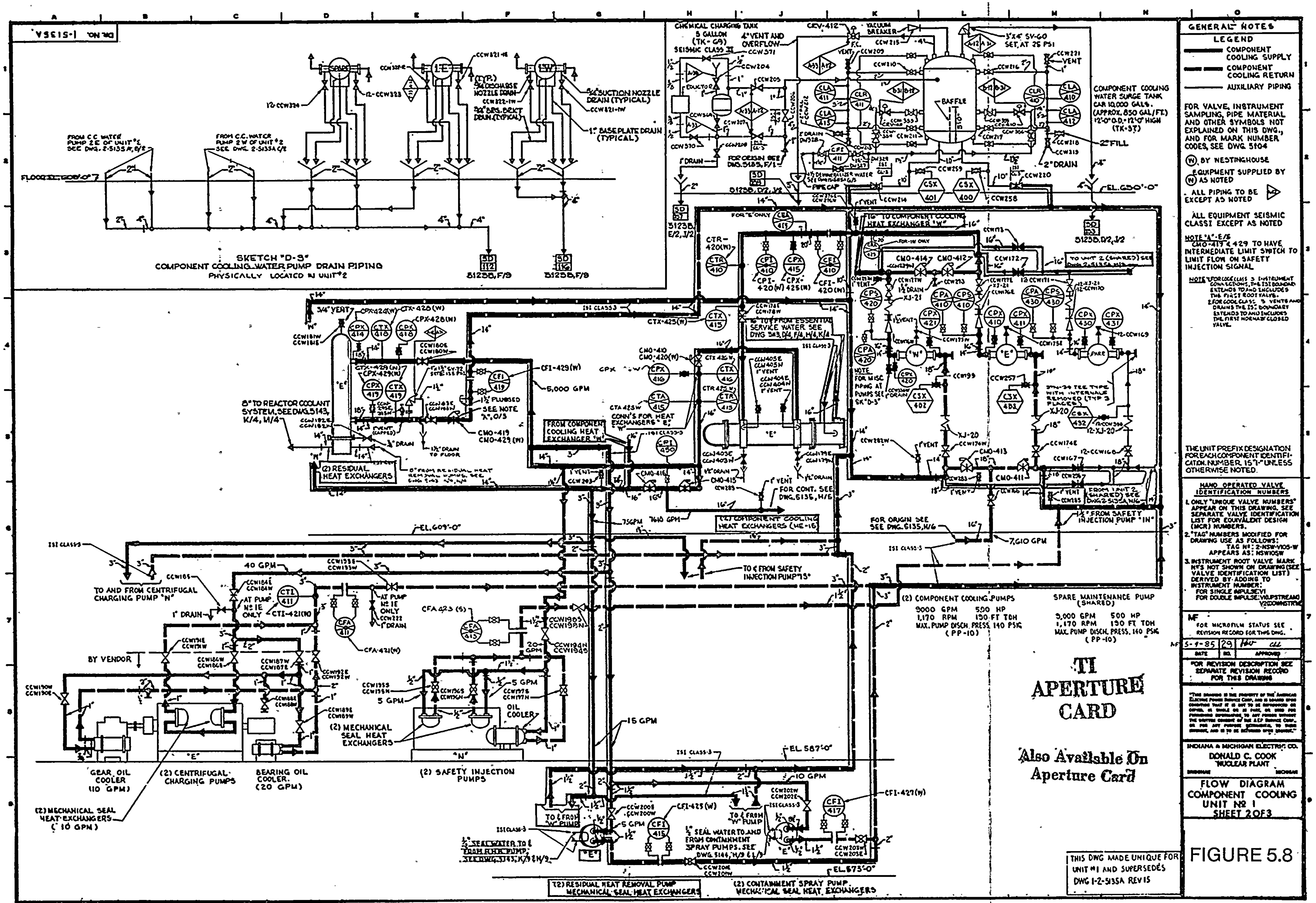


FIGURE 5.7.2

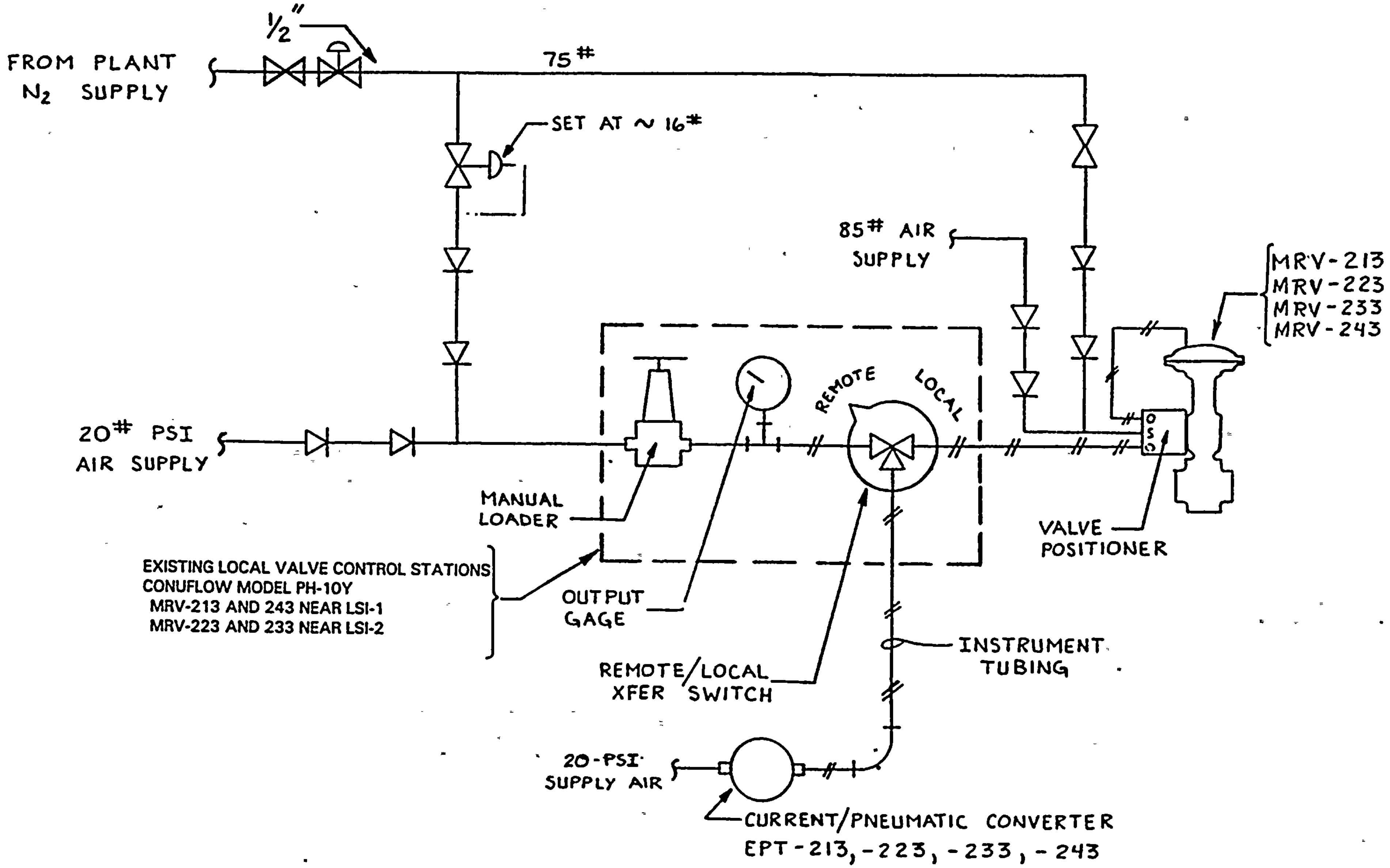
TI APERTURE CARD

Also Available On Aperture Card

8702190215-48

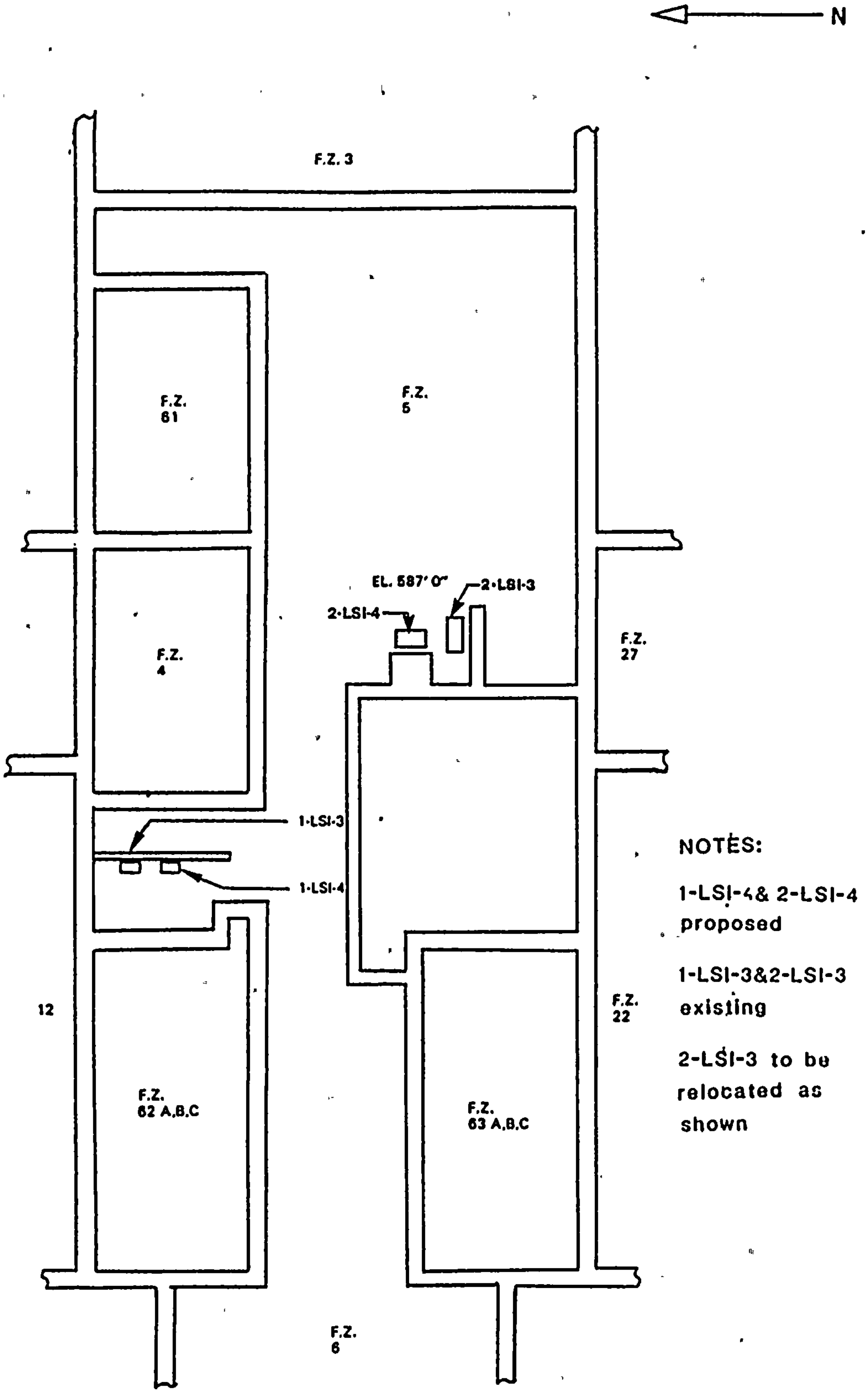


8702190215-41



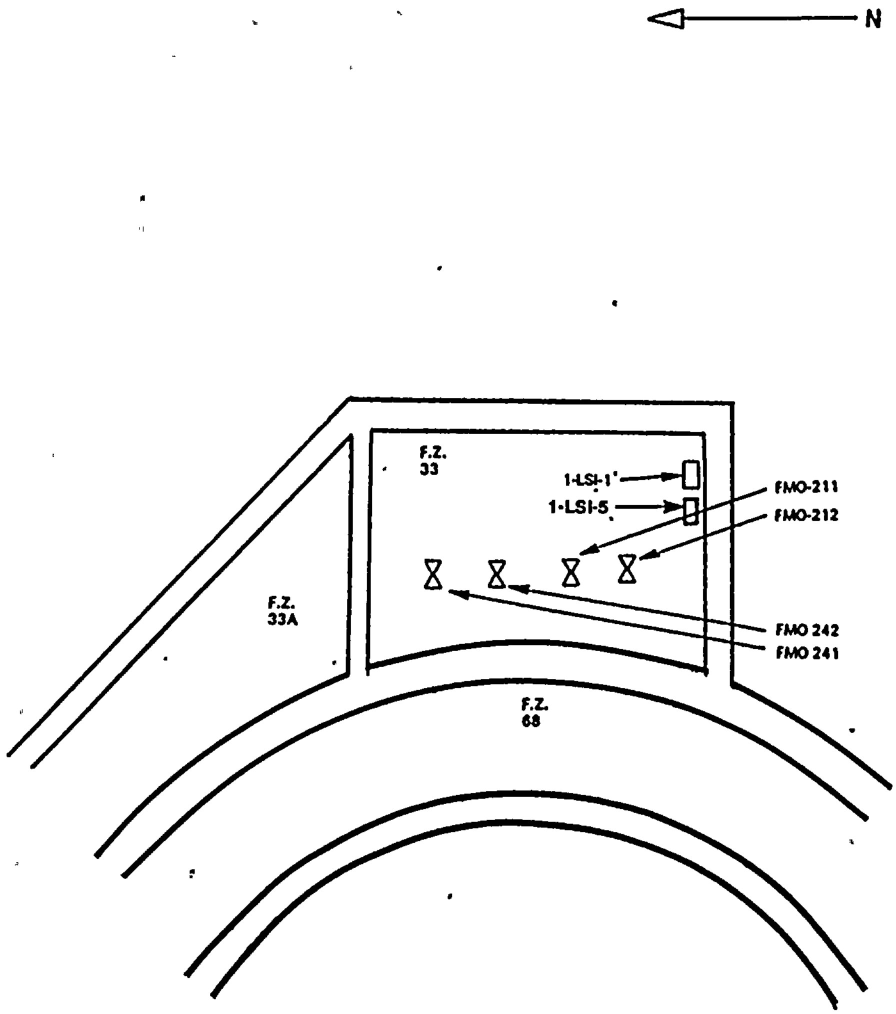
N2 SUPPLY FOR EMERGENCY OPERATION OF S.G. PORV'S

FIGURE 5.9



LOCATION OF LOCAL SHUTDOWN INDICATION CABINETS: 1-LSI-3, 1-LSI-4, 2-LSI-3, 2-LSI-4

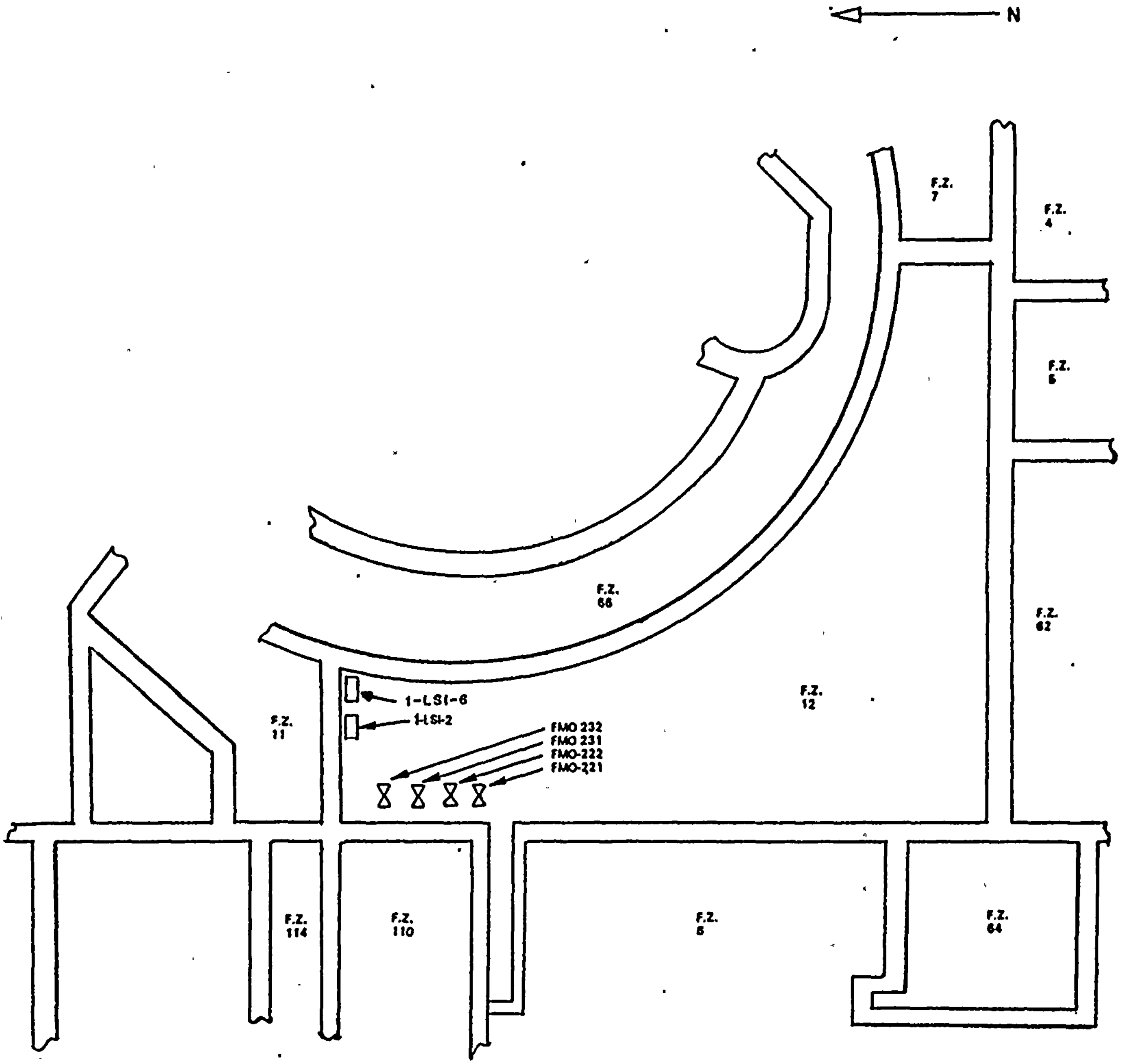
FIGURE 5.10.1



LOCATION OF EXISTING LOCAL SHUTDOWN
INDICATION CABINET 1-LSI-1

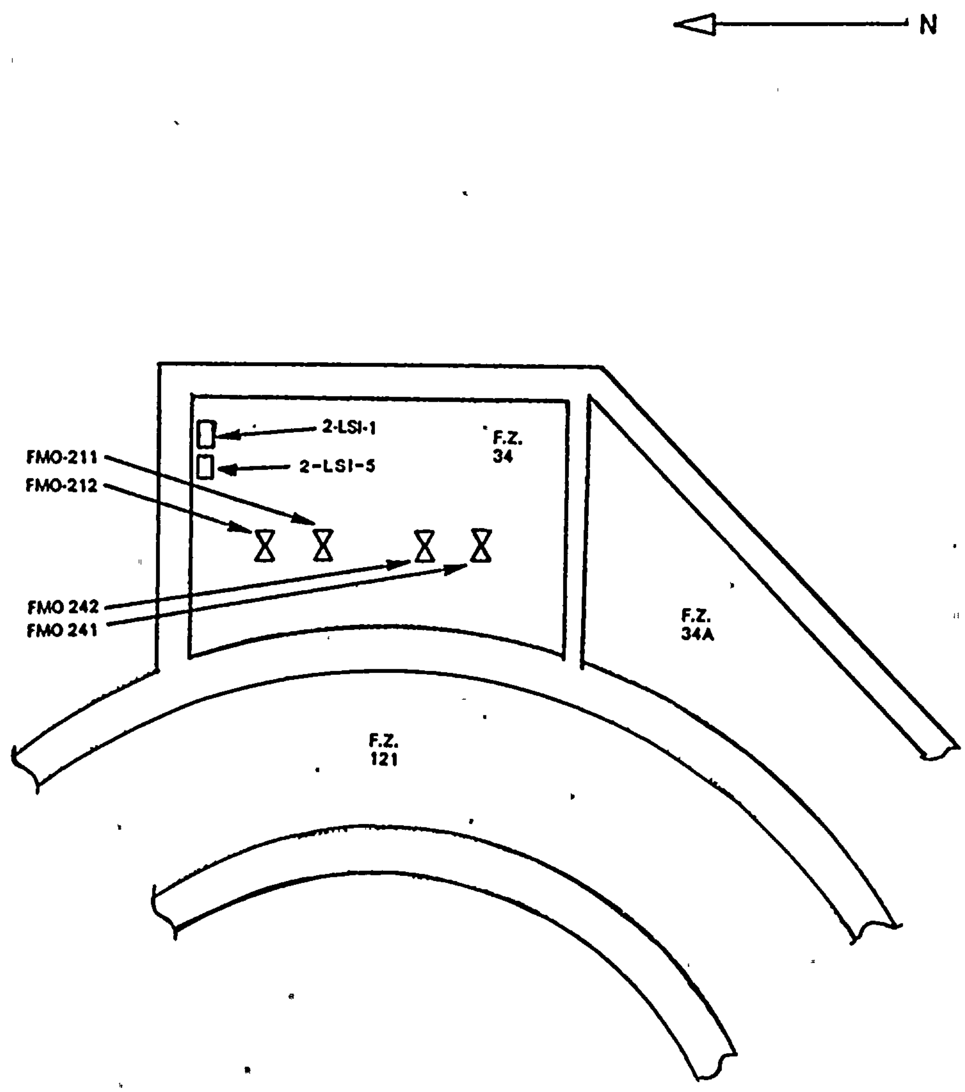
LOCATION OF EXISTING LOCAL SHUTDOWN INDICATION CABINET 1-LSI-1 AND PROPOSED LOCAL SHUTDOWN CABINET 1-LSI-5

FIGURE 5.10.2



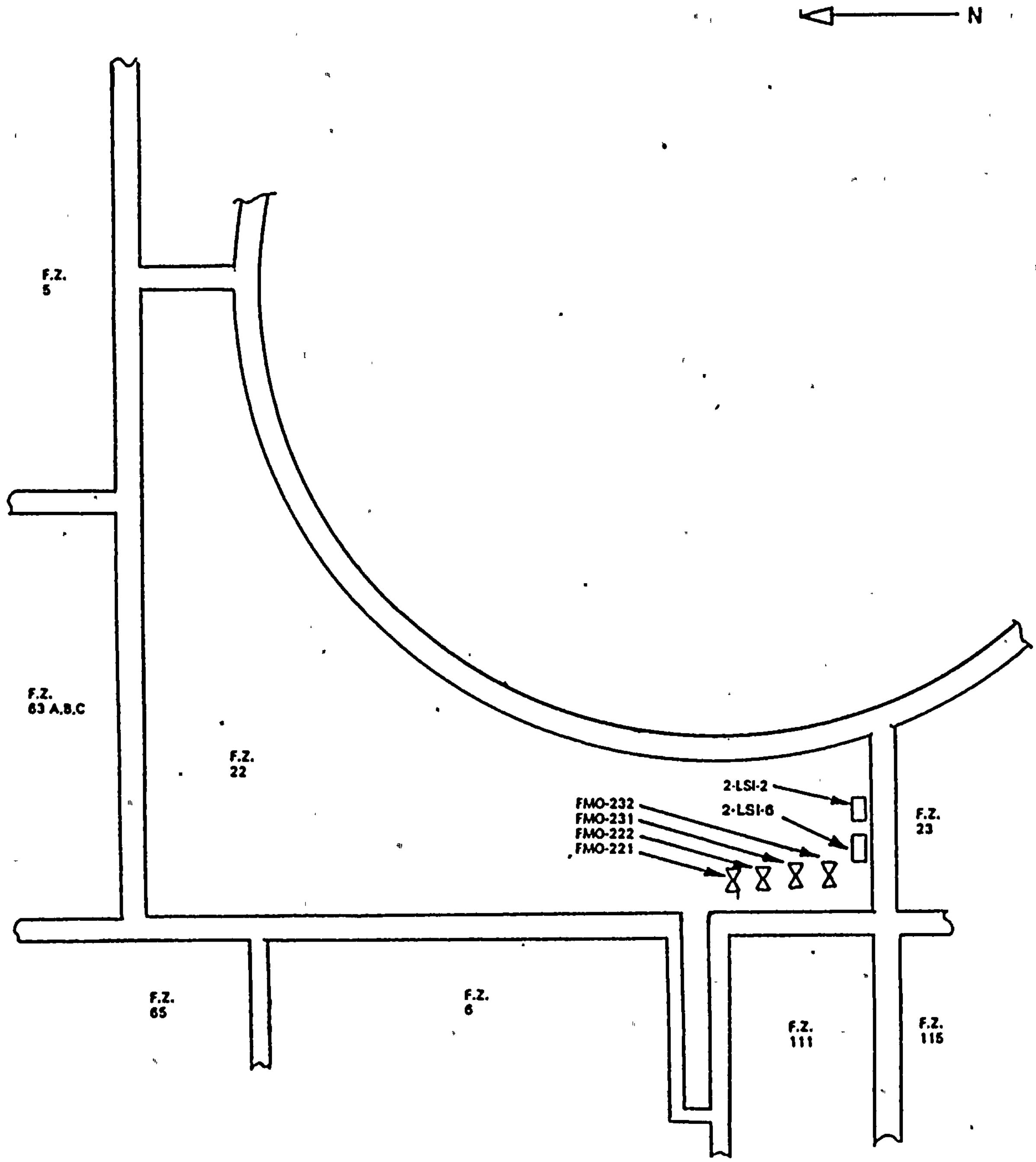
LOCATION OF EXISTING LOCAL SHUTDOWN INDICATION CABINET
1-LSI-2 AND PROPOSED LOCAL SHUTDOWN INDICATION CABINET 1 LSI-6

FIGURE 5.10.3



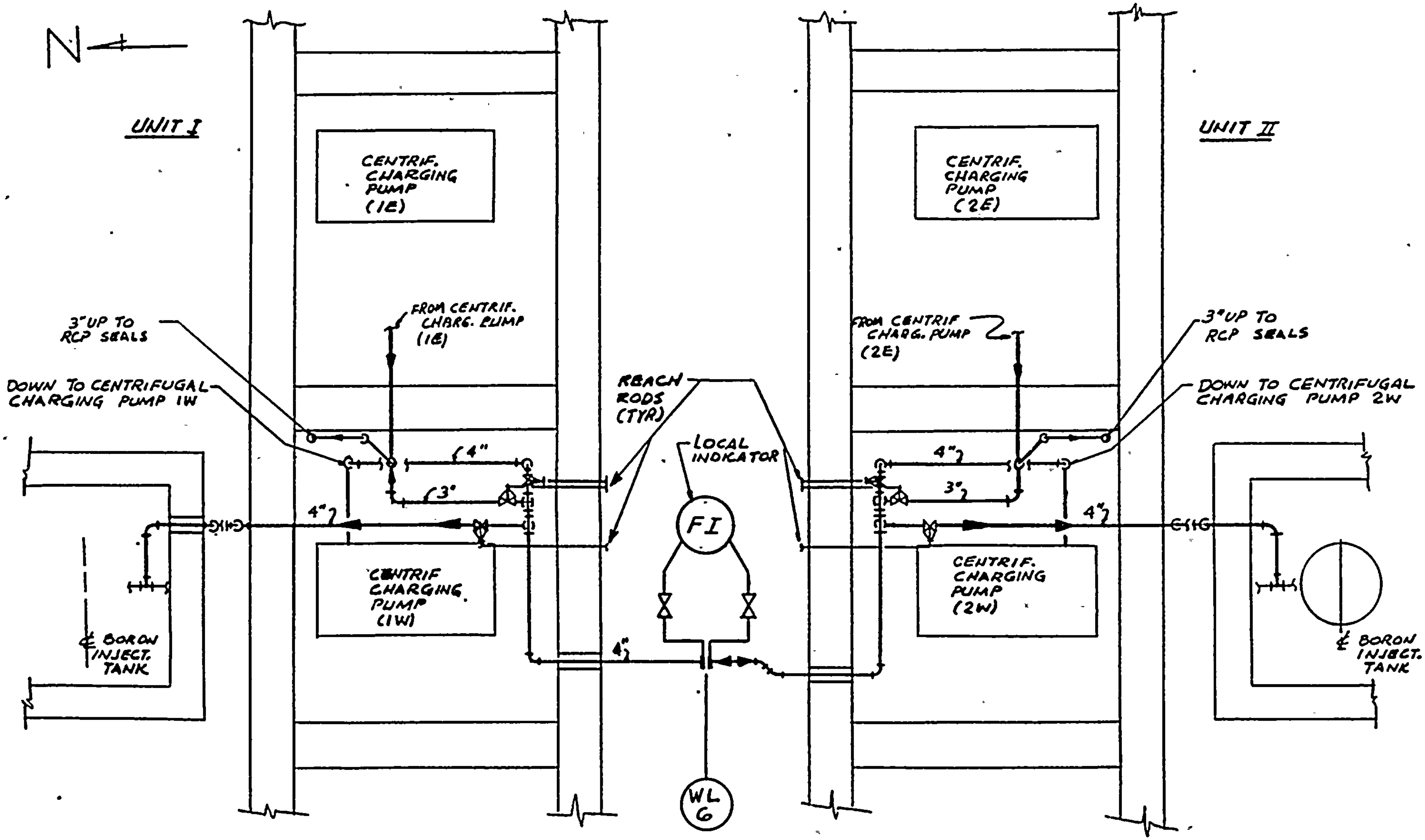
LOCATION OF EXISTING LOCAL SHUTDOWN INDICATION CABINET
2-LSI-1 AND PROPOSED LOCAL SHUTDOWN INDICATION CABINET 2-LSI-5

FIGURE 5.10.4



LOCATION OF EXISTING LOCAL SHUTDOWN INDICATION CABINET 2-LSI-2 AND PROPOSED LOCAL SHUTDOWN INDICATION CABINET 2-LSI-6

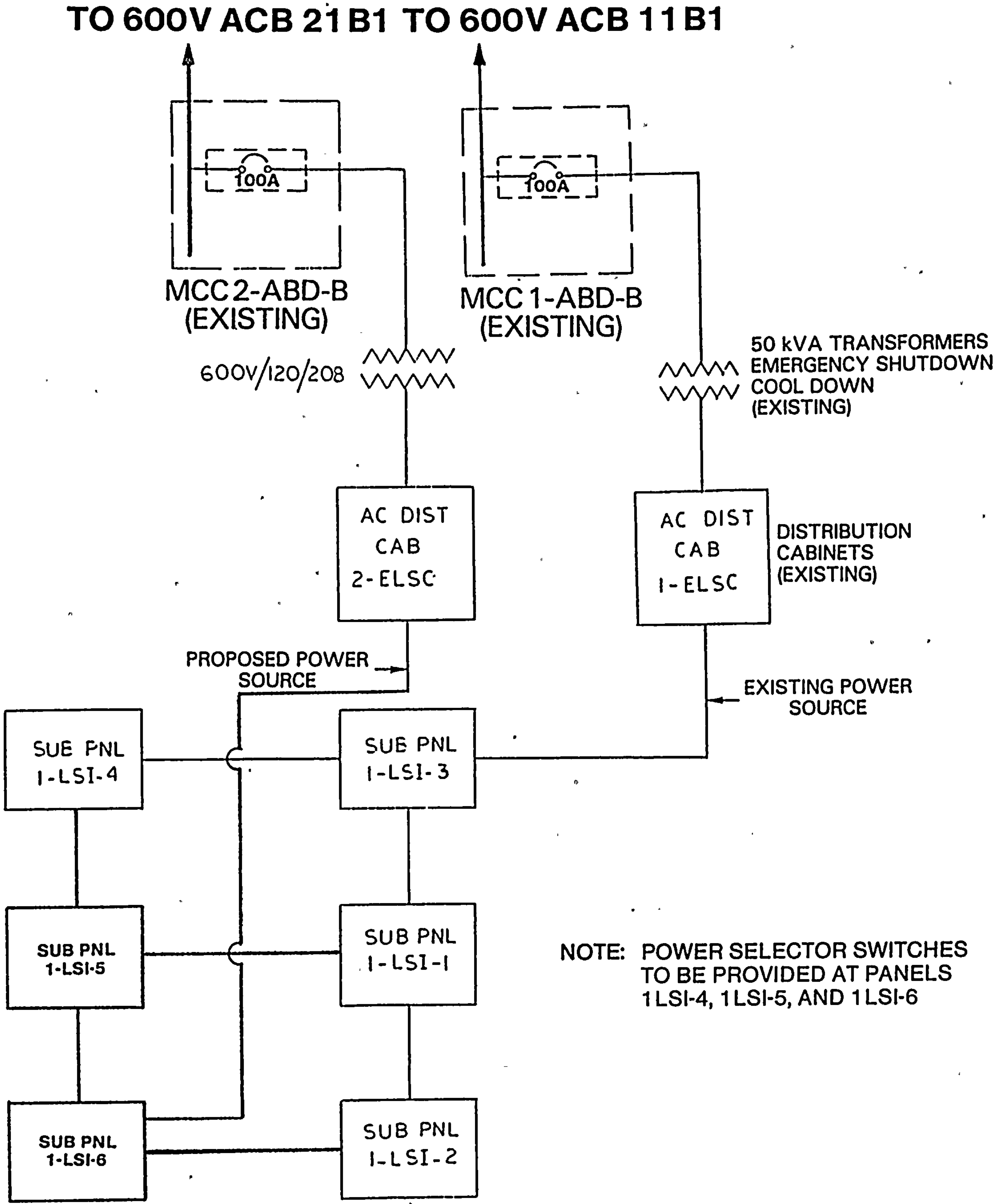
FIGURE 5.10.5



NOT TO SCALE

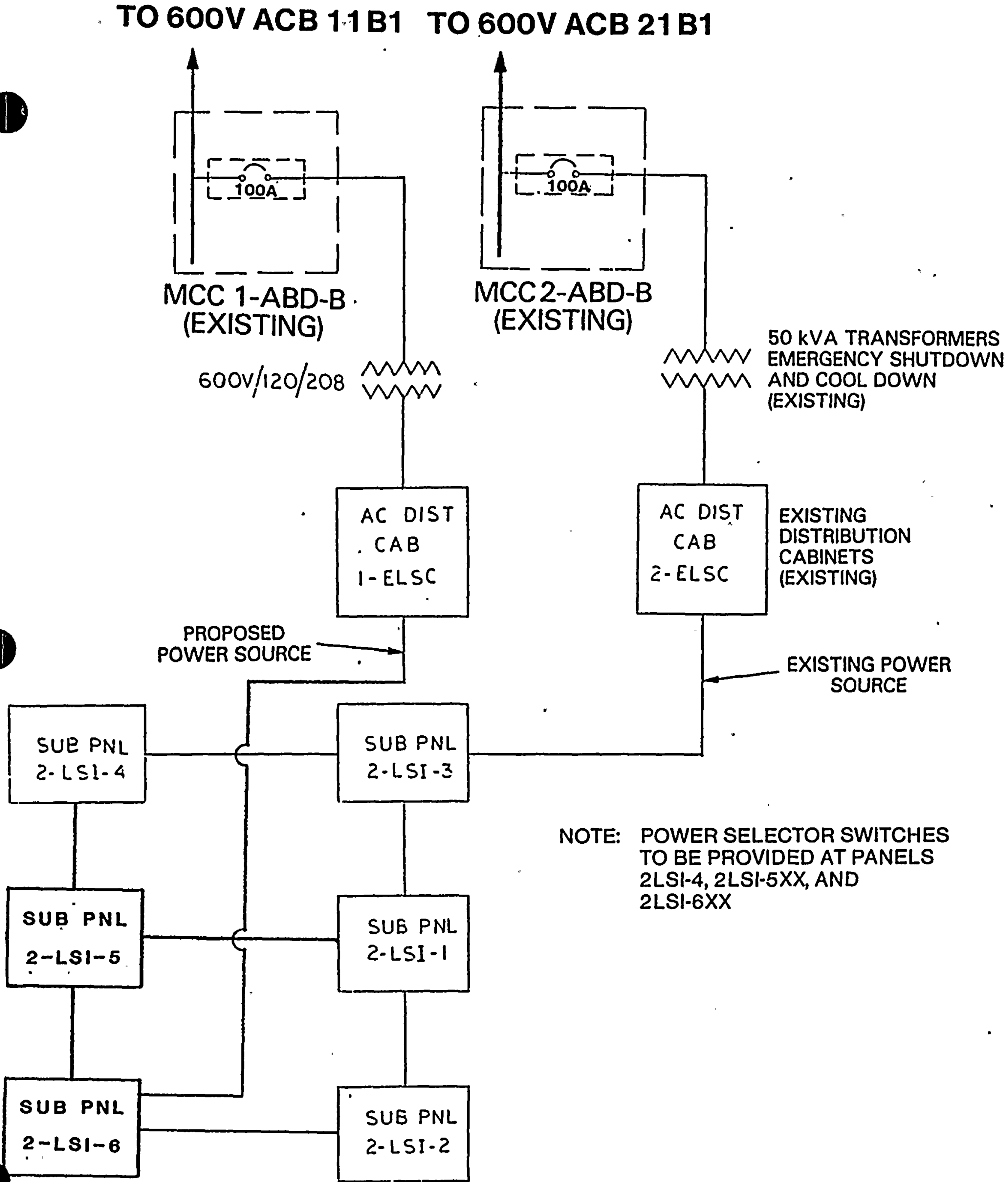
CVCS CROSS-TIE PIPING DIAGRAM

FIGURE 5.11



ONE LINE DIAGRAM FOR PROPOSED POWER SOURCES TO UNIT 1 LSI PANELS

FIGURE 5.12.1

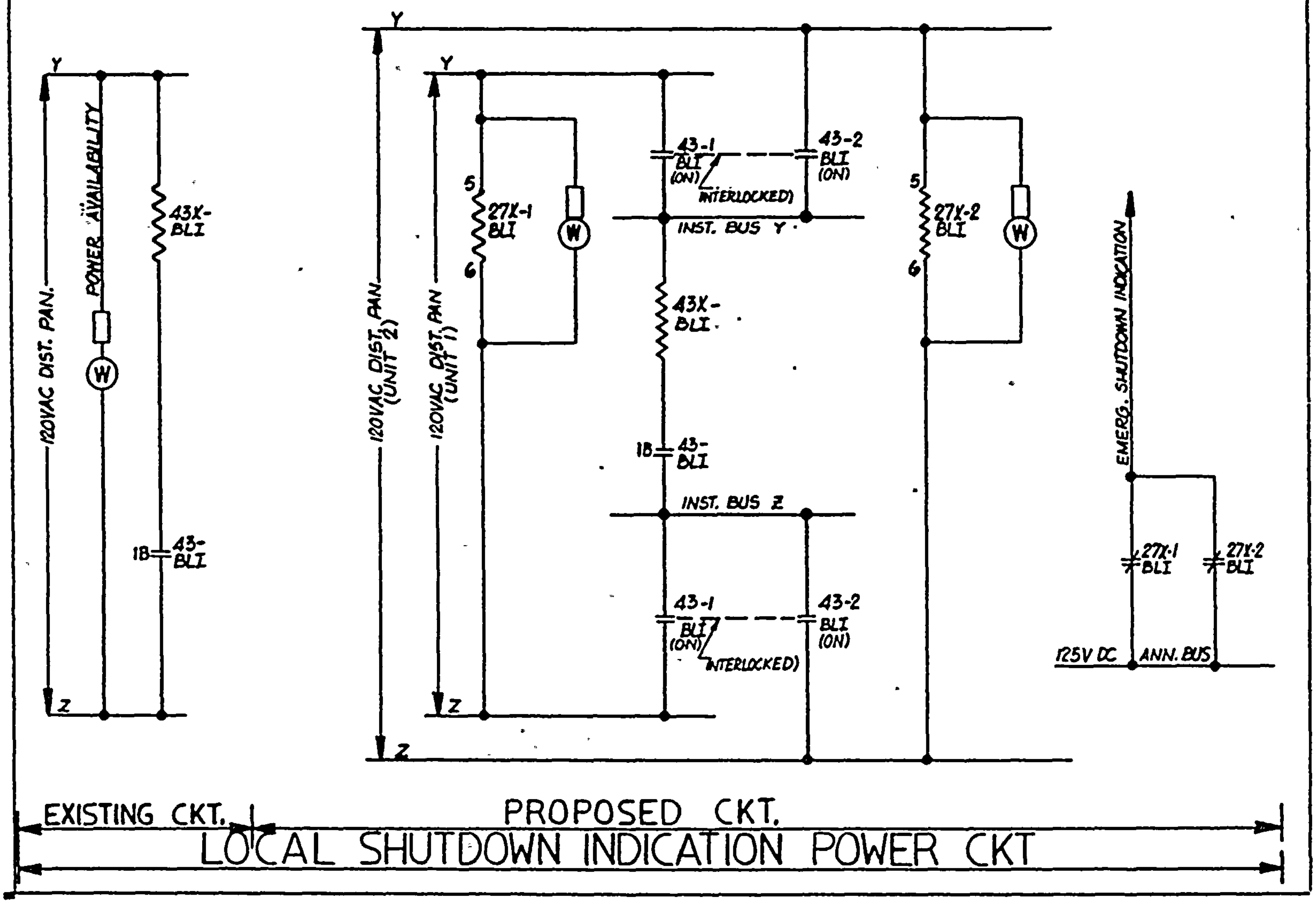


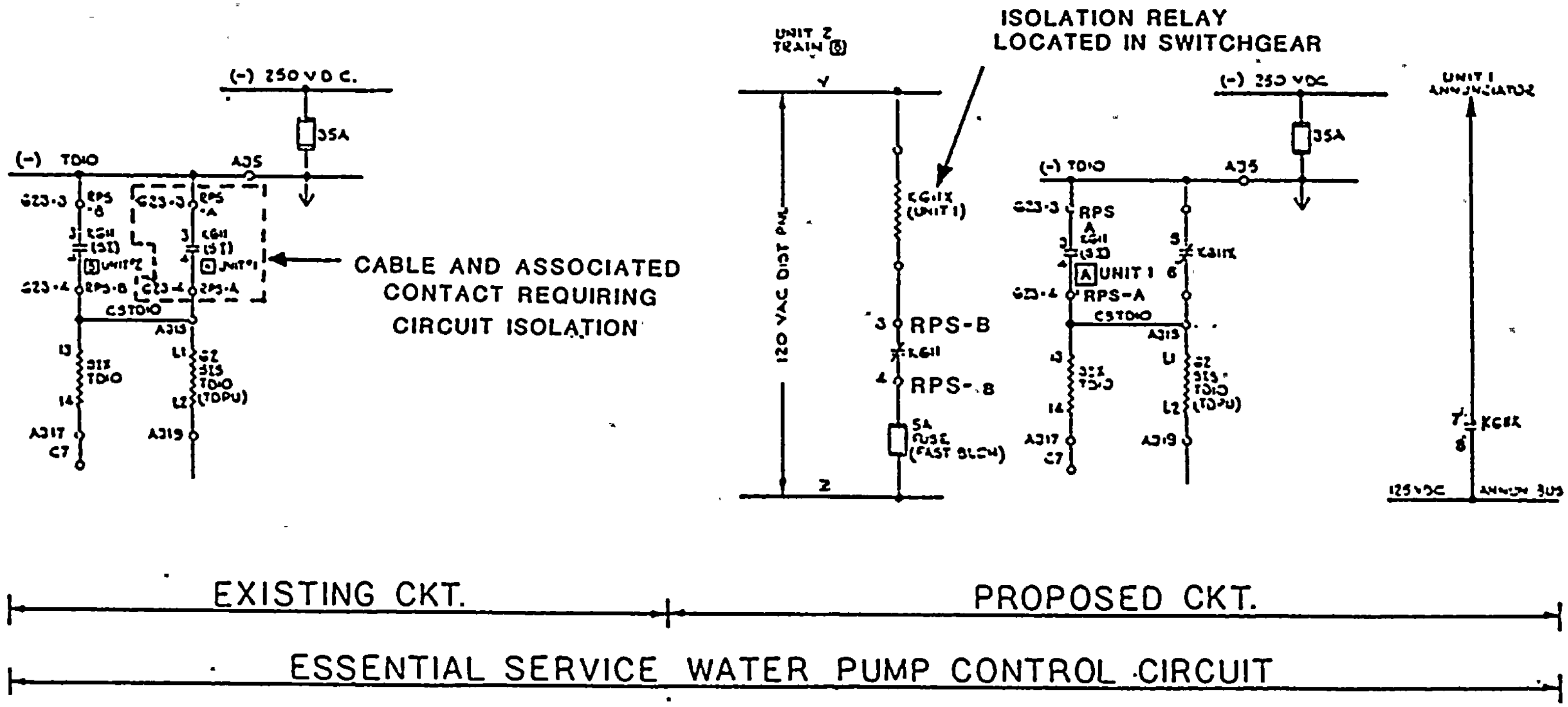
ONE LINE DIAGRAM FOR PROPOSED POWER SOURCES TO UNIT 2 LSI PANELS

FIGURE 5.12.2

LSI PANEL POWER SUPPLY SCHEMATIC (TYPICAL)

FIGURE 5.13





UNIT 2 PUMP CIRCUIT SHOWN (TYPICAL FOR ALL ESW PUMPS)

FIGURE 5.14.1

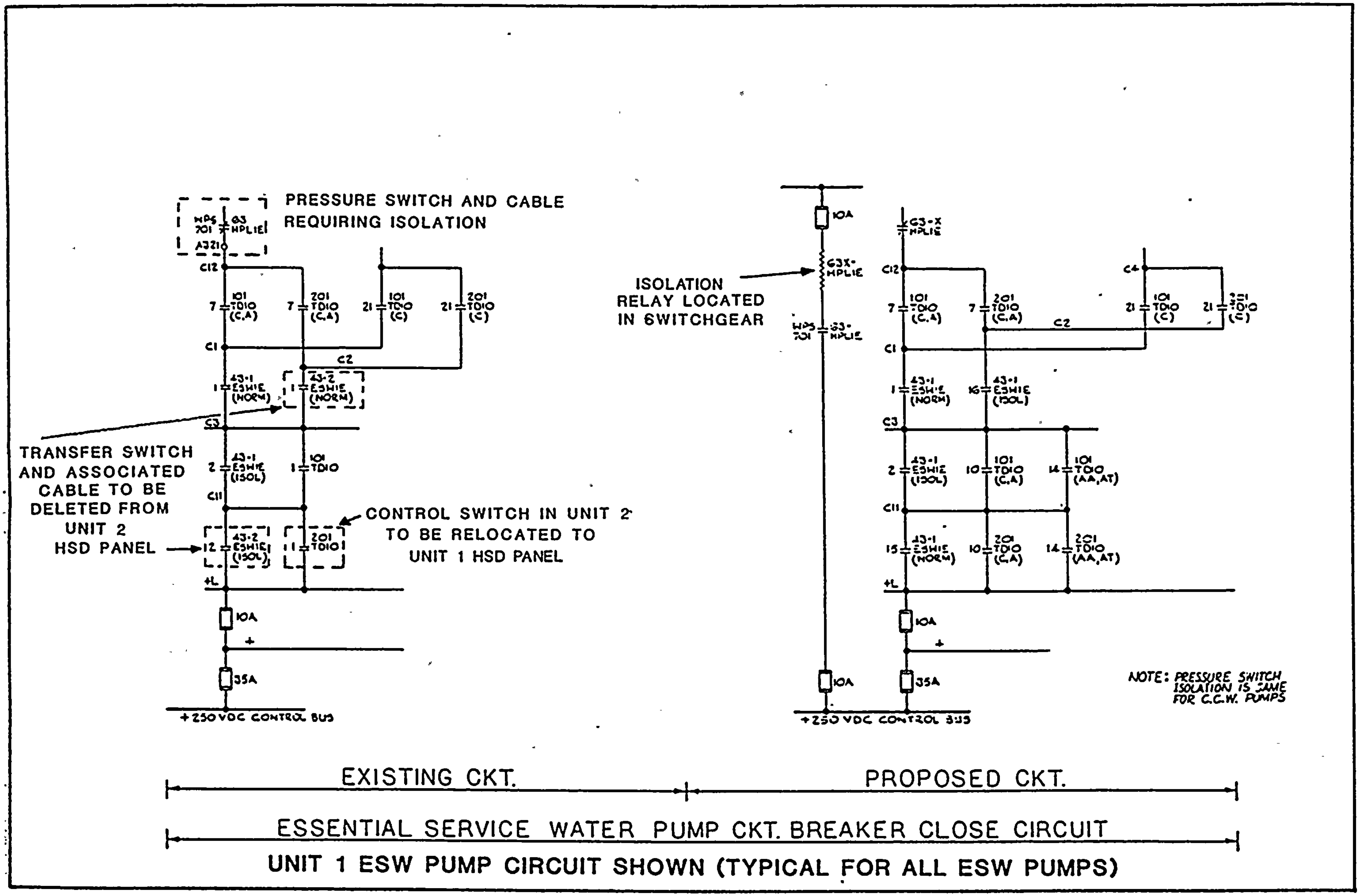
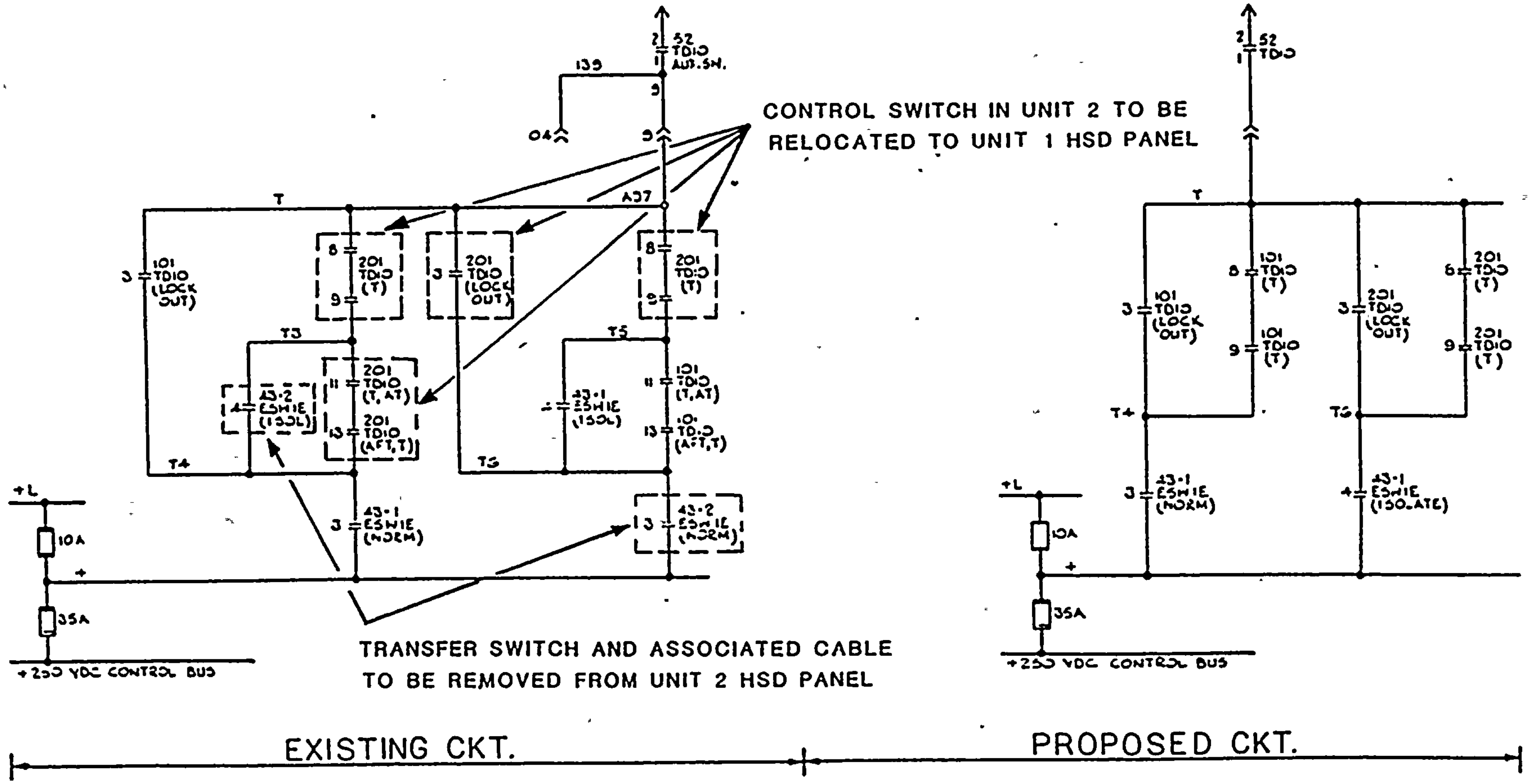

PRESSURE SWITCH AND CABLE REQUIRING ISOLATION
TRANSFER SWITCH AND ASSOCIATED CABLE TO BE DELETED FROM UNIT 2 HSD PANEL
CONTROL SWITCH IN UNIT 2 TO BE RELOCATED TO UNIT 1 HSD PANEL
+250 VDC CONTROL BUS
ISOLATION RELAY LOCATED IN SWITCHGEAR
NOTE: PRESSURE SWITCH ISOLATION IS SAME FOR C.C.W. PUMPS
EXISTING CKT.
PROPOSED CKT.
ESSENTIAL SERVICE WATER PUMP CKT. BREAKER CLOSE CIRCUIT
UNIT 1 ESW PUMP CIRCUIT SHOWN (TYPICAL FOR ALL ESW PUMPS)

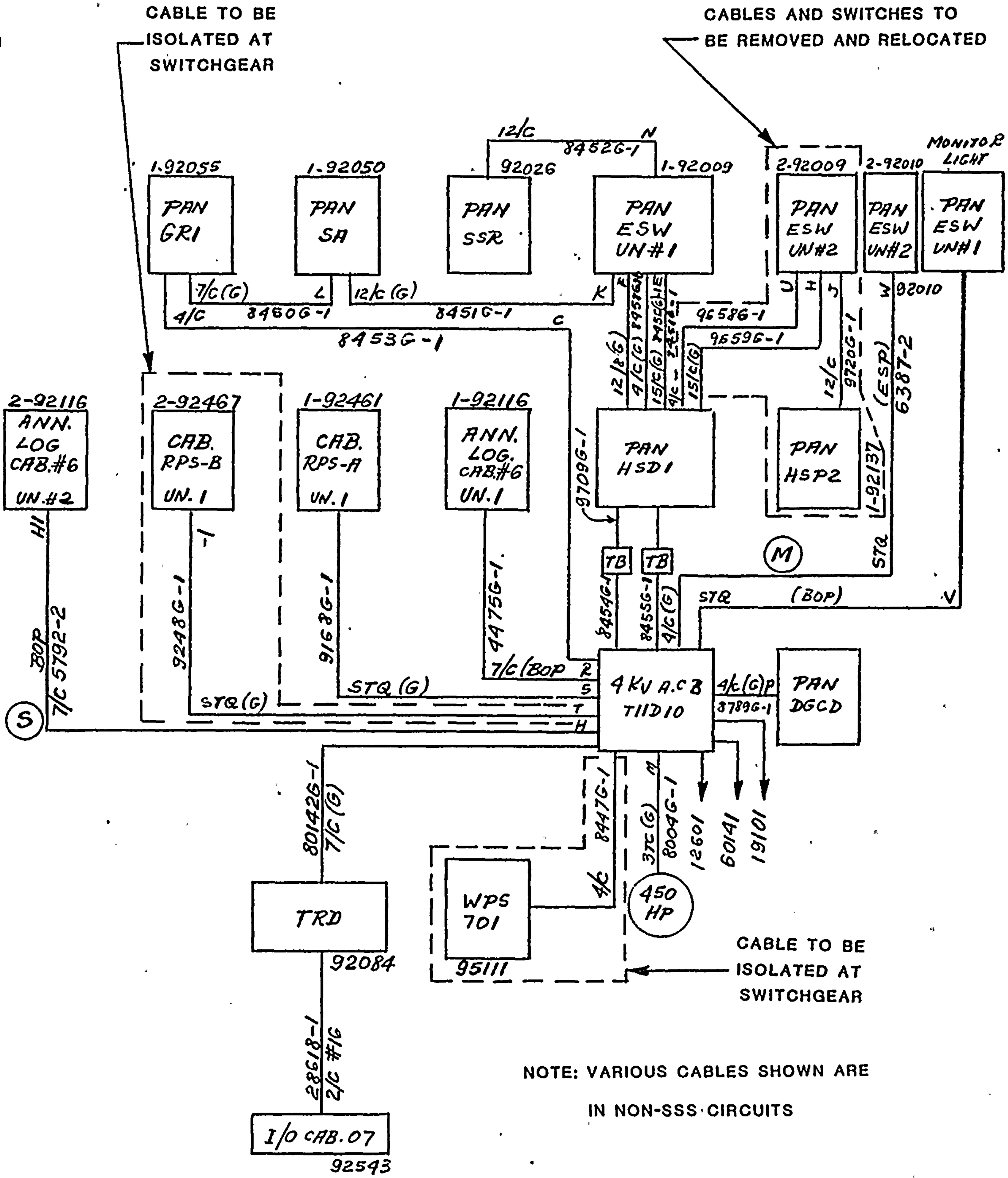
FIGURE 5.14.2



ESSENTIAL SERVICE WATER PUMP CKT. BREAKER TRIP CIRCUIT

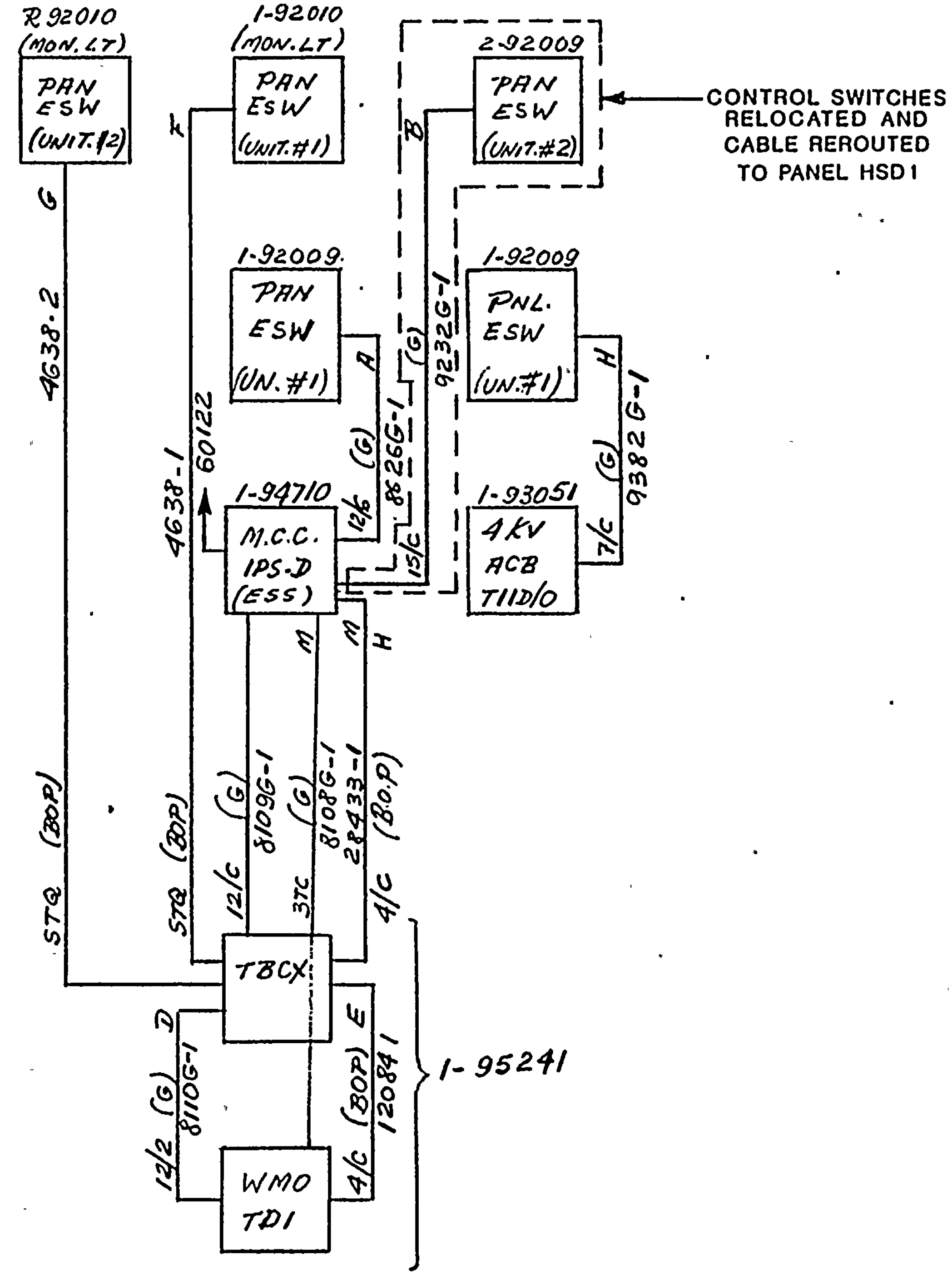
UNIT 1 ESW PUMP CIRCUIT SHOWN (TYPICAL FOR ALL ESW PUMPS)

FIGURE 5.14.3



ESW PUMP SCHEMATIC (TYPICAL)

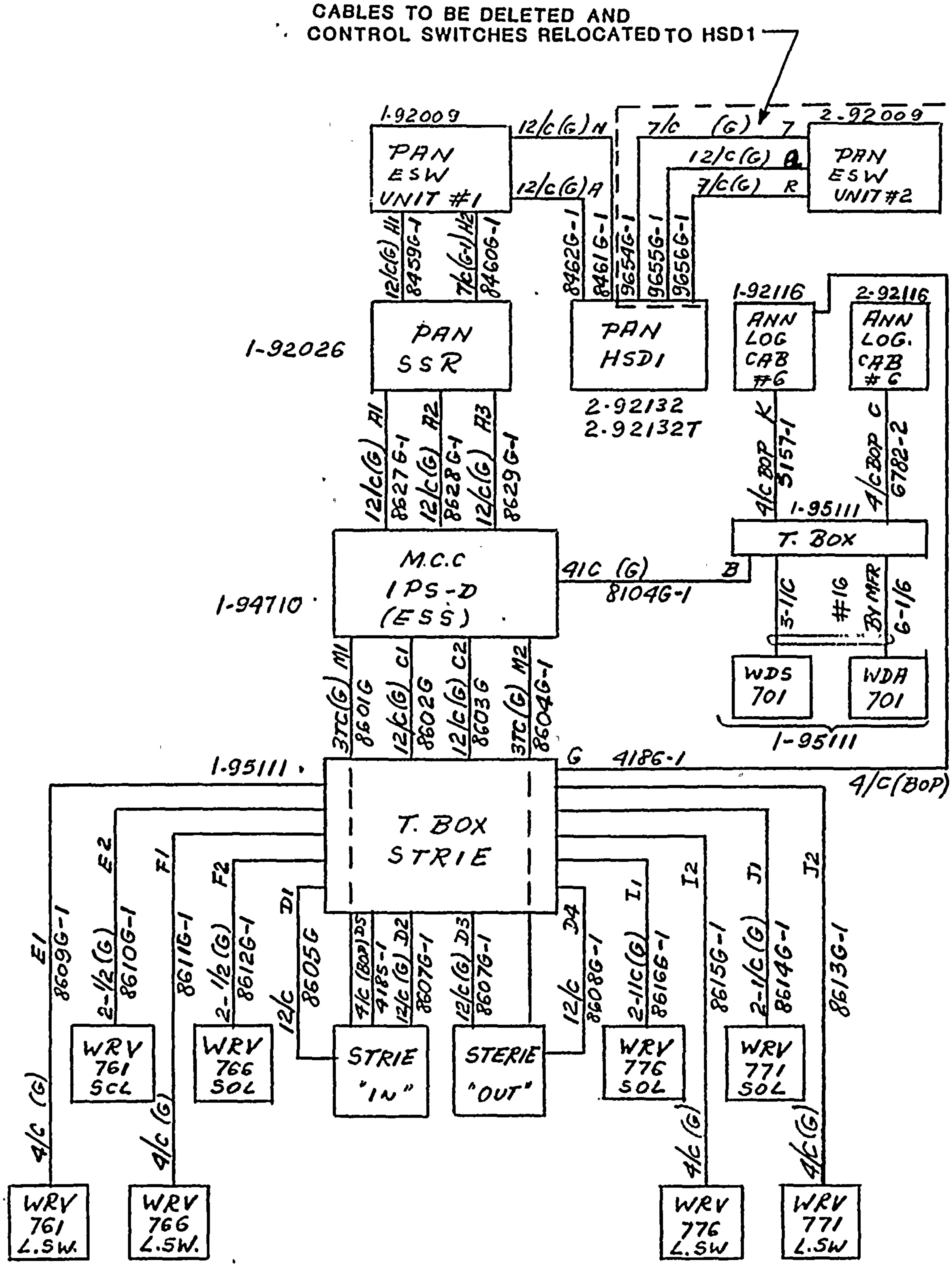
FIGURE 5.15



ESW PUMP DISCHARGE VALVE SCHEMATIC (TYPICAL)

FIGURE 5.16

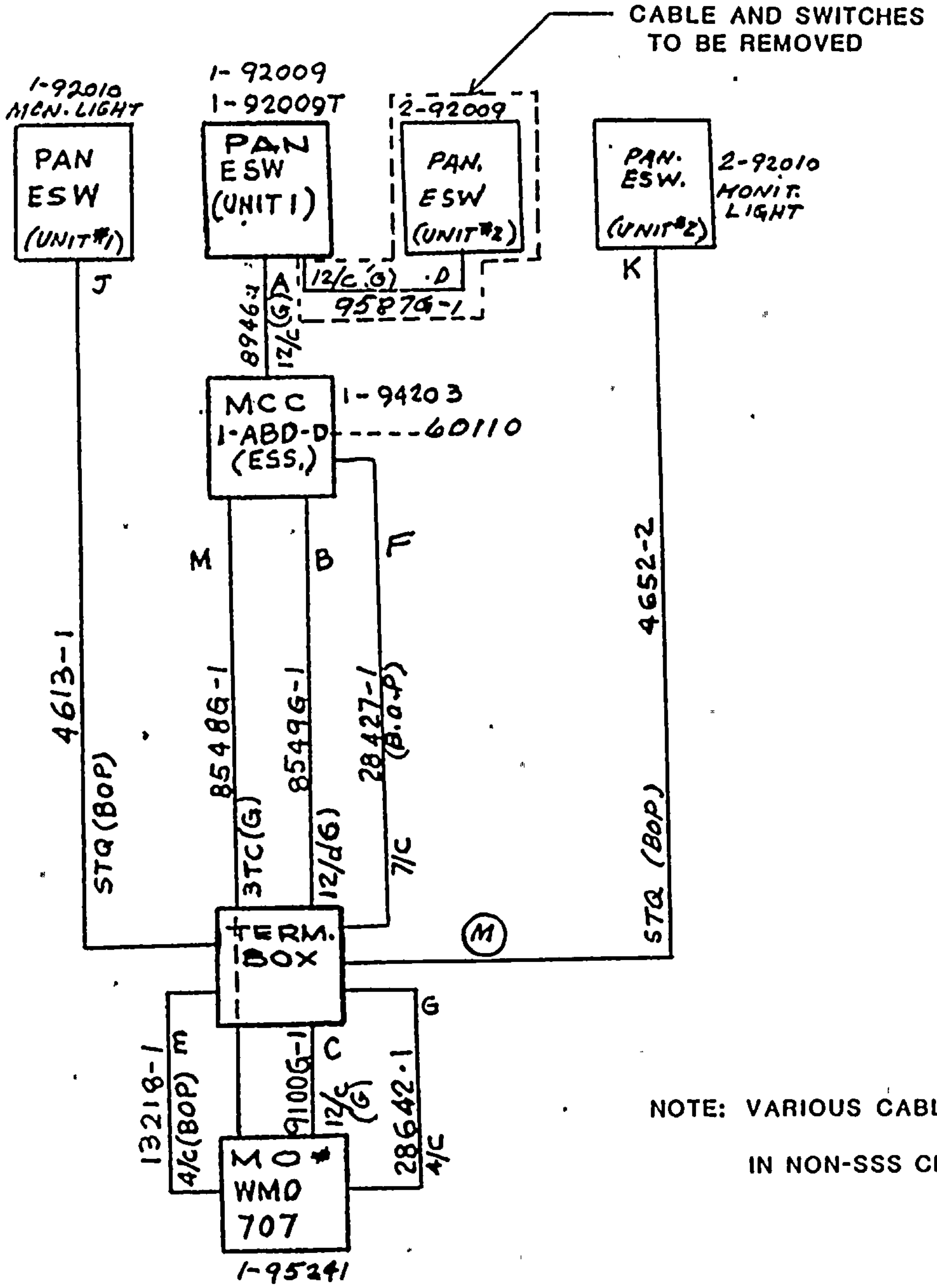
NOTE: VARIOUS CABLES SHOWN ARE IN NON-SSS CIRCUITS



ESW PUMP STRAINER SCHEMATIC (TYPICAL)

NOTE: VARIOUS CABLES SHOWN
ARE IN NON-SSS CIRCUITS

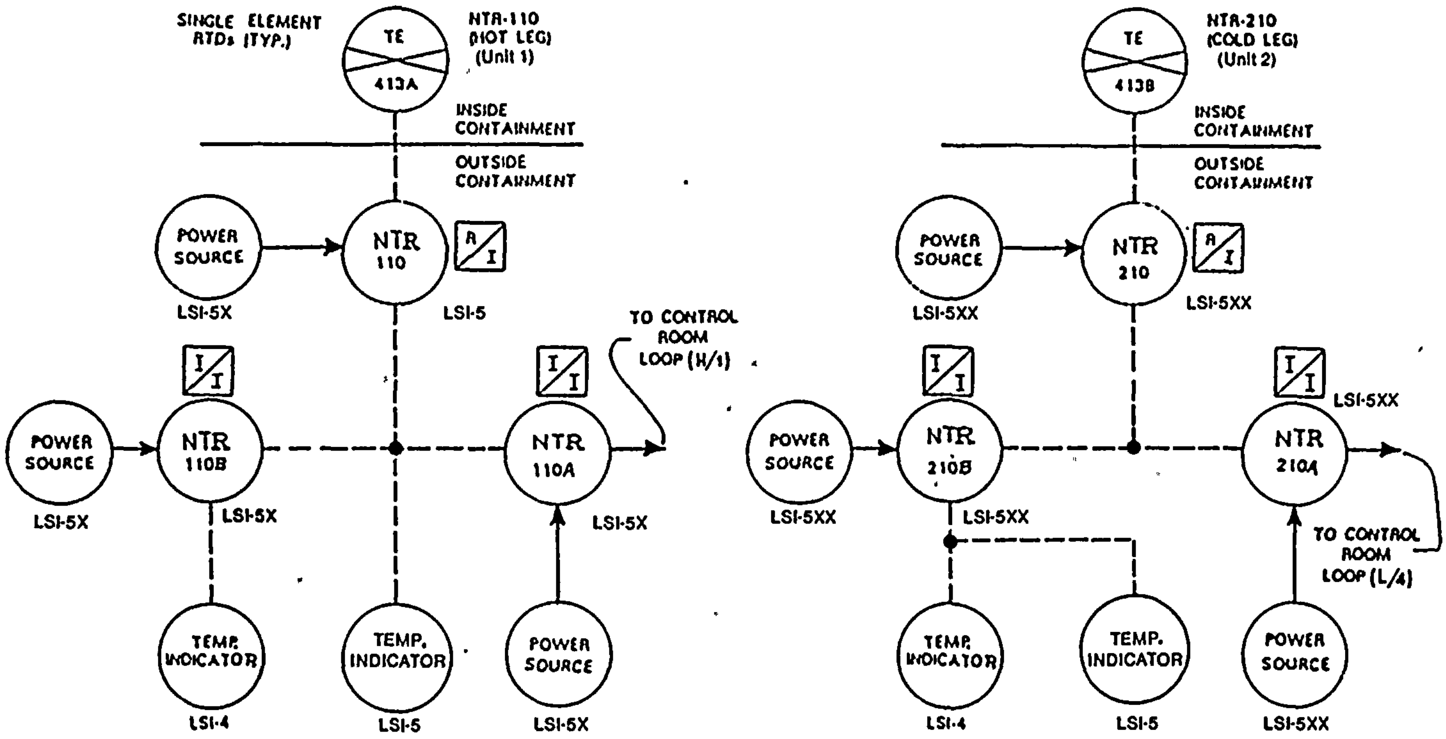
FIGURE 5.17



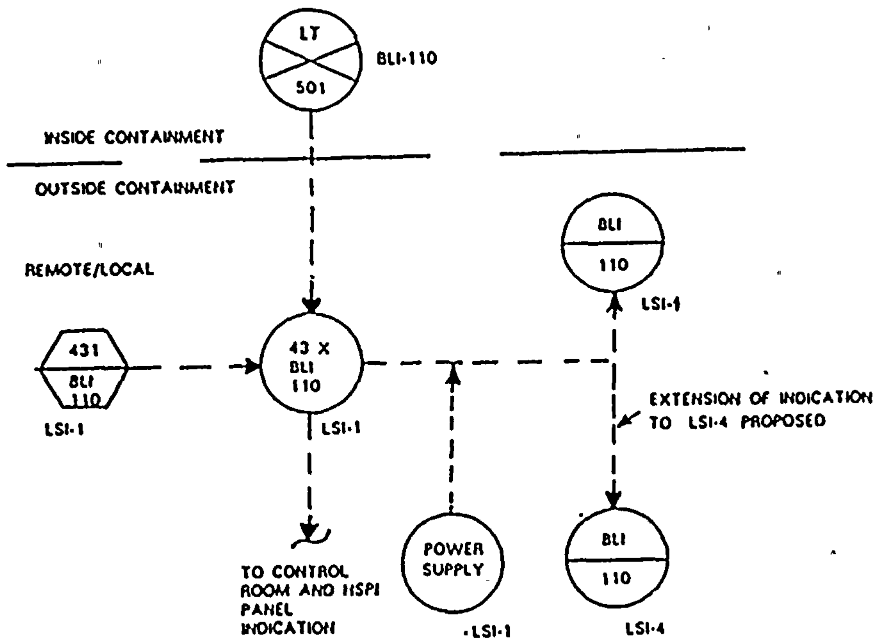
NOTE: VARIOUS CABLES SHOWN ARE IN NON-SSS CIRCUITS

ESW CROSS-TIE VALVE (TYPICAL)

FIGURE 5.18

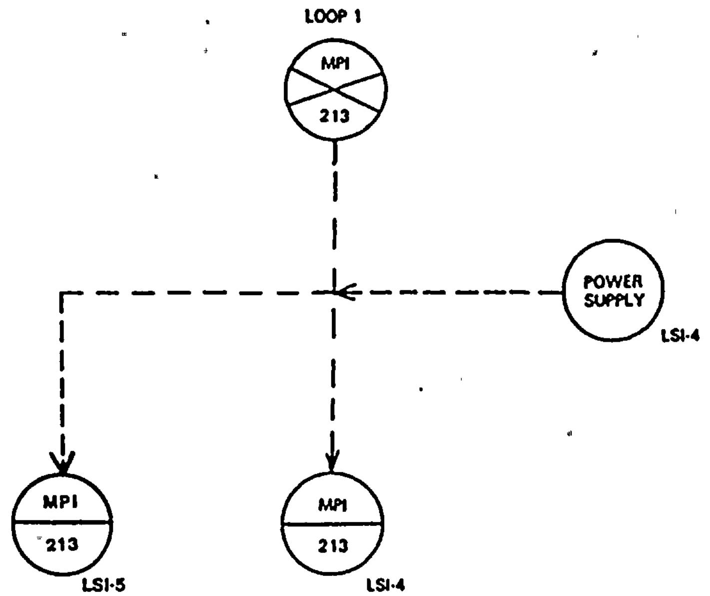


PROPOSED TH AND Tc LOCAL INSTRUMENTATION (LOOP 1 SHOWN —LOOPS 2,3 AND 4 SIMILAR)



EXISTING WIDE-RANGE STEAM GENERATOR LEVEL LOCAL INSTRUMENTATION (LOOP 1 SHOWN — LOOPS 2,3 AND 4 SIMILAR)

FIGURE 5.19.1 LSI INSTRUMENTATION



PROPOSED STEAM GENERATOR PRESSURE LOCAL INSTRUMENTATION.
(LOOP 1 SHOWN — LOOPS 2, 3, AND 4 SIMILAR)

EXISTING PRESSURIZER LEVEL
LOCAL INSTRUMENTATION

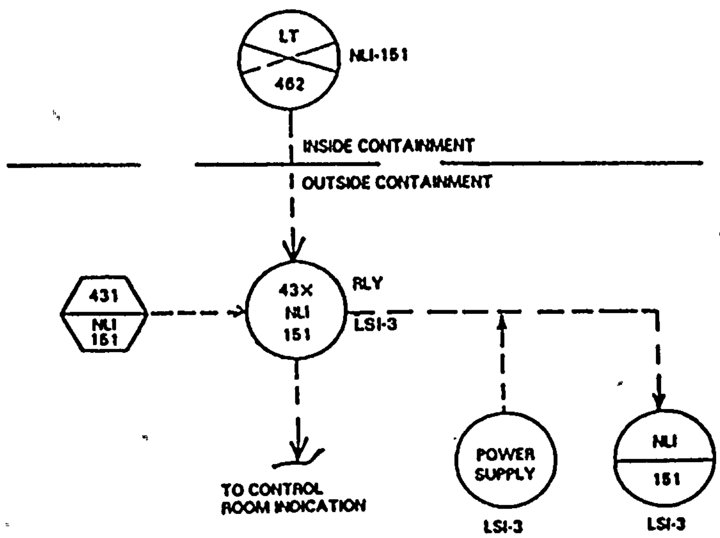
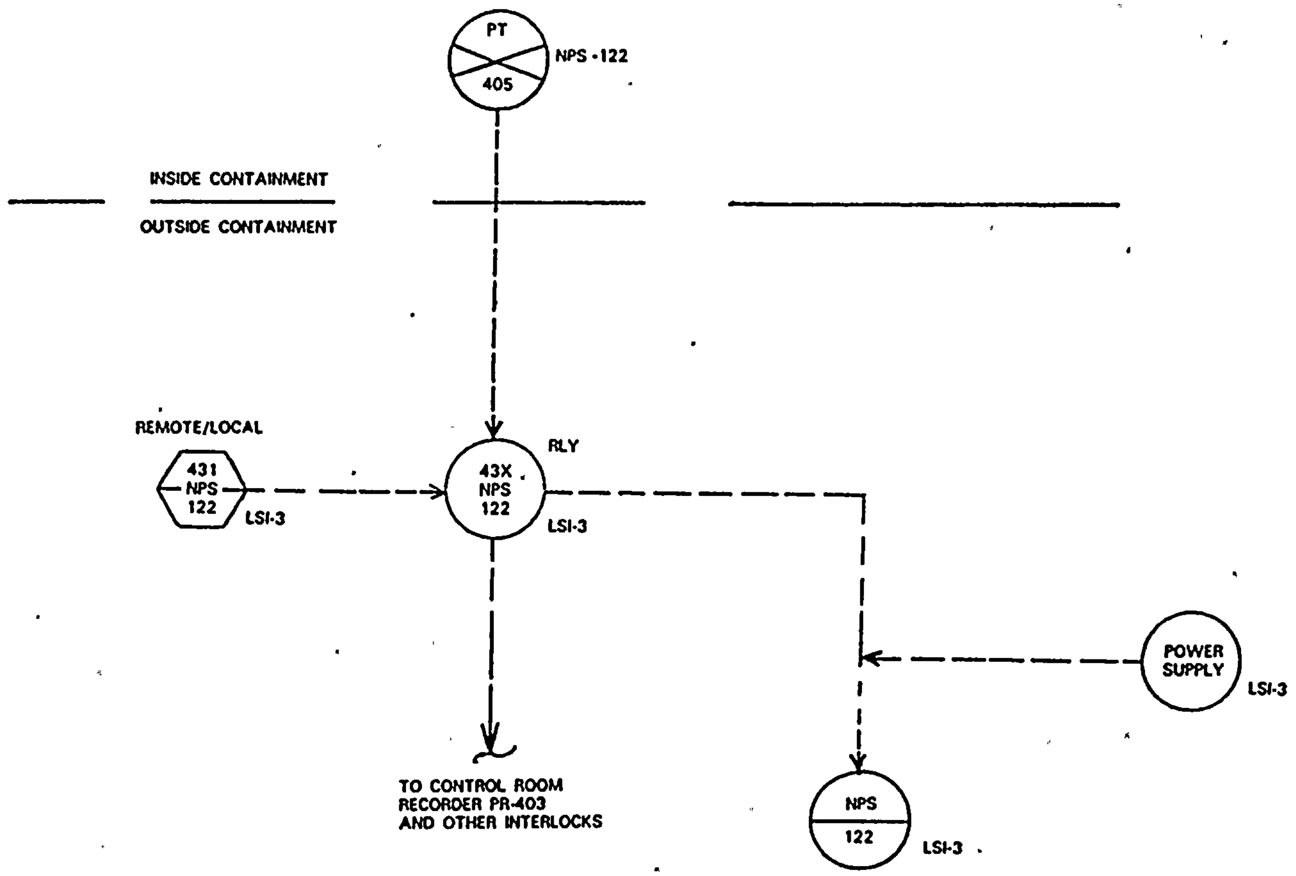
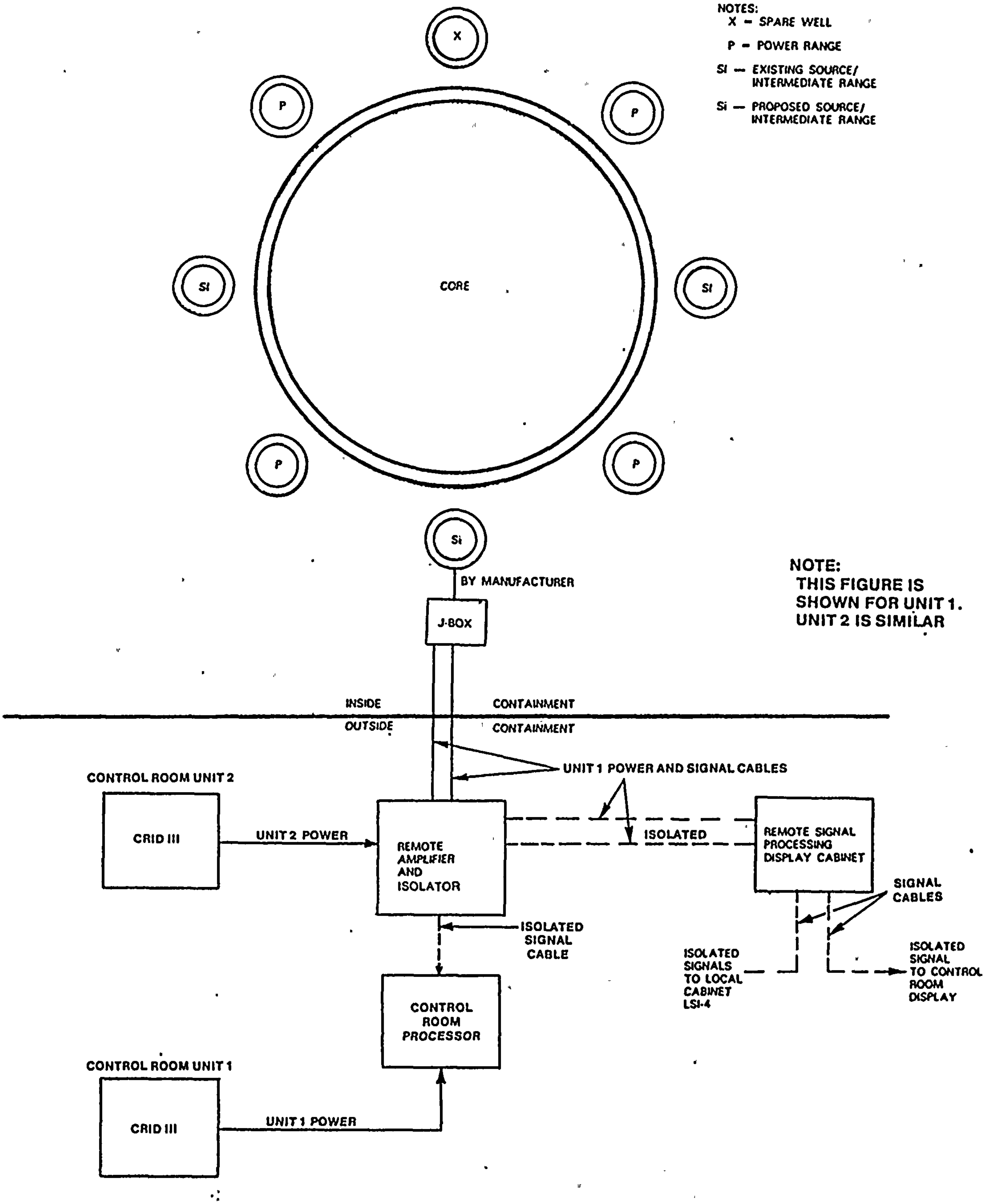


FIGURE 5.19.2 LSI INSTRUMENTATION



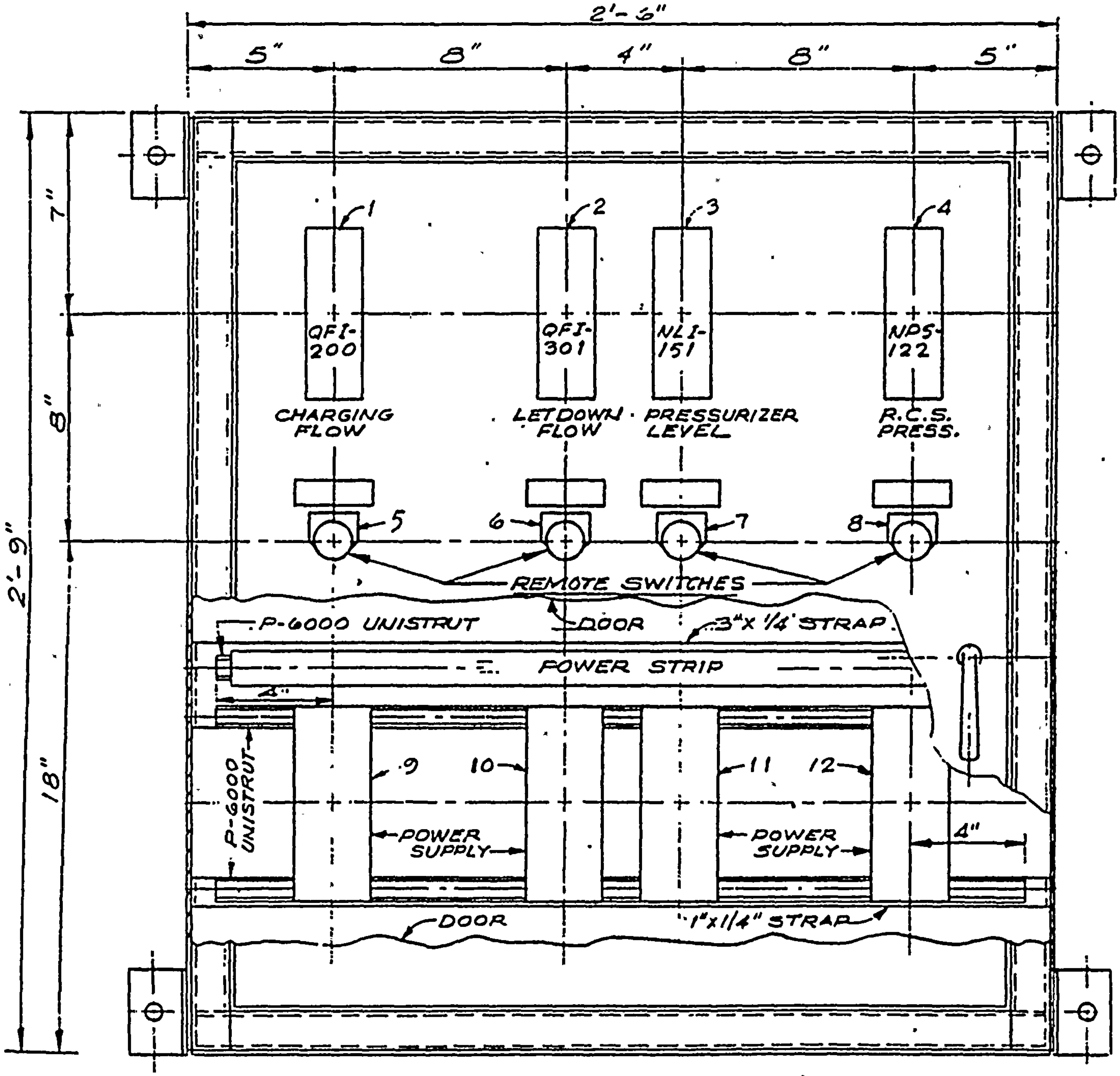
EXISTING REACTOR COOLANT
WIDE RANGE PRESSURE LOCAL
INSTRUMENTATION

FIGURE 5.19.3 LSI INSTRUMENTATION



PROPOSED UNIT 1 SRM INSTRUMENTATION

FIGURE 5.20

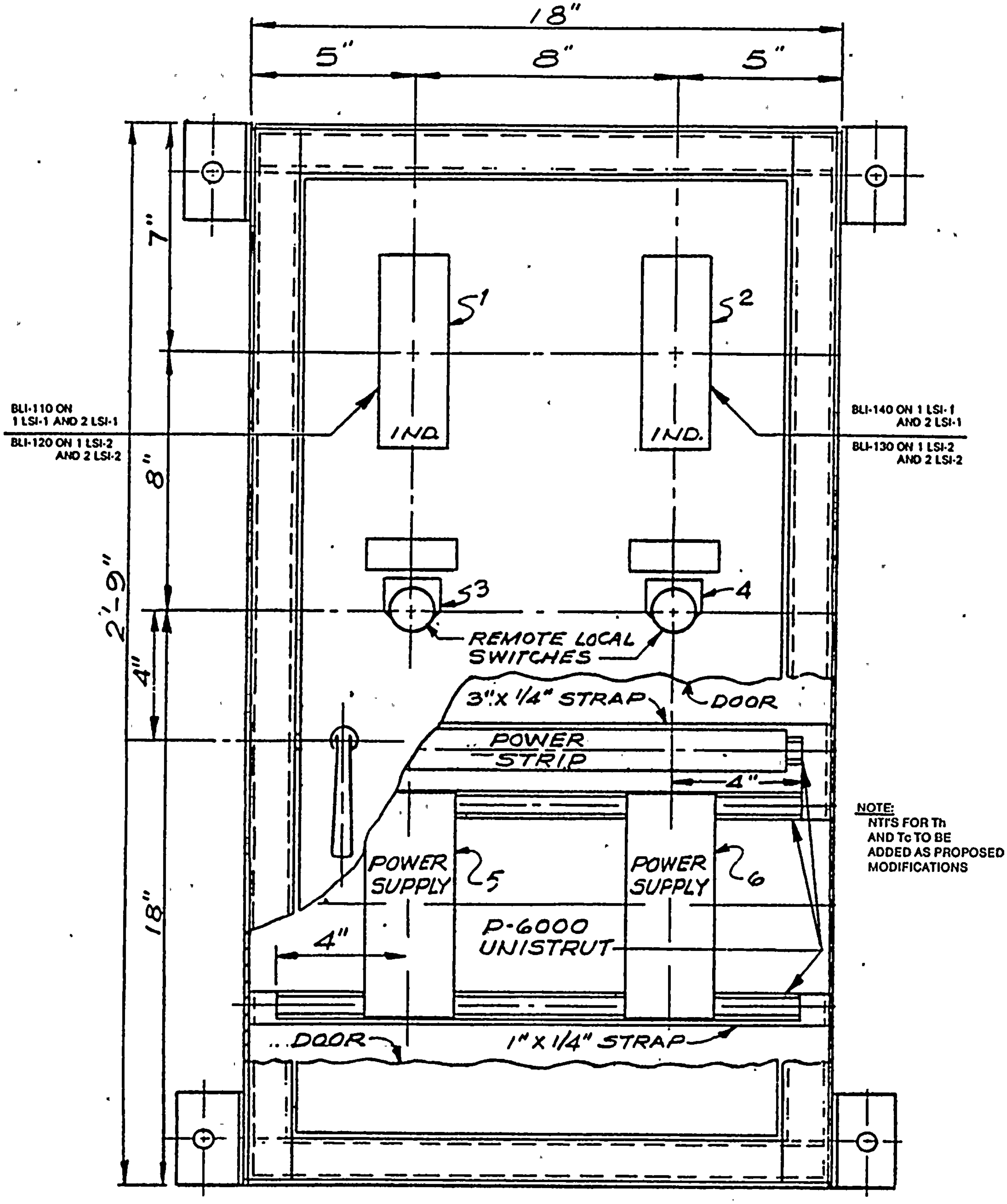


CABINET 1LSI-3 (UNIT # 1)
CABINET 2LSI-3 (UNIT # 2)

NOTE: CHARGING AND LETDOWN FLOW NOT REQUIRED SSS

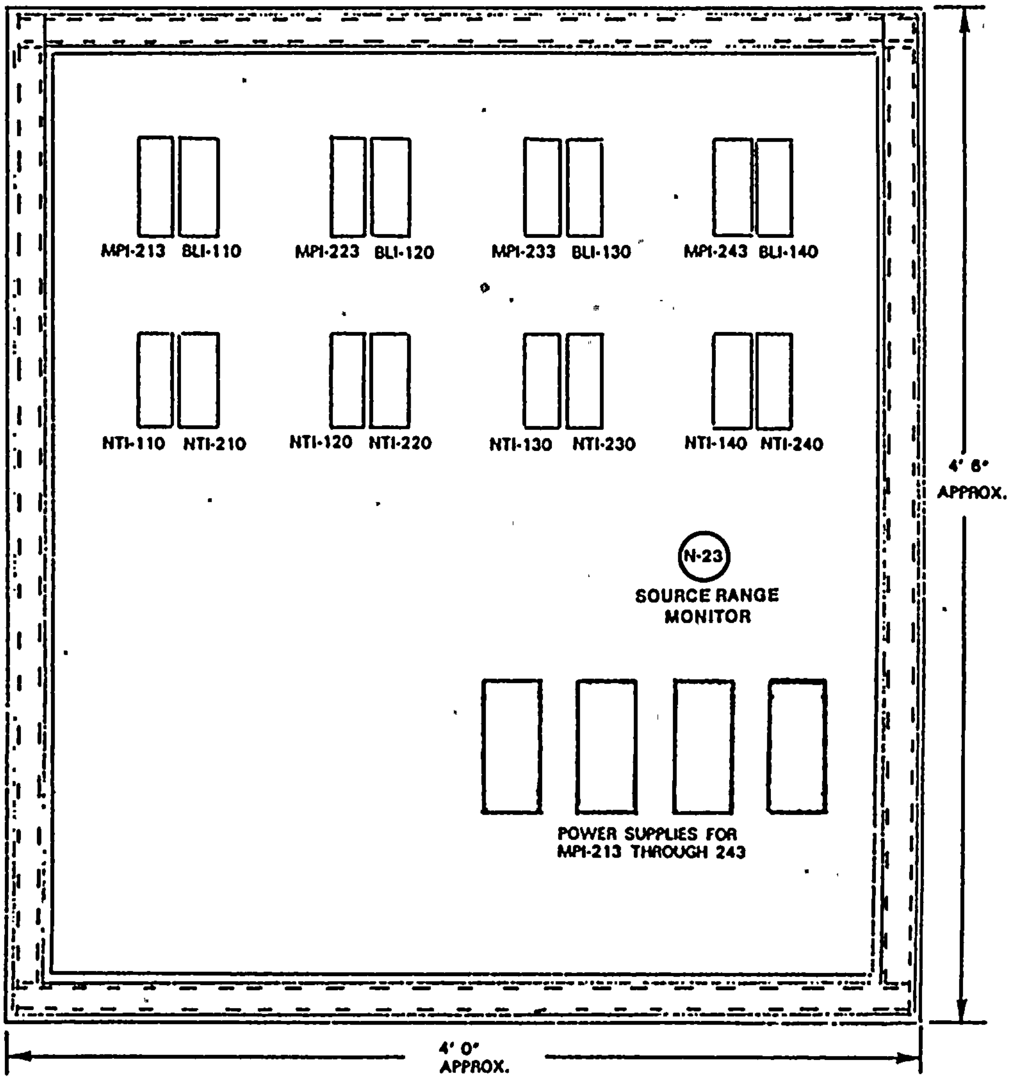
EXISTING LOCAL SHUTDOWN IND. CABINETS

FIGURE 5.21.1



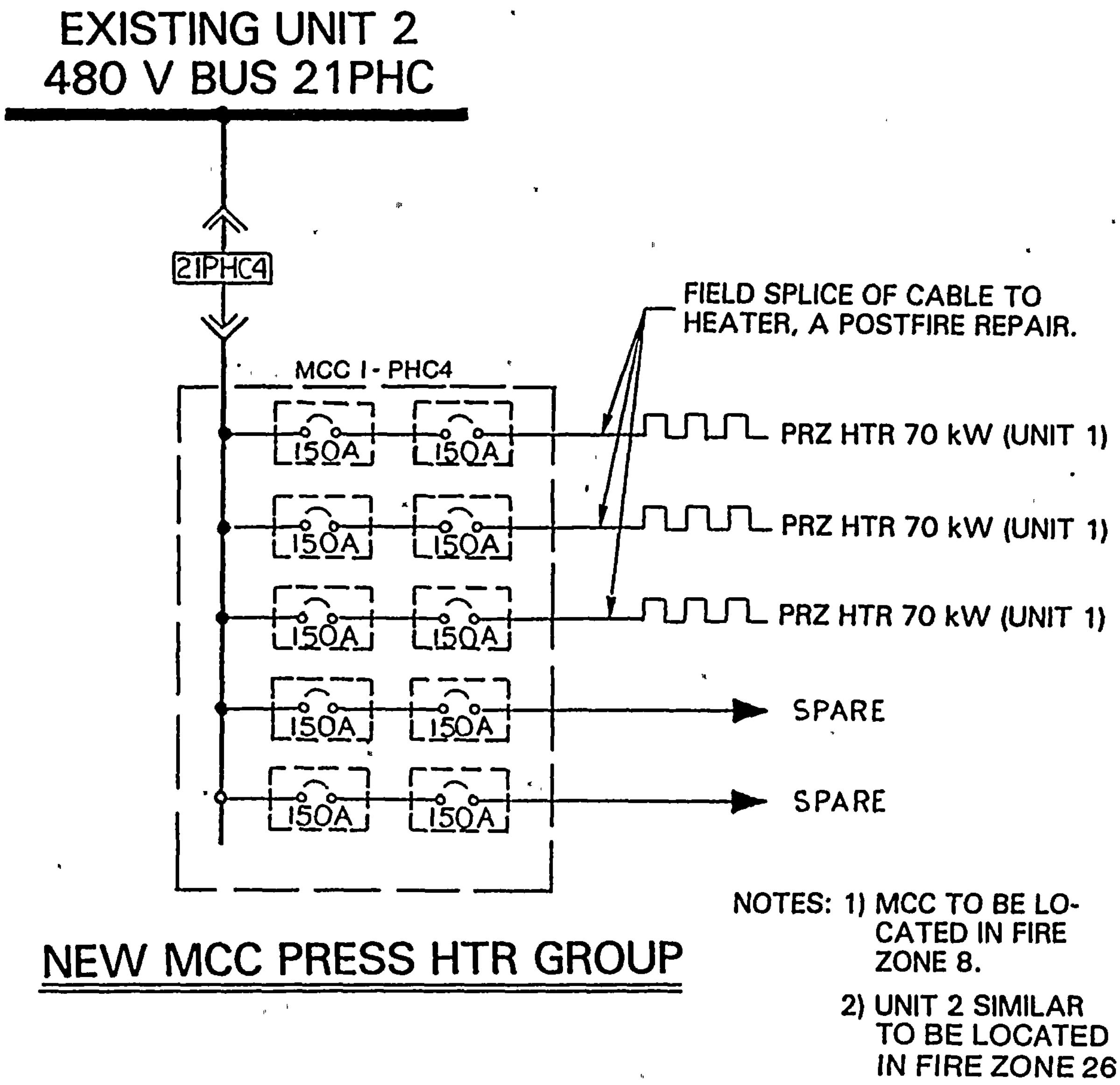
CABINETS 1LSI-1 & 1LSI-2 (UNIT#1)
CABINETS 2LSI-1 & 2LSI-2 (UNIT#2)

EXISTING LOCAL SHUTDOWN IND. CABINET FIGURE 5.21.2



GENERAL OUTLINE OF PROPOSED LOCAL SHUTDOWN IND. CABINET

1 LSI-4 (UNIT#1)
2 LSI-4 (UNIT#2)
FIGURE 5.21.3



ALTERNATE POWER SOURCE FOR UNIT 1

PRESSURIZER HEATERS

FIGURE 5.22

6. REPAIRS AND COLD SHUTDOWN OPERABILITY

6.1 Introduction

Appendix R Section III.G.1(a) states that:

> "one train of systems necessary to achieve and maintain hot shutdown conditions from either Control Room or emergency control station(s) is free of fire damage..."

Section III.G.1(b) states:

> "systems necessary to achieve and maintain cold shutdown from either the Control Room or emergency control station(s) can be repaired within 72 hours."

Section III.L.1 states that:

> "alternative or dedicated shutdown capability provided for a specific fire area shall be able to ... achieve and maintain hot standby conditions for a PWR and achieve cold shutdown conditions within 72 hours and maintain cold shutdown conditions thereafter."

Section III.L.5 states:

> "equipment and systems comprising the means to achieve and maintain cold shutdown conditions shall not be damaged by fire; or the fire damage to such equipment and systems shall be limited so that the systems can be made operable and cold shutdown achieved within 72 hours."

The D.C. Cook Technical Specifications define these applicable plant modes as follows:

Hot Standby (Mode 3) - The initial safe shutdown state with the reactor at zero power, k_{eff} less than 0.99 and RCS average temperature greater than or equal to 350°F.

Hot Shutdown (Mode 4) - Reactor at zero power, k_{eff} less than 0.99 and RCS temperature between 350°F and 200°F.

Cold Shutdown (Mode 5) - Reactor at zero power, k_{eff} less than 0.99 and RCS temperature at or below 200°F.

Based on these definitions, both hot and cold shutdown are RCS cooldown states that occur as a result of reactor heat removal via the RHR system. The systems required for initiation and maintenance of RCS heat removal are therefore identical for both the hot and cold shutdown regions. Repair of systems or equipment required to achieve cold shutdown must be accomplished prior to initiation of the RHR system and entry into hot shutdown conditions (as defined by the technical specifications).

For all fire zones at D.C. Cook, with the exception of those requiring complete alternative shutdown, cold shutdown conditions can be achieved within 72 hours of a fire without requiring any repair activities. For those zones requiring complete alternative shutdown, one repair activity (i.e., repowering of an RHR pump) is required and a second activity (i.e., repowering of pressurizer heaters) is proposed to provide operational flexibility. These are:

(1) Repowering of one RHR pump from the unaffected unit's EPS, and

(2) Repowering of three banks of pressurizer heaters from the unaffected unit's EPS. A bank of heaters consists of three heater elements connected in a delta configuration.

Neither repair is required to achieve initial hot standby conditions after a fire. It is Indiana and Michigan's interpretation of the provisions of Appendix R that repairs are not permitted to achieve initial hot standby conditions. Such repairs are permitted during cooldown in the hot standby mode to ultimately achieve cold shutdown conditions within the 72-hour time-frame permitted by Appendix R. Should Indiana and Michigan's interpretation of the repair provisions of Sections III.G.1(b), III.L.1 and III.L.5 be incorrect, then Indiana and Michigan formally requests an exemption from these provisions of Appendix R with respect to the two repair activities required to achieve RHR operation (hot and cold shutdown) for alternative shutdown method AS1.

Section 6.2 provides a description of the repair activities that will be performed and provides the basis for the above-stated exemption request, should it be required.

6.2 Pressurizer Heaters

6.2.1 Repowering of Pressurizer Heaters

Pressurizer heaters have been included as part of safe shutdown equipment, since they provide one method of maintaining sufficient reactor coolant system pressure. Adequate maintenance of RCS pressure ensures that the primary coolant is subcooled and core cooling via natural circulation is maintained.

In response to various TMI issues, a study was performed to determine the heater capacity required to maintain RCS pressure with an assumed loss of off-site power. After an initial heat loss from the pressurizer due to a decrease in pressurizer level, T_{sat} will decrease at approximately $7^{o}F$ per hour due to conservatively assumed ambient heat losses. With this assumed decrease in saturation temperature in the pressurizer, loss of adequate subcooling could occur five to six hours later. Heater input at any time prior to this period would more than offset the heat losses assumed and allow system pressure to be stabilized at any desired value. Since the study assumed that decay heat was removed by the steam generator safety valves, the highest reactor coolant system temperature and least margin to subcooling was assumed. Based on this and subsequent analysis, adequate subcooling margin can be maintained within the reactor coolant system with a margin of greater than four hours, assuming no cooldown (use of steam generator PORVs). Should cooldown of the Reactor Coolant System be initiated prior to this time, an adequate subcooling margin will be maintained without pressurizer heaters for a substantially longer time frame.

The safe shutdown systems available for all fire zones, including those requiring alternative shutdown, provide the capability to cool down the Reactor Coolant System during hot standby at a rate of $25^{o}F$ per hour. This cooldown is by natural circulation with a flow path achieved through the core and the individual loops. However, water in the upper area of the reactor vessel remains stagnate and hot. The cooldown of this area of the system is mostly by heat radiation and convection to the containment. While the circulating section of the system can be cooled much faster, the water in the vessel head, like that in the pressurizer, will be assumed to cool at the rate of 7°F per hour and system depressurization will be controlled to maintain a 50°F subcooling margin above this value. Should the heater be unavailable, cooldown of the loops will proceed at a rate equal to or in excess of 10°F per hour. With these cooldown rates, the pressurizer will cool down and depressurize from 2235 psig (@ 635°F) to 435 psig (@ 456°F) in a period of 32 hours, and the loops will be cooled to approximately 300°F, at which point the RHR system can be placed in service. Assuming cooldown was initiated at four hours post-fire, more than 36 hours are available to initiate other system realignments and repowering of one RHR pump to permit entry into RHR cooling mode. Hot shutdown RHR entry conditions could therefore be achieved without pressurizer heaters.

The conclusion can be drawn, based on the above discussion, that pressurizer heaters are not required for safe shutdown. Indiana and Michigan has not included the heaters in its safe shutdown equipment listing but has proposed to initiate modifications to provide for repowering of the heaters in order to provide operational flexibility to the D.C. Cook operating staff, should such postulated fires occur. In addition, these activities will provide the capability to maintain controlled hot standby conditions for extended periods of time, should the need arise.

6.2.2 Procedures and Material for Pressurizer Heater Repowering

As discussed in Section 5.5.10, a 480V MCC will be permanently installed in the fire-affected unit for this repair activity. This MCC will be powered from a 480V switchgear circuit breaker located in the unaffected unit. Since a minimum heater power of 150 KW is sufficient for cooldown activities, three sets of power cables with prefabricated terminations will be stored at the MCC. In the event of a fire, these power cables will be routed from the MCC to the electrical penetrations for repowering of three banks of pressurizer heaters (one bank of heaters consists of three heater elements connected in a delta configuration). Each of the three heater banks provides approximately 70 KW of heat. Thus, repowering of any three heater circuits (or banks) from any of the backup heater groups will satisfy the above 150 KW requirement.

In addition, the tools and procedures necessary to disconnect the existing cabling and complete the splice to the repair power cabling will be permanently located on site.

The general procedure for repowering the heaters will be as follows:

- Verify that the unit backup heater group's normal and alternate power sources are deenergized;
- Disconnect the heater group power cabling at the containment electrical penetration;

- o Route the new power cables from the alternate source motor control center (in the affected unit) to the electrical penetration area;
- o Terminate the repair power cable to the containment penetration in the fire-affected unit;
- o Verify appropriate terminations and notify operations that heaters are available for use; and
- o Energize the heaters as required.

6.3 Repowering of RHR Pumps

For those fire zones requiring the complete alternative shutdown method, repowering of one of the fire-affected unit's RHR pump from the unaffected unit is required. For these fire zones, loss of permanent power and/or control to the RHR pumps could occur due to loss of the pumps' 4kV breaker control circuits or loss of the supporting EPS power generation and distribution system cables or equipment. Rather than attempt the substantial repair activities associated with re-establishing power to one of the affected unit's RHR pumps, I&M has proposed to repower the pump using the existing distribution equipment and cabling which provides power to one of the unaffected unit's RHR or CTS pumps. Single failures or other plant transient conditions need not be assumed in meeting the requirements of Appendix R; therefore, both residual heat removal and containment spray trains and equipment in the unaffected unit can be assumed available. Thus, loss of power to one residual heat removal pump or containment spray pump in the unaffected unit will not impact the ability of that unit to maintain stable plant operating conditions.

As previously discussed, the safe shutdown system's cooldown capability provides a time frame of at least 32 hours post-fire within which the RHR pump repowering repairs may be accomplished. This time frame is well in excess of that necessary to ensure proper repair activities.

6.3.1 <u>Procedures and Materials for Repowering of RHR Pump</u>

Should repowering of one RHR pump from the unaffected unit's power sources be required, the temporary power may be obtained from one of the unaffected unit's RHR or CTS pumps, or from an unaffected unit 4.16kV breaker as appropriate. The IAG and corporate engineering support teams will be consulted for the selection of the alternative source. The power cables, materials, tools and procedures will be stored on-site. The general procedure for repowering one pump is as follows:

- o Verify that the applicable power sources are deenergized in both units;
- o Disconnect the power cabling at both sources;
- o Route the repair power cabling between the applicable pump and source locations;
- o Splice the repair power cable to the unaffected unit's power cable;
- o Megger and hi-pot test the repaired cable;
- o Terminate the repaired cable to the affected unit's RHR pump motor;
- o Verify proper terminations, check for proper motor rotation and notify operations;
- o Align the appropriate RHR system valves; and
- o Close the associated 4kV breaker from the Control Room of the unaffected unit.

6.4 Conclusions

In accordance with the provisions of Appendix R, Indiana and Michigan has demonstrated the ability of achieving cold shutdown conditions for all fires assumed at D.C. Cook within the 72-hour time-frame permitted by the rule. Indiana and Michigan recognizes that the provisions of Appendix R do not require plant operating personnel to attain cold shutdown conditions of the fire-affected unit within 72 hours should a fire occur at D.C. Cook. However, operating procedures, repair procedures and modifications will be provided that permit the capability of achieving cold shutdown within the time period. Procedures also will be structured to provide the operating staff with the necessary flexibility to determine the appropriate post-fire activities and plant conditions that will maintain D.C. Cook in the most stable safe shutdown state possible.

7. EXEMPTION REQUESTS AND ANALYSES

7.1 Introduction

A safe shutdown analysis has been completed for the D.C. Cook Nuclear Plant in the fire areas designated in Table 1-1 of this report. As a result of that analysis, 11 areas were identified in March 1983 that require exemptions from the specific requirements of Appendix R, Section III.G. Eight of the eleven exemptions are from Section III.G.3 and the remaining three are from Section III.G.2. Two additional technical exemptions were requested in June 1984. These exemption include (1) ventilation duct penetrations in the Auxiliary Building not supplied with fire dampers, and (2) seismic gaps between the Containment and Auxiliary Buildings. This section documents the safe shutdown systems and fire hazards analyses performed on these 13 areas and provides the bases by which the exemption requests are justified.

As a result of the proposed alternative shutdown capability, eight areas require exemptions from Section III.G.3, in that a fixed suppression system is not installed in the area. They are identified as follows:

(1) The Unit 1 and Unit 2 Transformer Rooms (Fire Zones 14 and 20) located in the Auxiliary Building

(2) The Unit 1 and Unit 2 ESW Pump Rooms (Fire Zones 29A, 29B, 29E and 29C, 29D, 29F) located in the Screenhouse

(3) The Unit 1 and Unit 2 main steam line and valve enclosures (Fire Zones 33, 33A, 33B, 105 and 34, 34A, 34B) located in the outside containment annulus area

(4) The Unit 1 and Unit 2 Main Control Rooms (Fire Zones 53 and 54) located in the Auxiliary Building.

The three exemptions requested from Section III.G.2 are for the RHR/CTS pump area (Fire Zones 1, 1A through 1H, 136, 137, 138A, 138B and 138C) the ESW pump basement (Fire Zone 29G), and the south end of elevation 609 ft of the Auxiliary Building (Fire Zone 44S).

Subsequent to the March 1983 submittal, the implementation of proposed modifications was commenced. During this period, various proposed fire protection modifications either could not be physically implemented or would not achieve the intended level of protection or conformance. Reviews of the fire area boundaries were performed and additional unprotected or unsealed openings, ducts or doors were identified. Engineering evaluations were performed to resolve the above mentioned issues and as such, additional modifications were proposed and/or justifications were provided for the unsealed or unprotected openings, ducts, doors or hatches.

The engineering evaluations that were performed to withdraw the proposed modifications mentioned in the exemption requests have analyzed the impact on redundant safe shutdown capability or the basis for the exemption request. During this period, two additional technical exemptions were also requested. These exemptions are presented in Subsections 7.13 and 7.14.

Eight exemption requests (Subsections 7.13 through 7.20), submitted in March 1983, were no longer required; as such, those exemption requests were withdrawn. Subsections 7.13 through 7.20 of the March 1983 submittal were requests for exemptions from the fixed suppression system requirements of Section III.G.3 for Fire Zones 66, 67, 74, 75, 120, 121, 122, and 123. Based on further discussion with the NRC Staff and their clarifications of the III.G.2 and III.G.3 provisions, Indiana and Michigan Electric Company has formally withdrawn the exemption requests for these fire zones. It is Indiana and Michigan Electric Company's present understanding that the fire hazards analysis previously conducted and modifications proposed (with the exception of the detection system) will achieve compliance with the fire protection provisions of Appendix R Section III.G.2(d), and (f) for these fire zones. The proposed modification to install automatic detection systems is therefore withdrawn since detection is not required to achieve adequate fire protection compliance with the provisions of Section III.G.2(d) or (f).

Section 9 of this report presents the engineering evaluations performed since March 1983. The exemption requests were reviewed for text changes that were required as a result of the evaluations. The evaluations demonstrate that there is no impact on either redundant safe shutdown capability or the bases and conclusions of the affected exemption. In addition, some editorial changes were also made to provide further clarification for the exemption request.

The exemptions requested in Subsections 7.2 through 7.12 are based on the conditions and configurations of D.C. Cook as of March 1983. The exemptions requested in Subsections 7.13 and 7.14 based on the conditions and configurations of D.C. Cook as of June 1984. In some instances, evaluations were performed to justify not implementing modifications. These evaluations are presented in Section 9 of this report and are based on the configuration of the D.C. Cook plant at the end of the 1986 Unit 2 refueling outage. In addition, due to ongoing efforts to comply with 10 CFR 50 Appendix R and subsequent generic NRC clarifications, various modifications in conjunction with the performance of engineering evaluations have resulted in revisions to various requested exemptions. These revisions are based on the existing configuration of the D.C. Cook plant at the end of the 1986 Unit 2 refueling outage.

The requested exemptions in Subsections 7.2 through 7.12 were submitted in 1983 and the requested exemptions in Subsections 7.13 and 7.14 were submitted in 1984. These exemptions have been reviewed by NRC Staff, and SERs were issued approving the configuration and separation of the safe shutdown systems in the fire zones of concern, as well as the adequacy of fire protection features.

Additional fire protection modifications are proposed to provide added assurance that at least one train of redundant safe shutdown equipment remains free of fire damage. In particular, extensive fire protection modifications are being proposed in the Control Rooms and in the area of the component cooling water pumps. The following sections provide the details of the safe shutdown systems and fire protection analyses performed; these sections also demonstrate that strict compliance with Section III.G of Appendix R would not enhance fire protection safety above that which is provided by the proposed commitments.

The following exemption requests are contained in this section:

7.2 RHR/CTS Pump Area, Auxiliary Building, Elevation 573 ft

EXEMPTION REQUEST

Per the provision of 10 CFR 50.48(c)(6) and 10 CFR 50.12, Indiana Michigan Electric Company requests exemption from the specific requirements of Appendix R Section III.G.2; i.e., an automatic fire suppression system shall be installed in the area.

7.2.1 Area Description

The RHR/CTS Pump Area, which contains Fire Zones 1, 1A through 1H, 136, 137, 138A, 138B and 138C, is located in the east central sub-basement floor of the Auxiliary Building at elevation 573 ft. The area contains a large area common to both units, eight individual cubicles containing residual heat removal pumps and containment spray pumps for both units, three individual cubicles containing CVCS hold-up tanks and two pipe tunnels that are located north and south of Fire Zone 1. These locations have low combustible loading, are behind locked access gates, are not normally accessible, and contain no safe shutdown equipment or cables. As such, they are not mentioned elsewhere in this exemption request.

Each of the eight pump cubicles has a controlled access screen mesh door that is located behind a missile shield wall. A section of the wall forming the entrance way is provided with a removable block section (4 ft x 5 ft) for pump maintenance. The blocks are reinforced with a number of perpendicular lengths of steel channel affixed to the permanent section of the wall.

The RHR pumps of each unit are separated from each other by three-hour constructed walls running north and south. The Unit 1 pumps are separated from the Unit 2 pumps by approximately 23 ft between the walls forming the entrance way.

The floor and ceiling barriers are also of three-hour construction. The access doors are screen mesh for ventilation purposes; however, the missile shield walls, approximately 14 ft in length forming a "T" at the entrance ways, extend beyond the width of the doorway.

The entranceways to the pump cubicles are provided with curbs 6 inches high. The suction valves for the pump in each cubicle are located behind part-height missile shield walls provided with an accessway and a 3 ft 6 in. high curb forming part of the missile shield.

The centerlines of the RHR pumps are located approximately 12 ft from the entrance ways of the cubicles and approximately 4 ft from the wall dividing the pumps for each unit. The individual pump cubicles are provided with floor drains.

Entry to the area is from elevation 587 ft via a stairway that is located in the common section between the Unit 1 and Unit 2 RHR pump cubicles. Two elevators also access the area one passenger and one freight. Pertinent room dimensional data is contained in Fire Area Summary Evaluation Table 7.2-1 and Figure 7.2.

7.2.2 Safe Shutdown Equipment

This fire area contains the Unit 1 residual heat removal pumps (PP-35E and PP-35W) located in the north cubicles and Unit 2 residual heat removal pumps (PP-35E and PP-35W) in the south cubicles. The suction valve for each pump is located in the respective cubicle behind missile shield walls (IMO-310 for PP-35E and IMO-320 for PP-35W). The containment spray pumps are located in individual cubicles also, but are not necessary for safe shutdown.

The power cable associated with the RHR pumps enters the fire area through concrete-embedded conduit and is routed into the individual pump cubicles. Cable for the RHR pump suction valves and the minimum flow valves is present in the common area between the Unit 1 and Unit 2 pump cubicles. Each pump cubicle contains only the components and cabling associated with that pump. A cable for the green train Unit 2 charging pump lube oil pump is also in the common zone; however, all other Unit 2 and Unit 1 CVCS safe shutdown cables are located outside of this fire area.

7.2.3 Fire Protection Systems

This fire area contains no automatic suppression systems. A manual 1-1/2-in. hose reel with adjustable angle spray nozzle is located in the common fire zone. Four 20 lb ABC dry chemical extinguishers, four 15 lb CO_2 extinguishers and a 1-inch CO_2 hose reel of 150 ft length are all located in the fire area.

This fire area is equipped with seven ionization smoke detectors that alarm in the Unit 1 Control Room on the Emergency Fire Panel. No detection exists in the individual pump rooms.

7.2.4 Fire Hazards Analysis

This fire area is constructed in such a way that each residual heat removal pump is separately located in an individual room isolated from its redundant division by a concrete wall. Each pump room has an access control gate that is accessible from the common area separating Unit 1 from Unit 2. The access gates for each room are located behind missile shield walls that form a "T" in front of the pump rooms of each unit. The shield wall functions as a radiant energy shield providing protection from fires outside the pump cubicles. Each pump room has floor drains and the pump rooms are curbed at the entrance doors.

An exhaust ventilation duct is provided for each RHR pump cubicle. These ducts are routed to a common vertical air shaft. A separate air shaft is provided for each unit to connect the Unit 1 East and West Pump Rooms and the Unit 2 East and West Pump Rooms, respectively. The fire area has a fixed combustible loading of under 20,000 Btu/ft^2 for an equivalent fire severity of under 15 minutes. (The actual combustible loading and equivalent fire severity existing at this time are 4079 Btu/ft^2 and 2.9 minutes, respectively.) No specific sections of the fire area that contain high densities of combustible materials exist.

Transient combustibles are not carried through this fire zone as the access is either via an elevator or a stairway.

The individual pump rooms are separated by 11 ft 4 in. centerline-to-centerline with a concrete wall midway between each room. The cubicles are constructed such that the distance from one pump to another, as measured by existing one cubicle and entering the other, is greater than 20 ft with no intervening combustibles. The proposed modifications will upgrade the walls separating the pumps to three-hour barriers. The existing ventilation ducts that could transmit hot combustion gases from one pump cubicle to its counterpart will be protected with fire-rated dampers. With these modifications, a fire in one cubicle must travel the circuitous path via the access gates located behind the missile shield enclosures from one cubicle to the other in order to affect both pumps of one unit. A fire in the common section between units would have to travel behind the missile shield wall (approximately 14 ft long) and enter both redundant pump cubicles. Thus constructed, no modifications to the access control gates, formed of screen mesh for ventilation purposes, are proposed.

The conduits for the power cables of the four RHR pumps are located in the common Unit 1 and 2 area. The red and green trains of each unit are separated by approximately 17 ft. The conduits for the red division pumps of both units (1PP-35W and 2PP-35W) will be provided with one-hour protection from an exposure fire. Due to the length of time before which the RHR system must be in operation, the suction valves will be manually operated at the appropriate time.

The ceilings in the pump cubicles have vertical pipe exiting through sleeves. The penetration will be provided with seals to prevent a fire in one of the cubicles from affecting any components in the elevation above.

Each pump contains two gallons of lubricating oil; however, absent any ignition source this small quantity of oil presents no threat to redundant safe shutdown equipment.

7.2.5 Proposed Modifications

The fire hazards analysis performed revealed that this fire area is not in compliance with Appendix R and, as a result, the fire area will be upgraded with fire protection modifications.

7.2.5.1 Ventilation Ducts

The ventilation ducts connecting each unit's east and west RHR pump rooms will be provided with three-hour-rated fire dampers. An engineering evaluation has been performed justifying the lack of fire-rated dampers in the exhaust ventilation ducts of the CTS pump cubicles. See Subsection 9.4 for this evaluation.

The exemption request in Subsection 7.13 provides justification for existence of undamped ventilation ducts penetrating through the ceiling of Fire Zone 1.

7.2.5.2 Penetrations

The penetrations in the wall separating the East and West Pump Rooms of each unit will be provided with three-hour-rated fire seals. The penetrations through the ceiling to the above elevation will be provided with at least one-hour-rated fire seals. Engineering evaluations have been performed justifying the existence of the unrated openings in the ceiling of Fire Zones 1A through 1H for leakage detection purposes. These leakage detection chases connect RHR and CTS pump rooms to their respective heat exchanger cubicles. The chases pass through the fire zones in which the charging pumps are located. These zones are located between the pump and heat exchanger cubicles, with steel plate covers providing access into the chases for leak detection purposes. See Subsections 9.31 and 9.32 for these evaluations.

7.2.5.3 Area Detection

Additional area detection will be provided to include the individual pump rooms for the eight pumps in the fire area.

7.2.5.4 RHR Pump Power Cables

The 4-inch conduits containing the cable for redundant divisions of each unit are present in the extreme northwest and southwest corners of the common area between units. The red division pump power conduits (8003R-1 and 8003R-2) will be provided with fire protection barriers equivalent to a one-hour rating, thus ensuring availability of one division per unit.

7.2.5.5 Stairway

Modifications will be made for stairway suppression in accordance with Subsection 8.2.2.

7.2.6 Conclusion

Based on the previous analysis, exemption is requested from an automatic suppression system in the areas as prescribed in Section III.G.2 of Appendix R. The bases that justify the exemption are summarized as follows:

(1) The walls separating RHR pumps will be upgraded to three-hour ratings and the ceiling penetrations are to be upgraded providing a one-hour fire rating.

(2) The conduits containing cables for the red division pump of each unit are to be provided with one-hour protection.

(3) The existing detection system is to be extended to include each of the eight individual pump rooms.

(4) The ventilation system connecting redundant RHR pump cubicles is to be provided with three-hour-rated fire dampers to provide separation of redundant divisions.

(5) The fixed combustible loading is under 20,000 Btu/ft^2 with no allowable storage of transient combustibles. The fire severity is less than 15 minutes, with an existing fire severity of approximately three minutes.

(6) The individual pump rooms are constructed to prevent fire from leaving one pump room and entering another or from entering two pump rooms from the common area.

(7) No intervening combustibles are present that present a hazard to the two redundant divisions or to each unit's red divisions.

(8) Modifications required to meet Section III.G.2 would not significantly enhance fire protection safety above that provided by present commitments.

(9) The RHR system is not required to operate for many hours after the fire, and valves at that time will be manually aligned to initiate Mode 4 operation.

(10) Repowering of RHR pumps for cold shutdown is available for any RHR pump with fire affected power cable (see Section 5).

(11) Subsections 7.13, 9.4, 9.31, 9.32 and 9.33 provide the fire hazards analyses and/or safe shutdown evaluations performed to justify the existence of unrated boundary components in this fire area.

SUMMARY EVALUATION TABLE 7.2-1

FIRE AREA: Fire Zone 1, 1A through 1H, 136, 137, 138A through 138C

DESCRIPTION: RHR/CTS Pump Area, Auxiliary Building, Elevation 573 ft

EVALUATION PARAMETERS SUMMARY

A. Area Description

1. Construction -

a. Walls -

North - reinforced concrete, in excess of three-hour rating

South - reinforced concrete, in excess of three-hour rating

East - reinforced concrete, in excess of three-hour rating

West - reinforced concrete, in excess of three-hour rating

b. Floor - reinforced concrete, in excess of three-hour rating; floor is curbed and has drains

c. Ceiling - reinforced concrete, in excess of three-hour rating

2. Ceiling height - 11 ft 3 in.

3. Area - 14,450 ft^2

4. Area volume - 229,926 ft^3

5. Ventilation - 36,000 cfm

6. Access in Zone - Unobstructed

B. Safe Shutdown Equipment

IMO-310 RHR Pump Suction (Units 1 & 2)
PP-35E RHR Pump East (Units 1 & 2)
IMO-320 RHR Pump Suction (Units 1 & 2)
PP-35W RHR Pump West (Units 1 & 2)

C. Fire Hazards

1. Type of combustibles in area -

   Cable insulation
   Lube oil
   Cellulosics
   Class B solvents
   Plastics
   Rubber

2. Total fixed combustible loading considered for the purpose of the analysis - 20,000 Btu/ft^2

3. Actual quantity of fixed combustibles -

   Cable - 17,448,738 Btu

   Lube oil - 16,607,100 Btu

   Cellulosics - 18,223,822 Btu

   Class B solvents - 3,102,000 Btu

   Plastics - 2,803,000 Btu

   Rubber - 15,800,975 Btu

   TOTAL - 4079 Btu/ft^2

D. Existing Fire Protection

1. Fire Detection Systems -

   Ionization with 7 detectors
   Alarm in Unit 1 Control Room on Emergency Fire Panel

2. Fire Extinguishing Systems - Manual

4 - 20 lb ABC dry chemical extinguishers
4 - 15 lb CO_2 extinguishers
1 - CO_2 hose reel with 150 ft 1 in. hose
1 - water hose reel with 75 ft 1-1/2 in. hose and adjustable angle spray nozzle

7.3 Fire Area 14 Transformer Room, Elevation 591 ft Unit 1

EXEMPTION REQUEST

Per the provisions of 10 CFR 50.48(c)(6) and 10 CFR 50.12 Indiana and Michigan Electric Company requests exemption from the specific requirements of Appendix R Section III.G.3; i.e., a fixed fire suppression system shall be installed in the fire area.

7.3.1 Area Description

Located immediately north of the Unit 1 "CD" Diesel Generator Room at elevation 591 ft, Fire Area 14 has three-hour-rated walls, floor and ceiling, except for two 1-1/2 hour dampers to the Turbine Building and an unrated field fabricated fusible link guillotine-type damper to the Unit 1 Diesel Oil Pump Room (Fire Area 13). Subsection 9.7 presents the engineering evaluation that was performed to justify this unrated damper. This fire area has the two Unit 1 pressurizer heater transformers located approximately 12 ft apart and the two Unit 1 emergency diesel test breakers. Access to the area is through an unlabeled door built to a three-hour rating approximately 12 ft wide that faces the Turbine Room. Pertinent room dimensional data is contained in Fire Area 14 Summary Evaluation Table 7.3-1 and Figure 7.3.

7.3.2 Safe Shutdown Equipment

Fire Area 14 contains the pressurizer heater transformers for Unit 1 (TR11PHA and TR11PHC), which are not required for safe shutdown but identified for operational flexibility, and the Unit 1 emergency diesel generator test breakers (DGTAD and DGTCD) with associated cables.

7.3.3 Fire Protection System

Fire Area 14 presently contains no automatic suppression or detection system. A manual 1-1/2 in. water hose reel (75 ft) with adjustable water spray nozzle is adjacent to the fire area. Two 20 lb Purple-K dry chemical and two 15 lb CO_2 extinguishers are located in the area.

7.3.4 Fire Hazards Analysis

Fire Area 14 is bounded by three-hour-rated barriers with the exception of (a) two dampers, each rated 1-1/2 hours, located in the west wall to Fire Zone 79, the Turbine Room of Unit 1, and (b) an unrated field fabricated fusible link guillotine-type damper to the Unit 1 Diesel Oil Pump Room (Fire Area 13). Subsection 9.7 presents the engineering evaluation that was performed to justify this unrated damper. In addition, the access door is an unlabeled roll-up door built to three-hour specifications.

The emergency diesel generator test breakers are located approximately 40 ft apart. The pressurizer heater transformers are noncombustible and approximately 12 ft apart.

The area has a fixed combustible loading of under 13,000 Btu/ft^2 for an equivalent fire severity of under 10 minutes. (The actual combustible loading and equivalent fire severity existing at this time are 1056 Btu/ft^2 and 0.8 minute, respectively.) There are no specific sections of the fire area that contain high densities of combustible materials.

A fire in this fire area could affect both emergency diesel generators and the pressurizer heaters for Unit 1 and consequently would affect the emergency power systems in Unit 1. All Unit 2 systems are unaffected by a fire in this area and, thus, alternate shutdown capability exists using Unit 2 systems.

7.3.5 <u>Proposed Modifications</u>

The Fire Area 14 will be equipped with automatic detection with alarming functions in the Unit 1 Control Room. As alternate shutdown capability exists using Unit 2 systems, no other modifications are proposed for this fire area 14.

7.3.6 <u>Conclusion</u>

Based on the previous analysis, an exemption is requested from the requirement that a fixed suppression system be installed in areas where alternate shutdown capability exists as prescribed in Section III.G.3 of Appendix R. The bases that justify the exemption are summarized as follows:

(1) Alternate shutdown capability exists using Unit 2 systems.

(2) The modifications proposed include the installation of an automatic detection system in the fire area.

(3) The fire area has a minimum rating of one hour.

(4) The combustible loading of the fire area is under 13,000 Btu/ft^2 and fire severity is calculated to be less than 10 minutes.

(5) Modifications required to meet Section III.G.3 would not significantly enhance fire protection safety above that are provided by present commitments.

(6) Subsection 9.7 provides the fire hazards analysis performed to justify the unrated damper to Fire Area 13.

SUMMARY EVALUATION TABLE 7.3-1

FIRE AREA: 14

DESCRIPTION: Transformer Room, Elevation 591 ft, Unit 1

EVALUATION PARAMETERS SUMMARY

A. Area Description

1. Construction -

a. Walls -

North	- reinforced concrete, in excess of three-hour rating
South	- reinforced concrete, in excess of three-hour rating
East	- reinforced concrete, in excess of three-hour rating
West	- reinforced concrete, in excess of three-hour rating

b. Floor - reinforced concrete, in excess of three-hour rating

c. Ceiling - reinforced concrete, in excess of three-hour rating

2. Ceiling height - 12 ft 7 in.

3. Area - 2072 ft^2

4. Room volume - 25,900 ft^3

5. Ventilation - 18,000 cfm

6. Access in Zone - Unobstructed

B. Safe Shutdown Equipment

TR11PHA - 4kV/480V Transformer 11PHA
TR11PHC - 4kV/480V Transformer 11PHC

C. Fire Hazards

1. Type of combustibles in area -

   Cable insulation
   Plastics
   Rubber

2. Total fixed combustible loading considered for the purpose of the analysis - 13,000 Btu/ft^2

3. Actual quantity of fixed combustibles -

   Cable - 1,322,400 Btu

   Plastics - 767,025 Btu

   Rubber - 100,800 Btu

   TOTAL - 1056 Btu/ft^2

D. Existing Fire Protection

1. Fire Detection Systems -

   None

2. Fire Extinguishing Systems -

   2 - 20 lb Purple-K dry chemical extinguishers
   2 - 15 lb CO_2 extinguishers
   1 - water hose reel with 75 ft 1-1/2 in. hose and adjustable water spray nozzle

7.4 Fire Area 20 Transformer Room, Elevation 591 ft Unit 2

EXEMPTION REQUEST

Per the provisions of 10 CFR 50.48(c)(6) and 10 CFR 50.12 Indiana and Michigan Electric Company requests exemption from the specific requirements of Appendix R Section III.G.3; i.e., a fixed fire suppression system shall be installed in the fire area.

7.4.1 Area Description

Located immediately south of the Unit 2 "AB" Diesel Generator Room at elevation 591 ft, Fire Area 20 has three-hour-rated walls, floor and ceiling, except for two 1-1/2 hour dampers to the Turbine Building and an unrated field fabricated fusible link guillotine-type damper to the Unit 2 Diesel Oil Pump Room (Fire Area 21). Subsection 9.8 presents the engineering evaluation that was performed to justify this unrated damper. This fire area has the two Unit 2 pressurizer heater transformers located approximately 12 ft apart and the two Unit 2 emergency diesel test breakers. Access to the area is through an unlabeled door built to three-hour specification approximately 12 ft wide that faces the Turbine Room for Unit 2 in the west wall. Pertinent room dimensional data is contained in Fire Area 20 Summary Evaluation Table 7.4-1 and Figure 7.4.

7.4.2 Safe Shutdown Equipment

Fire Area 20 contains the pressurizer heater transformers for Unit 2 (TR21PHA and TR21PHC), which are not required for safe shutdown but identified for operational flexibility, and the Unit 2 emergency diesel generator test breakers (DGTAB and DGTCD) with associated cables.

7.4.3 Fire Protection System

Fire Area 20 presently contains no automatic suppression or detection systems. A manual 1-1/2 in. water hose reel (75 ft) with adjustable water spray nozzle is adjacent to the fire area. Two 20 lb Purple-K dry chemical and two 15 lb CO_2 extinguishers are located in the area.

7.4.4 Fire Hazards Analysis

Fire Area 20 is bounded by three-hour-rated barriers with the exception of (a) two dampers, each rated at 1-1/2 hours, located in the west wall to Fire Zone 85, the Turbine Room of Unit 2, and (b) an unrated field fabricated fusible link guillotine-type damper to the Unit 2 Diesel Oil Pump Room (Fire Area 21). Subsection 9.8 presents the engineering evaluation that was performed to justify this unrated damper. In addition, the access door is an unlabeled roll-up door built to three-hour specifications.

The emergency diesel generator test breakers are located approximately 35 ft apart. The pressurizer heater transformers are noncombustible and approximately 12 ft apart.

The area has a fixed combustible loading of under 20,000 Btu/ft^2 for an equivalent fire severity of under 15 minutes. (The actual combustible loading and equivalent fire severity existing at this time are 1503 Btu/ft^2 and 1 minute, respectively.)

A fire in this area could affect both emergency diesel generators and the pressurizer heaters for Unit 2 and consequently would affect the emergency power systems in Unit 2. All Unit 1 systems are unaffected by a fire in this area and thus alternate shutdown capability exists using Unit 1 systems.

7.4.5 Proposed Modifications

Fire Area 20 will be equipped with automatic detection with alarming functions in the Unit 2 Control Room. As alternate shutdown capability exists using Unit 1 systems, no other modifications are proposed for this fire area.

7.4.6 Conclusion

Based on the previous analysis, exemption is requested from the requirement that a fixed suppression system be installed in areas where alternate shutdown capability exists as prescribed in Section III.G.3 of Appendix R. The bases that justify the exemption are summarized as follows:

(1) Alternate shutdown capability exists using Unit 1 systems.

(2) The modifications proposed include the installation of an automatic detection system in the fire area.

(3) The fire area has a minimum rating of one hour.

(4) The combustible loading of the fire area is under 20,000 Btu/ft^2 and fire severity is calculated to be less than 15 minutes.

(5) Modifications required to meet Section III.G.3 would not significantly enhance fire protection safety above that provided by present commitments.

(6) Subsection 9.8 provides the fire hazards analysis performed to justify the unrated damper to Fire Area 21.

SUMMARY EVALUATION TABLE 7.4-1

FIRE AREA: 20

DESCRIPTION: Transformer Room, Elevation 591 ft, Unit 2

EVALUATION PARAMETERS SUMMARY

A. Area Description

1. Construction -

a. Walls -

North - reinforced concrete, in excess of three-hour rating

South - reinforced concrete, in excess of three-hour rating

East - reinforced concrete, in excess of three-hour rating

West - reinforced concrete, in excess of three-hour rating

b. Floor - reinforced concrete, in excess of three-hour rating

c. Ceiling - reinforced concrete, in excess of three-hour rating

2. Ceiling height - 12 ft 7 in.

3. Area - 2072 ft^2

4. Room volume - 25,900 ft^3

5. Ventilation - 18,000 cfm

6. Access in Zone - Unobstructed

B. Safe Shutdown Equipment

TR21PHA - 4kV/480V Transformer 21PHA
TR21PHC - 4kV/480V Transformer 21PHC

C. Fire Hazards

1. Type of combustibles in area -

   Cable insulation
   Plastics
   Rubber

2. Total fixed combustible loading considered for the purpose of the analysis - 20,000 Btu/ft^2

3. Actual quantity of fixed combustibles -

   Cable - 1,558,619 Btu

   Plastics - 1,457,250 Btu

   Rubber - 100,800 Btu

   TOTAL - 1503 Btu/ft^2

D. Existing Fire Protection

1. Fire Detection Systems -

   None

2. Fire Extinguishing Systems - Manual

   2 - 20 lb Purple-K dry chemical extinguishers
   2 - 15 lb CO_2 extinguishers
   1 - water hose reel with 75 ft 1-1/2 in. hose and adjustable water spray nozzle

7.5 Fire Zone 29 (A,B,E) Unit 1 Essential Service Water Pumps and Motor Control Centers

EXEMPTION REQUEST

> Per the provisions of 10 CFR 50(c)(6) and 10 CFR 50.12 Indiana and Michigan Electric Company requests exemption from the specific requirements of Appendix R, Section III.G.3; i.e., a fixed fire suppression system shall be installed in the area.

7.5.1 Area Description

Fire Zone 29 (A, B, E) is located on the east central side of the screenhouse, that is adjacent to the Turbine Building elevation 591 ft. The fire zone is comprised of the two pump cubicles for Unit 1 ESW pumps (PP-1E and PP-1W) each located in missile-barriered enclosures and a separate cubicle for the motor control centers (1PS-A and 1PS-D). Fire Zone 29 (A, B, E) is the counterpart of Unit 2 Fire Zone 29 (C, D, F).

Access to the pumps is gained through the north side access control gate from the screenhouse area. The access gate is constructed of screen mesh for ventilation purposes. Additional ventilation is provided through undampered duct openings in the ceiling of 29A and 29B to provide cooling to the ESW pumps. Subsection 9.25 presents the engineering evaluation that was performed to justify these undampered ventilation duct openings. The pump cubicles share a common corridor with a wall separating the pumps and a missile shield perpendicular to the wall partially enclosing the pumps. The pumps are installed on pedestals approximately four feet off the ground. The east/west wall separating this Unit 1 zone from the Unit 2 zone is three-hour-rated.

A stairway is present in the northwest corner of the west pump room Fire Zone 29B that accesses Fire Zone 29G, the level immediately below the Unit 1 and Unit 2 ESW pump areas.

The motor control centers are located adjacent to each other in a common enclosure with a screen mesh access control gate protected by a missile shield wall. Pertinent room dimensional data is contained in Fire Zone 29 (A, B, E) Summary Evaluation Table 7.5-1 and Figures 7.5.1 through 7.5.3.

7.5.2 Safe Shutdown Systems

Fire Zone 29 (A, B, E) contains both ESW pumps for Unit 1 (PP-1E and PP-1W), the strainers for both pumps (ESWSE and ESWSW), the discharge valves for both pumps (WMO-701 and WMO-702), and both motor control centers (1PS-A and 1PS-D) that serve the strainers and valves. No Unit 2 and no other Unit 1 safe shutdown cable or equipment is located in the fire zone.

7.5.3 Fire Protection Systems

Fire Zone 29 (A, B, E) presently has no fixed suppression or automatic detection and contains only cables and components for the Unit 1 Essential Service Water System. The zone contains a 1-1/2 in. water hose reel (75 ft) outside the zone at the access gate to pump enclosure. Outside the zone in the screenhouse are three 20 lb Purple-K dry chemical and three 15 lb CO_2 fire extinguishers.

7.5.4 Fire Hazards Analysis

The Unit 1 pump enclosure may sustain a fire that could be assumed to render both Unit 1 ESW pumps inoperable. Similarly, a fire in the motor control center cubicle would render the associated Unit 1 strainers and valves inoperable. The walls, floors, and ceilings of Fire Zone 29 (A, B, E) are three-hour-rated except for (a) the stairway to Fire Zone 29G that is a common Unit 1/Unit 2 zone below the pump cubicles, (b) the screen mesh access gates that provide entrance to these zones from Fire Zone 142, and (c) undampered ceiling ventilation duct openings. Subsection 9.25 presents the engineering evaluation that was performed to justify these undampered ventilation duct openings. (Fire Zone 29G is discussed in Subsection 7.7.)

The motor control centers for Unit 1 are separated from Unit 2 by 48 ft, and each is in a separate cubicle. The cables exiting the MCCs are embedded in concrete and are routed directly to the respective unit's pump cubicles. The power cable for the ESW pumps is routed from below the pumps in Fire Zone 29G up through the floor.

Each pump contains five gallons of lubricating oil; however, absent any ignition source, the oil presents no threat to the ESW pumps in both units. Because of its location, Fire Zone 29(A,B,E) is not in a path normally traversed with transient combustibles.

No transient combustibles are allowed to be stored in Fire Zones 29A, 29B or 29E, and fixed combustibles amount to the small quantity of lube oil for each pump, a small amount of plastics, and cable insulation. The total fixed combustible loading of Fire Zones 29A, 29B and 29E is under 20,000 Btu/ft^2 for an equivalent fire severity of under 15 minutes. (The actual combustible loading and equivalent fire severity existing at this time are 6667 Btu/ft^2 and 5 minutes, respectively.) There are no specific sections of the fire zones that contain high densities of combustible materials.

The Unit 1 ESW system is cross-tied outside the zone to the Unit 2 ESW system. Therefore, alternate shutdown capability exists for Fire Zone 29(A,B,E) using Unit 2 ESW components providing essential service water to Unit 1 while maintaining service to Unit 2.

7.5.5 Proposed Modifications

The fire hazards analysis performed revealed that Fire Zone 29(A,B,E) is not in compliance with Appendix R and, as a result, the fire zone will be upgraded with the installation of an automatic detection system that provides alarms in the Control Room.

7.5.6 Conclusion

Based on the previous analysis, exemption is requested from the requirement that a fixed suppression system be installed in areas where alternate shutdown capability exists as prescribed by Section III.G.3 of Appendix R. The bases that justify the exemption are summarized as follows:

(1) The Unit 1 and Unit 2 ESW systems are cross-tied outside the zone and, therefore, alternate shutdown capability exists for Unit 1 using Unit 2 ESW systems. No Unit 2 safe shutdown equipment or cables are in the fire zone.

(2) The fire zone will be provided with an automatic fire detection system.

(3) The Unit 1 ESW pumps are separated from Unit 2 ESW pumps by a three-hour-rated wall.

(4) Fire Zone 29G is to be modified to prevent a fire in Fire Zones 29A, 29B or 29E that spreads down the open stair to Fire Zone 29G from affecting both units' ESW systems (see Subsections 7.7 and 9.25 of this report).

(5) Subsection 9.25 presents the engineering evaluation performed to justify the screen mesh access gates to the ESW pump cubicles and the unrated steel plate hatch in the ceiling of Fire Zone 29G to the Unit 2 ESW pump cubicles. Subsection 9.25 also identifies the proposed installation of rated dampers in the ceiling of the Unit 2 ESW pump cubicles.

(6) The fixed combustible loading is under 20,000 Btu/ft^2 with a fire severity of under 15 minutes.

(7) The fire zone does not provide a normally used path of transient combustibles.

(8) Modifications required to meet Section III.G.3 would not significantly enhance fire protection safety above that provided by present commitments.

SUMMARY EVALUATION TABLE 7.5-1

FIRE ZONES: 29(A,B,E)

DESCRIPTION: Unit 1 Essential Service Water Pumps and Motor Control Centers

EVALUATION PARAMETERS SUMMARY

A. Area Description

1. Construction -

a. Walls -

North - reinforced concrete, in excess of three-hour rating

South - reinforced concrete, in excess of three-hour rating

East - reinforced concrete, in excess of three-hour rating

West - reinforced concrete, in excess of three-hour rating

b. Floor - reinforced concrete, in excess of three-hour rating

c. Ceiling - reinforced concrete, in excess of three-hour rating

2. Ceiling height - 16 ft 5 in. for Fire Zones 29A and 29B
12 ft 9 in. for Fire Zone 29E

3. Area - 826 ft^2

4. Zones volume - 13,261 ft^3

5. Ventilation - 20,000 cfm

6. Access in Zone - Equipment forms partial obstruction

B. Safe Shutdown Equipment

PP-1E - ESW Pump 1E	WMO-701 - 1E Disch Valve
PP-1W - ESW Pump 1W	WMO-702 - 1W Disch Valve
ESWE - 1E Strainer	1PS-A MCC for pump strainer and discharge valve
ESWE - 1W Strainer	1PS-D MCC for pump strainer and discharge valve

C. Fire Hazards

1. Type of combustibles in area -

   Cable insulation
   Lube oil
   Plastics

2. Total fixed combustible loading considered for the purpose of the analysis - 20,000 Btu/ft^2

3. Actual quantity of fixed combustibles -

   Cable - 3,570,454 Btu

   Lube oil - 1,461,000 Btu

   Plastics - 475,792

   TOTAL - 6667 Btu/ft^2

D. Existing Fire Protection

1. Fire Detection Systems -

   None

2. Fire Extinguishing Systems - Manual

   3 - 20 lb Purple-K dry chemical extinguishers, outside pump enclosures in screenhouse

   3 - 15 lb CO_2 extinguishers, outside pump enclosures in screenhouse

   1 - Water hose reel with 75 ft 1-1/2 in. hose and adjustable angle spray nozzle

7.6 Fire Zone 29 (C,D,F) Unit 2 Essential Service Water Pumps and Motor Control Centers

EXEMPTION REQUEST

Per the provisions of 10 CFR 50.48(c)(6) and 10 CFR 50.12 Indiana and Michigan Electric Company requests exemptions from the specific requirements of Appendix R, Section III.G.3; i.e., a fixed fire suppression system shall be installed in the fire area.

7.6.1 Area Description

This fire zone is the Unit 2 equivalent of Fire Zone 29(A,B,E). Fire Zone 29(C,D,F) is located on the extreme west central side of the screenhouse that is adjacent to the Turbine Building elevation 591 ft.. The fire zone is comprised of the two pump cubicles for Unit 2 ESW pumps (PP-2E and PP-2W) each located in missile-barriered enclosures, and a separate cubicle for the motor control centers.(2PS-A and 2PS-D).

Access to the pumps is gained through the south side access control gate from the screenhouse area. The access gate is constructed of screen mesh for ventilation purposes. Additional ventilation is provided through undampered duct openings in the ceiling of 29C and 29D. The duct openings will be provided with three-hour-rated dampers. Subsection 9.25 provides the engineering evaluation that requires adding dampers to the duct openings. The pump cubicles share a common corridor with a wall separating the pumps and a missile shield perpendicular to the wall partially enclosing the pumps. The pumps are installed on pedestals approximately four feet off the ground. The east/west wall separating this Unit 2 zone from the Unit 1 pumps is three-hour-rated.

An open hatch is present in the southeast corner of the east pump room. The hatch provides access to Fire Zone 29G that is the level immediately below both the Unit 1 and Unit 2 ESW pump areas.

The motor control centers are located adjacent to each other in a common enclosure with a screen mesh access control door protected by a missile shield wall. Pertinent room dimensional data is contained in Fire Zone 29(C,D,F) Summary Evaluation Table 7.6-1 and Figures 7.6.1 and 7.6.2.

7.6.2 Safe Shutdown Systems

Fire Zone 29(C,D,F) contains both ESW pumps for Unit 2 (PP-2E and PP-2W), the strainers for both pumps (ESWSE and ESWSW), the discharge valves for both pumps (WMO-703 and WMO-704) and both motor control centers (2PS-A and 2PS-D) that serve the strainers and valves. No other Unit 2 and no Unit 1 safe shutdown equipment or cable is located in the fire zone.

7.6.3 Fire Protection Systems

Fire Zone 29(C,D,F) presently has no fixed suppression or automatic detection and contains only cables and components for the Unit 2 Essential Service Water System. The zone contains a 1-1/2 inch water hose reel (75 ft) outside the zone at the access door to the pump enclosure. Outside the zone in the screenhouse are three 20 lb Purple-K dry chemical and three 15 lb CO_2 fire extinguishers.

7.6.4 Fire Hazards Analysis

The Unit 2 pump enclosure may sustain a fire that could be assumed to render both Unit 2 ESW pumps inoperable. Similarly, a fire in the MCC cubicle would render the associated Unit 2 strainers and valves inoperable. The walls, floors, and ceilings of Fire Zone 29(C,D,F) are three-hour-rated except for (a) the ladder hatch to 29G (from the east pump cubicle, which is a common Unit 1/Unit 2 zone below the pump cubicles), (b) the screen mesh access gates that provide entrance to these zones from Fire Zone 142, and (c) the undampered ceiling ventilation duct openings. (Fire Zone 29G is discussed in Subsection 7.7.)

The motor control centers for Unit 2 are separated from Unit 1 by 48 ft and each is in a separate cubicle. The cables exiting the MCCs are embedded in concrete and are routed directly to the respective unit's pump cubicle. The power cable for the ESW pumps is routed from below the pumps in Fire Zone 29G up through the floor.

Each pump contains five gallons of lubricating oil; however, absent any ignition source, the oil presents no threat to the ESW pumps in both units. Because of its location, Fire Zone 29(C,D,F) is not in a path normally traversed with transient combustibles. No transient combustibles are allowed to be stored in the fire zone and fixed combustibles amount to cable insulation, plastics, and the small quantity of lube oil from each. The total fixed combustible loading of Fire Zones 29C, 29D and 29F is under 20,000 Btu/ft^2 for an equivalent fire severity of under 15 minutes. (The actual combustible loading and equivalent fire severity existing at this time are 6379 Btu/ft^2 and 4.8 minutes, respectively.) There are no specific sections of the fire zones that contain high densities of combustible materials.

The Unit 2 ESW system is cross-tied outside the zone to the Unit 1 ESW system. Therefore, alternate shutdown capability exists for Fire Zone 29(C,D,F) using Unit 1 ESW components to provide essential service water to Unit 2 while maintaining service to Unit 1.

7.6.5 Proposed Modifications

The fire hazards analysis performed revealed that Fire Zone 29(C,D,F) is not in compliance with Appendix R, and as a result the fire zone will be upgraded with fire protection modifications.

7.6.5.1 Detection System

An automatic detection system will be installed in the fire zone that provides alarms in the Control Room.

7.6.5.2 Ladder Hatch

An engineering evaluation has been performed justifying the existence of the unrated ladder hatch. See Subsections 7.7.4 and 9.25.

7.6.5.3 Ventilation Ducts

The undampered ventilation openings in the ceiling of 29C and 29D will be provided with three-hour-rated dampers per the evaluation in Subsection 9.25.

7.6.6 Conclusion

Based on the previous analysis, an exemption is requested from the requirement that a fixed suppression system be installed in areas where alternate shutdown capability exists as prescribed by Section III.G.3 of Appendix R. The bases that justify the exemption are summarized as follows:

(1) The Unit 2 and Unit 1 ESW systems are cross-tied and alternate shutdown capability exists for Unit 2 outside the area using Unit 1 ESW systems. No Unit 1 safe shutdown equipment or cables are in the fire zone.

(2) The fire zone will be provided with a fire detection system.

(3) The unit 2 ESW pumps are separated from Unit 1 ESW pumps by a three-hour-rated wall.

(4) An engineering evaluation has been performed that concluded that a fire will not propagate through the unrated ladder hatch between Fire Zones 29G and 29C (see Subsection 9.25).

(5) The fixed combustible loading is under 20,000 Btu/ft^2 with a fire severity of less than 15 minutes.

(6) The fire zone does not provide a normally used path of transient combustibles.

(7) Subsection 9.25 presents the engineering evaluation performed to justify the screen mesh access gates to the ESW pump cubicles and the unrated steel plate hatch in the ceiling of Fire Zone 29G to Fire Zone 29C. Subsection 9.25 also identifies the proposed installation of rated dampers in the ceiling of Fire Zones 29C and 29D.

(8) Modifications required to meet Section III.G.3 would not significantly enhance fire protection safety above that provided by present commitments.

SUMMARY EVALUATION TABLE 7.6-1

FIRE ZONES: 29(C,D,F)

DESCRIPTION: Unit 2 Essential Service Water Pumps and Motmor Control Centers

EVALUATION PARAMETERS SUMMARY

A. Area Description

1. Construction -

a. Walls -

North - reinforced concrete, in excess of three-hour rating

South - reinforced concrete, in excess of three-hour rating

East - reinforced concrete, in excess of three-hour rating

West - reinforced concrete, in excess of three-hour rating

b. Floor - reinforced concrete, in excess of three-hour rating

c. Ceiling - reinforced concrete, in excess of three-hour rating

2. Ceiling height - 16 ft 5 in. for Fire Zones 29C and 29D
12 ft 9 in. for Fire Zone 29F

3. Area - 826 ft^2

4. Zone volume - 13,261 ft^3

5. Ventilation - 20,000 cfm

6. Access in Zone - Equipment forms partial obstruction

B. Safe Shutdown Equipment

PP-2E - ESW Pump 2E	WMO-703 - 2E Disch Valve
PP-2W - ESW Pump 2W	WMO-704 - 2W Disch Valve
ESWSE - Strainer PP-2E	2PS-A MCC for pump strainer and discharge valve
ESWSW - Strainer PP-2W	2PS-D MCC for pump strainer and discharge valve

C. Fire Hazards

1. Type of combustibles in area -

   Cable insulation
   Lube oil
   Plastics

2. Total fixed combustible loading considered for the purpose of the analysis - 20,000 Btu/ft^2

3. Actual quantity of fixed combustibles -

   Cable - 3,021,140 Btu

   Lube oil - 1,461,000 Btu

   Plastics - 786,592 Btu

   TOTAL - 6379 Btu/ft^2

D. Existing Fire Protection

1. Fire Detection Systems -

   None

2. Fire Extinguishing Systems - Manual

   3 - 20 lb Purple-K dry chemical extinguishers, outside in screenhouse

   3 - 15 lb CO_2 extinguishers, outside in screenhouse

   1 - Water hose reel with 75 ft 1-1/2 in. hose and adjustable angle spray nozzle

7.7 Fire Zone 29G Screenhouse Auxiliary MCC Room, Elevation 575 ft, Both Units

EXEMPTION REQUEST

Per the provisions of 10 CFR 50.48(c)(6) and 10 CFR 50.12 Indiana and Michigan Electric Company requests exemptions from the specific requirements of Appendix R, Section III.G.2; i.e., an automatic fire suppression system shall be installed in the fire area.

7.7.1 Area Description

Fire Zone 29G is the basement level below the essential service water pumps of both Units 1 and 2 and contains two nonsafe shutdown motor control centers. The fire zone has a hatch with a ladder up to the Unit 2 ESW southeast pump cubicle and a stairway to the northwest Unit 1 pump cubicle.

The ceiling and walls are all three-hour-rated except for the unrated ladder hatch and the open stairwell. An engineering evaluation has been done justifying the existence of the unrated hatch (see Subsection 9.25). Conduit for all four ESW pumps, their valves and strainers, enters the east wall via embedded conduit except for WMO-701 (the Unit 1 east pump discharge valve). All the conduit comes through the wall in pull boxes at near ceiling height and immediately exits up into the ceiling slab. The cabling into the ceiling runs in embedded conduit to its respective pump cubicle. All ceiling and wall penetrations are sealed with three-hour-rated fire seals.

Pertinent room dimensional data is contained in Zone 29G Summary Evaluation Table 7.7-1 and Figure 7.7.1.

7.7.2 Safe Shutdown Equipment

Fire Zone 29G contains no safe shutdown equipment except cables in conduit for the components of both Units 1 and 2 Essential Service Water Systems. The cables for the four pump strainers and discharge valves are located in conduit and in pull boxes at ceiling height. The conduits enter the zone from the Turbine Room floor slab and immediately exit through the ceiling slab to respective pump cubicles. Except for one conduit, the zone exit points are all within the pull boxes. One ESW discharge valve (WMO-701) conduit runs from the pull box near the ceiling to the cubicle area for the Unit 1 east pump. The four pump power cables enter the zone through the east wall at about ceiling height (being run into the zone in the floor slab of the Turbine Building) and are routed near the ceiling to the respective pump cubicle area where they exit Fire Zone 29G through the ceiling.

7.7.3 Fire Protection Systems

Fire Zone 29G has no automatic suppression or detection systems installed and is provided with the manual suppression within the zone and systems available to 29(A,B,E).

7.7.4 Fire Hazards Analysis

Fire Zone 29G is a common zone for both Unit 1 and Unit 2. The only safe shutdown equipment in the area is conduit containing cables for the ESW systems of both units. The total fixed combustible loading of Fire Zone 29G is under 13,000

Btu/ft^2 for an equivalent fire severity under 10 minutes. (The actual combustible loading and equivalent fire severity existing at this time are 11,858 Btu/ft^2 and 8.8 minutes, respectively.)

The pump power cables are in four inch conduit entering the fire zone through the east wall. The valves and strainers for all four pumps likewise enter the fire zone through the east wall and immediately exit up through the ceiling. No protection presently exists for the conduits of all four pumps. The fire zone provides no path for transient combustibles; however, protection to all cabling associated with both units' ESW systems will be provided. There are no specific sections of the fire zone that contain high densities of combustible materials.

An open stairway entering from the Unit 1 West ESW pump cubicle, Fire Zone 29B, and a ladder and a hatch opening from Unit 2 East ESW pump cubicle, Fire Zone 29C, provide a common connection between Unit 1 and 2 ESW pumps via Fire Zone 29G. Hot combustible gases from a fire in Fire Zone 29G could affect the ESW pumps in both units. The hatch opening from the Unit 2 East pump cubicle will prevent propagation of fire effects into the pump area. An engineering evaluation has been performed that provides justification for not coating the hatch because this will not increase the level of protection presently provided in the area. See Subsection 9.25 for the engineering justifications. The hatch will ensure that hot combustible gases resulting from a fire in Fire Zone 29G will not affect the Unit 2 ESW pumps.

The Unit 1 west pump cubicle is provided with 10,000 cfm of ducted supply air. All cabling for the supply fans is embedded in concrete from the MCC in Fire Zone 29E to the fan motors, with none of the cabling existing in Fire Zone 29G. Two supply fans are provided with only one required as each provides 100% of the required air flow for the cubicle. Air is exhausted from this cubicle through the screen mesh security gate in the north wall. Due to the low combustible loading in Fire Zone 29G and these natural exhaust air flow paths out of the Unit 1 West pump cubicle, hot gases or other products of combustion from a fire in Fire Zone 29G that would flow up the stairway will flow directly out of the cubicle and prevent the formation of a stratified layer of hot gases with sufficient depth to damage the Unit 1 ESW pumps.

At the NRC Staff's request, we have reviewed the Fire Hazard Analysis to determine if three-hour raceway barriers for two of the four ESW pump trains would be preferable to one-hour barriers for all four ESW trains. Based on the low in-situ combustible loadings and a lack of major activity in the zone, Indiana and Michigan Electric Company believes that the previously proposed one-hour barriers for all four trains achieve an equivalent or superior level of fire protection for the zone configuration. In addition, the design and installation issues associated with the three-hour raceway barriers suggest that implementation of that alternative is not preferred.

Based on these considerations, both the east and west trains of ESW for both Units 1 and 2 will be protected from the effects of fires in Fire Zone 29G. In the highly unlikely event that a fire in Fire Zone 29G should cause failure for both Unit 1 ESW pumps, alternate shutdown capability for Unit 1 is available through the use of the Unit 2 ESW pumps. The alternative shutdown capability is described in Subsection 5.2.3.

Manual hose stations are provided in the Screenhouse for fighting fires in Fire Zone 29G. The hose stations are located such that all portions of Fire Zone 29G can be covered with 75 feet of hose and 30 feet of water stream. Figures 7.7.2 and 7.7.3 indicate the locations of manual hose stations and portable extinguishers for fighting fires in Fire Zone 29G.

7.7.5 Proposed Modifications

The fires hazards analysis performed revealed that Fire Zone 29G is not in compliance with Appendix R and as a result the zone will be upgraded with fire protection modifications.

7.7.5.1 Fire Detection

The fire zone will be provided with an automatic fire detection system.

7.7.5.2 Hatch

The hatch exiting the fire zone to the east pump cubicle of Unit 2 was to be provided with at least a three-hour-rated fire hatch door to isolate the Unit 2 pump rooms from the Unit 1 pump rooms (via 29G). An engineering evaluation has been performed that provides justification for not providing a three-hour-rated hatch since this will not increase the level of protection presently provided in the area. See Subsection 9.25 for the engineering justifications.

7.7.5.3 Conduits

The following conduits will be provided with one-hour fire protection (grouped in four pull boxes) from the entry to exit point in the fire zone:

PULL BOX	PULL BOX	PULL BOX	PULL BOX
8626G-1	8624R-1	8618R-2	8977G-2
8627G-1	8624R-2	8619R-2	9987G-2
8628G-1	8618R-1	8620R-2	8629G-2
8629G-1	8619R-1	8996R-2	8627G-2
	8620R-1	8996R-1	8628G-2

7.7.5.4 Pump Power and Discharge Valve Conduits

The following pump power and discharge valve conduits will be provide with one-hour protection from the entry to the exit point of the fire zone:

8004R-1 (PP-1W Unit-2)	8004G-2 (PP-2E Unit-2)	9232G-1 (WMO-701 Unit-1 East)
8004G-1 (PP-1E Unit-1)	8004R-2 (PP-2W Unit-2)	

7.7.6 Conclusion

Based on the previous analysis, exemption is requested from an automatic suppression system as prescribed in Section III.G.2 of Appendix R. The bases that justify the exemption are summarized as follows:

(1) An automatic fire detection system is to be provided for the fire zone.

(2) The conduits of both divisions (all four pumps and associated components) are to be provided with one-hour fire protection.

(3) An engineering evaluation has been performed that concluded that a fire will not propagate through the unrated ladder hatch between Fire Zones 29G and 29C (see Subsection 9.25).

(4) The fixed combustible loading of Fire Zone 29G is under 13,000 Btu/ft^2 with a fire severity of less than 10 minutes.

(5) The fire zone is not in a normal path for transporting transient combustibles.

(6) Modifications required to meet Section III.G.2 would not significantly enhance fire protection safety above that provided by present commitments.

SUMMARY EVALUATION TABLE 7.7-1

FIRE ZONE: 29G

DESCRIPTION: Screenhouse Auxiliary MCC Room, Elevation 575 ft, both units

EVALUATION PARAMETERS SUMMARY

A. Area Description

1. Construction -

a. Walls -

North - reinforced concrete, in excess of three-hour rating

South - reinforced concrete, in excess of three-hour rating

East - reinforced concrete, in excess of three-hour rating

West - reinforced concrete, in excess of three-hour rating

b. Floor - reinforced concrete, in excess of three-hour rating

c. Ceiling - reinforced concrete, in excess of three-hour rating

2. Ceiling height - 12 ft 5 in.

3. Area - 1544 ft^2

4. Room volume - 19,171 ft^3

5. Ventilation - 0 cfm

6. Access in Zone - Unobstructed

B. Safe Shutdown Equipment

None

C. Fire Hazards

1. Type of combustibles in area -

   Cable insulation
   Cellulosics
   Plastics
   Rubber

2. Total fixed combustible loading considered for the purpose of the analysis - 27,000 Btu/ft^2

3. Actual quantity of fixed combustibles -

   Cable - 17,285,320 Btu

   Cellulosics - 257,238 Btu

   Plastics - 719,065 Btu

   Rubber - 50,400 Btu

   TOTAL - 11,858 Btu/ft^2

D. Existing Fire Protection

1. Fire Detection Systems -

   None

2. Fire Extinguishing Systems - Manual

   3 - 20 lb Purple-K dry chemical extinguishers, inside the zone and outside pump enclosures in screen house

   3 - 15 lb CO_2 extinguishers, inside the zone and outside pump enclosures in screen house

   1 - water hose reel with 75 ft 1-1/2 in. hose and adjustable angle spray nozzle

7.8 Fire Zones 33, 33A, 33B and 105 Unit 1 East Main Steam Valve Enclosure and Contractor Access Control Building

EXEMPTION REQUEST

Per the provisions of 10 CFR 50.48(c)(6) and 10 CFR 50.12 Indiana and Michigan Electric Company requests exemptions from the specific requirements of Appendix R, Section III.G.3; i.e., a fixed fire suppression system shall be installed in the fire area.

7.8.1 Fire Area Description

Fire Zones 33, 33A, 33B are located immediately outside the Containment Building of Unit 1 at an elevation of 612 ft. The zones include the north area around containment that contains main steam lines and also includes the nonessential service water valve gallery on the west side directly opposite the East Main Steam Valve Enclosure. The fire area in which these zones are located also includes Fire Zone 105, the Contractors Access Control Area. Pertinent dimensional data is contained in Fire Zones 33, 33A, 33B and 105 Summary Evaluation Table 7.8-1 and Figure 7.8.

7.8.2 Safe Shutdown Equipment

Fire Zones 33, 33A, 33B contain all main steam pressure transmitters for steam generators 1 and 4, the electro-pneumatic transmitters for all four Unit 1 steam generator power operated relief valves, steam generators 1 and 4 auxiliary feedwater inlet valves (FMO-211, 212, 241, 242), the local shutdown indication panel (LSI-1) and the power operated relief valves and safeties for steam generators 1 and 4. The main steam stop valves for steam generators 1 and 4 are also in the area.

7.8.3 Fire Protection Systems

Fire Zones 33, 33A, 33B have no automatic suppression system. A thermistor detection system and manual water deluge suppression system is installed for the charcoal filters located in the area. Fire Zone 105 is protected by an automatic wet pipe sprinkler system.

The area also has manual 75 ft 1-1/2 in. hose station and CO_2 fire extinguishers.

7.8.4 Fire Hazards Analysis

All interior walls, floors and ceilings are of reinforced concrete construction, with the exception of the unrated wall that separates Fire Zones 33A and 105. Excluding doors and metal barriers to the exterior of the area, seismic gaps between Containment and Fire Zones 33, 33A and 33B, open hatch to Fire Zone 116 below, steel grate in the floor of Fire Zone 33 to Fire Zone 8 below, numerous penetrations of the wall between Fire Zone 33A and Fire Zone 108, and an unrated wall to Fire Zone 105, all barriers have a minimum fire rating of one hour. Engineering evaluations or exemption requests have been performed or granted justifying these unrated portions of the area boundaries. (See Subsections 7.14, 9.23, 9.29, 9.35 and 9.38.) Penetrations exist between Fire Zone 33B and Fire Zone 12 and will be sealed.

The analysis indicated the presence of all four steam generator power-operated relief valve EPTs in these zones. The transmitters are greater than 100 ft apart; however, alternate shutdown capabilities will exist for this area with the proposed modifications to the steam generator PORVs.

The fixed combustible loading of the area is under 27,000 Btu/ft^2 for an equivalent fire severity of under 20 minutes. (The actual combustible loading and equivalent fire severity existing at this time are 11,530 Btu/ft^2 and 8.5 minutes, respectively.) Of the total, approximately 45% of the combustible loading is contained in Fire Zone 105; this zone is protected by an automatic wet pipe sprinkler system.

7.8.5 <u>Proposed Modifications</u>

The only redundant components in the area necessary for safe shutdown are the EPTs for the four steam generator PORVs. The EPTs and their associated cables are over 100 ft apart. Should a fire affect both trains of steam generator PORVs one division will be operable outside the area at a local control station.

7.8.5.1 <u>Floor Grate</u>

Three-hour-rated dampers were provided for the grate in the floor of Fire Zone 33 to Fire Area 8 below before submittal of the March 1983 Appendix R report.

7.8.5.2 <u>Penetrations</u>

The penetrations that exist between Fire Zones 33 and 12 will be sealed with a three-hour-rated seal.

7.8.5.3 <u>Fire Detection</u>

The fire area will be provided with an automatic fire detection system that will alarm in the Unit 1 Control Room.

7.8.6 Conclusion

Based on the previous analysis an exemption is requested from the requirement that a fixed suppression system be installed in areas where alternate shutdown capability exists as required by Section III.G.3 of Appendix R. The bases that justify the exemption are summarized as follows:

(1) Affected components in the fire area have alternate shutdown capability.

(2) The components of concern are horizontally separated by greater than 100 ft.

(3) The fixed combustible loading in the fire area is under 27,000 Btu/ft^2 with an equivalent fire severity of less than 20 minutes.

(4) Penetrations between Fire Zone 33B and Fire Zone 12 have been sealed (see Subsection 8.4.3). Engineering evaluations have been performed in Subsections 9.23, 9.29, 9.35 and 9.38 to justify unprotected openings to adjacent fire areas. An exemption (see Subsection 7.14) was requested and granted for unrated seismic gaps between Fire Zones 33, 33A and 33B and the Containment structure.

(5) The modifications required to meet Section III.G.3 would not significantly enhance fire protection safety above that provided by present commitments.

SUMMARY EVALUATION TABLE 7.8-1

FIRE ZONES: 33, 33A, 33B and 105

DESCRIPTION: Unit 1 East Main Steam Valve Enclosure and Contractor Access Control Building

EVALUATION PARAMETERS SUMMARY

A. Area Description

1. Construction -

a. Walls -

North - metal clad exterior wall

South - reinforced concrete, in excess of three-hour rating

East - reinforced concrete, in excess of three-hour rating

West - reinforced concrete, in excess of three-hour rating

b. Floor - reinforced concrete, in excess of three-hour rating

c. Ceiling - reinforced concrete, in excess of three-hour rating

2. Ceiling height - Approx. 68 ft for Fire Zone 33
31 ft 8 in. for Fire Zone 33A
24 ft 6 in. for Fire Zone 105
8 ft 6 in. for Fire Zone 33B

3. Area - 7236 ft^2

4. Zones volume - Approx. 206,518 ft^3

5. Ventilation - Fire Zone 33 - 47,750 cfm
Fire Zones 33A and 33B - 4000 cfm
Fire Zone 105 - 1250 cfm

6. Access in Zone - Equipment forms partial obstruction

B. Safe Shutdown Equipment

MPP-210, 211, 212, 240, 241, 242 - SG Pressure Transmitters
MRV-213, 243 - SG Power Operated Relief Valves
SV-1, 2, 3, - Safety Valves
FMO-211, 212, 241, 242 - SG Supply MOVs
LSI-1 - Local Shutdown Station

C. Fire Hazards

1. Type of combustibles in area -

   Cable insulation
   Charcoal
   Cellulosics
   Class B solvents
   Plastics
   Rubber

2. Total fixed combustible loading considered for the purpose of the analysis - 27,000 Btu/ft^2

3. Actual quantity of fixed combustibles -

   Cable - 25,446,125 Btu

   Charcoal - 2,145,000 Btu

   Cellulosics - 31,019,871 Btu

   Class B solvents - 3,102,000 Btu

   Plastics - 18,486,386 Btu

   Rubber - 3,259,875 Btu

   TOTAL - 11,533 Btu/ft^2

D. Existing Fire Protection

1. Fire Detection Systems -

   Thermistor heat detection for the charcoal filter unit

2. Fire Extinguishing Systems -

   Manual deluge water spray for the charcoal filter unit
   Manual hose stations and portable extinguishers (ABC, Purple-K and CO_2) available
   Automatic wet pipe sprinklers in Fire Zone 105

7.9 Fire Area 34, 34A, 34B, Unit 2 East Main Steam Valve Enclosure

EXEMPTION REQUEST

Per the provisions of 10 CFR 50.48(c)(6) and 10 CFR 50.12 Indiana and Michigan Electric Company requests exemptions from the specific requirements of Appendix R, Section III.G.3, i.e., a fixed fire suppression system shall be installed in the fire area.

7.9.1 Fire Area Description

Fire Area 34, 34A, 34B is located immediately outside the Containment Building of Unit 2 at an elevation of 612 ft. This fire area is the Unit 2 counterpart to Fire Area 33, 33A, 33B. The area includes the south area around containment that contains main steam lines and also includes the nonessential service water valve gallery on the west side directly opposite the East Main Steam Valve Enclosure. Pertinent dimensional data is contained in Table 7.9-1, Fire Area 34, 34A, 34B. Evaluation Parameters Summary and Figure 7.9.

7.9.2 Safe Shutdown Equipment

Fire Area 34, 34A, 34B contains all main steam pressure transmitters for steam generators 1 and 4, the electro-pneumatic transmitters for all four Unit 2 generator power operated relief valves, steam generators 1 and 4 auxiliary feedwater inlet valves (FMO-211, 212, 241, 242), the local shutdown indication panel (LSI-1) and the power operated relief valves and safety for steam generators 1 and 4. The main steam valves for steam generators 1 and 4 are also in the area.

7.9.3 Fire Protection Systems

Fire Area 34, 34A, 34B has no automatic suppression system. A thermistor detection system and manual water deluge suppression system is installed for the charcoal filters located in the area. The area also has a manual 75 ft 1-1/2 in. hose station and CO_2 fire extinguishers.

7.9.4 Fire Hazards Analysis

The interior walls, floors and ceilings are of reinforced concrete construction. Excluding doors and metal wall to the exterior of the area, the seismic gaps between Fire Zones 34, 34A, 34B and Containment, open hatch to Fire Zone 117 below, steel grate in the floor of Fire Zone 34 to Fire Zone 26, and numerous penetrations of the wall between Fire Zone 34A and Fire Zone 109, all barriers have a minimum fire rating of one hour. Engineering evaluations or exemption requests have been performed or granted justifying these unrated portions of the area boundaries (see Subsections 7.14 and 9.36). Penetrations exist between Fire Zone 34B and Fire Zone 22 and will be sealed.

The analysis indicated the presence of all four steam generator power operated relief valve EPTs in the area. The transmitters are greater than 100 ft apart; however, alternate shutdown capabilities will exist for this area with the proposed modifications to the steam generator PORVs.

The fixed combustible loading of the area is under 20,000 Btu/ft^2 with an equivalent fire severity of less than 15 minutes. (The actual combustible loading and equivalent fire severity existing at this time are 5909 Btu/ft^2 and 4.3 minutes, respectively.)

7.9.5 Proposed Modifications

The only redundant components in the area necessary for safe shutdown are the EPTs for the four steam generator PORVs. The EPTs and their associated cables are over 100 ft apart. Should a fire affect both trains of steam generator PORVs, one division will be operable outside the area at a local control station.

7.9.5.1 Floor Grate

Three-hour fire-rated dampers were provided for the grate in the floor of Fire Zone 34 to Fire Zone 26 below before submittal of the March 1983 Appendix R report.

7.9.5.2 Penetrations

The penetrations that exist between Fire Zones 34B and 22 will be sealed.

7.9.5.3 Fire Detection

The fire area will be provided with an automatic fire detection system that will alarm in the Unit 2 Control Room.

7.9.6 Conclusion

Based on the previous analysis, an exemption is requested from the requirement that a fixed suppression system be installed in areas where alternate shutdown capability exists, as required by Section III.G.3 of Appendix R. The bases that justify the exemption are summarized as follows:

(1) Affected components in the fire area have alternate shutdown capability.

(2) The components of concern are horizontally separated by greater than 100 ft.

(3) The fixed combustible loading in fire area is under 20,000 Btu/ft^2 with an equivalent fire severity of less than 15 minutes.

(4) Penetrations between Fire Zone 34B and Fire Zone 22 have been sealed (see Subsection 8.8.3). Engineering evaluations have been performed in Subsections 9.24, 9.36 and 9.38 to justify unprotected openings to adjacent fire areas. An exemption (see Subsection 7.14) was requested and granted for unrated seismic gaps between Fire Zones 34, 34A, and 34B and the Containment structure.

(5) The modifications required to meet Section III.G.3 would not significantly enhance fire protection safety above that provided by present commitments.

SUMMARY EVALUATION TABLE 7.9-1

FIRE AREA: 34, 34A, 34B

DESCRIPTION: Unit 2 East Main Valve Enclosure

EVALUATION PARAMETERS SUMMARY

A. Area Description

1. Construction -

a. Walls -

North - reinforced concrete, in excess of three-hour rating

South - metal clad exterior wall

East - reinforced concrete, in excess of three-hour rating

West - reinforced concrete, in excess of three-hour rating

b. Floor - reinforced concrete, in excess of three-hour rating

c. Ceiling - reinforced concrete, in excess of three-hour rating

2. Ceiling height - Approx. 68 ft for Fire Zone 34
31 ft 8 in. for Fire Zone 34A
8 ft 6 in. for Fire Zone 34B

3. Area - 4856 ft^2

4. Area volume - Approx. 177,660 ft^3

5. Ventilation - Fire Zone 34 - 4900 cfm
Fire Zones 34A and 34B - 4000 cfm

6. Access in Zone - Equipment forms partial obstruction

B. Safe Shutdown Equipment

MPP-210, 211, 212, 240, 241, 242 - SG Pressure Transmitters
SV-1, 2, 3, - Safety Valves
MRV-213, 243 - SG Power Operated Relief Valves
FMO-211, 212, 241, 242 - SG Supply MOVs
LSI-1 - Local Shutdown Station

C. Fire Hazards

1. Type of combustibles in area -

   Cable insulation
   Charcoal
   Cellulosics
   Class B solvents
   Plastics
   Rubber

2. Total fixed combustible loading considered for the purpose of the analysis - 20,000 Btu/ft^2

3. Actual quantity of fixed combustibles -

   Cable - 11,993,276 Btu

   Charcoal - 2,145,000 Btu

   Cellulosics - 5,483,200 Btu

   Class B solvents - 3,102,000 Btu

   Plastics - 2,233,550 Btu

   Rubber - 3,754,023 Btu

   TOTAL - 5909 Btu/ft^2

D. Existing Fire Protection

1. Fire Detection Systems -

   Thermistor heat detection for the charcoal filter unit

2. Fire Extinguishing Systems -

   Manual deluge water spray for the charcoal filter unit
   Manual hose stations and portable extinguishers (ABC, Purple-K, and CO_2) available

7.10 Fire Zone 44S Auxiliary Building South, Elevation 609 ft, Both Units

EXEMPTION REQUEST

Per the provisions of 10 CFR 50.48(c)(6) and 10 CFR 50.12 Indiana and Michigan Electric Company requests exemption from Appendix R Section III.G.2; i.e., enclosure of cable and equipment and associated nonsafety circuits of one redundant train in a fire barrier having a one-hour rating.

7.10.1 Fire Zone Description

Fire Zone 44S is the south half of elevation 609 ft of the Auxiliary Building, that has been artificially segmented for the purposes of the analysis at approximately 120 ft from the south wall. The north half of the fire zone (44N) contains only Unit 1 safe shutdown equipment and cables and has alternate shutdown capability using Unit 2 systems and components. Fire Zone 44S contains predominantly Unit 2 safe shutdown cables. However, five component cooling water pumps (1PP-10E, 1PP-10W, 2PP-10E, 2PP-10W and the spare pump usable for either unit) are located in the extreme south end of the fire zone. The CCW pumps are mounted on pedestals with concrete curbs completely surrounding the pedestals. The curbs are six inches high and the pedestals are four inches high. The floor around each of the CCW pumps is curbed in such a manner that oil leaking from any one pump or motor will be confined by the boundary of the curbing. Thus the oil is not allowed to pool and flow towards and/or directly around the adjacent CCW pump. Ventilation supply ducts are located over each motor that completely umbrella the pump motors. Normal access into the area is through the north end of Fire Zone 44N, through the Auxiliary Building access control area. Both Unit 1 and Unit 2 CCW pumps are normally aligned to their respective units during full power operation. The spare pump is available for use with either unit during maintenance of one of the normal pumps by electrically connecting the pump and manually aligning the valves.

The centerlines of east and west pump motors for both units are separated by approximately 13 ft. The Unit 1 east and Unit 2 west pumps at the motor end bearings (closest points) are separated by approximately 5 ft 5 in., while the Unit 1 west pump motor, on a diagonal, to Unit 2 west pump motor is separated by approximately 16 ft 6 in. The five CCW pumps are all located within a section of Fire Zone 44S approximately 35 ft by 35 ft. The Unit 2 CCW heat exchangers run north and south and are approximately 12 ft north of the Unit 1 east pump and separated from each other by approximately 7 ft. The heat exchanger outlet valves CMO-410 and CMO-420 are located at the north end of the Unit 2 CCW heat exchangers approximately 75 ft from the south wall of Fire Zone 44S.

A four-foot wide ventilation duct runs east and west between Unit 1 and Unit 2 CCW pumps approximately 10 ft off the floor. Subsection 9.3 presents the engineering evaluation performed to justify the HVAC duct penetration to Fire Zone 52 above. Pertinent dimensional data for Fire Zone 44S is given in Summary Evaluation Table 7.10 and Figures 7.10.1, 7.10.2, 7.10.3, and 7.10.8.

7.10.2 Safe Shutdown Equipment

Fire Zone 44S contains all four CCW pumps for Units 1 and 2, the two Unit 2 CCW heat exchangers, the CCW pump suction valves (only required for RCP thermal seal return to CCW pumps), Unit 2 CCW heat exchanger outlet valves, Unit 2 CCW common service header valves, Unit 2 ESW to CCW heat exchanger inlet, Unit 2 ESW to CCW heat exchanger outlet and Unit 2 MCC 2-AZV-A. The spare CCW pump is also in Fire Zone 44S.

With the exception of the component cooling water pumps 1PP-10E and 1PP-10W, there are no Unit 1 cables or components in Fire Zone 44S that are essential for safe shutdown. Thus, for most systems, Unit 1 is available for alternate shutdown capability. Proposed fire protection modifications will provide availability of all four emergency diesels, all four essential service water pumps and at least two of the four component cooling water pumps. The remaining systems of Unit 1 used for alternate shutdown in Unit 2 are outside of this fire zone and free of fire damage.

7.10.3 Fire Protection Systems

Fire Zone 44S has partial area automatic dry pilot preaction suppression system and full area ionization detection. Manual suppression systems include ten 20 lb ABC dry chemical and ten 15 lb CO_2 fire extinguishers; three CO_2 hose reels with 150 ft 1 in. hoses and three water hose reels with 75 ft 1-1/2 in. hoses equipped with adjustable angle spray nozzles. The fire zone is also equipped with 20 ionization detectors.

7.10.4 Fire Hazards Analysis

The fixed combustible loading of the area is under 33,000 Btu/ft^2 for an equivalent fire severity of less than 25 minutes. (The actual combustible loading and equivalent fire severity existing at this time are 19,192 Btu/ft^2 and 14.2 minutes, respectively.) The combustible loading is approximately 52% from cable insulation, 12% from cellulosics, 33% from plastics and rubber, and 3% Class B flammable liquid combustibles in the fire zone.

There are no specific areas of the fire zone that contain high concentrations of fixed combustibles.

The arrangement of the CCW pumps and heat exchangers is presented in Figures 7.10.1 and 7.10.2. The power cables for the pumps are run in conduit in the floor slab and enter the fire zone through the floor into the pump pedestal at the termination point of the motors. No pump control cables are located in the fire zone. The overhead area above the pumps is essentially free of fixed combustibles as the cable trays in the fire zone run north and south to the east and west of the pumps.

Two ceiling elevations exist in Fire Zone 44S. The clear floor to ceiling height over the component cooling water pumps is 10 ft 11 in., with that over the rest of the fire zone being 20 ft 4 in. Figure 7.10.4 is a plan and elevation view of the ceiling heights in the vicinity of the component cooling water pumps. Due to the change in ceiling elevations, the products of combustion from a fire in the vicinity of the pumps would tend to flow up into the 20 ft 4 in. high ceiling space. This will prevent a stratified layer of hot gases from forming to a depth sufficient to damage the component cooling water pumps unaffected by the direct results of the fire.

Open stairways provide access from the 591 ft and 633 ft elevations to Fire Zone 44S on the 609 ft elevation. Access to the component cooling water area of Fire Zone 44S is open and unobstructed, thereby ensuring adequate fire brigade response for manual fire fighting purposes should the need arise.

7.10.5 Proposed Modifications

The fire hazards analysis revealed the pumps and heat exchangers with associated components do not comply with Appendix R and as a result Fire Zone 44S will be upgraded with fire protection modifications.

7.10.5.1 Water Suppression System

The entire fire zone will be protected by extending the existing automatic dry pilot preaction water suppression system. The system was extended in Fire Zone 44S to provide area coverage over the Units 1 and 2 CCW pumps, directly over the CCW pump bearings, and over the monitor tank area. The general design criteria for the installation is as follows:

(1) The sprinkler heads shall be positioned in such a manner that they will adequately control and/or extinguish a fire that could originate on the floor of the protected area and cause an exposure to conduits, piping and/or equipment required for safe shutdown.

(2) The design of the sprinkler system should consider the fire to involve transient combustible and external ignition sources and not be caused by electrically originated fires in overloaded cables.

(3) Suppression will consist of ceiling-mounted sprinklers in addition to sprinklers located for direct water application onto the CCW pump bearings. The ceiling-mounted sprinklers provide area coverage over the CCW pumps and will provide a design density on the order of 0.4 gpm/ft^2. Refer to Figures 7.10.5 and 7.10.6 for plan and elevation views of the dry pilot preaction suppression system for the CCW pump area.

(4) The sprinkler systems shall be supported seismically where necessary and analyzed for inadvertent operation or actuation.

(5) The sprinkler systems shall be designed to the applicable portions of NFPA 13-1978.

(6) Heat collectors, where applicable, shall be installed to assure reliable sprinkler actuation.

(7) Safety-related equipment is required to be protected from inadvertent sprinkler operation that could render equipment inoperable due to water spray.

(8) Drainage capability in the vicinity of the pumps consists of drain openings on each of the five pump pedestals and a grid of 4-inch diameter drains covering the entire floor area of Fire Zone 44S. Adequate capacity is provided for drainage of suppression water resulting from a fire in this zone.

7.10.5.2 Fire Barrier

A fire barrier of steel construction coated with a subliming material will be provided between the Unit 1 and Unit 2 pumps. This barrier will be located beneath the existing HVAC duct work to approximately 6 ft 6 in. The barrier will also extend north between the Unit 1 east pump and the spare pump. (See Figure 7.10.3.) Figures 7.10.7 and 7.10.8 are draft plan and elevation views of the proposed barrier. The barrier will be seismically qualified and constructed of two approximately 3/4-in. thick TSI Thermolag panels, one on either side of 1/4-in. expanded metal. The TSI panels will be overlapped to provide protection for the bolts attaching the panels to the metal studs (see Figure 7.10.9).

7.10.5.3 Fire Detection

The area will be provided with expanded coverage of both the automatic dry pilot detection system associated with the preaction sprinkler system and the area ionization detection system. The dry pilot detection will consist of pilot sprinkler heads (which function as heat detectors) located over the CCW pumps and throughout the normally accessible areas of the fire zone. Refer to Figures 7.10.5 and 7.10.6 for plan and elevation views of the dry pilot preaction suppression system for the CCW pump area. Additional ionization detectors will be provided in the area of the CCW pumps.

7.10.5.4 Fire Dampers

Subsection 9.3 presents the engineering evaluation performed to justify the HVAC ductwork that is common to all five CCW pumps. Per the results of that evaluation, a three-hour-rated fire damper will be provided at the top of the vertical portion of the HVAC duct where it penetrates into Fire Zone 52 above.

Subsection 7.13 presents the exemption request justifying undampered HVAC ducts penetrating through floor and ceiling slabs of Fire Zone 44S.

7.10.6 Conclusion

Based on the previous analysis, exemption is requested from the requirement that cables and equipment of one redundant train be enclosed in a fire barrier having a one-hour rating as prescribed by Section III.G.2 of Appendix R. The bases that justify the exemption are summarized as follows:

(1) A fire barrier will be placed between the Unit 1 and Unit 2 CCW pumps and between the spare pump and the Unit 1 east pump. Thus modified, two of the four operational pumps will be free of fire damage.

(2) The existing automatic suppression system will be extended to provide coverage of all CCW pumps.

(3) Additional automatic detection will be provided for the CCW pump area.

(4) CCW pump cables are in embedded conduit with the exception of the connecting pigtail at the motor.

(5) No trays traverse the area of the pumps. The fire zone has a combustible loading of under 33,000 Btu/ft^2 with a fire severity of less than 25 minutes.

(6) The lube oil in the pumps has no credible ignition source.

(7) Subsection 9.3 presents the engineering evaluation performed to justify the common HVAC ductwork running from Fire Zone 52 down to Fire Zone 44S where it is distributed over all five CCW pumps. Per the results of that evaluation, a three-hour-rated fire damper will be provided at the top of the HVAC shaft where it penetrates into Fire Zone 52.

(8) Subsection 7.13 presents the exemption request justifying undampered HVAC ducts penetrating through floor and ceiling slabs of Fire Zone 44S.

(9) The modifications required to meet Section III.G.2 would not significantly enhance fire protection safety above that provided by present commitments.

SUMMARY EVALUATION TABLE 7.10-1

FIRE ZONE: 44S

DESCRIPTION: Auxiliary Building South, Elevation 609 ft, Both Units

EVALUATION PARAMETERS SUMMARY

A. Area Description

1. Construction -

   a. Walls -

      North - artificial boundary; no wall

      South - reinforced concrete, in excess of three-hour rating

      East - reinforced concrete, in excess of three-hour rating

      West - reinforced concrete, in excess of three-hour rating

   b. Floor - reinforced concrete, in excess of three-hour rating

   c. Ceiling - reinforced concrete, in excess of three-hour rating

2. Ceiling height - Varies from 12 ft to 20 ft 4 in.

3. Area - 9360 ft^2

4. Zone volume - 159,391 ft^3

5. Ventilation - 38,000 cfm

6. Access in Zone - Unobstructed

B. Safe Shutdown Equipment

PP-10E, PP-10W - Units 1 & 2 CCW Pumps (4)
CMO-413, CMO-411 - Units 1 & 2 CCW Pump Suction Valves
HE-15E, HE-15W - CCW HX Inlet Valves, Unit 2

B. Safe Shutdown Equipment (continued)

CMO-410, CMO-420, - CCW HX Outlet Valves, Unit 2
CMO-415, CMO-416 - CCW Common Service Header Valves, Unit 2
WMO-732, WMO-736 - ESW to CCW HX, Inlet Valve, Unit 2
WMO-734, WMO-738 - ESW to CCW HX, Outlet Valve, Unit 2
MCC-2-AZV-A - Unit 2

C. Fire Hazards

1. Type of combustibles in area -

   Cable insulation
   Lube oil
   Cellulosics
   Class B solvents
   Plastics
   Rubber

2. Total fixed combustible loading considered for the purpose of the analysis - 33,000 Btu/ft^2

3. Actual quantity of fixed combustibles -

   Cable - 92,796,061 Btu

   Lube oil - 3,652,500 Btu

   Cellulosics - 21,927,000 Btu

   Class B solvents - 3,102,000 Btu

   Plastics - 36,914,052 Btu

   Rubber - 21,266,600 Btu

   TOTAL - 19,192 Btu/ft^2

D. Existing Fire Protection

1. Fire Detection Systems -

   20 ionization smoke detectors

2. Fire Extinguishing Systems -

   Dry pilot preaction sprinklers over CCW pumps, pump bearings, monitor tanks, and normally accessible zone locations

7.11 Fire Area 53 Unit 1 Control Room

EXEMPTION REQUEST

Per the provisions of 10 CFR 50.48(c)(6) and 10 CFR 50.12 Indiana and Michigan Electric Company requests exemption from the specific requirements of Appendix R, Section III.G.3; i.e., a fixed fire suppression system shall be installed in the area.

7.11.1 Fire Area Description

Fire Area 53 is the Unit 1 Control Room located on elevation 633 ft immediately adjacent to the Unit 2 Control Room. The Unit 1 Control Room contains all the normal control panels for plant operation and most relay and instrument cabinets associated with plant control. In addition, the Unit 2 hot shutdown panel (Fire Zone 145) is located in the southwest corner of the Control Room and is approximately 12 ft 6 in. long by 5 ft 1 in. wide. The top of the panel is approximately eight inches from the false ceiling of the Control Room. The hot shutdown panel is of steel construction with a steel door at the front of the panel. Pertinent dimensional data is contained in Fire Area 53 Summary Evaluation Table 7.11-1 and Figure 7.11.

7.11.2 Safe Shutdown Equipment

The Unit 1 Control Room contains the control panels, relay and instrument cabinets and associated cabling for Unit 1. The Unit 2 hot shutdown panel is also in the Control Room.

7.11.3 Fire Protection Systems

Fire Area 53 has no automatic suppression system. There are 46 ionization detectors located in the Control Room including detection in and around HSD2 and above the suspended ceiling. Located outside the Control Room are two 1-1/2 in. water hose reels (75 ft each) with adjustable spray nozzles. Inside the Control Room are six 15 lb CO_2 fire extinguishers and one BioPac one-hour breathing apparatus. Two CO_2 hose reels (100 ft and 150 ft) are located outside the fire area.

7.11.4 Fire Hazards Analysis

The hot shutdown panel is a steel enclosure with steel doors across the front of the panel. No equipment internal to the panel is exposed to the direct effects of any postulated room fire during normal operation because of the normally closed panel door. See Figure 7.11 for a sketch of the panels. The Unit 2 hot shutdown panel is located in the section of the Unit 1 Control Room that houses numerous other control, relay and instrument panels for Unit 1. The Control Room area is protected from other fire zones by three-hour-rated floors, ceilings and walls except for one unrated ceiling hatch and one floor hatch that is unrated. Also, the common connecting door between the Control Rooms is unrated. Two separate engineering evaluations have been done justifying the existing unrated hatches in the ceiling and floor. See Subsections 9.5 and 9.13, respectively, for these evaluations. The common connecting door between Control Rooms will be upgraded to three hours. The HSD2 panel was originally installed to comply with the requirements of 10 CFR 50 GDC 19 and is used to provide shutdown from outside the Control Room for Design Basis considerations other than Appendix R fires.

The fixed combustible loading for the entire Control Room is under 47,000 Btu/ft^2 for an equivalent fire severity of under 35 minutes. (The actual combustible loading and equivalent fire severity existing at this time are 28,225 Btu/ft^2 and 21.2 minutes, respectively.) The area near the Unit 2 hot shutdown panel has few exposed cables as the cables enter and exit the panels in the area predominantly through the floor via sealed penetrations. Thus, there is a small quantity of fixed combustibles in the area of the HSD2.

With the exception of small quantities of organic solvent used to service the equipment in the room, no transient combustibles are stored, routed through or used in this section of the Control Room. This low volume of fixed combustibles combined with the minimum volume of transient combustibles used in the area creates an extremely low fire hazard.

In the event of a fire in the Unit 1 Main Control Room, the unit can be safely shut down from Unit 2 by the use of the alternate safe shutdown method.

7.11.5 Proposed Modifications

The fire hazards analysis performed revealed that the Unit 1 Control Room is not in compliance with Appendix R. A postulated fire in the Unit 1 Control Room may involve both Unit 1 systems and components and the Unit 2 HSD panel that would affect Unit 2 systems and components. Additional fire protection features will be provided to ensure that fires external to the HSD2 panel do not damage internal wiring and fires internal to the panel do not spread outside.

7.11.5.1 Floor and Ceiling Hatches

Engineering evaluations have been performed justifying the existence of the unrated hatches in the floor and ceiling of the Unit 1 Control Room, Fire Area 53. (See Subsections 9.5 and 9.13.)

7.11.5.2 Connecting Door

Upgrade the common connecting door to a three-hour rating.

7.11.5.3 Hot Shutdown Panel

The hot shutdown panel will be provided with a fire barrier having an equivalence of a three-hour fire rating. The construction of the barrier will be such that access to the panel will not be impeded; however, the barrier will function to prevent fire damage to and from the HSD2 panel.

7.11.6 Conclusion

Based on the previous analysis, an exemption is requested from the requirement that a fixed suppression system be installed in areas where alternate shutdown capability exists as prescribed in Section III.G.3 of Appendix R. The bases that justify the exemption are summarized as follows:

(1) Automatic detection is present in the area of the Unit 2 HSD panel and inside the panel to ensure early warning of a fire in or near the panel.

(2) The hot shutdown panel will be provided with the equivalent of a three-hour fire barrier.

(3) The Control Room is continuously manned and has portable fire protection available.

(4) The fixed combustible loading of the Control Room is under 47,000 Btu/ft^2 for an equivalent fire severity of less than 35 minutes. The fixed combustible loading in the area near the HSD2 is low.

(5) The amount of transient combustibles allowed in the Control Room is extremely low and will be controlled.

(6) The unit has alternate safe shutdown capability from Unit 2.

(7) Subsections 9.5 and 9.13 present the engineering evaluations performed to justify the unrated hatches in the floor and ceiling of Fire Zone 53.

(8) The connecting door between the Unit 1 and Unit 2 Control Rooms will be upgraded to a three-hour-rated fire door.

(9) Installation of a fixed suppression system to meet Section III.G.3 would not enhance fire protection safety above that provided by present commitments.

SUMMARY EVALUATION TABLE 7.11-1

FIRE ZONE: 53

DESCRIPTION: Unit 1 Control Room

EVALUATION PARAMETERS SUMMARY

A. Area Description

1. Construction -

   a. Walls -

      North - reinforced concrete or block; three-hour rating; openings sealed with silicone foam

      South - reinforced concrete or block; three-hour rating; openings sealed with silicone foam

      East - reinforced concrete or block; three-hour rating; openings sealed with silicone foam

      West - reinforced concrete or block; three-hour rating; openings sealed with silicone foam

   b. Floor - reinforced concrete or block; three-hour rating; openings sealed with silicone foam

   c. Ceiling - reinforced concrete or block; three-hour rating; openings sealed with silicone foam

2. Ceiling height - 15 ft 7 in.

3. Area - 4410 ft^2

4. Room volume - 66,150 ft^3

5. Ventilation - 13,000 cfm (normal)
   19,000 cfm (emergency)

6. Access in Zone - Unobstructed

B. Safe Shutdown Equipment

All Control Panels and most Relay Cabinets for Unit 1

C. Fire Hazards

1. Type of combustibles in area -

   Cable insulation
   Cellulosics
   Plastics
   Rubber

2. Total fixed combustible loading considered for the purpose of the analysis - 47,000 Btu/ft^2

3. Actual quantity of fixed combustibles -

   Cable - 38,534,338 Btu

   Cellulosics - 53,359,547 Btu

   Plastics - 30,154,925 Btu

   Rubber - 2,435,040 Btu

   TOTAL - 28,225 Btu/ft^2

D. Existing Fire Protection

1. Fire Detection Systems -

   45 ionization detectors

2. Fire Extinguishing Systems - Manual

   6 - 15 lb CO_2 extinguishers
   1 - BioPac breathing apparatus in Control Room
   5 - BioPacs outside in Turbine Building
   2 - CO_2 hose reels, 100 ft and 150 ft
   2 - water hose reels each with 75 ft 1-1/2 in. hose and adjustable nozzles

7.12 Fire Area 54 Unit 2 Control Room

EXEMPTION REQUEST

> Per the provisions of 10 CFR 50.48(c)(6) and 10 CFR 50.12 Indiana and Michigan Electric Company requests exemption from the specific requirements of Appendix R, Section III.G.3; i.e., a fixed fire suppression system shall be in the area.

7.12.1 Fire Area Description

Fire Area 54 in Unit 2 is equivalent to Fire Area 53 in Unit 1. Fire Area 54 is the Unit 2 Control Room located on elevation 633 ft immediately adjacent to the Control Room. The Unit 2 Control Room contains all the normal control panels for plant operation and most relay instrument cabinets associated with plant control. In addition, the Unit 1 hot shutdown panel (Fire Zone 144) is located in the northwest corner of the Control Room and is approximately 12 ft 6 in. long by 5 ft 1 in. wide. The top of the panel is approximately eight inches from the false ceiling of the Control Room. The hot shutdown panel is of steel construction with a steel door at the front of the panel. Pertinent dimensional data is contained in Fire Area 54 Summary Evaluation Table 7.12-1 and Figure 7.12.

7.12.2 Safe Shutdown Equipment

The Unit 2 Control Room contains the control panels, relay and instrument cabinets and associated paneling for Unit 2. The Unit 1 hot shutdown panel is also in the Control Room.

7.12.3 Fire Protection Systems

Fire Zone 54 has no automatic suppression system. There are 42 ionization detectors located in the Control Room including detection in and around the HSD1 and above the suspended ceiling. Located outside the Control Room are two 1-1/2 in. water hose reels (75 ft each) with adjustable spray nozzles. Inside the Control Room are six 15 lb CO_2 fire extinguishers and one "BioPac" one-hour breathing apparatus. Two CO_2 hose reels (100 ft and 150 ft) are also located outside the fire zone.

7.12.4 Fire Hazards Analysis

The hot shutdown panel is a steel enclosure with steel doors across the front of the panel. No equipment internal to the panel is exposed to the direct effects of any postulated room fire during normal operation because of the normally closed panel door. See Figure 7.12 for a sketch of the panels. The Unit 2 hot shutdown panel is located in the section of the Unit 2 Control Room that houses numerous other control, relay and instrument panels for Unit 2. The Control Room area is protected from other fire zones by three-hour-rated floors, ceilings and walls except for (a) one unrated ceiling hatch, (b) one unrated floor hatch, (c) one undampered ventilation duct, and (d) the unrated common connecting door between the Control Rooms. Three separate engineering evaluations have been done justifying the existing unrated hatch configurations in the ceiling and floor, and the undampered ventilation duct. See Subsections 9.5, 9.17 and 9.2, respectively, for these evaluations. The common connecting door between Control Rooms will be upgraded to three hours. The HSD1 panel was originally installed to comply with the requirements of 10 CFR 50 GDC 19 and is used to provide shutdown from outside the Control Room for Design Basis considerations other than Appendix R fires.

The fixed combustible loading for the entire Control Room is under 47,000 Btu/ft^2 for an equivalent fire severity of under 35 minutes. (The actual combustible loading and equivalent fire severity existing at this time are 30,069 Btu/ft^2 and 22.6 minutes, respectively.) The area near the Unit 1 hot shutdown panel has few exposed cables as the cables enter and exit the panels in the area predominantly through the floor via sealed penetrations. Thus, there is a small quantity of fixed combustibles in the area of the HSD1.

With the exception of small quantities of organic solvent used to service the equipment in the room, no transient combustibles are stored, routed through or used in this section of the Control Room. This low volume of fixed combustibles combined with the minimum volume of transient combustibles used in the area create an extremely low area fire hazard.

In the event of a fire in the Unit 2 Main Control Room, the unit can be safely shut down from Unit 1 by the use of the alternate safe shutdown method.

7.12.5 Proposed Modifications

The fire hazards analysis performed revealed that the Unit 2 Control Room is not in compliance with Appendix R. A postulated fire in the Unit 2 Control Room may involve both Unit 2 systems and components and the Unit 1 HSD panel. Additional fire protection features will be provided to ensure that fires external to the HSD1 do not damage internal wiring and fires internal to the panel do not spread outside.

7.12.5.1 Floor and Ceiling Hatches

Engineering evaluations have been performed justifying the existence of the unrated hatches in the floor and ceiling of the Unit 2 Control Room, Fire Area 54. (See Subsections 9.5 and 9.17.)

7.12.5.2 Connecting Door

Upgrade the common connecting door to a three-hour rating.

7.12.5.3 Ventilation Duct

An engineering evaluation has been performed justifying the existence of the undampered ventilation duct between the Control Room and Fire Zone 73. See Subsection 9.2 for this evaluation.

7.12.5.4 Hot Shutdown Panel

The hot shutdown panel will be provided with a fire barrier having an equivalence of a three-hour fire rating. The construction of the barrier will be such that access to the panel will not be impeded however, the barrier will function to prevent fire damage to and from the HSD1 panel.

7.12.6 Conclusion

Based on the previous analysis, an exemption is requested from the requirement that a fixed suppression system be installed in areas where alternate shutdown capability exists as prescribed in Section III.G.3 of Appendix R. The bases that justify the exemption are summarized as follows:

(1) Automatic detection is present in the area of the Unit 1 HSD panel and inside the panel to ensure early warning of a fire in or near the panel.

(2) The hot shutdown panel will be provided with a fire barrier having the equivalence of a three-hour fire rating.

(3) The Control Room is continuously manned and has portable fire protection available.

(4) The fixed combustible loading of the Control Room is under 47,000 Btu/ft^2 for an equivalent fire severity of less than 35 minutes. The fixed combustible loading in the area near the HSD1 is low.

(5) The amount of transient combustibles allowed in the Control Room is extremely low and will be controlled.

(6) The unit has alternate safe shutdown capability from Unit 1.

(7) Subsections 9.5, 9.17, and 9.2 present the engineering evaluations performed to justify the unrated floor and ceiling hatches and the undampered ventilation duct through the ceiling.

(8) The connecting door between the Unit 1 and Unit 2 Control Rooms will be upgraded to a three-hour-rated fire door.

(9) Installation of fixed suppression systems to meet Section III.G.3 would not enhance fire protection safety above that provided by present commitments.

SUMMARY EVALUATION TABLE 7.12-1

FIRE ZONE: 54

DESCRIPTION: Unit 2 Control Room

EVALUATION PARAMETERS SUMMARY

A. Area Description

1. Construction -

a. Walls -

North - reinforced concrete or block; three-hour rating; openings sealed with silicone foam

South. - reinforced concrete or block; three-hour rating; openings sealed with silicone foam

East - reinforced concrete or block; three-hour rating; openings sealed with silicone foam

West - reinforced concrete or block; three-hour rating; openings sealed with silicone foam

b. Floor - reinforced concrete or block; three-hour rating; openings sealed with silicone foam

c. Ceiling - reinforced concrete or block; three-hour rating; openings sealed with silicone foam

2. Ceiling height - 15 ft 7 in.

3. Area - 4410 ft^2

4. Room volume - 66,150 ft^3

5. Ventilation - 13,000 cfm (normal)
   19,000 cfm (emergency)

6. Access in Zone - Unobstructed

B. Safe Shutdown Equipment

All Control Panels and most Relay Cabinets for Unit 2

C. Fire Hazards

1. Type of combustibles in area -

   Cable insulation
   Cellulosics
   Plastics
   Rubber

2. Total fixed combustible loading considered for the purpose of the analysis - 47,000 Btu/ft^2

3. Actual quantity of fixed combustibles -

   Cable - 54,843,131 Btu

   Cellulosics - 50,875,516 Btu

   Plastics - 26,294,425 Btu

   Rubber - 596,400 Btu

   TOTAL - 30,069 Btu/ft^2

D. Existing Fire Protection

1. Fire Detection Systems -

   41 ionization detectors

2. Fire Extinguishing Systems - Manual

   6 - 15 lb CO_2 extinguishers
   2 - CO_2 hose reels, 100 ft and 150 ft, outside room
   2 - water hose reels each with 75 ft 1-1/2 in. hose and adjustable spray nozzles
   1 - BioPac one-hour breathing apparatus in Control Room
   5 - BioPacs outside in Turbine Building

7.13 Auxiliary Building HVAC Duct Penetrations

EXEMPTION REQUEST

> Per the provisions of 10 CFR 50.48 and 10 CFR 50.12 Indiana and Michigan Electric Company requests exemption from the requirements of Appendix R; i.e., fire-rated dampers shall be installed in the fire area boundaries.

This analysis has been completed to provide technical justification for not installing fire dampers in the ventilation system duct penetrations that communicate between fire areas vertically from elevation to elevation. The ventilation ducts associated with the 22 penetrations were located on HVAC drawings showing the entire flow path of each duct. Penetrations into zones/areas equipped with rated fire dampers were eliminated and what remained is depicted on Figures 7.13-1 through 7.13-8.

The registers in the remaining ducts were located with the direction of the arrows on each defining whether it is supply () or exhaust (). Each figure represents the elevations of the Auxiliary Building showing both units. The circled numbers on the figures represent fire zones/areas found and the numbers next to the arrows indicate the register number found in corresponding Tables 7.13-1 through 7.13-6. Only the fire zones/areas containing the ducting of concern are represented on the figures. The figures are letter-coded to identify the fire area involved and defined at the boundaries with the unique markings. For detailed boundaries of each fire area or zone and specific general arrangement drawings, refer to Section 2, Figures 2.1 through 2.11 of this report. Figures 7.13-1 through 7.13-8 are meant to indicate the presence of the duct or register in a fire zone/area and not to provide specific locations within the zone/area. Tables 7.13-1 through 7.13-6 identify the specific American Electric Power Service Corporation HVAC drawing number and drawing coordinates to locate the registers.

The 22 duct penetrations and associated registers were evaluated individually as depicted on the figures. The registers within a zone/area were evaluated with respect to safe shutdown component and circuit locations. The March 1983 submittal considered fire damage to safe shutdown systems, components and circuits within areas and zones. This same information will be utilized, as appropriate to resolve issues arising from the register locations within a fire zone/area. The general approach was to 1) consider the effect on Section III.G.2 compliance; i.e., evaluate the damage to redundant safe shutdown equipment and/or circuits, and 2) consider the effect on Section III.G.3; i.e., evaluate damage to alternate shutdown equipment and/or circuits. Thus, where an individual duct communicated with different zones or areas, the duct penetrations and registers were evaluated to determine the impact on the two cases just described. Both cases consider area/zone communication between elevations and at the fire area/zone boundaries where the duct penetration was not provided with a fire damper. The impact of ducts and registers on safe shutdown also considers the location of suppression and detection systems, the amount of combustible material in the zone/area, and particularly the provided method of safe shutdown as described in the March 1983 submittal.

The stairways communicating between elevations have been provided with automatic suppression systems to maintain elevations as separate fire areas. The mechanical and electrical ceiling/floor penetrations are being provided with seals in accordance with the March 1983 submittal.

The combustible loading values and surface areas presented are given for the entire fire area. Plant walkdowns have been performed and physical raceway location drawings have been evaluated to determine that the combustible loading in the fire areas evaluated is uniformly distributed through the area. Fire areas containing concentrated combustibles will be specifically discussed in the evaluation of the area.

Evaluation of Figure 7.13-1

The exhaust duct represented on this figure is designed to remove warm air from various areas of Unit 1 and discharges to the air shaft at the north end of Fire Zone 44. This figure shows two duct penetrations (30 in. x 26 in. and 72 in. x 30 in.). The following summary tables provide the fire protection features and safe shutdown compliance methods for the zones/areas of concern.

o Fire protection features

Fire Area/Zone	Detection	Suppression
1	Ionization Detectors	Automatic Suppression System in Stairway only
6N	Ionization Detectors	Automatic Preaction Sprinkler
6M	Ionization Detectors	Automatic Preaction Sprinkler
44N	Ionization Detectors	Automatic Preaction Sprinkler

o Safe shutdown compliance methods

Fire Area/Zone	Compliance Methods
1	Cables required for safe shutdown are being provided with fire wrapping.
6M	One division of redundant safe shutdown cables for each unit is being provided with fire wrapping.
6N	Modifications are being implemented to provide alternative shutdown capability.
44N	Modifications are being implemented to provide alternative shutdown capability.

As shown in Figure 7.13-1, the air shaft extends up to the 633 ft elevation where the exhaust fans, creating a negative pressure in the air shaft, expel the warm air to the atmosphere. Fire Zone 1, on the 573 ft elevation, is a portion of Fire Area A that also contains Fire Zones 1A through 1H, 136, 137, 138A, 138B, and 138C. The safe shutdown components within this area (RHR pumps and associated cables) will be protected from fire as defined in the March 1983 submittal. The ventilation duct registers in this area, as shown on Figure 7.13-1, are located within the north section of Fire Zone 1, which only contains RHR pump cables. The cables within Fire Zone 1 required for safe shutdown (RHR pump power cables) are being provided with fire wrapping and thus would not be affected by hot gases or combustion products from the ventilation registers in this fire zone. In addition, the fire area has a fixed combustible loading of under 20,000 Btu/ft^2 with an equivalent fire severity of less than 15 minutes. (The actual combustible loading and equivalent fire severity existing at this time are 4079 Btu/ft^2 and 2.9 minutes, respectively.) The area also contains automatic detection within each fire zone. The mechanical and electrical penetrations through the ceiling to the 587 ft elevation are sealed including the 30 in. x 26 in. ventilation duct exiting Fire Zone 1 into Fire Zone 6N.

Fire Zone 6N contains the duct penetrating from below as shown in Figure 7.13-1. Fire Zone 6N on the 587 ft elevation is a portion of Fire Area B, which also contains Fire Zones 6A, 6M, 6S, 5, 61, 64A, 64B, 65A and 65B. Fire Zone 6N contains motor control centers as well as various redundant safe shutdown system component cables for Unit 1. However, Fire Zone 6N, as described in the March 1983 submittal, will be provided with alternate shutdown capability. The zone is also equipped with automatic suppression and detection (enhanced since March 1983 submittal). Fire Area B has a fixed combustible loading of under 27,000 Btu/ft^2 with an equivalent fire severity of less than 20 minutes. (The actual combustible loading and equivalent fire severity existing at this time are 8947 Btu/ft^2 and 6.5 minutes, respectively.) The automatic suppression system for Fire Area B contains approximately 168 sprinkler heads that provide coverage for approximately 23,600 ft^2. Five of the sprinkler heads are located within a ten foot cylindrical radius of the duct penetration through the floor and additional sprinklers are located in the vicinity of the registers and remaining duct work. The fire area also contains approximately 36 ionization type detectors. The registers in the area with the exception of register 5 are all located in the north section (Fire Zone 6N). Register 5 is located in fire Zone 6M, which contains redundant safe shutdown circuits and that has been provided with fire wrapping protection of one redundant division for each unit as described in the March 1983 submittal. Fire Zone 6M is also provided with automatic suppression and detection. These systems in concert with installed fire wrapping provide adequate protection from hot gases and combustion products potentially transmitted through the ventilation system. Fire Zone 6N is provided with seals in the mechanical and electrical ceiling penetrations to the 609 ft elevation, including the ventilation duct exiting into Fire Zone 44N.

Fire Zone 44N, located on the 609 ft elevation, is a part of the Fire Area C, which also contains Fire Zones 43, 44S, 44A through 44H, and 37. Fire Zone 44N contains motor control centers and various redundant cables of systems required for safe shutdown. As indicated on Figure 7.13-1, all the registers are located in the north end. The large duct (72 in. x 30 in.) penetrating the floor from the 587 ft elevation has seven sprinkler heads at the 609 ft elevation within a ten-foot cylindrical radius of the penetration. In total, Fire Area C has a fixed combustible loading of under 47,000 Btu/ft^2 with an equivalent fire severity of 35 minutes. (The actual combustible loading and equivalent fire severity existing at this time are 34,482 Btu/ft^2 and 25.8 minutes, respectively.) Fire Area C contains approximately 240 sprinkler heads covering an area of approximately 26,261 ft^2. The area also contains approximately 30 ionization type detectors. Adequate coverage for the duct and the registers is provided by these fire protection devices to ensure adequate protection from hot gases and combustible products potentially transmitted through the ventilation system. In addition, Fire

Zone 44N will be provided with alternate shutdown capability. As indicated in Table 5-2 in Section 5 of the March 1983 submittal, both Fire Zones 6N and 44N have the same systems and components potentially affected. Thus the communication of the two zones does not affect the compliance strategy nor the safe shutdown capability.

Evaluation of Figure 7.13-2

Figure 7.13-2 has a similar duct configuration as Figure 7.13-1, but represents Unit 2. This figure represents two duct penetrations (25 in. x 28 in. and 36 in. x 24 in.). The following summary tables provide the fire protection features and safe shutdown compliance methods for the zones/areas of concern.

- Fire protection features

Fire Area/Zone	Detection	Suppression
1	Ionization Detectors	Automatic Suppression in the Stairway only
6S	Ionization Detectors	Automatic Preaction Sprinkler
6M	Ionization Detectors	Automatic Preaction Sprinkler
44S	Ionization Detectors	Automatic Preaction Sprinkler

- Safe shutdown compliance methods

Fire Area/Zone	Compliance Methods
1	Cables required for safe shutdown are being provided with fire wrapping.
6S	Modifications are being implemented to provide alternative shutdown capability.
6M	One division of redundant safe shutdown cables for each unit is being provided with fire wrapping.
44S	Modifications are being implemented to provide alternative shutdown capability.

The fire zones are located within the fire areas previously described in the Figure 7.13-1 evaluation, so combustible loadings and fire severities are the same. The 573 ft elevation is the same as the Unit 1 side, including the cable and component configuration. The HVAC system configuration on the 587 ft elevation is similar to Unit 1. Fire Zone 6S will be provided with alternate shutdown capability and compliance in Fire Zone 6M is described in the Figure 7.13-1 evaluation.

The penetration through the floor to the 587 ft elevation within Fire Zone 6S has one sprinkler head to provide water suppression in the immediate vicinity of the vertical run. The penetration area of the 36 in. x 24 in. duct is protected by four sprinkler heads in Fire Zone 44S within a ten foot cylindrical radius of the duct to prevent duct related fire damage. Also, Fire Zone 44S will be provided with alternate shutdown capability with the exception of the component cooling water pumps that, as described in the March 1983 submittal, are protected to ensure the availability of at least two CCW pumps for safe shutdown.

Evaluation of Figure 7.13-3

Figure 7.13-3 has a similar configuration as Figure 7.13-2, but this figure represents a single duct with two penetrations (each 44 in. x 24 in.). The following summary tables provide the fire protection features and safe shutdown compliance methods for the zones/areas of concern.

o Fire protection features

Fire Area/Zone	Detection	Suppression
6S	Ionization Detectors	Automatic Preaction Sprinkler
44S	Ionization Detectors	Automatic Preaction Sprinkler
52	Ionization Detectors	Automatic Preaction Sprinkler

o Safe shutdown compliance methods

Fire Area/Zone	Compliance Methods
6S	Modifications are being implemented to provide alternative shutdown capability.
44S	Modifications are being implemented to provide alternative shutdown capability.
52	Modifications are being implemented to provide alternative shutdown capability.

The duct is part of the supply ventilation system coming from the 633 ft elevation down to the 587 ft elevation. As indicated on Figure 7.13-3, one register is on the 587 ft elevation in Fire Zone 6S. The shutdown method, fire protection features and combustible loading are described in the Figure 7.13-3 evaluation for this zone. The penetration in the ceiling of Fire Zone 6S is protected by two sprinkler heads located in the 587 ft elevation within a ten foot cylindrical radius of the duct penetration. The duct from the floor to the ceiling within Fire Zone 44S is continuous with no register openings. Additional protection is provided by at least five sprinkler heads in the immediate vicinity of the duct in Fire Zone 44S. The duct penetrating into the 633 ft elevation has a register opening in the south end of Fire Zone 52, which is part of Fire Area D. The penetration through the floor into Fire Zone 52 has six sprinkler heads within a ten-foot cylindrical radius of the duct. Fire Zone 52 has alternate shutdown provisions for the main steam system located outside Fire Area D, while all other safe shutdown systems within Fire Area D have at least one redundant train located outside the area. Cold shutdown systems require manual operation of valves that are also located outside of the area. Fire Area D has a fixed combustible loading of under 47,000 Btu/ft^2 with an equivalent fire severity of less than 35 minutes. (The actual combustible loading and equivalent fire severity existing at this time are 30,778 Btu/ft^2 and 23 minutes, respectively.) Fire Area D is equipped with automatic fire suppression and detection and contains approximately 222 sprinkler heads in Fire Zone 52 and approximately 87 sprinkler heads in Fire Zone 51. Fire Area D has 39 ionization detectors, including 17 in Fire Zone 52. The charcoal filter units in Fire Area D are each protected by a manual deluge system. A thermistor circuit in each charcoal filter unit provides alarm annunciation in its associated Control Room.

Evaluation of Figure 7.13-4

Figure 7.13-4 represents one duct penetration (30 in. x 24 in.) and is similar to Figures 7.13-2 and 7.13-3. The exhaust duct shown communicates with Fire Zones 6S and 44S, and is ducted to the air shaft in the extreme south end of Fire Zone 44S. The duct in Fire Zone 6S has register openings, but is continuous with no register openings within Fire Zone 44S and is adjacent to the duct described in Figure 7.13-3. The sprinkler head arrangement is identical for both the ducts located at Fire Zone 44S as shown in Figures 7.13-3 and 7.13-4; therefore, the evaluation performed in Figure 7.13-3 applies to Figure 7.13-4.

For fire protection features and safe shutdown capability compliance methods, refer to the section concerning Fire Areas/Zones 6S and 44S.

Evaluation of Figure 7.13-5

Figure 7.13-5 represents two duct penetrations of the same size (52 in. x 24 in.) that communicate with Fire Zones 6N and 44N. The following summary tables provide the fire protection features and safe shutdown compliance methods for the zones/areas of concern.

- Fire protection features

Fire Area/Zone	Detection	Suppression
6N	Ionization Detectors	Automatic Preaction Sprinkler
44N	Ionization Detectors	Automatic Preaction Sprinkler

o Safe shutdown compliance methods

Fire Area/Zone	Compliance Methods
6N	Modifications are being implemented to provide alternative shutdown capability.
44N	Modifications are being implemented to provide alternative shutdown capability.

The explanation of safe shutdown, fire protection features, and combustible loadings are contained in the evaluation of Figure 7.13-1. The ducts shown are parallel to each other. The penetrations through the ceiling of Fire Zone 6N are protected by two sprinkler heads within a 16 foot cylindrical radius of the ducts. These ducts, as shown in Figure 7.13-5, are continuous in Fire Zone 44N with no register openings. Additional protection of the duct penetration is provided by two sprinkler heads each over the penetration from Fire Zone 44N into the supply air plenum.

Evaluation of Figure 7.13-6

Figure 7.13-6 represents one duct penetration (34 in. x 30 in.). The duct, as indicated on Figure 7.13-6, enters the auxiliary cable vault in Unit 2 that is equipped with a rated fire damper. The duct continues from the auxiliary cable vault to Fire Zone 52 that is also equipped with a fire damper. For fire protection features and safe shutdown capability compliance methods refer to the previous section concerning Fire Zones 6S, 44S and 52. The duct penetration at the 609 ft elevation is protected by the presence of three sprinkler heads within a 10-ft cylindrical radius on the 6S side and two on the 44S side.

Evaluation of Figures 7.13-7 and 7.13-8

Figures 7.13-7 and 7.13-8 represent a total of 12 duct penetrations (four 45 in. x 35 in., two 40 in. x 40 in., two 36 in. x 36 in., two 22 in. x 34 in. and two 28 in. x 34 in.), with Unit 2 being a mirror image of Unit 1 and each unit containing six duct penetrations. The following summary tables provide the fire protection features and safe shutdown compliance methods for the zones/areas of concern.

- Fire protection features

Fire Area/Zone	Detection	Suppression
49	Ionization detectors and Thermistors for charcoal filter unit	Automatic deluge for charcoal filter unit
50	Ionization detectors and Thermistors for charcoal filter unit	Automatic deluge for charcoal filter unit
69	Ionization detectors and Thermistors for HVAC units	Automatic deluge for charcoal filter unit

- o Safe shutdown compliance methods

Fire Area/Zone	Compliance Methods.
49	At least one redundant division of safe shutdown cables is located outside the fire area
50	At least one redundant division of safe shutdown cables is located outside the fire area
69 including the HVAC vestibules on the 650 ft elevation	The locations contain no safe shutdown systems, components or cables.

There are no registers or openings in the ducts shown on Figures 7.13-7 and 7.13-8; however, they do communicate from Fire Area D in Zones 49 (Unit 1) and 50 (Unit 2) to Fire Zone 69 including the HVAC vestibules at the 650 ft elevation. Fire Zones 49 and 50, as part of Fire Area D, have been analyzed for safe shutdown with the Section III.G.2 compliance methods presented in the March 1983 submittal. Fire Zone 69, including the HVAC vestibules on the 650 ft elevation and the area in which they are contained, has no safe shutdown equipment or circuits located in them. Fire Areas D and E were combined for the purposes of this analysis. Because Fire Area E has a fixed combustible loading of under 20,000 Btu/ft^2 with an equivalent fire severity of less than 15 minutes (the actual combustible loading and equivalent fire severity existing at this time are 2998 Btu/ft^2 and 2.2 minutes, respectively) and contains no safe shutdown components or circuits, the combination of these areas does not change the method of safe shutdown for Fire Area D.

Conclusions for Ventilation Duct Penetration Evaluation

This analysis has been completed to provide technical justification for not installing fire dampers in the ventilation system duct penetrations that communicate between fire areas vertically from elevation to elevation. The fire protection features, e.g., suppression and detection systems and/or the low combustible loadings within these areas, provide adequate assurance that fire damage related to ventilation ducting will not impair safe shutdown capability. The major emphasis, however, should be placed on the method of compliance and safe shutdown for each of the fire zones/areas involved. The center line fire zones on the 587 ft and 609 ft elevations will be provided with fire wrapping for safe shutdown circuits. The north and south portions of both elevations are being modified to provide alternate safe shutdown capability. Elevations 587, 609 and 633 have been modified to provide additional automatic suppression coverage. Also, the registers between and within elevations have been evaluated and determined not to communicate between redundant safe shutdown components or circuits.

A single fire starting in one of the fire areas of concern that is communicating through vertical undampered ducts would not affect safe shutdown capability. The technical bases for this analyses is summarized below:

(1) Existing suppression systems in areas/zones that are provided with automatic suppression systems will extinguish the postulated fire and fire will not propagate outside of the area/zone.

(2) Combustible loading contained in the fire areas/zones of concern is under 47,000 Btu/ft^2.

(3) In fire areas/zones that are not provided with automatic suppression systems, the required safe shutdown components and/or cables are being protected.

(4) A fire starting in an area could be assumed to propagate to the adjacent area through vertical undampered duct penetrations. However, safe shutdown outside of these areas still can be achieved using the unaffected train or alternate safe shutdown method.

In conclusion, this analysis verifies that the safe shutdown system requirements relative to the guidelines of Appendix R are being met and the exemption from installation of fire dampers in the ventilation ducts is justified. In addition, this exemption request has no impact on the exemption requests contained in Subsections 7.2 and 7.10 of this report.

TABLE 7.13-1

AIR REGISTER LOCATION

AIR REGISTER NUMBER	LOCATION		DRAWING NUMBER
	AREA	COORDINATES	
1	Reactor Coolant Drain Tank Pump	WL-4.5 & W of WL-M	12-5713-4
2	Pipe Tunnel	WL-4.7 & W of WL-M	12-5713-4
3	Drain Tank and Pump	WL-5.3 & W of WL-M	12-5713-4
4	Sump Pump Room	WL-4.5 & E of WL-L	12-5713-4
5	Reactor Coolant Filter Unit 1	WL-5.5 & WL-M	12-5715-10
6	Valve Operating Gallery	WL-3.6 & WL-K	12-5715-10
7	Boric Acid Evaporating Room	WL-4 & WL-K	12-5715-10
8	Seal Water Injection Area	WL-4.5 & W of WL-M	12-5715-10
9	Pipeway	WL-4.5 & WL-M	12-5715-10
10	Gas Decay Tank Room	WL-4.8 & W of WL-L	12-5715-10
11	Tunnel, Elevation 601 ft	WL-5 & W of WL-L	12-5715-10
12	Volume Control Tank	WL-5 & E of WL-L	12-5717-7
13	Concentrate Holding Tank	WL-5.2 & WL-K	12-5717-7
14	Waste Gas Compressor Room	WL-4.4 & E of WL-K	12-5717-7
15	Concentrate Holding Tank	WL-5.2 & WL-K	12-5717-7

TABLE 7.13-2

AIR REGISTER LOCATION

AIR REGISTER NUMBER	LOCATION		DRAWING NUMBER
	AREA	COORDINATES	
1	Pipe Tunnel	WL-7.5 & WL-M	12-5713-4
2	Reactor Coolant Drain Tank	Wl-7.3 & WL-M	12-5713-4
3	Sump Pump & Tank	WL-7 & WL-M	12-5713-4
4	Pipeway	WL-8 & WL-M	12-5715-10
5	Seal Water Injection Filters	WL-8 & WL-M	12-5715-10
6	Reactor Coolant/Seal Water Filter	WL-6.4 & WL-M	12-5715-10
7	Monitor Tank Area	WL-8.4 & WL-M	12-5717-7
8	Monitor Tank Area	WL-8 & WL-M	12-5717-7
9	Monitor Tank Area	WL-7.6 & WL-M	12-5717-7
10	Monitor Tank Area	WL-7.3 & WL-M	12-5717-7
11	Volumn Control Tank Area	WL-7 & E of WL-M	12-5717-7
12	Seal Water Heat Exchanger Area	WL-7 & E of WL-M	12-5717-7

TABLE 7.13-3

AIR REGISTER LOCATION

AIR REGISTER NUMBER	LOCATION		DRAWING NUMBER
	AREA	COORDINATES	
1	Behind MCC's on Elevation 587	WL-8 & E of WL-M	12-5715-10
2	Elevation 633 ft Unit 2 Side	WL-8.2 & W of WL-M	12-5719-7

TABLE 7.13-4

AIR REGISTER LOCATION

AIR REGISTER NUMBER	LOCATION		DRAWING NUMBER
	AREA	COORDINATES	
1	Valve Gallery Pipe Tunnel	WL-7 & W of WL-L	12-5715-10
2	Gas Decay Tank Room	WL-7 & W of WL-L	12-5715-10
3	Boric Acid Evaporator	WL-8 & WL-K	12-5715-10
4	Valve Operating Gallery	WL-8.5 & WL-K	12-5715-10

TABLE 7.13-5

AIR REGISTER LOCATION

AIR REGISTER NUMBER	LOCATION AREA	LOCATION COORDINATES	DRAWING NUMBER
1	CVCS Facility	WL-4.4 & WL-L	12-5715-10
2	CVCS Facility	WL-4.4 & WL-L	12-5715-10

TABLE 7.13-6

AIR REGISTER LOCATION

AIR REGISTER NUMBER	LOCATION		DRAWING NUMBER
	AREA	COORDINATES	
1	Monitor Pumps	WL-8 & WL-L	12-5715-10

7.14 Containment Building Seismic Gaps

EXEMPTION REQUEST

> Per the provisions of 10 CFR 50.48 and 10 CFR 50.12 Indiana and Michigan Electric Company requests exemption from the requirements of Appendix R; i.e., fire-rated seals shall be installed in the seismic gap penetrations around the Containment Buildings.

A seismic gap exists around the Containment Building of each unit that provides an opening of approximately 6 inches between the Containment Building and the walls, ceilings and floors of the structures immediately adjacent to containment. The March 1983 submittal did not address the seismic gap when fire area boundaries were defined. Thus, this evaluation has been performed to confirm that these seismic gaps in the fire boundaries do not affect safe shutdown capability.

The fire areas and zones adjacent to the perimeter of containment that contain seismic gaps are the following:

Fire Areas as Presented by Table 7.14-1-1

Fire Area	Description	Elevation
7	Quadrant 1 Cable Tunnel	596 ft
8	Quadrant 4 Cable Tunnel	596 ft
10	Quadrant 3M Cable Tunnel	596 ft
11	Quadrant 3S Cable Tunnel	596 ft
38	Quadrant 2 Cable Tunnel	612 ft

Fire Areas as Presented by Table 7.14-1-2

Fire Area	Description	Elevation
23	Quadrant 3N Cable Tunnel	596 ft
24	Quadrant 3M Cable Tunnel	596 ft
26	Quadrant 4 Cable Tunnel	596 ft
27	Quadrant 1 Cable Tunnel	596 ft
39	Quadrant 2 Cable Tunnel	612 ft

Fire Areas/Zones as Presented by Table 7.14-2-1

Fire Area/ Zone	Description	Elevation
33B	NESW Valve Area	612 ft
12	Quadrant 2 Piping Tunnel	596 ft
49	HVAC Vestibule	633 ft
69	Auxiliary Building	650 ft
108	West Steam Valve Enclosure	612 ft

Fire Areas/Zones as Presented by Table 7.14-2-2

Fire Area/ Zone	Description	Elevation
34B	NESW Valve Area	612 ft
22	Quadrant 2 Piping Tunnel	596 ft
50	HVAC Vestibule	633 ft
69	Auxiliary Building	650 ft
109	West Steam Valve Enclosure	612 ft

The March 1983 submittal, the primary source of information for this analysis, contains additional information on the fire area and zone descriptions. The attached tables (7.14-1-1, 7.14-1-2, 7.14-2-1, 7.14-2-2) provide a summary of the evaluations performed on the areas or zones affected by seismic gaps.

The general methodology used was to evaluate the area/zone of concern in concert with the adjacent areas/zones on the left, right, and immediately above. The new area defined by this method (seismic gap evaluation area) was analyzed to determine the impact on safe shutdown components and circuits. Four fire areas, as previously defined in the March 1983 submittal, contain multiple zones within the area and are part of this analysis.

The seismic gap evaluation areas only considers the zone or area immediately adjacent to the postulated fire area. This configuration assumes the seismic gap will allow communication between adjacent areas or zones. Due to distance, low combustible loading, location of combustibles and/or presence of detection and suppression systems the affect of the fire will not involve <u>all</u> areas and zones that communicate by seismic gaps.

Fire Zones 33 and 33A were not considered within the seismic gap evaluation as they are only adjacent to each other and Fire Zone 33B. Fire Zones 33, 33A and 33B were evaluated as one area in the March 1983 submittal. Fire Zone 33B is considered in this evaluation and includes Fire Zone 33A as part of the seismic gap evaluation area. The mirror image zones (34, 34A, 34B) in Unit 2 were considered in a similar manner. The communication between Fire Zones 49 and 50 is through Fire Zone 52 separated by over 150 feet. Fire Zone 51 is adjacent to 52. Fire Zones 49 (Unit 1) and 50 (Unit 2) are the only zones within the area that contain seismic gaps at the containment wall. The communication between Fire Zones 49 and 50 within this area was evaluated in the March 1983 submittal. Fire Zone 52 is provided with automatic suppression and detection and thus provides adequate assurance that either a fire or related combustion products would be contained within Fire Zone 49 (the same configuration exists for Fire Zone 50). The fire area containing zones 3, 32, 36, 69, and 48 contain no safe shutdown equipment and could have been included into a larger area but to minimize the size of fire areas these fire zones are considered as one area.

The compliance strategies (i.e., safe shutdown method) for each area or zone are maintained and used throughout the evaluation while taking into account additional considerations such as:

(1) Distance between fire zones/areas

(2) Location of combustibles

(3) Combustible loading

(4) Detection and suppression systems

Evaluation of Tables 7.14-1-1 and 7.14-1-2

Five previously defined fire areas in each unit have automatic CO_2 suppression and detection systems in the area. These areas are listed in Tables 7.14-1-1 and 7.14-1-2. The walls, floors, and ceilings of the ten areas (including both units) are constructed to at least a 1-1/2-hour fire rating. A seal in the seismic gaps provides a barrier for containing the gaseous suppression system. The seal is affixed to both the containment wall and the floor, ceiling or wall of the perimeter buildings. The seal is made of glass fiber reinforced silicone sheeting and is a fire retardant material.

A fire originating within the areas containing automatic suppression would stay confined to that area and be extinguished by the automatic suppression system. Thus, each of these ten areas was evaluated as an isolated area based on the assumption that the fire within the areas containing suppression systems would be contained and extinguished in the area.

Evaluation of Tables 7.14-2-1 and 7.14-2-2

Evaluations of areas or zones that were not equipped with automatic suppression systems considered the seal damaged in adjacent areas/zones (left, right and above), including those containing automatic suppression. Each newly defined evaluation area was analyzed on a safe shutdown system basis with the results presented in the system evaluation column in Tables 7.14-2-1 and 7.14-2-2. The areas and/or zones of concern that do not have automatic suppression systems have low combustible loadings and within the immediate vicinity of the seismic gaps are generally void of exposed fixed combustibles.

The zones/areas of concern are presented in Tables 7.14-2-1 and 7.14-2-2. Excluding the areas containing automatic suppression from the postulated fire location, the following combinations of areas/zones are evaluated:

Unit 1 Postulated Fire Locations and Associated Zones/Areas

1. 33B with 33A, 38 and 108
2. 12 with 7, 11, 33B and 38
3. 49 with 69 and 108
4. 69 with 108
5. 108 with 49 and 69

Unit 2 Postulated Fire Locations and Associated Zones/Areas

1. 34B with 34A, 39 and 109
2. 22 with 27, 23, 34B and 39
3. 50 with 69 and 109
4. 69 with 109
5. 109 with 50 and 69

Tables 7.14-2-1 and 7.14-2-2 present the results of the system evaluation for each postulated fire location.

Conclusion for Containment Seismic Gap Evaluation

This seismic gap evaluation shows the safe shutdown capability for D.C. Cook Nuclear Plant (Units 1 and 2) has not been compromised as a result of seismic gaps. The analysis performed and the results presented in the tables indicate, on a system basis, the capability to safely shut down both units when considering fire damage to safe shutdown components and circuits contained in the seismic gap evaluation areas. The method of analysis is conservative when considering the fire hazards involved in the vicinity of the seismic gaps. That is, it is not anticipated that the evaluated areas would be affected to the extent that fire would propagate through the seismic gaps and cause damage throughout the evaluation area. Combustion products would likely enter the adjacent areas or zones; however, damage to safe shutdown components and circuits would likely not occur.

In any event, the analysis contained herein assumes the damage to safe shutdown components and circuits in the seismic gap evaluation area did occur and verifies that safe shutdown capability is maintained. In addition, this exemption request has no impact on the exemption requests contained in Subsections 7.8, 7.9, or 7.13 of this report.

TABLE 7.14-1-1

UNIT 1 FIRE AREAS/ZONES PROTECTED BY AUTOMATIC CO_2 SUPPRESSION

FIRE AREA*	COMBUSTIBLE LOADING (BTU/FT^2)	AREA (FT^2)	EQUIVALENT FIRE SEVERITY (MIN)**	SUPPRESSION	DETECTION	COMMENT
7	116,629	960	100 (88)	CO_2 AUTOMATIC	IONIZATION AND INFRARED TYPES	EXISTING AUTOMATIC CO_2 SUPPRESSION SYSTEM WILL EXTINGUISH ANY POSTULATED FIRE IN THE AREA/ ZONE AND THE FIRE WILL NOT PROPAGATE OUTSIDE OF THE AREA/ZONE THROUGH SEISMIC GAPS. THE PREVIOUS SAFE SHUTDOWN CAPABILITY COMPLIANCE METHODS STILL APPLY.
8	30,841	2,050	35 (23.1)	CO_2 AUTOMATIC	IONIZATION AND INFRARED TYPES	EXISTING AUTOMATIC CO_2 SUPPRESSION SYSTEM WILL EXTINGUISH ANY POSTULATED FIRE IN THE AREA/ ZONE AND THE FIRE WILL NOT PROPAGATE OUTSIDE OF THE AREA/ZONE THROUGH SEISMIC GAPS. THE PREVIOUS SAFE SHUTDOWN CAPABILITY COMPLIANCE METHODS STILL APPLY.
10	104,250	800	90 (78.3)	CO_2 AUTOMATIC	IONIZATION AND INFRARED TYPES	EXISTING AUTOMATIC CO_2 SUPPRESSION SYSTEM WILL EXTINGUISH ANY POSTULATED FIRE IN THE AREA/ ZONE AND THE FIRE WILL NOT PROPAGATE OUTSIDE OF THE AREA/ZONE THROUGH SEISMIC GAPS. THE PREVIOUS SAFE SHUTDOWN CAPABILITY COMPLIANCE METHODS STILL APPLY.
11	26,344	840	30 (19.7)	CO_2 AUTOMATIC	IONIZATION AND INFRARED TYPES	EXISTING AUTOMATIC CO_2 SUPPRESSION SYSTEM WILL EXTINGUISH ANY POSTULATED FIRE IN THE AREA/ ZONE AND THE FIRE WILL NOT PROPAGATE OUTSIDE OF THE AREA/ZONE THROUGH SEISMIC GAPS. THE PREVIOUS SAFE SHUTDOWN CAPABILITY COMPLIANCE METHODS STILL APPLY.
38	41,288	2,650	45 (31)	CO_2 AUTOMATIC	IONIZATION AND INFRARED TYPES	EXISTING AUTOMATIC CO_2 SUPPRESSION SYSTEM WILL EXTINGUISH ANY POSTULATED FIRE IN THE AREA/ ZONE AND THE FIRE WILL NOT PROPAGATE OUTSIDE OF THE AREA/ZONE THROUGH SEISMIC GAPS. THE PREVIOUS SAFE SHUTDOWN CAPABILITY COMPLIANCE METHODS STILL APPLY.

*FIRE AREAS AS DEFINED IN SAFE SHUTDOWN CAPABILITY ASSESSMENT OF MARCH 1983 SUBMITTAL
**FIRE SEVERITY VALUES ARE ASSUMED AND (ACTUAL)

TABLE 7.14-1-2

UNIT 2 FIRE AREAS/ZONES PROTECTED BY AUTOMATIC CO_2 SUPPRESSION

FIRE AREA*	COMBUSTIBLE LOADING (BTU/FT^2)	AREA (FT^2)	EQUIVALENT FIRE SEVERITY (MIN)**	SUPPRESSION	DETECTION	COMMENT
27	85,009	1,056	75 (63.9)	CO_2 AUTOMATIC	IONIZATION AND INFRARED TYPES	EXISTING AUTOMATIC CO_2 SUPPRESSION SYSTEM WILL EXTINGUISH ANY POSTULATED FIRE IN THE AREA/ ZONE AND THE FIRE WILL NOT PROPAGATE OUTSIDE OF THE AREA/ZONE THROUGH SEISMIC GAPS. THE PREVIOUS SAFE SHUTDOWN CAPABILITY COMPLIANCE METHODS STILL APPLY.
26	21,086	2,746	25 (15.9)	CO_2 AUTOMATIC	IONIZATION AND INFRARED TYPES	EXISTING AUTOMATIC CO_2 SUPPRESSION SYSTEM WILL EXTINGUISH ANY POSTULATED FIRE IN THE AREA/ ZONE AND THE FIRE WILL NOT PROPAGATE OUTSIDE OF THE AREA/ZONE THROUGH SEISMIC GAPS. THE PREVIOUS SAFE SHUTDOWN CAPABILITY COMPLIANCE METHODS STILL APPLY.
24	78,083	800	70 (58.7)	CO_2 AUTOMATIC	IONIZATION AND INFRARED TYPES	EXISTING AUTOMATIC CO_2 SUPPRESSION SYSTEM WILL EXTINGUISH ANY POSTULATED FIRE IN THE AREA/ ZONE AND THE FIRE WILL NOT PROPAGATE OUTSIDE OF THE AREA/ZONE THROUGH SEISMIC GAPS. THE PREVIOUS SAFE SHUTDOWN CAPABILITY COMPLIANCE METHODS STILL APPLY.
23	28,716	840	35 (21.5)	CO_2 AUTOMATIC	IONIZATION AND INFRARED TYPES	EXISTING AUTOMATIC CO_2 SUPPRESSION SYSTEM WILL EXTINGUISH ANY POSTULATED FIRE IN THE AREA/ ZONE AND THE FIRE WILL NOT PROPAGATE OUTSIDE OF THE AREA/ZONE THROUGH SEISMIC GAPS. THE PREVIOUS SAFE SHUTDOWN CAPABILITY COMPLIANCE METHODS STILL APPLY.
39	30,622	2,667	35 (23)	CO_2 AUTOMATIC	IONIZATION AND INFRARED TYPES	EXISTING AUTOMATIC CO_2 SUPPRESSION SYSTEM WILL EXTINGUISH ANY POSTULATED FIRE IN THE AREA/ ZONE AND THE FIRE WILL NOT PROPAGATE OUTSIDE OF THE AREA/ZONE THROUGH SEISMIC GAPS. THE PREVIOUS SAFE SHUTDOWN CAPABILITY COMPLIANCE METHODS STILL APPLY.

*FIRE AREAS AS DEFINED IN SAFE SHUTDOWN CAPABILITY ASSESSMENT OF MARCH 1983 SUBMITTAL
**FIRE SEVERITY VALUES ARE ASSUMED AND (ACTUAL)

TABLE 7.14-2-1

UNIT 1 FIRE AREAS/ZONES OF CONCERN

SEISMIC GAP EVALUATION AREA							
POSTULATED FIRE LOCATION	ADJACENT AREA/ZONE OF CONCERN	COMBUSTIBLE LOADING (BTU/FT^2)	AREA (FT^2)	EQUIVALENT FIRE SEVERITY (MIN)**	SUPPRESSION	DETECTION	SYSTEM EVALUATION
33B*		236	600	10 (0.2)	NONE	NONE	FIRE ZONES 33B, 33A, 38, 108 AND 49 ARE COMBINED AS ONE AREA FOR THIS SYSTEM EVALUATION. THE SAFE SHUTDOWN SYSTEMS AVAILABILITY IS PRESENTED BELOW: 1. MS - INSTRUMENTATION ASSOCIATED WITH STEAM GENERATORS 1 AND 4 IS AVAILABLE IN CONJUNCTION WITH MANUAL OPERATION OF ASSOCIATED MRVs OUTSIDE OF THE EVALUATION AREA. 2. AF - TWO OUT OF THREE TRAINS OF THE AF SYSTEMS ARE LOCATED OUTSIDE THE EVALUATION AREA; THUS, STEAM GENERATORS 1 AND 4 CAN BE SUPPLIED WITH AUXILIARY FEEDWATER. 3. RCS - T_h AND T_c NORMAL INDICATIONS ARE AFFECTED, BUT ALTERNATIVE INDICATION CAPABILITY IS BEING PROVIDED AS PRESENTED IN MARCH 1983 SUBMITTAL. AT LEAST ONE TRAIN OF OTHER RCS PROCESS MONITORING SYSTEM COMPONENTS IS LOCATED OUTSIDE OF THE EVALUATION AREA. 4. CVCS- THE SAFE SHUTDOWN COMPONENTS AND CIRCUITS ASSOCIATED WITH THIS SYSTEM ARE LOCATED OUTSIDE OF THE EVALUATION AREA, EXCEPT THE CABLE ASSOCIATED WITH QRV-251, WHICH FAILS AT 50 GPM MINIMUM FLOW POSITION. 5. THE FOLLOWING SYSTEMS HAVE NO COMPONENTS OR CIRCUITS IN THE EVALUATION AREA: o ESSENTIAL SERVICE WATER (ESW) o COMPONENT COOLING WATER (CCW) o EMERGENCY POWER SYSTEM (EPS) o RESIDUAL HEAT REMOVAL (RHR)
	33A*	9,129	3,216	20 (6.7)	MANUAL DELUGE FOR CHARCOAL FILTER	THERMISTOR FOR CHARCOAL FILTER UNIT	
	38	41,288	2,650	45 (31)	AUTOMATIC CO_2	IONIZATION AND INFRARED TYPES	
	108	10,187	897	20 (7.6)	NONE	NONE	

*FIRE ZONES 33, 33A AND 33B ARE CONTAINED IN A FIRE AREA FOR WHICH THE COMBUSTIBLE LOADING IS 11,530 BTU/FT^2, AREA IS 7,236 FT^2 AND EQUIVALENT FIRE SEVERITY IS 8.5 MINUTES
**FIRE SEVERITY VALUES ARE ASSUMED AND (ACTUAL)

TABLE 7.14-2-[illegible](continued)

SEISMIC GAP EVALUATION AREA							
POSTULATED FIRE LOCATION	ADJACENT AREA/ZONE OF CONCERN	COMBUSTIBLE LOADING (BTU/FT^2)	AREA (FT^2)	EQUIVALENT FIRE SEVERITY (MIN)**	SUPPRESSION	DETECTION	SYSTEM EVALUATION
12		1,722	7,812	15 (1.2)	NONE	NONE	FIRE ZONES 12, 7, 11, 33B AND 38 ARE COMBINED AS ONE AREA FOR THIS SYSTEM EVALUATION. THE SAFE SHUTDOWN SYSTEMS AVAILABILITY IS PRESENTED BELOW: 1. MS - AT LEAST ONE TRAIN OF SAFE SHUTDOWN COMPONENTS AND CIRCUITS ASSOCIATED WITH THIS SYSTEM ARE LOCATED OUTSIDE OF THE EVALUATION AREA. 2. AF - AT LEAST ONE TRAIN OF SAFE SHUTDOWN COMPONENTS AND CIRCUITS OF THIS SYSTEM ASSOCIATED WITH THE SAME UNAFFECTED MS TRAIN ARE LOCATED OUTSIDE OF THE EVALUATION AREA. 3. RCS - T_h AND T_c NORMAL INDICATIONS ARE AFFECTED, BUT ALTERNATIVE INDICATION CAPABILITY IS BEING PROVIDED AS PRESENTED IN MARCH 1983 SUBMITTAL. AT LEAST ONE TRAIN OF OTHER SAFE SHUTDOWN PROCESS MONITORING SYSTEM COMPONENTS ARE LOCATED OUTSIDE OF THE EVALUATION AREA. 4. CVCS- THE SAFE SHUTDOWN COMPONENTS AND CIRCUITS ASSOCIATED WITH THIS SYSTEM ARE LOCATED OUTSIDE OF THE EVALUATION AREA, EXCEPT QRV-251, WHICH FAILS AT 50 GPM MINIMUM FLOW POSITION. 5. EPS - AT LEAST ONE TRAIN OF SAFE SHUTDOWN COMPONENTS AND CIRCUITS OF THIS SYSTEM ARE LOCATED OUTSIDE OF THE EVALUATION AREA. THE ELSC LOCATED IN THE AREA, WHICH COULD BE AFFECTED, SUPPLIES POWER TO THE AFFECTED TRAIN OF SAFE SHUTDOWN INSTRUMENTATION DISCUSSED ABOVE. 6. RHR - MANUAL OPERATION OF THE AFFECTED VALVES, WHICH HAVE CABLES IN THE EVALUATION AREA, IS AVAILABLE.
	7	116,629	960	100 (87.5)	AUTOMATIC CO_2	IONIZATION AND INFRARED TYPES	
	11	26,344	840	30 (19.7)	AUTOMATIC CO_2	IONIZATION AND INFRARED TYPES	
	33B*	236	600	10 (0.2)	NONE	NONE	
	38	41,288	2,650	45 (31)	AUTOMATIC CO_2 //	IONIZATION AND INFRARED TYPES	

(THIS FIRE AREA IS CONTINUED ON THE NEXT PAGE)

*FIRE ZONES 33, 33A AND 33B ARE CONTAINED IN A FIRE AREA FOR WHICH THE COMBUSTIBLE LOADING IS 11,530 BTU/FT^2, AREA IS 7,236 FT^2 AND EQUIVALENT FIRE SEVERITY IS 8.5 MINUTES
**FIRE SEVERITY VALUES ARE ASSUMED AND (ACTUAL)

SEISMIC GAP EVALUATION AREA							
POSTULATED FIRE LOCATION	ADJACENT AREA/ZONE OF CONCERN	COMBUSTIBLE LOADING (BTU/FT^2)	AREA (FT^2)	EQUIVALENT FIRE SEVERITY (MIN)**	SUPPRESSION	DETECTION	SYSTEM EVALUATION
12 (cont.)							7. THE FOLLOWING SAFE SHUTDOWN SYSTEMS, COMPONENTS AND CIRCUITS ARE LOCATED OUTSIDE OF THE EVALUATION AREA: o ESW o CCW
49		86,725	3,200	75 (65.2)	MANUAL DELUGE FOR CHARCOAL FILTER	IONIZATION AND THERMISTOR FOR CHARCOAL FILTER	FIRE ZONES 49, 69 AND 108 ARE COMBINED AS ONE AREA FOR THIS SYSTEM EVALUATION REGARDING SAFE SHUTDOWN CAPABILITY ASSESSMENT. FIRE ZONES 49 AND 69 CONTAIN NO SAFE SHUTDOWN SYSTEMS, COMPONENTS AND CIRCUITS. THE SAFE SHUTDOWN COMPONENTS AND CIRCUITS LOCATED IN THIS EVALUATION AREA ARE THE COMPONENTS AND CIRCUITS LOCATED IN FIRE ZONE 108 FOR WHICH COMPLIANCE METHOD IS PRESENTED IN 1983 SUBMITTAL.
	69	2,998	17,914	15 (2.2)	MANUAL DELUGE FOR HVAC UNIT	IONIZATION AND THERMISTORS FOR HVAC UNITS	
	108	10,187	897	20 (7.6)	NONE	NONE	
69		2,998	17,914	15 (2.2)	MANUAL DELUGE FOR HVAC UNIT	IONIZATION AND THERMISTORS FOR HVAC UNITS	FIRE ZONES 69 AND 108 ARE COMBINED AS ONE AREA FOR THIS SYSTEM EVALUATION REGARDING SAFE SHUTDOWN CAPABILITY ASSESSMENT. FIRE ZONE 69 CONTAINS NO SAFE SHUTDOWN SYSTEMS, COMPONENTS AND CIRCUITS. THE SAFE SHUTDOWN COMPONENTS AND CIRCUITS LOCATED IN THIS EVALUATION AREA ARE THE COMPONENTS AND CIRCUITS LOCATED IN FIRE ZONE 108 FOR WHICH COMPLIANCE METHOD IS PRESENTED IN 1983 SUBMITTAL.
	108	10,187	897	20 (7.6)	NONE	NONE	

**FIRE SEVERITY VALUES ARE ASSUMED AND (ACTUAL)

TABLE 7.14-2-[illegible] (continued)

SEISMIC GAP EVALUATION AREA							
POSTULATED FIRE LOCATION	ADJACENT AREA/ZONE OF CONCERN	COMBUSTIBLE LOADING (BTU/FT^2)	AREA (FT^2)	EQUIVALENT FIRE SEVERITY (MIN)**	SUPPRESSION	DETECTION	SYSTEM EVALUATION
108		10,187	897	20 (7.6)	NONE	NONE	FIRE ZONES 49, 69 AND 108 ARE COMBINED AS ONE AREA FOR THIS SYSTEM EVALUATION REGARDING SAFE SHUTDOWN CAPABILITY ASSESSMENT. FIRE ZONES 49 AND 69 CONTAIN NO SAFE SHUTDOWN SYSTEMS, COMPONENTS AND CIRCUITS. THE SAFE SHUTDOWN COMPONENTS AND CIRCUITS LOCATED IN THIS EVALUATION AREA ARE THE COMPONENTS AND CIRCUITS LOCATED IN FIRE ZONE 108 FOR WHICH COMPLIANCE METHOD IS PRESENTED IN 1983 SUBMITTAL.
	49	86,725	3,200	75 (65.2)	MANUAL DELUGE FOR CHARCOAL FILTER	IONIZATION AND THERMISTOR FOR CHARCOAL FILTER	
	69	2,998	17,914	15 (2.2)	MANUAL DELUGE FOR HVAC UNIT	IONIZATION AND THERMISTORS FOR HVAC UNITS	

**FIRE SEVERITY VALUES ARE ASSUMED AND (ACTUAL)

TABLE 7.14-2-2

UNIT 2 FIRE AREAS/ZONES OF CONCERN

SEISMIC GAP EVALUATION AREA							
POSTULATED FIRE LOCATION	ADJACENT ZONE OF CONCERN	COMBUSTIBLE LOADING (BTU/FT^2)	AREA (FT^2)	EQUIVALENT FIRE SEVERITY (MIN)**	SUPPRESSION	DETECTION	SYSTEM EVALUATION
34B*		5,735	600	15 (4.3)	NONE	NONE	FIRE ZONES 34B, 34A, 39, 109 AND 50 ARE COMBINED AS ONE AREA FOR THIS SYSTEM EVALUATION. THE SAFE SHUTDOWN SYSTEMS AVAILABILITY IS PRESENTED BELOW: 1. MS - INSTRUMENTATION ASSOCIATED WITH STEAM GENERATORS 1 AND 4 IS AVAILABLE IN CONJUNCTION WITH MANUAL OPERATION OF ASSOCIATED MRVs. 2. AF - MANUAL OPERATION OF AFFECTED FM0212 AND 242 IN CONJUNCTION WITH REMOTE OPERATION OF OTHER REQUIRED SAFE SHUTDOWN COMPONENTS OF THIS SYSTEM OUTSIDE OF THE EVALUATION AREA WILL UTILIZE AF SYSTEM TO SUPPLY AUXILIARY FEEDWATER TO STEAM GENERATORS 1 AND 4. 3. RCS - T_h AND T_c NORMAL INDICATIONS ARE AFFECTED, BUT ALTERNATIVE INDICATION CAPABILITY IS BEING PROVIDED AS PRESENTED IN MARCH 1983 SUBMITTAL. AT LEAST ONE TRAIN OF OTHER RCS SAFE SHUTDOWN PROCESS MONITORING SYSTEM COMPONENTS IS LOCATED OUTSIDE OF THE EVALUATION AREA. 4. CVCS- THE SAFE SHUTDOWN COMPONENTS ASSOCIATED WITH THIS SYSTEM ARE LOCATED OUTSIDE OF THE EVALUATION AREA, EXCEPT THE CABLE ASSOCIATED WITH QRV-251, WHICH FAILS AT 50 GPM MINIMUM FLOW POSITION. 5. EPS - SAFE SHUTDOWN COMPONENTS AND CIRCUITS OF ONE TRAIN OF EPS, WHICH INCLUDES DGAB, ARE LOCATED OUTSIDE OF THE EVALUATION AREA.
	34A*	4,204	3,216	15 (3.1)	MANUAL DELUGE FOR CHARCOAL FILTER IN 34A	THERMISTOR FOR CHARCOAL FILTER UNIT IN 34A	
	39	30,622	2,667	35 (23)	AUTOMATIC CO_2	IONIZATION AND INFRARED TYPES	
	109	15,872	897	25 (11.8)	NONE	NONE	

(THIS FIRE AREA IS CONTINUED ON THE NEXT PAGE)

*FIRE ZONES 34, 34A AND 34B ARE CONTAINED IN A FIRE AREA FOR WHICH THE COMBUSTIBLE LOADING IS 5,909 BTU/FT^2, AREA IS 4,856 FT^2 AND EQUIVALENT FIRE SEVERITY IS 4.3 MINUTES

**FIRE SEVERITY VALUES ARE ASSUMED AND (ACTUAL)

SEISMIC GAP EVALUATION AREA							
POSTULATED FIRE LOCATION	ADJACENT ZONE OF CONCERN	COMBUSTIBLE LOADING (BTU/FT^2)	AREA (FT^2)	EQUIVALENT FIRE SEVERITY (MIN)**	SUPPRESSION	DETECTION	SYSTEM EVALUATION
34B (cont.)							6. CCW - CIRCUITS AND COMPONENTS ASSOCIATED WITH THIS SYSTEM REQUIRED FOR HOT SHUTDOWN ARE LOCATED OUTSIDE OF THE EVALUATION AREA. MANUAL OPERATION OF THE AFFECTED VALVES REQUIRED FOR COLD SHUTDOWN IS AVAILABLE. 7. RHR - MANUAL OPERATION OF THE AFFECTED VALVES, WHICH HAVE CABLES IN THE EVALUATION AREA, IS AVAILABLE. 8. ESW - NOT AFFECTED. EVALUATION AREA DOES NOT CONTAIN COMPONENTS OR CIRCUITS ASSOCIATED WITH THIS SYSTEM REQUIRED FOR SAFE SHUTDOWN.
22		1,022	8,460	10 (0.6)	NONE	NONE	FIRE ZONES 22, 27, 23, 34B AND 39 ARE COMBINED AS ONE AREA FOR THIS SYSTEM EVALUATION. THE SAFE SHUTDOWN SYSTEMS AVAILABILITY IS PRESENTED BELOW: 1. MS - INSTRUMENTATION ASSOCIATED WITH STEAM GENERATORS 1 AND 4 IS AVAILABLE IN CONJUNCTION WITH MANUAL OPERATION OF ASSOCIATED MRVs OUTSIDE OF THE EVALUATION AREA. 2. AF - MANUAL OPERATION OF AFFECTED FM0212 AND 242 AND FRV 247 IN CONJUNCTION WITH REMOTE OPERATION OF OTHER COMPONENTS OF THIS SYSTEM REQUIRED FOR SAFE SHUTDOWN OUTSIDE OF THE EVALUATION AREA WILL UTILIZE AF SYSTEM TO SUPPLY AUXILIARY FEEDWATER TO STEAM GENERATORS 1 AND 4. 3. RCS - T_h AND T_c NORMAL INDICATIONS ARE AFFECTED, BUT ALTERNATIVE INDICATION CAPABILITY IS BEING PROVIDED AS PRESENTED IN MARCH 1983 SUBMITTAL. AS LEAST ONE TRAIN OF OTHER RCS SAFE SHUTDOWN PROCESS MONITORING SYSTEM COMPONENTS IS LOCATED OUTSIDE OF THE EVALUATION AREA.
	27	85,009	1,056	75 (63.9)	AUTOMATIC CO_2	IONIZATION AND INFRARED TYPES	
	23	28,716	840	35 (21.5)	AUTOMATIC CO_2	IONIZATION AND INFRARED TYPES	
	34B*	5,735	600	15 (4.3)	NONE	NONE	
	39	30,622	2,667	35 (23)	AUTOMATIC CO_2	IONIZATION AND INFRARED TYPES	

(THIS FIRE AREA IS CONTINUED ON THE NEXT PAGE)

*FIRE ZONES 34, 34A AND 34B ARE CONTAINED IN A FIRE AREA FOR WHICH THE COMBUSTIBLE LOADING IS 5,909 BTU/FT^2, AREA IS 4,856 FT^2 AND EQUIVALENT FIRE SEVERITY IS 4.3 MINUTES

**FIRE SEVERITY VALUES ARE ASSUMED AND (ACTUAL)

SEISMIC GAP EVALUATION AREA: POSTULATED FIRE LOCATION	SEISMIC GAP EVALUATION AREA: ADJACENT ZONE OF CONCERN	COMBUSTIBLE LOADING (BTU/FT^2)	AREA (FT^2)	EQUIVALENT FIRE SEVERITY (MIN)**	SUPPRESSION	DETECTION	SYSTEM EVALUATION
22 (cont.)							4. CVCS- THE SAFE SHUTDOWN COMPONENTS ASSOCIATED WITH THIS SYSTEM ARE LOCATED OUTSIDE OF THE EVALUATION AREA, EXCEPT CABLE ASSOCIATED WITH QRV-251, WHICH FAILS AT 50 GPM MINIMUM FLOW POSITION. 5. EPS - SAFE SHUTDOWN COMPONENTS AND CIRCUITS OF ONE TRAIN OF EPS, WHICH INCLUDES DGAB, ARE LOCATED OUTSIDE OF THE EVALUATION AREA. 6. CCW - CIRCUITS AND COMPONENTS ASSOCIATED WITH THIS SYSTEM REQUIRED FOR HOT SHUTDOWN ARE LOCATED OUTSIDE OF THE EVALUATION AREA. MANUAL OPERATION OF THE AFFECTED VALVES REQUIRED FOR COLD SHUTDOWN IS AVAILABLE. 7. RHR - MANUAL OPERATION OF THE AFFECTED VALVES, WHICH HAVE CABLES IN THE EVALUATION AREA, IS AVAILABLE. 8. ESW - NOT AFFECTED. EVALUATION AREA DOES NOT CONTAIN COMPONENTS OR CIRCUITS ASSOCIATED WITH THIS SYSTEM REQUIRED FOR SAFE SHUTDOWN.
50		44,309	3,200	45 (33.2)	MANUAL DELUGE FOR CHARCOAL FILTER	IONIZATION AND THERMISTOR FOR CHARCOAL FILTER	FIRE ZONES 50, 69 AND 109 ARE COMBINED AS ONE AREA FOR THIS SYSTEM EVALUATION. THE SAFE SHUTDOWN SYSTEMS AVAILABILITY IS PRESENTED BELOW: 1. MS - INSTRUMENTATION ASSOCIATED WITH STEAM GENERATORS 1 AND 4 IS AVAILABLE IN CONJUNCTION WITH MANUAL OPERATION OF ASSOCIATED MRVs OUTSIDE OF THE EVALUATION AREA. 2. AF - ONE TRAIN OF THIS SYSTEM INCLUDING PUMP PP-3W (AND ASSOCIATED CABLES) AND FMO212 AND 242 AND ASSOCIATED CABLES ARE LOCATED OUTSIDE OF THE EVALUATION AREA.
	69	2,998	17,914	15 (2.2)	MANUAL DELUGE FOR HVAC UNIT	IONIZATION AND THERMISTORS FOR HVAC UNITS	
	109	15,872	897	25 (11.8)	NONE	NONE	

(THIS FIRE AREA IS CONTINUED ON THE NEXT PAGE)

**FIRE SEVERITY VALUES ARE ASSUMED AND (ACTUAL)

SEISMIC GAP EVALUATION AREA							
POSTULATED FIRE LOCATION	ADJACENT ZONE OF CONCERN	COMBUSTIBLE LOADING (BTU/FT^2)	AREA (FT^2)	EQUIVALENT FIRE SEVERITY (MIN)**	SUPPRESSION	DETECTION	SYSTEM EVALUATION
50 (cont.)							3. CVCS- COMPONENTS AND CIRCUITS ASSOCIATED WITH THIS SYSTEM ARE LOCATED OUTSIDE OF THE EVALUATION AREA, EXCEPT ONE OF THE CHARGING PUMPS SUCTION VALVE CABLE (REDUNDANT VALVE IS AVAILABLE). 4. CCW - CIRCUITS AND COMPONENTS ASSOCIATED WITH THIS SYSTEM REQUIRED FOR HOT SHUTDOWN ARE LOCATED OUTSIDE OF THE EVALUATION AREA. MANUAL OPERATION OF THE AFFECTED VALVES REQUIRED FOR COLD SHUTDOWN IS AVAILABLE. 5. RHR - MANUAL OPERATION OF THE AFFECTED VALVES, WHICH HAVE CABLES IN THE EVALUATION AREA, IS AVAILABLE. 6. THE FOLLOWING SAFE SHUTDOWN SYSTEMS COMPONENTS AND CIRCUITS ARE LOCATED OUTSIDE OF THE EVALUATION AREA: o RCS o EPS o ESW
69		2,998	17,914	15 (2.2)	MANUAL DELUGE FOR HVAC UNIT	IONIZATION AND THERMISTORS FOR HVAC UNITS	FIRE ZONES 69 AND 108 ARE COMBINED AS ONE AREA FOR THIS SYSTEM EVALUATION REGARDING SAFE SHUTDOWN CAPABILITY ASSESSMENT. FIRE ZONE 69 CONTAINS NO SAFE SHUTDOWN SYSTEMS, COMPONENTS AND CIRCUITS. THE SAFE SHUTDOWN COMPONENTS AND CIRCUITS LOCATED IN THIS EVALUATION AREA ARE THE COMPONENTS AND CIRCUITS LOCATED IN FIRE ZONE 108 FOR WHICH COMPLIANCE METHOD IS PRESENTED IN 1983 SUBMITTAL.
	109	15,872	897	25 (11.8)	NONE	NONE	

**FIRE SEVERITY VALUES ARE ASSUMED AND (ACTUAL)

TABLE 7.14-2-[illegible] (continued)

SEISMIC GAP EVALUATION AREA							
POSTULATED FIRE LOCATION	ADJACENT ZONE OF CONCERN	COMBUSTIBLE LOADING (BTU/FT^2)	AREA (FT^2)	EQUIVALENT FIRE SEVERITY (MIN)**	SUPPRESSION	DETECTION	SYSTEM EVALUATION
109		15,872	897	25 (11.8)	NONE	NONE	FIRE ZONES 50, 69 AND 109 ARE COMBINED AS ONE AREA FOR THIS SYSTEM EVALUATION. THE SAFE SHUTDOWN SYSTEMS AVAILABILITY IS PRESENTED BELOW: 1. MS - INSTRUMENTATION ASSOCIATED WITH STEAM GENERATORS 1 AND 4 IS AVAILABLE IN CONJUNCTION WITH MANUAL OPERATION OF ASSOCIATED MRVs OUTSIDE OF THE EVALUATION AREA. 2. AF - ONE TRAIN OF THIS SYSTEM INCLUDING PUMP PP-3W (AND ASSOCIATED CABLES) AND FMO212 AND 242 AND ASSOCIATED CABLES ARE LOCATED OUTSIDE OF THE EVALUATION AREA. 3. CVCS- COMPONENTS AND CIRCUITS ASSOCIATED WITH THIS SYSTEM ARE LOCATED OUTSIDE OF THE EVALUATION AREA, EXCEPT ONE OF THE CHARGING PUMPS SUCTION VALVE CABLE (REDUNDANT VALVE IS AVAILABLE). 4. CCW - CIRCUITS AND COMPONENTS ASSOCIATED WITH THIS SYSTEM REQUIRED FOR HOT SHUTDOWN ARE LOCATED OUTSIDE OF THE EVALUATION AREA. MANUAL OPERATION OF THE AFFECTED VALVES REQUIRED FOR COLD SHUTDOWN IS AVAILABLE. 5. RHR - MANUAL OPERATION OF THE AFFECTED VALVES, WHICH HAVE CABLES IN THE EVALUATION AREA, IS AVAILABLE. 6. THE FOLLOWING SAFE SHUTDOWN SYSTEMS COMPONENTS AND CIRCUITS ARE LOCATED OUTSIDE OF THE EVALUATION AREA: o RCS o EPS o ESW
	50	44,309	3,200	45 (33.2)	MANUAL DELUGE FOR CHARCOAL FILTER	IONIZATION AND THERMISTOR FOR CHARCOAL FILTER	
	69	2,998	17,914	15 (2.2)	MANUAL DELUGE FOR HVAC UNIT	IONIZATION AND THERMISTORS FOR HVAC UNITS	

**FIRE SEVERITY VALUES ARE ASSUMED AND (ACTUAL)

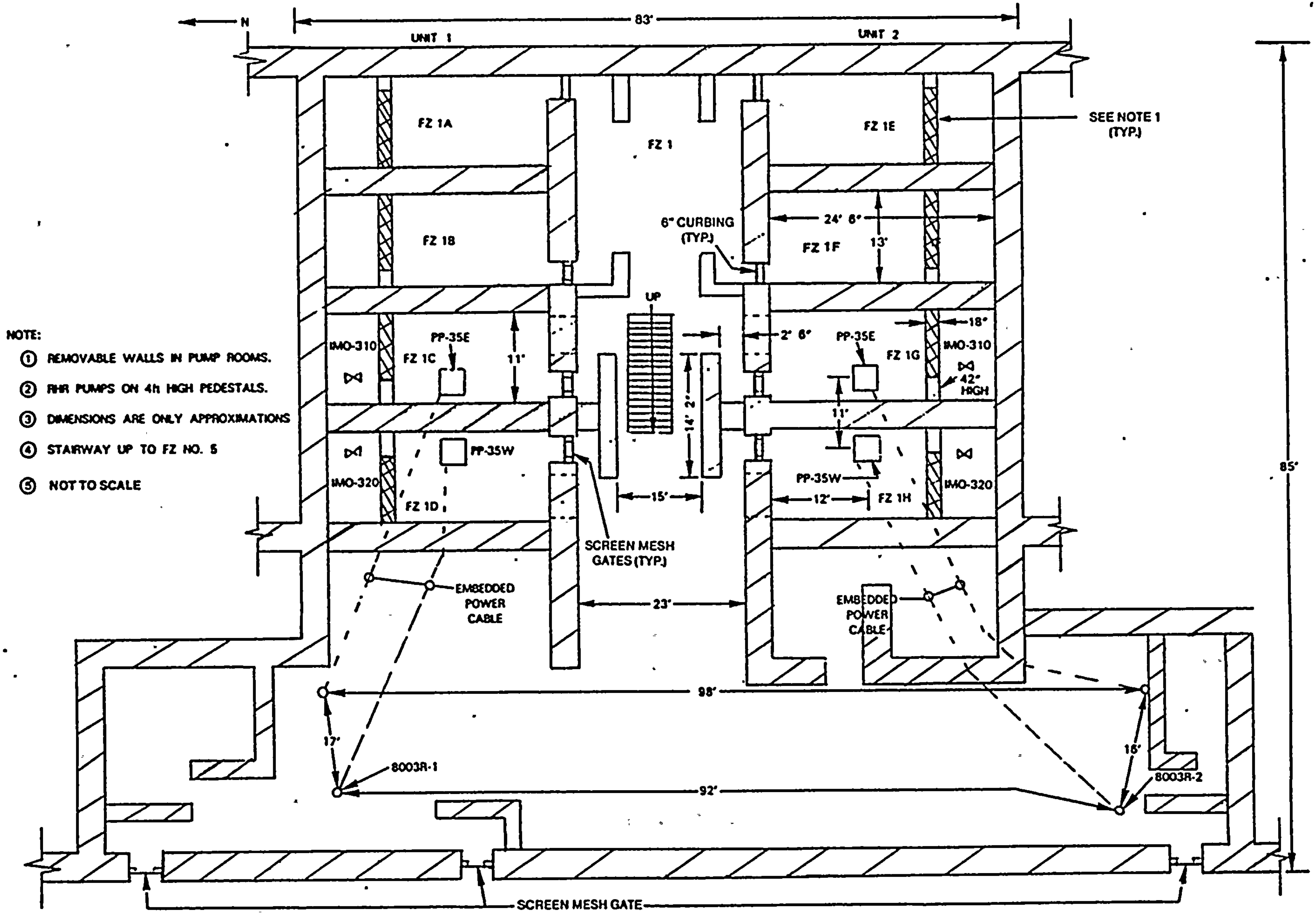
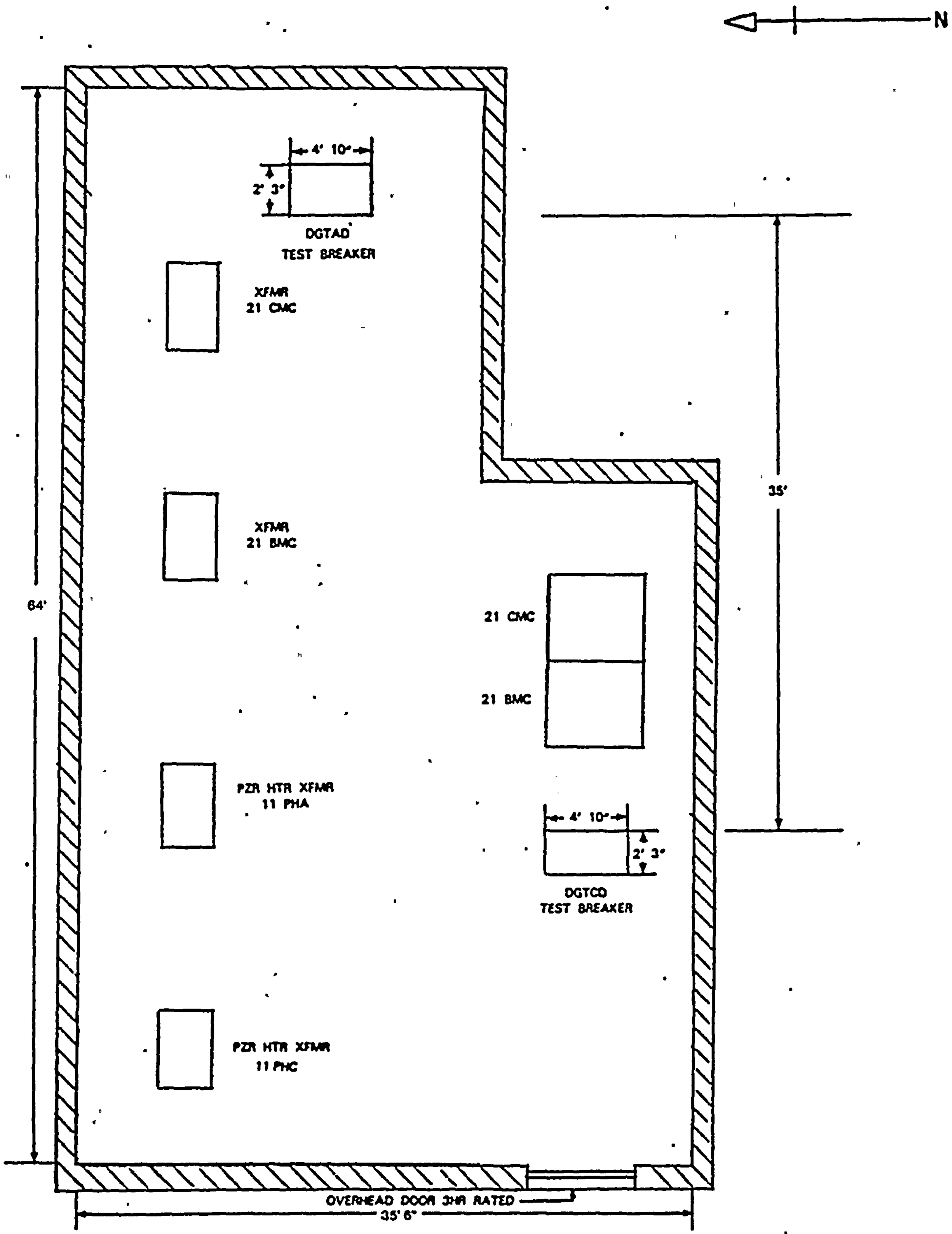


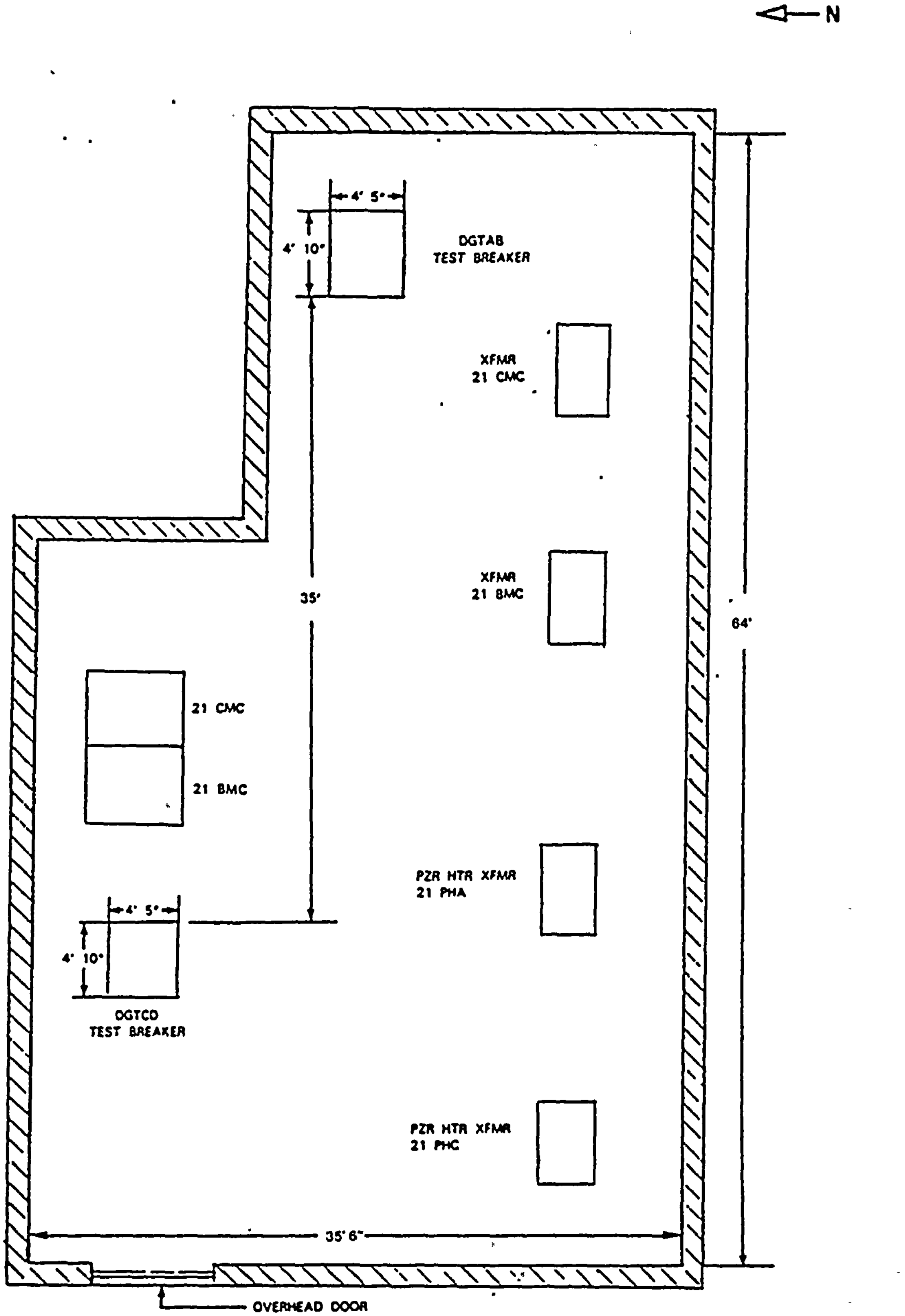
FIGURE 7.2 RHR/CTS PUMP AREA AUXILIARY BUILDING FIRE ZONE 1, 1A - H ELEV. 573'



NOTE: DIMENSIONS ARE APPROXIMATE

FIGURE 7.3 TRANSFORMER ROOM UNIT 1

FIRE ZONE 14 ELEV. 591'



NOTE: DIMENSIONS ARE APPROXIMATE

FIGURE 7.4 TRANSFORMER ROOM UNIT 2

FIRE ZONE 20 ELEV. 591'

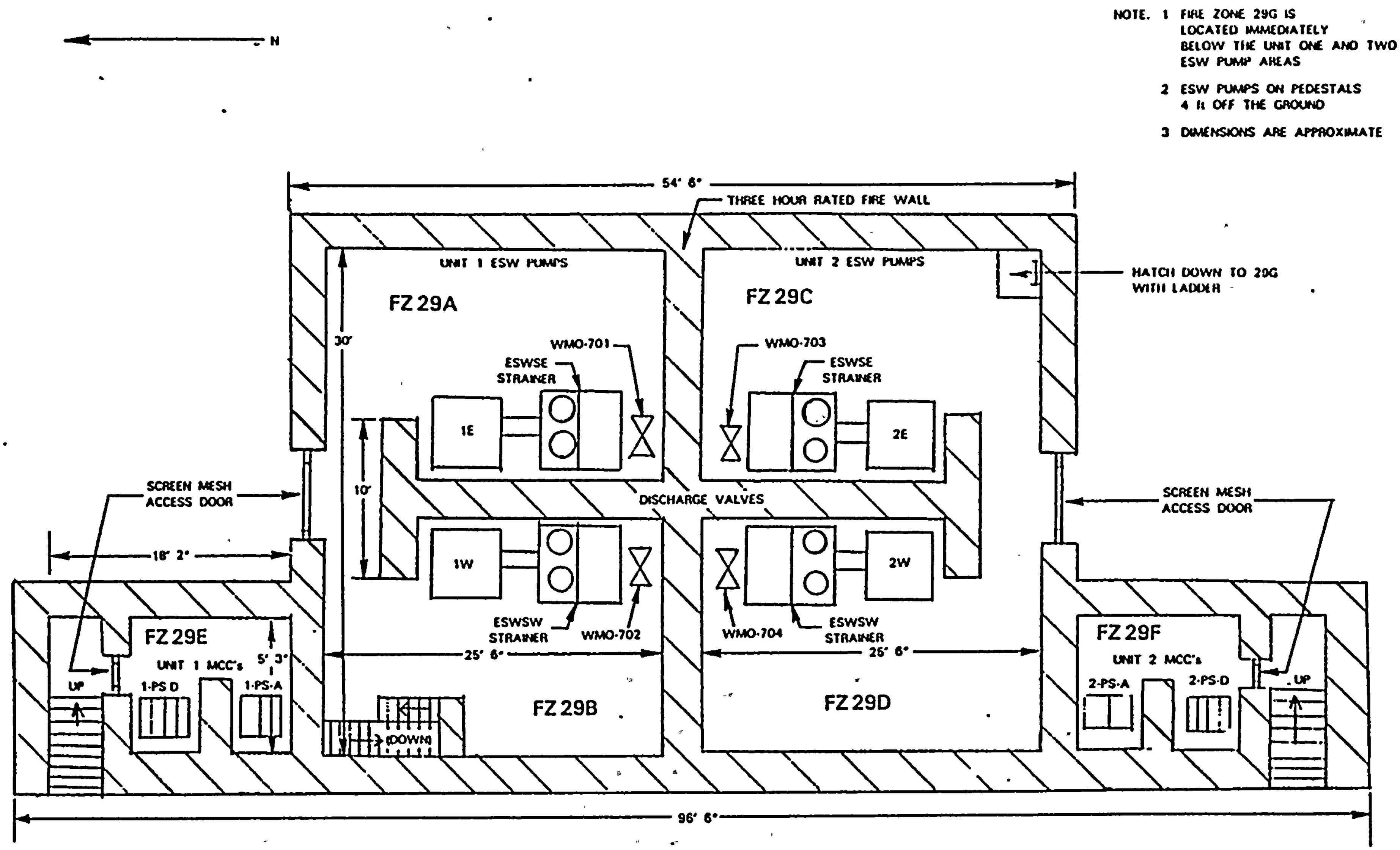
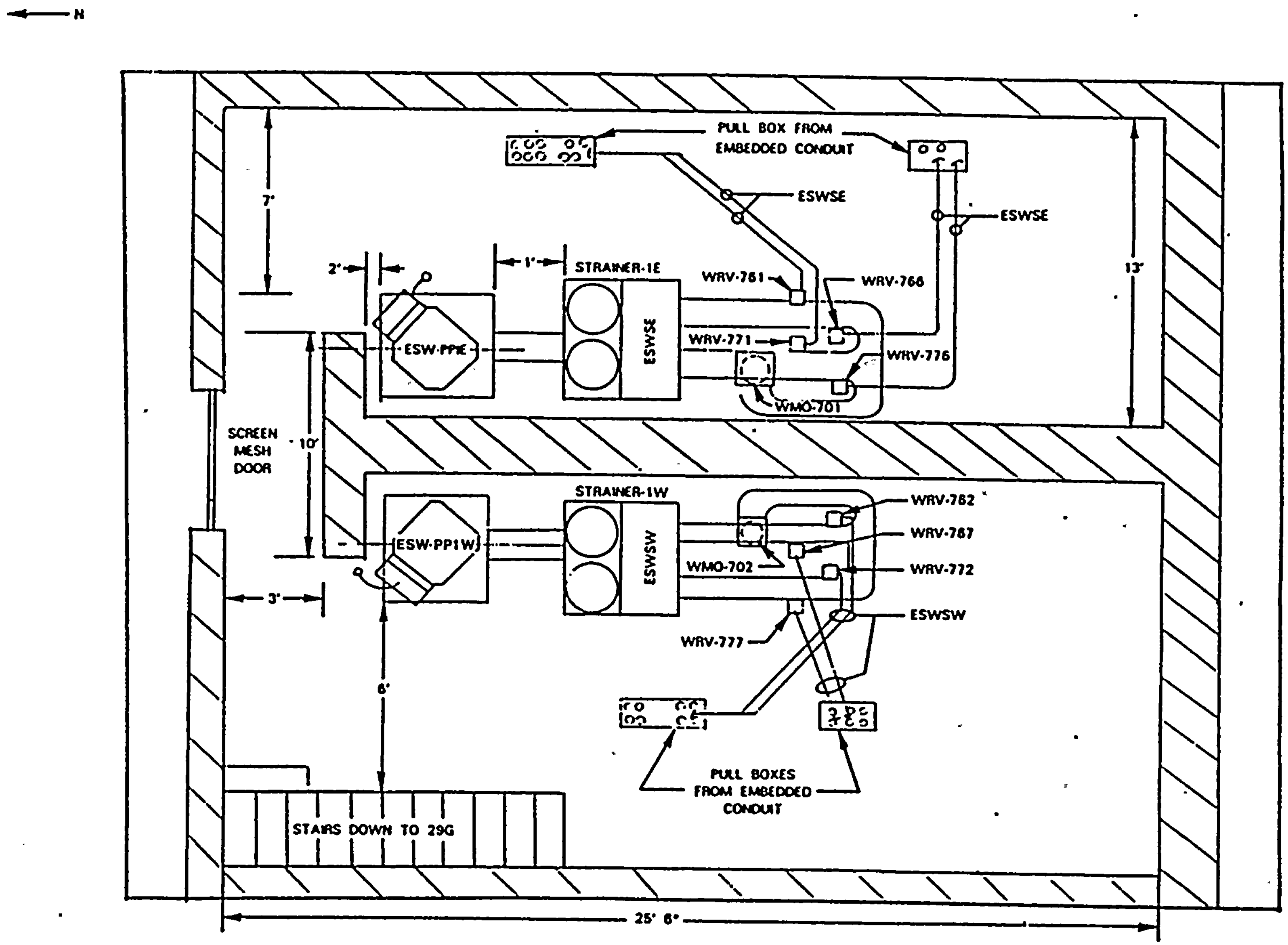


FIGURE 7.5.1 ESW PUMP AREAS UNIT 1 & UNIT 2

FIRE ZONES 29, 29A, 29B, 29C, 29D, 29E, 29F ELEV. 591'



NOTE: 1 PUMPS ARE ON 4 ft HIGH PEDESTALS

2 DIMENSIONS ARE ONLY APPROXIMATIONS

FIGURE 7.5.2 ESW PUMP AREA UNIT 1

FIRE ZONE 29A & 29B

ELEV. 591'

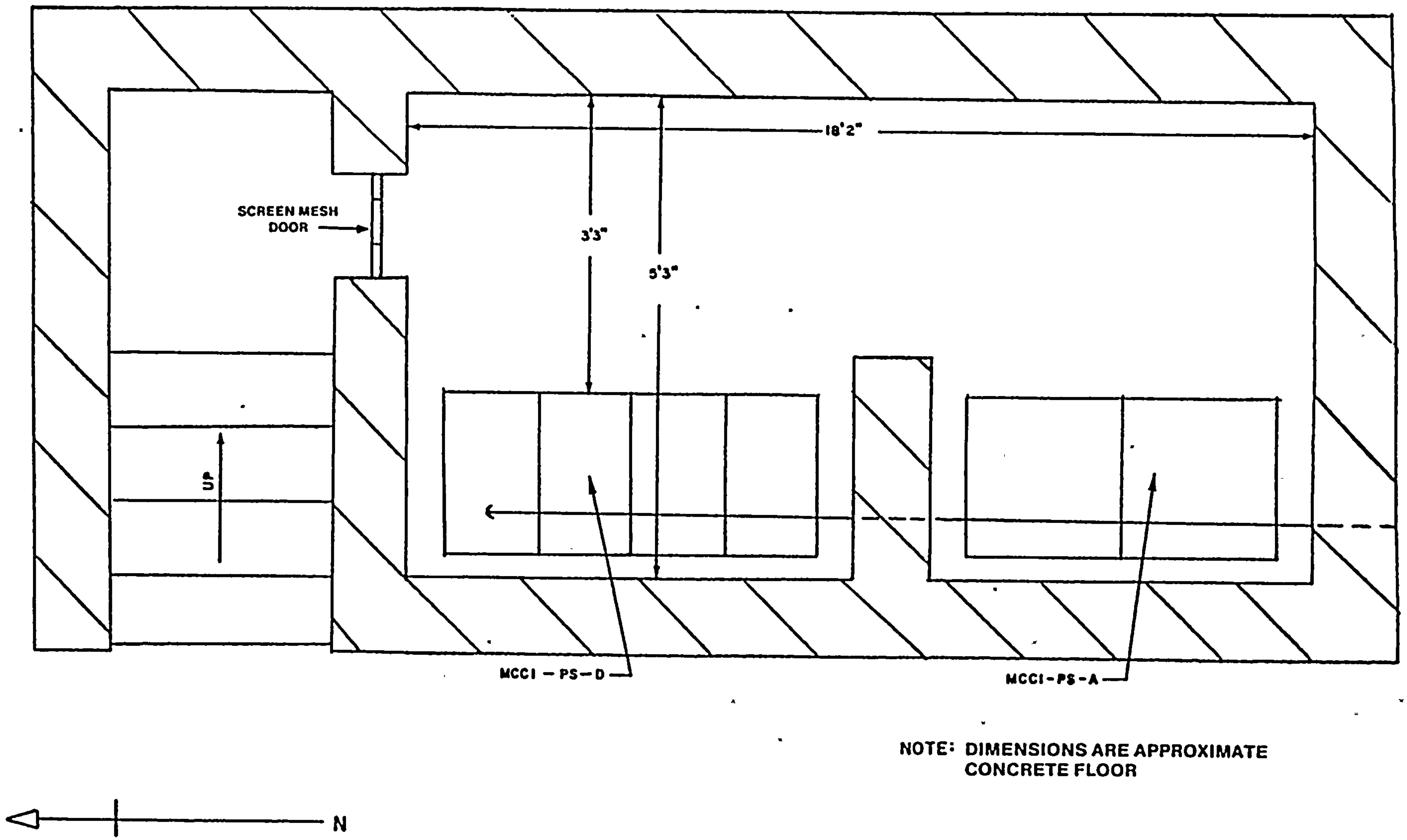


FIGURE 7.5.3 ESW MCC AREA UNIT 1

FIRE ZONE 29E ELEV. 591'

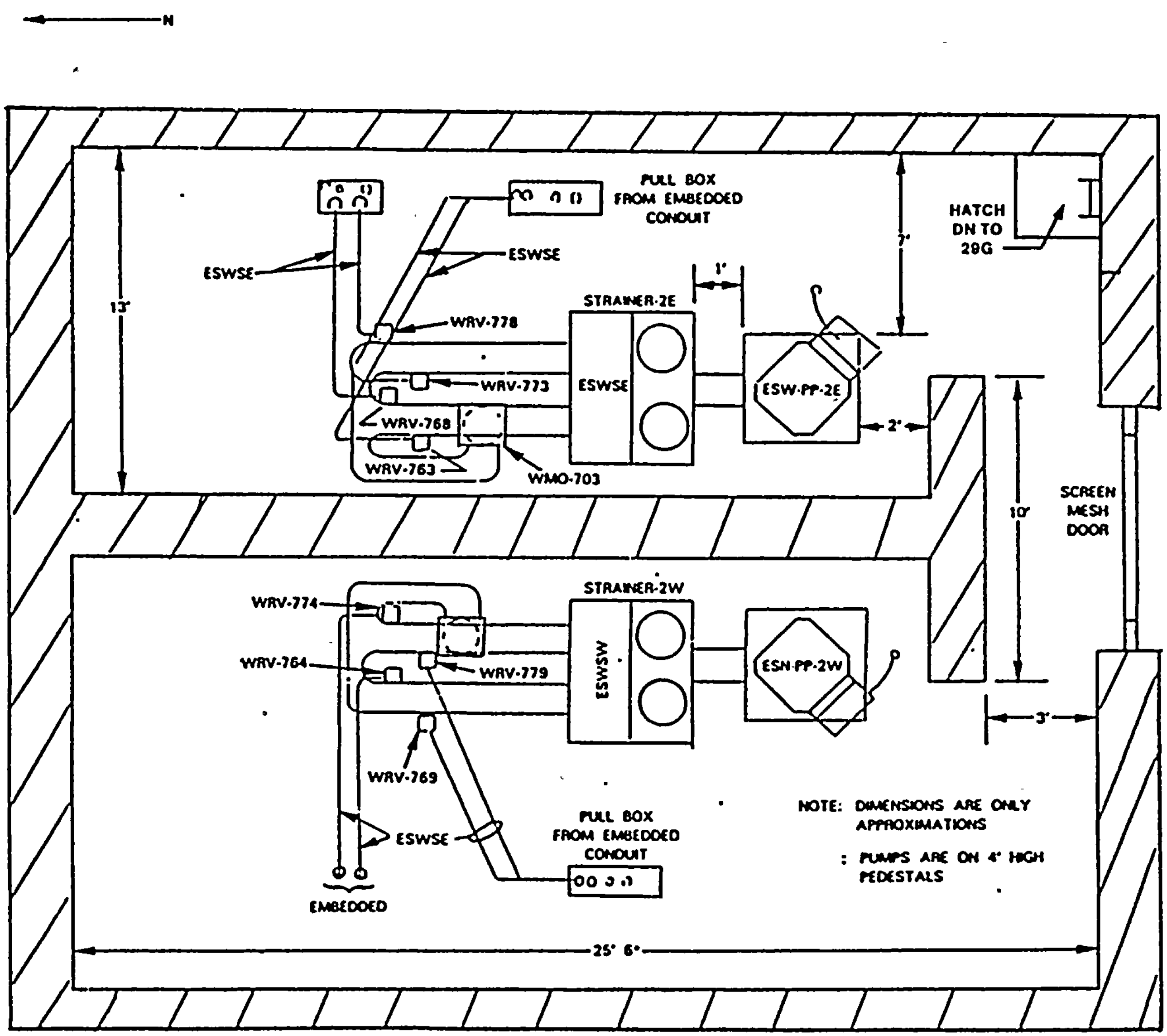
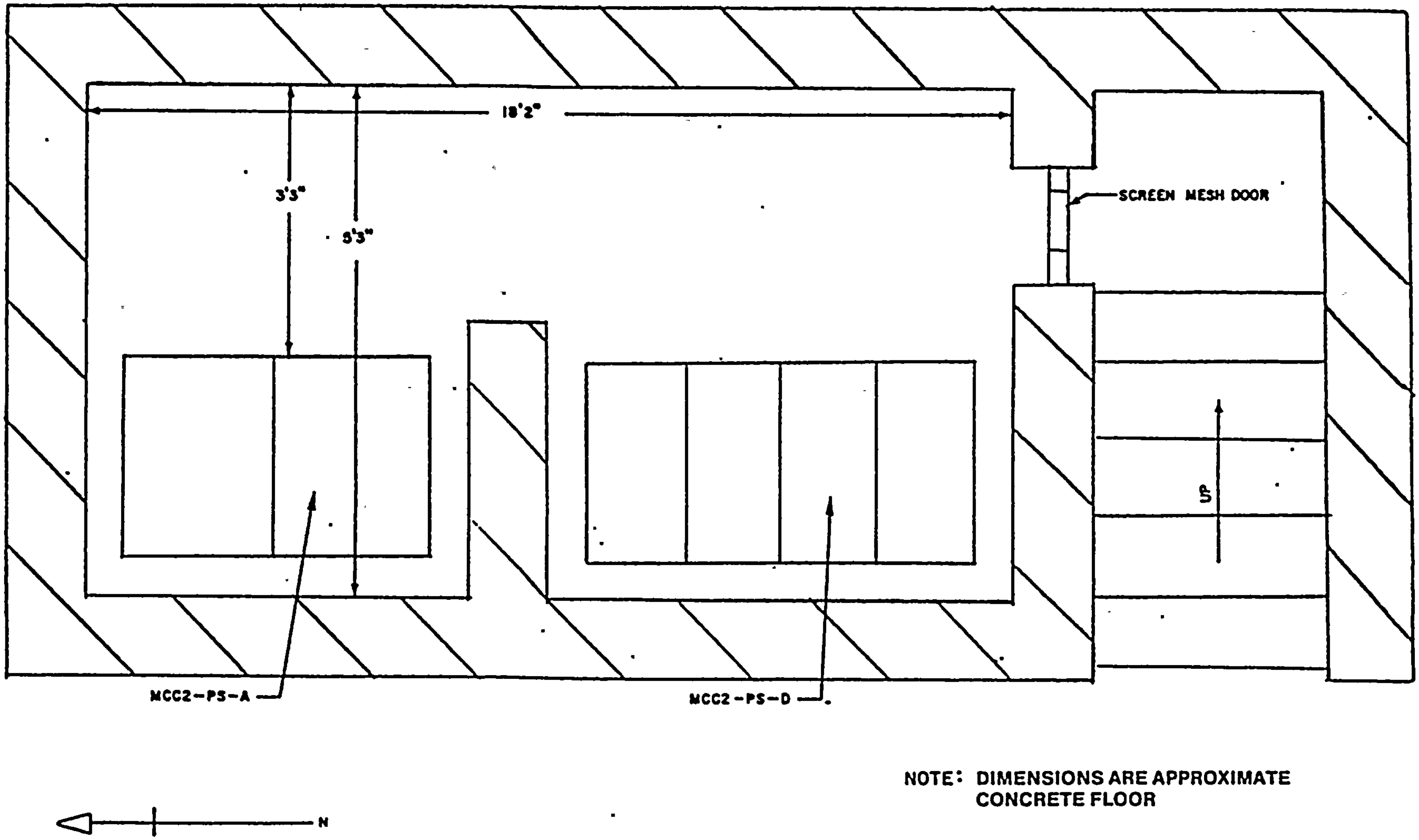


FIGURE 7.6 1 ESW PUMP AREA UNIT 2

FIRE ZONE 29C,D ELEV 591'



NOTE: DIMENSIONS ARE APPROXIMATE
CONCRETE FLOOR

FIGURE 7.6.2 ESW MCC AREA UNIT 2

FIRE ZONE 29F ELEV. 591'

FIGURE 7.7.1

ELEV. 591'

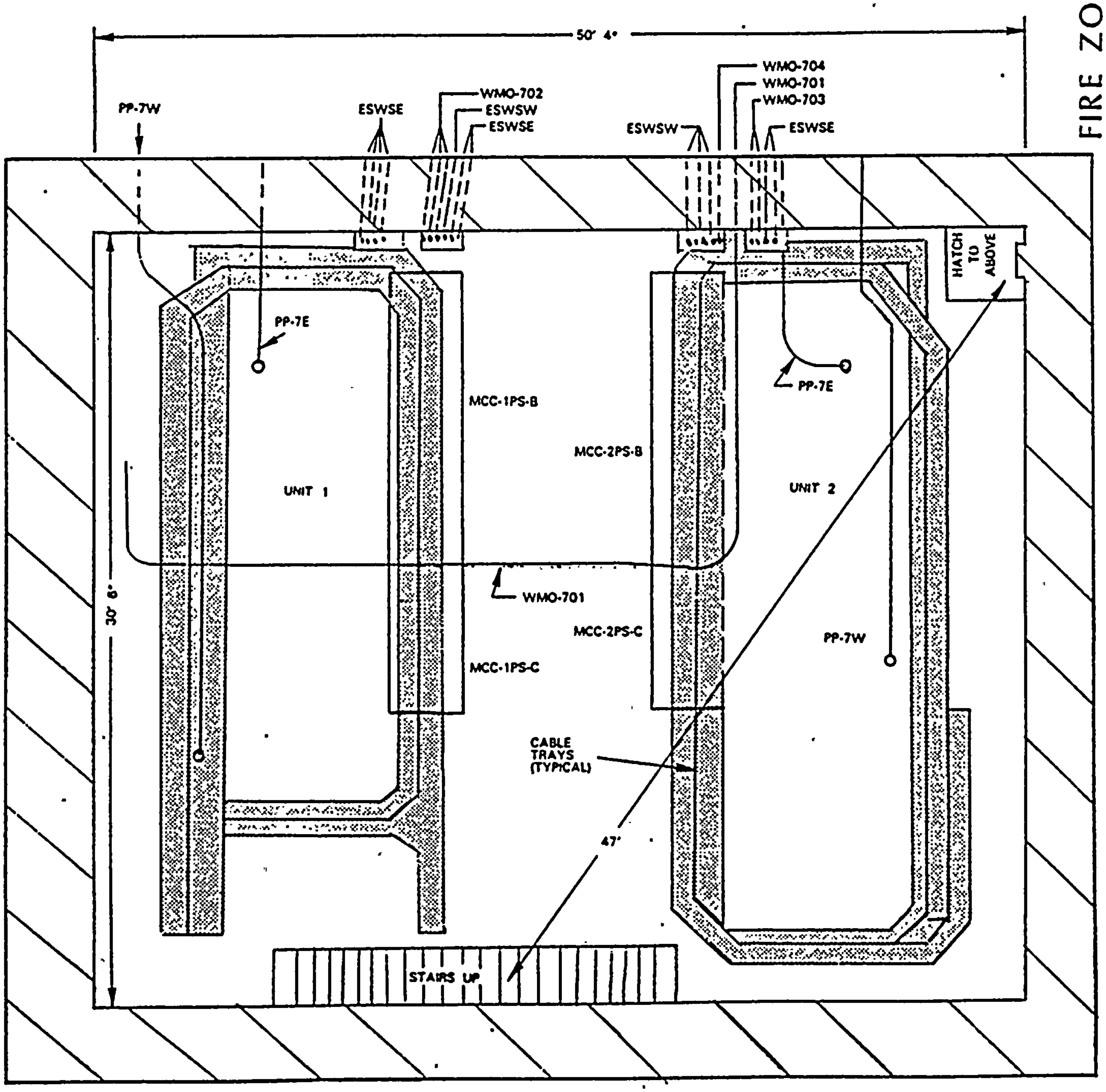
FIRE ZONE 29 G

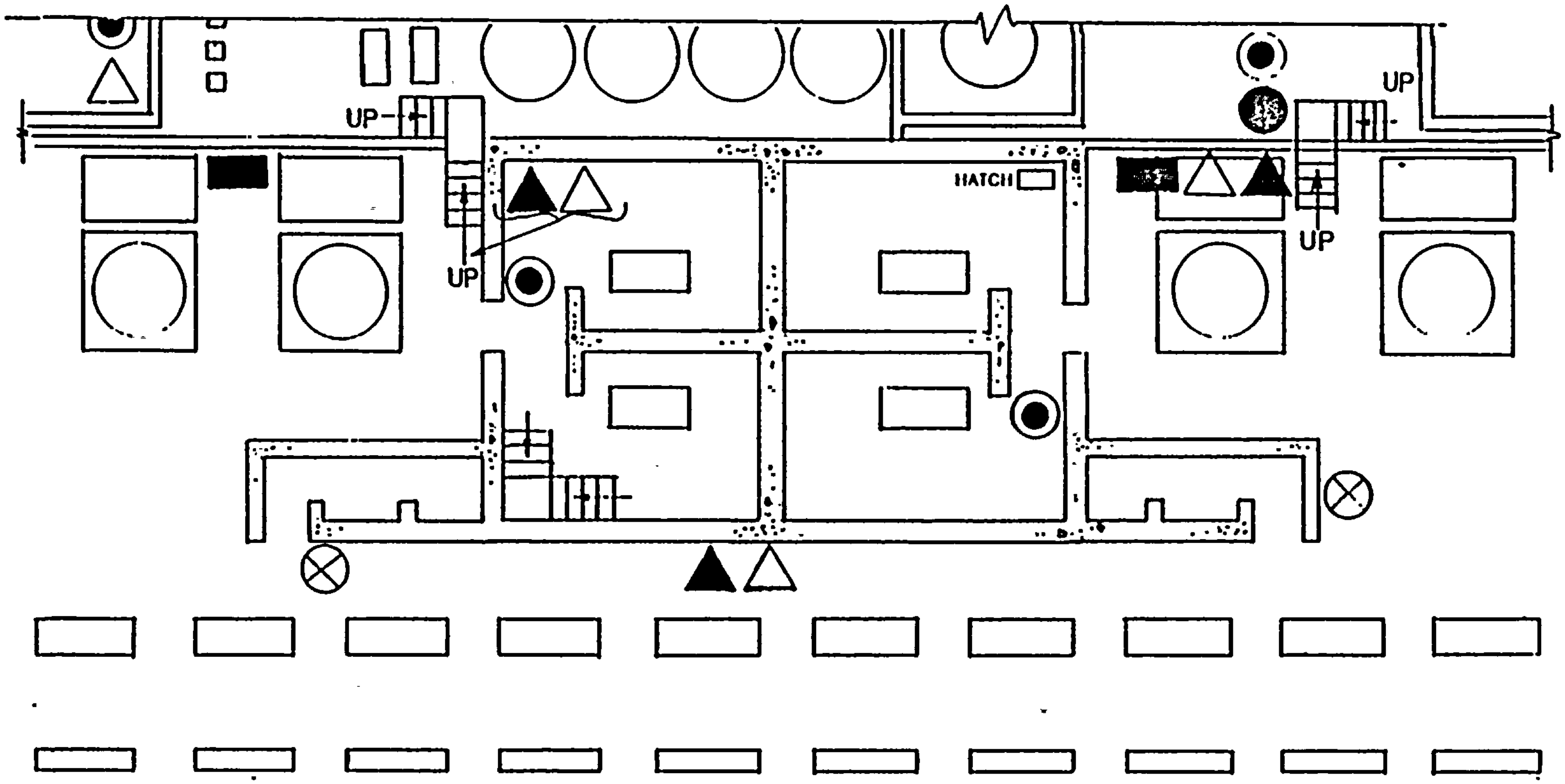
N

FIRE ZONE NO. 29G

NOTE: ① DIMENSIONS ARE ONLY APPROXIMATIONS

② MCC's ARE NON-SAFE SHUTDOWN EQUIPMENT



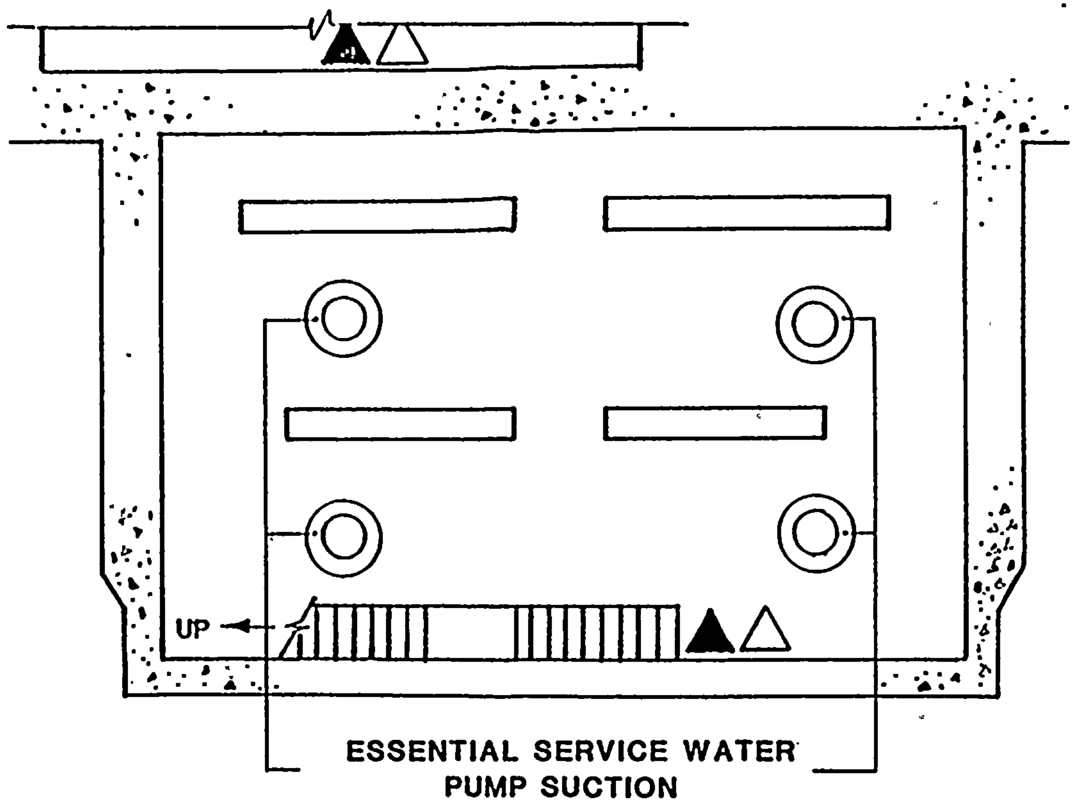


PART PLAN SCREENHOUSE EL. 591

LEGEND

- DRY CHEMICAL FIRE EXTINGUISHER
- CO_2 FIRE EXTINGUISHER
- 150 LB. WHEELED DRY CHEMICAL EXTINGUISHER
- TELEPHONE
- GAITRONICS
- HOSE STATION

FIGURE 7.7.2 MANUAL FIREFIGHTING EQUIPMENT (LOCATED IN THE SCREEN HOUSE) AVAILABLE FOR ZONE 29G



PART PLAN SCREENHOUSE EL. 573

LEGEND

△ DRY CHEMICAL FIRE EXTINGUISHER

▲ CO_2 FIRE EXTINGUISHER

FIGURE 7.7.3 MANUAL FIREFIGHTING EQUIPMENT LOCATED IN ZONE 29G

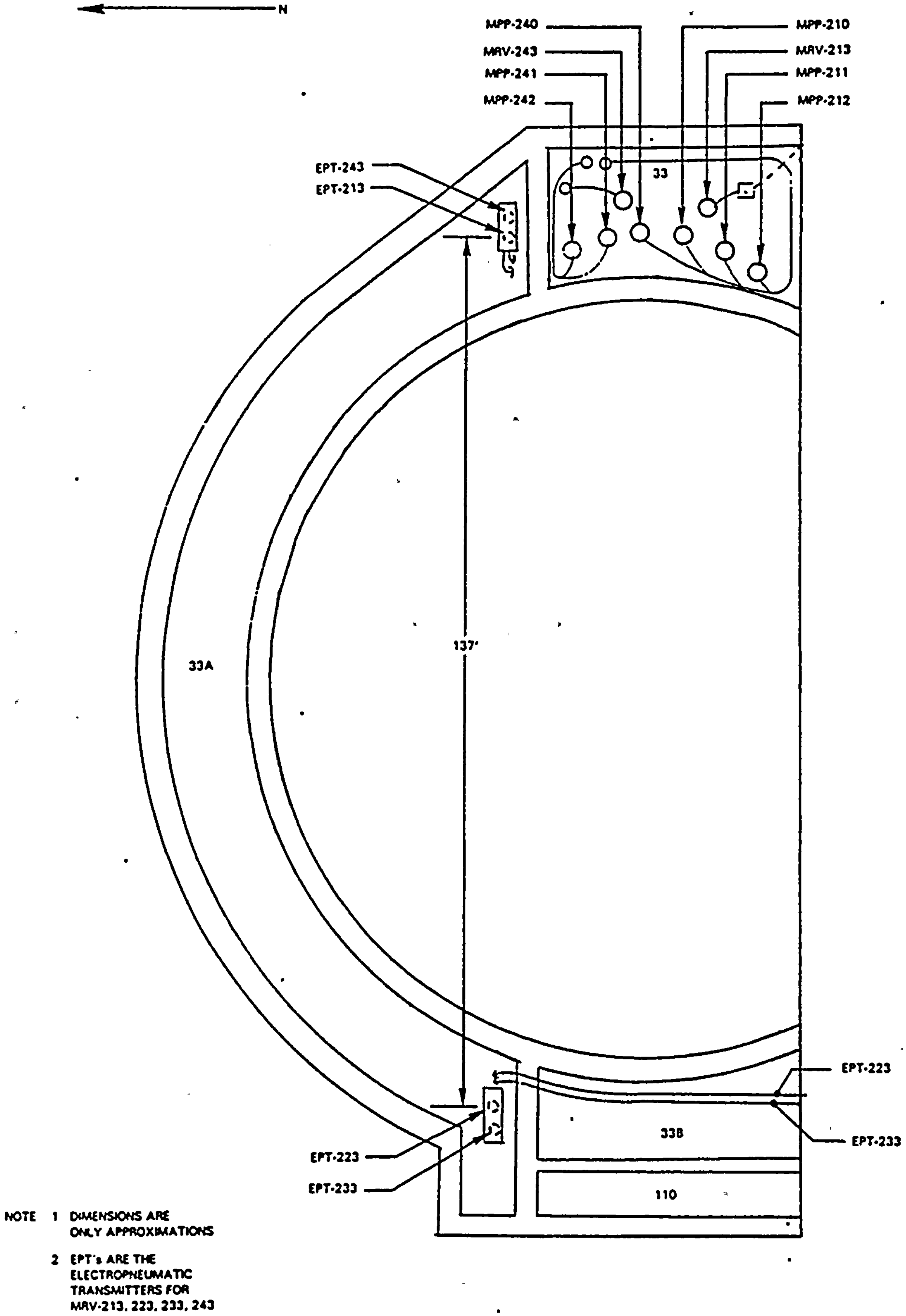
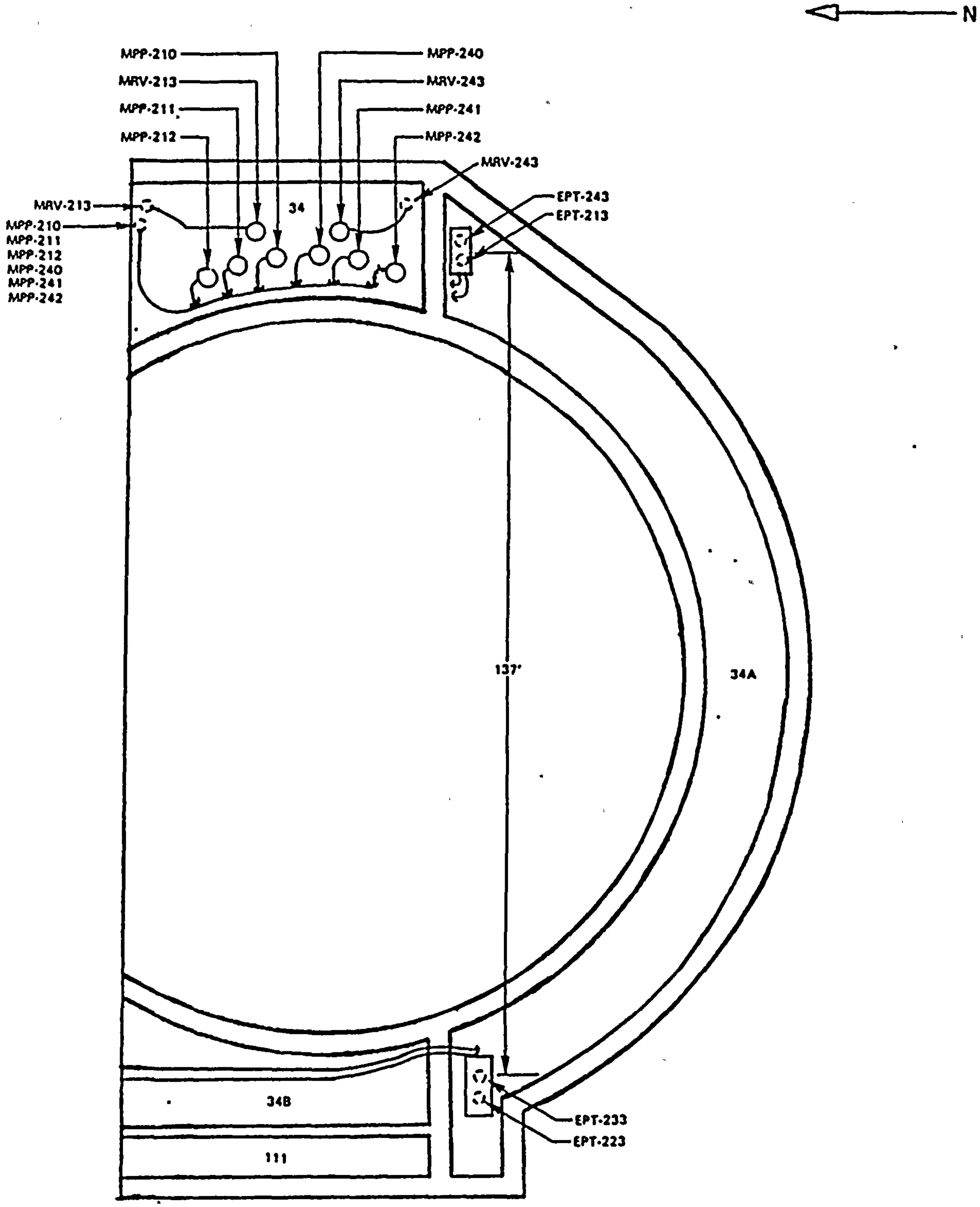


FIGURE 7.8 EAST MAIN STEAM ENCLOSURE MAIN STEAM PIPING AND WEST NESW PIPING AREA UNIT 1

FIRE ZONES 33, 33A, 34B, ELEV. 612'



NOTE. ① DIMENSIONS ARE ONLY APPROXIMATIONS

② EPT's ARE THE ELECTROPNEUMATIC TRANSMITTERS FOR MRV-213, 223, 233, 243

FIGURE 7.9 EAST MAIN STEAM ENCLOSURE MAIN STEAM PIPING AND WEST NESW PIPING AREA UNIT 2

FIRE ZONES 34, 34A, 34B ELEV. 612'

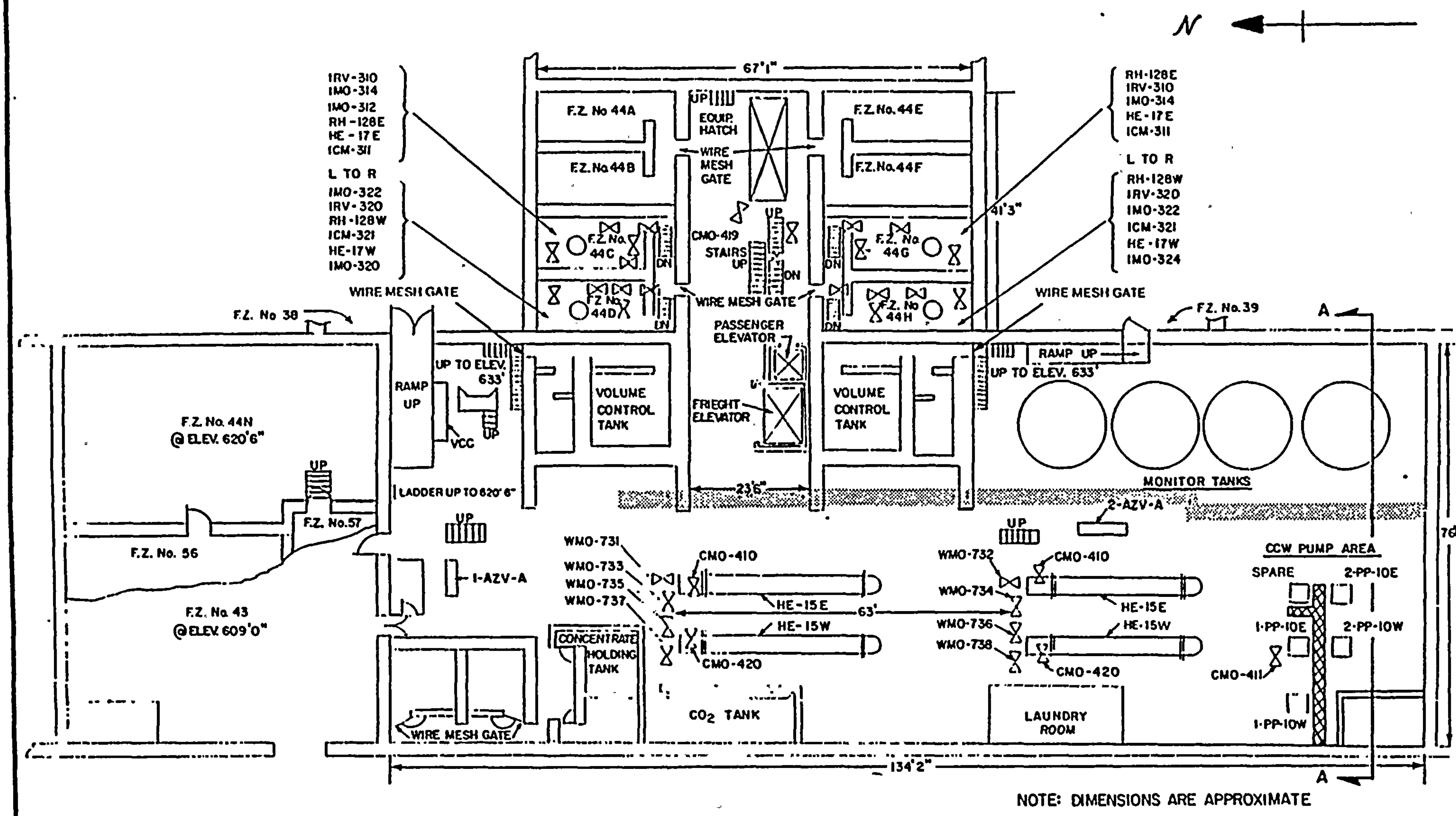


FIGURE 7.10.1 AUXILIARY BUILDING — EL. 609

GENERAL OUTLINE OF FIRE ZONES 44N, 44S

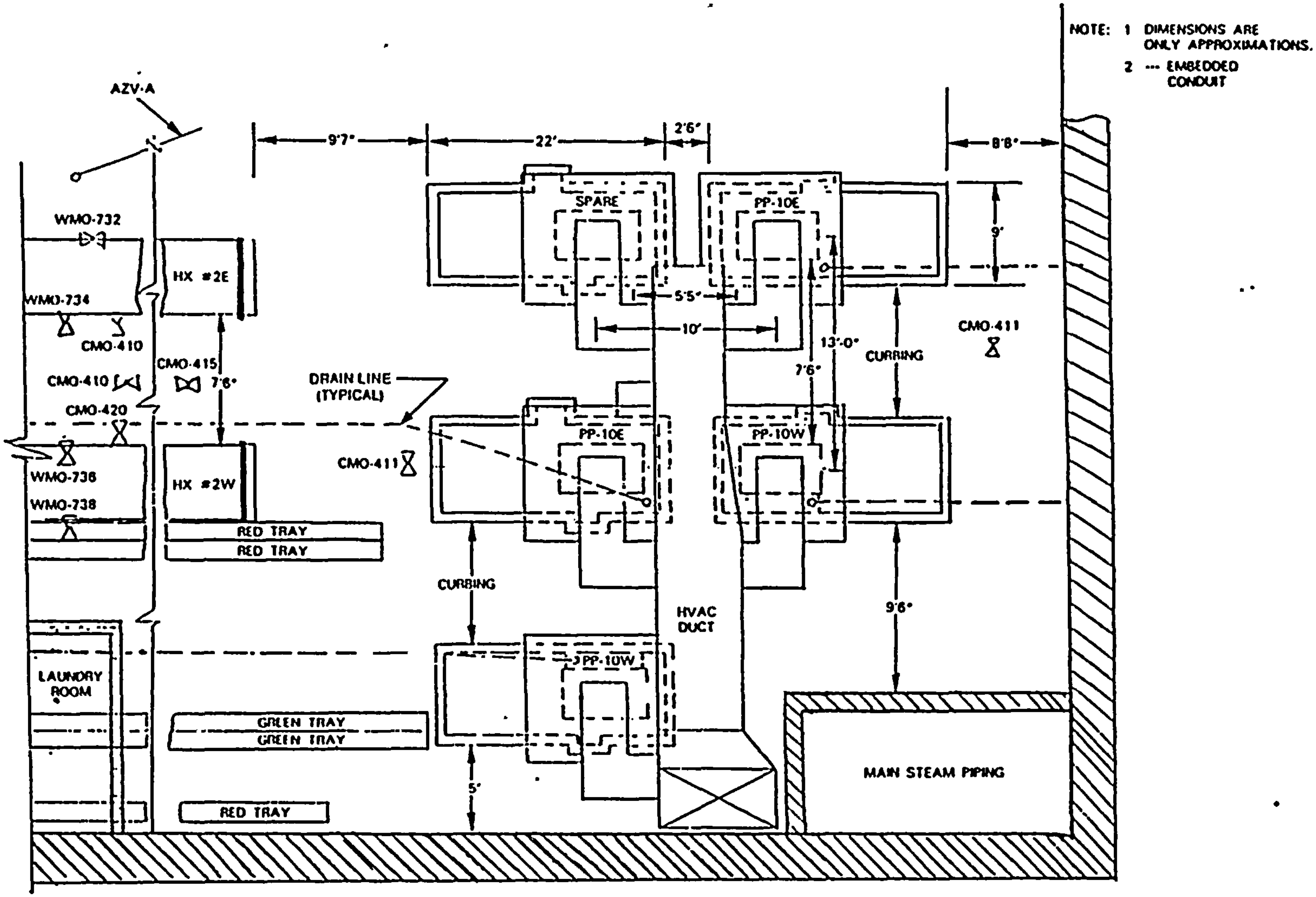
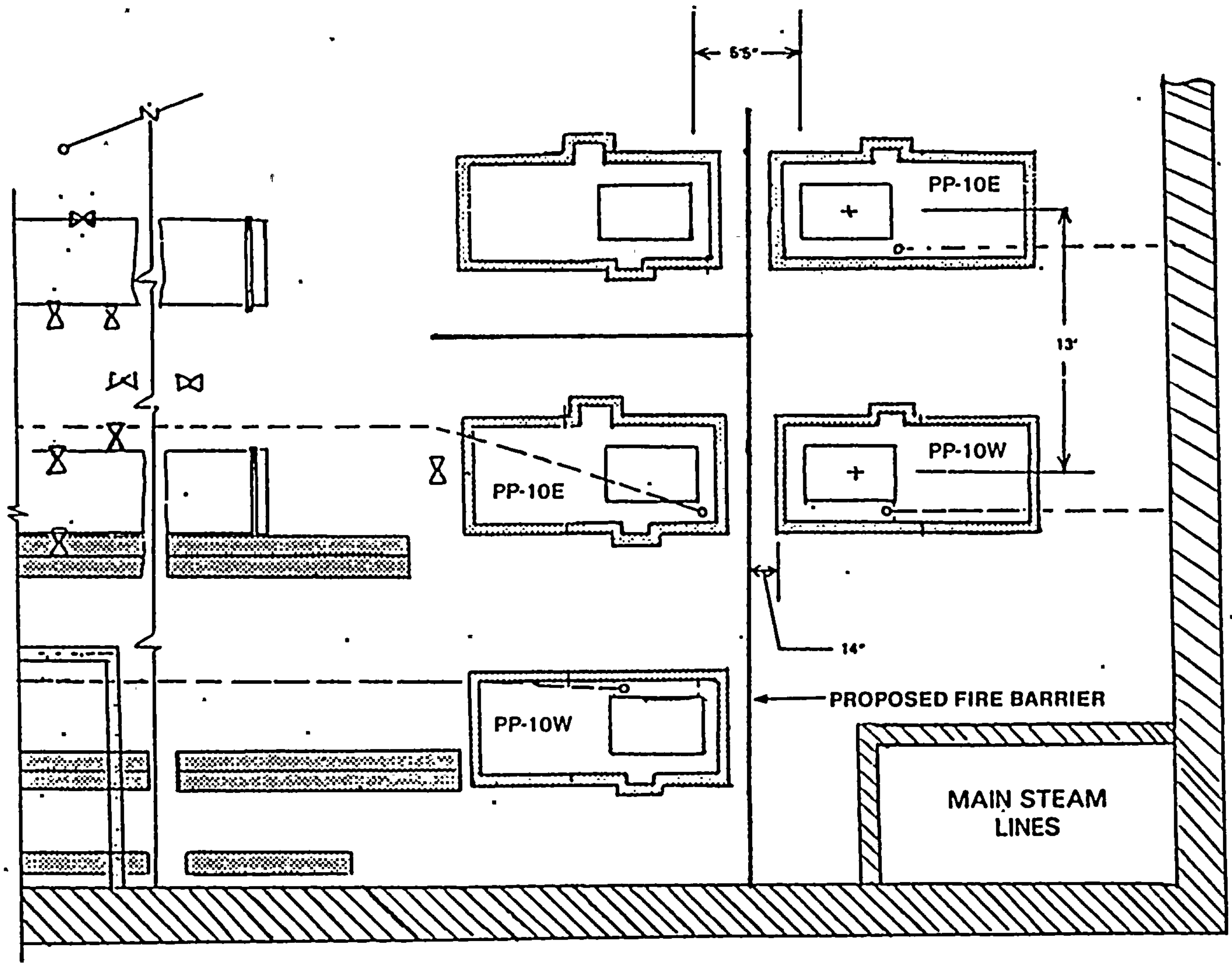


FIGURE 7.10.2 ZONE 44S — SOUTH END AUXILIARY BUILDING — EL. 609

PARTIAL PLAN FIRE ZONES 44S NEAR CCW PUMPS

EVEL. 609'



PROPOSED FIRE BARRIER LOCATION

FIRE ZONE 44S

FIGURE 7.10.3 CCW PUMPS PROPOSED FIRE BARRIER LOCATION

NOTE:
SEE FIGURE 7.10.2 FOR IDENTIFICATION OF COMPONENTS

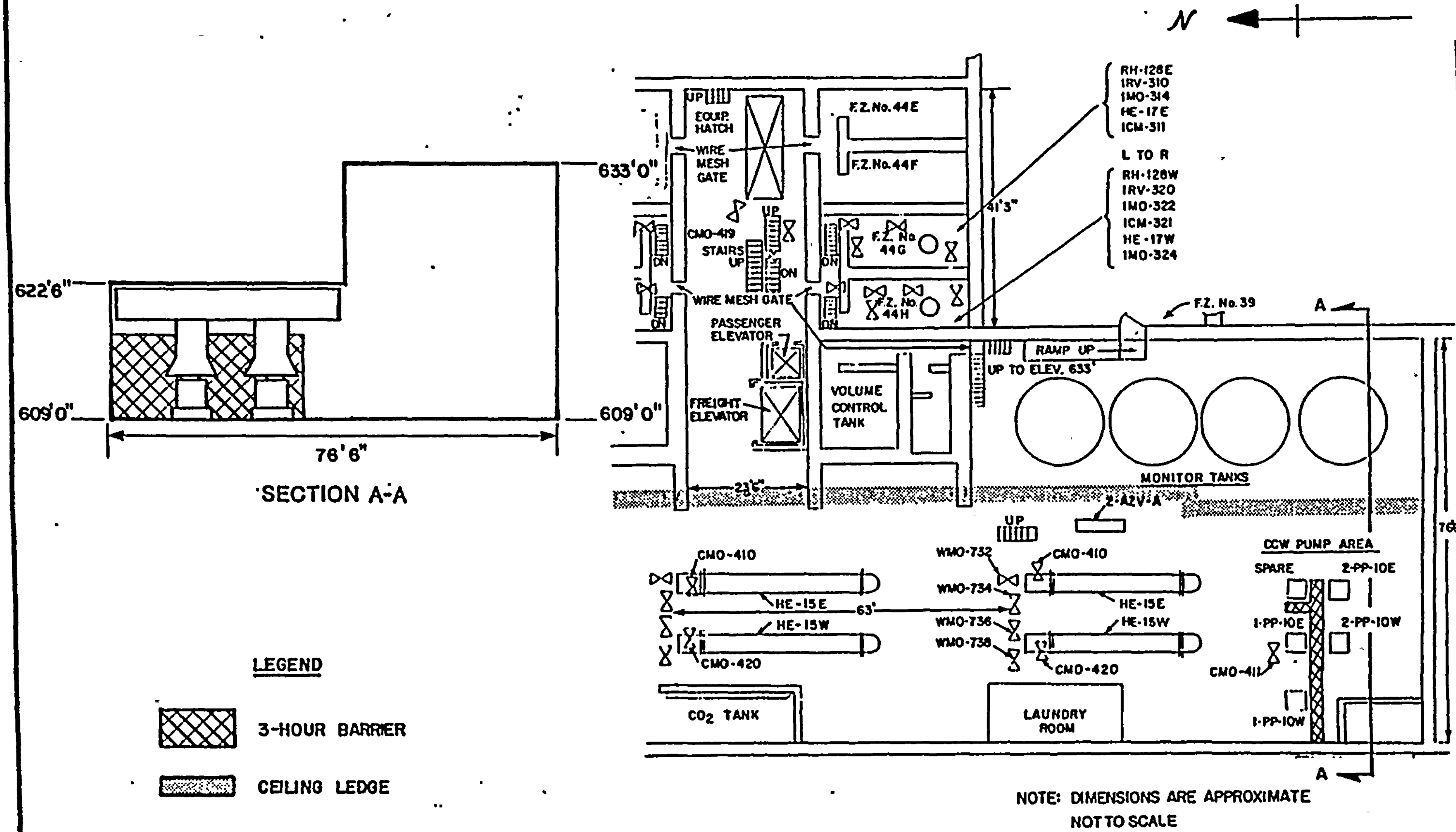


FIGURE 7.10.4 PLAN AND ELEVATION OF CEILING LEDGE IN FIRE ZONE 44S

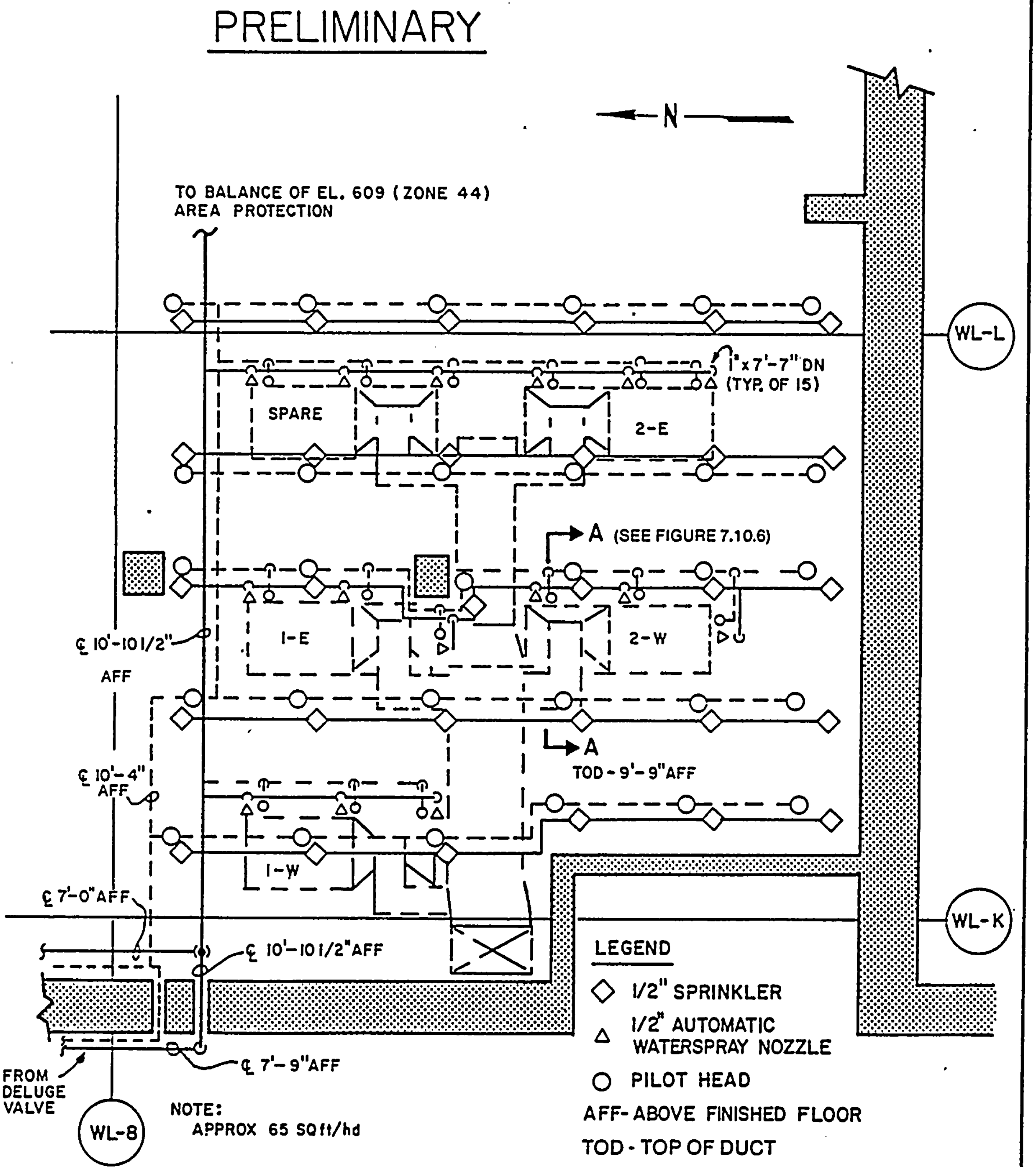
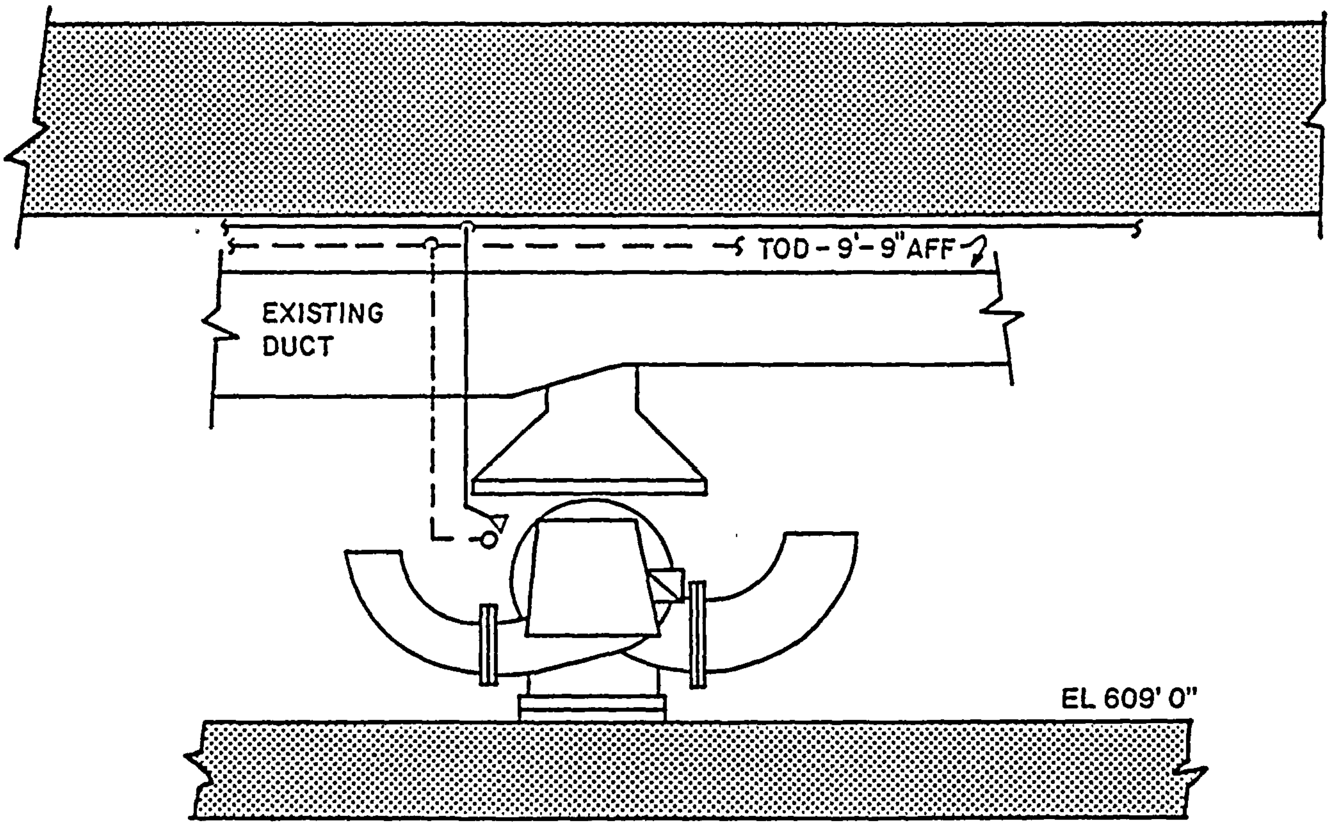


FIGURE 7.10.5 PROPOSED PLAN
LAYOUT OF SUPPRESSION AND DETECTION SYSTEMS

PRELIMINARY



SECTION A–A
SEE FIGURE 7.10.5

LEGEND
- △ 1/2" AUTOMATIC WATERSPRAY NOZZLE
- ○ PILOT HEAD

TOD - TOP OF DUCT
AFF - ABOVE FINISHED FLOOR

FIGURE 7.10.6 SCHEMATIC ELEVATION VIEW OF DETECTION AND SUPPRESSION SYSTEMS

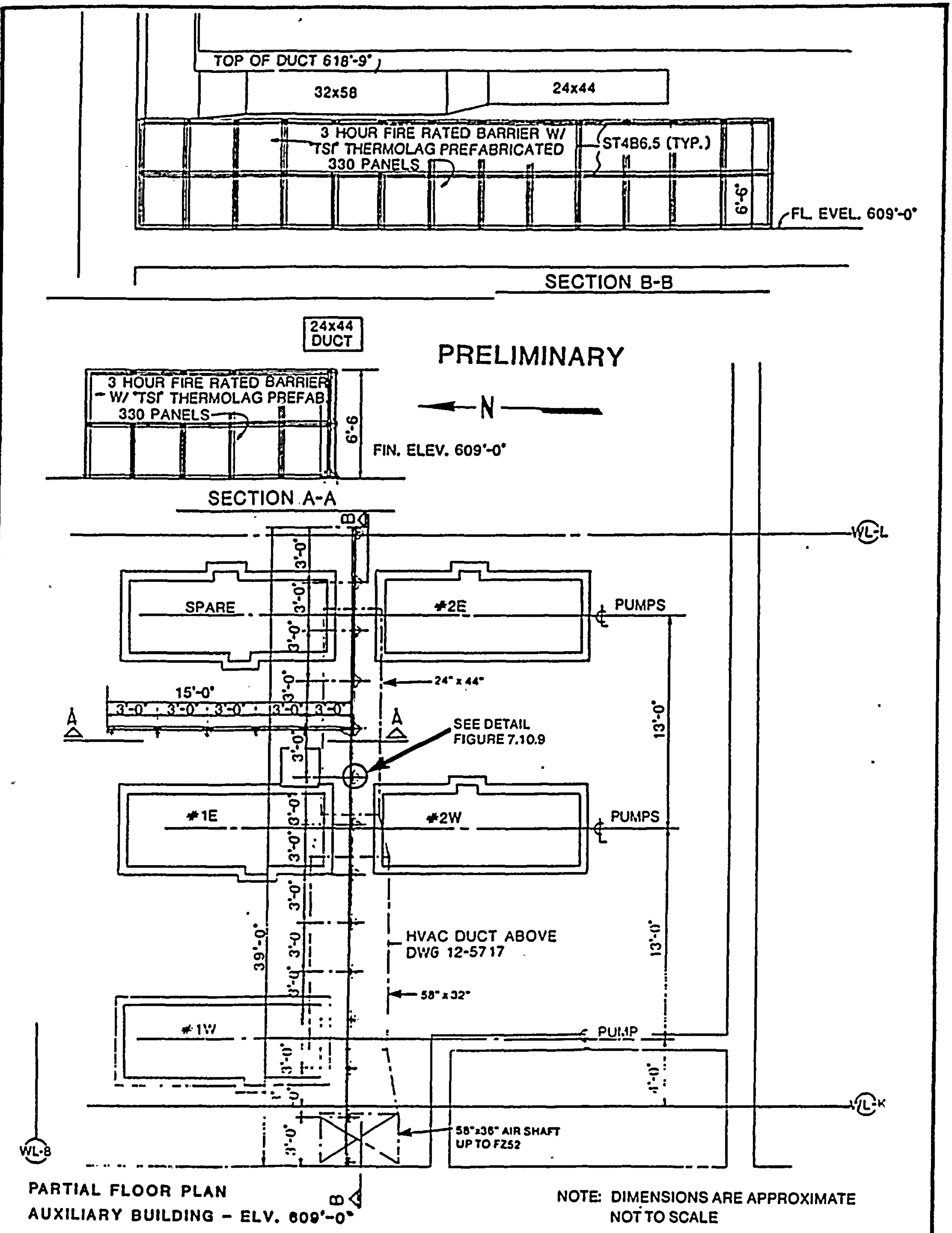
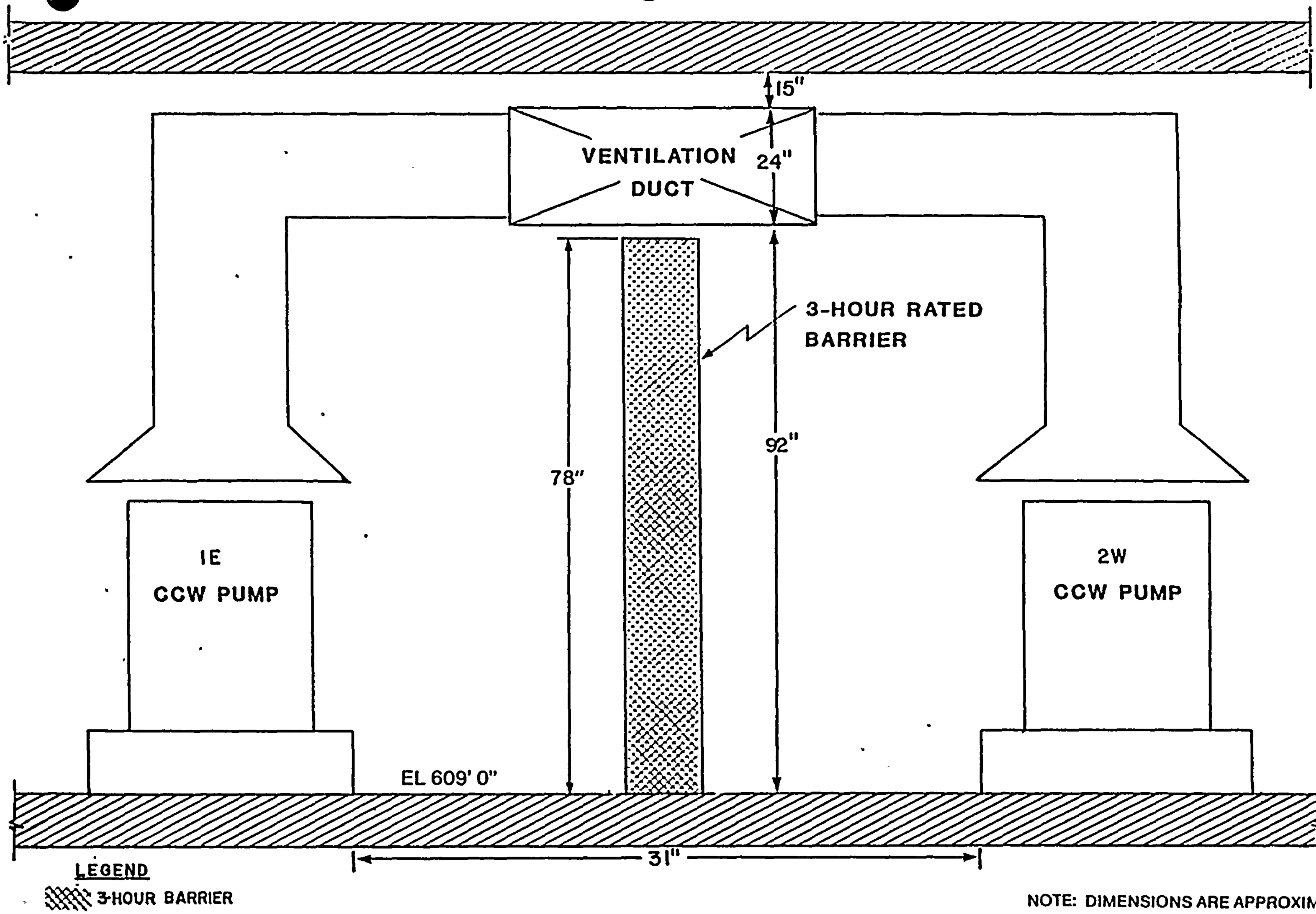


FIGURE 7.10.7 FIRE BARRIER BETWEEN COMPONENT COOLING WATER PUMPS



NOTE: DIMENSIONS ARE APPROXIMATE NOT TO SCALE

FIGURE 7.10.8 ELEVATION OF CCW PUMP FIRE BARRIER

PRELIMINARY

D.C. COOK PLANT - PUMPS FIRE BARRIER DETAIL

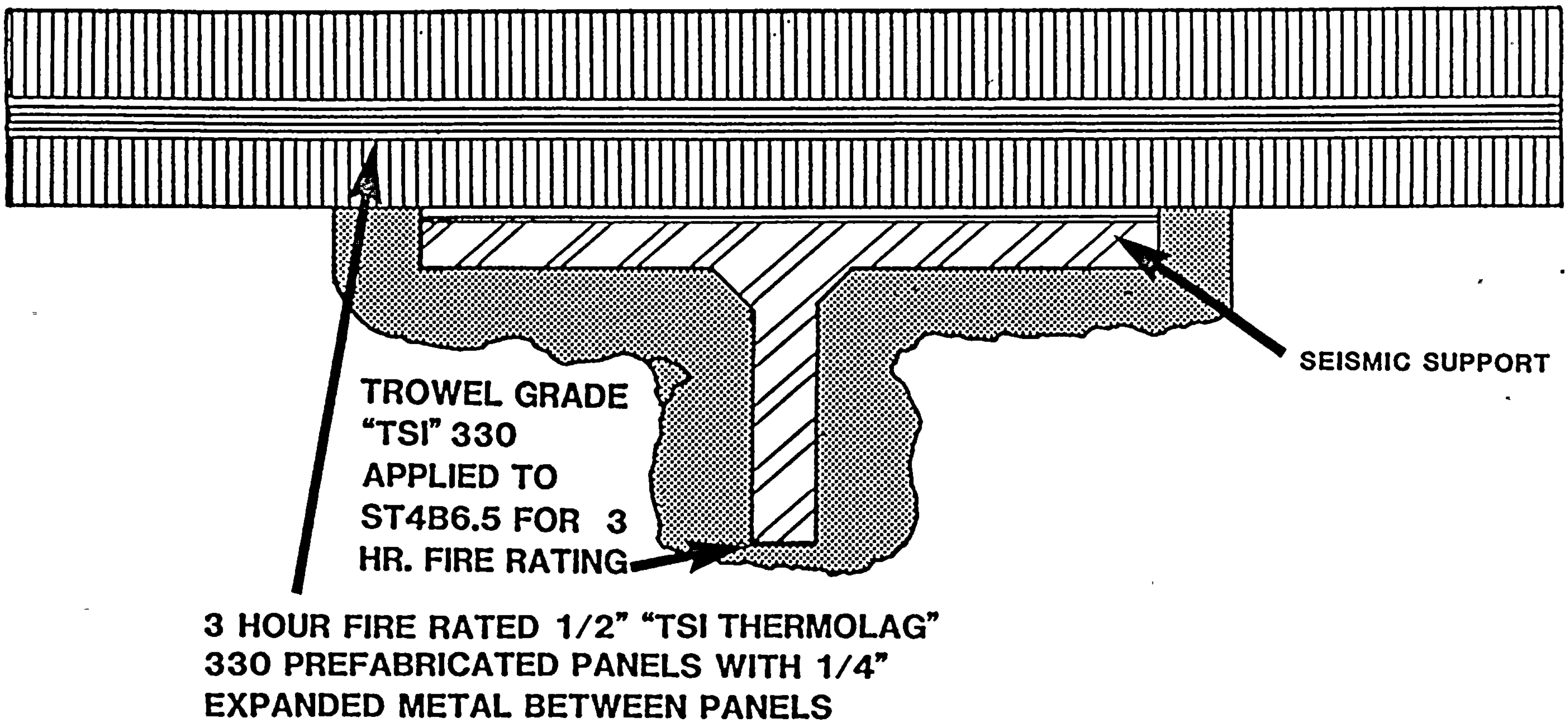


FIGURE 7.10.9 FIRE BARRIER BETWEEN COMPONENT COOLING WATER PUMPS

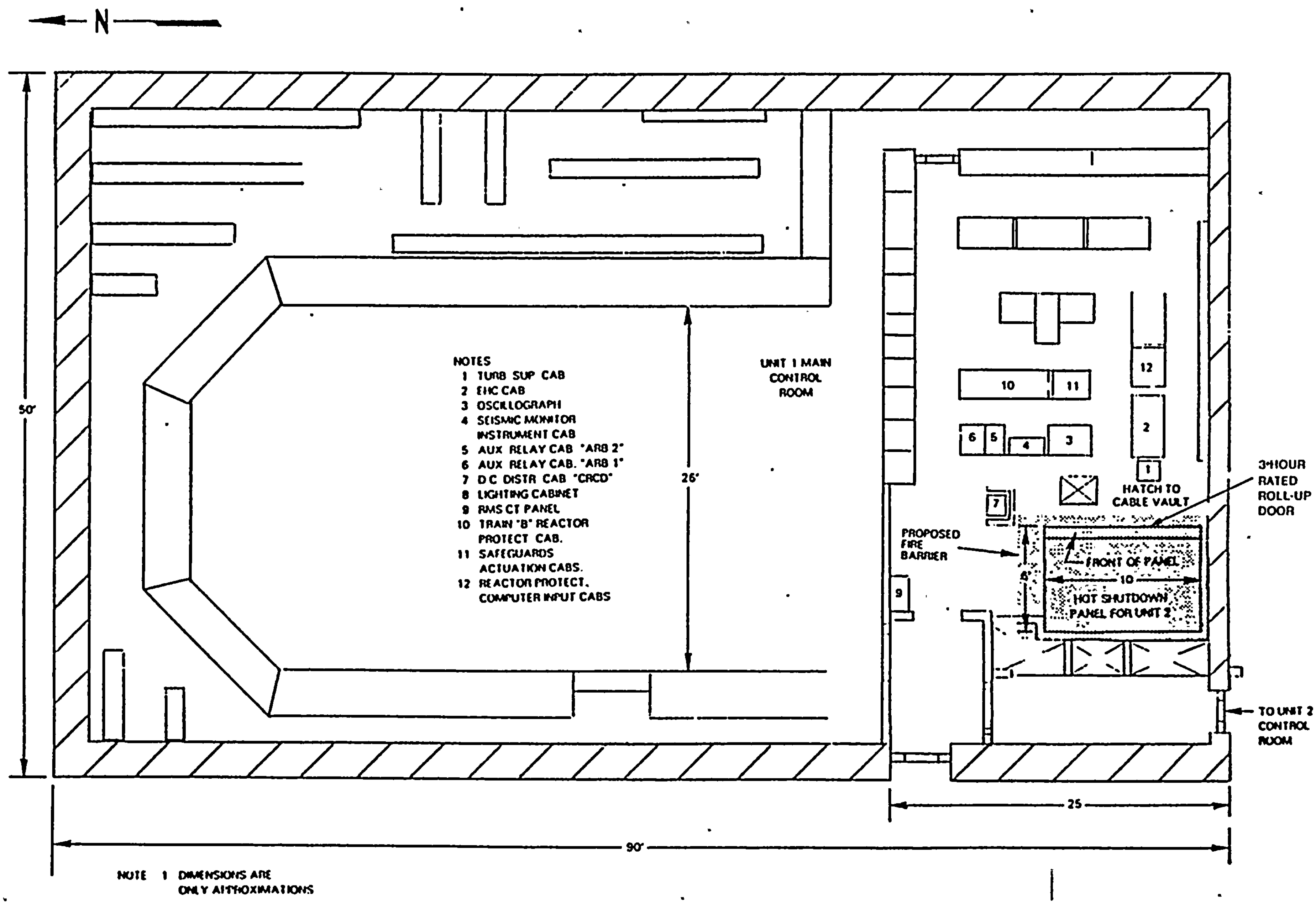


FIGURE 7.11 CONTROL ROOM UNIT 1

ZONE 53 ELEV. 633'

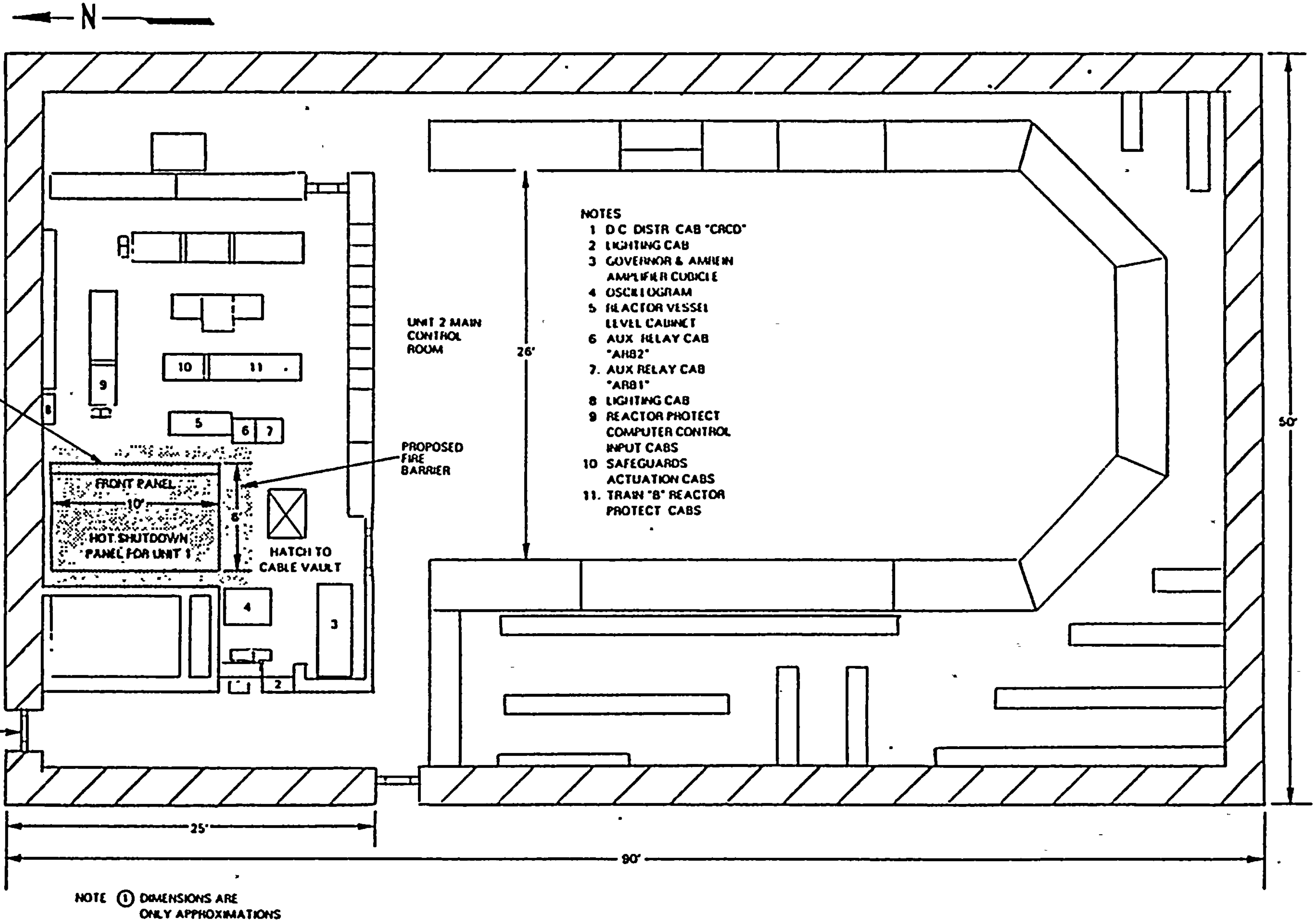
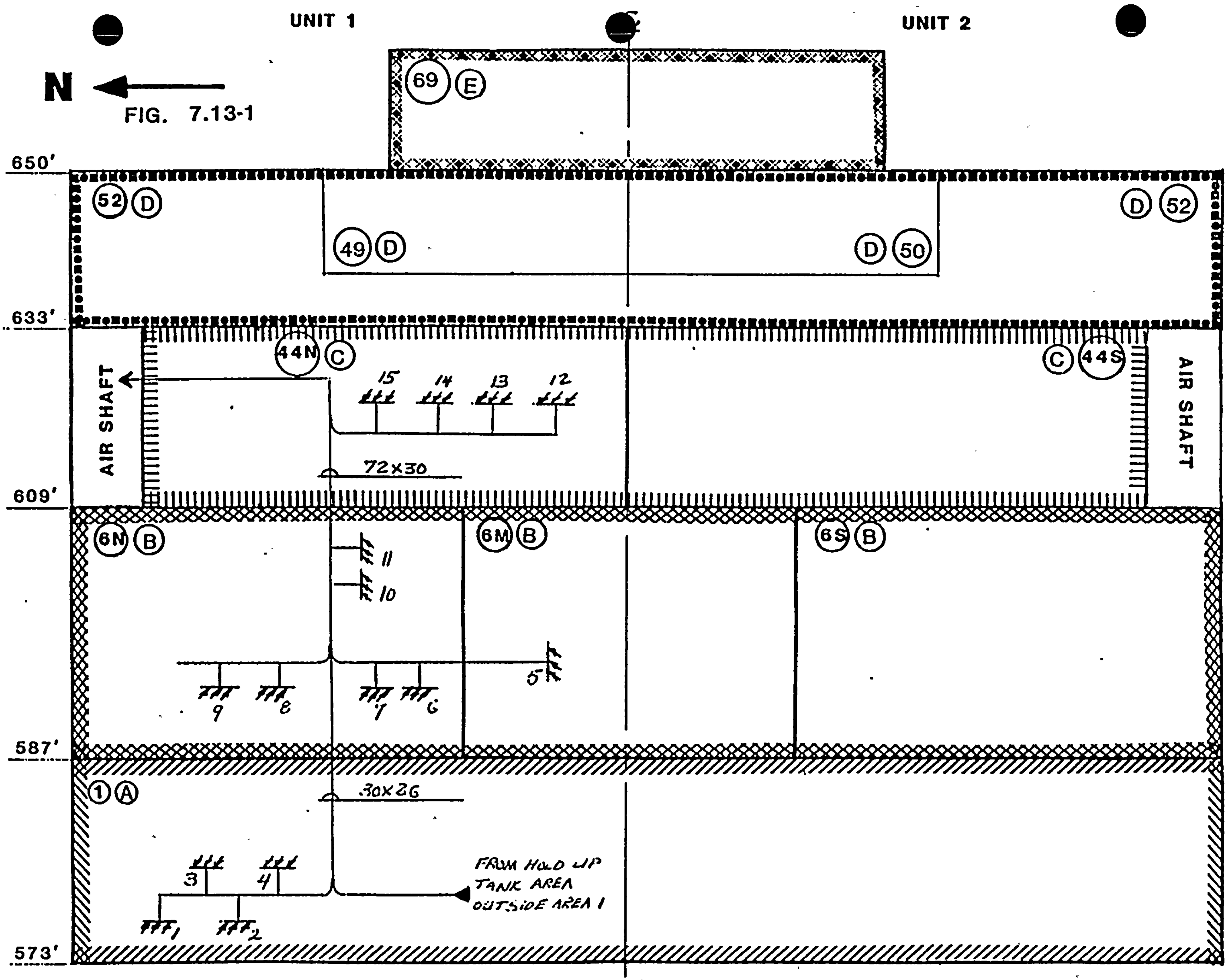
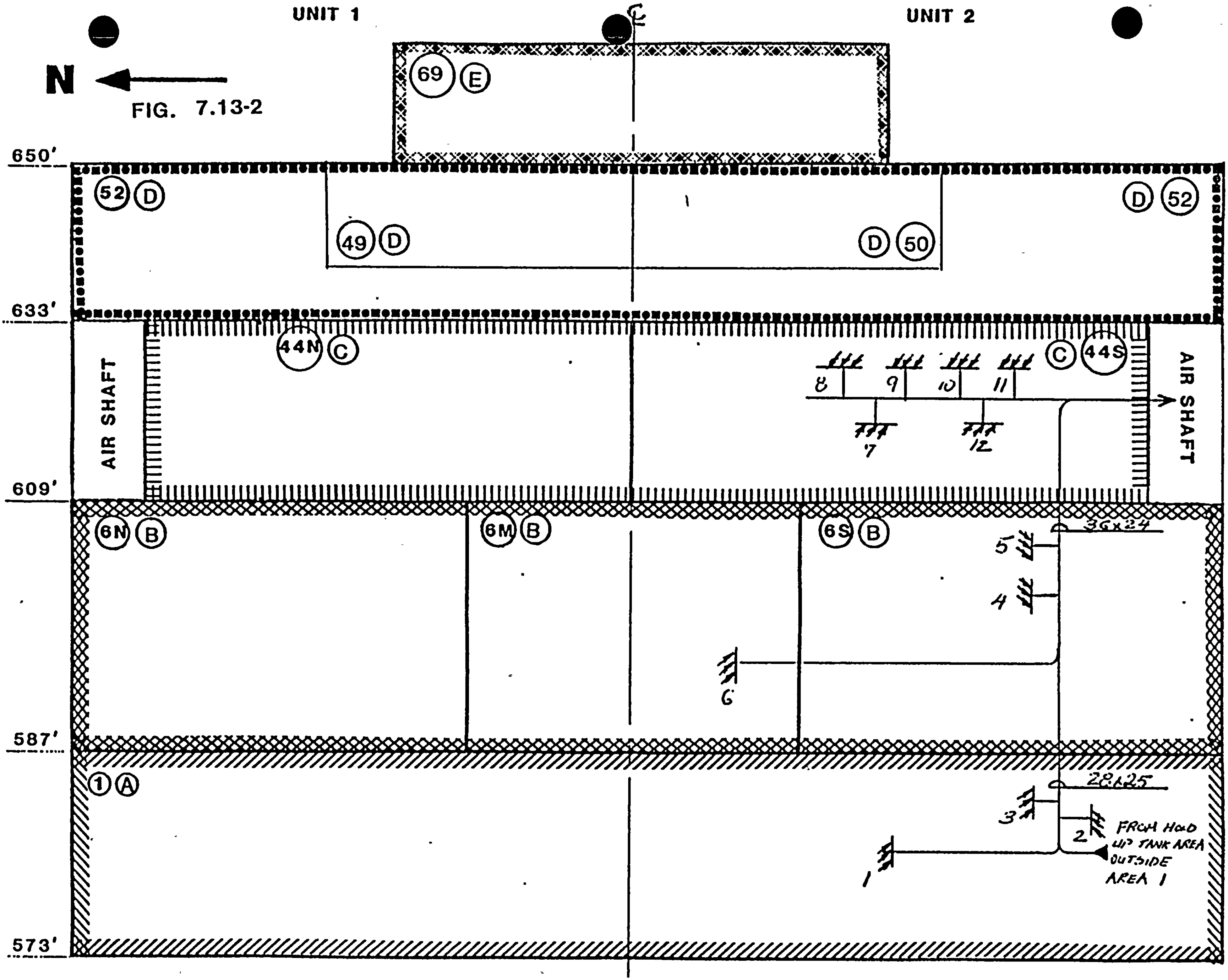


FIGURE 7.12 CONTROL ROOM UNIT 2

ZONE 54 ELEV. 633'



UNIT 1
UNIT 2
N
FIG. 7.13-1
650'
633'
609'
587'
573'
69 E
52 D
49 D
D 50
D 52
44N C
C 44S
AIR SHAFT
AIR SHAFT
15
14
13
12
72x30
6N B
6M B
6S B
11
10
5
9
8
7
6
1 A
30x26
3
4
1
2
FROM HOLD UP TANK AREA OUTSIDE AREA 1



UNIT 1
UNIT 2
℄
N
650'
633'
609'
587'
573'
69 E
52 D
49 D
D 50
D 52
44N C
C 44S
AIR SHAFT
AIR SHAFT
8
9
10
11
7
12
6N B
6M B
6S B
36x24
5
4
6
1 A
28x25
3
2
1
FROM HOLD UP TANK AREA OUTSIDE AREA 1

FIG. 7.13-2

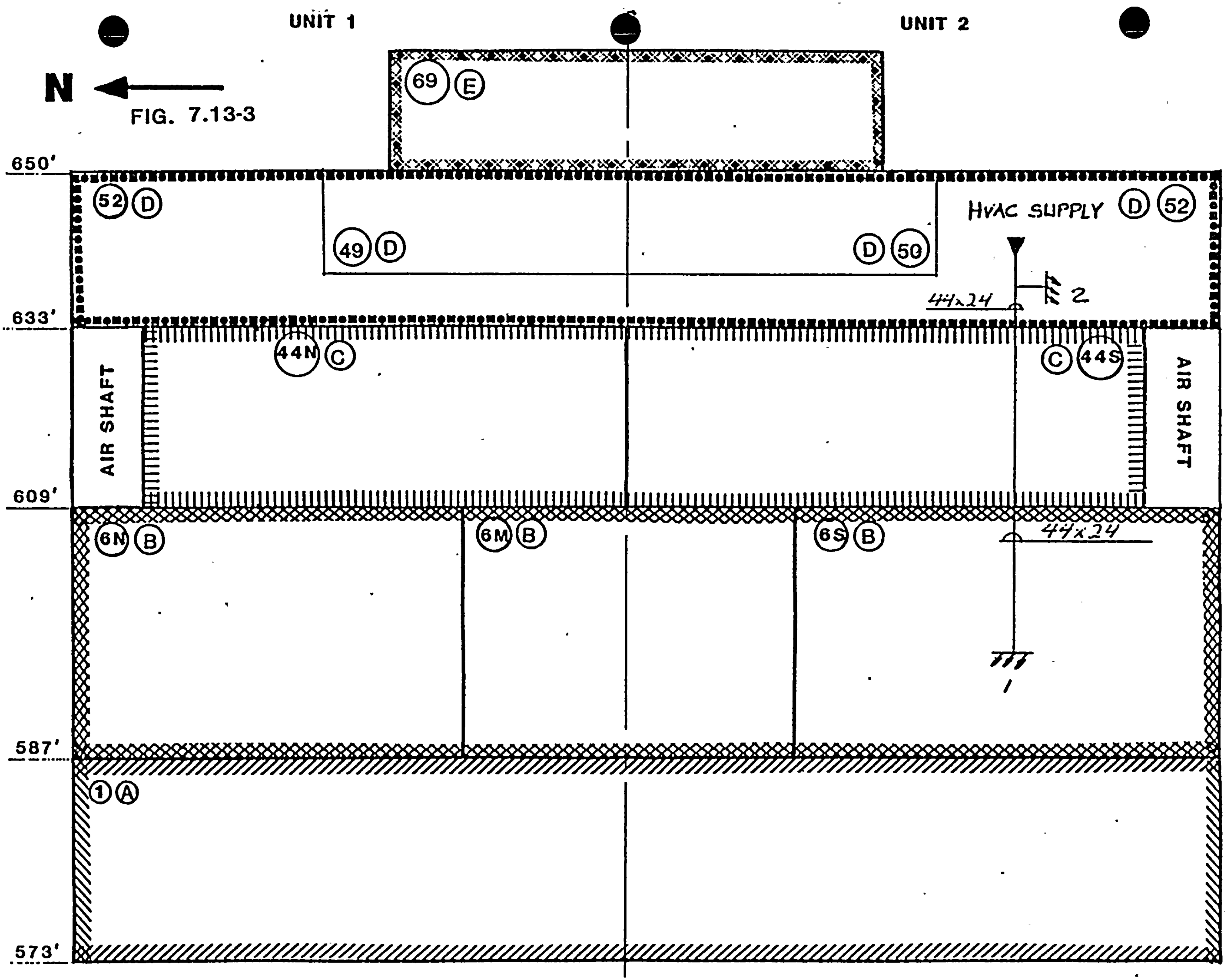
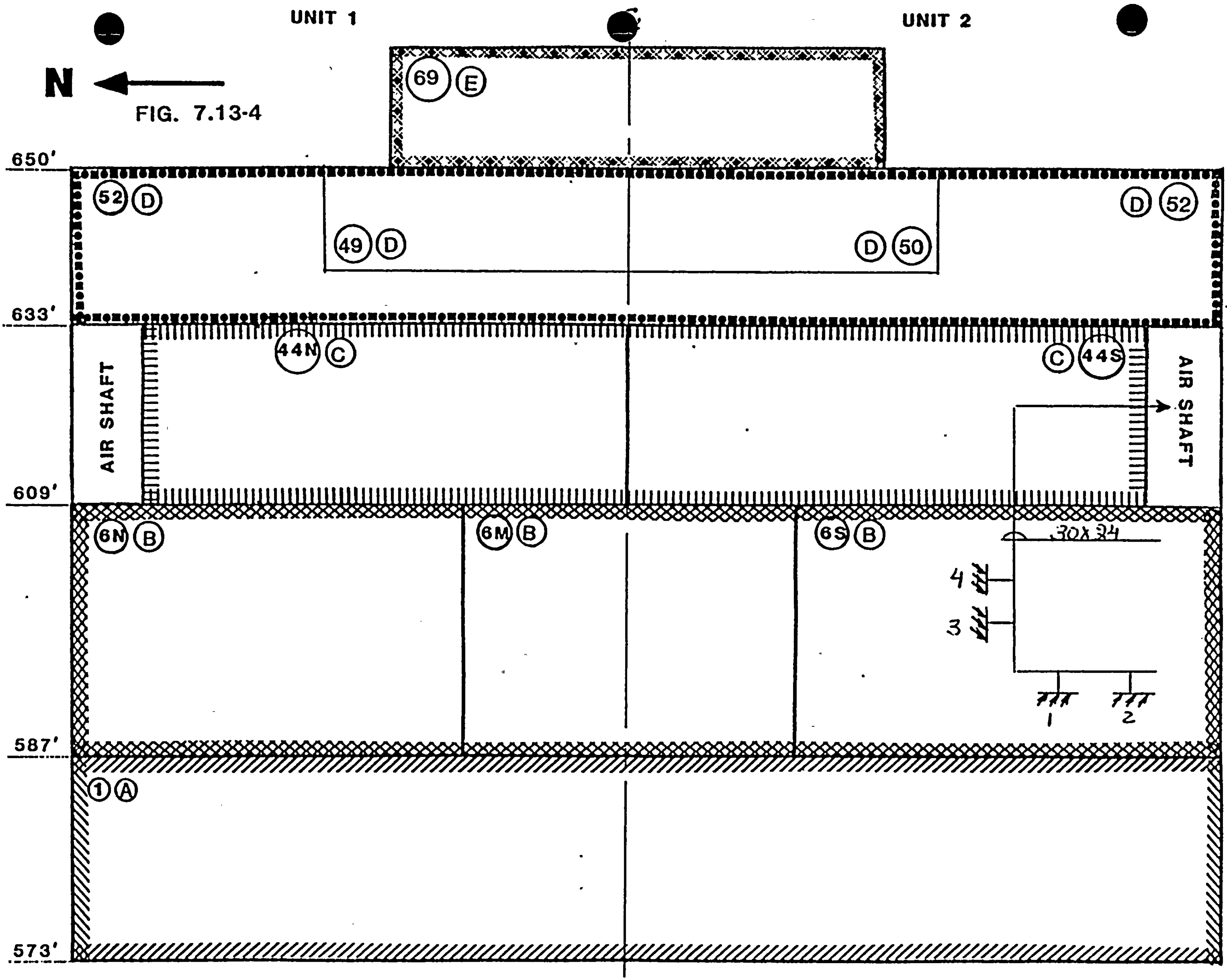

UNIT 1
UNIT 2
N
650'
633'
609'
587'
573'
69 E
52 D
49 D
D 50
HVAC SUPPLY
D 52
44x24
2
44N C
C 44S
AIR SHAFT
AIR SHAFT
6N B
6M B
6S B
44x24
1
1 A

FIG. 7.13-3

FIG. 7.13-4


UNIT 1
UNIT 2
N
650'
633'
609'
587'
573'
69 E
52 D
49 D
D 50
D 52
44N C
C 44S
AIR SHAFT
AIR SHAFT
6N B
6M B
6S B
30x34
4
3
1
2
1 A

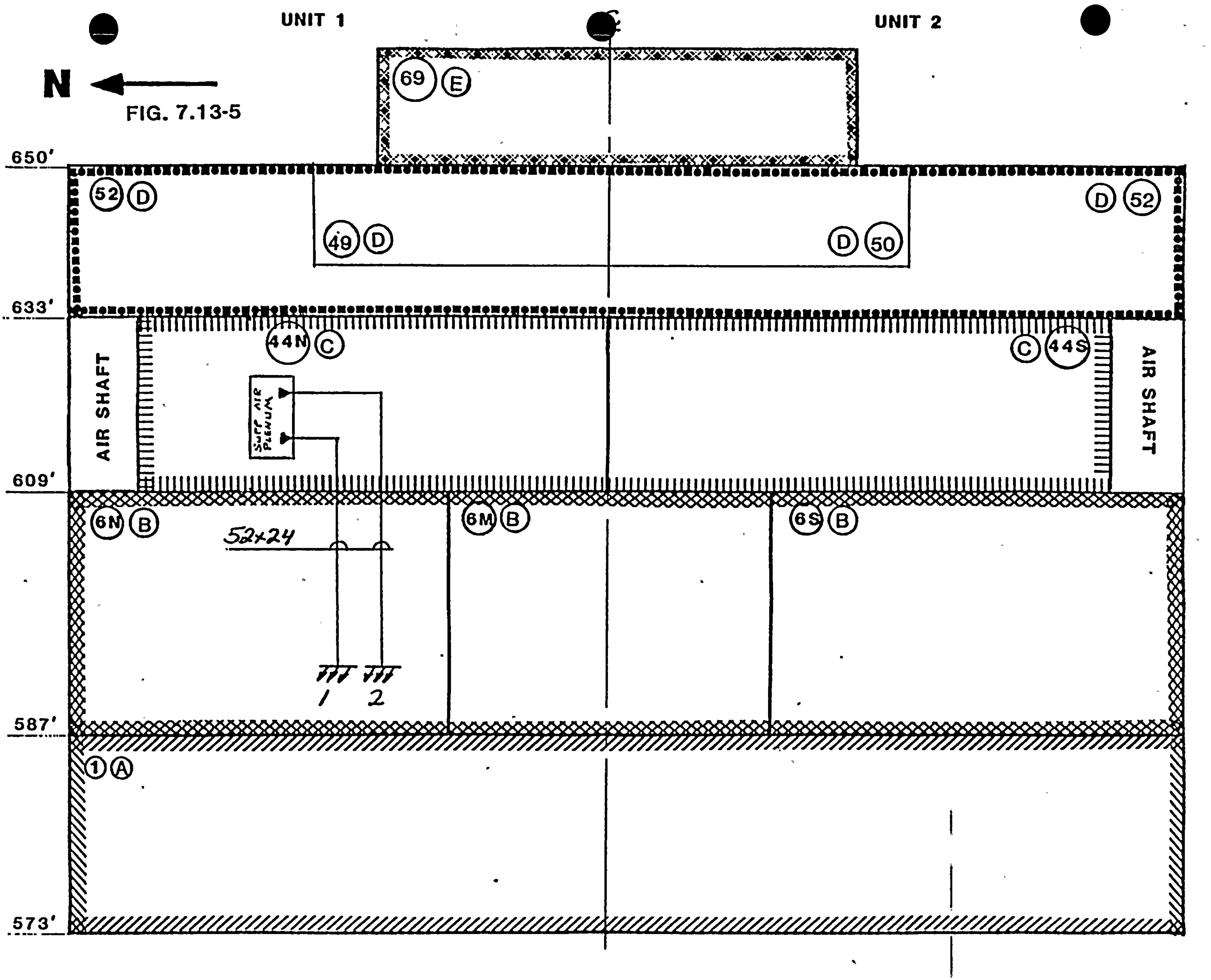
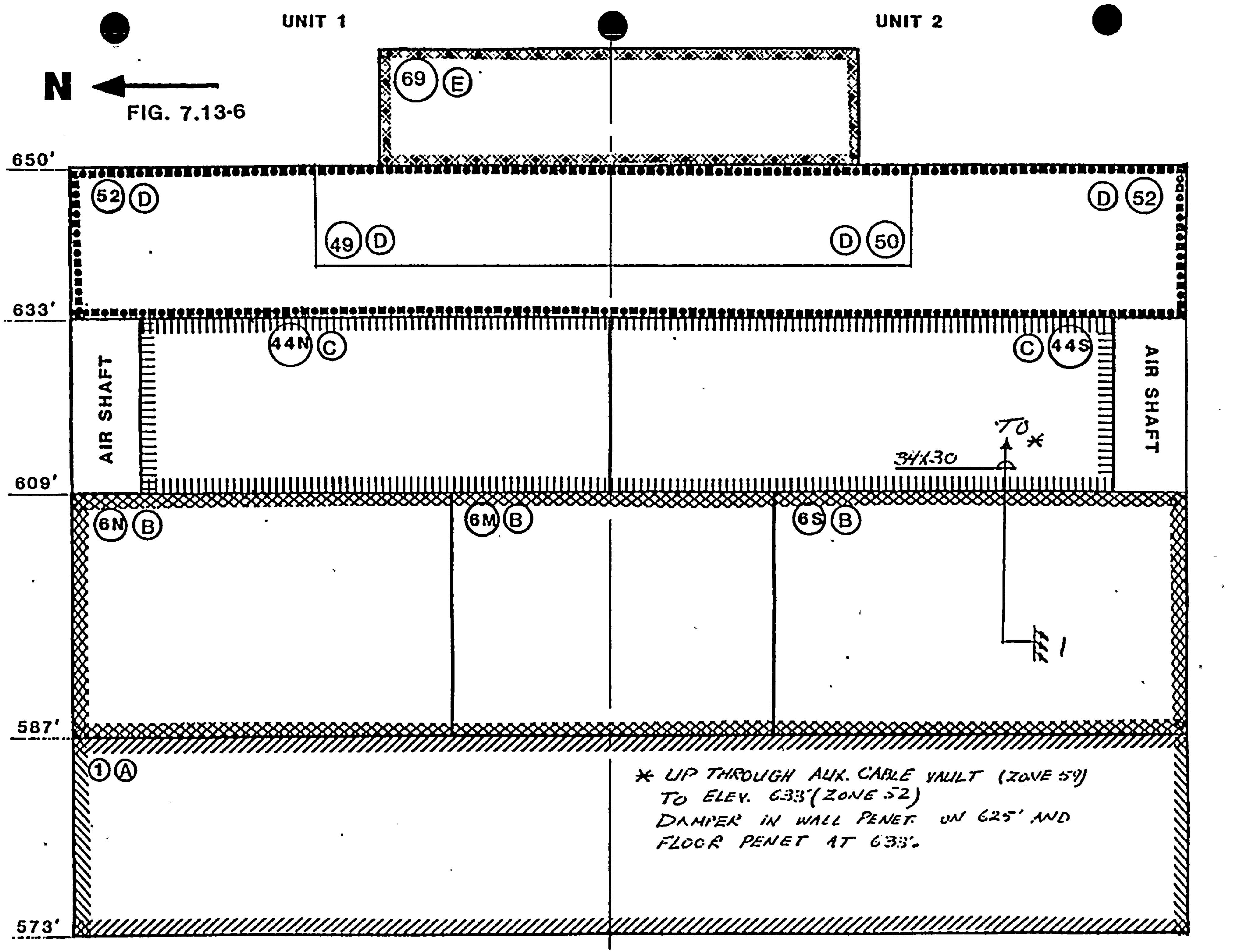
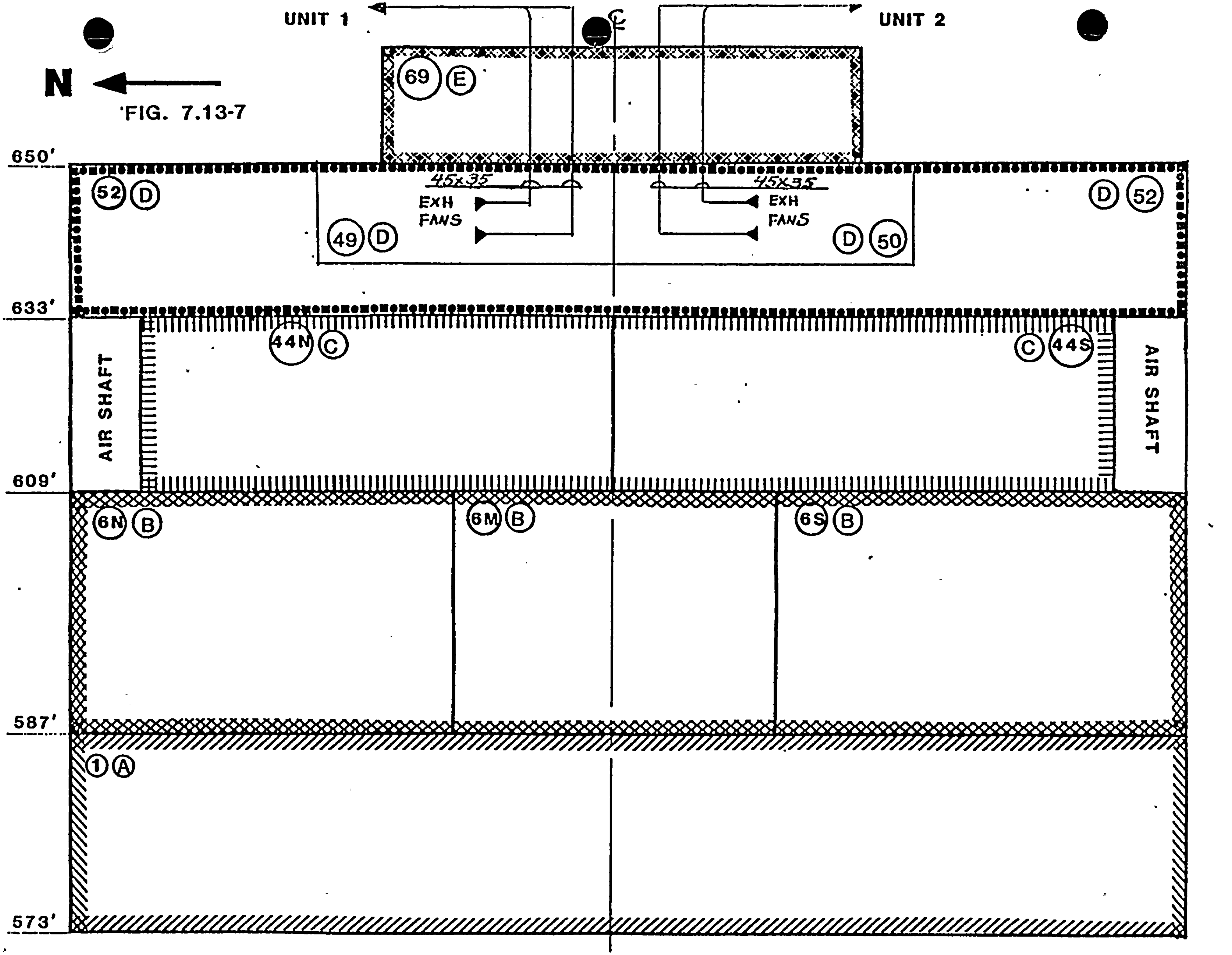

UNIT 1
UNIT 2
N
FIG. 7.13-5
650'
633'
609'
587'
573'
69 E
52 D
49 D
D 50
D 52
44N C
C 44S
AIR SHAFT
AIR SHAFT
SUPP AIR PLENUM
52x24
6N B
6M B
6S B
1
2
1 A

FIG. 7.13-6



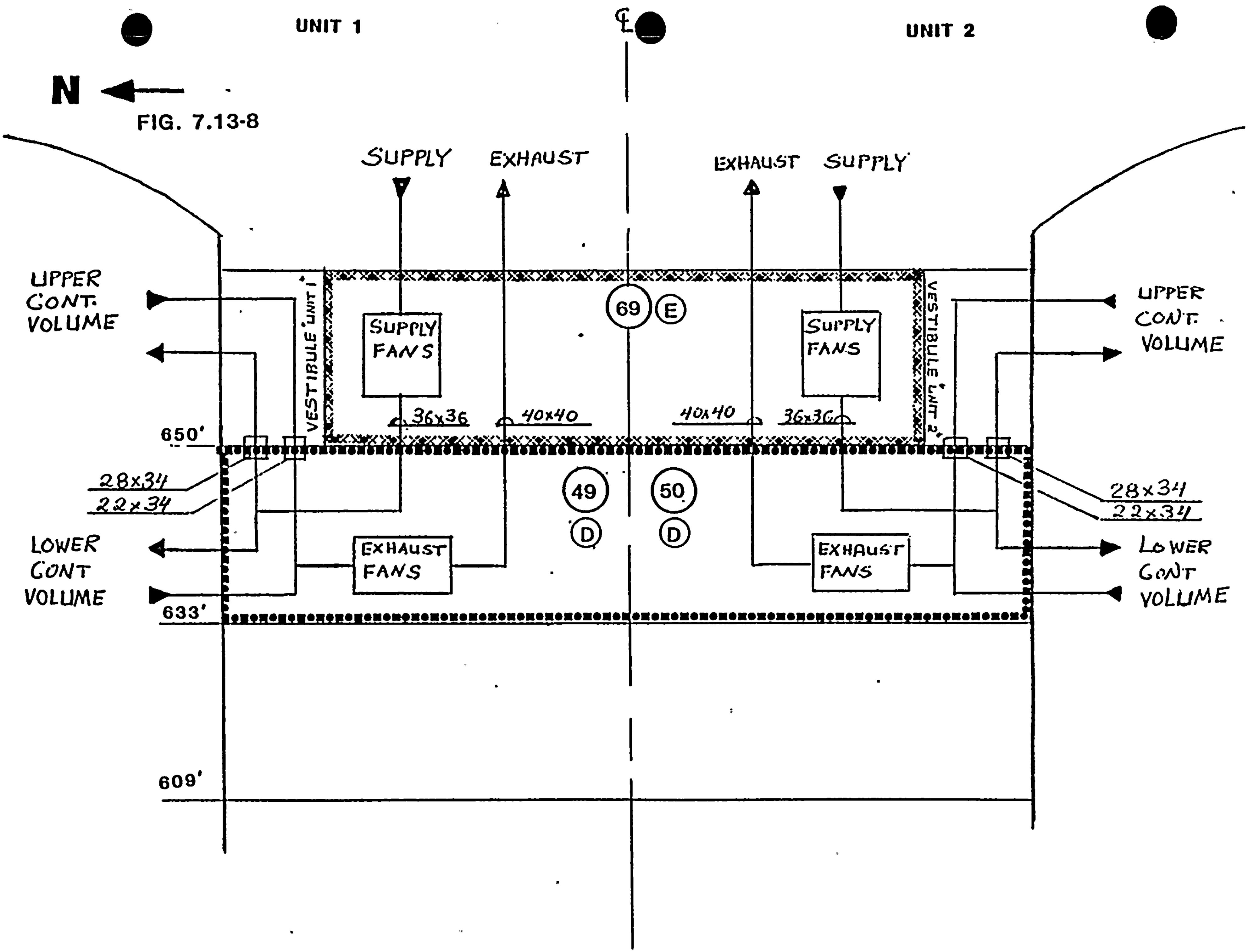
UNIT 1
UNIT 2
N
650'
633'
609'
587'
573'
69 E
52 D
49 D
D 50
D 52
AIR SHAFT
44N C
C 44S
AIR SHAFT
TO *
34X30
6N B
6M B
6S B
1
1 A
* UP THROUGH AUX. CABLE VAULT (ZONE 59)
TO ELEV. 633' (ZONE 52)
DAMPER IN WALL PENET. ON 625' AND
FLOOR PENET AT 633'.

FIG. 7.13-7



UNIT 1
UNIT 2
N
650'
633'
609'
587'
573'
69 E
52 D
49 D
D 50
D 52
45x35
45x35
EXH
FANS
EXH
FANS
44N C
C 44S
AIR SHAFT
AIR SHAFT
6N B
6M B
6S B
1 A

FIG. 7.13-8


UNIT 1
UNIT 2
N
SUPPLY
EXHAUST
EXHAUST
SUPPLY
UPPER CONT. VOLUME
UPPER CONT. VOLUME
VESTIBULE UNIT 1
VESTIBULE UNIT 2
SUPPLY FANS
SUPPLY FANS
69
E
36x36
40x40
40x40
36x36
650'
28x34
22x34
28x34
22x34
49
50
D
D
LOWER CONT VOLUME
LOWER CONT VOLUME
EXHAUST FANS
EXHAUST FANS
633'
609'

8. PROPOSED MODIFICATIONS

Introduction

The safe shutdown system review for the D.C. Cook Nuclear Plant indicated that most fire areas were in compliance with Appendix R. The majority of the areas not in compliance will be provided with alternate shutdown capability, which is discussed in detail in Section 5. A comprehensive fire hazards analysis was performed on the remaining fire areas. The majority of these areas will be brought into Section III.G compliance via fire protection modifications. Refer to Table 1-1 for the specific III.G compliance measures achieved. The balance of 11 fire areas, or zones, require exemption requests or engineering evaluations and will be modified to the greatest extent practicable to ensure at least one train of safe shutdown circuits and components remains free of fire damage. The specific exemption requests are discussed in Section 7.

Since the 1983 submittal, Appendix R long-term conformance work has continued at D.C. Cook. As a result, several engineering evaluations have been performed that have added several fire protection modifications and alleviated the need for several fire protection modifications previously identified in the 1983 Appendix R submittal. The engineering evaluations performed since 1983 are contained in Section 9.

This section identifies the proposed fire protection modifications necessary to bring fire areas into compliance with Section III.G or to satisfy the assumptions made in Section 7 for each exemption from the provisions of Section III.G requested or to support the engineering evaluations made in Section 9.

In addition to the fire protection modifications proposed in this section, certain mechanical and electrical system modifications will be performed to meet the requirements of Section III.G.3. These mechanical and electrical system modifications, which were proposed and discussed in Section 5, when implemented, will provide the alternative shutdown capability proposed for D.C. Cook. These alternative shutdown modifications are repeated in this section by system classification (e.g., ESW, CVCS, CCW, etc.). During the course of the electrical system coordination study, various electrical circuit protective device protection curves were modified to optimize electrical coordination. Recalibration of the installed devices to these new curves will also be implemented as a plant modification.

The total scope of these system and fire protection modifications, as proposed, will bring D.C. Cook to a uniform level of protection in all fire areas such that further modifications would not substantially enhance overall fire protection. A number of modifications, as originally proposed, were contingent upon either the NRC acceptance of the alternative shutdown capability or the granting of the exemptions discussed in Section 7, which have both been received.

Fire Protection Modifications

The modifications discussed in this section are those specifically involving fire protection features and are categorized as follows:

(1) Conduit and Cable Tray Protection

(2) Suppression and Detection

(3) Boundary Modification

The majority of the modifications proposed will upgrade the ratings of fire area boundaries to provide a fire resistance in excess of the expected combustible loading on either side of the boundary.

Conduit and cable tray protection, when required, will provide a fire rating equivalent to one hour and protect at least one redundant train of systems in the zone or area. In some cases, additional conduits and cable trays may be protected even though not required for separation of redundant trains of systems. This may occur where, due to the physical proximity of conduits and cable trays not requiring protection, adequate protection cannot be achieved without protecting the adjacent conduits and cable trays. Fire stops have been provided in certain cable trays in order to remove intervening combustibles as an issue in various plant locations. Unit 1 firestopping was performed under RFC-01-2681 while Unit 2 firestopping was performed under RFC-02-2696. The suppression and detection modifications will comply with applicable fire protection codes and standards for installation and coverage. The modifications made will provide suppression and detection in all areas containing redundant safe shutdown equipment where alternate shutdown is not practical or an exemption is requested. The boundary modifications are generally made to upgrade fire area boundaries to a rating commensurate with the combustible fire loading of the fire area, or to provide protection between two redundant divisions.

The modifications proposed will bring the D. C. Cook Plant to a uniform level of protection for all areas such that further modifications would not enhance fire protection safety. The modifications proposed are described in the subsequent paragraphs.

8.1 Fire Area 1 (Fire Zones 1, 1A through 1H, 136, 137, 138A, 138B and 138C) RHR and CTS Pump Area

8.1.1 Conduit and Cable Tray Protection

The power cable in conduits 8003R-1 and 8003R-2 for the west RHR pumps (1PP-35W and 2PP-35W) Units 1 and 2, respectively, will be provided with fire protection barriers equivalent to one-hour rating. Table 8-1 provides a list by fire zone of the wrapped raceways, the cables of concern within those raceways and their associated components. The conduits are located in the extreme northwest and southwest corners of the fire area entering from conduit embedded in concrete. The conduits are being protected in order to support an exemption from the criteria of Appendix R, Section III.G.2(c). Section III.G.2(c) requires that at least one train of redundant safe shutdown equipment or cables located in the same fire area be provided with one hour protection. In addition, detection and suppression are required for the area. The exemption in Section 7.2 of this report is requested from the suppression criteria of Appendix R, Section III.G.2(c).

8.1.2 Suppression and Detection

The eight pump cubicles will be provided with automatic fire detection with remote alarming capability in the Control Rooms. This modification is required to support the exemption request in Section 7.2 of this report with respect to detection criteria of Appendix R, Section III.G.2(c). Providing detection capability in the pump cubicles results in detection in normally accessible locations of the fire area.

8.1.3 Boundary Modifications/Evaluations

The seals and penetrations in the walls separating the east RHR pumps from the west RHR pumps of both units will be upgraded to a three-hour fire rating. This modification is required to separate redundant safe shutdown components that are located in the same fire area per the criteria of Appendix R, III.G.2(c). In addition, it is required to support the exemption request in Section 7.2 of this report.

Ceiling penetrations will be upgraded to provide at least a one-hour fire rating to separate this fire area from the one above on the 587 ft elevation of the Auxiliary Building. The Auxiliary Building HVAC duct exemption presented in Section 7.13 provides justifications for the undampered ducts penetrating through the ceiling of Fire Zone 1.

The ventilation duct entering the common air shaft (Fire Zones 12 or 22) from the east and west RHR pumps of both units will be provided with three-hour-rated dampers to separate the two trains of each unit's RHR pumps per the criteria of Appendix R, Section III.G.2(c) and also to support the exemption request in Section 7.2 of this report. The engineering evaluations presented in Section 9.4 justify the undampered HVAC openings to these same air shafts from the containment spray pump cubicles. The engineering evaluation presented in Section 9.33 justifies the undampered shaft opening connecting Fire Zone 138B with Fire Zone 6A.

The stairway opening between the pump cubicles will be provided with automatic suppression from the modifications proposed in Fire Zone 5 to separate this fire area from the one above on the 587 ft elevation of the Auxiliary Building (see Section 8.2).

An engineering evaluation has been performed justifying the undampered ventilation ducts between Fire Zones 1A and 1B to Fire Zone 12 and between Fire Zones 1E and 1F to Fire Zone 22. (See Section 9.4.)

An engineering evaluation has been performed justifying the unsealed openings in leakage detection pipe chases that connect the RHR and containment spray pump cubicles on the 57.3 ft elevation (Fire Zones 1A through 1H) with their heat exchanger cubicles on the 609 ft elevation (Fire Zones 44A through 44H).. Opening for leak detection purposes are provided within the charging pump cubicles on the 587 ft elevation (Fire Zone 62A, 62B, 62C, 63A, 63B and 63C). (See Sections 9.31 and 9.32.)

8.2 Fire Zone 5 East End of the Auxiliary Building Between the Unit 1 and Unit 2 Charging Pump Cubicles

8.2.1 Conduit and Cable Tray Protection

The cable trays (1AZ-C50, 1AZ-C46 AND 1AZ-P8) and conduit 8026R-1 for the red train of Unit 1 CVCS will be provided with fire protection barriers equivalent to a one-hour rating. The conduits for emergency diesel generators (Unit 1 DGAB) 8506R-1 and (Unit 2 DGCD) 8155G-2 and the associated pull boxes will be provided with fire protection barriers equivalent to a one-hour rating. Table 8-1 provides a list by fire zone of the wrapped raceways, the cables of concern within those raceways and their associated components. The conduits are being protected in order to bring Fire Zone 5 into compliance with the criteria of Appendix R, Section III.G.2(c). Section III.G.2(c) requires that at least one train of redundant safe shutdown equipment or cables located in the same fire area be provided with one hour protection. In addition, detection and suppression are required for the fire area.

8.2.2 Suppression and Detection

The existing automatic dry pilot reaction sprinkler system will be extended to provide protection around the perimeter of the stairway openings that lead to Fire Zone 1 below and Fire Zone 44N above to ensure the integrity of the boundary separating the two fire areas.

8.2.3 Boundary Modifications/Evaluations

The access control gates and the ventilation openings to the charging pump cubicles will be modified as described in Section 8.24.3 in order to ensure the integrity of the boundaries between separate fire areas. The penetrations to Fire Zones 44N, 62A, 62B, 62C and 63A, 63B, 63C will be provided with seals equivalent to the rating of the concrete slab/wall in order to ensure the integrity of the boundaries between separate fire areas.

The engineering evaluations presented in Sections 9.6 and 9.28 provide justification for combining Fire Zones 6A and 61 with Fire Zones 5, 6N, 6M, 64A, 64B, 65A and 65B.

The engineering evaluations presented in Sections 9.34 and 9.37 provide justification for undampered ventilation ducts and minor unsealed penetrations between Fire Zone 5 and Fire Zones 36 and 32, respectively.

8.3 <u>Fire Zones 6A, 6N, 6M, 6S, 61, 64A, 64B, 65A and 65B Auxiliary Building Elevations 587 ft and 601 ft</u>

8.3.1 <u>Conduit and Cable Tray Protection</u>

The following raceways will be provided with fire protection barriers equivalent to a one-hour fire rating: 8505R-1 and its associated pull box for Unit 1 DGAB; troughs 2AZ-C80, 2A-C14, 2A-C15, 2AZ-C60, 2AZ-C58, 2AZ-C59, and conduits 9747R-2, 9748R-2, 8744R-2, 8786R-2, and 9767R-2 for the red train of Unit 2 AFW; troughs 2AZ-C58 (listed above), 2AZ-C75, 2AZ-C62 and 2AZ-C86 for the red train of Unit 2 CVCS; conduit 8154G-2 and its associated pull box for the Unit 2 DGCD; cable trays 1A-P20, 1A-C55, 1AZ-P9, 1AZ-P8, 1AZ-C54, 1AZ-C56 and 1AZ-C50 for the red train of Unit 1 CVCS. Table 8-1 provides a list by fire zone of the wrapped raceways, the cables of concern within those raceways and their associated components. The conduits are being protected to ensure compliance with the criteria of Appendix R, Section III.G.2(c), which requires that at least one train of redundant safe shutdown equipment or cables located in the same fire area be provided with one hour protection. In addition, detection and suppression are required for the fire area. The open cable trays traversing the zone from the north side to the south side will be appropriately fire-stopped to prevent fire propagation from one section of the fire zone to the other. This modification is required to ensure compliance with the criteria of Appendix R, Section III.G.2(b), which requires a minimum of 20 ft of horizontal separation without intervening combustibles between redundant safe shutdown equipment or cables located in the same fire area. In addition, detection and suppression are required for the fire area.

8.3.2 Suppression and Detection

The existing automatic dry pilot preaction sprinkler system will be extended to provide protection around the perimeter of the stairway openings that lead to Fire Zones 44N and 44S above and from Fire Zone 1 below in order to ensure the integrity of boundaries between separate fire areas.

8.3.3 Boundary Modifications/Evaluations

The penetrations in the ceiling of Fire Zones 6N, 6M and 6S to the elevation above Fire Zones 44N and 44S will be provided with seals equivalent to the rating of the concrete slab in order to ensure the integrity of boundaries between separate fire areas.

The Auxiliary Building HVAC duct exemption presented in Section 7.13 provides justifications that the undampered ducts penetrating through the floor and ceiling of these fire zones do not impact safe shutdown capability.

The engineering evaluation presented in Section 9.4 provides justification for undampered ventilation ducts from Fire Zones 64A and 64B to Fire Area 12, along with undampered ventilation ducts from Fire Zones 65A and 65B to Fire Area 22.

The engineering evaluations presented in Section 9.6 and 9.28 provide justification for combining Fire Zones 6A and 61 with Fire Zones 5, 6A, 6N, 6M, 69, 64A, 64B, 65A and 65B.

The engineering evaluations presented in Sections 9.6 and 9.33 provide justification for not sealing the unsealed openings and penetrations in the boundaries of Fire Zone 6A to adjacent fire zones. However, unsealed penetrations to the Unit 1 and Unit 2 charging pump cubicles (Fire Zones 62A, 62B, 62C, 63A, 63B, and 63C) were required to be sealed in order to ensure the integrity of boundaries between separate fire areas.

8.4 Fire Area 12 Unit 1 Quadrant 2 Piping Tunnel

8.4.1 Conduit and Cable Tray Protection

None proposed

8.4.2 Suppression and Detection

None proposed

8.4.3 Boundary Modifications/Evaluations

An engineering evaluation has been performed (see Section 9.4) requiring three-hour fire-rated dampers to be installed in the HVAC penetrations to the Unit 1 charging pump cubicles (Fire Zones 62A, 62B and 62C). In addition, the unsealed penetrations to Fire Zones 62A, 62B, 62C (see Section 9.4) and 33B will be sealed with a rating at least equivalent to the boundary rating. Both sets of modifications are required in order to ensure the integrity of boundaries between separate fire areas. See Seismic Gap Exemption Request Section 7.14 for justifying the unsealed seismic gap to Fire Zone 33B. See Section 9.23 for justification of the manway opening from the trench in Fire Area 12 to Fire Area 116. Engineering evaluations have also been performed (see Section 9.4) justifying the existing undampered ventilation openings into adjacent fire zones (1A, 1B, 64A, 64B, 44A, 44B, 44C, 44D, 49 and 69). For additional boundary modifications to Fire Zones 1C and 1D, see Section 8.1.3.

8.5 Fire Area 14 Unit 1 Transformer Room

8.5.1 Conduit and Cable Tray Protection

None proposed

8.5.2 Suppression and Detection

An automatic fire detection system will be installed in the zone providing remote alarms to the Control Room. This modification is required to support the exemption request in Section 7.3 of this report, from the fixed suppression criteria of Appendix R, Section III.G.3. Section III.G.3 requires that areas provided with alternate shutdown capability also be protected by a detection and fixed suppression system.

8.5.3 Boundary Evaluations

An engineering evaluation has been performed justifying the unrated, field-fabricated HVAC damper to Fire Zone 13 (see Section 9.7).

Continued on Page 8-12A

8.5A Fire Area 15 Unit 1 Diesel Generator Room

8.5A.1 Conduit and Cable Tray Protection

The following conduits of the red train will be provided with a fire protection barrier equivalent to a three-hour rating: 8003R-1, 8004R-1, 8048R-1, 8503R-1, and 8504R-1. Table 8-1 provides a list by fire zone of the wrapped raceways, the cables of concern within those raceways, and their associated components. The conduits are being protected in order to ensure compliance with Appendix R, Section III.G.2(a).

8.5A.2 Suppression and Detection

None proposed

8.5A.3 Boundary Modifications/Evaluations

None proposed

Continued on Page 8-13

8.6 Fire Area 17C Auxiliary Feedwater Pump Corridor

8.6.1 Conduit and Cable Tray Protection

The following conduits of the red train Unit 1 AFW pump (1PP-3W) will be provided with a fire protection barrier equivalent to a one-hour rating: 9875R-1, 9874R-1, 9747R-1 and 9748R-1. The following conduits for the red train Unit 2 AFW pump (2PP-3W) will be provided with similar protection: 8788R-2, 8789R-2, 9747R-2, and 9748R-2. Table 8-1 provides a list by fire zone of the wrapped raceways, the cables of concern within those raceways and their associated components. The conduits are being protected in order to ensure compliance with Appendix R, Section III.G.2(c). In addition, detection and suppression are required for the fire area.

8.6.2 Suppression and Detection

The existing automatic wet pipe sprinkler system in the Unit 2 Turbine-Driven Feed Pump Room will be extended to provide area coverage to Fire Area 17C so as to ensure compliance with Appendix R, Section III.G.2(c).

The fire area will be equipped with an automatic detection system that provides alarms in the Control Room so as to ensure compliance with Appendix R, Section III.G.2(c).

8.6A Fire Area 19 Unit 2 Diesel Generator Room

8.6A.1 Conduit and Cable Tray Protection

The following green train conduits will be provided with a fire protection barrier equivalent to a three-hour rating:

8001G-2, 8003G-2, 8004G-2, 8007G-2, 8048G-2, 8544G-2, and 8545G-2. Table 8-1 provides a list by fire zone of the wrapped raceways, the cables of concern within those raceways, and their associated components. The conduits are being protected in order to ensure compliance with Appendix R, Section III.G.2(a).

8.6A.2 <u>Suppression and Detection</u>

None proposed.

8.6A.3 <u>Boundary Modifications/Evaluations</u>

None proposed

8.7 <u>Fire Area 20 Unit 2 Transformer Room</u>

8.7.1 <u>Conduit and Cable Tray Protection</u>

None proposed

8.7.2 <u>Suppression and Detection</u>

The area will be equipped with an automatic fire detection system that provides alarms in the Control Room. This modification is required to support the exemption request in Section 7.4 of this report from the fixed suppression criteria of Appendix R, Section III.G.3. Section III.G.3 requires that areas or zones provided with alternate shutdown capability also be protected by a detection and fixed suppression system.

8.7.3 <u>Boundary Evaluations</u>

An engineering evaluation has been performed justifying the unrated, field fabricated HVAC damper to Fire Zone 21 (see Section 9.8).

8.8 Fire Area 22 Unit 2 Quadrant 2 Piping Tunnel

8.8.1 Conduit and Cable Tray Protection

None proposed

8.8.2 Suppression and Detection

None proposed

8.8.3 Boundary Modifications/Evaluations

An engineering evaluation has been performed (see Section 9.4) requiring three-hour fire-rated dampers to be installed in the HVAC penetrations to Fire Zones 63A, 63B and 63C. In addition, the unsealed penetrations to Fire Zones 63A, 63B, 63C (see Section 9.4) and 34B will be sealed with a rating at least equivalent to the boundary. Both sets of modifications are required in order to ensure the integrity of boundaries between separate fire areas. See Seismic Gap Exemption Request Section 7.14 for justifying the unsealed seismic gap to Fire Zone 34B. See Section 9.24 for justification of the manway opening from the trench in Fire Area 22 to Fire Area 117. Engineering evaluations have also been performed (see Section 9.4) justifying the existing unsealed HVAC penetration to Fire Zones 1E, 1F, 65A, 65B, 44E, 44F, 44G, 44H, 50 and 69. For additional boundary modifications to Fire Zones 1G and 1H, see Section 8.1.3.

8.9 Fire Zone 29(A,B,E) Unit 1 ESW Pump Area Including the MCCs

8.9.1 Conduit and Cable Tray Protection

None proposed

8.9.2 Suppression and Detection

The fire zone will be equipped with an automatic detection system providing alarms in the Control Room. This modification is required to support the exemption request in Section 7.5 of this report from the fixed suppression criteria of Appendix R, Section III.G.3. Section III.G.3 requires that areas or zones provided with alternate shutdown capability also be protected by a detection and fixed suppression system.

8.9.3 Boundary Modifications/Evaluations

The penetrations in the wall separating Fire Zones 29A and 29B from Fire Zones 29C and 29D will be upgraded to a three-hour fire rating. This modification is required to separate redundant safe shutdown components that are located in the same fire area per the criteria of Appendix R, Section III.G.2(a). In addition, it is required to support the fixed suppression exemption request in Section 7.5 of this report. An engineering evaluation has been performed (see Section 9.25) justifying the undampered HVAC penetrations located in the ceiling of Fire Zones 29A and 29B, the screen mesh security access gates providing access to the zones from Fire Zone 142, and the open stairway from Fire Zone 29B to Fire Zone 29G.

8.10 Fire Zone 29 (C,D,F) Unit 2 ESW Pump Area Including the MCC Room

8.10.1 Conduit and Cable Tray Protection

None proposed

8.10.2 Suppression and Detection

The fire zone will be equipped with an automatic detection system that provides alarms in the Control Room. This modification is required to support the exemption request in Section 7.6 of this report from the fixed suppression criteria of Appendix R, Section III.G.3. Section III.G.3 requires that areas or zones provided with alternate shutdown capability also be protected by a detection and fixed suppression system.

8.10.3 Boundary Modifications/Evaluations

Engineering evaluations have been performed (see Section 9.25) justifying the unrated hatch located between the floor of Fire Zone 29C and the ceiling of Fire Zone 29G, and the screen mesh security access gates providing access to the zones from Fire Zone 142. In addition, Section 9.25 provides justification for requiring three-hour-rated fire dampers to be installed in the HVAC penetrations located in the ceiling of Fire Zones 29C and 29D, along with the sealing of open penetrations in the barrier. This modification is required to separate redundant safe shutdown components that are located in the same fire area per the criteria of Appendix R, Section III.G.2(a). In addition, it is required to support the fixed suppression exemption request in Section 7.6 of this report. For additional boundary modifications to Fire Zones 29A and 29B, refer to Section 8.9.3.

8.11 Fire Zone 29G Unit 1 and Unit 2 Screenhouse Auxiliary MCC Room

8.11.1 Conduit and Cable Tray Protection

The following conduits and associated pull boxes will be provided with fire protection barriers equivalent to a one-hour rating:

Pull Box #1 and 8626G-1, 8627G-1, 8628G-1, 8629G-1

Pull Box #2 and 8624R-1, 8624R-2, 8618R-1, 8619R-1,8620R-1

Pull Box #3 and 8618R-2, 8619R-2, 8620R-2, 8996R-2, 8996R-1

Pull Box #4 and 8977G-2, 9987G-2, 8629G-2, 8628G-2, 8627G-2

The following conduits for the power supplies to the four ESW pumps will be provided with fire protection barriers equivalent to a one-hour rating: 8004R-1, 8004G-1, 8004G-2, 8004R-2 and 9232G-1 for valve WMO-701. Table 8-1 provides a list by fire zone of the wrapped raceways, the cables of concern within those raceways and their associated components. The conduits are being protected in order to support the exemption in Section 7.7 of this report from the automatic suppression criteria of Appendix R, Section III.G.2(c). Section III.G.2(c) requires at least one train of redundant safe shutdown equipment or cables located in the same fire area be provided with one hour protection. In addition, suppression and detection are required for the zone.

8.11.2 Suppression and Detection

The fire zone will be equipped with an automatic detection system providing alarms in the Control Room to support the automatic suppression exemption request in Section 7.7 of this report.

8.11.3 Boundary Modifications/Evaluations

An engineering evaluation has been performed justifying the unrated hatch located in the ceiling of Fire Zone 29G to Fire Zone 29C and the open stairway to 29B. (See Section 9.25.)

8.12 Fire Area 33,33A,33B and 105 Unit 1 East Main Steam Valve Enclosure, Main Steam Piping Area, West NESW Valve Area, and Contractor Access Control Building

8.12.1 Conduit and Cable Tray Protection

None proposed

8.12.2. Suppression and Detection

Fire Zones 33, 33A and 33B will be provided with an automatic detection system that provides alarms in the Control Room. This modification is required to support the exemption request in Section 7.8 of this report from the fixed suppression criteria of Appendix R, Section III.G.3. Section III.G.3 requires that areas or zones provided with alternate shutdown capability also be protected by a detection and fixed suppression system.

8.12.3 Boundary Modifications/Evaluations

A three-hour fire-rated damper was provided for the grate in the floor to Fire Area 8 below prior to March 1983 in order to ensure the integrity of boundaries between separate fire areas. Refer to Section 8.4.3 for additional boundary modification to Fire Area 12. See Seismic Gap Exemption Request Section 7.14 for justifying the unsealed seismic gap to Fire Area 12. See Section 9.23 for justification of the unprotected opening to Fire Area 116. Refer to Section 9.29 for boundary evaluation and consolidation of Fire Zone 105 into the fire area containing Fire Zones 33, 33A and 33B. See Section 9.35 for justification of the undampered and unsealed pipe penetrations from Fire Zone 33A to Fire Zone 108.

8.13 Fire Area 34, 34A, 34B Unit 2 East Main Steam Valve Enclosure, Main Steam Piping Area, and West NESW Valve Area

8.13.1 Conduit and Cable Tray Protection

None proposed.

8.13.2 Suppression and Detection

The fire area will be provided with an automatic detection system that provides alarms in the Control Room. This modification is required to support the exemption request in Section 7.9 of this report from the fixed suppression criteria of Appendix R, Section III.G.3. Section III.G.3 requires that areas or zones provided with alternate shutdown capability also be protected by a detection and fixed suppression system.

8.13.3 Boundary Modifications/Evaluations

A three-hour fire-rated damper was provided for the grate in the floor to Fire Area 26 below prior to March 1983 in order to ensure the integrity of boundaries between separate fire areas. Refer to Section 8.8.3 for additional boundary modification to Fire Area 22. See Seismic Gap Exemption Request Section 7.14 for justifying the unsealed seismic gap to Fire Area 22. See Section 9.24 for justification of the unprotected opening of Fire Area 117. See Section 9.36 for justification of the undampered and unsealed pipe penetrations from Fire Zones 34A to Fire Zone 109.

8.14 Fire Area 40(A and B) Unit 1 4kV Switchgear Rooms and Fire Area 41 Unit 1 ESS and MCC Rooms

8.14.1 Conduit and Cable Tray Protection

None proposed

8.14.2 Suppression and Detection

None proposed

8.14.3 Boundary Evaluations

Engineering evaluations have been performed justifying the existence of unrated hatches from Fire Zone 40B and Fire Area 41 up to Fire Area 55. See Sections 9.15 and 9.16.

8.15 Fire Zone 43 Access Control Area

8.15.1 Conduit and Cable Tray Protection

None proposed

8.15.2 Suppression and Detection

None proposed

8.15.3 Boundary Evaluations

Engineering evaluations have been performed to justify the existence of the unrated hatch to Fire Area 56 (see Section 9.14), unrated doors to Fire Zone 110 (see Section 9.21), and unprotected opening to Fire Zone 91 (see Section 9.1). Refer to Section 9.10 for boundary evaluation and consolidation of Fire Zone 43 into the fire area containing Fire Zones 37, 44N, 44S, 44A through 44H.

8.16 Fire Zones 44N and 44S Auxiliary Building Component Cooling Water System Area Elevation 609 ft

8.16.1 Conduit and Cable Tray Protection

Fire protection barriers having an equivalent of one-hour fire rating will be provided for the following: 2AZ-C58 and 9152R-2 for Unit 2 ESW (WMO-738); 8344G-2 and 8333G-2 for Unit 2 EPS (DGCD); 2A-C3, 2A-C6 and 2AI-C24 for Unit 2 AFW (2PP-3E); 1AZ-C20 for Unit 1 AFW (1PP-3-E); 2AZ-C58 (previously noted) for Unit 2 CVCS (PP-50W[LO]). Table 8-1 provides a list by fire zone of the wrapped raceways, the cables of concern within those raceways and their associated components. The conduits are being protected to ensure compliance with the criteria of Appendix R, Section III.G.2(c), which requires that at least one train of redundant safe shutdown equipment or cables located in the same fire area be provided with one hour protection. In addition, detection and suppression are required for the fire area.

The open cable trays traversing the zone from the north side to the south side will be appropriately fire-stopped to prevent fire propagation from one section of the fire zone to the other. This modification is required to ensure compliance with the criteria of Appendix R, Section III.G.2(b), which requires a minimum of 20 ft of horizontal separation without intervening combustibles between redundant safe shutdown equipment or cables located in the same fire area. In addition, detection and suppression are required for the fire area.

8.16.2 Suppression and Detection

The existing automatic dry pilot sprinkler system will be extended into the far north section of Fire Zone 44N at elevation 620 ft 6 in., by the entrances to Fire Zone 43, in the vicinity of the CCW pumps, and by the monitor tanks to provide total area coverage in the normally accessible areas. This modification is required to ensure compliance with the criteria of Appendix R, Sections III.G.2(b) and III.G.2(c). In the immediate vicinity of the component cooling water pumps, the extended suppression system will provide enhanced coverage for protection of the CCW pumps by paying particular attention to spacing and sprinkler head location. The design of the system will provide added assurance that the suppression system will prevent any damage to CCW pumps as the result of a fire. In addition, two ionization smoke detectors will be located at ceiling level in the vicinity of the CCW pumps. The extended suppression system will also provide coverage around the perimeter of the three stairway openings leading up to adjacent Fire Zones 51 and 52 in order to ensure the integrity of boundaries between separate fire areas. The detection and suppression system modifications are required to support the exemption in Section 7.10 of this report with respect to separation of redundant CCW pumps located in the same fire area.

8.16.3 <u>Boundary Modifications/Evaluations</u>

The penetrations from Fire Zones 44N and 44S to Fire Zone 52 will be sealed to the equivalent rating of the concrete slab in order to ensure the integrity of boundaries between separate fire areas. The Auxiliary Building HVAC duct exemption presented in Section 7.13 provides justification for the undampered ducts penetrating through the floor and ceiling of Fire Zones 44N and 44S.

The area of the CCW pumps will be provided with a steel construction fire barrier that is coated with a subliming material to be located between the Unit 1 and 2 pumps. The fire barrier will also be extended between the existing spare pump and the Unit 1 east pump, thus providing a physical separation of CCW pumps to ensure the availability of at least two of the four operational pumps per the criteria of Appendix R, Section III.G.2(a).

An engineering evaluation has been performed (see Section 9.3) justifying the configuration of the barrier separating the Unit 1 and 2 CCW pumps and the undampered common ventilation ducts over the pumps. Section 9.3 also requires that a fire-rated damper be added to the HVAC shaft where it penetrates into Fire Zone 52 above in order to ensure the integrity of boundaries between separate fire areas. For additional boundary modifications to Fire Zones 5, 6N, and 6S, see Sections 8.2.3 and 8.3.3. For boundary evaluation between Fire Zones 43 and 44N, see Section 9.10.

Section 9.6 presents the 601-ft pipe tunnel evaluation. This evaluation justifies the unrated boundary barriers between Fire Zone 6A and Fire Zones 44N and 44S.

An engineering evaluation has been performed (see Section 9.22) justifying the unrated doors between Fire Zones 44S and 111.

8.17 Fire Area 47(A and B) Unit 2 4kV Switchgear Rooms and Fire Area 45 Unit 2 ESS and MCC Rooms

8.17.1 Conduit and Cable Tray Protection

None proposed

8.17.2 Suppression and Detection

None proposed

8.17.3 Boundary Modifications/Evaluations

Engineering evaluations have been performed to justify the existence of unrated hatches from Fire Area 45 and Fire Area 47B to Fire Area 60. See Sections 9.19 and 9.20.

8.18 Fire Zones 49 and 50 Unit 1 and Unit 2 HVAC Vestibule

8.18.1 Conduit and Cable Tray Protection

None proposed

8.18.2 Suppression and Detection

None proposed

8.18.3 Boundary Modifications/Evaluations

Engineering evaluations have been performed combining the fire area containing Fire Zones 49 and 50 with the fire area that contained Fire Zones 3, 32, 36, 48 and 69 (see Section 9.9) along with Fire Areas 31, 35, 106, 107 and 146 (see Section 9.30).

The seismic gap exemption presented in Section 7.14 provides justification for the unsealed seismic gap communicating with Fire Zones 33B, 69 and 108 for Unit 1, and Fire Zones 34B, 69 and 109 for Unit 2.

8.19 Fire Zones 51 and 52 East and West End of Auxiliary Building Elevation 633 ft

8.19.1 Conduit and Cable Tray Protection

None proposed

8.19.2 Suppression and Detection

The fire zones will be provided with an automatic dry pilot reaction sprinkler system that will include protection around the perimeter of the stairwell openings leading up to adjacent Fire Zone 69 and the normally accessible areas within Fire Zones 51 and 52. These modifications are required to ensure compliance with Appendix R, Sections III.G.2(b) and III.G.2(c), and also to ensure the integrity of boundaries between separate fire areas.

8.19.3 Boundary Modifications/Evaluations

An engineering evaluation has been performed justifying the existence of the unrated hatch leading to Fire Area 59 (see Section 9.18).

Refer to Section 9.9 for the evaluation of combining the fire area containing Fire Zones 51 and 52 with the fire area that contained Fire Zones 3, 32, 36, 48 and 69. In addition, Section 9.30 presents the evaluation combining, the above-mentioned fire area with Fire Areas 31, 35, 106, 107 and 146.

For additional boundary modifications to penetration seals and fire dampers to Fire Zones 44N and 44S, refer to Section 8.16.3.

8.20 Fire Area 53 Unit 1 Control Room

8.20.1 Conduit and Cable Tray Protection

None proposed

8.20.2 Suppression and Detection

None proposed

8.20.3 Boundary Modifications/Evaluations

The Unit 2 hot shutdown panel (Fire Zone 145) will be provided with a fire protection barrier having a rating equivalent to three hours. The barrier will be designed to provide access to the panel for its intended use while still serving as a three-hour fire protection barrier. This modification is required to separate redundant/alternate safe shutdown components originally located in the same fire area. As a result of this modification, Fire Zone 145 will be located in a fire area separate from Fire Area 53.

The door connecting to Fire Area 54 will be upgraded to a three-hour rating. This modification is required to ensure the integrity of boundaries between separate fire areas. Engineering evaluations have been performed justifying the unrated hatch to Fire Zone 57 (see Section 9.13) and the unrated hatch to Fire Zone 70 (see Section 9.5).

8.21 Fire Area 54 Unit 2 Control Room

8.21.1 Conduit and Cable Tray Protection

None proposed.

8.21.2 Suppression and Detection

None proposed

8.21.3 Boundary Modifications/Evaluations

The Unit 1 hot shutdown panel (Fire Zone 144) will be provided with a fire protection barrier having a rating equivalent to three hours. The barrier will be designed to provide access to the panel for its intended use while still serving as a three-hour fire protection barrier. This modification is required to separate redundant/alternate safe shutdown components originally located in the same fire area. As a result of this modification, Fire Zone 144 will be located in a fire area separate from Fire Area 54.

The door connecting to Fire Area 53 will be upgraded to a three-hour rating. This modification is required in order to ensure the integrity of boundaries between separate fire areas.

Engineering evaluations have been performed justifying the unrated hatch to Fire Zone 58 (see Section 9.17), the unrated hatch to Fire Zone 73 (see Section 9.5), and the undampered HVAC ventilation duct to Fire Zone 73 (see Section 9.2).

8.22 Fire Zone 57 Unit 1 Control Room Cable Vault

8.22.1 Conduit and Cable Tray Protection

None proposed

8.22.2 Suppression and Detection

None proposed

8.22.3 Boundary Modifications/Evaluations

An engineering evaluation has been performed to justify the existence of the unrated hatch from Fire Area 53 to Fire Zone 57. (See Section 9.13.)

8.23 Fire Zone 58 Unit 2 Control Room Cable Vault

8.23.1 Conduit and Cable Tray Protection

None proposed

8.23.2 Suppression and Detection

None proposed

8.23.3 Boundary Modifications/Evaluations

An engineering evaluation has been performed to justify the existence of the unrated hatch from Fire Area 54 to Fire Zone 58 (see Section 9.17).

8.24 Fire Area 62(A,B,C) Unit 1 Charging Pump Area and Fire Area 63(A,B,C) Unit 2 Charging Pump Area

8.24.1 Conduit and Cable Tray Protection

None proposed

8.24.2 Suppression and Detection

None proposed

8.24.3 Boundary Modifications

The opening (2 ft x 4 ft) in the wall to Fire Zone 5 will be provided with a damper having an equivalent fire rating of three hours. The penetrations to Fire Zones 5, 6A, 12 and 22 will be sealed to an equivalent rating of the concrete wall. These modifications are required in order to ensure the integrity of boundaries between separate fire areas.

Both access control gates from Fire Zone 5 will be replaced with three-hour-rated fire doors that will be normally held open by fusible links for ventilation purposes. This modification is required in order to ensure the integrity of boundaries between separate fire areas.

See Sections 8.4.3 (Unit 1) and 8.8.3 (Unit 2) for additional boundary modifications to Fire Areas 12 and 22.

8.25 Fire Zone 79 Unit 1 Turbine Room Between the Unit 1 Emergency Diesels

8.25.1 Conduit and Cable Tray Protection

The cable tray 1AZ-C34 containing Unit 1 green division safe shutdown systems cables will be provided with a fire protection barrier having a rating equivalent to one hour. Table 8-1 provides a list by fire zone of the wrapped raceways, the cables of concern within those raceways and their associated components. This modification is required in order to ensure compliance with Appendix R, Section III.G.2(c), which requires at least one train of redundant safe shutdown equipment or cables located in the same fire area to be provided with one hour protection. In addition, detection and suppression are required for the fire area.

8.25.2 Suppression and Detection

The existing wet pipe sprinkler suppression system in Fire Zone 79 will be extended to include the ramp/corridor area between the Unit 1 EDGs. A detection system will be added that provides alarms in the Control Room. These modifications are required to ensure compliance with the criteria of Appendix R, Section III.G.2(c).

8.25.3 Boundary Modifications

None proposed

8.26 Fire Zone 85 Unit 2 Turbine Room Between the Unit 2 Emergency Diesels

8.26.1 Conduit and Cable Tray Protection

The cable trays 2AZ-C55, 2E-C9, 2E-C10 and 2AZ-C99 containing green division safe shutdown system cables will be provided with a fire protection barrier having a rating equivalent to one hour. Table 8-1 provides a list by fire zone of the wrapped raceways, the cables of concern within those raceways and their associated components. This modification is required to ensure compliance with the criteria of Appendix R, Section III.G.2(c). Section III.G.2(c) requires that at least one train of redundant safe shutdown equipment or cables located in the same fire area be provided with one hour protection. In addition, detection and suppression are required in this fire area.

8.26.2 Suppression and Detection

The existing wet pipe sprinkler system in Fire Zone 85 will be extended to include the ramp/corridor area between the Unit 2 EDGs. A detection system will be added that provides alarms in the Control Room. These modifications are required to ensure compliance with the criteria of Appendix R, Section III.G.2(c).

8.26.3 Boundary Modifications

None proposed

8.27 Fire Zone 122 Unit 1 Containment Instrument Room

8.27.1 Conduit and Cable Tray Protection

At least one channel of pressurizer liquid level indication will be protected with a radiant energy shield. Also, the trays that are intervening combustibles between channels will be fire-stopped. These modifications are required in order to ensure compliance with Appendix R, Section III.G.2(f) and III.G.2(d) respectively.

8.27.2 Suppression and Detection

Proposed modification withdrawn by supplement to this report dated August 1983.

8.27.3 Boundary Modifications

None proposed

8.28 Fire Zone 123 Unit 2 Containment Instrument Room

Fire Zone 123 will be provided with the same modifications as Fire Zone 122 in Unit 1.

8.29 Fire Zones 66, 74 Units 1 and 2 Containment Piping Annulus
Fire Zones 67, 75 Units 1 and 2 Lower Volume
Fire Zones 120, 121 Units 1 and 2 Containment
Accumulator Enclosure

8.29.1 Conduit and Cable Tray Protection

None proposed

8.29.2 Suppression and Detection

Proposed modification withdrawn by supplement to this report dated August 1983.

8.29.3 Boundary Modifications

None proposed

Alternative Shutdown Modifications

The modifications discussed in this section are those specifically associated with the alternate shutdown capability of the plant. These modifications are required to achieve operability of the Alternate Shutdown System in compliance with 10 CFR 50 Appendix R Section III.G.3.

8.30 Chemical and Volume Control System (CVCS)

Installation of a permanent 4-in. cross-tie between the CVCS systems of Units 1 and 2. This modification is required to provide charging capability for those alternate shutdown fire areas where the unit specific charging pumps have been disabled. Refer to Section 5.5.1, P&ID Figure 5.5 and proposed physical arrangement in Figure 5.11.

8.31 Process Monitoring System

8.31.1 Repowering of Existing LSI Panels

Provide alternative 120V ac power from the unaffected unit's emergency power sources. This modification is required to provide ac power for process monitoring instrumentation independent of those fire areas where one unit's ac power is lost. Refer to Section 5.5.2, the one-line diagrams in Figures 5.12.1 and 5.12.2 and the electrical schematic shown in Figure 5.13.

8.31.2 Steam Generator Pressure for LSI Panels

Installation of local pressure indication for steam generators 1 and 4 at panel LSI-5 and steam generators 2 and 3 at panel LSI-6. The signals will also be transmitted to a new local shutdown panel LSI-4. This modification is required to provide steam generator pressure indication for those fire areas where Control Room indication has been lost.

8.31.3 Source Range Monitoring at LSI Panels

A new source range monitoring channel will be installed with local indication at a new local shutdown panel LSI-4. This modification is required to provide source range indication for those fire areas where Control Room indication has been lost. Refer to Section 5.5.8 and Figure 5.20 for the proposed design.

8.31.4 Centralized Control Panel LSI-4

Provide local indication for RCS temperature hot and cold legs, steam generator pressure, steam generator level and source range monitoring on new local shutdown panel LSI-4. In addition, panels LSI-3 and LSI-4 will be provided with the capability of being powered from the unaffected unit's EPS. This modification is required to provide process monitoring indication for those fire areas where Control Room indication has been lost. Refer to Section 5.5.9.

8.31.5 <u>T_h and T_c for LSI Panels</u>

Hot leg (T_h) and cold leg (T_c) temperature information will be provided at panels LSI-5, LSI-6 and LSI-4. T_h and T_c for RCS loops 1 and 4 will be available at LSI-5 and LSI-4. T_h and T_c for RCS loops 2 and 3 will be available at LSI-6 and LSI-4. This modification is required to provide T_h and T_c indication for those fire areas where Control Room indication has been lost. Refer to Section 5.5.6.

8.32 <u>ESW System</u>

8.32.1 <u>ESW Pump Circuit Modifications</u>

Add isolation relays to the circuits that start the ESW pumps from the discharge header pressure switches as well as from the opposite unit's Safety Injection (SI) signal.

Also, relocate the redundant ESW pump breaker controls and their associated cables, which presently exist for these pumps in the alternate unit's Control Room, to their own unit's hot shutdown panel. In addition, the second ESW pump's breaker control circuitry and associated cables in the alternate unit's hot shutdown panel will be removed. These modifications are required to ensure that the unaffected units ESW pumps will be available. Refer to Section 5.5.3.

8.32.2 <u>ESW Strainer and Valve Circuit Modifications</u>

Modifications, similar to those described for the ESW pump in 8.32.1 above, will be provided for the ESW pump discharge valves, strainers and header cross-tie valves. Refer to Section 5.5.4.

8.32.3 <u>CCW Pump Circuit Modifications</u>

Provide isolation of CCW pump pressure switch and associated cabling with isolation relays identical to the method proposed for the ESW pump pressure switches. This modification is required to ensure that the unaffected unit's CCW pumps will be available. Refer to Section 5.5.5.

8.32.4 <u>Emergency Power System (EPS)</u>

Install a 480V MCC in each unit that will be powered by the EPS system of the opposite unit. These MCCs will be used to provide alternate shutdown capability for the repowering of the backup pressurizer heaters (any three banks of heaters) from the opposite unit. This emergency power system will be installed using a D.C. Cook plant repair procedure. This modification is not required to comply with 10 CFR 50 Appendix R. This modification provides added operator flexibility for controlling cooldown and depressurization.

TABLE 8-1

WRAPPED RACEWAYS/CABLES BY FIRE ZONE

FIRE ZONE	UNIT #	RACEWAY	SYSTEM	CABLE	COMPONENT
1	1	8003R-1	RHR	8003R-1	1PP-35W
1	2	8003R-2	RHR	8003R-2	2PP-35W
5	1	1AZ-C50	CVCS	8031R-1 8890R-1	IMO-911 PP-50W(LO)
5	1	1AZ-C46	CVCS	8031R-1 8890R-1	IMO-911 PP-50W(LO)
5	1	1AZ-P8	CVCS	8026R-1	IMO-911
5	1	8026R-1	CVCS	8026R-1	IMO-911
5	1	8506R-1	EPS	8506R-1	1AB1
5	2	8155G-2	EPS	8155G-2	2CD2
6N	1	8505R-1	EPS	8505R-1	1AB2
6M	2	2AZ-C80	AFW	9747R-2 9748R-2	FMO-212 FMO-242
6M	2	2A-C14	AFW	9747R-2 9748R-2	FMO-212 FMO-242
6M	2	2A-C15	AFW	8786R-2	FRV-247
6M	2	2AZ-C60	AFW	8786R-2	FRV-247
6M	2	2AZ-C58	AFW	9767R-2	2PP-3W
6M	2	2AZ-C59	AFW	9747R-2 9748R-2 8786R-2	FMO-212 FMO-242 FRV-247
6M	2	9747R-2	AFW	9747R-2	FMO-212
6M	2	9748R-2	AFW	9748R-2	FMO-242

TABLE 8-1

WRAPPED RACEWAYS/CABLES BY FIRE ZONE

FIRE ZONE	UNIT #	RACEWAY	SYSTEM	CABLE	COMPONENT
6S,M	2	8744R-2	AFW	8744R-2	2PP-3W
6M	2	8786R-2	AFW	8786R-2	FRV-247
6M	2	9767R-2	AFW	9767R-2	2PP-3W
6S,M	2	2AZ-C58	CVCS	8912R-2	PP-50W(LO)
6M	2	2AZ-C75	CVCS	8890R-2	PP-50W(LO)
6M,S	2	2AZ-C62	CVCS	8912R-2 8890R-2	PP-50W(LO) PP-50W(LO)
6M	2	2AZ-C86	CVCS	8890R-2	PP-50W(LO)
6M	2	8154G-2	EPS	8154G-2	2CD1
6M	1	1A-P20	CVCS	8026R-1	IMO-911
6M	1	1A-C55	CVCS	8031R-1	IMO-911
6M	1	1AZ-P9	CVCS	8026R-1	IMO-911
6M	1	1AZ-P8	CVCS	8026R-1	IMO-911
6M	1	1AZ-C54	CVCS	8031R-1	IMO-911
6N	1	1AZ-C56	CVCS	8890R-1	PP-50W(LO)
6M	1	1AZ-C50	CVCS	8031R-1 8890R-1	IMO-911 PP-50W(LO)
15	Refer to Page 7 of this table				
17C	1	9747R-1	AFW	9747R-1	FMO-212
17C	1	9874R-1	AFW	9874R-1 9875R-1	FMO-242 FMO-212
17C	1	9875R-1	AFW	9875R-1	FMO-212
17C	1	9748R-1	AFW	9748R-1	FMO-242
17C	2	8788R-2	AFW	8789R-2 8788R-2	FMO-242 FMO-212
17C	2	8789R-2	AFW	8789R-2	FMO-242

TABLE 8-1

WRAPPED RACEWAYS/CABLES BY FIRE ZONE

FIRE ZONE	UNIT #	RACEWAY	SYSTEM	CABLE	COMPONENT
17C	2	9747R-2	AFW	9747R-2	FMO-212
17C	2	9748R-2	AFW	9748R-2	FMO-242
19	2	8001G-2	AFW	8001G-2	2PP-3E
19	2	8003G-2	RHR	8003G-2	2PP-35E
19	2	8004G-2	ESW	8004G-2	2PP-7E
19	2	8007G-2	CVCS	8007G-2	2PP-50E
19	2	8048G-2	EPS	8048G-2	AB-D
19	2	8544G-2	EPS	8544G-2	ABD-C
19	2	8545G-2	EPS	8545G-2	ABD-D
29G	1	8626G-1	ESW	8626G-1	WMO-701
29G	1	8627G-1	ESW	8627G-1	ESWSE
29G	1	8628G-1	ESW	8628G-1	ESWSE
29G	1	8629G-1	ESW	8629G-1	ESWSE
29G	1	8624R-1	ESW	8624R-1	WMO-702
29G	1	8624R-2	ESW	8624R-2	WMO-702
29G	1	8618R-1	ESW	8618R-1	ESWSW
29G	1	8619R-1	ESW	8619R-1	ESWSW
29G	1	8620R-1	ESW	8620R-1	ESWSW
29G	2	8618R-2	ESW	8618R-2	ESWSW
29G	2	8619R-2	ESW	8619R-2	ESWSW
29G	2	8620R-2	ESW	8620R-2	ESWSW
29G	2	8996R-2	ESW	8996R-2	WMO-704

TABLE 8-1

WRAPPED RACEWAYS/CABLES BY FIRE ZONE

FIRE ZONE	UNIT #	RACEWAY	SYSTEM	CABLE	COMPONENT
29G	2	8996R-1	ESW	8996R-1	WMO-704
29G	2	8977G-2	ESW	8977G-2	WMO-703
29G	2	9987G-2	ESW	9987G-2	WMO-703
29G	2	8629G-2	ESW	8629G-2	ESWSE
29G	2	8628G-2	ESW	8628G-2	ESWSE
29G	2	8627G-2	ESW	8627G-2	ESWSE
29G	1	8004R-1	ESW	8004R-1	1PP-7W
29G	1	8004G-1	ESW	8004G-1	1PP-7E
29G	2	8004G-2	ESW	8004G-2	2PP-7E
29G	2	8004R-2	ESW	8004R-2	2PP-7W
29G	1	9232G-1	ESW	9232G-1	WMO-701
44N	2	2AZ-C58	ESW	9152R-2	WMO-738
44S,N	2	9152R-2	ESW	9152R-2	WMO-738
44S	2	8344G-2	EPS	8344G-2	DGCD
44S	2	8333G-2	EPS	8333G-2	DGCD
44N	2	2A-C3	AFW	8131G-2 9763G-2	FRV-257 2PP-3E
44N	2	2A-C6	AFW	8131G-2 9763G-2	FRV-257 2PP-3E
44N	2	2AI-C24	AFW	8131G-2 9763G-2	FRV-257 2PP-3E
44N	1	1AZ-C20	AFW	9834G-1	1PP-3E
44N	2	2AZ-C58	CVCS	8912R-2	PP-50W(LO)

TABLE 8-1

WRAPPED RACEWAYS/CABLES BY FIRE ZONE

FIRE ZONE	UNIT #	RACEWAY	SYSTEM	CABLE	COMPONENT
79	1	1AZ-C34	EPS	8095G-1	1CD1
				8098G-1	1CD2
				8333G-1	DGCD
				8338G-1	DGCD
				8339G-1	DGCD
				8340G-1	DGCD
				8343G-1	DGCD
				8344G-1	DGCD
				8345G-1	DGCD
				8346G-1	DGCD
				8347G-1	DGCD
				8348G-1	DGCD
				8349G-1	DGCD
				8400G-1	DGCD
				8409G-1	DGCD
				8410G-1	DGCD
			ESW	8466G-1	WMO-725
			EPS	8526G-1	1CD1
				8527G-1	1CD2
				8592G-1	DGCD
				8639G-1	DGCD
			ESW	8789G-1	1PP-7E
			CCW	8862G-1	1PP-10E
			CVCS	8874G-1	PP-50E(LO)
			RHR	8889G-1	1PP-35E
			ESW	8946G-1	WMO-707
			AFW	9290G-1	1PP-3E
85	2	2AZ-C55	EPS	8095G-2	2CD1
				8098G-2	2CD2
			ESW	8789G-2	2PP-7E
			CCW	8862G-2	2PP-10E
			RHR	8889G-2	2PP-35E
			EPS	9231G-2	DGCD
			AFW	9290G-2	2PP-3E
85	2	2AZ-C99	EPS	8338G-2	DGCD
				8339G-2	DGCD
				8340G-2	DGCD
				8343G-2	DGCD
				8345G-2	DGCD
				8346G-2	DGCD
				8347G-2	DGCD
				8348G-2	DGCD

TABLE 8-1

WRAPPED RACEWAYS/CABLES BY FIRE ZONE

FIRE ZONE	UNIT #	RACEWAY	SYSTEM	CABLE	COMPONENT
				8349G-2	DGCD
				8400G-2	DGCD
				8409G-2	DGCD
				8410G-2	DGCD
			ESW	8466G-2	WMO-726
			EPS	8526G-2	2CD1
				8527G-2	2CD2
				8592G-2	DGCD
				8639G-2	DGCD
			CVCS	8874G-2	PP-50E(LO)
			ESW	8946G-2	WMO-708
85	2	2E-C9	EPS	8095G-2	2CD1
				8098G-2	2CD2
			ESW	8789G-2	2PP-7E
			CCW	8862G-2	2PP-10E
			RHR	8889G-2	2PP-35E
			EPS	9231G-2	DGCD
			AFW	9290G-2	2PP-3E
85	2	2E-C10	EPS	8340G-2	DGCD
				8343G-2	DGCD
				8345G-2	DGCD
				8346G-2	DGCD
				8347G-2	DGCD
				8348G-2	DGCD
				8349G-2	DGCD
				8400G-2	DGCD
				8409G-2	DGCD
				8410G-2	DGCD
			ESW	8466G-2	WMO-726
			EPS	8526G-2	2CD1
				8527G-2	2CD2
				8592G-2	DGCD
				8639G-2	DGCD
			CVCS	8874G-2	PP-50E(LO)
			ESW	8946G-2	WMO-708

TABLE 8-1

WRAPPED RACEWAYS/CABLES BY FIRE ZONE

FIRE ZONE	UNIT #	RACEWAY	SYSTEM	CABLE	COMPONENT
15	1	8003R-1	RHR	8003R-1	PP-35W
		8004R-1	ESW	8004R-1	PP-7W
		8048R-1	EPS	8048R-1	AB-A
		8503R-1	EPS	8503R-1	ABD-A
		8504R-1	EPS	8504R-1	ABD-B

9. BOUNDARY EVALUATIONS

This section provides a compilation of fire area boundary evaluations which have been performed since the issuance of the March 1983 report. These evaluations were developed as a result of various areas of concern identified by Indiana and Michigan Electric Company with respect to Appendix R conformance. In some cases, plant locations that were not identified in the March 1983 Appendix R submittal have been combined with adjacent fire areas. With the exception of the Unit 1 and Unit 2 hot shutdown panels (Fire Zones 144 and 145), these locations do not contain safe shutdown equipment or cables. In other cases, evaluations were performed to justify unrated components of fire area boundaries.

The evaluations contained in this section have been prepared in accordance with appropriate NRC guidelines. Each evaluation is structured similar to the exemption requests contained in Section 7 of this report. There are six major subheadings for each evaluation. They are identified as follows:

(1) Purpose, which identifies why the evaluation is being performed;

(2) Description, which identifies the zone(s) of concern and describes the unrated portion of the fire area boundaries;

(3) Safe Shutdown Equipment, which identifies safe shutdown capabilities in the zone(s) of concern;

(4) Fire Protection Equipment, which identifies the automatic and manual detection and suppression capabilities in the zone(s) of concern;

(5) Fire Hazards Analysis, which identifies and evaluates the impact of the unrated portion of the fire area boundary on safe shutdown capabilities in the zone(s) of concern; and

(6) Conclusions, which summarizes the proposed modifications, if any, and the reasons why the unrated portion of the fire area boundaries does not impact on redundant safe shutdown capabilities.

The result is a technical evaluation that addresses the impact of unrated components of fire area boundaries on redundant safe shutdown capabilities located on either side of the fire area boundaries.

The boundary evaluations in this section can be divided into the following major categories:

(1) Boundary evaluations addressing field constructed fire dampers or undampered ventilation ductwork in fire area boundaries (see Sections 9.1 through 9.4, 9.7, 9.8, 9.25, 9.34, 9.35, 9.36, 9.37, 9.38, 9.40 and 9.41);

(2) Boundary evaluations addressing unrated hatches or doors in fire area boundaries (see Sections 9.5, 9.13 through 9.22, 9.25, 9.37 and 9.39);

(3) Boundary evaluations addressing unprotected openings in fire area boundaries (see Sections 9.6, 9.23, 9.24, 9.25, 9.31, 9.32, 9.33, 9.35, 9.36 and 9.37); and

(4) Boundary evaluations which justify combining adjacent fire areas into larger fire areas (see Sections 9.9 through 9.12, and 9.26 through 9.30).

While the evaluations in each category are all structured the same (i.e., similar to the exemption requests), the technical issues which are addressed differ. Therefore, information that is important to include in one evaluation may not be included in an evaluation in a different category. For example, combustible loadings and methods of safe shutdown must be considered for the first three categories of evaluations identified above. In a number of these evaluations, the actual combustible loading in the fire zone or fire areas is less than the combustible loading upon which the evaluation is based. The actual combustible loading is identified in parentheses. This is done such that installing additional cable or combustible materials (in minor quantities) will not void the bases and conclusions of the evaluations. However, combustible loading is not of real concern in evaluations addressing combining fire areas into larger fire areas. What is of most concern are the methods of safe shutdown.

The following boundary evaluations are contained in this section:

9.1 Fire Zone 43 and Fire Zone 91 Duct Evaluation

Purpose

The purpose of this evaluation is to analyze the impact on redundant safe shutdown capability of an undampered HVAC steel duct that penetrates the wall between the Access Control Area and the southeast portion of the Unit 1 Turbine Room (Fire Zone 43 and Fire Zone 91, respectively). In addition, this evaluation does not adversely impact on other evaluations or exemption requests contained in this report.

Description

Fire Zone 43 is located on the 609 ft elevation of the Auxiliary Building. It is part of a larger fire area that includes Fire Zones 37, 44N, 44S and 44A through 44H. Fire Zone 91 is part of a larger fire area that includes the entirety of the Turbine Building, along with the Main Steam Pipe Tunnels and west Valve Houses. The barrier separating the two zones is constructed of reinforced concrete capable of achieving a three-hour rating; however, an undampered 7-in. diameter steel duct penetrates the wall between the two zones.

Safe Shutdown Equipment

Fire Zones 43 and 91 contain cables required for safe shutdown of D.C. Cook Unit 1. Should a fire occur in either of these zones, alternate shutdown capability meeting the criteria of Appendix R Section III.G.3 is available outside of Fire Zone 43. Redundant safe shutdown capability meeting the criteria of Appendix R Section III.G.2 is available outside of Fire Zone 91.

Fire Protection Equipment

An automatic ionization detection system is installed below the suspended ceiling in Fire Zone 43. Automatic suppression capability is not provided in Fire Zone 43. Fire Zone 91 is protected by an automatic wet pipe sprinkler system. Automatic detection is not provided in Fire Zone 91. Manual suppression capabilities in the form of portable extinguishers and hose stations are available for use in both fire zones.

Fire Hazards Analysis

The barrier separating Fire Zone 43 and Fire Zone 91 is capable of achieving a three-hour fire rating; however, a 7-in. diameter steel duct penetrating this barrier is not provided with a fire damper. The undampered 7-in. diameter HVAC steel duct is located in the wall separating Fire Zone 43 from Fire Zone 91. For a fire to propagate between Fire Zone 43 and Fire Zone 91, a fire of sufficient duration and intensity would be required to challenge the inherent capabilities of the steel ductwork.

Section 3-3.2.1 of NFPA No. 90A requires that approved fire dampers shall be installed where HVAC ducts penetrate partitions required to have a fire resistance rating of two hours or more. The combustible loading in Fire Zone 43 results in an equivalent fire severity of under 60 minutes. (The actual fire severity existing at this time is under 56 minutes.) The combustible loading in Fire Zone 91 results in an equivalent fire severity of under 40 minutes. (The actual fire severity existing at this time is under 20 minutes.) As such, the required fire rating of the barrier separating the two zones is under one hour. Therefore, per the criteria of NFPA 90A, a fire damper is not required in the 7-in. diameter steel duct penetrating this barrier. However, as this barrier is identified as a boundary fire barrier, further justification is required for not installing a fire damper in the steel duct. The following discussion provides the additional justification for not installing the fire damper:

> Studies of the performance of steel ducts... with and without fire dampers under an ASTM E-119 fire exposure, were carried out in December 1982 at Underwriters Laboratories, Inc., by the Thermal Insulation Manufacturers Association (TIMA). Two separate fire tests in the wall furnace were conducted on steel ducts....
>
> The demonstrated structural performance of sheet steel ducts in the fire test provided additional evidence for NFPA 90A to maintain its provision that no fire dampers are required where steel ducts penetrate walls having a one-hour fire resistance rating....
>
> Steel ducts in the TIMA fire tests, under . . .positive-pressure fire-test conditions, remained intact on both sides (the fire exposed and unexposed side) of the wall. By maintaining its structural integrity in the one-hour-rated partition opening, the steel duct acted as a fire stop against the passage of flames and hot gases for one hour--with or without fire dampers...
>
> Steel ducts without a fire damper provide the same fire protection as Underwriters Laboratories labeled fire dampers, fire doors, and wired glass fire windows--to restrict the passage of hot gases and flames. (Temperature

on the side away from the fire is not a factor in the pass/fail test criteria of these assemblies; i.e., fire dampers, fire doors and wired glass fire windows.)[1]

Please note that the dimensions of the ductwork referred to in these studies were 10 in. by 10 in., which is larger than the duct referenced in this evaluation.

Conclusion

Based on the preceding evaluation, reasonable assurance is provided that a fire in Fire Zone 43 or Fire Zone 91 would not impair the safe shutdown capabilities of D.C. Cook Unit 1. In addition, this evaluation does not adversely impact on other evaluations or exemption requests contained in this report. The bases which justify this conclusion are summarized as follows:

(1) Fire Zone 43 has an equivalent fire severity of under 60 minutes, while Fire Zone 91 has an equivalent fire severity of under 40 minutes.

(2) Based on the combustible loading and equivalent fire severities on either side of the barrier separating Fire Zone 43 and Fire Zone 91, a barrier with a one-hour fire rating is sufficient to separate the two zones based upon the hazards to which they could be exposed.

(3) Section 3-3.2.1 of NFPA 90A requires fire dampers in HVAC duct penetrations if the required fire rating of the barrier is two hours or more.

(4) Studies of the performance of steel ducts without fire dampers under an ASTM E119 fire exposure of one hour reveal that steel ducts provide the same fire protection as labeled fire dampers.

1/ "Fire Research for HVAC Systems," Richard G. Gewain, The Construction Specifier, April 1984, pp. 64-69.

(5) The 7-in. diameter duct penetrating the barrier is of steel construction.

(6) Installing a labeled fire damper in the 7-in. diameter steel duct penetrating the barrier requiring a one-hour fire rating would not significantly enhance the protection provided by the existing configuration.

9.2 Fire Area 54 and Fire Zone 73 Duct Evaluation

Purpose

The purpose of this evaluation is to analyze the impact on redundant safe shutdown capability of an undampered HVAC steel duct that penetrates the floor/ceiling assembly between the Unit 2 Control Room and Unit 2 HVAC Equipment Room (Fire Area 54 and Fire Zone 73, respectively). In addition, this evaluation does not adversely impact on other evaluations or exemption requests contained in this report.

Description

Fire Area 54 is located on the 633 ft elevation of the Auxiliary Building. Fire Zone 73 is located directly above on the 650 ft elevation. Fire Zone 73 is part of a larger fire area that includes Fire Zones 70, 71 and 72. The barrier separating Fire Area 54 and Fire Zone 73 is constructed of reinforced concrete capable of achieving a three-hour fire rating; however, a 6-in. diameter undampered HVAC duct exhausts air directly to the outside from the Unit 2 Control Room toilet through the HVAC Equipment Room above.

Safe Shutdown Equipment

Fire Area 54 contains control and instrumentation cabling for safe shutdown of D.C. Cook Unit 2. Should a fire occur in the Unit 2 Control Room, complete alternate shutdown capability meeting the criteria of Appendix R Section III.G.3 is provided outside of the fire area. Fire Zone 73 and the fire area in which it is located contain no safe shutdown equipment cables or components.

Fire Protection Equipment

Automatic area detection is provided in Fire Zones 70 and 73, with automatic thermistor detection and manual deluge water spray systems protecting charcoal filter units in these two zones. Fire Zones 71 and 72 are provided with full area detection and automatic Halon 1301 suppression systems. Fire Area 54 is provided with an automatic ionization detection system above and below the suspended ceiling. Automatic suppression capabilities are not provided in Fire Area 54. Manual suppression capabilities in the form of portable extinguishers and hose stations are available for use in Fire Area 54.

Fire Hazards Analysis

The undampered 6-in. diameter HVAC steel duct is located in the floor/ceiling assembly separating the Unit 2 Control Room toilet from the Unit 2 HVAC Equipment Room above. For a fire to impact on redundant safe shutdown capability, the fire would have to spread between the Unit 1 and Unit 2 Control Rooms on the 633 ft elevation through the 6-in. diameter exhaust duct to Fire Zone 73 on the 650 ft elevation.

The combustible loading in Fire Area 54 results in an equivalent fire severity of under 35 minutes, with a negligible combustible loading in the toilet. (The actual fire severity existing at this time is under 23 minutes). Smoke and hot gases from a fire in Fire Area 54 could enter the charcoal filter units in Fire Zone 73 through the filter units return duct until the fire damper closes. The charcoal filter units in Fire Zone 73 are protected by automatic thermistor detection and manual deluge water spray systems. Should sufficient heat enter the charcoal filter units to ignite the charcoal, the automatic thermistor detection system will activate alarms in the Control Room. Upon arrival of the fire brigade, the deluge water spray system could be actuated to control and/or extinguish the fire. Reasonable assurance is provided that a fire of this type will not spread to the remainder of Fire Zone 73 or the fire area in which it is located.

Fire Zone 73 has a combustible loading resulting in an equivalent fire severity of under 20 minutes. (The actual fire severity existing at this time is under seven minutes.) The combustible loading for the entire fire area in which Fire Zone 73 is located results in an equivalent fire severity of under 35 minutes. (The actual fire severity existing at this time is under 25 minutes.) A previous evaluation dealt with the potential for fire propagation between the Unit 1 and Unit 2 Control Rooms from a fire in Fire Zones 70, 71, 72 and 73 via steel plate access hatches coated with pyrocrete (see Section 9.5, "Fire Zones 70 and 73 Hatch Evaluation"). Thus, the only concern addressed here is the potential for a fire in Fire Zones 70, 71, 72 and 73 to propagate down the undampered HVAC exhaust duct to the Unit 2 Control Room toilet.

Should a fire occur in Fire Zones 70, 71, 72 and 73, the potential exists for fire to spread down the exhaust duct into the Unit 2 Control Room toilet. Two facts tend to minimize this possibility. One is that the direction of air flow is from the toilet directly to the outside through Fire Zone 73. The second is that automatic thermistor detection and manual deluge water spray systems protect the charcoal filter units. The suppression systems would control and/or extinguish any fires that spread into the charcoal filter units from a fire in Fire Zones 70, 71, 72 and 73.

Should fire spread into the Unit 2 Control Room via the 6-in. diameter undampered HVAC exhaust duct, alternate shutdown capability meeting the criteria of Appendix R Section III.G.3 is provided outside of the area. A previous evaluation indicates that fire will not spread from Fire Zones 70, 71, 72 and 73 into the Unit 1 Control Room; therefore, the undampered HVAC duct to the Unit 2 Control Room toilet does not impact on redundant safe shutdown capability.

Conclusion

Based on the previous evaluation, reasonable assurance is provided that a fire in Fire Area 54 or Fire Zones 70, 71, 72 and 73 would not impair the safe shutdown capabilities of D.C. Cook Unit 2. In addition, this evaluation does not adversely impact on other evaluations or exemption requests contained in this report. The bases that justify this conclusion are summarized as follows:

(1) Fire Area 54 contains control and instrumentation cabling for safe shutdown of D.C. Cook Unit 2; however, no safe shutdown equipment cables or components are provided in Fire Zones 70, 71, 72 and 73.

(2) Complete alternate shutdown capability is provided for Fire Area 54. Since there are no safe shutdown equipment cables or components in Fire Zones 70, 71, 72 and 73, there will be no impact to safe shutdown capability should a fire involve both fire areas.

(3) The automatic thermistor detection and manual deluge water spray suppression systems in the charcoal filter units in Fire Zone 73, along with the direction of air flow from the toilet in the Unit 2 Control Room directly to the outside, provide reasonable assurance that a fire will not spread through the charcoal filter unit either down into Fire Area 54 or up into Fire Zones 70, 71, 72 and 73.

(4) Should a fire propagate between Fire Area 54 (Unit 2 Control Room) and Fire Zone 73 and spread beyond the charcoal filter units, Section 9.5 evaluation (titled, "Fire Zones 70 and 73 Hatch Evaluation") demonstrates that a fire involving Fire Zones 70, 71, 72 and 73 would not propagate down into the Unit 1 Control Room (Fire Area 53).

(5) Installing a labeled fire damper in the 6-in. diameter HVAC exhaust duct from the Unit 2 Control Room toilet directly to the outside through the HVAC Equipment Room above would not significantly enhance the protection provided by the existing configuration.

9.3 CCW Pump Air Supply Duct Evaluation (Fire Zone 44S)

Purpose

The purpose of this evaluation is to analyze the impact on redundant safe shutdown capability of the common supply air duct for the Unit 1, Unit 2 and spare CCW pumps located at elevation 609 ft of the Auxiliary Building in Fire Zone 44S. In addition, this evaluation does not adversely impact on other evaluations or exemption requests contained in this report.

Description

The supply duct originates at the Auxiliary Building air supply fans located in Fire Zone 52 at elevation 633 ft. From the supply fans, air travels down to elevation 609 ft via an enclosed vertical chase along the west wall of the Auxiliary Building. On elevation 609 ft, cooling air is supplied to the CCW pumps via a main supply duct running horizontally in the east-west direction to the vicinity of the CCW pumps. A separate 4 ft x 3 ft air supply hood is provided for each CCW pump and is supplied from a branch duct originating from the main supply duct. This evaluation addresses the potential for communication of fire between the CCW pumps via these associated supply ducts.

Safe Shutdown Equipment

Fire Zone 44S contains all four CCW pumps for Units 1 and 2, the spare CCW pump, the two Unit 2 CCW heat exchangers, the Unit 2 CCW pump suction valves, Unit 2 CCW heat exchanger outlet valves, Unit 2 CCW common service header valves, Unit 2 CCW to

RHR heat exchanger valves, Unit 2 ESW to CCW heat exchanger inlet valves, Unit 2 ESW to CCW heat exchanger outlet and Unit 2 MCC 2-AZV-A.

With the exception of the component cooling water pumps 1PP-10E, 1PP-10W and associated power cables, there are no Unit 1 cables or components in Fire Zone 44S which are essential for safe shutdown. Due to cross-tie capabilities, any two of the five CCW pumps are adequate to achieve and maintain shutdown conditions for both units simultaneously. The remaining systems of Unit 1 used for alternate shutdown for Unit 2 are outside of this fire zone.

Fire Protection Equipment

The CCW pump area is provided with both ceiling mounted ionization detectors and an automatic preaction pilot sprinkler system. In addition, sprinkler heads and pilot head heat detectors have been located and spaced to provide enhanced coverage of the CCW pumps. This combination of ceiling mounted sprinklers and sprinklers directly over the pumps themselves provides reasonable assurance against damage to redundant pumps as a result of a fire occurring in the vicinity of the pumps.

Fire Hazards Analysis

The general area (Fire Zone 44S) containing the pumps has an equivalent fire severity of under 25 minutes. (The actual fire severity existing at this time is 14.2 minutes.) The immediate area of the pumps has a comparatively low fire severity since the primary source of combustion is the 25 gallons of lube oil contained within the five CCW pump units. There is, however, no readily available source of ignition for this lube oil in the event of a leak. The floor around each of the CCW pumps is curbed in such a manner that oil leaking from any one pump or motor will be confined by the boundary of the curbing. Thus, the oil is confined to the immediate vicinity of the leak.

The resultant damage of any fire in the pump area is limited. A three-hour fire-rated barrier has been erected to prevent the spread of fire between the Unit 1, Unit 2 and spare pumps. The barrier is of steel construction coated with a fire protective material to achieve a three-hour fire rating. It is located between the Unit 1 and Unit 2 pumps in the east-west direction and also extends North between the Unit 1 east pump and the spare pump. Figures 9.3-1, 9.3-2 and 9.3-3 depict the layout and configuration of this barrier. A fire detection and suppression system has been provided to assure reliable and quick response to thermal conditions in the area of the pumps. Pilot head heat detectors and sprinkler heads have been positioned around each pump for direct water application onto the pump's bearings (hot sources). This is in addition to the detection and suppression system used in Fire Zone 44S for general area coverage. The application rate of suppression onto the CCW pump bearings is at a higher density than the system protecting the general area of Fire Zone 44S.

In the event of a fire, smoke and hot combustibles would tend to rise to ceiling level and stratify. The ceiling height in the immediate vicinity of the CCW pumps is 10 ft 11 in. To the east of the CCW pumps, the ceiling height increases to 20 ft 4 in. Figure 9.3-3 depicts the ceiling heights with respect to the CCW pumps. In order for any significant amounts of smoke and hot combustibles to impact on redundant CCW pumps, a build-up of smoke and hot combustibles would have to occur filling the ceiling area first and then accumulating in a downward direction until it reached the level of the pumps. Due to the volume of higher ceiling area of the ceiling heights, it is highly improbable that smoke could stratify down to the level of the pumps; therefore, the only potential for heat and smoke transmission from one pump to another is via the supply ductwork itself.

The 4 ft by 3 ft supply air hood for each CCW pump is approximately 6 inches from the top surface of the pump motor. When the air supply units are operating, supply air coming out the duct will limit smoke propagation into the duct. When the air supply units are not operating, smoke and combustible gases from a fire in the vicinity of a pump would have to rise up through the surrounding area around the perimeter of the hood, into the hood itself, and then into the branch duct of a given CCW pump. Smoke would have to travel through the branch duct to the main supply duct and then traverse into a branch duct of a second CCW pump. It would then have to move down the branch duct and finally exit from the hood located over the second CCW pump motor prior to impacting on a second CCW pump. This represents a tortuous path which fire must take in order to impact on redundant pumps. This configuration provides reasonable assurance that a fire in the vicinity of one CCW pump will not adversely impact on the capabilities of the other redundant CCW pumps to achieve and maintain safe shutdown conditions.

The vertical portion of the main supply air run does not contain fire dampers, thereby providing a direct path of communication between Fire Zone 52 on elevation 633 ft and Fire Zone 44S on elevation 609 ft. To maintain the boundary fire barrier between Fire Zones 52 and 44S, a three-hour-rated fire damper will be installed at the top of the vertical portion of the supply air run.

Conclusion

Based on the previous analysis, a fire-rated damper is required at the point where the main duct enters at the top of the air shaft from Fire Zone 52 on the 633 ft elevation; however, fire-rated dampers are not required at any of the branch ducts to the CCW pump supply air hoods. This evaluation does not adversely impact on other evaluations or exemption requests contained in this report. The bases which justify this conclusion are summarized as follows:

(1) There is essentially no combustible material in the vicinity of the CCW pumps, other than lube oil

contained within the pumps. If the oil within the pumps were to spill onto the floor, there is no readily available source of ignition.

(2) The resultant damage from a fire in the pump area would be limited due to (a) the three-hour fire barrier separating the pumps and (b) the quick response of the detection and suppression systems at both the ceiling and pump levels.

(3) Smoke and hot combustibles would collect within the beam pockets at the 10 ft 11 in. high ceiling level immediately over the CCW pumps and then tend to flow up into the 20 ft 4 in. high ceiling space. This will prevent a stratified layer of hot gases from forming to a depth sufficient to damage the CCW pumps unaffected by the direct results of the fire.

(4) Due to the close proximity of the hood to the top surface of the CCW pump motor, the surrounding area around the perimeter of the hood through which smoke and hot combustibles would have to pass is severely limited.

(5) To impact on redundant pumps simultaneously, smoke and hot gases would have to enter the supply air hood directly over one CCW pump, travel through the branch duct into the main supply duct, travel through the branch duct of a second CCW pump, and then travel down that pump's supply air hood to impact on the pump motor. This represents a tortuous path which fire must travel, thereby providing reasonable assurance that a fire in the vicinity of one pump will not adversely impact on the ability of redundant pumps to achieve and maintain safe shutdown conditions.

9.4 Auxiliary Building Vertical Air Shafts Evaluation (Fire Areas 12 and 22)

Purpose

The purpose of this evaluation is to analyze the impact on redundant safe shutdown capability of two vertical air shafts, located in the Auxiliary Building, that extend from the 573 ft elevation to just below the 650 ft elevation with dampered and undampered ventilation openings. In addition, this evaluation does not adversely impact on other evaluations or exemption requests contained in this report.

Description

The Unit 1 air shaft located in Fire Area 12 rises vertically within Fire Area 12 and abuts the various Auxiliary Building pump and exchanger cubicles (e.g., charging, RHR, CTS, safety injection, etc.) extending from the 573 ft elevation to just below the 650 ft elevation. Similarly, the Unit 2 air shaft located in Fire Area 22 rises vertically within Fire Area 22 and abuts the various Auxiliary Building pump and exchanger cubicles.

At the 573 ft elevation, an undampered air exhaust duct (approximately 1 ft by 2 ft in size) takes air from each Unit 1 containment spray pump cubicle (Fire Zones 1A and 1B) and discharges this air into the Unit 1 air shaft. Similarly, the Unit 2 air shaft and corresponding pump cubicles (Fire Zones 1E and 1F) contain the same type and number of undampered exhaust ducts. The Units 1 and 2 RHR pump cubicles (Fire Zones 1C, 1D, 1G and 1H) contain a three-hour-rated damper in the exhaust duct which discharges air into the air shafts.

At the 587 ft elevation, an undampered exhaust duct (approximately 2 ft by 1-1/2 ft) common to each Unit 1 safety injection pump cubicle (Fire Zones 64A and 64B) takes air from each of the cubicles and discharges this air into the Unit 1 air shaft. In addition, undampered exhaust ducts take air from each of the three charging pump cubicles (Fire Zones 62A, 62B, and 62C) and discharge this air into the Unit 1 air shaft. Similarly, the Unit 2 air shaft and corresponding pump cubicles (Fire Zones 63A, 63B and 63C, 65A and 65B) contain the same type and number of undampered exhaust ducts.

At the 609 ft elevation, undampered exhaust ducts take air from the Unit 1 RHR and containment spray heat exchanger cubicles (Fire Zones 44A through 44D) and discharge this air into the Unit 1 air shaft. The exhaust ducts are located just below the ceiling of the air shaft, near the 650 ft elevation. Similarly, the Unit 2 air shaft and corresponding exchanger cubicles (Fire Zones 44E through 44H) contain the same type and number of undampered exhaust ducts.

The exhaust air discharged into the Unit 1 air shaft flows upwards to the 633 ft elevation where it is exhausted from the Auxiliary Building by two air exhaust fans (1HV-AES-1 and 1HV-AES-2) located in Fire Zone 49. Although the fan units have manually operated dampers for flow control, there are no fire-rated dampers at the air shaft's north wall where the air leaves the shaft to enter the exhaust fan units. Similarly, the Unit 2 air shaft exhausts air at the 633 ft elevation through two air exhaust fans (2HV-AES-1 and 2HV-AES-2) located in Fire Zone 50. No fire-rated dampers exist at the air shaft's south wall where the air leaves the shaft to enter the exhaust fan units.

Safe Shutdown Equipment

Fire Zones 49 and 50 are located on elevation 633 ft and are contained in the fire area defined by Fire Zones 49, 50, 51, 52, 3, 31, 32, 35, 36, 48, 69, 106, 107, and 146. Safe shutdown equipment is located in Fire Zones 50, 52, 69, 106 and 107 including 1-CMO-429, 2-CMO-429 (CCW to RHR heat exchanger isolation MOV), 1-CCW-214, 1-CCW-220, 2-CCW-214, 2-CCW-220 (Unit 1 and Unit 2 CCW surge tank manual isolation valve), MCCs 1-AM-A, 2-AM-A, 1-AM-D, 2-AM-D, and battery BN with associated distribution cabinet DCN (Unit 1 and Unit 2). Various cables are located in Fire Zones 32, 50, 51, 52, 69, 106 and 107. Fire Zones 3, 31, 35, 36, 48, 49 and 146 do not contain any safe shutdown equipment and/or cables. Based on the safe shutdown system analysis, in the event of a fire in this area, all safe shutdown systems have at least one path free of fire damage in each unit except for source range monitoring instrumentation. However, the March 1983 submittal recommended the addition of an alternate source range neutron monitoring channel to provide indication at local shutdown panel LSI-4 located in Fire Zone 5.

Fire Zones 44A through 44H are located on elevation 609 ft and are contained in the fire area defined by Fire Zones 44A through 44H, 37, 43, 44N and 44S. This fire area contains various safe shutdown motor control centers, pumps and redundant cables. As recommended in Section 8 of this report, various modifications will be made in this fire area to ensure safe shutdown capability.

Fire Area 12 at the 596 ft elevation, which includes the Unit 1 air shaft, contains steam generator 2 and 3 supply valves (FMO-221, -222, -231, -232), containment sump to RHR pump suction valves (ICM-305, 306), local shutdown indication panels (LSI-2, LSI-6), and various safe shutdown cables associated with these equipment. The CCW to RCP thermal barrier isolation valves are also located in this fire area (CCM-453, -454, -458, -459); however, these valves are not required for safe shutdown and were included in the original evaluation for plant operational flexibility. As concluded by the March 1983 submittal, at least one path of safe shutdown components is available in each of the safe shutdown systems.

Fire Area 22 at the 596 ft elevation, which includes the Unit 2 air shaft, contains steam generator 2 and 3 supply valves (FMO-221, -222, -231, -232) containment sump to RHR pump suction valves (ICM-305, 306), local shutdown indication panels (LSI-2, LSI-6) and various safe shutdown cables similar to those cables found in Fire Area 12. The CCW to RCP thermal barrier isolation valves (CCM-453, -454, -458, -459) are also located in this fire area; however, these valves are not required for safe shutdown and were included in the original evaluation for plant operational flexibility. As concluded by the March 1983 submittal, at least one path of safe shutdown components is available in each of the safe shutdown systems.

Fire Zones 64A and 64B (Unit 1 safety injection cubicles) and 65A and B (Unit 2 safety injection cubicles) are located on elevation 587 ft and are contained in the fire area defined by Fire Zones 5, 6A, 6N, 6M, 6S, 64A, 64B, 65A and 65B. This fire area contains 1-LSI-3, 2-LSI-3, MCCs 1-AB-A, 1-AB-D, 2-AB-A, 2-AB-D, 1-ABV-A, 1-ABV-D, 2-ABV-A, 2-ABV-D, battery distribution cabinets 1-ABN, 2-ABN, and Unit 2 charging flow control valve 2-QRV-251. In addition, various safe shutdown cables are located within this fire area. As recommended in Section 8 of this report, various modifications will be made in this fire area to ensure shutdown capability.

Unit 1 Fire Zones 62A, 62B, and 62C define a fire area located on elevation 587 ft which contains the Unit 1 RWST to CVCS pumps isolation valves IMO-910, IMO-911; charging pumps PP-50E, PP-50W; charging lube oil pumps PP-50E (LO) and PP-50W (LO); minimum flow valves QMO-225 and QMO-226; and charging flow control valve QRV-251. In addition, various safe shutdown cables are located within this fire area. In the event of a fire in this area, the Unit 1 CVCS pumps would be lost. Sections 5 and 8 of this report propose the cross connection of the plant CVCS systems such that the charging functions of the fire affected unit can be maintained via the cross connection of the unaffected unit's CVCS system. All other safe shutdown systems are available in the event of a fire.

Unit 2 Fire Zones 63A, 63B and 63C define a fire area located on elevation 587 ft which contains the Unit 2 RWST to CVCS pumps isolation valves IMO-910, IMO-911; charging pumps PP-50E, PP-50W; charging lube oil pumps PP-50E (LO), PP-50W (LO); and minimum flow valves QMO-225 and QMO-226. This would result in the loss of the Unit 2 CVCS pumps in the event of a fire. However, as previously described, the charging functions of the fire affected unit can be maintained via the cross connection of the unaffected unit's CVCS system. Various other safe shutdown components and cables associated with the auxiliary feedwater, EPS and RCS systems are also located in this fire area; however, at least one path of safe shutdown components is available during a fire.

Fire Zones 1A, 1B, 1E and 1F are located on elevation 573 ft and are contained within a fire area defined by Fire Zones 1, 1A through 1H, 136, 137, 138A, 138B and 138C. This fire area contains RHR pumps PP-35E and PP-35W and RHR pump suction valves IMO-310 and IMO-320 for both units. In addition, various safe shutdown cables are located within this fire area. Section 8 of this report recommends certain modifications which, after installation, will ensure that at least one path of safe shutdown components will be available for all systems.

Fire Protection Equipment

Fire Zone 1 contains an automatic detection system for the general corridor area. Section 8 of this report recommends that the RHR and CTS pump cubicles be provided with automatic detection, including remote alarming capability in the Control Rooms, and the installation of fire dampers in the boundary of the RHR pump rooms to the vertical air shafts in Fire Areas 12 and 22. It also recommends that automatic sprinklers be located around the perimeter of the open stairway to the 587 ft elevation to ensure the integrity of the barrier separating these two elevations. These recommendations have been implemented.

The fire area at the 587 ft 0 in. and 601 ft 0 in. elevation of the Auxiliary Building is defined by Fire Zones 5, 6A, 6N, 6M, 6S, 64A, 64B, 65A and 65B. With the exception of Fire Zone 6A (601 ft pipe tunnel), these zones contain both automatic dry pilot preaction sprinklers (including protection of stairways to adjacent elevations) and ionization detection.

The fire area defined by Fire Zone 62A, 62B and 62C (Unit 1 charging pump cubicles) contains both automatic dry pilot preaction sprinklers and ionization detection. Similarly, the fire area defined by Fire Zones 63A, 63B and 63C (Unit 2 charging pump cubicles) contains both automatic dry pilot preaction sprinklers and ionization detection.

Fire Areas 12 and 22 do not contain either automatic suppression or detection systems.

The fire area defined by Fire Zones 37, 43, 44N, 44S and 44A through 44H contains automatic detection in Fire Zones 37, 43, 44N and 44S. Automatic dry pilot preaction sprinklers, including protection of stairways to adjacent elevations, are provided in Fire Zones 44N and 44S.

The fire area defined by Fire Zones 3, 31, 32, 35, 36, 48, 49, 50, 51, 52, 69, 106, 107, and 141 contains automatic detection in Fire Zones 32, 48, 49, 50, 51, 52, 69, 106 and 107. Only partial coverage is provided in Fire Zone 3. No detection coverage is provided in Fire Zones 31, 35, 36 and 146. Thermistors are also provided for the charcoal filter units in Fire Zones 49, 50 and 69. Automatic dry pilot preaction sprinklers are contained in Fire Zones 32, 51 and 52 with partial coverage provided in Fire Zone 3. A manual deluge system is used for the charcoal filter units in Fire Zones 49, 50 and 69.

Fire Hazards Analysis

The combustible loadings for all of the above fire areas are indicated by the following:

Fire Area or Fire Zones Composing a Fire Area	Area Fire Severity (Minutes)
FZs 1, 1A through 1H, 136, 137, 138A, 138B, 138C	15

FZs 3,32,36,48,49,50 51,52,69, 106,107,146	25
FZs 5,6N,6A,6M,6S,61, 64A&B,65A&B	20
12 (including air shaft)	15
22 (including air shaft)	10
FZs 37,43,44N,44S,44A through 44H	35
FZs 62A,B,C	35
FZs 63A,B,C	35

Each of the air exhaust duct penetrations from the charging pump cubicles (Fire Zones 62A, 62B, 62C, 63A, 63B and 63C) into the respective unit's air shaft are to be upgraded with three-hour-rated fire dampers to maintain the fire rating of the fire area boundary in which the penetrations are located. This eliminates the combustible loading of the charging pump cubicles to be considered in this evaluation. Products of combustion from any of the fire areas bounding either vertical air shaft must pass through its associated air shaft in order to communicate with another fire area. Smoke and hot combustibles entering either air shaft would tend to stream upwards to the top of the shaft. In order for any significant amounts of smoke and hot combustibles to impact on safe shutdown components and cables in other fire areas, a build-up of smoke and hot combustibles would have to bank down until it reached the undampered duct penetrations. This build-up of combustion products would be limited by the exhaust fans located in Fire Zones 49 and 50 for Units 1 and 2 respectively which run continually. Under normal conditions, these fans would dissipate the products of combustion to the outside before a build-up could take place. If these air exhaust fans were not in operation, combustion products could begin to bank down and enter the undampered exhaust ducts starting with the ducts at the top of the shaft. The amount of the combustible loading in each of the fire areas of concern, along with lack of exhaust capability, would make the accumulation of significant amounts of combustion products difficult if not impossible within the air shaft especially at the lower elevation exhaust ducts. In addition, as products of combustion pass through either vertical air shaft into other fire areas, the hot combustibles would tend to naturally cool down over this lengthy path of travel.

The following scenarios are provided to illustrate the circuitous path required to impact redundant safe shutdown equipment in each of the fire areas concerned.

<u>Elevations 633 ft and 650 ft</u>

The fire area defined by Fire Zones 3, 31, 32, 35, 36, 48, 49, 50, 51, 52, 69, 106, 107, and 146 is located at various elevations of the plant, including elevations 587, 609, 630, 633 and 650 ft. Only Fire Zones 49 (Unit 1 HVAC vestibule) and 50 (Unit 2 HVAC vestibule) abut the air shafts without fire dampers. Each fire zone contains two engineered safeguard system ventilation fans which take air from their respective air shaft and exhaust it through a duct from the Auxiliary Building roof. Since there is no fire-rated damper at the air shaft duct penetration for each fan, products of combustion may enter Fire Zones 49 or 50.

In order for a fire to be transmitted from the air shaft to either fire zone, one or both ventilation fans must be off. Products of combustion must then enter the air shaft duct penetrations and escape into either the ventilation fans or their associated ducts into either Fire Zone 49 or 50. Fire would then have to travel from either Fire Zone 49 or 50 to the other fire zones contained in the fire area. It is unlikely that a fire could be initiated in this manner and then engulf the entire fire area.

As previously discussed, Fire Zones 32, 50, 51, 52, 69, 106 and 107 are the only fire zones in the fire area containing safe shutdown equipment and/or cables. These fire zones contain automatic detection systems for general area detection, with thermistors and a manual deluge system also provided for the charcoal filter units in Fire Zones 49 and 50. Fire Zones 49 through 52 are not protected by automatic dry pilot sprinkler systems; however, Section 8 of this report recommended an automatic dry pilot sprinkler system be installed in Fire Zones 51 and 52. These modifications have been implemented. This fire area has a combined fire severity of 25 minutes. The actual fire severity existing at this time is under 13 minutes.

In order for a fire to travel from either Fire Zone 49 or 50 to Fire Zones 3, 31, 32, 35, 36, 48, 69 and 146, the path must be through the unrated penetrations between Fire Zones 49 and 69 or between Fire Zones 50 and 69. Since the only path to these other fire zones is through unrated and/or unsealed penetrations leading to Fire Zone 69, this path is restricted. (It is restricted due to the presence of barriers with penetrations which may or may not be sealed. This presents more restrictions than would exist if the barrier did not exist at all.)

Fire could also spread from Fire Zone 49 to 52 to 51 or Fire Zone 50 to 52 to 51, and then spread either into Fire Zones 106 and 107 or up into Fire Zone 69. From Fire Zone 69, fire could then spread down into Fire Zones 32, 35, 36, 48, 3 and 146, which are connected to Fire Zone 69 on lower elevations. While it is credible that fire could spread from either Fire Zones 49 or 50 to Fire Zones 51 and 52, the automatic detection and dry pilot suppression systems in both fire zones will act to limit fire spread to either Fire Zones 51 and 52 or other adjacent fire zones.

The more direct and plausible route is directly from either Fire Zone 49 or 50 directly up into Fire Zone 69 and from Fire Zone 69 to the adjacent fire zones. Fire Zones 69, 32 and 48 are provided with automatic detection and partial detection coverage is provided in Fire Zone 3. Dry pilot preaction suppression systems are provided in Fire Zone 32 with partial coverage provided in Fire Zone 3. In addition, Fire Zone 69 is provided with a manual deluge system for the HVAC charcoal filter units. In the unlikely event that hot combustibles should enter Fire Zone 69 from either HVAC vestibule and then enter the charcoal filter unit and ignite the charcoal, the fire protection systems provided would detect and upon actuation will extinguish the fire within the unit. Therefore, damage to safe shutdown equipment due to the transmission of fire between the air shafts and this fire area is not a credible event.

Elevation 609 ft

Products of combustion entering the fire area defined by Fire Zones 37, 43, 44N, 44S, and 44A through 44H would enter through undampered duct penetrations in the CTS/RHR heat exchanger cubicles just below the 650 ft elevation. Fire Zones 44A through 44H each contain an exhaust penetration in a common wall with its respective air shaft. Unit 1 Fire Zones 44A and 44B do not contain any safe shutdown components or cables. Unit 2 Fire Zones 44E and 44F contain no safe shutdown equipment and only a few cables associated with the CVCS flow control valve (QRV-251) and the CVCS pump suction isolation valve (IMO-911). Unit 1 Fire Zones 44C, 44D and Unit 2 Fire Zones 44G, 44H contain the RHR heat exchangers, valves and associated cables. Since all of the above fire zones adjacent to the air shafts contain mostly mechanical equipment and piping, the combustible loading in these fire zones is low. As a result, the CTS and RHR heat exchanger cubicles are not a primary source of ignition for any hot combustibles which might enter the cubicles via the exhaust penetrations. None of the CTS/RHR heat exchanger cubicles contain either automatic detection or suppression systems. However, a fire in Fire Zones 44A through 44H would impact only cold shutdown valves which could be manually operated by plant personnel.

Fire Zones 37, 43, 44N and 44S are provided with automatic detection systems. An automatic dry pilot preaction suppression system has been provided for Fire Zones 44N and 44S. For fire to impact on these fire zones, it would have to spread into the zones from the vertical air shafts via the heat exchanger cubicles. The exhaust ducts to the heat exchanger cubicles are located just below elevation 650 ft, with the top of the entrance door to each cubicle located at approximately elevation 616 ft. Products of combustion would have to bank down to the level of the top of the doors in order to spread out into Fire Zones 44N and 44S. This is not considered a credible event. However, any products of combustion or fire emanating from the CTS/RHR heat exchanger cubicles would be detected and extinguished by these fire protection systems in Fire Zones 44N and 44S. Therefore, damage to safe shutdown equipment due to the transmission of fire between the air shaft and this fire area is not a credible event.

<u>Elevation 587 ft</u>

The duct penetrations entering the Safety Injection (SI) cubicles (Unit 1 Fire Zones 64A and 64B and Unit 2 Fire Zones 65A and 65B) are located at approximately the 587 ft elevation. A single duct penetration in each air shaft is shared by both SI pumps of a unit. A common duct extends from the penetration to each of the pump cubicles where air is taken from the cubicle area and exhausted into the shaft. There are no safe shutdown components located in the SI cubicles. However, these cubicles are part of a fire area containing various safe shutdown components and cables. Fire Zones 5, 6A, 6N, 6M and 6S are adjacent to the SI cubicles of both units and contain safe shutdown components, such as local shutdown indication panels, various motor control centers, distribution cabinets, charging flow control valve and associated cables.

In order for a fire to be transmitted from the air shaft to these components, products of combustion would have to be generated in sufficient quantities as to fill the air shaft from approximately the 650 ft to the 587 ft elevations of the air shaft. The smoke and hot combustibles would have to then enter the undampered exhaust duct and exit the duct above the SI pumps. The smoke and hot gases would then have to ignite combustibles in the SI pump cubicles and then spread through the SI cubicles, around the missile shield wall, and into Fire Zone 6N. This is not a credible event due to the following considerations:

(1) Both the SI cubicles and Fire Zones 5, 6N, 6M and 6S have been provided with automatic detection and dry pilot preaction suppression systems.

(2) This fire area has a combustible loading that results in a fire severity of 20 minutes. (The actual fire

severity existing at this time is under 6.5 minutes).

(3) The combustible loading in the immediate vicinity but outside of the SI cubicles is significantly lower than the rest of the fire area. Therefore, damage to safe shutdown equipment due to the transmission of fire between the air shaft and this fire area is not a credible event.

Elevation 573 ft

Products of combustion entering the fire area containing Fire Zones 1, 1A-1H, 136, 137, 138A, 138B and 138C would be via the containment spray pump cubicles. The access doors are screen mesh for ventilation purposes; however, the missile shield walls, approximately 14 ft in length forming a "T" at the entrance ways, extend beyond the width of the doorway. Since the RHR pumps and associated valves are the only redundant safe shutdown components in this area, a fire would have to pass through the CTS cubicles and around the missile walls into a common area between the Unit 1 and 2 cubicles. (A fire could not travel from the air shaft to the RHR cubicles directly since the air ducts between the air shaft and the RHR cubicles are provided fire rated dampers.) It would then have to enter the RHR cubicles by passing around the associated missile shield walls. In addition, the penetrations to Fire Zones 1A, 1B, 1E and 1F (the CTS cubicles) from the air shaft are located at the lowest elevation of the air shaft (approximately 573 ft). In order for combustion products to enter these penetrations, smoke and hot combustibles would have to be generated in sufficient quantities as to fill Fire Areas 12 and 22 including their respective air shafts. This is extremely unlikely since the combustible loading in the fire areas of concern is low. Therefore, transmission of fire between the air shaft and the RHR cubicles is not a credible event.

Systems Analysis

The above fire hazards analysis demonstrates the extremely unlikely scenarios required for a fire to be transmitted so as to totally engulf either air shaft and their respective adjoining fire areas at various elevations. Using the above scenarios as a basis, a systems analysis can be performed to determine the impact of a fire on the safe shutdown capability of the plant. For the purposes of this analysis, the following assumptions are used:

(1) The vertical air shafts are a common means of communication of fire to all of the fire areas described above; however, it is not credible that all of these fire areas are simultaneously engulfed by fire.

(2) The only fire areas assumed to be involved in a fire at any time are the fire areas defined by either air shaft (i.e., Fire Areas 12 or 22) and only one of the other fire areas adjacent to the air shaft under consideration.

(3) Considering assumption (2) above, the worst-case scenario is defined as a fire totally engulfing either Fire Area 12 or 22 and then travelling the circuitous path (described in the previous scenarios) in one of the adjacent fire areas until the fire reaches a fire zone within the fire area containing a suppression system capable of extinguishing the fire. The fire does not travel any further within the fire area.

(4) It is assumed that the fire starts at the 587 ft elevation (i.e., Quadrant 2 pipe tunnel area for both

units) of the air shaft and then travels through the vertical portion of the air shaft to the unrated penetrations. This is a reasonable assumption since the primary source of combustible loading for both air shafts is located in the Quadrant 2 pipe tunnel of each unit.

The following is a discussion of the systems analysis for each of the previously described scenarios using the above assumptions:

<u>Elevations 633 ft and 650 ft</u>

<u>Fire Area Containing Fire Zones 49, 50, 51, 52, 3, 32, 36, 48, 69 and Fire Area 12 or 22</u>

For a fire in either Unit 1 or Unit 2 air shaft (Fire Area 12 or Fire Area 22 respectively), it is assumed for the purposes of this analysis that the fire will engulf Fire Area 12 and Fire Zone 49 in Unit 1 or Fire Area 22 and Fire Zone 50 in Unit 2. This assumption is based on the following:

(1) A fire originating in either air shaft must produce enough products of combustion to fill the top of the air shaft (i.e., just below the 650 ft elevation). The products of combustion, produced from low combustible loading contained in each air shaft, will tend to be dispersed within the large volume of the air shaft.

(2) The hot combustibles produced from the air shaft fire will tend to cool rapidly because of the low combustible loading and large volume.

(3) The HVAC exhaust air fan units located in Fire Zones 49 (Unit 1) and 50 (Unit 2) contain detection and deluge systems associated with their charcoal filters. These deluge systems are capable of extinguishing any fire in the charcoal beds which may originate either internal to or external to these air fan units.

As a result of the above, the systems analysis assumes a loss of safe shutdown components (i.e., equipment and/or cables) only in Fire Area 12 and Fire Zone 49 (which contains no safe shutdown equipment or cables) for Unit 1 or in Fire Area 22 and Fire Zone 50 for Unit 2.

For both the Unit 1 and Unit 2 systems analyses, it was concluded that at least one path of safe shutdown components exists for each safe shutdown system.

This evaluation for the above fire areas and fire zones does not affect the existing exemption requests concerning the Auxiliary Building HVAC Duct Penetrations (Section 7.13) or the Containment Seismic Gaps (Section 7.14).

Elevation 609 ft

Fire Area Containing Fire Zones 37, 43, 44N, 44S, 44A through 44H and Fire Area 12 or 22

A similar method of analysis may be used for the above fire areas. For a fire in either the Unit 1 or Unit 2 air shaft (Fire Area 12 or Fire Area 22 respectively), it is assumed for the purposes of this analysis that the fire will engulf Fire Area 12 and Fire Zones 44A, 44B, 44C, 44D in Unit 1 or Fire Area 22 and Fire Zones 44E, 44F, 44G, 44H in Unit 2. This assumption is based on the following:

(1) As previously discussed, each air shaft has a low combustible loading (20,000 Btu/ft^2 for the Unit 1 air shaft and 13,000 Btu/ft^2 for the Unit 2 air shaft) which will tend to disperse throughout the large volume of the air shaft.

(2) The hot combustibles produced will tend to cool rapidly within the large air shaft volume.

(3) The CTS and RHR heat exchanger cubicles are large volumes and contain mostly mechanical equipment and piping; the combustible loading in these fire zones is low. If hot combustibles were transmitted into these cubicles from the air shaft (either Unit 1 or Unit 2), it would be extremely difficult for a fire to develop in any of these cubicles.

As a result of the above, the systems analysis assumes a loss of safe shutdown components (i.e., equipment and/or cables) only in Fire Area 12 and Fire Zones 44A through 44D for Unit 1 or in Fire Area 22 and Fire Zones 44E through 44H for Unit 2.

For both the Unit 1 and Unit 2 systems analyses, it was concluded that at least one path of safe shutdown components exists for each safe shutdown system.

This evaluation for the above fire areas and fire zones does not affect the existing exemption requests concerning the Auxiliary Building HVAC Duct Penetrations (Section 7.13) or the Containment Seismic Gaps (Section 7.14).

Elevation 587 ft

Fire Area Containing Fire Zones 5, 6A, 6N, 6M, 6S, 61, 64A, 64B, 65A, 65B and Fire Area 12 or 22

For a fire in either the Unit 1 or Unit 2 air shaft, it is assumed for the purposes of this analysis that the fire will engulf Fire Area 12 and Fire Zones 64A, 64B in Unit 1 or Fire Area 22 and Fire Zones 65A, 65B in Unit 2. This assumption is based on the following:

(1) As previously discussed, each air shaft has a low combustible loading (20,000 Btu/ft^2 for the Unit 1 air shaft and 13,000 Btu/ft^2 for the Unit 2 air shaft) which will tend to disperse throughout the large volume of the air shaft.

(2) The hot combustibles produced will tend to cool rapidly within the large air shaft volume.

(3) The Safety Injection Pump cubicles (i.e., Fire Zones 64A and 64B in Unit 1 and 65A and 65B in Unit 2) are large volumes, with the following combustible loading values:

Fire Zone	Assumed Combustible Loading for this Evaluation	(Actual Combustible Loading)
64A	27,000 Btu/ft^2	(12,642 Btu/ft^2)
64B	27,000 Btu/ft^2	(10,739 Btu/ft^2)
65A	27,000 Btu/ft^2	(11,518 Btu/ft^2)
65B	27,000 Btu/ft^2	(13,008 Btu/ft^2)

If hot combustibles were transmitted into these cubicles from the air shaft (either Unit 1 or Unit 2), it would be unlikely that a fire could develop because of the amount of the combustible loadings and the general area detection and suppression systems in each zone.

As a result of the above, the systems analysis assumes a loss of safe shutdown components (i.e., equipment and/or cables) only in Fire Area 12 and Fire Zones 64A and 64B for Unit 1 or in Fire Area 22 and Fire Zones 65A and 65B for Unit 2.

For both the Unit 1 and Unit 2 systems analyses, it was concluded that at least one path of safe shutdown components exists for each safe shutdown system.

This evaluation for the above fire areas and fire zones does not affect the existing exemption requests concerning the Auxiliary Building HVAC Duct Penetrations (Section 7.13) or the Containment Seismic Gaps (Section 7.14).

Elevation 573 ft

Fire Area Containing Fire Zones 1, 1A through 1H, 136, 137, 138A, 138B, 138C and Fire Area 12 or 22

For a fire in either the Unit 1 or Unit 2 air shaft, it is assumed for the purposes of this analysis that the fire will engulf Fire Area 12 and Fire Zones 1A and 1B in Unit 1 or Fire Area 22 and Fire Zones 1E and 1F in Unit 2. This assumption is based on the following:

(1) As previously discussed, each air shaft has a low combustible loading (20,000 Btu/ft^2 for the Unit 1 air shaft and 13,000 Btu/ft^2 for the Unit 2 air shaft) which will tend to disperse any products of combustion throughout the large volume of the air shaft.

(2) The hot combustibles produced will tend to cool rapidly within the large air shaft volume.

(3) The Containment Spray Pump cubicles (i.e., Fire Zones 1A and 1B in Unit 1 and 1E and 1F in Unit 2) are large volumes, with combustible loading values of under 20,000 Btu/ft^2 for each cubicle. If hot combustibles were transmitted into these cubicles from the air shaft (either Unit 1 or Unit 2), it would be unlikely that a fire could develop or be transmitted to Fire Zone 1 due to the amount of the combustible loadings and its primary locations (within the pumps). In addition, Fire Zone 1 contains general area detection systems.

(4) A previous exemption request was submitted to and approved by NRC requesting an exemption from installation of an automatic suppression system in the RHR/CTS pump area. The exemption provides a detailed fire hazards analysis demonstrating that the fire area

and Pump Room cubicles are constructed to prevent a fire from leaving one Pump Room and entering another or from entering two Pump Rooms from the common area.

As a result of the above, the systems analysis assumes a loss of safe shutdown components (i.e., equipment and/or cables) only in Fire Area 12 and Fire Zones 1, 1A and 1B for Unit 1 or in Fire Area 22 and Fire Zones 1, 1E and 1F for Unit 2.

For both the Unit 1 and Unit 2 systems analyses, it was concluded that at least one path of safe shutdown components exists for each safe shutdown system.

This evaluation for the above fire areas and fire zones does not affect the existing exemption requests concerning the Auxiliary Building HVAC Duct Penetrations (Section 7.13) or the Containment Seismic Gaps (Section 7.14).

Conclusion

Based on the previous analysis, reasonable assurance can be provided that a fire in any of the adjoining fire areas to the Auxiliary Building air shafts with undampered or unrated duct penetrations or a fire in either air shaft will not adversely impact on safe shutdown capabilities of the plant. In addition, this evaluation does not adversely impact on other evaluations or exemption requests contained in this report. The bases for the above conclusion are summarized below:

(1) The air exhaust duct penetrations from the charging pump cubicles (Fire Zones 62A, 62B, 62C and 63A, 63B, 63C) into the respective unit's air shaft will be upgraded to maintain the fire rating of the fire area boundary.

(2) Smoke and hot combustibles entering either air shaft would normally tend to be exhausted through the Engineered Safeguards Systems to do the plant vents.

(3) Smoke and hot combustibles entering either air shaft would tend to stream upwards to the ceiling of the air shaft, when the units are not running, spreading out into Fire Zones 49 (from Fire Zone 12) or 50 (from Fire Zone 22) through the undampered openings at ceiling level. The hot smoke would have to result in the ignition of combustible material in either Fire Zone 49 or 50 in order to spread to adjacent fire zones. Due to automatic detection and suppression capabilities in adjacent zones containing safe shutdown equipment or cables, this is not considered a credible event. In the shafts, products of combustion would tend to accumulate and move downwards and spreading out into Fire Zones 44A, 44B, 44C and 44D (for Unit 1), 44E, 44F, 44G and 44H (for Unit 2) through the undampered openings at ceiling level. Products of combustion would then begin to fill up the heat exchanger cubicles prior to entering Fire Zone 44N through the steel grate doorways at the 609 ft elevation. This represents a circuitous path for smoke and hot combustibles to take in order to impact safe shutdown components. Products of combustion could accumulate more and move downwards in the shaft, filling Fire Zone 12 (Unit 1) or Fire Zone 22 (Unit 2) before entering other fire areas. This also represents a circuitous path.

(4) The route a fire would have to take from a fire area adjacent to either air shaft, through the air shaft and into a second fire area represents a circuitous path.

(5) The fire areas adjacent to the vertical air shafts and the air shafts themselves all have combustible loadings of under 35,000 Btu/ft^2 for an equivalent fire severity of under 25 minutes.

(6) Detection and/or suppression systems exist in the adjacent fire areas which are capable of detecting and/or extinguishing a fire and minimizing the damage to safe shutdown equipment and cables.

(7) A fire engulfing any of the fire areas directly communicating with the two vertical air shafts has been considered in the above fire protection and systems analyses. A fire in any of these fire areas will not jeopardize the safe shutdown capability of the plant.

9.5 Fire Zones 70 and 73 Hatch Evaluation

Purpose

The purpose of this evaluation is to analyze the impact of unrated floor hatches located between the HVAC Equipment Rooms (Fire Zones 70 and 73) and the Units' 1 and 2 Main Control Rooms (Fire Zones 53 and 54) on either redundant safe shutdown capability, the fixed suppression exemption requests for the Main Control Rooms contained in Sections 7.11 and 7.12 of this report or engineering evaluation 9.2 and 9.39. A three-hour fire-rated hatch assembly is not commercially available for use in this location.

Description

Fire Zones 70 and 73 are located on the 650 ft elevation of the Auxiliary Building. These fire zones are part of a larger fire area (which also includes Fire Zones 71 and 72 - Unit 1 and 2 Computer Rooms) directly above the Unit 1 and Unit 2 Control Rooms. The unrated floor hatches provide access from the Units' 1 and 2 Control Rooms to the HVAC Equipment Rooms. Each hatch is protected with a layer of pyrocrete on the side of the hatch exposed to the Control Rooms. All other penetrations of the barrier to the Control Rooms are protected with fire-rated material. The HVAC ducts passing through the floor are provided with fire-rated dampers.

Safe Shutdown Equipment

The fire area defined by Fire Zones 70, 71, 72 and 73 contains no safe shutdown equipment, components or cables.

Fire Protection Equipment

Automatic area detection is provided in Fire Zones 70 and 73, with automatic thermistor detection and manual deluge water spray systems for the charcoal filter units. Fire Zones 71 and 72 have full area detection and automatic Halon suppression systems. Fire Areas 53 and 54 are not provided with automatic or fixed suppression system, but ionization type smoke detectors are installed above and below the suspended ceiling and manual fire fighting equipment is available.

Fire Hazards Analysis

Fire Zones 70, 71, 72, and 73 have a combustible loading of under 47,000 Btu/ft^2 for an equivalent fire severity of approximately 35 minutes (the actual combustible loading and equivalent fire severity existing at this time are under 33,820 Btu/ft^2 and 25 minutes respectively). The area contains automatic area detection in all four fire zones and automatic Halon suppression systems in Fire Zones 71 and 72. Manual deluge water spray systems are provided for charcoal filter units in Fire Zones 70 and 73. The probability of fire involving both hatches simultaneously is low. As a consequence, the probability of fire spreading down into one or both units' Control Rooms is also low. Should fire spread down into one Control Room, alternate safe shutdown capability exists.

Another concern is the probability of a fire occurring in one Control Room and spreading up through the unrated hatches into Fire Zones 70 or 73 and traverse down through the hatch on the other side to the Control Room of the opposite unit.

The combustible loading for Fire Area 53 is under 47,000 Btu/ft^2 for an equivalent fire severity under 35 minutes (the actual combustible loading and equivalent fire severity existing at this time are 28,225 Btu/ft^2 and 21.2 minutes, respectively). The combustible loading for Fire Area 54 is under 47,000 Btu/ft^2 for equivalent fire severity under 35 minutes (the actual combustible loading and equivalent fire severity existing at this time are 30,069 Btu/ft^2 and 22.6 minutes). There is no other communication path between the Control Rooms and HVAC Rooms. The HVAC ducts passing through the floor have rated fire dampers. The hatches are protected with a layer of pyrocrete. Furthermore, the Control Rooms are constantly manned and have area detection above and below suspended ceiling. The HVAC Rooms above have automatic area detection and manual suppression systems for the charcoal filter units.

It is unlikely that a fire could propagate through such a tortuous path undetected and involve both units' Control Rooms simultaneously.

Conclusion

Based on the above evaluation, reasonable assurance is provided that a fire in Fire Zones 70, 71, 72 and 73 would not impair the safe shutdown capabilities in either unit. In addition, this evaluation does not impact on the bases of the fixed suppression exemption requests for the Main Control Room or the Engineering Evaluation 9.2 and 9.39.

The bases that justify the conclusion are summarized as follows:

(1) Fire Zones 70, 71, 72 and 73 contain no safe shutdown components or cables.

(2) Fire Zones 70, 71, 72 and 73 are provided with detection systems. Fire Zones 71 and 72 have automatic Halon suppression systems. Fire Zones 70 and 73 have manual deluge water spray systems for the charcoal filter units.

(3) The combustible loading in Fire Zones 70, 71, 72 and 73 is under 47,000 Btu/ft^2.

(4) The hatches, although not fire-rated, would limit the potential involvement of fire areas at the 633 ft elevation, with or without the coating of pyrocrete applied to each.

(5) The Control Rooms are constantly manned; the probability of fire in one Control Room resulting in damage in the other Control Room is low.

(6) A hypothesized fire in either unit's Control Room will be detected immediately, and it could be extinguished by manual fire fighting equipment.

(7) A complete alternate safe shutdown capability for the Control Rooms exists. Therefore, fire involving either unit's Control Room would not impair the safe shutdown capability.

9.6 601 ft Pipe Tunnel Evaluation (Fire Zone 6A)

Purpose

The purpose of this evaluation is to analyze the impact of the 601 ft elevation pipe tunnel on redundant safe shutdown capabilities contained on the 587 ft and 609 ft elevations. In addition, this evaluation does not adversely impact on other evaluations or exemption requests contained in this report.

Description

The 601 ft pipe tunnel (designated as Fire Zone 6A) provides a path of communication between Fire Zones 5, 6N, 6M, 6S, 62A, 62B, 62C, 63A, 63B, 63C, 64A, 64B, 65A and 65B on the 587 ft elevation of the Auxiliary Building and Fire Zones 43, 44A through 44H, 44N and 44S on the 609 ft elevation of the Auxiliary Building. Fire Zone 37 is located on the 617 ft elevation of the Auxiliary Building. The 587 ft and 609 ft elevations are defined as separate fire areas in the March 1983 Appendix R submittal for D.C. Cook. A portion of the pipe tunnel is located on the 609 ft elevation directly beneath Fire Zone 37. The portion of the pipe tunnel on the 609 ft elevation is the main entrance access point into the tunnel itself.

Figure 9.6-1 is a plan view of the 587 ft elevation, with the shaded area indicating where the 601 ft pipe tunnel protrudes down into the 587 ft elevation. Figure 9.6-2 is a plan view of the 609 ft elevation (with the exception of Fire Zone 37, which is actually at the 617 ft elevation), with the shaded area indicating where the 601 ft pipe tunnel is located below. Note that the portion of the pipe tunnel below Fire Zone 37 is at the 609 ft elevation, with the remainder located at the 601 ft elevation. Figure 9.6-3 is a blow-up of the 609 ft elevation, with the entrance access vestibule indicated as it exists on the 609 ft elevation and the remainder of the shaded area located on the 601 ft elevation. Figure 9.6-4 is an elevation view of the Auxiliary Building looking south with the shaded area indicating the location of the pipe tunnel.

Access is gained to the pipe tunnel via a normally locked, key card controlled steel gate access door at the 609 ft elevation (see Figure 9.6-3). An entrance access vestibule in the shape of an oblong "T" is located just inside the steel gate access door. In the south wall of the stem of the "T" is an unrated hollow metal door which provides access to a C-shaped walkway with the long portion of the "C" running north-south. Both the entrance access vestibule and the C-shaped walkway are located on the 609 ft elevation directly below Fire Zone 37. Ladder openings are provided in the northwest and southwest corners of the C-shaped walkway which provide access to the 601 ft portion of the pipe tunnel (see Figures 9.6-3 and 9.6-4).

On the 601 ft elevation, the pipe tunnel is arranged in the form of two inverted T's, with one on the Unit 1, or north, side of the Auxiliary Building, and the other on the Unit 2, or south, side of the Auxiliary Building (refer to Figure 9.6-3). The stem of each T runs east-west from the ladder opening to the west wall of the Auxiliary Building, with the tops of both T's joined along the Auxiliary/ Turbine Building wall. The stem of each T runs over a portion of the open area of Fire Zone 5, the charging pump cubicles (Fire Zones 62A, 62B and 62C for Unit 1 and Fire Zones 63A and 63B for Unit 2), the safety injection pump cubicles (Fire Zones 64A and 64B for Unit 1 and 65A and 65B for Unit 2), Fire Zone 6N for Unit 1 and Fire Zone 6S for Unit 2. The tops of both T's traverse Fire Zone 6N, Fire Zone 6M, and Fire Zone 6S. The 601 ft pipe tunnel also abuts Fire Area 12 (the quadrant 2 piping tunnel of Unit 1), Fire Area 22 (the quadrant 2 piping tunnel of Unit 2), Fire Zones 80 and 84 of the Turbine Building, and the corridor to the Auxiliary Feed Pump Rooms (Fire Area 17C) located in the Turbine Building (refer to Figures 9.6-1 and 9.6-3). On the 609 ft elevation, the pipe tunnel runs underneath the 617 ft elevation Valve Gallery (Fire Zone 37), the RHR and containment spray pump heat exchangers (Fire Zones 44A-H) and the main open floor area of Fire Zones 44N and 44S. A hatch opening provides access into the stem of each T of the pipe tunnel on the 609 ft elevation, with one hatch located in Fire Zone 44N and the other in Fire Zone 44S (refer to Figure 9.6-3).

Safe Shutdown Equipment

The 601 ft pipe tunnel contains no safe shutdown equipment, cables, or components.

Fire Protection Equipment

Automatic detection and suppression capabilities are not provided in the 601 ft pipe tunnel. With the exception of Fire Areas 12 and 22, Fire Zones 37, 44A through 44H, and Fire Zones 80 and 84 of the Turbine Building, automatic detection and suppression capabilities are provided in all areas and zones abutting the 601 ft pipe tunnel. Fire Zone 5 is protected by area detection and automatic dry pilot preaction sprinkler in normally accessible areas with the exception of small portions between Fire Zones 4 and 62A which is provided with detection only. Automatic suppression is provided in Fire Zones 80 and 84. Fire Zone 37 has area detection in the T-shaped vestibule and contains no suppression systems and Fire Areas 12 and 22 contain no automatic detection or suppression capabilities. The "T" shaped entrance access vestibule at elevation 609 ft of Fire Zone 44N does not contain detection or suppression capabilities. The remaining portions of Fire Zone 44N contain detection and suppression systems.

Fire Hazards Analysis

There are negligible exposed combustibles within either the 609 ft or 601 ft elevations of the pipe tunnel. There is a limited amount of cables within the pipe tunnel, but they are all installed within rigid steel conduit. No pumps or motors are located within the pipe tunnel; therefore, lubricating oil is not contained in the tunnel and is not required during maintenance operations. The pipe tunnel is a normally locked, high radiation area, and it does not provide access to any other plant locations; therefore, the potential for storage and/or transport of transient combustibles in or through the pipe tunnel is low. Based on these considerations, the fixed and transient combustible loading in the 601 ft pipe tunnel is under 13,000 Btus/ft^2 for equivalent fire severity under 10 minutes (the actual combustible loading and equivalent fire severity existing at this time are 143 Btu/ft^2 and 0.1 minutes respectively).

There are three access points into the pipe tunnel, with all three existing on the 609 ft elevation (refer to Figure 9.6-5). One is a steel gate, normally locked swing door which opens into the entrance access vestibule on the 609 ft elevation directly below Fire Zone 37. This is the main entrance access point to the pipe tunnel. From the entrance access vestibule, an unrated hollow metal swing door provides access to the C-shaped walkway, and hence, the two ladder openings down to the 601 ft elevation of the pipe tunnel. The other two access points are hatch openings in the floor of the 609 ft elevation which open to the stem of each "T" due west of each unit's seal water heat exchanger cubicle. The hatch openings are protected by steel plate hatch covers that are sealed with high density lead (~150 pcf) which, although not fire-rated, act as radiation and smoke barriers.

There are numerous penetrations in the walls, floor, and ceiling of the pipe tunnel to adjacent areas and zones. The approximate location and number of penetrations are as indicated in Figures 9.6-5 through 9.6-15. The layout of the 609 ft portion of the pipe tunnel is indicated on Figure 9.6-5, with the general location of penetrations and the method of sealing them indicated where appropriate. The shaded penetrations on Figures 9.6-6, 9.6-8 and 9.6-10 have been sealed with either silicone foam, high density lead, a combination of the two, or by steel plate hatches with high density lead and/or ventilation ductwork. All penetrations to Fire Areas 12 and 22 have been sealed in this manner, along with all penetrations in the ceiling of the 601 ft portion of the pipe tunnel to Fire Zones 44N and 44S above (see Figures 9.6-6, 9.6-8 and 9.6-10).

The remainder of the penetrations indicated on Figures 9.6-5 through 9.6-14 are open and provide a potential path for communication between areas and/or zones abutting the pipe tunnel. With the exception of the openings to the charging pump cubicles (Fire Zones 62A, 62B, 62C and 63A, 63B and 63C) which will be sealed with three-hour fire-rated material, the remaining penetrations will not be sealed. The justification for not sealing the remaining penetrations can be broken down into three interrelated discussions. They are:

- Combustible Loading
- Existing Detection and Suppression
- Communication Paths to Impact on Safe Shutdown

Each is discussed with respect to the potential impact on safe shutdown capabilities in the pipe tunnel and the abutting fire areas and/or zones on the 609 ft and 587 ft elevations of the Auxiliary Building.

587 ft Elevation

On the 587 ft elevation of the Auxiliary Building, Fire Zones 5, 6N, 6M, 6S, 64A, 64B, 65A, 65B, 62A, 62B, 62C, 63A, 63B and 63C abut the pipe tunnel. The penetrations to the charging pump cubicles, Fire Zones 62A, 62B, 62C and Fire Zones 63A, 63B, 63C, will be upgraded to achieve a three-hour fire rating, thereby assuring the integrity of the barrier to the pipe tunnel. The remaining fire zones form a single fire area which has a combustible loading and equivalent fire severity of approximately 27,000 Btus/ft^2 and 20 minutes, respectively. (The actual combustible loading and equivalent fire severity existing at this time are 12,420 Btu/ft^2 and 9.3 minutes respectively). Figures 9.6-7 through 9.6-15 indicate the locations of unprotected penetrations in the pipe tunnel boundaries to the zones on the 587 ft elevation which abut it.

The fire zones on the 587 ft elevation that abut the pipe tunnel are protected by area detection and automatic dry pilot preaction sprinklers. Fire Zone 5 is protected by area detection and automatic dry pilot preaction sprinklers in normally accessible areas with the exception of small portions between 62A and Fire Zone 4 which is provided with detection only. This combination of automatic ionization detection for early warning and automatic preaction sprinklers for extinguishment of any potential fires will limit the fire damage.

Prior to fire extinguishment, heat and smoke can enter the pipe tunnel through the unsealed penetrations indicated on Figures 9.6-7 through 9.6-15. Any heat and smoke entering the pipe tunnel would be cooled by the actuation of the preaction sprinklers. Due to the lack of combustibles within the pipe tunnel itself, a fire could not propagate into the tunnel or initiate a new fire within the tunnel due to the migration of cooled smoke and heat into the tunnel. As all penetrations to Fire Zones 44N and 44S on the 609 ft elevation above the pipe tunnel are sealed, any heat and smoke would have to fill the top and stem of the "T's" of the tunnel and migrate up the ladder openings to the 609 ft portion of the tunnel to impact on Fire Zones 44A-H, 44S, and 44N on the 609 ft elevation of the Auxiliary Building. Due to the protection provided by the normally closed unrated hollow metal door from the C-shaped walkway to the entrance access vestibule on the 609 ft elevation, heat and smoke would have to fill the volume of the C-shaped walkway prior to migrating out through the open penetrations near floor level in its west wall to the entrance access vestibule. From the entrance access vestibule, smoke and heat would then have to migrate out into Fire Zone 44N.

To impact on safe shutdown capability on the 609 ft elevation, smoke and heat would then have to migrate through Fire Zone 44N into Fire Zone 44S and initiate a fire in both zones. Three considerations preclude this from happening. First is the open stairway up to the 650 ft elevation, which is approximately 20 ft west of the entrance access opening to the vestibule. (The vestibule does not contain safe shutdown equipment.) Smoke and heat would tend to migrate up this stair prior to traveling further west to impact on Fire Zone 44S. Second is the existing detection and preaction sprinkler systems on the 609 ft elevation. Should fire occur as a result of smoke and heat traveling out the access opening, the early warning detection system would initiate manual fire fighting activities while the suppression systems would begin to control and extinguish the fire prior to impacting on Fire Zones 44N and 44S simultaneously. Third, and most important, is the circuitous path that smoke and heat would have to take to travel from the 587 ft elevation through the pipe tunnel to enter the 609 ft elevation. In order to impact on the 609 ft elevation, smoke and heat originating on the 587 ft elevation would have to stratify at the ceiling level of the 587 ft elevation prior to entering the pipe tunnel. Smoke and heat would then have to migrate through the pipe tunnel and penetrate out into the 609 ft elevation. As smoke and heat migrates through the pipe tunnel, it would tend to cool and disperse, due to the lack of combustible materials to provide additional fuel for the fire. As a result, reasonable assurance is provided that smoke and heat originating from a fire on the 587 ft elevation will not be able to migrate through the pipe tunnel and adversely impact on safe shutdown capability on the 609 ft elevation.

With respect to Fire Areas 12 and 22, which also abut the pipe tunnel at this elevation, the same circuitous path and detection and suppression capabilities on the 587 ft and 609 ft elevations exist. In addition, the combustible loading in Fire Areas 12 and 22 is under 20,000 and 13,000 Btu/ft^2 with an equivalent fire severity of under 15 and 10 minutes, respectively, and all penetrations to the pipe tunnel area sealed. These considerations preclude the possibility of a fire in either Fire Area 12 or 22 from impacting on safe shutdown capability on the 587 ft or 609 ft elevation.

Pipe Tunnel

The pipe tunnel has minimal fixed or transient combustibles that could either be the initial material ignited or a secondary source for ignition as a result of fire entering the pipe tunnel. Therefore, the pipe tunnel will, itself, have no impact on safe shutdown capability with the exception of it functioning as a potential path for fire communication on and between elevations of the Auxiliary Building.

Due to the location of penetrations in the walls of the pipe tunnel to Fire Zones 6N, 6M, and 6S on the 587 ft elevation, the potential exists for fire, smoke, and/or heat to traverse through the pipe tunnel to both Unit 1 and Unit 2 sides of the Auxiliary Building. This is not a worst-case scenario due to the lack of combustibles in the pipe tunnel and the existence of barriers (even though all penetrations are not sealed) between the pipe tunnel and the 587 ft elevation. The worst-case scenario is a fire originating in the open area of Fire Zone 6M and moving in both directions to Fire Zones 6N and 6S. This scenario has already been considered in the March 1983 Appendix R submittal, which has been reviewed and approved by the NRC. Therefore, fire transmission between Fire Zones 6N, 6M, and 6S through the pipe tunnel does not require further consideration.

609 ft and 617 ft Elevations

On the 609 ft elevation of the Auxiliary Building, Fire Zones 44N, 44S, and 44A through 44H abut the pipe tunnel. Fire Zone 37 on the 617 ft elevation is located above the pipe tunnel. These fire zones and Fire Zone 43, which does not abut the pipe tunnel, make up a single fire area which has a fixed combustible loading of approximately 47,000 Btu/ft^2 for an equivalent fire severity of approximately 35 minutes. (The actual combustible loading and equivalent fire severity existing at this time are 34,482 Btu/ft^2 and 25.8 minutes, respectively.)

All penetrations from the floor of the zones on the 609 ft and 617 ft elevation to the pipe tunnel are protected by silicone foam, high density lead, a combination of both, or steel plate hatch covers with high density lead. The only other penetrations to the pipe tunnel consist of a steel gate access door to the entrance access vestibule, an unrated hollow metal swing door from the vestibule to the C-shaped walkway, and the unsealed penetrations near the floor in the west wall of the entrance access vestibule. It is more likely for a fire in Fire Zone 44N to attack the door openings first, prior to impacting on the sealed floor penetrations or the unsealed penetrations in the west wall located near the floor. As with the 587 ft elevation, the existing early warning ionization detection system outside the access vestibule in Fire Zone 44N would initiate fire fighting activities. The automatic preaction sprinkler systems (also outside the access vestibule in Fire Zone 44N) would act to control and/or extinguish a fire, thereby reducing the fire damage.

Based on the existing level of detection and suppression, the amount of the combustible loading and equivalent fire severity in the abutting areas and/or zones (except Fire Zone 43) approximately 40,000 Btu/ft^2 and 30 minutes, respectively (the actual combustible loading and fire severity existing at this time are 25,853 Btu/ft^2 and 19 minutes, respectively) and the location and protection provided for the penetrations to the pipe tunnel, there is reasonable assurance that fire in abutting zones on the 609 ft and 617 ft elevations will not adversely impact on the pipe tunnel itself. In addition, heat and smoke from a fire on this elevation would tend to rise up to the ceiling of the 609 ft and 617 ft elevations prior to stratifying down to the level of the door and penetration openings into the pipe tunnel.

<u>Conclusion</u>

Based on the previous evaluation, reasonable assurance can be provided that a fire on the 587 ft elevation or on the 609 ft elevation in the pipe tunnel will not adversely impact on safe shutdown capabilities. In addition, this evaluation does not adversely impact on other evaluations or exemption requests contained in this report. The bases which justify this conclusion are summarized as follows:

(1) There are low exposed fixed or transient combustibles located within the pipe tunnel; therefore, fire cannot either initiate in the tunnel or result in the tunnel as a result of a fire in adjacent areas and/or zones.

(2) The combustible loadings on the 587 ft and 609 ft elevations are 27,000 Btu/ft^2 and 47,000 with equivalent fire severities of 20 and 35 minutes, respectively.

(3) Automatic detection and preaction sprinkler systems are provided in most portions of the zones abutting the pipe tunnel with unsealed penetrations; Fire Zone 37 has area detection only; and Fire Areas 12, 22 and Fire Zone 44N pipe tunnel vestibule which abut the pipe tunnel and do not contain detection or suppression capabilities, have low fire loads.

(4) All penetrations to the charging pump cubicles for Unit 1 (Fire Zones 62A-C) and Unit 2 (Fire Zones 63A-C) from the pipe tunnel will be sealed with three-hour-rated material.

(5) The March 1983 Appendix R submittal, which has been reviewed and approved by the NRC, proposed modifications to prevent fire in one zone of the 587 ft elevation from adversely impacting on alternate shutdown capabilities in other zones of the 587 ft elevation; therefore, the impact of fire occurring in one zone of the 587 ft elevation and spreading to other zones of the same elevation need not be further addressed.

(6) Due to (1) the circuitous path which fire must take from the 587 ft elevation through the pipe tunnel and onto the 609 ft elevation to impact on redundant safe shutdown capabilities on the 609 ft elevation, (2) the cooling action of the suppression systems on both elevations, and (3) lack of combustible within the pipe

tunnel, reasonable assurance is provided that safe shutdown capability on the 609 ft elevation will not be adversely impacted by a fire on the 587 ft elevation.

(7) Separating the pipe tunnel from either the 587 ft or 609 ft elevations will not enhance the protection provided by the existing configuration and proposed modifications.

9.7 Fire Area 13 and Fire Area 14 Boundary Evaluation

Purpose

The purpose of this fire area boundary evaluation is to determine the impact on redundant safe shutdown capability of an unrated field fabricated fusible link guillotine type damper presently located between Fire Areas 13 (Unit 1 Diesel Oil Pump Room) and 14 (Unit 1 Transformer Room). In addition, this evaluation does not adversely impact on other evaluations or exemption requests contained in this report.

Description

Fire Areas 13 and 14 are located on the 587 and 591 ft elevations of the Auxiliary Building. Access is provided directly into Fire Area 14 from the Turbine Building (Fire Zone 79), while access to Fire Area 13 is via the 1CD Diesel Generator Room, Fire Area 15. An unrated, field fabricated fire damper constructed of 3/8-in. plate steel is provided in an HVAC opening in the common wall separating Fire Areas 13 and 14.

Safe Shutdown Equipment

The safe shutdown components contained in Fire Area 13 are the diesel generator fuel oil transfer pumps 1CD1, 1CD2, 2CD1, 2CD2 and their associated power cables.

Fire Area 14 contains cables associated with both diesel generator test breakers (ACB 1DGTAB and 1DGTCD). In addition, the pressurizer heater 4kV/480V transformers and their associated primary and secondary power cables are located in Fire Area 14. These transformers provide 480V power to the pressurizer heaters. The pressurizer heaters and their associated transformers are not required for safe shutdown of the unit, however, the heaters were included in the original analysis for the March 1983 submittal for plant operational flexibility.

Fire Protection Equipment

Presently, Fire Area 14 does not contain a fire detection (i.e., ionization or infrared) system. Section 8 of this report, however, does indicate that a fire detection system will be installed in Fire Area 14 providing remote alarms in the Control Room. Automatic fire detection and carbon dioxide suppression systems are provided for Fire Area 13 which has a fire severity of under 30 minutes (the actual fire severity existing at this time is under 19 minutes). While Fire Area 14 does not have an automatic suppression system, it does contain manual fire fighting equipment and has a fire severity of less than 10 minutes (the actual fire severity existing at this time is less than 1 minute).

Fire Hazards Analysis

Fire Area 13 contains Safe Shutdown Components 1CD1, 1CD2, 2CD1 and 2CD2 fuel oil transfer pumps and their associated power cables. Loss of these components and cables would result in a subsequent loss of capability of transferring fuel oil from the Unit 1 "CD" fuel oil tank to the Unit 1 and Unit 2 "CD" diesel generators. However, there are no effects on the capability of the Unit 1 and Unit 2 "AB" diesel generators. This results in one train of safe shutdown components being free of fire damage.

Fire Area 14 contains the pressurizer heater 4kV/480V transformers, TR11PHA and TR11PHC, and their associated primary and secondary power cables. The loss of these components and cables results in the loss of all pressurizer heater groups (i.e., backup and control groups). The pressurizer heaters are not required for safe shutdown and as discussed in Section 6 of the March 1983 submittal modification have been recommended to repower the pressurizer heaters from the unaffected unit. Various safe shutdown cables associated with the Unit 1 diesel generator "CD" are also routed in Fire Area 14. These cables would be lost in the event of a fire and diesel generator "CD" would not be available. In addition, Fire Area 14 contains cables associated with both diesel generator test breakers (ACB 1DGTAB and 1DGTCD). The 4160V power cables running from the upstream 4kV circuit breakers to ACB 1DGTAB and ACB 1DGTCD could fail in the shorted condition. This would result in the diesel generators being inoperative and would require complete alternative shutdown from Unit 2 in the event of a fire.

On the basis of the above, consolidating Fire Areas 13 and 14 would result in the loss of 3 out of 4 diesel generators. The only operable diesel generator would be the Unit 2 "AB" diesel. Since both an "AB" and a "CD" train associated pump is required for the component cooling water and essential service water systems, one diesel generator is not sufficient to safely shutdown both units. This precludes any consolidation of Fire Areas 13 and 14.

If Fire Areas 13 and 14 can not be consolidated, then the only alternative is to qualify the field fabricated damper between the two fire areas. Factory Mutual has published a standard, "Loss Prevention Data" Section 1-45, which applies to air duct systems. The objectives of the standard are:

(1) To restrict the spread of fire, smoke, and heat through air-conditioning systems from one fire area to another or into a building from outside.

(2) To maintain the fire resistive integrity of building elements, such as floors, walls, and columns affected by the duct system installation, by minimizing ignition sources and combustibility of the elements of the duct system.

(3) To discuss the use of air duct systems for the additional purpose of emergency smoke control.

The standard provides design guidance and recommendations for duct systems including location and minimum design requirements for fire dampers. In reviewing the Factory Mutual system specifications Section 1-45 "Loss of Prevention Data" page 3, Item 2 under "Recommendations" states:

> Wherever ducts pass through interior fire cutoffs of three-hour or more fire resistance ratings, openings 18 in. (455 mm) or more in diameter or on longest side should be protected by a door arrangement having an overall fire rating of three hours. At openings in such cutoffs not exceeding 18 in. (455 mm) in diameter or on longest side, 1/8-in. (3.2 mm) steel plates may be used.

The field constructed damper is less than 18 inches on its longest side and is 3/8-in. thick steel plate. It meets the Factory Mutual requirements for protection of openings not exceeding 18-in. on the longest side located in barriers required to have a three (3) hour fire rating. Based on this guidance, the existing 3/8-in. thick fusible-link actuated steel plate provides adequate protection for the ventilation opening in the barrier common to Fire Areas 13 and 14. In addition to the fusible link, the damper is provided with a CO_2 pop off device which will close the damper upon actuation of the CO_2 system in Fire Zone 13. Therefore, these two fire areas can be considered as individual fire areas.

Conclusion

Based on the previous evaluation, the existing carbon dioxide actuated damper located between Fire Areas 13 and 14 is an acceptable device for maintaining the rating of the fire area boundary. In addition, this evaluation does not adversely impact on other evaluations or exemption requests contained in this report. These bases that justify this conclusion are summarized as follows:

(1) Fire Areas 13 and 14 can not be consolidated into a single fire area on the basis that the potential loss of three out of four diesel generators would jeopardize the safe shutdown capabilities of the plant.

(2) The existing damper meets the requirements of the Factory Mutual system specifications for fire dampers.

(3) After the modifications recommended in the March 1983 submittal are completed, both Fire Areas 13 and 14 will contain automatic fire detection systems.

(4) Fire Area 13 presently is provided with an automatic carbon dioxide suppression system which would quickly extinguish a fire in this area. Fire Area 14 has been provided with manual fire fighting equipment and has an equivalent fire severity of less than 10 minutes (the actual fire severity existing at this time is less than 1 minute).

(5) Since Fire Area 14 has a combustible loading of under 13000 Btu/ft^2, this area is not a primary source of fire.

(6) Replacing the existing 3/8-in. thick steel plate damper with a three-hour-rated damper would not enhance the protection provided by the existing configuration.

9.8 Fire Area 21 and Fire Area 20 Boundary Evaluation

Purpose

The purpose of this fire area boundary evaluation is to determine the impact on redundant safe shutdown capability of an unrated field fabricated fusible link guillotine type damper presently located between Fire Areas 21 (Unit 2 Diesel Oil Pump Room) and 20 (Unit 2 Transformer Room). In addition, this evaluation does not adversely impact on other evaluations or exemption requests contained in this report.

Description

Fire Areas 20 and 21 are located on the 587 and 591 ft elevations of the Auxiliary Building. Access is provided directly into Fire Area 20 from the Turbine Building (Fire Zone 85), while access to Fire Area 21 is via the 2AB Diesel Generator Room, Fire Area 19. An unrated, field fabricated fire damper constructed of 3/8-in. plate steel is provided in an HVAC opening in the common wall separating Fire Areas 20 and 21.

Safe Shutdown Equipment

The safe shutdown components contained in Fire Area 21 are the diesel generator fuel oil transfer pumps 1AB1, 1AB2, 2AB1, 2AB2 and their associated power cables.

Fire Area 20 contains cables associated with both diesel generator test breakers (ACB 2DGTAB and 2DGTCD). In addition, the pressurizer heater 4kV/480V transformers and their associated primary and secondary power cables are located in Fire Area 20. These transformers provide 480V power to the pressurizer heaters. The pressurizer heaters and their associated transformers are not required for safe shutdown of the unit, however, the heaters were included in the original analysis for the March 1983 submittal for plant operational flexibility.

Fire Protection Equipment

Presently, Fire Area 20 does not contain a fire detection (i.e., ionization or infrared) system. Section 8 of this report, however, does indicate that a fire detection system will be installed in Fire Area 20 providing remote alarms in the Control Room. Automatic fire detection and carbon dioxide suppression systems are provided for Fire Area 21 which has a fire severity of under 35 minutes (the actual fire severity existing at this time is under 21 minutes). While Fire Area 20 does not have an automatic suppression system, it does contain manual fire fighting equipment and has a fire severity of less than 15 minutes (the actual fire severity at this time is approximately 1 minute).

Fire Hazards Analysis

Fire Area 21 contains Safe Shutdown Components 1AB1, 1AB2, 2AB1 and 2AB2 fuel oil transfer pumps and their associated power cables. Loss of these components and cables would result in a subsequent loss of capability of transferring fuel oil from the Unit 2 "AB" fuel oil tank to the Unit 1 and Unit 2 "AB" diesel generators. However, there are no effects on the capability of the Unit 1 and Unit 2 "CD" diesel generators. This results in one train of safe shutdown components being free of fire damage.

Fire Area 20 contains the pressurizer heater 4kV/480V transformers, TR21PHA and TR21PHC, and their associated primary and secondary power cables. The loss of these components and cables results in the loss of all pressurizer heater groups (i.e., backup and control groups). The pressurizer heaters are not required for safe shutdown and as discussed in Section 6 of the March 1983 submittal modifications have been recommended to repower the pressurizer heaters from the unaffected unit. In addition, Fire Area 20 contains cables associated with both diesel generator test breakers (ACB 2DGTAB and 2DGTCD). The 4160V power cables running from the upstream 4kV circuit breakers to ACB 2DGTAB and ACB 2DGTCD could fail in the shorted condition. This would result in the diesel generators being inoperative and would require complete alternative shutdown from Unit 1 in the event of a fire.

On the basis of the above, consolidating Fire Areas 20 and 21 would result in the loss of 3 out of 4 diesel generators. The only operable diesel generator would be the Unit 1 "CD" diesel. Since both an "AB" and a "CD" train associated pump is required for the component cooling water and essential service water systems, one diesel generator is not sufficient to safely shutdown both units. This precludes any consolidation of Fire Areas 20 and 21.

If Fire Areas 20 and 21 cannot be consolidated, then the only alternative is to qualify the field fabricated damper between the two fire areas. Factory Mutual has published a standard, "Loss Prevention Data" Section 1-45 which applies to air duct systems. The objectives of the standard are:

(1) "To restrict the spread of fire, smoke, and heat through air-conditioning systems from one fire area to another or into a building from outside.

(2) To maintain the fire resistive integrity of building elements, such as floors, walls, and columns affected by the duct system installation, by minimizing ignition sources and combustibility of the elements of the duct system.

(3) To discuss the use of air duct systems for the additional purpose of emergency smoke control."

The standard provides design guidance and recommendations for duct systems including location and minimum design requirements for fire dampers. In reviewing the Factory Mutual System specifications Section 1-45 "Loss Prevention Data," Page 3, Item 2, under "Recommendations" states:

> "Wherever ducts pass through interior fire cutoffs of three-hour or more fire resistance ratings, openings 18 in. (455 mm) or more in diameter or on longest side should be protected by a door arrangement having an overall fire rating of three hours. At openings in such cutoffs not exceeding 18 in. (455 mm) in diameter or on longest side, 1/8 in. (3.2 mm) steel plates may be used."

The field constructed damper is less than 18 in. on its longest side and is 3/8 in. thick steel plate. It meets the Factory Mutual requirements for protection of openings not exceeding 18 in. on the longest side located in barriers required to have a three-hour fire rating. Based on this guidance, the existing 3/8-in. thick fusible-link actuated steel plate provides adequate protection for the ventilation opening in the barrier common to Fire Areas 20 and 21. In addition to the fusible link, the damper is provided with a CO_2 pop off device which will close the damper upon actuation of the CO_2 system in Fire Zone 21. Therefore, these two fire areas can be considered as individual fire areas.

Conclusion

Based on the previous evaluation, the existing carbon dioxide actuated damper located between Fire Areas 20 and 21 is an acceptable device for maintaining the rating of the fire area boundary. In addition, this evaluation does not adversely impact on other evaluations or exemption requests contained in this report. The bases which justify this conclusion are summarized as follows:

(1) Fire Areas 20 and 21 cannot be consolidated into a single fire area on the basis that the potential loss of three out of four diesel generators would jeopardize the safe shutdown capabilities of the plant.

(2) The existing damper meets the requirements of the Factory Mutual System specifications for fire dampers.

(3) After the modifications recommended in the March 1983 submittal are completed, both Fire Areas 20 and 21 will contain automatic fire detection systems.

(4) Fire Area 21 presently is provided with an automatic carbon dioxide suppression system which would quickly extinguish a fire in this area. Fire Area 20 has been provided with manual fire fighting equipment and has an equivalent fire severity of 15 minutes (the actual fire severity existing at this time is approximately 1 minute).

(5) Since Fire Area 20 has a low combustible loading of under 20,000 Btu/ft^2, less than 15 minutes fire severity, this area is not a primary source of fire.

(6) Replacing the existing 3/8-in. thick steel plate damper with a three-hour-rated damper would not enhance the protection provided by the existing configuration.

9.9 Fire Area Containing Fire Zones 3, 32, 36, 48, and 69 and Fire Area Containing Fire Zones 49, 50, 51, and 52 Boundary Evaluation

Purpose

The purpose of this evaluation is to determine if the above fire areas can be consolidated into one fire area and not adversely impact on redundant safe shutdown capability. In addition, this evaluation does not adversely impact on other evaluations or exemption requests contained in this report.

Description

The March 1983 submittal "Safe Shutdown Capability Assessment and Proposed Modifications" to 10 CFR 50, Appendix R, Section III.G. identified Fire Zones 3, 32, 36, 48, and 69 as one fire area, and Fire Zones 49, 50, 51, and 52 as a separate fire area.

The above defined fire areas are communicating with each other through unrated barrier penetrations, undampered HVAC ducts and air intake and exhaust plenums.

Safe Shutdown Equipment

The fire area consisting of Fire Zones 3, 32, 36, 48, and 69 does not contain any safe shutdown components and/or cables in Fire Zones 3, 36 and 48. Fire Zone 69 contains the Unit 1 and Unit 2 CCW surge tank manual isolation valves. Fire Zones 32 and 69 contain cables associated with two of the Unit 1 safety injection accumulator isolation MOVS. Fire Zone 69 also contains Unit 1 cables associated with two pressurizer PORVs, two pressurizer block valves, two reactor head vent valves and two post-accident sampling valves. The fire area consisting of Fire

Zones 49, 50, 51, and 52 contains safe shutdown components and/or cables in Fire Zones 50, 51 and 52. The compliance method in this fire area is presented in Table 1-1.

Fire Protection Equipment

Fire Zones 32, 48 and 69 are provided with ionization smoke detectors and partial detection coverage is provided in Fire Zone 3. Dry pilot preaction suppression systems are provided in Fire Zone 32 and partial coverage is provided in Fire Zone 3. In addition, Fire Zone 69 is provided with an automatic thermistor detection system and manual deluge system for the HVAC charcoal filter units. Fire Zones 49, 50, 51, and 52 are provided with automatic fire protection features, specifically area ionization smoke detection and each charcoal filter unit is provided with a manual deluge system with an automatic thermistor detection system. An automatic dry pilot preaction suppression system is provided in the normally accessible areas of Fire Zones 51 and 52.

Fire Hazards Analysis

The equivalent fire severity in the fire area containing Fire Zones 3, 32, 36, 48 and 69 is 15 minutes (the actual fire severity existing at this time is 5 minutes) and in the fire area containing Fire Zones 49, 50, 51 and 52 is 35 minutes (the actual fire severity existing at this time is 21 minutes). The equivalent fire severity of the combined fire areas is 25 minutes (the actual fire severity existing at this time is 12 minutes).

The March 1983 Submittal "Safe Shutdown Capability Assessment and Proposed Modifications" to 10 CFR 50, Appendix R, Section III.G., generically identified for all areas of the plant for the safety injection accumulator valves to be manually operated for cold shutdown and for the pressurizer PORVs, reactor head vent valves, and the post-accident sampling valves to be deenergized to a fail safe position. Refer to Section 4.4.5 and Table 4-3 respectively. Since these two manual actions can be performed independent of any fire area within the plant, combining the two fire areas into a single fire area would not impair safe shutdown capability or change the compliance strategy for either fire area. A a result no additional safe shutdown components or cables needed to be evaluated beyond what was analyzed in the original submittal.

Conclusion

Based on the previous evaluation, combining Fire Zones 3, 32, 36, 48, 69, 49, 50, 51 and 52 into a single fire area would not adversely impact on redundant safe shutdown capability. In addition, this evaluation does not adversely impact on other evaluations or exemption requests contained in this report. The bases which justify this conclusion are summarized as follows:

(1) Combining Fire Zones 3, 32, 36, 48, 49, and 69 with Fire Zones 49, 50, 51, and 52 to form one fire area would not impair safe shutdown capability.

(2) Manual action can be taken independent of the fire areas of concern to mitigate the consequences of any possible spurious actions.

(3) The safety injection accumulator valves can be closed manually for cold shutdown.

(4) Fire Zones 32, 50, 51, 52 and 69, which include safe shutdown components and/or circuits, are analyzed and compliance methods are identified in Section 1 of this report.

(5) The combustible loading in Fire Zones 3, 32, 36, 48, and 69 is under 15 minutes. Fire Zones 32, 48 and 69 are provided with ionization smoke detectors, with partial coverage in Fire Zone 3. Fire Zones 3 and 32 are provided with automatic dry pilot preaction sprinkler systems, with partial coverage in Fire Zone 3. Fire Zones 36 and 69 contain transient combustibles, but since both of these zones are controlled access areas, transient combustibles do not present a problem.

(6) An automatic dry pilot preaction suppression system is provided in the normally accessible areas of Fire Zones 51 & 52.

(7) Manual deluge water spray system is provided for the charcoal filter units located in Fire Zone 52.

(8) Upgrading the boundary barrier separating Fire Zones 3, 32, 36, 48, and 69 from Fire Zones 49, 50, 51, and 52 will not significantly enhance the safe shutdown capability or the protection afforded by the existing configuration.

9.10 Fire Area 43 and Fire Zone 44N Boundary Evaluation

Purpose

The purpose of this evaluation is to analyze the impact on redundant safe shutdown capability of combining Fire Area 43 with the fire area consisting of Fire Zones 44N, 44S, 44A through 44H, and 37. In addition, this evaluation does not adversely impact on other evaluations or exemption requests contained in this report.

Description

The March 1983 submittal, "Safe Shutdown Capability Assessment and Proposed Modifications" to 10 CFR 50, Appendix R, Section III.G identified the access control area as a rated fire area (Fire Area 43). Fire Area 43 has been reclassified as a fire zone and is now considered part of the fire area containing Fire Zones 37, 44A through 44H, 44S and 44N. The consolidation of Fire Zone 43 into the above defined fire area was made as a result of unrated barrier penetrations communicating with Fire Zone 44N.

Safe Shutdown Equipment

Fire Area 43 does not contain any safe shutdown components; however, power cables to 600V MCCs AM-A and AM-D of Unit 1 traverse through this area. Loss of these power cables would result in a subsequent loss of power to the Unit 1 component cooling water (CCW) pump suction valves (CMO-411 and 413) and CCW heat exchanger outlet valves (CMO-410 and 420). In addition, power is lost to the Unit 1 CCW heat exchanger 15E essential service water inlet and outlet valves (WMO-731 and 733).

Fire Protection Equipment

Automatic or fixed suppression features are not provided in Fire Area 43, but ionization type smoke detectors are installed and manual fire fighting equipment is available. Fire Zones 44N and 44S are provided with full area automatic dry pilot preaction sprinklers and ionization detectors in normally accessible locations of each zone.

Fire Hazards Analysis

- Available manual operation of Unit 1 CCW pump suction valve 44S (CMO-413) and CCW heat exchanger 15W outlet valve 44N (CMO-420), located in Fire Area 44, will allow alignment of the cooling water flow path for the Unit 1 centrifugal charging pump (PP-50W).

- Remote operational capability of other hot safe shutdown system components is not affected by a fire in Fire Zone 43. The zone adjacent to Fire Zone 43 is 44N and, as described in this report, Fire Zone 44N is to be provided with alternate shutdown capability outside of the fire zone.

The cables traversing Fire Zone 43 (power feeds to AM-A and AM-D) are also routed through Fire Zone 44N. Thus, the method of safe shutdown for Fire Zone 44N takes into account the existence of these power feeds to AM-A and AM-D MCCs and thus, consolidating Fire Zone 43 into the fire area containing Fire Zone 44N has no impact on safe shutdown capability. Manual operation of the affected valves associated with the two motor control centers is available and considered in both fire zones (43 and 44N). Thus, safe shutdown condition can be achieved and maintained by performing manual operation of other required safe shutdown components from outside of the fire zone.

Conclusions

Based on the previous evaluations, combining Fire Area 43 into a larger fire area that includes Fire Zones 37, 44N, 44S, and 44A through 44H will not adversely impact on redundant safe shutdown capability. In addition, this evaluation will not adversely impact on other evaluations or exemption requests contained in this report. The bases for this conclusion are summarized as follows:

(1) Combining Fire Zone 43 (formally Fire Area 43) into the same fire area containing Fire Zone 44N would not impair safe shutdown capability.

(2) The combining of Fire Zone 43 into the fire area containing Fire Zone 44N will not add more safe shutdown components, circuits and cables above those already existing in Fire Zone 44N.

(3) Fire Zone 44N, which includes the components, circuits and cables required for safe shutdown, is provided with automatic preaction sprinklers and smoke detectors.

(4) Fire propagation from Fire Zone 44N to Fire Zone 43 would not have a detrimental impact on the safe shutdown capability.

(5) Fire Zone 43 is provided with manual fire fighting equipment and smoke detectors. Transient combustibles do exist in the area, but since Fire Zone 43 is continuously manned, transient combustibles do not present a problem.

(6) The walls and ceilings between Fire Zones 43 and 44N, although not fire-rated, would limit the potential involvement of Fire Zone 44N as a result of a fire in Fire Zone 43.

(7) Upgrading the boundary barrier separating Fire Zones 43 and 44N is not required as combining these two zones into a larger fire area does not impact on the safe shutdown capability.

9.11 Units 1 and 2 Turbine Building, Main Steam Pipe Tunnels and Service/Office Building Evaluation

Purpose

The purpose of this evaluation is to analyze the impact on redundant safe shutdown capability of combining the Turbine and Service/Office Buildings and the Unit 1 and Unit 2 main steam pipe tunnels (Fire Zones 108, 109, 110 and 111) into one fire area. In addition, this evaluation does not adversely impact on other evaluations or exemption requests contained in this report.

Descriptions

In the March 1983 Appendix R submittal, ten (10) separate fire areas were identified in the Turbine Building. Seven (7) of the fire areas were made up of individual fire zones. They were identified as Fire Areas 78, 83, 88 and 89 on the 591 ft elevation, and Fire Areas 94, 95, and 100 on the 609 ft elevation. The remaining three (3) fire areas consisted of multiple zones on various levels of the Turbine Building. One fire area consisted of Fire Zones 112, 113, 114, and 115; a second consisted of Fire Zones 2, 77, 79, 80, 81, 82, 90, 91, 92, 93, 126, and 127 (the Unit 1 side of the Turbine Building); the third consisted of Fire Zones 84, 85, 86, 87, 96, 97, 98, 99, 124, 125, and 128 (the Unit 2 side of the Turbine Building).

During the course of the ongoing Appendix R consolidation effort, several inconsistencies were noted between the protection provided for the boundaries of the identified fire areas and NRC criteria contained within various documents (most notably Generic Letter 83-33). One such inconsistency was unrated water tight doors and unprotected ventilation openings in the wall separating Fire Zones 112 and 113 from Fire Zone 2, which were identified as being in separate fire areas. A second inconsistency was an unprotected open stairway in the floor/ceiling assembly separating Fire Zone 2 from Fire Zone 84, which were identified as being in separate fire areas. A third inconsistency was unrated door assemblies and unprotected openings between the main steam pipe tunnels (Fire Zones 110 and 111 for Unit 1 and Unit 2, respectively) and fire zones in the Turbine Building fire areas (Fire Zones 80 and 91 for Unit 1 and Fire Zones 84 and 96 for Unit 2).

In addition to the inconsistencies in the boundaries of previously identified fire areas, those plant locations which were not identified in the March 1983 submittal (no fire zones or NFZ's) presented problems with justifying the fire area boundaries. Specifically, the Turbine Deck on the 633 ft elevation is open to both the Unit 1 and Unit 2 Turbine Building fire areas and the Service Building abuts the Unit 1 Turbine Building fire area to the north. These plant locations are now identified as Fire Zones 129, 130, and 131, respectively.

Safe Shutdown Equipment

Fire Zone 108 contains the following safe shutdown equipment and their associated cables:

(1) Unit 1 steam generators 2 and 3 PORVs;
(2) Pressure transmitters for steam generators 2 and 3;
(3) Steam generators 2 and 3 main steam stop valves (MSSVs);
(4) Steam generators 2 and 3 safety relief valves; and
(5) Unit 1 turbine-driven AFW pump steam supply isolation valves.

Fire Zone 109 contains the following safe shutdown equipment and their associated cables:

(1) Unit 2 steam generators 2 and 3 PORVs;
(2) Pressure transmitters for steam generators 2 and 3;
(3) Steam generators 2 and 3 main steam stop valves (MSSVs);
(4) Steam generators 2 and 3 safety relief valves; and
(5) Unit 2 turbine-driven AFW pump steam supply isolation valves.

Redundant safe shutdown capability is available for both Fire Zone 108 and Fire Zone 109 outside of the fire area in which they both are located. Therefore, fire could involve both Fire Zones 108, and 109 without impacting on redundant safe shutdown capability.

Fire Zones 112, 113, 114 and 115 contain the SW cross-connect and DG cooling valves and associated cables. Various safe shutdown cables are routed through Fire Zones 79, 80, 84, 85, 91 and 110. The green train cables in Fire Zones 79 and 85 are protected to ensure one train of redundant systems is available in the event of a fire engulfing Unit 1 or Unit 2 Turbine Building.

Fire Protection Equipment

Fire Zones 79 and 85 are protected by automatic detection and wet pipe sprinklers systems. Automatic wet pipe sprinkler systems are provided in Fire Zones 77 through 94 and Fire Zones 96 through 99. Automatic thermistor, detection and CO_2 suppression are provided in Fire Zones 83, 88, 95 and 100, with dry pilot preaction sprinkler systems provided in Fire Zones 95 and 100. The turbines in Fire Zones 129 and 130 are provided with automatic thermistor detection and manual deluge suppression under the appearance lagging, and dry chemical suppression for the turbine bearings. Fire Zone 124, 125, 126, and 127 contain various levels of automatic detection and suppression capabilities.

Fire Hazards Analysis

In order to resolve both the inconsistencies between previously identified fire areas and the impact of the NFZ's, an Appendix R safe shutdown analysis has been performed with respect to combining these locations into a single fire area. The results are the following:

(a) When Unit 1 Main Steam Pipe Tunnel Area (Fire Zones 108 and 110) is combined with Turbine Building Area, Unit 1 can be safely shut down by using Unit 2 East Auxiliary Feedwater Pump. This alternate shutdown action will be required when a fire propagates between Fire Zones 108 and 79. For a fire to propagate between these fire zones, the fire would have to be of sufficient duration and intensity to engulf Fire Zones 110 and 80 (Fire Zone 80 is protected by an automatic sprinkler system).

(b) When Unit 2 Main Steam Pipe Tunnel Area (Fire Zones 109 and 111) is combined with Turbine Building Area, Unit 2 can be safely shut down by using Unit 1 East Auxiliary Feedwater Pump. This alternate shutdown action will be required when a fire propagates between Fire Zones 109 and 85. For a fire to propagate between these fire zones, the fire would have to be of sufficient duration and intensity to engulf Fire Zones 111 and 84 (Fire Zone 84 is protected by an automatic sprinkler system).

(c) When both Unit 1 and Unit 2 Main Steam Pipe Tunnel areas are combined together with the Turbine Building into one fire area; safe shutdown is not impacted for either unit. In the highly unlikely event of a fire involving all of the above mentioned fire zones, both units can be safely shut down using opposite units Auxiliary Feedwater Pumps. For this fire scenario, one train of the other safe shutdown systems will be available for each unit. Required manual actions are (1) opening of the AFW Cross-Connect Valves and (2) isolation of the steam supply paths to Unit 1 Turbine-Driven AFW Pump. There would be no requirement for one or three hour barriers, additional detection or suppression systems, or exemption requests in order to meet the criteria of Appendix R to 10 CFR 50.

As such, the following fire zones are now considered to be part of a single fire area: 2, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100, 108, 109, 110, 111, 112, 113, 114, 115, 124, 125, 126, 127, 128, 129, 130 and 131.

Conclusion

Based on the previous evaluation, the ten fire areas in the Unit 1 and Unit 2 Turbine Buildings, the entirety of the Service Building, the main turbine deck, and the Unit 1 and Unit 2 main steam pipe tunnels can be combined into a single fire area. In addition, this evaluation does not adversely impact on other evaluations or exemption requests contained in this report. The bases for this conclusion are summarized as follows:

(1) The green train cables are protected to ensure one train of redundant systems is available in the event of a fire engulfing Unit 1 or Unit 2 Turbine Building.

(2) Due to the location of detection and suppression systems in the intervening zones between the fire zones containing safe shutdown cables and/or equipment, it is highly unlikely that fire could spread to all fire zones.

(3) Should fire spread to all fire zones, alternate shutdown capability is available by using opposite unit auxiliary feedwater pumps and manual operations.

9.12 Turbine Building and Screen House Boundary Evaluation

Purpose

The purpose of this evaluation is to analyze the impact on redundant safe shutdown capability of combining the Turbine Building, Main Steam Pipe Tunnels, and Service/Office Building fire area with the Screen House Fire Area (exclusive of the Essential Service Water Pump Fire Area, Fire Zones 29A through 29G). In addition, portions of the Turbine Building that were not previously identified in the 1983 Appendix R submittal will be combined with the Turbine Building Fire Area. These new fire zones include Fire Zones 139, 140, 141, and 143.

The Screen House fire zones under consideration include Fire Areas 28 and 30, and Fire Zones 142 and 143. Fire Zones 142 and 143 are portions of the Screen House that were not previously identified in the 1983 Appendix R submittal. The combination of the Turbine Building and Screen House fire areas will reduce the number of area boundaries that require surveillance and will not adversely impact on other evaluations or exemption requests contained in this report.

Description

Fire Areas 28 and 30 are the Unit 1 and Unit 2 Diesel Fire Pump Rooms located on the 591 ft elevation of the Screen House. Fire Zone 142 is the traveling screen and circulating water pump areas of the Screen House, located on the 591 ft elevation. Fire Zone 143 is the intake and discharge area below the basement of the Screen House and Turbine Building. Fire Zone 139 is the Turbine Room sump located on the 570 ft-9 in. elevation of the Turbine Building. Fire Zone 140 is the caustic storage tank room located on the 571 ft-9 in. elevation of the Turbine Building. Fire Zone 141 is the screen wash pump room located on the 571 ft-9 in. elevation of the Turbine Building. Fire Zones 2, 77 through 100, 108 through 115, and 124 through 131 make up the balance of the Turbine Building Fire Area. See Section 9.11 of this report for a more detailed description of these fire zones.

Safe Shutdown Equipment

Fire Zones 139, 140, 141, 142, 143 and Fire Areas 28 and 30 do not contain safe shutdown cables or components. Section 9.11 of this report identified safe shutdown capabilities in the Turbine and Service/Office Buildings and Main Steam Tunnels fire area.

Fire Protection Equipment

Automatic wet pipe sprinkler systems are provided in Fire Areas 28 and 30. The remaining fire zones located in the Screenhouse are not provided with automatic detection or suppression capability. See Section 9.11 of this report for a more detailed discussion of the fire protection features of the Turbine and Service/Office Buildings and Main Steam Tunnels.

Fire Hazards Analysis

Fire Zones 139 and 143 have fire severities less than 10 minutes (actual fire severity existing at this time is zero). Fire Zones 140 and 141 contain low amounts of combustible materials with equivalent fire severity under 25 minutes (actual fire severity existing at this time is 2.6 and 1.5 minutes, respectively). The combustibles in Fire Zone 142 and Fire Areas 28 and 30 are located in the Screen House, which is separated from the Turbine Building by an 8-in. concrete wall and two access doors. The automatic wet pipe sprinkler system provided in each Diesel Fire Pump Room (Fire Areas 28 and 30) would control and/or extinguish any fire starting from these rooms.

The safe shutdown cables that exist in the Turbine Building Fire Area are all located in the vicinity of Column Line H, which is approximately 150 ft from the wall to the Screen House (Column Line A).

Conclusion

Reasonable assurance exists that the combustibles in the Screen House and newly identified Turbine Building fire zones would not endanger the safe shutdown capability in the Turbine Building. In addition, this evaluation does not adversely impact on other evaluations or exemption requests contained in this report. The bases which justify this conclusion are summarized as follows:

(1) If a fire should start in either Diesel Fire Pump Room (Fire Area 28 or 30) where the highest concentrations of combustibles exist, the automatic wet pipe sprinkler system would control and/or extinguish the fire.

(2) An 8-in. concrete wall with two access doors separates the Screen House from the Turbine Building fire area.

(3) The safe shutdown cables in the Turbine Building are separated from the Screen House wall by approximately 150 ft.

(4) Fire Zones 139, 140, 141, 142, 143 and Fire Areas 28 and 30 do not contain safe shutdown cables or components.

(5) One train of safe shutdown systems, components, and cables exists independent of the combined Turbine Building and Screen House fire areas.

9.13 <u>Fire Area 53 and Fire Area 57 Hatch Evaluation</u>

<u>Purpose</u>

The purpose of this evaluation is to analyze the impact of an unrated steel plate hatch located between the Unit 1 Control Room and the Unit 1 Control Room Cable Vault (Fire Area 53 and Fire Area 57, respectively) on either redundant safe shutdown capability or the request for a fixed suppression exemption in Fire Area 53 in Section 7.11 of this report. A three-hour fire-rated hatch assembly is not commercially available for use in this location. In addition, this evaluation does not adversely impact on other evaluations or exemption requests contained in this report.

Description

Fire Area 53 is located on the 633 ft elevation of the Auxiliary Building. Fire Area 57 is located directly below on the 624 ft-0 in. elevation. The barrier separating the two areas is constructed of reinforced concrete with a three-hour fire rating; however, an unrated steel plate hatch in the floor of Fire Area 53 provides access to Fire Area 57.

Safe Shutdown Equipment

Fire Areas 53 and 57 contain all control and instrumentation cabling required for safe shutdown of D.C. Cook Unit 1. Should a fire occur in either fire area, complete alternate shutdown capability outside of both areas is provided using Unit 2 equipment.

Fire Protection Equipment

Automatic ionization detection systems are installed in Fire Area 53 and Fire Area 57. Automatic suppression is not provided in Fire Area 53. Fire Area 57 is protected by an automatic total flooding Halon 1301 suppression system and by a manually actuated total flooding CO_2 suppression system. Manual suppression capabilities in the form of portable extinguishers and hose stations are available for use in both fire areas.

Fire Hazards Analysis

The steel plate hatch is located in the floor/ceiling assembly separating Fire Area 57 on the 624 ft-0 in. elevation from Fire Area 53 on the 633 ft elevation. For a fire to propagate between Fire Area 57 and Fire Area 53, a fire of sufficient duration and intensity would be required to challenge the inherent fire protection capabilities of the steel plate hatch.

The failure point of exposed structural steel is taken to be when its load-carrying capability is reduced to 60% of its yield strength. This limit normally occurs when the temperature of the steel reaches 1000°F. Under the ASTM E119 Standard Time-Temperature curve, an equivalent fire severity of 5-10 minutes is required to achieve this temperature. Although the steel plate hatch is not a load-carrying structural component, the failure criteria of structural steel can be applied to the steel plate hatch to establish a conservative base above which failure could be postulated.

Fire Area 57 has a fixed combustible loading of under 120,000 Btu/ft^2 for an equivalent fire severity of approximately 90 minutes (the actual combustible loadings and equivalent fire severity existing at this time are 103590 Btu/ft^2 and 77.8 minutes respectively). An equivalent fire severity of 90 minutes would raise the temperature of the steel plate hatch to well over 1000°F if the fire was not promptly detected and extinguished. An automatic total flooding Halon 1301 suppression system actuated by the detection system is provided in Fire Area 57. Should the Halon 1301 system fail to extinguish the fire, the total flooding CO_2 system would be manually actuated. The combination of automatic detection, automatic Halon 1301 suppression, and manually actuated CO_2 as a backup provides reasonable assurance that a fire involving fixed combustibles in Fire Area 57 would not adversely impact on the capability of the steel plate hatch to protect the opening in the barrier. The existence of the automatic detection system and the automatic Halon 1301 and manual CO_2 suppression systems will tend to mitigate the impact of increases in the fixed combustible loading or the presence of transient combustibles, provided that the increases do not exceed the capabilities of the suppression system.

Fire Area 53 is the continuously manned Control Room. It has a fixed combustible loading of under 47,000 Btu/ft^2 for an equivalent fire severity of under 35 minutes. (The actual combustible loading and equivalent fire severity existing at this time are 28,225 Btu/ft^2 and 21.2 minutes, respectively.) The amount of transient combustibles allowed in the Control Room and will be controlled. An equivalent fire severity of 35 minutes could raise the temperature of the hatch above 1000^{o}F. Two considerations must be taken into account. First, the steel plate hatch is located in the floor of Fire Area 53. The higher temperatures associated with a fire in this area would tend to be near ceiling level. Floor-based temperatures should be considerably lower than those at the ceiling.

Secondly, the fire area is continuously manned by trained operators. Manual fire fighting activities can be expected to take place almost immediately after detection of the fire. There is reasonable assurance, therefore, that a fire involving fixed and/or transient combustibles in Fire Area 53 would not adversely impact on the capability of the steel plate hatch to protect the opening in the barrier.

Conclusion

Based on the above evaluation, reasonable assurance is provided that a fire in Fire Area 53 or Fire Area 57 would not impair the safe shutdown capabilities of D.C. Cook Unit 1. In addition, this evaluation does not impact on the bases of the fixed suppression exemption request for Fire Area 53 or on other evaluations or exemption requests contained in this report.

The bases that justify the conclusion are summarized as follows:

(1) An equivalent fire severity of 5-10 minutes is required to raise the temperature of load-carrying structural steel up to its failure point of 1000^{o}F.

(2) The steel plate hatch is not a load-carrying structural component; however, a 5-10 minute fire severity can be used to establish a conservative base above which failure could be postulated without additional fire protection.

(3) Fire Area 57 has an equivalent fire severity of 90 minutes; however, automatic detection, automatic Halon 1301 suppression and manually actuated CO_2 suppression will result in detection and suppression of a fire in this area in its incipient stages. Increases in the fixed and/or transient combustible loadings in

Fire Area 57 should also be mitigated by the presence of the detection and suppression systems, provided that the increases do not exceed system capabilities.

(4) The equivalent fire severity of Fire Area 53 is under 35 minutes.

(5) The hatch is located in the floor, and floor-based temperatures can be expected to be significantly lower than those at ceiling level.

(6) An automatic detection system is provided in Fire Area 53.

(7) Fire Area 53 is continuously manned. Manual fire fighting activities can be expected almost immediately after detection of the fire.

(8) Should a fire occur in either Fire Area 53 or Fire Area 57, complete alternate shutdown capability outside of both fire areas is provided using Unit 2 equipment.

(9) Replacing the steel plate hatch with one of fire-rated construction would not significantly enhance the protection provided by the existing configuration.

9.14 Fire Zone 43 and Fire Area 56 Hatch Evaluation

Purpose

The purpose of this evaluation is to analyze the impact of an unrated steel plate floor hatch located between the Access Control Area and the Unit 1 Auxiliary Cable Vault (Fire Zone 43 and Fire Area 56, respectively) on redundant safe shutdown capability. A three-hour fire-rated hatch assembly is not commercially available for use in this location. In addition, this evaluation does not adversely impact on other evaluations or exemption requests contained in this report.

Description

Fire Zone 43 is located on the 609 ft-6 in. elevation of the Auxiliary Building. It is part of a larger fire area that includes Fire Zones 37, 44N, 44S, and 44A through 44H. Fire Area 56 is located directly above Fire Zone 43 on the 620 ft-6 in. elevation of the Auxiliary Building. The barrier separating the two zones is constructed of reinforced concrete with a three-hour fire rating; however, an unrated steel plate hatch in the ceiling of Fire Zone 43 provides access to Fire Area 56.

Safe Shutdown Equipment

Fire Zone 43 and Fire Area 56 contain cables required for safe shutdown of D.C. Cook Unit 1. Should a fire occur in either of these locations, complete alternate shutdown capability is provided outside of the fire area and fire zone using Unit 2 equipment.

Fire Protection Equipment

Automatic ionization detection systems are installed in Fire Zone 43 below the suspended ceiling and in Fire Area 56. Fire Zone 43 is not protected by automatic suppression. Fire Area 56 is protected by an automatic CO_2 total flooding extinguishing system that is activated by the detection system. Manual suppression capabilities in the form of portable extinguishers and hose stations are available for use in both locations.

Fire Hazards Analysis

The steel plate hatch is located in the floor/ceiling assembly separating Fire Zone 43 on the 609 ft-6 in. elevation from Fire Area 56 on the 620 ft-6 in. elevation. For a fire to propagate between Fire Zone 43 and Fire Area 56, a fire of sufficient duration and intensity would be required to challenge the inherent capabilities of the steel plate hatch.

The failure point of exposed structural steel is taken to be when its load-carrying capability is reduced to 60% of its yield strength. This limit normally occurs when the temperature of the steel reaches 1000^{O}F. Under the ASTM E119 Standard Time-Temperature curve, an equivalent fire severity of 5-10 minutes is required to achieve this temperature. The steel plate hatch is not a load-carrying structural component; however, the failure criteria of structural steel can be applied to the steel plate hatch to establish a conservative base above which failure could be postulated.

Fire Zone 43 is a normally manned location; however, during some back shift periods with reduced manning, the RP duties may require the zone to be unoccupied. A fixed combustible loading of under 80,000 Btu/ft^2 for an equivalent fire severity of 60 minutes exists in Fire Zone 43. (The actual combustible loading and equivalent fire severity existing at this time are under 74,361 Btu/ft^2 and under 56 minutes, respectively.) The equivalent fire severity (60 minutes) in Fire Zone 43 will raise the temperature of structural steel up to its failure point (5-10 minutes). However, a fire in this zone should be detected in its incipient stages by either the automatic detection system or the personnel normally manning the area. This combination of automatic detection and normal manning provides reasonable assurance that a fire involving fixed and/or transient combustibles in Fire Zone 43 would not adversely impact on the capability of the steel plate hatch to adequately protect the opening in the barrier.

Fire Area 56 has a fixed combustible loading of under 80,000 Btu/ft^2 for an equivalent fire severity of approximately 60 minutes (the actual combustible loading and equivalent fire severity existing at this time are 68,120 Btu/ft^2 and 51 minutes respectively). An equivalent fire severity of 60 minutes would raise the temperature of the steel plate hatch to over 1000^{o}F if the fire was not promptly detected and extinguished. A total flooding automatic CO_2 system is provided in Fire Area 56. It is actuated by the ionization detection system. The combination of automatic detection and CO_2 suppression ensures detection and suppression of a fire in Fire Area 56 in its incipient stages. This provides reasonable assurance that a fire involving fixed combustibles in Fire Area 56 would not adversely impact on the capability of the steel plate hatch to protect the opening in the barrier. The existence of the automatic detection and suppression systems will tend to mitigate increases in the fixed combustible loading or the presence of transient combustibles, provided that the increases do not exceed the capabilities of the suppression system.

Conclusion

Based on the above evaluation, reasonable assurance is provided that a fire in Fire Zone 43 or Fire Area 56 would not impair the safe shutdown capabilities of D.C. Cook Unit 1. In addition, this evaluation does not adversely impact on other evaluations or exemption requests contained in this report.

The bases that justify the conclusion are summarized as follows:

(1) An equivalent fire severity of 5-10 minutes is required to raise the temperature of load-carrying structural steel up to its failure point of 1000°F.

(2) The steel plate hatch is not a load-carrying structural component; however, a 5-10 minute fire severity can be used to establish a conservative base, above which failure could be postulated without additional fire protection.

(3) Fire Zone 43 has an equivalent fire severity of 60 minutes.

(4) An automatic detection system is provided in Fire Zone 43 and is normally manned, thereby ensuring early detection of fire.

(5) The equivalent fire severity of Fire Area 56 is under 60 minutes; however, an automatically actuated, total flooding CO_2 system is provided.

(6) The provision of the CO_2 system actuated by the ionization detection system ensures detection and suppression of a fire in Fire Area 56 in its incipient stages. Increases in the fixed and/or transient combustible loadings in Fire Area 56 should also be

mitigated by the presence of the detection and suppression systems, provided that the increases do not exceed the capabilities of the suppression system.

(7) Should a fire occur in either Fire Zone 43 or Fire Area 56, complete alternate shutdown capability using Unit 2 equipment is provided. Therefore, should fire spread between the two locations, the same alternate shutdown method would be utilized.

(8) Replacing the steel plate hatch with one of fire-rated construction would not significantly enhance the protection provided by the existing configuration.

9.15 Fire Zone 40B and Fire Area 55 Hatch Evaluation

Purpose

The purpose of this evaluation is to analyze the impact of an unrated steel plate floor hatch located between the Unit 1 4kV Switchgear Room and the Unit 1 Switchgear Room Cable Vault (Fire Zone 40B and Fire Area 55, respectively) on redundant safe shutdown capability. A three-hour fire-rated hatch assembly is not commercially available for use in this location. In addition, this evaluation does not adversely impact on other evaluations or exemption requests contained in this report.

Description

Fire Zone 40B is located on the 609 ft-6 in. elevation of the Auxiliary Building. It is part of a larger fire area that includes Fire Zone 40A. Fire Area 55 is located directly above Fire Zone 40B on the 625 ft-10 in. elevation. The barrier separating the two areas is constructed of reinforced concrete with a three-hour fire rating; however, an unrated steel plate hatch in the ceiling of Fire Zone 40B provides access to Fire Area 55.

<u>Safe Shutdown Equipment</u>

Fire Zone 40B and Fire Area 55 contain cables and equipment required for safe shutdown of D.C. Cook Unit 1. Should a fire occur in either Fire Zone 40B or Fire Area 55, complete alternate shutdown capability outside of the fire area or zone is provided using Unit 2 equipment.

<u>Fire Protection Equipment</u>

Automatic ionization and infrared detection systems are installed in Fire Zone 40B and Fire Area 55. An automatic total flooding CO_2 suppression system is provided in Fire Zone 40B. An automatic total flooding CO_2 suppression system is also provided in Fire Area 55, except that coverage does not extend into the CD Battery Room. (The hatch is not located in the CD Battery Room.) Manual suppression capabilities in the form of portable extinguishers and hose stations are available for use in both Fire Zone 40B and Fire Area 55.

<u>Fire Hazards Analysis</u>

The steel plate hatch is located in the floor/ceiling assembly separating Fire Zone 40B on the 609 ft-6 in. elevation from Fire Area 55 on the 625 ft-10 in. elevation. For a fire to propagate between Fire Zone 40B and Fire Area 55, a fire of sufficient duration and intensity would be required to challenge the inherent fire protection capabilities of the steel plate hatch.

The failure point of exposed structural steel is taken to be when its load-carrying capability is reduced to 60% of its yield strength. This limit normally occurs when the temperature of the steel reaches 1000°F. Under the ASTM E119 Standard Time-Temperature curve, an equivalent fire severity of 5-10 minutes is required to achieve this temperature. Although the steel plate hatch is not a load-carrying structural component, the failure criteria of structural steel can be applied to the steel plate hatch to establish a conservative base above which failure could be postulated.

Fire Zone 40B has a fixed combustible loading of under 33,000 Btu/ft^2 for an equivalent fire severity of approximately 25 minutes (the actual combustible loading and equivalent fire severity existing at this time are 18,144 Btu/ft^2 and 13.6 minutes respectively). An equivalent fire severity of under 25 minutes would raise the temperature of the hatch to over 1000°F if the fire was not promptly detected and extinguished. An automatic total flooding CO_2 suppression system actuated by ionization and infrared detectors is provided in Fire Zone 40B. The combination of automatic detection and automatic total flooding CO_2 suppression provides reasonable assurance that a fire involving fixed combustibles in Fire Zone 40B would not adversely impact on the capability of the steel plate hatch to protect the opening in the barrier. The existence of the automatic detection and suppression systems will tend to mitigate increases in the fixed combustible loading or the presence of transient combustibles, provided that the increases do not exceed the capabilities of the suppression system.

Fire Area 55 has a fixed combustible loading of approximately 47,000 Btu/ft^2 for an equivalent fire severity of approximately 35 minutes (the actual combustible loading and equivalent fire severity existing at this time are 33,536 Btu/ft^2 and 25.1 minutes respectively). An equivalent fire severity of under 35 minutes would raise the temperature of the steel plate hatch to over 1000°F if the fire was not promptly detected and extinguished. An automatic total flooding CO_2 suppression system (which does not protect the CD Battery Room) actuated by ionization and infrared detectors is provided in Fire Area 55. The combination of automatic detection and automatic total flooding CO_2 suppression provides reasonable assurance that a fire involving fixed combustibles in Fire Area 55 would not adversely impact on the capability of the steel plate hatch to protect the opening in the barrier. The existence of the automatic detection and suppression systems will tend to mitigate increases in the fixed combustible loading or the presence of transient combustibles, provided that the increases do not exceed the capabilities of the suppression system.

Conclusion

Based on the above evaluation, reasonable assurance is provided that a fire in Fire Zone 40B or Fire Area 55 would not impair safe shutdown capabilities of D.C. Cook Unit 1. In addition, this evaluation does not adversely impact on other evaluations or exemption requests contained in this report.

The bases that justify the conclusion are summarized as follows:

(1) An equivalent fire severity of 5-10 minutes is required to raise the temperature of load-carrying structural steel up to its failure point of 1000°F.

(2) The steel plate hatch is not a load-carrying structural component; however, a 5-10 minute fire severity can be used to establish a conservative base above which failure could be postulated without additional fire protection.

(3) Fire Zone 40B has an equivalent fire severity of under 25 minutes; however, automatic detection and automatic CO_2 suppression would result in detection and suppression of a fire in Fire Zone 40B in its incipient stages. Increases in the fixed and/or transient combustible loading in Fire Zone 40B would be mitigated by the presence of the automatic detection and suppression systems, provided that the increases do not exceed the capabilities of the suppression system.

(4) Fire Area 55 has an equivalent fire severity of under 35 minutes; however, automatic detection and automatic CO_2 suppression (except for the CD Battery Room) would result in detection and suppression of a fire in Fire Area 55 in its incipient stages. Increases in the fixed and/or transient combustible loadings in Fire Area 55 (excluding the CD Battery Room) would be mitigated by the presence of the automatic detection and suppression systems, provided that the increases do not exceed the capabilities of the suppression system.

(5) Should a fire occur in either Fire Zone 40B or Fire Area 55, complete alternate capability is provided

outside of the fire area or zone using Unit 2 equipment.

(6) Replacing the steel plate hatch with one of fire-rated construction would not significantly enhance the protection provided by the existing configuration.

9.16 Fire Area 41 and Fire Area 55 Hatch Evaluation

Purpose

The purpose of this evaluation is to analyze the impact of an unrated steel plate hatch located between the Unit 1 Engineering Safety System and MCC Room and the Unit 1 Switchgear Room Cable Vault (Fire Area 41 and Fire Area 55, respectively) on redundant safe shutdown capability. A three-hour fire-rated hatch assembly is not commercially available for use in this location. In addition, this evaluation does not adversely impact on other evaluations or exemption requests contained in this report.

Description

Fire Area 41 is located on the 609 ft-6 in. elevation of the Auxiliary Building. Fire Area 55 is located directly above Fire Area 41 on the 625 ft-10 in. elevation. The barrier separating the two areas is constructed of reinforced concrete with a three-hour fire rating; however, a steel plate hatch in the ceiling of Fire Area 41 provides access into the Battery Room enclosure of Fire Area 55.

Safe Shutdown Equipment

Fire Area 41 and Fire Area 55 contain cables and equipment required for safe shutdown of D.C. Cook Unit 1. Should a fire occur in either Fire Area 41 or Fire Area 55, complete alternate shutdown capability outside of both fire areas is provided using Unit 2 equipment.

Fire Protection Equipment

Automatic ionization and infrared detection systems are installed in Fire Area 41 and Fire Area 55. The CD Battery Room enclosure of Fire Area 55 is provided only with ionization detection. An automatic total flooding CO_2 suppression system is provided in Fire Area 41 and Fire Area 55. Automatic suppression capability is not provided in the CD Battery Room enclosure. Manual suppression capabilities in the form of portable extinguishers and hose stations are available for use in both Fire Area 41 and Fire Area 55, including the CD Battery Room enclosure.

Fire Hazards Analysis

The steel plate hatch is located in the floor/ceiling assembly separating Fire Area 41 on the 609 ft-6 in. elevation and the CD Battery Room enclosure of Fire Area 55 on the 625 ft-10 in. elevation. For a fire to propagate between Fire Area 41 and Fire Area 55, a fire of sufficient duration and intensity would be required to challenge the inherent fire protection capabilities of the steel plate hatch.

The failure point of exposed structural steel is taken to be when its load-carrying capability is reduced to 60% of its yield strength. This limit normally occurs when the temperature of the steel reaches 1000°F. Under the ASTM E119 Standard Time-Temperature curve, an equivalent fire severity of 5-10 minutes is required to achieve this temperature. Although the steel plate hatch is not a load-carrying structural component, the failure criteria of structural steel can be applied to the steel plate hatch to establish a conservative base above which failure could be postulated.

Fire Area 41 has a fixed combustible loading of under 40,000 Btu/ft^2 for an equivalent fire severity of approximately 30 minutes (the actual combustible loading and equivalent fire severity existing at this time are 27,614 Btu/ft^2 and 20.7 minutes respectively). An equivalent fire severity of under 30 minutes would raise the temperature of the hatch to over 1000°F if the fire was not promptly detected and extinguished. An automatic total flooding CO_2 suppression system actuated by ionization and infrared detectors is provided in Fire Area 41. The combination of automatic detection and automatic total flooding CO_2 suppression provides reasonable assurance that a fire involving fixed combustibles in Fire Area 41 would not adversely impact on the capability of the steel plate hatch to protect the opening in the barrier. The existence of the automatic detection and suppression systems will tend to mitigate increases in the fixed combustible loading or the presence of transient combustibles, provided that the increases do not exceed the capabilities of the suppression system.

Fire Area 55 has a fixed combustible loading of approximately 47,000 Btu/ft^2 for an equivalent fire severity of approximately 35 minutes (the actual combustible loading and equivalent fire severity existing at this time are 33,536 Btu/ft^2 and 25.1 minutes, respectively). An equivalent fire severity of under 35 minutes would raise the temperature of the steel plate hatch over 1000°F if the fire was not promptly detected and extinguished.

The fixed combustible materials in the CD Battery Room enclosure are the battery casings. Transient combustibles are not postulated in this location based on controlled access to the 4kV Room complex. Maintenance activities would require minimal amounts of combustible materials. Fire would have to spread into the CD Battery Room enclosure from the remainder of Fire Area 55 in order to ignite the casings. An automatic total flooding CO_2 suppression system (which does not protect the CD Battery Room) actuated by ionization and infrared detectors is provided in Fire Area 55. The combination of automatic detection and automatic total flooding CO_2 suppression provides reasonable assurance that a fire involving fixed combustibles in Fire Area 55 would not spread into the CD Battery Room enclosure, ignite the battery casings, and adversely impact on the capability of the steel plate hatch to protect the opening in the barrier. Increases in the fixed combustible loading or the presence of transient combustibles outside of the CD Battery Room enclosure in Fire Area 55 would be mitigated by the presence of the automatic detection and suppression systems, provided that the increases do not exceed the capabilities of the suppression system.

Conclusion

Based on the above evaluation, reasonable assurance is provided that a fire in Fire Area 41 or Fire Area 55 would not impair safe shutdown capabilities of D.C. Cook Unit 1. In addition, this evaluation does not adversely impact on other evaluations or exemption requests contained in this report.

The bases that justify the conclusion are summarized as follows:

(1) An equivalent fire severity of 5-10 minutes is required to raise the temperature of load-carrying structural steel up to its failure point of 1000°F.

(2) The steel plate hatch is not a load-carrying structural component; however, a 5-10 minute fire severity can be used to establish a conservative base above which failure could be postulated without additional fire protection.

(3) Fire Area 41 has an equivalent fire severity of under 30 minutes; however, automatic detection and automatic CO_2 suppression should result in detection and suppression of a fire in Fire Area 41 in its incipient stages. Increases in the fixed and/or transient combustible loadings in Fire Area 41 would be mitigated by the presence of the automatic detection and suppression systems, provided that the increases do not exceed the capabilities of the suppression systems.

(4) Fire Area 55 has an equivalent fire severity of under 35 minutes; however, automatic detection and automatic CO_2 suppression (except for the CD Battery Room) should result in detection and suppression of a fire in Fire Area 55 in its incipient stages. Increases in the fixed and/or transient combustible loadings in Fire Area 55 (excluding the CD Battery Room) would be mitigated by the presence of the automatic detection and suppression systems, provided that the increases do not exceed the capabilities of the suppression systems.

(5) The only combustible materials in the Battery Room Enclosure are the battery casings. Fire would have to spread into the enclosure from the remainder of Fire Area 55.

(6) Should a fire occur in either Fire Area 41 or Fire Area 55, complete alternate capability is provided outside of the fire areas using Unit 2 equipment.

(7) Replacing the steel plate hatch with one of fire-rated construction would not significantly enhance the protection provided by the existing configuration.

9.17 Fire Area 54 and Fire Area 58 Hatch Evaluation

Purpose

The purpose of this evaluation is to analyze the impact of an unrated steel plate hatch located between the Unit 2 Control Room and the Unit 2 Control Room Cable Vault (Fire Area 54 and Fire Area 58, respectively) on either redundant safe shutdown capability or the request for fixed suppression exemption in Fire Area 54 in Section 7.12 of this report. A three-hour fire-rated hatch assembly is not commercially available for use in this location. In addition, this evaluation does not adversely impact on other evaluations or exemption requests contained in this report.

Description

Fire Area 54 is located on the 633 ft elevation of the Auxiliary Building. Fire Area 58 is located directly below on the 624 ft-0 in. elevation. The barrier separating the two areas is constructed of reinforced concrete with a three-hour fire rating; however, an unrated steel plate hatch in the floor of Fire Area 54 provides access to Fire Area 58.

Safe Shutdown Equipment

Fire Areas 54 and 58 contain all control and instrumentation cabling required for safe shutdown of D.C. Cook Unit 2. Should a fire occur in either fire area, complete alternate shutdown capability is provided outside of both fire areas using Unit 1 equipment.

Fire Protection Equipment

Automatic ionization detection systems are installed in Fire Area 54 and Fire Area 58. Automatic suppression is not provided in Fire Area 54. Fire Area 58 is protected by an automatic total flooding Halon 1301 suppression system and by a manually actuated totally flooding CO_2 suppression system. Manual suppression capabilities in the form of portable extinguishers and hose stations are available for use in both fire areas.

Fire Hazards Analysis

The steel plate hatch is located in the floor/ceiling assembly separating Fire Area 58 on the 624 ft-0 in. elevation from Fire Area 54 on the 633 ft elevation. For a fire to propagate between Fire Area 58 and Fire Area 54, a fire of sufficient duration and intensity would be required to challenge the inherent fire protection capabilities of the steel plate hatch.

The failure point of exposed structural steel is taken to be when its load-carrying capability is reduced to 60% of its yield strength. This limit normally occurs when the temperature of the steel reaches 1000°F. Under the ASTM E119 Standard Time-Temperature curve, an equivalent fire severity of 5-10 minutes is required to achieve this temperature. Although the steel plate hatch is not a load-carrying structural component, the failure criteria of structural steel can be applied to the steel plate hatch to establish a conservative base above which failure could be postulated.

Fire Area 58 has a fixed combustible loading of under 113,000 Btu/ft^2 for an equivalent fire severity of approximately 85 minutes (the actual combustible loading and equivalent fire severity existing at this time are 99,344 Btu/ft^2 and 74.7 minutes respectively). An equivalent fire severity of under 85 minutes would raise the temperature of the steel plate hatch to well over 1000°F if the fire was not promptly detected and extinguished. An automatic total flooding Halon 1301 system actuated by ionization detectors is provided in Fire Area 58. Should the Halon 1301 system fail to extinguish the fire, the total flooding CO_2 system would be manually actuated. The combination of automatic detection, automatic total flooding Halon 1301 suppression, and manually actuated CO_2 as a backup provides reasonable assurance that a fire involving fixed combustibles in Fire Area 58 would not adversely impact on the capability of the steel plate hatch to protect the opening in the barrier. The existence of the automatic detection and suppression systems will tend to mitigate increases in the fixed combustible loading or the presence of transient combustibles, provided that the increases do not exceed the capabilities of the suppression system.

Fire Area 54 is a continuously-manned Control Room. It has a fixed combustible loading of 47,000 Btu/ft^2 for an equivalent fire severity of under 35 minutes. (The actual combustible loading and equivalent fire severity existing at this time are under 30,069 Btu/ft^2 and 22.6 minutes, respectively.) The amount of transient combustibles allowed in the Control Room will be controlled. An equivalent fire severity of under 35 minutes could raise the temperature of the hatch above 1000°F. Two considerations must be taken into account. First, the steel plate hatch is located in the floor of Fire Area 54. The higher temperatures associated with a fire in this area would tend to be near ceiling level. Floor-based temperatures should be considerably lower than those at the ceiling. Secondly, the fire area is continuously manned by trained operators. Manual fire fighting activities can be expected to take place almost immediately after detection of the fire. There is reasonable assurance, therefore, that a fire involving fixed and/or transient combustibles in Fire Area 54 would not adversely impact on the capability of the steel plate hatch to protect the opening in the barrier.

Conclusion

Based on the above evaluation, reasonable assurance is provided that a fire in Fire Area 54 or Fire Area 58 would not impair the safe shutdown capabilities of D.C. Cook Unit 2 or impact on the fixed suppression exemption request for Fire Area 54. In addition, this evaluation does not adversely impact on other evaluations or exemption requests contained in this report.

The bases that justify the conclusion are summarized as follows:

(1) An equivalent fire severity of 5-10 minutes is required to raise the temperature of load-carrying structural steel up to its failure point of $1000^{o}F$.

(2) The steel plate hatch is not a load-carrying structural component; however, a 5-10 minute fire severity can be used to establish a conservative base above which failure could be postulated without additional fire protection.

(3) Fire Area 58 has an equivalent fire severity of under 85 minutes; however, automatic detection, automatic Halon 1301 suppression and manually actuated CO_2 suppression should result in detection and suppression of a fire in this area in its incipient stages. Increases in the fixed and/or transient combustible loadings in Fire Area 58 would tend to be mitigated by the presence of the automatic detection and suppression systems, provided that the increases do not exceed the capabilities of the suppression system.

(4) The equivalent fire severity of Fire Area 54 is under 35 minutes.

(5) The hatch is located in the floor, and floor-based temperatures can be expected to be significantly lower than those at ceiling level.

(6) An automatic detection system is provided in Fire Area 54.

(7) Fire Area 54 is continuously manned. Manual fire fighting activities can be expected almost immediately after detection of the fire.

(8) Should a fire occur in either Fire Area 54 or Fire Area 58, complete alternate shutdown capability outside of both fire areas is provided using Unit 1 equipment.

(9) Replacing the steel plate hatch with one of fire-rated construction would not significantly enhance the protection provided by the existing configuration.

9.18 Fire Zone 52 and Fire Area 59 Hatch Evaluation

Purpose

The purpose of this evaluation is to analyze the impact of an unrated steel plate floor hatch located between the 633 ft elevation of the Auxiliary Building and the Auxiliary Cable Vault (Fire Zone 52 and Fire Area 59, respectively) on redundant safe shutdown capability. A three-hour fire-rated hatch assembly is not commercially available for use in this location. In addition, this evaluation does not adversely impact on other evaluations or exemption requests contained in this report.

Description

Fire Zone 52 is located on the 633 ft elevation of the Auxiliary Building. It is part of a larger fire area that includes Fire Zones 49, 50, 51, 3, 32, 69, 36, and 48. Fire Area

59 is located directly below the southwest corner of Fire Zone 52 on the 622 ft-6 in. elevation of the Auxiliary Building. The barrier separating the two areas is constructed of reinforced concrete with a three-hour fire rating; however, an unrated steel plate hatch in the floor of Fire Zone 52 provides access to Fire Area 59.

Safe Shutdown Equipment

Fire Zone 52 contains cables required for safe shutdown of D.C. Cook Units 1 and 2. The March 1983 Appendix R Submittal identified methods of achieving compliance with Appendix R in this area (extending suppression coverage throughout the zone and alternate shutdown via local PORV control), which were reviewed and approved by the NRC. Fire Area 59 contains cables for safe shutdown of D.C. Cook Unit 2. Should a fire occur in Fire Area 59, complete alternate shutdown capability is provided outside of the fire area using Unit 1 equipment.

Fire Protection Equipment

Automatic ionization detection systems are installed in Fire Zone 52 and Fire Area 59. A preaction sprinkler system, which requires actuation of the pilot line detector system to allow water to enter the sprinkler piping system, with heat then required to fuse individual sprinkler heads, is provided in Fire Zone 52. An automatic total flooding CO_2 suppression system that is actuated by the detection system is provided in Fire Area 59.

Manual suppression capabilities in the form of portable extinguishers and hose stations are available for use in both locations.

Fire Hazards Analysis

The steel plate hatch is located in the floor/ceiling assembly separating Fire Zone 52 on the 633 ft elevation from Fire Area 59 on the 622 ft-6 in. elevation. For a fire to propagate between Fire Zone 52 and Fire Area 59, a fire of sufficient duration and intensity would be required to challenge the inherent fire protection capabilities of the steel plate hatch.

The failure point of exposed structural steel is taken to be when its load-carrying capability is reduced to 60% of its yield strength. This limit normally occurs when the temperature of the steel reaches $1000^{\circ}F$. Under the ASTM E119 Standard Time-Temperature curve, an equivalent fire severity of 5-10 minutes is required to achieve this temperature. Although the steel plate hatch is not a load-carrying structural component, the failure criteria of structural steel can be applied to the steel plate hatch to establish a conservative base above which failure could be postulated.

The fixed combustible loading in Fire Zone 52 is under 27,000 Btu/ft^2 for an equivalent fire severity of approximately 20 minutes. (The actual combustible loading and equivalent fire severity existing at this time are 10,717 Btu/ft^2 and 7.9 minutes respectively.) Fire Zone 52 is located in a fire area with an average fixed combustible loading of under 33,000 Btu/ft^2 for an equivalent fire severity of approximately 25 minutes. (The actual combustible loading and equivalent fire severity existing at this time are 17,283 Btu/ft^2 and 12.9 minutes, respectively.) On the level on which this zone is located (made up of Fire Zones 49, 50, 51 and 52), the average fixed combustible loading is under 47,000 Btu/ft^2 for an equivalent fire severity of approximately 35 minutes. (The actual combustible loading and equivalent fire severity existing at this time are 28,629 Btu/ft^2 and 21.4 minutes, respectively.) However, the equivalent fire severity of those zones (Fire Zones 49, 50, 51 and 52) on the 633 ft elevation (35 minutes) would raise the temperature to over 1000°F if the fire was not promptly detected and extinguished. An automatic dry pilot preaction sprinkler system is provided in Fire Zone 52. This combination of automatic ionization detection and dry pilot preaction sprinklers provides reasonable assurance that a fire involving fixed combustibles in the fire area containing Fire Zone 52 would not adversely impact on the capability of the steel plate hatch to protect the opening in the barrier. The existence of the automatic detection and suppression systems will tend to mitigate increases in the fixed combustible loading or the presence of transient combustibles, provided that the increases do not exceed the capabilities of the suppression system.

Fire Area 59 has a fixed combustible loading of under 67,000 Btu/ft^2 for an equivalent fire severity of approximately 50 minutes. (The actual combustible loading and equivalent fire severity existing at this time are 54,237 Btu/ft^2 and 40.7 minutes, respectively.) An equivalent fire severity of 50 minutes would raise the temperature of the steel plate hatch to over 1000^{o}F if the fire was not promptly detected and extinguished. An automatic total flooding CO_2 suppression system actuated by the detection system is provided in Fire Area 59. The combination of automatic detection and automatic total flooding CO_2 suppression provides reasonable assurance that a fire involving fixed combustibles would not adversely impact on the capability of the steel plate hatch to protect the opening in the barrier. The existence of the automatic detection and suppression systems will tend to mitigate increases in the fixed combustible loading or the presence of transient combustibles, provided that the increases do not exceed the capabilities of the suppression system.

Conclusion

Based on the above evaluation, reasonable assurance is provided that a fire in Fire Zone 52 or Fire Area 59 would not impair safe shutdown capabilities of D.C. Cook Units 1 and 2. In addition, this evaluation does not adversely impact on other evaluations or exemption requests contained in this report.

The bases that justify the conclusion are summarized as follows:

(1) An equivalent fire severity of 5-10 minutes is required to raise the temperature of load-carrying structural steel up to its failure point of 1000°F.

(2) The steel plate hatch is not a load-carrying structural component; however, a 5-10 minute fire severity can be used to establish a conservative base above which failure could be postulated without additional fire protection.

(3) Fire Zone 52 has an equivalent fire severity of 20 minutes. The combination of fire zones making up the fire area in which Fire Zone 52 is located has an average fire severity of 25 minutes. The average combustible loading of those fire zones on the 633 ft elevation that are included in the fire area with Fire Zone 52 is 35 minutes.

(4) The automatic ionization detection and dry pilot preaction sprinkler systems installed in Fire Zone 52 would result in detection and suppression of a fire involving fixed combustibles in its incipient stages. Increases in the fixed and/or transient combustible loadings in Fire Zone 52 will be mitigated by the presence of automatic suppression systems, provided that the increases do not exceed the capabilities of the suppression systems.

(5) Fire Area 59 has an equivalent fire severity of 50 minutes; however, automatic detection and automatic CO_2 suppression should result in detection and suppression of a fire involving fixed combustibles in Fire Area 59 in its incipient stages. Increases in the fixed and/or transient combustible loadings in Fire Area 59 will be mitigated by the presence of automatic suppression systems, provided that the increases do not exceed the capabilities of the suppression systems.

(6) Replacing the steel plate hatch with one of fire-rated construction would not significantly enhance the protection provided by the existing configuration.

9.19 Fire Area 45 and Fire Area 60 Hatch Evaluation

Purpose

The purpose of this evaluation is to analyze the impact of an unrated steel plate hatch located between the Unit 2 Engineering Safety System and MCC Room and the Unit 2 Switchgear Room Cable Vault (Fire Area 45 and Fire Area 60, respectively) on redundant safe shutdown capability. A three-hour fire-rated hatch assembly is not commercially available for use in this location. In addition, this evaluation does not adversely impact on other evaluations or exemption requests contained in this report.

Description

Fire Area 45 is located on the 609 ft-6 in. elevation of the Auxiliary Building. Fire Area 60 is located directly above Fire Area 45 on the 625 ft-10 in. elevation. The barrier separating the two areas is constructed of reinforced concrete with a three-hour fire rating; however, a steel plate hatch in the ceiling of Fire Area 45 provides access into the CD Battery Room enclosure of Fire Area 60.

Safe Shutdown Equipment

Fire Area 45 and Fire Area 60 contain cables and equipment required for safe shutdown of D.C. Cook Unit 2. Should a fire occur in either Fire Area 45 or Fire Area 60, complete alternate shutdown capability outside of both fire areas is provided using Unit 1 equipment.

Fire Protection Equipment

Automatic ionization and infrared detection systems are installed in Fire Area 45 and Fire Area 60. The CD Battery Room enclosure of Fire Area 60 is provided only with ionization detection. An automatic total flooding CO_2 suppression system is provided in Fire Area 45 and Fire Area 60. Automatic suppression capability is not provided in the CD Battery Room enclosure. Manual suppression capabilities in the form of portable extinguishers and hose stations are available for use in both Fire Area 45 and Fire Area 60, including the CD Battery Room enclosure.

Fire Hazards Analysis

The steel plate hatch is located in the floor/ceiling assembly separating Fire Area 45 on the 609 ft-6 in. elevation and the CD Battery Room enclosure of Fire Area 60 on the 625 ft-10 in. elevation. For a fire to propagate between Fire Area 45 and Fire Area 60, a fire of sufficient duration and intensity would be required to challenge the inherent fire protection capabilities of the steel plate hatch.

The failure point of exposed structural steel is taken to be when its load-carrying capability is reduced to 60% of its yield strength. This limit normally occurs when the temperature of the steel reaches 1000^{o}F. Under the ASTM E119 Standard Time-Temperature curve, an equivalent fire severity of 5-10 minutes is required to achieve this temperature. Although the steel plate hatch is not a load-carrying structural component, the failure criteria of structural steel can be applied to the steel plate hatch to establish a conservative base above which failure could be postulated.

Fire Area 45 has a fixed combustible loading of under 40,000 Btu/ft^2 for an equivalent fire severity of approximately 30 minutes. (The acxtual combustible loading and equivalent fire severity existing at this time are 23,443 Btu/ft^2 and 17.6 minutes, respectively.)

An equivalent fire severity of 30 minutes would raise the temperature of the hatch to over 1000°F if the fire was not promptly detected and extinguished. An automatic total flooding CO_2 suppression system actuated by ionization and infrared detectors is provided in Fire Area 45. The combination of automatic detection and automatic total flooding CO_2 suppression provides reasonable assurance that a fire involving fixed combustibles in Fire Area 45 would not adversely impact on the capability of the steel plate hatch to protect the opening in the barrier. The existence of the automatic detection and suppression systems will tend to mitigate increases in the fixed combustible loading or the presence of transient combustibles, provided that the increases do not exceed the capabilities of the suppression system.

Fire Area 60 has a fixed combustible loading of approximately 40,000 Btu/ft^2 for an equivalent fire severity of approximately 30 minutes. (The actual combustible loading and equivalent fire severity existing at this time are 25,487 Btu/ft^2 and 19 minutes, respectively.) An equivalent fire severity of 30 minutes would raise the temperature of the steel plate hatch to over $1000^{o}F$ if the fire was not promptly detected and extinguished.

The only combustible materials in the CD Battery Room enclosure are the battery casings. Transient combustibles are not postulated in Fire Area 60, including the CD Battery Room, based on controlled access throughout the entire 4kV Room complex. Maintenance activities would require minimal amounts of combustible materials. Fire would have to spread into the enclosure from the remainder of Fire Area 60 in order to ignite the casings. An automatic total flooding CO_2 suppression system (which does not protect the CD Battery Room) actuated by ionization and infrared detectors is provided in Fire Area 60. The combination of automatic detection and automatic total flooding CO_2 suppression provides reasonable assurance that a fire involving fixed combustibles in Fire Area 60 would not spread into the CD Battery Room enclosure, ignite the battery casings, and adversely impact on the capability of the steel plate hatch to protect the opening in the barrier. The existence of the automatic detection and suppression systems will tend to mitigate increases in the fixed combustible loading or the presence of transient combustibles, provided that the increases do not exceed the capabilities of the suppression system.

Conclusion

Based on the above evaluation, reasonable assurance is provided that a fire in Fire Area 45 or Fire Area 60 would not impair safe shutdown capabilities of D.C. Cook Unit 2. In addition, this evaluation does not adversely impact on other evaluation or exemption requests contained in this report.

The bases that justify the conclusion are summarized as follows:

(1) An equivalent fire severity of 5-10 minutes is required to raise the temperature of load-carrying structural steel up to its failure point of 1000°F.

(2) The steel plate hatch is not a load-carrying structural component; however, a 5-10 minute fire severity can be used to establish a conservative base above which failure could be postulated without additional fire protection.

(3) Fire Area 45 has an equivalent fire severity of 30 minutes; however, automatic detection and automatic CO_2 suppression should result in detection and suppression of a fire in Fire Area 45 in its incipient stages. Increases in the fixed and/or transient combustible loadings in Fire Area 45 would be mitigated by the presence of automatic suppression systems, provided that the increases do not exceed the capabilities of the suppression systems.

(4) Fire Area 60 has an equivalent fire severity of 30 minutes; however, automatic detection and automatic CO_2 suppression (except for the CD Battery Room) should result in detection and suppression of a fire in Fire Area 60 in its incipient stages. Increases in the fixed and/or transient combustible loadings in Fire Area 60 (excluding the CD Battery Room) would be mitigated by the presence of automatic suppression systems, provided that the increases do not exceed the capabilities of the suppression systems.

(5) The only combustible materials in the Battery Room enclosure are the battery casings. Fire would have to spread into the enclosure from the remainder of Fire Area 60.

(6) Should a fire occur in either Fire Area 45 or Fire Area 60, complete alternate capability is provided outside of both fire areas using Unit 1 equipment.

(7) Replacing the steel plate hatch with one of fire-rated construction would not significantly enhance the protection provided by the existing configuration.

9.20 Fire Zone 47B and Fire Area 60 Hatch Evaluation

Purpose

The purpose of this evaluation is to analyze the impact of an unrated steel plate hatch located between the Unit 2 4kV Switchgear Room and the Unit 2 Switchgear Room Cable Vault (Fire Zone 47B and Fire Area 60, respectively) on redundant safe shutdown capability. A three-hour fire-rated hatch assembly is not commercially available for use in this location. In addition, this evaluation does not adversely impact on other evaluations or exemption requests contained in this report.

Description

Fire Zone 47B is located on the 609 ft-6 in. elevation of the Auxiliary Building. It is part of a larger fire area that includes Fire Zone 47A. Fire Area 60 is located directly above Fire Zone 47B on the 625 ft-10 in. elevation. The barrier separating the two areas is constructed of reinforced concrete with a three-hour fire rating; however, an unrated steel plate hatch in the ceiling of Fire Zone 47B provides access to Fire Area 60.

Safe Shutdown Equipment

Fire Zone 47B and Fire Area 60 contain cables and equipment required for safe shutdown of D.C. Cook Unit 2. Should a fire occur in either Fire Zone 47B or Fire Area 60, complete alternate shutdown capability outside of the fire area or zone is provided using Unit 1 equipment.

Fire Protection Equipment

Automatic ionization and infrared detection systems are installed in Fire Zone 47B and Fire Area 60. An automatic total flooding CO_2 suppression system is provided in Fire Zone 47B. An automatic total flooding CO_2 suppression system is also provided in Fire Area 60, except that coverage does not extend into the CD Battery Room. (The hatch is not located in the CD Battery Room.) Manual suppression capabilities in the form of portable extinguishers and hose stations are available for use in both Fire Zone 47B and Fire Area 60.

Fire Hazards Analysis

The steel plate hatch is located in the floor/ceiling assembly separating Fire Zone 47B on the 609 ft-6 in. elevation from Fire Area 60 on the 625 ft-10 in. elevation. For a fire to propagate between Fire Zone 47B and Fire Area 60, a fire of sufficient duration and intensity would be required to challenge the inherent fire protection capabilities of the steel plate hatch.

The failure point of exposed structural steel is taken to be when its load-carrying capability is reduced to 60% of its yield strength. This limit normally occurs when the temperature of the steel reaches 1000°F. Under the ASTM E119 Standard Time-Temperature curve, an equivalent fire severity of 5-10 minutes is required to achieve this temperature. Although the steel plate hatch is not a load-carrying structural component, the failure criteria of structural steel can be applied to the steel plate hatch to establish a conservative base above which failure could be postulated.

Fire Zone 47B has a fixed combustible loading of under 33,000 Btu/ft^2 for an equivalent fire severity of approximately 25 minutes. (The actual combustible loading and equivalent fire severity existing at this time are 17,136 Btu/ft^2 and 12.9 minutes, respectively. An equivalent fire severity of 25 minutes would raise the temperature of the hatch to over 1000°F if the fire was not promptly detected and extinguished. An automatic total flooding CO_2 suppression system actuated by ionization and infrared detectors is provided in Fire Zone 47B. The combination of automatic detection and automatic total flooding CO_2 suppression provides reasonable assurance that a fire involving fixed and/or transient combustibles in Fire Zone 47B would not adversely impact on the capability of the steel plate hatch to protect the opening in the barrier. The existence of the automatic detection and suppression systems will tend to mitigate increases in the fixed combustible loading or the presence of transient combustibles, provided that the increases do not exceed the capabilities of the suppression system.

Fire Area 60 has a fixed combustible loading of approximately 40,000 Btu/ft^2 for an equivalent fire severity of approximately 30 minutes. (The actual combustible loading and equivalent fire severity existing at this time are 25, 487 Btu/ft^2 and 19 minutes, respectively.) An equivalent fire severity of 30 minutes would raise the temperature of the steel plate hatch to over 1000^{o}F if the fire was not promptly detected and extinguished. An automatic total flooding CO_2 suppression system (which does not protect the CD Battery Room) actuated by ionization and infrared detectors is provided in Fire Area 60. The combination of automatic detection and automatic total flooding CO_2 suppression provides reasonable assurance that a fire involving fixed and/or transient combustibles in Fire Area 60 would not adversely impact on the capability of the steel plate hatch to protect the opening in the barrier. The existence of the automatic detection and suppression systems will tend to mitigate increases in the fixed combustible loading or the presence of transient combustibles, provided that the increases do not exceed the capabilities of the suppression system.

Conclusion

Based on the above evaluation, reasonable assurance is provided that a fire in Fire Zone 47B or Fire Area 60 would not impair safe shutdown capabilities of D.C. Cook Unit 2. In addition, this evaluation does not adversely impact on other evaluations or exemption requests contained in this report.

The bases that justify the conclusion are summarized as follows:

(1) An equivalent fire severity of 5-10 minutes is required to raise the temperature of load-carrying structural steel up to its failure point of 1000°F.

(2) The steel plate hatch is not a load-carrying structural component; however, a 5-10 minute fire severity can be used to establish a conservative base above which failure could be postulated without additional fire protection.

(3) Fire Zone 47B has an equivalent fire severity of 25 minutes; however, automatic detection and automatic CO_2 suppression would result in detection and suppression of a fire in Fire Zone 47B in its incipient stages. Increases in the fixed and/or transient combustible loading would be mitigated by the presence of automatic detection and suppression systems in Fire Zone 47B, provided that the increases do not exceed the capabilities of the suppression system.

(4) Fire Area 60 has an equivalent fire severity of 30 minutes; however, automatic detection and automatic CO_2 suppression (except for the CD Battery Room) would result in detection and suppression of a fire in Fire Area 60 in its incipient stages. Increases in the fixed and/or transient combustible loadings would be mitigated by the presence of automatic detection and suppression systems in Fire Area 60 (excluding the CD Battery Room), provided that the increases do not exceed the capabilities of the suppression systems.

(5) Should a fire occur in either Fire Zone 47B or Fire Area 60, complete alternate capability is provided outside of the fire area or zone using Unit 1 equipment.

(6) Replacing the steel plate hatch with one of fire-rated construction would not significantly enhance the protection provided by the existing configuration.

9.21 Fire Zone 110 and Fire Zone 43 Door Evaluation

Purpose

The purpose of this evaluation is to analyze the impact of three unrated door assemblies located between the Unit 1 Main Steam Accessway and the Access Control Area (Fire Zone 110 and Fire Zone 43, respectively) on redundant safe shutdown capability. In addition, this evaluation does not adversely impact on other evaluations or exemption requests contained in this report.

Description

Fire Zone 110 is part of a larger fire area that also includes Fire Zone 108 and the entirety of the Turbine Building. Fire Zone 110 originates on the 587 ft elevation and is connected to the Turbine Building through an unrated door on this elevation and by steam line openings on the 609 ft elevation. Fire Zone 110 rises up through the 609 ft elevation along the east and west walls of Fire Zone 43, with the portion along the east wall joining Fire Zone 108 on the 633 ft elevation and the portion along the west wall terminating below the 633 ft elevation. The portion of Fire Zone 110 along the west wall of Fire Zone 43 is open to Fire Zone 91 in the Turbine Building from the 620 to 631 ft elevations for steam pipe access to the turbines. Fire Zone 43 is part of a larger fire area that includes Fire Zones 37, 44S, and 44N and 44A through 44H, all of which are located on the 609 ft elevation of the Auxiliary Building. The east wall of Fire Zone 43 is separated from Fire Zone 110 by three-hour-rated construction. The west wall of Fire Zone 43 is separated from Fire Zone 110 by three-hour-rated construction; however, three unrated door assemblies of hollow metal construction provide access into Fire Zone 110 from the Radiation Control Office in Fire Zone 43.

Safe Shutdown Equipment

Fire Zone 110 does not contain safe shutdown equipment or cables. Fire Zone 108, which is part of the same fire area, contains cables, valves, and instrumentation associated with safe shutdown of D.C. Cook Unit 1 using Steam Generators 2 and 3. Given a fire in Fire Zones 108 or 110, redundant safe shutdown capability is provided using valves and instrumentation associated with Unit 1 Steam Generators 1 and 4 located in Fire Zones 33 and 33A, which are part of a separate fire area.

Fire Zone 43 contains cables associated with safe shutdown of D.C. Cook Unit 1. Alternate shutdown capability is provided outside of this fire zone using Unit 2 equipment and either Unit 1 Steam Generators 2 and 3 or Unit 1 Steam Generators 1 and 4. The cables, valves and instrumentation located in Fire Zone 108 are not required to ensure safe shutdown capability given a fire in Fire Zone 43, as alternate shutdown capability is provided in Fire Zones 33 and 33A.

Fire Protection Equipment

An automatic ionization detection system is installed below the suspended ceiling in Fire Zone 43, with one detector provided in the Radiation Control Office that abuts Fire Zone 110. Fire Zone 43 is not protected by automatic suppression. Automatic detection and automatic suppression are not provided in Fire Zone 110. Manual suppression capabilities in the form of portable extinguishers and hose stations are available for use in both zones.

Fire Hazards Analysis

Fire Zone 43 has a fixed combustible loading of under 80,000 Btu/ft^2 for an equivalent fire severity of 60 minutes. (The actual combustible loading and equivalent fire severity existing at this time are under 74,361 Btu/ft^2 and 55.8 respectively.) Transient combustibles in this fire zone are limited to materials being brought into the Auxiliary Building. Fire Zone 43 is the access control area to the Auxiliary Building and, as such, is normally manned; however, during some back shift periods with reduced manning, RP duties may require the zone to be unoccupied. Automatic detection is provided in this zone, with one detector located in the Radiation Control Office. The three unrated doors to Fire Zone 110 are located in this office and are not easily accessible due to file cabinets being placed up against them. The combination of low fire loading, automatic detection, and normal manning of the fire zone provides reasonable assurance that fire will be quickly discovered and extinguished. As such, the doors provide adequate protection for the opening in the barrier.

Fire Zone 110 has a fixed combustible loading of under 27,000 Btu/ft^2 and equivalent fire severity less than 20 minutes. (The actual combustible loading and equivalent fire severity existing at this time are 803 Btu/ft^2 and 0.6 minutes, respectively.) Transient combustibles in the form of wood and oxy-acetylene cylinders are sometimes stored on the 587 ft elevation of Fire Zone 110. The combustible loading and equivalent fire severity in Fire Zone 110 due to transient combustibles are under 40,000 Btu/ft^2 and 30 minutes, respectively. The bottom of the three unrated doors are located approximately 22 ft above the floor of this zone in a vertical shaft along the east wall of the shaft and the west wall of Fire Zone 43. Based upon their location, the doors would not be directly exposed to fire. In order to impact on the doors, heat and hot gases would have to rise up the shaft to below the 633 ft elevation and bank down to the level of the doors. Main steam piping penetrations exist in the west wall of Fire Zone 110 connecting it with Fire Zone 91 of the Turbine Building. Heat and hot gases rising up the shaft would tend to spill out into the Turbine Building and not bank down the shaft to the level of the doors. Based on the amount of fixed combustibles and the anticipated amount of transient combustibles, reasonable assurance is provided that a fire in Fire Zone 110 would not adversely impact on the capability of the doors to protect the openings in the barrier.

Conclusion

Based on the above evaluation, reasonable assurance is provided that a fire in Fire Zone 43 or Fire Zone 110 would not impair the safe shutdown capabilities of D.C. Cook Unit 1. In addition, this evaluation does not adversely impact on other evaluation or exemption requests contained in this report.

The bases that justify the conclusion are summarized as follows:

(1) Fire Zone 43 has an equivalent fire severity of under 60 minutes.

(2) Fire Zone 43 is the access control area and is normally manned. Transient combustibles are limited to materials being brought into the Auxiliary Building.

(3) Fire Zone 43 is provided with an automatic detection system, with one detector in the Radiation Control Office that abuts Fire Zone 110.

(4) Fire Zone 110 has fixed combustible loading under 27,000 Btu/ft^2 (combustible loading existing at this time is negligible).

(5) Transient combustibles, in the form of wood and oxy-acetylene cylinders, would be located on the 587 ft elevation of Fire Zone 110 with a combustible loading and equivalent fire severity of under 40,000 Btu/ft^2 and less than 30 minutes, respectively.

(6) The bottom of the doors are located in a vertical shaft approximately 22 ft above the floor of Fire Zone 110.

(7) In order to impact on the unrated hollow metal doors, heat and hot gases from a fire in Fire Zone 110 would have to rise up to the top of the shaft (at approximately the 633 ft elevation) and bank down to the level of the doors.

(8) Main steam line openings from Fire Zone 110 to Fire Zone 91 of the Turbine Building between the 620 and 631 ft elevations allow products of combustion to spill out into the Turbine Building as opposed to banking down to the level of the doors.

(9) Given a fire in Fire Zones 108 or 110, redundant safe shutdown capability is provided in Fire Zones 33 and 33A, which are located in a separate fire area.

(10) Given a fire in Fire Zone 43, redundant safe shutdown capability is provided using either Unit 1 steam generators 2 and 3 (with cables, valves, and instrumentation located in Fire Zone 108) or Unit 1 steam generators 1 and 4 (with cables, valves, and instrumentation located in Fire Zones 33 and 33A).

(11) Replacing the unrated hollow metal doors with rated fire door assemblies would not significantly enhance the protection provided by the existing configuration.

9.22 Fire Zone 111 and Fire Zone 44S Door Evaluation

Purpose

The purpose of this evaluation is to analyze the impact of three unrated door assemblies located between the Unit 2 Main Steam Accessway and the south end of the 609 ft elevation of the Auxiliary Building (Fire Zone 111 and Fire Zone 44S, respectively) on redundant safe shutdown capability. In addition, this evaluation does not adversely impact on other evaluations or exemption requests contained in this report.

Description

Fire Zone 111 is part of a larger fire area that also includes Fire Zone 109 and the entirety of the Turbine Building. Fire Zone 111 originates on the 587 ft elevation and is connected to the Turbine Building through an unrated door on this elevation and by steam line openings on the 609 ft elevation. Fire Zone 111 rises up through the 609 ft elevation along the east and west walls of Fire Zone 44S, with the portion along the east wall joining Fire Zone 109 on the 633 ft elevation and the portion along the west wall terminating below the 633 ft elevation. The portion of Fire Zone 111 along the west wall of Fire Zone 44S is open to Fire Zone 96 in the Turbine Building from the 620 to 631 ft elevations for steam pipe access to the turbines. Fire Zone 44S is part of a larger fire area that includes Fire Zones 37, 44S, and 44N and 44A through 44H, all of which are located on the 609 ft elevation of the Auxiliary Building. The west wall of Fire Zone 44S is separated from Fire Zone 111 by three-hour-rated construction; however, three unrated door assemblies of hollow metal construction that are padlocked shut provide access into Fire Zone 111 from Fire Zone 44S directly west of the component cooling water (CCW) pumps.

Safe Shutdown Equipment

Fire Zone 111 does not contain safe shutdown equipment or cables. Fire Zone 109, which is part of the same fire area, contains cables, valves, and instrumentation associated with safe shutdown of D.C. Cook Unit 2 using steam generators 2 and 3. Given a fire in Fire Zones 109 or 111, redundant safe shutdown capability is provided using valves and instrumentation associated with Unit 2 steam generators 1 and 4 located in Fire Zones 34 and 34A, which are part of a separate fire area.

Fire Zone 44S contains cables and equipment associated with safe shutdown of D.C. Cook Units 1 and 2. A three-hour barrier has been provided between the Unit 1 and Unit 2 CCW pumps to ensure availability of one unit's pumps given a fire in the vicinity of the CCW pumps. Alternate shutdown capability is provided outside of this fire zone using Unit 1 equipment and either Unit 2 steam generators 2 and 3 or Unit 2 steam generators 1 and 4. The cables, valves and instrumentation located in Fire Zone 109 are not required to ensure safe shutdown capability given a fire in Fire Zone 44S, as alternate shutdown capability is provided in Fire Zones 34 and 34A.

Fire Protection Equipment

Automatic detection and automatic suppression are not provided in Fire Zone 111. Fire Zone 44S is provided with an ionization detection system. A dry pilot preaction sprinkler system is installed in Fire Zone 44S. This pilot-actuated sprinkler system is extended directly over the CCW pumps to spray against the CCW pump bearings. Manual suppression capabilities in the form of portable extinguishers and hose stations are available for use in both zones.

Fire Hazards Analysis

Fire Zone 44S has a fixed combustible loading of under 33,000 Btu/ft^2 for an equivalent fire severity of approximately 25 minutes. (The actual combustible loading and equivalent fire severity existing at this time are 19,192 Btu/ft^2 and 14.2 minutes, respectively.) An ionization detection system and a dry pilot preaction sprinkler system are located in this zone. Enhanced protection is provided over the CCW pumps from this pilot-actuated sprinkler system to spray against the pump bearings. The combination of automatic detection and the pilot-actuated sprinkler system covering the zone and the CCW pump bearings ensure early detection and suppression of a fire in the zone. This provides reasonable assurance that the three unrated hollow-metal doors adequately protect the openings in the barrier to Fire Zone 111. The existence of the automatic detection and suppression systems will tend to mitigate increases in the fixed combustible loading or the presence of transient combustibles, provided that the increases do not exceed the capabilities of the suppression system.

Fire Zone 111 has a fixed combustible loading of under 27,000 Btu/ft^2 and equivalent fire severity less than 20 minutes (the actual combustible loading and equivalent fire severity existing at this time are 838 Btu/ft^2 and 0.6 minutes, respectively.) Transient combustibles in the form of wood and oxy-acetylene cylinders are sometimes stored on the 587 ft elevation of Fire Zone 111. The combustible loading and equivalent fire severity in Fire Zone 111 due to transient combustibles are under 40,000 Btu/ft^2 and less than 30 minutes, respectively. The bottom of the three unrated doors are located approximately 22 ft above the floor of this zone in a vertical shaft along the east wall of Fire Zone 111 and west of Fire Zone 44S. Based upon their location, the doors would not be directly exposed to fire. In order to impact on the doors, heat and hot gases would have to rise up the shaft to below the 633 ft elevation and bank down to the level of the doors. Main steam piping penetrations exist in the west wall of Fire Zone 111 connecting it with Fire Zone 96 of the Turbine Building. Heat and hot gases rising up the shaft would tend to spill out into the Turbine Building and not bank down the shaft to the level of the doors. Based on the amount of fixed combustibles and the anticipated amount of transient combustibles, reasonable assurance is provided that a fire in Fire Zone 111 would not adversely impact on the capability of the doors to protect the openings in the barrier.

<u>Conclusion</u>

Based on the above evaluation, reasonable assurance is provided that a fire in Fire Zone 44S or Fire Zone 111 would not impair the safe shutdown capabilities of D.C. Cook Units 1 or 2. In addition, this evaluation does not adversely impact on other evaluations or exemption requests contained in this report.

The bases that justify the conclusion are summarized as follows:

(1) Fire Zone 44S has an equivalent fire severity of 25 minutes.

(2) Automatic detection and dry pilot preaction sprinklers are provided in this zone.

(3) Enhanced protection is provided over the CCW pumps from the pilot-actuated suppression system that sprays water on the CCW pump bearings.

(4) Increases in the fixed and/or transient combustible loadings in Fire Zone 44S would be mitigated by the presence of the automatic detection and suppression systems, provided that the increases do not exceed the capabilities of the suppression system.

(5) Fire Zone 111 has a fixed combustible loading under 27,000 Btu/ft^2 (The actual combustible loading existing at this time is negligible.)

(6) Transient combustibles in the form of wood and oxy-acetylene cylinders would be located on the 587 ft elevation of Fire Zone 111 with a combustible loading and equivalent fire severity of under 40,000 Btu/ft^2 and less than 30 minutes, respectively.

(7) The bottom of the doors are located in a vertical shaft approximately 22 ft above the floor of Fire Zone 111.

(8) In order to impact on the unrated hollow metal doors, heat and hot gases from a fire in Fire Zone 111 would have to rise up to the top of the shaft (at approximately the 633 ft elevation) and bank down to the level of the doors.

(9) Main steam line openings from Fire Zone 111 to Fire Zone 96 of the Turbine Building between the 620 and 631 ft elevations allow products of combustion to spill out into the Turbine Building as opposed to banking down to the level of the doors.

(10) Given a fire in Fire Zones 109 or 111, redundant safe shutdown capability is provided in Fire Zones 34 and 34A, which are located in a separate fire area.

(11) Given a fire in Fire Zone 44S, redundant safe shutdown capability is provided using either Unit 2 Steam Generators 2 and 3 (with associated cables, valves, and instrumentation located in Fire Zone 109) or Unit 2 Steam Generators 1 and 4 (with associated cables, valves, and instrumentation located in Fire Zones 34 and 34A).

(12) Replacing the unrated hollow metal doors with rated fire door assemblies would not significantly enhance protection provided by the existing configuration.

9.23 Fire Area 116 Boundary Evaluation

Purpose

The purpose of this evaluation is to analyze the impact of two manway openings connecting Fire Area 116 with adjacent fire areas on redundant safe shutdown capability. In addition, this evaluation does not adversely impact on other evaluations or exemption requests contained in this report.

Description

Fire Area 116 is a pipe tunnel located entirely below grade that travels from the east side of Unit 1 Containment to the west side of Unit 1 Containment. Fire Area 116 is at the 593 ft elevation along the east and north sides of Unit 1 Containment. On the east side, it is accessed by a ladder opening in the floor of Fire Zone 33 at the 612 ft elevation. Along the west side and for a short distance on the north side of Unit 1 Containment, Fire Area 116 is at the 586 ft elevation. Access down into the trench on the west side is from a ladder in Fire Area 12 at the

591 ft elevation. The trench opens directly to Fire Area 116 along the north wall of Fire Area 12. A distance in excess of 250 ft separates the openings from Fire Area 116 to Fire Area 12 and Fire Zone 33.

Safe Shutdown Equipment

Fire Area 116 contains no safe shutdown equipment. Fire Zone 33 contains the following valves and associated cabling for Steam Generators 1 and 4:

- o Safety valves
- o AFW feed regulation valves
- o Pressure transmitters
- o MSIVs
- o PORVs
- o LSI panel

Fire Zone 12 contains the following valves and associated cabling for Steam Generators 2 and 3:

- o AFW feed regulation valves
- o Containment sump to RHR pump suction valve
- o LSI panel

Should a fire involve both Fire Zone 33 and Fire Area 12, the potential exists to lose power to control the position of the AFW feed regulation valves for all four steam generators. However, the valves are normally open. Should fire damage the cables to these valves, they fail as is, which is in the open position.

Fire Protection Equipment

Automatic suppression and automatic detection are not provided in Fire Area 116 or Fire Area 12. Automatic detection was proposed for the fire area containing Fire Zone 33 in the March 1983 Appendix R Submittal to support the fixed area suppression exemption request for alternate shutdown. Manual suppression capabilities in the form of portable extinguishers are available for use in these locations with hose station also available for use in Fire Zones 33A, 33B and Fire Area 12. Two hose stations are currently being installed in Fire Area 12.

Fire Hazards Analysis

Fire Area 116 has a fixed combustible loading and resulting equivalent fire severity of under 13,000 Btu/ft^2 and 10 minutes respectively. (The actual combustible loading and equivalent fire severity existing at this time are 437 Btu/ft^2 and 0.2 minutes, respectively.) Transient combustibles are not postulated in this area as it is a radiation area with access controlled by Health Physics, and access to the area is via ladders. Maintenance activities are minimal in this area, and it is not a normal access route to any other plant locations. Reasonable assurance is provided that a fire in Fire Area 116 would not propagate out into either Fire Zone 33 or Fire Area 12. Therefore, the two manway openings do not adversely impact on the capabilities of the boundaries of Fire Area 116.

Fire Area 12 has a fixed combustible loading of under 20,000 Btu/ft^2 for an equivalent fire severity of under 15 minutes. (The actual combustible loading and equivalent fire severity existing at this time are 1,722 Btu/ft^2 and 1.2 minutes, respectively.) Maintenance activities are minimal in this area, and it is not a normal travel route to any other plant locations. As such, minimal transient combustibles are postulated in Fire Area 12. Should a fire occur in this area, the products of combustion would tend to rise to ceiling level. As the manway opening to Fire Area 116 is accessed via a ladder to a trench below the normal floor level of Fire Area 12, reasonable assurance is provided that a fire in Fire Area 12 would not propagate out into Fire Area 116. Therefore, the manway opening from the trench that connects Fire Area 116 and Fire Area 12 does not adversely impact on the capabilities of the barrier separating the two areas.

Fire Zone 33 is part of a fire area that also contains Fire Zones 33A, 33B and 105. The average fixed combustible loading in the fire area is under 27,000 Btu/ft^2 for an equivalent fire severity of under 20 minutes. (The actual combustible loading and equivalent fire severity existing at this time are under 11,530 Btu/ft^2 and less than 8.5 minutes, respectively.) Transient combustibles are postulated in Fire Zone 33A as it provides access to both the Unit 1 Containment and the Contractors Access Control Area (Fire Zone 122 and Fire Area 105, respectively) and Fire Zone 33.

Fire Zone 33A is a high ceiling area. As such, products of combustion from fire occurring in this zone would tend to rise to ceiling level. These products of combustion could propagate into Fire Zone 33 through the walkway opening and unsealed piping penetrations. This would, however, have minimal impact on the ladder opening to Fire Area 116 as Fire Zone 33 is a high ceiling area, and the ladder opening is located in the floor of Fire Zone 33. Reasonable assurance is provided that a fire in the fire area containing Fire Zone 33 would not propagate down into Fire Area 116 through the ladder opening. Therefore, the ladder opening that connects Fire Zone 33 and Fire Area 116 does not adversely impact on the capabilities of the barrier separating the two. While Fire Area 116 could be combined with either Fire Area 12 or Fire Zone 33, it is maintained as a separate fire area for the purposes of this evaluation.

Conclusion

Based on the above evaluation, reasonable assurance is provided that the two manway openings connecting Fire Area 116 with Fire Area 12 and Fire Zone 33 do not impair redundant safe shutdown capability. In addition, this evaluation does not adversely impact or other evaluations or exemption requests contained in this report.

The bases that justify this conclusion are summarized as follows:

(1) Fire Area 116 has a combustible loading of less than 13,000 Btu/ft^2 for an equivalent fire severity of 10 minutes.

(2) The combustible loading in Fire Area 12 is under 20,000 Btu/ft^2 for a fire severity of less than 15 minutes.

(3) The fire area containing Fire Zone 33 has an equivalent fire severity of under 20 minutes.

(4) Fires occurring in the fire area containing Fire Zone 33 would tend to rise to ceiling levels.

(5) The access opening to Fire Area 116 from Fire Area 12 is below the normal floor level of Fire Area 12; the access opening to Fire Area 116 from Fire Zone 33 is via a ladder opening in the floor of Fire Zone 33.

(6) A distance in excess of 250 ft separates the manway opening connecting Fire Area 12 and Fire Zone 33 with Fire Area 116.

(7) Should a fire propagate between Fire Area 12 and Fire Zone 33 through Fire Area 116, there would be no impact on safe shutdown capability as the AFW feed regulation valves all fail as is, which is in the open position.

(8) Protecting the manway openings to Fire Area 116 from Fire Area 12 and Fire Zone 33 with fire rated material would not significantly enhance the protection provided by the existing configuration.

9.24 Fire Area 117 Boundary Evaluation

Purpose

The purpose of this evaluation is to analyze the impact of two manway openings connect Fire Area 117 with adjacent fire areas on redundant safe shutdown capability. In addition, this evaluation does not adversely impact on other evaluations or exemption requests contained in this report.

Description

Fire Area 117 is a pipe tunnel located entirely below grade that travels from the east side of Unit 2 Containment to the west side of Unit 2 Containment. Fire Area 117 is at the 593 ft elevation along the east and south sides of Unit 2 Containment. On the east side, it is accessed by a ladder opening in the floor of Fire Zone 34 at the 612 ft elevation. Along the west side and for a short distance on the south side of Unit 2 Containment, Fire Area 117 is at the 586 ft elevation. Access down into the trench on the west side is from a ladder in Fire Area 22 at the 591 ft elevation. The trench opens directly to Fire Area 117 along the south wall of Fire Area 22. A distance in excess of 250 ft separates the openings from Fire Area 117 to Fire Area 22 and Fire Zone 34.

Safe Shutdown Equipment

Fire Area 117 contains no safe shutdown equipment. Fire Zone 34 contains the following valves and associated cabling for steam generators 1 and 4:

- o Safety valves
- o AFW feed regulation valves
- o Pressure transmitters
- o MSIVs
- o PORVs
- o LSI panel

Fire Zone 22 contains the valves and associated cabling for steam generators 2 and 3:

- o AFW feed regulation valves
- o Containment sump to RHR pump suction valve
- o LSI panel

Should a fire involve both Fire Zone 34 and Fire Area 22, the potential exists to lose power to control the position of the AFW feed regulation valves for all four steam generators. However, the valves are normally open. Should fire damage the cables to these valves, they fail as is, which is in the open position.

Fire Protection Equipment

Automatic suppression and automatic detection are not provided in Fire Area 117 or Fire Area 22. Automatic detection was proposed for the fire area containing Fire Zone 34 in the March 1983 Appendix R submittal to support the fixed area suppression exemption request for alternate shutdown. Manual suppression capabilities in the form of portable extinguishers are available for use in these locations, with hose stations also available for use in Fire Zone 34A, 34B and Fire Area 22. Two hose stations are currently being installed in Fire Area 22.

Fire Hazards Analysis

Fire Area 117 has a fixed combustible loading of under 13,000 Btu/ft^2 with a resultant equivalent fire severity of less than 10 minutes. (The actual combustible loading and equivalent fire severity existing at this time are 515 Btu/ft^2 and 0.4 minutes, respectively.) Transient combustible are not postulated in this area as it is a radiation area with access controlled by Health Physics, and access to the area is via ladders. Maintenance activities are minimal in this area, and it is not a normal access route to any other plant locations. Reasonable assurance is provided that a fire in Fire Area 117 would not propagate out into either Fire Zone 34 or Fire Area 22. Therefore, the two manway openings do not adversely impact on the capabilities of the boundaries of Fire Area 117.

Fire Area 22 has a combustible loading of under 13,000 Btu/ft^2 for an equivalent fire severity of under 10 minutes. (The actual combustible loading and equivalent fire severity existing at this time are 1,022 Btu/ft^2 and 0.6 minutes respectively.) Maintenance activities are minimal in this area, and it is not a normal travel route to any other plant locations. As such, minimal transient combustibles are postulated in Fire Area 22. Should a fire occur in this area, the products of combustion would tend to rise to ceiling level. As the manway opening to Fire Area 117 is accessed via a ladder to a trench below the normal floor level of Fire Area 22, reasonable assurance is provided that a fire in Fire Area 22 would not propagate out into Fire Area 117. Therefore, the manway opening from the trench that connects Fire Area 117 and Fire Area 22 does not adversely impact on the capabilities of the barrier separating the two areas.

Fire Zone 34 is part of a fire area that also contains Fire Zones 34A and 34B. The average fixed combustible loading in the fire area is under 20,000 Btu/ft^2 for an equivalent fire severity of under 15 minutes. (The actual combustible loading and equivalent fire severity existing at this time are under 5,909 Btu/ft^2 and less than 5 minutes, respectively.) Transient combustibles are postulated in Fire Zone 34A as it provides access to both Fire Zone 34 and Unit 2 Containment.

Fire Area 34A is a high ceiling area. As such, products of combustion from fires occurring in this zone would tend to rise to ceiling level. These products of combustion could propagate into Fire Zone 34 through the walkway opening and unsealed piping penetrations. This would, however, have minimal impact on the ladder opening to Fire Area 117 as Fire Zone 34 is also a high ceiling area, and the ladder opening is located in the floor of Fire Zone 34. Reasonable assurance is provided that a fire in the fire area containing Fire Zone 34 would not propagate down into Fire Area 117 through the ladder opening. Therefore, the ladder opening that connects Fire Zone 34 and Fire Area 117 does no adversely impact on the capabilities of the barrier separating the two. While Fire Area 117 could be combined with either Fire Area 22 or Fire Zone 34, it is maintained as a separate fire area for the purposes of this evaluation.

<u>Conclusion</u>

Based on the above evaluation, reasonable assurance is provided that the two manway openings connecting Fire Area 117 with Fire Area 22 and Fire Zone 34 do not impair redundant safe shutdown capability. In addition, this evaluation does not adversely impact on other evaluations or exemption requests contained in this report.

The bases that justify this conclusion are summarized as follows:

(1) Fire Area 117 has a combustible loading of under 13,000 Btu/ft^2 for an equivalent fire severity of under 10 minutes.

(2) The combustible loading in Fire Area 22 is under 13,000 Btu/ft^2 for an equivalent fire severity of less than 10 minutes.

(3) The fire area containing Fire Zone 34 has an equivalent fire severity of under 15 minutes.

(4) Fires occurring in the fire area containing Fire Zone 34 would tend to rise to ceiling levels.

(5) The access opening to Fire Area 117 from Fire Area 22 is below the normal floor level of Fire Area 22; the access opening to Fire Area 117 from Fire Zone 34 is via a ladder opening in the floor of Fire Zone 34.

(6) A distance in excess of 250 ft separates the manway openings connecting Fire Area 22 and Fire Zone 34 through Fire Area 117.

(7) Should a fire propagate between Fire Area 22 and Fire Zone 34 through Fire Area 117, there would be no impact on safe shutdown capability as the AFW feed regulation valves all fail as is, which is in the open position.

(8) Protecting the manway openings to Fire Area 117 from Fire Area 22 and Fire Zone 34 with fire rated material would not significantly enhance the protection provided by the existing configuration.

9.25 Essential Service Water Pump House Hatch and Fire Damper Evaluation

Purpose

The purpose of this evaluation is to analyze the impact of: (1) an unrated steel plate hatch located between the ceiling of the Circulating Water Pump Motor Control Room, Fire Zone 29G, and the floor of Unit 2 ESW Pump Cubicle, Fire Zone 29C (a three-hour fire-rated hatch assembly is not commercially available for use in this location); (2) undampered ventilation ducts located in the ceiling of Fire Zones 29A, 29B, 29C and 29D; and (3) screen mesh access gates into the Unit 1 and Unit 2 ESW pump cubicles on redundant safe shutdown capability or the full area suppression exemption requests in the Essential Service Water (ESW) Pump House. In addition, this evaluation does not adversely impact on other evaluations or exemption requests contained in this report.

Description

Fire Zone 29G is located directly below the Unit 1 Essential Service Water (ESW) Pump Cubicles (Fire Zones 29A and 29B), and the Unit 2 ESW Pump Cubicles (Fire Zones 29C and 29D). Fire Zones 29A and 29B are separated from Fire Zones 29C and 29D by a three-hour-rated barrier. Undampered HVAC supply air openings exist in the ceiling of all four fire zones, with unsealed piping penetrations through the ceiling of the Unit 1 cubicles and sealed penetrations through the ceiling of the Unit 2 cubicles. An open walkway connects Fire Zone 29A and Fire Zone 29B of Unit 1, while a similar walkway connects Fire Zone 29C and Fire Zone 29D. An open curbed stairway from Fire Zone 29B provides access to Fire Zone 29G, while an unrated steel plate hatch in the ceiling of Fire Zone 29G provides access to Fire Zone 29C. The ESW Pump House is located within the larger screenhouse area. The roof of the ESW Pump House is at elevation 610 ft-0 in., while the roof of the Screen House is at elevation 635 ft-7 in.

Safe Shutdown Equipment

Fire Zones 29A and 29B contain the Unit 1 East and West ESW pumps, respectively. Fire Zones 29C and 29D contain the Unit 2 East and West ESW pumps, respectively. The Unit 1 ESW pumps provide alternate shutdown capability for a fire occurring in the Unit 2 ESW pump cubicles. Conversely, the Unit 2 ESW pumps provide alternate shutdown capability for a fire occurring in the Unit 1 ESW pump cubicles. Fire Zone 29G contains cables for the components of both Units 1 and 2 ESW systems. The cables are in conduit, which are protected by minimum one-hour fire-rated material.

Fire Protection Equipment

Automatic detection systems are provided in the Unit 1 ESW pump cubicles (Fire Zones 29A and 29B) and in the Circulating Water Pump Motor Control Room (Fire Zone 29G). (See Sections 8.9.2 and 8.11.2.) Automatic detection systems are currently being installed in the Unit 2 ESW pump cubicles (Fire Zones 29C and 29D). (See Section 8.1.0.2.) Automatic suppression is not provided in any of these fire zones as identified in exemption requests 7.5, 7.6, and 7.7. Manual suppression capabilities in the form of portable extinguishers and hose stations are available for use in these zones.

Fire Hazards Analysis

For a fire to adversely impact on redundant safe shutdown capability, fire must involve Units 1 and 2 ESW pumps and cubicles. For a fire in Fire Zones 29A and 29B (Unit 1 ESW pump cubicles), alternate shutdown capability is provided by utilizing Unit 2 ESW pumps. For a fire in Fire Zones 29C and 29D (Unit 2 ESW pump cubicles), alternate shutdown capability is provided by utilizing Unit 1 ESW pumps.

The required safe shutdown cables in Fire Zone 29G has been protected by a minimum of one-hour fire-rated material, thus a fire in Fire Zone 29G will not affect safe shutdown.

Fire Zone 29G and Fire Zones 29A and 29B communicate by an open stairway. A fire can be postulated to involve these fire zones (29A, 29B and 29G). In this case, Unit 1 ESW pumps are potentially affected and Unit 2 ESW pumps, located in Fire Zones 29C and 29D, should be utilized to provide required cooling water for both units.

The steel plate hatch is located in the floor/ceiling assembly separating Fire Zone 29G from Fire Zone 29C. Undampered HVAC supply air openings exist in the ceiling of Fire Zones 29A, 29B, 29C, and 29D. Screen mesh access gates provides access into the Unit 1 and Unit 2 ESW pumps from the Screenhouse, Fire Zone 142. For fire to adversely impact on redundant safe shutdown capability, fire must either:

(1) Spread from Fire Zone 29G up through the open stairway to Fire Zone 29B of Unit 1 and through the steel plate hatch to Fire Zone 29C of Unit 2;

(2) Spread from the ESW pump cubicles of one unit (through the open stairway of Unit 1 or the steel plate hatch of Unit 2) down into Fire Zone 29G and then propagate up into the ESW pump cubicles of the opposite unit (through the open stairway of Unit 1 or the steel plate hatch of Unit 2);

(3) Spread through the undampered HVAC supply air openings in the ceiling of Fire Zones 29A, 29B, 29C and 29D; or

(4) Spread through Fire Zone 142 into Fire Zones 29A and 29B and Fire Zones 29C and 29D) via the screen mesh access gates from a fire originating either in Fire Zone 142 or in the Unit 1 or Unit 2 ESW pump cubicles.

For the first two fires that are postulated, a fire of sufficient duration and intensity would be required to challenge the inherent fire protection capabilities of the steel plate hatch. The failure point of exposed structural steel is taken to be when its load carrying capability is reduced to 60% of its yield strength. This limit normally occurs when the temperature of the steel reaches 1000°F. Under the ASTM E119 Standard Time-Temperature curve, an equivalent fire severity of 5-10 minutes is required to achieve this temperature. Although the steel plate hatch located in the barrier separating Fire Zones 29C and 29G is not a load carrying structural component, the failure criteria of structural steel can be applied to the steel plate hatch to establish a conservative base above which failure could be postulated.

For the third and fourth postulated fires, a fire would have to travel from the ESW pump cubicles of one unit to the ESW pump cubicles of the other unit, or into each of the four pump cubicles simultaneously. The path of fire spread for the third postulated fire would have to be via the undampered HVAC supply air openings of each cubicle and involve the transient combustible loading on the roof of the ESW pump house. For the fourth postulated fire, a fire would have to spread into the Unit 1 and Unit 2 ESW pump cubicles through the Screen House, Fire Zone 142. Each is discussed separately below.

<u>Postulated Fire No. 1</u>

Fire Zone 29G has a fixed combustible loading of under 13,000 Btu/ft^2 for an equivalent fire severity of under 10 minutes. (The actual combustible loading and equivalent fire severity existing at this time are under 11,858 Btu/ft^2 and 8.8 minutes, respectively.) An equivalent fire severity of 10 minutes would raise the temperature of the steel plate hatch up to 1000°F. Significant quantities of transient combustibles are not postulated in Fire Zone 29G due to its controlled access (via locked screen gate doors into Fire Zones 29A and 29B and Fire Zones 29C and 29D), and the lack of easy transport of combustibles down into the zone (the open stairway from Fire Zone 29B and the ladder from the hatch from Fire Zone 29C). The stairway is also provided with a 6 in. high curb that will prevent spilled combustible liquids from flowing down into Fire Zone 29G from above. In conjunction with accessibility problems, over 200 lbs of wood (with a heat potential of 8000 Btu/lb) would be required to raise the equivalent fire severity in Fire Zone 29G by one minute. Since there are no pumps, sumps, or other similar equipment in the zone, lubricating oil is not postulated as a transient combustible as it is not required for maintenance purposes.

The combustible loading in Fire Zone 29G would raise the temperature of the steel plate hatch up to 1000°F. However, two issues mitigate the potential for this to occur. The first is the existing automatic detection system in Fire Zone 29G. Postulated fires would be quickly detected and annunciated in the Control Room, resulting in fire brigade response to the zone. The second is the open stairway to Fire Zones 29A and 29B. Heat building up at ceiling level in Fire Zone 29G would tend to flow up the stairway into Fire Zones 29A and 29B. This would limit heat buildup in the vicinity of the steel plate hatch. Therefore, while fire could spread from Fire Zone 29G up the open stairway to Fire Zones 29A and 29B, reasonable assurance is provided that it will not simultaneously spread through the steel plate hatch into Fire Zones 29C and 29D.

Postulated Fire No. 2

Fire Zones 29A and 29B have a fixed combustible loading of approximately 20,000 Btu/ft^2 for an equivalent fire severity of approximately 15 minutes. (The actual combustible loading and equivalent fire severity existing at this time are 6,842 Btu/ft^2 and 5.1 minutes, respectively.) Transient combustibles would take the form of lubricating oil during change out of the ESW pumps. Each ESW pump contains five gallons of lube oil for a total of ten gallons. Assuming that two five-gallon cans (at a heat potential of 146,100 Btu/gal) are brought in for maintenance purposes, the equivalent fire severity would be increased by less than 5 minutes, for a total equivalent fire severity from fixed and transient combustibles of approximately 20 minutes.

A fire resulting from this quantity of fixed and transient combustibles could spread down through the stairway opening into Fire Zone 29G. However, due to the natural tendency for fire to spread upwards and outwards, this would only result from a spill of lubricating oil down the stairway. The potential for this to occur is limited by the 6-in. high curb around the perimeter of the stairway. Fire would then have to spread through Fire Zone 29G into Fire Zones 29C and 29D through the unrated hatch. This scenario was previously addressed and is not a credible event.

Fire Zones 29C and 29D have a fixed combustible loading of approximately 20,000 Btu/ft^2 for an equivalent fire severity of approximately 15 minutes. (The actual combustible loading and equivalent fire severity existing at this time are 6,842 Btu/ft^2 and 5.1 minutes, respectively.) Transient combustibles would take the form of lubricating oil during change-out of the ESW pumps. Each ESW pump contains five gallons of lube oil for a total of ten gallons. Assuming that two 5-gal cans (at a heat potential of 146,100 Btu/gal) are brought in for maintenance purposes, the equivalent fire severity would be increased by less than five minutes, for a total equivalent fire severity from fixed and transient combustibles of under 20 minutes. An equivalent fire severity of under ten minutes would raise the temperature of the steel hatch up to 1000°F. However, the hatch is located in the floor of Fire Zone 29C. The higher temperatures associated with a fire in either Fire Zone 29C or 29D would tend to be near ceiling level. Floor-based temperatures should be considerably lower than those at ceiling level. The floor hatch entrance is also raised above the rest of the floor by a 12 in. high curb. This curb will prevent spilled combustible liquids from burning directly on the hatch and flowing down through the hatch in Fire Zone 29G below. Automatic detection is provided in Fire Zones 29C and 29D. This combination of detection, an equivalent fire severity of under 20 minutes, and curbed hatch provides reasonable assurance that a fire involving fixed and/or transient combustibles in Fire Zones 29C and 29D would not adversely impact on the capability of the steel plate hatch to protect the opening in the barrier.

Postulated Fire No. 3

For the third postulated fire, sufficient combustible material must be present on the roof of the ESW Pump Cubicles to impact on redundant safe shutdown capabilities in Fire Zones 29A and 29B and Fire Zones 29C and 29D. Ignition of this material either independently or as the result of a fire in the Unit 1 or Unit 2 ESW Pump Cubicles could result in loss of redundant safe shutdown capability. The roof of the cubicles is used for temporary storage of significant amounts of wood, rubber hoses, and the like. Therefore, the postulated fires previously addressed in this evaluation could spread up through the undampered HVAC supply air openings and ignite the material on the roof. Ignition of material on the roof in this manner, or ignition of the material independently, could result in fire being pulled through the supply air openings into redundant ESW pump cubicles simultaneously. As such, three-hour-rated dampers will be installed in the HVAC openings to the Unit 2 ESW Pump Cubicles. This will ensure that the Unit 2 ESW Pump Cubicles will be unaffected by a fire involving transient combustibles on the roof of the cubicles. Fire could spread down through the undampered openings into Fire Zones 29A and 29B. However, as previously demonstrated, a fire in Fire Zones 29A and 29B that spreads down into Fire Zone 29G will not result in a fire of sufficient duration that will challenge the steel plate hatch and spread up into Fire Zones 29C and 29D.

Postulated Fire No. 4

For the fourth postulated fire, sufficient combustible material must be present in the Screenhouse, Fire Zone 142, to allow fire to spread between the Unit 1 and Unit 2 ESW pump cubicles via the screen mesh access gates. This would involve fire spreading a linear distance of approximately 175 ft. Fire Zones 29A and 29B and Fire Zones 29C and 29D have fixed and transient combustible loadings of approximately 20,000 Btu/ft^2 for equivalent fire severities of approximately 15 minutes. (The actual combustible loading and equivalent fire severity existing at this time are 6,842 Btu/ft^2 and 5.1 minutes, respectively.) Fire Zone 142 has a fixed combustible loading of approximately 53,000 Btu/ft^2 for equivalent fire severity of 40 minutes. (The actual combustible loading and equivalent severity existing at this time are 25,652 Btu/ft^2 and 19 minutes, respectively.) With a floor area of approximately 18,608 ft^2, it would take a transient combustible loading of 3100 lbs. of wood at 8000 Btu/lb. to result in a transient fire severity of one minute. Fires occurring in, or spreading into, Fire Zone 142 would tend to rise up to ceiling level. Fire Zone 142 has a ceiling height of approximately 45 ft, while that of the ESW pump cubicles is approximately 15 ft. Based on the amount of combustible loading in the Unit 1 and Unit 2 ESW pump cubicles and in the Screenhouse, along with the 45 ft vs. 15 ft ceiling heights between the two, fire spreading through the Screenhouse to/from the ESW pump cubicles of both units is not a credible event.

Conclusion

Based on the above evaluation, reasonable assurance is provided that a fire originating: (1) on the roof of ESW Pump House; (2) in Fire Zones 29A and 29B; (3) in Fire Zone 29G; (4) in Fire Zones 29C and 29D; or (5) in Fire Zone 142, would not impair safe shutdown capabilities of D.C. Cook Units 1 and 2. In addition, this evaluation does not impact on the bases of the full area and fixed suppression exemption requests in the ESW Pump House and it does not adversely impact on other evaluations or exemption requests contained in this report.

The bases that justify the conclusion are summarized as follows:

(1) An equivalent fire severity of 5-10 minutes is required to raise the temperature of load carrying structural steel up to its failure point of 1000°F.

(2) The steel plate hatch is not a load carrying structural component; however, a 5-10 minute fire severity can be used to establish a conservative base above which failure could be postulated without additional fire protection.

(3) In order to impact on redundant safe shutdown capability, fire would have to spread either through the hatch separating Fire Zones 29C and 29D from Fire Zone 29G, or into the Unit 1 and Unit 2 ESW cubicles via the undampered HVAC supply air openings in the ceiling of all four cubicles, (however, a modification is proposed to install fire-rated dampers in the ceiling of Fire Zones 29C and 29D, making this path of spread not a credible event) or through the screen mesh access gates into Fire Zones 29A, 29B, 29C, and 29D. The potential paths for fire spread through these openings are as follows:

(a) From Fire Zones 29A and 29B down into Fire Zone 29G and then up through the unrated hatch into Fire Zones 29C and 29D;

(b) From Fire Zones 29A and 29B up to the roof of the ESW Pump House through the undampered HVAC supply air openings and then down into Fire Zones 29C and 29D;

(c) From Fire Zones 29C and 29D down through the unrated hatch into Fire Zone 29G and then up into Fire Zones 29A and 29B;

(d) From Fire Zones 29C and 29D up to the roof of the ESW Pump House through the undampered HVAC supply air openings and then down into Fire Zones 29A and 29B;

(e) From the roof of the ESW Pump House down through the undampered HVAC supply air openings into Fire Zones 29A and 29B and Fire Zones 29C and 29D simultaneously;

(f) From Fire Zone 29G up the open stairway into Fire Zones 29A and 29B and through the unrated hatch into Fire Zones 29C and 29D simultaneously;

(g) From Fire Zones 29A and 29B (or Fire Zones 29C and 29D) out through the screen mesh access gate into Fire Zone 142 then through the screen mesh access gate into Fire Zones 29C and 29D (or Fire Zones 29A and 29B); or

(h) Into Fire Zones 29A and 29B and Fire Zones 29C and 29D simultaneously through the screen mesh access gates from Fire Zone 142.

(4) Fire Zone 29G has an equivalent fire severity of under ten minutes; over 200 lbs of wood or 11 gallons of lubricating oil would be required to raise the fire severity by one minute.

(5) Access and transport of combustibles into Fire Zone 29G is restricted by the locked screen mesh access gates above, the stairway from Fire Zone 29B, and the ladder from Fire Zone 29C. In addition, the 6 in. high curb around the stairway opening and 12 in. high curb around the hatch entrance will prevent flow of spilled combustible liquids down into Fire Zone 29G from Fire Zones 29B and 29C respectively.

(6) Fire Zones 29A and 29B and Fire Zones 29C and 29D have an equivalent fire severity of under 15 minutes; transient combustibles (lubricating oil) during maintenance activities could raise the fire severity by under ten minutes.

(7) Due to the location of the steel plate hatch, in the floor of Fire Zone 29C, the only credible fire to impact on the hatch is one that occurs in Fire Zone 29G below. A postulated fire in Fire Zone 29G would be quickly detected, resulting in fire brigade response. In addition, heat building up at ceiling level in Fire Zone 29G would tend to flow up the open stairway to Fire Zones 29A and 29B. Reasonable assurance is provided that a fire in Fire Zone 29G will not spread simultaneously to Fire Zones 29A and 29B and Fire Zones 29C and 29D.

(8) Three-hour-rated dampers will be installed in the HVAC openings in the ceiling of Fire Zones 29C and 29D.

(9) Automatic detection is provided throughout the ESW Pump House (in Fire Zones 29A, 29B, 29C, 29D and 29G).

(10) Replacing the steel plate hatch with one of rated construction would not significantly enhance the protection provided by the existing configuration and proposed modification.

(11) The screen mesh access gates into Fire Zones 29A and 29B and into Fire Zones 29C and 29D are separated by a linear distance of approximately 175 ft. Due to the 40 minute equivalent fire severity in Fire Zone 142, the 15 minute equivalent fire severity in Fire Zones 29A and 29B and Fire Zones 29C and 29D, and the 45-ft ceiling height of the Screenhouse, reasonable assurance is provided that fire will not spread between the Unit 1 and Unit 2 ESW pump cubicles via the Screenhouse.

9.26 Fire Area 9 and Fire Area 10 Boundary Evaluation

Purpose

The purpose of this evaluation is to analyze the impact of combining Fire Area 9 with Fire Area 10 on redundant safe shutdown capability. This combination will reduce the number of fire area boundaries which require surveillance. In addition, this evaluation does not adversely impact on other evaluations or exemption requests contained in this report.

Description

Fire Area 9 is the Unit 1 Quadrant 3N Cable Tunnel located on the 596 ft elevation of the Auxiliary Building. Fire Area 10 is the Quadrant 3M Cable Tunnel and is located directly south of Fire Area 9 on the 596 ft elevation.

Safe Shutdown Equipment

Fire Areas 9 and 10 do not contain safe shutdown components; however, each area contains safe shutdown cables. Fire Area 10 contains safe shutdown cables for the following Unit 1 components:

Hot Shutdown Components

(1) One train of steam generators 1, 2, 3 and 4 level instrumentation;

(2) One train of auxiliary feedwater supply valves for steam generators 2 and 3;

(3) One train of pressurizer water level instrumentation;

(4) One train of RCS pressure instrumentation;

(5) Steam generators 1 and 4 PORVs;

(6) Reactor head vent valves;

(7) Post-accident sampling vent valves;

(8) Loops 2 and 3 cold leg temperature instrumentation;

(9) Loops 2 and 3 hot leg temperature instrumentation;

(10) One pressurizer PORV block valve (power only);

(11) One pressurizer PORV; and

(12) One train of letdown isolation valves.

Cold Shutdown Components

(1) One RHR inlet and one RHR outlet isolation valves; and

(2) Loops 1 and 3 safety injection accumulators valves.

Fire Area 9 contains safe shutdown cables for the following Unit 1 components:

Hot Shutdown

(1) Two pressurizer PORV block valves (power only).

Cold Shutdown

(1) Loops 2 and 4 safety injection accumulator valves; and

(2) One RHR inlet isolation valve.

Fire Protection Equipment

Fire Area 9 and Fire Area 10 are both provided with automatic CO_2 suppression systems and automatic detection systems.

Fire Hazards Analysis

In order to mitigate possible spurious operation, the following valves will require deenergizing from the Control Room for hot shutdown:

(1) One reactor head vent;

(2) One post-accident sampling vent valve;

(3) One pressurizer PORV; and

(4) Steam generators 1 and 4 PORVs.

In order to achieve cold shutdown, the following valves would require manual operation:

(1) Two RHR inlet isolation valves;

(2) Loops 1, 2, 3 and 4 safety injection accumulator valves; and

(3) RHR outlet isolation valve.

Based upon the previously identified modifications and manual operator actions, one train of safe shutdown systems and components will be available independent of combined Fire Areas 9 and 10.

Conclusion

Based on the above evaluation, reasonable assurance is provided that a fire in combined Fire Areas 9 and 10 would not impair the safe shutdown capabilities at D.C. Cook Units 1 or 2.

In addition, this evaluation does not adversely impact on other evaluations or exemption requests contained in this report.

The bases that justify this conclusion are summarized as follows:

(1) Redundant steam generator level instrumentation exists outside Fire Areas 9 and 10.

(2) Loops 1 and 4 hot and cold leg temperature indication is unaffected.

(3) Safety injection accumulators and RHR inlet and outlet isolation valves are located outside Fire Areas 9 and 10 allowing the valves to be manually operated.

(4) The capability to deenergize the following valves to fail in safe position is available from the Control Room; reactor head vent valves, steam generator PORVs, post-accident sampling vent valves and pressurizer PORVs.

(5) One train of redundant safe shutdown systems and components are available independent of Fire Areas 9 and 10 combined.

(6) Both fire areas are provided with automatic CO_2 suppression systems.

9.27 Fire Area 24 and Fire Area 25 Boundary Evaluation

Purpose

The purpose of this evaluation is to analyze the impact of combining Fire Area 24 with Fire Area 25 on redundant safe shutdown capability. This combination will reduce the number of fire area barriers which require surveillance.

In addition, this evaluation does not adversely impact on other evaluations or exemption requests contained in this report.

Description

Fire Area 24 is the Unit 2 Quadrant 3M Cable Tunnel located on the 596 ft elevation of the Auxiliary Building. Fire Area 25 is the Quadrant 3S Cable Tunnel and is located directly south of Fire Area 24 on the 596 ft elevation.

Safe Shutdown Equipment

Fire Areas 24 and 25 do not contain safe shutdown components; however, each area contains safe shutdown cables. Fire Area 24 contains safe shutdown cables for the following Unit 2 components:

Hot Shutdown Components

(1) Two out of four trains of steam generators 1, 2, 3 and 4 level instrumentation;

(2) One train of auxiliary feedwater supply valves for steam generators 1 and 4;

(3) Two out of four trains of pressurizer water level instrumentation;

(4) One train of RCS pressure instrumentation;

(5) Reactor head vent valves;

(6) Post-accident sampling vent valves;

(7) Loops 2 and 3 cold leg temperature instrumentation;

(8) Loops 2 and 3 hot leg temperature instrumentation;

(9) One pressurizer PORV block valve (power only);

(10) One pressurizer PORV;

(11) One train of letdown isolation valves;

(12) Two out of three of steam generators 1 and 4 pressure instrumentation; and

(13) One train of source range monitoring channel.

(14) 2-LSI-6XX

<u>Cold Shutdown Components</u>

(1) One RHR inlet and one RHR outlet isolation valves; and

(2) Loops 1 and 3 safety injection accumulators valves.

Fire Area 25 contains safe shutdown cables for the following Unit 2 components:

<u>Hot Shutdown</u>

(1) Two pressurizer PORV block valves (power only).

<u>Cold Shutdown</u>

(1) Loops 2 and 4 safety injection accumulator valves; and

(2) One RHR inlet isolation valve.

<u>Fire Protection Equipment</u>

Fire Area 24 and Fire Area 25 both have automatic CO_2 suppression systems and automatic detection systems.

Fire Hazards Analysis

In order to mitigate possible spurious operation, the following valves will require deenergizing from the Control Room for hot shutdown:

(1) One reactor head vent;

(2) One post-accident sampling vent valve; and

(3) One pressurizer PORV.

In order to achieve cold shutdown, the following valves would require manual operation:

(1) Two RHR inlet isolation valves;

(2) Loops 1, 2, 3 and 4 safety injection accumulator valves; and

(3) RHR outlet isolation valve.

Based upon the previously identified modifications and manual operator actions, one train of safe shutdown systems and components will be available independent of combined Fire Areas 24 and 25.

Conclusion

Based on the above evaluation, reasonable assurance is provided that a fire in combined Fire Areas 24 and 25 would not impair the safe shutdown capabilities at D.C. Cook Unit 2. In addition, this evaluation does not adversely impact on other evaluations or exemption request contained in this report.

The bases that justify this conclusion are summarized as follows:

(1) Redundant steam generator level instrumentation exists outside Fire Areas 24 and 25.

(2) Loops 1 and 4 hot and cold leg temperature indication is unaffected.

(3) Safety injection accumulators and RHR inlet and outlet isolation valves are located outside Fire Areas 24 and 25 allowing the valves to be manually operated.

(4) The capability to deenergize the following valves to fail in safe position is available from the Control Room; reactor head vent valves, post-accident sampling vent valves and pressurizer PORVs.

(5) One train of redundant safe shutdown systems and components are available independent of Fire Areas 24 and 25 combined.

(6) Both fire areas are provided with automatic CO_2 suppression systems.

9.28 Fire Area 61 and Fire Zone 5 Boundary Evaluation

Purpose

The purpose of this evaluation is to analyze the impact of combining Fire Area 61 with the fire area containing Fire Zones 5, 6A, 6N, 6M, 6S, 64A, 64B, 65A and 65B on redundant safe shutdown capability. This combination will reduce the number of fire area boundaries which require surveillance. In addition, this evaluation does not adversely impact on other evaluations or exemption requests contained in this report.

Description

Fire Zones 64A, 64B, 65A and 65B are the Unit 1 and Unit 2 Safety Injection Pump Rooms on the 587 ft elevation in the Auxiliary Building. Fire Zones 5, 6N, 6M and 6S are the east and west common areas of Units 1 and 2 on the 587 ft elevation in the Auxiliary Building. Fire Zone 6A is a pipe tunnel located on the 601 ft elevation of the Auxiliary Building above Fire Zones 5, 6N, 6M, 6S, 62A, 62B, 62C, 63A, 63B and 63C. Fire Area 61 is the Spray Additive Tank Room located on the 587 ft elevation of the Auxiliary Building adjacent to Fire Zone 5. Fire Zones 62A, 62B, and 62C are Unit 1 charging pump cubicles and Fire Zones 63A, 63B, and 63C are Unit 2 charging pump cubicles located on 587 ft elevation of Auxiliary Building adjacent to Fire Zone 5.

Safe Shutdown Equipment

Fire Area 61 does not contain safe shutdown components or cables. Fire Zones 5, 6A, 6N, 6M, 6S, 64A, 64B, 65A and 65B contain safe shutdown cables and/or components for both Units 1 and 2.

Fire Protection Equipment

Fire detection systems are installed throughout Fire Zones 5, 6N, 6M, 6S, 64A, 64B, 65A, 65B and Fire Area 61. Automatic suppression is provided in Fire Zones 5, 6N, 6M, 6S, 64A, 64B, 65A and 65B but not in Fire Area 61. Manual suppression capabilities in the form of portable extinguishers and hose stations are available for use in both fire areas.

Fire Hazards Analysis

Fire Area 61 is separated from Fire Zone 5 by reinforced concrete walls. Fire Area 61 has a fixed combustible loading of under 27,000 Btu/ft^2, which corresponds to an equivalent fire severity of 20 minutes. (The actual combustible loading and equivalent fire severity existing at this time are 13,846 and 10.4 minutes, respectively.) Automatic detection is provided in Fire Area 61, which will provide early warning and prompt manual fire fighting activities. If a fire was to start in Fire Area 61, reasonable assurance is provided that the fire would be contained and burn out before it spreads to Fire Zone 5. This can be accredited to the fire severity of less than 20 minutes and the existence of concrete walls. If the fire was to spread from Fire Area 61 to Fire Zone 5, the automatic detection and suppression systems in Fire Zone 5 would actuate and control and/or extinguish the fire before it could damage the safe shutdown cables in Fire Zone 5.

Fire Zone 5, which is adjacent to Fire Area 61, has a combustible loading of under 27,000 Btu/ft^2 for an equivalent fire severity of 20 minutes (the actual combustible loading and equivalent fire severity existing at this time are 11,229 Btu/ft^2 and 8.5 minutes, respectively); however, Fire Zone 5 is provided with an automatic detection system and an automatic preaction sprinkler system.

Since Fire Area 61 does not contain safe shutdown cables or components, combining it with the fire area containing Fire Zones 5, 6A, 6N, 6S, 6M, 64A, 64B, 65A and 65B will not impact safe shutdown capability. The compliance strategy for these zones will be the same as identified in the 1983 Appendix R submittal.

Conclusion

Based on the above evaluation, reasonable assurance is provided that combining Fire Area 61 with Fire Zones 5, 6A, 6N, 6M, 6S, 64A, 64B, 65A, and 65B will not impair the safe shutdown capabilities of D.C. Cook Units 1 and 2.

The bases that justify the conclusion are summarized as follows:

(1) Fire Area 61 has an equivalent fire severity of less than 20 minutes.

(2) Fire Area 61 is separated with reinforced concrete walls that will limit fire spread to Fire Zone 5.

(3) Fire Area 61 is provided with an automatic detection system.

(4) Fire Area 61 does not contain safe shutdown components or cables; therefore, combining Fire Area 61 with fire area containing Fire Zones 5, 6A, 6N, 6M, 6S, 64A, 64B, 65A and 65B will not add any safe shutdown cables or components.

(5) Manual fire suppression systems are available for both fire areas.

(6) If a fire should spread from Fire Area 61 to Fire Zone 5, the automatic detection and the automatic preaction sprinkler suppression systems would control and/or extinguish the fire before it could damage the safe shutdown cables and components in Fire Zone 5.

9.29 Fire Area 105 and Fire Areas 33, 33A, 33B Boundary Evaluation

Purpose

The purpose of this analysis is to analyze the impact of combining Fire Area 105 with the fire area containing Fire Zones 33, 33A, 33B on safe shutdown capability. This combination will reduce the number of fire area boundaries which require surveillance. In addition, this evaluation does not adversely impact on other evaluations or exemption requests contained in this report.

Description

Fire Area 105 ~~is~~ the Unit 1 Contractor Access Control Building located on the 612 ft elevation directly north of Fire Zone 33A. Fire Zone 33A is the Unit 1 East Main Steam Line Area located on the 612 ft elevation of the Auxiliary Building. Fire Zone 33B is the Unit 1 Nonessential Service Water Valve Area located southwest of Fire Zone 33A on the 612 ft elevation of the Auxiliary Building. Fire Zone 33 is the Unit 1 East Main Steam Valve Enclosure located southeast of Fire Zone 33A on the 612 ft elevation of the Auxiliary Building.

Safe Shutdown Equipment

Fire Area 105 does not contain safe shutdown components or cables. The fire area containing Fire Zones 33, 33A, 33B contains the following safe shutdown components: Unit 1 steam generators 1 and 4 PORVs, auxiliary feedwater supply valves, steam generators 1 and 4 main steam stop valves (MSSVs), steam generators 1 and 4 pressure transmitters, and Unit 1 Local Shutdown Indication panels LSI-1 and LSI-5. Fire Zones 33, 33A, and 33B also contain safe shutdown cables for the above-mentioned safe shutdown components.

Fire Protection Equipment

Fire Area 105 is provided with an automatic wet pipe sprinkler system. Detection system is provided for Fire Zones 33, 33A, and 33B. Manual deluge water spray system is provided for the charcoal filter units located in Fire Zone 33A.

Fire Hazards Analysis

Since Fire Area 105 does not contain safe shutdown cables or components, combining it with the fire area containing Fire Zones 33, 33A and 33B, will not affect safe shutdown. The safe shutdown compliance strategy for both of these areas will be the same as previously identified in the 1983 Appendix R submittal where safe shutdown is achievable independent of both fire areas.

Fire Zones 33A and 33B, which are part of Fire Area 33, 33A and 33B, were addressed in the seismic gap exemption request (see Section 7.14). The exemption request concluded that a fire starting from Fire Zone 33B may propagate through the seismic gap to Fire Zones 33A, 38, and 108. The bases for this justification is still acceptable if Fire Area 105 is combined with Fire Zones 33, 33A and 33B for the following reasons:

(1) Fire Area 105 does not communicate directly with Fire Zone 33B. It only communicates with Fire Zone 33A.

(2) The combustibles in Fire Area 105 are separated from Fire Zone 33A by unrated gypsum walls with unsealed penetrations and unrated access doors.

(3) A fire propagating through the seismic gap between Fire Zones 33B, 38, and 108 would be limited as stated in the seismic gap evaluation because of the low combustible loading near the seismic gap and/or presence of detection and suppression systems.

(4) Redundant safe shutdown systems and components are independent of Fire Zones 33A, 33B, 38 and 108 as stated in the previous seismic gap evaluation.

Fire Zone 33, which is part of Fire Area 33, 33A, and 33B, was also part of a boundary evaluation involving Fire Area 116 (see Section 9.23). Fire Area 116 is a pipe tunnel in excess of 250 ft connecting Fire Zone 33 and Fire Area 12. As previously stated in this analysis (Section 9.23), if a fire were to propagate through Fire Zone 33 and Fire Area 116 and Fire Area 12, safe shutdown would not be affected. Since Fire Area 105 is not adjacent to Fire Zone 33 and does not contain safe shutdown components or cables, it will not jeopardize the justifications for this evaluation.

The Fire Area 33, 33A, 33B exemption request asked for an exemption from the requirement for a fixed suppression system installed in the areas where alternate shutdown capability exist as required by III.G.3 of Appendix R (see Section 7.8). The justifications for this exemption are summarized as follows:

(1) Affected components in the fire area have alternate shutdown capability.

(2) The components of concern are horizontally separated by greater than 100 ft.

(3) The combustible loading in the fire area is under 27,000 Btu/ft^2 with an equivalent fire severity of approximately 20 minutes. (The actual combustible loading and equivalent fire severity existing at this time are 9,530 Btu/ft^2 and 7 minutes, respectively.)

(4) The modifications required to meet Section III.G.3 would not significantly enhance fire protection safety above that provided by present commitments.

Fire Area 105 has a combustible loading of under 33,000 Btu/ft^2 which corresponds to a fire severity of 25 minutes. (The actual combustible loading and equivalent fire severity existing at this time are 15,619 and 11.7 minutes, respectively.) However, Fire Area 105 is provided with an automatic wet pipe sprinkler system.

If a fire were to start in Fire Area 105, it would be extinguished before it could spread to Fire Zone 33B. Therefore the exemption request for Fire Area 33, 33A, 33B is unaffected by combining Fire Area 105 with Fire Area 33, 33A, 33B.

Conclusion

Based on the above evaluation, reasonable assurance is provided that combining Fire Area 105 with the fire area that contains Fire Zones 33, 33A and 33B will not impair the safe shutdown capabilities of D.C. Cook Units 1 and 2. In addition, this evaluation does not adversely impact on other evaluations or exemption requests contained in this report.

The bases that justify the conclusions are summarized as follows:

(1) Fire Area 105 is separated from Fire Zone 33A by unrated gypsum walls with unsealed penetrations and unrated access doors.

(2) Fire Zone 105 does not contain safe shutdown components or cables.

(3) Fire Area 105 will not affect the justifications for the seismic gap evaluation because of distance from seismic gap, the wall separating it from Fire Zone 33A and exclusion of safe shutdown cables or components.

(4) Fire Area 105 will not affect the justification for the Fire Zone 116 boundary evaluation because Fire Area 105 does not contain safe shutdown components or cables, and is not adjacent to Fire Zone 33.

(5) Fire Area 105 is provided with an automatic wet pipe sprinkler system.

9.30 Fire Zones 3, 32, 36, 48, 49, 50, 51, 52, 69 and Fire Areas 106, 107, 31, 35, 146 Boundary Evaluation

Purpose

The purpose of this evaluation is to analyze the impact of combining the fire area containing Fire Zones 3, 32, 36, 48, 49, 50, 51, 52, and 69 with Fire Areas 106, 107, 31, 35, and 146 on redundant safe shutdown capability. This combination will reduce the number of fire area boundaries that require surveillance and will not adversely impact on other evaluations or exemption requests contained in this report.

Description

Fire Zone/Area	Description	Elev. (ft)
3	Drumming/Storage Area	589
32	Cask Handling Area	609
36	Spent Fuel Pit Pump Room	609
48	New Fuel Storage Room	
49	Unit 1 HVAC Vestibule	633
50	Unit 2 HVAC Vestibule	633
51	East End Auxiliary Building	633
52	West End Auxiliary Building	633
69	Auxiliary Building	650
106	Unit 1 Aux. Feedwater Battery Room	633
107	Unit 2 Aux. Feedwater Battery Room	633
31	Concrete Mixing Building	609
35	Instrument Calibration Room	609
146*	Loading Platform Area	609

*The Loading Platform area was not previously identified as a fire zone in the 1983 Appendix R submittal.

Safe Shutdown Equipment

The fire area defined by Fire Zones 3, 32, 36, 48, 49, 50, 51, 52 and 69 contains safe shutdown equipment, which is located in Fire Zones 50, 52 and 69. This equipment includes 1-CMO-429, 2-CMO-429 (CCW to RHR heat exchanger isolation MOV), 1-CCW-214, 1-CCW-220, 2-CCW-214, 2-CCW-220 (CCW surge tank manual isolation valves), MCCs 1-AM-A, 2-AM-A, 1-AM-D, 2-AM-D and battery distribution cabinet DCN (Unit 1 and Unit 2). Various cables are routed in Fire Zones 32, 50, 51, 52 and 69 of this fire area. Based on the safe shutdown system analysis, in the event of a fire in this fire area, all safe shutdown systems have at least one path free of fire damage in each unit except for source range monitoring instrumentation. However, the March 1983 submittal recommended the addition of an alternate source range neutron monitoring channel to provide indication at local shutdown panel LSI-4 located in Fire Zone 5.

Fire Areas 31, 35 and 146 contain no safe shutdown equipment and/or cables. Fire Areas 106 and 107 contain BN batteries and associated cables. The associated cables of Unit 1 BN battery, which is located in Fire Area 106, are routed to Fire Zone 52. The associated cables of Unit 2 BN battery, which is located in Fire Area 107, are routed to Fire Zone 50.

Fire Protection Equipment

Fire Areas 106 and 107 are each provided with an automatic heat detector. Automatic detection or suppression capability is not provided in Fire Areas 31, 35, 106, 107, and 146.

Fire Zones 32, 48, and 69 are provided with ionization smoke detectors and partial detection coverage is provided in Fire Zone 3. Dry pilot preaction suppression systems are provided in Fire Zone 32 and partial coverage is provided in Fire Zone 3. In addition, Fire Zone 69 is provided with an automatic thermistor detection system and manual deluge system for the HVAC charcoal filter units. Fire Zone 49, 50, 51, and 52 are provided with automatic fire protection features, specifically area ionization smoke detection and each charcoal filter unit is provided with a manual deluge system with an automatic thermistor detection system. An automatic dry pilot preaction suppression system is provided in the normally accessible area of Fire Zones 51 and 52.

Fire Hazards Analysis

The safe shutdown compliance method for the combined fire areas will not change from that identified in the 1983 Appendix R submittal for the fire area containing Fire Zones 3, 31, 32, 35, 36, 48, 49, 50, 51, 52, 69, 106, 107 and 146 since the safe shutdown cables in Fire Areas 106 and 107 also are contained in Fire Zones 50 and 52.

Conclusion

Based on the results of the previous evaluation, Fire Areas 31, 35, 106, 107, and 146 can be combined with Fire Zones 3, 32, 36, 48, 49, 50, 51, 52, and 69 to form a larger fire area. This evaluation does not adversely impact on other evaluations or exemption requests contained in this report. The basis for this conclusion is that only Fire Areas 106 and 107 contain safe shutdown cables and these cables are also located in Fire Zone 52.

9.31 Boundary Evaluation of Fire Zones 62A, 62B and 62C

Purpose

The purpose of this evaluation is to analyze the impact of steel plate covered access openings to vertical chases/leakage detection boxes in Fire Zones 62A, 62B, and 62C that connect the RHR and containment spray pumps below with their heat exchangers above on (1) redundant safe shutdown capability and (2) the full area suppression exemption request for the 573 ft elevation of the Auxiliary Building. In addition, this evaluation does not adversely impact on other evaluations or exemption requests contained in this report.

Description

The containment spray and RHR pumps are located on the 573 ft elevation of the Auxiliary Building in Fire Zones 1A, 1B, 1C and 1D. The heat exchangers associated with these pumps are located on 609 ft elevation in Fire Zones 44A, 44B, 44C and 44D. The piping between each pump and its heat exchanger passes through Fire Zones 62A, 62B, and 62C on the 587 ft elevation. The piping for each pump/heat exchanger is enclosed within a separate concrete chase. One chase exists in Fire Zone 62A, two in Fire Zone 62B, and one in Fire Zone 62C. A steel plate cover normally bolted onto one face of each chase provides access into the chase for leakage detection purposes. The top and bottom of each chase is not sealed.

Safe Shutdown Equipment

Fire Zones 1A and 1B contain the Unit 1 containment spray pumps with their associated heat exchanges located in Fire Zones 44A and 44B. This equipment is not required for safe shutdown purposes.

Fire Zones 1C and 1D contain the Unit 1 RHR pumps with their associated heat exchangers located in Fire Zones 44C and 44D. They are required for cold shutdown purposes only. The adequacy of RHR pump separation and manual operations of valves in the heat exchanger cubicles were addressed in the March 1983 Appendix R submittal. Fire Zones 62A, 62B and 62C contain the Unit 1 charging pumps. Given a fire that involves these fire zones, complete alternate shutdown capability is provided outside of the area using Unit 2 equipment.

Fire Protection Equipment

Automatic ionization detection systems are installed in Fire Zones 1A, 1B, 1C and 1D and in Fire Zones 62A, 62B and 62C. A preaction sprinkler system is installed in Fire Area 62A, 62B and 62C. Automatic detection and suppression capabilities are not provided in Fire Zones 44A, 44B, 44C and 44D. Manual suppression capabilities in the form of portable extinguishers and manual hose stations are available for use in all locations.

Fire Hazards Analysis

The fixed and transient combustible loading in Fire Zones 1A, 1B, 1C and 1D is under 20,000 Btu/ft^2 for an equivalent fire severity of under 15 minutes. (The actual fixed combustible loading existing at this time is less than 6,242 Btu/ft^2 for an equivalent fire severity of under five minutes.) The fixed combustible loading in Fire Zones 62A, 62B and 62C is 47,000 Btu/ft^2 for an equivalent fire severity of under 35 minutes. (The actual combustible loading and equivalent fire severity existing at this time are 32,538 Btu/ft^2 and under 25 minutes, respectively.) The automatic detection and preaction sprinkler systems in these zones will act to limit the impact of transient combustibles, provided that they are not of such a quantity to overwhelm the suppression system. The fixed and transient combustible loading in Fire Zones 44A, 44B, 44C and 44D is under 20,000 Btu/ft^2 for an equivalent fire severity of 15 minutes. (The actual fixed combustible loading existing at this time is 5573 for equivalent fire severity of four minutes.)

573 ft Elevation

The RHR pumps and heat exchangers are required solely for cold shutdown purposes. The March 1983 Appendix R submittal demonstrated that a fire occurring on the 573 ft elevation of the Auxiliary Building would not impact on redundant safe shutdown capability of the RHR pumps. Therefore, the only potential impact for fire on the 573 ft elevation would be for fire spread up into the charging pump cubicles and/or the RHR heat exchanger cubicles.

Based on a fixed and transient combustible loading of 20,000 Btu/ft^2 for an equivalent fire severity of 15 minutes, the steel plate covers would have to be removed from the vertical chases/leakage detection boxes in order to impact on the charging pumps in Fire Zones 62A, 62B and 62C. Should fire enter the charging pump cubicles, the existing preaction sprinkler system would act to mitigate fire spread in the cubicles. In addition, complete alternate shutdown capability is available for a fire that spreads into the Unit 1 charging pump cubicles from the Unit 1 RHR or containment spray pump cubicles below. Should fire spread up the leak detection boxes from the RHR pump cubicles into the RHR heat exchanger cubicles, sufficient time exists for manually operating any required valves in the heat exchanger cubicles to achieve cold shutdown conditions. As such, fire on the 573 ft elevation of the Auxiliary Building will not adversely impact on redundant hot or cold safe shutdown capability.

<u>587 ft Elevation</u>

The March 1983 Appendix R submittal demonstrated that a fire occurring in Fire Zones 62A, 62B and 62C would not impact on redundant safe shutdown capability as the Unit 2 charging pumps in Fire Zones 63A, 63B and 63C would still be available. Therefore, the only potential impact for fire in Fire Zones 62A, 62B and 62C would be for fire to spread down through the vertical chase/leakage detection boxes into redundant RHR pump cubicles simultaneously, or up into the RHR pump heat exchanger cubicles simultaneously.

The probability of a fire spreading down into the RHR pump cubicles is negligible. This is based on the natural tendency for fire to spread upwards and outwards. While oil fires could spread to the level below, six in. high curbs at the 587-ft floor elevation of each vertical chase/leakage detection box opening will prevent this from occurring. The potential does exist for an uncontrolled fire involving 46,655 Btu/ft^2 of combustible loading in Fire Zones 62A, 62B and 62C to spread upwards into the RHR pump heat exchanger cubicles. However, the automatic detection and preaction sprinklers in the charging pump cubicles will act to control postulated fires until the fire brigade arrives to complete extinguishment. Postulated heat and smoke spread up the vertical chases/leak detection boxes will, therefore, be kept to a minimum. Detrimental impact on redundant hot or cold safe shutdown capability is, therefore, not postulated.

<u>609 ft Elevation</u>

The March 1983 Appendix R submittal demonstrated that a fire in one heat exchanger cubicle on the 609 ft elevation of the Auxiliary Building would not impact on redundant safe shutdown capability on this elevation or the elevation above. The only potential impact for fire in the heat exchanger cubicles is for fire to spread down into the charging pump cubicles below. The fixed and transient combustible loadings in the cubicles are under 20,000 Btu/ft^2. Oil is not required in these areas for maintenance purposes. As such, the only postulated transient combustibles are ordinary combustibles. Therefore, the potential for fire to spread down the vertical chases/leakage detection boxes into the charging pump cubicles is not considered a credible event.

Conclusions

Based on the above evaluation, reasonable assurance is provided that a fire in the vicinity of the vertical chases/leakage detection boxes passing through Fire Zones 62A, 62B and 62C would not impair safe shutdown capabilities of D.C. Cook or impact on the full area suppression exemption request for the 573 ft elevation of the Auxiliary Building. In addition, this evaluation does not adversely impact on other evaluations or exemption requests contained in this report.

The bases that justify the conclusion are summarized as follows:

(1) The containment spray and RHR pump cubicles (Fire Zones 1A, 1B, 1C and 1D) on the 573 ft elevation have fixed and transient combustible loadings of under 20,000 Btu/ft^2. (The actual fixed combustible loading existing at this time is under 6,242 Btu/ft^2).

(2) The containment spray and RHR heat exchanger cubicles (Fire Zones 44A, 44B, 44C and 44D) on the 609 ft elevation have fixed and transient combustible loadings of under 20,000 Btu/ft^2.

(3) The charging pump cubicles (Fire Zones 62A, 62B and 62C) on the 587 ft elevation have a fixed combustible loading of under 47,000 Btu/ft^2.

(4) The automatic detection systems in the containment spray and RHR pump cubicles will result in prompt detection of incipient fire conditions, with resultant response of the fire brigade.

(5) The automatic detection and preaction sprinkler systems in the charging pump cubicles will act to control and/or extinguish postulated fires prior to the arrival of the fire brigade.

(6) The six in. high curbs at the 587-ft floor elevation of the access openings into each vertical chase/leakage detection box will prevent fire spread down to the containment spray and RHR pump cubicles below.

(7) The RHR pumps and heat exchangers are required for cold shutdown purposes only, with RHR pump power cable repairs and manual operation of valves in the heat exchanger cubicles addressed in the March 1983 Appendix R submittal, Section 6.

(8) Given fire spread to or originating in the charging pump cubicles, complete alternate shutdown capability is available using Unit 2 charging pump equipment.

(9) Protecting the bolted on steel plate covers, or posting fire watches when removed, would not significantly enhance the protection provided by the existing configuration.

9.32 Boundary Evaluation of Fire Zones 63A, 63B and 63C

Purpose

The purpose of this evaluation is to analyze the impact of steel plate covered access openings to vertical chases/leakage detection boxes in Fire Zones 63A, 63B and 63C that connect the RHR and containment spray pumps below with their heat exchangers above on (1) redundant safe shutdown capability and (2) the full area suppression exemption request for the 573 ft elevation of the Auxiliary Building. In addition, this evaluation does not adversely impact on other evaluations or exemption requests contained in this report.

Description

The containment spray and RHR pumps are located on the 573 ft elevation of the Auxiliary Building in Fire Zones 1E, 1F, 1G and 1H. The heat exchangers associated with these pumps are located on 609 ft elevation in Fire Zones 44E, 44F, 44G and 44H. The piping between each pump and its heat exchanger passes through Fire Zones 63A, 63B and 63C on the 587 ft elevation. The piping for each pump/heat exchanger is enclosed within a separate concrete chase. One chase exists in Fire Zone 63A, two in Fire Zone 63B, and one in Fire Zone 63C. A steel plate cover normally bolted onto one face of each chase provides access into the chase for leakage detection purposes. The top and bottom of each chase is not sealed.

Safe Shutdown Equipment

Fire Zones 1E and 1F contain the Unit 1 containment spray pumps with their associated heat exchanges located in Fire Zones 44E and 44F. This equipment is not required for safe shutdown purposes.

Fire Zones 1G and 1H contain the Unit 1 RHR pumps with their associated heat exchangers located in Fire Zones 44G and 44H. They are required for cold shutdown purposes only. The adequacy of RHR pump separation and manual operations of valves in the heat exchanger cubicles were addressed in the March 1983 Appendix R submittal. Fire Zones 63A, 63B and 63C contain the Unit 2 charging pumps. Given a fire that involves these fire zones, complete alternate shutdown capability is provided outside of the area using Unit 1 equipment.

Fire Protection Equipment

Automatic ionization detection systems are installed in Fire Zones 1E, 1F, 1G and 1H and in Fire Zones 63A, 63B and 63C. A preaction sprinkler system is installed in Fire Zones 63A, 63B and 63C. Automatic detection and suppression capabilities are not provided in Fire Zones 44E, 44F, 44G and 44H. Manual suppression capabilities in the form of portable extinguishers and manual hose stations are available for use in all locations.

Fire Hazards Analysis

The fixed and transient combustible loading in Fire Zones 1E, 1F, 1G and 1H is under 20,000 Btu/ft^2 for an equivalent fire severity of under 15 minutes. (The actual fixed combustible loading existing at this time is less than 6063 Btu/ft^2 for an equivalent fire severity of 4.5 minutes.) The fixed combustible loading in Fire Zones 63A, 63B and 63C is less than 47,000 Btu/ft^2 for an equivalent fire severity of under 35 minutes. (The actual combustible loading and equivalent fire severity existing at this time are 32,217 Btu/ft^2 and 24 minutes, respectively.) The automatic detection and preaction sprinkler systems in these zones will act to limit the impact of transient combustibles, provided that they are not of such a quantity to overwhelm the suppression system. The fixed and transient combustible loading in Fire Zones 44E, 44F, 44G and 44H is under 20,000 Btu/ft^2 for an equivalent fire severity of 15 minutes. (The actual fixed combustible loading existing at this time is 7,645 Btu/ft^2 for equivalent fire severity 5.7 minutes.)

573 ft Elevation

The RHR pumps and heat exchangers are required solely for cold shutdown purposes. The March 1983 Appendix R submittal demonstrated that a fire occurring on the 573 ft elevation of the Auxiliary Building would not impact on redundant safe shutdown capability of the RHR pumps. Therefore, the only potential impact for fire on the 573 ft elevation would be for fire spread up into the charging pump cubicles and/or the RHR heat exchanger cubicles.

Based on a fixed and transient combustible loading of under 20,000 Btu/ft^2 for an equivalent fire severity of 15 minutes, the steel plate covers would have to be removed from the vertical chases/leakage detection boxes in order to impact on the charging pumps in Fire Zones 63A, 63B and 63C. Should fire enter the charging pump cubicles, the existing preaction sprinkler system would act to mitigate fire spread in the cubicles. In addition, complete alternate shutdown capability is available for a fire that spreads into the Unit 2 charging pump cubicles from the Unit 2 RHR or containment spray pump cubicles below. Should fire spread up the leak detection boxes from the RHR pump cubicles into the RHR heat exchanger cubicles, sufficient time exists for manually operating any required valves in the heat exchanger cubicles to achieve cold shutdown conditions. As such, fire on the 573 ft elevation of the Auxiliary Building will not adversely impact on redundant hot or cold safe shutdown capability.

<u>587 ft Elevation</u>

The March 1983 Appendix R submittal demonstrated that a fire occurring in Fire Zones 63A, 63B and 63C would not impact on redundant safe shutdown capability as the Unit 1 charging pumps in Fire Zones 62A, 62B and 62C would still be available. Therefore, the only potential impact for fire in Fire Zones 63A, 63B and 63C would be for fire to spread down through the vertical chase/leakage detection boxes into redundant RHR pump cubicles simultaneously, or up into the RHR pump heat exchanger cubicles simultaneously.

The probability of a fire spreading down into the RHR pump cubicles is negligible. This is based on the natural tendency for fire to spread upwards and outwards. While oil fires could spread to the level below, six in. high curbs at the 587-ft floor elevation of each vertical chase/leakage detection box opening will prevent this from occurring. The potential does exist for an uncontrolled fire involving less than 47,000 Btu/ft^2 of combustible loading in Fire Zones 63A, 63B and 63C to spread upwards into the RHR pump heat exchanger cubicles. However, the automatic detection and preaction sprinklers in the charging pump cubicles will act to control postulated fires until the fire brigade arrives to complete extinguishment. Postulated heat and smoke spread up the vertical chases/leak detection boxes will, therefore, be kept to a minimum. Detrimental impact on redundant hot or cold safe shutdown capability is, therefore, not postulated.

<u>609 ft Elevation</u>

The March 1983 Appendix R submittal demonstrated that a fire in one heat exchanger cubicle on the 609 ft elevation of the Auxiliary Building would not impact on redundant safe shutdown capability on this elevation or the elevation above. The only potential impact for fire in the heat exchanger cubicles is for fire to spread down into the charging pump cubicles below. The fixed and transient combustible loadings in the cubicles are under 20,000 Btu/ft^2 with fixed combustible loading. Oil is not required in these areas for maintenance purposes. As such, the only postulated transient combustibles are ordinary combustibles. Therefore, the potential for fire to spread down the vertical chases/leakage detection boxes into the charging pump cubicles is not considered a credible event.

Conclusions

Based on the above evaluation, reasonable assurance is provided that a fire in the vicinity of the vertical chases/leakage detection boxes passing through Fire Zones 63A, 63B and 63C would not impair safe shutdown capabilities of D.C. Cook or impact on the full area suppression exemption request for the 573 ft elevation of the Auxiliary Building. In addition, this evaluation does not adversely impact on other evaluations or exemption requests contained in this report.

The bases that justify the conclusion are summarized as follows:

(1) The containment spray and RHR pump cubicles (Fire Zones 1E, 1F, 1G and 1H) on the 573 ft elevation have fixed and transient combustible loadings of under 20,000 Btu/ft^2. (The actual fixed combustible loading existing at this time is under 6063 Btu/ft^2).

(2) The containment spray and RHR heat exchanger cubicles (Fire Zones 44E, 44F, 44G and 44H) on the 609 ft elevation have fixed and transient combustible loadings of under 20,000 Btu/ft^2. (The actual fixed combustible loading existing at this time is 7645 Btu/ft^2.)

(3) The charging pump cubicles (Fire Zones 63A, 63B and 63C) on the 587 ft elevation have a fixed combustible loading of under 47,000 Btu/ft^2.

(4) The automatic detection systems in the containment spray and RHR pump cubicles will result in prompt detection of incipient fire conditions, with resultant response of the fire brigade.

(5) The automatic detection and preaction sprinkler systems in the charging pump cubicles will act to control and/or extinguish postulated fires prior to the arrival of the fire brigade.

(6) The six in. high curbs at the 587-ft floor of the access openings into each vertical chase/leakage detection box will prevent fire spread down to the containment spray and RHR pump cubicles below.

(7) The RHR pumps and heat exchangers are required for cold shutdown purposes only, with RHR pump power cable repairs and manual operation of valves in the heat exchanger cubicles addressed in the March 1983 Appendix R submittal, Section 6.

(8) Given fire spread to or originating in the charging pump cubicles, complete alternate shutdown capability is available using Unit 1 charging pump equipment.

(9) Protecting the bolted on steel plate covers, or posting fire watches when removed, would not significantly enhance the protection provided by the existing configuration.

9.33 Fire Zone 6A to Fire Zone 138B Boundary Evaluation

Purpose

The purpose of this evaluation is to analyze the impact of a vertical shaft connecting Fire Zone 6A (the 601 ft. Pipe Tunnel) and Fire Zone 138B (CVCS Hold Up Tank Room B) on redundant safe shutdown capability. In addition, this evaluation does not impact on other evaluations or exemption requests contained in this report.

Description

Fire Zone 6A is located on the 601 ft elevation of the Auxiliary Building. It is part of a larger fire area that includes Fire Zones 5, 6N, 6M, 6S, 61, 64A, 64B, 65A, and 65B. Fire Zone 138B is located on the 562 ft elevation of the Auxiliary Building. It is part of a larger fire area that includes Fire Zones 1, 1A through 1H, 136, 137, 138A, and 138C. A concrete shaft connects the two zones of the identified fire areas. The shaft originates in Fire Zone 6A via a grate located in the floor of the zone at approximately column line H and the centerline of the plant. This is the highest point of the shaft. The shaft passes vertically through Fire Zone 6M and is totally enclosed in this zone. The shaft penetrates through the floor of Fire Zone 6M at the 587 ft elevation and terminates at ceiling level within Fire Zone 138B. An opening at ceiling level in Fire Zone 138B, at approximately the 585 ft elevation, is the lowest point of the shaft.

Safe Shutdown Equipment

Neither Fire Zone 6A nor Fire Zone 138B contain equipment or cables required for safe shutdown purposes.

Fire Protection Equipment

Neither Fire Zone 6A nor Fire Zone 138B are provided with automatic detection or suppression.

Fire Hazards Analysis

Fire Zone 6A and Fire Zone 138B have combustible loadings of under 13,000 Btu/ft^2 for equivalent fire severities of less than 10 minutes. (The actual fixed combustible loading existing at this time is negligible.) Both zones are high radiation areas that do not provide access to other plant areas . Therefore, the potential for storage of transient combustible materials in either location is considered negligible.

Neither zone contains either safe shutdown equipment or significant quantities of combustible materials. Therefore, the main way in which the shaft could result in a detrimental impact on safe shutdown capability would be for it to channel fire between various levels of the Auxiliary Building. Based on this, fire would have to originate on the 573 ft elevation of the Auxiliary Building, penetrate into the CVCS Hold Up Tank area and then spread up the shaft from Fire Zone 138B into Fire Zone 6A. From Fire Zone 6A, fire would then have to spread out into either Fire Zones 6N or 6S on the 587 ft elevation, or spread out into Fire Zones 44N and 44S on the 609 ft elevation.

(Note that exemption request Section 7.13 of this report addresses undampered ventilation ductwork that passes through multiple levels of the Auxiliary Building. It was demonstrated in this exemption request that fire could involve Fire Zone 1 on the 573 ft elevation, Fire Zone 6N on the 587 ft elevation, and Fire Zone 44N on the 609 ft elevation without impacting on redundant safe shutdown capability. Therefore, fire spreading up the shaft would have to involve both Fire Zones 6N and 6S on the 587 ft elevation or Fire Zones 44N and 44S on the 609 ft elevation prior to impacting on redundant safe shutdown capability.)

In order for fire to spread into the shaft located in Fire Zone 138B, a fire of sufficient duration and intensity must occur in the zones adjacent to Fire Zone 138B. The area in which this zone is located has a combustible loading of under 20,000 Btu/ft^2 for an equivalent fire severity of under 15 minutes. (The actual combustible loading existing at this time in the fire area is approximately 4079 Btu/ft^2 and equivalent fire severity of three minutes.) The highest concentration of combustibles in the area exists in Fire Zone 1. The adjacent CVCS Hold Up Tank Rooms, Fire Zones 138A and 138C, have negligible actual combustible loadings. Due to the combustible loadings in the fire area in which Fire Zone 138B is located, along with the negligible quantities of combustible material in adjacent fire zones, a fire of the magnitude that would be required to impact on redundant safe shutdown equipment on upper elevations is not a credible event.

In addition, an automatic detection system is provided in Fire Zones 1 and 1A through 1H of this fire area. The remaining zones of the fire area contain combustible loading of under 13,000 Btu/ft^2. (Actual combustible loading at this time is negligible.) Fires that involve combustible materials in this fire area will be promptly detected and result in the initiation of fire brigade activities. Should any smoke from a fire on this elevation filter into Fire Zone 138B and spread up the shaft into Fire Zone 6A, it will not result in fire spread up into Fire Zone 6A (and hence potentially into Fire Zones 6N, 6S, 44N, or 44S) due to the lack of combustible materials to ignite in Fire Zone 6A.

<u>Conclusion</u>

Based on the preceding evaluation, reasonable assurance is provided that a fire on the 573 or 562 ft elevations of the Auxiliary Building will not spread up the shaft in Fire Zone 138B to Fire Zone 6A and spread from there so as to impair redundant safe shutdown capabilities. In addition, reasonable assurance is provided that this evaluation does not impact on other evaluations or exemption requests contained in this report. The bases which justify this conclusion are summarized as follows:

(1) Fire Zones 138B and 6A have combustible loadings of under 13,000 Btu/ft^2, with negligible quantities of fixed combustibles existing at this time.

(2) Fire Zones 138B and 6A are both high radiation areas that do not provide access to other plant locations.

(3) The fire area in which Fire Zone 138B is located has a combustible loading of under 20,000 Btu/ft^2.

(4) Fire Zones 138B and 6A do not contain any safe shutdown equipment or cables; as such, there will be no impact on safe shutdown capability even should fire spread between the two zones.

(5) Automatic detection is provided in all fire zones on the 573 ft elevation of the Auxiliary Building that contain fixed combustible materials.

(6) Should smoke and heat from a fire filter into Fire Zone 138B and spread up the shaft to Fire Zone 6A, fire will not ignite in the zone due to the lack of fixed combustible materials in Fire Zone 6A.

9.34 Fire Zone 36 to Fire Zone 5 Boundary Evaluation

Purpose

The purpose of this evaluation is to analyze the impact on redundant safe shutdown capability of an undampered duct penetrating the barrier separating Fire Zone 36 from Fire Zone 5. In addition, this evaluation does not adversely impact on other evaluations or exemption requests contained in this report.

Description

Fire Zone 36 is located on the 609 ft elevation of the Auxiliary Building. It is part of a larger fire area that includes Fire Zones 3, 31, 32, 35, 48, 49, 50, 51, 52, 69, 106, 107, and 146. Fire Zone 5 is located on the 587 ft elevation of the Auxiliary Building. It is part of a larger fire area that includes Fire Zones 6A, 6N, 6M, 6S, 61, 64A, 64B, 65A, and 65B. The undampered HVAC duct passes through Fire Zone 48 into Fire Zone 36 and then penetrates the floor of Fire Zone 36, which is constructed of 30 in. thick concrete. The duct then passes into Fire Zone 5. Air is exhausted through the duct from Fire Zones 48 and 36 through Fire Zone 5.

Safe Shutdown Equipment

Fire Zone 36 does not contain any safe shutdown related equipment or cable. Other zones in this area containing safe shutdown equipment or cables are Fire Zones 32, 50, 51, 52, 69, 106 and 107. The modifications proposed in Section 8 of this report, along with other evaluations contained in this section, provide reasonable assurance that one train of safe shutdown systems will be available in case of a fire in this fire area.

Fire Zone 5 contains safe shutdown equipment or cables for both Units 1 and 2. Other zones in this area containing safe shutdown systems are Fire Zones 6N, 6M, and 6S. Fire Zone 6M contains both Unit 1 and 2 systems, Fire Zone 6N contains primarily Unit 1 systems, and Fire Zone 6S contains primarily Unit 2 systems. The modifications proposed in Section 8 of this report, along with other evaluations contained in this section, provide reasonable assurance that safe shutdown capability will be available in case of a fire originating in this fire area.

Fire Protection Equipment

Fire Zone 36 is not provided with automatic detection or automatic suppression capability. Other zones in this area containing detection and/or suppression capabilities are Fire Zones 3 (partial ionization detection and dry pilot sprinklers), 32, 51, and 52 (ionization detection and dry pilot sprinklers), 48 (ionization detection), 49, 50, and 69 (ionization detection, and thermistor detection with manual water spray for the charcoal filter units), and Fire Zones 106 and 107 (heat detection).

Ionization smoke detection and dry pilot preaction sprinkler systems are provided in Fire Zone 5, 6N, 6M, 6S, 64A, 64B, 65A, and 65B. Fire Zone 61 is provided with ionization detection, while Fire Zone 6A is not provided with detection or suppression capability.

Fire Hazards Analysis

Fire Zone 36 has a combustible loading of under 20,000 Btu/ft^2 for an equivalent fire severity of less than 15 minutes. (The actual fixed combustible loading existing at this time is 3,719 Btu/ft^2 for equivalent fire severity of 2.7 minutes.) The fire area in which this zone is located has a total combustible loading of under 33,000 Btu/ft for an equivalent fire severity of 25 minutes. (The actual combustible loading and equivalent fire severity existing at this time are 17,283 Btu/ft^2 and 12.9 minutes, respectively.) Fire Zone 5 has a combustible loading of under 27,000 Btu/ft2 for an equivalent fire severity of 20 minutes. (The actual combustible loading and equivalent fire severity existing at this time are 11,299 Btu/ft^2 and 8.5 minutes, respectively.) The area in which this zone is located has a total combustible loading of under 27,000 Btu/ft^2 for an equivalent fire severity of 20 minutes. (The actual combustible loading and equivalent fire severity existing at this time are 8,947 Btu/ft^2 and 6.5 minutes, respectively.)

Fire Zone 36 does not contain safe shutdown equipment or cables; as such, fire could spread into the zone from Fire Zone 5 without impacting on redundant safe shutdown capability. For fire in Fire Zone 5 to be able to impact on locations containing safe shutdown equipment in the fire area which houses Fire Zone 36, fire would have to spread up into the 633 ft elevation of the Auxiliary Building. There are three routes such a fire could potentially take.

One route would be for for fire to travel from Fire Zone 5 to Fire Zone 36 on the 609 ft elevation. It would then have to travel to Fire Zone 48 on the 633 ft elevation and then to Fire Zone 51. However, this route would require fire to spread directly into Fire Zone 51 through the fuel transfer canal which runs between the two zones. This is not a credible event.

A second route would be for fire to travel from Fire Zone 5 to Fire Zone 36 on the 609 ft elevation. It would then have to travel to Fire Zone 48 on the 633 ft elevation, up to Fire Zone 69 on the 650 ft elevation, and then down to Fire Zones 49, 50, 51, 52, 106, and 107 on the 633 ft elevation. This is not a credible event due to:

(1) The low combustible loadings throughout these zones;

(2) The presence of detection in Fire Zones 48, 69, 49, 50, 51, 52, 106, and 107;

(3) The presence of dry pilot sprinklers in Fire Zones 51 and 52; and

(4) The circuitous path that fire must take to spread between these identified fire zones.

The third route is for fire to spread from Fire Zone 5 to Fire Zones 36 and 32 on the 609 ft elevation. From Fire Zone 32, it would have to spread directly into Fire Zone 69 on the 650 ft elevation and then down to Fire Zones 49, 50, 51, 52, 106, and 107 on the 633 ft elevation. This is not a credible event due to:

(1) The low combustible loadings throughout these zones;

(2) The presence of detection in Fire Zones 32, 69, 49, 50, 51, 52, 106, and 107;

(3) The presence of dry pilot sprinklers in Fire Zones 32, 51 and 52; and

(4) The circuitous path that fire must take to spread between these identified fire zones.

The same circuitous paths exist for fire to travel from Fire Zones 49, 50, 51, 52, 106, and 107 on the 633 ft elevation of the Auxiliary Building to Fire Zones 5, 6N, 6M, and 6S on the the 587 ft elevation. In addition, the zones on the 587 ft elevation are all provided with ionization detection and dry pilot sprinkler systems, with the exception of Fire Zone 61, which is only provided with an ionization detection system. Therefore, fire spread between the identified zone is not a credible event.

Conclusion

Based on the preceding evaluation, reasonable assurance is provided that the undampered ventilation duct passing through the barrier separating Fire Zones 5 and 36 will not impact on either redundant safe shutdown capability or other evaluations or exemptions included in this report. The bases which justify this conclusion are summarized as follows:

(1) Fire Zone 36 has a combustible loading of under 20,000 Btu/ft^2 for an equivalent fire severity of 15 minutes. (The actual fixed combustible loading existing at this time is 3,719 Btu/ft^2.) The fire area in which this zone is located has a total combustible loading of under 33,000 Btu/ft for an equivalent fire severity of 25 minutes.

(2) Fire Zone 5 has a combustible loading of under 27,000 Btu/ft2 for an equivalent fire severity of 20 minutes. The area in which this zone is located has a total combustible loading of under 27,000 Btu/ft2 for an equivalent fire severity of 20 minutes.

(3) The fire severities existing in the zones through which fire must travel to reach zones containing safe shutdown equipment are not sufficient to overcome the circuitous paths which fire must take.

(4) Automatic detection and/or automatic suppression capabilities are provided in enough of the intervening fire zones between zones containing safe shutdown equipment that fire brigade response will occur well before redundant safe shutdown capabilities are jeopardized.

9.35 Fire Zone 108 to Fire Zone 33A Boundary Evaluation

Purpose

The purpose of this evaluation is to analyze the impact on redundant safe shutdown capability of unsealed penetrations and an undampered installation duct in the barrier separating Fire Zone 108 from Fire Zone 33A. In addition, this evaluation does not adversely impact on other evaluations or exemption requests contained in this report.

Description

Fire Zone 108 is the Unit 1 West Main Steam Valve Enclosure located in the west main steam valve house which also includes Fire Zone 110. Fire Zone 108 rises from approximately the 624 ft elevation to the 682 ft elevation, with Fire Zone 110 joining this zone through a shaft opening in the floor at the 624 ft elevation. These two zones are part of a larger fire area that includes the Unit 1 and Unit 2 Turbine Buildings, the Unit 2 west main steam valve house, the Screen House, and the Service Building.

Fire Zone 33A is located on the 612 ft elevation of the Auxiliary Building. It is part of a larger fire area that includes Fire Zones 33, 33B, and 105. Fire Zone 33A rises from the 612 ft elevation to the roof at the 644 ft elevation.

The north wall of Fire Zone 108 interfaces with the south wall of Fire Zone 33A from approximately the 624 ft elevation to just below the roof at the 644 ft elevation. Two main steam line pipes pass at an angle through a 15 ft wide by 6 ft high opening in this interface. Each pipe is approximately 42 in. in diameter with 8 in. of insulation. In addition, the pipes are designed such that approximately 6 in. of movement is expected when the pipes go from the hot to cold conditions. There are several other unsealed penetrations through this boundary interface including an undampered HVAC exhaust duct; however, the opening provided for the two main steam pipes is the largest of the unprotected openings and is the worst case bounding situation.

Safe Shutdown Equipment

Fire Zones 33A, 33B, and 105 contain no safe shutdown equipment. Fire Zone 33 contains the following safe shutdown equipment and associated cables:

(1) Unit 1 steam generators 1 and 4 PORVs;

(2) Steam generators 1 and 4 auxiliary feedwater supply valves;

(3) Steam generators 1 and 4 main steam stop valves (MSSVs);

(4) Unit 1 Local Shutdown Indication panels LSI-1 and LSI-5;

(5) Steam generators 1 and 4 safety relief valves; and

(6) Steam generators 1 and 4 pressure transmitters.

The cabling for the Unit 1 steam generators 1 and 4 PORVs are also routed through and located in Fire Zone 33A.

Fire Zone 108 contains the following safe shutdown equipment and their associated cables:

(1) Unit 1 steam generators 2 and 3 PORVs;

(2) Pressure transmitters for steam generators 2 and 3;

(3) Steam generators 2 and 3 main steam stop valves (MSSVs);

(4) Steam generators 2 and 3 safety relief valves; and

(5) Unit 1 turbine driven AFW pump steam supply isolation valves.

Fire Protection Equipment

Fire Zones 108 and 110 are not provided with automatic detection or automatic suppression capability. Fire Zone 33A is provided with automatic detection capability, as are Fire Zones 33 and 33B in the same fire area. A thermistor and manual water spray suppression system are provided for the charcoal filter unit in Fire Zone 33A. Fire Zone 105 is provided with an automatic wet pipe sprinkler system.

Fire Hazards Analysis

The seismic gap exemption request contained in Section 7.13 of this report demonstrated that fire could involve Fire Zones 33A, 33B, and 108 without impacting on redundant safe shutdown capability. At worst, this would result in loss of steam generators 2 and 3 in Fire Zone 108 along with the PORVs for steam generators 1 and 4 in Fire Zone 33. However, these valves can be manually operated in Fire Zone 33.

The fixed suppression exemption request in Section 7.8 of this report demonstrated that a fire originating in either Fire Zone 33, Fire Zone 33A, or Fire Zone 33B will not impact on

Section 9.28 of this report, combining Fire Area 105 with Fire Zones 33, 33A, and 33B will not impact on either safe shutdown capability or the fixed suppression exemption request for Fire Zones 33, 33A, and 33B. The only potential impact on safe shutdown capability that must be addressed is the probability for fire to spread to Fire Zones 33 and 108 simultaneously.

Fire Zone 108 has a combustible loading of less than 27,000 Btu/ft^2 with an equivalent fire severity of 20 minutes. (The actual combustible loading and equivalent fire severity existing at this time are 10,187 Btu/ft^2 and 7.6 minutes, respectively.) Should any transient combustibles be brought into the combustible loading could potentially increase to approximately 40,000 Btu/ft^2. This could result in a maximum equivalent fire severity of approximately 30 minutes.

Postulated fires occurring in Fire Zone 108 would tend to spread upwards in the zone towards the 682 ft elevation as opposed to spreading down through the unsealed penetrations at the 635 to 644 ft elevations into Fire Zone 33A. The lack of combustible liquids either existing or required in Fire Zone 108 reinforces this assumed path of fire spread. The products of combustion from such a fire would have to bank down approximately 50 ft prior to entering Fire Zone 33A. Given a total combustible loading of 40,000 Btu/ft^2, this is not a credible event. Therefore, a fire originating in Fire Zone 108 that spreads down into Fire Zone 33A and then into Fire Zone 33 is not a credible event.

The fire area in which Fire Zones 33, 33A, 33B, and 105 are located has a combustible loading and equivalent fire severity of under 27,000 Btu/ft^2 and 20 minutes respectively. (The actual fixed combustible loading and equivalent fire severity existing at this time is approximately 11,530 Btu/ft^2 and 8.5 minutes respectively.) The majority of this loading exists in Fire Zone 105, which is protected by an automatic wet pipe sprinkler system. The combustible loadings and equivalent fire severities in Fire Zones 33 and 33A are under 27,000 Btu/ft^2 and 20 minutes (with actual values of less than 10,840 Btu/ft^2 and 8 minutes each).

In order for fire to impact on both Fire Zone 108 and Fire Zone 33 simultaneously, it would have to originate in Fire Zone 33A or 33B. The products of combustion would then have to spread into both fire zones in order to impact on redundant safe shutdown capability. The following factors act to mitigate the probability of this occurring:

(1) Fire Zone 33A is approximately 170 ft in length;

(2) An automatic detection system is provided throughout Fire Zones 33, 33A, and 33B, including automatic thermistor detection and manual water spray suppression for the charcoal filter unit in Fire Zone 33A, thereby ensuring prompt fire brigade response and initiation of manual fire fighting activities;

(3) Fire Zones 33, 33A, and 108 have approximate volumes of 70,720, 101,840 and 42,159 ft^3, respectively;

(4) While there is a continuity of combustibles between Fire Zones 33 and 33A that could result in fire damage in both fire zones, the continuity of combustibles does

not extend into Fire Zone 108. Therefore, fire damage in Fire Zone 108 will have to occur as a result of hot combustible gases spreading into the zone; and

(5) Due to the 170 ft of spatial separation between Fire Zones 108 and 33, along with the large volumes of Fire Zones 33, 33A, and 108, products of combustion that do traverse this route will be sufficiently dispersed and cooled so as not to pose a hazard to Fire Zones 108 and 33 simultaneously.

Based on these considerations, the probability of fire adversely impacting on Fire Zones 108 and 33 simultaneously is not a credible event.

Conclusion

Based on the preceding evaluation, reasonable assurance is provided that a fire will not impact on redundant safe shutdown capability located in Fire Zones 108, 33A, and 33. In addition, the evaluation does not adversely impact on other evaluations or exemption requests contained in this report. The bases which justify these conclusions are summarized as follows:

(1) Fire Zone 108 has a combustible loading of under 27,000 Btu/ft^2. Should any transient combustibles be brought into Fire Zone 108, the combustible load could potentially increase to approximately 40,000 Btu/ft^2. This could result in a maximum equivalent fire severity of 30 minutes.

(2) The fire area in which Fire Zones 33, 33A, 33B, and 105 are located has a combustible loading and equivalent fire severity of under 27,000 Btu/ft^2 and 20 minutes respectively. (The actual fixed combustible loading and equivalent fire severity existing at this time is approximately 11,530 Btu/ft^2 and 8.5 minutes, respectively.)

(3) The majority of this loading exists in Fire Zone 105, which is protected by an automatic wet pipe sprinkler system.

(4) The combustible loadings and equivalent fire severities in Fire Zones 33 and 33A are under 27,000 Btu/ft2 and 20 minutes (with actual values of less than 10,840 Btu/ft2 and 8 minutes each).

(5) The seismic gap exemption request contained in Section 7.13 of this report demonstrated that fire could involve Fire Zones 33A, 33B, and 108 without impacting on redundant safe shutdown capability.

(6) The fixed suppression exemption request in Section 7.8 of this report demonstrated that a fire originating in either Fire Zone 33, Fire Zone 33A, or Fire Zone 33B will not impact on redundant safe shutdown capability.

(7) An automatic detection system is provided throughout Fire Zones 33, 33A, and 33B, thereby ensuring prompt fire brigade response and initiation of manual fire fighting activities;

(8) Fire Zones 33, 33A, and 108 have approximate volumes of 70,720, 101,840, and 42,159 ft3, respectively;

(9) Due to the 170 ft of spatial separation between Fire Zones 108 and 33, along with the large volumes of Fire Zones 33, 33A, and 108, products of combustion that do traverse this route will be sufficiently dispersed and cooled so as not to pose a hazard to Fire Zones 108 and 33 simultaneously.

The cabling for the Unit 2 steam generators 1 and 4 PORVs are also routed through and located in Fire Zone 34A.

Fire Zone 109 contains the following safe shutdown equipment and their associated cables:

(1) Unit 2 steam generators 2 and 3 PORVs;

(2) Pressure transmitters for steam generators 2 and 3;

(3) Steam generators 2 and 3 main steam stop valves (MSSVs);

(4) Steam generators 2 and 3 safety relief valves; and

(5) Unit 2 turbine driven AFW pump steam supply isolation valves.

Fire Protection Equipment

Fire Zones 109 and 111 are not provided with automatic detection or automatic suppression capability. Fire Zone 34A is provided with automatic detection capability, as are Fire Zones 34 and 34B in the same fire area. A thermistor detection and manual water spray suppression system are provided for the charcoal filter unit in Fire Zone 34A.

Fire Hazards Analysis

The seismic gap exemption request contained in Section 7.13 of this report demonstrated that fire could involve Fire Zones 34A, 34B, and 109 without impacting on redundant safe shutdown capability. At worst, this would result in loss of steam generators 2 and 3 in Fire Zone 109 along with the PORVs for steam generators 1 and 4 in Fire Zone 34. However, these valves can be manually operated in Fire Zone 34.

The fixed suppression exemption request in Section 7.9 of this report demonstrated that a fire originating in either Fire Zone 34, Fire Zone 34A, or Fire Zone 34B will not impact on redundant safe shutdown capability. The only potential impact on safe shutdown capability that must be addressed is the probability for fire to spread to Fire Zones 34 and 109 simultaneously.

Fire Zone 109 has a combustible loading of less than 33,000 Btu/ft^2 with equivalent fire severity of 25 minutes. Should any transient combustibles be brought into Fire Zone 109, the combustible could potentially increase to approximately 47,000 Btu/ft^2. This could result in a maximum equivalent fire severity of under 35 minutes. The actual combustible loading and equivalent fire severity existing at this time are 15,872 Btu/ft^2 and 11.8 minutes, respectively.

Postulated fires occurring in Fire Zone 109 would tend to spread upwards in the zone towards the 682 ft elevation as opposed to spreading down through the unsealed penetrations at the 635 to 644 ft elevations into Fire Zone 34A. The lack of combustible liquids either existing or required in Fire Zone 109 reinforces this assumed path of fire spread. The products of combustion from such a fire would have to bank down approximately 50 ft prior to entering Fire Zone 34A. Given a total combustible loading of under 47,000 Btu/ft^2, this is not a credible event. Therefore, a fire originating in Fire Zone 109 that spreads down into Fire Zone 34A and then into Fire Zone 34 is not a credible event.

The fire area in which Fire Zones 34, 34A, and 34B are located has a combustible loading and equivalent fire severity of approximately 20,000 Btu/ft2 and 15 minutes respectively. (The actual fixed combustible loading and equivalent fire severity existing at this time is less than 5,909 Btu/ft2 and 4.3 minutes respectively.) The combustible loadings and equivalent fire severities in Fire Zones 34 and 34A are under 20,000 Btu/ft2 and 15 minutes (with actual values of less than 5,937 Btu/ft2 and 4.5 minutes each).

In order for fire to impact on both Fire Zone 109 and Fire Zone 34 simultaneously, it would have to originate in Fire Zone 34A or 34B. The products of combustion would then have to spread into both fire zones in order to impact on redundant safe shutdown capability. The following factors act to mitigate the probability of this occurring:

(1) Fire Zone 34A is approximately 170 ft in length;

(2) An automatic detection system is provided throughout Fire Zones 34, 34A, and 34B, including automatic thermistor detection and manual water spray suppression for the charcoal filter unit in Fire Zone 34A, thereby ensuring prompt fire brigade response and initiation of manual fire fighting activities;

(3) Fire Zones 34, 34A, and 109 have approximate volumes of 70,720, 101,840 and 42,159 ft3, respectively;

(4) While there is a continuity of combustibles between Fire Zones 34 and 34A that could result in fire damage in both fire zones, the continuity of combustibles does not extend into Fire Zone 109. Therefore, fire damage in Fire Zone 109 will have to occur as a result of hot combustible gases spreading into the zone; and

(5) Due to the 170 ft of spatial separation between Fire Zones 109 and 34, along with the large volumes of Fire Zones 34, 34A, and 109, products of combustion that do traverse this route will be sufficiently dispersed and cooled so as not to pose a hazard to Fire Zones 109 and 34 simultaneously.

Based on these considerations, the probability of fire adversely impacting on Fire Zones 109 and 34 simultaneously is not a credible event.

Conclusion

Based on the preceding evaluation, reasonable assurance is provided that a fire will not impact on redundant safe shutdown capability located in Fire Zones 109, 34A, and 34. In addition, the evaluation does not adversely impact on other evaluations or exemption requests contained in this report. The bases which justify these conclusions are summarized as follows:

(1) Fire Zone 109 has a combustible loading of under 33,000 Btu/ft^2. The combustible could potentially increase to approximately 47,000 Btu/ft2. This could result in a maximum equivalent fire severity of under 35 minutes.

(2) The fire area in which Fire Zones 34, 34A, and 34B are located has a combustible loading and equivalent fire severity of approximately 20000 Btu/ft2 and 15 minutes respectively. (The actual fixed combustible loading and equivalent fire severity existing at this time is less than 5909 Btu/ft2 and 4.3 minutes respectively.)

(3) The combustible loadings and equivalent fire severities in Fire Zones 34 and 34A are under 20,000 Btu/ft2 and 15 minutes (with actual values of less than 5937 Btu/ft2 and 4.5 minutes each).

(4) The seismic gap exemption request contained in Section 7.13 of this report demonstrated that fire could involve Fire Zones 34A, 34B, and 109 without impacting on redundant safe shutdown capability.

(5) The fixed suppression exemption request in Section 7.9 of this report demonstrated that a fire originating in either Fire Zone 34, Fire Zone 34A, or Fire Zone 34B will not impact on redundant safe shutdown capability.

(6) An automatic detection system is provided throughout Fire Zones 34, 34A, and 34B, thereby ensuring prompt fire brigade response and initiation of manual fire fighting activities;

(7) Fire Zones 34, 34A, and 109 have approximate volumes of 70,720, 101,840, and 42,159 ft3, respectively;

(8) Due to the 170 ft of spatial separation between Fire Zones 109 and 34, along with the large volumes of Fire Zones 34, 34A, and 109, products of combustion that do traverse this route will be sufficiently dispersed and cooled so as not to pose a hazard to Fire Zones 109 and 34 simultaneously.

9.37 Fire Zone 32 to Fire Zone 5 Boundary Evaluation

Purpose

The purpose of this evaluation is to analyze the impact on redundant safe shutdown capability of: (1) an undampered duct; (2) an unrated door; and (3) several minor unsealed penetrations in the wall and ceiling of a stairway enclosure separating Fire Zone 5 from Fire Zone 32. In addition, this evaluation does not adversely impact on other evaluations or exemption requests contained in this report.

Description

Fire Zone 32 is located on the 609 ft elevation of the Auxiliary Building. It is open from the 609 ft elevation up to the roof of the Auxiliary Building, which is at approximately the 705 ft elevation. It is part of a larger fire area that includes Fire Zones 3, 31, 35, 36, 48, 49, 50, 51, 52, 69, 106, 107, and 146. Fire Zone 5 is located on the 587 ft elevation of the Auxiliary Building. It is part of a larger fire area that includes Fire Zones 6A, 6N, 6M, 6S, 61, 64A, 64B, 65A, and 65B. An open stairway in the northeast corner of Fire Zone 5 provides access up to Fire Zone 32. At the top of the stairs above the 609 ft elevation, an enclosure constructed of 8 in. thick concrete block (on the north, east, and west sides only) with a 5 in. thick poured concrete ceiling is provided. The configuration of the barriers results in the open stairway portion of the 609 ft elevation being included as part of Fire Zone 5 on the 587 ft elevation.

An unrated hollow metal door provides access from Fire Zone 5 to Fire Zone 32 from the top of the stairway through the east wall of the stairway enclosure. A ventilation duct that supplies outside air through Fire Zone 32 to the charcoal filter units in Fire Zone 5 penetrates the ceiling of the stairway enclosure and is not provided with a fire damper. A 1-in. gap exists between the duct and the ceiling which is not sealed. In addition, an unsealed gap exists around a standpipe penetrating through the east wall of the stairway enclosure to Fire Zone 32.

Safe Shutdown Equipment

Fire Zone 32 does not contain any safe shutdown equipment but does contain safe shutdown cables associated with two of the Unit 1 safety injection accumulator valves. Other zones in this area containing safe shutdown equipment and/or cables are Fire Zones 50, 51, 52, 69, 106, and 107. The modifications proposed in Section 8 of this report, along with other evaluations contained in this section, provide reasonable assurance that one train of safe shutdown systems will be available in case of a fire in this fire area.

Fire Zone 5 contains safe shutdown equipment or cables for both Units 1 and 2. Other zones in this area containing safe shutdown systems are Fire Zones 6N, 6M, and 6S. Fire Zone 6M contains both Unit 1 and 2 systems, Fire Zone 6N contains primarily Unit 1 systems, and Fire Zone 6S contains primarily

Unit 2 systems. The modifications proposed in Section 8 of this report, along with other evaluations contained in this section, provide reasonable assurance that safe shutdown capability will be available in case of a fire originating in this fire area.

Fire Protection Equipment

Fire Zone 32 is provided with automatic detection and dry pilot preaction sprinklers at the ceiling of the 650 ft elevation. Other zones in this area containing detection and/or suppression capabilities are Fire Zones 3 (partial ionization detection and dry pilot sprinklers), 51 and 52 (ionization detection and dry pilot sprinklers), 48 (ionization detection), 49, 50, and 69 (ionization detection, and thermistor detectors with manual water spray for the charcoal filter units), and Fire Zones 106 and 107 (heat detection).

Ionization smoke detection and dry pilot preaction sprinkler systems are provided in Fire Zone 5, 6N, 6M, 6S, 64A, 64B, 65A, and 65B. Fire Zone 61 is provided with ionization detection, while Fire Zone 6A is not provided with detection or suppression capability.

Fire Hazards Analysis

Fire Zone 32 has a combustible loading of under 40,000 Btu/ft^2 for an equivalent fire severity of less than 30 minutes. (The actual fixed combustible loading and equivalent fire severity existing at this time are less than 23,311 Btu/ft^2 and 17.4 minutes, respectively). The fire area in which this zone is located has a total combustible loading of less than 33,000 Btu/ft2 for an equivalent fire severity of 25 minutes (The actual combustible loading and equivalent fire severity existing at this time area 17,283 Btu/ft^2 and 12.9 minutes, respectively.) Fire Zone 5 has a combustible loading of under 27,000 Btu/ft^2 for an equivalent fire severity of 20 minutes. (The actual combustible loading and equivalent fire severity existing at this time area 11,229 Btu/ft^2 and 8.5 minutes each.) The area in which this zone is located has a total combustible loading of under 27,000 Btu/ft^2 for an equivalent fire severity of 20 minutes. (The actual combustible loading and equivalent fire severity existing at this time are 8947 Btu/ft^2 and 6.5 minutes, respectively.)

Fire Zone 32 does not contain safe shutdown equipment or cables; as such, fire could spread into the zone from Fire Zone 5 without impacting on redundant safe shutdown capability. For fire in Fire Zone 5 to be able to impact on locations containing safe shutdown equipment in the fire area which houses Fire Zone 32, fire would have to spread up into the 633 ft elevation of the Auxiliary Building and impact on Fire Zones 50, 51, 52, 106, or 107. There are three routes such a fire could potentially take.

One route would be for for fire to travel from Fire Zone 5 to Fire Zone 32 through the unrated door, undampered duct or unsealed gaps around the duct and standpipe penetrations. It would then have to travel into Fire Zone 48 on the 633 ft elevation through an unrated door and then through the west wall of Fire Zone 48 directly into Fire Zone 51. However, this route would require fire to spread directly into Fire Zone 51 through the fuel transfer canal which runs between the two zones. This is not a credible event.

A second route would be for fire to travel from Fire Zone 5 to Fire Zone 32 on the 609 ft elevation. It would then have to travel into Fire Zone 48 on the 633 ft elevation through an unrated door, up to Fire Zone 69 on the 650 ft elevation, and then down to Fire Zones 49, 50, 51, 52, 106, and 107 on the 633 ft elevation. This is not a credible event due to:

(1) The low combustible loadings throughout these zones;

(2) The presence of detection in Fire Zones 48, 69, 49, 50, 51, 52, 106, and 107;

(3) The presence of dry pilot sprinklers in Fire Zones 51 and 52; and

(4) The circuitous path that fire must take to spread between these identified fire zones.

The third route is for fire to spread from Fire Zone 5 to Fire Zone 32 on the 609 ft elevation. The fire would then have to spread up to the 650 ft elevation of Fire Zone 32, spread directly into Fire Zone 69 on the 650 ft elevation, and then spread down to Fire Zones 49, 50, 51, 52, 106, and 107 on the 633 ft elevation. This is not a credible event due to:

(1) The low combustible loadings throughout these zones;

(2) The presence of detection in Fire Zones 32, 69, 49, 50, 51, 52, 106, and 107;

(3) The presence of dry pilot sprinklers in Fire Zones 32, 51 and 52; and

(4) The circuitous path that fire must take to spread between these identified fire zones.

The same circuitous paths exist for fire to travel from Fire Zones 49, 50, 51, 52, 106, and 107 on the 633 ft elevation of the Auxiliary Building to Fire Zones 5, 6N, 6M, and 6S on the the 587 ft elevation. In addition, the zones on the 587 ft elevation are all provided with ionization detection and dry pilot sprinkler systems, with the exception of Fire Zone 61, which is only provided with an ionization detection system. Therefore, fire spread between the identified zones is not a credible event.

<u>Conclusion</u>

Based on the preceding evaluation, reasonable assurance is provided that the undampered ventilation duct, unrated door, and unsealed penetrations through the barriers separating Fire Zones 5 and 32 will not impact on either redundant safe shutdown capability. In addition, this evaluation does not adversely impact on other evaluations or exemption requests contained in this report. The bases which justify this conclusion are summarized as follows:

(1) Fire Zone 32 has a combustible loading of under 40,000 Btu/ft^2 for an equivalent fire severity of 30 minutes. (The actual fixed combustible loading existing at this time is less than 23,311 Btu/ft2.) The fire area in which this zone is located has a total combustible loading of 33,000 Btu/ft2 for an equivalent fire severity of 25 minutes.

(2) Fire Zone 5 has a combustible loading of under 27,000 Btu/ft2 for an equivalent fire severity of 20 minutes. The area in which this zone is located has a total combustible loading of under 27,000 Btu/ft2 for an equivalent fire severity of 20 minutes.

(3) The fire severities existing in the zones through which fire must travel to reach zones containing safe shutdown equipment are not sufficient to overcome the circuitous paths which fire must take.

(4) Automatic detection and/or automatic suppression capabilities are provided in enough of the intervening fire zones that fire brigade response will occur well before redundant safe shutdown capabilities are jeopardized.

9.38 Fire Zone 69 to Fire Zones 108 and 109 Boundary Evaluation

Purpose

The purpose of this evaluation is to analyze the impact on redundant safe shutdown capability of undampered containment instrumentation room exhaust ductwork that penetrate the barriers separating Fire Zone 69 from Fire Zones 108 and 109. In addition, the purpose of this evaluation is to demonstrate that it does not adversely impact on either the exemptions or technical evaluations appearing in Sections 7 and 9 of this report.

Description

Fire Zone 69 is located on the 650 ft elevation of the Auxiliary Building. It is part of a larger fire area that includes 3, 31, 32, 35, 36, 48, 49, 50, 51, 52, 106, 107, and 146. Fire Zones 108 and 109 rise vertically from the 624 ft elevation to the roof of each units' West Main Steam Valve House. The two zones are part of a larger fire area that includes the Unit 1 and Unit 2 Turbine Buildings, the Service Building, the Screen House, and the Unit 1 and Unit 2 West Main Steam Valve Enclosures.

Containment instrumentation room exhaust ductwork rises up from the roof of the Instrumentation Rooms in Fire Zones 33A and 34A and enters Fire Zones 108 and 109. The ductwork passes through Fire Zones 108 and 109 into Fire Zone 69. One 14 in. diameter duct penetrates from Fire Zone 108 into Fire Zone 69, with a similar duct penetrating from Fire Zone 109 into Fire Zone

69. The ductwork then proceeds to the plant vent system passing through the roof of Fire Zone 69 to the exterior. Fire dampers are not provided where the ductwork penetrates Fire Zones 108 and 109 from Fire Zone 33A, 34A, or 69.

Safe Shutdown Equipment

Fire Zone 69 contains the Unit 1 and Unit 2 CCW surge tank manual isolation valves (1-CCW-214, 1-CCW-220, 2-CCW-214, 2-CCW-220).. Fire Zone 69 also contains cables associated with the following Unit 1 components (see Table 4-3 and Section 4.4.5):

(1) two pressurizer PORVs;

(2) two pressurizer block valves;

(3) two reactor head vent valves;

(4) two post-accident sampling valves; and

(5) safety injection accumulator valves.

Other fire zones that do contain safe shutdown cable and/or equipment in the area in which Fire Zone 69 is located are Fire Zones 32, 50, 51, 52, 106, and 107.

Fire Zone 108 contains the following safe shutdown equipment and their associated cables:

(1) Unit 1 steam generators 2 and 3 PORVs;

(2) Pressure transmitters for steam generators 2 and 3;

(3) Steam generators 2 and 3 main steam stop valves (MSSVs);

(4) Steam generators 2 and 3 safety relief valves; and

(5) Unit 1 turbine driven AFW pump steam supply isolation valves.

Fire Zone 109 contains the following safe shutdown equipment and their associated cables:

(1) Unit 2 steam generators 2 and 3 PORVs;

(2) Pressure transmitters for steam generators 2 and 3;

(3) Steam generators 2 and 3 main steam stop valves (MSSVs);

(4) Steam generators 2 and 3 safety relief valves; and

(5) Unit 2 turbine driven AFW pump steam supply isolation valves.

Redundant safe shutdown capability is available for Fire Zones 108, 109 and 69 outside of the fire area in which they are located. Therefore, fire could involve Fire Zones 69, 108, and 109 without impacting on redundant safe shutdown capability.

Fire Protection Equipment

Fire Zone 69 is provided with automatic detection capability and manual water spray suppression for the AHVs in the zone. Neither Fire Zone 108 or 109 contain automatic detection or suppression capability.

Fire Hazards Analysis

Fire Zones 108 and 109 have a combustible loading of under 27,000 and 33,000 Btu/ft^2 for an equivalent fire severity of under 20 and 25 minutes, respectively. (The actual combustible loading and equivalent fire severity existing at this time are 10,187 Btu/ft^2 and 2.2 minutes for Fire Zone 108, and 15,872

Btu/ft^2 and 11.8 minutes for Fire Zone 109, respectively.) Should transient combustibles be brought into the zone, the combustible loading could increase to 40,000 Btu/ft^2 for Fire Zone 108, and 47,000 Btu/ft^2 for Fire Zone 109. This could result in an equivalent fire severity of 30 and 35 minutes, respectively.

Fire Zone 69 has a combustible loading of under 20,000 Btu/ft^2 for an equivalent fire severity of under 15 minutes. (The actual combustible loading and equivalent fire severity existing at this time is less than 2998 Btu/ft^2 and 2.2 minutes, respectively). The area in which this zone is located has an average combustible loading of less than 33,000 Btu/ft^2 for an equivalent fire severity of 25 minutes. (The actual combustible loading and equivalent fire severity existing at this time are 17,283 Btu/ft^2 and 12.9 minutes, respectively).

The seismic gap exemption request contained in Section 7.14 of this report demonstrated that fire could involve Fire Zones 49 and 108 or Fire Zones 50 and 109 without impacting on redundant safe shutdown capability. The evaluation contained in Section 9.9 of this report combined Fire Zones 49, 50, 51, and 52 into a larger fire area that included Fire Zones 3, 32, 36, 48, and 69. The combination of the seismic gap exemption request and the evaluation contained in Section 9.9 of this report show that a fire originating from Fire Zones 49, 50, 108, or 109 will not jeopardize redundant safe shutdown capability. This is in part due to the modifications that were completed in Fire Zones 51 and

52 as recommended in the March 1983 Appendix R submittal to ensure safe shutdown capability given a fire originating in these two zones or in Fire Zones 49 or 50.

For fire to adversely impact on redundant safe shutdown capability, it would have to spread to the two AFW battery rooms on the 633 ft elevation of the Auxiliary Building (Fire Zones 106 and 107) or their associated cables located in Fire Zones 52 and 50 respectively. The fire would also have to spread to the two corridors running between the Unit 1 and Unit 2 diesel generator rooms on the 591 ft elevation of the Turbine Buildings. A fire that spreads in this manner could result in the loss of both turbine-driven AFW pumps and 3 out of 4 diesel generators.

The evaluation contained in Section 9.30 of this report addressed combining Fire Zones 106 and 107 with Fire Zones 49, 50, 51, 52, 3, 31, 32, 35, 36, 48, 69, and 146 to form a larger fire area. The potential for fire to to spread to Fire Zones 52 or 106 and Fire Zones 50 or 107 was addressed. This fire was not considered a credible event due to the presence of automatic detection in all four zones and automatic dry pilot suppression in Fire Zone 52. The evaluation that combined the Unit 1 and Unit 2 Turbine Buildings into a larger fire area, contained in Section 9.11 of this report, addressed the possibility of fire in the Turbine Buildings spreading to the corridors between the diesel generator rooms in each unit. The potential for this to occur was also identified as being an unlikely event.

In addition to the two unlikely events occurring as identified in Sections 9.11 and 9.30 of this report, fire would also have to spread from Fire Zones 108 and 109 in the West Main Steam Valve Enclosures for each unit into Fire Zone 69 on the 650 ft elevation of the Auxiliary Building. From Fire Zone 69, the fire would then have to spread down into Fire Zones 106 or 52 and Fire Zones 50 or 107 on the 633 ft elevation. This fire, which spreads throughout the Unit 1 and Unit 2 Turbine Buildings and from there to the 650 and 633 ft elevations of the Auxiliary Building is not a credible event.

The only other potential fire which should be addressed in this evaluation is one that originates in Fire Zone 69, spreads to both Fire Zones 108 and 109 simultaneously, and from there spreads through Fire Zones 33A and 34A into Fire Zones 33 and 34. A fire that spreads in this manner could result in the loss of all four steam generators in both units.

The two evaluations contained in Sections 9.35 and 9.36 of this report address the potential for fire to spread from either Fire Zone 108 or Fire Zone 109 into either Fire Zone 33 or Fire Zone 34. The types of fires identified in these two evaluations were not considered credible events. For fire to accomplish the same goal, but also originate in Fire Zone 69, it would have to be a fire far larger than could be supported by the 20,000 Btu/ft2 combustible loading existing in Fire Zone 69. Therefore, this fire is also not a credible event.

Conclusions

Based on the preceding evaluation, reasonable assurance is provided that a fire that involves either Fire Zones 69, 108, or 109 will not adversely impact on redundant safe shutdown capabilities via the undampered containment instrument room piping/ductwork penetrating through the fire zones. In addition, the undampered pipe/ducts will not adversely impact on other evaluations or exemptions contained in this report. The bases which justify this conclusion are summarized as follows:

(1) The combustible loadings in the zones of concern are less than 20,000 Btu/ft^2 for Fire Zone 69; 40,000 Btu/ft^2 for Fire Zone 108; and 47,000 Btu/ft^2 for Fire Zone 109.

(2) Automatic detection capability is provided in Fire Zone 69 which would result in prompt fire brigade response given a fire in this zone.

(3) Previously evaluations have addressed most of the potential fires that could affect the zones of concern and they were identified as not being credible events.

(4) For fire to impact on redundant safe shutdown capability, it would either have to (1) spread to both West Main Steam Valve Enclosures simultaneously or (2) involve both the 591 ft elevation of the Unit 1 and Unit 2 Turbine Buildings and the 633 ft elevation of the Auxiliary Building; neither fire is a credible event.

9.39 Fire Zone 70 to Fire Zone 129 Boundary Evaluation

Purpose

The purpose of this evaluation is to analyze the impact on redundant safe shutdown capability of an unrated door connecting Fire Zone 129 (the Unit 1 Turbine Deck) and Fire Zone 70 (the Unit 1 Control Room HVAC Room). In addition, this evaluation does not adversely impact on other evaluations or exemption requests contained in this report.

Description

Fire Zone 129 is located on the 633 ft elevation of the Unit 1 Turbine Building. It is part of a larger fire area that includes the Unit 1 and Unit 2 Turbine Buildings, the West Main Steam Valve Enclosures of each unit, the Service/Office Building, and the Screen House. Fire Zone 70 is located on the 650 ft elevation of the Auxiliary Building directly above the Unit 1 Control Room. It is part of a larger fire area that includes Fire Zones 71, 72, and 73. An open stairway provides access up the east wall of Fire Zone 129 to an elevator equipment room at approximately the 650 ft elevation. Within the elevator equipment room is an unrated door that leads into Fire Zone 70.

Safe Shutdown Equipment

Neither Fire Zone 129 nor Fire Zone 70 contain equipment or cables required for safe shutdown purposes.

Fire Protection Equipment

Fire Zone 129 is provided with thermistor detection and manual water spray and dry chemical suppression for the Unit 1 turbines. Fire Zone 70 is provided with an area and duct smoke detection system, and automatic thermistor detection with manual water spray suppression system for the charcoal filter units in the zone.

Fire Hazards Analysis

Due to the location of the door and the elevations at which the two zones are located, the only potential fire that must be considered in this evaluation is one that spreads into Fire Zone 70 from the elevator equipment room of Fire Zone 129. The fire would then have to spread into the Control Rooms of both units simultaneously in order to impact on redundant safe shutdown capability. Should fire spread into Fire Zone 70, then the paths for fire to spread are identical to those presented in the evaluation contained in Section 9.5 of this report. That evaluation, which addressed the unrated hatches in the floor of Fire Zones 70 and 73 to Fire Areas 53 and 54 below, concluded that fire occurring in Fire Zones 70, 71, 72, and/or 73 would not impact on redundant safe shutdown capability. Therefore, the analysis and conclusions identified in Section 9.5 also apply.

Conclusion

Based on the previous evaluation, reasonable assurance is provided that the unrated door between Fire Zones 129 and 70 does not adversely impact on either redundant safe shutdown capabilities. In addition, this evaluation does not adversely impact on other evaluations or exemption requests contained in this report. The bases which justify this conclusion are summarize as follows:

(1) Neither Fire Zone 129 nor Fire Zone 70 contain equipment or cables required for safe shutdown.

(2) Due to the location of the unrated door, which is approximately 27 ft above the floor of the Unit 1 turbine deck and within an elevator equipment room enclosure, the only potential for fire spread is from the equipment room enclosure to Fire Zone 70 and from there to both Control Rooms simultaneously.

(3) The potential for fire to spread from Fire Zones 70, 71, 72, and/or 73 to both Control Rooms simultaneously was addressed in the evaluation contained in Section 9.5 of this report. The conclusions of that evaluation, which was that fire would not spread in this manner, also apply to this evaluation.

9.40 Fire Zone 7 to Fire Zone 61 Boundary Evaluation

Purpose

The purpose of this fire area boundary evaluation is to determine the impact on redundant safe shutdown capability of two unrated field fabricated fusible link actuated guillotine type dampers presently located between Fire Zone 7 (Unit 1 Quadrant 1 Cable Tunnel) and Fire Zone 61 (Spray Additive Tank Room). In addition, this evaluation will also verify that there is no adverse impact to other evaluations or exemption requests contained in this report.

Description

Fire Zone 7 is the Unit 1 Quadrant 1 Cable Tunnel, el. 596 ft. Fire Zone 61 is located on the 587 ft elevation of the Auxiliary Building. An unrated, field fabricated fire damper constructed of 3/8-in. steel plate is provided in a 3 in. diameter HVAC opening in the common wall separating Fire Zone 7 and Fire Zone 61. Fire Zone 7, by itself, makes up a fire area, while the fire area containing Fire Zone 61 consists of Fire Zones 5, 6A, 6M, 6N, 6S, 61, 64A, 64B, 65A and 65B. Fire Zone 5 is the only adjacent zone to Fire Zone 61 within the same fire area..

Safe Shutdown Equipment

Fire Zone 7 contains no safe shutdown components but does contain safe shutdown cables. The safe shutdown cables are associated with various process monitoring instrumentation, auxiliary feedwater supply valves and pressurizer PORV's and block valves.

No safe shutdown components or cables exist in Fire Zone 61. However, the fire area which contains Fire Zone 61 does have safe shutdown components and cables. A majority of the safe shutdown components and cables within Fire Zone 5, which is adjacent to Fire Zone 61, are associated with local and alternate shutdown process monitoring indication.

Fire Protection Equipment

Fire detection and automatic carbon dioxide suppression systems are provided for Fire Zone 7 which has an equivalent fire severity under 100 minutes (the actual fire severity existing at this time is approximately 87 minutes). While Fire Zone 61 does not have an automatic suppression system, it does contain a smoke detection system with manual fire fighting equipment located outside of the zone and an equivalent fire severity under 20 minutes (the actual fire severity existing at this time is approximately 10 minutes). Fire Zone 5 having an equivalent fire severity of less than 20 minutes (the actual fire severity existing at this time is approximately 8.5 minutes), is also equipped with automatic fire detection and water suppression systems.

Fire Hazards Analysis

Fire Zone 7, with an equivalent fire severity of under 100 minutes (the actual fire severity existing at this time is approximately 87 minutes), is equipped with an automatic carbon dioxide suppression system which would quickly extinguish a fire in this zone. Therefore, reasonable assurance is provided that a fire originating within Fire Zone 7 would not spread to any other fire areas/zones. Fire Zone 61, although not equipped with an automatic suppression system, is provided with an ionization smoke detection system to ensure fast response to any fire starting within this zone. The smoke detection system coupled with: (1) the lack of safe shutdown cables or equipment within the zone; (2) an equivalent fire severity of under 20 minutes (the actual fire severity existing at this time is approximately 10 minutes); and (3) manual fire fighting equipment located outside the zone, ensures a fast response and extinguishment of any fire starting within this zone. If a fire should start in Fire Zone 5 (the only adjacent fire zone to Fire Zone 61 within the same fire area) the detection and suppression systems, coupled with the equivalent fire severity of under 20 minutes (the actual fire severity existing at this time is approximately 8.5 minutes), provides reasonable assurance that the fire will not spread to Fire Zone 61.

Factory Mutual has published a standard, "Loss Prevention Data" Section 1-45 which applies to air duct systems. The objectives of the standard are:

(1) "To restrict the spread of fire, smoke, and heat through air-conditioning systems from one fire area to another or into a building from outside.

(2) To maintain the fire resistive integrity of building elements, such as floors, walls, and columns affected by the duct system installation, by minimizing ignition sources and combustibility of the elements of the duct system.

(3) To discuss the use of air duct systems for the additional purpose of emergency smoke control."

The standard provides design guidance and recommendations for duct systems including location and minimum design requirements for fire dampers. In reviewing the Factory Mutual System specifications Section 1-45 "Loss Prevention Data," Page 3, Item 2, under "Recommendations" states:

> "Wherever ducts pass through interior fire cutoffs of three-hour or more fire resistance ratings, openings 18 in. (455 mm) or more in diameter or on longest side should be protected by a door arrangement having an overall fire rating of three hours. At openings in such cutoffs not exceeding 18 in. (455 mm) in diameter or on longest side, 1/8 in. (3.2 mm) steel plates may be used."

The field constructed dampers are located in ducts which go through a wall penetration that is less than 18 in. in diameter. The dampers are constructed of 3/8 in. thick steel plate. They meet the Factory Mutual requirements for protection of openings not exceeding 18 in. in diameter located in barriers required to have a three-hour fire rating. Based on this guidance, the existing 3/8-in. thick fusible-link actuated steel plate provides adequate protection for the ventilation opening in the barrier common to Fire Zone 7 and Fire Zone 61. Therefore, the boundary barrier between Fire Zones 7 and 61 can be considered as a fire area boundary.

Conclusion

Based on the previous evaluation, the existing field fabricated fusible link actuated guillotine type dampers located between Fire Zone 7 and Fire Zone 61 is an acceptable device for maintaining the rating of the fire area boundary. In addition, this evaluation does not adversely impact on other evaluations or exemption requests contained in this report. The bases which justify this conclusion are summarized as follows:

(1) The existing damper meets the requirements of the Factory Mutual System specifications for fire dampers.

(2) Fire Zone 7 presently is provided with an automatic carbon dioxide suppression system which would quickly extinguish a fire in this area. Fire Zone 61 has been provided with an automatic smoke detection system, manual fire fighting equipment located outside the zone and has an equivalent fire severity of under 20 minutes.

(3) Since Fire Zone 61 has a combustible loading under 27,000 Btu/ft^2 (under 20 minutes fire severity) this area is not a primary source of fire.

(4) Fire Zone 5, which is the only adjacent fire zone to 61 within the same fire area, is provided with automatic fire detection and suppression and has an equivalent fire severity of less than 20 minutes.

(5) Replacing the existing 3/8-in. thick steel plate dampers with a three-hour-rated dampers would not enhance the protection provided by the existing configuration.

9.41 Fire Zones 37 and 51 HVAC Duct Penetrations

Purpose

The purpose of this evaluation is to analyze the impact on safe shutdown capability due to 15 undampered HVAC penetrations connecting the 617 ft and 633 ft elevations of the Auxiliary Building between Fire Zones 37 and 51. In addition, this evaluation will also verify that there is no adverse impact to other evaluations or exemption requests contained in this report.

Description

Each of the fifteen undampered HVAC ducts (8" in diameter) provide exhaust air for the demineralizer tank cubicles located on the 617 ft elevation of the Auxiliary Building located in Fire Zone 37. Fire Zone 37 is part of the fire area defined by Fire Zones 37, 43, 44A, 44B, 44C, 44D, 44E, 44F, 44G, 44H, 44N, and 44S.

Each of the demineralizer tank cubicles has an undampered (8" diameter) supply duct penetrating from the 609 ft elevation of Fire Zone 44N below and into the lower portion of each cubicle in Fire Zone 37. No ductwork is provided within the cubicles themselves. Ducts originate at the ceiling over each tank, rise approximately vertically, and enter a common exhaust header located on the 633 ft elevation of the Auxiliary Building in Fire Zone 51. Fire Zone 51 is part of the fire area defined by Fire Zones 3, 31, 32, 35, 36, 48, 49, 50, 51, 52, 69, 106, 107, and 146. The common exhaust duct then traverses through Fire Zone 51 to Fire Zone 52 on the 633 ft elevation of the Auxiliary Building. Air from this duct is normally exhausted from the Auxiliary Building by two exhaust fans (2-HV-AX-1,2).

Safe Shutdown Equipment

Fire Zone 51 is located on elevation 633 ft and is contained in the fire area defined by Fire Zones 3, 31, 32, 35, 36, 48, 49, 50, 51, 52, 69, 106, 107, and 146. Safe shutdown equipment is located in Fire Zones 50, 52, 69, 106, and 107. The equipment includes 1-CMO-429, 2-CMO-429 (CCW to RHR heat exchanger isolation MOV), 1-CCW-214, 1-CCW-220, 2-CCW-214, 2-CCW-220 (CCW surge tank manual isolation valves), MCCs 1-AM-A, 2-AM-A, 1-AM-D, 2-AM-D, battery distribution cabinet DCN (Unit 1 and Unit 2) and batteries associated with turbine-driven AFW pumps. Various cables are located in Fire Zones 32, 50, 51, 52, 69, 106 and 107. Fire Zones 3, 31, 35, 36, 48, 49 and 146 do not contain any safe shutdown equipment and/or cables. Based on the safe shutdown system analysis, in the event of a fire in this area, all safe shutdown systems have at least one path free of fire damage in each unit except for source range monitoring instrumentation. However, the March 1983 submittal recommended the addition of an alternate source range neutron monitoring channel to provide indication at local shutdown panel LSI-4 located in Fire Zone 5.

Fire Zone 37 is located on elevation 617 ft and is contained in the fire area defined by Fire Zones 37, 43, 44A through 44H, 44N and 44S. This fire area contains various safe shutdown motor control centers, pumps and redundant cables. As recommended in Section 8 of this report, various modifications will be made in this fire area to ensure safe shutdown capability. Fire Zone 37 contains no safe shutdown equipment and/or cables.

Fire Protection Equipment

The fire area defined by Fire Zones 37, 43, 44A through 44H, 44N, and 44S contains automatic detection in Fire Zones 37 (outside of the demineralizer cubicles), 43, 44N and 44S. Automatic dry pilot preaction sprinklers, including protection of stairways to adjacent elevations, are provided in Fire Zones 44N and 44S.

The fire area defined by Fire Zones 3, 31, 32, 35, 36, 48, 49, 50, 51, 52, 69, 106, 107, and 146 contains automatic detection in Fire Zones 32, 48, 49, 50, 51, 52, 69, 106 and 107. Only partial coverage is provided in Fire Zone 3. No detection coverage is provided in Fire Zones 31, 35, 36 and 146. Thermistors are also provided for the charcoal filter units in Fire Zones 49, 50 and 69. Automatic dry pilot preaction sprinklers are contained in Fire Zones 32, 51 and 52 with partial coverage provided in Fire Zone 3. A manual deluge system is used for the charcoal filter units in Fire Zones 49, 50 and 69.

Fire Hazards Analysis

The above fire areas have equivalent fire severities as indicated by the following:

Fire Area or Fire Zones Composing a Fire Area	Area Fire Severity (Minutes)
FZs 3,32,36,48,49,50 51,52,69,106,107,146	25
FZs 37,43,44A through 44H,44N,44S	35

In order for a fire to affect both fire areas, a fire would have to start in Fire Zone 37 or propagate from Fire Zone 44N to 37. The fire would have to then travel through the exhaust ducts of Fire Zone 37 to Fire Zone 51. Fire Zones 44N and 37 (outside of the demineralizer cubicles) are provided with automatic detection systems. As previously stated, Fire Zone 44N is provided with an automatic dry pilot preaction suppression system. Therefore, if a fire was to start in 44N, it would most likely be extinguished in its incipient stages before smoke and hot combustible gas could travel through Fire Zone 37 to Fire Zone 51. However, if hot combustible gas and smoke were to travel to Fire Zone 37, enter the individual demineralizer cubicles, and then spread into the undampered common exhaust duct in Fire Zone 51 above, normally one of the two Unit 2 Auxiliary Building exhaust system ventilation fans would exhaust the smoke and gas.

As previously discussed, Fire Zones 50, 51, 52, 106 and 107 are the only fire zones in the fire area containing safe shutdown equipment and/or cables. These fire zones contain automatic detection systems for general area detection, with thermistors and a manual deluge system also provided for the charcoal filter units in Fire Zones 49 and 50. Fire Zones 51 and 52 are protected by automatic dry pilot sprinkler systems. This fire area has an equivalent fire severity of less than 25 minutes. (The actual fire severity existing at this time is under 12.9 minutes.)

Should the products of combustion escape the duct and enter Fire Zone 51 or 52, reasonable assurance is provided that the fire protection systems would detect and act to extinguish the fire. Therefore, transmission of fire between the two fire areas is not a credible event.

Systems Analysis

The above fire hazards analysis demonstrates that it is extremely unlikely for a fire to propagate to the adjoining fire areas at various elevations. Using the above scenarios as a basis, a systems analysis can be performed to determine the impact of a fire on the safe shutdown capability of the plant. For the purposes of this analysis, the following assumptions are used:

(1) The exhaust duct is a common means of communication of fire to both of the fire areas described above; however, it is not credible that both of the entire fire areas are simultaneously engulfed by fire.

(2) Considering assumption (1) above, the worst-case scenario is defined as a fire totally engulfing either one of the fire areas. The fire would then travel the circuitous path, described in the previous scenarios, in one of the adjacent fire areas until the fire reaches a fire zone within the fire area containing a detection and suppression system capable of detecting and extinguishing the fire.

(3) It is assumed that the fire starts at the 609 ft elevation of the Auxiliary Building (Fire Zone 44N) and then travels through the vertical portion of the HVAC duct to the unrated penetrations into Fire Zone 37. It would then have to enter the exhaust duct connecting to the common header in Fire Zone 51.

For the purposes of this analysis it is assumed that the fire will involve the fire area defined by Fire Zones 37, 43, 44A through 44H, 44N, and 44S, along with Fire Zone 51 or 52. However, since III.G.2 separation has been established between Fire Zones 44N and 44S both of these fire zones will not burn simultaneously.

As a result, the systems analysis assumes a loss of safe shutdown components (i.e., equipment and/or cables) only in Fire Zones 37, 43, 44A through 44H, and 44N along with Fire Zone 51 and/or 52.

For both the Unit 1 and Unit 2 systems analyses, it was concluded that at least one path of safe shutdown components exists for each safe shutdown systems.

This evaluation for the above fire areas and fire zones does not affect the existing exemption requests concerning the Auxiliary Building HVAC Duct Penetrations (Section 7.13) or the Containment Seismic Gaps (Section 7.14).

<u>Conclusion</u>

Based on the previous analysis, reasonable assurance can be provided that a fire starting from Fire Zones 37 and/or 44N and propagating through the undampered ducts to Fire Zone 51 and 52 will not adversely impact on safe shutdown capabilities of the plant. In addition, this evaluation does not adversely impact on other evaluations or exemption requests contained in this report. The bases for the above conclusion are summarized below:

(1) Smoke and hot combustibles entering any of the 15 exhaust ducts would normally tend to be exhausted through the engineered safeguards systems out the Unit 2 plant vent.

(2) Smoke and hot combustibles entering any of the 15 exhaust ducts would tend to accumulate in the horizontal sections of the common exhaust header in Fire Zones 51 and 52, when the fan units are not running. The hot smoke would have to result in the ignition of combustible material in either Fire Zone 51 and/or 52 in order to spread to adjacent fire zones. Due to existence of the automatic detection and suppression systems in Fire Zones 51 and 52, this is not considered a credible event.

(3) Detection and suppression systems exist in the adjacent fire areas to the 15 exhaust ducts where combustibles exist.

(4) A fire involving Fire Zones 37, 43, 44A through 44H, and 44N, along with 51 and/or 52, has been considered in the above fire protection analysis. A fire involving these fire zones will not jeopardize the safe shutdown capability of the plant.

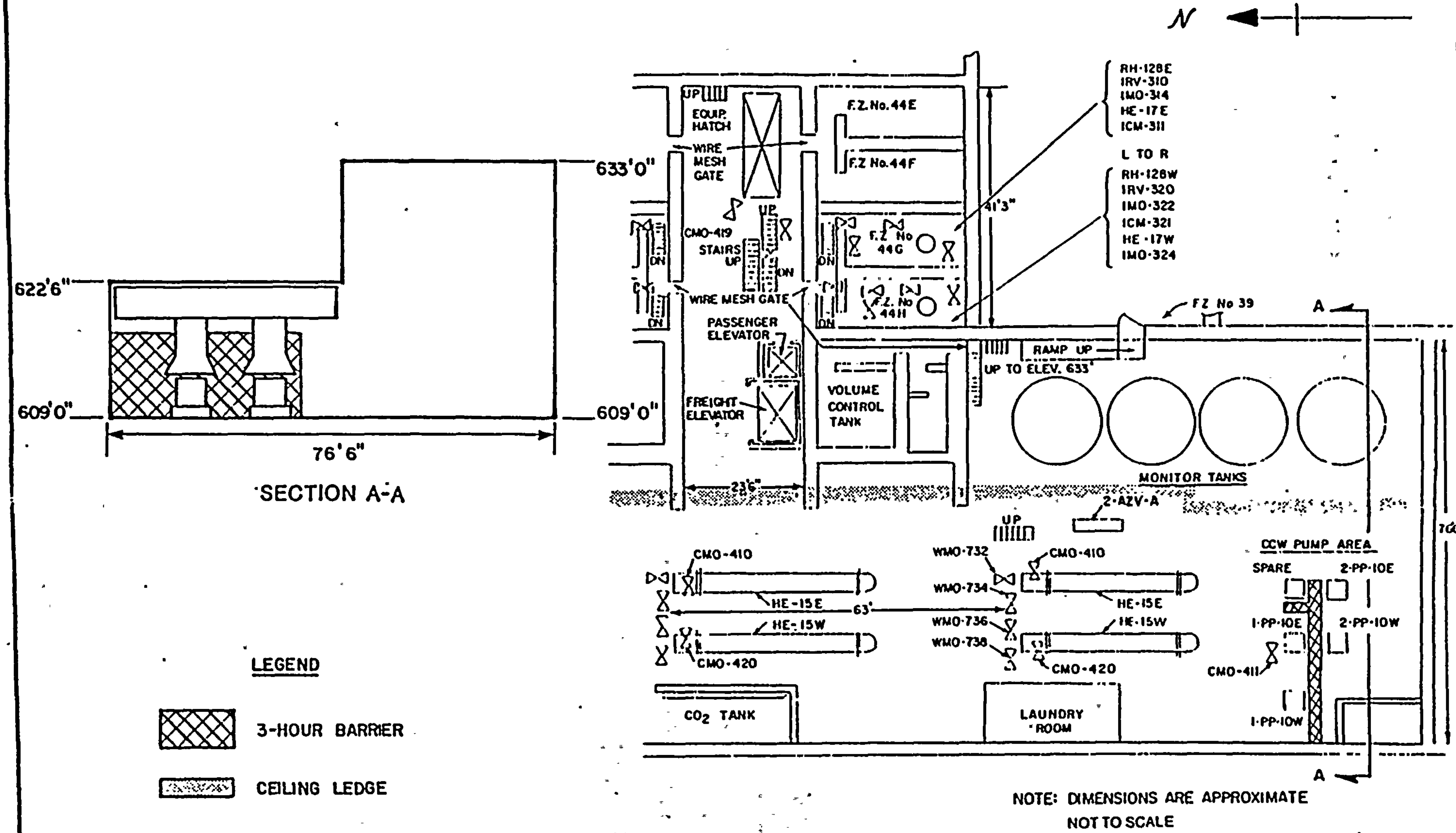
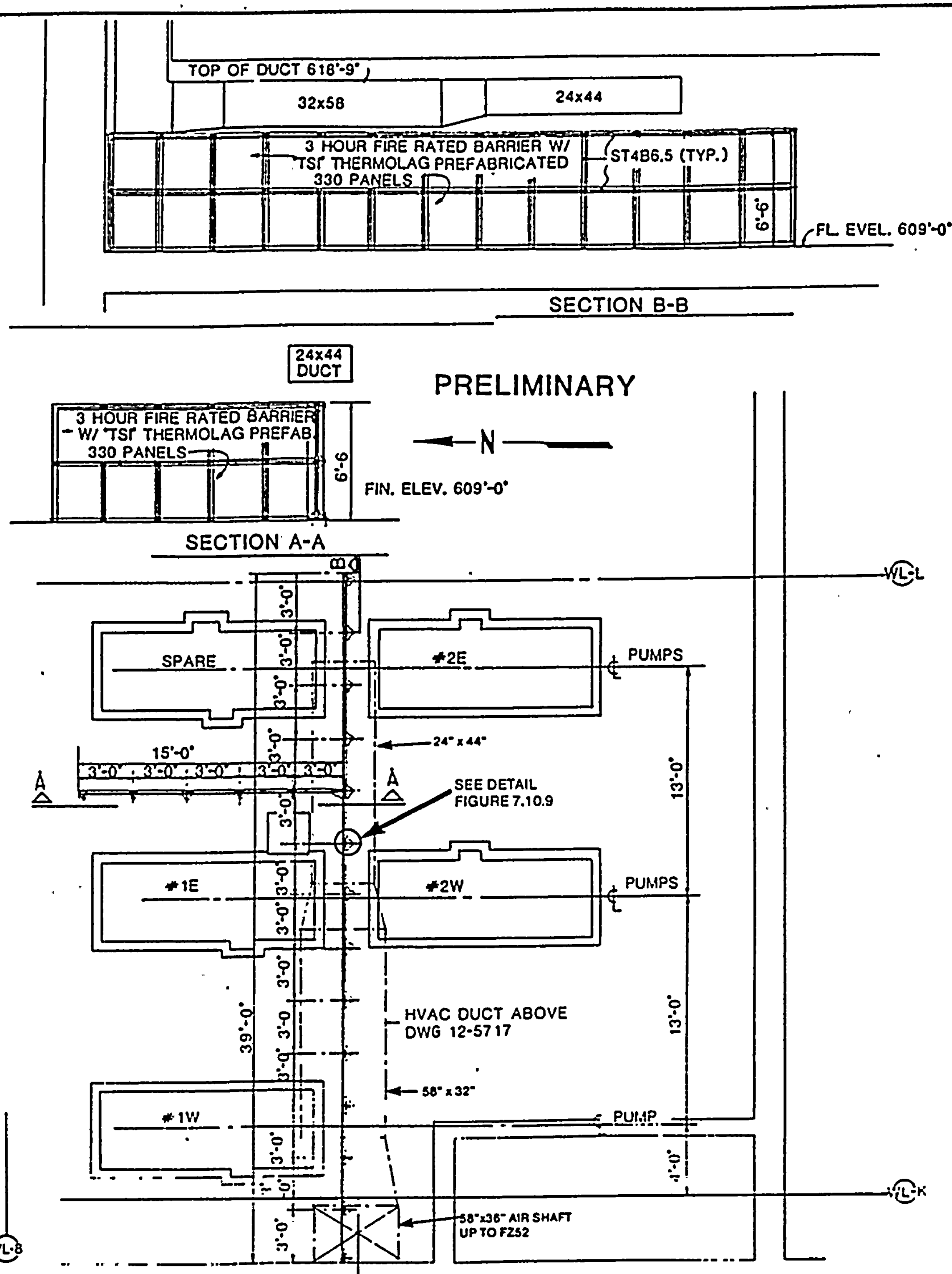


FIGURE 9.3-1 PLAN AND ELEVATION OF CEILING LEDGE IN FIRE ZONE 44S



PARTIAL FLOOR PLAN
AUXILIARY BUILDING - ELV. 609'-0"

NOTE: DIMENSIONS ARE APPROXIMATE
NOT TO SCALE

FIGURE 9.3-2 FIRE BARRIER BETWEEN COMPONENT COOLING WATER PUMPS

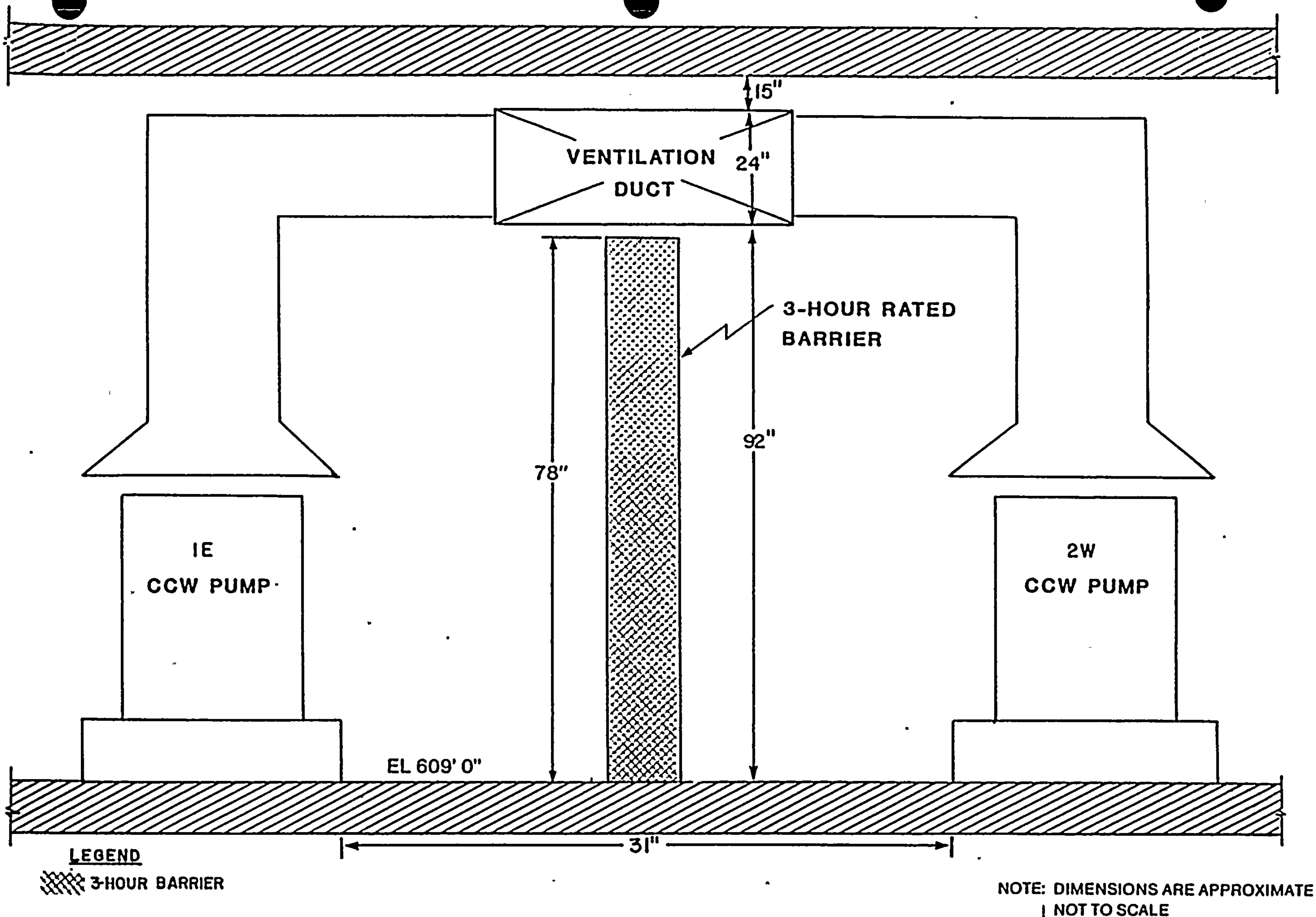
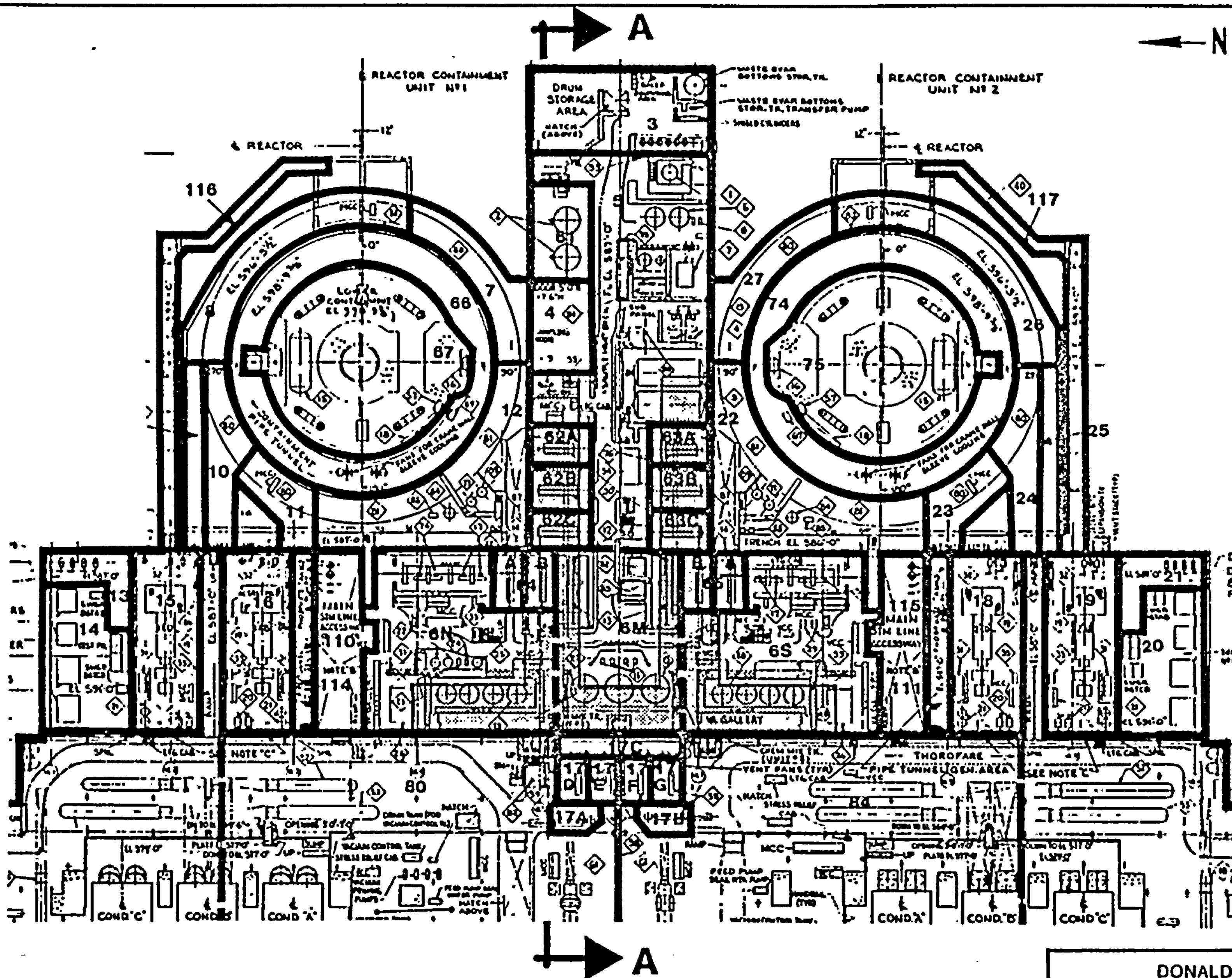


FIGURE 9.3-3 ELEVATION OF CCW PUMP FIRE BARRIER

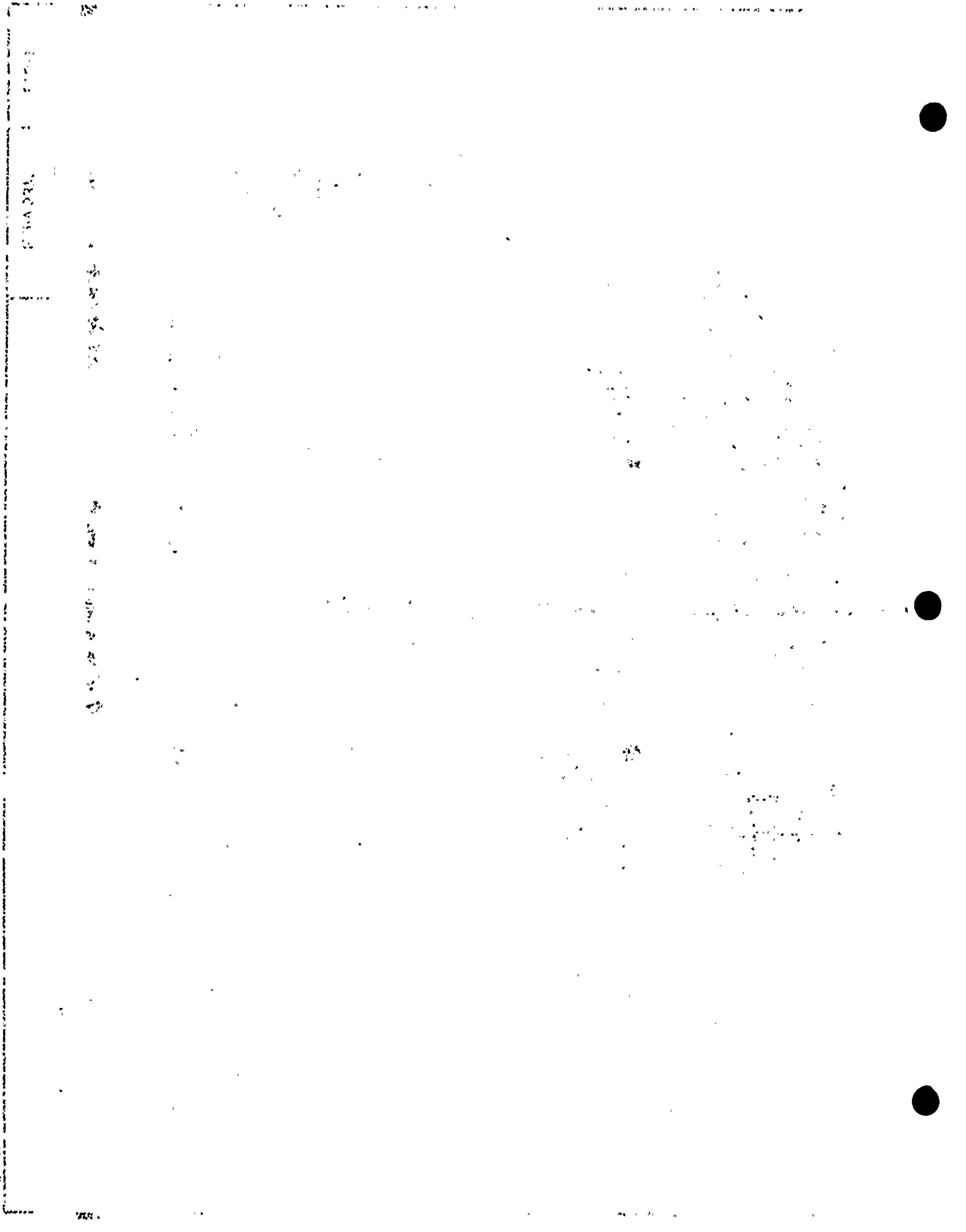


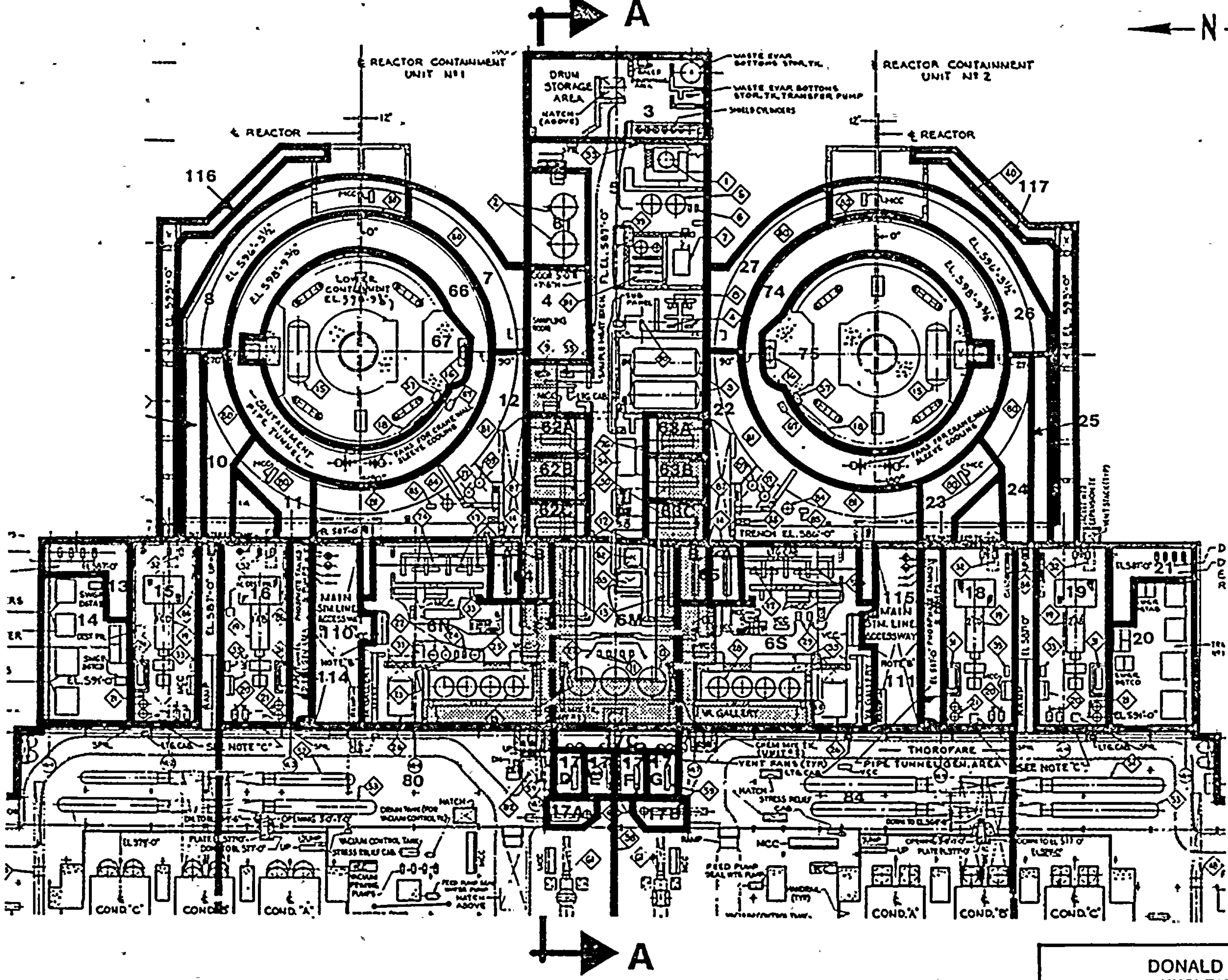
(SEE FIGURE 9.6-4)

PIPE TUNNEL ELEV.601'

DONALD C. COOK NUCLEAR PLANT	
PIPE TUNNEL EVALUATION	
ELEV 587'	FIGURE NO. 9.6-1

85-AEP-0003
P142 PT 011



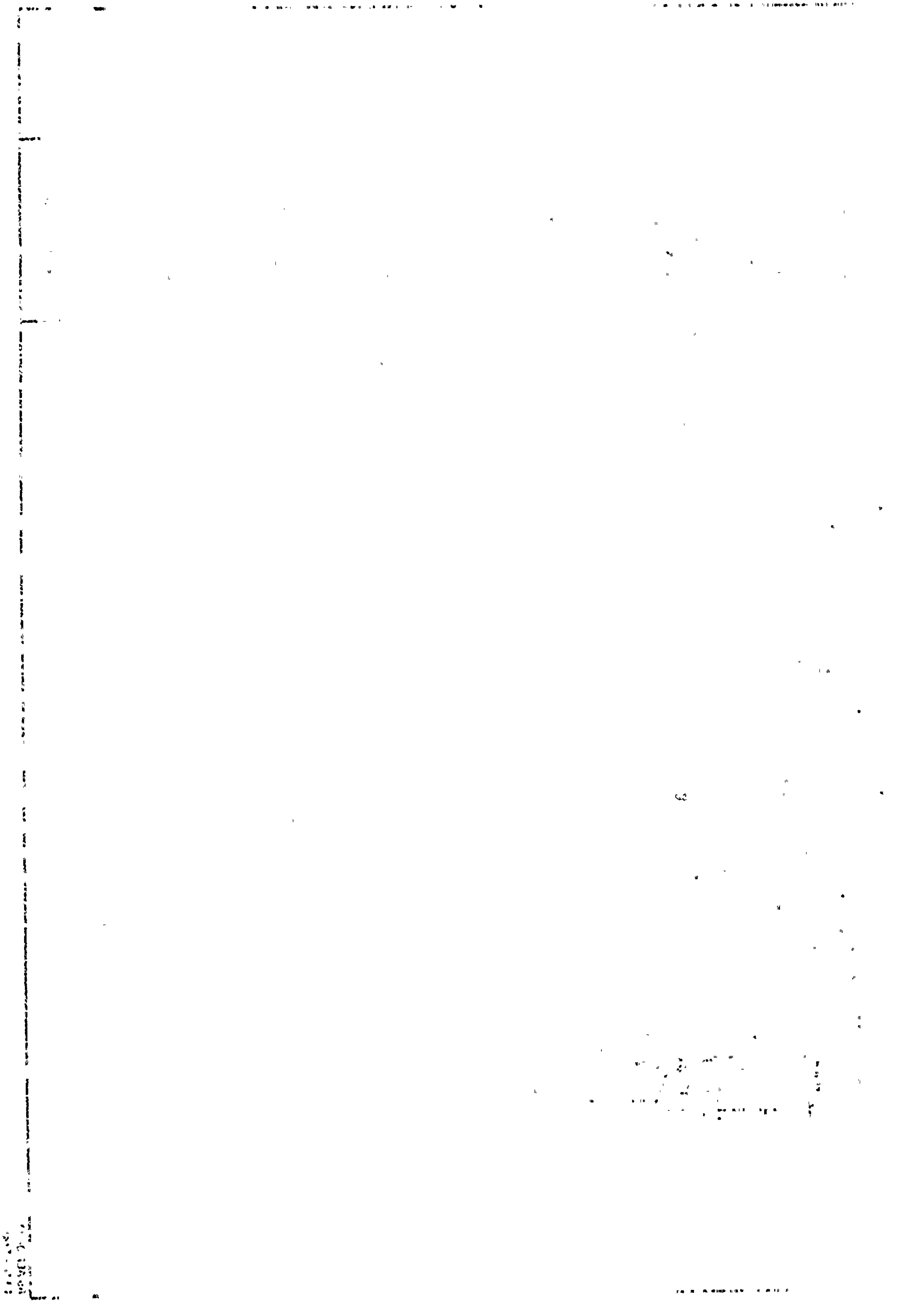


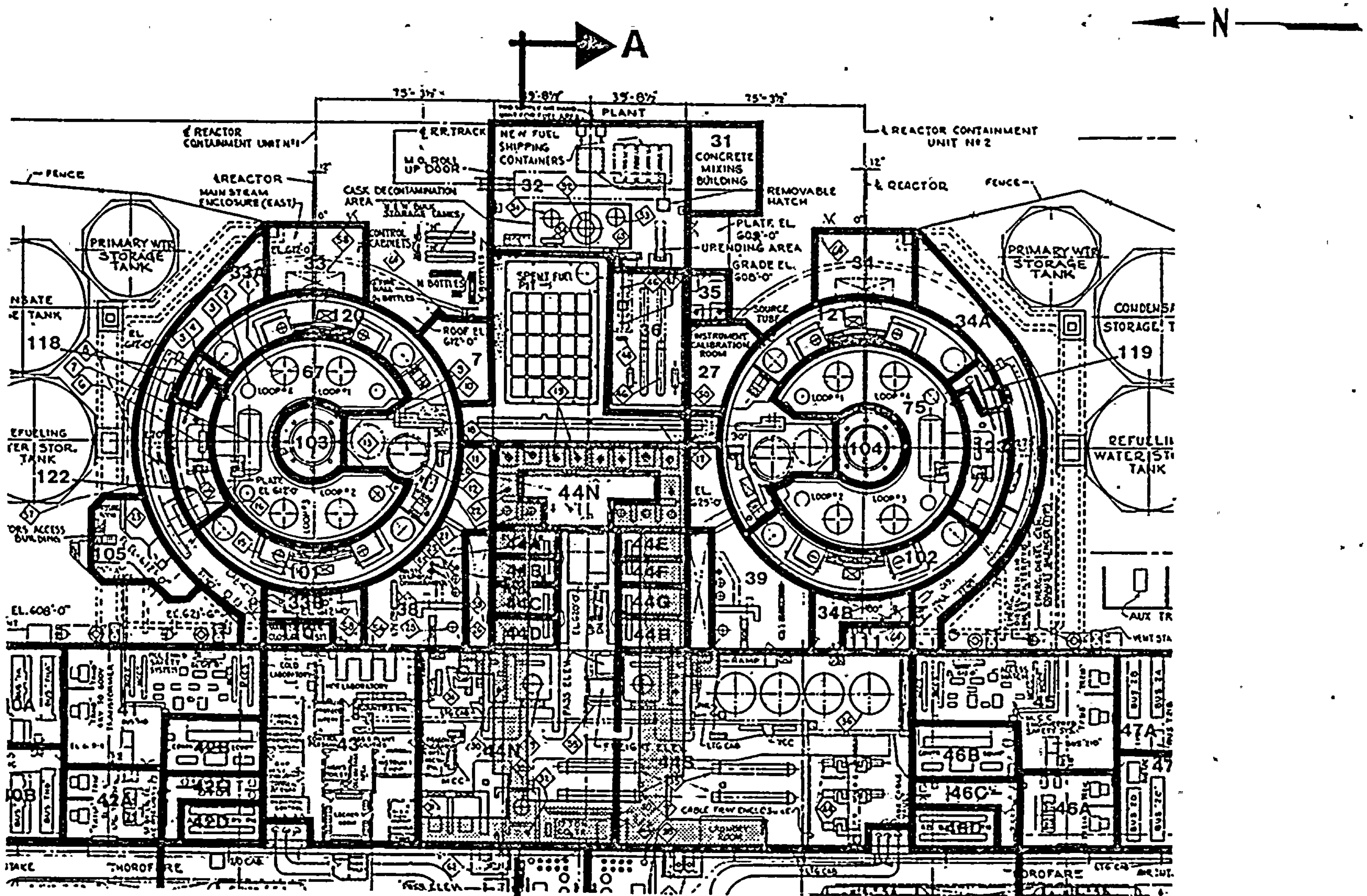
(SEE FIGURE 9.6-4)

PIPE TUNNEL ELEV.601'

DONALD C. COOK NUCLEAR PLANT	
PIPE TUNNEL EVALUATION	
ELEV 587'	FIGURE NO. 9.6-1

85-AEP-0003
P142-PT-001





A

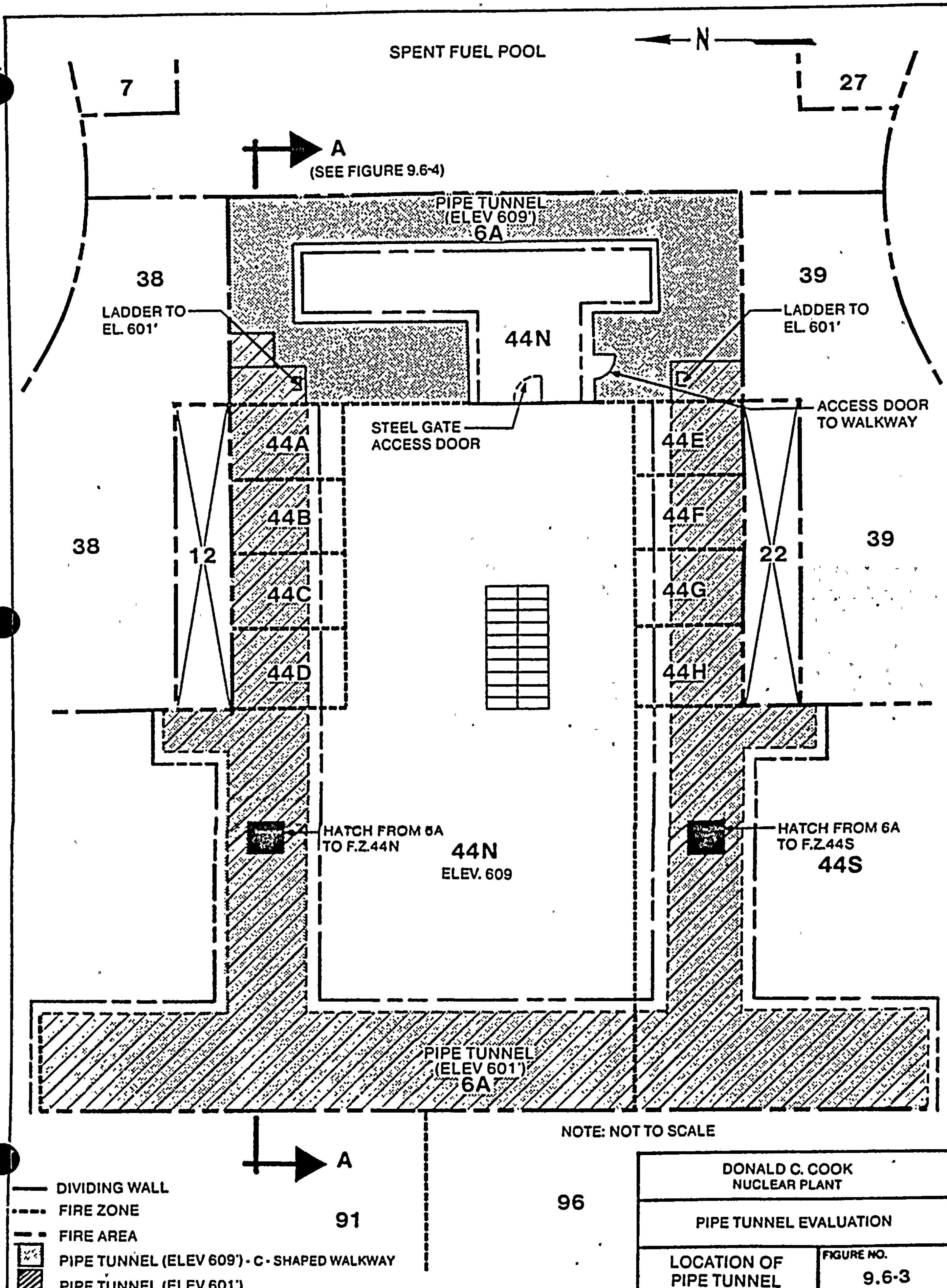
(SEE FIGURE 9.6-4)

NOTE: DIMENSIONS ARE APPROXIMATE
NOT TO SCALE

PIPE TUNNEL ELEV 601', 609'

DONALD C. COOK NUCLEAR PLANT	
PIPE TUNNEL EVALUATION	
ELEV. 609'	FIGURE NO. 9.6-2

85-AEP-0003
P142-PT-002

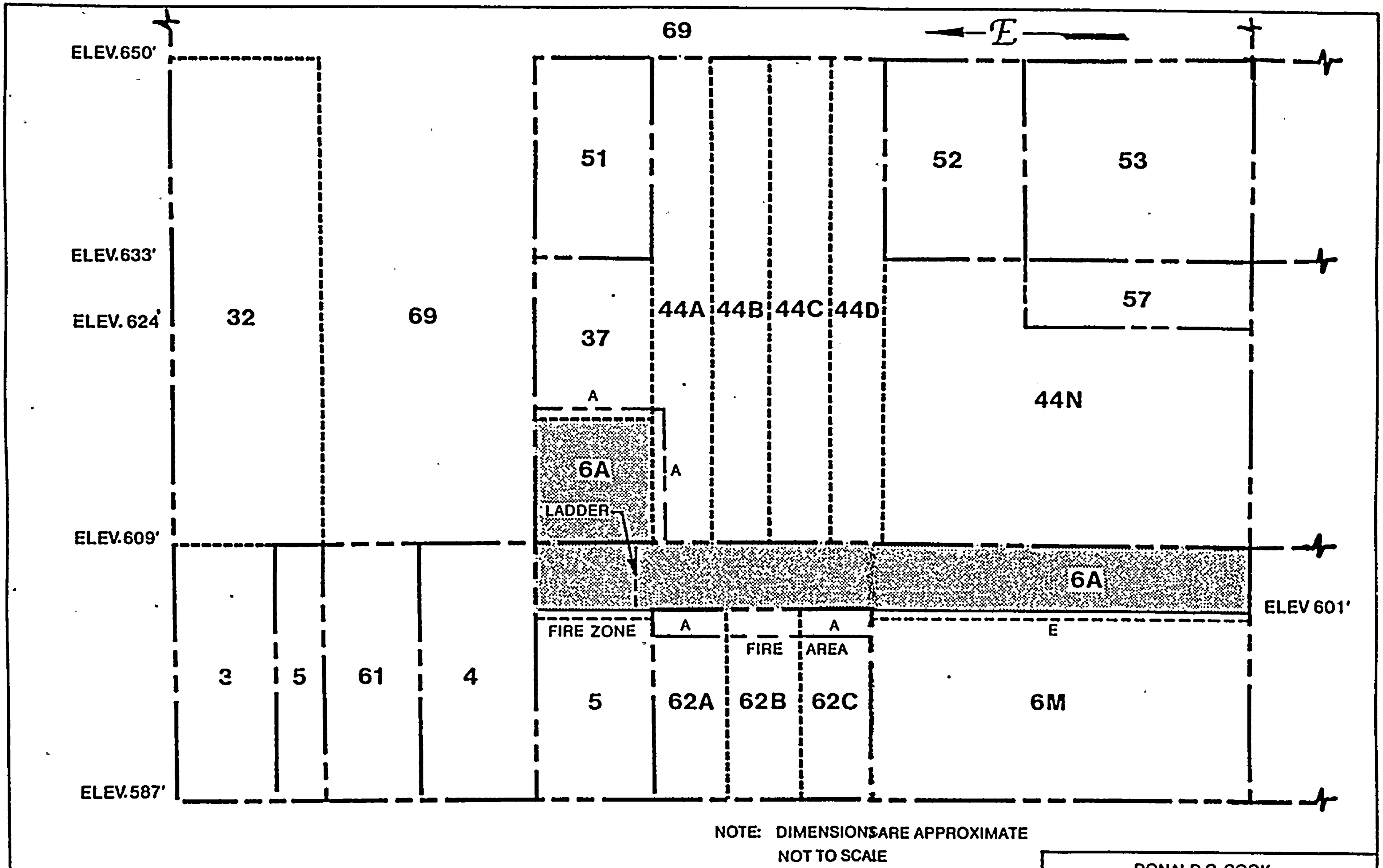


DONALD C. COOK
NUCLEAR PLANT

PIPE TUNNEL EVALUATION

LOCATION OF PIPE TUNNEL

FIGURE NO. 9.6-3

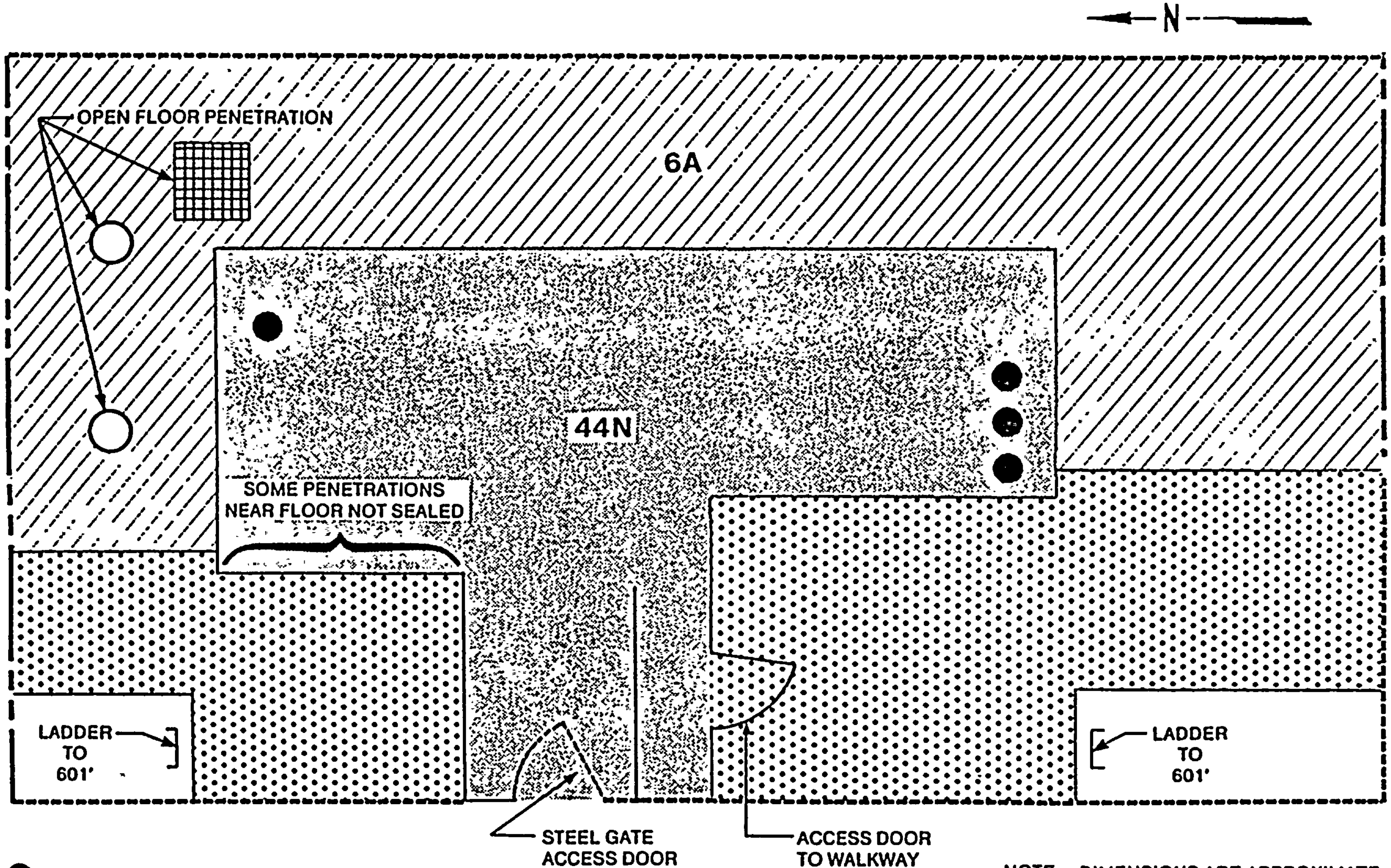


DONALD C. COOK
NUCLEAR PLANT

PIPE TUNNEL EVALUATION

SECTION A-A

FIGURE NO
9.6-4

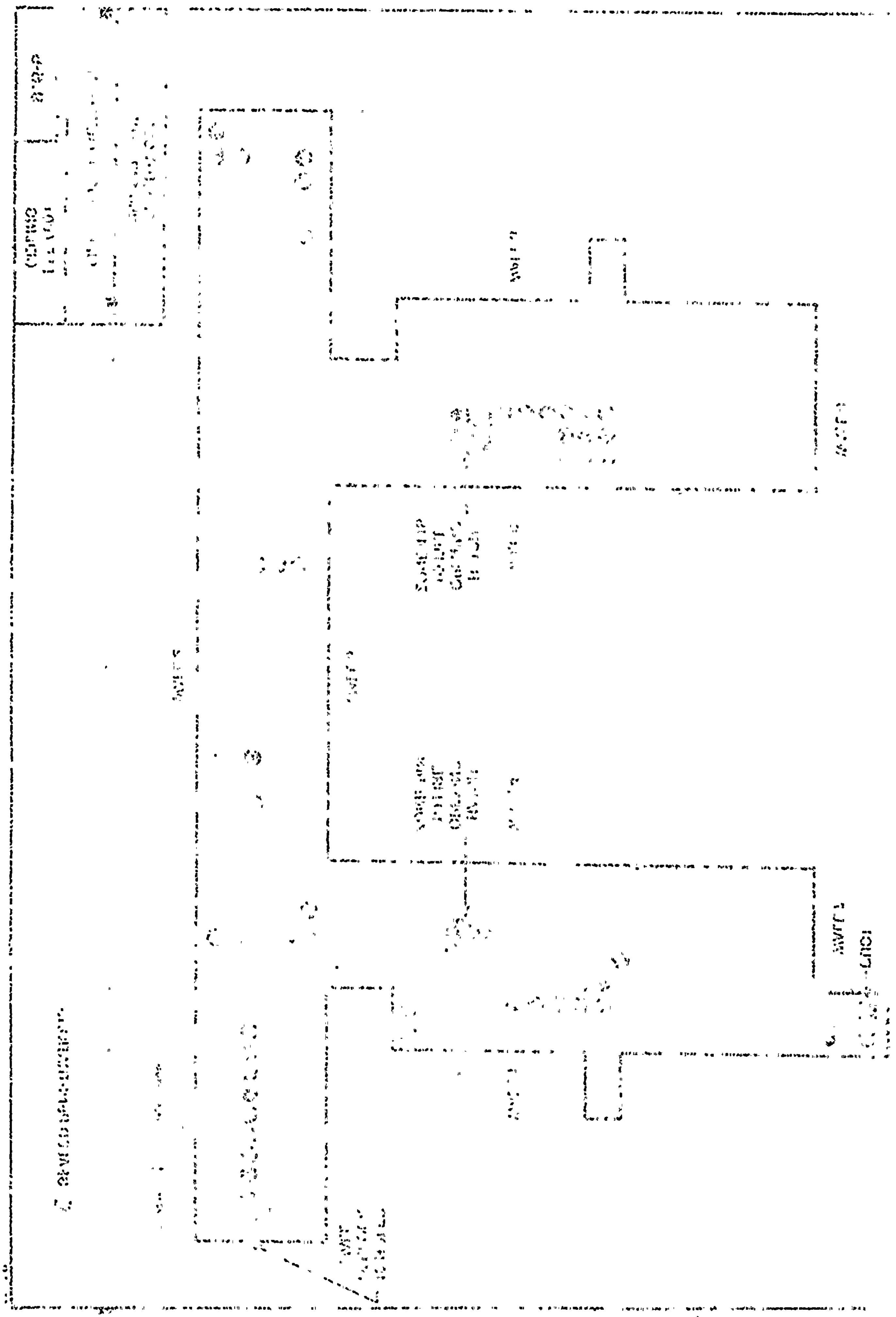


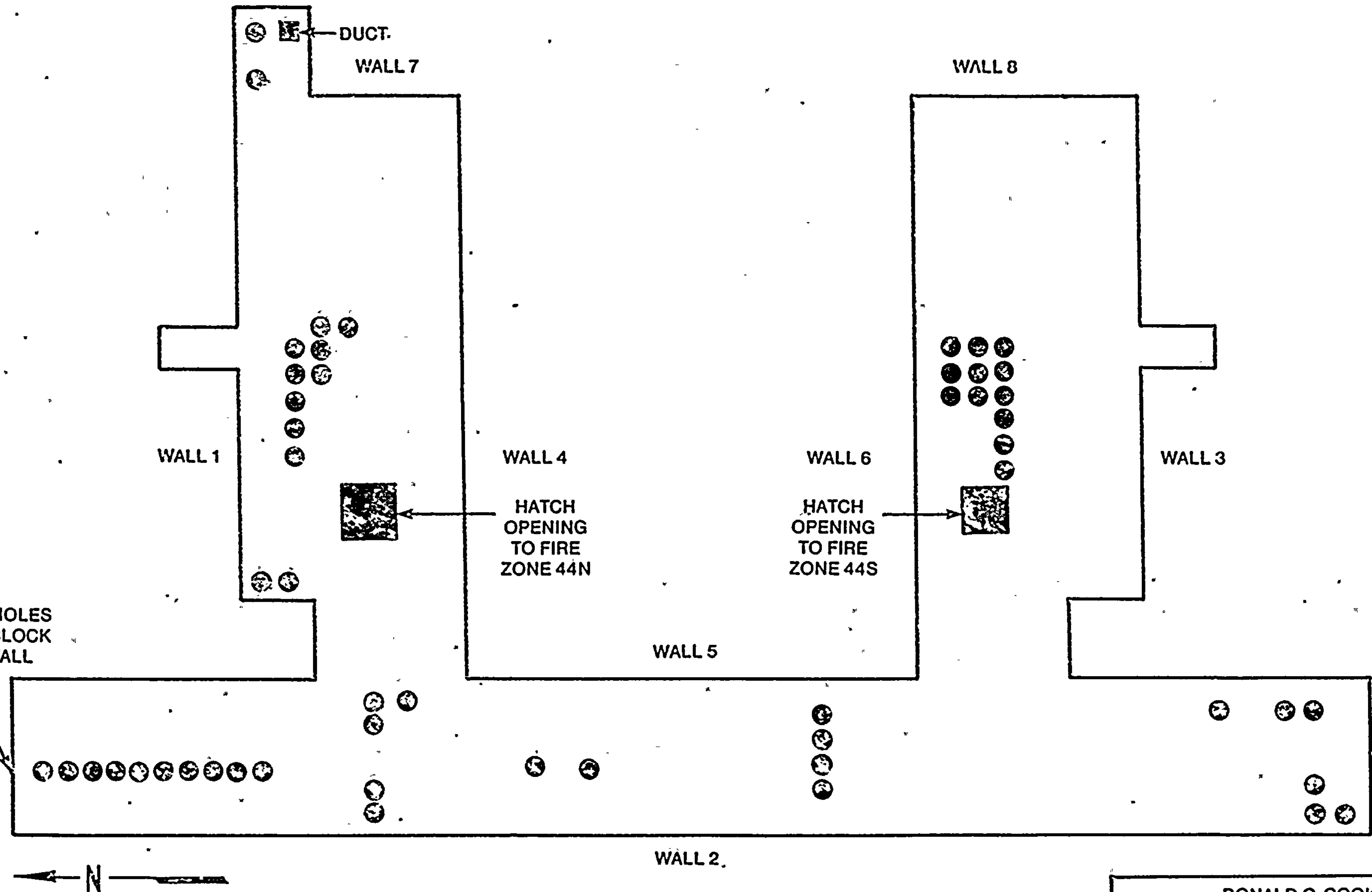
44N

- SEALED PENETRATIONS
- PENETRATIONS SEALED WITH UNRATED HIGH DENSITY LEAD
- NO PENETRATIONS; CEILING
- NO PENETRATIONS; WALLS
- ½-¾" LEAD PLATES ON CEILING WITH UNSEALED PENETRATIONS TO VERY HIGH RADIATION AREAS ABOVE
- PENETRATIONS SEALED WITH UNRATED MATERIALS TO PREVENT AIR FLOW

NOTE: DIMENSIONS ARE APPROXIMATE
NOT TO SCALE

DONALD C. COOK NUCLEAR POWER	
ROOM 601 PIPE TUNNEL	
ELEV.609'	FIGURE NO. 9.6-5





SEALED PENETRATIONS

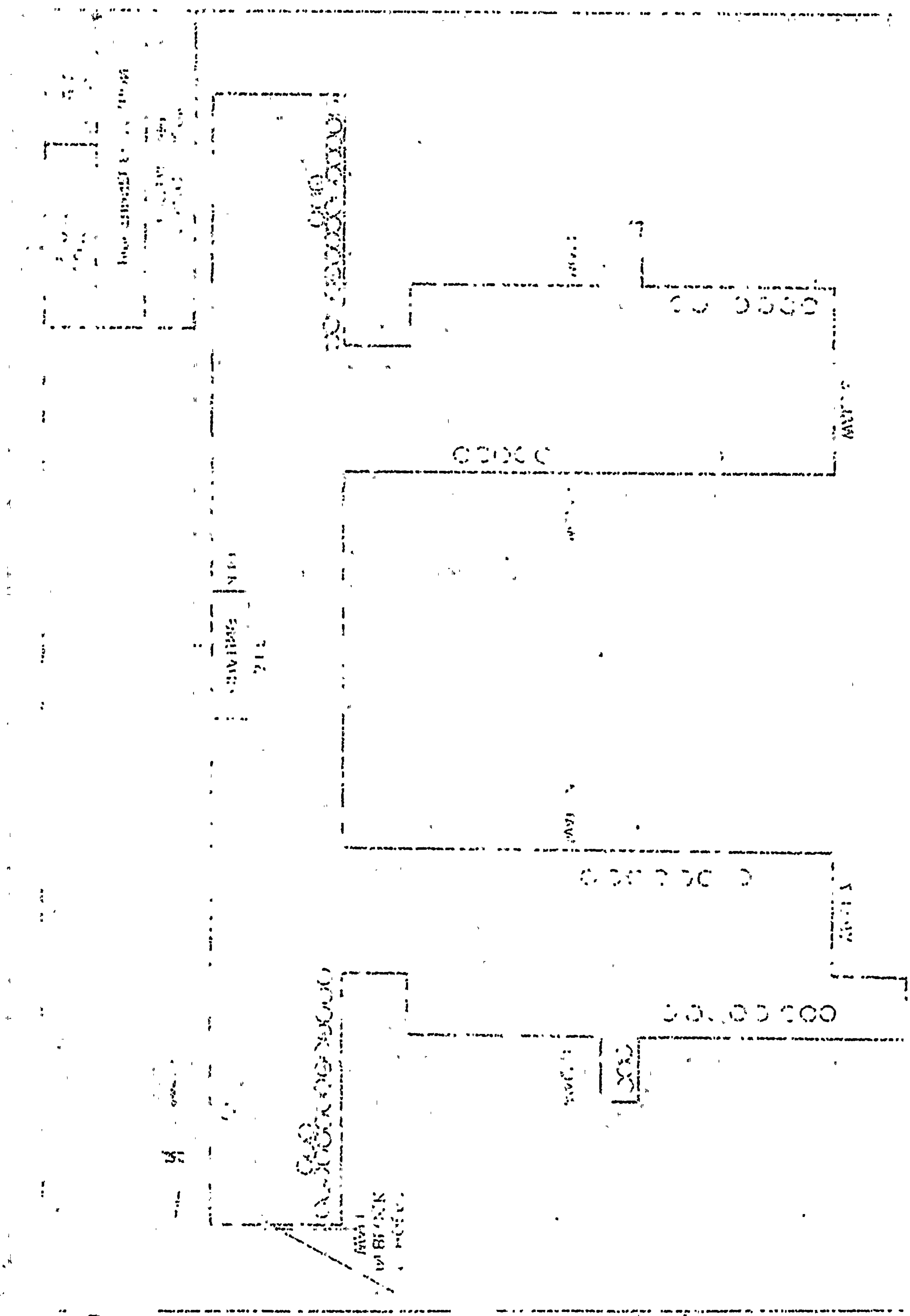
DONALD C. COOK
NUCLEAR PLANT

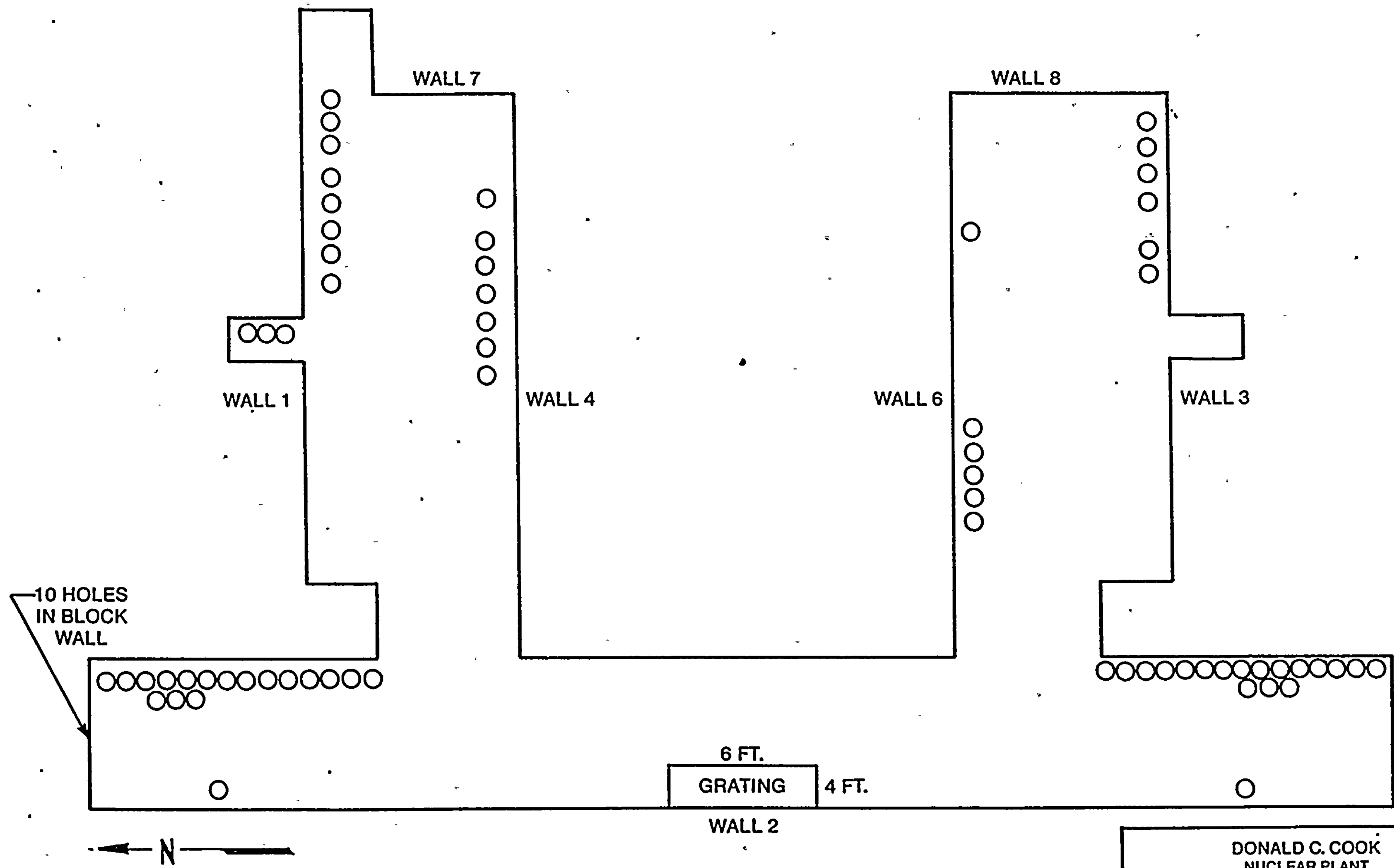
PIPE TUNNEL EVALUATION

ELEV 601'
CEILING

FIGURE NO.
9.6-6

85-AEP-0003
P142-PT-006



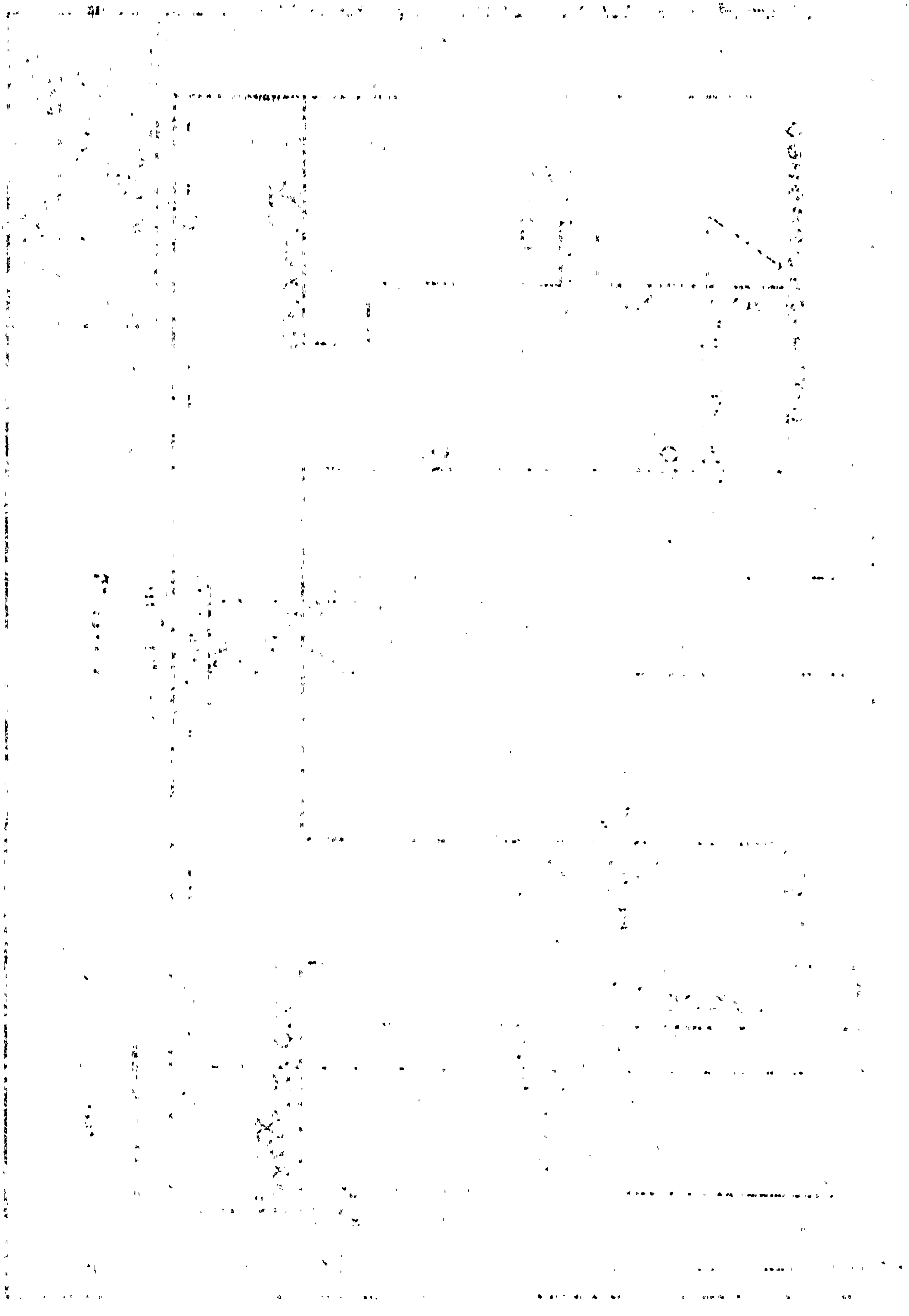


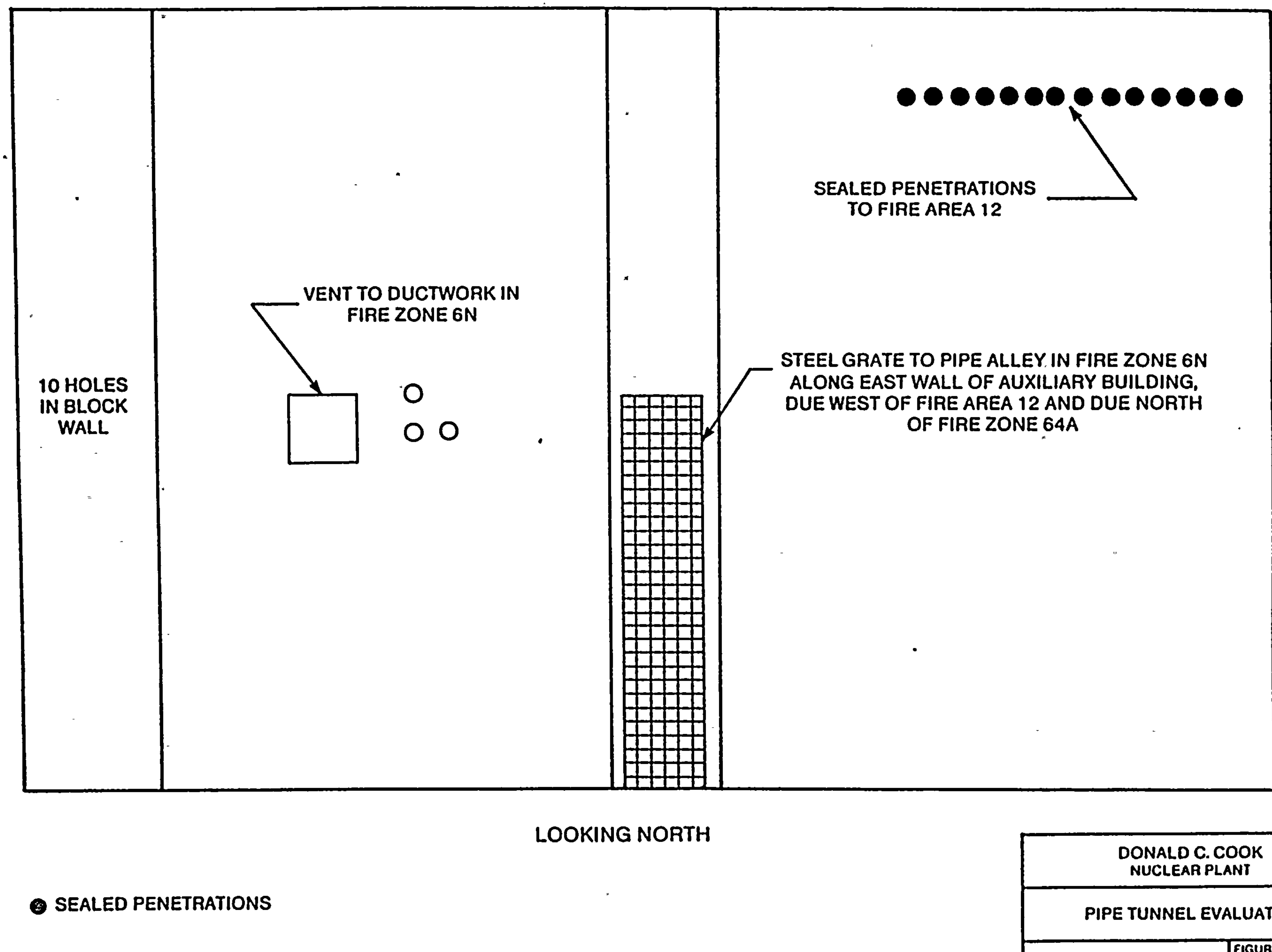
DONALD C. COOK NUCLEAR PLANT

PIPE TUNNEL EVALUATION

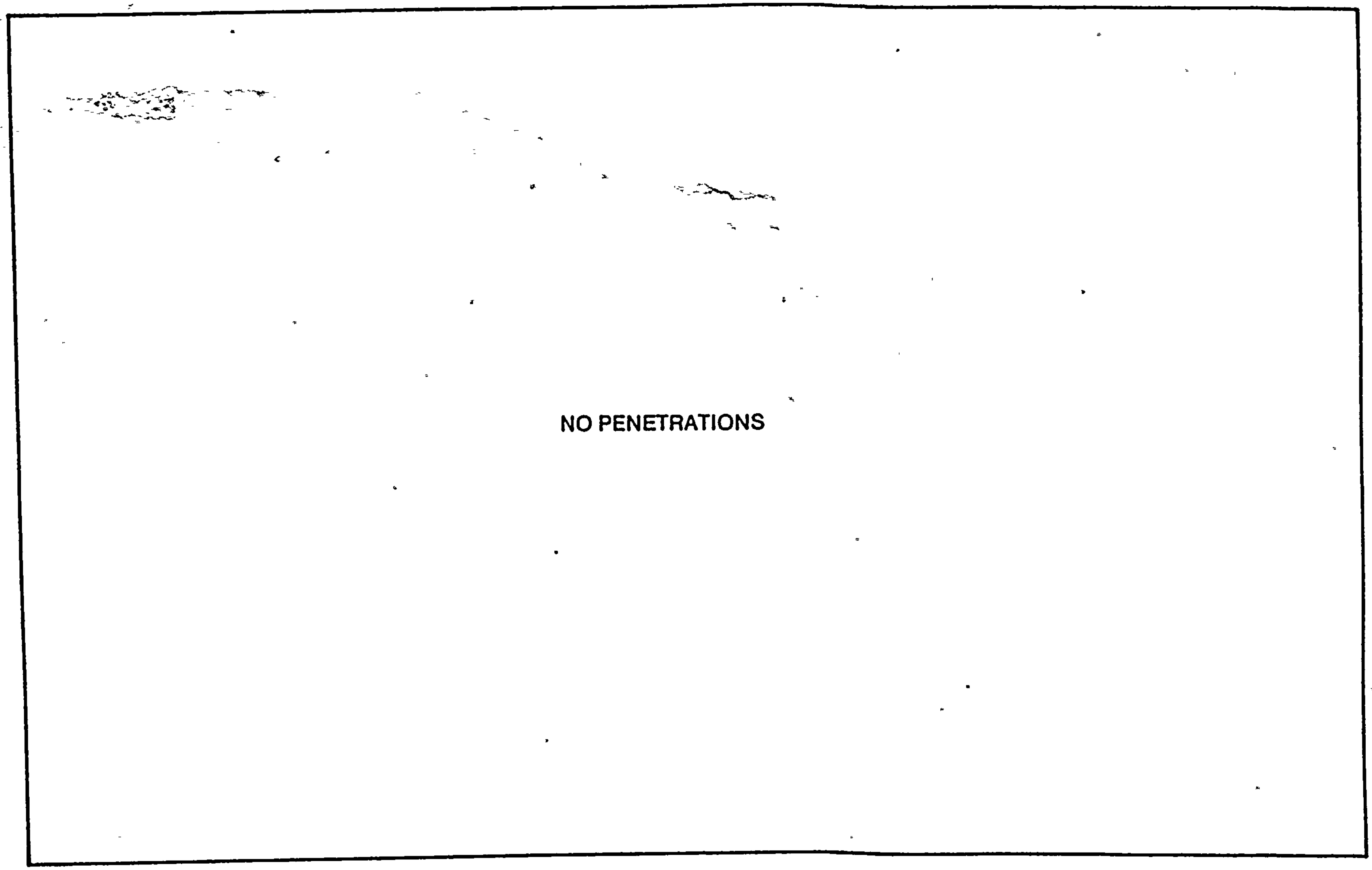
ELEV 601' FLOOR

FIGURE NO. 9.6-7



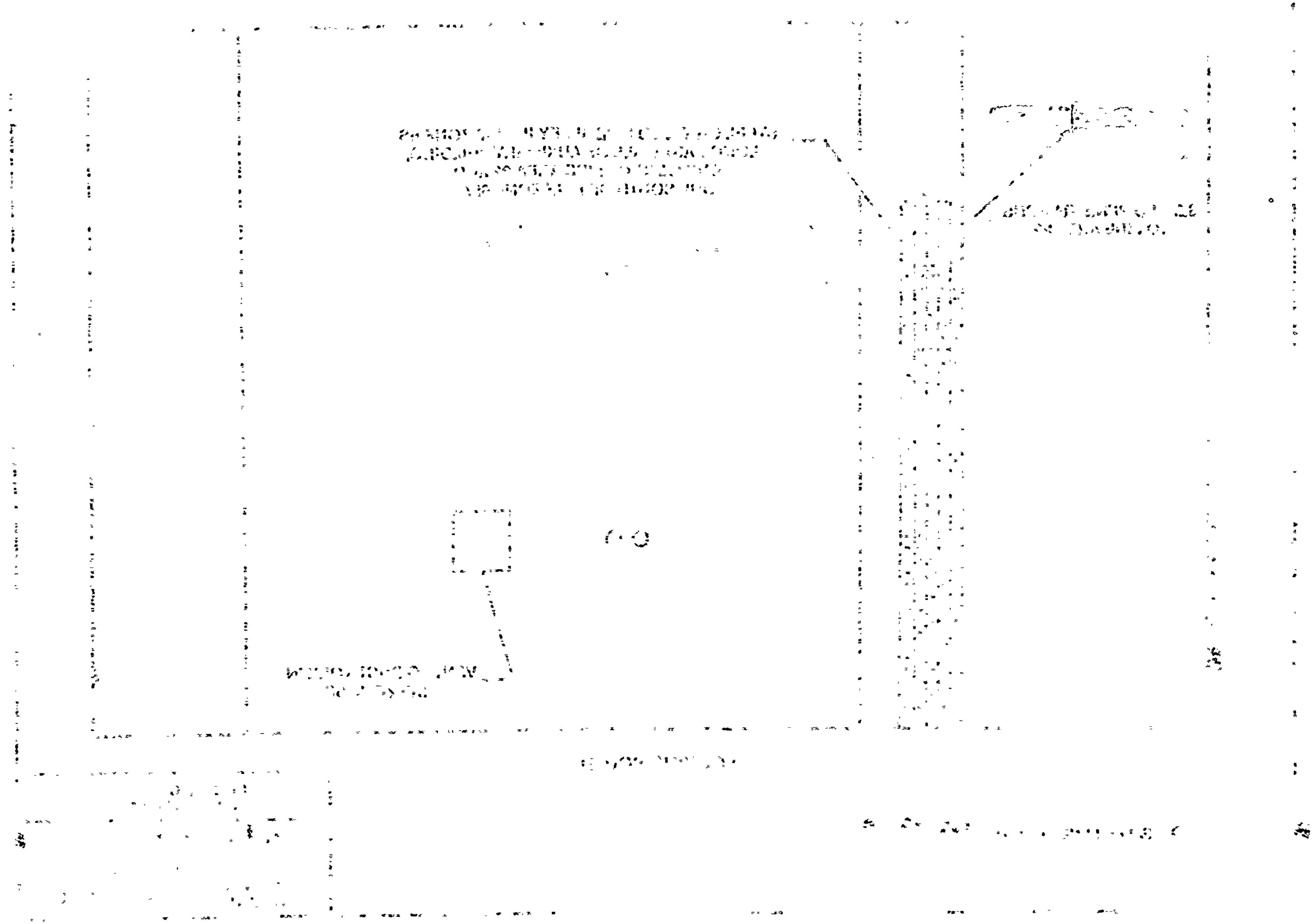


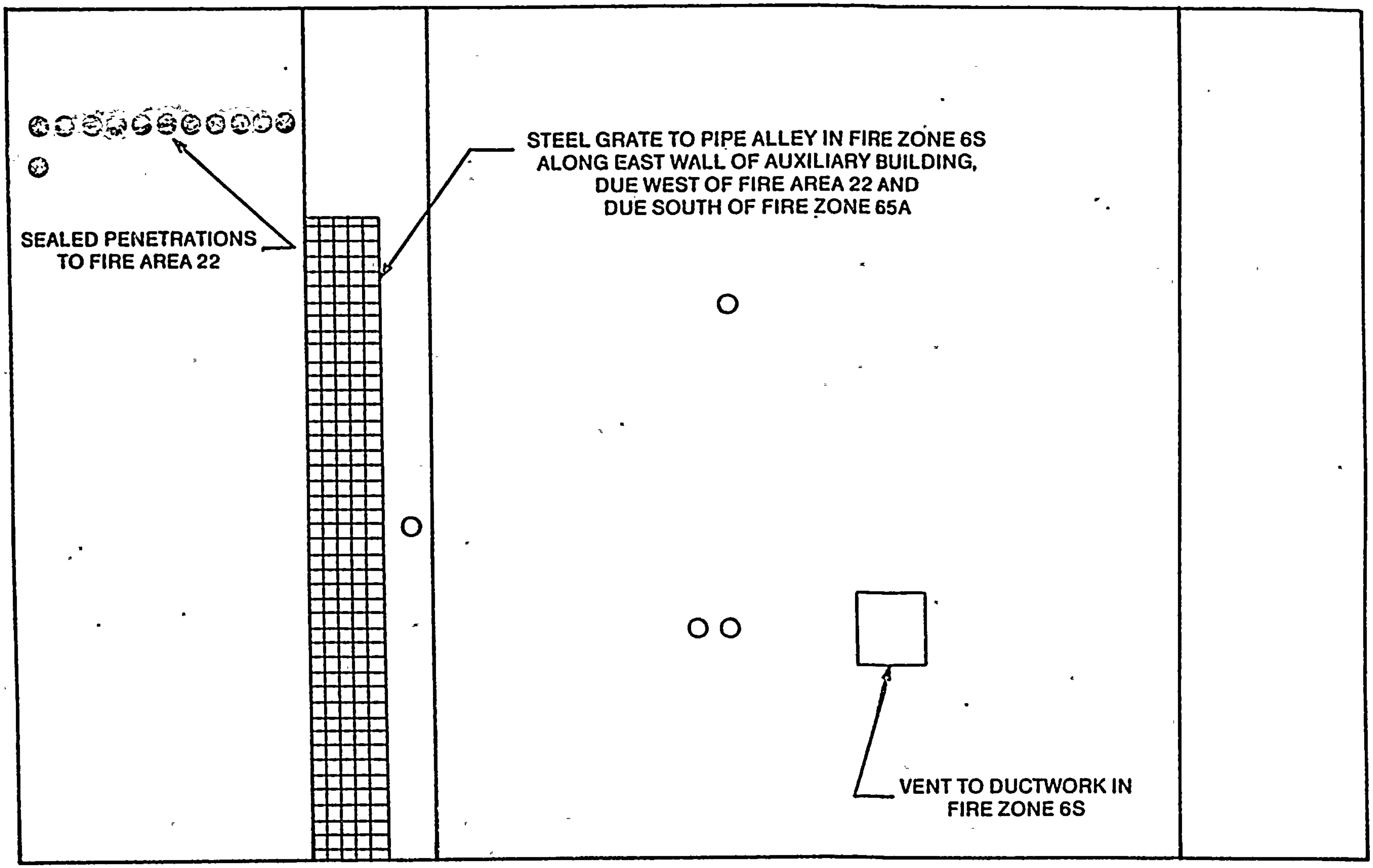
DONALD C. COOK NUCLEAR PLANT	
PIPE TUNNEL EVALUATION	
ELEV 601' WALL NO. 1	FIGURE NO 9.6-8



LOOKING WEST

DONALD C. COOK NUCLEAR PLANT	
PIPE TUNNEL EVALUATION	
ELEV 601' WALL NO. 2	FIGURE NO 9.6-9





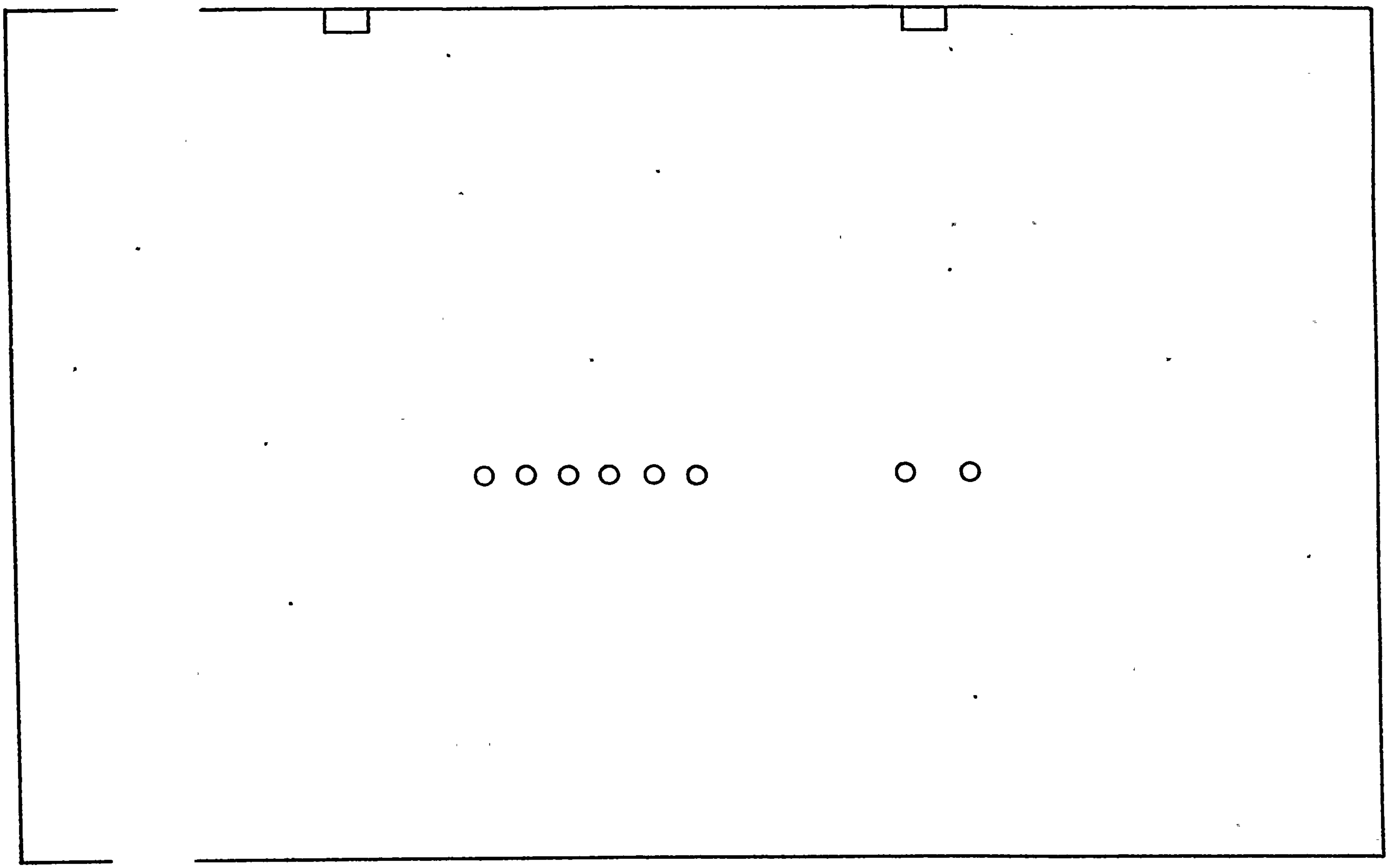
LOOKING SOUTH

SEALED PENETRATIONS

DONALD C. COOK NUCLEAR PLANT	
PIPE TUNNEL EVALUATION	
ELEV 601' WALL NO. 3	FIGURE NO 9.6-10

[illegible]

[illegible]



LOOKING SOUTH

DONALD C. COOK
NUCLEAR PLANT

PIPE TUNNEL EVALUATION

ELEV 601'
WALL NO. 4

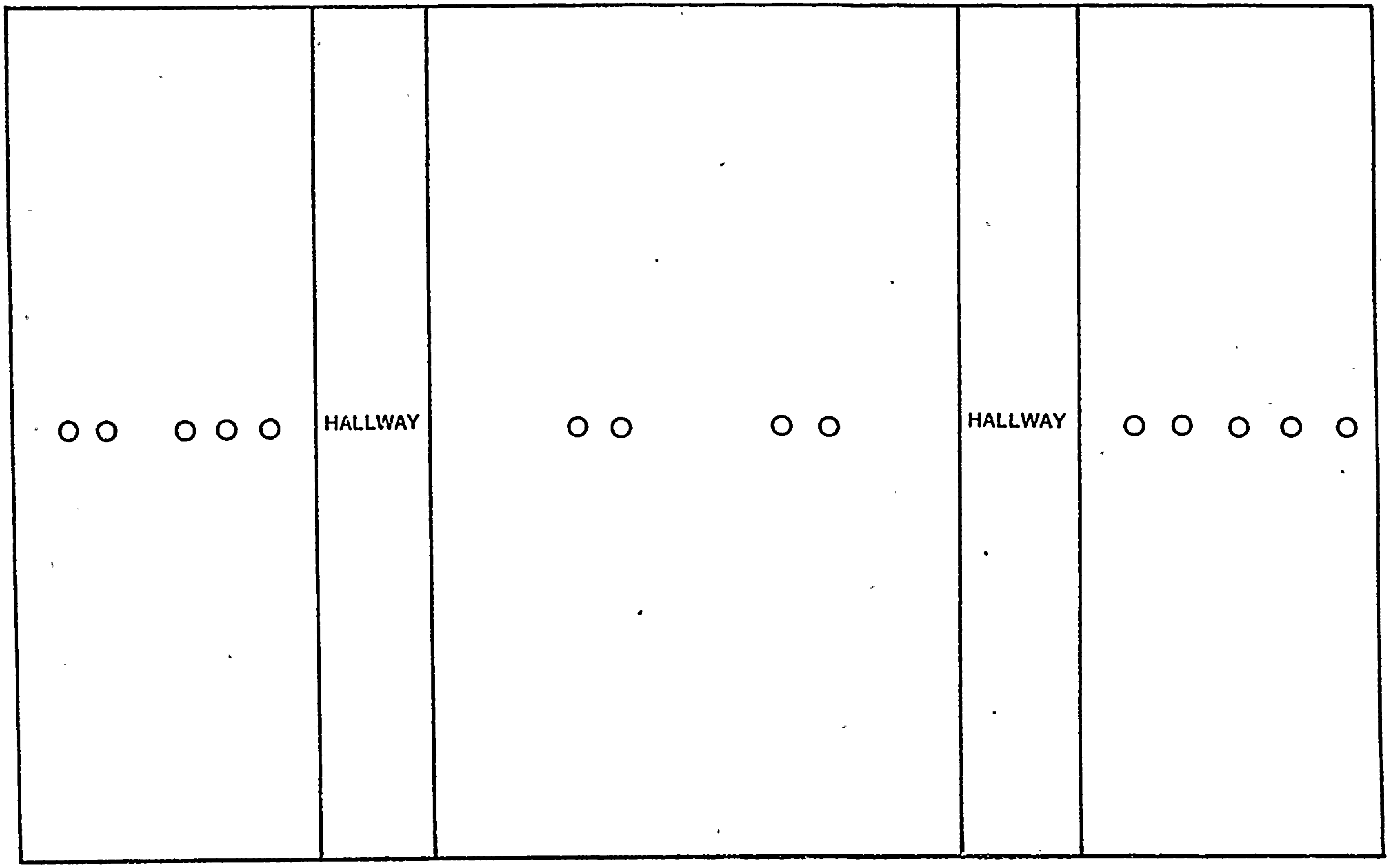
FIGURE NO
9.6-11

[illegible]

[illegible]

[illegible]

[illegible]



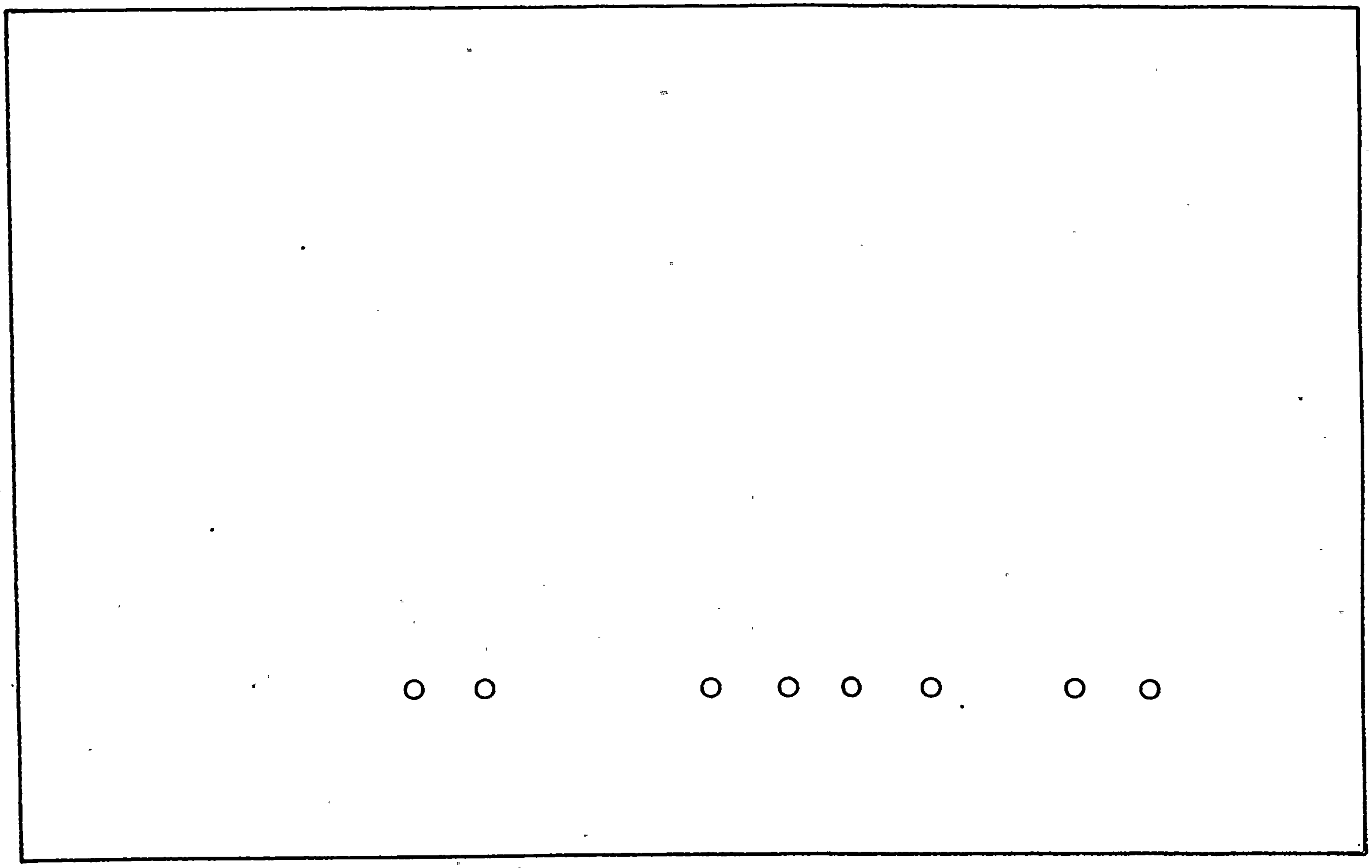
LOOKING EAST

DONALD C. COOK
NUCLEAR PLANT

PIPE TUNNEL EVALUATION

ELEV 601'
WALL NO. 5

FIGURE NO
9.6-12



LOOKING NORTH

DONALD C. COOK NUCLEAR PLANT	
PIPE TUNNEL EVALUATION	
ELEV 601' WALL NO. 6	FIGURE NO 9.6-13

ELEV 601'
WALL NO. 3

5.6-15

PIPE TUNNEL EVALUATION

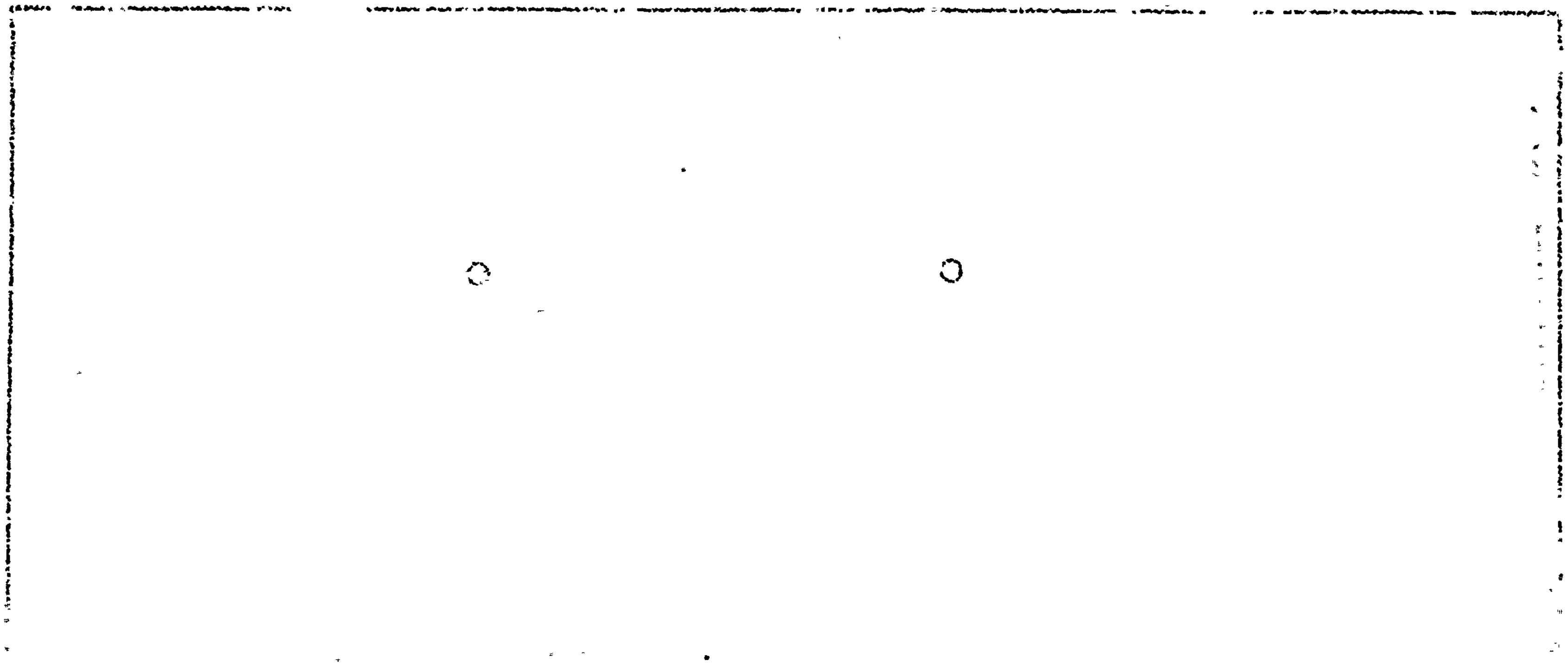
ELEV 601'
WALL NO. 1

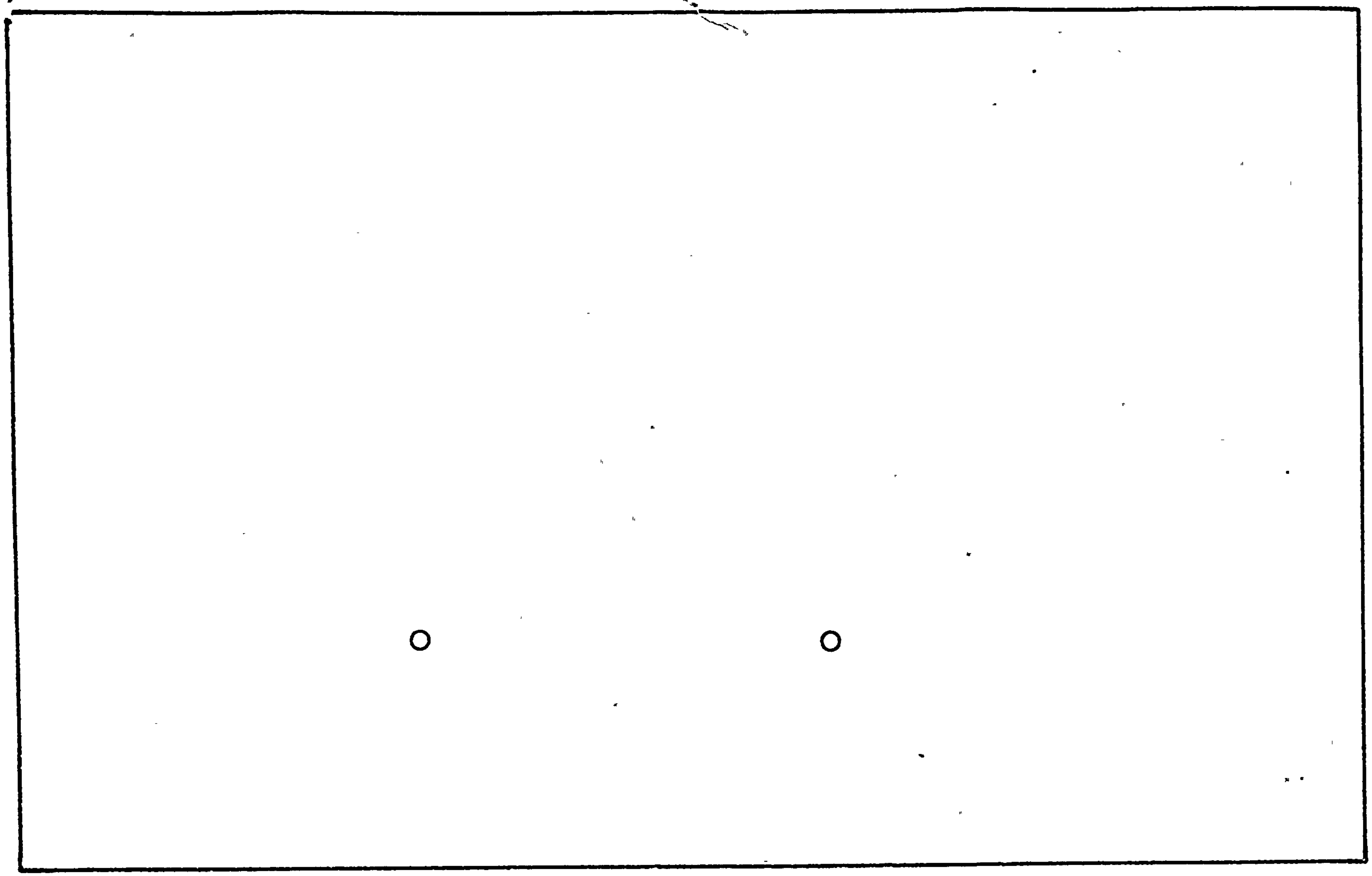
FIGURE NO.
5.6-14

PIPE TUNNEL EVALUATION

DONALD C. COOK
NUCLEAR PLANT

LOOKING EAST

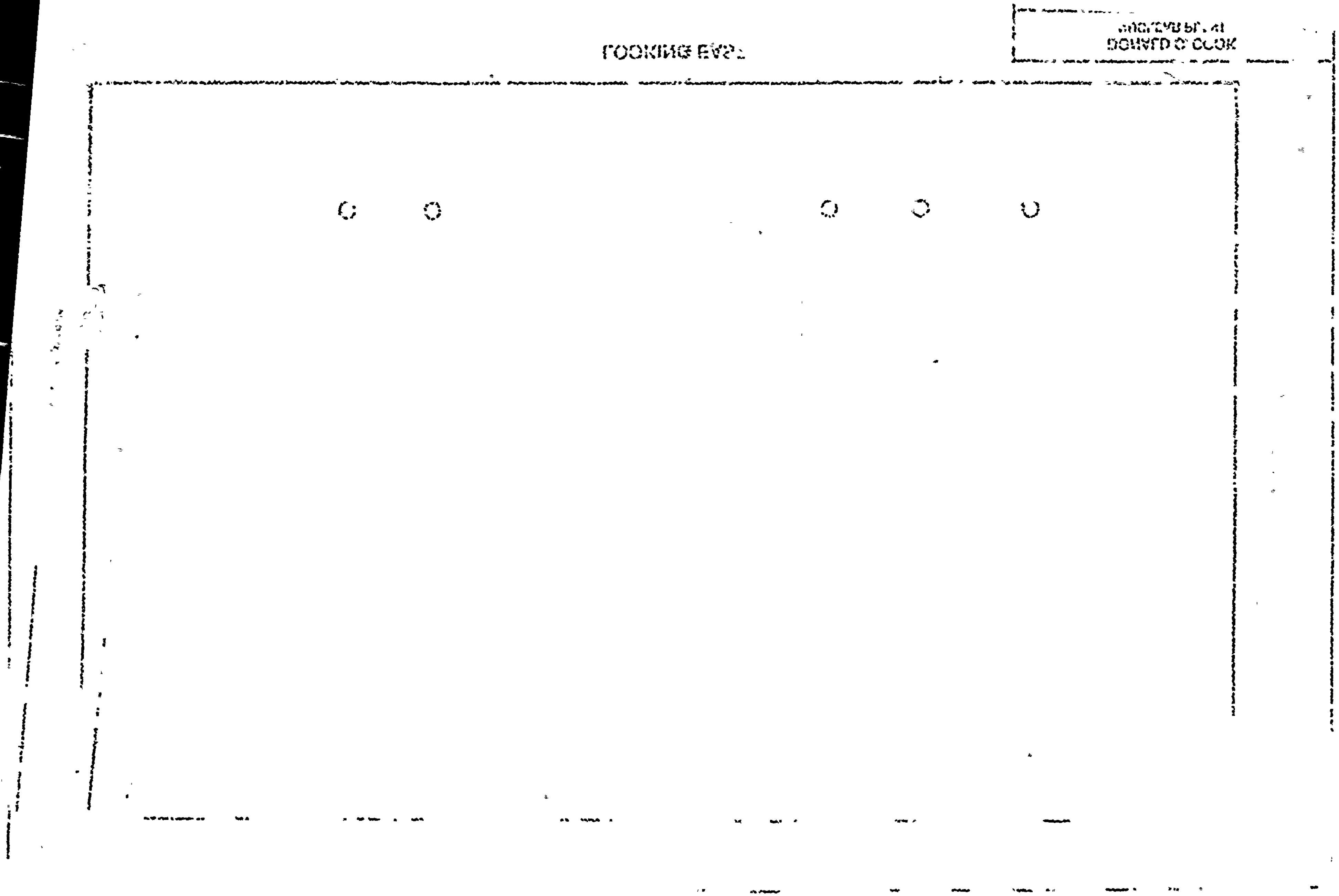


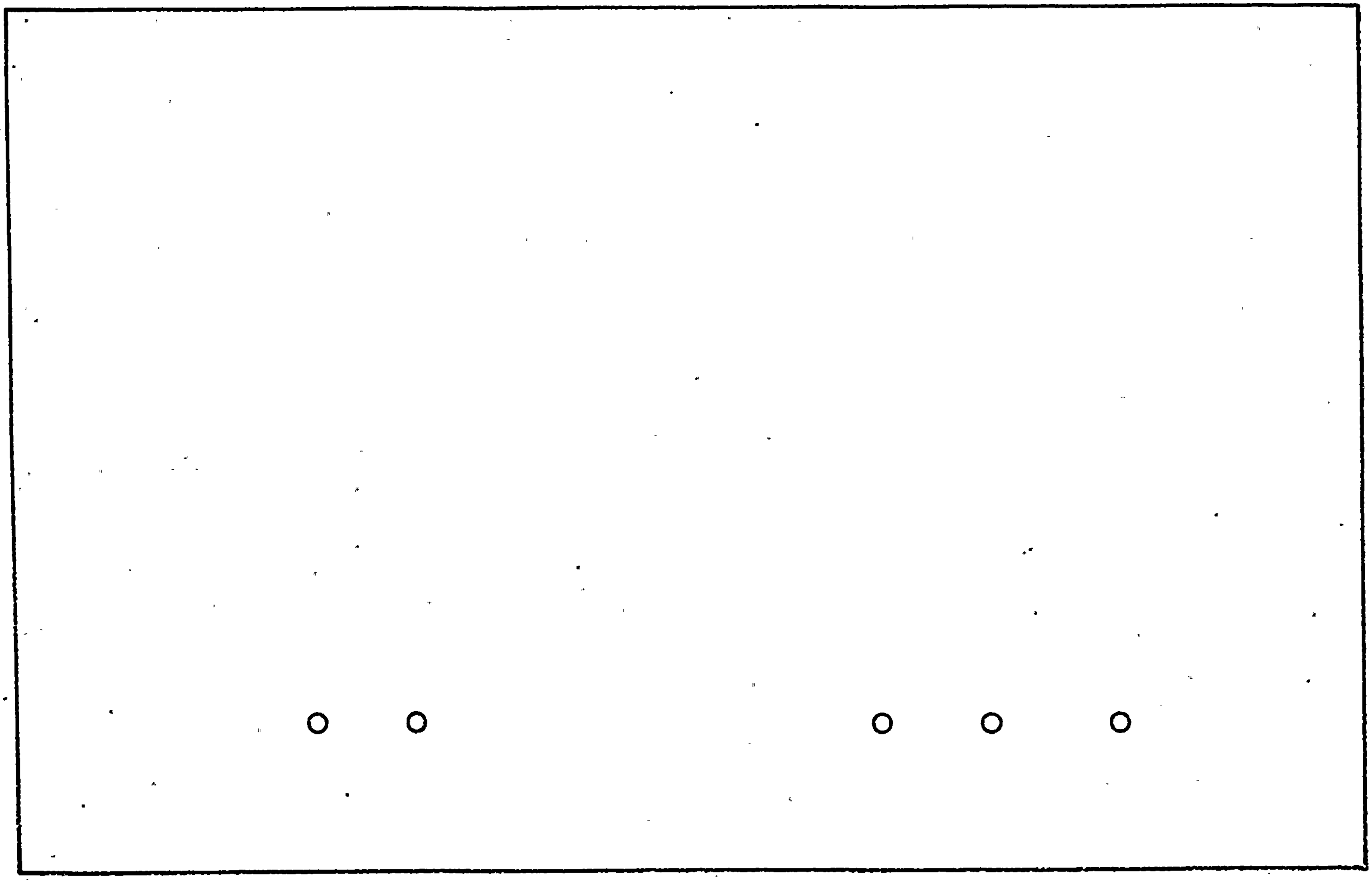


LOOKING EAST

DONALD C. COOK NUCLEAR PLANT	
PIPE TUNNEL EVALUATION	
ELEV 601' WALL NO. 7	FIGURE NO. 9.6-14

85-AEP-0003


DONALD C. COOK
NUCLEAR PL. NT
LOOKING EAST



LOOKING EAST

DONALD C. COOK NUCLEAR PLANT	
PIPE TUNNEL EVALUATION	
ELEV 601' WALL NO. 8	FIGURE NO. 9.6-15

85-AEP-0003

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[illegible]

[illegible] procedure [illegible] have [illegible]

[illegible]