UNITED STATES
NUCLEAR REGULATORY
COMMISSION
DOCKET NO. 50-315
DOCKET NO. 50-316

SAFE-SHUTDOWN CAPABILITY ASSESSMENT AND PROPOSED MODIFICATIONS

10 CFR 50, APPENDIX R, SECTION IIIG

UNITS 1 & 2

DONALD C. COOK NUCLEAR PLANT

INDIANA & MICHIGAN ELECTRIC COMPANY

AMERICAN ELECTRIC POWER SYSTEM

I&M

MARCH 1983

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Attachment

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ERRATA FOR SAFE SHUTDOWN CAPABILITY ASSESSMENT AND PROPOSED MODIFICATION REPORT

SECTION 1

Page 1-10	The definition of Hot Standby which appears on this page should be replaced with the definition that appears on Page 6-2.
Table 1-1, Page 1	For Fire Zones 126 and 127 the "N" in the Automatic Suppression column should be changed to an "E".

SECTION 2

Page 2-3	Line 13 - "preceding" should be replaced "following".
Table 2-1, Page 8	Fire Zone 104 should be designated as Unit 2, not Unit 1.

SECTION 3

Page 3-6	Line 7 should read: "...from metal clad switchgear and motor control centers..."

SECTION 4

Page 4-7	The definition of Hot Standby which appears on this page should be replaced with the definition that appears on Page 6-2.
Page 4-15	Fifth line from the bottom the "=" sign should be replaced with a "≦" sign.

Page 4-19	Third line under Boron Injection Tank: "without control rods" should be deleted.
	Eighth line under Boron Injection Tank: "165°F" should be replaced with ≤ 145°F.
Page 4-20	Third line: delete the words "all the".
Page 4-35	Second line from the bottom: replace "identical" with "similar".
Page 4-36	Fourth line from the bottom should read "...T11A AND T11B..."
Page 4-37	Fifth line from the bottom "air-operated" should be replaced with "operated air".
Page 4-38	Tenth line from the top, the word "identical" should be replaced with "similar".
Table 4-3, Page 3	Under column "Effect of Malfunction", both "bit" and "bat" should be capitalized to "BIT" and "BAT".
Table 4-3, Page 4	Under column "Effect of Malfunction" - "QRV-11" should be replaced with "QRV-111".
Figure 4.20	Reference drawing coordinates G-3,-4 and -5 and H-5: the T11C1 breaker tie between Bus T11C and Bus 1C should be colored orange.
Figure 4.22	For battery 1CD, the 600-volt auxiliary buses, battery charger, rectifiers, and battery CD charger transfer cabinets and power feed should be colored orange in the same manner shown for battery 1AB.

SECTION 5

Page 5-12	Last sentence first paragraph in Section 5.2.6 should be deleted.
Page 5-13	Delete first sentence second paragraph in Section 5.2.7 and replace as follows: "various equipment (pressurizer 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."
Page 5-15	Fourth line from the bottom of the page delete the word "are".
Page 5-31	Section 5.5.5 second sentence "Table 5-2" should be replaced with "Table 5-8".
Page 5-33	First sentence Section 5.6.1 delete the word "immediately".
Figure 5.10.3	Figure title "1-LSI-1" should read "1-LSI-2".
Figure 5.19.3	"NSP-122" should be replaced with "NPS-122".
Figure 5.21.2	The figure should have a note stating the following: "NTI's for TH and TC to be added as proposed modifications".
Figure 5.19.1	Upper diagram all "NLI's" identified in figure should be replace with "NTI".

SECTION 6

Page 6-4	Last line delete the second "an".
Page 6-5	Eighth line from the bottom replace the word "process" with "proceed".

SECTION 7

Page 7-1	Fifth line should read "Appendix"
	Third paragraph, third line from the bottom should read, "Building".
	Second line from the bottom of page 7-1 should read, "Unit 2 main steam" line.
Page 7-12	The last sentence on the page should read, "....water spray nozzle is adjacent to the fire area" instead of, "in the fire area".
Page 7-17	First sentence should read, "Located immediately south" instead of "north".

"470,000 Btu; 50 Btu/ft2".

Page 7-62	The second sentence should read, "There are 46 ionization detectors...", instead of reading, "There are 32 ionization detectors...".
Page 7-63	The first sentence should read, "....is approximately 40,000,000 Btu...." instead of, "is approximately 41,500,000 Btu....".
Page 7-64	Under "Hatch Floor" section it should read, "Upgrade hatch floor..." instead of "Upgrade floor hatch...".
Page 7-76	The second sentence should read, "...contained in the cable trays..." instead of reading, "...contained in the cable traps...".
Page 7-77	Section 7.13.5.1 title should read, "<u>Installation of Hot and Cold Leg Temperature RTDs</u>"
Page 7-79	Under section B, include "SV-102, SV-103 RHR Safety Valves".
Page 7-85	Section D, #1, change "None" to "Thermistors are presently installed on RCP motors, charcoal filters, and cable trays." Section D, #2 should read, "Automatic deluge system for the charcoal filters." Instead of "Manual deluge". And "Partial sprinkler protection..." should read "Sprinkler protection...".
Page 7-88	Section 7.15.5.1 title should read, "<u>Installation of Hot and Cold Leg Temperature RTD's</u>"
Page 7-89	Section A, #1c, should read, "Ceiling - reinforced concrete in excess of a 3 hour rating" instead of reading "later".

Page 7-96	Section D, #1, change "None" to "Thermistors are presently installed on RCP motors, charcoal filters, and cable trays."
	Section D, #2 should read, "Automatic deluge system for the charcoal filters." Instead of "Manual deluge". And "Partial sprinkler protection..." should read "Sprinkler protection...".
Page 7-117	Section D, #1 should read, "Fire detection systems - none".

SECTION 8

Page 8-5	Under Section 8.2.3, delete "8.23.3"; replace with "8.16.2".
	Under Section 8.3.1, line 4, change "2AC-15" to "2A-C15".

Page 7-17	Last sentence should read, "...with adjustable water spray nozzle is adjacent to the fire area." Instead of "in the fire area."
Page 7-22	First sentence should read, "Fire Zone 29(A,B,E,) is located on the east central side of the screenhouse", instead of "extreme west central side...".
Page 7-30	First sentence should read, "Fire Zone 29(C,D,F)" instead of "Fire Zone 29(C,D,E)".
Page 7-44	First sentence should read, "All interior walls, floors,..." instead of, "The walls, floors,...".
Page 7-46	Under Section B, "TK-32 - Condensate Storage Tank" should be deleted.
Page 7-49	The fourth line from the bottom should read, "...in approximately 5800 BTU/ft^2." Instead of "6,000/ft."
Page 7-52	Under Section C, #2, should read, "Cable - 8,900,000 Btu" instead of, "12,000,000 Btu".
Page 7-55	Last sentence should read, "...with 17 ionization detectors", instead of "with 17 ionizing detectors."
Page 7-56	First sentence should read, "... 125,000,000 Btu... in approximately 12,800 Btu/ft^2" instead of "... 120,000,000 Btu... in approximately 12,750 Btu/ft^2".
Page 7-59	Under section A, #3, should read, "150,000" instead of, "150,0000".
	Section A.4 ventilation should read 38,000 cfm instead of later.
Page 7-60	Under section B, "CMO-419 - CCW to RHR HX, Unit 2", should be deleted.
	Under section C, #2c, should read "Cloth - 970,000 Btu; 100 Btu/ft^2" instead of

Donald C. Cook

Nuclear Plant Units 1 & 2

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TABLES

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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.

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.

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 presently exists in 91 of the fire zones reviewed.

(2) Separation between required safe shutdown circuits which meets the specific requirements of Section III.G.2 of Appendix R to 10 CFR 50 will exist in an additional 15 fire zones pending fire protection and cable rerouting modifications.

(3) Alternative shutdown, which meets the requirements of Section III.G.3 and III.L of Appendix R to 10 CFR 50, will exist for 32 fire zones.

(4) Exemption requests from the specific requirements of Section III.G.2 of Appendix R are requested in 3 fire zones where zone features provide equivalent protection.

(5) Exemption requests from the specific requirements of Section III.G.3 of Appendix R are requested in 16 fire zones where zone features provide equivalent protection.

(6) All associated circuits having a separation less than that required by Section III.G.2 of Appendix R 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 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 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 28 of 80 fire areas when compared against the specific criteria of Appendix R, Section III.G.

For 40 of the 80 fire areas, proposed modifications including upgrading of fire barriers, installation of suppression and detection systems, circuit modifications, cable rerouting, tray and conduit wrapping, and process piping modifications will achieve fire zone and area compliance with the specific criteria of Appendix R, Section III.G.

For the remaining 12 fire areas, similar modifications are proposed but verbatim compliance with Appendix R is not achieved. For these areas, exemption requests are formally 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 eight sections. Section 2.0 identifies the fire areas and fire zones developed to support the Appendix R analyses performed. Criteria for establishing fire areas and zones are discussed as well as the process used to determine the associated fire hazard severity.

Section 3.0 provides a description of the active fire protection features at D.C. Cook. This includes a detailed discussion of the detection and suppression systems and identifies the features provided on a zone-by-zone basis.

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.

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.

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 and the normal actions and repairs required to assure that cold shutdown can be achieved and maintained within 72 hours are identified.

Section 7.0 contains a detailed analysis for each fire area and zone identified as not being in compliance with Section III.G of Appendix R, and for which modifications are proposed to the extent that modifications beyond existing commitments would not enhance fire protection safety. Each of the zones is described in detail and a fire hazards analysis, including results, is provided for each zone. 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.

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.).

1.4 Definitions, Abbreviations and Acronyms

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 which contains safe shutdown systems, equipment, and cables 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.

Automatic Detection - 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).

Automatic Suppression - 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.

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

Fire Area - 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 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 and separates fire areas or zones.

Fire Brigade - the team of plant personnel assigned to firefighting 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°F and 200°F.

Hot Standby - the initial safe shutdown state with the reactor at zero power, K_{eff} less than 0.99 and RCS average temperature between 547°F and 350°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 make up the redundant trains of systems 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.

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

<u>Unaffected Unit</u> - 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.

<u>Water Spray System</u> - 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 <u>Acronyms and Abbreviations</u>

AFW - Auxiliary Feedwater

AOV - Air-Operated Valve

BIT - Boron Injection Tank

CCW - Component Cooling Water

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	APPLICABLE APPENDIX R PROVISIONS III.G.2	III.G.3	AREA BOUNDARY OR 3-HOUR	COMPLIANCE METHODS WITHIN ZONE 1-HOUR	20 FEET	DETECTION	AUTOMATIC SUPPRESSION
FIRE AREA: UNIT 1 TURBINE BUILDING: 1.5 HOUR BOUNDARY								
2	NONE	EC					N	N
77	NONE	EC					N	E
79	1	PC			PC(1)		P	E(4)
80	1	EC		EC(2)			N	E
81	NONE	EC					N	E
82	NONE	EC					N	E
90	NONE	EC					N	E
91	1	EC		EC(2)			N	E
92	NONE	EC					N	E
93	NONE	EC					N	E
126	NONE	EC					E	N
127	NONE	EC					E	N
**								
FIRE AREA: UNIT 2 TURBINE BUILDING: 1.5 HOUR BOUNDARY								
84	2	EC		EC (2)			N	E

(Fire Area continued next page)

TABLE 1.1 APPENDIX R SUMMARY COMPLIANCE TABLE (Continued)

FIRE ZONE	SSS EQPT OR CABLE WITHIN ZONE	APPLICABLE APPENDIX R PROVISIONS III.G.2	APPLICABLE APPENDIX R PROVISIONS III.G.3	AREA BOUNDARY OR 3-HOUR	COMPLIANCE METHODS WITHIN ZONE 1-HOUR	20 FEET	DETECTION	AUTOMATIC SUPPRESSION
(Fire Area continued from previous page)								
85	2	PC			PC(1)		P	E(4)
86	NONE	EC					N	E
87	NONE	EC					N	E
96	NONE	EC					N	E
97	NONE	EC					N	E
98	NONE	EC					N	E
99	NONE	EC					N	E
124	NONE	EC					E	E
125	NONE	EC					E	E
128	NONE	EC					N	N
************								
FIRE AREA: UNIT 1 DIESEL FIRE PUMP ROOM: 3 HOUR BOUNDARY								
28	NONE	EC					N	E
************								
FIRE AREA: UNIT 1 HEATING BOILER ROOM: 3 HOUR BOUNDARY								
78	NONE	EC					N	E

FIRE ZONE	SSS EQPT OR CABLE WITHIN ZONE	APPLICABLE APPENDIX R PROVISIONS III.G.2	APPLICABLE APPENDIX R PROVISIONS III.G.3	AREA BOUNDARY OR 3-HOUR	COMPLIANCE METHODS WITHIN ZONE 1-HOUR	20 FEET	DETECTION	AUTOMATIC SUPPRESSION
FIRE AREA: UNIT 1 TURBINE ROOM LUBE OIL ROOM: 3 HOUR BOUNDARY								
83	NONE	EC					E	E
FIRE AREA: UNIT 1 TURBINE ROOM AUXILIARY HEATING BOILER: 3 HOUR BOUNDARY								
94	NONE	EC					N	E
FIRE AREA: UNIT 1 TURBINE ROOM TURBINE OIL TANK ROOM: 3 HOUR BOUNDARY								
95	NONE	EC					E	E
FIRE AREA: UNIT 2 DIESEL FIRE PUMP ROOM: 3 HOUR BOUNDARY								
30	NONE	EC					N	E
FIRE AREA: UNIT 2 TURBINE ROOM LUBE OIL ROOM: 3 HOUR BOUNDARY								
88	NONE	EC					E	E
FIRE AREA: UNIT 2 TURBINE ROOM MISCELLANEOUS OIL ROOM: 3 HOUR BOUNDARY								
89	NONE	EC					N	E

FIRE ZONE	SSS EQPT OR CABLE WITHIN ZONE	APPLICABLE APPENDIX R PROVISIONS III.G.2	III.G.3	AREA BOUNDARY OR 3-HOUR	COMPLIANCE METHODS WITHIN ZONE 1-HOUR	20 FEET	DETECTION	AUTOMATIC SUPPRESSION
FIRE AREA: UNIT 2 TURBINE ROOM TURBINE TANK ROOM: 3 HOUR BOUNDARY								
100	NONE	EC					E	E
FIRE AREA: UNIT 1 WEST AUXILIARY FEED PUMP ROOM: 3 HOUR BOUNDARY								
17A	1	EC		EC(2)			N	N
FIRE AREA: UNIT 2 WEST AUXILIARY FEED PUMP ROOM: 3 HOUR BOUNDARY								
17B	2	EC		EC(2)			N	N
FIRE AREA: AUXILIARY FEED PUMP ROOM VESTIBULE: 3 HOUR BOUNDARY								
17C	1&2	PC			PC(1)		P	P
FIRE AREA: UNIT 1 EAST AUXILIARY FEED PUMP ROOM: 3 HOUR BOUNDARY								
17D	1	EC		EC(2)			N	N
FIRE AREA: UNIT 1 TURBINE-DRIVEN AUXILIARY FEED PUMP ROOM: 3 HOUR BOUNDARY								
17E	1	EC		EC(2)			N	E

FIRE ZONE	SSS EQPT OR CABLE WITHIN ZONE	APPLICABLE APPENDIX R PROVISIONS III.G.2	III.G.3	AREA BOUNDARY OR 3-HOUR	COMPLIANCE METHODS WITHIN ZONE 1-HOUR	20 FEET	DETECTION	AUTOMATIC SUPPRESSION
FIRE AREA: UNIT 2 TURBINE-DRIVEN AUXILIARY FEED PUMP ROOM: 3 HOUR BOUNDARY								
17F	2	EC		EC(2)			N	E
************								
FIRE AREA: UNIT 2 EAST AUXILIARY FEED PUMP ROOM: 3 HOUR BOUNDARY								
17G	2	EC		EC(1)			N	N
************								
FIRE AREA: ESSENTIAL WATER PUMP AREA: 3 HOUR BOUNDARY								
29A 29B 29E	1		ER				P	ER(5)
29C 29D 29F	2		ER				P	ER(5)
29G	1&2	ER			PC(1)		P	ER
************								
FIRE AREA: AUXILIARY BUILDING - ELEV. 573'0" - 3 HOUR BOUNDARY								
1	1&2	ER			PC(1)		E	ER
1A	NONE	EC					P	(3)
1B	NONE	EC					P	(3)

(Fire Area continued next page)

FIRE ZONE	SSS EQPT OR CABLE WITHIN ZONE	APPLICABLE APPENDIX R PROVISIONS III.G.2	III.G.3	AREA BOUNDARY OR 3-HOUR	COMPLIANCE METHODS WITHIN ZONE 1-HOUR	20 FEET	DETECTION	AUTOMATIC SUPPRESSION
(Fire Area continued from previous page)								
1C	1	(3)				PC	P	(3)
1D	1	(3)				PC	P	(3)
1E	NONE	EC					P	(3)
1F	NONE	EC					P	(3)
1G	2	(3)				PC	P	(3)
1H	2	(3)				PC	P	(3)
<u>FIRE AREA: SAMPLING ROOM ELEV. 587'0": 1.5 HOUR BOUNDARY</u>								
4	1	EC		EC(2)			E	N
<u>FIRE AREA: AUXILIARY BUILDING ELEV. 587'0": 1.5 HOUR BOUNDARY</u>								
5	1&2	PC			PC(1)		E	E(4)
6N			PC				E	E(4)
6M	1&2	PC			PC(1)		E	E
6S	2		PC				E	E(4)
64A 64B	NONE	EC					E	E
(Fire Area continued next page)								

TABLE 1.1 APPENDIX R SUMMARY COMPLIANCE TABLE (Continued)

FIRE ZONE	SSS EQPT OR CABLE WITHIN ZONE	APPLICABLE APPENDIX R PROVISIONS III.G.2	III.G.3	AREA BOUNDARY OR 3-HOUR	COMPLIANCE METHODS WITHIN ZONE 1-HOUR	20 FEET	DETECTION	AUTOMATIC SUPPRESSION
(Fire Area continued from previous page)								
65A 65B	2	EC		EC(2)			E	E
************************************								
FIRE AREA: UNIT 1 CHARGING PUMPS ROOM ELEV. 587'0": 1 HOUR BOUNDARY								
62A 62B 62C	1		PC	PC(2)			E	E
************************************								
FIRE AREA: UNIT 2 CHARGING PUMPS ROOM ELEV. 587'0": 1 HOUR BOUNDARY								
63A 63B 63C	2		PC	PC(2)			E	E
************************************								
FIRE AREA: AUXILIARY BUILDING ELEV. 609' 0": 1.5 HOUR BOUNDARY								
37	NONE	EC					E	N
44N	1		PC				E	E(4)
44S	1&2		ER				E(4)	E(4)
44A	NONE	EC					N	N
(Fire Area continued next page)								

FIRE ZONE	SSS EQPT OR CABLE WITHIN ZONE	APPLICABLE APPENDIX R PROVISIONS III.G.2	III.G.3	AREA BOUNDARY OR 3-HOUR	COMPLIANCE METHODS WITHIN ZONE 1-HOUR	20 FEET	DETECTION	AUTOMATIC SUPPRESSION
(Fire Area continued from previous page)								
44B	NONE	EC					N	N
44C	1	EC					N	N
44D	1	EC					N	N
44E	NONE	EC					N	N
44F	NONE	EC					N	N
44G	2	EC					N	N
44H	2	EC						
**								
<u>FIRE AREA: AUXILIARY BUILDING EAST SIDE AND TOP ELEV.: 1.5-HOUR BOUNDARY</u>								
3	NONE	EC					E	E
32	NONE	EC					E	E
36	NONE	EC					N	N
48	NONE	EC					E	N
69	NONE	EC					E	N

TABLE 1.1 APPENDIX R SUMMARY COMPLIANCE TABLE (Continued)

FIRE ZONE	SSS EQPT OR CABLE WITHIN ZONE	APPLICABLE APPENDIX R PROVISIONS III.G.2	III.G.3	AREA BOUNDARY OR 3-HOUR	COMPLIANCE METHODS WITHIN ZONE 1-HOUR	20 FEET	DETECTION	AUTOMATIC SUPPRESSION
FIRE AREA: HVAC & COMPUTER ROOM ELEV. 650'0": 3-HOUR BOUNDARY								
70	NONE	EC					E	N
71	NONE	EC					E	E
72	NONE	EC					E	E
73	NONE	EC					E	N
FIRE AREA: CONCRETE MIXING BUILDING ELEV. 609'0": 3-HOUR BOUNDARY								
31	NONE	EC					N	N
FIRE AREA: INSTRUMENT CALIBRATION ROOM ELEV. 609'0": 3-HOUR BOUNDARY								
35	NONE	EC					N	N
FIRE AREA: UNIT 1 QUADRANT 2 CABLE TUNNEL ELEV. 612'0": 1.5-HOUR BOUNDARY								
38	1		PC	PC(2)			E	E
FIRE AREA: UNIT 2 QUADRANT 2 CABLE TUNNEL ELEV. 612'0": 1.5-HOUR BOUNDARY								
39	2		PC	PC(2)			E	E

FIRE ZONE	SSS EQPT OR CABLE WITHIN ZONE	APPLICABLE APPENDIX R PROVISIONS III.G.2	III.G.3	AREA BOUNDARY OR 3-HOUR	COMPLIANCE METHODS WITHIN ZONE 1-HOUR	20 FEET	DETECTION	AUTOMATIC SUPPRESSION
FIRE AREA: UNIT 1 TURBINE-DRIVEN AUXILIARY FEEDWATER BATTERY ROOM: 1.5-HOUR BOUNDARY								
106	1	EC		EC(2)			E	N
******								
FIRE AREA: UNIT 2 TURBINE-DRIVEN AUXILIARY FEEDWATER BATTERY ROOM: 1.5-HOUR BOUNDARY								
107	2	EC		EC(2)			E	N
******								
FIRE AREA: AUXILIARY BUILDING ELEV. 633'0": 3-HOUR BOUNDARY								
49	NONE	PC		PC(2)			E	N
50	2	PC		PC(2)			E	N
51	1&2	PC		PC(2)			E	P
52	1&2		PC	PC(2)			E	P
******								
FIRE AREA: UNIT 1 EAST MAIN STEAM ENCLOSURE: 1.5-HOUR BOUNDARY								
33 33A 33B	1		ER	PC(2)			N	ER(5)

FIRE ZONE	SSS EQPT OR CABLE WITHIN ZONE	APPLICABLE APPENDIX R PROVISIONS III.G.2	III.G.3	AREA BOUNDARY OR 3-HOUR	COMPLIANCE METHODS WITHIN ZONE 1-HOUR	20 FEET	DETECTION	AUTOMATIC SUPPRESSION
FIRE AREA: UNIT 2 EAST MAIN STEAM ENCLOSURE: 1.5-HOUR BOUNDARY								
34 34A 34B	2		ER	PC(2)			N	ER(5)
FIRE AREA: UNIT 1 QUADRANT 1 CABLE TUNNEL ELEV. 596'3.5": 3-HOUR BOUNDARY								
7	1		PC	EC(2)			E	E
FIRE AREA: UNIT 1 QUADRANT 4 CABLE TUNNEL ELEV. 596'-3.5"								
8	1	EC		EC(2)			E	E
FIRE AREA: UNIT 1 QUADRANT 3N CABLE TUNNEL ELEV. 596'3.5" : 1.5-HOUR BOUNDARY								
9	1	EC		EC(2)			E	E
FIRE AREA: UNIT 1 QUADRANT 3M CABLE TUNNEL ELEV. 596' 3.5": 1.5 HOUR BOUNDARY								
10	1	EC		EC(2)			E	E
FIRE AREA: UNIT 1 QUADRANT 3S CABLE TUNNEL ELEV. 596' 3.5": 1.5 HOUR BOUNDARY								
11	1	EC		EC(2)			E	E

TABLE 1.1 APPENDIX R SUMMARY COMPLIANCE TABLE (Continued)

FIRE ZONE	SSS EQPT OR CABLE WITHIN ZONE	APPLICABLE APPENDIX R PROVISIONS III.G.2	APPLICABLE APPENDIX R PROVISIONS III.G.3	AREA BOUNDARY OR 3 HOUR	COMPLIANCE METHODS WITHIN ZONE 1 HOUR	20 FEET	DETECTION	AUTOMATIC SUPPRESSION
FIRE AREA: UNIT 1 QUADRANT 2 PIPING TUNNEL ELEV. 596' 3.5" : 1.5-HOUR BOUNDARY								
12	1	PC		PC(2)			N	N
FIRE AREA: UNIT 2 QUADRANT 2 PIPING TUNNEL ELEV. 596' 3.5" : 1.5-HOUR BOUNDARY								
22	2	PC		PC(2)			N	N
FIRE AREA: UNIT 2 QUADRANT 3N CABLE TUNNEL ELEV. 596' 3.5" :1.5-HOUR BOUNDARY								
23	2	EC		EC(2)			E	E
FIRE AREA: UNIT 2 QUADRANT 3M CABLE TUNNEL ELEV. 596' 3.5": 1.5 HOUR BOUNDARY								
24	2	EC		EC(2)			E	E
FIRE AREA: UNIT 2 QUADRANT 3S CABLE TUNNEL BLEV. 596'3.5": 1.5-HOUR BOUNDARY								
25	2	EC		EC(2)			E	E
FIRE AREA: UNIT 2 QUADRANT 4 CABLE TUNNEL ELEV. 596'3.5": 1.5-HOUR BOUNDARY								
26	2	EC		EC(2)			E	E

FIRE ZONE	SSS EQPT OR CABLE WITHIN ZONE	APPLICABLE APPENDIX R PROVISIONS III.G.2	III.G.3	AREA BOUNDARY OR 3 HOUR	COMPLIANCE METHODS WITHIN ZONE 1 HOUR	20 FEET	DETECTION	AUTOMATIC SUPPRESSION
FIRE AREA: UNIT 2 QUADRANT 1 CABLE TUNNEL ELEV. 596'3.5": 3-HOUR BOUNDARY								
27	2		PC	EC(2)			E	E
FIRE AREA: ACCESS CONTROL AREA EC 609'0": 1.5-HOUR BOUNDARY								
43	1	EC					E	P
FIRE AREA: SPRAY ADDITIVE TANK ROOM ELEV. 587'0": 1.5 HOUR BOUNDARY								
61	NONE	EC					E	N
FIRE AREA: CONTRACTOR ACCESS CONTROL: 1.5-HOUR BOUNDARY								
105	NONE	EC					N	E
FIRE AREA: RW; CS; PW TANK AREA PIPE TUNNEL UNIT 1: 3-HOUR BOUNDARY								
116	NONE	EC					N	N
FIRE AREA: RW; CS; PW TANK AREA PIPE TUNNEL UNIT 2: 3-HOUR BOUNDARY								
117	NONE	EC					N	N

FIRE ZONE	SSS EQPT OR CABLE WITHIN ZONE	APPLICABLE APPENDIX R PROVISIONS III.G.2	III.G.3	AREA BOUNDARY OR 3 HOUR	COMPLIANCE METHODS WITHIN ZONE 1 HOUR	20 FEET	DETECTION	AUTOMATIC SUPPRESSION
FIRE AREA: ESSENTIAL SERVICE WATER PIPE TUNNELS								
112	1	PC		PC(2)			N	N
113	2	PC		PC(2)			N	N
114	1	PC		PC(2)			N	N
115	2	PC		PC(2)			N	N
FIRE AREA: UNIT 1 WEST STEAM VALVE ENCLOSURE AND MAIN STEAM ACCESSWAY: 3-HOUR BOUNDARY								
108	1	EC		EC			N	N
110	1	EC		EC			N	N
FIRE AREA: UNIT 1 WEST STEAM VALVE ENCLOSURE AND MAIN STEAM ACCESSWAY: 3-HOUR BOUNDARY								
109	2	EC		EC			N	N
111	2	EC		EC			N	N
FIRE AREA: UNIT 1 DIESEL OIL PUMP ROOM ELEV. 587'0": 3-HOUR BOUNDARY								
13	1&2	EC		EC			E	E

FIRE ZONE	SSS EQPT OR CABLE WITHIN ZONE	APPLICABLE APPENDIX R PROVISIONS III.G.2	APPLICABLE APPENDIX R PROVISIONS III.G.3	AREA BOUNDARY OR 3 HOUR	COMPLIANCE METHODS WITHIN ZONE 1 HOUR	20 FEET	DETECTION	AUTOMATIC SUPPRESSION
FIRE AREA: UNIT 1 TRANSFORMER ROOM ELEV. 591'0": 1.5-HOUR BOUNDARY								
14	1		ER				P	ER(5)
FIRE AREA: UNIT 1 1 CD DIESEL ROOM ELEV. 587'0": 1.5-HOUR BOUNDARY								
15	1			EC(2)			E	E
FIRE AREA: UNIT 1 1 AB DIESEL ROOM ELEV. 587'0" PC: 1.5-HOUR BOUNDARY								
16	1	EC		EC(2)			E	E
FIRE AREA: UNIT 2 DIESEL OIL PUMP ROOM ELEV. 587'0": 3-HOUR BOUNDARY								
21	1&2	EC		EC(2)			E	E
FIRE AREA: UNIT 2 TRANSFORMER ROOM ELEV. 591'0": 1.5 HOUR BOUNDARY								
20	2		ER				P	ER(5)
FIRE AREA: UNIT 2 CD DIESEL ROOM ELEV. 587'0": 1.5 HOUR BOUNDARY								
18	2		PC	EC(2)			E	E

TABLE 1.1 APPENDIX R SUMMARY COMPLIANCE TABLE (Continued)

FIRE ZONE	SSS EQPT OR CABLE WITHIN ZONE	APPLICABLE APPENDIX R PROVISIONS III.G.2	III.G.3	AREA BOUNDARY OR 3 HOUR	COMPLIANCE METHODS WITHIN ZONE 1 HOUR	20 FEET	DETECTION	AUTOMATIC SUPPRESSION
FIRE AREA: UNIT 2 AB DIESEL ROOM ELEV. 587'0": 1.5 HOUR BOUNDARY								
19	2	EC		EC(2)			E	E
FIRE AREA: UNIT 1 4 KV SWITCHGEAR ROOMS ELEV. 609'0": 1.5-HOUR BOUNDARY								
40A 40B	1		PC	PC(2)			E	E
FIRE AREA: UNIT 1 ENGINEERING SAFETY SYSTEMS AND MMC ROOM ELEV. 609'0": 1.5-HOUR BOUNDARY								
41	1		PC	PC(2)			E	E
FIRE AREA: UNIT 1 CRD MCC ROOM ELEV. 609'0: 1.5-HOUR BOUNDARY								
42A 42B 42C 42D	1		PC	EC(2)			E	E
FIRE AREA: UNIT 2 4 KV SWITCHGEAR ROOM ELEV. 609'0": 1.5-HOUR BOUNDARY								
47A 47B	2		PC	PC(2)			E	E
FIRE AREA: UNIT 2 ENGINEERING SAFETY SYSTEMS AND MCC ROOM ELEV. 609'0" : 1.5-HOUR BOUNDARY								
45	2		PC	PC(2)			E	E

TABLE 1.1 APPENDIX R SUMMARY COMPLIANCE TABLE (Continued)

FIRE ZONE	SSS EQPT OR CABLE WITHIN ZONE	APPLICABLE APPENDIX R PROVISIONS III.G.2	III.G.3	AREA BOUNDARY OR 3 HOUR	COMPLIANCE METHODS WITHIN ZONE 1 HOUR	20 FEET	DETECTION	AUTOMATIC SUPPRESSION
FIRE AREA: UNIT 2 CRD MCC ROOM ELEV. 609'0": 1.5 HOUR BOUNDARY								
46A 46B 46C 46D	2		PC	EC(2)			E	E(27)
******								
FIRE AREA: UNIT 1 CONTROL ROOM: 3-HOUR BOUNDARY								
53	1		ER	PC(2)			E	ER(5)
******								
FIRE AREA: UNIT 1 SWITCHGEAR ROOM CABLE VAULT: 3-HOUR BOUNDARY								
55	1		PC	EC(2)			E	E
******								
FIRE AREA: UNIT 1 AUXILIARY CABLE VAULT : 1.5-HOUR BOUNDARY								
56	1		PC	EC(2)			E	E
******								
FIRE AREA: UNIT 1 CONTROL ROOM CABLE VAULT : 1.5-HOUR BOUNDARY								
57	1		PC	EC(2)			E	E

FIRE ZONE	SSS EQPT OR CABLE WITHIN ZONE	APPLICABLE APPENDIX R PROVISIONS III.G.2	III.G.3	AREA BOUNDARY OR 3 HOUR	COMPLIANCE METHODS WITHIN ZONE 1 HOUR	20 FEET	DETECTION	AUTOMATIC SUPPRESSION
FIRE AREA: UNIT 2 CONTROL ROOM: 3-HOUR BOUNDARY								
54	2		ER	PC(2)			E	ER(5)
FIRE AREA: UNIT 2 SWITCHGEAR ROOM CABLE VAULT : 3-HOUR BOUNDARY								
60	2		PC	EC(2)			E	E
FIRE AREA: UNIT 2 AUXILIARY CABLE VAULT: 1.5-HOUR BOUNDARY								
59	2		PC	EC(2)			E	E
FIRE AREA: UNIT 2 CONTROL ROOM CABLE VAULT : 3-HOUR BOUNDARY								
58	2		PC	EC(2)			E	E
FIRE AREA: UNIT 1 CONTAINMENT: 3 HOUR BOUNDARY								
66	1		ER				PC	ER(5)
67	1		ER				PC	ER(5)
68	1	EC				EC	N	N
101	1	EC				EC	N	N

(Fire Area continued next page)

FIRE ZONE	SSS EQPT OR CABLE WITHIN ZONE	APPLICABLE APPENDIX R PROVISIONS III.G.2	III.G.3	AREA BOUNDARY OR 3 HOUR	COMPLIANCE METHODS WITHIN ZONE 1 HOUR	20 FEET	DETECTION	AUTOMATIC SUPPRESSION
(Fire Area continued from previous page)								
103	1	EC				EC	N	N
118	NONE	EC					N	N
120	1		ER				PC	ER(5)
122	1		ER				PC	ER(5)
**								
FIRE AREA: UNIT 2 CONTAINMENT: 3 HOUR BOUNDARY								
74	2		ER				PC	ER(5)
75	2		ER				PC	ER(5)
76	2	EC				EC	N	N
102	2	EC				EC	N	N
104	2	EC				EC	N	N
119	NONE	EC					N	N
121	2		ER				PC	ER(5)
123	2		ER				PC	ER(5)

TABLE 1.1 APPENDIX R SUMMARY COMPLIANCE TABLE (Continued)

LEGEND:

NONE:	NO SSS COMPONENTS OR CABLES IN THE ZONE
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
EC:	EXISTING COMPLIANCE
PC:	PROPOSED COMPLIANCE
ER:	EXEMPTION REQUEST
E:	EXISTING (APPLIES TO SUPPRESSION AND DETECTION)
N:	NONE (APPLIES TO SUPPRESSION AND DETECTION)
P:	PROPOSED (APPLIES TO SUPPRESSION AND DETECTION)

FOOTNOTES:

(1):	RACEWAY PROTECTION
(2):	APPLIES TO AREA BOUNDARY
(3):	EXEMPTION REQUEST FOR ZONE 1 APPLIES
(4):	SUPPRESSION EXTENSION PROPOSED
(5):	APPLIES TO FIXED 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 thru 2.11.

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:

- Identify safety-related systems or equipment;
- Isolate safety-related systems or equipment from unacceptable fire hazards by spatial separation or by the provision of fire barriers or enclosures;
- Provide fire detection and/or suppression equipment to minimize the effects of a fire; and
- 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 and safety-related equipment or cables 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 the cable tunnels at the 596 ft elevation of both units, where 1-1/2 hour concrete block walls had been added to zone the fixed, automatic detection and suppression systems. 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 which, if required, could be defined as fire areas or could be used as barriers during the III.G.2.c separation analysis. The study resulted in subdivisions of certain previously defined zones. These were identified in the subsequent analysis by a letter preceding 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).

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

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 boundary fire barriers. The rating of the barriers is determined by the fire hazard within each area. At D.C. Cook, the construction of walls, floors and ceilings is typically of heavy, reinforced concrete with an inherent fire rating in excess of 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 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. 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 which contain unrated doors.

Where ducts penetrate area boundaries and pass directly to the plant exterior or exit within rated enclosures through other areas to the plant exterior rated dampers may also not exist.

This situation occurs in Zones 40A, 40B, 47A and 47B (Switchgear Rooms); Zones 15, 16, 18, 19 (Diesel Generator Rooms); and Zones 10 and 24 (the Quadrant 3M cable tunnels). 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 within the stair openings. These systems form a barrier which inhibits the passage of hot gases, flames and products of combustion to the area above. Based on the low area combustible loading of each level of the Auxiliary Building (less than ten minutes for any fire area), this water suppression provides an adequate barrier which prevents fire propagation to adjoining levels. This protection permits each level of the Auxiliary Building to be treated as a separate fire area.

All hatches, where they form part of a boundary separating fire areas containing safe shutdown equipment, have, or will have, a layer of pyrocrete or other material added to provide a level of protection appropriate to the area hazard.

Other penetrations and openings in barriers separating fire areas which contain safety-related equipment are sealed to provide a level of fire protection commensurate with the fire hazard in the fire area.

Where area walls form a natural division between plant buildings, the areas do not contain safety-related equipment, and the combustible loading in the vicinity of the wall is extremely low, penetrations and openings may not be sealed. 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, etc).

No artificial boundaries (i.e., large open spaces) exist between defined fire areas. 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 performed. In all instances, these artificial boundaries were recognized as such, and all separation analysis performed between such zones used the III.G.2 20-ft 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 this criteria, 80 fire areas were identified at D.C. Cook. These fire areas, which mayconsist 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 basis. The location of the automatic detection and suppression systems, which are described in Section 3, are also listed in Table 2-2. Each horizontal line in Table 2-2 delineates one of the 80 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 the table and are separated from other areas by the tables 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 which form the boundaries of the area.

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. Area surveys were also conducted 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 <u>Fire Protection Handbook</u>. 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 2-1

FIRE ZONE IDENTIFICATION TABLE

Fire Zone	Identification
1	Auxiliary Building - El 573' 0"
1A	Containment Spray Pump East, Auxiliary Building El 573' 0"-Unit 1
1B	Containment Spray Pump West, Auxiliary Building El 573' 0"-Unit 1
1C	Reactor Heat Removal Pump East, Auxiliary Building El 573' 0"-Unit 1
1D	Reactor Heat Removal Pump West, Auxiliary Building El 573' 0"-Unit 1
1E	Containment Spray Pump East, Auxiliary Building El 573' 0"-Unit 2
1F	Containment Spray Pump West, Auxiliary Building El 573' 0"-Unit 2
1G	Reactor Heat Removal East, Auxiliary Building El 573' 0"-Unit 2
1H	Reactor Heat Removal West, Auxiliary Building El 573' 0"-Unit 2
2	Pump Bay - El 569' 0"
3	Drumming/Drum Storage - El 589' 0"
4	Sampling Room El 587' 0"
5	Auxiliary Building - El 587' 0" (East End)
6	Auxiliary Building - El 587' 0" (West End)
7	Quadrant 1 Cable Tunnel - El 596' 3-1/2"-Unit 1
8	Quadrant 4 Cable Tunnel - El 596' 3-1/2"-Unit 1
9	Quadrant 3N Cable Tunnel - El 596' 3-1/2"-Unit 1

Fire Zone	Identification
10	Quadrant 3M Cable Tunnel - El 596' 3-1/2"-Unit 1
11	Quadrant 3S Cable Tunnel - El 596' 3-1/2"-Unit 1
12	Quadrant 2 Piping Tunnel - El 596' 3-1/2"-Unit 1
13	Diesel Oil Pump Room - El 587' 0"-Unit 1
14	Transformer Room - El 591' 0"-Unit 1
15	1CD Diesel Room - El 587' 0"-Unit 1
16	1AB Diesel Room - El 587' 0"-Unit 1
17A	West Aux. Feed Pump Room - El 591' 0"-Unit 1
17B	West Aux. Feed Pump Room - El 591' 0"-Unit 2
17C	Corridor to Aux. Feed Pump Rooms - El 591' 0"-Both Units
17D	East Aux. Feed Pump Room - El 591' 0"-Unit 1
17E	Turbine Aux. Feed Pump Room - El 591' 0"-Unit 1
17F	Turbine Aux. Feed Pump Room - El 591' 0"-Unit 2
17G	East Aux. Feed Pump Room - El 591' 0"-Unit 2
18	2CD Diesel Room - El 587' 0"-Unit 2
19	2AB Diesel Room - El 587' 0"-Unit 2
20	Transformer Room - El 591' 0"-Unit 2
21	Diesel Oil Pump Room - El 587' 0"-Unit 2
22	Quadrant 2 Piping Tunnel - El 596' 3 1/2"-Unit 2
23	Quadrant 3N Cable Tunnel - El 596' 3 1/2"-Unit 2
24	Quadrant 3M Cable Tunnel - El 596' 3 1/2"-Unit 2
25	Quadrant 3S Cable Tunnel - El 596' 3 1/2"-Unit 2
26	Quadrant 4 Cable Tunnel - El 596' 3 1/2"-Unit 2

Fire Zone	Identification
27	Quadrant 1 Cable Tunnel - El 596' 3 1/2"-Unit 2
28	Unit 1 Diesel Fire Pump Room - El 591' 0"
29A	Essential Service Water Pump PP-1E - El 591' 0"-Unit 1
29B	Essential Service Water Pump PP-1W - El 591' 0"-Unit 1
29C	Essential Service Water Pump PP-2E - El 591' 0"-Unit 2
29D	Essential Service Water Pump PP-2w - El 591' 0"-Unit 2
29E	Motor Control Center for ESW Pumps - El 591' 0"-Unit 1
29F	Motor Control Center for ESW Pumps - El 591' 0"-Unit 2
29G	Screen House Motor Control Room for ESW - El 575' 0"-Units 1 & 2
30	Unit 2 Diesel Fire Pump Room - El 591' 0"
31	Concrete Mixing Building - El 609' 0"
32	Cask Handling Area - El 609' 0"
33	Main Steam Valve Enclosure, East El 612' 0"-Unit 1
33A	Main Steam Line Area, East El 612' 0"-Unit 1
33B	Non Essential Service Water Valve Area, East El 612' 0"-Unit 1
34	Main Steam Valve Enclosure, West El 612' 0"-Unit 2
34A	Main Steam Line Area, West El 612' 0"-Unit 2
34B	Non Essential Service Water Valve Area, West El 612' 0"-Unit 2
35	Instrument Calibration Room - El 609' 0"
36	Spent Fuel Pit Pump Room - El 609' 0"
37	Valve Gallery - El 617' 0"
38	Quadrant 2 Cable Tunnel - El 612' 0" - Unit 1

Fire Zone	Identification
39	Quadrant 2 Cable Tunnel - El 612' 0" - Unit 2
40A	4 KV Switch Gear Room - El 609' 0" - Unit 1
40B	4 KV Switch Gear Room - El 609' 0" - Unit 1
41	ENG Safety SYST & MCC Room - El 609' 0" (& Underfloor) - Unit 1
42A	E.P.S. Transformer Room El 609' 0" - Unit 1
42B	E.P.S. Control Rod Driver Room - El 609' 0" - Unit 1
42C	E.P.S. Motor Control Room - El 609' 0" - Unit 1
42D	E.P.S. (AB) Battery Room - El 609' 0" - Unit 1
43	Access Control Area - El 609' 0"
44N	Auxiliary Building North - El 609'0"
44S	Auxiliary Building South - El 609'0"
44A	Containment Spray Pump #9E, Auxiliary Building - El 609' 0" - Unit 1
44B	Containment Spray Pump #9W, Auxiliary Building - El 609' 0" - Unit 1
44C	Reactor Heat Removal Pump #17E, Auxiliary Building - El 609' 0" - Unit 1
44D	Reactor Heat Removal Pump #17W, Auxiliary Building - El 609' 0" - Unit 1
44E	Containment Spray Pump #9E, Auxiliary Building - El 609' 0" - Unit 2
44F	Containment Spray Pump #9W, Auxiliary Building - El 609' 0" - Unit 2
44G	Reactor Heat Removal Pumps #17E, Auxiliary Building - El 609' 0" - Unit 2
44H	Reactor Heat Removal Pumps #17W, Auxiliary Building - El 609' 0" - Unit 2

Fire Zone	Identification
45	ENG Safety SYST. & MCC Room - El 609' 0" (& Underfloor) - Unit 2
46A	EPS Transformer Room - El 609' 0" - Unit 2
46B	EPS Control Rod Driver Room - El 609' 0" - Unit 2
46C	EPS Motor Control Room - El 609' 0" - Unit 2
46D	EPS (AB) Battery Room - El 609' 0" - Unit 2
47A	4KV Switch Gear Room - El 609' 0" - Unit 2
47B	4KV Switch Gear Room - El 609' 0" - Unit 2
48	New Fuel Storage Room
49	HVAC Vestibule - Unit 1
50	HVAC Vestibule - Unit 2
51	Auxiliary Building - El 633' 0" (East End)
52	Auxiliary Building - El 633' 0" (West End)
53	Unit 1 Control Room
54	Unit 2 Control Room
55	Switchgear Room Cable Vault - Unit 1
56	Auxiliary Cable Vault - Unit 1
57	Control Room Cable Vault - Unit 1
58	Control Room Cable Vault - Unit 2
59	Auxiliary Cable Vault - Unit 2
60	Switchgear Room Cable Vault - Unit 2
61	Spray Additive Tank Room - El 587' 0"
62A	Reciprocating Pump - El 587' 0" - Unit 1
62B	Charging Pump - El 587' 0" - Unit 1

Fire Zone	Identification
62C	Charging Pump - El 587' 0" - Unit 1
63A	CVCS Reciprocating Pump - El 587' 0" - Unit 2
63B	CVCS Charging Pump - El 587' 0" - Unit 2.
63C	CVCS Charging Pump - El 587' 0" - Unit 2
64A	Safety Injection Pump East - El 587' 0"-Unit 1
64B	Safety Injection Pump West - El 587' 0"-Unit 1
65A	Safety Injection Pump East - El 587' 0"-Unit 2
65B	Safety Injection Pump West - El 587' 0"-Unit 2
66	Containment # 1 Piping Annulus
67	Containment # 1 Lower Volume
68	Containment # 1 Upper Volume
69	Auxiliary Building - El 650' 0"
70	Control Room HVAC Unit 1 - El 650' 0"
71	Computer Room Unit 1 - El 650' 0"
72	Computer Room Unit 2 - El 650' 0"
73	Control Room HVAC Unit 2 - El 650' 0"
74	Containment # 2 Piping Annulus
75	Containment # 2 Lower Volume
76	Containment # 2 Upper Volume
77	Welding Shop Unit 1
78	Heating Boiler Room Unit 1
79	Turbine Room Unit 1 (N.E. Portion) El 591' 0"

Fire Zone	Identification
80	Turbine Room Unit 1 (S.E. Portion) El 591' 0"
81	Turbine Room Unit 1 (S.W. Portion) El 591' 0"
82	Turbine Room Unit 1 (N.W. Portion) El 591' 0"
83	Turbine Room Unit 1 Lube Oil Room - El 591' 0"
84	Turbine Room Unit 2 (N.E. Portion) El 591' 0"
85	Turbine Room Unit 2 (S.E. Portion) El 591' 0"
86	Turbine Room Unit 2 (S.W. Portion) El 591' 0"
87	Turbine Room Unit 2 (N.W. Portion) El 591' 0"
88	Turbine Room Unit 2 Lube Oil Room - El 591' 0"
89	Turbine Room Unit 2 Misc. Oil Room - El 591' 0"
90	Turbine Room Unit 1 (N.E. Portion) El 609' 0"
91	Turbine Room Unit 1 (S.E. Portion) El 609' 0"
92	Turbine Room Unit 1 (S.W. Portion) El 609' 0"
93	Turbine Room Unit 1 (N.W. Portion) - El 609' 0"
94	Turbine Room Unit 1 Aux. Heating Boiler - El 609' 0"
95	Turbine Room Unit 1 Turb. Oil Tank Room - El 609' 0"
96	Turbine Room Unit 2 (N.E. Portion) - El 609' 0"
97	Turbine Room Unit 2 (S.E. Portion) - El 609' 0"
98	Turbine Room Unit 2 (S.W. Portion) - El 609' 0"
99	Turbine Room Unit 2 (N.W. Portion) - El 609' 0"
100	Turbine Room Unit 2 Turbine Tank Room - El 609' 0"
101	Containment 1 Accumulator Enc. - El 612' 0" (West)
102	Containment 1 Accumulator Enc. - El 612' 0" (West)

Fire Zone	Identification
103	Reactor Head Enclosure - Unit 1
104	Reactor Head Enclosure - Unit 1
105	Contractor Access Control
106	Aux. F.W. Battery Room
107	Aux. F.W. Battery Room
108	West Steam Valve Enclosure Unit 1
109	West Steam Valve Enclosure Unit 2
110	Main Steam Accessway Unit 1
111	Main Steam Accessway Unit 2
112	Essential Service Water Pipe Tunnel Unit 1
113	Essential Service Water Pipe Tunnel Unit 2
114	Essential Service Water Pipe Tunnel Unit 1
115	Essential Service Water Pipe Tunnel Unit 2
116	RW, CS, PW Tank Area Pipe Tunnel Unit 1
117	RW, CS, PW Tank Area Pipe Tunnel Unit 2
118	Containment Regen Heat Exchanger Room Unit 1
119	Containment Regen Heat Exchanger Room Unit 2
120	Containment 1 Accumulator Enclosure East
121	Containment 2 Accumulator Enclosure East
122	Containment 1 Instrumentation Room Unit 1
123	Containment 2 Instrumentation Room Unit 2
124	UPS Inverter Room Security - El 591' 0"
125	CAS Security - El 633' 0"

Fire Zone	Identification
126	Tech Support Center El 633' 0"
127	TSC, UPS Battery Inverter Room El 650' 0"
128	UPS Battery Room Security El 591' 0"

Table 2-2

Existing Protection For Fire Areas

Fire Area & Zones	Existing Area Detection By Zone	Existing Area Suppression By Zone	Minimum Rating Of Fire Area Boundaries	Area Fire Severity (Minutes)
1	7 Ionization[22]	None	3 Hour [1,19]	
1A thru 1H	None	None		2
3	2 Ionization (Not Drum Storage)	Automatic Sprinkler (Not Drum Storage)		
32&69	34 Ionization Thermistors For HVAC Units	Preaction Sprinkler Automatic Deluge for HVAC Unit		
36	None	None	1-1/2 Hour[1,19]	1
48	4 Ionization	None		
4	3 Ionization	None	1-1/2 Hour	9
5	14 Ionization[22]	Auto Preaction Sprinklers[20]		
6N	3 Ionization[22]	Automatic Preaction Sprinklers[20]		
6M	8 Ionization[22]	Automatic Preaction Sprinklers[20]	1-1/2 Hr[1,12,19]	7
64A&B	4 Ionization	Automatic Preaction Sprinkler		
65A&B	4 Ionization	Automatic Preaction Sprinkler		
6S	3 Ionization[22]	Automatic Preaction Sprinkler[20]		

Table 2-2

Existing Protection For Fire Areas

Fire Area	Existing Area Detection By Zone	Existing Area Suppression By Zone	Minimum Rating Of Fire Area Boundaries	Area Fire Severity (Minutes)
7	4 Ionization 3 Infrared	Automatic CO_2	3 Hour	86
8	6 Ionization 5 Infrared	Automatic CO_2	1-1/2 Hour[2]	23
9	4 Ionization 3 Infrared	Automatic CO_2	1-1/2 Hour	50
10	4 Ionization 3 Infrared	Automatic CO_2	1-1/2 Hour	78
11	3 Ionization 3 Infrared	Automatic CO_2	1-1/2 Hour	21
12	None	None	1-1/2 Hour	<1
13	Thermistors	Automatic CO_2	3 Hour	54
14	None	None	1-1/2 Hour	<1
15	Thermistors	Automatic CO_2	1-1/2 Hour	344[24]
16	Thermistors	Automatic CO_2	1-1/2 Hour	332[24]

Table 2-2

Existing Protection For Fire Areas

Fire Area	Existing Area Detection By Zone	Existing Area Suppression By Zone	Minimum Rating Of Fire Area Boundaries	Area Fire Severity (Minutes)
17A	None	None	3 Hour	<1
17B	None	None	3 Hour	<1
17C	None	None	3 Hour	2
17D	None	None	3 Hour	<1
17E	None	Automatic Sprinkler	3 Hour	<1
17F	None	Automatic Sprinkler	3 Hour[3]	<1
17G	None	None	3 Hour	<1
18	Thermistors	Automatic CO_2	1-1/2 Hour	337[24]
19	Thermistors	Automatic CO_2	1-1/2 Hour	331[24]
20	None	None	1-1/2 Hour	<1
21	Thermistors	Automatic CO_2	3 Hour	60
22	None	None	1-1/2 Hour	<1

Table 2-2

Existing Protection For Fire Area

Fire Area	Existing Area Detection By Zone	Existing Area Suppression By Zone	Minimum Rating Of Fire Area Boundaries	Area Fire Severity (Minutes)
23	3 Ionization 3 Infrared	Automatic CO_2	1-1/2 Hour	21
24	4 Ionization 3 Infrared	Automatic CO_2	1-1/2 Hour	58
25	4 Ionization 3 Infrared	Automatic CO_2	1-1/2 Hour	45
26	6 Ionization 5 Infrared	Automatic CO_2	1-1/2 Hour[4]	16
27	4 Ionization 3 Infrared	Automatic CO_2	3 Hour	63
28	None	Automatic Sprinkler	3 Hour	258
29A	None	None	3 Hour[1,17,21]	1
29B	None	None		
29C	None	None		
29D	None	None		
29E	None	None		
29F	None	None		
29G	None	None		

Table 2-2

Existing Protection For Fire Areas

Fire Area	Existing Area Detection By Zone	Existing Area Suppression By Zone	Minimum Rating Of Fire Area Boundaries	Area Fire Severity (Minutes)
30	None	Automatic Sprinkler	3 Hour	258
31	None	None	3 Hour	13
33 (Also 33A and 33B)	Thermistor for Charcoal Filter Unit in 33A	Automatic Deluge for Charcoal Filter Unit in 33A	1-1/2 Hour[2]	8
34 (Also 34A and 34B	Thermistors for Charcoal Filter Unit in 34A	Automatic Deluge for Charcoal Filter Unit in 34A	1-1/2 Hour[4]	4
35	None	None	3 Hour	4
38	7 Ionization 4 Infrared	Automatic CO_2	1-1/2 Hour	29
39	7 Ionization 4 Infrared	Automatic CO_2	1-1/2 Hour	21
40A&B	4 Ionization 6 Infrared	Automatic CO_2	1-1/2 Hour[5]	15
41	9 Ionization 5 Infrared	Automatic CO_2	1-1/2 Hour[5]	17
42A-D	8 Ionization 5 Infrared	Automatic CO_2 Except In Battery Room	1-1/2 Hour	17

Table 2-2

Existing Protection For Fire Areas

Fire Area	Existing Area Detection By Zone	Existing Area Suppression By Zone	Minimum Rating Of Fire Area Boundaries	Area Fire Severity (Minutes)
43	25 Ionization	None	1-1/2 Hour [6]	3
37	3 Ionization	None	1-1/2 Hour [1,19,26]	10
44N	10 Ionization	Automatic Preaction Sprinklers [27]		
44S	17 Ionization	Automatic Preaction Sprinklers, Partial Coverage [23]		
44A thru 44H	NONE	NONE		
45	9 Ionization 5 Infrared	Automatic CO_2,	1-1/2 Hour [7]	14
46A-D	8 Ionization 5 Infrared	Automatic CO_2, Except In Battery Room	1-1/2 Hour	25
47A&B	4 Ionization 6 Infrared	Automatic CO_2	1-1/2 Hour [7]	15

Table 2-2

Existing Protection For Fire Areas

Fire Area	Existing Area Detection By Zone	Existing Area Suppression By Zone	Minimum Rating Of Fire Area Boundaries	Area Fire Severity (Minutes)
49	7 Ionization & Thermistors For Charcoal Filter Unit	Automatic Deluge For Charcoal Filter Unit		
50	7 Ionization & Thermistors For Charcoal Filter Unit	Automatic Deluge For Charcoal Filter Unit		
51	8 Ionization	None	3 Hour[8,19]	10
52	17 Ionization	None		
53	46 Ionization	None	3 Hour[9,10,18]	7
54	42 Ionization	None	3 Hour[10,11,18]	10
55	13 Ionization 10 Infrared	Automatic CO_2, Except in Battery Room	3 Hour[5]	30
56	6 Ionization	Automatic CO_2	1-1/2 Hour[6]	51
57	65 Ionization	Manual CO_2 Automatic Halon 1301	1-1/2 Hour[9]	71
58	76 Ionization	Automatic Sprinkler Manual CO_2 Automatic Halon 1301	3 Hour[11]	67

Table 2-2

Existing Protection For Fire Areas

Fire Area	Existing Area Detection By Zone	Existing Area Suppression By Zone	Minimum Rating Of Fire Area Boundaries	Area Fire Severity (Minutes)
59	6 Ionization	Automatic CO_2	1-1/2 Hour[8]	41
60	13 Ionization 10 Infared	Automatic CO_2 Except in Battery Room	3 Hour[7]	24
61	2 Ionization	None	1-1/2 Hour	<1
62A,B and C	6 Ionization	Automatic Preaction Sprinklers	3 Hour[12,17]	57
63A,B and C	6 Ionization	Automatic Preaction Sprinklers	3 Hour[12,17]	58
70	12 Ionization, Thermistors for Charcoal Filter Unit	Automatic Deluge For Charcoal Filer Unit		
71	2 Ionization	Automatic Halon 1301	3 Hour[10]	6
72	2 Ionization	Automatic Halon 1301		
73	12 Ionization, Thermistors For Charcoal Filter Unit	Automatic Deluge For Charcoal Filter Unit		

Table 2-2

Existing Protection For Fire Areas

Fire Area	Existing Area Detection By Zone	Existing Area Suppression By Zone	Minimum Rating Of Fire Area Boundaries	Area Fire Severity (Minutes)
66	Thermistors for Cable Trays	None		
67	Thermistors for Reactor Coolant Pumps and Air Handling Units Thermistors for Cable Trays	Manual Sprinkler For Reactor Coolant Pumps Automatic Deluge For Air Handling Units		
68	Thermistors for Cable Trays	None		
101	Thermistors for Cable Trays	None	3 Hour [13]	17
103	Thermistors for Cable Trays	None		
118	None	None		
120	None	None		
122	None	None		

Table 2-2

Existing Protection For Fire Areas

<table>
<tr><th>Fire Area</th><th>Existing Area Detection By Zone</th><th>Existing Area Suppression By Zone</th><th>Minimum Rating Of Fire Area Boundaries</th><th>Area Fire Severity (Minutes)</th></tr>
<tr><td>74</td><td>Thermistors For Cable Trays</td><td>None</td><td rowspan="9">3 Hour[13]</td><td rowspan="9">15</td></tr>
<tr><td rowspan="2">75</td><td>Thermistors For Reactor Coolant Pumps and Air Handling Units</td><td>Manual Sprinkler For Reactor Coolant Pump</td></tr>
<tr><td>Thermistors For Cable Trays</td><td>Automatic Deluge For Air Handling Units</td></tr>
<tr><td>76</td><td>Thermistors For Cable Trays</td><td>None</td></tr>
<tr><td>102</td><td>Thermistors For Cable Trays</td><td>None</td></tr>
<tr><td>104</td><td>Thermistors For Cable Trays</td><td>None</td></tr>
<tr><td>119</td><td>None</td><td>None</td></tr>
<tr><td>121</td><td>None</td><td>None</td></tr>
<tr><td>123</td><td>None</td><td>None</td></tr>
</table>

Table 2-2

Existing Protection For Fire Areas

Fire Area	Existing Area Detection By Zone	Existing Area Suppression By Zone	Minimum Rating Of Fire Area Boundaries	Area Fire Severity (Minutes)
2	None	None		
77	None	Automatic Sprinkler		
79	None	Automatic Sprinkler Except Between Zone 15 and Zone 16		
80	None	Automatic Sprinkler		
81	None	Automatic Sprinkler		
82	None	Automatic Sprinkler		
90	None	Automatic Sprinkler		
91	None	Automatic Sprinkler	1-1/2 Hour[3,14,25]	8
92	None	Automatic Sprinkler		
93	None	Automatic Sprinkler		
126	8 Ionization	Automatic Halon 1301 and Sprinklers		
127	6 Ionization	Automatic Halon 1301		
78	None	Automatic Sprinkler	3 Hour	6
83	None	Automatic Sprinkler	3 Hour	5456

Table 2-2

Existing Protection For Fire Areas

Fire Area	Existing Area Detection By Zone	Existing Area Suppression By Zone	Minimum Rating Of Fire Area Boundaries	Area Fire Severity (Minutes)
84	None	Automatic Sprinkler		
85	None	Automatic Sprinkler Except Between Zone 18 and 19		
86	None	Automatic Sprinkler		
87	None	Automatic Sprinkler		
96	None	Automatic Sprinkler		
97	None	Automatic Sprinkler	1-1/2 Hour [15]	3
98	None	Automatic Sprinkler		
99	None	Automatic Sprinkler		
124	Ionization	Automatic Halon 1301		
125	Ionization	Automatic Halon 1301		
128	None	None		
88	Thermistor Cable Trays	Automatic Sprinkler and Automatic CO_2	3 Hour	8632
89	None	Automatic Sprinkler	3 Hour	1223
94	None	Automatic Sprinkler	3 Hour	6
95	Thermistors	Automatic Sprinkler and Automatic CO_2	3 Hour	5278

Table 2-2

Existing Protection For Fire Areas

Fire Area	Existing Area Detection By Zone	Existing Area Suppression By Zone	Minimum Rating Of Fire Area Boundaries	Area Fire Severity (Minutes)
100	Thermistors	Automatic Sprinkler Automatic CO_2	3 Hour	6728
105	None	Automatic Sprinkler	1-1/2 Hour	~30
106	1 Heat Detector	None	1-1/2 Hour	110[16]
107	1 Heat Detector	None	1-1/2 Hour	97[16]
108	None	None	3 Hour[14]	~0
110	None	None		
109	None	None	3 Hour[15]	~10
111	None	None		
112	None	None	3 Hour[25]	~0
113	None	None		
114	None	None		
115	None	None		
116	None	None	3 Hour	~0
117	None	None	3 Hour	~0

Notes:

1. Open stairway(s) penetrate boundary.
2. Grate in ceiling of Zone 8 to Zone 33 above.
3. Floor drainage opening from Zone 17F to Zone 2 below.
4. Grate in ceiling of Zone 26 to Zone 34 above.
5. Hatch with layer of pyrocrete provides access from Zone 40B and Zone 41 to Zone 55 above.
6. Hatch with layer of pyrocrete provides access from Zone 43 to Zone 56 above.
7. Hatch with layer of pyrocrete provides access from Zone 45 and Zone 47B to Zone 60 above.
8. Hatch with layer of pyrocrete provides access from Zone 59 to Zone 52 below.
9. Hatch with layer of pyrocrete provides access from Zone 53 to Zone 5[illegible] below.
10. Hatches with layer of pyrocrete provide access from control rooms to HVAC equipment rooms above.
11. Hatch with layer of pyrocrete provides access from Zone 54 to Zone 58 below.
12. Small openings near ceiling connect Zone 5 with Zone 62 and Zone 63.
13. Hatches provide only access points from lower volume of containment to the upper volume of containment.
14. Open pipeways above door providing access from Zone 80 to Zone 110.
15. Open pipeways above door providing access from Zone 84 to Zone 111.
16. Plastic battery cases are only combustible material.
17. Controlled access into each zone is via a locked screen mesh gate.

18. 3 hour door separating control rooms has beem modified to include wire glass vision panel in excess or 100 in^2.

19. Elevator doors have 2-hour-fire-rating.

20. Suppression coverage does not extend into zone cubicles containing radioactive equipment located behind shield walls with controlled access screen mesh gates.

21. Open stair connects 29B and 29G, ladder connects 29D and 29G.

22. Detection coverage does not extend into zone cubicles containing radioactive equipment located behind shield walls with controlled access screeen mesh gates.

23. Suppression coverage does not extend into zone cubicles containing radioactive equipment located behind shield wall with controlled access screen mesh gates, or over the monitor tanks, component cooling pumps.

24. Major combustible is fuel oil day tank located within 4-hour rated constuction with 3-hour rated access doors.

25. Small openings connect Zone 2 with Zones 112 and 113.

26. Suppression and Detection coverage does not extend into 44A thru 44H, classified as high radiation areas with controlled access.

27. Suppression coverage does not extend into far north section of Zone at El. 620'-6" or by entrances to Zone 43.

FIRE AREA AND ZONE IDENTIFICATION

In the following
color coded figures, 2-1 thru 2-11;
BLUE indicates FIRE AREAS
ORANGE indicates FIRE ZONES

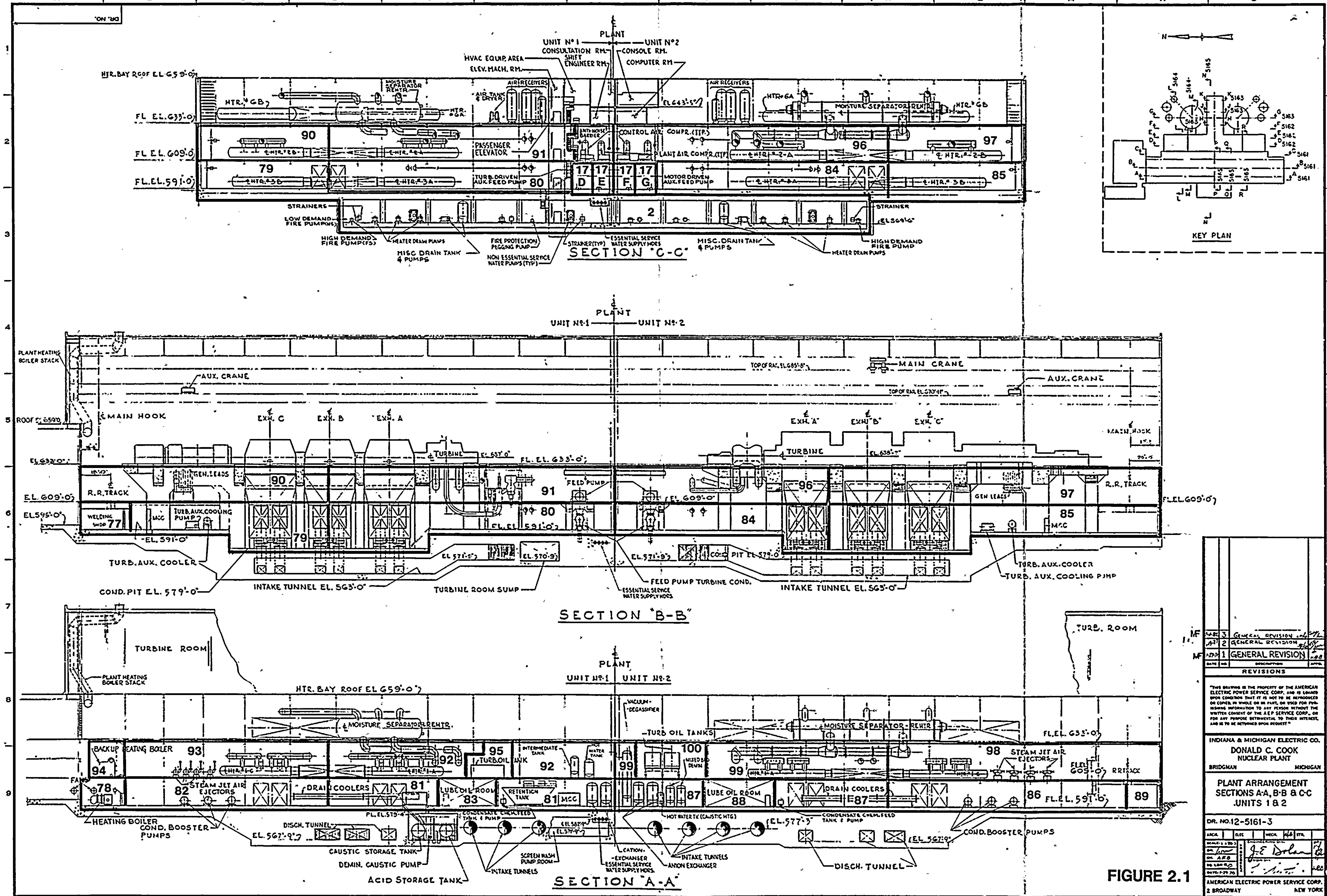

SECTION "C-C"
SECTION "B-B"
SECTION "A-A"
KEY PLAN
PLANT
UNIT Nº 1
UNIT Nº 2
TURBINE ROOM
MAIN CRANE
AUX. CRANE
MAIN HOOK
TURBINE
R.R. TRACK
INTAKE TUNNEL EL. 563'-0"
TURBINE ROOM SUMP
COND. PIT EL. 579'-0"
FEED PUMP TURBINE COND.
TURB. AUX. COOLER
TURB. AUX. COOLING PUMP
HTR. BAY ROOF EL 659'-0"
MOISTURE SEPARATOR-REHTR.
BACKUP HEATING BOILER
HEATING BOILER
COND. BOOSTER PUMPS
STEAM JET AIR EJECTORS
DRAIN COOLERS
LUBE OIL ROOM
TURB OIL TANKS
DISCH. TUNNEL
CAUSTIC STORAGE TANK
DEMIN. CAUSTIC PUMP
ACID STORAGE TANK
INTAKE TUNNELS
REVISIONS
1 GENERAL REVISION
2 GENERAL REVISION
3 GENERAL REVISION
INDIANA & MICHIGAN ELECTRIC CO.
DONALD C. COOK NUCLEAR PLANT
BRIDGMAN MICHIGAN
PLANT ARRANGEMENT
SECTIONS A-A, B-B & C-C
UNITS 1 & 2
DR. NO. 12-5161-3
AMERICAN ELECTRIC POWER SERVICE CORP.
2 BROADWAY NEW YORK

FIGURE 2.1

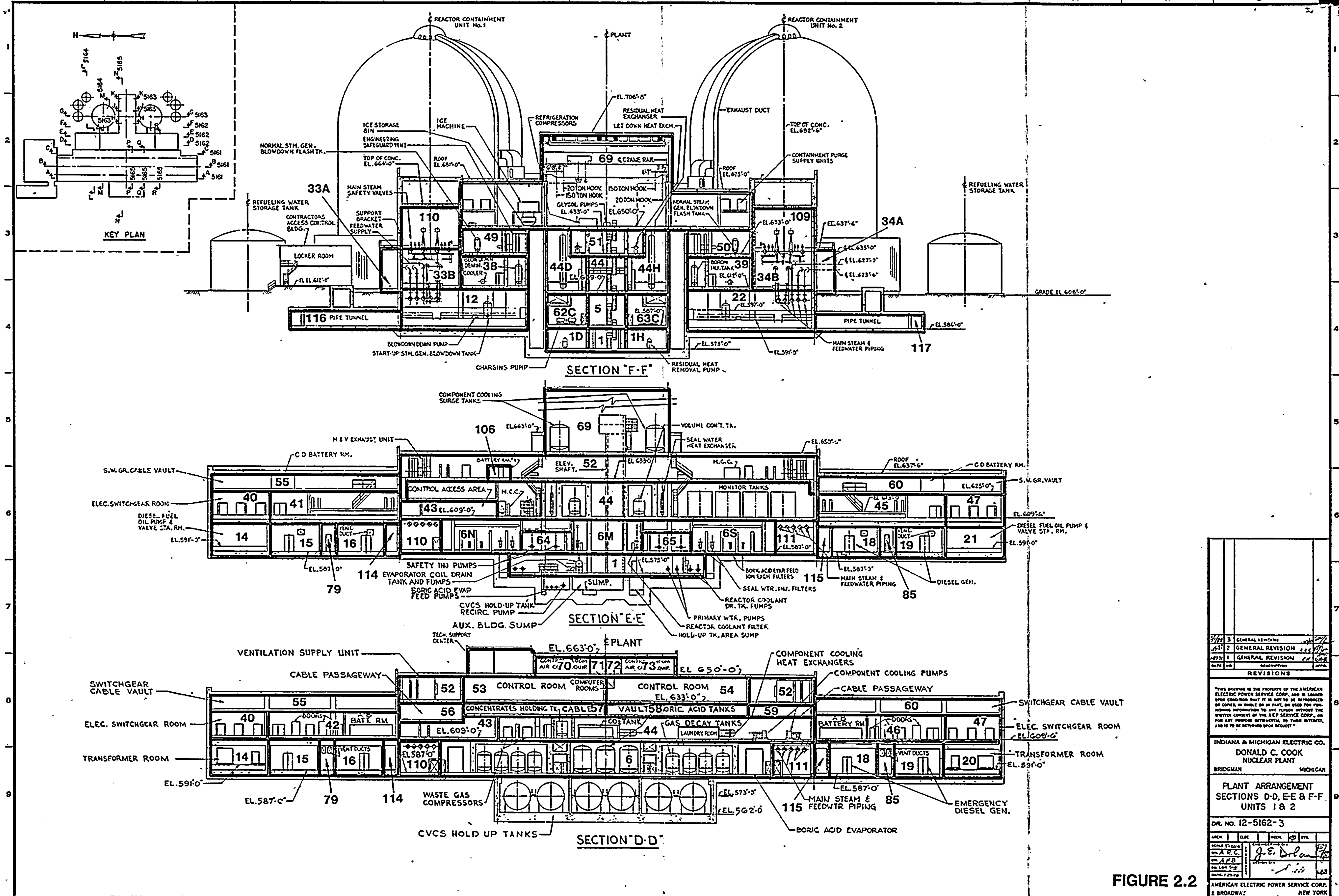
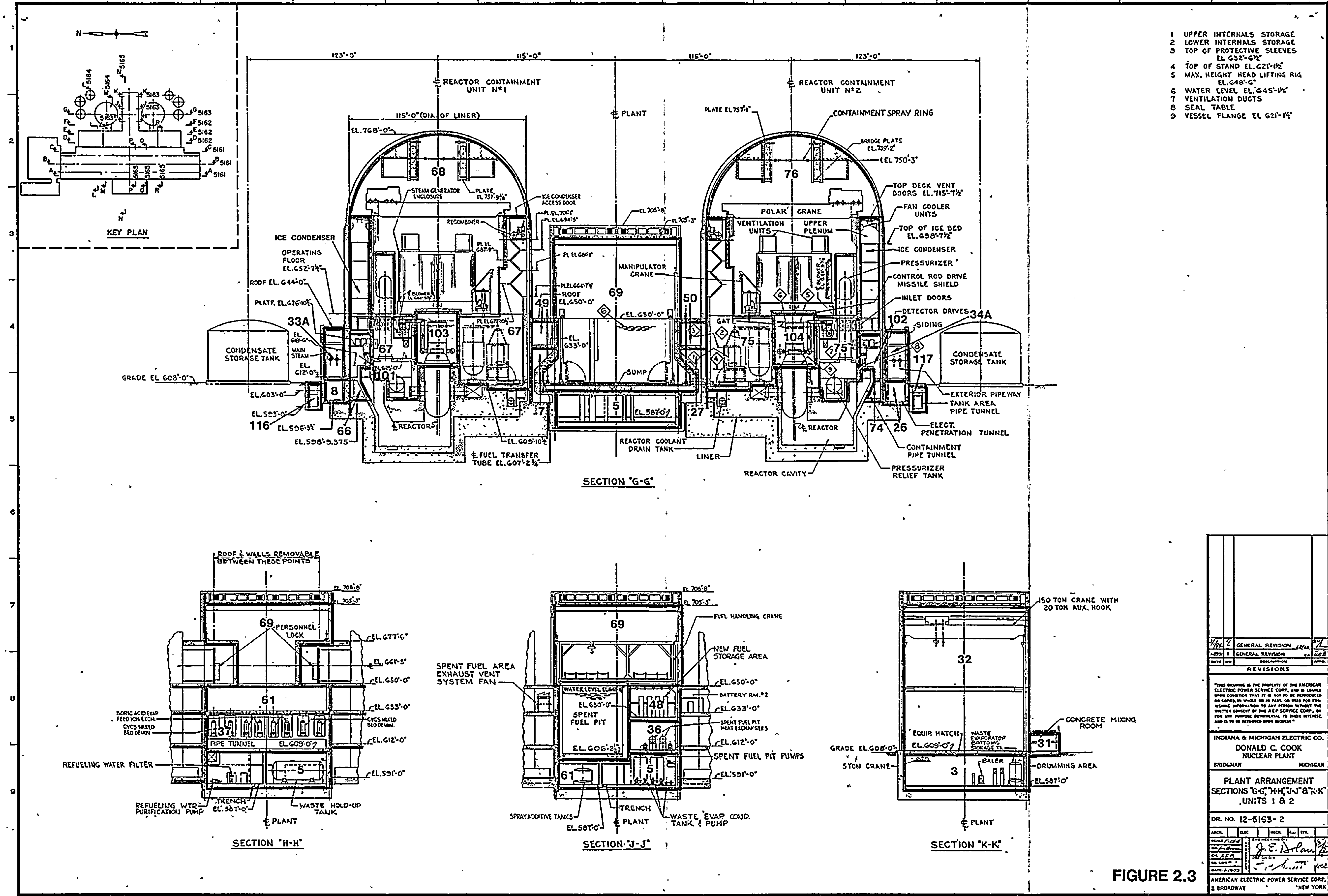
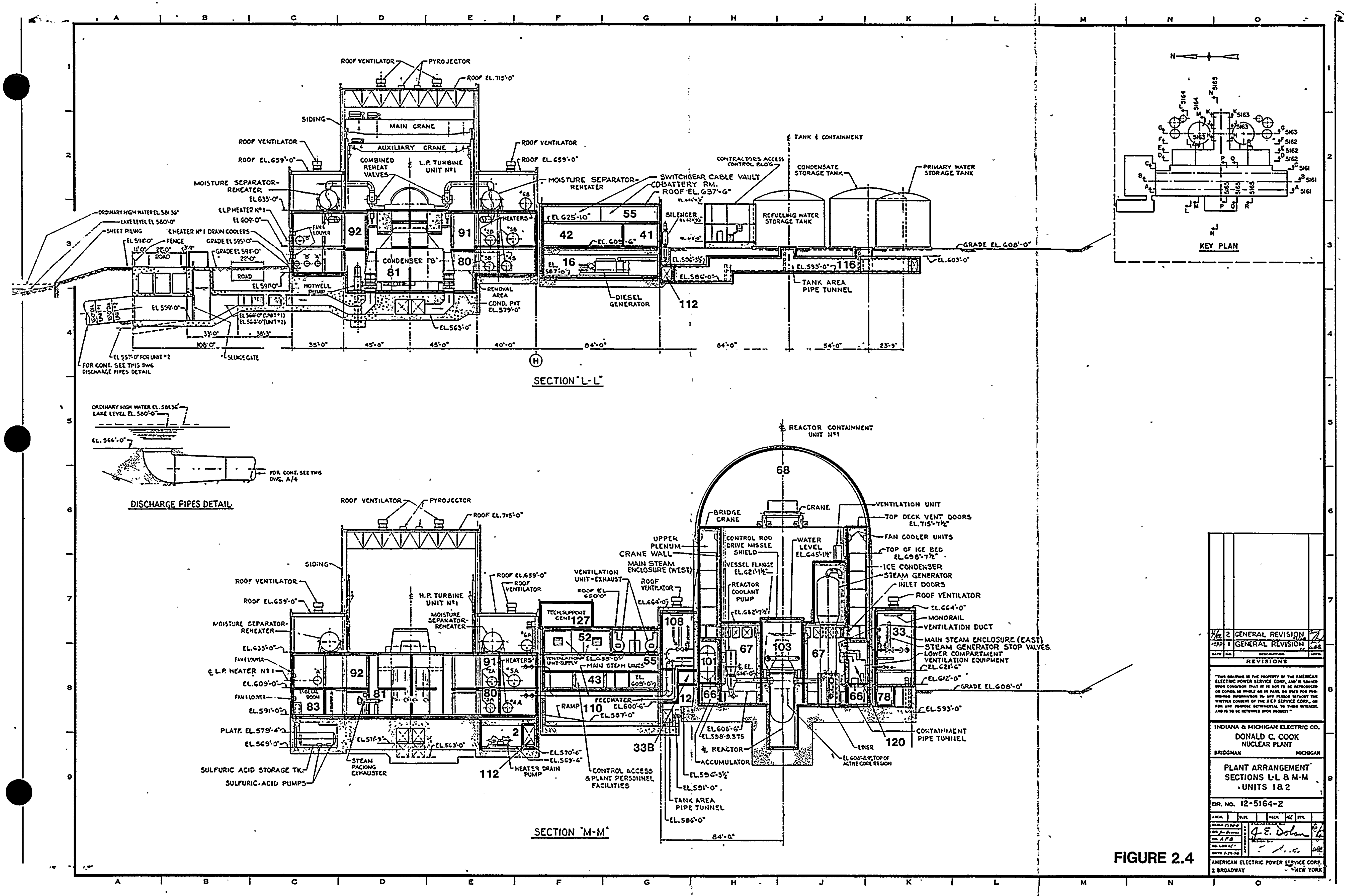

KEY PLAN
SECTION "F-F"
SECTION "E-E"
SECTION "D-D"
REACTOR CONTAINMENT UNIT No. 1
REACTOR CONTAINMENT UNIT No. 2
PLANT
REFUELING WATER STORAGE TANK
CONTROL ROOM
SWITCHGEAR CABLE VAULT
ELEC. SWITCHGEAR ROOM
TRANSFORMER ROOM
VENTILATION SUPPLY UNIT
CABLE PASSAGEWAY
COMPONENT COOLING HEAT EXCHANGERS
COMPONENT COOLING PUMPS
WASTE GAS COMPRESSORS
CVCS HOLD UP TANKS
BORIC ACID EVAPORATOR
MAIN STEAM & FEEDWTR PIPING
EMERGENCY DIESEL GEN.
AUX. BLDG. SUMP
GRADE EL.608'-0"
REVISIONS
3 GENERAL REVISION
2 GENERAL REVISION
1 GENERAL REVISION
INDIANA & MICHIGAN ELECTRIC CO.
DONALD C. COOK NUCLEAR PLANT
BRIDGMAN MICHIGAN
PLANT ARRANGEMENT SECTIONS D-D, E-E & F-F UNITS 1 & 2
DR. NO. 12-5162-3
AMERICAN ELECTRIC POWER SERVICE CORP. 2 BROADWAY NEW YORK

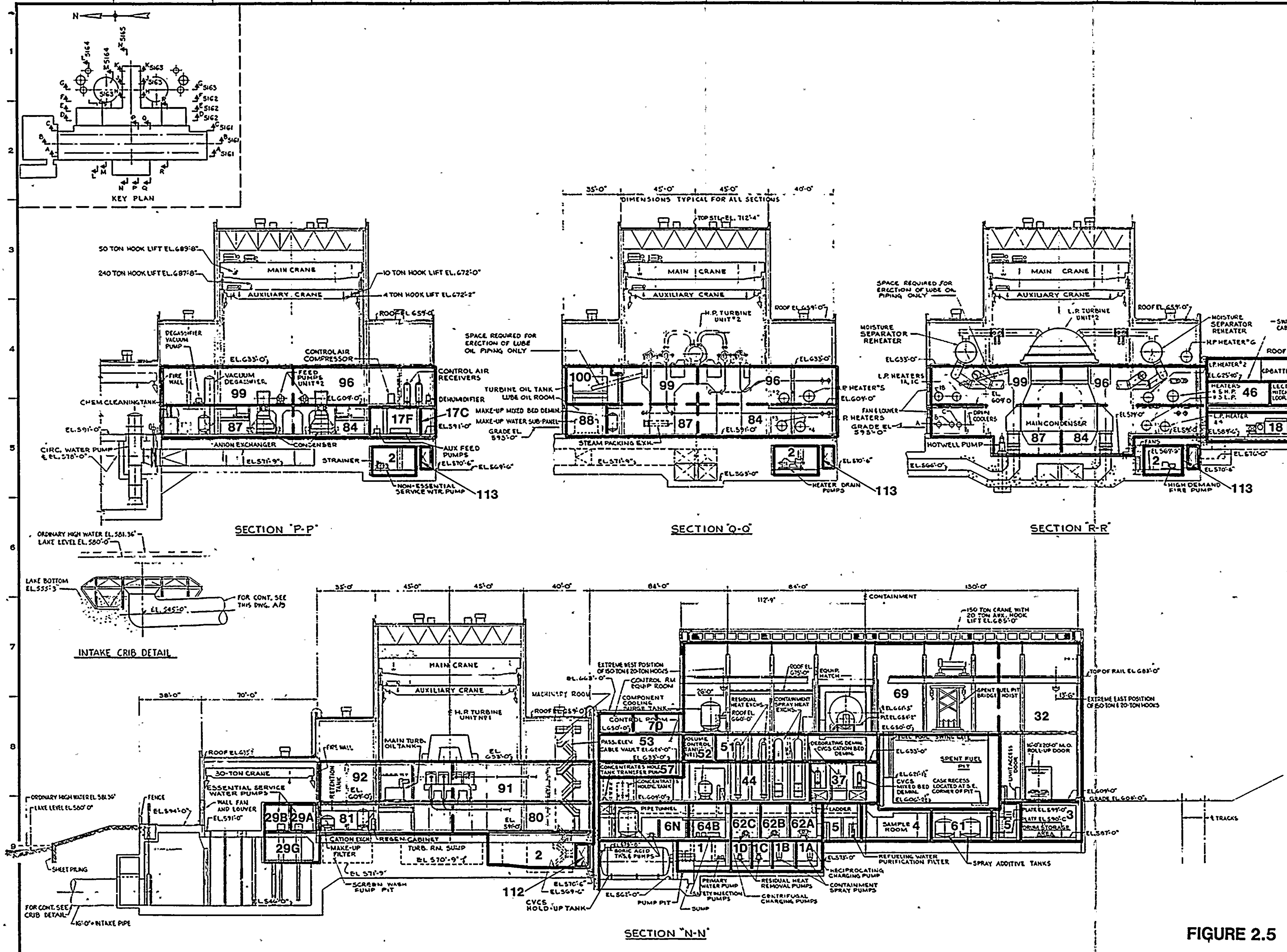
FIGURE 2.2



1 UPPER INTERNALS STORAGE
2 LOWER INTERNALS STORAGE
3 TOP OF PROTECTIVE SLEEVES EL 632'-6½"
4 TOP OF STAND EL 621'-1½"
5 MAX. HEIGHT HEAD LIFTING RIG EL 648'-6"
6 WATER LEVEL EL 645'-1½"
7 VENTILATION DUCTS
8 SEAL TABLE
9 VESSEL FLANGE EL 621'-1½"
KEY PLAN
REACTOR CONTAINMENT UNIT Nº1
REACTOR CONTAINMENT UNIT Nº2
PLANT
CONTAINMENT SPRAY RING
POLAR CRANE
VENTILATION UNITS
UPPER PLENUM
TOP DECK VENT DOORS EL. 715'-7½"
FAN COOLER UNITS
TOP OF ICE BED EL. 698'-7½"
ICE CONDENSER
PRESSURIZER
CONTROL ROD DRIVE MISSILE SHIELD
INLET DOORS
DETECTOR DRIVES
SIDING
MANIPULATOR CRANE
OPERATING FLOOR EL. 652'-7½"
CONDENSATE STORAGE TANK
GRADE EL 608'-0"
SUMP
REACTOR
REACTOR COOLANT DRAIN TANK
LINER
REACTOR CAVITY
FUEL TRANSFER TUBE EL. 607'-2¾"
EXTERIOR PIPEWAY
TANK AREA PIPE TUNNEL
ELECT. PENETRATION TUNNEL
CONTAINMENT PIPE TUNNEL
PRESSURIZER RELIEF TANK
SECTION "G-G"
ROOF & WALLS REMOVABLE BETWEEN THESE POINTS
PERSONNEL LOCK
PIPE TUNNEL
REFUELING WATER FILTER
REFUELING WTR PURIFICATION PUMP
TRENCH
WASTE HOLD-UP TANK
SECTION "H-H"
SPENT FUEL AREA EXHAUST VENT SYSTEM FAN
FUEL HANDLING CRANE
NEW FUEL STORAGE AREA
SPENT FUEL PIT
SPENT FUEL PIT PUMPS
SPRAY ADDITIVE TANKS
WASTE EVAP. COND. TANK & PUMP
SECTION "J-J"
150 TON CRANE WITH 20 TON AUX. HOOK
CONCRETE MIXING ROOM
EQUIP. HATCH
BALER
DRUMMING AREA
SECTION "K-K"
REVISIONS
GENERAL REVISION
INDIANA & MICHIGAN ELECTRIC CO.
DONALD C. COOK NUCLEAR PLANT
BRIDGMAN MICHIGAN
PLANT ARRANGEMENT SECTIONS "G-G", "H-H", "J-J" & "K-K" UNITS 1 & 2
DR. NO. 12-5163-2
AMERICAN ELECTRIC POWER SERVICE CORP. 2 BROADWAY NEW YORK

FIGURE 2.3


SECTION "L-L"
SECTION "M-M"
DISCHARGE PIPES DETAIL
KEY PLAN
ROOF VENTILATOR
PYROJECTOR
ROOF EL. 715'-0"
SIDING
MAIN CRANE
AUXILIARY CRANE
COMBINED REHEAT VALVES
L.P. TURBINE UNIT Nº1
H.P. TURBINE UNIT Nº1
ROOF EL. 659'-0"
MOISTURE SEPARATOR-REHEATER
SWITCHGEAR CABLE VAULT
BATTERY RM.
ROOF EL. 637'-6"
SILENCER
CONTRACTORS ACCESS CONTROL BLDG
CONDENSATE STORAGE TANK
PRIMARY WATER STORAGE TANK
REFUELING WATER STORAGE TANK
TANK & CONTAINMENT
GRADE EL. 608'-0"
TANK AREA PIPE TUNNEL
DIESEL GENERATOR
CONDENSER "B"
HOTWELL PUMP
REMOVAL AREA
COND. PIT EL. 579'-0"
EL. 563'-0"
FENCE
ROAD
SHEET PILING
LAKE LEVEL EL. 580'-0"
ORDINARY HIGH WATER EL. 581.36'
SLUICE GATE
FOR CONT. SEE THIS DWG. DISCHARGE PIPES DETAIL
HEATERS
REACTOR CONTAINMENT UNIT Nº1
BRIDGE CRANE
CRANE
VENTILATION UNIT
TOP DECK VENT DOORS EL. 715'-7½"
FAN COOLER UNITS
UPPER PLENUM
CRANE WALL
CONTROL ROD DRIVE MISSLE SHIELD
WATER LEVEL EL. 645'-1½"
TOP OF ICE BED EL. 698'-7½"
MAIN STEAM ENCLOSURE (WEST)
VESSEL FLANGE EL. 621'-1½"
ICE CONDENSER
STEAM GENERATOR
INLET DOORS
REACTOR COOLANT PUMP
ROOF VENTILATOR
MONORAIL
VENTILATION DUCT
MAIN STEAM ENCLOSURE (EAST)
STEAM GENERATOR STOP VALVES.
LOWER COMPARTMENT VENTILATION EQUIPMENT
TECH SUPPORT CENT
VENTILATION UNIT-EXHAUST
VENTILATION UNIT-SUPPLY
MAIN STEAM LINES
FEEDWATER
RAMP
LUBE OIL ROOM
SULFURIC ACID STORAGE TK.
SULFURIC-ACID PUMPS
STEAM PACKING EXHAUSTER
HEATER DRAIN PUMP
CONTROL ACCESS & PLANT PERSONNEL FACILITIES
REACTOR
ACCUMULATOR
LINER
CONTAINMENT PIPE TUNNEL
REVISIONS
GENERAL REVISION
INDIANA & MICHIGAN ELECTRIC CO.
DONALD C. COOK NUCLEAR PLANT
BRIDGMAN MICHIGAN
PLANT ARRANGEMENT SECTIONS L-L & M-M UNITS 1&2
DR. NO. 12-5164-2
AMERICAN ELECTRIC POWER SERVICE CORP.
2 BROADWAY NEW YORK
FIGURE 2.4



	4	GENERAL REVISION	
	3	GENERAL REVISION	
	2	ADDED SPACE REQ'D FOR ERECTION OF LUBE OIL PIPING	
	1	GENERAL REVISION	
DATE	NO.	DESCRIPTION	APPD.

REVISIONS

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INDIANA & MICHIGAN ELECTRIC CO.
DONALD C. COOK NUCLEAR PLANT
BRIDGMAN MICHIGAN

PLANT ARRANGEMENT
SECTIONS "N-N" "P-P" "Q-Q" & "R-R"
UNITS 1 & 2

DR. NO. 12-5165-4

J. E. Dolan

AMERICAN ELECTRIC POWER SERVICE CORP.
2 BROADWAY NEW YORK

FIGURE 2.5

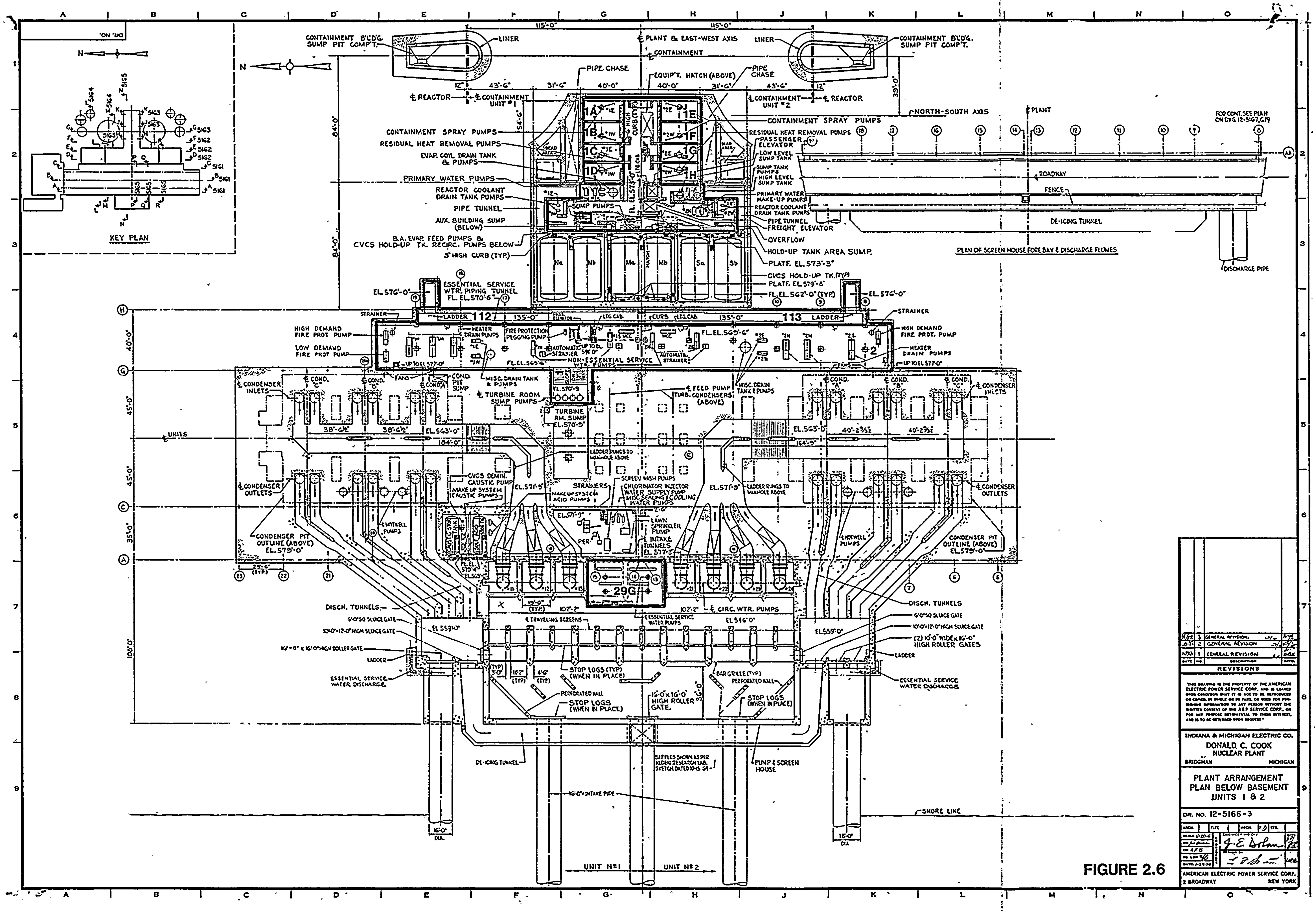
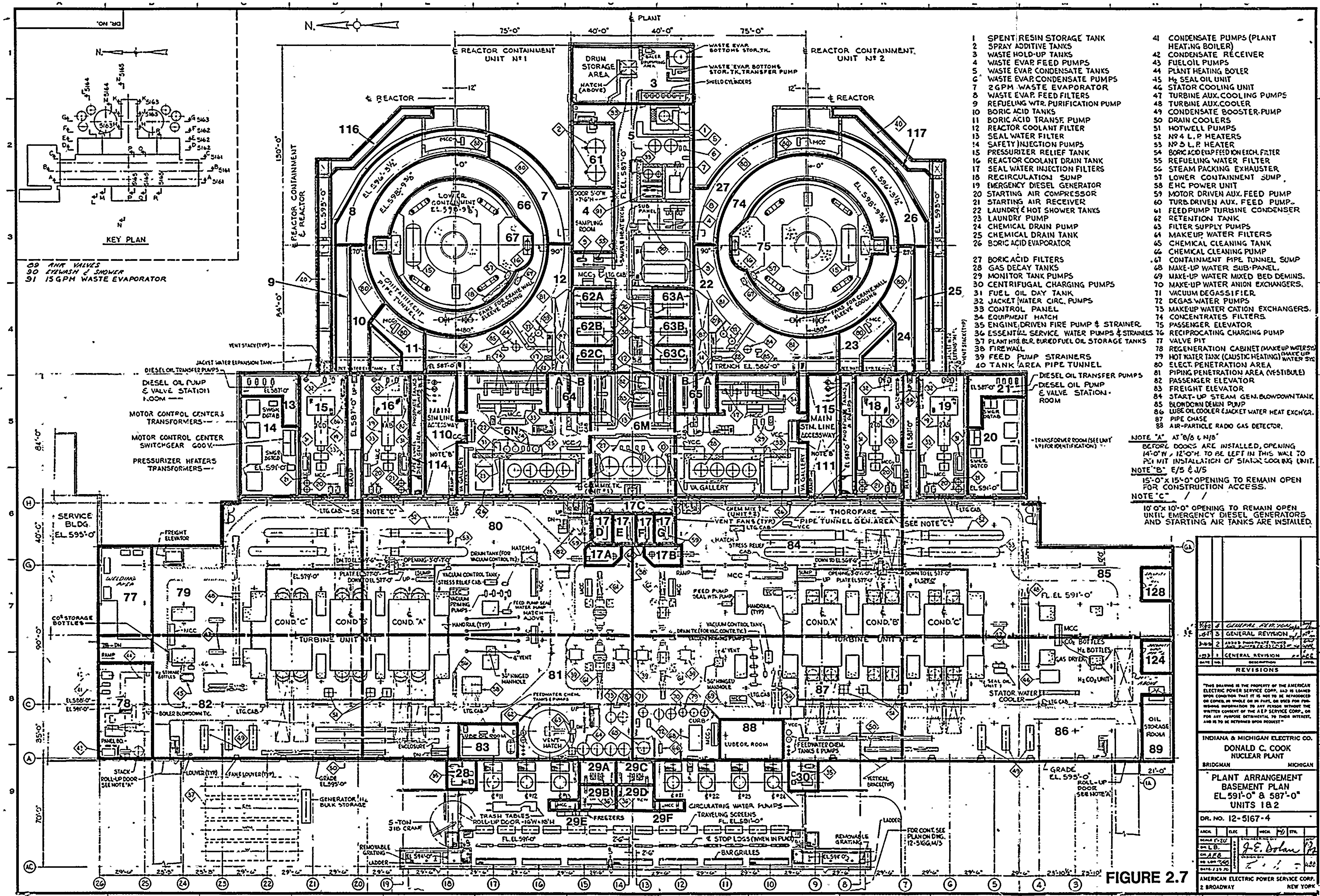

KEY PLAN
CONTAINMENT BLD'G. SUMP PIT COMP'T.
LINER
PLANT & EAST-WEST AXIS
CONTAINMENT
PIPE CHASE
EQUIP'T. HATCH (ABOVE)
REACTOR
CONTAINMENT UNIT #1
CONTAINMENT UNIT #2
NORTH-SOUTH AXIS
PLANT
CONTAINMENT SPRAY PUMPS
RESIDUAL HEAT REMOVAL PUMPS
EVAP. COIL DRAIN TANK & PUMPS
PRIMARY WATER PUMPS
REACTOR COOLANT DRAIN TANK PUMPS
PIPE TUNNEL
AUX. BUILDING SUMP (BELOW)
B.A. EVAP. FEED PUMPS & CVCS HOLD-UP TK. RECIRC. PUMPS BELOW
3" HIGH CURB (TYP.)
PASSENGER ELEVATOR
LOW LEVEL SUMP TANK
SUMP TANK PUMPS
HIGH LEVEL SUMP TANK
PRIMARY WATER MAKE-UP PUMPS
REACTOR COOLANT DRAIN TANK PUMPS
FREIGHT ELEVATOR
OVERFLOW
HOLD-UP TANK AREA SUMP.
PLATF. EL. 573'-3"
CVCS HOLD-UP TK.(TYP)
PLATF. EL. 579'-8"
FL. EL. 562'-0" (TYP)
SUMP PUMPS
ROADWAY
FENCE
DE-ICING TUNNEL
PLAN OF SCREEN HOUSE FORE BAY & DISCHARGE FLUMES
DISCHARGE PIPE
FOR CONT. SEE PLAN ON DWG 12-5167,G/9
ESSENTIAL SERVICE WTR. PIPING TUNNEL FL. EL. 570'-6"
EL. 576'-0"
STRAINER
LADDER
HIGH DEMAND FIRE PROT PUMP
LOW DEMAND FIRE PROT PUMP
HEATER DRAIN PUMPS
FIRE PROTECTION PEGGING PUMP
AUTOMATIC STRAINER
NON-ESSENTIAL SERVICE WTR. PUMPS
FL. EL. 565'-6"
FANS
MISC. DRAIN TANK & PUMPS
TURBINE ROOM SUMP PUMPS
COND. PIT SUMP
CONDENSER INLETS
CONDENSER OUTLETS
FEED PUMP TURB. CONDENSERS (ABOVE)
TURBINE RM. SUMP EL. 570'-9"
UNITS
EL. 563'-0"
LADDER RUNGS TO MANHOLE ABOVE
CVCS DEMIN. CAUSTIC PUMP
MAKE UP SYSTEM CAUSTIC PUMPS
MAKE UP SYSTEM ACID PUMPS
STRAINERS
SCREEN WASH PUMPS
CHLORINATOR INJECTOR WATER SUPPLY PUMP
MISC SEALING & COOLING WATER PUMPS
LAWN SPRINKLER PUMP
INTAKE TUNNELS EL. 577'-3"
EL. 571'-9"
HOTWELL PUMPS
CONDENSER PIT OUTLINE (ABOVE) EL. 579'-0"
DISCH. TUNNELS
CIRC. WTR. PUMPS
ESSENTIAL SERVICE WATER PUMPS
TRAVELING SCREENS
EL. 546'-0"
EL. 559'-0"
6'-0"x50 SLUICE GATE
10'-0"x12'-0" HIGH SLUICE GATE
16'-0" x 16'-0" HIGH ROLLER GATE
(2) 10'-0" WIDE x 16'-0" HIGH ROLLER GATES
LADDER
ESSENTIAL SERVICE WATER DISCHARGE
STOP LOGS (TYP) (WHEN IN PLACE)
BAR GRILLE (TYP)
PERFORATED WALL
16'-0"x16'-0" HIGH ROLLER GATE.
DE-ICING TUNNEL
BAFFLES SHOWN AS PER ALDEN RESEARCH LAB. SKETCH DATED 10-15-69
PUMP & SCREEN HOUSE
16'-0" INTAKE PIPE
SHORE LINE
16'-0" DIA.
UNIT No 1
UNIT No 2
REVISIONS
GENERAL REVISION
INDIANA & MICHIGAN ELECTRIC CO.
DONALD C. COOK NUCLEAR PLANT
BRIDGMAN MICHIGAN
PLANT ARRANGEMENT PLAN BELOW BASEMENT UNITS 1 & 2
DR. NO. 12-5166-3
AMERICAN ELECTRIC POWER SERVICE CORP. 2 BROADWAY NEW YORK

FIGURE 2.6



1 SPENT RESIN STORAGE TANK
2 SPRAY ADDITIVE TANKS
3 WASTE HOLD-UP TANKS
4 WASTE EVAP. FEED PUMPS
5 WASTE EVAP. CONDENSATE TANKS
6 WASTE EVAP. CONDENSATE PUMPS
7 2GPM WASTE EVAPORATOR
8 WASTE EVAP. FEED FILTERS
9 REFUELING WTR. PURIFICATION PUMP
10 BORIC ACID TANKS
11 BORIC ACID TRANSF. PUMP
12 REACTOR COOLANT FILTER
13 SEAL WATER FILTER
14 SAFETY INJECTION PUMPS
15 PRESSURIZER RELIEF TANK
16 REACTOR COOLANT DRAIN TANK
17 SEAL WATER INJECTION FILTERS
18 RECIRCULATION SUMP
19 EMERGENCY DIESEL GENERATOR
20 STARTING AIR COMPRESSOR
21 STARTING AIR RECEIVER
22 LAUNDRY & HOT SHOWER TANKS
23 LAUNDRY PUMP
24 CHEMICAL DRAIN PUMP
25 CHEMICAL DRAIN TANK
26 BORIC ACID EVAPORATOR
27 BORIC ACID FILTERS
28 GAS DECAY TANKS
29 MONITOR TANK PUMPS
30 CENTRIFUGAL CHARGING PUMPS
31 FUEL OIL DAY TANK
32 JACKET WATER CIRC. PUMPS
33 CONTROL PANEL
34 EQUIPMENT HATCH
35 ENGINE DRIVEN FIRE PUMP & STRAINER
36 ESSENTIAL SERVICE WATER PUMPS & STRAINERS
37 PLANT HTG. BLR. BURIED FUEL OIL STORAGE TANKS
38 FIREWALL
39 FEED PUMP STRAINERS
40 TANK AREA PIPE TUNNEL
41 CONDENSATE PUMPS (PLANT HEATING BOILER)
42 CONDENSATE RECEIVER
43 FUELOIL PUMPS
44 PLANT HEATING BOILER
45 H2 SEAL OIL UNIT
46 STATOR COOLING UNIT
47 TURBINE AUX. COOLING PUMPS
48 TURBINE AUX. COOLER
49 CONDENSATE BOOSTER PUMP
50 DRAIN COOLERS
51 HOTWELL PUMPS
52 Nº 4 L.P. HEATERS
53 Nº 5 L.P. HEATER
54 BORIC ACID EVAP FEED ION EXCH. FILTER
55 REFUELING WATER FILTER
56 STEAM PACKING EXHAUSTER
57 LOWER CONTAINMENT SUMP
58 EHC POWER UNIT
59 MOTOR DRIVEN AUX. FEED PUMP
60 TURB. DRIVEN AUX. FEED PUMP
61 FEEDPUMP TURBINE CONDENSER
62 RETENTION TANK
63 FILTER SUPPLY PUMPS
64 MAKEUP WATER FILTERS
65 CHEMICAL CLEANING TANK
66 CHEMICAL CLEANING PUMP
67 CONTAINMENT PIPE TUNNEL SUMP
68 MAKE-UP WATER SUB-PANEL
69 MAKE-UP WATER MIXED BED DEMINS.
70 MAKE-UP WATER ANION EXCHANGERS.
71 VACUUM DEGASSIFIER
72 DEGAS WATER PUMPS
73 MAKE-UP WATER CATION EXCHANGERS.
74 CONCENTRATES FILTERS
75 PASSENGER ELEVATOR
76 RECIPROCATING CHARGING PUMP
77 VALVE PIT
78 REGENERATION CABINET (MAKEUP WATER SYS)
79 HOT WATER TANK (CAUSTIC HEATING) (MAKE UP WATER SYS)
80 ELECT. PENETRATION AREA
81 PIPING PENETRATION AREA (VESTIBULE)
82 PASSENGER ELEVATOR
83 FREIGHT ELEVATOR
84 START-UP STEAM GEN. BLOWDOWN TANK
85 BLOWDOWN DEMIN PUMP
86 LUBE OIL COOLER & JACKET WATER HEAT EXCH'GR.
87 PIPE CHASE
88 AIR-PARTICLE RADIO GAS DETECTOR.
89 AHR VALVES
90 EYEWASH & SHOWER
91 15GPM WASTE EVAPORATOR
NOTE "A" AT "B/8 & N/8"
BEFORE DOORS ARE INSTALLED, OPENING 14'-0" W, 12'-0" H. TO BE LEFT IN THIS WALL TO PERMIT INSTALLATION OF STATOR COOLING UNIT.
NOTE "B" E/5 & J/5
15'-0" x 15'-0" OPENING TO REMAIN OPEN FOR CONSTRUCTION ACCESS.
NOTE "C"
10'-0" x 10'-0" OPENING TO REMAIN OPEN UNTIL EMERGENCY DIESEL GENERATORS AND STARTING AIR TANKS ARE INSTALLED.
KEY PLAN
REACTOR CONTAINMENT UNIT Nº 1
REACTOR CONTAINMENT UNIT Nº 2
TURBINE UNIT Nº 1
TURBINE UNIT Nº 2
SERVICE BLDG. EL. 595'-0"
DIESEL OIL PUMP & VALVE STATION ROOM
MOTOR CONTROL CENTERS TRANSFORMERS
MOTOR CONTROL CENTER SWITCHGEAR 600V.
PRESSURIZER HEATERS TRANSFORMERS
DIESEL OIL TRANSFER PUMPS
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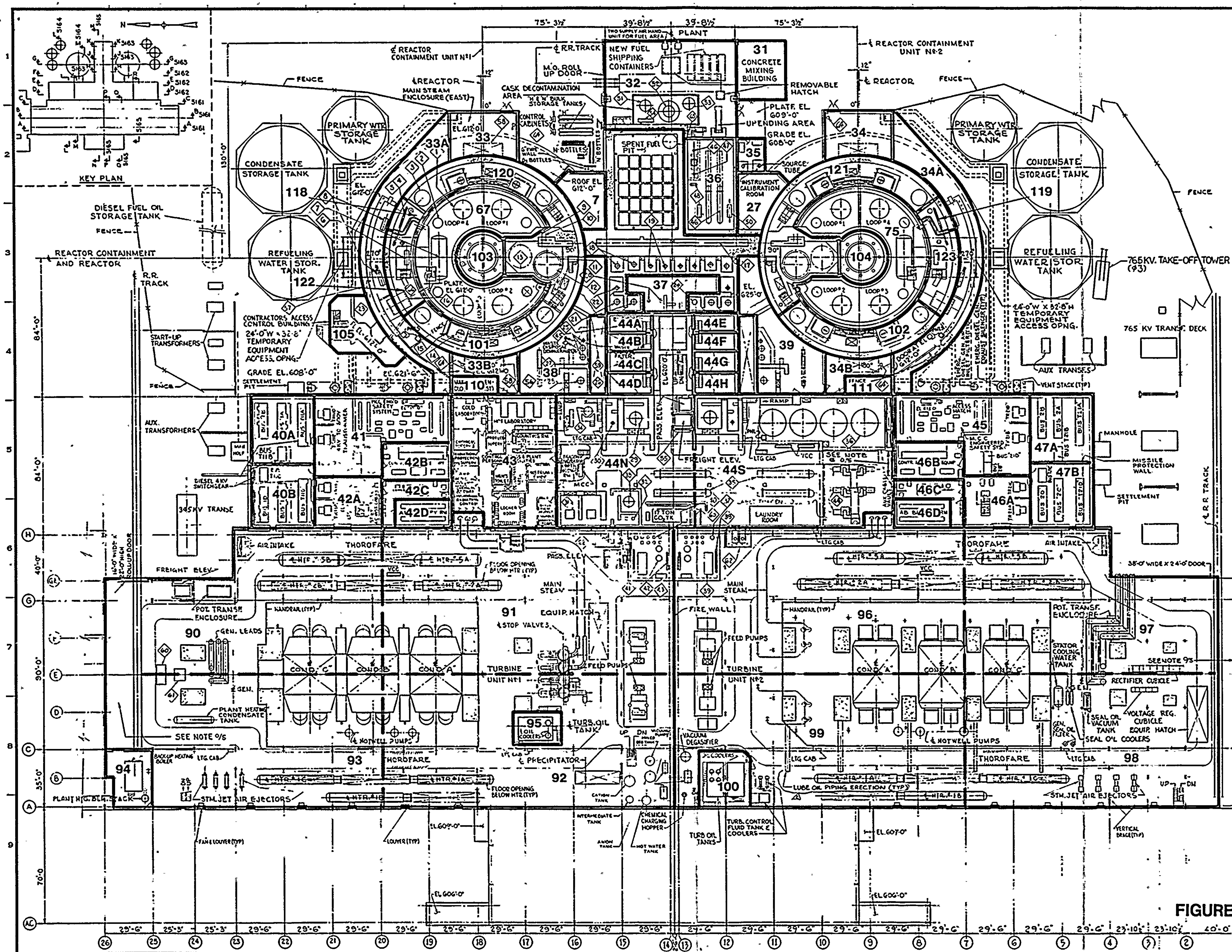
INDIANA & MICHIGAN ELECTRIC CO.
DONALD C. COOK NUCLEAR PLANT
BRIDGMAN MICHIGAN
PLANT ARRANGEMENT BASEMENT PLAN EL. 591'-0" & 587'-0" UNITS 1 & 2
DR. NO. 12-5167-4
J. E. Dolan
AMERICAN ELECTRIC POWER SERVICE CORP.
2 BROADWAY NEW YORK

FIGURE 2.7



ITEM NO.	DESCRIPTION
1.	STEAM GENERATOR
2	REACTOR COOLANT PUMP
3.	ACCUMULATOR
4.	REGENERATIVE HEAT EXCHANGER
5.	EXCESS LET-DOWN HEAT EXCHANGER
6	SEAL TABLE
7	PRESSURIZER RELIEF TANK
8.	INSTRUMENTATION ROOM PURGE SYS.
9.	℄ REFUELING EQUIPMENT
10.	℄ RCC CHANGE FIXTURE
11	VESSEL FLG. PROTECTION RING IT FLOOD STGE
12	REACTOR UPPER INTERNALS STORAGE
13	REACTOR LOWER INTERNALS STORAGE
14	VENTILATING UNIT
15	BLOWER
16	PERSONNEL LOCK
17	℄ FUEL TRANSFER SYSTEM
18	CVCS MIXED BED DEMINERALIZER
19	B.A. EVAPORATOR FEED ION EXCHANGER
20	B.A. EVAPORATOR CONDENSATE DEMIN.
21	DEBORATING DEMINERALIZER
22	CVCS CATION BED DEMINERALIZER
23	DRY CLEANER MACHINE ROOM
24	SPENT FUEL PIT DEMINERALIZER
25	CONTAINMENT SPRAY HEAT EXCHANGER
26	RESIDUAL HEAT EXCHANGER
27	BLOWDOWN HEATEXCHANGER
28	BORON INJECTION TANK
29	VOLUME CONTROL TANK
30	SEAL WATER HEAT EXCHANGER
31	WASTE GAS COMPRESSORS
32	CONCENTRATE HOLDING TK. TRANSFER PUMPS
33	CONCENTRATE HOLDING TANK
34	BORIC ACID BATCHING TANK
35	COMPONENT COOLING HEAT EXCHANGER
36	MONITOR TANKS
37	PLANT AIR RECEIVER
38	PLANT AIR AFTERCOOLER
39	PLANT AIR COMPRESSOR
40	CONTROL AIR DEHUMIDIFIER
41	CONTROL AIR RECEIVERS
42	CONTROL AIR AFTERCOOLER
43	CONTROL AIR COMPRESSOR
44	COMPONENT COOLING PUMPS
45	BLOWDOWN PURIFICATION DEMIN.
46	SPENT FUEL PIT FILTER
47	SPENT FUEL PIT SKIMMER FILTER
48	SPENT FUEL PIT SKIMMER PUMP
49	SPENT FUEL PIT HEAT EXCHANGERS
50	SPENT FUEL PIT PUMPS
51	HEAD LIFTING DEVICE STG. AREA
52	CASK
53	CASK HEAD
54	CASK LIFTING DEVICE STG AREA
55	ELEC. PILASTERS
56	VESTIBULE EL. 612'-0"
57	EXTERIOR PIPEWAY
58	NON-ESSENTIAL SERVICE WATER CONTROL & ISOLATION VALVE AREA
59	PIPE CHASE
60	ALTEREX CABINET
61	RECTIFIER CUBICLE
62	ESS SERV WTR. PIPE CHASE, WITH MISSILE PROTECTION BARRIER
63	EVAP. CONDENSATE FILTER
64	LOCAL SHUTDOWN INDICATING PANELS
65	CASK DROP PROTECTION SYSTEM
66	EQUIPMENT HATCH OPENING 26'×50'

NOTE: 4/5, 8/6
FLOOR ATTACHMENTS FOR LP ROTOR UP-ENDING DEVICE TO BE ADDED IN THE TRACK BAY

NOTE: 7/5
15'-0" × 15'-0" OPNG. TO REMAIN OPEN FOR CONSTRUCTION ACCESS

DATE	NO.	DESCRIPTION	APPD.
4/1/80	4	GENERAL REVISION	
1-6-77	3	GENERAL REVISION	
3-4-71	2	ADDED SPACE REQUIRED FOR ERECTION OF LUBE OIL PIPING	
4-23-71	1	GENERAL REVISION	

REVISIONS

INDIANA & MICHIGAN ELECTRIC CO.
DONALD C. COOK NUCLEAR PLANT
BRIDGMAN MICHIGAN

PLANT ARRANGEMENT MEZZANINE FLOOR EL. 609'-0" UNITS 1 & 2

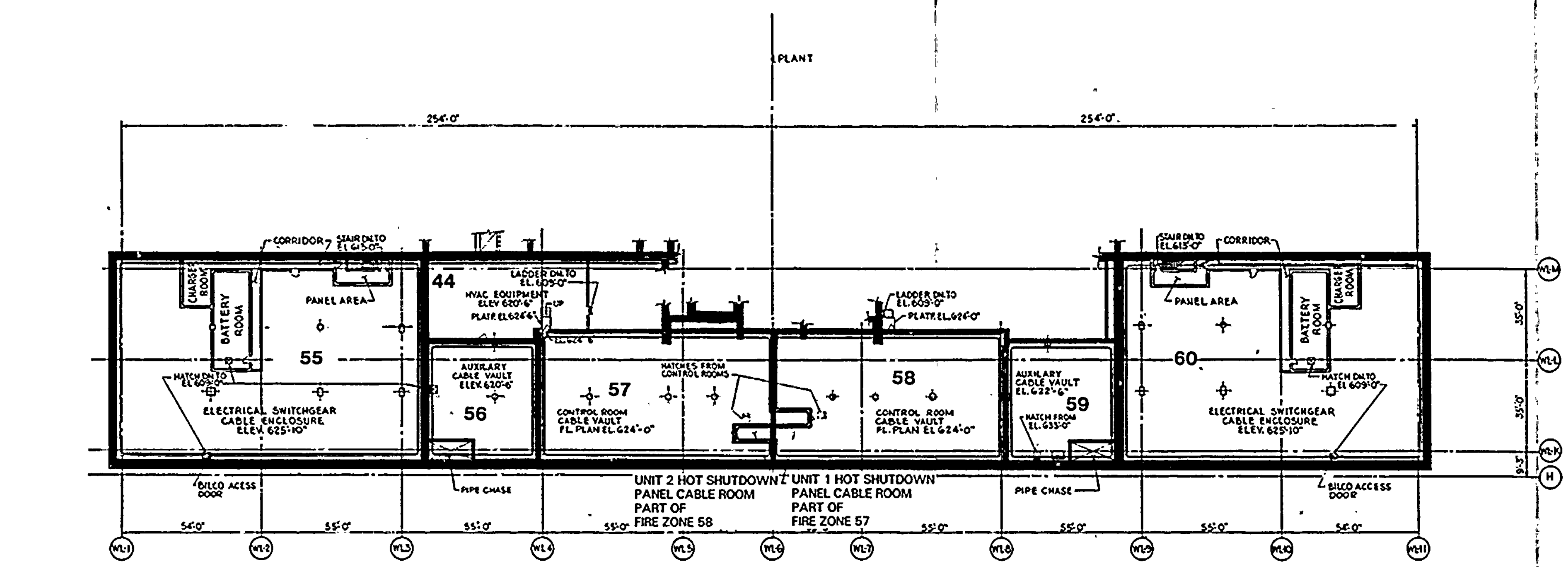
DR. NO. 12-5168-4

SCALE 1"=20'-0"
DATE 1-29-70
J. E. Dolan

AMERICAN ELECTRIC POWER SERVICE CORP.
2 BROADWAY NEW YORK

FIGURE 2.8

DR. No. 12-5168A



PLAN ELEV 620'-6 TO 625'-10"

DATE	NO.	DESCRIPTION	APPD.
9/82	1	RE-ISSUED	

REVISIONS

INDIANA & MICHIGAN ELECTRIC CO.
DONALD C. COOK NUCLEAR PLANT
BRIDGMAN MICHIGAN

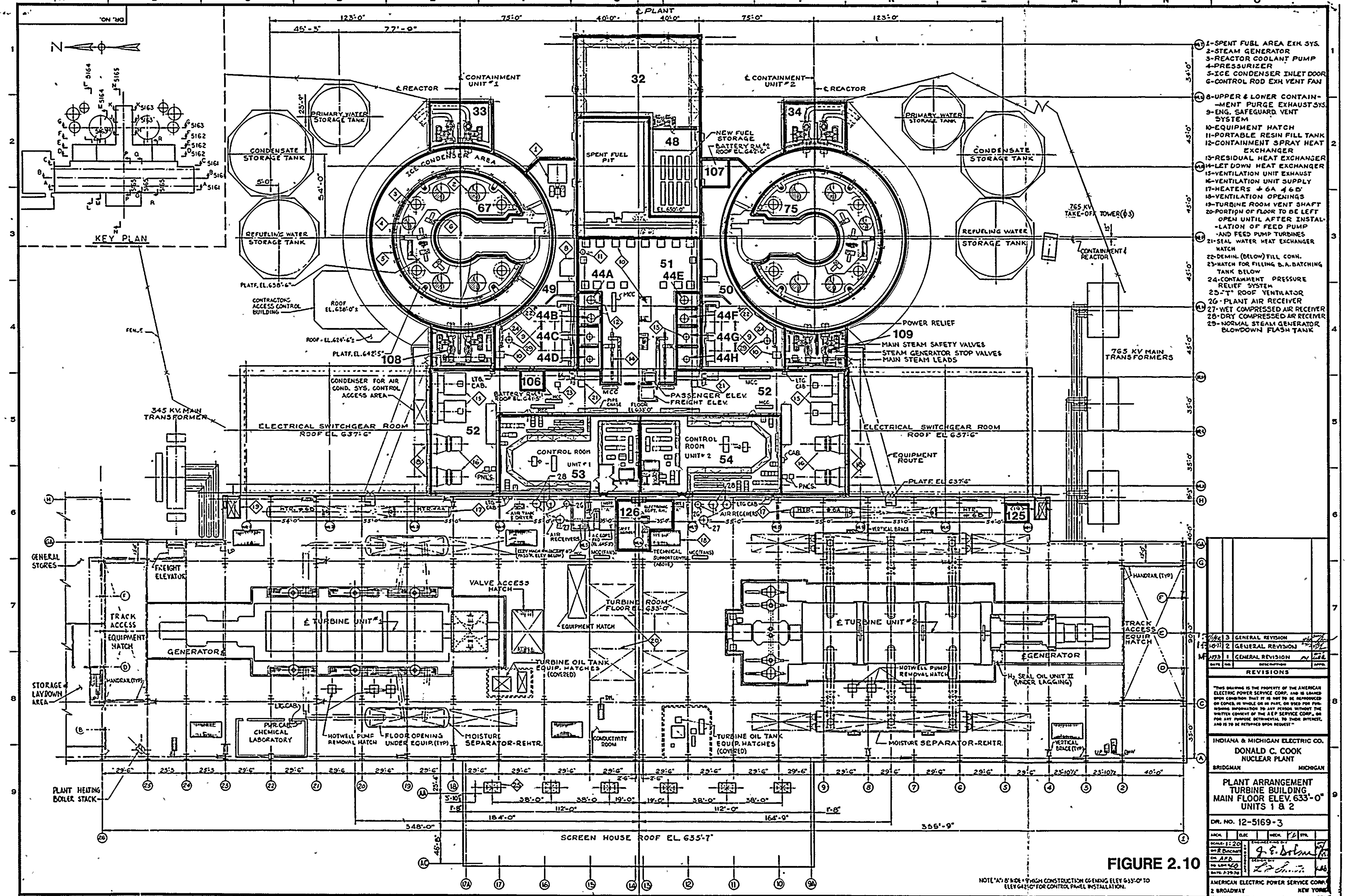
PARTIAL PLANT ARR'G'T FROM EL. 620'-6" TO 625'-10" UNIT 1 & 2

DR. NO. 12-5168 A-1

SCALE: 1:20
DATE: 2-28-77

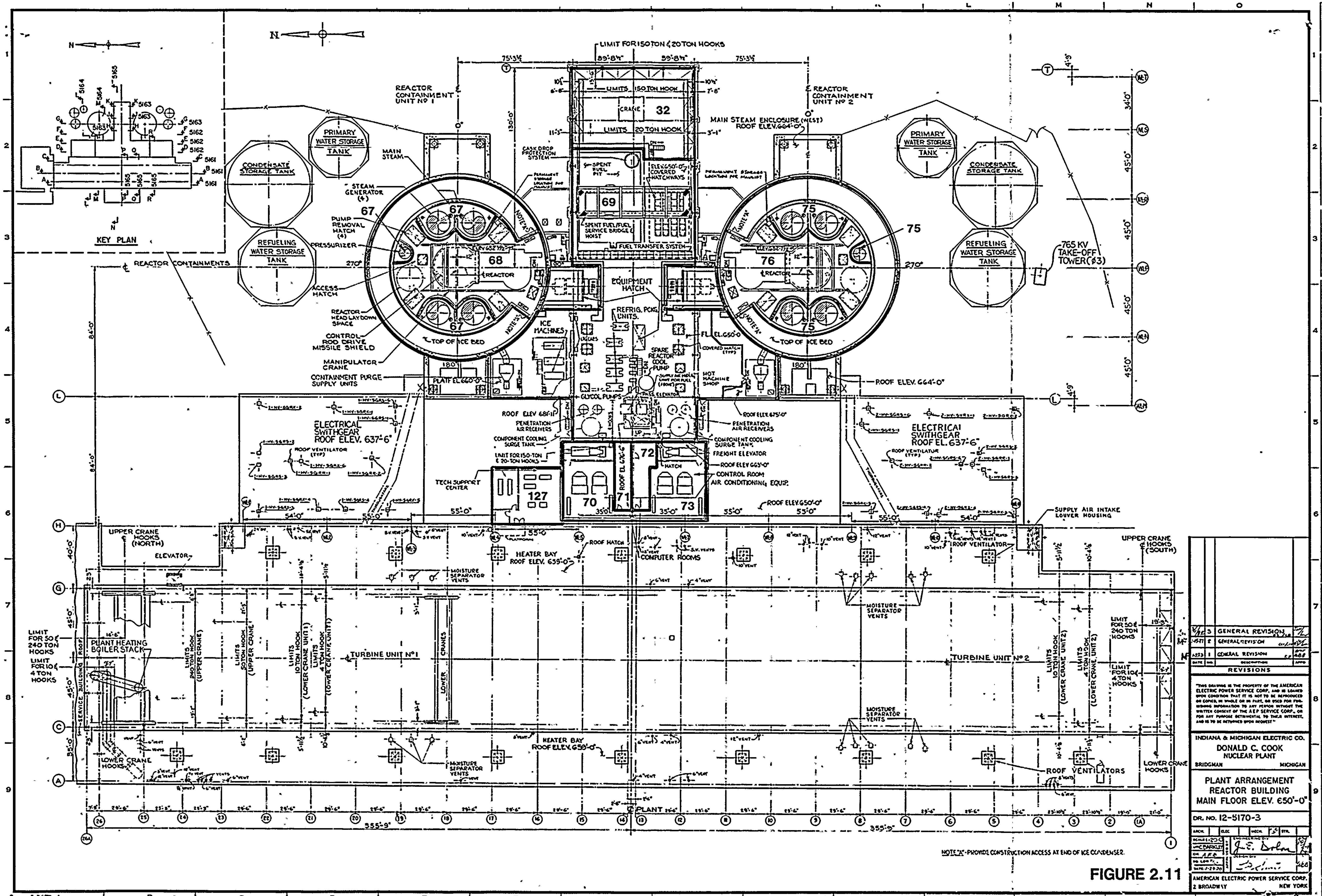
AMERICAN ELECTRIC POWER SERVICE CORP.

FIGURE 2.9



1-SPENT FUEL AREA EXH. SYS.
2-STEAM GENERATOR
3-REACTOR COOLANT PUMP
4-PRESSURIZER
5-ICE CONDENSER INLET DOOR
6-CONTROL ROD EXH. VENT FAN
8-UPPER & LOWER CONTAINMENT PURGE EXHAUST SYS.
9-ENG. SAFEGUARD VENT SYSTEM
10-EQUIPMENT HATCH
11-PORTABLE RESIN FILL TANK
12-CONTAINMENT SPRAY HEAT EXCHANGER
13-RESIDUAL HEAT EXCHANGER
14-LET DOWN HEAT EXCHANGER
15-VENTILATION UNIT EXHAUST
16-VENTILATION UNIT SUPPLY
17-HEATERS 6 & 6A 6B
18-VENTILATION OPENINGS
19-TURBINE ROOM VENT SHAFT
20-PORTION OF FLOOR TO BE LEFT OPEN UNTIL AFTER INSTALLATION OF FEED PUMP AND FEED PUMP TURBINES
21-SEAL WATER HEAT EXCHANGER HATCH
22-DEMIN. (BELOW) FILL CONN.
23-HATCH FOR FILLING B.A. BATCHING TANK BELOW
24-CONTAINMENT PRESSURE RELIEF SYSTEM
25-"T" ROOF VENTILATOR
26-PLANT AIR RECEIVER
27-WET COMPRESSED AIR RECEIVER
28-DRY COMPRESSED AIR RECEIVER
29-NORMAL STEAM GENERATOR BLOWDOWN FLASH TANK
KEY PLAN
℄ PLANT
℄ CONTAINMENT UNIT #1
℄ CONTAINMENT UNIT #2
℄ REACTOR
PRIMARY WATER STORAGE TANK
CONDENSATE STORAGE TANK
REFUELING WATER STORAGE TANK
ICE CONDENSER AREA
SPENT FUEL PIT
NEW FUEL STORAGE
BATTERY RM. #2 ROOF EL. 642'-6"
CONTRACTOR'S ACCESS CONTROL BUILDING
ROOF EL. 638'-0"±
ROOF - EL. 624'-6"±
PLATF. EL. 638'-6"
PLATF. EL. 642'-5"
POWER RELIEF
MAIN STEAM SAFETY VALVES
STEAM GENERATOR STOP VALVES
MAIN STEAM LEADS
765 KV TAKE-OFF TOWER (ϕ3)
CONTAINMENT ℄ REACTOR
765 KV MAIN TRANSFORMERS
345 KV. MAIN TRANSFORMER
CONDENSER FOR AIR COND. SYS. CONTROL ACCESS AREA
ELECTRICAL SWITCHGEAR ROOM ROOF EL. 637'-6"
CONTROL ROOM UNIT #1
CONTROL ROOM UNIT #2
PASSENGER ELEV.
FREIGHT ELEV.
EQUIPMENT ROUTE
PLATF. EL. 637'-6"
AIR RECEIVERS
TECHNICAL SUPPORT CENTER (ABOVE)
GENERAL STORES
FREIGHT ELEVATOR
TRACK ACCESS
EQUIPMENT HATCH
GENERATOR ℄
VALVE ACCESS HATCH
℄ TURBINE UNIT #1
℄ TURBINE UNIT #2
TURBINE ROOM FLOOR EL. 633'-0"
EQUIPMENT HATCH
TURBINE OIL TANK EQUIP. HATCHES (COVERED)
HOTWELL PUMP REMOVAL HATCH
H2 SEAL OIL UNIT II (UNDER LAGGING)
℄ GENERATOR
STORAGE & LAYDOWN AREA
CHEMICAL LABORATORY
FLOOR OPENING UNDER EQUIP. (TYP)
MOISTURE SEPARATOR-REHTR.
CONDUCTIVITY ROOM
HANDRAIL (TYP)
VERTICAL BRACE (TYP)
PLANT HEATING BOILER STACK
SCREEN HOUSE ROOF EL. 635'-7"
NOTE "A": 8' WIDE x 9' HIGH CONSTRUCTION OPENING ELEV 633'-0" TO ELEV 642'-0" FOR CONTROL PANEL INSTALLATION.
REVISIONS
3 GENERAL REVISION
2 GENERAL REVISION
1 GENERAL REVISION
INDIANA & MICHIGAN ELECTRIC CO.
DONALD C. COOK NUCLEAR PLANT
BRIDGMAN MICHIGAN
PLANT ARRANGEMENT TURBINE BUILDING MAIN FLOOR ELEV. 633'-0" UNITS 1 & 2
DR. NO. 12-5169-3
AMERICAN ELECTRIC POWER SERVICE CORP. 2 BROADWAY NEW YORK

FIGURE 2.10



KEY PLAN
LIMIT FOR 150 TON & 20 TON HOOKS
LIMITS 150 TON HOOK
LIMITS 20 TON HOOK
CRANE
32
REACTOR CONTAINMENT UNIT Nº 1
REACTOR CONTAINMENT UNIT Nº 2
MAIN STEAM ENCLOSURE (WEST) ROOF ELEV. 664'-0"
PRIMARY WATER STORAGE TANK
CONDENSATE STORAGE TANK
REFUELING WATER STORAGE TANK
MAIN STEAM
STEAM GENERATOR (4)
PUMP REMOVAL HATCH (4)
PRESSURIZER
ACCESS HATCH
REACTOR HEAD LAYDOWN SPACE
CONTROL ROD DRIVE MISSILE SHIELD
MANIPULATOR CRANE
CONTAINMENT PURGE SUPPLY UNITS
TOP OF ICE BED
CASK DROP PROTECTION SYSTEM
SPENT FUEL PIT
ELEV. 650'-0" COVERED HATCHWAYS
SPENT FUEL/FUEL SERVICE BRIDGE & HOIST
FUEL TRANSFER SYSTEM
67
68
69
75
76
REACTOR CONTAINMENTS
REACTOR
EQUIPMENT HATCH
ICE MACHINES
REFRIG. PCKG. UNITS
SPARE REACTOR COOL PUMP
HOT MACHINE SHOP
GLYCOL PUMPS
PASS. ELEVATOR
765 KV TAKE-OFF TOWER (Ø3)
ROOF ELEV. 664'-0"
PLATF. EL. 660'-0"
ROOF ELEV. 681'-11"
ROOF ELEV. 675'-0"
PENETRATION AIR RECEIVERS
COMPONENT COOLING SURGE TANK
LIMIT FOR 150-TON & 20-TON HOOKS
FREIGHT ELEVATOR
ROOF ELEV. 663'-0"
CONTROL ROOM AIR CONDITIONING EQUIP.
ROOF ELEV. 650'-0"
ELECTRICAL SWITHGEAR ROOF ELEV. 637'-6"
ELECTRICAL SWITHGEAR ROOF EL. 637'-6"
ROOF VENTILATOR (TYP)
TECH SUPPORT CENTER
127
70
71
72
73
SUPPLY AIR INTAKE LOUVER HOUSING
UPPER CRANE HOOKS (NORTH)
UPPER CRANE HOOKS (SOUTH)
ELEVATOR
HEATER BAY ROOF ELEV. 659'-0"
ROOF HATCH
COMPUTER ROOMS
MOISTURE SEPARATOR VENTS
ROOF VENTILATOR
LIMIT FOR 50 & 240 TON HOOKS
LIMIT FOR 10 & 4 TON HOOKS
PLANT HEATING BOILER STACK
SERVICE BUILDING ROOF
TURBINE UNIT Nº 1
TURBINE UNIT Nº 2
LOWER CRANES
HEATER BAY ROOF ELEV. 658'-0"
LOWER CRANE HOOKS
ROOF VENTILATORS
PLANT
355'-9"
NOTE "A" - PROVIDE CONSTRUCTION ACCESS AT END OF ICE CONDENSER.
REVISIONS
3 GENERAL REVISION
2 GENERAL REVISION
1 GENERAL REVISION
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INDIANA & MICHIGAN ELECTRIC CO.
DONALD C. COOK NUCLEAR PLANT
BRIDGMAN MICHIGAN
PLANT ARRANGEMENT REACTOR BUILDING MAIN FLOOR ELEV. 650'-0"
DR. NO. 12-5170-3
AMERICAN ELECTRIC POWER SERVICE CORP.
2 BROADWAY NEW YORK

FIGURE 2.11

3. DETECTION AND SUPPRESSION SYSTEMS

Section 3 provides detailed information on the detection and suppression systems presently installed at the D.C. Cook Nuclear Plant. 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 which assure 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.

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 System Descriptions

Three modes of fire detection are provided at the D.C. Cook Nuclear Plant. They are ionization smoke detection, thermistor heat detection, and infared flame detection. In addition, there are spot locations protected by heat detectors which are electrically connected to ionization smoke detection systems in specific fire areas.

The ionization smoke detection systems are the primary form of fire detection in the plant. Infrared flame detectors are used in conjunction with the smoke detection systems in some fire zones that are protected by a gaseous suppression system. In these fire zones, activation of the smoke detection system and the flame detection system are required before actuation of the suppression system.

Thermistor detection systems are provided in a number of fire zones in the plant. Single zones of detection are provided for alarm purposes in the turbine, lube oil rooms, turbine oil tank rooms and for the in-containment cable trays. Two zones of thermistor detection are provided for alarm and automatic activation of suppression systems for the diesel generator rooms of both units. Thermistor detection and actuation of supression systems also exist for the charcoal filter units, reactor coolant pumps, turbine water spray systems, and diesel fuel pump rooms.

The charcoal filter units' and diesel fuel pump rooms' Carbon Dioxide suppression systems are automatically actuated by one zone of thermistor detection. 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.

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, which are sealed open, are closed 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 Halon systems protecting the Cable Spreading Rooms are also supervised.

3.2.2 System Descriptions

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.

3.2.2.1 Water Suppression Systems

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

- o Automatic wet pipe sprinkler systems
- o Preaction sprinkler systems
- o Water spray suppression systems
- o 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 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 electric motor-driven pump in the other unit will start through the logic system. If more capacity is still needed, as sensed by header pressure, the diesel-driven fire pump in the unit requiring water suppression will start. If still more capacity is needed to maintain header pressure, the remaining diesel motor-driven pump will start, followed by the electric motor-driven low demand fire pump if adequate header pressure is still not maintained.

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 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, and low oil pressure alarmed in the respective Control Room.

The wet pipe, pre-action and water spray sprinkler systems are the primary forms of automatically applying water on a fire. A pre-action sprinkler system differs from a wet pipe system only in that heat detection is required before water will enter the pipe network in the area. The sprinkler heads are closed, as with the wet pipe systems, and require heat to open each individual head. In addition, specific areas and/or equipment are protected by automatic and/or manual fixed-water spray systems. Each automatic pre-action 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 spaced approximately 75 feet apart in plant areas outside containment (such as the Turbine and Auxiliary Buildings). Additional hose stations are located at access areas to the Control Room cable vaults, the auxiliary cable vault and the containment cable tunnels, with hose stations also located within the tunnels.

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, cable and conduit openings) 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 are 10, 24, 40A, 40B, and 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. For the system to function automatically, where so equipped, both zones of detection (either ionization smoke detection and infrared flame detection, or two zones of thermistor heat detection) must sense a fire condition. Should a loss of power prevent the system from automatically discharging, the 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 area valves, providing access into each protected area for the suppressant. It is then possible for personnel to go to the specific pilot valve cabinet controlling the operation of these valves and manually open them.

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 Cable Spreading Rooms (Fire Areas 57 and 58) and the security guard house. Each system has its own set of Halon 1301 cylinders; there is no main supply tank as is associated with the Carbon Dioxide system. Penetration seals have been provided to ensure that the required concentration of the agent is maintained. Although the concentrations of Halon required for extinguishment do 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. Each system can be manually actuated from the appropriate control cabinet or cylinder bank.

3.2.2.4 <u>Partial Zone or Area Coverage</u>

The installation of the suppression systems in all D.C. Cook fire areas containing redundant safe shutdown equipment provides adequate coverage for the combustibles which may exist in those areas. Certain areas or zones are identified in Table 2.2 as containing partial coverage. The criteria developed to determine the acceptability of partial coverage for these selected zones and areas is as follows:

- For fire zone areas identified as high or extremely high radiation areas, with radioactive processing equipment and storage tanks, with low combustible loads, controlled and locked personnel access, and shield walls separating the equipment from the remainder of the fire area, fire suppression may not have been provided. The substantial ALARA considerations associated with the installation of systems in these areas combined with the extremely low probability of fires occuring in these regions formed the criteria which justified the exclusion of automatic suppression systems from these rooms.

- For fire zone areas separated from the major zone by fire-rated wall construction, which contain process piping and heat exchangers, essentially zero combustible loadings, control and locked personnel access and are classified as high radioactive areas, no automatic suppression systems were installed. 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 exclusion of automatic suppression systems from these rooms.
- For fire zones 49 and 50 which are separated from the remaining area zones by walls, floors and ceilings of rated construction adequate isolation and containment of potential zone fires are provided by the existing barrier construction. Zone detection and detection and suppression for the principal combustible source in the zone (charcoal filters), presently exist. Redundant

trains of safety-related equipment and cable are not contained within the zone. The safety-related cables located within the zone also exist for other portions of the fire area. Therefore, the zone boundary is not required to function as a III.G.2 barrier. These considerations formed the criteria which determined the acceptability of excluding automatic suppression from these zones.

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

4.1 Introduction

Paragraph 50.48(b) 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 given plant areas will be given that involve either in-situ combustibles 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 with respect to the availability of off-site power will be assumed. No concurrent or sequential design basis accidents or transients which would not occur as a direct result of these assumptions are assumed to exist. In addition, no random single failures other than those which occur as a direct result of other assumptions are assumed to occur.

4.2 Safety Functions

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

(1) Reactor 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 Makeup 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;

(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 systems 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) CEB 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 Reactor Heat Removal System is operable and these functions 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 CEB 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 single failure (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 purposes 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 between 547°F and 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 de-energize 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.

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.

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 shutdown 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 saturation margin within the Reactor Coolant System is essential to successful achievement and maintenance of safe shutdown. For the assumed scenario, maintenance of this subcooling margin is achieved by manual control of one bank of pressurizer heaters based on pressure and temperature information received from the RCS pressure and temperature instrumentation. After reactor trip and assuming stable hot standby conditions, pressurizer heater operability is not necessary for the first 4 to 6 hours.

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 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). Feedwater sources are available from the condensate storage tanks, and alternatively, from the Essential Service Water System (ESW). Feedwater may be supplied to the steam generators by the auxiliary motor-driven feed pumps or by the auxiliary steam turbine-driven feed pump.

Transition from stable hot standby condition to hot shutdown is achieved by the additional heat removal capability available when steam generator pressure is reduced. The 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.

As described above, the transition from stable hot standby to hot shutdown is achieved via operation of the Auxiliary Feedwater System and the power-operated relief valves. After reduction of reactor coolant system temperature below 350°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.

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 (and/or BIT injection path). 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 the RCS average temperature at hot full power to a cold shutdown value, 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 manual control of the pressurizer heaters, will maintain RCS pressure to assure that appropriate saturation margin is achieved for the RCS temperature which exists during this period. 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. Controlled manipulation of secondary system pressure will be monitored by steam generator pressure.

The transition from hot standby to hot shutdown 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:

- Emergency Power System
- Essential Service Water System
- Component Cooling Water System

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: Reactivity Control by control of soluble chemical neutron absorber (boron) concentration in the RCS, Rector Coolant Makeup Control by maintaining water inventory in the RCS, and maintenance of Reactor Coolant Pump Seal Integrity.

Normal reactivity shutdown capability is provided by control rods, with boric acid injection used to compensate for the xenon transients and for plant cooldown. The control and shutdown rod groups make the reactor at least 1% subcritical (k_{eff} = 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 stuck-rod condition need be assumed.

When the unit is at power, the quantity of boric acid retained in its Refueling Water Storage Tank and ready for injection to the RCS always exceeds that quantity required for normal cold shutdown. This quantity also exceeds the quantity of boric acid required to bring the reactor to hot shutdown and to compensate for subsequent xenon decay.

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 redundancy for reactor coolant makeup and boration:

(1) The charging line to the reactor coolant pumps' seals, and

(2) Injection via the Boron Injection Tank.

For the assumed event, charging and boration will be accomplished by operating a minimum of <u>one</u> centrifugal charging pump taking suction from the Refueling Water Storage Tank and injecting borated water through the Boron Injection Tank and/or the RCP seal injection lines to the RCS. 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 can 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 may 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, and the 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 without control rods 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 (165°F) which is in excess of the solubility limit (approximately 133°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.

Refueling Water Storage Tank

In addition to its normal duty to supply borated water to the refueling cavity for refueling operations, the RWST provides borated water to the all the 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. At 32oF, the solubility limit of boric acid is 2.2% by weight. Therefore, the concentration of boric acid in the RWST is well below the solubility limit at 32oF.

4.4.2 Reactor Coolant System

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- and 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 tubes on the secondary side of the "U" tube steam generators and adequate level within the pressurizer are requirements for natural circulation. Confirmation of flow while in natural circulation is accomplished through the use of temperature indications. Those indications are T_{cold} (T_c) and Thot (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. 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 the CVCS charging paths. High pressure seal water from the CVCS system is injected into the pumps through the 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 operational 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.

Pressurizers Heaters

Subcooling within the RCS is maintained by controlled operation of the pressurizer heaters and monitoring of RCS pressure and loop hot-leg temperature (T_h). For hot standby or hot shutdown, a minimum heater power of 150 kW will be available from any of the back-up heaters. This value will conservatively cover heat losses from the pressurizer at or below normal operating pressure with no allowance for continuous spray. Under loss of off-site power conditions, this heating capacity can be established within 4 hours.

Pressurizer Safety Valves

Overpressurization protection of the RCS is assured by three pressurizer code safety valves. The three pressurizer safety valves are spring-loaded, self-activated and have a set 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 main steam inventory and control of steam generator pressure are required for both hot standby and subsequent primary and secondary 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 secondary system will be isolated either by operation of the turbine stop valves or by the main steam generator stop valves.

In accordance with supporting FSAR analysis, 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 and hot shutdown) 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 stations (located at the auxiliary feedwater flow control valve stations).

The MS system is also designed to deliver motive steam to the turbine driver of 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 feedpump 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 tie.

Safety Valves

Following penetration 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 maximum 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 or hot shutdown 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 and hot shutdown to support RCS decay heat removal. For hot standby and hot shutdown, 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, both motor-driven pumps of the other unit can be aligned to the fire-affected unit by the opening of two pump manual discharge valves. 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. 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 Feed 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, 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 feed 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 driver for the 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 Feed Pumps

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

The minimum Technical specification volume of water in the condensate storage tank (CST) is the amount required to last 9 hours at hot shutdown conditions. 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 re-alignment 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 and reduce the temperature of the RCS during the cold shutdown phase 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°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 exchangers

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 unit's 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 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 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 unessential. For the present analysis of safe shutdown, no isolation of non-essential loads is assumed to be required. However, in anticipation of a potentially large cooling demand, the operator can isolate the component cooling inlet to the spent fuel pool heat exchangers or shift to the other unit's 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 alternate unit's 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:

(a) Component cooling heat exchangers

(b) 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 and 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 feed 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 which supplies power to essential safe shutdown equipment if the normal or the 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, voltage 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 identical, 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 4 kV 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 non-essential 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.

<u>4160 V Emergency Power System</u>

Each 4160V diesel bus (T11A, T11B, T11C AND T11D) is fed from a 4.16 kV 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 4.16 kV circuit breaker in each bus is automatically closed when its diesel generator is at speed and rated voltage and re-energizes the bus. The diesel generators will then supply all equipment which must operate under emergency conditions for the respective safeguard train.

Low Voltage Power Systems

The 600 auxiliary system distributes power for all low voltage station service demands other than the pressurizer heaters. The normal source of power for the 600 V system is the 4160 V system buses via the 4160/600 V 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 pressurizer heaters can be connected to the diesels.

The switchgear is metal-clad with 250V dc air-operated circuit breakers. The 4160/600V transformers are filled with non-flammable 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 a 1500 kVa, 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 1500 kVa 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.. An identical 600V system is provided for Unit 2.

Two 480V buses, 11PHA and 11PHC, are fed from two of the 4.16 kV buses, 1A and 1C respectively, via two 1000 kVa, 4160/480 V transformers. These buses supply power to the pressurizer heater loads. An identical 480V system is provided for Unit 2.

120 V AC Vital Instrument Bus System

The 120V ac Vital Instrument Bus System consists of four separate vital buses per unit which are supplied by four independent 5.0 kVa, single-phase static inverters. Two of the inverters connect to one of the unit batteries, the other two connect 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 circuit buses in either the fire-affected or unaffected unit.

250 V 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, 2-wire ungrounded main bus, and 2-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, 4 kV, 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 de-energized.

The trip and close coils for the 4 kV, 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>250 V 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, 2-wire ungrounded main bus, and 2-pole manually operated fused disconnecting switches.

During normal operation, the 250V dc load is fed from the battery charger, 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 generator from the auxiliary feedwater turbine-driven pump system, and the steam admission valve to the turbine-driven auxiliary feed 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 open. The battery is capable of serving the turbine-driven auxiliary feed 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 diagrams (hereafter referred to as P&IDs), system descriptions, and one-line diagrams 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, shorts or ground in control or power cabling.

(3) Power-operated components which 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 opens, shorts or grounds in control or power cabling.

(4) Major mechanical components which 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. 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 computerized data base 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 more than the minimum amount of equipment necessary to safely shutdown 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 as safe shutdown components.

The final safe shutdown component list developed for D.C. Cook Units 1 and 2 includes the 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 data base 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 all 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 only annunciator, computer, motor stator heaters and external monitoring circuits that are electrically isolated from 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 which contained the following information:

- o safe shutdown component data sheet;
- o mark-up of cable block diagrams with identified essential cables; and,
- o data base 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). Table 4.3 is a example.

4.7 Associated Circuits of Concern

4.7.1 Introduction

The separation and 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 mal-operation 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 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 (ACC-CE Type 1), or

   (b) will allow propagation of the fire into the common enclosure (ACC-CE-2).

4.7.2 Identification of Associated Circuits by Common Power Supply and Common Enclosures

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 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 to this level, 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" 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 non-propagating 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 (ACC-SO-1).

(2) Maloperation of equipment which is not defined as part of the safe shutdown systems, but which 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 (ACC-SO-2).

For ACC-SO-1, 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 ACC-SO-2, a systems engineering review was performed on plant systems 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 ACC-SO list.

The above exercise results in a list of potential spurious operation candidates (ACC-SO-1) and (ACC-SO-2) 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 caused 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 (i.e., 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 (i.e., opening of breakers to remove spurious operation, actuation of a master switch, etc.).

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

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 data base concurrently with the fire zone location of every cable trough in the plant. Individual cable routings were outputted with the location of all troughs identified the fire zones that were applicable for each particular cable. The routing of all conduits was also identified by fire zone and the data base updated. The complete route of each SSS cable and all the fire zones each cable is in were thereby identified. Table 4.3 is an example of the type of printout developed.

This data base 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. Table 4-5 is a example of this type of printout.

An additional data base 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 raceways 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/Non-Conformance with Appendix R, Section III.G

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

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

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

(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.

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TABLE 4.1

SAFE SHUTDOWN COMPONENTS ********* CHEMICAL AND VOLUME CONTROL SYSTEM

COMPONENT	DESCRIPTION	FIREZONE	POWER SUPPLIES	
TK-33	REFUELING WATER STORAGE TANK	116		
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	
QMO-225	PP-50E MINIMUM FLOW MOV	62C	ABV-D	
QMO-226	PP-50W MINIMUM FLOW MOV	62C	ABV-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	

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TABLE 4.1

SAFE SHUTDOWN COMPONENTS ********* REACTOR COOLANT SYSTEM

COMPONENT	DESCRIPTION	FIREZONE	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	
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	ELSC
NPS-122	RCS PRESSURE(W.RANGE)	66	CRID-III	ELSC
A1	PRESSURIZER HTR BACK-UP GRP A1	67	PHA-1	PHA-2
A2	PRESSURIZER HTR BACK-UP GRP A2	67	PHA-1	PHA-2
C1	PRESSURIZER HTR BACK-UP GRP C1	67	PHC-1	
C2	PRESSURIZER HTR BACK-UP GRP C2	67	PHC-2	
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	
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		

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TABLE 4.1

SAFE SHUTDOWN COMPONENTS ********* REACTOR COOLANT SYSTEM

COMPONENT	DESCRIPTION	FIREZONE	POWER SUPPLIES
SV-45B	PRESSURIZER SAFETY VALVE	67	
SV-45C	PRESSURIZER SAFETY VALVE	67	

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TABLE 4.1

SAFE SHUTDOWN COMPONENTS ********* MAIN STEAM SYSTEM

COMPONENT	DESCRIPTION	FIREZONE	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
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	

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TABLE 4.1

SAFE SHUTDOWN COMPONENTS ********* MAIN STEAM SYSTEM

COMPONENT	DESCRIPTION	FIREZONE	POWER SUPPLIES
SV-2	SG 1,4 SAFETY VALVES	33	
SV-3	SG 1,4 SAFETY VALVES	33	

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TABLE 4.1

SAFE SHUTDOWN COMPONENTS ********* AUXILIARY FEEDWATER SYSTEM

COMPONENT	DESCRIPTION	FIREZONE	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 SUPPLY 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	
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	33		

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TABLE 4.1

SAFE SHUTDOWN COMPONENTS ********* AUXILIARY FEEDWATER SYSTEM

COMPONENT	DESCRIPTION	FIREZONE	POWER SUPPLIES	
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	SG1 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	

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TABLE 4.1

SAFE SHUTDOWN COMPONENTS ********* REACTOR HEAT REMOVAL SYSTEM

COMPONENT	DESCRIPTION	FIREZONE	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	
SV-102	RHR DISCHARGE SAFETY VALVE	66		
SV-103	RHR SUCTION SAFETY VALVE	66		
IMO-128	RHR INLET ISO MOV	67	EZC-B	

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TABLE 4.1

SAFE SHUTDOWN COMPONENTS ********* COMPONENT COOLING WATER SYSTEM

COMPONENT	DESCRIPTION	FIREZONE	POWER SUPPLIES	
CCM-453	CCW TO RCP THERMAL BARRIER ISO MOV	12	AM-D	
CCM-454	CCW TO RCP THERMAL BARRIER ISO MOV	12	AM-A	
CCM-458	CCW TO RCP THERMAL BARRIER ISO MOV	12	AM-D	
CCM-459	CCW TO RCP THERMAL BARRIER ISO MOV	12	AM-A	
CMO-410	CCW HEAT EXCHANGER OUTLET MOV	44N	AM-D	
CMO-415	CCW COMMON SERVICE HEADER ISO MOV	44N	AM-D	
CMO-416	CCW COMMON 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	44N		
HE-15W	CCW HEAT EXCHANGER	44N		
CMO-411	CCW PUMP COMMON SUCTION HEADER ISO MOV	44S	AM-D	
CMO-413	CCW PUMP COMMON SUCTION HEADER ISO MOV	44S	AM-A	
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	

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SAFE SHUTDOWN COMPONENTS ********* ESSENTIAL SERVICE WATER SYSTEM

COMPONENT	DESCRIPTION	FIREZONE	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 MAKE UP TO PP-4	17E	MAN OPER
ESWSE	ESW PUMP 1E STRAINER	29A	PS-D
PP-7E	ESW PUMP	29A	T11D M[illegible]
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

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TABLE 4.1

SAFE SHUTDOWN COMPONENTS ********* EMERGENCY POWER SYSTEM

COMPONENT	DESCRIPTION	FIREZONE	POWER SUPPLIES	
TK-47	DIESEL FUEL OIL STORAGE TANK CD & AB			
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	
TR11PHA	4KV/480V TRANSFORMER 11PHA	14	T11A VIA 1A	
TR11PHC	4KV/480V TRANSFORMER 11PHC	14	T11D VIA 1C	
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
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

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TABLE 4.1

SAFE SHUTDOWN COMPONENTS ********* EMERGENCY POWER SYSTEM

COMPONENT	DESCRIPTION	FIREZONE	POWER SUPPLIES	
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
11PHA	480 BUS 11PHA	41	TR11PHA	MCAB
11PHC	480V BUS 11PHC	41	TR11PHC	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	
PHA-1	480V MCC 1-PHA1	41	11PHA	
PHA-2	480V MCC 1-PHA2	41	11PHA	
PHC-1	480V MCC 1-PHC-1	41	11PHC	
PHC-2	480V MCC 1-PHC-2	41	11PHC	
TR11B	4KV/600V TRANSFORMER 11B	41	T11B	
TR11D	4KV/600V TRANSFORMER 11D	41	T11D	
11A	600V BUS 11A	42A	TR11A	MCAB
11C	600V BUS 11C	42A	TR11C	MCCD
TR11A	4KV/600V TRANSFORMER 11A	42A	T11A	
TR11C	4KV/600V TRANSFORMER 11C	42A	T11C	

AMERICAN ELECTRIC POWER COMPANY
D.C. COOK - UNIT 1
TABLE 4.1

SAFE SHUTDOWN COMPONENTS ********* EMERGENCY POWER SYSTEM

COMPONENT	DESCRIPTION	FIREZONE	POWER SUPPLIES	
CRID-I	120 VAC INSTR DISTR PNL	42C	EZC-C	MCCD
CRID-II	120 VAC INSTR DISTR PNL	42C	EZC-D	MCCD
CRID-III	120 VAC INSTR DISTR PNL	42C	EZC-A	MCAB
CRID-IV	120 VAC INSTR DISTR PNL	42C	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	
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	
ABV-A	MCC 1-ABV-A	6N	AB-A	
ABV-D	MCC 1-ABV-D	6N	AB-D	

AMERICAN ELECTRIC POWER COMPANY
D.C. COOK - UNIT 2
TABLE 4.2

SAFE SHUTDOWN COMPONENTS ********* CHEMICAL AND VOLUME CONTROL SYSTEM

COMPONENT	DESCRIPTION	FIREZONE	POWER SUPPLIES	
TK-33	REFUELING WATER STORAGE TANK			
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-III	
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
QMO-225	PP-50E MINIMUM FLOW MOV	63C	ABV-D	
QMO-226	PP-50W MINIMUM FLOW MOV	63C	ABV-A	
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	

AMERICAN ELECTRIC POWER COMPANY
D.C. COOK - UNIT 2
TABLE 4.2

SAFE SHUTDOWN COMPONENTS ********* REACTOR COOLANT SYSTEM

COMPONENT	DESCRIPTION	FIREZONE	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	
LSI-3	LOCAL SHUTDOWN STATION	5	ELSC	
NPS-121	RCS PRESSURE(W.RANGE)	74	CRID-II	ELSC
NPS-122	RCS PRESSURE(W.RANGE)	74.	CRID-III	ELSC
NTR-210	LOOP 1 TC TEMPERATURE	75	CRID-II	CRP-2
NTR-220	LOOP 2 TC TEMPERATURE	75	CRID-II	CRP-2
NTR-120	LOOP 2 TH TEMPERATURE	75	CRID-I	CRP-2
NTR-130	LOOP 3 TH TEMPERATURE	75	CRID-II	CRP-2
NTR-230	LOOP 3 TC TEMPERATURE	75	CRID-II	CRP-2
NTR-140	LOOP 4 TH TEMPERATURE	75	CRID-I	CRP-2
NTR-240	LOOP 4 TC TEMPERATURE	75	CRID-II	CRP-2
NTR-110	LOOP 1 TH TEMPERATURE	75	CRID-III	CRP-2
A1	PRESSURIZER HTR BACK-UP GRP A1	75	PHA-1	PHA-2
C1	PRESSURIZER HTR BACK-UP GRP C1	75	PHC-1	
C2	PRESSURIZER HTR BACK-UP GRP C2	75	PHC-2	
A2	PRESSURIZER HTR BACK-UP GRP A2	75	PHA-1	PHA-2
SV-45A	PRESSURIZER SAFETY VALVE	75		

AMERICAN ELECTRIC POWER COMPANY
D.C. COOK - UNIT 2
TABLE 4.2

SAFE SHUTDOWN COMPONENTS ********* REACTOR COOLANT SYSTEM

COMPONENT	DESCRIPTION	FIREZONE	POWER SUPPLIES
SV-45B	PRESSURIZER SAFETY VALVE	75	
SV-45C	PRESSURIZER SAFETY VALVE	75	

AMERICAN ELECTRIC POWER COMPANY
D.C. COOK - UNIT 2
TABLE 4.2

SAFE SHUTDOWN COMPONENTS ********* MAIN STEAM SYSTEM

COMPONENT	DESCRIPTION	FIREZONE	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
SV-1	SG 1,4 SAFETY VALVES	34	
SV-2	SG 1,4 SAFETY VALVES	34	
SV-3	SG 1,4 SAFETY VALVES	34	

AMERICAN ELECTRIC POWER COMPANY
D.C. COOK - UNIT 2
TABLE 4.2

SAFE SHUTDOWN COMPONENTS ********* MAIN STEAM SYSTEM

COMPONENT	DESCRIPTION	FIREZONE	POWER SUPPLIES
MRV-213	SG 1 POWER OPERATED ATMOSPH RELIEF VALVE	34A	CRID-I
MRV-243	SG 4 POWER OPERATED ATMOSPH RELIEF VALVE	34A	CRID-I

AMERICAN ELECTRIC POWER COMPANY
D.C. COOK - UNIT 2
TABLE 4.2

SAFE SHUTDOWN COMPONENTS ********* AUXILIARY FEEDWATER SYSTEM

COMPONENT	DESCRIPTION	FIREZONE	POWER SUPPLIES	
TK-32	CONDENSATE STORAGE TANK			
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	
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	

AMERICAN ELECTRIC POWER COMPANY
D.C. COOK - UNIT 2
TABLE 4.2

SAFE SHUTDOWN COMPONENTS ********* AUXILIARY FEEDWATER SYSTEM

COMPONENT	DESCRIPTION	FIREZONE	POWER SUPPLIES	
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	SG1 WATER LEVEL (N.RANGE)	74	CRID-II	

AMERICAN ELECTRIC POWER COMPANY
D.C. COOK - UNIT 2
TABLE 4.2

SAFE SHUTDOWN COMPONENTS ********* REACTOR HEAT REMOVAL SYSTEM

COMPONENT	DESCRIPTION	FIREZONE	POWER SUPPLIES	
SV-102	RHR DISCHARGE SAFETY VALVE			
SV-103	RHR SUCTION SAFETY VALVE			
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 COMPANY
D.C. COOK - UNIT 2
TABLE 4.2

SAFE SHUTDOWN COMPONENTS ********* COMPONENT COOLING WATER SYSTEM

COMPONENT	DESCRIPTION	FIREZONE	POWER SUPPLIES	
CCM-458	CCW TO RCP THERMAL BARRIER ISO MOV	22	AM-D	
CCM-459	CCW TO RCP THERMAL BARRIER ISO MOV	22	AM-A	
CCM-453	CCW TO RCP THERMAL BARRIER ISO MOV	22	AM-D	
CCM-454	CCW TO RCP THERMAL BARRIER ISO MOV	22	AM-A	
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-413	CCW PUMP SUCTION MOV	44S	AM-A	
CMO-411	CCW PUMP SUCTION MOV	44S	AM-D	
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 COMMON 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	

AMERICAN ELECTRIC POWER COMPANY
D.C. COOK - UNIT 2
TABLE 4.2

SAFE SHUTDOWN COMPONENTS ********* ESSENTIAL SERVICE WATER SYSTEM

COMPONENT	DESCRIPTION	FIREZONE	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 COMPANY
D.C. COOK - UNIT 2
TABLE 4.2

SAFE SHUTDOWN COMPONENTS ********* EMERGENCY POWER SYSTEM

COMPONENT	DESCRIPTION	FIREZONE	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	
TR21PHA	4KV/480V TRANSFORMER TR21PHA	20	T11A VIA 1A	
TR21PHC	4KV/480V TRANSFORMER TR21PHC	20	T11D VIA 1C	
2AB2	DIESEL FUEL OIL TRANSFER PUMP	21	ABD-A	
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	

AMERICAN ELECTRIC POWER COMPANY
D.C. COOK - UNIT 2
TABLE 4.2

SAFE SHUTDOWN COMPONENTS ********* EMERGENCY POWER SYSTEM

COMPONENT	DESCRIPTION	FIREZONE	POWER SUPPLIES	
TR21B	4KV/600V TRANSFORMER 21B	45	T21B	
21B	600V BUS 21B	45	TR21B	MCAB
EZC-B	MCC 2-EZC-B	45	21B	
21PHA	480 BUS 21PHA	45	TR21PHA	MCAB
PHA-1	480V MCC 2-PHA-1	45	21PHA	
PHA-2	480V MCC 2-PHA-2	45	21PHA	
EZC-C	MCC 2-EZC-C	45	21C	
TR21D	4KV/600V TRANSFORMER 21D	45	T21D	
21D	600V BUS 21D	45	TR21D	MCCD
EZC-D	MCC 2-EZC-D	45	21D	
21PHC	480V BUS 21PHC	45	TR21PHC	MCCD
PHC-1	480V MCC 2-PHC-1	45	21PHC	
PHC-2	480V MCC 2-PHC-2	45	21PHC	
BCHAB1	250 VDC BATTERY CHARGER 2-AB1	45	EZC-A	
BCHAB2	250 VDC BATTERY CHARGER 2-AB2	45	EZC-B	
TR21A	4KV/600V TRANSFORMER 21A	46A	T21A	
21A	600V BUS 21A	46A	TR21A	MCAB
TR21C	4KV/600V TRANSFORMER 21C	46A	T21C	
21C	600V BUS 21C	46A	TR21C	MCCD
CRID-I	120 VAC INSTR DISTR PNL	46C	EZC-C	MCCD
CRID-II	120 VAC INSTR DISTR PNL	46C	EZC-D	MCCD
CRID-III	120 VAC INSTR DISTR PNL	46C	EZC-A	MCAB
CRID-IV	120 VAC INSTR DISTR PNL	46C	EZC-B	MCAB

AMERICAN ELECTRIC POWER COMPANY
D.C. COOK - UNIT 2
TABLE 4.2

SAFE SHUTDOWN COMPONENTS ********* EMERGENCY POWER SYSTEM

COMPONENT	DESCRIPTION	FIREZONE	POWER SUPPLIES		
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		
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	60			
AB-A	MCC 2-AB-A	6S	21A		
ABV-A	MCC 2-ABV-A	6S	AB-A		
AB-D	MCC 2-AB-D	6S	21D		
ABV-D	MCC 2-ABV-D	6S	AB-D		
ABN	250 VDC TRN BATTERY DISTR CAB	6S	DCN		

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
QRV-51	CVCS	Spurious opening of the pressurizer auxiliary spray air-operated valve QRV-51 (with CVCS pumps running) will result in uncontrolled 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).

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), assuring 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 D.C. distribution panel DCN. Disconnect switch to be kept open during normal operation (pre-fire) assuring no spurious valve opening. (Air-operated valves fail closed with loss of air or loss of power.)

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
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 or 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).

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
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).
QRV 111 QRV-112 QRV-160 QRV-161 QRV-162	CVCS	Spurious opening of QRV-11 and QRV-112 and either one of the orifice isolation valves will result in uncontrolled letdown.	Procedural isolation of the letdown path by opening circuit breaker at control room panels CCV-AB or CCV-CD or at DC distribution panels MCAB or MCCD will ensure letdown isolation (air-operated valves fail closed with loss of air or loss of power).

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
QRV-113 QRV-114 QRV-170	CVCS	Spurious opening of all valves in series will result in uncontrolled excess letdown.	(see above)
LB459C LB460D	RCS	Spurious operation of low-low pressurizer level switches will trip pressurizer heater's supply breakers at 480 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 de-energization of control group logic cabinets 1 and 2 (control rooms).
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 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.)

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
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 when not in shutdown cooling mode 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 normal operation (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).

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
IMO-330 IMO-331	RHR	Spurious opening of any of the containment spray headers isolation valves when in shutdown cooling 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 alignments 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 the 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 when in shutdown cooling mode (RHR) will divert RCS water to the containment.	Closed local manual valves at the suction of the RHR pumps (RH 104 E and W) before operation of RHR.

TABLE 4-4
EXAMPLE OF COMPUTERIZED SSS CABLE ROUTING OUTPUT

D.C. COOK NUCLEAR POWER PLANT
COMPONENT/FIREZONE ASSOCIATIONS
UNIT NO. 1
AUXILIARY FEEDWATER SYSTEM

COMPONENT: FMO-211 SG 1 SUPPLY MOV (PP-4)
FIREZONE: 33

RACEWAY	FIREZONE

CABLE NO. 9088BR — FROM: VCC 1AB-N / TO: PNL HSDI

RACEWAY	FIREZONE
9088BR	58
9088BR	57
9088BR	44
9088BR	6

CABLE NO. 9089BR — FROM: PNL HSDI / TO: PNL SG

RACEWAY	FIREZONE
9089BR	57
9089BR	58

CABLE NO 9090BR — FROM: VCC 1AB-N / TO: TB FOR VALVE FMO 211

RACEWAY	FIREZONE
9090BR	44
9090BR	38
9090BR	7
9090BR	8
9090BR	33

CABLE NO. 9091BR — FROM: VCC-1AB-N / TO: VALVE FMO 211

RACEWAY	FIREZONE
9091BR	44
9091BR	38
9091BR	7
9091BR	8
9091BR	33

CABLE NO. 9092BR — FROM: TB FOR VALVE FMO 211 / TO: VALVE FMO 211

RACEWAY	FIREZONE
9092BR	33

D.C. COOK NUCLEAR POWER PLANT
COMPONENT/FIREZONE ASSOCIATIONS
UNIT NO. 1
AUXILIARY FEEDWATER SYSTEM

COMPONENT: FMO-211 SG 1 SUPPLY MOV (PP-4)
FIREZONE: 33

RACEWAY	FIREZONE

CABLE NO 9272BR FROM: PNL TRB
TO: PNL GRA

9272BR	57

CABLE NO. 9273BR FROM: PNL TRB
TO: PNL GRB

9273BR	57

CABLE NO. 9280BR FROM: PNL TRB
TO: TB FOR FMO 211

9280BR	57
9280BR	44
9280BR	38
9280BR	7
9280BR	33
9280BR	8

CABLE NO. 9727BR FROM: VCC1AB-N
TO: PNL TRB

9727BR	6
9727BR	44
9727BR	57

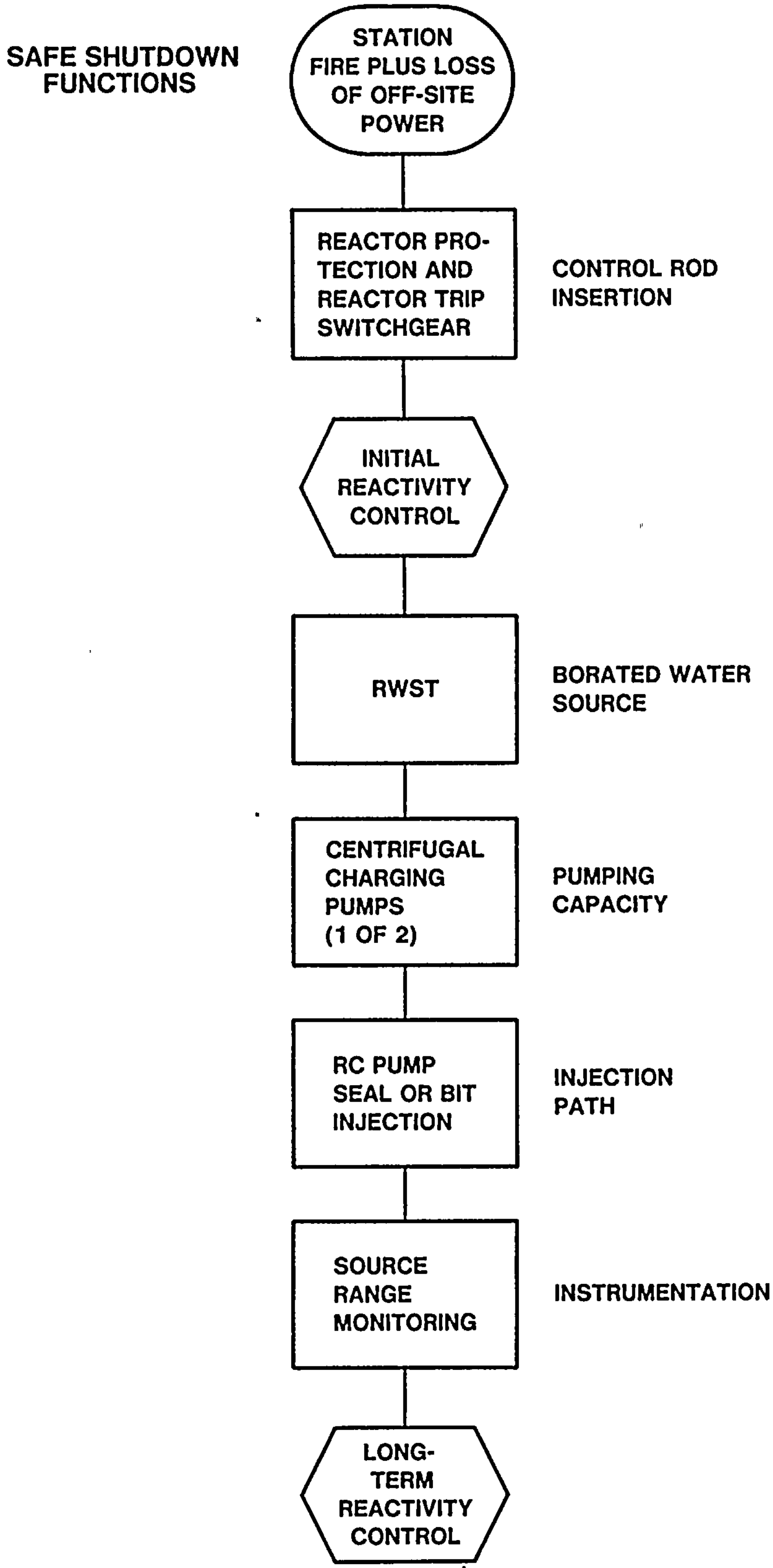
TABLE 4.5

D.C. COOK POWER PLANT - UNIT 1
SYSTEM: AF

DATE: 02/18/83

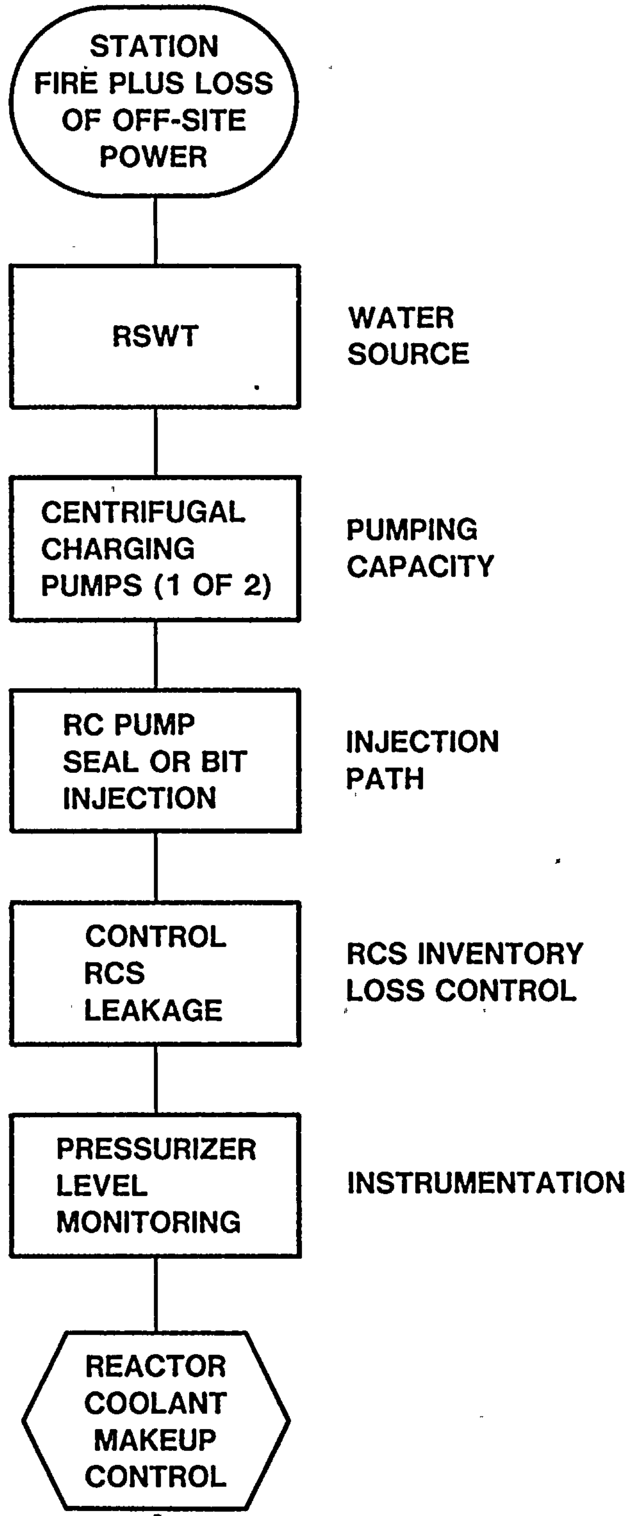
FIREZONE	RACEWAY	COMPONENT	CABLE
33	1MS-C14	FMO-212	9093R
33	1MS-C14	FMO-242	9087R
33	1MS-C4	FMO-212	9093R
33	1MS-C4	FMO-242	9087R
33	20151	BLI-110	20151
33	20152	BLI-140	20152
33	9085BR	FMO-241	9085BR
33	9086BR	FMO-241	9086BR
33	9086R	FMO-242	9086R
33	9087BR	FMO-241	9087BR
33	9087R	FMO-242	9087R
33	9088R	FMO-242	9088R
33	9090BR	FMO-211	9090BR
33	9091BR	FMO-211	9091BR
33	9092BR	FMO-211	9092BR
33	9092R	FMO-212	9092R
33	9093R	FMO-212	9093R
33	9094R	FMO-212	9094R
33	9280BR	FMO-211	9280BR
33	9283BR	FMO-241	9283BR

EXAMPLE OF COMPUTERIZED SYSTEM/FIRE ZONE SSS CABLE OUTPUT

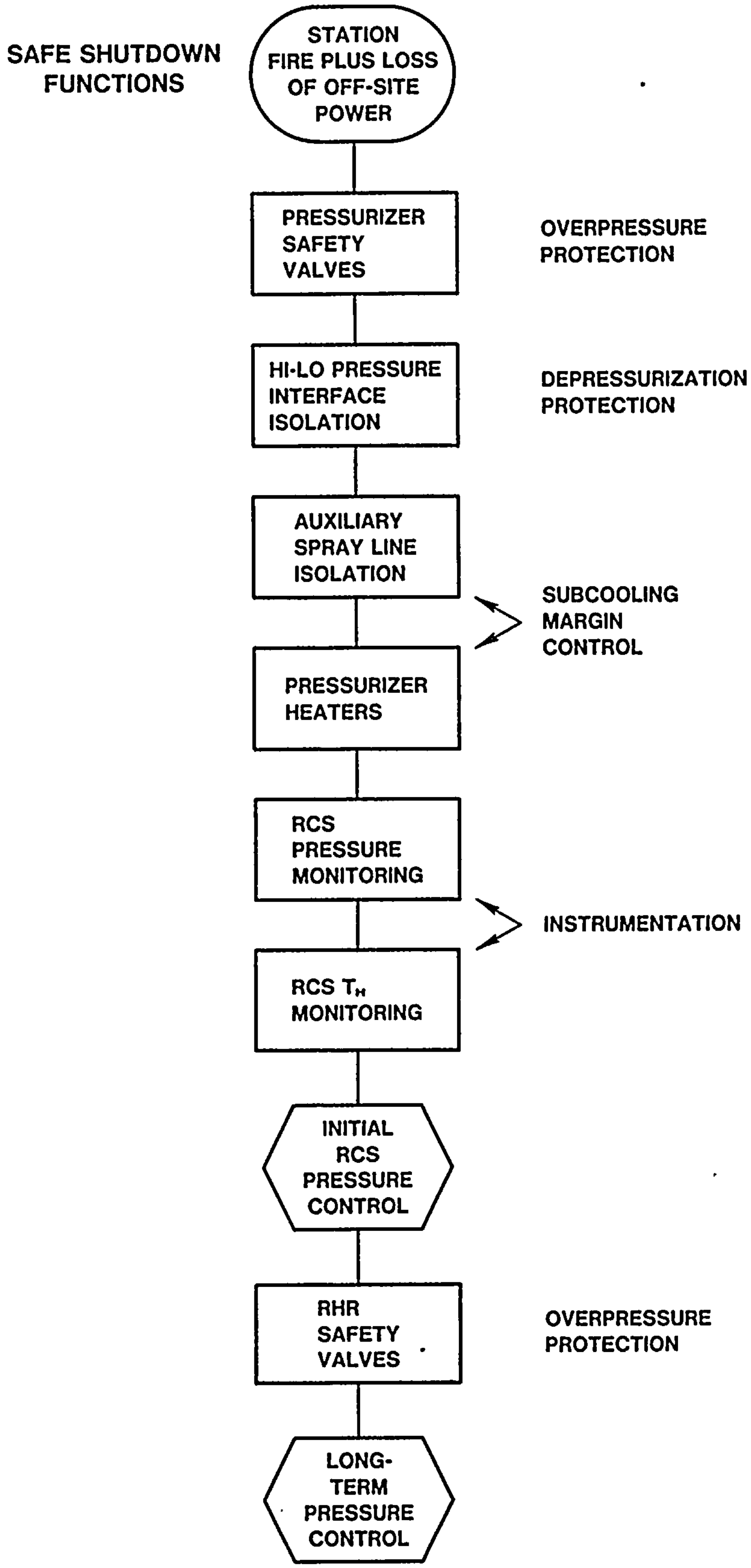


RCS REACTIVITY CONTROL FIGURE 4.1

SAFE SHUTDOWN FUNCTIONS

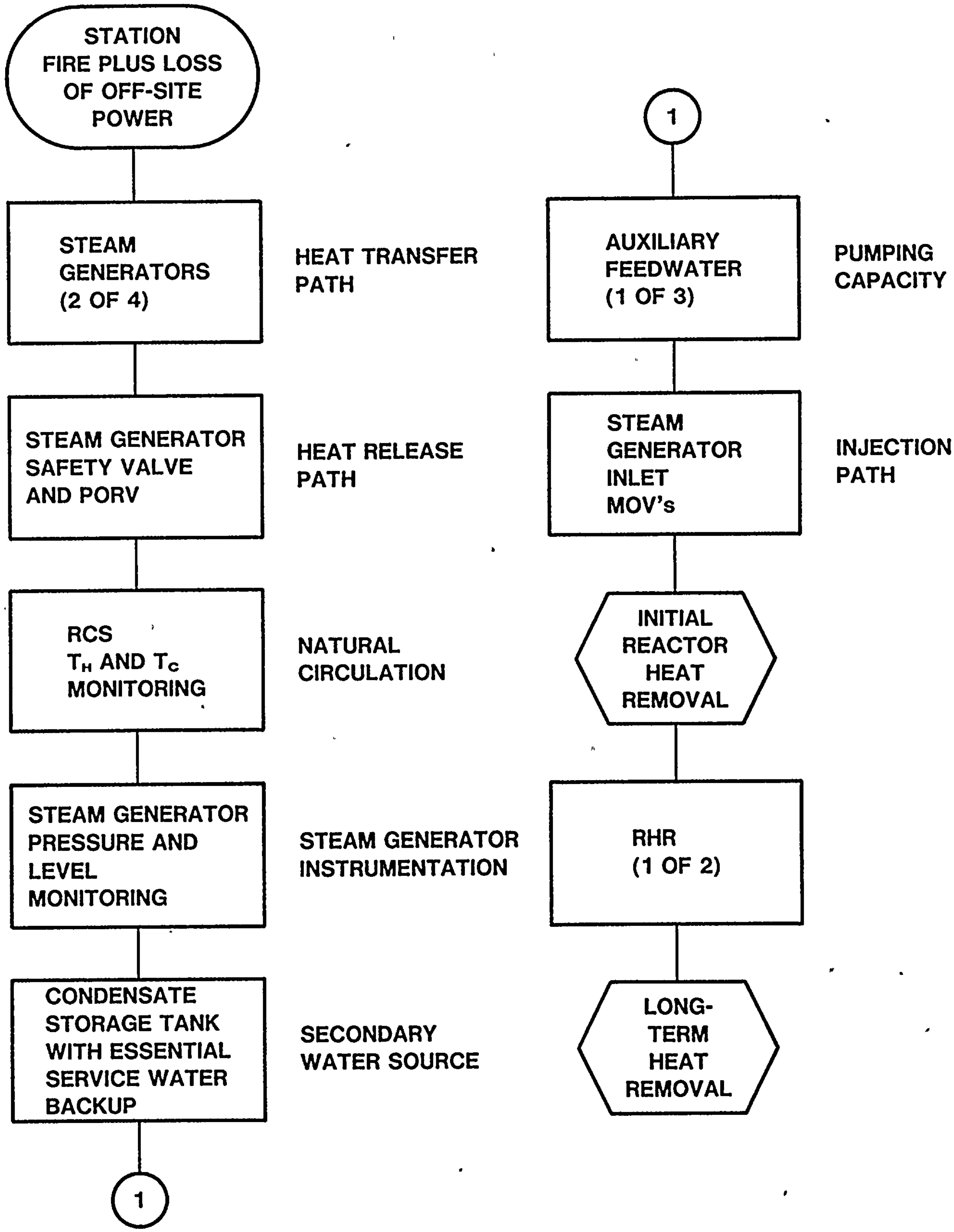


RCS MAKEUP CONTROL FIGURE 4.2

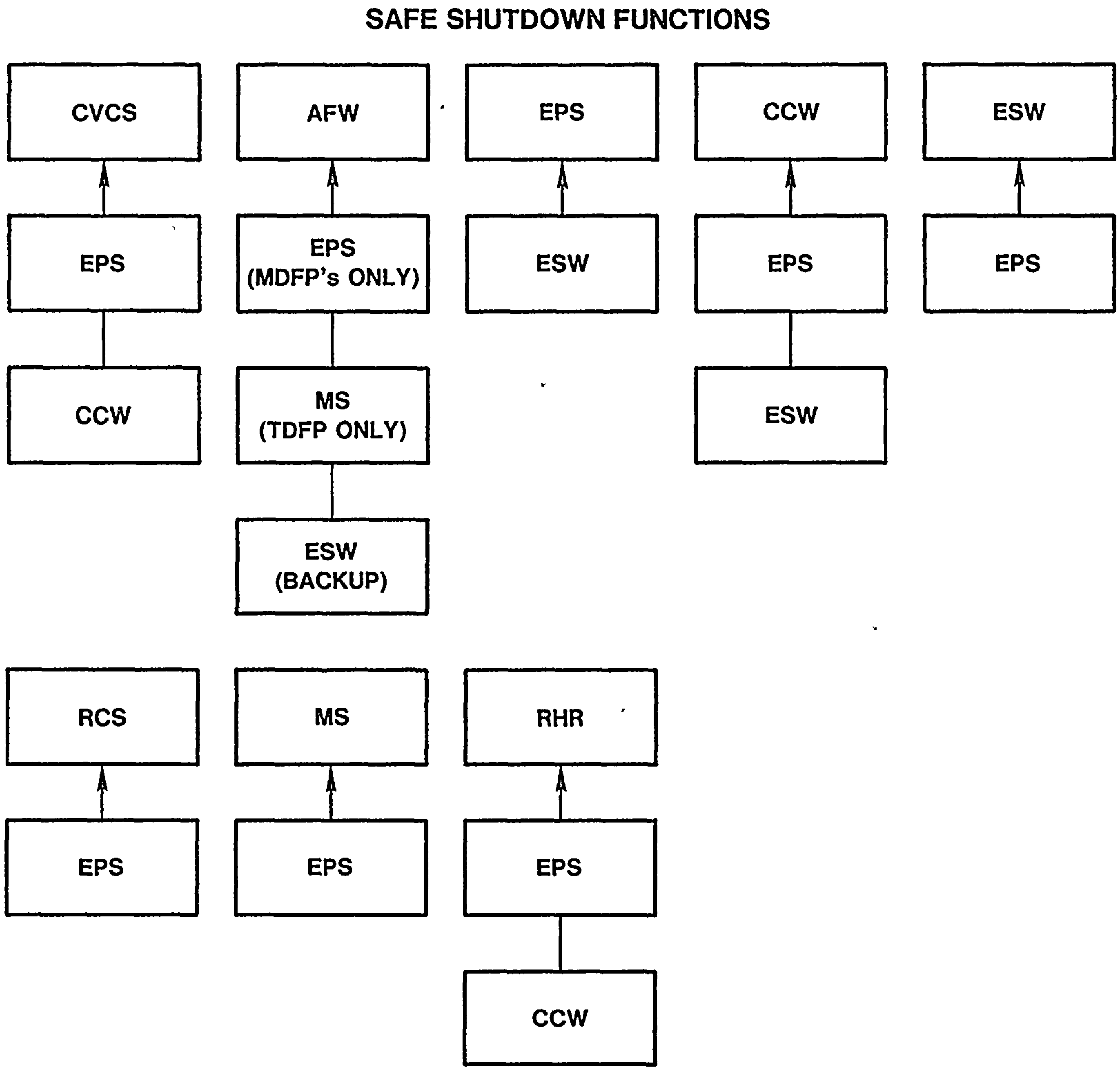


RCS PRESSURE CONTROL FIGURE 4.3

SAFE SHUTDOWN FUNCTIONS



REACTOR HEAT REMOVAL FIGURE 4.4



SUPPORTING SYSTEM INTERACTION DIAGRAM FIGURE 4.5

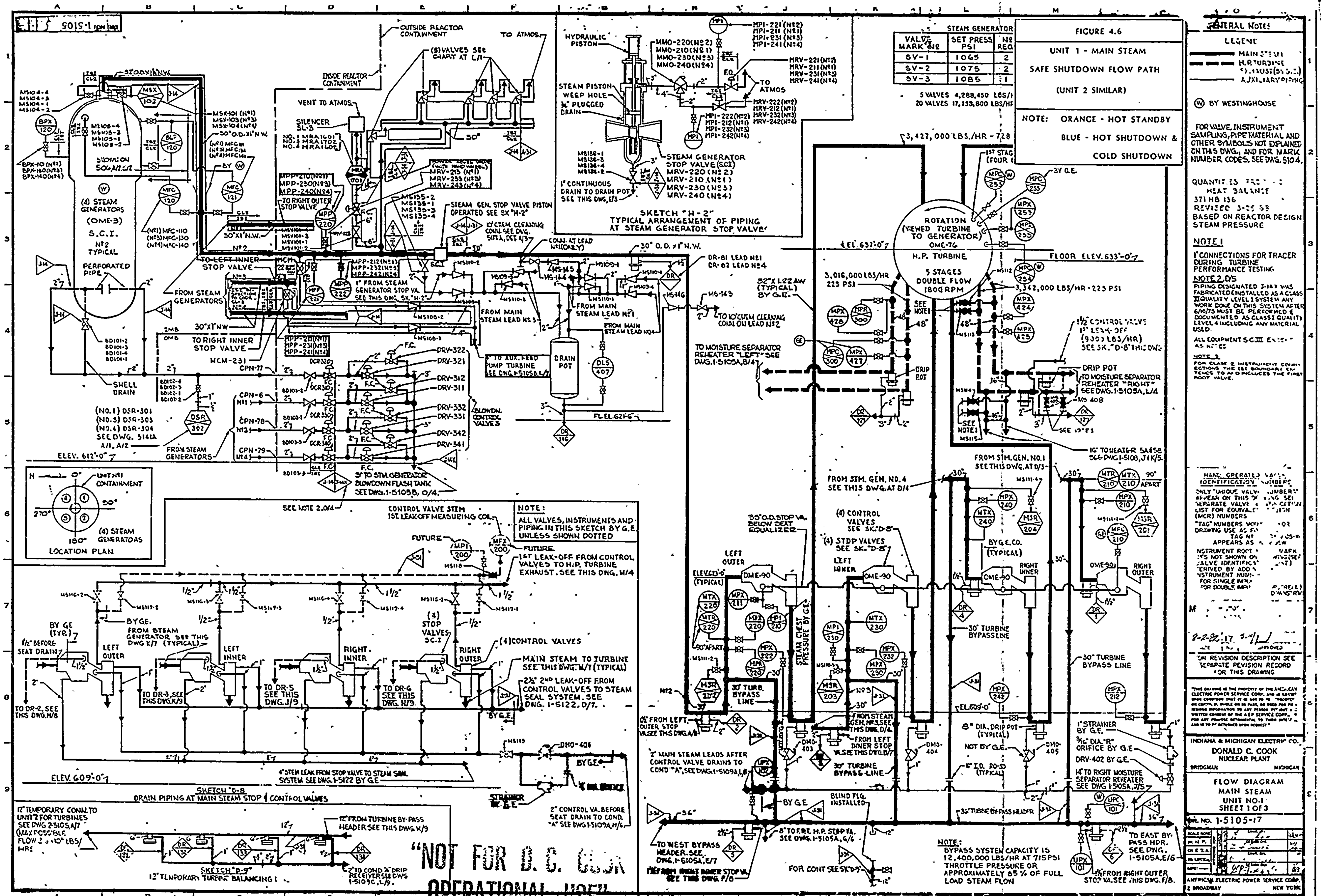


FIGURE 4.6
UNIT 1 - MAIN STEAM
SAFE SHUTDOWN FLOW PATH
(UNIT 2 SIMILAR)
NOTE: ORANGE - HOT STANDBY
BLUE - HOT SHUTDOWN & COLD SHUTDOWN
GENERAL NOTES
LEGEND
MAIN STEAM
AUXILIARY PIPING
Ⓦ BY WESTINGHOUSE
FOR VALVE, INSTRUMENT SAMPLING, PIPE MATERIAL AND OTHER SYMBOLS NOT EXPLAINED ON THIS DWG., AND FOR MARK NUMBER CODES, SEE DWG. 5104.
NOTE 1
1" CONNECTIONS FOR TRACER DURING TURBINE PERFORMANCE TESTING
NOTE 2 D/S
STEAM GENERATOR
VALVE MARK No	SET PRESS PSI
SV-1	1065
SV-2	1075
SV-3	1085
5 VALVES 4,288,450 LBS/HR
20 VALVES 17,153,800 LBS/HR
ROTATION (VIEWED TURBINE TO GENERATOR)
OME-76
H.P. TURBINE
5 STAGES
DOUBLE FLOW
1800 RPM
FLOOR ELEV. 633'-0"
3,016,000 LBS/HR 225 PSI
3,342,000 LBS/HR - 225 PSI
SKETCH "H-2"
TYPICAL ARRANGEMENT OF PIPING AT STEAM GENERATOR STOP VALVE
STEAM GENERATOR STOP VALVE (SCI)
(4) STEAM GENERATORS (OME-3) S.C.I. No 2 TYPICAL
LOCATION PLAN
NOTE: ALL VALVES, INSTRUMENTS AND PIPING IN THIS SKETCH BY G.E. UNLESS SHOWN DOTTED
SKETCH "D-8"
DRAIN PIPING AT MAIN STEAM STOP & CONTROL VALVES
SKETCH "D-9"
12" TEMPORARY TURBINE BALANCING LINE
NOTE: BYPASS SYSTEM CAPACITY IS 12,400,000 LBS/HR AT 715 PSI THROTTLE PRESSURE OR APPROXIMATELY 85 % OF FULL LOAD STEAM FLOW
"NOT FOR D.C. COOK OPERATIONAL USE"
INDIANA & MICHIGAN ELECTRIC CO.
DONALD C. COOK NUCLEAR PLANT
BRIDGMAN MICHIGAN
FLOW DIAGRAM
MAIN STEAM
UNIT NO. 1
SHEET 1 OF 3
DWG. NO. 1-5105-17
AMERICAN ELECTRIC POWER SERVICE CORP.
2 BROADWAY NEW YORK

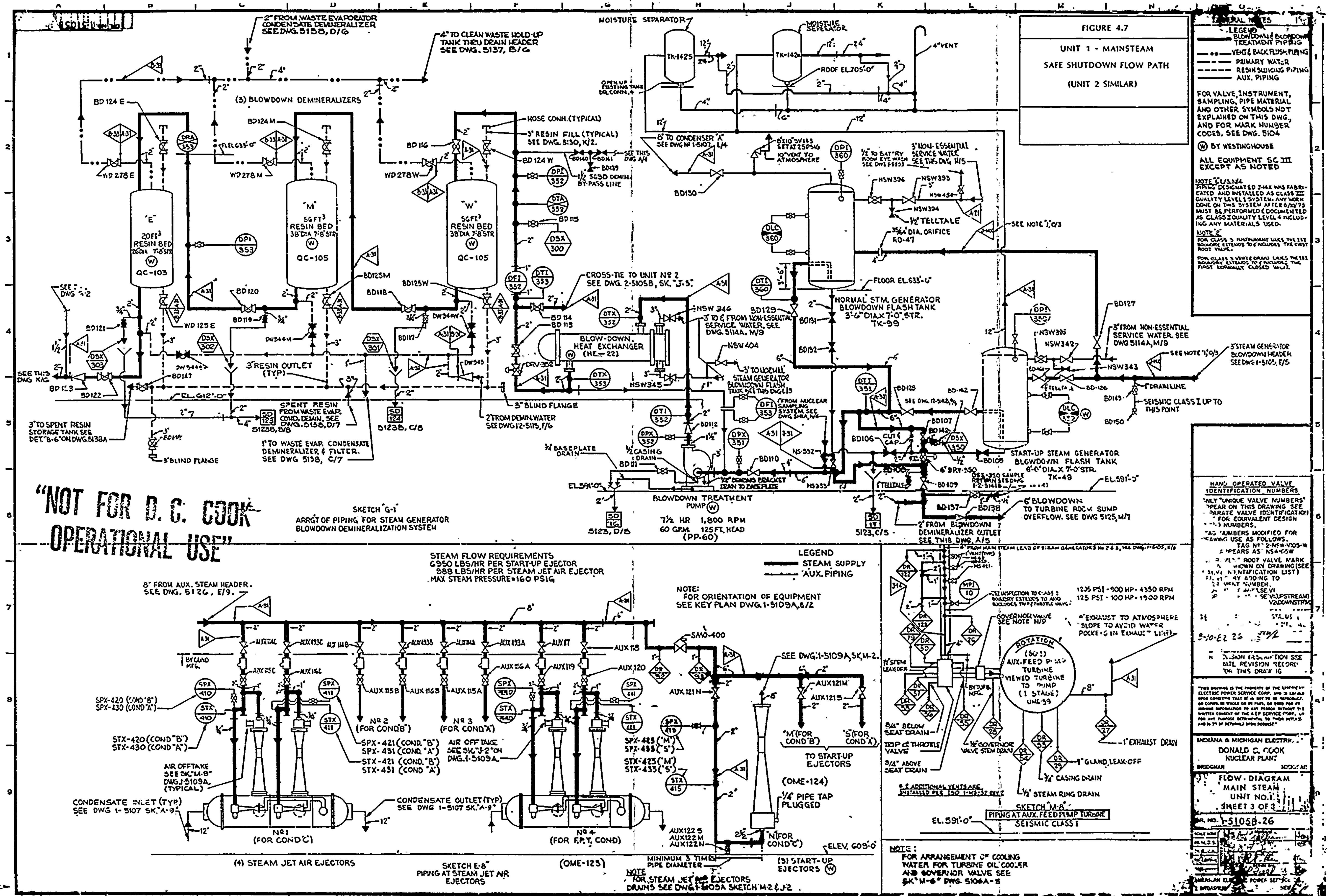


FIGURE 4.7

UNIT 1 - MAINSTEAM SAFE SHUTDOWN FLOW PATH

(UNIT 2 SIMILAR)

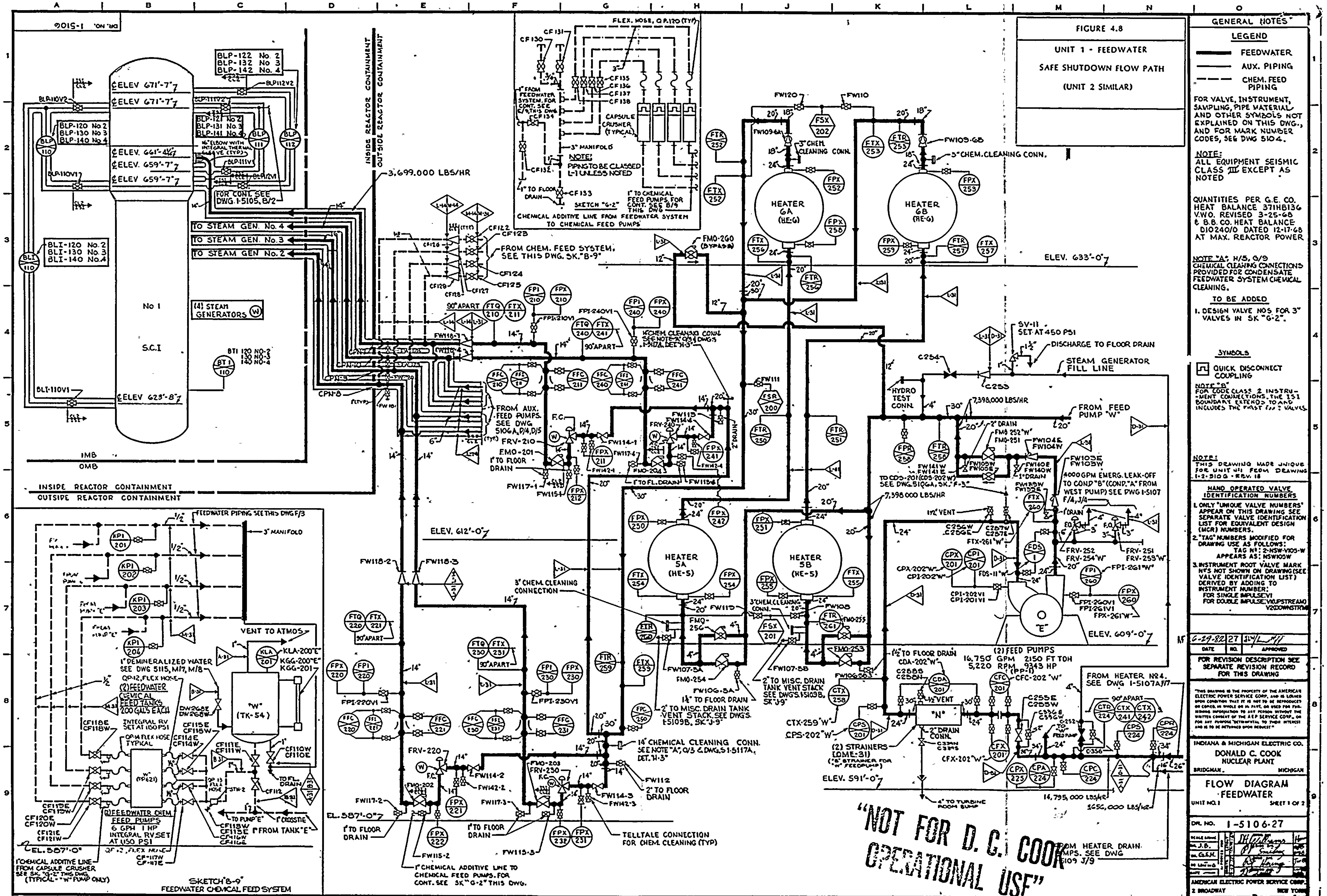


FIGURE 4.8
UNIT 1 - FEEDWATER
SAFE SHUTDOWN FLOW PATH
(UNIT 2 SIMILAR)
GENERAL NOTES
LEGEND
FEEDWATER
AUX. PIPING
CHEM. FEED PIPING
FOR VALVE, INSTRUMENT, SAMPLING, PIPE MATERIAL AND OTHER SYMBOLS NOT EXPLAINED ON THIS DWG., AND FOR MARK NUMBER CODES, SEE DWG 5104.
NOTE: ALL EQUIPMENT SEISMIC CLASS III EXCEPT AS NOTED
QUANTITIES PER G.E. CO. HEAT BALANCE 371HB136 V.W.O. REVISED 3-25-68 & B.B. CO. HEAT BALANCE D10240/0 DATED 12-17-68 AT MAX. REACTOR POWER
NOTE "A" H/5, O/9 CHEMICAL CLEANING CONNECTIONS PROVIDED FOR CONDENSATE FEEDWATER SYSTEM CHEMICAL CLEANING.
TO BE ADDED
1. DESIGN VALVE NOS FOR 3" VALVES IN SK "G-2".
SYMBOLS
QUICK DISCONNECT COUPLING
INSIDE REACTOR CONTAINMENT
OUTSIDE REACTOR CONTAINMENT
3,699,000 LBS/HR
TO STEAM GEN. No. 4
TO STEAM GEN. No. 3
TO STEAM GEN No. 2
(4) STEAM GENERATORS
HEATER 6A (HE-6)
HEATER 6B (HE-6)
HEATER 5A (HE-5)
HEATER 5B (HE-5)
ELEV. 633'-0"
ELEV. 612'-0"
ELEV. 609'-0"
ELEV. 591'-0"
EL. 587'-0"
STEAM GENERATOR FILL LINE
SV-11 SET AT 450 PSI
DISCHARGE TO FLOOR DRAIN
FROM FEED PUMP "W"
7,398,000 LBS/HR
(2) FEED PUMPS 16,750 GPM 2150 FT TDH 5,220 RPM 9343 HP
(2) STRAINERS
14,795,000 LBS/HR
FROM AUX. FEED PUMPS. SEE DWG 5106A, D/4, D/5
SKETCH "G-2" CHEMICAL ADDITIVE LINE FROM FEEDWATER SYSTEM TO CHEMICAL FEED PUMPS
SKETCH "B-9" FEEDWATER CHEMICAL FEED SYSTEM
VENT TO ATMOS.
(2) FEEDWATER CHEMICAL FEED TANKS 200 GAL'S EACH
(2) FEEDWATER CHEM FEED PUMPS 6 GPH 1 HP INTEGRAL RV SET AT 1150 PSI
TELLTALE CONNECTION FOR CHEM. CLEANING (TYP)
INDIANA & MICHIGAN ELECTRIC CO.
DONALD C. COOK NUCLEAR PLANT
BRIDGMAN, MICHIGAN
FLOW DIAGRAM FEEDWATER
UNIT NO. 1 SHEET 1 OF 2
DR. NO. 1-5106-27
AMERICAN ELECTRIC POWER SERVICE CORP.
2 BROADWAY NEW YORK
"NOT FOR D. C. COOK OPERATIONAL USE"

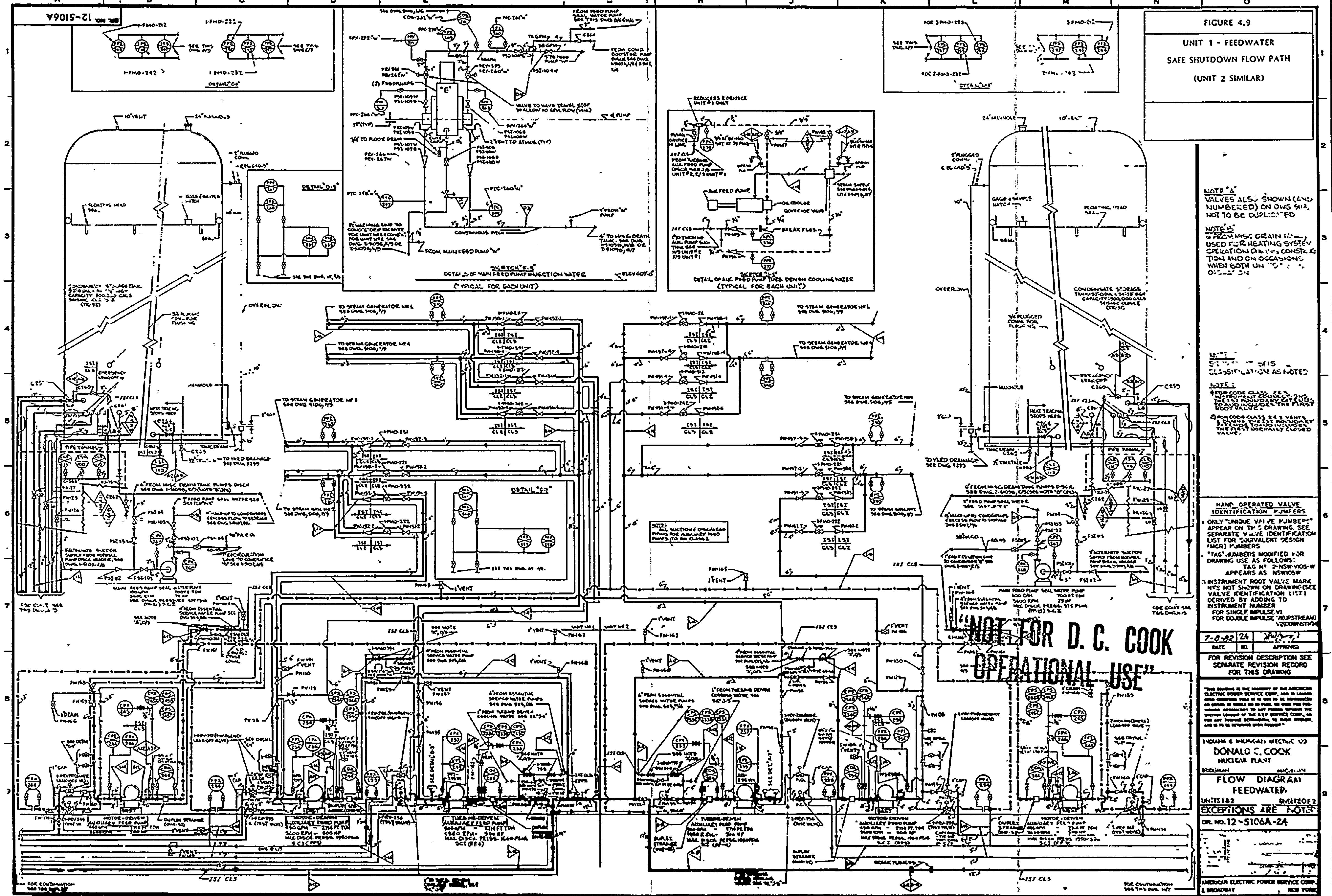


FIGURE 4.9
UNIT 1 - FEEDWATER
SAFE SHUTDOWN FLOW PATH
(UNIT 2 SIMILAR)
"NOT FOR D. C. COOK OPERATIONAL USE"
HAND OPERATED VALVE IDENTIFICATION NUMBERS
INDIANA & MICHIGAN ELECTRIC CO
DONALD C. COOK NUCLEAR PLANT
FLOW DIAGRAM FEEDWATER
EXCEPTIONS ARE NOTED
DR. NO. 12-5106A-24
AMERICAN ELECTRIC POWER SERVICE CORP.
2 BROADWAY NEW YORK

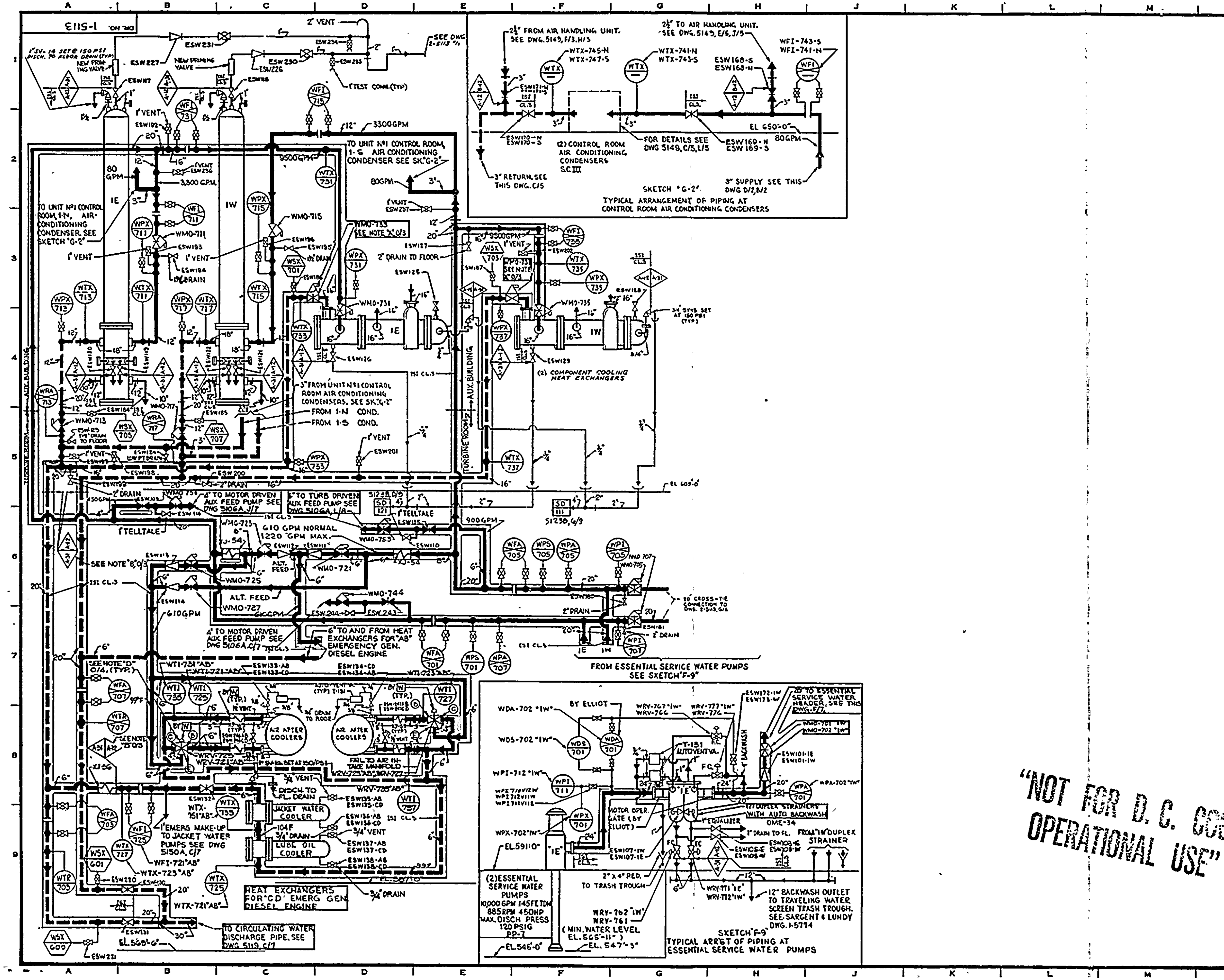


FIGURE 4.10

UNIT 1 - ESSENTIAL SERVCE WATER SAFE SHUTDOWN FLOW PATH

(UNIT 2 SIMILAR)

ON THIS DWG., AND FOR MARK NUMBER CODES, SEE DWG. 5104

SYMBOL
W BY WORTHINGTON

NOTE "A": C/3, E/3
WMO-733, 737 TO HAVE INTERMEDIATE LIMIT SWITCH TO LIMIT FLOW ON SAFETY INJECTION SIGNAL

NOTE "B": B/5
RETURN PIPING CHANGES FROM CLASS I (AUX. BLDG) TO CLASS III (TURB ROOM)

NOTE "C": B/7, E/7
ENCIRCLED LETTERS ARE SHOWN FOR ORIENTATION OF VALVE IN PIPING. THESE LETTERS REFLECT SIMILAR MARKINGS ON VALVE BODY

NOTE "D": THIS DWG. MADE UNIQUE AND SUPERSEDES DWG. 12-5113-21

NOTE "E": FOR CODE CLASS 2&3 INSTR. CONNECTIONS, THE ISI BOUNDARY EXTENDS TO AND INCLUDES THE FIRST ROOT VALVE.

NOTE "F": FOR CODE CLASS 2&3 VENTS AND DRAINS THE ISI BOUNDARY EXTENDS TO AND INCLUDES THE FIRST NORMALLY CLOSED VALVE.

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-V105-W APPEARS AS: NSW105W
3. 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

DATE	NO.	APPROVED
6-11-80	26	

FOR REVISION DESCRIPTION SEE SEPARATE REVISION RECORD FOR THIS DRAWING

INDIANA & MICHIGAN ELECTRIC CO.
DONALD C. COOK NUCLEAR PLANT
BRIDGMAN MICHIGAN

FLOW DIAGRAM ESSENTIAL SERVICE WATER UNITS NO 1

DR. NO. 1-5113-26

AMERICAN ELECTRIC POWER SERVICE CORP.
2 BROADWAY NEW YORK

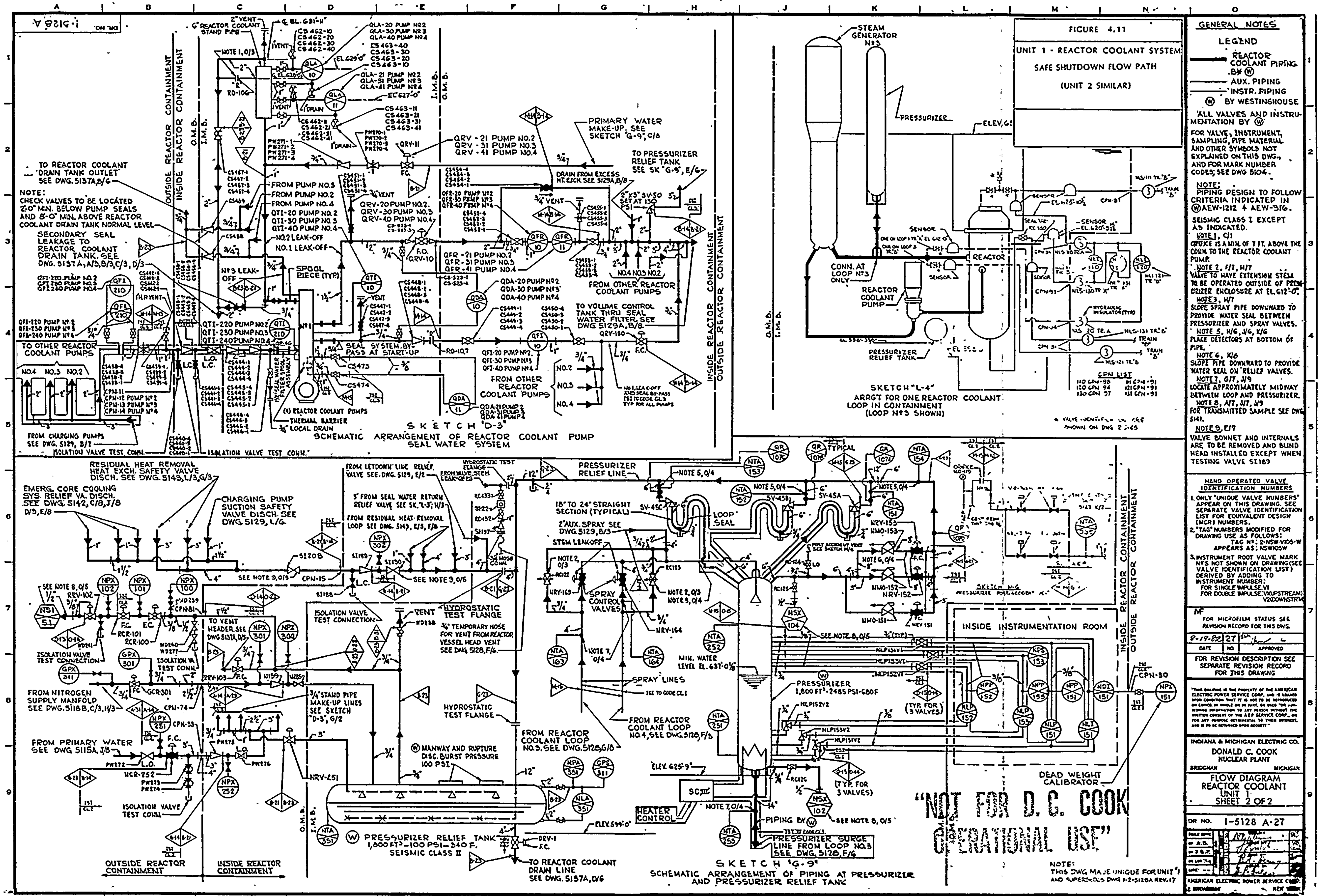


FIGURE 4.11
UNIT 1 - REACTOR COOLANT SYSTEM
SAFE SHUTDOWN FLOW PATH
(UNIT 2 SIMILAR)
GENERAL NOTES
LEGEND
REACTOR COOLANT PIPING BY Ⓦ
AUX. PIPING
INSTR. PIPING
Ⓦ BY WESTINGHOUSE
ALL VALVES AND INSTRUMENTATION BY Ⓦ
FOR VALVE, INSTRUMENT, SAMPLING, PIPE MATERIAL AND OTHER SYMBOLS NOT EXPLAINED ON THIS DWG., AND FOR MARK NUMBER CODES, SEE DWG 5104.
NOTE: PIPING DESIGN TO FOLLOW CRITERIA INDICATED IN ⓌAEW-1212 & AEW-316.
SEISMIC CLASS I EXCEPT AS INDICATED.
NOTE 1, C/1 ORIFICE IS A MIN. OF 7 FT. ABOVE THE CONN. TO THE REACTOR COOLANT PUMP.
NOTE 2, F/1, H/7 VALVE TO HAVE EXTENSION STEM TO BE OPERATED OUTSIDE OF PRESSURIZER ENCLOSURE AT EL. 612'-0".
NOTE 3, H/7 SLOPE SPRAY PIPE DOWNWARD TO PROVIDE WATER SEAL BETWEEN PRESSURIZER AND SPRAY VALVES.
NOTE 5, H/6, J/6, K/6 PLACE DETECTORS AT BOTTOM OF PIPE.
NOTE 6, K/6 SLOPE PIPE DOWNWARD TO PROVIDE WATER SEAL ON RELIEF VALVES.
NOTE 7, G/7, J/9 LOCATE APPROXIMATELY MIDWAY BETWEEN LOOP AND PRESSURIZER.
NOTE 8, A/7, J/7, J/9 FOR TRANSMITTED SAMPLE SEE DWG 5141.
NOTE 9, E/7 VALVE BONNET AND INTERNALS ARE TO BE REMOVED AND BLIND HEAD INSTALLED EXCEPT WHEN TESTING VALVE SI189
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-V105-W APPEARS AS: NSW105W
3. 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.
8-19-82 27
DATE NO. APPROVED
FOR REVISION DESCRIPTION SEE SEPARATE REVISION RECORD FOR THIS DRAWING
INDIANA & MICHIGAN ELECTRIC CO.
DONALD C. COOK NUCLEAR PLANT
BRIDGMAN MICHIGAN
FLOW DIAGRAM REACTOR COOLANT UNIT 1 SHEET 2 OF 2
DR NO. 1-5128 A-27
AMERICAN ELECTRIC POWER SERVICE CORP. 2 BROADWAY NEW YORK
"NOT FOR D.C. COOK OPERATIONAL USE"
NOTE: THIS DWG MADE UNIQUE FOR UNIT 1 AND SUPERSEDES DWG 1-2-5128A REV.17
SKETCH "D-3" SCHEMATIC ARRANGEMENT OF REACTOR COOLANT PUMP SEAL WATER SYSTEM
SKETCH "L-4" ARRGT FOR ONE REACTOR COOLANT LOOP IN CONTAINMENT (LOOP Nº3 SHOWN)
SKETCH "G-9" SCHEMATIC ARRANGEMENT OF PIPING AT PRESSURIZER AND PRESSURIZER RELIEF TANK
OUTSIDE REACTOR CONTAINMENT
INSIDE REACTOR CONTAINMENT
INSIDE INSTRUMENTATION ROOM
STEAM GENERATOR Nº3
PRESSURIZER
REACTOR
REACTOR COOLANT PUMP
PRESSURIZER RELIEF TANK
PRESSURIZER 1,800 FT³-2485 PSI-680F
Ⓦ PRESSURIZER RELIEF TANK 1,800 FT³-100 PSI-340 F. SEISMIC CLASS II
PRESSURIZER RELIEF LINE
PRESSURIZER SURGE LINE FROM LOOP NO.3 SEE DWG. 5128, F/6
DEAD WEIGHT CALIBRATOR
HEATER CONTROL
SPRAY CONTROL VALVES
LOOP SEAL
PRIMARY WATER MAKE-UP. SEE SKETCH "G-9", C/8
TO PRESSURIZER RELIEF TANK SEE SK "G-9", E/6
HYDROSTATIC TEST FLANGE
FROM NITROGEN SUPPLY MANIFOLD SEE DWG. 5118B, C/3, H/3
FROM PRIMARY WATER SEE DWG 5115A, J/8
TO REACTOR COOLANT DRAIN LINE SEE DWG. 5137A, D/6
RESIDUAL HEAT REMOVAL HEAT EXCH. SAFETY VALVE DISCH. SEE DWG. 5143, L/3, G/3
EMERG. CORE COOLING SYS. RELIEF VA. DISCH. SEE DWG. 5142, C/8, J/8 D/5, E/8
CHARGING PUMP SUCTION SAFETY VALVE DISCH. SEE DWG 5129, L/6
FROM CHARGING PUMPS SEE DWG. 5129, B/7
TO VOLUME CONTROL TANK THRU SEAL WATER FILTER. SEE DWG 5129A, B/8.
NOTE: CHECK VALVES TO BE LOCATED 2'-0" MIN. BELOW PUMP SEALS AND 8'-0" MIN. ABOVE REACTOR COOLANT DRAIN TANK NORMAL LEVEL.

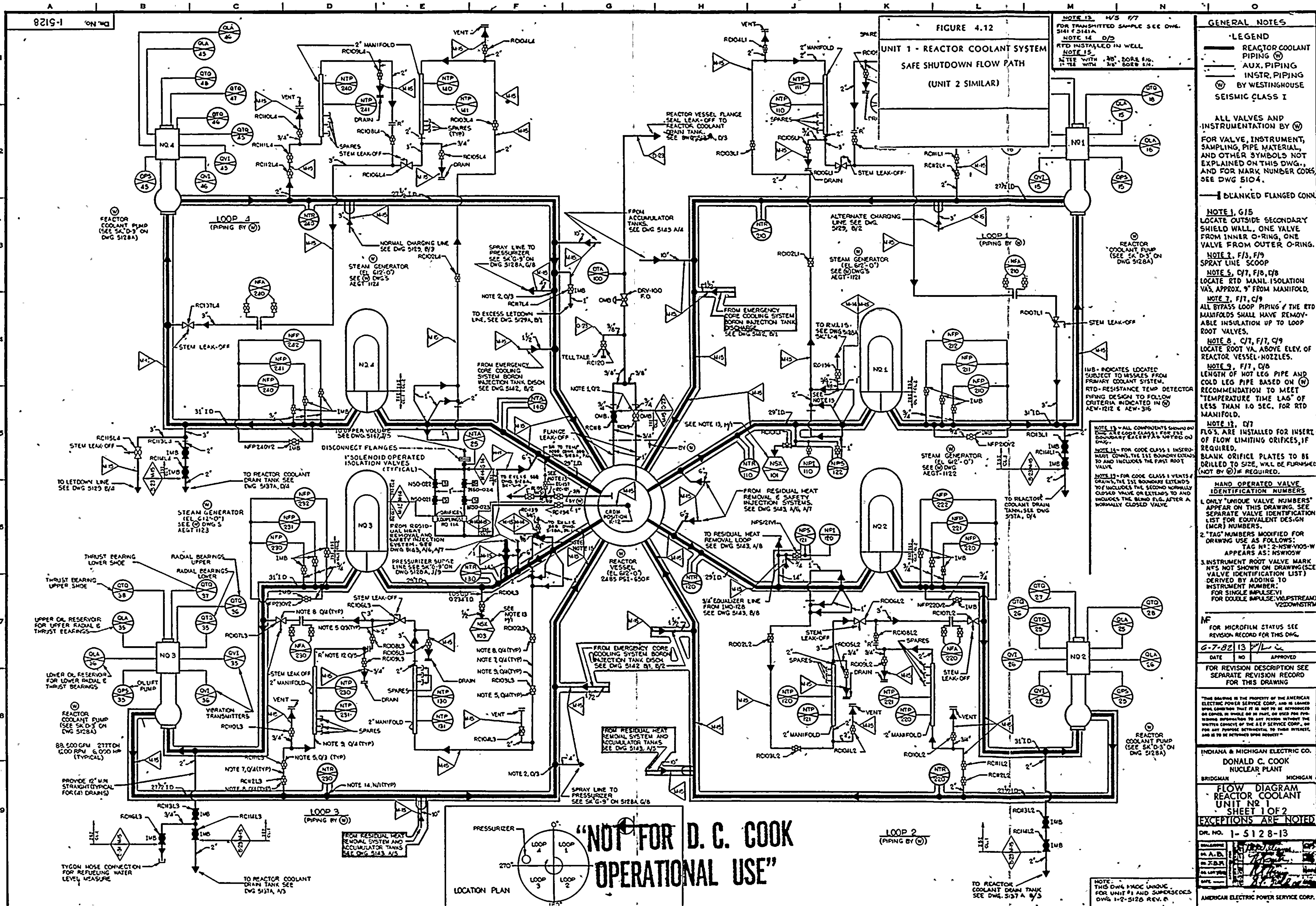


FIGURE 4.12
UNIT 1 - REACTOR COOLANT SYSTEM
SAFE SHUTDOWN FLOW PATH
(UNIT 2 SIMILAR)
DR. NO. 1-5128
GENERAL NOTES
LEGEND
REACTOR COOLANT PIPING Ⓦ
AUX. PIPING
INSTR. PIPING
Ⓦ BY WESTINGHOUSE
SEISMIC CLASS I
ALL VALVES AND INSTRUMENTATION BY Ⓦ
FOR VALVE, INSTRUMENT, SAMPLING, PIPE MATERIAL, AND OTHER SYMBOLS NOT EXPLAINED ON THIS DWG., AND FOR MARK NUMBER CODES, SEE DWG 5104.
BLANKED FLANGED CONN.
NOTE 1, G/5 LOCATE OUTSIDE SECONDARY SHIELD WALL. ONE VALVE FROM INNER O-RING, ONE VALVE FROM OUTER O-RING.
NOTE 2, F/3, F/9 SPRAY LINE SCOOP
NOTE 5, C/7, F/8, L/8 LOCATE RTD MANL. ISOLATION VA'S. APPROX. 9" FROM MANIFOLD.
NOTE 7, F/7, C/9 ALL BYPASS LOOP PIPING & THE RTD MANIFOLDS SHALL HAVE REMOVABLE INSULATION UP TO LOOP ROOT VALVES.
NOTE 8, C/7, F/7, C/9 LOCATE ROOT VA. ABOVE ELEV. OF REACTOR VESSEL NOZZLES.
NOTE 9, F/7, D/8 LENGTH OF HOT LEG PIPE AND COLD LEG PIPE BASED ON Ⓦ RECOMMENDATION TO MEET "TEMPERATURE TIME LAG" OF LESS THAN 1.0 SEC. FOR RTD MANIFOLD.
NOTE 12, D/7 FLG'S. ARE INSTALLED FOR INSERT. OF FLOW LIMITING ORIFICES, IF REQUIRED. BLANK ORIFICE PLATES TO BE DRILLED TO SIZE, WILL BE FURNISHED (NOT BY Ⓦ) IF REQUIRED.
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-V105-W APPEARS AS: NSW105W
3. 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)
NF FOR MICROFILM STATUS SEE REVISION RECORD FOR THIS DWG.
6-7-82 | 13
DATE | NO | APPROVED
FOR REVISION DESCRIPTION SEE SEPARATE REVISION RECORD FOR THIS DRAWING
INDIANA & MICHIGAN ELECTRIC CO.
DONALD C. COOK NUCLEAR PLANT
BRIDGMAN MICHIGAN
FLOW DIAGRAM REACTOR COOLANT UNIT Nº 1 SHEET 1 OF 2
EXCEPTIONS ARE NOTED
DR. NO. 1-5128-13
AMERICAN ELECTRIC POWER SERVICE CORP.
LOOP 1 (PIPING BY Ⓦ)
LOOP 2 (PIPING BY Ⓦ)
LOOP 3 (PIPING BY Ⓦ)
LOOP 4 (PIPING BY Ⓦ)
REACTOR VESSEL (EL 612'-0") 2485 PSI-650F
STEAM GENERATOR (EL 612'-0")
REACTOR COOLANT PUMP (SEE SK'D-3' ON DWG 5128A)
LOCATION PLAN
PRESSURIZER
"NOT FOR D. C. COOK OPERATIONAL USE"
NOTE: THIS DWG MADE UNIQUE FOR UNIT 1 AND SUPERSEDES DWG 1-2-5128 REV. 8.

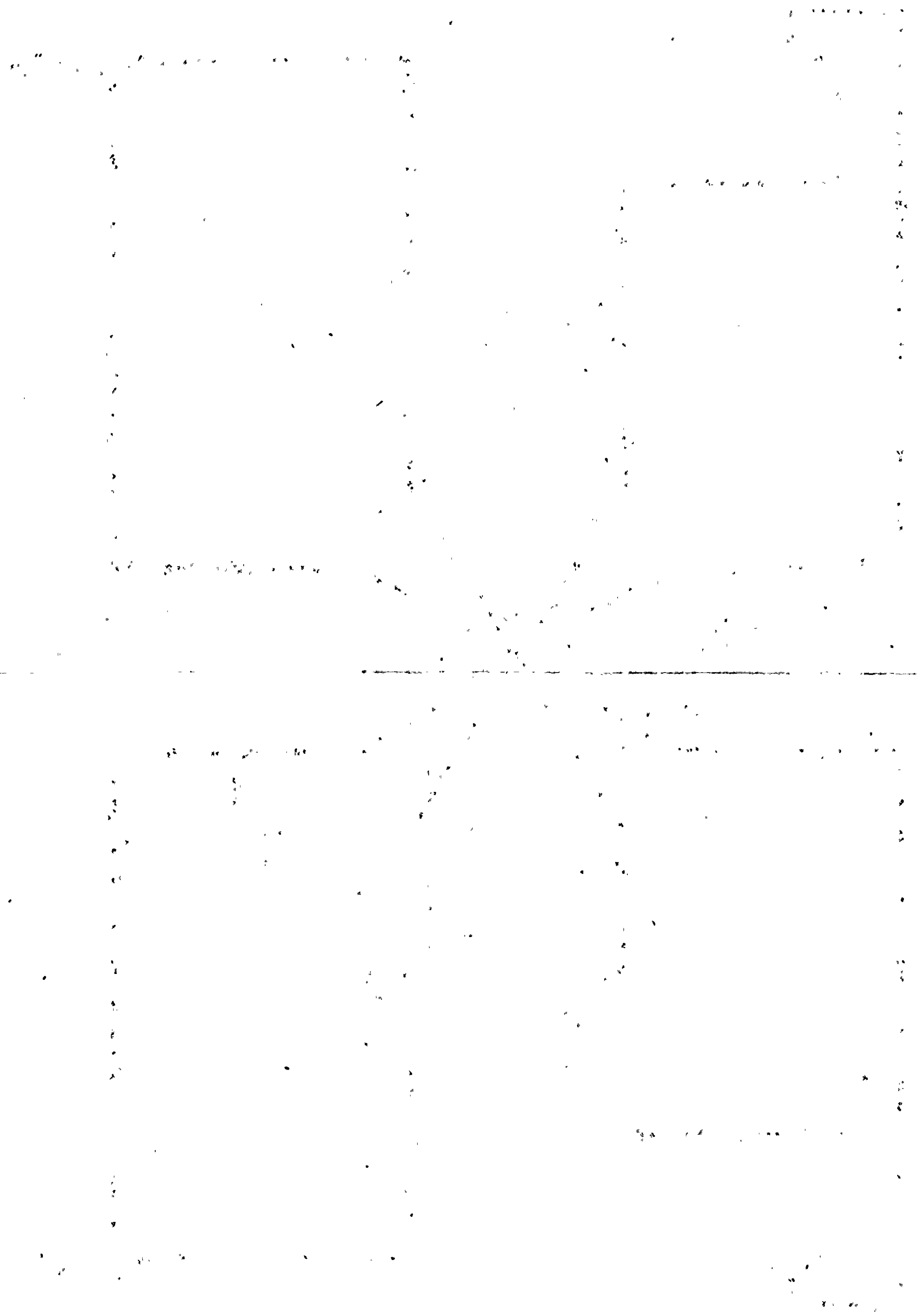
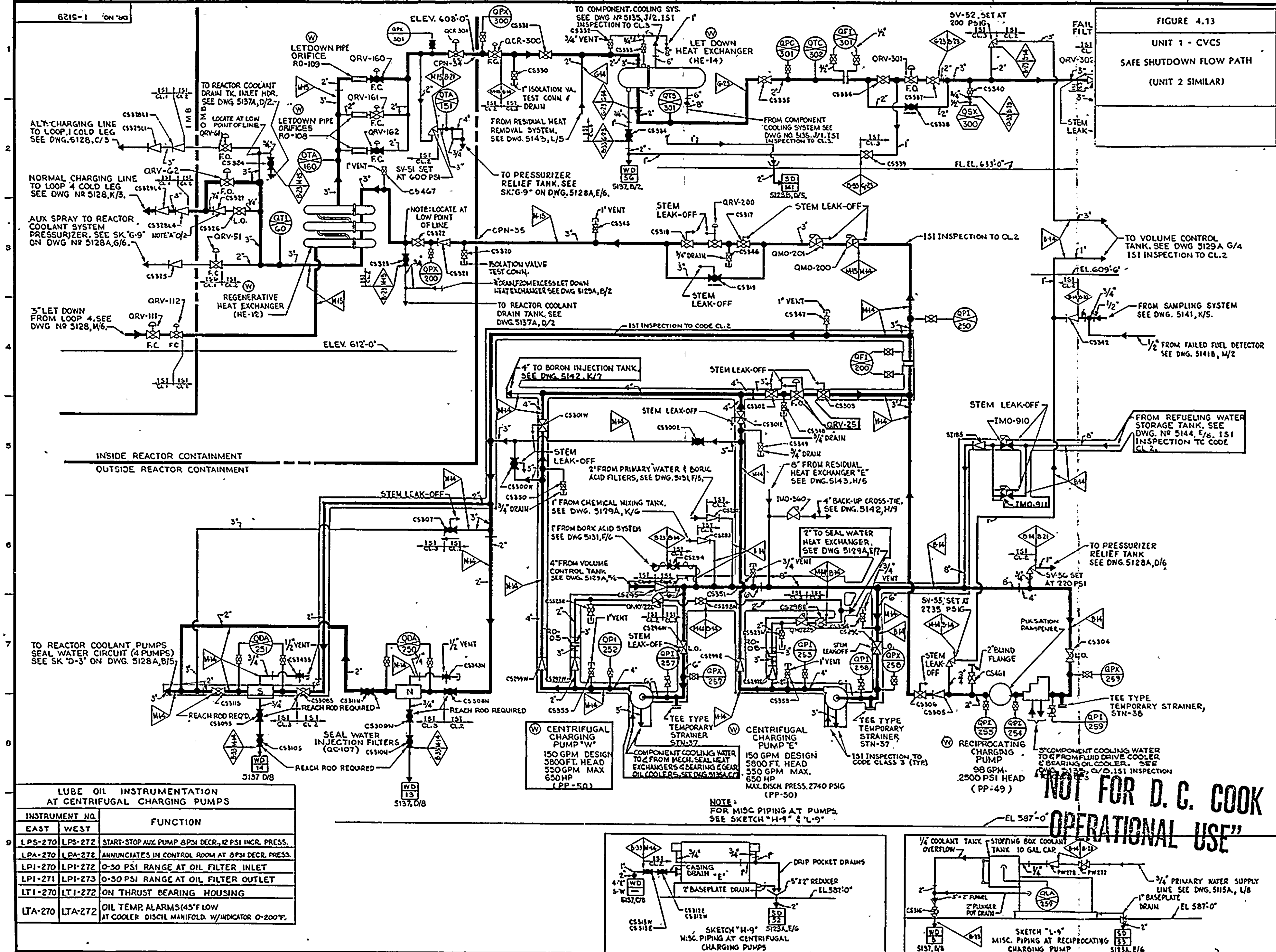


FIGURE 4.13

UNIT 1 - CVCS

SAFE SHUTDOWN FLOW PATH

(UNIT 2 SIMILAR)



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.

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.

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

Ⓦ BY WESTINGHOUSE EXCEPT AS NOTED

ALL VALVES & INSTRUMENTATION SUPPLIED BY Ⓦ

EQUIPMENT SUPPLIED BY Ⓦ AS NOTED

1. FOR CODE CLASS 2 & 3 INSTRUMENT CONNECTIONS, THE ISI BOUNDARY EXTENDS TO AND INCLUDES THE FIRST ROOT VALVE.
2. FOR CODE CLASS 2 & 3 VENTS & DRAINS, THE ISI BOUNDARY EXTENDS TO & INCLUDES THE FIRST NORMALLY CLOSED VALVE.

NOTE:
THIS DWG MADE UNIQUE FOR UNIT #1 AND SUPERSEDES DWG. 1-2-5129 REV 17

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 V105-W APPEARS AS, NSW105 W
3. 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
7-12-82	23	[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

DR. NO. 1-5129-23

AMERICAN ELECTRIC POWER SERVICE CORP. 2 BROADWAY NEW YORK

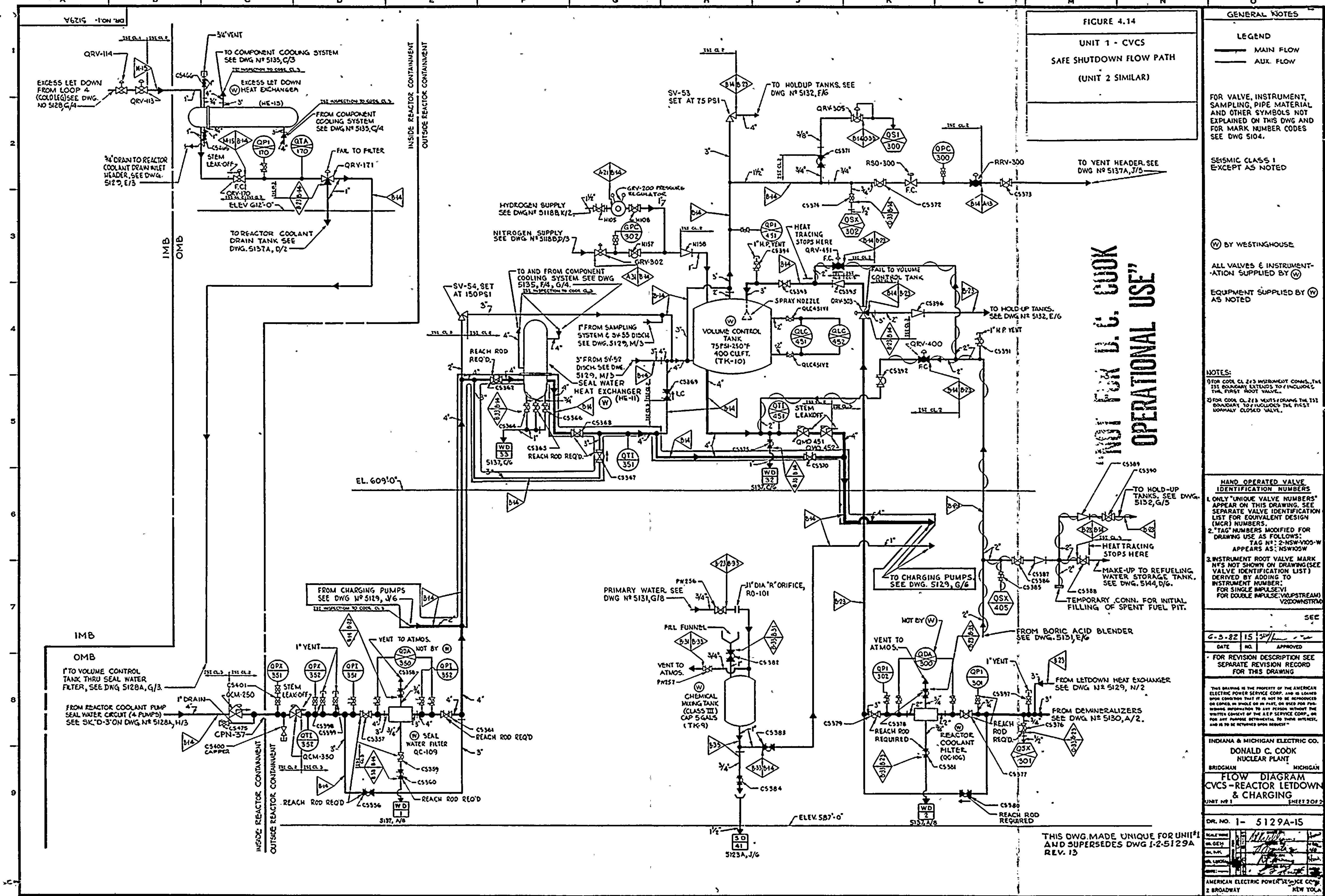


FIGURE 4.14
UNIT 1 - CVCS
SAFE SHUTDOWN FLOW PATH
(UNIT 2 SIMILAR)
GENERAL NOTES
LEGEND
MAIN FLOW
AUX. FLOW
FOR VALVE, INSTRUMENT, SAMPLING, PIPE MATERIAL AND OTHER SYMBOLS NOT EXPLAINED ON THIS DWG AND FOR MARK NUMBER CODES SEE DWG 5104.
SEISMIC CLASS I EXCEPT AS NOTED
Ⓦ BY WESTINGHOUSE
ALL VALVES & INSTRUMENTATION SUPPLIED BY Ⓦ
EQUIPMENT SUPPLIED BY Ⓦ AS NOTED
NOTES:
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-V105-W APPEARS AS: NSW105W
3. 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)
"NOT FOR D. C. COOK OPERATIONAL USE"
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
DR. NO. 1- 5129A-15
THIS DWG. MADE UNIQUE FOR UNIT #1 AND SUPERSEDES DWG 1-2-5129A REV. 13
AMERICAN ELECTRIC POWER SERVICE CORP. 2 BROADWAY NEW YORK
EXCESS LET DOWN FROM LOOP 4 (COLD LEG) SEE DWG. NO 5128,G/4
EXCESS LET DOWN HEAT EXCHANGER (HE-15)
TO COMPONENT COOLING SYSTEM SEE DWG Nº 5135,C/3
FROM COMPONENT COOLING SYSTEM SEE DWG Nº 5135,C/4
TO REACTOR COOLANT DRAIN TANK SEE DWG. 5137A, D/2
INSIDE REACTOR CONTAINMENT
OUTSIDE REACTOR CONTAINMENT
HYDROGEN SUPPLY SEE DWG Nº 5118B,K/2
NITROGEN SUPPLY SEE DWG Nº 5118B,D/3
SV-53 SET AT 75 PSI
TO HOLDUP TANKS. SEE DWG Nº 5132,F/6
TO VENT HEADER. SEE DWG Nº 5137A, J/5
SV-54, SET AT 150 PSI
SEAL WATER HEAT EXCHANGER (HE-11)
VOLUME CONTROL TANK 75 PSI-250°F 400 CU.FT. (TK-10)
TO HOLD-UP TANKS. SEE DWG Nº 5132, E/6
EL. 609'-0"
TO CHARGING PUMPS. SEE DWG. 5129, G/6
FROM CHARGING PUMPS SEE DWG Nº 5129, J/6
PRIMARY WATER SEE DWG Nº 5131,G/8
CHEMICAL MIXING TANK (CLASS III) CAP 5 GALS (TK-9)
FROM BORIC ACID BLENDER SEE DWG. 5131,E/6
FROM LETDOWN HEAT EXCHANGER SEE DWG Nº 5129, N/2
FROM DEMINERALIZERS SEE DWG Nº 5130,A/2.
REACTOR COOLANT FILTER (QC-106)
SEAL WATER FILTER QC-109
TO HOLD-UP TANKS, SEE DWG. 5132,G/5
MAKE-UP TO REFUELING WATER STORAGE TANK. SEE DWG. 5144,D/6.
TEMPORARY CONN. FOR INITIAL FILLING OF SPENT FUEL PIT.
1" TO VOLUME CONTROL TANK THRU SEAL WATER FILTER, SEE DWG 5128A, G/3.
FROM REACTOR COOLANT PUMP SEAL WATER CIRCUIT (4 PUMPS) SEE SK-D-3 ON DWG Nº 5128A, H/3
ELEV. 587'-0"

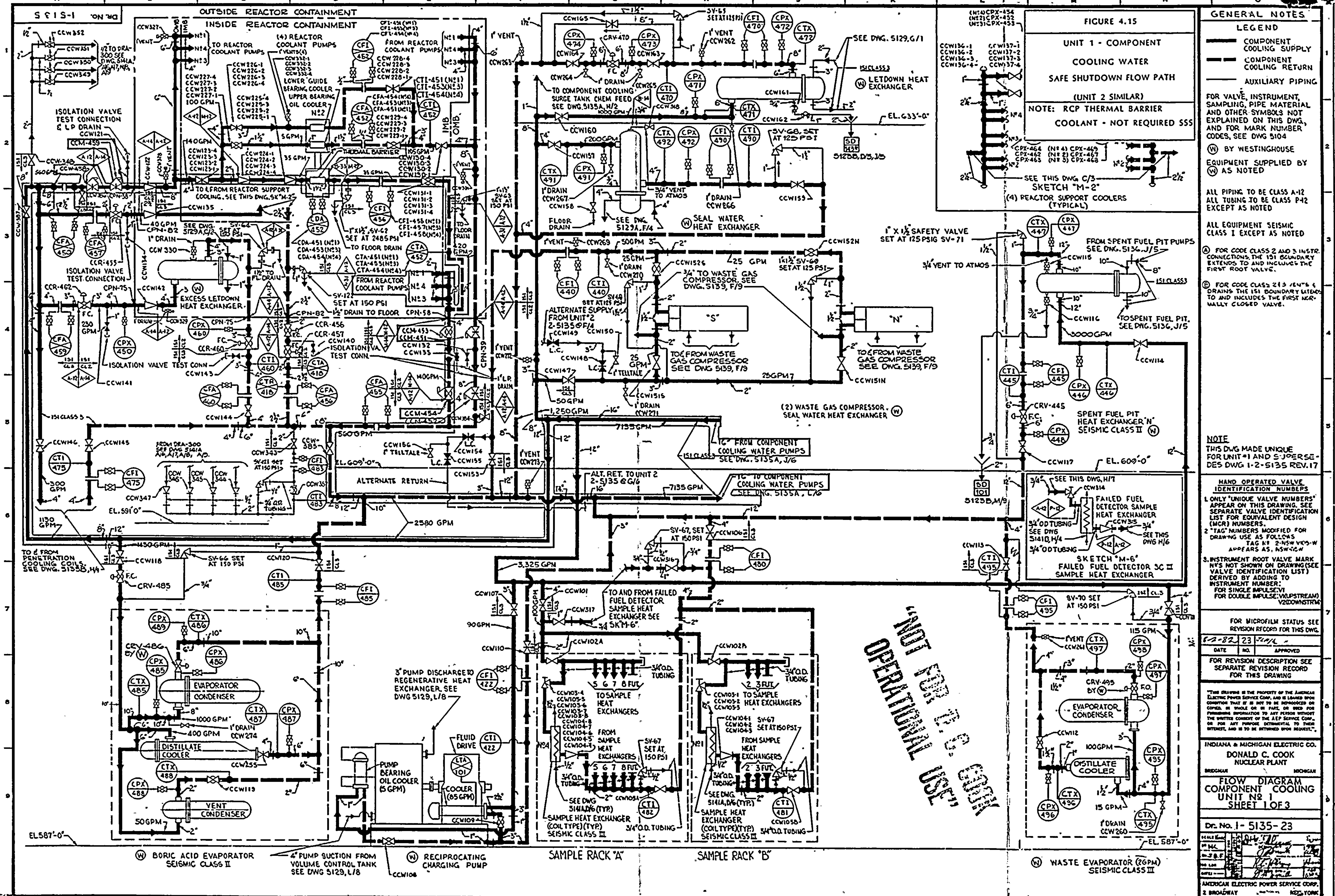


FIGURE 4.15
UNIT 1 - COMPONENT COOLING WATER SAFE SHUTDOWN FLOW PATH
(UNIT 2 SIMILAR)
NOTE: RCP THERMAL BARRIER COOLANT - NOT REQUIRED SSS
OUTSIDE REACTOR CONTAINMENT
INSIDE REACTOR CONTAINMENT
(4) REACTOR COOLANT PUMPS
FROM REACTOR COOLANT PUMPS
LOWER GUIDE BEARING COOLER
UPPER BEARING OIL COOLER
THERMAL BARRIER
TO & FROM REACTOR SUPPORT COOLING. SEE THIS DWG. SK"M-2"
ISOLATION VALVE TEST CONNECTION & LP DRAIN
EXCESS LETDOWN HEAT EXCHANGER
ISOLATION VALVE TEST CONN
FROM REACTOR COOLANT PUMPS
LETDOWN HEAT EXCHANGER
TO COMPONENT COOLING SURGE TANK CHEM FEED SEE DWG. 5135A, H/2
SEAL WATER HEAT EXCHANGER
ALTERNATE SUPPLY FROM UNIT 2 2-5135 @ F/4
TO & FROM WASTE GAS COMPRESSOR SEE DWG 5139, F/9
(2) WASTE GAS COMPRESSOR SEAL WATER HEAT EXCHANGER
16" FROM COMPONENT COOLING WATER PUMPS SEE DWG. 5135A, J/6
16" TO COMPONENT COOLING WATER PUMPS SEE DWG. 5135A, L/6
ALT. RET. TO UNIT 2 2-5135 @ G/4
ALTERNATE RETURN
2580 GPM
3,325 GPM
TO & FROM PENETRATION COOLING COILS SEE DWG. 5135B, H/4
EVAPORATOR CONDENSER
DISTILLATE COOLER
VENT CONDENSER
BORIC ACID EVAPORATOR SEISMIC CLASS II
4" PUMP SUCTION FROM VOLUME CONTROL TANK SEE DWG 5129, L/8
3" PUMP DISCHARGE TO REGENERATIVE HEAT EXCHANGER. SEE DWG 5129, L/8
PUMP BEARING OIL COOLER (5 GPM)
FLUID DRIVE
COOLER (85 GPM)
RECIPROCATING CHARGING PUMP
TO AND FROM FAILED FUEL DETECTOR SAMPLE HEAT EXCHANGER SEE SK "M-6"
TO SAMPLE HEAT EXCHANGERS
FROM SAMPLE HEAT EXCHANGERS
SAMPLE HEAT EXCHANGER (COIL TYPE)(TYP) SEISMIC CLASS III
SAMPLE RACK "A"
SAMPLE RACK "B"
"NOT FOR FIELD USE" OPERATIONAL USE"
FROM SPENT FUEL PIT PUMPS SEE DWG. 5136, J/5
TO SPENT FUEL PIT. SEE DWG. 5136, J/5
SPENT FUEL PIT HEAT EXCHANGER "N" SEISMIC CLASS II
(4) REACTOR SUPPORT COOLERS (TYPICAL)
SKETCH "M-2"
SKETCH "M-6" FAILED FUEL DETECTOR SC II SAMPLE HEAT EXCHANGER
WASTE EVAPORATOR (26GPM) SEISMIC CLASS III
GENERAL NOTES
LEGEND
COMPONENT COOLING SUPPLY
COMPONENT COOLING RETURN
AUXILIARY PIPING
FOR VALVE, INSTRUMENT, SAMPLING, PIPE MATERIAL AND OTHER SYMBOLS NOT EXPLAINED ON THIS DWG, AND FOR MARK NUMBER CODES, SEE DWG 5104
(W) BY WESTINGHOUSE
EQUIPMENT SUPPLIED BY (W) AS NOTED
ALL PIPING TO BE CLASS A-12 ALL TUBING TO BE CLASS P42 EXCEPT AS NOTED
ALL EQUIPMENT SEISMIC CLASS I EXCEPT AS NOTED
NOTE
THIS DWG MADE UNIQUE FOR UNIT #1 AND SUPERSEDES DWG 1-2-5135 REV. 17
HAND OPERATED VALVE IDENTIFICATION NUMBERS
INDIANA & MICHIGAN ELECTRIC CO.
DONALD C. COOK NUCLEAR PLANT
FLOW DIAGRAM COMPONENT COOLING UNIT NO 1 SHEET 1 OF 3
Dr. No. 1-5135-23
AMERICAN ELECTRIC POWER SERVICE CORP. 2 BROADWAY NEW YORK

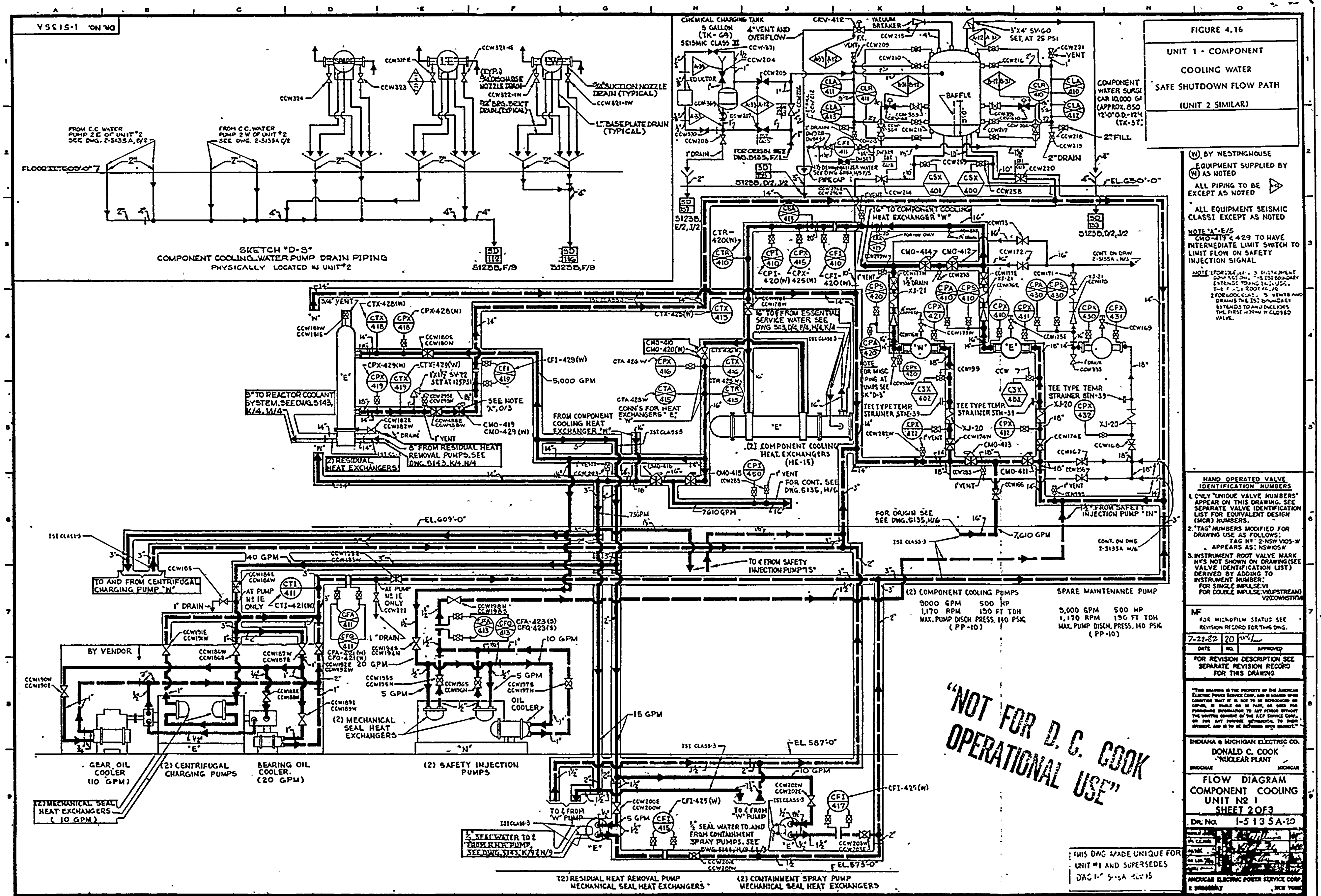
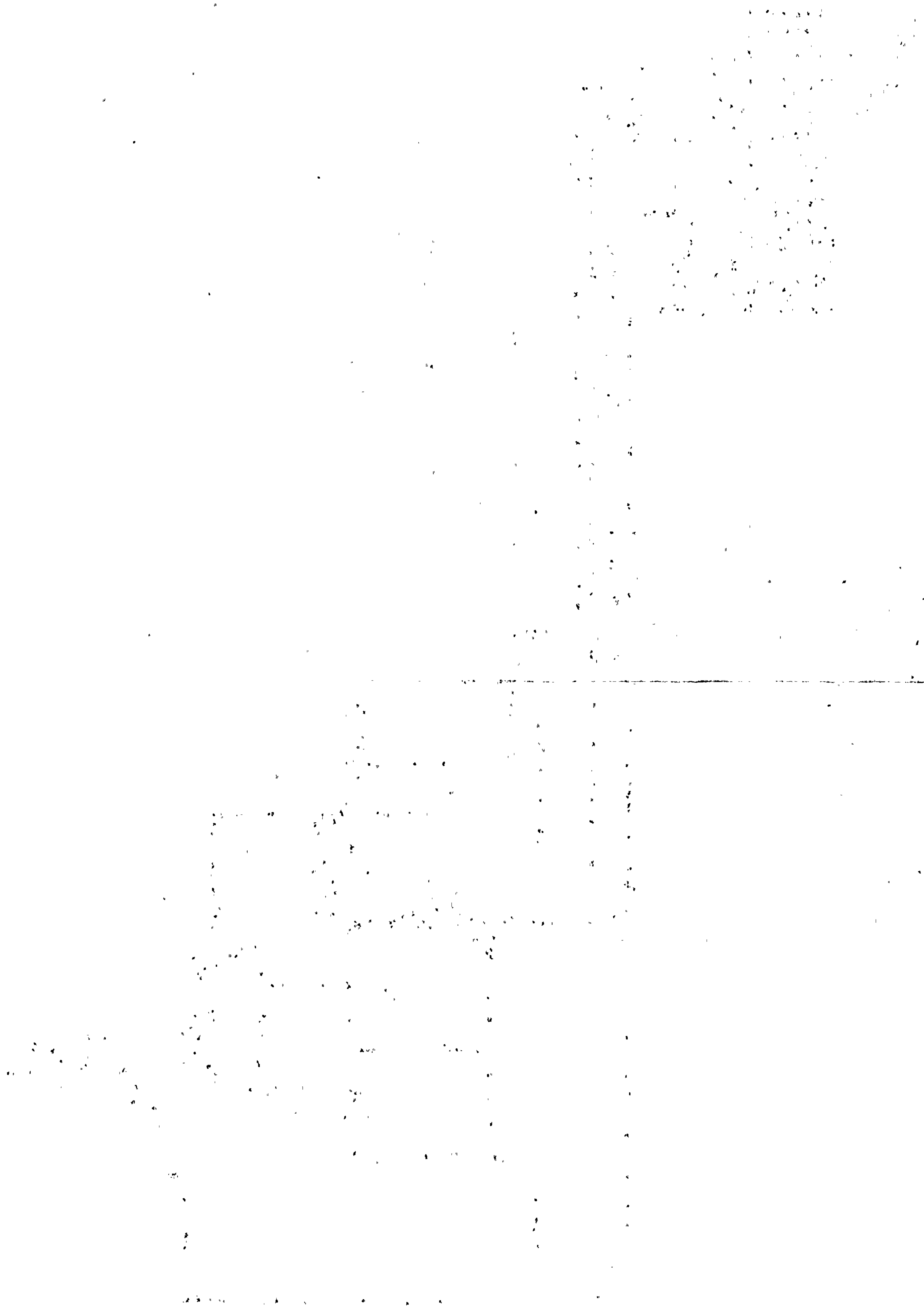


FIGURE 4.16
UNIT 1 - COMPONENT COOLING WATER SAFE SHUTDOWN FLOW PATH
(UNIT 2 SIMILAR)
SKETCH "D-3"
COMPONENT COOLING WATER PUMP DRAIN PIPING
PHYSICALLY LOCATED IN UNIT #2
FROM C.C. WATER PUMP 2E OF UNIT #2 SEE DWG. 2-5135A, B/2
FROM C.C. WATER PUMP 2W OF UNIT #2 SEE DWG. 2-5135A C/2
3/4" SUCTION NOZZLE DRAIN (TYPICAL)
1" BASE PLATE DRAIN (TYPICAL)
CHEMICAL CHARGING TANK 5 GALLON (TK-69) SEISMIC CLASS III
4" VENT AND OVERFLOW
VACUUM BREAKER
3"x4" SV-60 SET AT 25 PSI
BAFFLE
COMPONENT WATER SURGE TANK 10,000 GAL (APPROX. 850 GAL) (TK-37)
2" FILL
2" DRAIN
EL. 630'-0"
(W) BY WESTINGHOUSE
(N) EQUIPMENT SUPPLIED BY AS NOTED
ALL PIPING TO BE EXCEPT AS NOTED
ALL EQUIPMENT SEISMIC CLASS I EXCEPT AS NOTED
NOTE "A" - E/5
CMO-419 & 429 TO HAVE INTERMEDIATE LIMIT SWITCH TO LIMIT FLOW ON SAFETY INJECTION SIGNAL
16" TO COMPONENT COOLING HEAT EXCHANGER "W"
16" TO & FROM ESSENTIAL SERVICE WATER SEE DWG 5113, D/4, F/4, H/4, K/4
TEE TYPE TEMP. STRAINER STN-39
5,000 GPM
FROM COMPONENT COOLING HEAT EXCHANGER "W"
CONN'S FOR HEAT EXCHANGERS "E" "W"
(2) COMPONENT COOLING HEAT EXCHANGERS (HE-15)
6" TO REACTOR COOLANT SYSTEM, SEE DWG. 5143, K/4, M/4
6" FROM RESIDUAL HEAT REMOVAL PUMPS, SEE DWG. 5143, K/4, N/4
(2) RESIDUAL HEAT EXCHANGERS
FOR CONT. SEE DWG. 5135, H/6
7610 GPM
FOR ORIGIN SEE DWG. 5135, H/6
7,610 GPM
FROM SAFETY INJECTION PUMP "IN"
TO & FROM SAFETY INJECTION PUMP "IS"
EL. 609'-0"
TO AND FROM CENTRIFUGAL CHARGING PUMP "N"
(2) COMPONENT COOLING PUMPS
9000 GPM 500 HP
1,170 RPM 190 FT TDH
MAX. PUMP DISCH PRESS. 140 PSIG
(PP-10)
SPARE MAINTENANCE PUMP
9,000 GPM 500 HP
1,170 RPM 190 FT TDH
MAX. PUMP DISCH. PRESS. 140 PSIG
(PP-10)
BY VENDOR
GEAR OIL COOLER (10 GPM)
(2) CENTRIFUGAL CHARGING PUMPS
BEARING OIL COOLER (20 GPM)
(2) MECHANICAL SEAL HEAT EXCHANGERS
(2) SAFETY INJECTION PUMPS
OIL COOLER
(2) MECHANICAL SEAL HEAT EXCHANGERS (10 GPM)
EL. 587'-0"
15 GPM
TO & FROM "W" PUMP
1/2" SEAL WATER TO & FROM R.H.R. PUMP SEE DWG. 5143, K/9 & N/9
1/2" SEAL WATER TO AND FROM CONTAINMENT SPRAY PUMPS. SEE DWG. 5144
EL. 573'-0"
(2) RESIDUAL HEAT REMOVAL PUMP MECHANICAL SEAL HEAT EXCHANGERS
(2) CONTAINMENT SPRAY PUMP MECHANICAL SEAL HEAT EXCHANGERS
"NOT FOR D. C. COOK OPERATIONAL USE"
THIS DWG MADE UNIQUE FOR UNIT #1 AND SUPERSEDES
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:
3. INSTRUMENT ROOT VALVE MARK NO'S NOT SHOWN ON DRAWING (SEE VALVE IDENTIFICATION LIST) DERIVED BY ADDING TO INSTRUMENT NUMBER:
FOR REVISION DESCRIPTION SEE SEPARATE REVISION RECORD FOR THIS DRAWING
INDIANA & MICHIGAN ELECTRIC CO.
DONALD C. COOK NUCLEAR PLANT
FLOW DIAGRAM COMPONENT COOLING UNIT No 1 SHEET 2 OF 3
DR. NO. 1-5135A-20
AMERICAN ELECTRIC POWER SERVICE CORP.



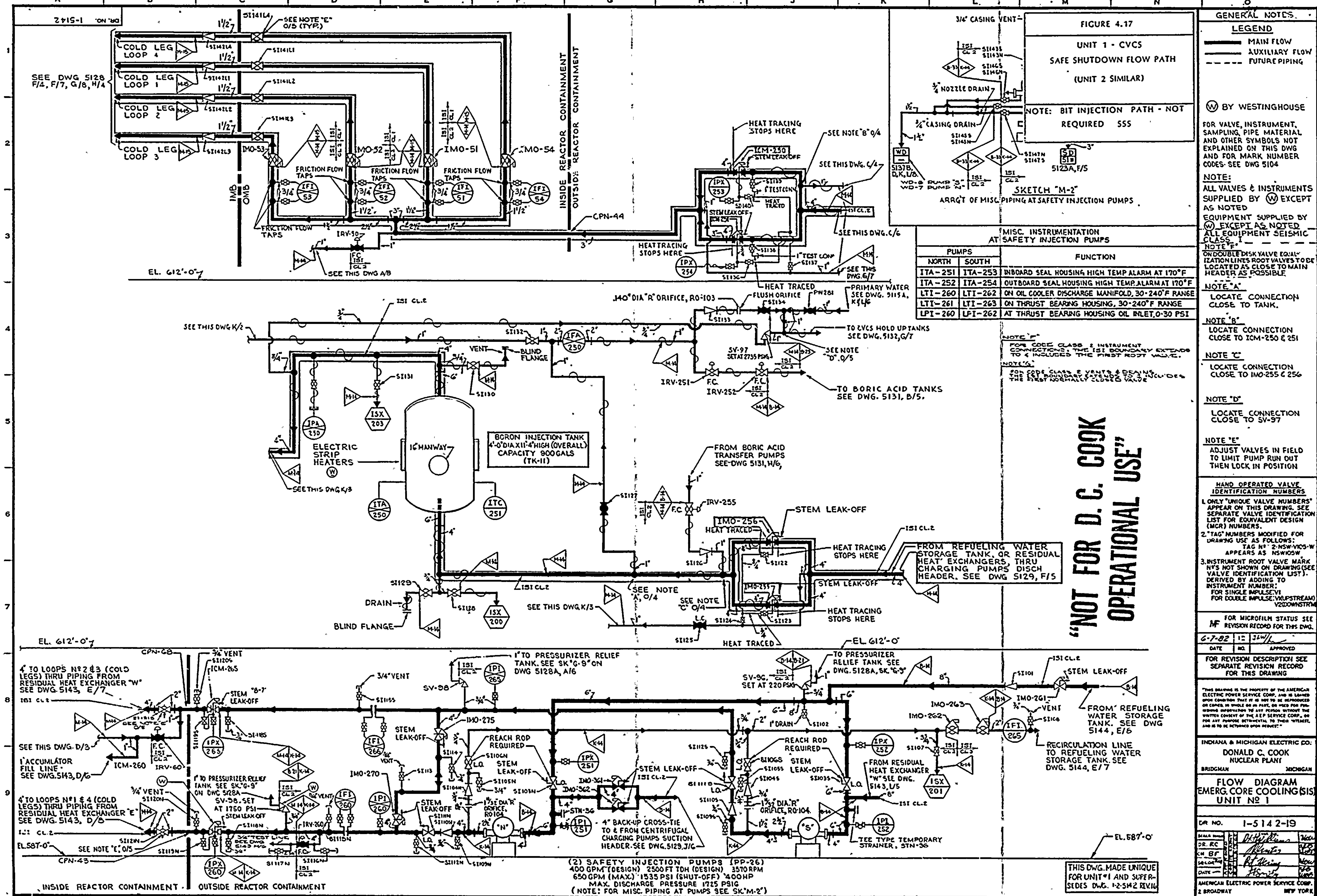


FIGURE 4.17
UNIT 1 - CVCS
SAFE SHUTDOWN FLOW PATH
(UNIT 2 SIMILAR)
NOTE: BIT INJECTION PATH - NOT REQUIRED SSS
SKETCH "M-2"
ARR'G'T OF MISC PIPING AT SAFETY INJECTION PUMPS
GENERAL NOTES
LEGEND
MAIN FLOW
AUXILIARY FLOW
FUTURE PIPING
Ⓦ BY WESTINGHOUSE
FOR VALVE, INSTRUMENT, SAMPLING, PIPE MATERIAL AND OTHER SYMBOLS NOT EXPLAINED ON THIS DWG AND FOR MARK NUMBER CODES SEE DWG 5104
NOTE:
ALL VALVES & INSTRUMENTS SUPPLIED BY Ⓦ EXCEPT AS NOTED
EQUIPMENT SUPPLIED BY Ⓦ EXCEPT AS NOTED
ALL EQUIPMENT SEISMIC CLASS I
NOTE "A"
LOCATE CONNECTION CLOSE TO TANK.
NOTE "B"
LOCATE CONNECTION CLOSE TO ICM-250 & 251
NOTE "C"
LOCATE CONNECTION CLOSE TO IMO-255 & 256
NOTE "D"
LOCATE CONNECTION CLOSE TO SV-97
NOTE "E"
ADJUST VALVES IN FIELD TO LIMIT PUMP RUN OUT THEN LOCK IN POSITION
HAND OPERATED VALVE IDENTIFICATION NUMBERS
MISC. INSTRUMENTATION AT SAFETY INJECTION PUMPS
PUMPS NORTH | SOUTH | FUNCTION
ITA-251 | ITA-253 | INBOARD SEAL HOUSING HIGH TEMP ALARM AT 170°F
ITA-252 | ITA-254 | OUTBOARD SEAL HOUSING HIGH TEMP ALARM AT 170°F
LTI-260 | LTI-262 | ON OIL COOLER DISCHARGE MANIFOLD, 30-240°F RANGE
LTI-261 | LTI-263 | ON THRUST BEARING HOUSING, 30-240°F RANGE
LPI-260 | LPI-262 | AT THRUST BEARING HOUSING OIL INLET, 0-30 PSI
BORON INJECTION TANK 4'-0" DIA X 11'-4" HIGH (OVERALL) CAPACITY 900 GALS (TK-11)
ELECTRIC STRIP HEATERS
FROM REFUELING WATER STORAGE TANK, OR RESIDUAL HEAT EXCHANGERS, THRU CHARGING PUMPS DISCH HEADER. SEE DWG 5129, F/5
(2) SAFETY INJECTION PUMPS (PP-26)
400 GPM (DESIGN) 2500 FT TDH (DESIGN) 3570 RPM
650 GPM (MAX) 1535 PSI (SHUT-OFF) 400 HP
MAX. DISCHARGE PRESSURE 1725 PSIG
(NOTE: FOR MISC. PIPING AT PUMPS SEE SK "M-2")
INSIDE REACTOR CONTAINMENT
OUTSIDE REACTOR CONTAINMENT
"NOT FOR D. C. COOK OPERATIONAL USE"
THIS DWG. MADE UNIQUE FOR UNIT #1 AND SUPERSEDES DWG. 1-2-5142 REV.16
INDIANA & MICHIGAN ELECTRIC CO.
DONALD C. COOK NUCLEAR PLANT
BRIDGMAN MICHIGAN
FLOW DIAGRAM EMERG. CORE COOLING (SIS) UNIT Nº 1
DR NO. 1-5142-19
AMERICAN ELECTRIC POWER SERVICE CORP.
2 BROADWAY NEW YORK

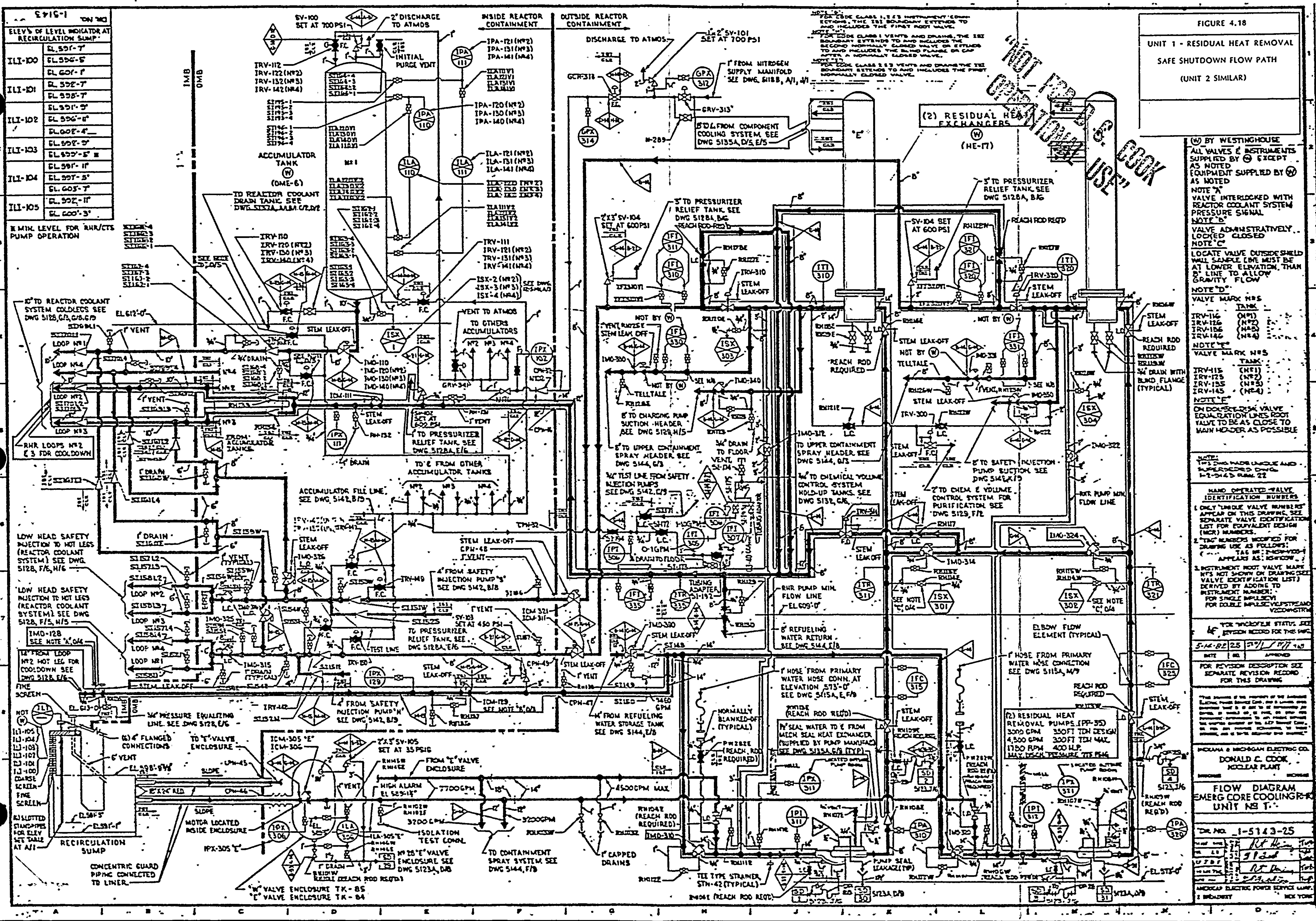


FIGURE 4.18

UNIT 1 - RESIDUAL HEAT REMOVAL SAFE SHUTDOWN FLOW PATH

(UNIT 2 SIMILAR)

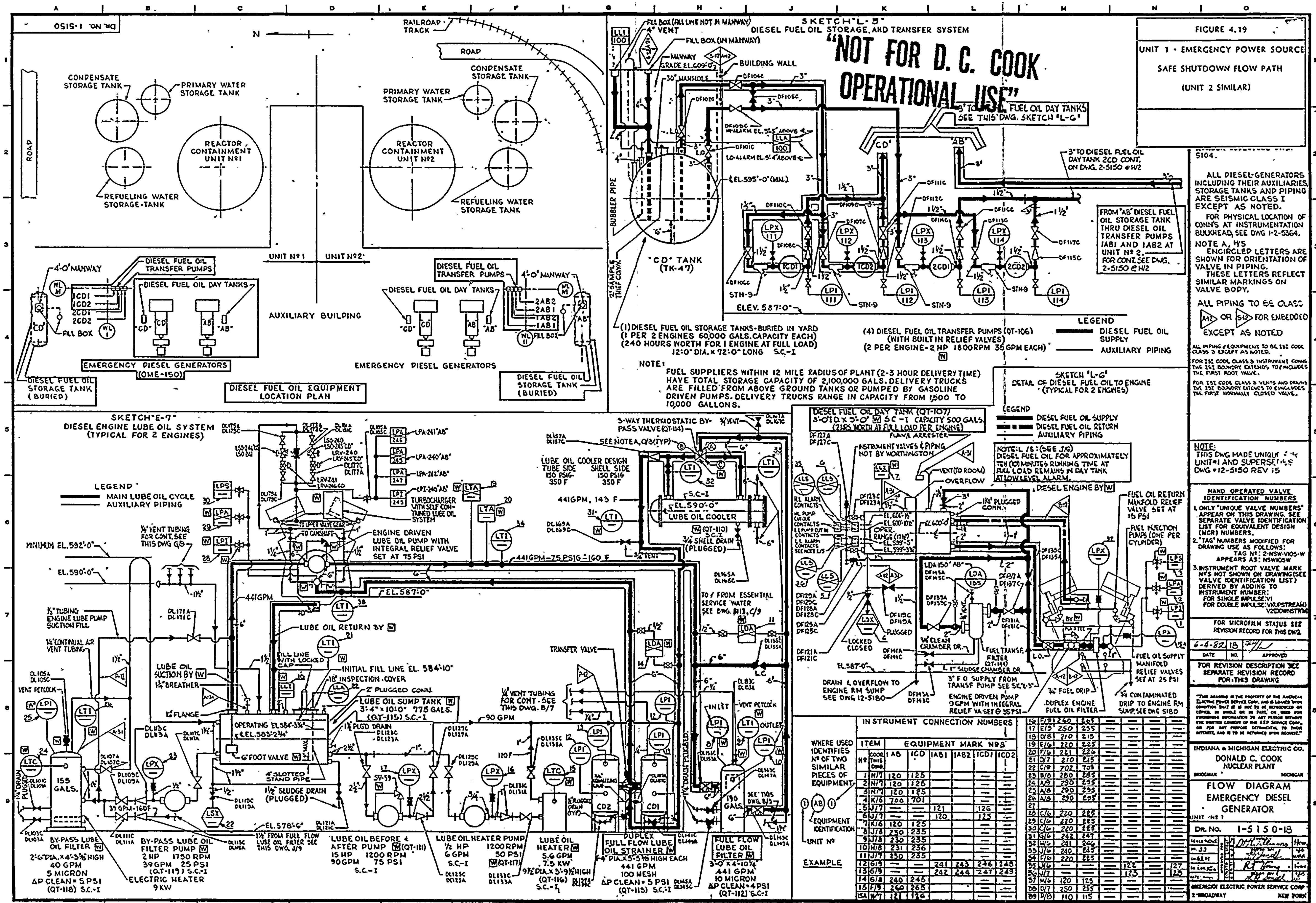


FIGURE 4.19
UNIT 1 - EMERGENCY POWER SOURCE SAFE SHUTDOWN FLOW PATH
(UNIT 2 SIMILAR)
"NOT FOR D. C. COOK OPERATIONAL USE"
DR. NO. 1-5150
RAILROAD TRACK
ROAD
CONDENSATE STORAGE TANK
PRIMARY WATER STORAGE TANK
REACTOR CONTAINMENT UNIT Nº1
REACTOR CONTAINMENT UNIT Nº2
REFUELING WATER STORAGE TANK
UNIT Nº1
UNIT Nº2
AUXILIARY BUILDING
DIESEL FUEL OIL TRANSFER PUMPS
DIESEL FUEL OIL DAY TANKS
4'-0" MANWAY
FILL BOX
EMERGENCY DIESEL GENERATORS (OME-150)
DIESEL FUEL OIL STORAGE TANK (BURIED)
DIESEL FUEL OIL EQUIPMENT LOCATION PLAN
SKETCH "L-5"
DIESEL FUEL OIL STORAGE, AND TRANSFER SYSTEM
"CD" TANK (TK-47)
BUBBLER PIPE
BUILDING WALL
(1) DIESEL FUEL OIL STORAGE TANKS-BURIED IN YARD (1 PER 2 ENGINES 60,000 GALS. CAPACITY EACH) (240 HOURS WORTH FOR 1 ENGINE AT FULL LOAD) 12'-0" DIA. x 72'-0" LONG S.C.-I
(4) DIESEL FUEL OIL TRANSFER PUMPS (QT-106) (WITH BUILT IN RELIEF VALVES) (2 PER ENGINE-2 HP 1800RPM 35 GPM EACH)
NOTE: FUEL SUPPLIERS WITHIN 12 MILE RADIUS OF PLANT (2-3 HOUR DELIVERY TIME) HAVE TOTAL STORAGE CAPACITY OF 2,100,000 GALS. DELIVERY TRUCKS ARE FILLED FROM ABOVE GROUND TANKS OR PUMPED BY GASOLINE DRIVEN PUMPS. DELIVERY TRUCKS RANGE IN CAPACITY FROM 1,500 TO 10,000 GALLONS.
LEGEND
DIESEL FUEL OIL SUPPLY
AUXILIARY PIPING
3" TO DIESEL FUEL OIL DAY TANK 2CD CONT. ON DWG. 2-5150 @ H/2
FROM "AB" DIESEL FUEL OIL STORAGE TANK THRU DIESEL OIL TRANSFER PUMPS 1AB1 AND 1AB2 AT UNIT Nº 2. FOR CONT. SEE DWG. 2-5150 @ H/2
ALL DIESEL-GENERATORS INCLUDING THEIR AUXILIARIES, STORAGE TANKS AND PIPING ARE SEISMIC CLASS I EXCEPT AS NOTED.
FOR PHYSICAL LOCATION OF CONN'S AT INSTRUMENTATION BULKHEAD, SEE DWG 1-2-5364.
NOTE A, H5 ENCIRCLED LETTERS ARE SHOWN FOR ORIENTATION OF VALVE IN PIPING. THESE LETTERS REFLECT SIMILAR MARKINGS ON VALVE BODY.
ALL PIPING TO BE CLASS A12 OR S12 FOR EMBEDDED EXCEPT AS NOTED
SKETCH "L-6"
DETAIL OF DIESEL FUEL OIL TO ENGINE (TYPICAL FOR 2 ENGINES)
DIESEL FUEL OIL DAY TANK (QT-107) 3'-0" I.D. x 5'-0" SC-I CAPACITY 500 GALS. (2 HRS WORTH AT FULL LOAD PER ENGINE)
DIESEL FUEL OIL SUPPLY
DIESEL FUEL OIL RETURN
AUXILIARY PIPING
NOTE: L/S: (SEE J/6) DIESEL FUEL OIL FOR APPROXIMATELY TEN (10) MINUTES RUNNING TIME AT FULL LOAD REMAINS IN DAY TANK AT LOW LEVEL ALARM.
SKETCH "E-7"
DIESEL ENGINE LUBE OIL SYSTEM (TYPICAL FOR 2 ENGINES)
MAIN LUBE OIL CYCLE
AUXILIARY PIPING
LUBE OIL COOLER
ENGINE DRIVEN LUBE OIL PUMP WITH INTEGRAL RELIEF VALVE SET AT 75 PSI
441 GPM - 75 PSIG - 160 F
LUBE OIL RETURN BY W
INITIAL FILL LINE EL. 584'-10"
18" INSPECTION COVER
LUBE OIL SUMP TANK 3'-4" x 10'-0" 775 GALS. (QT-115) S.C.-I
BY-PASS LUBE OIL FILTER 2'-6" DIA. x 4'-3 3/8" HIGH 40 GPM 5 MICRON ΔP CLEAN = 5 PSI (QT-118) S.C.-I
BY-PASS LUBE OIL FILTER PUMP 2 HP 1750 RPM 39 GPM 25 PSI (QT-119) S.C.-I
ELECTRIC HEATER 9 KW
LUBE OIL BEFORE & AFTER PUMP (QT-111) 15 HP 1200 RPM 90 GPM 75 PSI S.C.-I
LUBE OIL HEATER PUMP 1/2 HP 1200 RPM 6 GPM 50 PSI (QT-117) S.C.-I
LUBE OIL HEATER 5.6 GPM 7.5 KW (QT-116) S.C.-I
DUPLEX FULL FLOW LUBE OIL STRAINER 441 GPM 100 MESH ΔP CLEAN = 5 PSI (QT-113) S.C.-I
FULL FLOW LUBE OIL FILTER 441 GPM 10 MICRON ΔP CLEAN = 4 PSI (QT-112) S.C.-I
INSTRUMENT CONNECTION NUMBERS
EQUIPMENT IDENTIFICATION
EXAMPLE
HAND OPERATED VALVE IDENTIFICATION NUMBERS
INDIANA & MICHIGAN ELECTRIC CO.
DONALD C. COOK NUCLEAR PLANT
FLOW DIAGRAM EMERGENCY DIESEL GENERATOR
UNIT Nº 1
DR. NO. 1-5150-18
AMERICAN ELECTRIC POWER SERVICE CORP.
2 BROADWAY NEW YORK

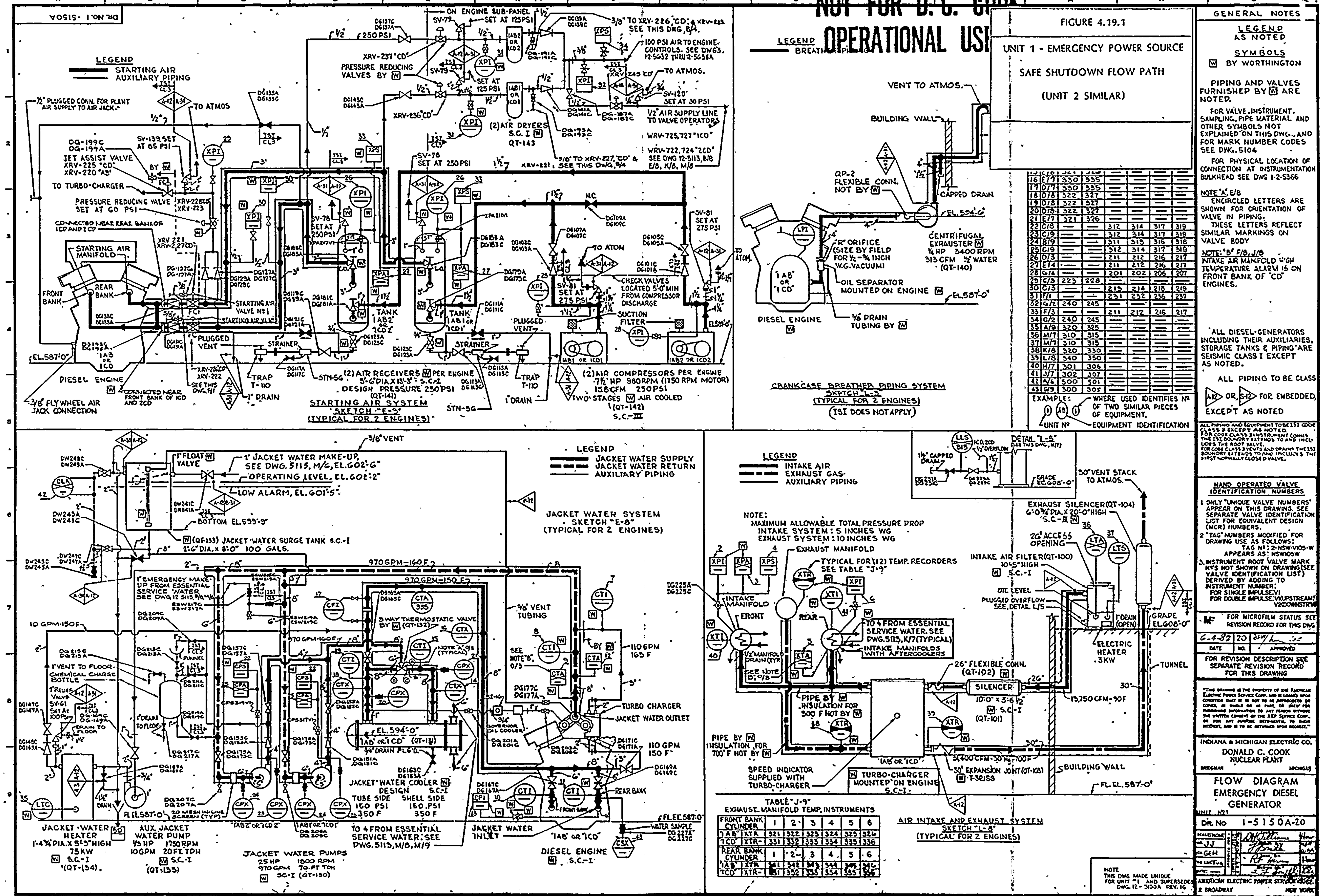
"NOT FOR D.C. COOK OPERATIONAL USE"

FIGURE 4.19.1

UNIT 1 - EMERGENCY POWER SOURCE

SAFE SHUTDOWN FLOW PATH

(UNIT 2 SIMILAR)



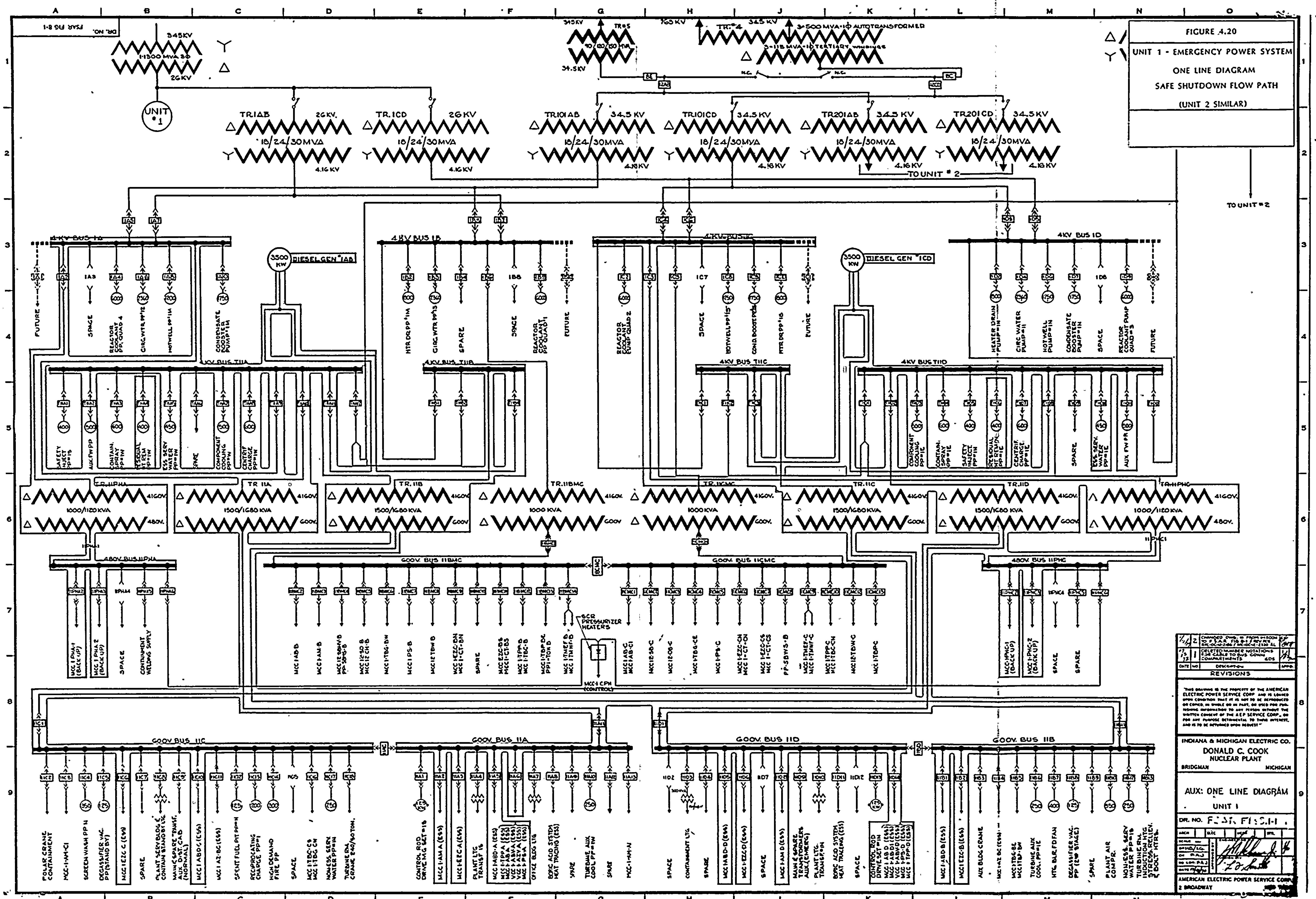


FIGURE 4.20
UNIT 1 - EMERGENCY POWER SYSTEM
ONE LINE DIAGRAM
SAFE SHUTDOWN FLOW PATH
(UNIT 2 SIMILAR)
345KV
1-1300 MVA 3Φ
26KV
UNIT #1
TR1AB
TR.1CD
TR101AB
TR101CD
TR201AB
TR201CD
18/24/30MVA
4.16KV
34.5KV
TO UNIT #2
DIESEL GEN #1AB
DIESEL GEN #1CD
3500 KW
4KV BUS 1A
4KV BUS 1B
4KV BUS 1C
4KV BUS 1D
4KV BUS T11A
4KV BUS T11B
4KV BUS T11C
4KV BUS T11D
TR.11PHA
TR 11A
TR.11B
TR.11BMC
TR.11CMC
TR.11C
TR.11D
TR.11PHC
600V. BUS 11BMC
600V. BUS 11CMC
480V. BUS 11PHA
480V. BUS 11PHC
600V. BUS 11C
600V. BUS 11A
600V. BUS 11D
600V. BUS 11B
SCR PRESSURIZER HEATERS
REVISIONS
INDIANA & MICHIGAN ELECTRIC CO.
DONALD C. COOK NUCLEAR PLANT
BRIDGMAN MICHIGAN
AUX: ONE LINE DIAGRAM
UNIT 1
AMERICAN ELECTRIC POWER SERVICE CORP.
2 BROADWAY

FIGURE 4.21

UNIT 1 - EMERGENCY POWER SYSTEM
SAFE SHUTDOWN FLOW PATH
(UNIT 2 SIMILAR)

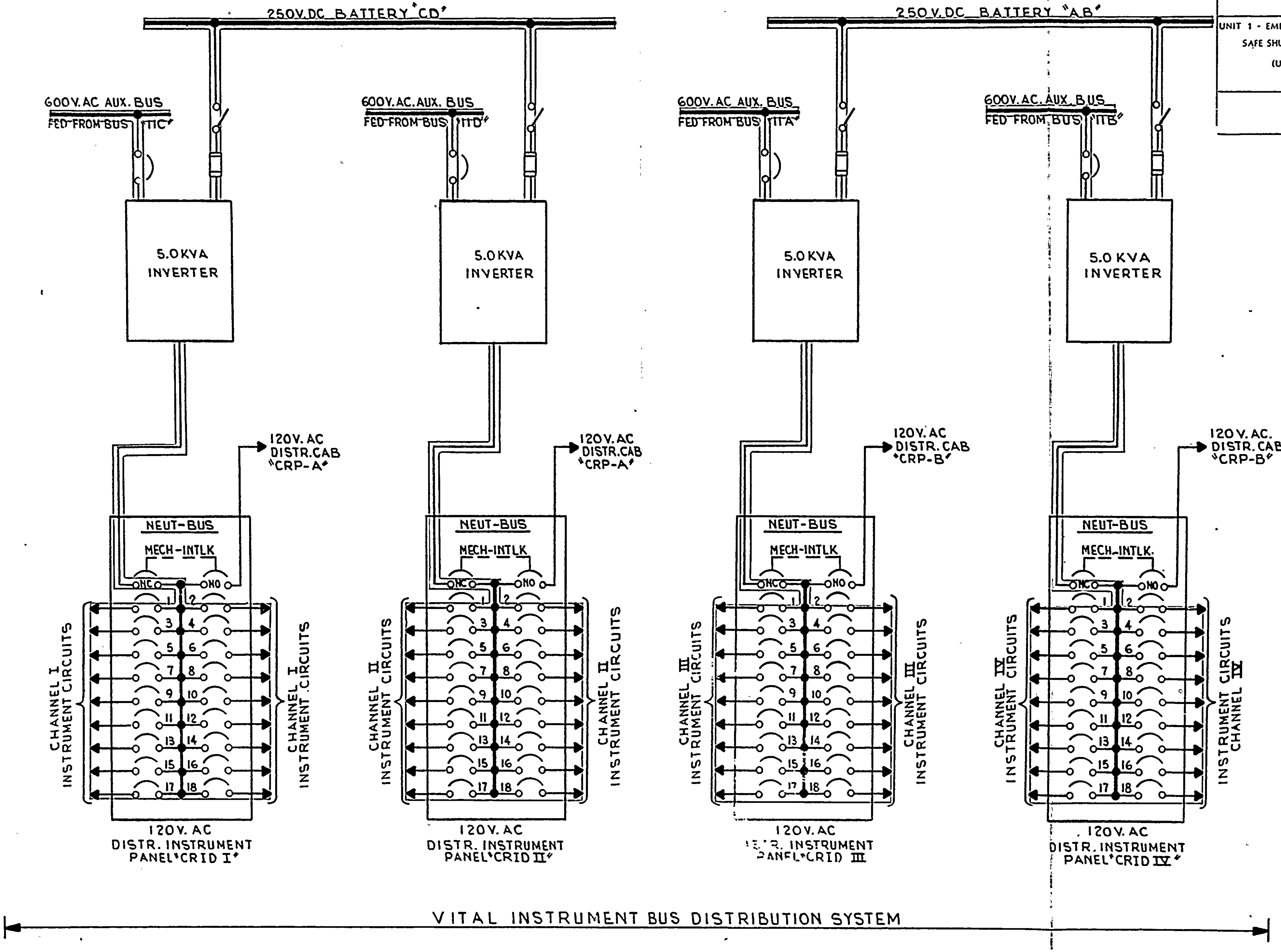


FIGURE 8.3-1
REV. 12-21-81

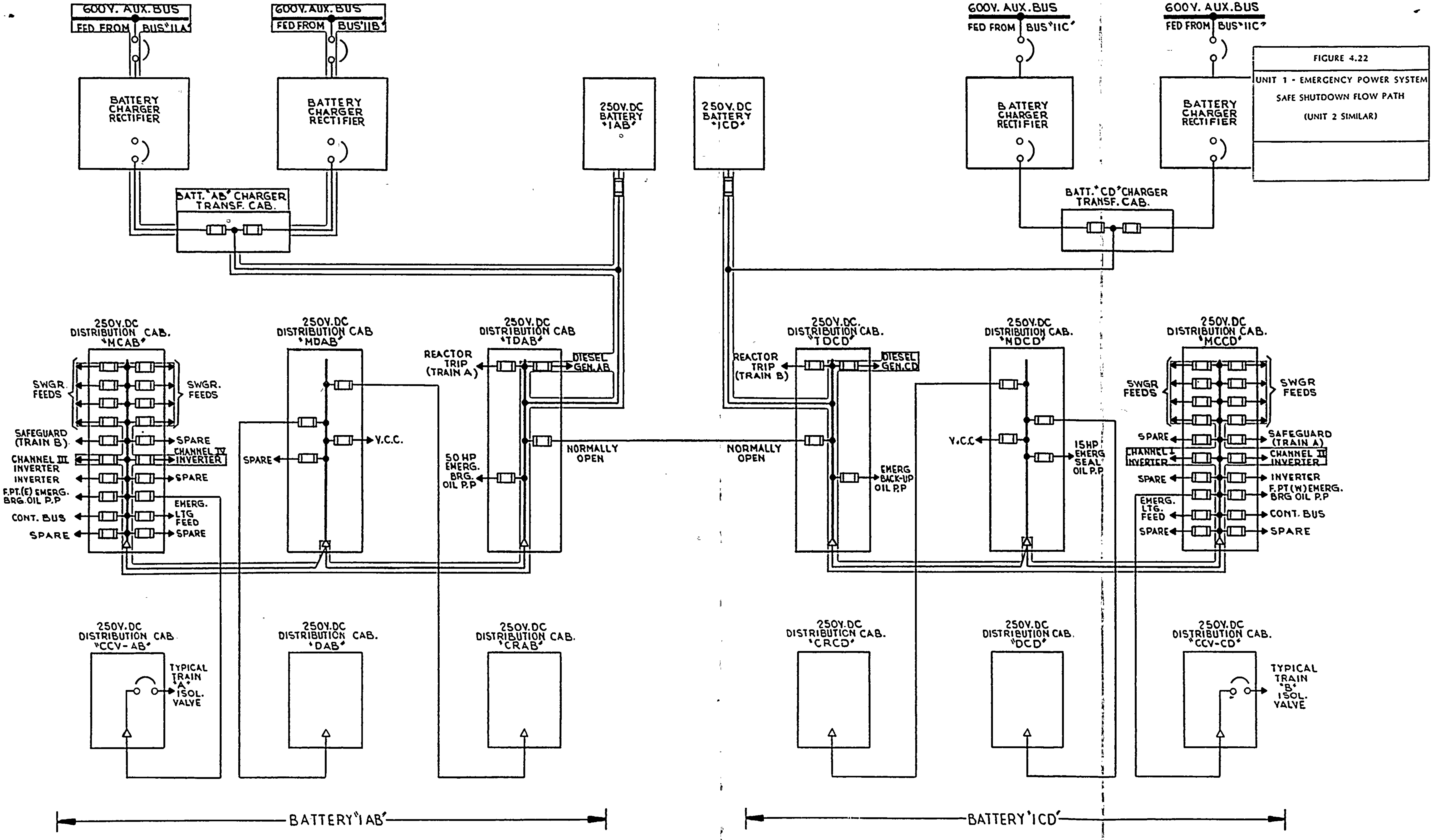
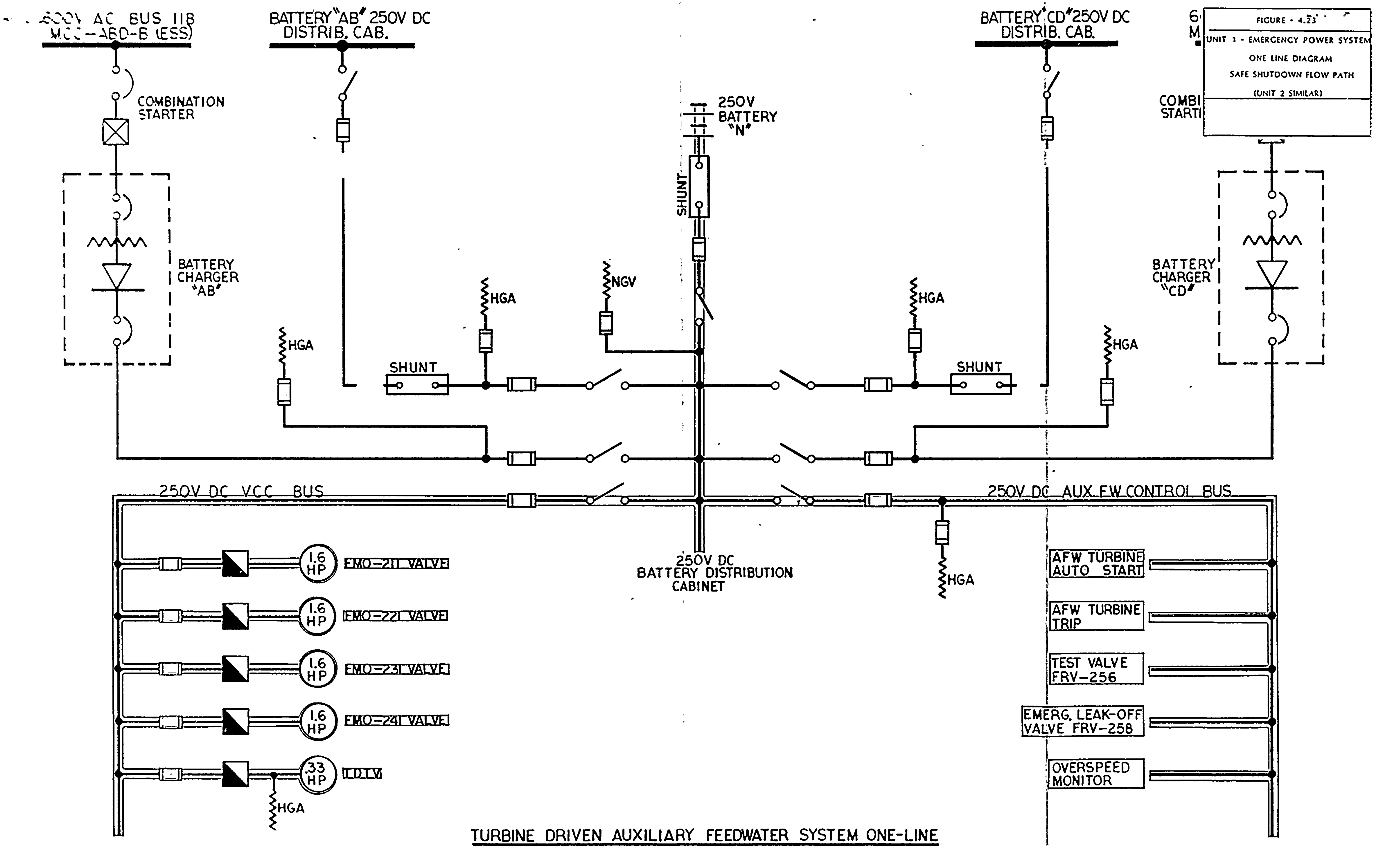


FIGURE 4.22

UNIT 1 - EMERGENCY POWER SYSTEM SAFE SHUTDOWN FLOW PATH

(UNIT 2 SIMILAR)



TURBINE DRIVEN AUXILIARY FEEDWATER SYSTEM ONE-LINE

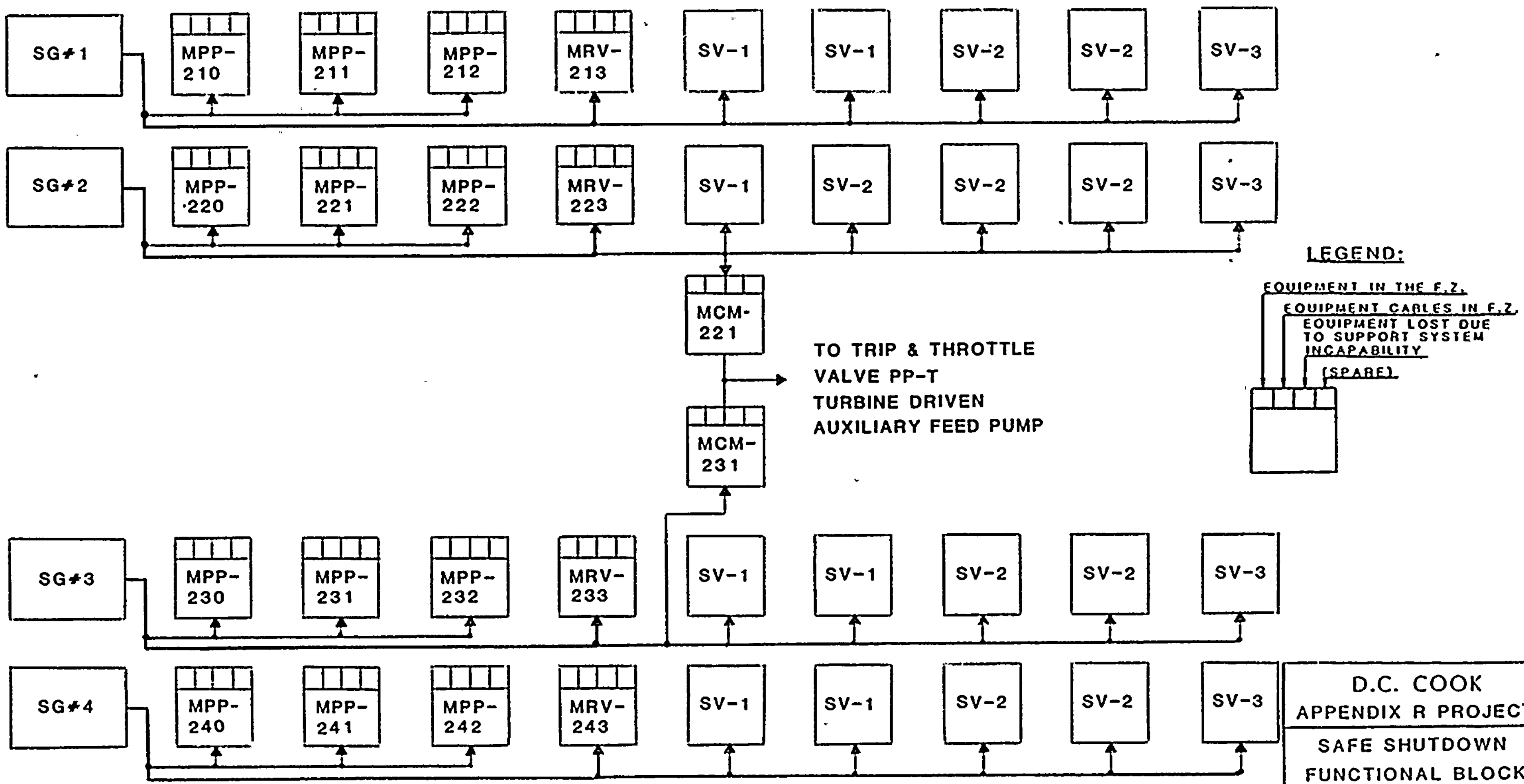
FIGURE - 4.23

UNIT 1 - EMERGENCY POWER SYSTEM

ONE LINE DIAGRAM

SAFE SHUTDOWN FLOW PATH

(UNIT 2 SIMILAR)



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

FIGURE 4.24

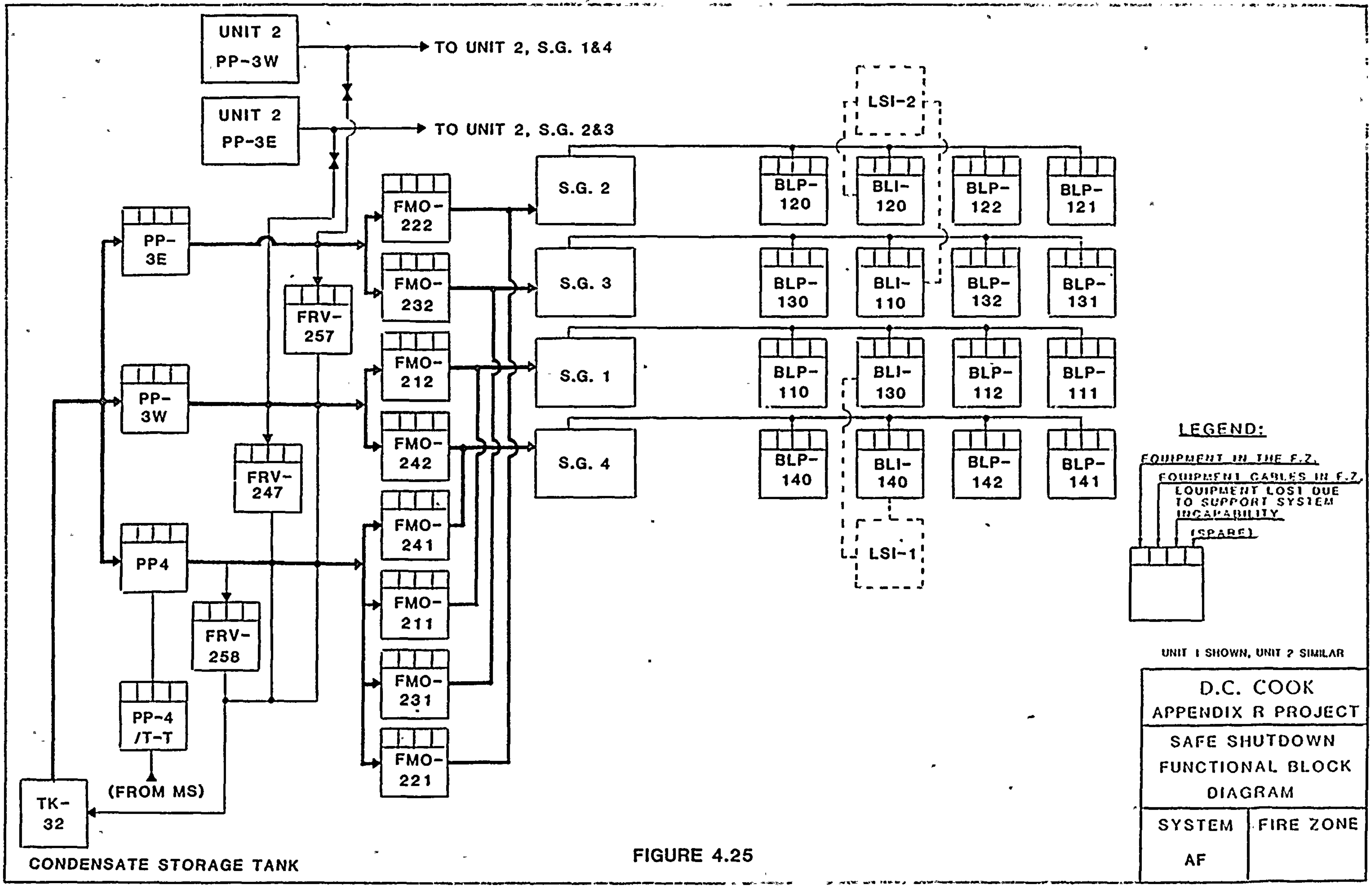

UNIT 2 PP-3W
TO UNIT 2, S.G. 1&4
UNIT 2 PP-3E
TO UNIT 2, S.G. 2&3
PP-3E
PP-3W
PP4
PP-4 /T-T
(FROM MS)
TK-32
CONDENSATE STORAGE TANK
FRV-257
FRV-247
FRV-258
FMO-222
FMO-232
FMO-212
FMO-242
FMO-241
FMO-211
FMO-231
FMO-221
S.G. 2
S.G. 3
S.G. 1
S.G. 4
LSI-2
BLP-120
BLI-120
BLP-122
BLP-121
BLP-130
BLI-110
BLP-132
BLP-131
BLP-110
BLI-130
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

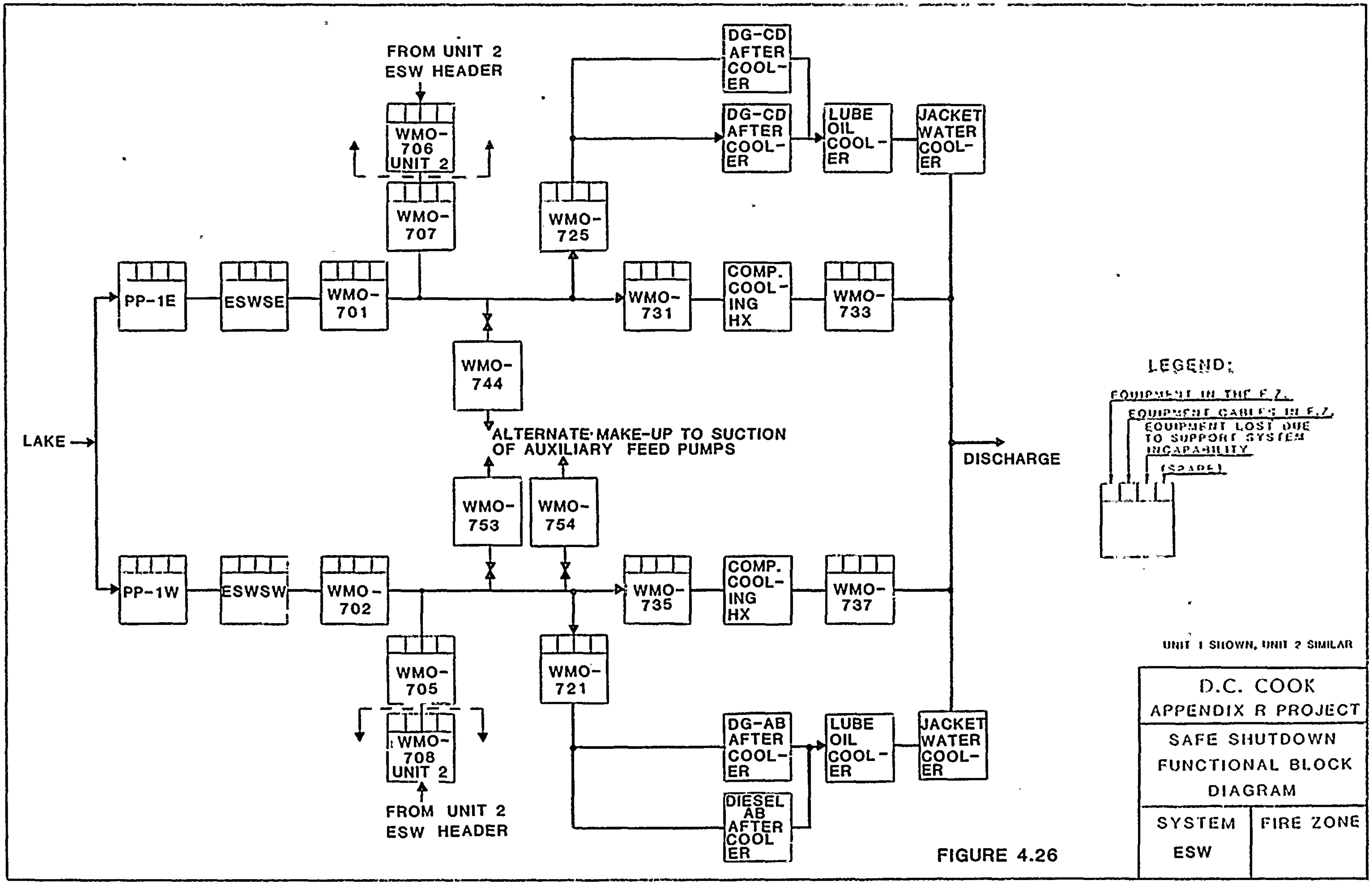
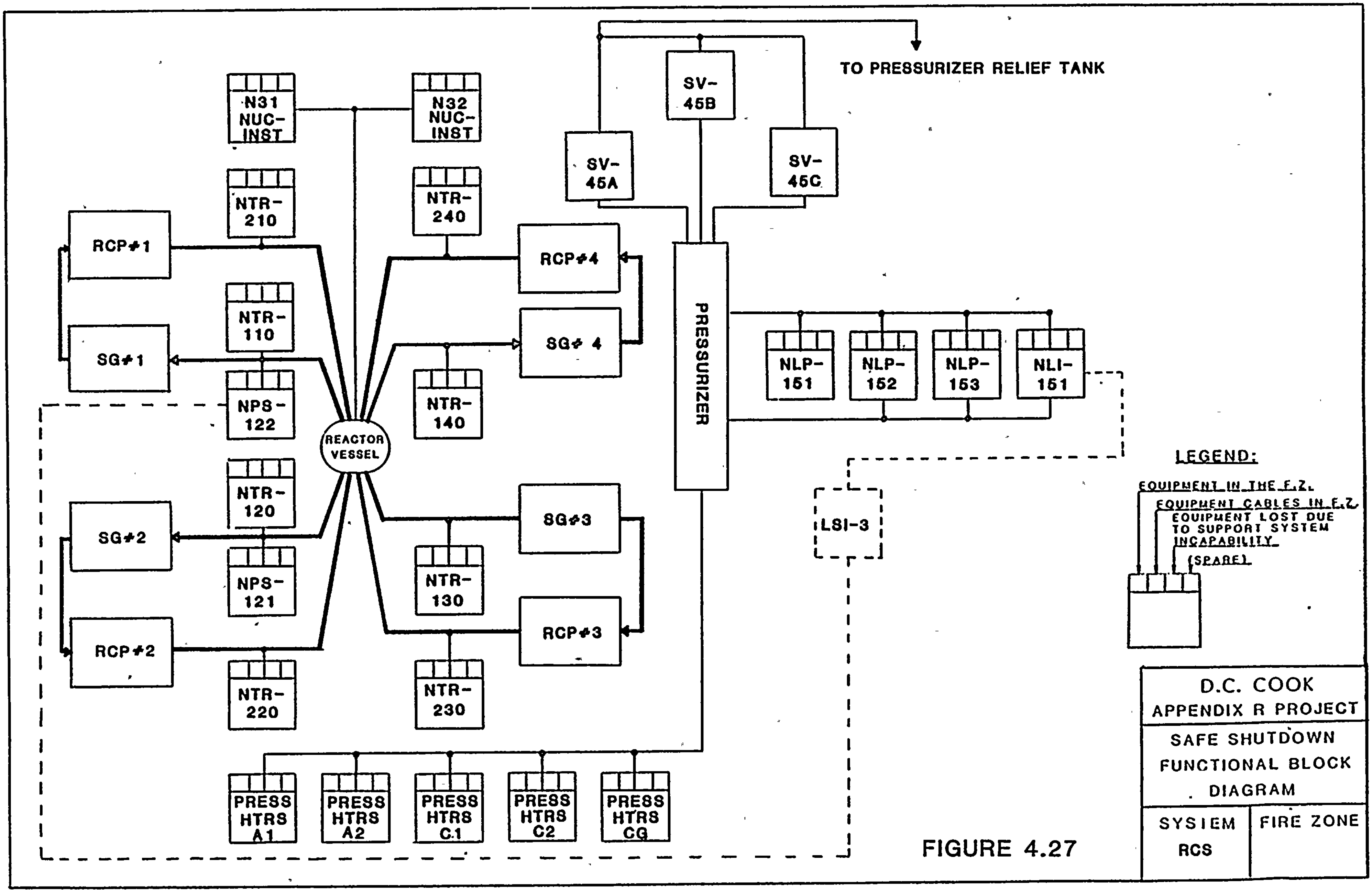

FROM UNIT 2 ESW HEADER
WMO-706 UNIT 2
WMO-707
DG-CD AFTER COOL-ER
DG-CD AFTER COOL-ER
LUBE OIL COOL-ER
JACKET WATER COOL-ER
WMO-725
PP-1E
ESWSE
WMO-701
WMO-731
COMP. COOL-ING HX
WMO-733
WMO-744
LAKE
ALTERNATE MAKE-UP TO SUCTION OF AUXILIARY FEED PUMPS
DISCHARGE
WMO-753
WMO-754
PP-1W
ESWSW
WMO-702
WMO-735
COMP. COOL-ING HX
WMO-737
WMO-705
WMO-721
WMO-708 UNIT 2
FROM UNIT 2 ESW HEADER
DG-AB AFTER COOL-ER
DIESEL AB AFTER COOL ER
LUBE OIL COOL-ER
JACKET WATER COOL-ER
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
ESW
FIRE ZONE

FIGURE 4.26



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

FIGURE 4.27

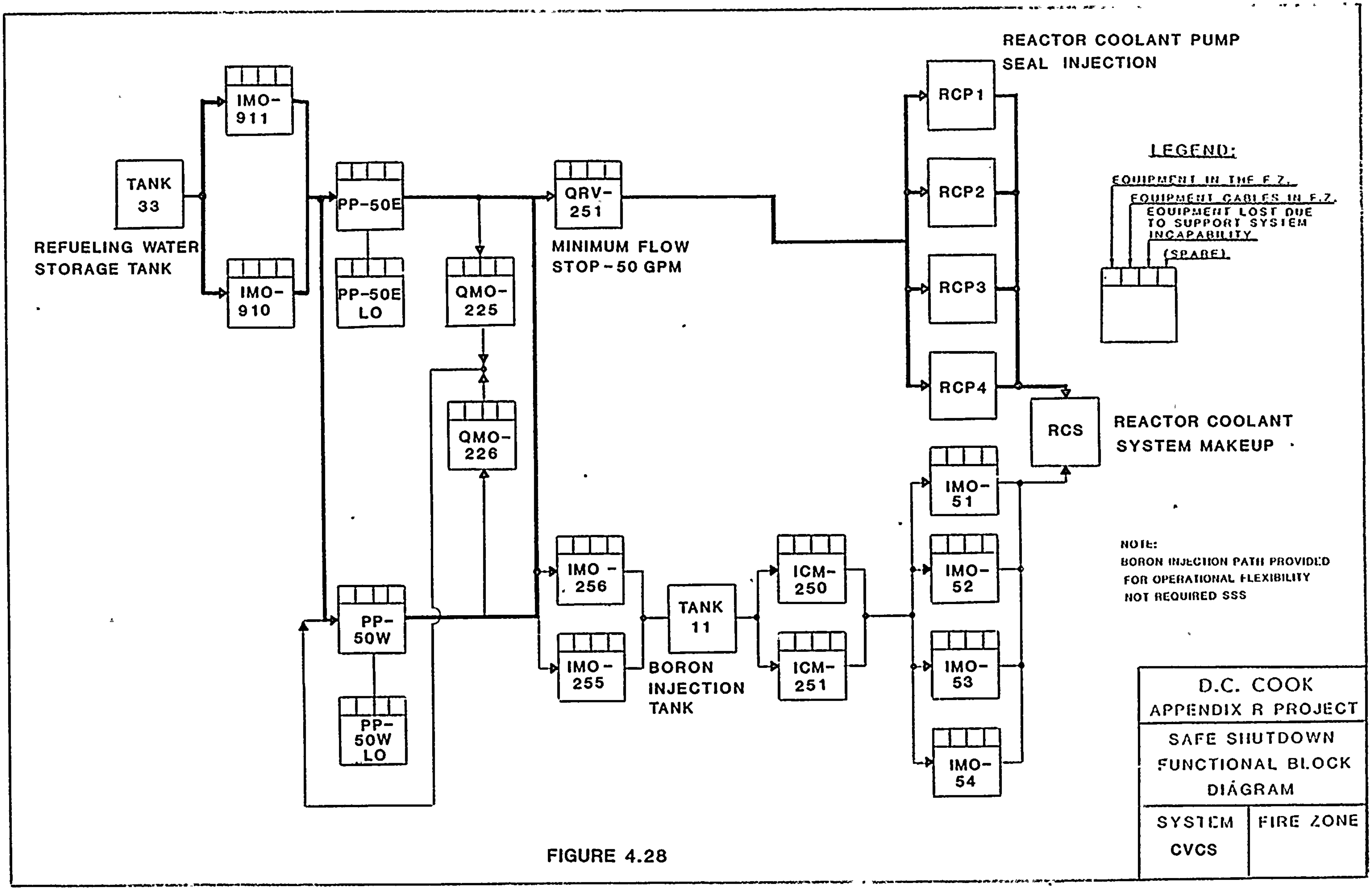
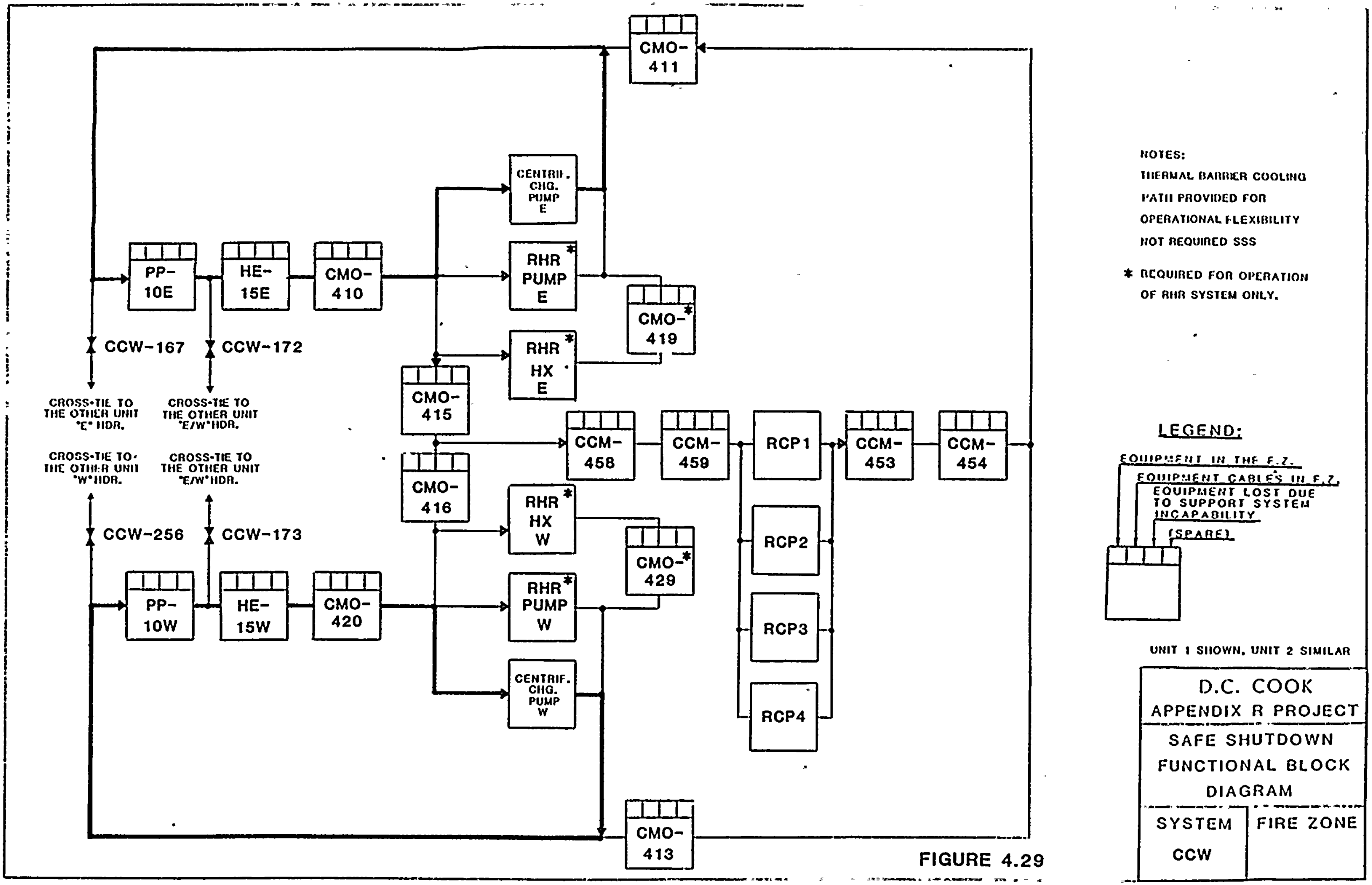
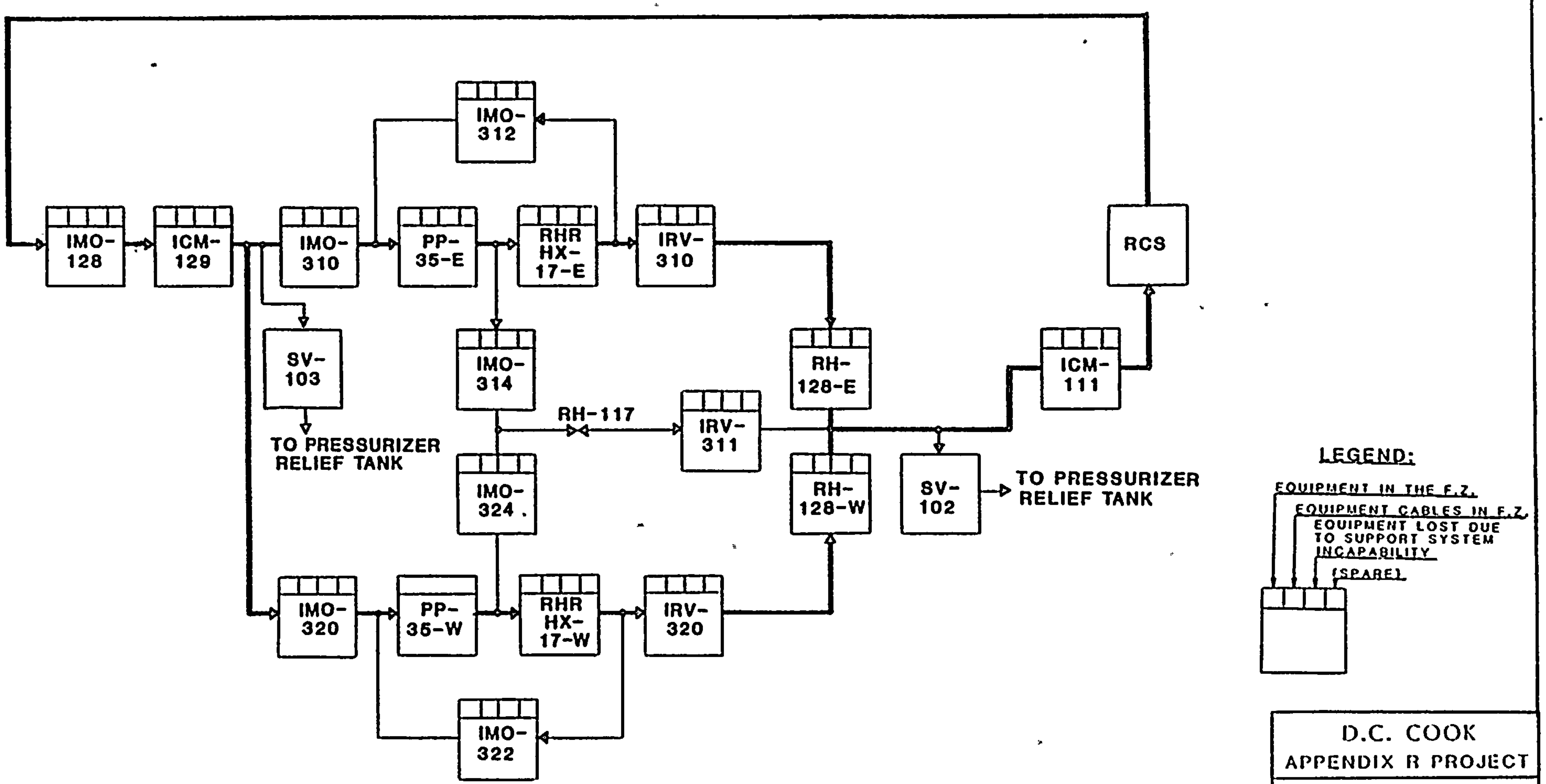

REACTOR COOLANT PUMP SEAL INJECTION
TANK 33
REFUELING WATER STORAGE TANK
IMO-911
IMO-910
PP-50E
PP-50E LO
QRV-251
MINIMUM FLOW STOP-50 GPM
QMO-225
QMO-226
PP-50W
PP-50W LO
RCP1
RCP2
RCP3
RCP4
RCS
REACTOR COOLANT SYSTEM MAKEUP
LEGEND:
EQUIPMENT IN THE F.Z.
EQUIPMENT CABLES IN F.Z.
EQUIPMENT LOST DUE TO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

FIGURE 4.28



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

FIGURE 4.29



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

FIGURE 4.30

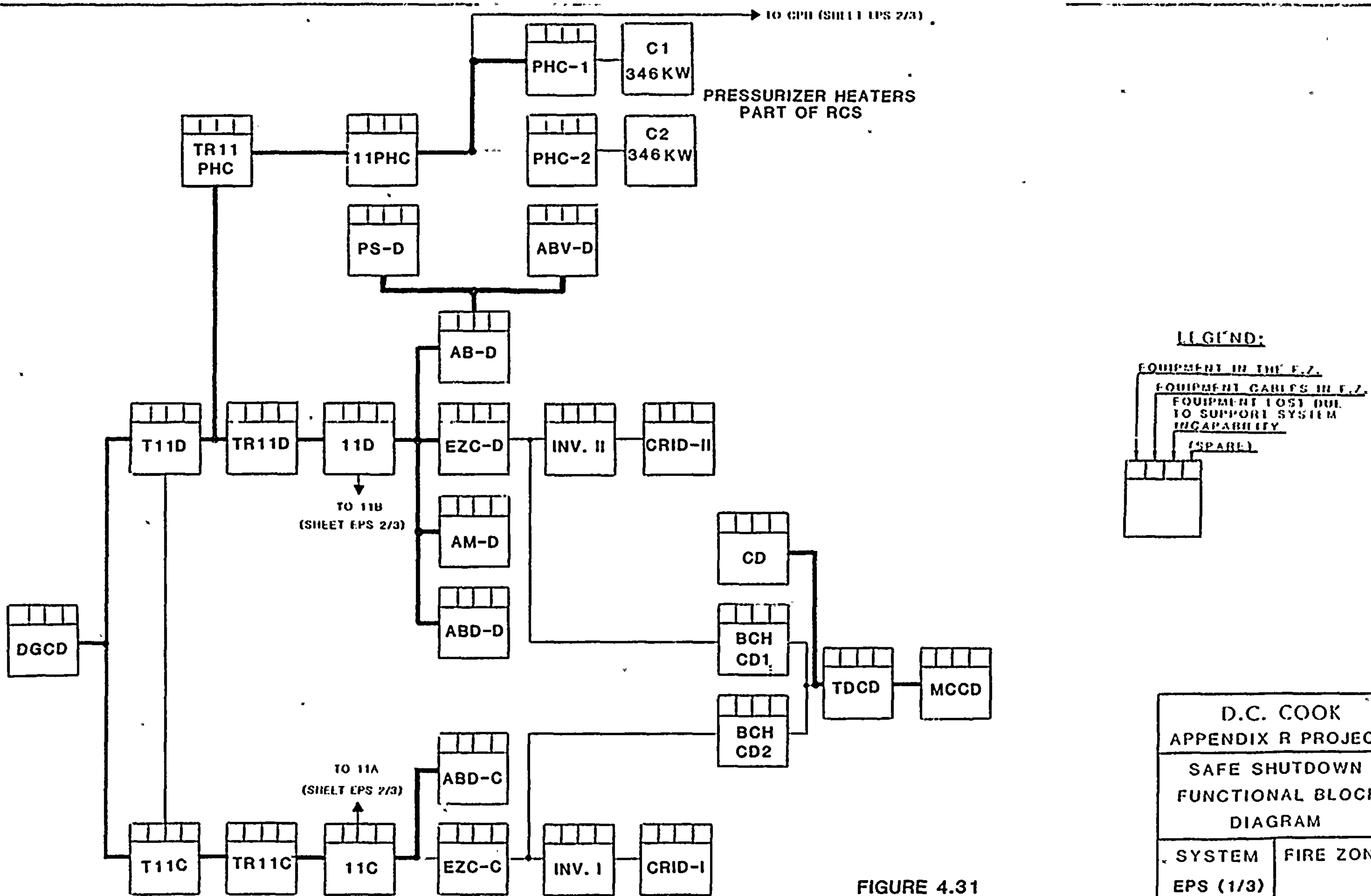


FIGURE 4.31

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

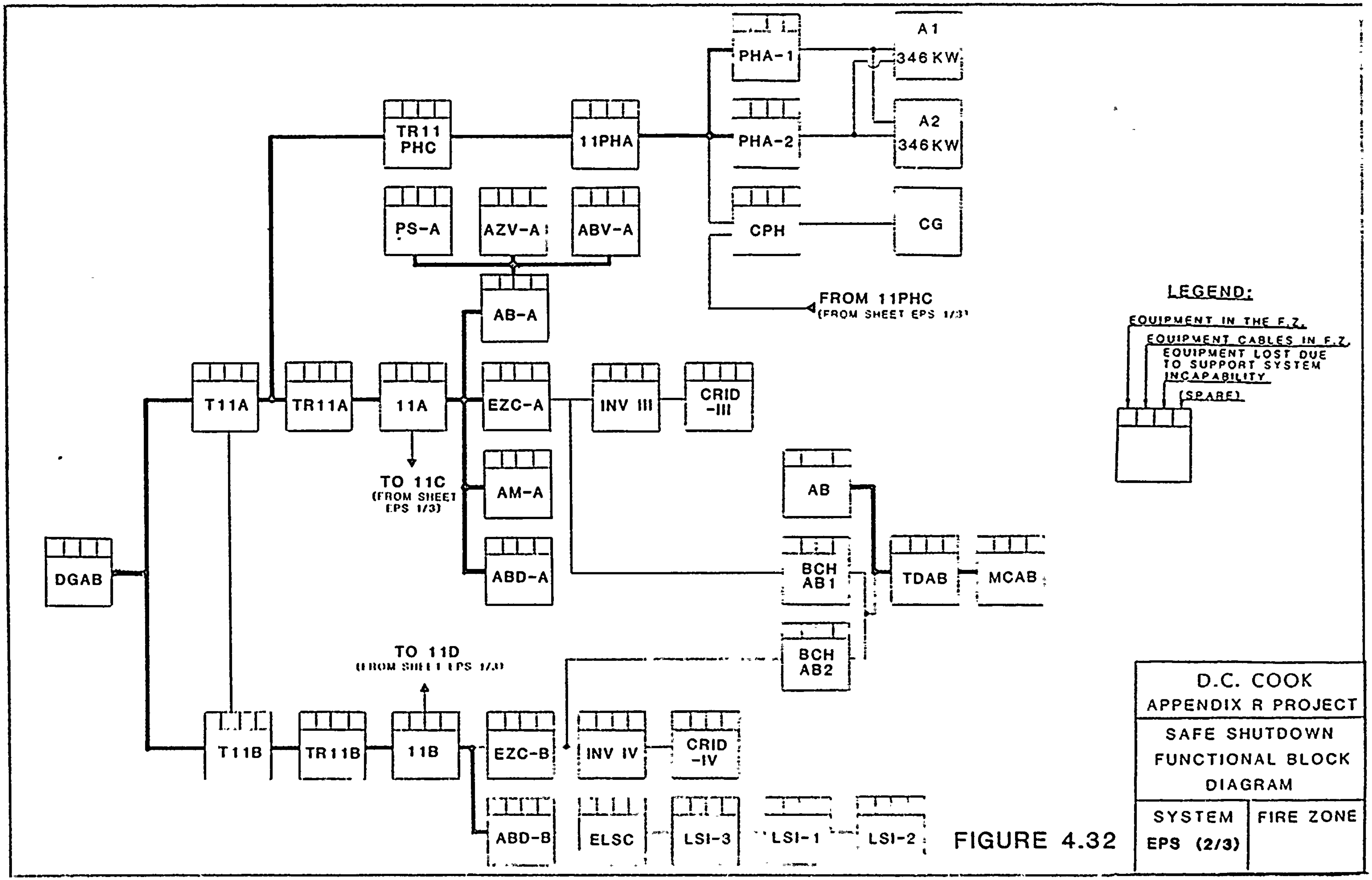
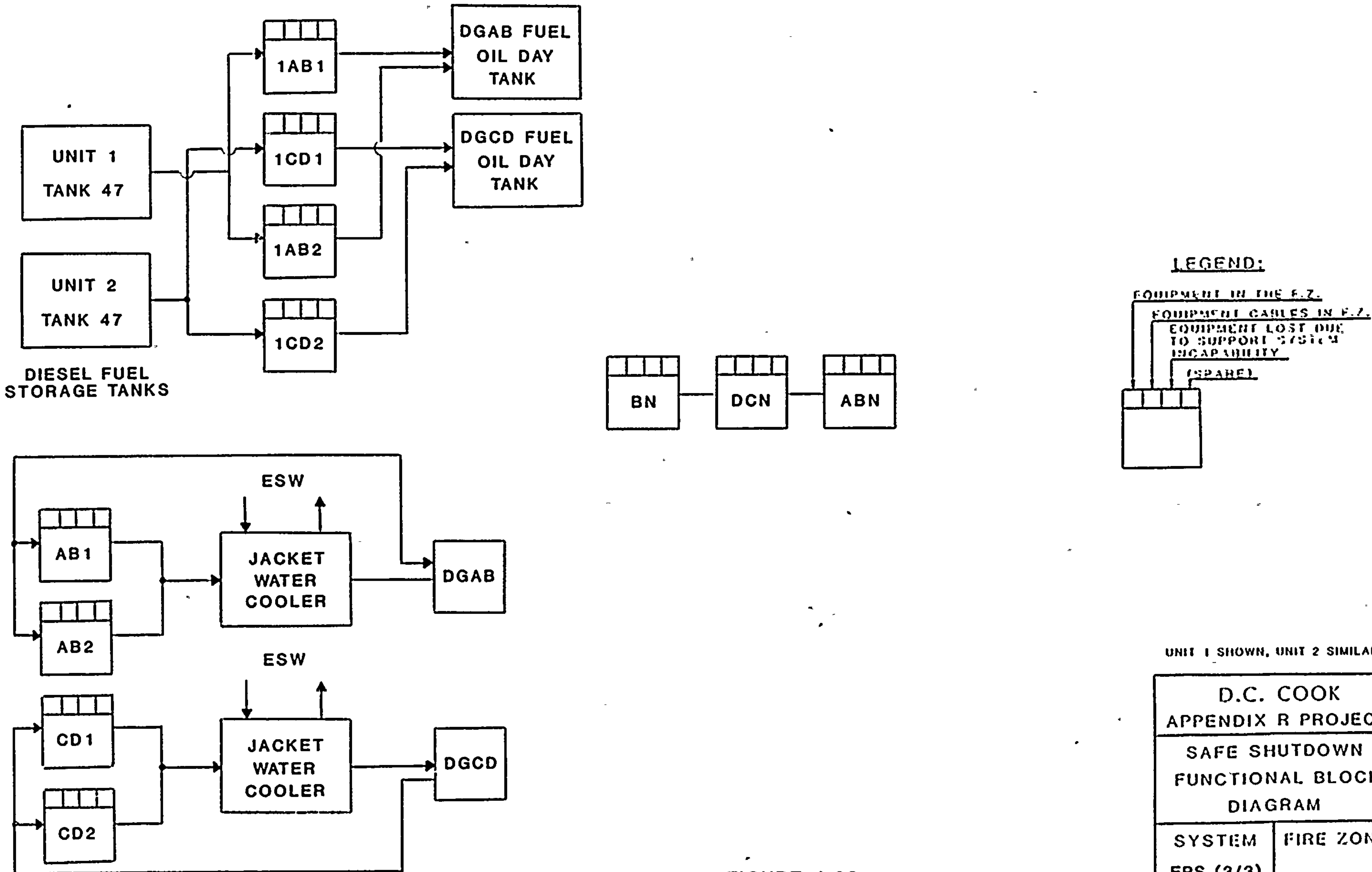

TR11 PHC
11PHA
PHA-1
PHA-2
CPH
A1 346 KW
A2 346 KW
CG
PS-A
AZV-A
ABV-A
AB-A
FROM 11PHC
(FROM SHEET EPS 1/3)
LEGEND:
EQUIPMENT IN THE F.Z.
EQUIPMENT CABLES IN F.Z.
EQUIPMENT LOST DUE TO SUPPORT SYSTEM INCAPABILITY
(SPARE)
T11A
TR11A
11A
EZC-A
INV III
CRID -III
TO 11C
(FROM SHEET EPS 1/3)
AM-A
ABD-A
AB
DGAB
BCH AB1
TDAB
MCAB
BCH AB2
TO 11D
(FROM SHEET EPS 1/3)
T11B
TR11B
11B
EZC-B
INV IV
CRID -IV
ABD-B
ELSC
LSI-3
LSI-1
LSI-2
D.C. COOK
APPENDIX R PROJECT
SAFE SHUTDOWN FUNCTIONAL BLOCK DIAGRAM
SYSTEM
EPS (2/3)
FIRE ZONE

FIGURE 4.32



D.C. COOK
APPENDIX R PROJECT

SAFE SHUTDOWN FUNCTIONAL BLOCK DIAGRAM

SYSTEM	FIRE ZONE
EPS (3/3)	

FIGURE 4.33

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 addtion, 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 provide for each specific fire zone the ability to achieve and maintain sub-critical 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:

- o Achieve and maintain cold shutdown reactivity conditions;
- o Maintain reactor coolant level within the level indication range of the pressurizer;
- o Achieve and maintain decay heat removal during hot standby hot shutdown and cold shutdown;
- o Provide monitoring of appropriate process variables necessary to perform and control alternative shutdown equipment; and,
- o Provide the process cooling, lubrication and other associated supporting functions necessary to permit the operation of the other primary 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 which, with the exception of instrumentation, requires no active normal SSS equipment, to the simple use of local pneumatic loading stations to control steam generator PORVs. One method, the "Complete Alternative Shutdown" method, is available to achieve safe shutdown for major 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 of each of the alternative shutdown methods 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 alternative shutdown methods selected accommodate both conditions when off-site power is or is not available. The equipment and systems comprising each of the alternative shutdown methods are normally capable of being powered by both on-site and off-site electrical power systems.

The equipment and systems provided to achieve hot standby are capable of maintaining such conditions until cold shutdown can be achieved. 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 which can be impacted by the fire, and

(2) Re-establishment of these 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 Spreading Rooms). 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 mal-operation of the equipment. Second, the addition of alternate control locations outside the Control Room creates the potential for inadvertent or malicious actions which 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 which could be used to achieve safe shutdown via some other alternative means. A few of these important features are:

- 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.

- The two units are provided with their own independent and redundant on-site emergency power systems which 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.

- The other major safe shutdown systems (ESW, CCW, AFW) are also independent train-oriented redundant systems which presently have manual cross-ties between units. The only exception is the CVCS system.

- 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.

- 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 unit unaffected by the fire 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 which 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 Zones 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 which requires alternative shutdown.

Sections 4.2 through 4.4 previously provided the definitions of the normal safe shutdown functions and primary and support systems and equipment required to achieve safe shutdown. Figures 4.1 through 4.5 depicted 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 modifications required, 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 & 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 inter-unit four-inch centrifugal charging discharge header cross-tie line. Manual operation of the line's isolation valves, located in Zone 5, will achieve immediate RCS make-up via the RCP seal injection path or Boron Injection Tank path. Figure 5.5 is a highlighted P&ID of this proposed cross-tie method.

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 fires, the shutdown functions of the AFW system will be achieved by manually opening existing inter-unit motor-driven AFW pump discharge header cross-tie valves and initiation and alignment of the associated equipment in one or both of the unaffected unit's motor-driven auxiliary feedwater trains.

Local indication of steam generator level and pressure, presently located at local panels LSI-1 and LSI-2, will be upgraded and re-powered from the unaffected unit's EPS. Steam generator level control will be achieved by manually throttling the 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. With the exception of Fire Zones 29(A,B,E) and 29(C,D,F), for the fire zones requiring complete alternative shutdown, the CCW and EPS 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 system functions in the fire-affected unit. This diversion is achieved via normally open unit cross-tie MOVs which are free of fire damage for fires within Fire Zones 29(A,B,E) and 29(C,D,E).

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 at hot or cold shutdown simultaneously (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 assure that fires in certain zones will not cause failures in all four ESW trains, circuit modifications are proposed which include the installation of isolation relays and cable rerouting, to assure that both trains of ESW in the unaffected unit will be available for all areas requiring alternative shutdown.

5.2.4 <u>Component Cooling Water System</u>

As discussed in Section 4.4.6, the CCW system as a supporting system for hot standby is necessary to provide the cooling needs of the centrifugal charging pumps in the CVCS system and, for operational flexibility, the cooling needs of the RCP seals when seal injection is not available. 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 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 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 is optional and not a required operation to achieve safe shutdown. In order to ensure that fires in various zones requiring alternative shutdown will not cause failures of all four CCW pumps' circuitry, modifications are proposed which 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.

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 back-up motive power provided by the permanent plant N_2 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 central local shutdown panel LSI-4, located adjacent to LSI-3, will include new source range monitoring, and hot and cold leg temperature monitoring. In addition, a new source range neutron monitoring instrument channel will be provided with indication available at local panel LSI-4.

The addition of these new dedicated non-safety-related instrument channels coupled with repowering of these and the existing channels from the unaffected unit's EPS provide the necessary equipment functions assumed lost 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 all the necessary electrical, power generation and distribution for the alternative shutdown systems.

Various equipment (pressurizer heaters, instrumentation and RHR pumps) in the unaffected unit cannot be used to support shutdown in the fire-affected unit 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, -2, -3 and LSI-4. 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 from 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 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 will also be required. Reference Section 6.3 for a detailed discussion of this repair activity.

5.2.8 <u>Residual Heat Removal</u>

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 <u>Alternative Shutdown Methods</u>

Five alternative shutdown methods are required to assure compliance with the provisions of Appendix R Section III.G. Reference Table 5-1 for a fire zone-alternative shutdown system matrix for information on the specific alternative shutdown method utilized to achieve safe shutdown for each fire zone requiring alternative shutdown.

5.3.1 <u>Method AS1</u>

Method AS1 is described as "Complete Alternative Shutdown" and requires 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, and 60 are the Control Rooms and cable vault 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, 44N, and 44S are the Auxiliary Building zones which 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 four 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, are which house the majority of the on-site emergency power generation and distribution equipment 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 which can affect operability of the respective unit's redundant diesel generators. The rooms also contain the pressurizer heater transformers and 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 which must be re-established 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 which 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 only. These areas are the Unit 1 and Unit 2 Charging Pump areas respectively. Should fires occur in these areas, only the ability to provide normal charging system makeup will be affected. All other normal SSS are outside 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 which is lost due to fires in these zones <u>and</u> which must be available to support the CVCS cross-tie method. Note that no normal SSS equipment which is required to support Method AS2 is unavailable due to fires in these areas.

5.3.3 <u>Method AS3</u>

Method AS3, the "Essential Service Water Crosstie 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, -706, -707 and -708) which exist outside these fire zones and are free of fire damage for all fire zones.

Table 5-4 identifies by system the normal SSS equipment which is lost due to fires in these zones <u>and</u> which must be available to support this alternative shutdown method. Note that no SSS equipment which is required to support Method AS3 is unavailable due to fires 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 which is lost and which 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 which 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 10, 15, 38, 66, 67, 120 and 122 for Unit 1 and 18, 24, 39, 74, 75, 121 and 123 for Unit 2. Zones 66, 67, 120, 122, 74, 75, 121 and 123 are the Unit 1 and Unit 2 containment zones, which contain cables for the existing T_h and T_c loops. The existing cable routing in these zones violates the Section III.G.2 criteria. Rather than rerouting or protecting this existing cabling, the new T_h and T_c loops required to support complete alternative shutdown will be properly routed and capable of being powered by the unaffected unit with indication at panels LSI-1, -2 and -4. This installation provides this alternative shutdown method.

Table 5-6 identifies by system the normal SSS equipment which is lost due to fires in Zones 10, 24, 66, 67, 74, 75, 120, 121, 122 and 123 and which must be available to support this alternative shutdown method.

Table 5-7 identifies by system the normal SSS equipment which is lost due to fires in Zones 15, 18, 38 and 39 and which 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 which 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) are principally focused on alternative shutdown designs which 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 thus permits restoration of other elements of the safe shutdown system circuits unaffected by the hypothesized fire. In addition, new circuits and cabling are typically added to re-establish 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 which is related to normal circuits and equipment in the fire area which 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) as portions thereof used to provide the shutdown capability with the loss of offsite 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 shutdowns 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 which 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.

Response 1.b

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 which bypass the fire zone of concern. As previously discussed, only the alternative shutdown ESW pump control circuits and certain LSI panel instruments contain cabling which 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 which 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 which ensure that 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 which will involve safety-related equipment are:

- o Repowering of one pressurizer heater group (repair);
- o Rerouting of ESW pump, discharge valve and strainer cables;
- o Installation of the CVCS piping cross-tie; and,
- o Post-fire repair using power jumpers for RHR pumps (repair).

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 which 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 2 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

We do not anticipate any modifications to the D.C. Cook Technical Specifications, but if any are required they 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 which 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:

- Repowering of pressurizer heaters
- Repowering of one RHR pump

Section 6 contains a detailed 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 Crosstie

Installation of a permanent CVCS cross-tie. The 4 in. 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 existing 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 non-safety-related. The power supply cables are also designated as non-safety-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 which 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 4 kV switchgear for all four ESW pumps. The relays will ensure that opens, shorts and grounds in the fire zones will not prevent proper operation of the ESW pumps in the unaffected unit. Table 5.8 identifies the cables which 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 opens, shorts and grounds in the fire-affected unit affecting the ESW pump controls in 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 assure isolation of field cabling are shown as Figure 5.14. The cables which 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 which 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 identical to the method proposed for the ESW pump pressure switches. Table 5-2 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-1, -2 and -4, new non-safety-related instrument circuits will be added. The circuits will use the second resistance temperature detector (RTD) element available in the proposed T_h and T_c dual element RTDs. 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-1. T_h and T_c for RCS loops 2 and 3 will be available at LSI-2. 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, local indicating pressure transmitters will be installed for steam generators 1 and 4 and 2 and 3 at panels LSI-1 and -2 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 Panel-LSI-4

In order to provide a centralized control and communication point for all action outside the Control Room, all required safe shutdown instrumentation which presently exists or is proposed on panels LSI-1 and -2 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 -4. Local indication for

RCS pressure, pressurizer level, charging and letdown flow are presently located on LSI-3. Local indication for RCS temperature hot and cold legs, 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.

5.5.10 Permanant Cable for Pressurizer Heater Repowering

To ensure that timely repairs can be affected to re-energize one bank of pressurizer heaters, permanent power cabling with prefabricated terminations will be routed for a heater backup group from the associated containment penetration area to an new 480 V MCC breaker cubicle in the unaffected unit. Proposed routing of the power cable will not be in any fire zones for which the cabling is required for alternative shutdown. 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 immediately 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.

(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, -242, and/or -222, -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,-242 and/or -222,-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/or LSI-2 panel instrumentation and manual control of the appropriate steam generator inlet valves and PORVs.

(12) The above three LSI stations are coordinated by using LSI-3 and -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 sub-critical 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 re-occupancy of the Control Room and re-establishment 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 5-6 hours post-fire if pressurizer 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 re-powering three pressurizer heater groups 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 depressurized or 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 which were previously in operation during hot shutdown.

TABLE 5-1

ALTERNATIVE SHUTDOWN METHODS/FIRE ZONE MATRIX

FIRE ZONES	ALTERNATIVE SHUTDOWN METHOD				
	METHOD A S 1 COMPLETE ALTERNATIVE SHUTDOWN	METHOD A S 2 CHARGING CROSSTIE & SUPPORTING SYSTEMS ONLY	METHOD A S 3 ESSENTIAL SERVICE WATER CROSSTIE & SUPPORT ONLY	METHOD A S 4 LOCAL PORV CONTROL ONLY	METHOD A S 5 Th & Tc MONITORING (LCI-3) ONLY
6N	1				
6S	2				
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,B,C,D	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

	ALTERNATIVE SHUTDOWN METHOD				
FIRE ZONES	METHOD A S 1 COMPLETE ALTERNATIVE SHUTDOWN	METHOD A S 2 CHARGING CROSSTIE & SUPPORTING SYSTEMS ONLY	METHOD A S 3 ESSENTIAL SERVICE WATER CROSSTIE & SUPPORT ONLY	METHOD A S 4 LOCAL PORV CONTROL ONLY	METHOD A S 5 Th & Tc MONITORING (LCI-3) ONLY
62A,B,C		1			
63A,B,C		2			
29A,B,E			1		
29C,D,F			2		
15				1	1
33				1	
38				1	1
18				2	2
34				2	
39				2	2
52				1,2	
10					1
24					2
66					1
67					1
120					1
122					1
74					2
75					2
121					2
123					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 THE FIRE
WHICH REQUIRES OPERATION POST-FIRE TO SUPPORT METHOD AS1
"COMPLETE ALTERNATIVE SHUTDOWN"

FIRE ZONES 14, 20, 53, 54, 55, 56, 57, 58, 59, 60, 6N, 6S, 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 at panel LSI-1
	MRV-223 MRV-233	Manual valve operation at panel LSI-2
RCS*	NLI-151 NPS-122	Isolation & transfer of indication to LSI-3

*For Zones 14 and 20 loss of all ac power will not affect operability of instrumentation systems or turbine-driven auxiliary feed pump due to availability of dc power for some time interval post-fire.

TABLE 5-2 cont'd.

System	Equipment	Method of Operation
	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-1, LSI-2 and LSI-4**
	PRESS. HTR	Repowering via repair from unaffected unit
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.

**Not considered as normal shutdown equipment but provides local information from same RTDs as normal instrument channels.

TABLE 5-3

NORMAL SHUTDOWN EQUIPMENT AFFECTED BY THE FIRE
WHICH REQUIRES OPERATION POST-FIRE TO SUPPORT METHOD AS2
"CHARGING CROSSTIE AND SUPPORTING SYSTEM ONLY"

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 fire zone
MS	None	No equipment or cable in fire zone
RCS	None	1 path free of fire damage
CCW	None	No equipment or cable in fire zone
ESW	None	No equipment or cable in fire zone
EPS	None	No equipment or cable in fire zone
RHR	None	No equipment or cable in fire zone

TABLE 5-4

NORMAL SHUTDOWN EQUIPMENT AFFECTED BY THE FIRE
WHICH REQUIRES OPERATION POST-FIRE TO SUPPORT METHOD AS3
"ESSENTIAL SERVICE WATER CROSSTIE AND SUPPORT ONLY"

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 THE FIRE
WHICH REQUIRES OPERATION POST-FIRE TO SUPPORT METHOD AS4
"LOCAL PORV CONTROL ONLY"

FIRE ZONES 33 and 34

SYSTEM	EQUIPMENT	METHOD OF OPERATION
CVCS	None	One path free of fire damage
AFW	None	One path free of fire damage
MS	MRV-223 MRV-233	Manual operation of SG-2 & SG-3 PORV at panel LSI-2
RCS	None	One path free of fire damage
CCW	None	One path free of fire damage
EPS	None	One path free of fire damage
ESW	None	One path free of fire damage
RHR	None	One path free of fire damage

TABLE 5-5 cont'd.

FIRE ZONE 52

System	Equipment	Method of Operation
CVCS	None	One path free of fire damage
AFW	None	One path free of fire damage
MS	MRV-213 MRV-243 OR MRV-223 MRV-233	Manual operation of PORVs from LSI-1 or LSI-2 respectively
RCS	None	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	One path free of fire damage
RHR	IMO-312 IMO-322	Manual alignment of either valve for RHR operation

TABLE 5-6

NORMAL SHUTDOWN EQUIPMENT AFFECTED BY THE FIRE
WHICH REQUIRES OPERATION POST-FIRE TO SUPPORT METHOD AS5
"T_H & T_C MONITORING (LSI-3) ONLY"

FIRE ZONES 7 and 27

SYSTEM	EQUIPMENT	METHOD OF OPERATION
CVCS	None	One path free of fire damage
AFW	None	One path free of fire damage
MS	None	No equipment or cables in fire zone
RCS	NTR-110 NTR-120 NTR-140	Routing of new cables to provide remote indication at LSI-1, LSI-2, and LSI-4 for all four loops T_h and T_c.
CCW	None	No equipment or cables in fire zone
ESW	None	No equipment or cables in fire zone
EPS	None	One path free of fire damage
RHR	IMO-128	Manual operation of IMO-128

TABLE 5-6 cont'd.

FIRE ZONES 10 and 24

System	Equipment	Method of Operation
CVCS	None	One path free of fire damage
AFW	None	One path free of fire damage
MS	None	One path free of fire damage
RCS	NTR-130 NTR-210 NTR-220 NTR-230 NTR-240	Routing of new cables to provide remote indication at LSI-1, LSI-2 and LSI-4 for all four loops T_h and T_c
CCW	None	One path free of fire damage
ESW	None	One path free of fire damage
EPS	None	One path free of fire damage
RHR	IMO-129	Manual operation of IMO-129

TABLE 5-6 cont'd.

FIRE ZONES 66 and 74

System	Equipment	Method of Operation
CVCS	None	One path free of fire damage
AFW	None	One path free of fire damage
MS	None	No equipment or cables in the fire zone
RCS	NTR-110 NTR-140 NTR-210 NTR-240 NTR-120 NTR-130 NTR-220 NTR-230	Routing of new cables to provide T_h & T_c remote indication at LSI-1, LSI-2, & LSI-4 for all four loops. These cables will be in Fire Zones 66 & 74 but the separation requirements of Appendix R will be met.
CCW	None	No equipment or cables in fire zone
ESW	None	No equipment or cables in fire zone
EPS	None	No equipment or cables in fire zone
RHR	IMO-128 IMO-129 ICM-111	Manual operation required

TABLE 5-6 cont'd.

FIRE ZONES 67 and 75

System	Equipment	Method of Operation
CVCS	None	One path free of fire damage
AFW	None	One path free of fire damage
MS	None	No equipment or cables in the fire zone
RCS	NTR-110 NTR-140 NTR-210 NTR-240 NTR-120 NTR-130 NTR-220 NTR-230	Routing of new cables to provide T_h & T_c remote indication at LSI-1, LSI-2, & LSI-4 for all four loops. These cables will be in Fire Zones 67 & 75 but the separation requirements of Appendix R will be met.
CCW	None	One path free of fire damage
ESW	None	No equipment or cables in fire zone
EPS	None	No equipment or cables in fire zone
RHR	IMO-128	Manual operation required

TABLE 5-6 cont'd.

FIRE ZONES 120 and 121

System	Equipment	Method of Operation
CVCS	None	One path free of fire damage
AFW	None	One path free of fire damage
MS	None	No equipment or cables in fire zone
RCS	NTR-110 NTR-140* NTR-120*	Routing of new cables to provide T_h & T_c remote indication at LSI-1, LSI-2, & LSI-4 for all four loops
CCW	None	No equipment or cables in fire zone
ESW	None	No equipment or cables in fire zone
EPS	None	No equipment or cables in fire zone
RHR	IMO-128	Manual operation required

*Fire Zone 120 only

TABLE 5-6 cont'd.

FIRE ZONES 122 and 123

System	Equipment	Method of Operation
CVCS	None	One path free of fire damage
AFW	None	One path free of fire damage
MS	None	No equipment or cables in fire zone
RCS	NTR-210 NTR-240 NTR-220 NTR-230	Routing of new cables to provide remote indication at LSI-1, LSI-2 & LSI-4 for all four loops T_h & T_c.
CCW	None	No equipment or cables in fire zone
ESW	None	No equipment or cables in fire zone
EPS	None	No equipment or cables in fire zone
RHR	IMO-128 ICM-129 ICM-111	Manual operation prior to RHR initiation

TABLE 5-7

NORMAL SHUTDOWN EQUIPMENT AFFECTED BY THE FIRE
WHICH REQUIRES OPERATION POST-FIRE TO SUPPORT METHOD AS4
"LOCAL PORV CONTROL ONLY" & AS5 "T_H & T_C MONITORING ONLY"

FIRE ZONES 38 AND 39

SYSTEM	EQUIPMENT	METHOD OF OPERATION
CVCS	None	One path free of fire damage
AFW	None	One path free of fire damage
MS	MRV-223 MRV-233 or MRV-213 MRV-243	Local manual control of PORVs at 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-1, LSI-2, & LSI-4
CCW	None	One path free of fire damage
ESW	None	No equipment or cables in the zone
EPS	None	One path free of fire damage
RHR	IMO-128** IMO-312	Manual operation of IMO-128

*Fire Zone 38 only
**Fire Zone 39 only

TABLE 5-7 cont'd.

FIRE ZONES 15 and 18

System	Equipment	Method of Operation
CVCS	None	One path free of fire damage
AFW	None	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-1, LSI-2, & LSI-4 for all four loops T_h and T_c
CCW	None	One path free of fire damage
ESW	None	One path free of fire damage
EPS	None	One path free of fire damage
RHR	IMO-129 ICM-111	Manual operation required prior to RHR initiation

TABLE 5-8

ESW PUMP SSS CABLES TO BE ISOLATED

PUMP	CABLE	FIRE ZONES
1-PP-7E (UNIT 1)	9248G-1	54, 58, 44S, 44N, 56, 55, 41, 40B
	8447G-1	112, 15, 79, 41, 55, 40B
1-PP-7W (UNIT 1)	9635R-1	54, 58, 44S, 44N, 57, 56, 55, 40A
	8447R-1	112, 16, 79, 55, 40A
2-PP-7E (UNIT 2)	9248G-2	53, 57, 58, 59, 60, 47B
	8447G-2	113, 18, 46A, 60, 47B
2-PP-7W (UNIT 2)	9635R-2	53, 57, 58, 59, 60, 47A
	8447R-2	113, 19, 85, 60, 46A, 45, 47A

CCW PUMP SSS CABLES TO BE ISOLATED

PUMP	CABLE	FIRE ZONES
1-PP-10E (UNIT 1)	9425G-1	44S, 44N, 56, 55, 40B
1-PP-10W (UNIT 1)	8690R-1	44S, 44N, 56, 55, 42A
2-PP-10E (UNIT 2)	9425G-2	44S, 59, 60, 46A, 47B
2-PP-10W (UNIT 2)	8690R-2	44S, 59, 60, 46A, 45, 47A

TABLE 5-9

ESW SYSTEM SSS CABLES TO BE REMOVED

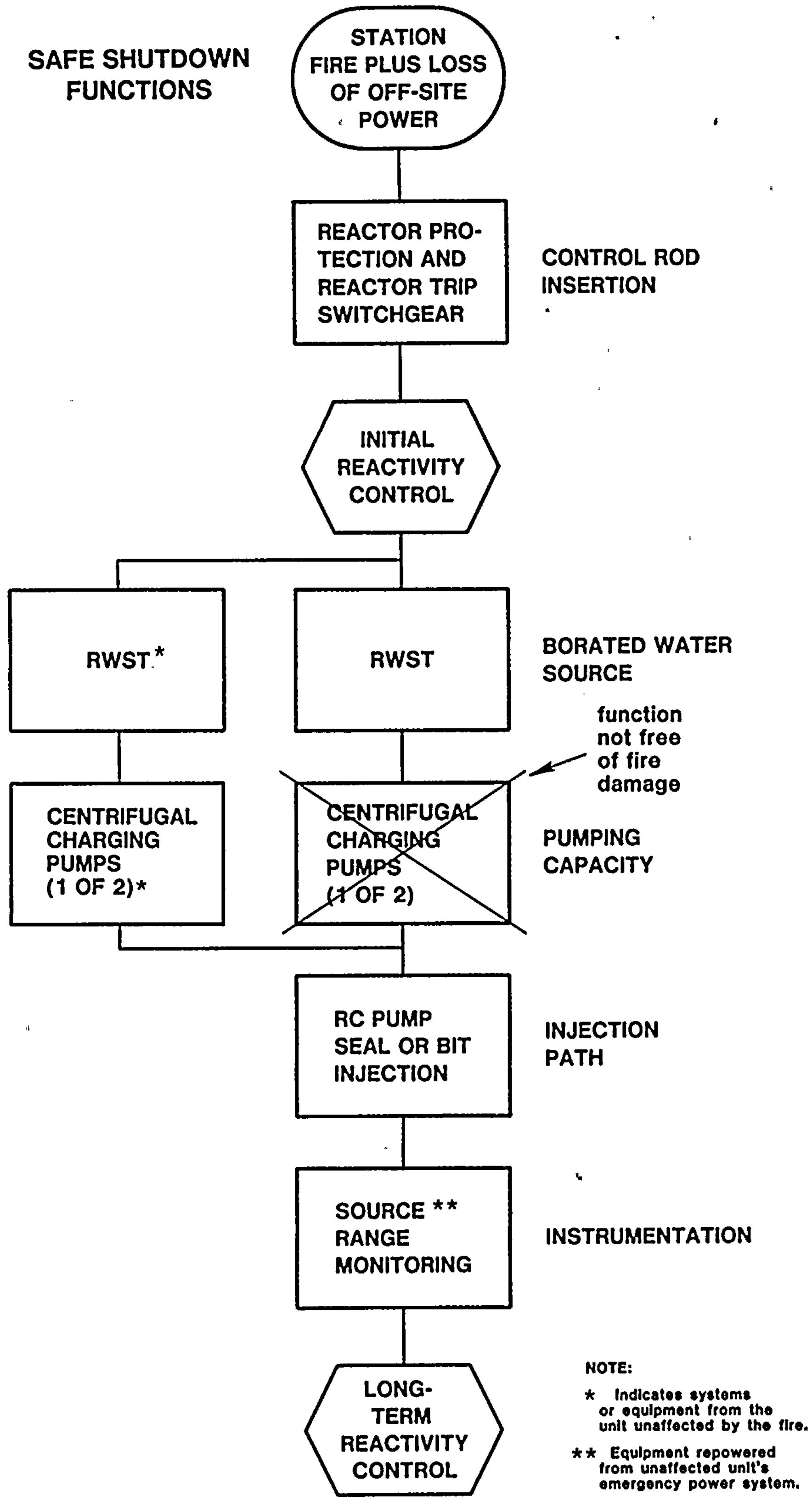
EQUIPMENT	CABLE	FIRE ZONES
ESWSE (UNIT 1)	9654G-1	54, 58, 57
	9655G-1	54, 58, 57
	9656R-1	54, 58, 57
ESWSW (UNIT 1)	9654R-1	54, 58, 57
	9655R-1	54, 58, 57
	9656R-1	54, 58, 57
WMO-701 (UNIT 1)	9232G-1*	29E, 29G, 58, 54
WMO-702 (UNIT 1)	8624R-2*	29E, 29G, 58, 54
WMO-705 (UNIT 1)	9235R-1	54, 57, 58, 53
WMO-707 (UNIT 1)	9587G-1	54, 57, 58, 53
1-PP-7E (UNIT 1)	9658G-1	54, 58
	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 rerouted

TABLE 5-9 cont'd.

EQUIPMENT	CABLE	FIRE ZONES
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
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

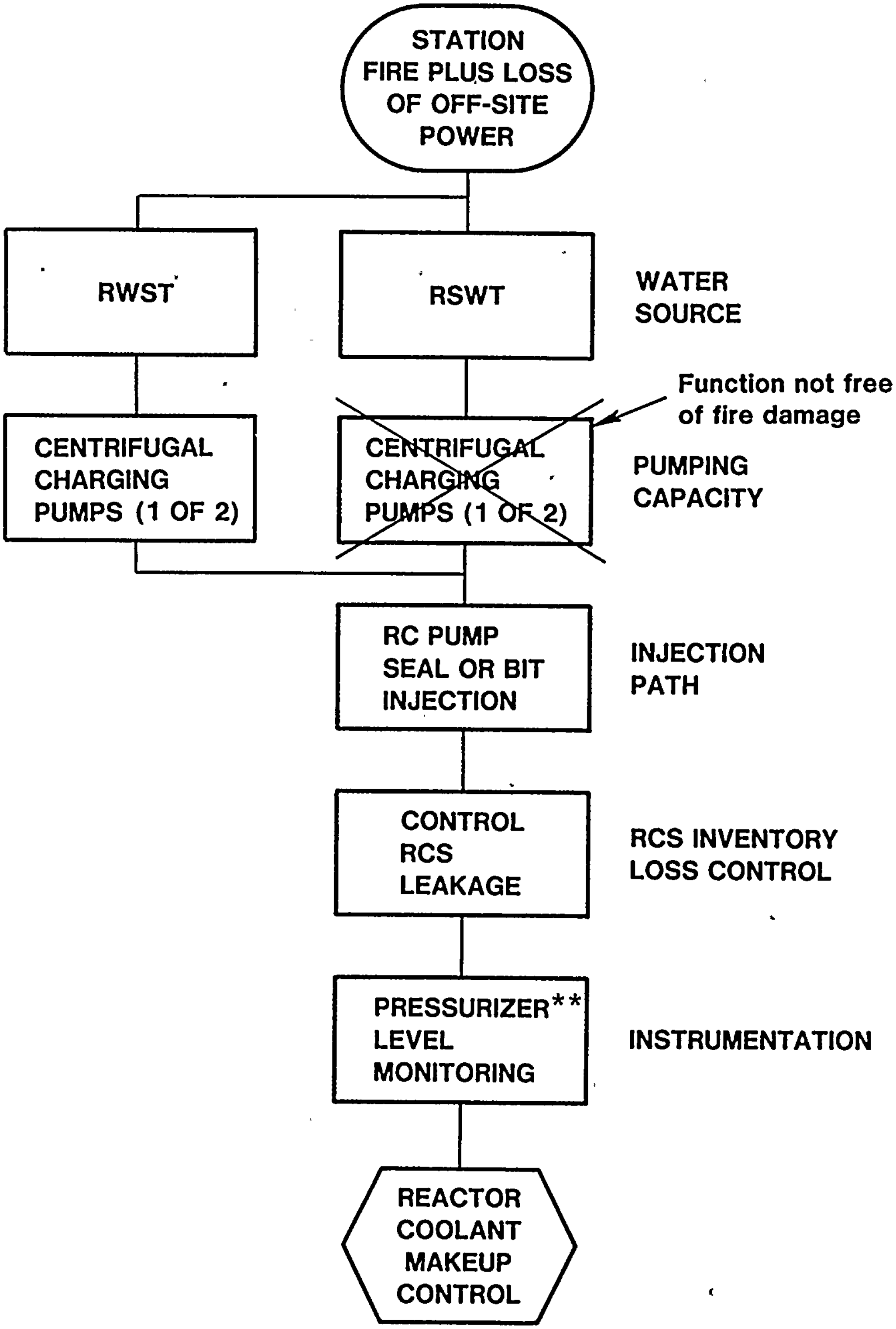
*Cables to be rerouted



ALTERNATIVE SHUTDOWN

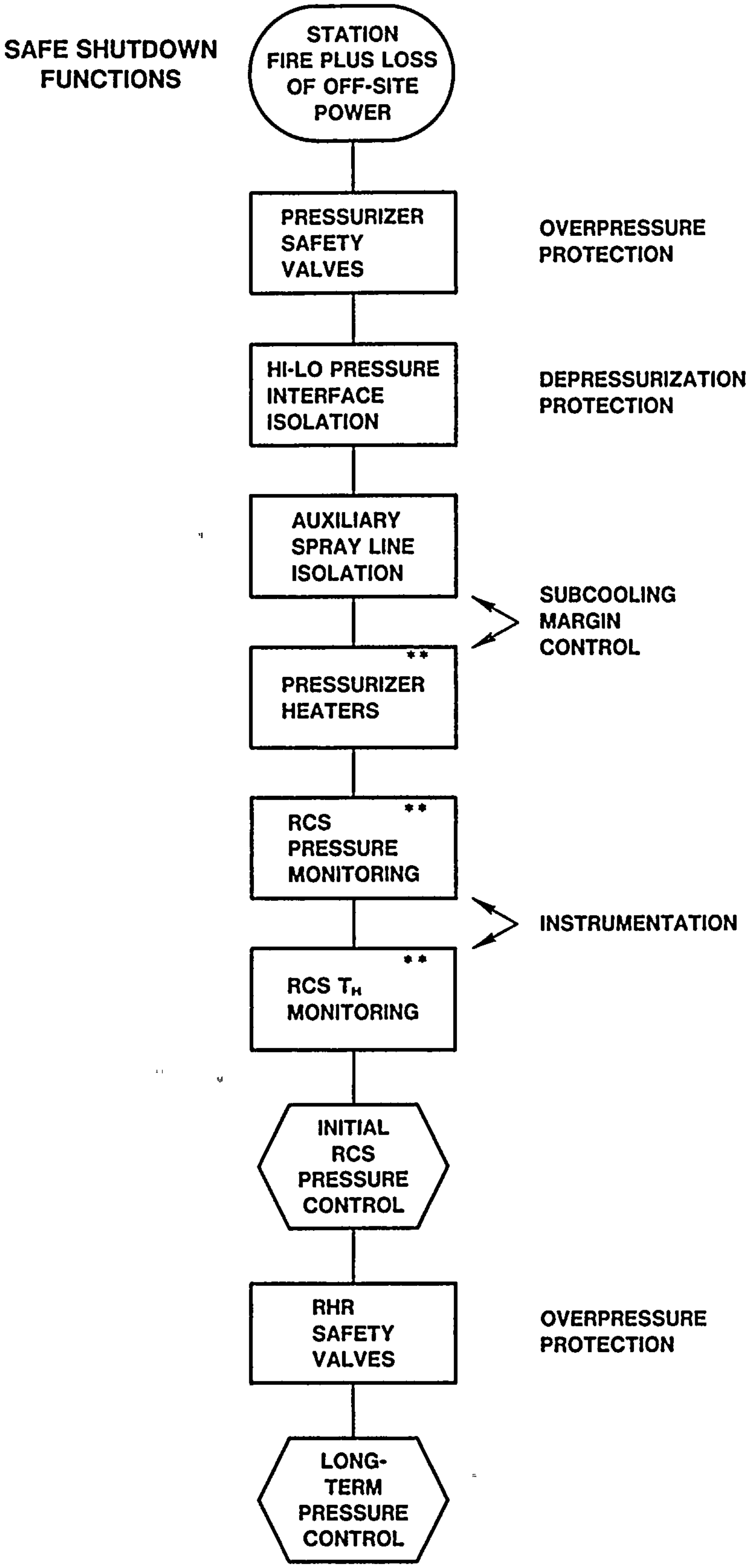
RCS REACTIVITY CONTROL FIGURE 5.1

SAFE SHUTDOWN FUNCTIONS

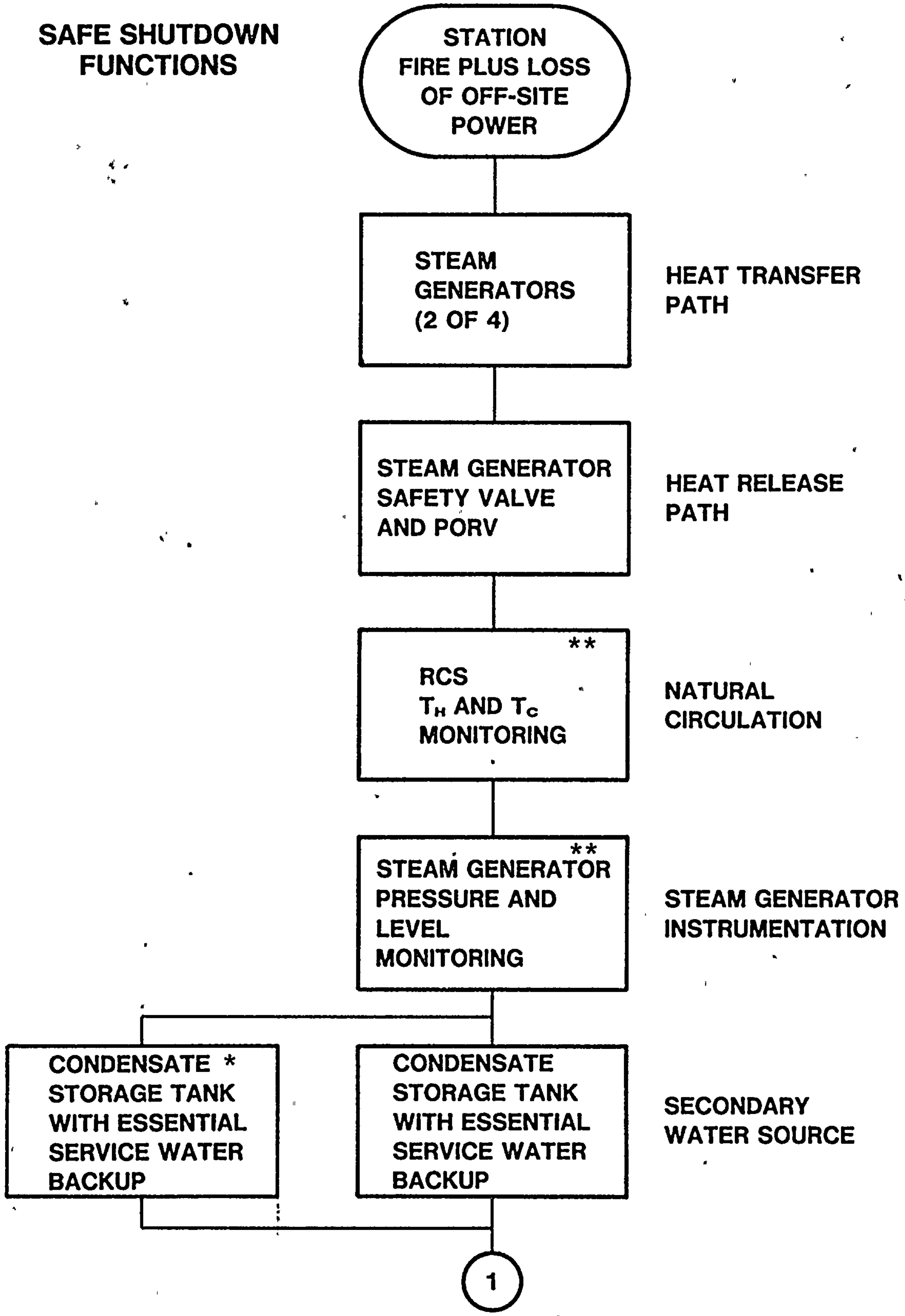


ALTERNATIVE SHUTDOWN

RCS MAKEUP CONTROL FIGURE 5.2



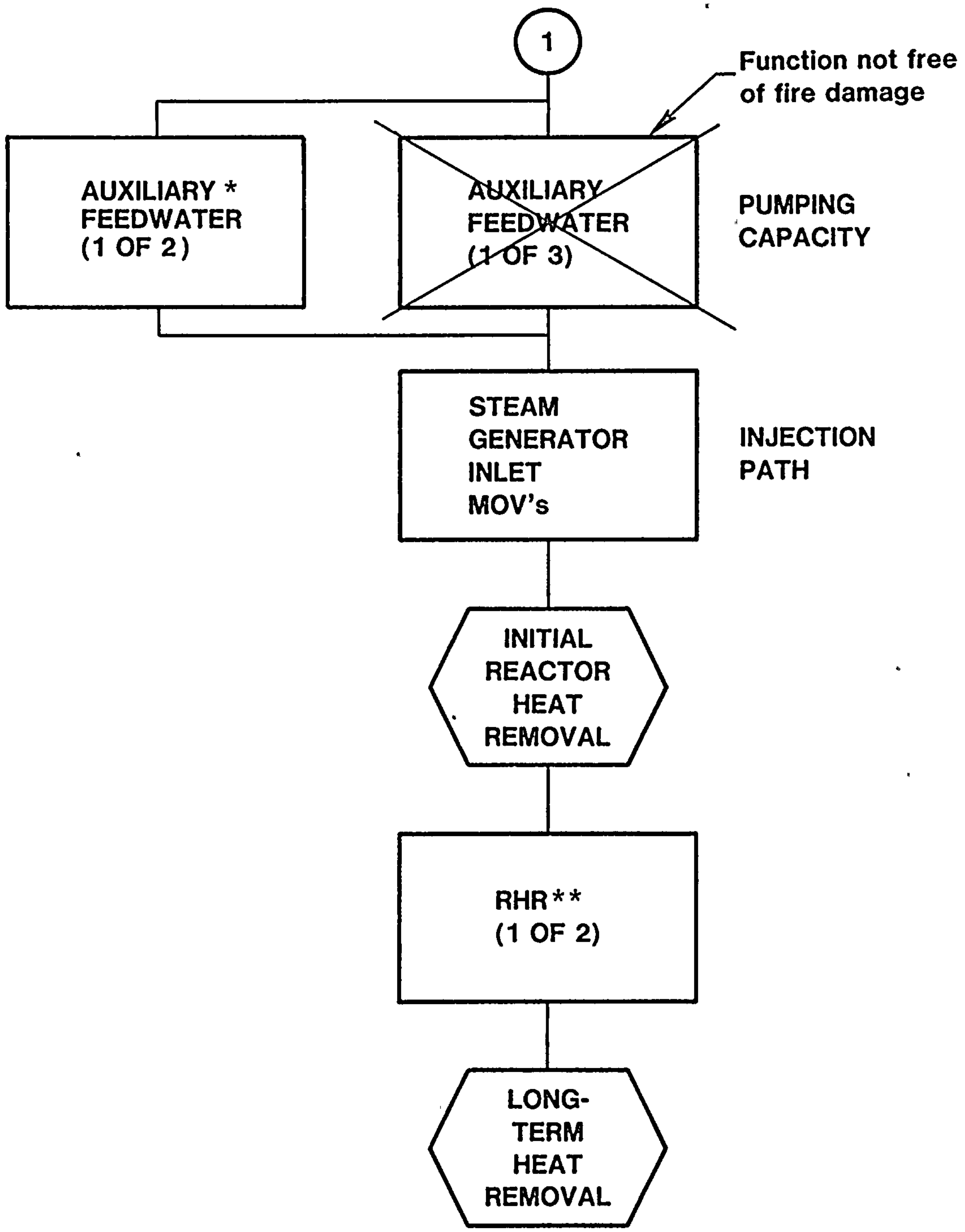
ALTERNATIVE SHUTDOWN
RCS PRESSURE CONTROL FIGURE 5.3



ALTERNATIVE SHUTDOWN

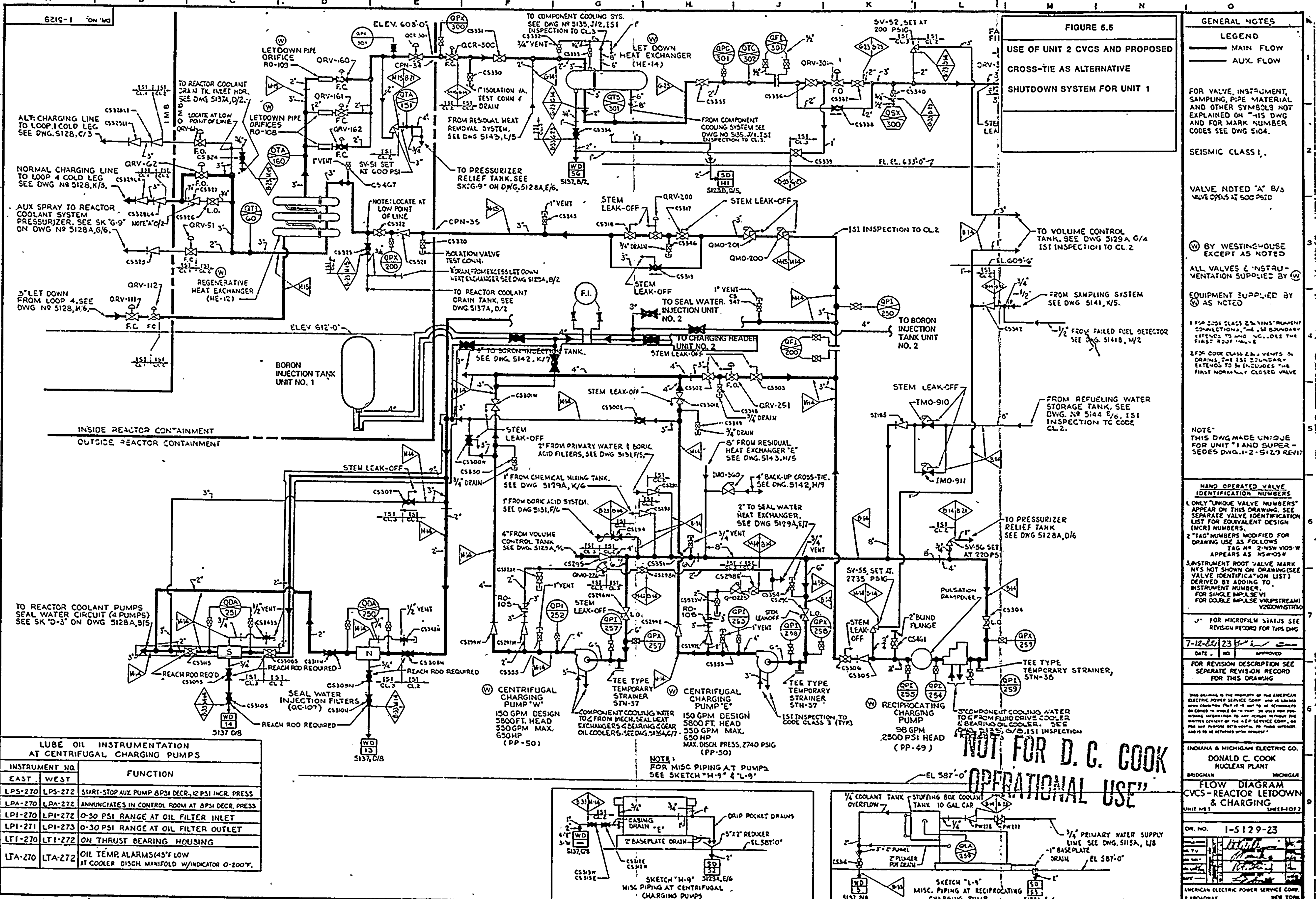
REACTOR HEAT REMOVAL FIGURE 5.4

SAFE SHUTDOWN FUNCTIONS



ALTERNATIVE SHUTDOWN

REACTOR HEAT REMOVAL FIGURE 5.4 (CONT)



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 (145°F LOW) AT COOLER DISCH. MANIFOLD W/INDICATOR 0-200°F.

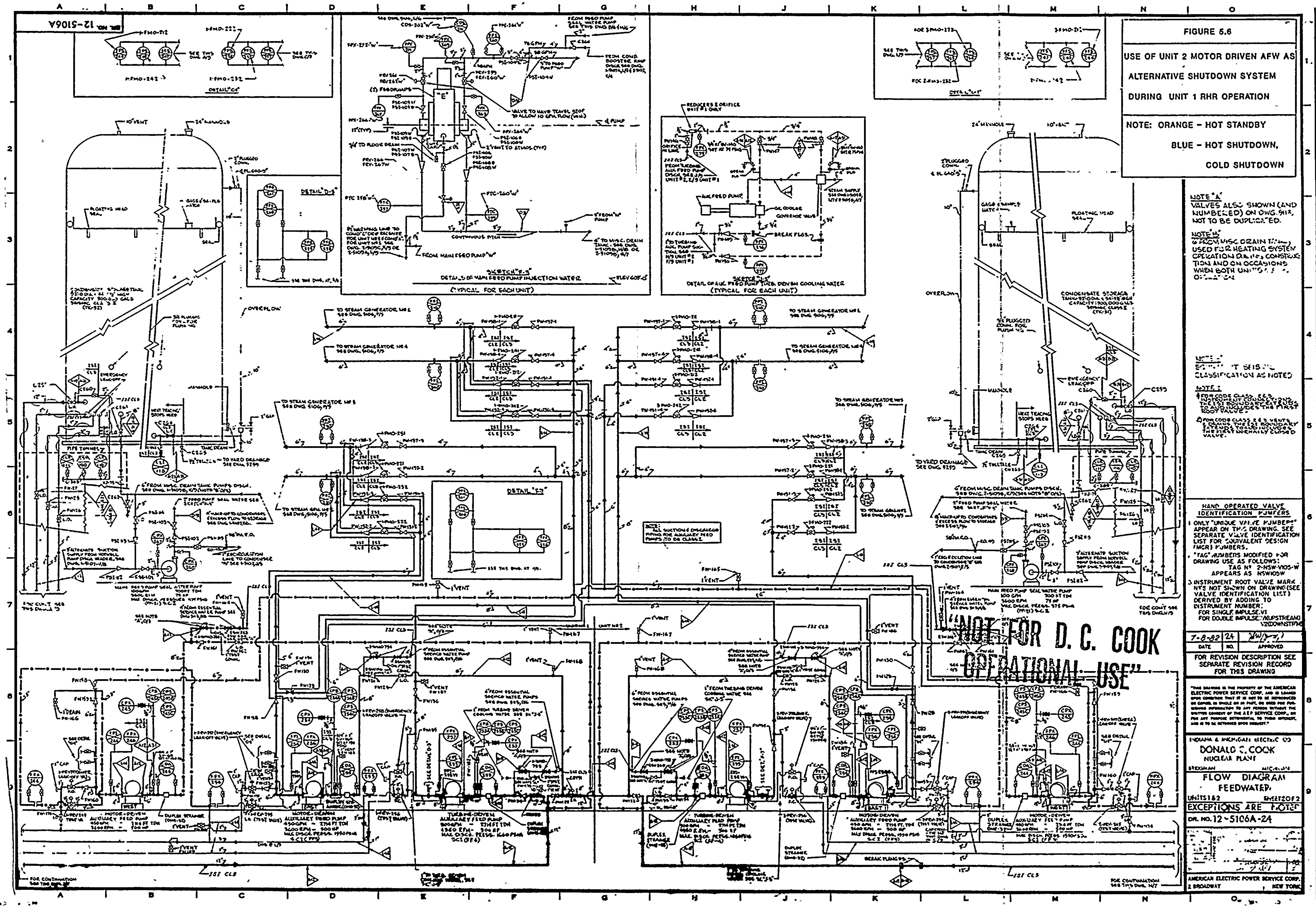


FIGURE 5.6
USE OF UNIT 2 MOTOR DRIVEN AFW AS ALTERNATIVE SHUTDOWN SYSTEM DURING UNIT 1 RHR OPERATION
NOTE: ORANGE - HOT STANDBY
BLUE - HOT SHUTDOWN, COLD SHUTDOWN
DR. NO. 12-5106A
"NOT FOR D. C. COOK OPERATIONAL USE"
DETAILS OF MAIN FEED PUMP INJECTION WATER
(TYPICAL FOR EACH UNIT)
DETAIL OF AUX. FEED PUMP TURB. DRIVEN COOLING WATER
(TYPICAL FOR EACH UNIT)
OVERFLOW
TO STEAM GENERATOR No. 1
TO STEAM GENERATOR No. 4
TO STEAM GENERATOR No. 3
HAND OPERATED VALVE IDENTIFICATION NUMBERS
FOR REVISION DESCRIPTION SEE SEPARATE REVISION RECORD FOR THIS DRAWING
INDIANA & MICHIGAN ELECTRIC CO
DONALD C. COOK NUCLEAR PLANT
FLOW DIAGRAM FEEDWATER
UNITS 1 & 2
EXCEPTIONS ARE NOTED
DR. NO. 12-5106A-24
AMERICAN ELECTRIC POWER SERVICE CORP.
2 BROADWAY NEW YORK

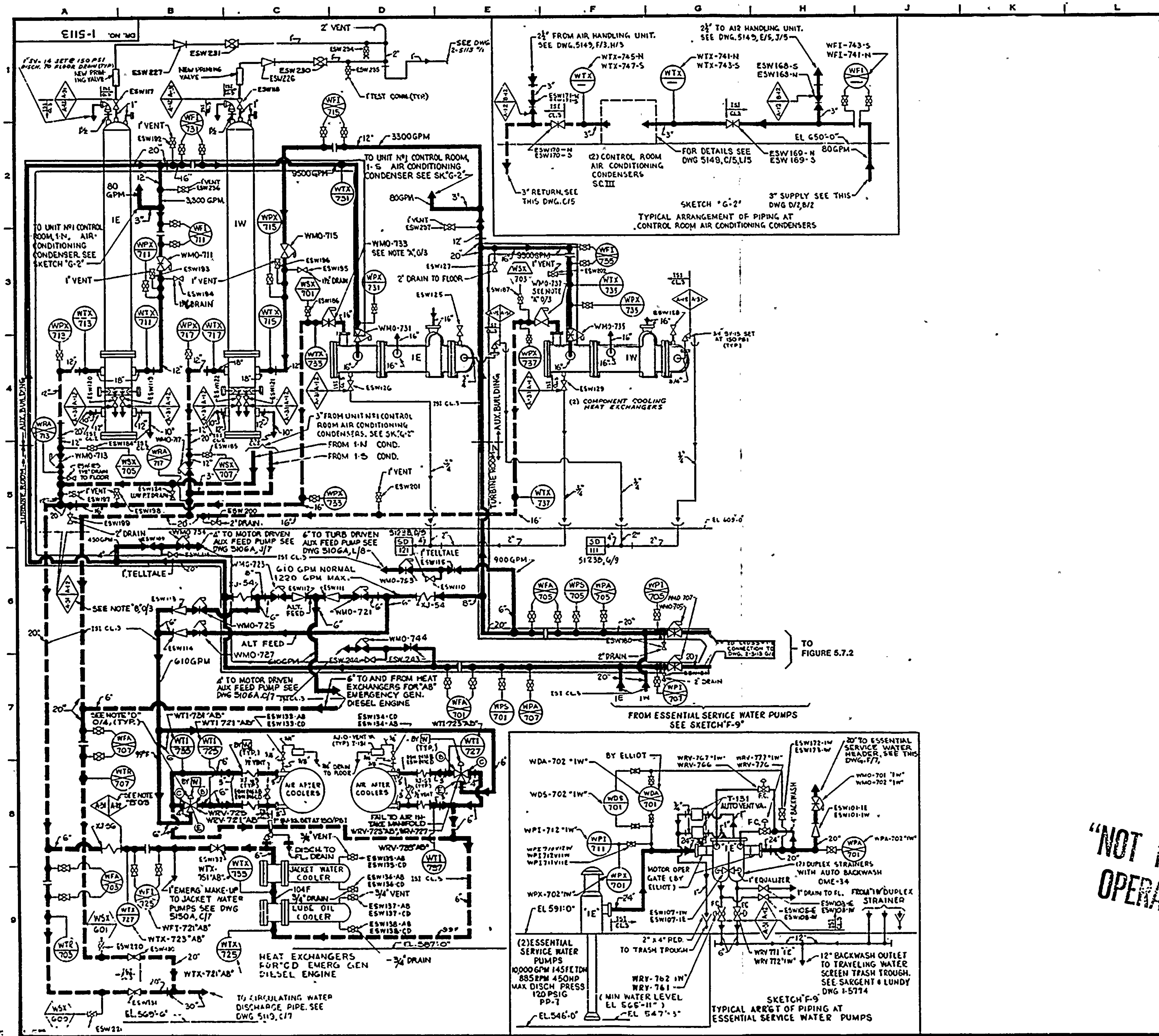


FIGURE 5.7.1

USE OF UNIT 2 ESW AS ALTERNATIVE SHUTDOWN SYSTEM FOR UNIT 1

NOTE: 1) HOT STANDBY CROSS-TIE FOR FIRE AREA 29 ONLY
2) HOT SHUTDOWN, COLD SHUTDOWN CROSS-TIE FOR AREAS REQUIRING COMPLETE ALTERNATE SHUTDOWN
3) INLET SHOWN, DISCHARGE SIMILAR

"NOT FOR D. C. COOK OPERATIONAL USE"

GENERAL NOTES.

LEGEND
- SUPPLY PIPING
- RETURN PIPING
- AUX. PIPING

ALL PIPING CLASS A-12 UNLESS NOTED

ALL EQUIPMENT SEISMIC CLASS I. EXCEPT AS NOTED.

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

SYMBOL
[W] BY WORTHINGTON

NOTE "A": C/3, E/3
WMO-733, 737 TO HAVE INTERMEDIATE LIMIT SWITCH TO LIMIT FLOW ON SAFETY INJECTION SIGNAL

NOTE "B": B/5.
RETURN PIPING CHANGES FROM CLASS I (AUX. BLDG) TO CLASS III (TURB ROOM)

NOTE "C": B/7, E/7,
ENCIRCLED LETTERS ARE SHOWN FOR ORIENTATION OF VALVE IN PIPING. THESE LETTERS REFLECT SIMILAR MARKINGS ON VALVE BODY

NOTE "D": THIS DWG MADE UNIQUE AND SUPERSEDES DWG. 12-5112-21

NOTE "E": FOR CODE CLASS 2&3 INSTR. CONNECTIONS, THE ISI BOUNDARY EXTENDS TO AND INCLUDES THE FIRST ROOT VALVE.

NOTE "F": FOR CODE CLASS 2&3 VENTS AND DRAINS THE ISI BOUNDARY EXTENDS TO AND INCLUDES THE FIRST NORMALLY CLOSED VALVE.

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-V105-W
   APPEARS AS: NSW105W
3. 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)

DATE	NO.	APPROVED
6-11-82	26	[illegible]

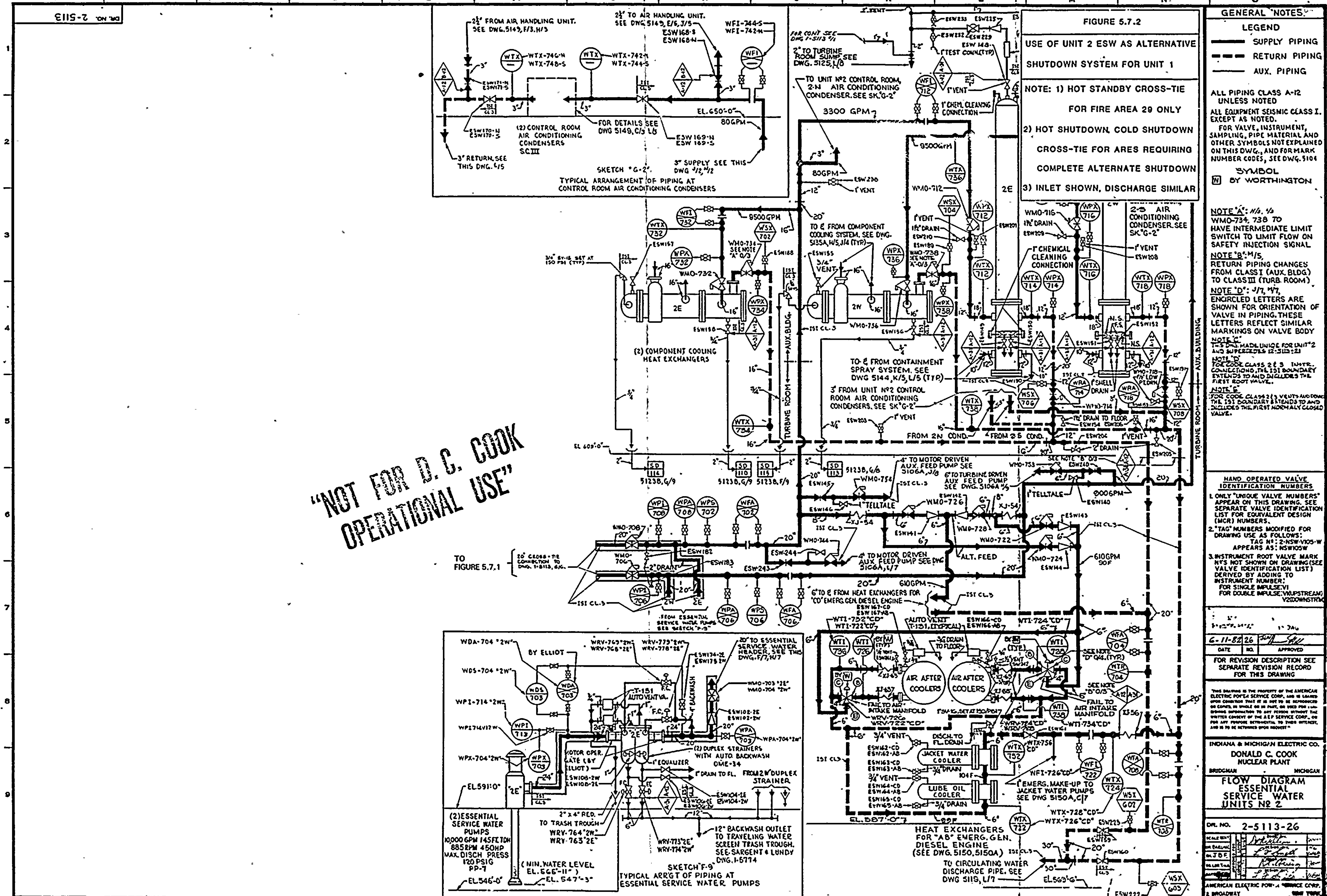
FOR REVISION DESCRIPTION SEE SEPARATE REVISION RECORD FOR THIS DRAWING

INDIANA & MICHIGAN ELECTRIC CO.
DONALD C. COOK NUCLEAR PLANT
BRIDGMAN MICHIGAN

FLOW DIAGRAM ESSENTIAL SERVICE WATER UNITS Nº 1

DR. NO. 1-5113-26

AMERICAN ELECTRIC POWER SERVICE CORP
2 BROADWAY NEW YORK



"NOT FOR D. C. COOK OPERATIONAL USE"
FIGURE 5.7.2
USE OF UNIT 2 ESW AS ALTERNATIVE SHUTDOWN SYSTEM FOR UNIT 1
NOTE: 1) HOT STANDBY CROSS-TIE FOR FIRE AREA 29 ONLY
2) HOT SHUTDOWN, COLD SHUTDOWN CROSS-TIE FOR ARES REQUIRING COMPLETE ALTERNATE SHUTDOWN
3) INLET SHOWN, DISCHARGE SIMILAR
GENERAL NOTES
LEGEND
SUPPLY PIPING
RETURN PIPING
AUX. PIPING
ALL PIPING CLASS A-12 UNLESS NOTED
ALL EQUIPMENT SEISMIC CLASS I. EXCEPT AS NOTED.
FOR VALVE, INSTRUMENT, SAMPLING, PIPE MATERIAL AND OTHER SYMBOLS NOT EXPLAINED ON THIS DWG., AND FOR MARK NUMBER CODES, SEE DWG. 5104
SYMBOL
W BY WORTHINGTON
NOTE "A": WMO-734, 738 TO HAVE INTERMEDIATE LIMIT SWITCH TO LIMIT FLOW ON SAFETY INJECTION SIGNAL
NOTE "B": RETURN PIPING CHANGES FROM CLASS I (AUX. BLDG) TO CLASS III (TURB. ROOM)
NOTE "D": ENCIRCLED LETTERS ARE SHOWN FOR ORIENTATION OF VALVE IN PIPING. THESE LETTERS REFLECT SIMILAR MARKINGS ON VALVE BODY
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-V105-W APPEARS AS: NSW105W
3. INSTRUMENT ROOT VALVE MARK Nº'S NOT SHOWN ON DRAWING (SEE VALVE IDENTIFICATION LIST) DERIVED BY ADDING TO INSTRUMENT NUMBER: FOR SINGLE IMPULSE: VI FOR DOUBLE IMPULSE: VU(UPSTREAM) V2(DOWNSTREAM)
6-11-82 26
DATE NO. APPROVED
FOR REVISION DESCRIPTION SEE SEPARATE REVISION RECORD FOR THIS DRAWING
INDIANA & MICHIGAN ELECTRIC CO.
DONALD C. COOK NUCLEAR PLANT
BRIDGMAN MICHIGAN
FLOW DIAGRAM ESSENTIAL SERVICE WATER UNITS Nº 2
DR. NO. 2-5113-26
AMERICAN ELECTRIC POWER SERVICE CORP.
SKETCH "G-2". TYPICAL ARRANGEMENT OF PIPING AT CONTROL ROOM AIR CONDITIONING CONDENSERS
(2) CONTROL ROOM AIR CONDITIONING CONDENSERS SC III
(2) COMPONENT COOLING HEAT EXCHANGERS
TO FIGURE 5.7.1
(2) ESSENTIAL SERVICE WATER PUMPS 10,000 GPM 145 FT TDH 885 RPM 450 HP MAX. DISCH PRESS 120 PSIG PP-7
SKETCH "F-9" TYPICAL ARR'G'T OF PIPING AT ESSENTIAL SERVICE WATER PUMPS
(2) DUPLEX STRAINERS WITH AUTO BACKWASH OME-34
HEAT EXCHANGERS FOR "AB" EMERG. GEN. DIESEL ENGINE (SEE DWG. 5150, 5150A)
AIR AFTER COOLERS
JACKET WATER COOLER
LUBE OIL COOLER
TO CIRCULATING WATER DISCHARGE PIPE. SEE DWG 5119, L/7
TURBINE ROOM
AUX. BUILDING

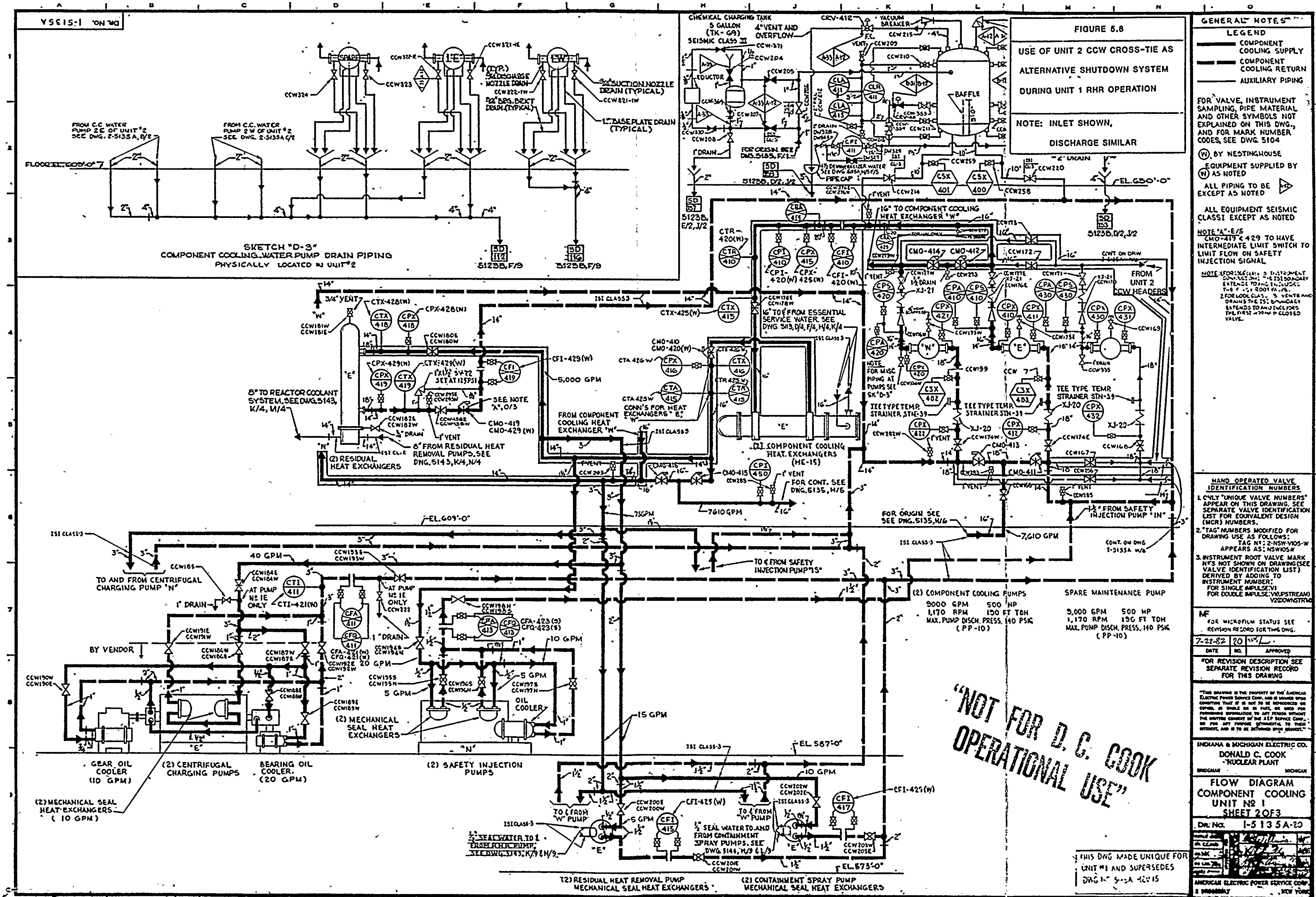
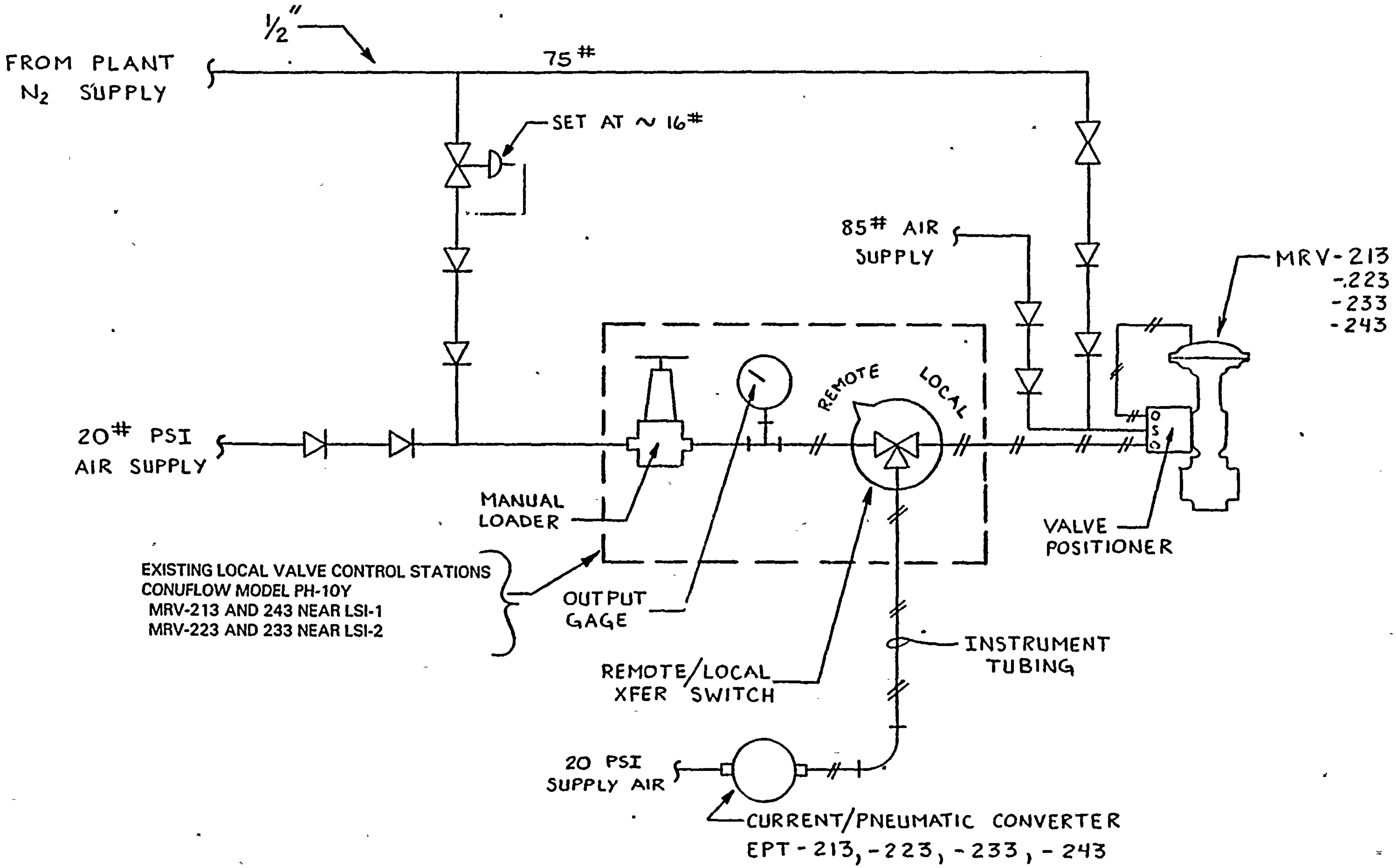
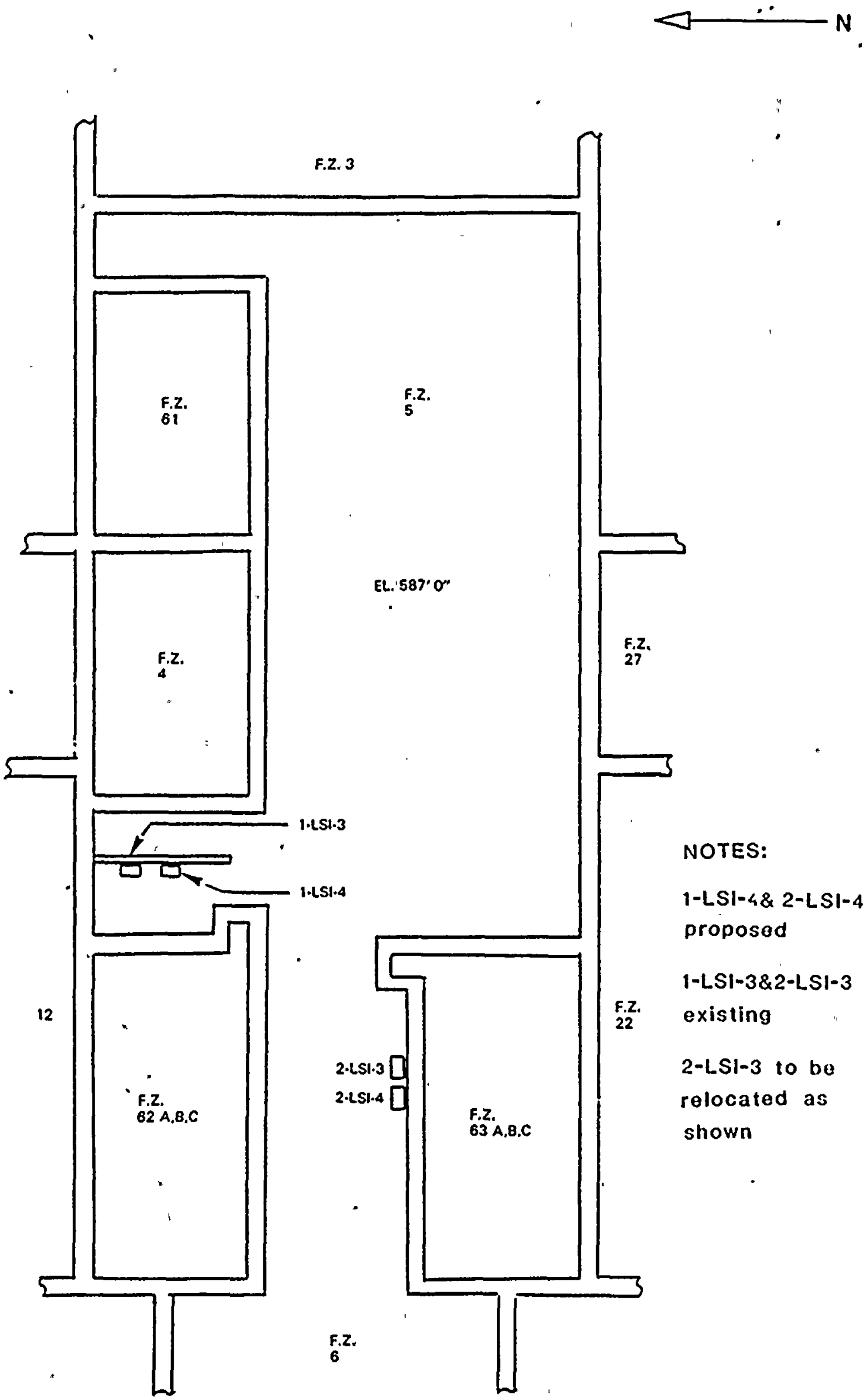


FIGURE 5.8
USE OF UNIT 2 CCW CROSS-TIE AS ALTERNATIVE SHUTDOWN SYSTEM DURING UNIT 1 RHR OPERATION
NOTE: INLET SHOWN, DISCHARGE SIMILAR
GENERAL NOTES
LEGEND
COMPONENT COOLING SUPPLY
COMPONENT COOLING RETURN
AUXILIARY PIPING
FOR VALVE, INSTRUMENT SAMPLING, PIPE MATERIAL AND OTHER SYMBOLS NOT EXPLAINED ON THIS DWG., AND FOR MARK NUMBER CODES, SEE DWG. 5104
BY WESTINGHOUSE
EQUIPMENT SUPPLIED BY AS NOTED
ALL PIPING TO BE EXCEPT AS NOTED
ALL EQUIPMENT SEISMIC CLASS I EXCEPT AS NOTED
HAND OPERATED VALVE IDENTIFICATION NUMBERS
SKETCH "D-3"
COMPONENT COOLING WATER PUMP DRAIN PIPING
PHYSICALLY LOCATED IN UNIT #2
CHEMICAL CHARGING TANK 5 GALLON (TK-69) SEISMIC CLASS II
(2) RESIDUAL HEAT EXCHANGERS
(2) COMPONENT COOLING HEAT EXCHANGERS (HE-15)
FROM UNIT 2 CCW HEADERS
(2) COMPONENT COOLING PUMPS
9000 GPM 500 HP
1,170 RPM 190 FT TDH
MAX. PUMP DISCH. PRESS. 140 PSIG (PP-10)
SPARE MAINTENANCE PUMP
9,000 GPM 500 HP
1,170 RPM 190 FT TDH
MAX. PUMP DISCH. PRESS. 140 PSIG (PP-10)
TO AND FROM CENTRIFUGAL CHARGING PUMP "N"
(2) MECHANICAL SEAL HEAT EXCHANGERS
GEAR OIL COOLER (10 GPM)
(2) CENTRIFUGAL CHARGING PUMPS
BEARING OIL COOLER (20 GPM)
(2) SAFETY INJECTION PUMPS
(2) MECHANICAL SEAL HEAT EXCHANGERS (10 GPM)
(2) RESIDUAL HEAT REMOVAL PUMP MECHANICAL SEAL HEAT EXCHANGERS
(2) CONTAINMENT SPRAY PUMP MECHANICAL SEAL HEAT EXCHANGERS
"NOT FOR D. C. COOK OPERATIONAL USE"
THIS DWG MADE UNIQUE FOR UNIT #1 AND SUPERSEDES
INDIANA & MICHIGAN ELECTRIC CO.
DONALD C. COOK NUCLEAR PLANT
FLOW DIAGRAM COMPONENT COOLING UNIT NO 1 SHEET 2 OF 3
DR. NO. 1-5135A-20
AMERICAN ELECTRIC POWER SERVICE CORP.



N2 SUPPLY FOR EMERGENCY OPERATION OF S.G. PORV'S

FIGURE 5.9



NOTES:

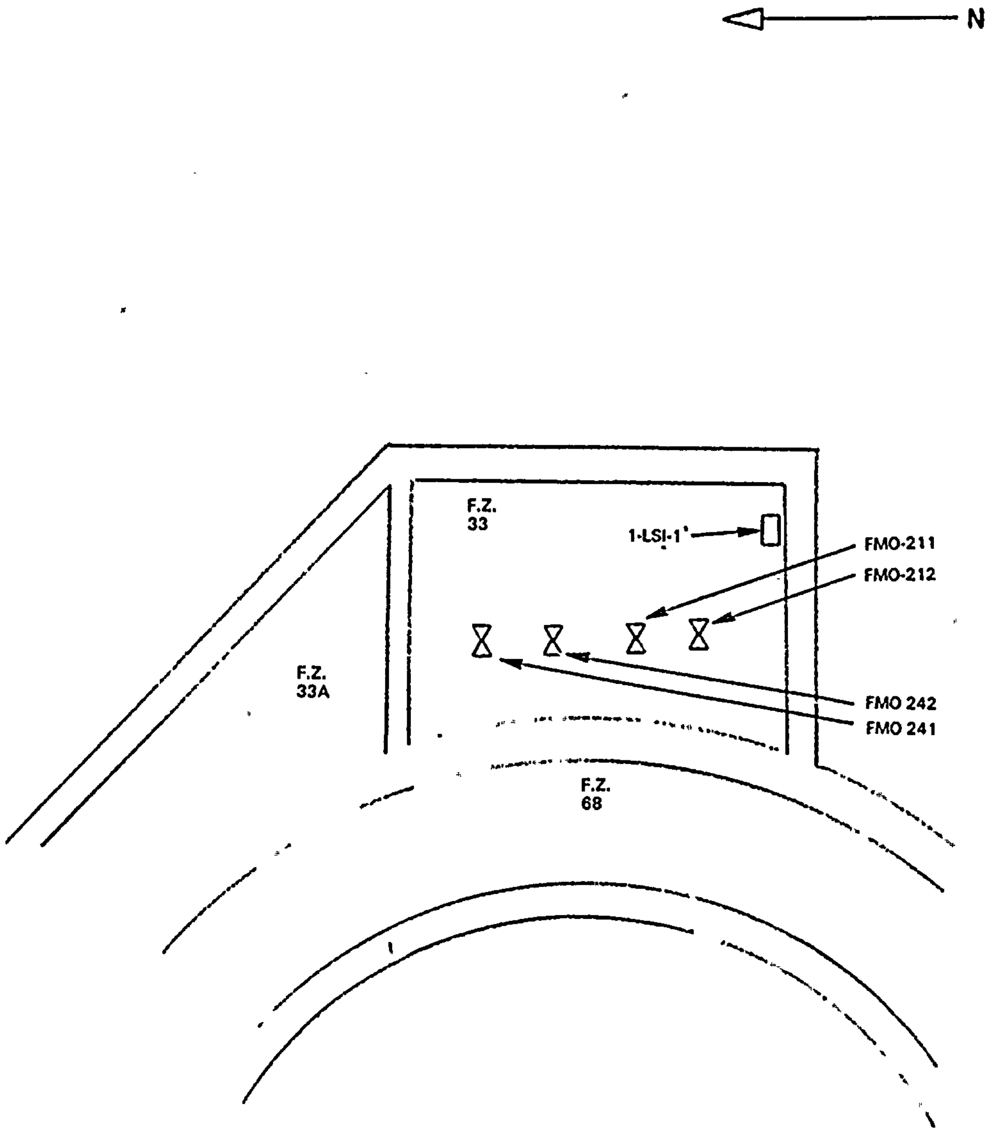
1-LSI-4& 2-LSI-4 proposed

1-LSI-3&2-LSI-3 existing

2-LSI-3 to be relocated as shown

LOCATION OF LOCAL SHUTDOWN INDICATION CABINETS:1-LSI-3, 1-LSI-4,2-LSI-3,2-LSI-4

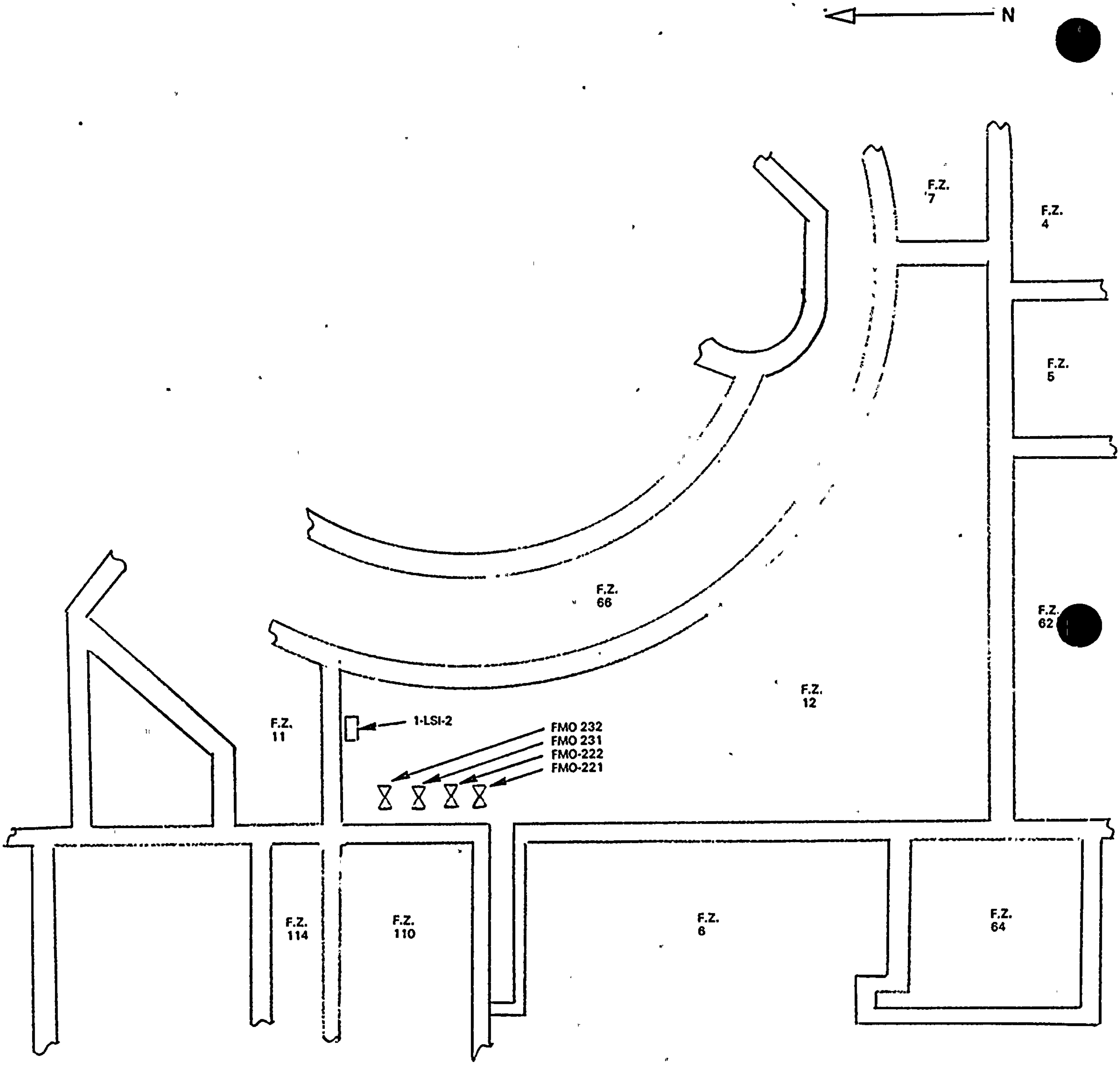
FIGURE 5.10.1



LOCATION OF EXISTING LOCAL SHUTDOWN
INDICATION CABINET 1-LSI-1

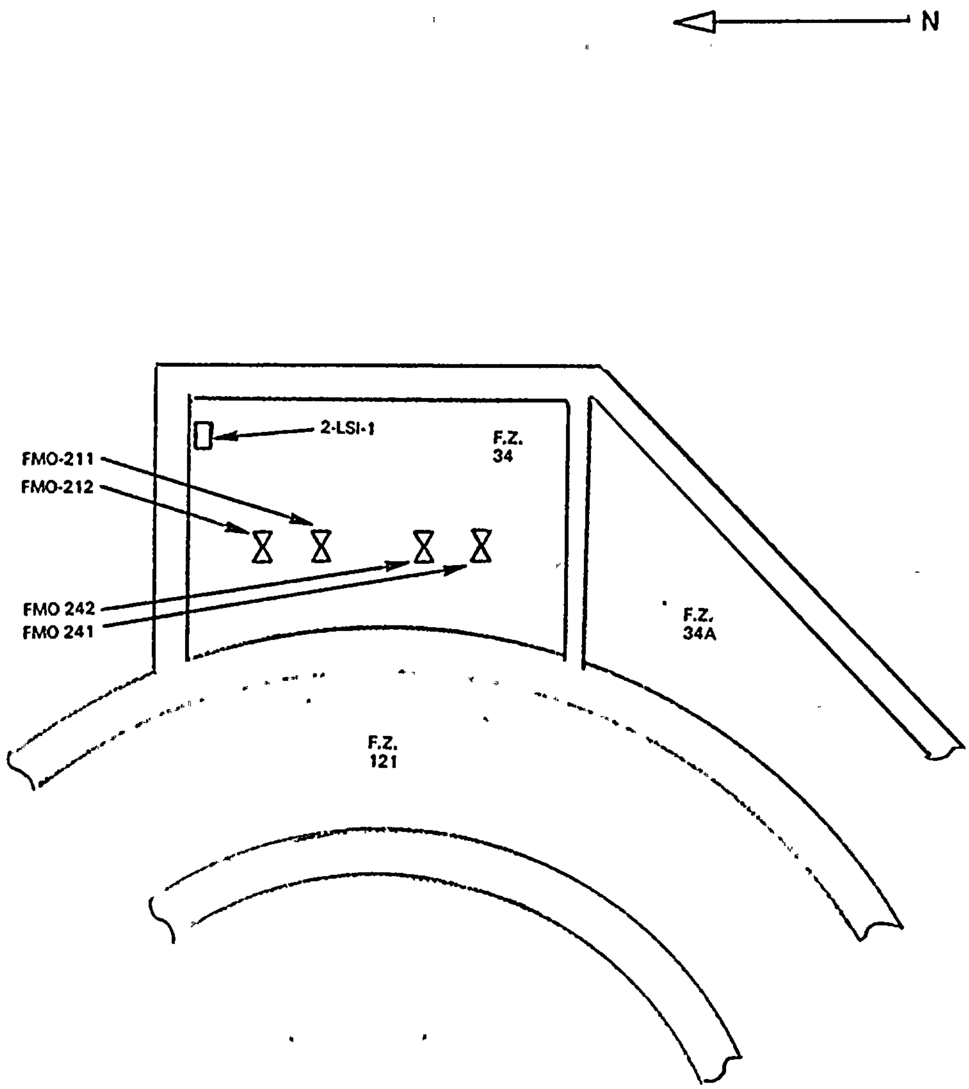
**EXISTING LOCAL SHUTDOWN INDICATION CABINET
LOCATION OF 1-LSI-1**

FIGURE 5.10.2



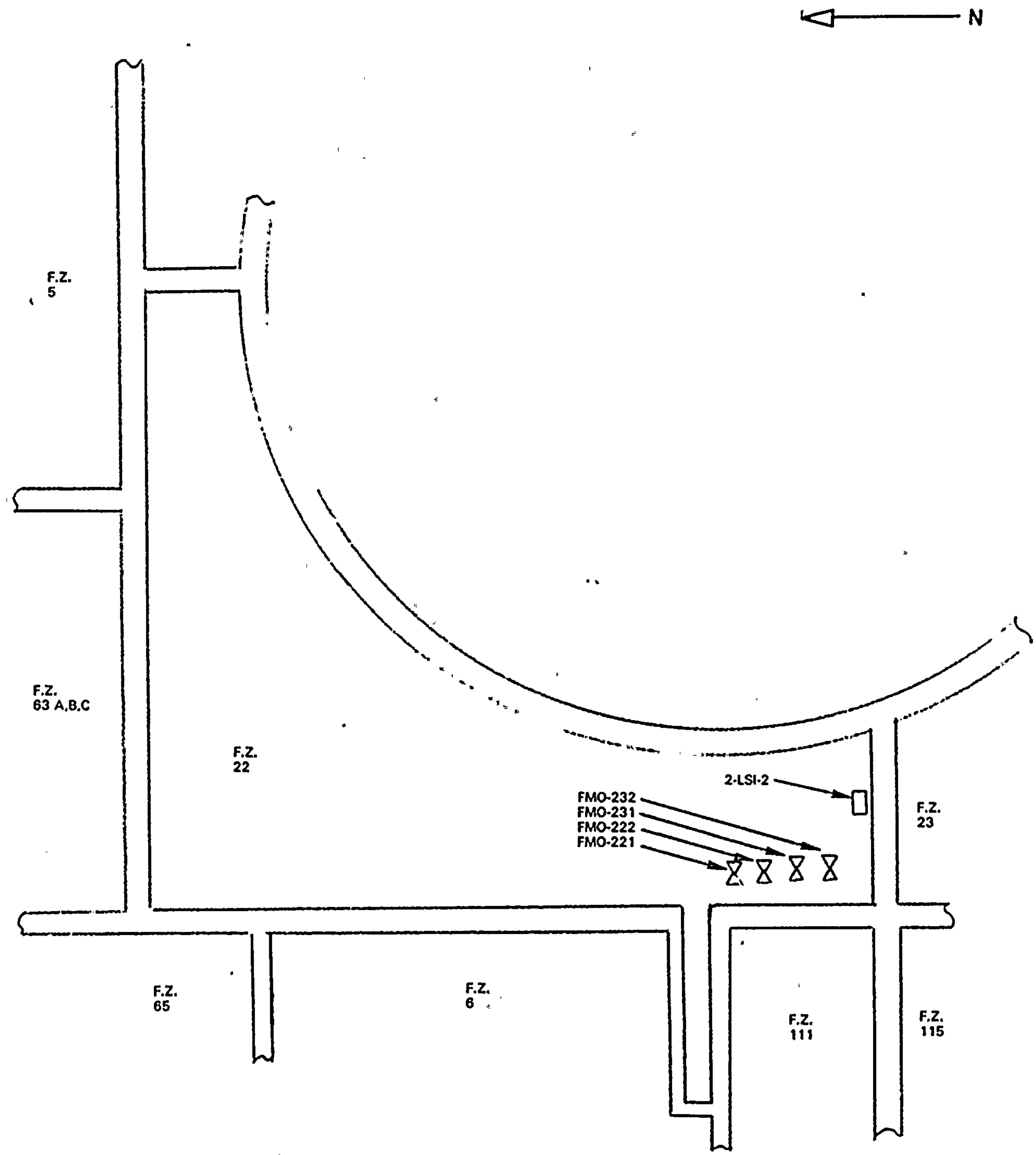
LOCATION OF EXISTING LOCAL SHUTDOWN INDICATION CABINET 1-LSI-1

FIGURE 5.10.3



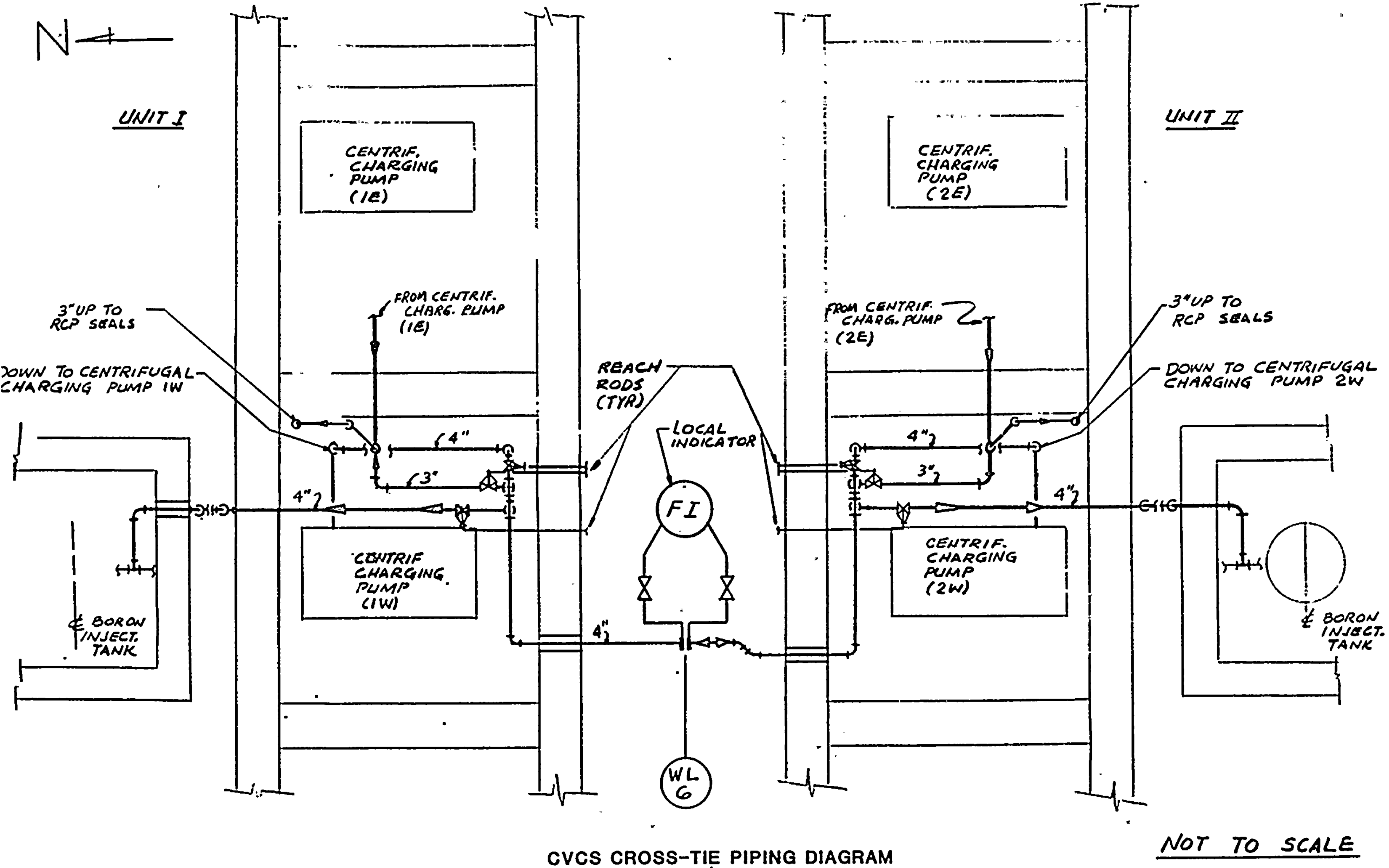
LOCATION OF EXISTING LOCAL SHUTDOWN INDICATION CABINET
2-LSI-1

FIGURE 5.10.4



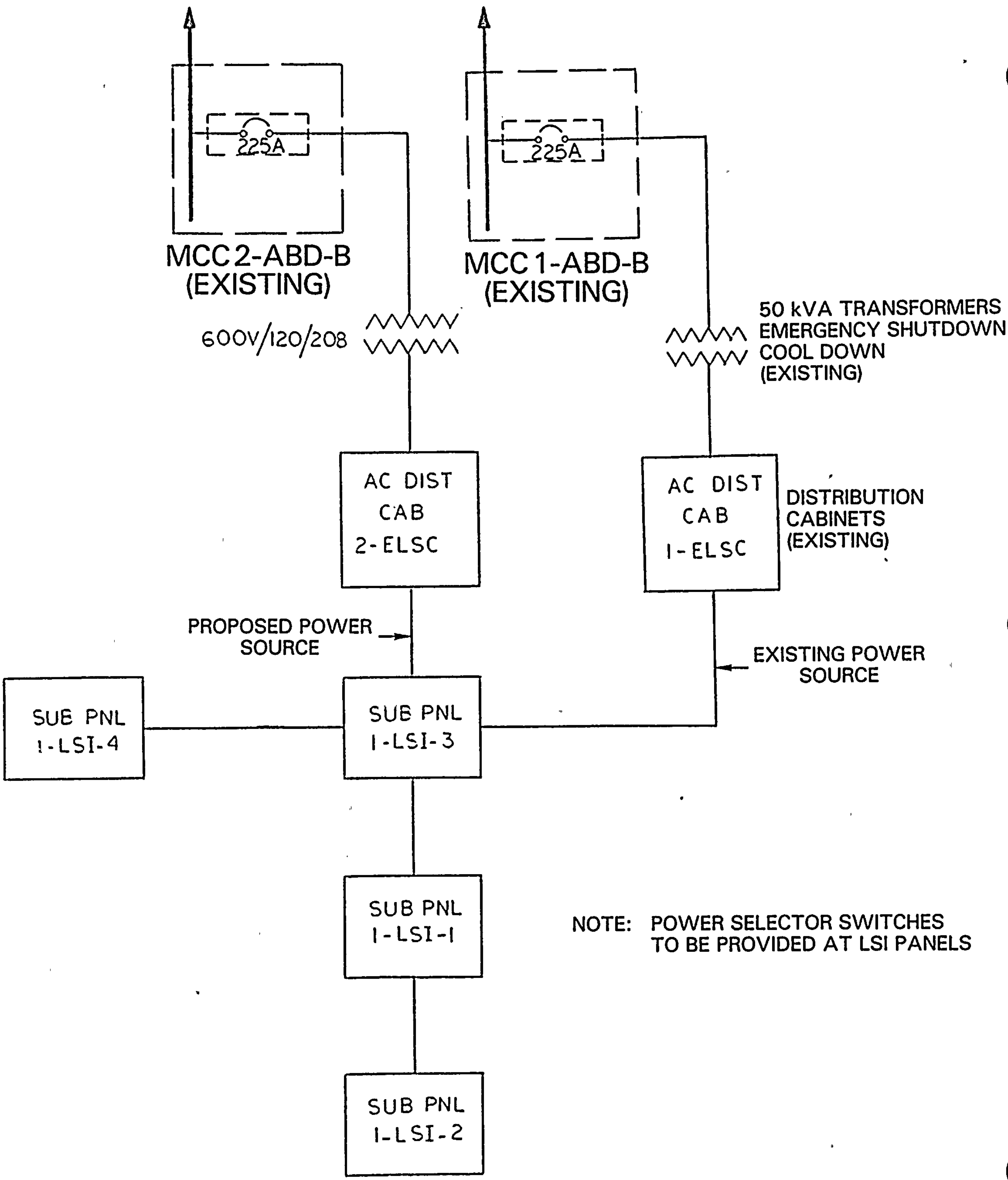
LOCATION OF EXISTING LOCAL SHUTDOWN INDICATION CABINET
2-LSI-2

FIGURE 5.10.5



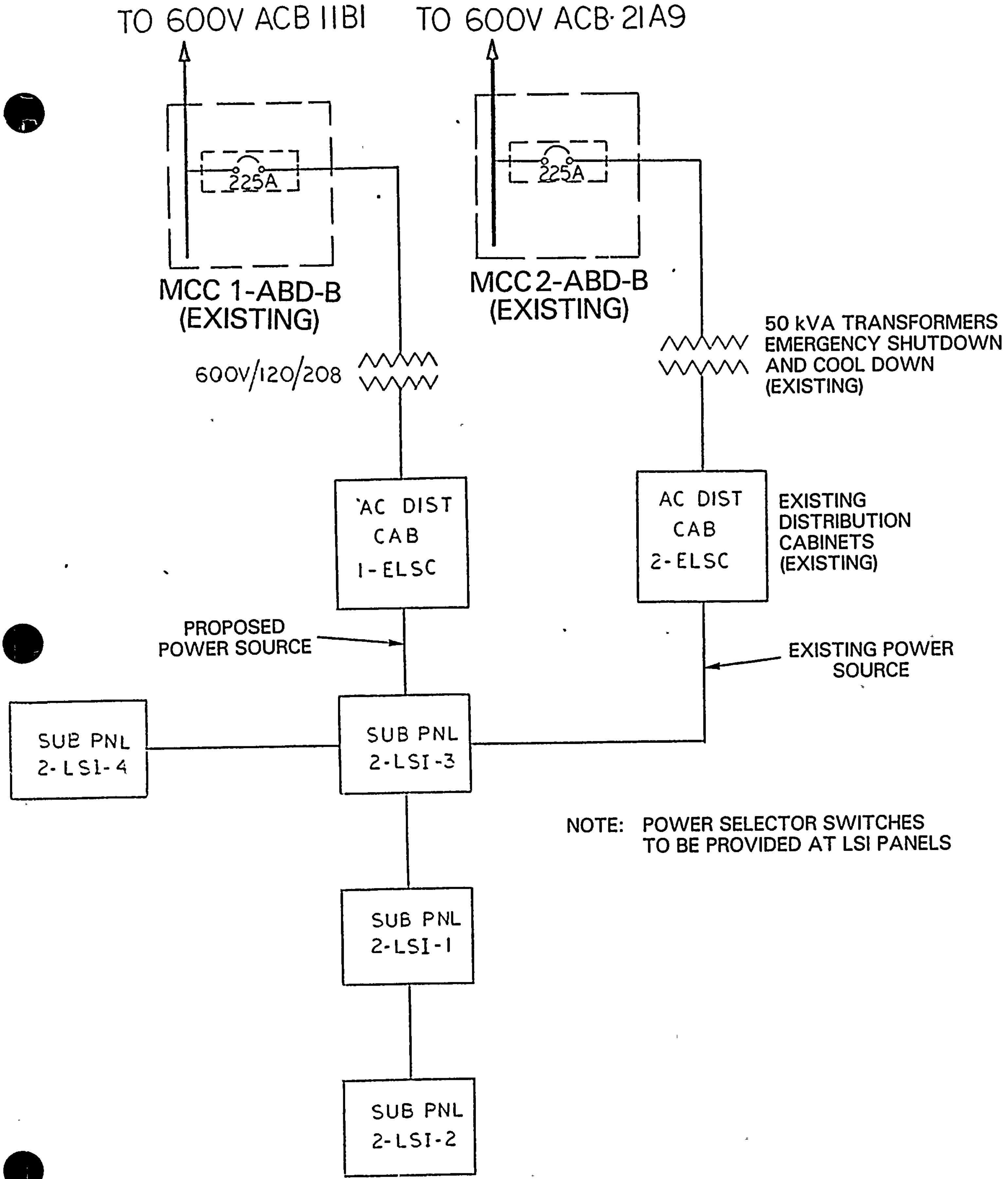
CVCS CROSS-TIE PIPING DIAGRAM

FIGURE 5.11



ONE LINE DIAGRAM FOR PROPOSED
POWER SOURCES TO UNIT 1 LSI PANELS

FIGURE 5.12.1

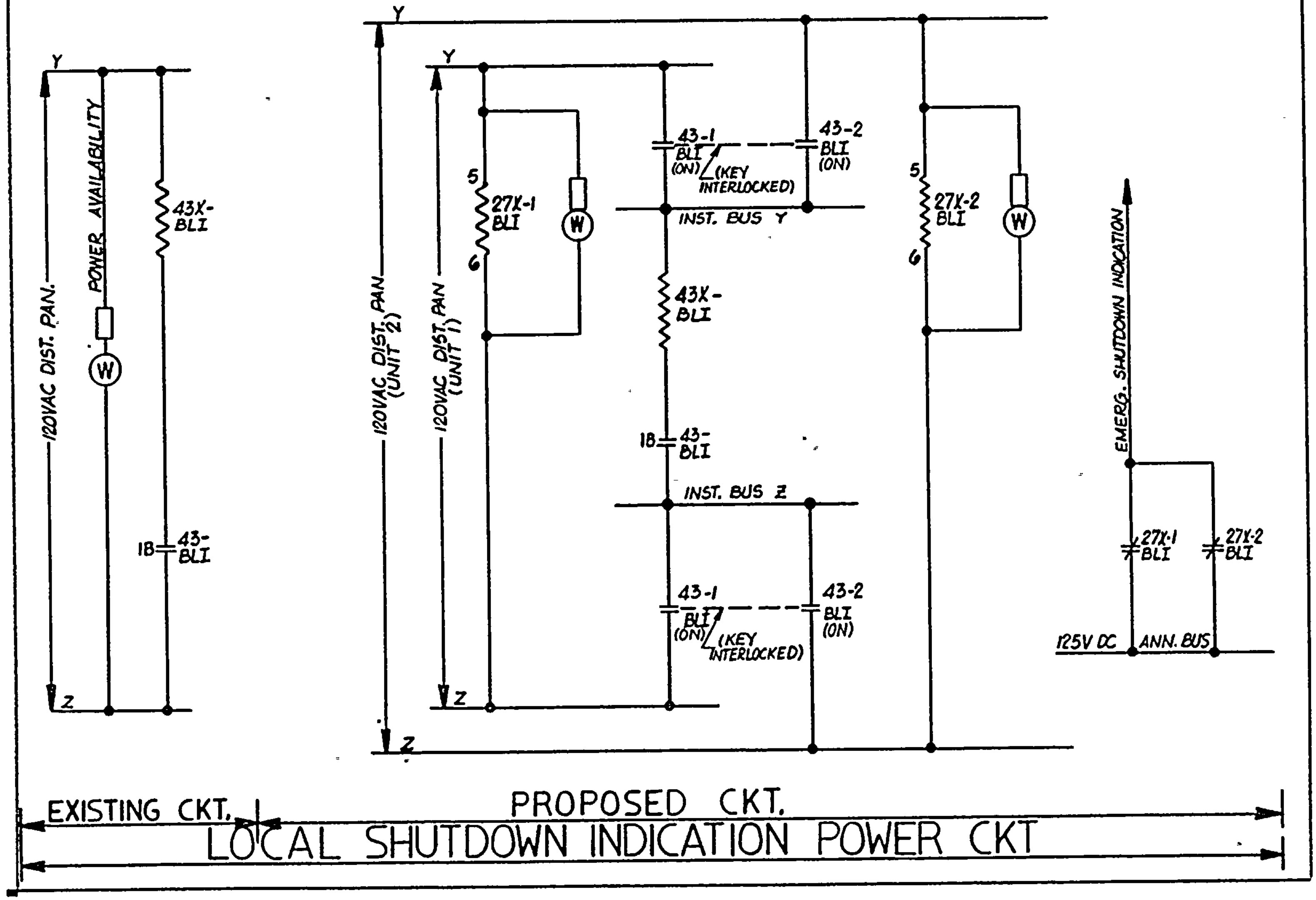


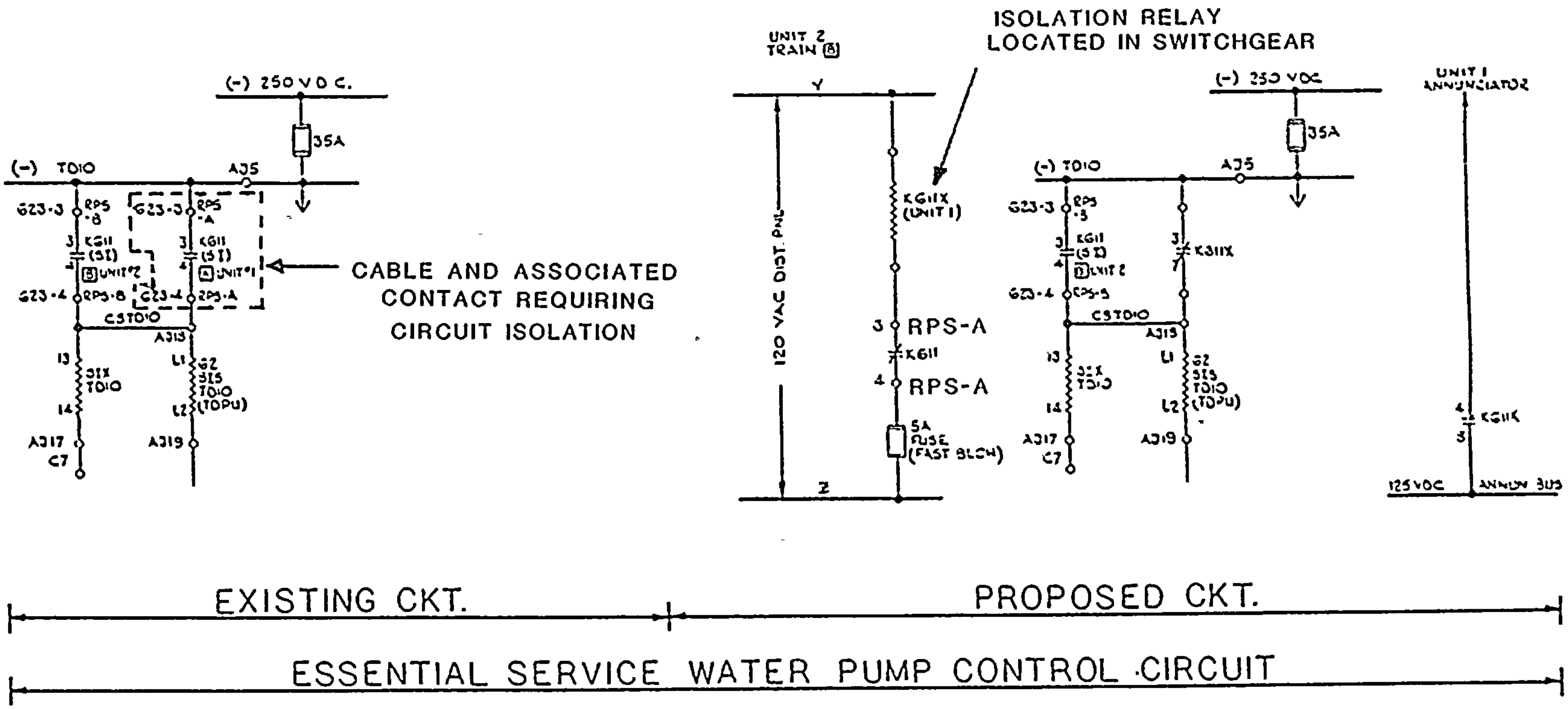
ONE LINE DIAGRAM FOR PROPOSED
POWER SOURCES TO UNIT 2 LSI PANELS

FIGURE 5.12.2

LSI PANEL POWER SUPPLY SCHEMATIC (TYPICAL)

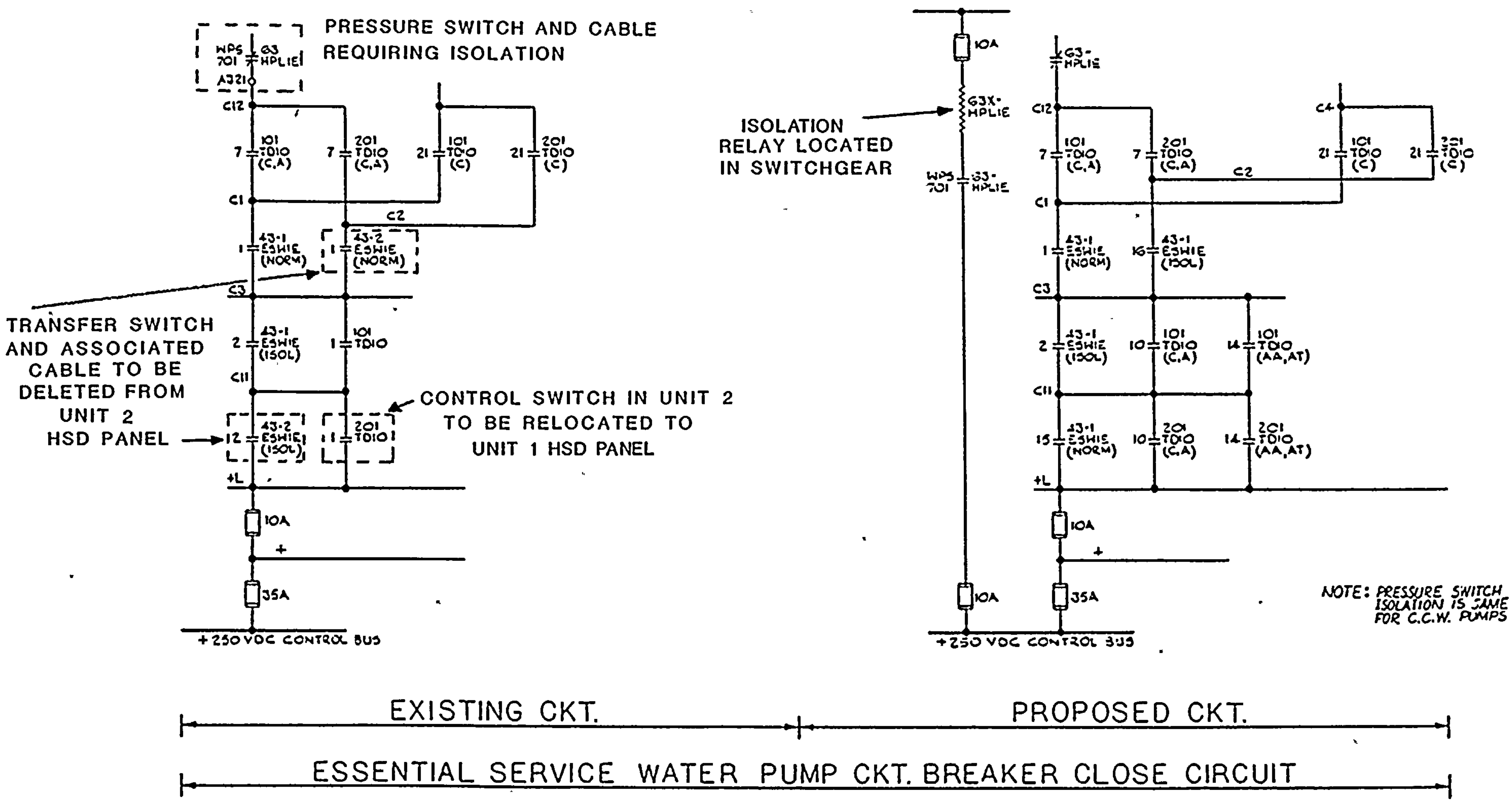
FIGURE 5.13





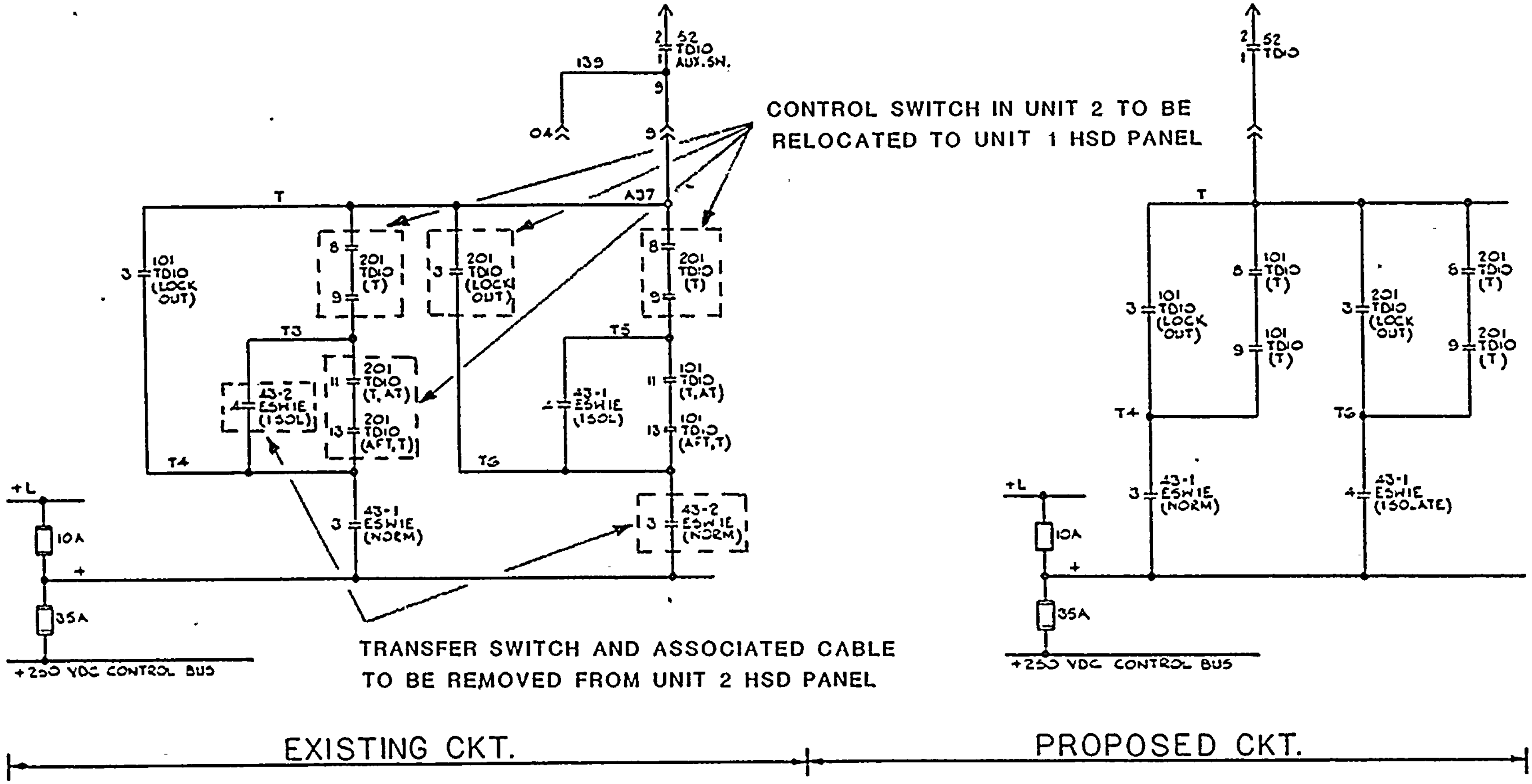
UNIT 2 PUMP CIRCUIT SHOWN (TYPICAL FOR ALL ESW PUMPS)

FIGURE 5.14.1



UNIT 1 ESW PUMP CIRCUIT SHOWN (TYPICAL FOR ALL ESW PUMPS)

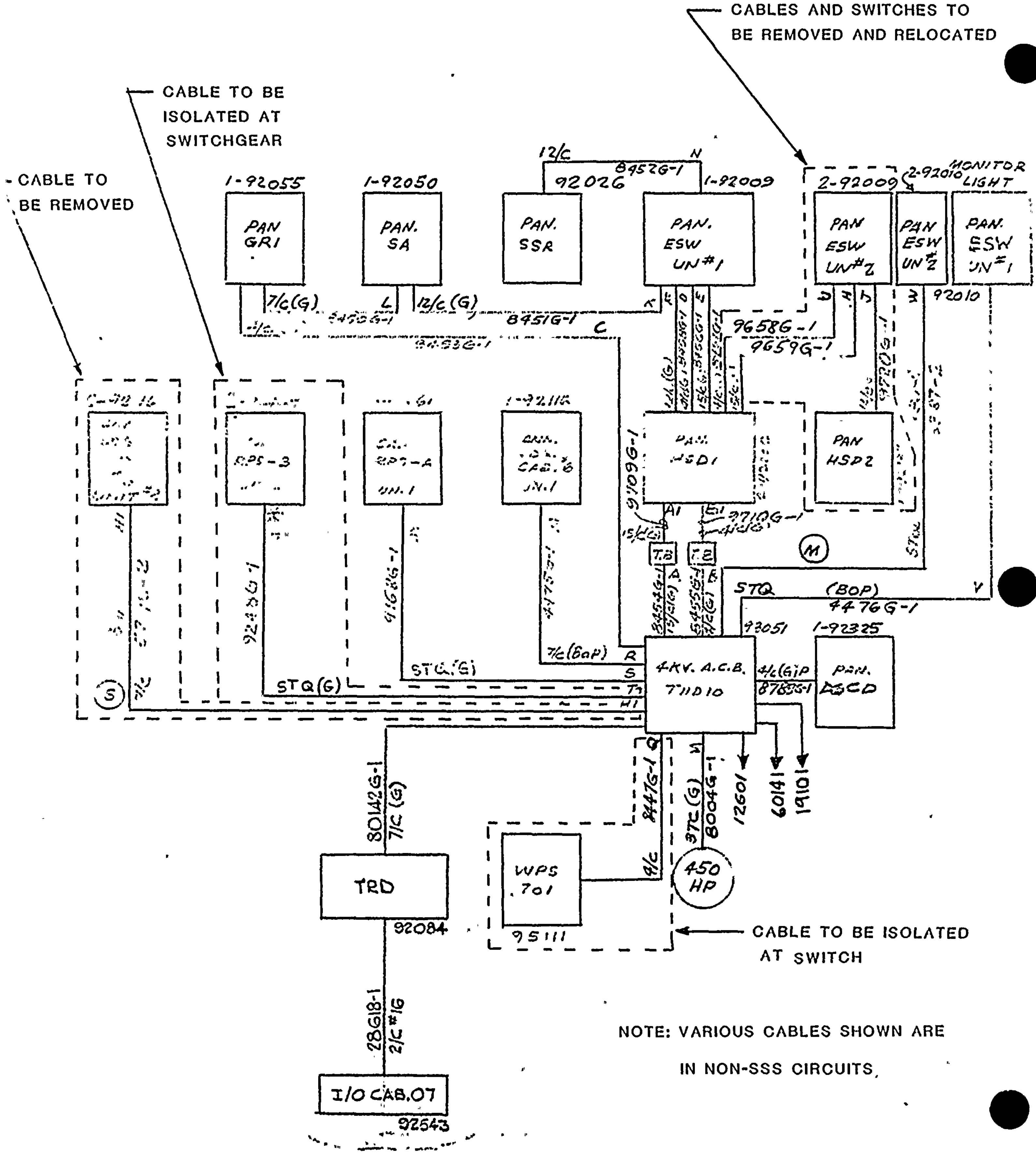
FIGURE 5.14.2



ESSENTIAL SERVICE WATER PUMP CKT. BREAKER TRIP CIRCUIT

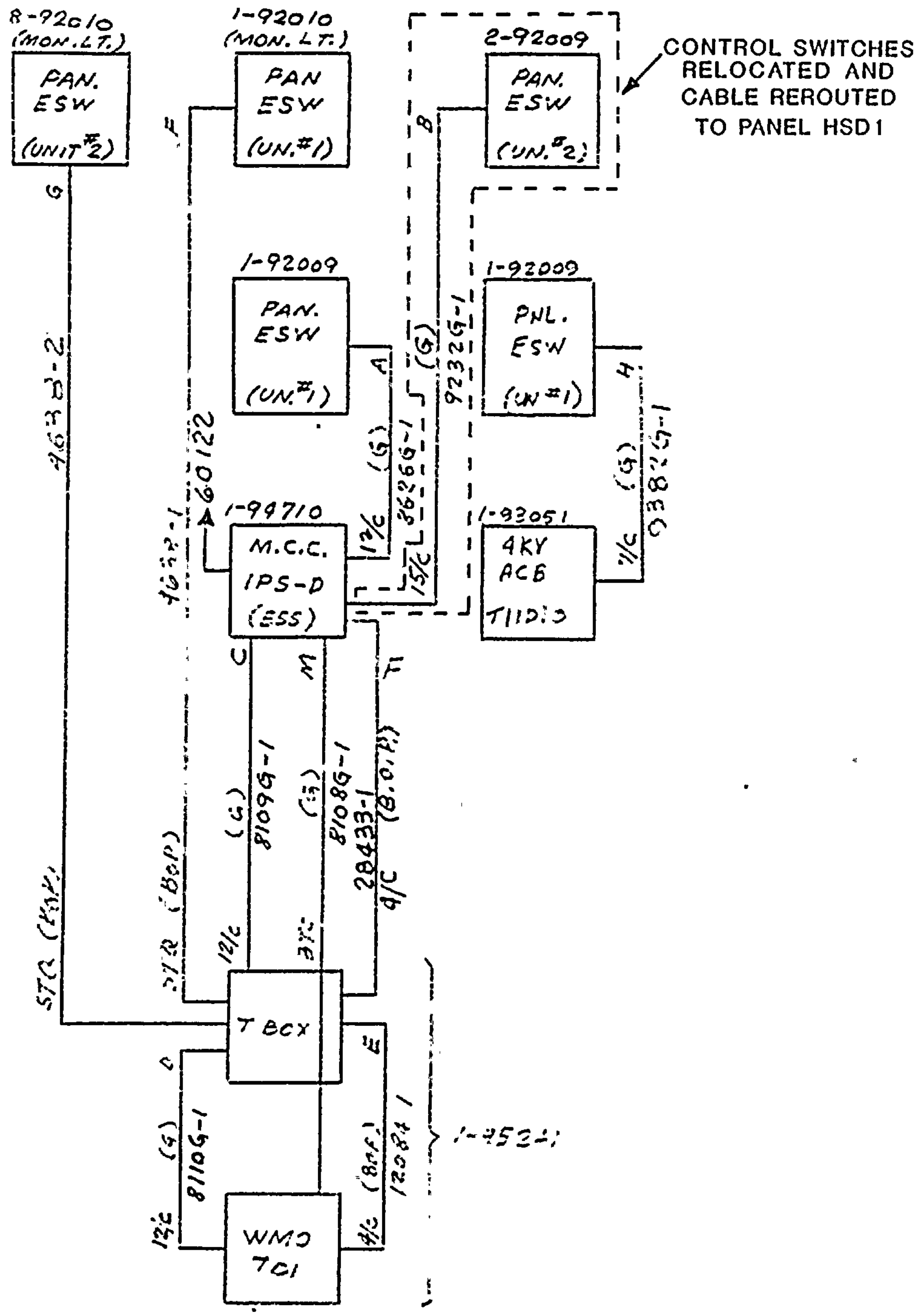
UNIT 1 ESW PUMP CIRCUIT SHOWN (TYPICAL FOR ALL ESW PUMPS)

FIGURE 5.14.3



ESW PUMP SCHEMATIC (TYPICAL)

FIGURE 5.15

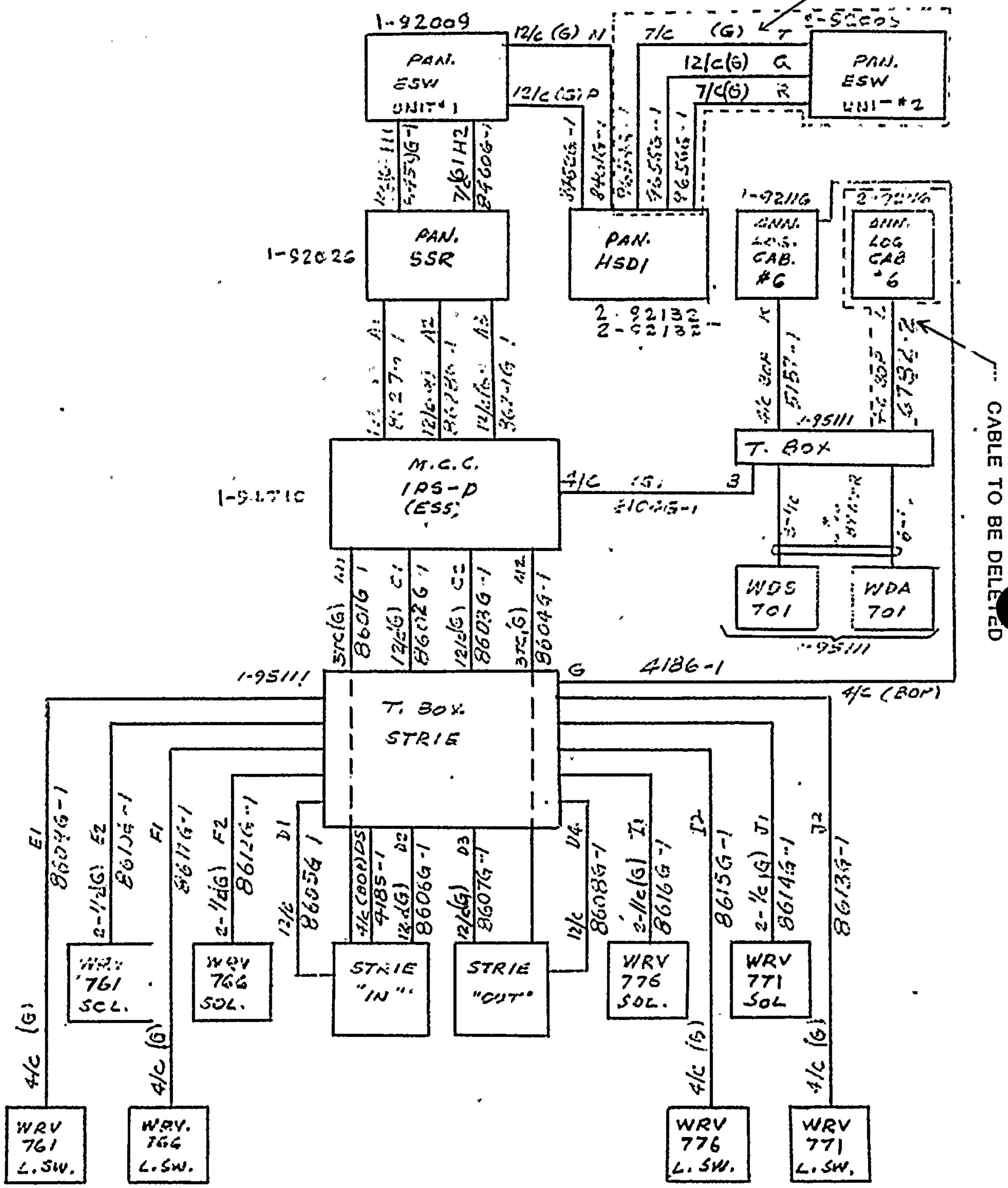


ESW PUMP DISCHARGE VALVE SCHEMATIC (TYPICAL)

FIGURE 5.16

NOTE: VARIOUS CABLES SHOWN ARE IN NON-SSS CIRCUITS.

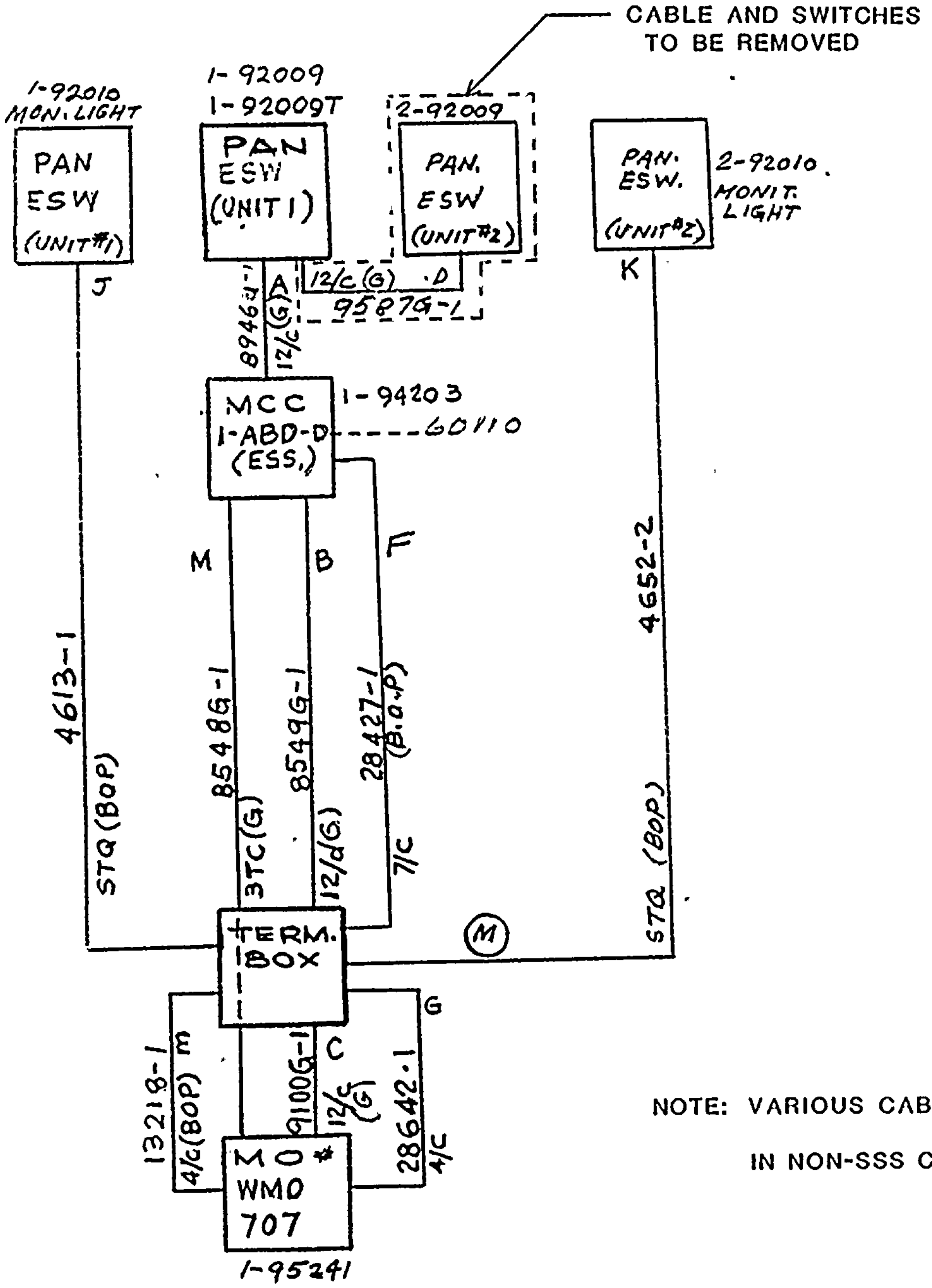
CABLES TO BE DELETED AND CONTROL SWITCHES RELOCATED TO HSD1



ESW PUMP STRAINER SCHEMATIC (TYPICAL)

NOTE: VARIOUS CABLES SHOWN ARE IN NON-SSS CIRCUITS

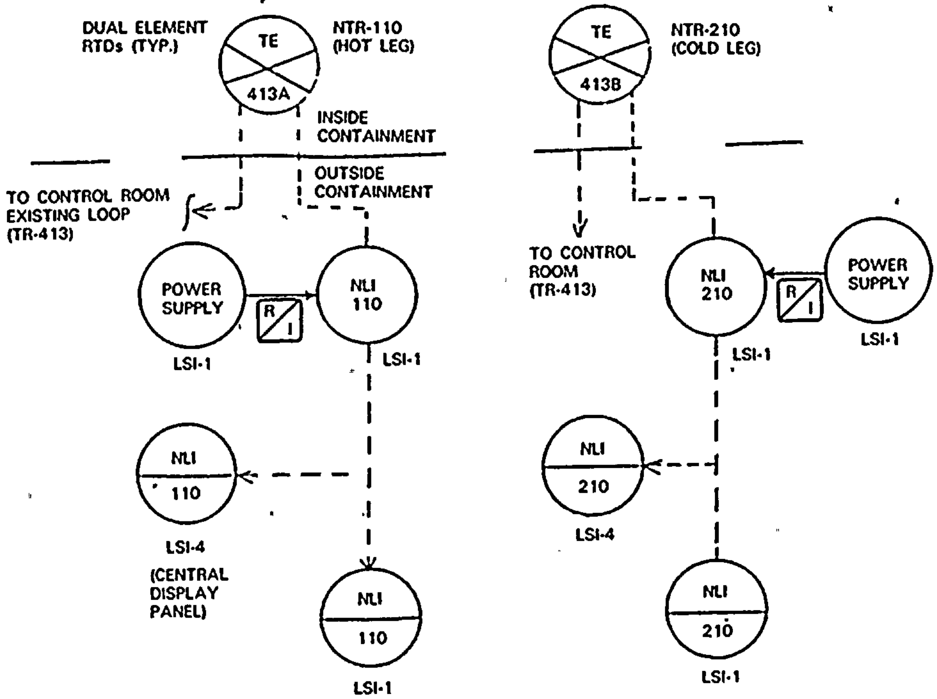
FIGURE 5.17



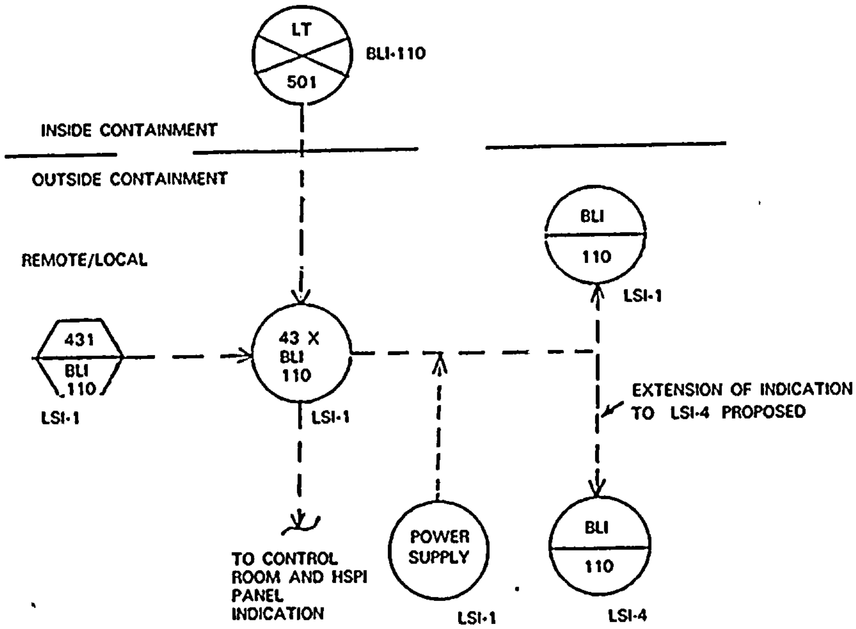
NOTE: VARIOUS CABLES SHOWN ARE IN NON-SSS CIRCUITS

ESW CROSS-TIE VALVE (TYPICAL)

FIGURE 5.18

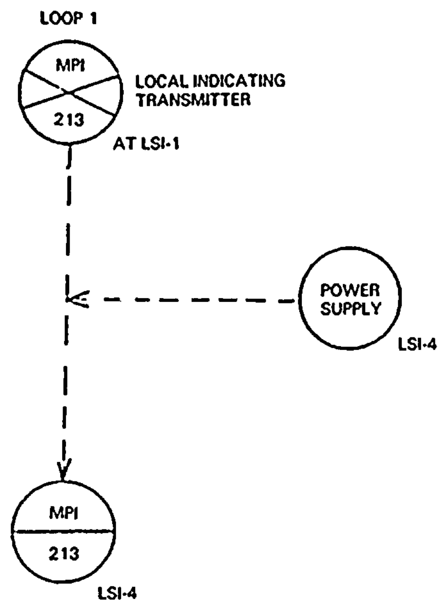


PROPOSED T_H AND T_C LOCAL INSTRUMENTATION (LOOP 1 SHOWN —LOOPS 2,3 AND 4 SIMILAR)



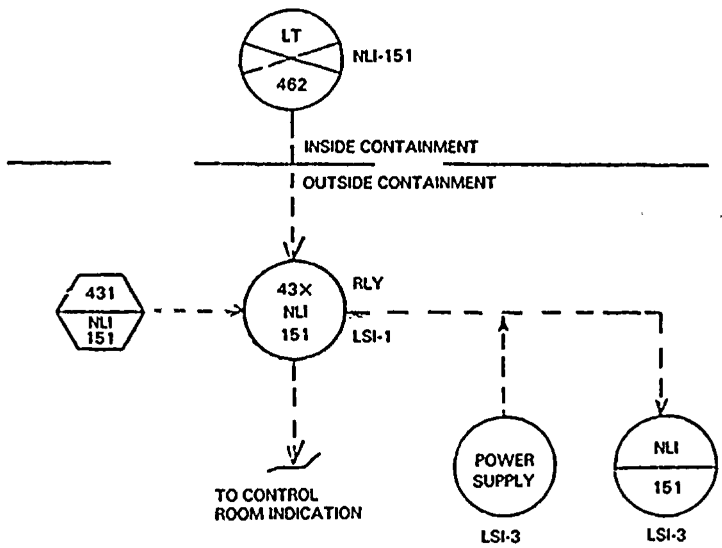
EXISTING WIDE-RANGE STEAM GENERATOR LEVEL LOCAL INSTRUMENTATION (LOOP 1 SHOWN — LOOPS 2,3 AND 4 SIMILAR)

FIGURE 5.19.1 LSI INSTRUMENTATION

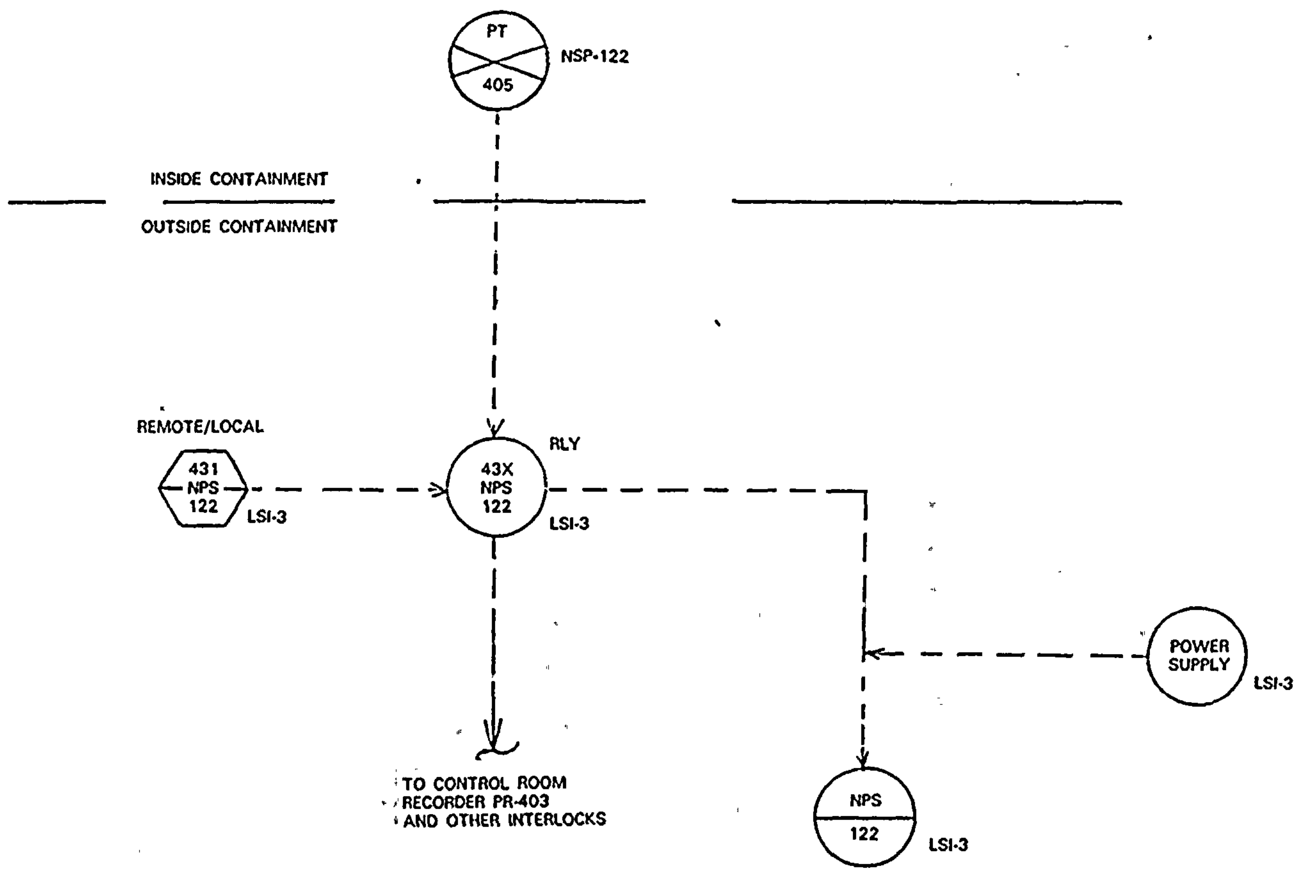


PROPOSED STEAM GENERATOR PRESSURE LOCAL INSTRUMENTATION.
(LOOP 1 SHOWN — LOOPS 2, 3, AND 4 SIMILAR)

EXISTING PRESSURIZER LEVEL
LOCAL INSTRUMENTATION

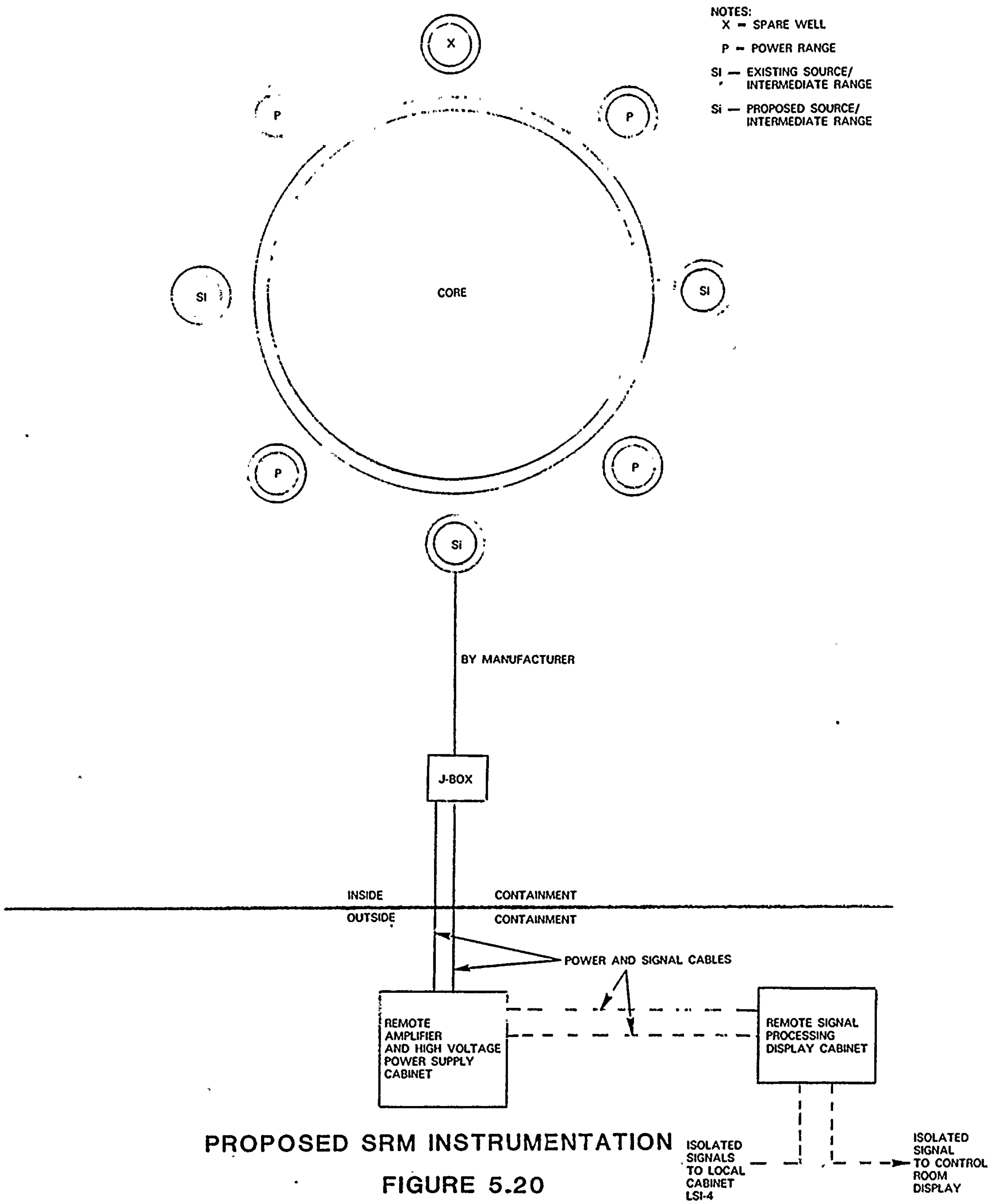


FIGUER 5.19.2 LSI INSTRUMENTATION



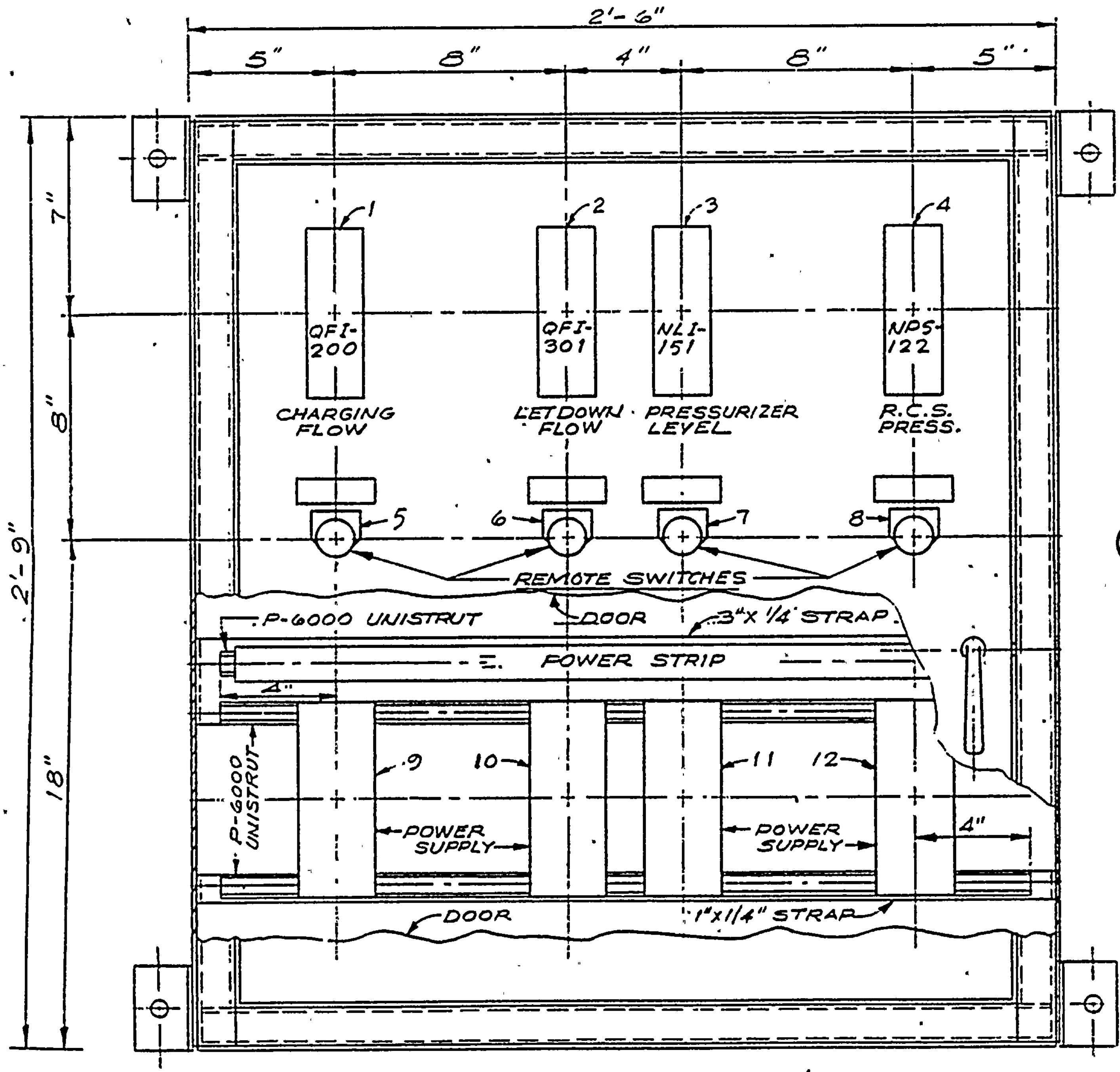
EXISTING REACTOR COOLANT
WIDE RANGE PRESSURE LOCAL
INSTRUMENTATION

FIGURE 5.19.3 LSI INSTRUMENTATION



PROPOSED SRM INSTRUMENTATION

FIGURE 5.20



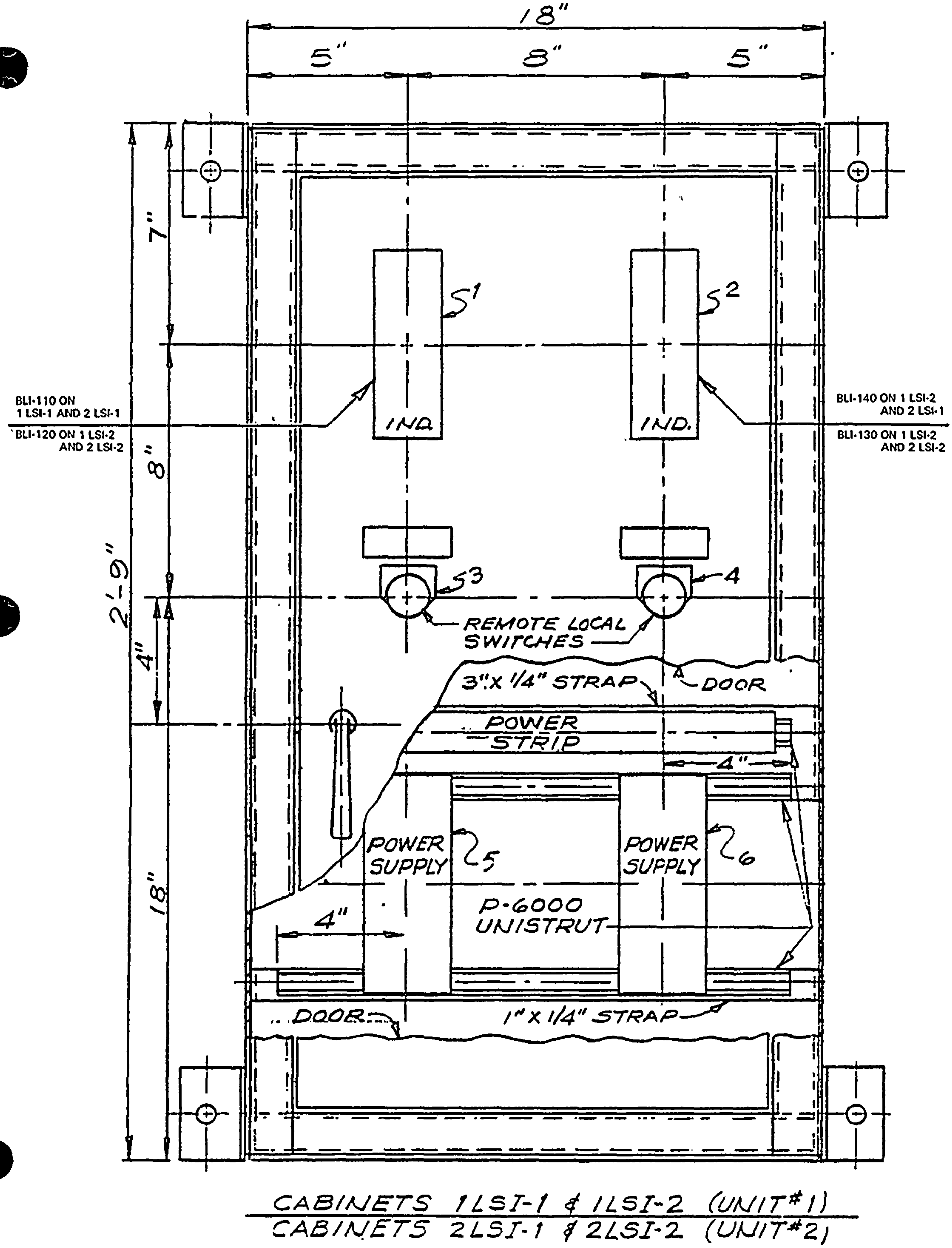
CABINET 1LSI-3 (UNIT# 1)

CABINET 2LSI-3 (UNIT# 2)

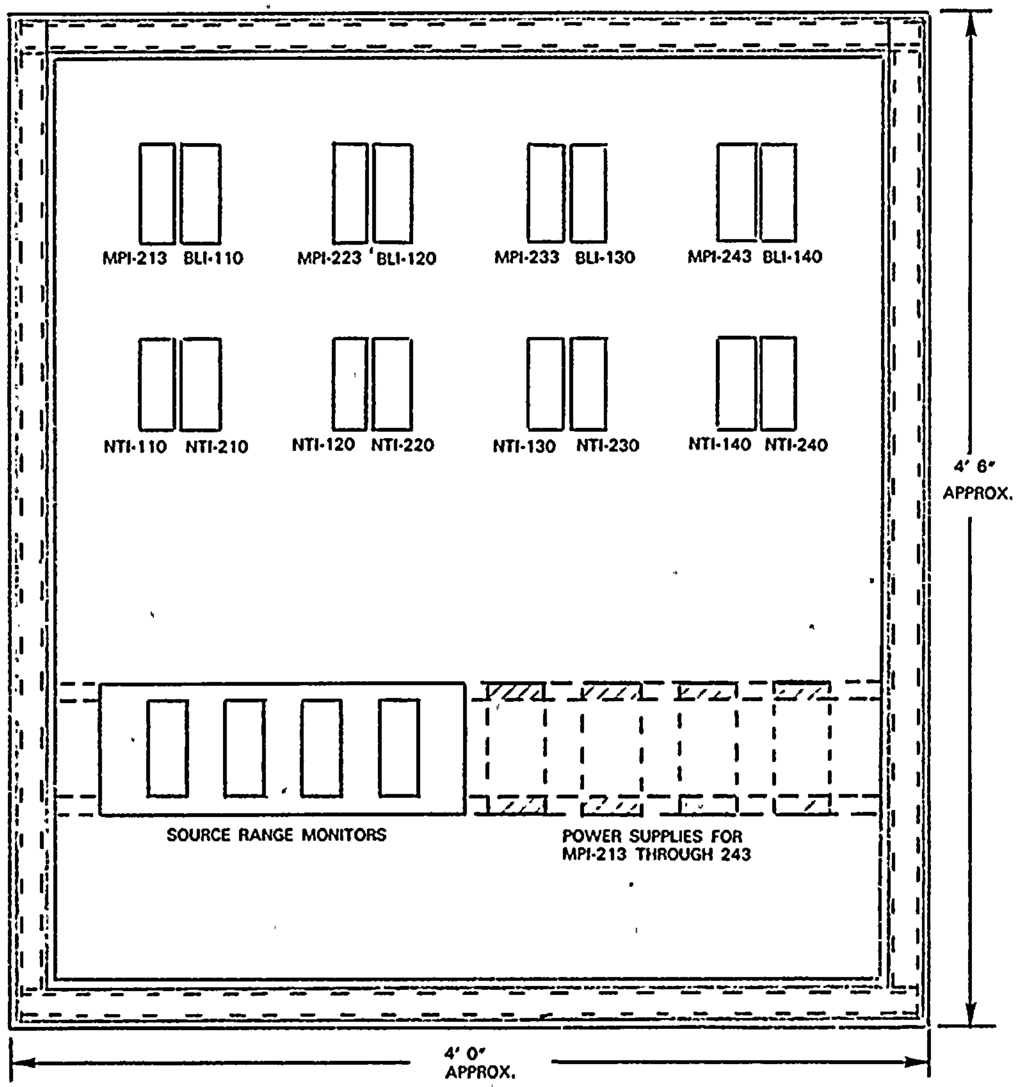
NOTE: CHARGING AND LETDOWN FLOW NOT REQUIRED SSS

EXISTING LOCAL SHUTDOWN IND. CABINETS

FIGURE 5.21.1



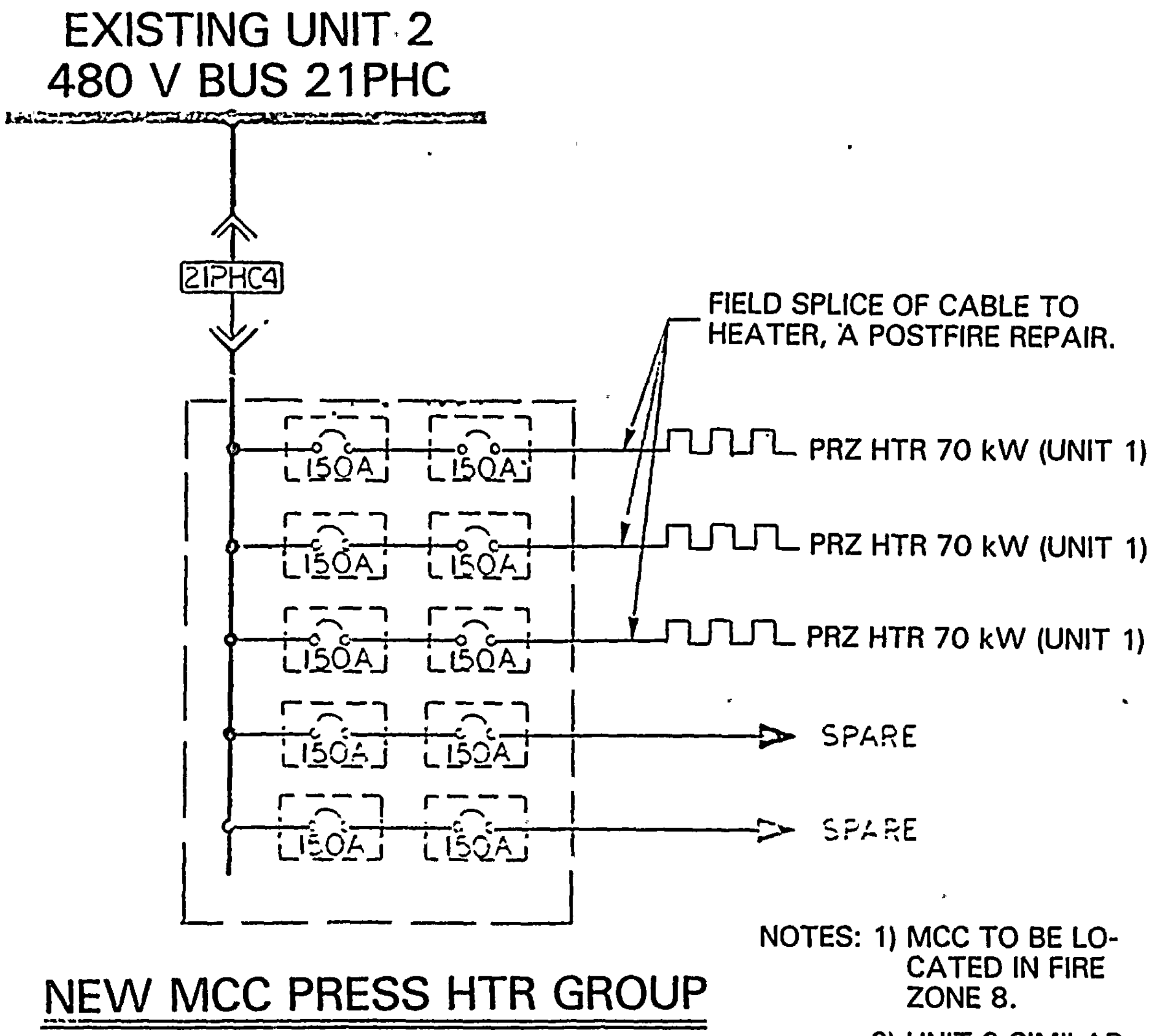
EXISTING LOCAL SHUTDOWN IND. CABINET FIGURE 5.21.2



GENERAL OUTLINE OF PROPOSED LOCAL SHUTDOWN IND. CABINET

1 LSI-4 (UNIT#1)
2 LSI-4 (UNIT#2)

FIGURE 5.21.3



NOTES: 1) MCC TO BE LOCATED IN FIRE ZONE 8.
2) UNIT 2 SIMILAR

ALTERNATE POWER SOURCE FOR UNIT 1
PRESSURIZER HEATERS

FIGURE 5.22

6.0 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 shutdown and cold shutdown are RCS cooldown states which occur as a result of reactor heat removal via the RHR system. The systems required for initiation and maintenance of reactor coolant system heat removal via the RHR system 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 is required and a second is proposed to provide operational flexibility. These are:

(1) Repowering of one RHR pump from the unaffected unit's EPS, and

(2) Repowering of one bank of pressurizer heaters from the unaffected unit's EPS.

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 and hot shutdown modes 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 which 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 assures 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, assuming no cooldown (use of steam generator PORVs) with a margin of greater than four hours. Should cooldown of the reactor coolant system be initiated prior to this time, an 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°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 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 process 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 have cooled to less than 300°F where 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, and 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 included the heaters in its safe shutdown equipment listing and proposes 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 permanent cabling will be installed between the affected unit's pressurizer heater containment penetration area and a separate 480 V MCC cubicle powered from the alternate unit. The cabling will be permanently terminated at the MCC and will be coiled in the containment penetration area.

The repair cables at the penetration area will have splicers and circuit markings installed. 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 in both units' penetration areas.

The general procedure for repowering the heaters will be as follows:

- o Verify that the unit backup heater group's normal and alternate power source is de-energized;
- o Disconnect the heater group power cabling at the containment electrical penetration;
- 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;
- 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 pumps by the unaffected unit is required. For these fire zones, loss of permanent power and/or control to the RHR pumps occurs due to loss of the pumps' 4 kV 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 a 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 assure proper repair activities.

6.3.1 Procedures and Materials for Repowering of RHR Pump

Should repowering of one RHR pump from the unaffected unit's power sources be required, the prepared, premeasured and phased power cables, materials, tools and procedures permanently stored in Fire Zone 1 will be used. The general procedure for repowering one pump is as follows:

- o Verify that the applicable power sources are de-energized in both units;
- o Disconnect the power cabling at both pumps;
- o Route the repair power cabling on the floor between the applicable pump locations (less than 80 ft);
- o Terminate the repair power cable to the unaffected unit's power feed cable and the fire-affected RHR pump motor;
- o Verify proper terminations, check for proper motor rotation, and notify operations;
- o Align the appropriate RHR system valves;
- o Close the associated 4 kV 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 which permit the capability of achieving cold shutdown within this 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 which 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, 19 fire areas or zones were identified which require exemptions from the specific requirements of Apppendix R, Section III.G. This section documents the fire hazards analyses performed on these 19 areas or zones and provides the basis by which the exemption requests are justified.

As a result of the proposed alternate shutdown capability, 16 fire zones require exemptions from Section III.G.3, in that a fixed suppression system is not installed in the area. Eight of these fire zones are inside containment where proposed alternate shutdown modifications involve installing additional instrumentation channels and cables. The fire zones in containment are 66, 67, 120, and 122 for Unit 1 and 74, 75, 121, and 123 for Unit 2.

Two of the areas, the Unit 1 and Unit 2 transformer rooms (fire zones 14 and 20), are located in the Auxiliary Buildings; two are in the Unit 1 and Unit 2 ESW pump rooms (fire zones 29A,B,E and 29C,D,F) and are located in the screenhouse; two are the Unit 1 and Unit 2 main stream line and valve enclosures (fire zones 33A,B and 34A,B) in the outside containment annulus area;

and the final two are the Unit 1 and Unit 2 main control rooms (fire zones 53 and 54).

The three exemptions requested from Section III.G.2 are for the RHR/CTS pump area (fire zones 1, 1A through 1H), the ESW pump basement (fire zone 29G), and the north end of the el 609 ft of the auxiliary building (fire zone 44S).

Additional fire protection modifications are proposed in each of the 19 areas or zones 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 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.

7.2 Fire Area 1 RHR/CTS Pump Area Auxiliary Building el. 573 ft

EXEMPTION REQUEST

> Per the provision 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.2, i.e., an automatic fire suppression system shall be installed in the area.

7.2.1 Area Description

Fire Area 1 is located in the east central sub-basement floor of the Auxiliary Building at el. 573 ft. The area contains a large area common to both units and eight individual cubicles containing residual heat removal pumps and containment spray pumps for both units. Each pump cubicle has a controlled access screen mesh door which 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 wall cubicles 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 floors and ceilings are also of three-hour construction. The access doors are screen mesh for ventilation purposes; however, the missile shield walls, approximately 13 ft 6 in. in length forming a "T" at the entrance ways, extend beyond the width of the doorway.

The entrance ways to the pump cubicle are provided with curbs six inches high. The suction valves for the pump in each cubicle are located behind part-height missile shield walls provided with an access way and a 3 ft 6 in. high curb forming part of the missile shield.

The center lines 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 el 587 ft via a stairway which 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 Zone 1 Summary Evaluation Table 7.2-1 and Figure 7.2.1.

7.2.2 Safe Shutdown Equipment

Fire Area 1 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 zone 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 Fire Area 1.

7.2.3 Fire Protection Systems

Fire Area 1 contains no automatic suppression systems. A manual 1-1/2 in. hose reel with adjustable angle spray nozzle is located in the 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.

Fire Area 1 is equipped with seven ionization smoke detectors which 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

Fire Area 1 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 which is accessible from the common area separating Unit 1 from Unit 2. The access gates for each room are located behind missile shield walls which 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.

Two ventilation ducts, one for each unit (two individual ducts) running in the pipe chases located outboard the pump cubicle of each unit, connect the Unit 1 east and west pump rooms and the Unit 2 east and west pump rooms respectively. The fire area contains predominantly cable insulation as fixed combustibles with a total fire loading of approximately 17,500,000 Btu which, when distributed over the fire area surface area, results in approximately 2300 Btu/ft^2. The equivalent fire severity is approximately two minutes. There are no specific sections of the fire area which contain high densities of combustible materials. 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 exiting 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 which 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 cubicles of the same unit which is as difficult a path as from one cubicle to another. 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 penetrations 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 2 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 Fire Area 1 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.

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 one-hour-rated fire seals.

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-in. conduits containing the cable for redundant divisions of each unit are present in the extreme north-west and south-west 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 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 Section 8.2.2.

7.2.6 Conclusion

Based on the previous analysis, exemption is requested from an automatic suppression system in the area as prescribed in Section III.G.2 of Appendix R. The bases which 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 very low with no allowable storage of transient combustibles. The fire severity is less than five 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 which 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)

SUMMARY EVALUATION TABLE 7.2-1

FIRE ZONE: 1

DESCRIPTION: Auxiliary Building

EVALUATION PARAMETERS SUMMARY

A. Area Description

1. Construction -

a. Walls -

North - reinforced concrete, in excess of 3-hr rating

South - reinforced concrete, in excess of 3-hr rating

East - reinforced concrete, in excess of 3-hr rating

West - reinforced concrete, in excess of 3-hr rating

b. Floor - reinforced concrete, in excess of 3-hr rating; floor is curbed and has drains

c. Ceiling - reinforced concrete, in excess of 3-hr rating

2. Ceiling height - 11' 3"

3. Room volume - 85104 ft^3

4. Ventilation - 14,000 cfm

5. Access in Zone - Unobstructed

B. Safe Shutdown Equipment

IMO-310 RHR Pump Suction
PP-35E RHR Pump East (Units 1 & 2)
IMO-320 RHR Pump Suction
PP-35W RHR Pump West (Units 1 & 2)

C. Fire Hazards

1. Type of combustibles in area -

   Cable insulation

2. Quantity of fixed combustibles -

   Cable - 17,500,000 Btu
   2300 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 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 in the fire area.

7.3.1 Area Description

Located immediately north of the Unit 1 "CD" diesel generator room at el 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, this area is entirely three-hour rated. 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 which faces the Turbine Room. Pertinent room dimensional data is contained in Fire Area 14 Summary Evaluation Table 7.3-1 and Figure 7.3.1.

7.3.2 Safe Shutdown Equipment

Fire Area 14 contains the pressurizer heater transformers for Unit 1 (TR11PHA and TR11PHC) and the Unit 1 emergency diesel generator test breakers with associated cables.

7.3.3 Fire Protection System

Fire Area 14 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 in the fire area. Two 20 lb P-K dry chemical and two 15 lb CO_2 extinguishers are also located in the area.

7.3.4 Fire Hazards Analysis

Fire Area 14 is bounded by three-hour-rated barriers with the exception of two dampers, each rated at 1-1/2 hours, located in the west wall to Fire Zone 79, the Turbine Room of Unit 1. 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, filled with Askarel insulating fluid, are approximately 12 ft apart.

The area contains predominantly cable insulation as fixed combustibles with a total fire loading of approximately 1,300,000 Btu which, when distributed over the surface of the fire area, results in approximately 620 Btu/ft^2. The equivalent fire severity is approximately one minute. There are no specific sections of the fire area which 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 Proposed Modifications

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 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 which 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 extremely low and fire severity is calculated to be less than five minutes.

(5) Modifications required to meet Section III.G.3 would not significantly enhance fire protection safety above that provided by present commitments.

SUMMARY EVALUATION TABLE 7.3-1

FIRE ZONE: 14

DESCRIPTION: Transformer Room - Unit 1

EVALUATION PARAMETERS SUMMARY

A. Area Description

1. Construction -

a. Walls -

North - reinforced concrete, in excess of 3-hr rating

South - reinforced concrete, in excess of 3-hr rating

East - reinforced concrete, in excess of 3-hr rating

West - reinforced concrete, in excess of 3-hr rating

b. Floor - reinforced concrete, in excess of 3-hr rating

c. Ceiling - reinforced concrete, in excess of 3-hr rating

2. Ceiling height - 12' 5"

3. Room volume - 26447 ft^3

4. Ventilation - 17,000 cfm

5. Access in Zone - Unobstructed

B. Safe Shutdown Equipment

TR-11 PHA - 4 kV/480 V
Transformer TR-11 PHA
TR-11 PHC - 4 kV/480 V
Transformer TR-11 PHC

C. Fire Hazards

1. Type of combustibles in area -

   Cable insulation

2. Quantity of fixed combustibles -

   Cable - 1,300,000 Btu
   620 Btu/ft^2

D. Existing Fire Protection

1. Fire detection systems - None

2. Fire extinguishing systems -

   2 - 20 lb. P-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 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 in the fire area.

7.4.1 Area Description

Located immediately north of the Unit 1 "CD" diesel generator room at el 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, this area is entirely three-hour rated. 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 which 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 7.4.1.

7.4.2 Safe Shutdown Equipment

Fire Area 20 contains the pressurizer heater transformers for Unit 2 (TR21PHA and TR21PHC) and the Unit 2 emergency diesel generator test breakers 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 in the fire area. Two 20 lb P-K dry chemical and two 15 lb CO_2 extinguishers are also located in the area.

7.4.4 Fire Hazards Analysis

Fire Area 20 is bounded by three-hour-rated barriers with the exception of two dampers, each rated at 1-1/2 hours, located in the west wall to Fire Zone 85, the Turbine Room of Unit 2. 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, filled with Askarel insulating fluid, are approximately 12 ft apart.

The area contains predominantly cable insulation as fixed combustibles with a total fire loading of approximately 1,560,000 Btu which, when distributed over the surface of the fire area, results in 685 Btu/ft^2. The equivalent fire severity is approximately one minute.

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 which 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 extremely low and fire severity is calculated to be less than five minutes.

(5) Modifications required to meet Section III.G.3 would not significantly enhance fire protection safety above that provided by present commitments.

SUMMARY EVALUATION TABLE 7.4-1

FIRE ZONE: 20

DESCRIPTION: Transformer Room, Unit 2

EVALUATION PARAMETERS SUMMARY

A. Area Description

1. Construction -

a. Walls -

North - reinforced concrete, in excess of 3-hr rating

South - reinforced concrete, in excess of 3-hr rating

East - reinforced concrete, in excess of 3-hr rating

West - reinforced concrete, in excess of 3-hr rating

b. Floor - reinforced concrete, in excess of 3-hr rating

c. Ceiling - reinforced concrete, in excess of 3-hr rating

2. Ceiling height - 151 in. = 12' 7"

3. Room volume - 28627 ft^3

4. Ventilation - 17,000 cfm

5. Access in Zone - Unobstructed

B. Safe Shutdown Equipment

TR-21 PHA - 4 kV/480 V
Transformer TR-21 PHA
TR-21 PHC - 4 kV/480 V
Transformer TR-21 PHC

C. Fire Hazards

1. Type of combustibles in area -

   Cable insulation

2. Quantity of fixed combustibles -

   Cable - 1,560,000 Btu
   685 Btu/ft^2

D. Existing Fire Protection

1. Fire detection systems - None

2. Fire extinguishing systems - Manual

   2 - 20 lb. P-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

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 extreme west central side of the screen house which is adjacent to the Turbine Building el 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 screen house area. The access gate is constructed of screen mesh for ventilation purposes. 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 is three-hour rated.

A stairway is present in the northwest corner of the west pump room which 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-.3.

7.5.2 <u>Safe Shutdown Systems</u>

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) which 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 <u>Fire Protection Systems</u>

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 the pump enclosure. Outside the zone in the screenhouse are three 20 lb P-K dry chemical and three 15 lb CO_2 fire extinguishers.

7.5.4 <u>Fire Hazards Analysis</u>

The Unit 1 pump enclosure may sustain a fire which 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 the stairway to Fire Zone 29G which is a common Unit 1/Unit 2 zone below the pump cubicles. (Fire Zone 29G is discussed in Section 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 cabling exiting the MCCs is embedded in concrete and is 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 2 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 the fire zone, and fixed combustibles amount to the small quantity of lube oil for each pump and the cable insulation. The total fuel loading of the zone is approximately 790,000 Btu which, when distributed over the fire zone surface area, results in approximately 990 Btu/ft^2. The equivalent fire severity is approximately one minute. There are no specific sections of the fire zone which 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 which 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 which justify the exemption are summarized as follows:

(1) The Unit 1 and Unit 2 ESW systems are cross-tied outside the zone and alternate shutdown capability therefore exists for Unit 1 using Unit 2 ESW systems. No other 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) The only path available for fire propagation is via Fire Zone 29G. Fire Zone 29G is to be modified to prevent a fire in any of the ESW zones (Unit 1 or Unit 2) from affecting both units' ESW systems (see Section 7.7 of this report).

(5) The fixed combustible loading is extremely low with a fire severity of less than five minutes.

(6) The fire zone does not provide a normally used path of transient combustibles.

(7) 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 ZONE: 29(A,B,E)

DESCRIPTION: Unit 1 Essential Service Water Pumps

EVALUATION PARAMETERS SUMMARY

A. Area Description

1. Construction -

a. Walls -

North - reinforced concrete, in excess of 3-hour rating

South - reinforced concrete, in excess of 3-hour rating

East - reinforced concrete, in excess of 3-hour rating

West - reinforced concrete, in excess of 3-hour rating

b. Floor - reinforced concrete, in excess of 3-hour rating

c. Ceiling - reinforced concrete, in excess of 3-hour rating

2. Ceiling height - 16' 5"

3. Room volume - 16006 ft^3

4. Ventilation - 30,000 cfm

5. Access in Zone - Equipment forms partial obstruction

B. Safe Shutdown Equipment

PP-1E - ESW Pump 1E	WMO-701 - 1E Disch Vlv
PP-1W - ESW Pump 1W	WMO-702 - 1W Disch Vlv

B. Safe Shutdown Equipment (Cont.)

ESWSE - 1E Strainer	1PS-A	MCCs for Pump
ESWSW - 1W Strainer	1PS-D	

C. Fire Hazards

1. Type of combustibles in area -

   Cable insulation

2. Quantity of fixed combustibles -

   Cable - 790,000 Btu
   990 Btu/ft^2

D. Existing Fire Protection

1. Fire detection systems - None

2. Fire extinguishing systems - Manual

   3 - 20 lb. P-K dry chemical extinguishers, outside pump enclosures in screen house
   3 - 15 lb. CO_2 extinguishers, outside pump enclosures in screen house
   2 - water hose reels each 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 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.

7.6.1 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 screen house which is adjacent to the Turbine Building el 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 screen house area. The access gate is constructed of screen mesh for ventilation purposes. 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 which 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 Figure 7.6.1.

7.6.2 Safe Shutdown Systems

Fire Zone 29(C,D,E) 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) which serve the strainers and valves. No Unit 2 and no other 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 screen house are three 20 lb P-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 which 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 the ladder hatch to 29G (from the east pump cubicle) which is a common Unit 1/Unit 2 zone below the pump cubicles. (Fire Zone 29G is discussed in Section 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 cabling exiting the MCCs is embedded in concrete and is 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 2 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 and the small quantity of lube oil for each. The total fuel loading of the zone is approximately 790,000 Btu which, when distributed over the fire zone surface area, results in approximately 990 Btu/ft^2. The equivalent fire severity is approximately one minute. There are no specific sections of the fire zone which 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 <u>Proposed Modifications</u>

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 <u>Detection System</u>

An automatic detection system will be installed in the fire zone which provides alarms in the control room.

7.6.5.2 <u>Ladder Hatch</u>

The ladder hatch to Fire Zone 29G below will be provided with a hatch cover having a minimum rating of one hour (reference Section 7.7.5).

7.6.6 <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 by Section III.G.3 of Appendix R. The bases which 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 other 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) The only path available for fire propagation is via Fire Zone 29G. Fire Zone 29G is to be modified to prevent a fire in any of the ESW zones (Unit 1 or Unit 2) from affecting both units' ESW systems (see Section 7.7 of this report).

(5) The fixed combustible loading is extremely low with a fire severity of less than five minutes.

(6) The fire zone does not provide a normally used path of transient combustibles.

(7) 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 ZONE: 29(C,D,F)

DESCRIPTION: Unit 2 Essential Service Water Pumps

EVALUATION PARAMETERS SUMMARY

A. Area Description

1. Construction -

a. Walls -

North - reinforced concrete, in excess of 3-hour rating

South - reinforced concrete, in excess of 3-hour rating

East - reinforced concrete, in excess of 3-hour rating

West - reinforced concrete, in excess of 3-hour rating

b. Floor - reinforced concrete, in excess of 3-hour rating

c. Ceiling - reinforced concrete, in excess of 3-hour rating

2. Ceiling height - 16' 5"

3. Room volume - 16006 ft^3

4. Ventilation - 30,000 cfm

5. Access in zone - Equipment forms partial obstruction

B. Safe Shutdown Equipment

PP-2E - ESW Pump 2E
PP-2W - ESW Pump 2W
WMO-703 - 2E Disch Vlv
WMO-704 - 2W Disch Vlv

B. Safe Shutdown Equipment (Cont.)

ESWSE - Strainer PP-2E	2PS-A	MCCs for Pumps
ESWSW - Strainer PP-2W	2PS-D	

C. Fire Hazards

1. Type of combustibles in area -

   Cable insulation

2. Quantity of fixed combustibles -

   Cable - 790,000 Btu
   990 Btu/ft^2

D. Existing Fire Protection

1. Fire detection systems - None

2. Fire extinguishing systems - Manual

   3 - 20 lb. P-K dry chemical extinguishers, outside in screen house
   3 - 15 lb. CO_2 extinguishers, outside in screen house
   2 - water hose reels each with 75 ft 1-1/2 in. hose and adjustable angle spray nozzle

7.7 Fire Zone 29G Circulating Water Pump Motor Control Room below Unit 1 and Unit 2 ESW Pump Rooms

EXEMPTION REQUEST

Per the provision 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.2, i.e., an automatic fire suppression system shall be installed in the 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 non-safe 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. Conduit for all four ESW pumps, their valves and strainers, enters the east wall via embedded conduit from the Turbine Room. With the exception of the four ESW pump power cables and a conduit 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 Fire 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 is run from the pull box near the ceiling to the cubicle area for the Unit 1 east pump and exits through the ceiling. 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 systems available to 29(A,B,E) and 29(C,D,F).

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 combustible loading, due entirely to cable insulation, is approximately

4,750,000 Btu which, when distributed over the fire zone surface area, results in approximately 3560 Btu/ft^2. The calculated fire severity is approximately three minutes.

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 which contain high densities of combustible materials.

A stairway entering from the Unit 1 west pump cubicle and a ladder in a hatch from Unit 2 east pump cubicle, approximately 40 ft apart, provide a common connection between Units 1 and 2. Hot combustible gases from a fire in Fire Zone 29G could affect the ESW pumps in both units. To protect the unlikely occurrence of all four pumps being affected, a fire-rated hatch cover will be provided in the ladder way to the Unit 2 west cubicle.

7.7.5 <u>Proposed Modifications</u>

The fire 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 <u>Fire Detection</u>

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 will be provided with at least a one-hour-rated fire hatch door to isolate the Unit 2 pump rooms from the Unit 1 pump rooms (via 29G).

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-1
8627G-1	8624R-2	8619R-2	9987G-2
8628G-1	8618R-1	8620R-2	8929G-2
8629G-1	8619R-1	8996R-2	8627G-2
	8620R-1		

7.7.5.4 Pump Power and Discharge Valve Conduits

The following pump power and discharge valve conduits will be provided 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 which 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) The hatch connecting the Unit 2 pump room to the Unit 1 pump room, via Fire Zone 29G, is to be provided with a one-hour-rated hatch cover.

(4) The combustible loading of Fire Zone 29G is extremely low with a fire severity of less than five 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: Circ Water Pumps MCC Room Below Unit 1 and Unit 2 ESW Pump Rooms

EVALUATION PARAMETERS SUMMARY

A. Area Description

1. Construction -

a. Walls -

North - reinforced concrete, in excess of 3-hour rating

South - reinforced concrete, in excess of 3-hour rating

East - reinforced concrete, in excess of 3-hour rating

West - reinforced concrete, in excess of 3-hour rating

b. Floor - reinforced concrete, in excess of 3-hour rating

c. Ceiling - reinforced concrete, in excess of 3-hour rating

2. Ceiling height - 12' 5"

3. Room volume - 19867 ft^2

4. Ventilation - 60,000 cfm

5. Access in Zone - Unobstructed

B. Safe Shutdown Equipment

None

C. Fire Hazards

1. Type of combustibles in area -

   Cable insulation

2. Quantity of fixed combustibles -

   Cable - 4,750,000 Btu
   3560 Btu/ft^2

D. Existing Fire Protection

1. Fire detection systems - None

2. Fire extinguishing systems - Manual

   3 - 20 lb. P-K dry chemical extinguishers, outside pump enclosures in screen house
   3 - 15 lb. CO_2 extinguishers, outside pump enclosures in screen house
   2 - water hose reels each with 75 ft 1-1/2 in. hose and adjustable angle spray nozzle

7.8 Fire Area 33,33A,33B Unit 1 East Main Steam 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 in the fire area.

7.8.1 Fire Area Description

Fire Area 33,33A,33B is located immediately outside the containment building of Unit 1 at an elevation of 612 ft. The area includes the north area around containment which contains main steam lines and also includes the non-essential service water valve gallery on the west side directly opposite the east main steam valve enclosure. Pertinent dimensional data is contained in Table 7.8-1, Fire Area 33,33A,33B. Elevation Parameters Summary and Figure 7.8-1.

7.8.2 Safe Shutdown Equipment

Fire Area 33,33A,33B contains all main steam pressure transmitters for steam generators 1 and 4, the electro-pneumatic transmittors 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) from the turbine driven pump, the local shutdown indication panel (LS1-1) and the power operated relief valves and safeties for steam generators 1 and 4. The main steam valves for steam generators 1 and 4 are also in the area.

7.8.3 Fire Protection Systems

Fire Area 33,33A,33B has no automatic suppression system. A thermistor actuated 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.

7.8.4 Fire Hazards Analysis

The walls, floors, and ceilings are of reinforced concrete construction. Excluding doors to the exterior of the area all barriers have a minimum fire rating of one hour. A ventilation duct connecting Fire Zone 33B to Fire Area 12 below is not provided with a fire damper and will be modified.

The analysis indicated the presence of all four steam generator power operated relief valve EPTs in the area. The transmitters are greater than 100 feet apart, however, alternate shutdown capabilities will exist for this area with the proposed modifications to the steam generator PORVs.

The combustible loading of the area is very low with a total of approximately 31,900,000 BTU which when distributed over the surface of the fire area results in approximately 11,000 BTU/ft^2. Of the total, approximately 25% of the combustible loading is attributed to charcoal filters. Equivalent fire severity is approximately eight minutes. There are no specific sections of the fire area with concentrated fixed combustibles.

7.8.5 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 feet 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 Ventilation Duct

The ventilation duct joining Fire Zone 33B with Fire Area 12 will be provided with a fire rated damper.

7.8.5.2 Fire Detection

The fire area will be provided with an automatic fire detection system that will alarm in the Unit 1 Control Room.

7.8.6 Conclusions

Based on the previous analysis an exemption is requested from the requirement that a fixed suppression be installed in areas where alternate shutdown capability exists as required by Section III.G.3 of Appendix R. The bases which 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 feet.

(3) The combustible loading in the fire area is very low with an equivalent fire severity of approximately eight minutes.

(4) 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 ZONE: 33, 33A, 33B

DESCRIPTION: Unit 1 East Main Steam Enclosure

EVALUATION PARAMETERS SUMMARY

A. Area Description

1. Construction -

a. Walls -

North - metal clad exterior wall

South - reinforced concrete, in excess of 3-hr rating

East - reinforced concrete, in excess of 3-hr rating

West - reinforced concrete, in excess of 3-hr rating

b. Floor - reinforced concrete, in excess of 3-hr rating;

c. Ceiling - reinforced concrete, in excess of 3-hr rating

2. Ceiling height - approx. 50 ft

3. Room volume - approx. 145,000 ft^3

4. Ventilation - 79,000 cfm

5. Access in Zone - Equipment forms partial obstruction

B. Safe Shutdown Equipment

MPP-210, 211, 212, 240, 241, 242 - SG Pressure
MRV-213, 243 - SG Power operated relief valves
SV-1, 2, 3 - Safety valves
FMO-211, 212, 241, 242 - Supply MOV
LSI-1 - Local Shutdown Station
TK-32 - Condensate Storage Tank

C. Fire Hazards

1. Type of combustibles in area -

   Cable insulation
   Charcoal

2. Quantity of fixed combustibles -

   Cable - 24,000,000 Btu
   8,300 Btu/ft^2

   Charcoal - 7,900,000 Btu
   2,720 Btu/ft^2

D. Existing Fire Protection

1. Fire detection systems -

   Thermistor heat detection for the charcoal filter unit

2. Fire extinguishing systems -

   Automatic deluge water spray for the charcoal filter unit. Manual hose stations available.

7.9 Fire Area 34,34A,34B, Unit 2 East Main Steam 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 supression system 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 which contains main steam lines and also includes the non-essential service water valve gallery on the west side directly opposite the east main steam value enclosure. Pertinent dimensional data is contained in table 7.9-1, Fire Area 34,34A,34B. Evaluation Parameters Summary and figure 7.9-1.

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 steam generator power operated relief valves, steam generators 1 and 4 auxiliary feedwater inlet valves (FMO 211, 212, 241, 242) from the turbine driven pump, 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 actuated 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 walls, floors and ceilings are of reinforced concrete construction. Excluding doors to the exterior of the area all barriers have a minimum fire rating of one hour. A ventilation duct connecting 34B to Fire Area 22 below is not provided with a fire damper and will be modified.

The analysis indicated the presence of all four steam generator power operated relief valve EPT's 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 PORV's.

The combustible loading of the area is very low with a total of approximately 19,900,000 BTU which when distributed over the surface of the fire area results in approximately 6,000 BTU/ft.Of the total, approximately 40% of the combustible loading is attributed to charcoal filters equivalent fire severity is approximately four minutes.

7.9.5 Proposed Modifications

The only redundant components in the area necessary for safe shutdown are the EPT's for the four steam generator PORV's. The EPT's and their associated cables are over 100 ft. apart. Should a fire affect both trains of steam generator PORV's one division will be operable outside the area at a local control station.

7.9.5.1 Ventilation Ducts

The ventilation duct joining Fire Zone 34B with Fire Area 22 will be provided with a fire-rated damper.

7.9.5.2 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 Conclusions

Based on the previous analysis an exemption is requested from the requirement that a fixed suppression be installed in areas where alternate shutdown capability exists as required by Section III.G.3 of Appendix R. The basis which 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 combustible loading in the fire area is very low with an equivalent fire severity of approximately 4 minutes.

(4) 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 ZONE: 34,34A,34B

DESCRIPTION: Unit 1 East Main Steam Enclosure

EVALUATION PARAMETERS SUMMARY

A. Area Description

1. Construction -

a. Walls -

North - reinforced concrete, in excess of 3-hour rating

South - metal clad exterior wall

East - reinforced concrete, in excess of 3-hr rating

West - reinforced concrete, in excess of 3-hr rating

b. Floor - reinforced concrete, in excess of 3-hr rating;

c. Ceiling - reinforced concrete, in excess of 3-hr rating

2. Ceiling height - approx. 50 ft

3. Room volume - approx. 145,000 ft^3

4. Ventilation - 79,000 cfm

5. Access in Zone - Equipment forms partial obstruction

B. Safe Shutdown Equipment

MPP-210, 211, 212, 240, 241, 242 - SG Pressure
SV-1, 2, 3 - Safety Valves
MRV-213, 243 - SG Power operated relief valves
FMO-211, 212, 241, 242 - SG Supply MOV
LSI-1 - Local Shutdown Station

C. Fire Hazards

1. Type of combustibles in area -

   Cable insulation
   Charcoal

2. Quantity of fixed combustibles -

   Cable - 12,000,000 Btu
   3,100 Btu/ft^2

   Charcoal - 7,900,000 Btu
   2,720 Btu/ft^2

D. Existing Fire Protection

1. Fire detection systems -

   Thermistor heat detection for the charcoal filter unit

2. Fire extinguishing systems -

   Automatic deluge water spray for the charcoal filter unit. Manual hose stations available.

7.10 Fire Zone 44S Component Cooling Water Pump Area at The South End of The Auxiliary Building el. 609 ft

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 non-safety circuits of one redundant train in a fire barrier having a 1-hour rating.

7.10.1 Fire Zone Description

Fire Zone 44S is the south half of el. 609 ft of the Auxiliary Building, which has been artificially segmented for purpose of 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 useable 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 exhaust ducts are located over each motor which completely umbrella the pump motors. Normal access into the room is through the north end of Fire Zone 44, 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 center lines of east and west pump motors for both units are separated by approximately 13 feet. 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 feet north of the Unit 1 east pump and separated from each other by approximately 7 feet. At the north end of the Unit 2 CCW heat exchangers are the heat exchanger outlet valves CMO-410 and CMO-420 approximately 75 feet 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. Pertinent dimensional data is contained in Fire Zone 44S Summary Evaluation Table 7.10 Figure 7.10.1.2.

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 CCW to RHR heat exchanger, Unit 2 ESW to CCW heat exchanger inlet, Unit 2 ESW to CCW heat exchanger outlet and Unit 2 MCC 2AZVA. 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 which are essential for safe shutdown. Thus, for most systems Unit 1 is available for alternate shutdown capability. Proposed fire protection modifications will provide for 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 suppression and 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 inch hoses and three water hose reels with 75 ft 1-1/2 inch hoses equipped with adjustable angle spray nozzles. The fire zone is also equipped with 17 ionizing detectors.

7.10.4 Fire Hazards Analysis

The fixed combustible loading of the area is approximately 120,500,000 Btu which when distributed over the surface area of the fire zone results in approximately 12,750 Btu/ft^2. The equivalent fire severity is 10 minutes. The combustible loading is almost entirely due to cable insulation with approximately 1% of the total from clothing in the laundry room and 3% from the 10 gallons of lube oil (total) in the five CCW pumps.

There are no specific areas of the fire zone which contain high concentrations of fixed combustibles.

The arrangement of the CCW pumps and heat exchangers is presented in Figures 7.10.1.1 and 7.10.1.2. 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.

7.10.5 Proposed Modifications

The fire hazards analysis performed 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 fire zone will be provided with an extended automatic water suppression system. The installation will be made between the Unit 1 pumps and Unit 2 pumps and between the east and west pumps of both units. 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) The sprinkler design shall utilize sprinkler heads which will respond quickly to thermal conditions.

(4) The sprinkler systems shall be supported seismically where necessary and analyzed for a moderate energy pipe crack in accordance with the criteria stated in BTP MEB 3-1.

(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 which could render equipment inoperable due to water spray.

7.10.5.2 Fire Barrier

A fire barrier of steel construction coated with an intumescent material, or equivalent, will be provided between the Unit 1 and Unit 2 pumps. This barrier will be located beneath the existing HVAC ducting up to approximately 10 feet. The barrier will also extend north between the Unit 1 east pump and the spare pump. (See Figure 7.10-3)

7.10.5.3 Fire Detection

The area will be provided with expanded coverage of the automatic detection system to provide extended coverage for the fire zone and particularly in the area of the CCW pumps.

7.10.6 Conclusions

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 1-hour rating as prescribed by Section III.G.2 of Appendix R. The bases which 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) There is essentially no combustible material in the immediate vicinity of the CCW pump. No trays traverse the area of the pumps. The fire zone has low combustible loading with fire severity approximately 10 minutes.

(6) The lube oil in the pumps has no credible ignition source.

(7) 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: Unit 2 Auxiliary Building, South End of F.Z. 44

EVALUATION PARAMETERS SUMMARY

A. Area Description

1. Construction -

a. Walls -

North - artificial boundary; no wall

South - reinforced concrete, in excess of 3-hour rating

East - reinforced concrete, in excess of 3-hour rating

West - reinforced concrete, in excess of 3-hour rating

b. Floor - reinforced concrete, in excess of 3-hour rating

c. Ceiling - reinforced concrete, in excess of 3-hour rating

2. Ceiling height - varies from 12 ft to 20' 4"

3. Room volume - 150,0000 - 200,000 ft^3

4. Ventilation - later

5. 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
HE-15E, HE-15W - CCW HX In, Unit 2
CMO-410, CMO-420 - CCW HX Out, Unit 2
CMO-415, CMO-416 - CCW Common Service HDR, Unit 2

B. Safe Shutdown Equipment (Cont.)

CMO-419 - CCW to RHR HX, Unit 2
WMO-732, WMO-736 - ESW to CCW HX, In, Unit 2
WMO-734, WMO-738 - ESW to CCW HX, Out, Unit 2
MCC-2 AZVA - Unit 2

C. Fire Hazards

1. Type of combustibles in area -

   a. Cable insulation

   b. Lubricating oil

   c. Cloth

2. Quantity of fixed combustibles -

   a. Cable - 120,000,000 Btu
      12,300 Btu/ft^2

   b. Lubricating Oil - 3,950,000 Btu
      400 Btu/ft^2

   c. Cloth - 470,000 Btu
      50 Btu/ft^2

D. Existing Fire Protection

1. Fire detection systems -

   17 ionization smoke detectors

2. Fire extinguishing systems -

   Partial area pre-action

7.11 Fire Area 53 Unit 1 Control Room

EXEMPTION REQUEST

> Per the provisions of 10CFR 50.48(c)(6) and 10CFR 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.

Fire Area Description

Fire Area 53 is the Unit 1 Control Room located on el 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 (HSD2) is located in the south-west 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 folding 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 7.11.1.

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 32 ionization detectors located in the Control Room including detection in and around HSD2. 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 two BioPac 1-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 folding doors across the front of the panel. No equipment internal to the panel is exposed to the direct effects of any postulated room fires during normal operation because of the normally closed panel door. See Figure 7.11.1 for a sketch of the panels. The Unit 2 hot shutdown panel is located in the section of the Unit 1 Control Room which 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 ceiling and one floor hatch, both of which have two-hour ratings. Also, the common connecting door between the Control Rooms is unrated. The floor hatch, which is in front of the HSD2, will be upgraded to a three-hour rating as well as the common connecting door. The HSD2 panel was not installed nor is it used as part of alternative shutdown per the requirements of Appendix R. The 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 combustible loading for the entire control room is approximately 41,500,000 Btu which when distributed over the surface of the fire area results in approximately 9100 Btu/ft^2. The equivalent fire severity is approximately seven minutes. 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.

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 HSD2 which 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 Hatch Floor

Upgrade floor hatch in front of HSD2 to a three-hour rating.

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 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 the HSDP.

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 which justify the exemption are summarized as follows:

(1) Automatic detection is present in the area of the Unit 2 HSDP 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 combustible loading of the Control Room is very low. The fire severity is approximately seven minutes. The fixed combustible loading in the area near the HSD2 is extremely low.

(5) The amount of transient combustibles allowed in the Control Room is extremely low and will be controlled.

(6) Modifications required to meet Section III.G.3 would not 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, 3-hr rating; openings sealed with silicone foam

South - reinforced concrete or block; 3-hr rating; openings sealed with silicone foam

East - reinforced concrete or block; 3-hr rating; openings sealed with silicone foam

West - reinforced concrete or block; 3-hr rating; openings sealed with silicone foam

b. Floor - reinforced concrete or block; 3-hr rating; openings sealed with silicone foam

c. Ceiling - reinforced concrete or block; 3-hr rating; openings sealed with silicone foam

2. Ceiling height - 15' 7"

3. Room volume - 68723 ft^3

4. Ventilation - 13,000 cfm

5. 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 -

   Paper
   Cable insulation

2. Quantity of fixed combustibles -

   Paper - 1,560,000 Btu
   Cable - 38,500,000 Btu

   Total - 9100 Btu/ft^2

D. Existing Fire Protection

1. Fire detection systems -

   46 ionization detectors

2. Fire extinguishing systems - Manual

   6 - 15 lb. CO_2 extinguishers
   2 - BIO PAC breathing apparatus
   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 10CFR50.48(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., afixed fire suppression system shall be installed 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 el 633 ft immediately adjacent to the Unit 1 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 (HSD1) is located in the Unit 2 Control Room. The hot shutdown panel is located in the north-west 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 folding 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 7.12.1.

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. 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 two "BioPac" 1-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 folding doors across the front of the panel. No equipment internal to the panel is exposed to the direct effects of any postulated room fires during normal operation because of the normally closed panel door. See Figure 7.12.1 for a sketch of the panels. The Unit 2 hot shutdown panel is located in the section of the Unit 2 Control Room which 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 one ceiling and one floor hatch, both of which have two-hour ratings. Also, the common connecting door between the Control Rooms is unrated. The floor hatch, which is in front of the HSD1, will be upgraded to a three-hour rating as well as the common connecting door. The HSD panel was not installed nor is it used as part of alternative shutdown per the requirements of Appendix R. The 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 combustible loading for the entire Control Room is approximately 56,560,000 Btu which, when distributed over the surface of the fire area, results in approximately 13,000 Btu ft^2. The equivalent fire severity is approximately ten minutes. 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.

7.12.5 <u>Proposed Modifications</u>

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 Hatch

Upgrade floor hatch in front of HSD1 to a three-hour rating.

7.12.5.2 Connecting Door

Upgrade the common connecting door to a three-hour rating.

7.12.5.3 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 wil function to prevent fire damage to the HSD1.

7.12.6 Conclusions

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 which justify the exemption are summarized as follows:

(1) Automatic detection is present in the area of the Unit 1 HSDP 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 combustible loading of the Control Room is very low. The fire severity is approximately ten minutes. The fixed combustible loading in the area near the HSD1 is extremely low.

(5) The amount of transient combustibles allowed in the Control Room is extremely low and will be controlled.

(6) Modifications required 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; 3-hr rating; openings sealed with silicone foam

South - reinforced concrete or block; 3-hr rating; openings sealed with silicone foam

East - reinforced concrete or block; 3-hr rating; openings sealed with silicone foam

West - reinforced concrete or block; 3-hr rating; openings sealed with silicone foam

b. Floor - reinforced concrete or block; 3-hr rating; openings sealed with silicone foam

c. Ceiling - reinforced concrete or block; 3-hr rating; openings sealed with silicone foam

2. Ceiling height - 15' 7"

3. Room volume - 68723 ft^3

4. Ventilation - 13,000 cfm

5. 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 -

   Paper
   Cable insulation

2. Quantity of fixed combustibles -

   Paper - 1,560,000 Btu
   Cable - 55,000,000 Btu

   Total - 13,000 Btu/ft^2

D. Existing Fire Protection

1. Fire detection systems -

   42 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 with adjustable spray nozzles
   2 - "Bio Pac" 1-hr breathing apparatus

7.13 Fire Zone 66 Containment Piping Annulus 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 exemptions from the specific requirements of Appendix R, Section III.G.3, i.e., a fixed fire suppression system shall be installed in the area.

7.13.1 Area Description

Fire Zone 66 is located in the piping annulus section of the containment building of Unit 1, at elevation 578 ft. The zone contains RHR safety valves and RHR isolation motor-operated valves, RCS instrumentation and steam generator instrumentation. Access to the zone is gained through the containment personnel hatch into the lower containment volume and down through a hatch to Fire Zone 66. Pertinent room dimensional data is contained in Fire Zone 66 Summary Evaluation Table 7.13-1 and Figure 7.13.1.

7.13.2 Safe Shutdown Equipment

Fire Zone 66 contains steam generators 1, 2, 3, and 4 wide-range level transmitters, steam generators 1, 2, 3, and 4 narrow-range level transmitters, the SI cold leg boron injection valves, the reactor coolant wide-range pressure transmitters, the RHR safety valves and RHR suction and return isolation motor-operated valves. In addition, safe shutdown cables for above equipment and for the pressurizer heaters and RCS instrumentation are contained in this zone.

7.13.3 Fire Protection Systems

Fire Zone 66 contains no automatic suppression or area detection systems. Thermistor thermal detectors are contained in the cable traps which alarm in the Control Room.

7.13.4 Fire Hazards Analysis

The walls, floors and ceilings are of a reinforced concrete construction. More than 20 ft separation exists between redundant safe shutdown equipment and for cables in the zone with the exception of the RCS hot and cold leg temperature channels for at least two of the four reactor coolant loops. The SIS cold leg boron injection isolation motor-operated valves IMO-51 through IMO-54 are not essential since another path for boration and charging is available. The RHR isolation valves can be locally operated post-fire for the shutdown cooling mode of operation.

The zone contains predominantly cable insulation as fixed combustibles with a total fire loading of approximately 106,000,000 Btu, which, when distributed over the surface of the fire zone, results in approximately 26,000 Btu/ft^2. The equivalent fire severity is approximately 19 minutes.

7.13.5 Proposed Modifications

The fire hazards analysis revealed that the cables associated with at least two reactor coolant system loops (hot and cold) temperature instrument channels are not in compliance with Appendix R and as a result the fire zone will be upgraded with modifications.

7.13.5.1 Installation of Hot and Cold Leg Temperature

Installation of additional RCS hot and cold leg temperature RTDs and indicators in a fire zone independent of the one under consideration. The new cable must be routed through this area; however, if 20 ft of horizontal separation cannot be achieved, then a radiant energy shield will be provided for the cable.

7.13.5.2 Automatic Detection System

An automatic detection system will be provided for the zone.

7.13.6 Conclusion

Based on the previous analysis, exemption is requested from the requirements that a fixed fire suppression system be installed in the zone under consideration. The bases which justify the exemption are summarized as follows:

(1) The fire zone will be provided with an automatic fire detection system

(2) Installation of additional RCS hot and cold leg temperature RTDs and indication.

(3) All other redundant equipment and cables in the zone required for hot standby or hot shutdown (hot shutdown cooling mode) are separated by more than 20 feet.

(4) The fire zone is inside containment and not normally accessible during operation.

(5) Modifications required to meet Section III.G.3 would not significantly enhance fire protection safety above that provided by present commitments.

SUMMARY EVALUATION TABLE 7.13-1

FIRE ZONE: 66

DESCRIPTION: Unit 1 Containment Piping Annulus

EVALUATION PARAMETERS SUMMARY

A. Area Description

1. Construction -

a. Walls -

North - reinforced concrete, in excess of 3-hr rating

South - reinforced concrete, in excess of 3-hr rating

East - reinforced concrete, in excess of 3-hr rating

West - reinforced concrete, in excess of 3-hr rating

b. Floor - reinforced concrete, in excess of 3-hr rating; floor drains

c. Ceiling - reinforced concrete, in excess of 3-hr rating

2. Ceiling height - approx. 11 ft

3. Room volume - approx. 45,000 ft^3.

4. Ventilation - 6,000 cfm

5. Access in Zone - Limited

B. Safe Shutdown Equipment

BLI-110,-120,-130,-140 S/G -1,-2,-3,-4 wide range H_2O level
BLP-110, -111, -120, -121,-130,
-130,-131,-140,-141 S/G -1,-2,-3,-4 narrow range H_2O level

B. Safe Shutdown Equipment (Cont.)

IMO-51, -52, -53, -54 BIT ISOL valves
NPS-121, -122 wide-range RCS pressure
ICM-111 RHR Outlet ISOL valves
ICM-129 RHR Inlet ISOL valve

C. Fire Hazards

1. Type of combustibles in area -

   Cable insulation

2. Quantity of fixed combustibles -

   Cable - 106,000,000 Btu
   26,000 Btu/ft^2

D. Existing Fire Protection

1. Fire detection systems - Thermistor thermal detectors are located in cable trays.

2. Fire extinguishing systems - none

7.14 Fire Zone 67 Containment Lower Volume 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 area.

7.14.1 Area Description

Fire Zone 67 is located in the containment lower volume of Unit 1 at el 598 ft 9 in. The zone contains all the reactor coolant pumps and steam generators, pressurizer relief tank, pressurizer, containment auxiliary HVAC units, reactor coolant temperature RTDs (hot and cold legs) and one of the RHR suction supply isolation valves. Access to the zone is gained through the containment personnel hatch and through the containment instrument room into the containment lower volume. Pertinent room dimensional data is contained in Fire Zone 67 Summary Evaluation Table 7.14-1 and Figure 7.14.1.

7.14.2 Safe Shutdown Equipment

Fire Zone 67 contains the pressurizer heaters, all hot and cold leg temperatures RTDs, pressurizer safety valves and RHR valve IMO-128 (suction from the RCS), and associated cables for above electrically operated devices. The zone also contains the four reactor coolant pumps and motors, four steam generators, pressurizer relief tank, pressurizer and two containment auxiliary clean-up HVAC units.

7.14.3 Fire Protection System

Fire Zone 67 contains a thermistor actuated deluge suppression system for the containment auxiliary HVAC charcoal filters and fixed manual water suppression system for each RCP motor. An oil collelction system is also provided for the RCP lube oil system. The cable trays, RCP motors and charcoal filters contain thermistor thermal detectors which alarm in the Control Room.

7.14.4 Fire Hazards Analysis

The walls, floor, and ceiling are all of reinforced concrete construction. Access to this area is through the containment access hatch. Redundant RCS temperature instrumentation is adequately separated with the exception of the hot leg temperature instrument cables.

The zone contains cable insulation, lube oil for the reactor coolant pumps and charcoal for the HVAC units for a total fixed fire loading of approximately 555,000,000 Btu which, when distributed over the surface of the fire zone, results in approximately 152,000 Btu/ft^2. The equivalent fire severity is approximately 114 minutes. The RCP motors, charcoal filters and cable trays are provided with thermistor thermal detectors. The RCP motors have fixed manual water suppression and charcoal filters have thermal detector actuated deluge systems.

7.14.5 Proposed Modifications

The pressurizer heaters and associated cables are in this zone. Safe shutdown capability without operation of the pressurizer heaters is possible since other means of RCS pressure control are available.

The fire hazards analysis revealed that the RCS hot leg temperature instrument cables are not in compliance with Appendix R.

Alternate shutdown capability for the RCS temperature instrumentation will be provided. New hot and cold leg temperature indication for all four RCS loops of Unit 1 will be provided at a local control station independent from Fire Zone 67. The new cable must be routed through this area; however, if 20 feet of horizontal separation cannot be achieved, then a radiant energy shield will be provided for the cables. Also, an automatic detection system will be provided.

7.14.6 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 which justify the exemption are summarized as follows:

(1) The modifications recommended include the installation of new RCS temperature indicators and associated instrument cables, providing an alternative location for RCS temperature monitoring.

(2) The loss of the pressurizer heaters will not threaten safe shutdown capability of Unit 1.

(3) Other safe shutdown cables in the area are separated by more than 20 feet.

(4) RHR valve IMO-128 is not needed until shutdown cooling mode is required and manual valve operation is feasible for this component.

(5) The charcoal filters are equipped with thermistor actuated deluge systems.

(6) A fixed manual suppression system exists for the RCP motors.

(7) A lube oil collection system exists for each RCP motor.

(8) The area will be provided with an automatic detection system which provides alarms in the Control Room.

(9) The area is not normally accessible during operation.

(10) Modifications required to meet Section III.G.3 would not significantly enhance fire protection safety above that provided by present commitments.

SUMMARY EVALUATION TABLE 7.14-1

FIRE ZONE: 67

DESCRIPTION: Unit 1 Containment Lower Volume

EVALUATION PARAMETERS SUMMARY

A. Area Description

1. Construction -

a. Walls -

North - reinforced concrete, in excess of 3-hr rating

South - reinforced concrete, in excess of 3-hr rating

East - reinforced concrete, in excess of 3-hr rating

West - reinforced concrete, in excess of 3-hr rating

b. Floor - reinforced concrete, in excess of 3-hr rating; floor drains

c. Ceiling - reinforced concrete, in excess of 3-hr rating

2. Ceiling height - approx. 90 ft

3. Room volume - approx. 330,000 ft^3

4. Ventilation - 216,000 cfm

5. Access in Zone - Limited

B. Safe Shutdown Equipment

NTR-110, -120, -130, -140 - T_h loop indic.
NTR-210, -220, -230, -240 - T_c loop indic.
SV45 A,B,C - PZR Safeties
IMO-128 - RHR Inlet Isol. Vlv

C. Fire Hazards

1. Type of combustibles in area -

   Cable insulation
   Lube oil pumps
   Charcoal filters

2. Quantity of fixed combustibles -

   Total - 555,000,000 Btu
   152,000 Btu/ft^2

D. Existing Fire Protection

1. Fire detection systems - None

2. Fire extinguishing systems -

   Manual deluge
   Partial sprinkler protection is provided over the Reactor Coolant Pumps (activation is manual only)

7.15 Fire Zone 74 Containment Piping Annulus 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 area.

7.15.1 Area Description

Fire Zone 74, the Unit 2 counterpart of Fire Zone 66, is located in the piping annulus section of the containment building of Unit 2, at el 598 ft. The zone contains RHR safety valves and motor-operated isolation valves, RCS instrumentation and steam generator instrumentation. Access to the zone is gained through the containment personnel hatch into the lower containment volume and through a hatch to Fire Zone 74. Pertinent room dimensional data is contained in Fire Zone 74 Summary Evaluation Table 7.15-1 and Figure 7.15.1.

7.15.2 Safe Shutdown Equipment

Fire Zone 74 contains the steam generators 1, 2, 3, and 4 wide-range level transmitters, steam generators 1, 2, 3, and 4 narrow-range level transmitters, the SI cold leg boron injection valves, the reactor coolant wide-range pressure transmitters, the RHR safety valves and RHR suction, and return motor-operated isolation valves. In addition, safe shutdown cables for above equipment and for the pressurizer heaters and RCS instrumentation are contained in this fire zone.

7.15.3 Fire Protection Systems

Fire Zone 74 contains no automatic suppression or detection systems; however, the cable trays are provided with thermistor thermal detectors which alarm in the Control Room.

7.15.4 Fire Hazards Analysis

The walls, floors, and ceilings are of a reinforced concrete construction. More than 20 ft separation exists between redundant safe shutdown equipment and for cables in the zone with the exception of the RCS hot and cold leg temperature channels for at least two of the four reactor coolant loops. The SIS cold leg boron injection motor-operated isolation valves IMO-51 through IMO-54 are not essential since another path for boration and charging is available. The RHR isolation valves can be locally operated post-fire for the shutdown cooling mode of operation.

The zone contains predominantly cable insulation as fixed combustibles with a total fire loading of approximately 120,000,000 Btu which, when distributed over the surface of the fire zone results in approximately 29,000 Btu/ft^2. The equivalent fire severity is approximately 21 minutes.

7.15.5 Proposed Modifications

The fire hazards analysis revealed that the cables associated with at least two reactor coolant system loops (hot and cold) temperature instrument channels are not in compliance with Appendix R and as a result the fire zone will be upgraded with modifications.

7.15.5.1 Installation of Hot and Cold Leg Temperature

Installation of additional RCS hot and cold leg temperature RTDs and indicators in a fire zone independent of the one under consideration. The new cable must be routed through this area; however, if 20 feet of horizontal separation cannot be achieved, then a radiant energy shield will be provided for the cables.

7.15.5.2 Automatic Fire Detection System

An automatic fire detection system will be provided for the zone.

7.15.6 Conclusion

Based on the previous analysis, exemption is requested from the requirements that a fixed fire suppression system be installed in areas where alternate shutdown capability exists as prescribed in Section III.G.3 of Appendix R. The bases which justify the exemption are summarized as follows:

(1) The fire zone will be provided with an automatic fire detection system.

(2) Installation of additional RCS hot and cold leg temperature RTDs and indication.

(3) All other redundant equipment and cables in the zone required for hot standby or hot shutdown (hot shutdown cooling mode) are separated by more than 20 feet.

(4) The fire zone is inside containment and not normally accessible during operation.

(5) Modifications required to meet Section III.G.3 would not enhance fire protection safety above that provided by present commitments.

SUMMARY EVALUATION TABLE 7.15-1

FIRE ZONE: 74

DESCRIPTION: Unit 2 Containment Piping Annulus

EVALUATION PARAMETERS SUMMARY

A. Area Description

1. Construction -

a. Walls -

North - reinforced concrete, in excess of 3-hr rating

South - reinforced concrete, in excess of 3-hr rating

East - reinforced concrete, in excess of 3-hr rating

West - reinforced concrete, in excess of 3-hr rating

b. Floor - reinforced concrete, in excess of 3-hr rating; floor drains

c. Ceiling - later

2. Ceiling height - approx. 11 ft

3. Room volume - approx. 45,000 ft^3

4. Ventilation - 6,000 cfm

5. Access in Zone - Limited

B. Safe Shutdown Equipment

BLI-110,-120,-130,-140 S/G -1,-2,-3,-4 wide-range H_2O level
BLP-110,-111,-120,-121,
-130,-131,-140,-141,S/G -1,-2,-3,-4 narrow-range H_2O level
IMO-51, -52, -53, -54 BIT ISOL valves
NLI-151 PZR level
NPS-121, -122 wide-range RCS pressure
ICM-111 RHR Outlet ISOL

B. Safe Shutdown Equipment (Cont.)

ICM-129 RHR Inlet ISOL
SV-102 RHR Discharge safety valve
SV-103 RHR Suction safety valve

C. Fire Hazards

1. Type of combustibles in area -

   Cable insulation

2. Quantity of fixed combustibles -

   Cable - 120,000,000 Btu
   29,000 Btu/ft^2

D. Existing Fire Protection

1. Fire detection systems - thermistor thermal detectors in the cable trays.

2. Fire extinguishing systems - none

7.16 Fire Zone 75 Containment Lower Volume Unit 2

EXEMPTION REQUESTS

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 area.

7.16.1 Area Description

Fire Zone 75 is located in the containment lower volume of Unit 2 at el 598 ft 9 in. The zone contains all the reactor coolant pumps and steam generators, pressurizer relief tank, pressurizer, containment auxiliary HVAC units, reactor coolant temperature transmitters (hot and cold legs) and one of the RHR inlet isolation valves. Access to the zone is gained through the containment personnel hatch and through the containment instrument room into the containment lower volume.

Pertinent room dimensional data is contained in Fire Zone 75 Summary Evaluation Table 7.16-1 and Figure 7.16.1.

7.16.2 Safe Shutdown Equipment

Fire Zone 75 contains the pressurizer heater, all hot and cold leg temperature RTDs, the pressurizer safety valves and RHR valve IMO-128 (suction from the RCS), and associated cables for above electrically operated devices. The zone also contains the four reactor coolant pumps and motors, four steam generators, pressurizer relief tank, pressurizer and two containment auxiliary clean-up HVAC units.

7.16.3 Fire Protection System

Fire Zone 75 contains a thermistor actuated deluge suppression system for the containment auxiliary HVAC charcoal filters and a fixed manual water suppression system for each RCP motor. An oil collection system is also provided for the RCP lube oil system. The cable trays, RCP motors and charcoal filters are equipped with thermistor thermal detectors which alarm in the Control Room.

7.16.4 Fire Hazards Analysis

The walls, floors and ceilings are of reinforced concrete construction. Access to this zone is through the containment access hatch. Redundant RCS temperature instrumentation is adequately separated with the exception of the hot leg temperature instrument cables.

The zone contains cable insulation, lube oil for the reactor coolant pumps and charcoal for the HVAC units for a total fixed fire loading of approximately 190,000,000 Btu which, when distributed over the surface of the fire zone, results in approximately 157,000 Btu/ft^2. The equivalent fire severity is approximately 118 minutes. The RCP motors, charcoal filters and cable trays are provided with thermistor thermal detectors. The RCP motors have fixed manual water suppression and charcoal filters have thermal detector actuated deluge systems.

7.16.5 Proposed Modifications

The pressurizer heaters and associated cables are in this zone. Safe shutdown capability without operation of the pressurizer heaters is possible since other means of RCS pressure control are available.

The fire hazards analysis revealed that the RCS hot leg temperature instrument cables are not in compliance with Appendix R. Alternate shutdown capability for the RCS temperature instrumentation will be provided. New hot and cold leg temperature indication for all four RCS loops of Unit 2 will be provided at a local control station independent from Fire Zone 75. The new cable must be routed through this area; however, if 20 ft of horizontal separation cannot be achieved, then a radiant energy shield will be provided for the cables. Also an automatic detection system will be provided in this fire zone.

7.16.6 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 which justify the exemption are summarized as follows:

(1) The modifications recommended include the installation of new RCS temperature indicators and associated instrument cables, providing an alternative location for RCS temperature monitoring.

(2) The loss of the pressurizer heaters will not threaten safe shutdown capability of Unit 2.

(3) Other safe shutdown cables in the area are separated by more than 20 feet.

(4) RHR valve IMO-128 is not needed until shutdown cooling mode is required and manual valve operation is feasible for this component.

(5) The charcoal filters are equipped with thermistor actuated deluge systems.

(6) A fixed manual suppression system exists for the RCP motors.

(7) A lube oil collection system exists for each RCP motor.

(8) The area will be provided with an automatic detection system which provides alarms in the Control Room.

(9) The area is not normally accessible during operation.

(10) Modifications required to meet Section III.G.3 would not enhance fire protection safety above that provided by present commitments.

SUMMARY EVALUATION TABLE 7.16-1

FIRE ZONE: 75

DESCRIPTION: Unit 2 Containment Lower Volume

EVALUATION PARAMETERS SUMMARY

A. Area Description

1. Construction -

a. Walls -

North - reinforced concrete, in excess of 3-hr rating

South - reinforced concrete, in excess of 3-hr rating

East - reinforced concrete, in excess of 3-hr rating

West - reinforced concrete, in excess of 3-hr rating

b. Floor - reinforced concrete, in excess of 3-hr rating; floor drains

c. Ceiling - reinforced concrete, in excess of 3-hr rating

2. Ceiling height - approx. 90 ft

3. Room volume - approx. 330,000 ft^3

4. Ventilation - 216,000 cfm

5. Access in Zone - Limited

B. Safe Shutdown Equipment

NTR-110, -120, -130, -140 - T_H loop indic.
NTR-210, -220, -230, -240 - T_C loop indic.
SV-102 RHR Disch. Safety Vlv.
SV-103 RHR Suct. Safety Vlv.

C. Fire Hazards

1. Type of combustibles in area -

   Cable insulation
   Lube oil
   Charcoal

2. Quantity of fixed combustibles -

   Cable - 112,000,000 Btu = 31,000 Btu/ft^2
   Lube oil - 420,000,000 Btu = 115,000 Btu/ft^2
   Charcoal - 42,000,000 Btu = 12,000 Btu/ft^2

D. Existing Fire Protection

1. Fire detection systems - thermistor thermal detectors in cable trays, RCP motors and charcoal filters.

2. Fire extinguishing systems -

   Automatic deluge water spray actuated by thermistor on HVAC units and RCP's.

7.17 Fire Zone 120 Containment Unit 1 Accumulator Enclosure East

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, room or zone under consideration.

7.17.1 Area Description

Fire Zone 120 is located within the containment building Unit 1, at the accumulator enclosure east. The walls, floors and ceilings are constructed of reinforced concrete. The zone contains two steam generator narrow-range level transmitters. Access to the zone is through the containment personnel access hatch. Pertinent room dimensional data is contained in Fire Zone 120 Summary Evaluation Table 7.17-1 and Figure 7.17.1.

7.17.2 Safe Shutdown Equipment

Fire Zone 120 contains narrow-range level transmitters for steam generators 1 and 4. The zone also contains the cables associated with all remaining level indication for steam generators 1 and 4. Cables for RCS hot leg temperature indication of loops 2 and 4 are in the fire zone. In order to achieve adequate indication and control of natural circulation cooldown, steam generator level indication and primary system hot and cold leg temperature indication must be available for the steam generators and RCS loops utilized. In this fire zone, affected cables and equipment result in loss of steam generator level and hot leg temperature for loops 2 and 4. Thus, modifications for RCS loop temperature will be made to provide temperature indication for loops 2 and 3. Safe shutdown cables for one RHR suction valve do not impede safe hot shutdown, since for safe shutdown cooling mode, this component can be locally operated.

7.17.3 Fire Protection System

Automatic detection or suppression is not provided in this fire zone.

7.17.4 Fire Hazards Analysis

Fire Zone 120 contains cables for RCS hot leg temperature indication (NTR-120). In order to provide necessary RCS loop temperatures for the associated steam generators used for natural circulation cooldown, the cables for loop temperatures will be modified.

The fire zone contains predominantly cable insulation which has a combustible loading of approximately 10,000,000 Btu which, when distributed over the surface of the fire zone, results in approximately 8500 But/ft^2. The equivalent fire severity is approximately six minutes. The zone is not normally accessible during operation.

7.17.5 Proposed Modifications

The fire hazards analysis revealed that the cables for one channel of RCS hot leg temperature (NTR-120) do not comply with the specific requirements of Appendix R and modifications will be made to reroute new cables for hot and cold leg temperature indication. The redundant cables will be horizontally separated by 20 ft or will be provided with radiant energy shields. Also, an automatic detection system will be provided.

7.17.6 Conclusion

Based on the previous analysis, alternate shutdown modifications will be made to provide remote reading RCS temperature indication. 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 which justify the exemption are summarized as follows:

(1) Alternate RCS loop temperature indication will be provided with cables routed either with adequate separation or provided with radiant energy shields in accordance with Section III.G.2.

(2) The fire zone will be provided with automatic detection.

(3) The combustible loading in the fire zone is low with a fire severity of approximately seven minutes.

(4) Access to the fire zone is not normally available during operations.

(5) Modifications required to meet Section III.G.3 would not significantly enhance fire protection safety above that provided by present commitments.

SUMMARY EVALUATION TABLE 7.17-1

FIRE ZONE: 120

DESCRIPTION: Unit 1 Containment Accumulator Enclosure

EVALUATION PARAMETERS SUMMARY

A. Area Description

1. Construction -

a. Walls -

North - reinforced concrete, in excess of 3-hr rating

South - reinforced concrete, in excess of 3-hr rating

East - reinforced concrete, in excess of 3-hr rating

West - reinforced concrete, in excess of 3-hr rating

b. Floor - reinforced concrete, in excess of 3-hr rating

c. Ceiling - reinforced concrete, in excess of 3-hr rating

2. Ceiling height - approx. 26 ft

3. Room volume - approx. 32,000 ft^3

4. Ventilation - 10,800 cfm

5. Access in Zone - Limited

B. Safe Shutdown Equipment

Cables only

C. Fire Hazards

1. Type of combustibles in area -

   Cable insulation

2. Quantity of fixed combustibles -

   Cable - 10,000,000 Btu
   8,500 Btu/ft^2

D. Existing Fire Protection

1. Fire detection systems -

   None

2. Fire extinguishing systems -

   None

7.18 Fire Zone 121 Containment Unit 2 Accumulator Enclosure East

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 area, room or zone under consideration.

7.18.1 Area Description

Fire Zone 121, the Unit 2 counterpart of Fire Zone 120 in Unit 1, is located within the Containment Building Unit 2, at the accumulator enclosure east. The walls, floors and ceilings are constructed of reinforced concrete. The zone contains two steam generator-narrow range level transmitters. Access to the zone is through the containment personnel access hatch. Pertinent room dimensional data is contained in Fire Zone 121 Summary Evaluation Table 7.18-1 and Figure 7.18.1.

7.18-2 Safe Shutdown Equipment

Fire Zone 121 contains steam generators 1 and 4 narrow-range level transmitters. The zone also contains cables associated with three of four hot leg temperature indicators.

In order to achieve adequate indication and control of natural circulation cooldown, steam generator level indication and primary system hot and cold leg temperature indication must be available for the steam generators and RCS loops utilized. In this fire zone, affected cables and equipment result in loss of steam generator level and hot leg temperature for loops 2 and 4.

Thus, modifications to RCS loop temperature will be made to provide temperature modification for loops 2 and 3.

Safe shutdown cables for one RHR suction valve do not impede safe hot shutdown since for safe shutdown cooling mode this component can be locally operated.

7.18.3 Fire Protection System

Automatic detection or suppression does not exist in this fire zone

7.18.4 Fire Hazards Analysis

Fire Zone 121 contains hot leg temperature indication for three of four loops as well as the liquid level transmitters for numbers 1 and 4 steam generators. In order to provide necessary RCS loop temperatures for the associated steam generators used for natural circulation cooldown, the cables for loop temperatures will be modified.

The fire zone contains predominantly cable insulation which has a combustible loading of approximately 4,800,000 Btu which, when distributed over the surface of the fire zone, results in approximately 4,000 Btu/ft^2. The equivalent fire severity is approximately three minutes. The zone is not normally accessible during operation.

7.18.5 Proposed Modifications

The fire hazards analysis revealed that the cables for hot leg temperature indication do not comply with the specific requirements of Appendix R and modifications will be made to reroute new cables for hot and cold leg temperature indication. The redundant cables will be horizontally separated by 20 ft or will be provided with radiant energy shields. Also, an automatic detection system will be provided in this fire zone.

7.18.6 Conclusions

Based on the previous analysis, alternate shutdown modifications will be made to provide remote reading RCS temperature indication. 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 which justify the exemption are summarized as follows:

(1) Alternate RCS loop temperature indication will be provided with cables routed either with adequate separation, or provided with radiant energy shields in accordance with Section III.G.2.

(2) The fire zone will be provided with an automatic detection system.

(3) The combustible loading in the fire zone is low with a fire severity of approximately three minutes.

(4) Access to the fire zone is not normally available during operation.

(5) Modifications required to meet Section III.G.3 would not significantly enhance fire protection safety above that provided by present commitments.

SUMMARY EVALUATION TABLE 7.18-1

FIRE ZONE: 121

DESCRIPTION: Unit 2 Containment Accumulator Enclosure

EVALUATION PARAMETERS SUMMARY

A. Area Description

1. Construction -

a. Walls -

North - reinforced concrete, in excess of 3-hr rating

South - reinforced concrete, in excess of 3-hr rating

East - reinforced concrete, in excess of 3-hr rating

West - reinforced concrete, in excess of 3-hr rating

b. Floor - reinforced concrete, in excess of 3-hr rating

c. Ceiling - reinforced concrete, in excess of 3-hr rating

2. Ceiling height - approx. 26 ft

3. Room volume - approx. 32,000 ft^3

4. Ventilation - 10,800 cfm

5. Access in Zone - Limited

B. Safe Shutdown Equipment

BLP-112, - 142 S/G Normal Range Water Level

C. Fire Hazards

1. Type of combustibles in area -

   Cable insulation

2. Quantity of fixed combustibles -

   Cable - 4,800,000 Btu
   4,000 Btu/ft^2

D. Existing Fire Protection

1. Fire detection systems -

   None

2. Fire extinguishing systems -

   None

7.19 Fire Zone 122 Unit 1 Containment Instrument Room

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 area, room or zone under consideration.

7.19.1 Area Description

Fire Zone 122 is located within the Containment Building Unit 1. The zone contains all the pressurizer pressure and level instruments with their cables in addition to cables for RCS and RHR components. Access to the zone is normally gained through the containment personnel hatch. The zone also has an unrated door to Fire Zone 67 and an unrated hatch to Fire Zone 66. Otherwise, it is bounded by three-hour barriers. Pertinent room dimensional data is contained in Fire Zone 122 Summary Evaluation Table 7.19-1 and Figure 7.19.1.

7.19.2 Safe Shutdown Equipment

Fire Zone 122 contains the three pressurizer water level instruments required for safe shutdown, with associated instrument cables. Cables for RHR isolation motor-operated valves IMO-128, ICM-129, and ICM-111 are routed through this area as well as all cold leg temperature instrument cables.

7.19.3 Fire Protection System

The fire zone presently does not contain any automatic fire detection or suppression systems.

7.19.4 Fire Hazards Analysis

Fire Zone 122 is bordered by three-hour-rated barriers with the exception of the door to Fire Zone 67 and the hatch to Fire Zone 66.

The various pressurizer water level transmitters and RCS cold leg instrumentation cables are separated by less than 20 ft for which modifications are proposed. The fire zone has a fixed combustible loading of approximately 9,500,000 Btu which, when distributed over the surface area of the fire zone, results in approximately 16,400 Btu/ft^2. The equivalent fire severity is approximately 15 minutes. Of the total combustible loading, approximately 15% is attributed to the 27 pints of lube oil contained in the incore neutron detector drive motors.

7.19.5 Recommended Modifications

The fire hazards analysis revealed that this zone is not in compliance with Appendix R. As a result, the fire zone will be upgraded with modifications.

7.19.5.1 Radiant Energy Shields

Modification to protect at least one of the pressurizer level transmitters and associated cables will be provided by radiant energy shields.

7.19.5.2 Cold Leg and Hot Leg Temperature

Alternate RCS cold leg and hot leg temperature will be provided with adequate horizontal separation or protected by radiant energy shields.

7.19.5.3 Automatic Fire Detection System

The fire zone will be provided with an automatic fire detection system that will alarm in the Unit 1 Control Room.

7.19.6 Conclusion

Based on the previous analysis and proposed modifications, the pressurizer level transmitters will be modified to comply with Section III.G.2 for inside noninerted containment buildings. The proposed modifications for RCS loop temperature indication, however, is being made to provide alternate routing of the instrumentation cables associated with hot and cold leg temperature. Therefore, an exemption is requested from Section III.G.3 of Appendix R for the required fixed suppression system in areas where alternate shutdown capability exists in the area. The bases which justify this exemption are summarized as follows:

(1) The redundant pressurizer level transmitters and associated cables for one train will be protected by a noncombustible radiant energy shield.

(2) The fire zone will be equipped with an automatic detection system.

(3) The combustible loading in the zone is low and fire severity is approximately 15 minutes.

(4) RCS hot and cold leg temperature instrument cabling will be provided with adequate horizontal separation or protected by a radiant energy shield.

(5) A procedure will be implemented to limit the quantity and type of transient combustibles which can be taken into the fire zone.

(6) Modifications required to meet Section III.G.3 would not significantly enhance fire protection safety above that provided by present commitments.

SUMMARY EVALUATION TABLE 7.19-1

FIRE ZONE: 122

DESCRIPTION: Unit 1 Containment Instrumentation Room

EVALUATION PARAMETERS SUMMARY

A. Area Description

1. Construction -

   a. Walls -

      North - reinforced concrete, in excess of 3-hr rating

      South - reinforced concrete, in excess of 3-hr rating

      East - reinforced concrete, in excess of 3-hr rating

      West - reinforced concrete, in excess of 3-hr rating

   b. Floor - reinforced concrete, in excess of 3-hr rating

   c. Ceiling - reinforced concrete, in excess of 3-hr rating

2. Ceiling height - approx. 25 ft

3. Room volume - approx. 15,000 ft^3

4. Ventilation - 9,600 cfm

5. Access in Zone - Limited

B. Safe Shutdown Equipment

NLI-151, NLP-151, 152, 153 - Pressurizer Water Level

C. Fire Hazards

1. Type of combustibles in area -

   Cable insulation

2. Quantity of fixed combustibles -

   Cable - 9,500,000 Btu
   16,400 Btu/ft^2

D. Existing Fire Protection

1. Fire detection systems -

   None

2. Fire extinguishing systems -

   None

7.20 Fire Zone 123 Unit 2 Containment Instrument Room

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 area, room or zone under consideration.

7.20.1 Area Description

Fire Zone 123, the Unit 2 counterpart of Fire Zone 122 in Unit 1, is located within the Containment Building Unit 2. The zone contains all the pressurizer pressure and level instruments with their cables in addition to cables for RCS and RHR components. Access to the zone is normally gained through the containment personnel hatch. The area also has an unrated door to Fire Zone 75 and unrated hatch to Fire Zone 74. Otherwise, it is bounded by three-hour barriers. Pertinent room dimensional data is contained in Fire Zone 123 Summary Evaluation Table 7.20-1 and Figure 7.20.1.

7.20.2 Safe Shutdown Equipment

Fire Zone 123 contains the three pressurizer water level instruments required for safe shutdown, with associated instrument cables. Cables for RHR isolation motor-operated valves IMO-128, ICM-129, and ICM-111 are routed through this area as well as all cold leg temperature instrument cables.

7.20.3 Fire Protection System

The fire zone presently does not contain any automatic detections or suppression systems.

7.20.4 Fire Hazards Analysis

Fire Zone 123 is bordered by three-hour-rated barriers with the exception of the door to Fire Zone 75 and the hatch to Fire Zone 74.

The various pressurizer water level transmitters and RCS cold leg instrumentation cables are separated by less than 20 ft for which modifications are proposed. The fire zone has a fixed combustible loading of approximately 12,500,000 Btu which, when distributed over the surface area of the fire zone, results in approximately 21,600 Btu/ft^2. The equivalent fire severity is approximately 19 minutes. Of the total combustible loading, approximately 10% is attributed to the 27 pints of lube oil contained in the incore neutron detector drive motor.

7.20.5 Recommended Modifications

The fire hazards analysis revealed that this zone is not in compliance with Appendix R. As a result, the fire zone will be upgraded with modifications.

7.20.5.1 Radiant Energy Shields

Modification to protect at least one of the pressurizer level transmitters and associated cables will be provided by radiant energy shields.

7.20.5.2 Alternate Cold Leg and Hot Leg Temperature

Alternate RCS cold leg and hot leg temperature will be provided with adequate horizontal separation or protected by radiant energy shields.

7.20.5.3 Automatic Fire Detection System

The fire zone will be provided with an automatic fire detection system that will alarm in the Unit 2 Control Room.

7.20.6 Conclusion

Based on the previous analysis and proposed modifications, the pressurizer level transmitters will be modified to comply with Section III.G.2 for inside noninerted containment buildings. The proposed modifications for RCS loop temperature indication, however, is being made to provide alternate routing of the instrumentation cables associated with hot and cold leg temperature. Therefore, an exemption is requested from Section III.G.3 of Appendix R for the required fixed suppression system installed in areas where alternate shutdown capability exists. The bases which justify this exemption are summarized as follows:

(1) The redundant pressurizer level transmitters and associated cables for one train will be protected by a noncombustible radiant energy shield.

(2) The fire zone will be provided with an automatic detection system.

(3) The combustible loading in the zone is low and fire severity is approximately 15 minutes.

(4) RCS hot and cold leg temperature instrument cabling will be provided with adequate horizontal separation or protected by a radiant energy shield.

(5) A procedure will be implemented to limit the quantity and type of transient combustibles which can be taken into the fire zone.

(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 7.20-1

FIRE ZONE: 123

DESCRIPTION: Unit 2 Containment Instrumentation Room

EVALUATION PARAMETERS SUMMARY

A. Area Description

1. Construction -

a. Walls -

North - reinforced concrete, in excess of 3-hr rating

South - reinforced concrete, in excess of 3-hr rating

East - reinforced concrete, in excess of 3-hr rating

West - reinforced concrete, in excess of 3-hr rating

b. Floor - reinforced concrete, in excess of 3-hr rating;

c. Ceiling - reinforced concrete, in excess of 3-hr rating

2. Ceiling height - approx. 25 ft

3. Room volume - approx. 15,000 ft^3

4. Ventilation - 9,600 cfm

5. Access in Zone - Limited

B. Safe Shutdown Equipment

NLI-151, NLP-151, -152, -153 - Pressurizer Water Level

C. Fire Hazards

1. Type of combustibles in area -

   a. Cable insulation

2. Quantity of fixed combustibles -

   a. Cables - 12,500,000 Btu
      21,600 Btu/ft^2

D. Existing Fire Protection

1. Fire detection systems -

2. Fire extinguishing systems -

   None

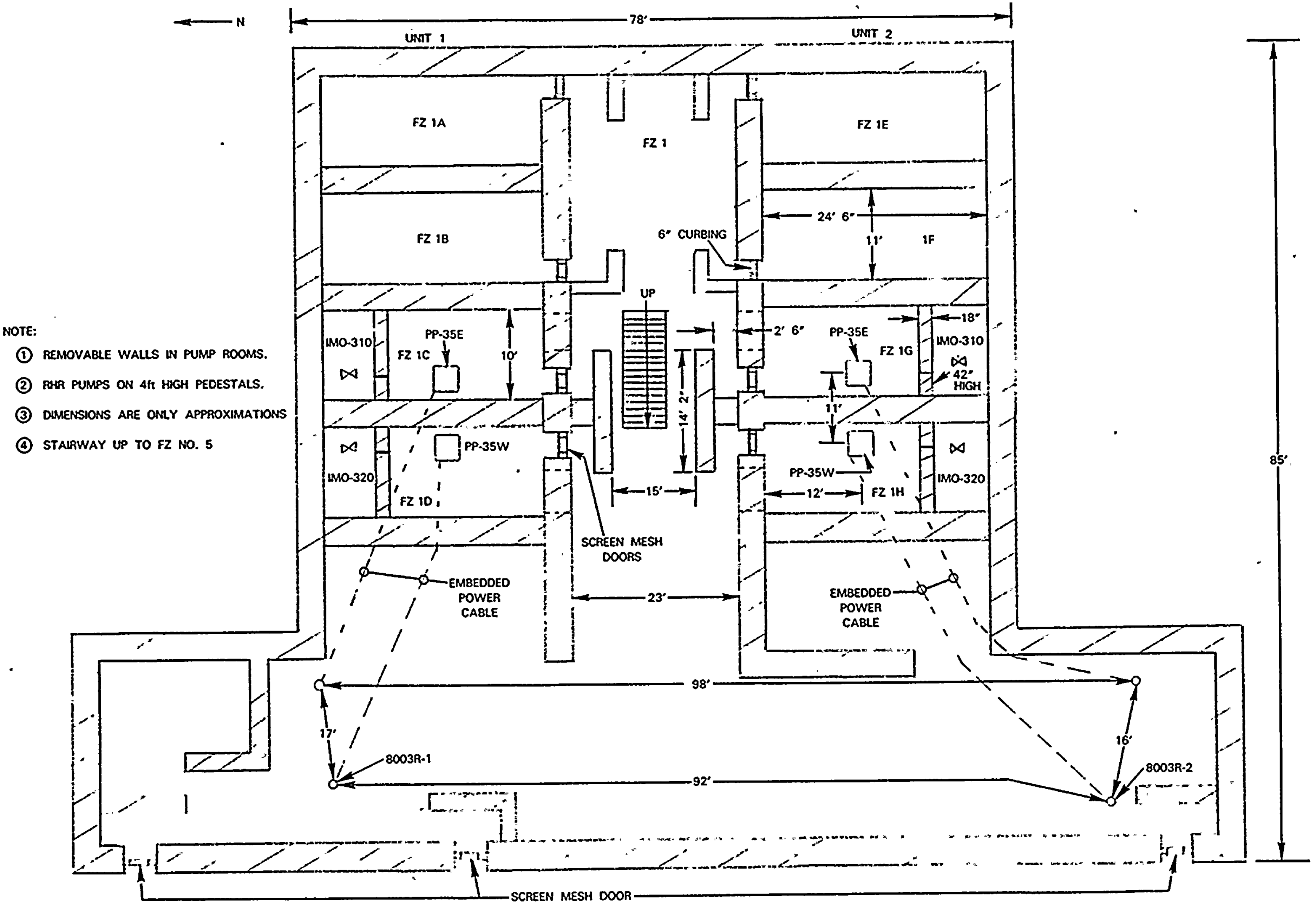
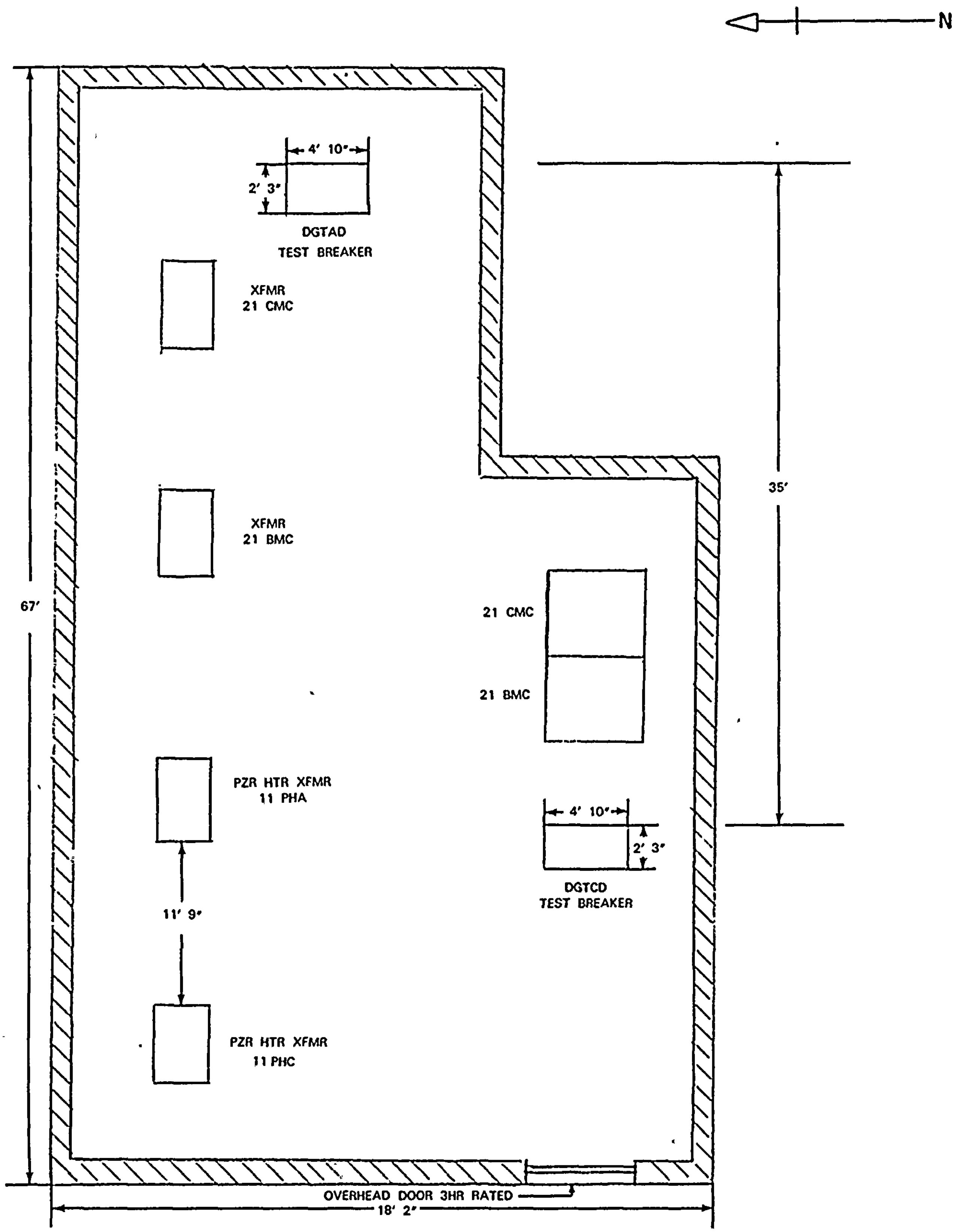


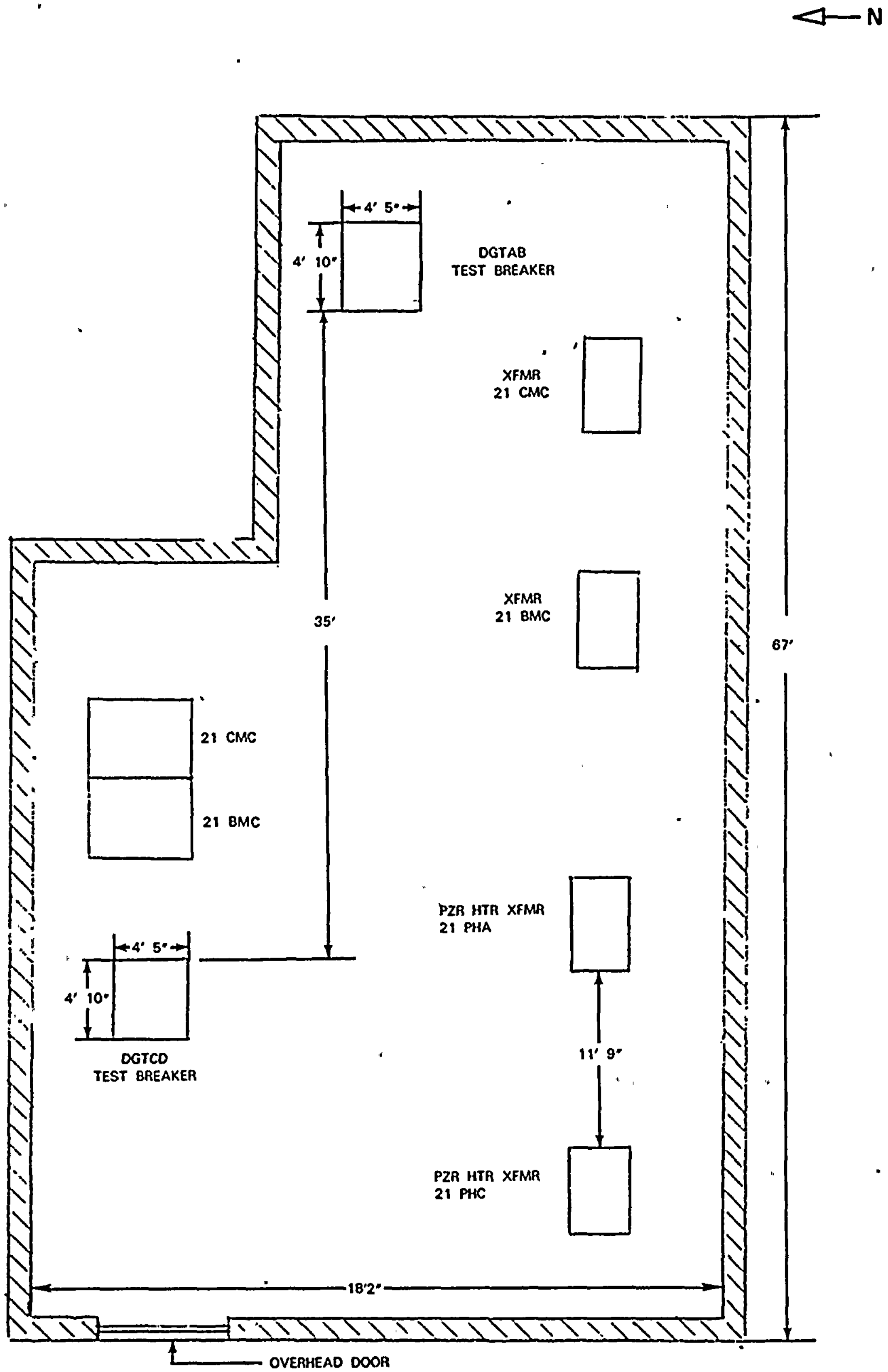
FIGURE 7.2 RHR/CTS PUMP AREA AUXILIARY BUILDING FIRE ZONE 1, 1A - H ELEV. 573'



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'

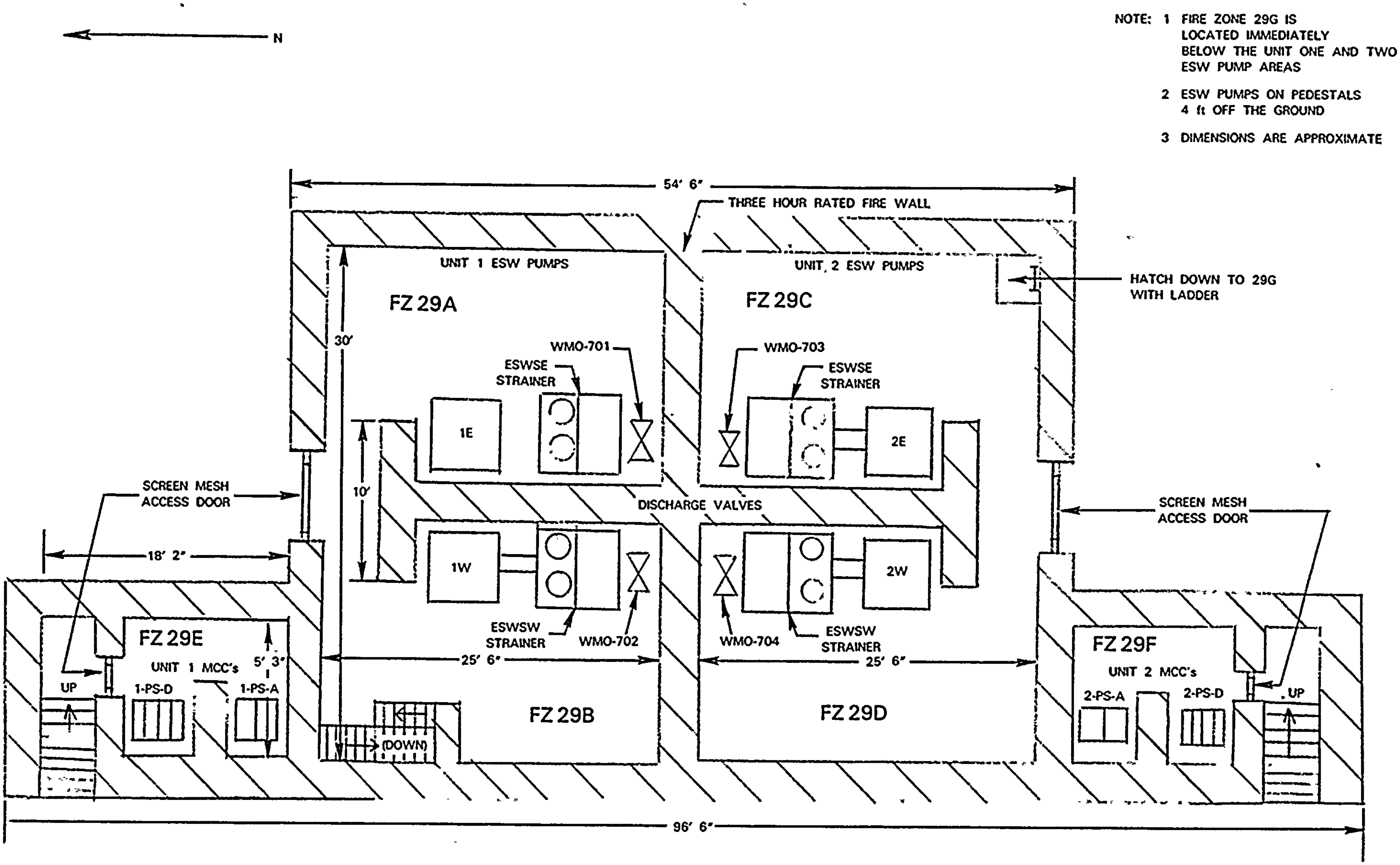
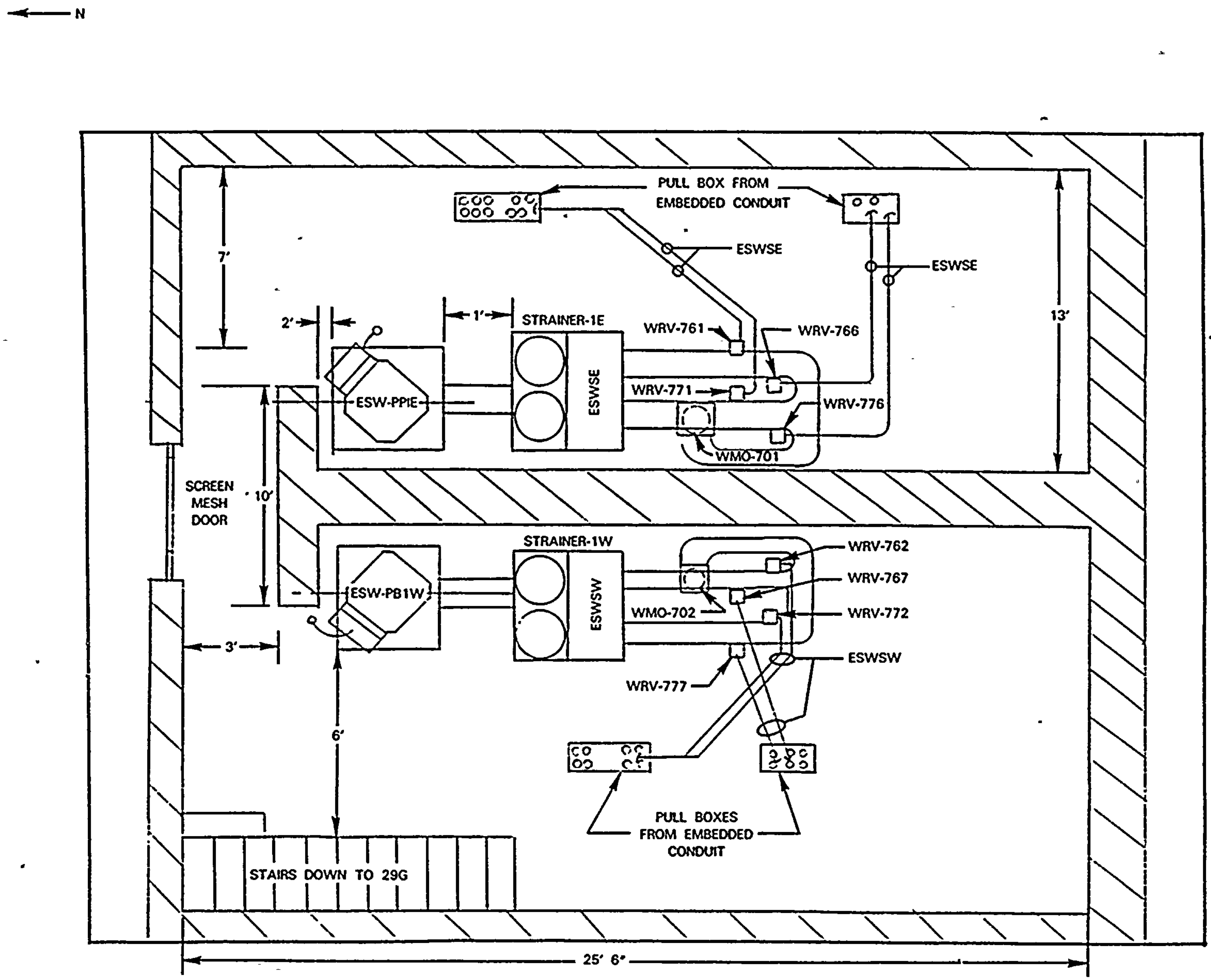


FIGURE 7.5.1 ESW PUMP AREAS UNIT 1 & UNIT 2

FIRE ZONES 29, 29A, 29B, 29C, 29D, 29E, 29F

ELEV. 591'

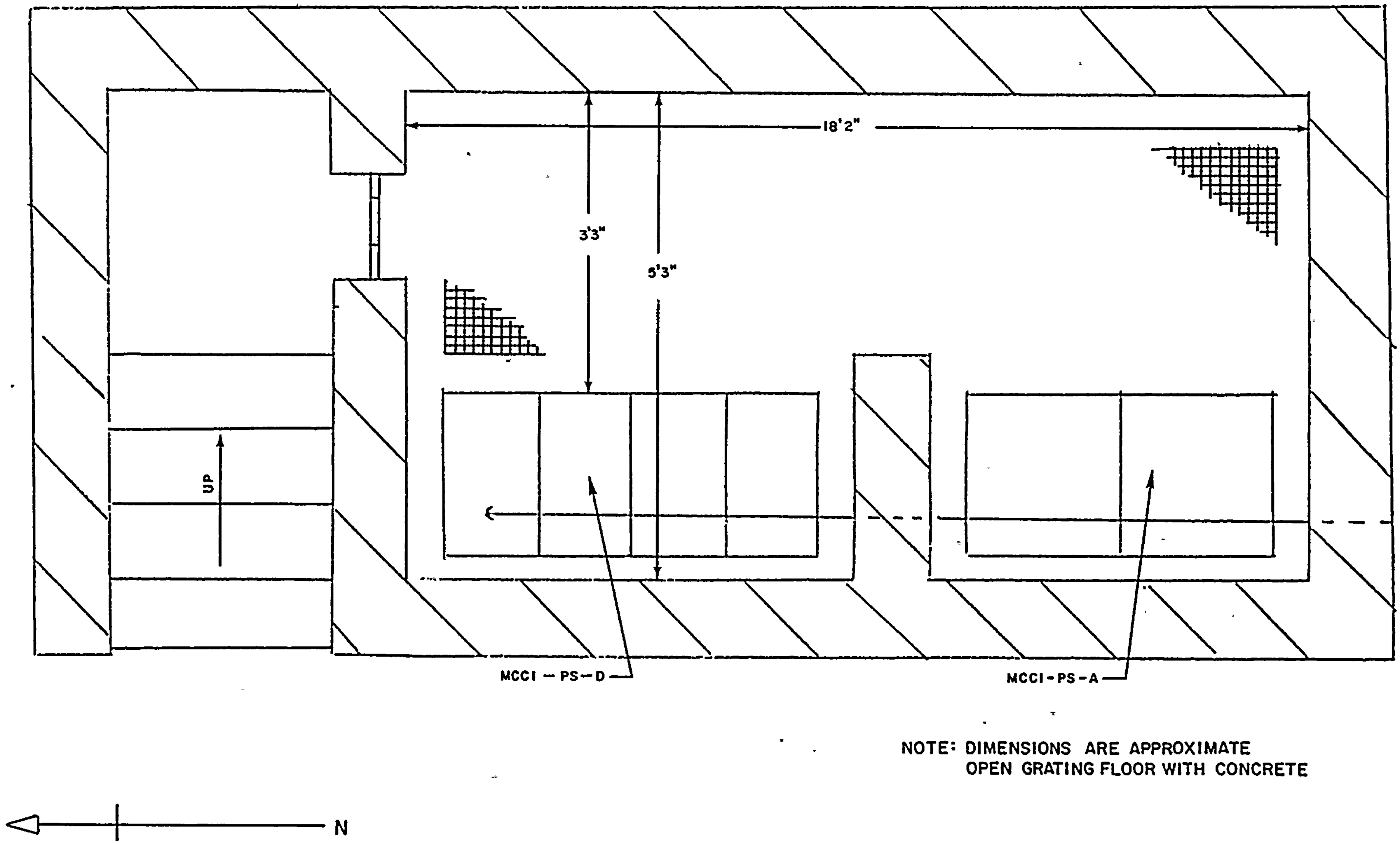


NOTE: 1 PUMPS ARE ON 4 ft HIGH PEDESTALS

2 DIMENSIONS ARE ONLY APPROXIMATIONS

FIRE ZONE 29A & 29B ELEV. 591'

FIGURE 7.5.2 ESW PUMP AREA UNIT 1



NOTE: DIMENSIONS ARE APPROXIMATE
OPEN GRATING FLOOR WITH CONCRETE

FIGURE 7.5.3 ESW MCC AREA UNIT 1

FIRE ZONE 29E ELEV. 591'

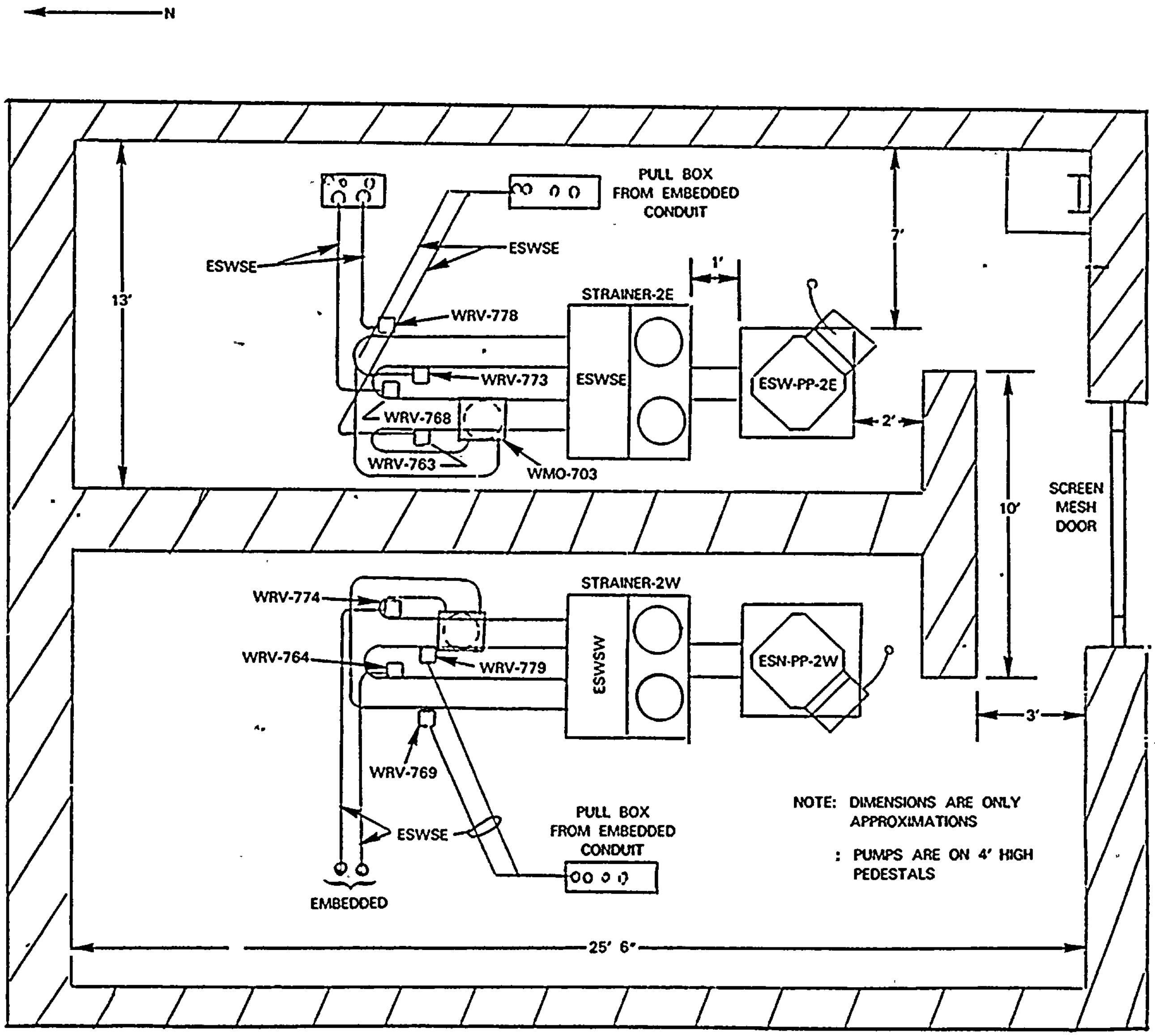


FIGURE 7.6.1 ESW PUMP AREA UNIT 2 FIRE ZONE 29C,D ELEV. 591'

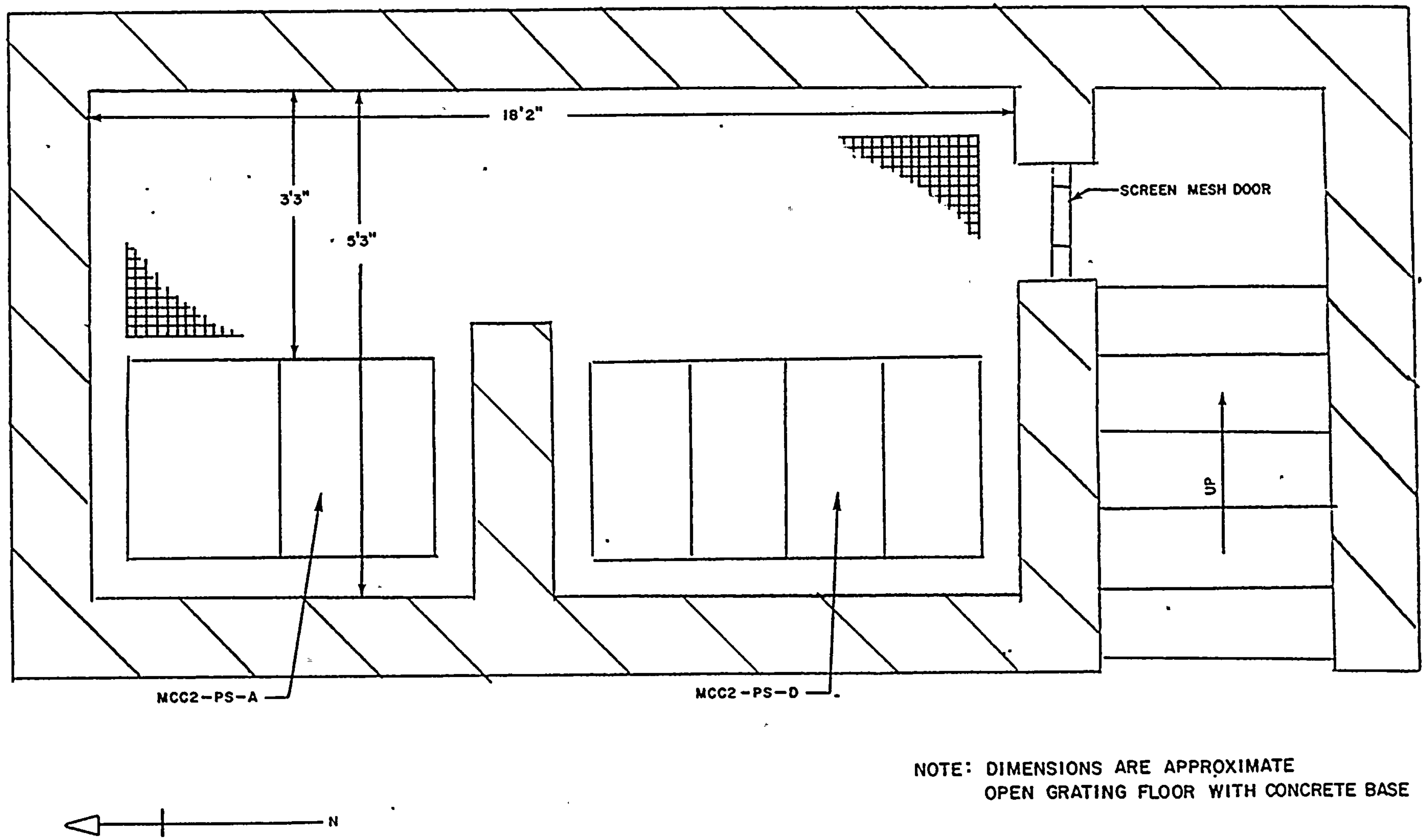
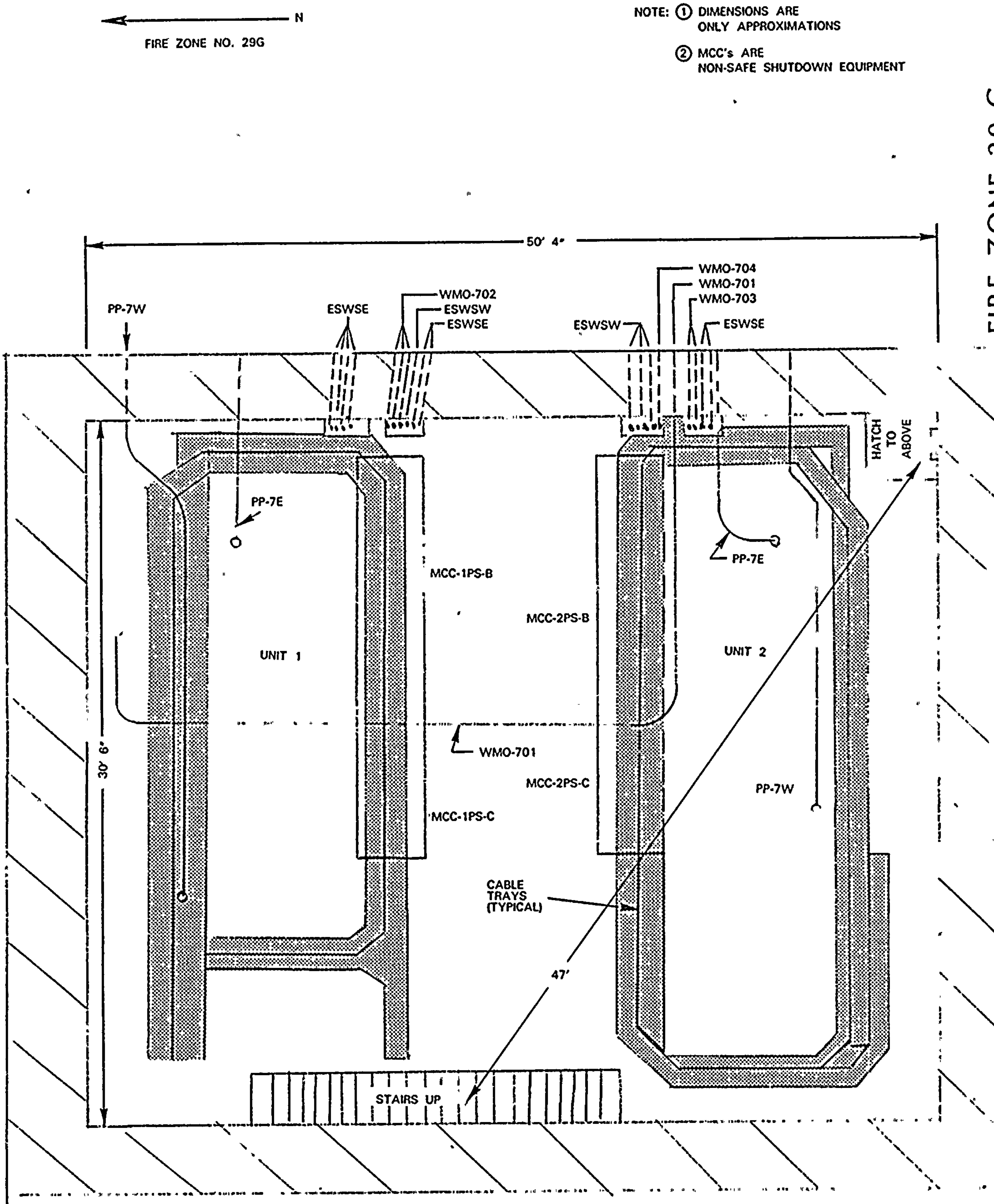


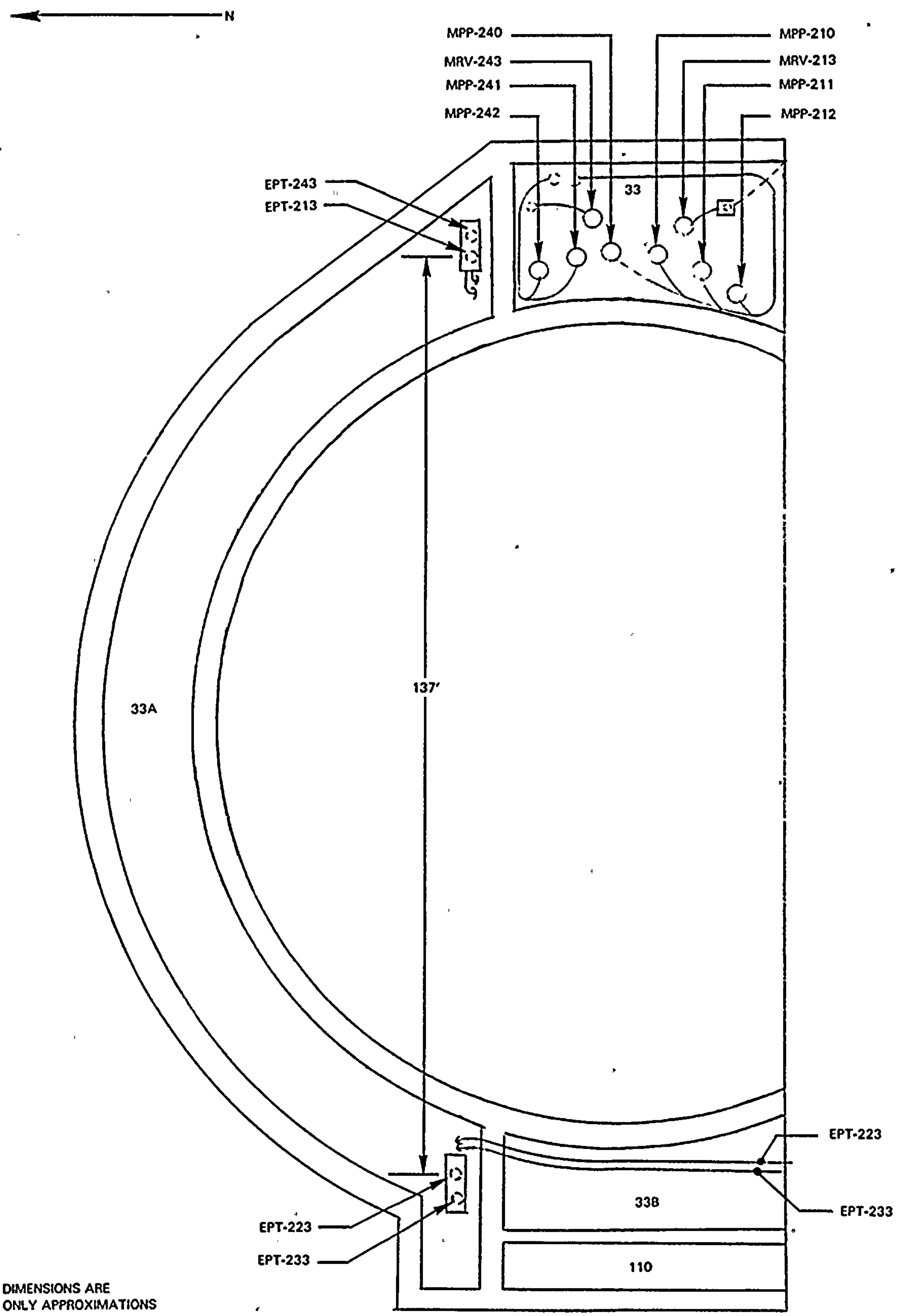
FIGURE 7.6.2 ESW MCC AREA UNIT 2

FIRE ZONE 29F ELEV. 591'

FIGURE 7.7



FIRE ZONE 29 G ELEV. 591'

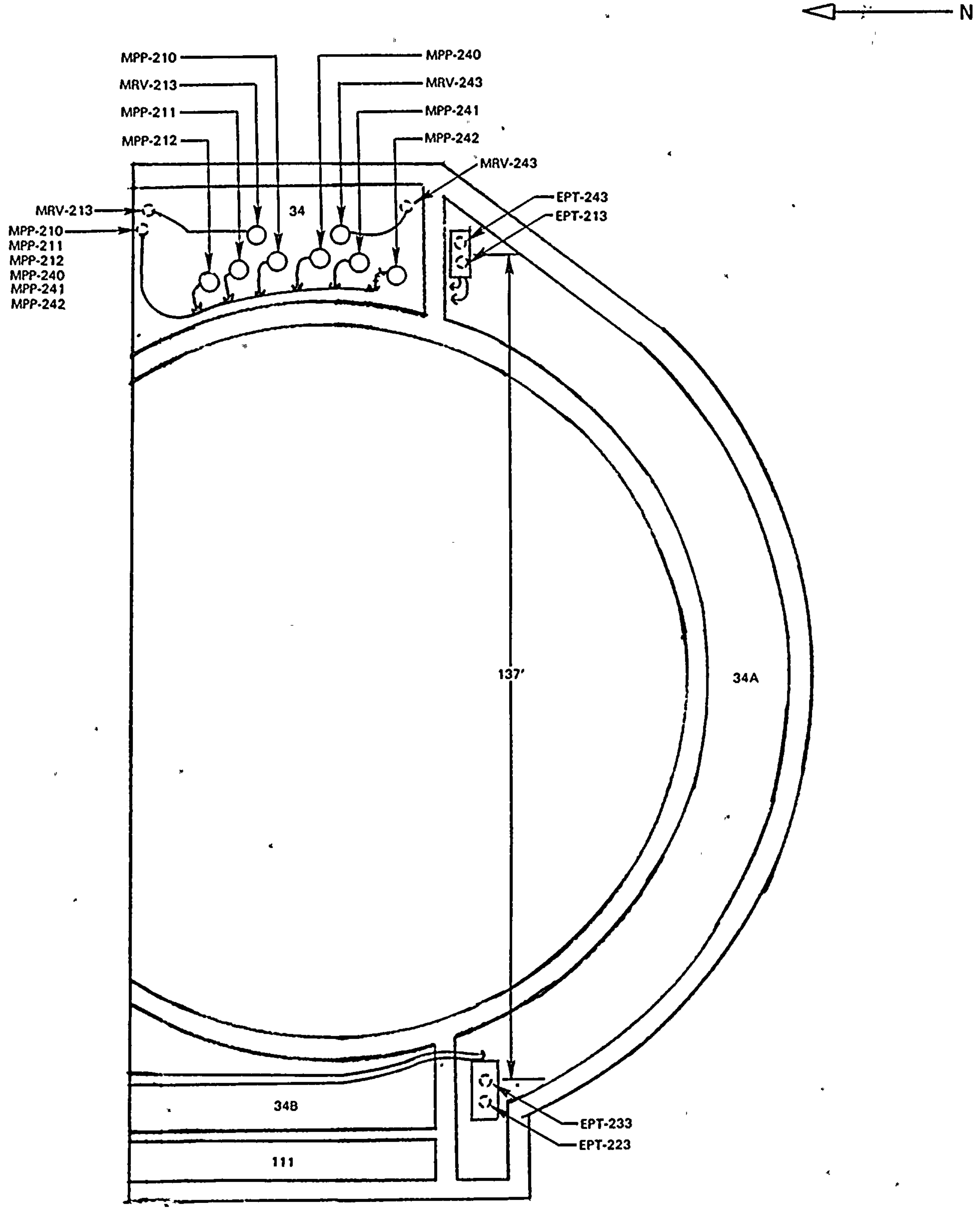


NOTE: 1 DIMENSIONS ARE ONLY APPROXIMATIONS

2 EPT's ARE THE ELECTROPNEUMATIC TRANSMITTERS FOR MRV-213, 223, 233, 243

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'

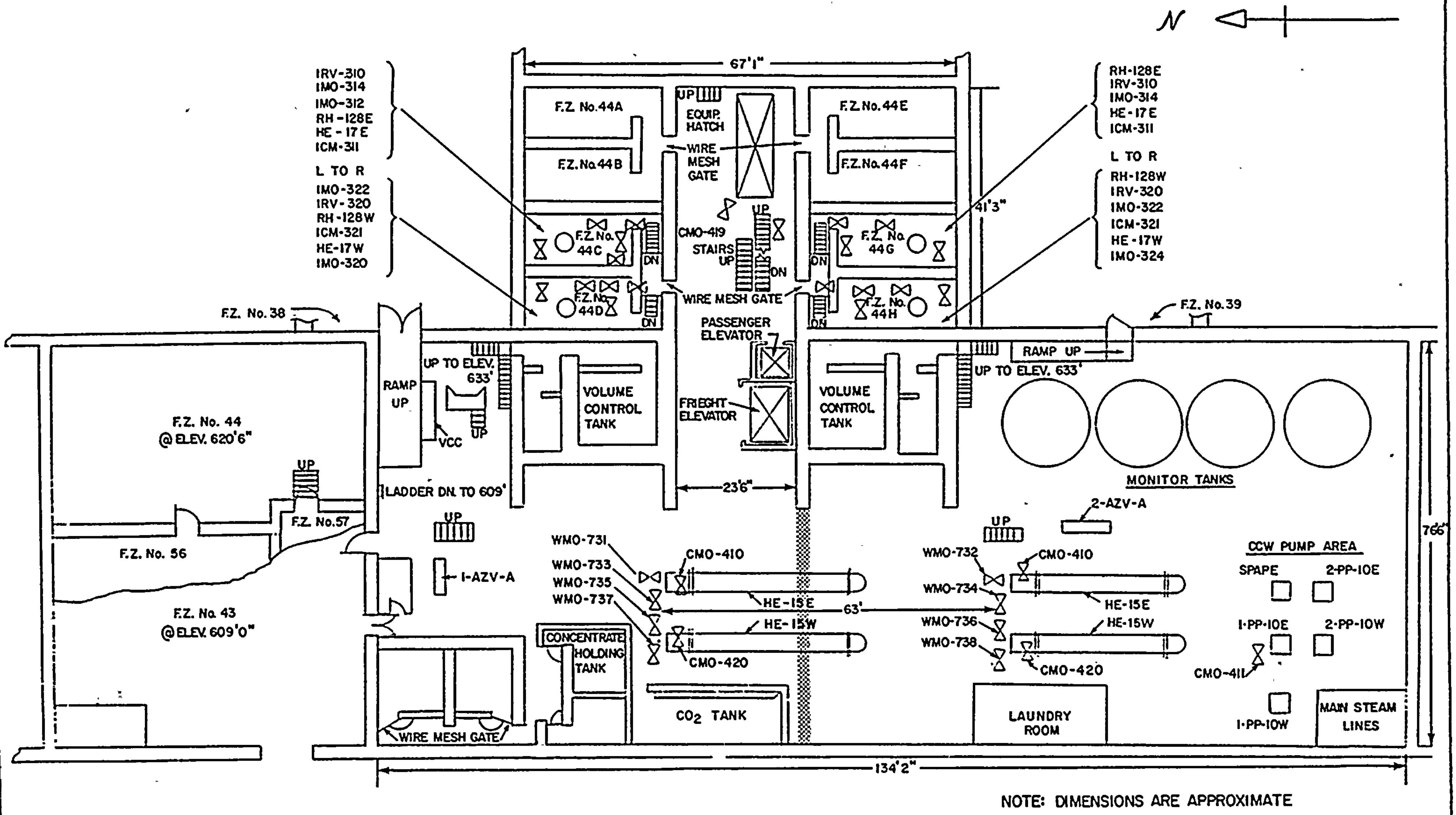


FIGURE 7.10.1 AUXILIARY BUILDING — EL. 609

GENERAL OUTLINE OF FIRE ZONES 44N, 44M, 44S

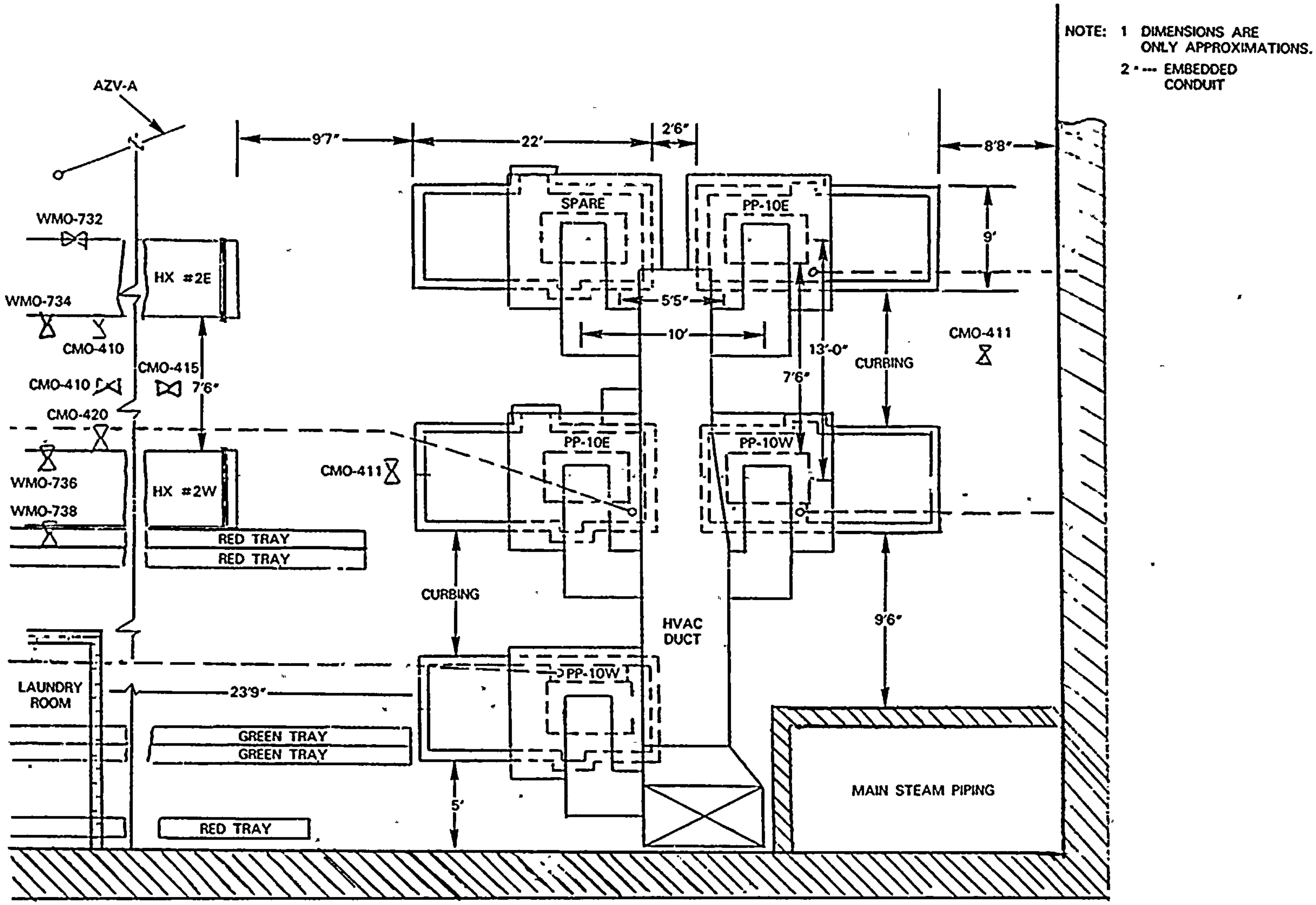
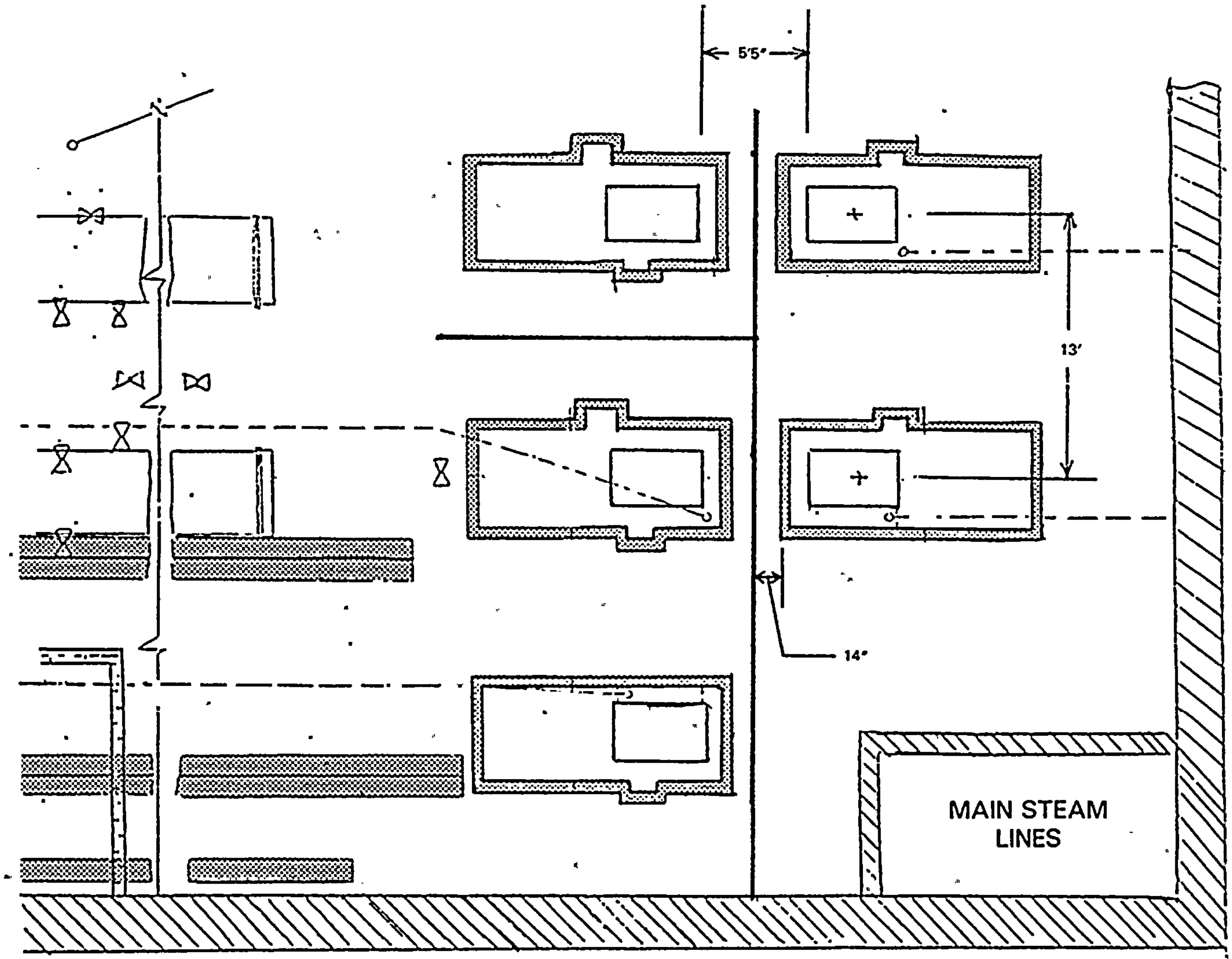


FIGURE 7.10.2 ZONE 44S — SOUTH END AUXILIARY BUILDING — EL. 609

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

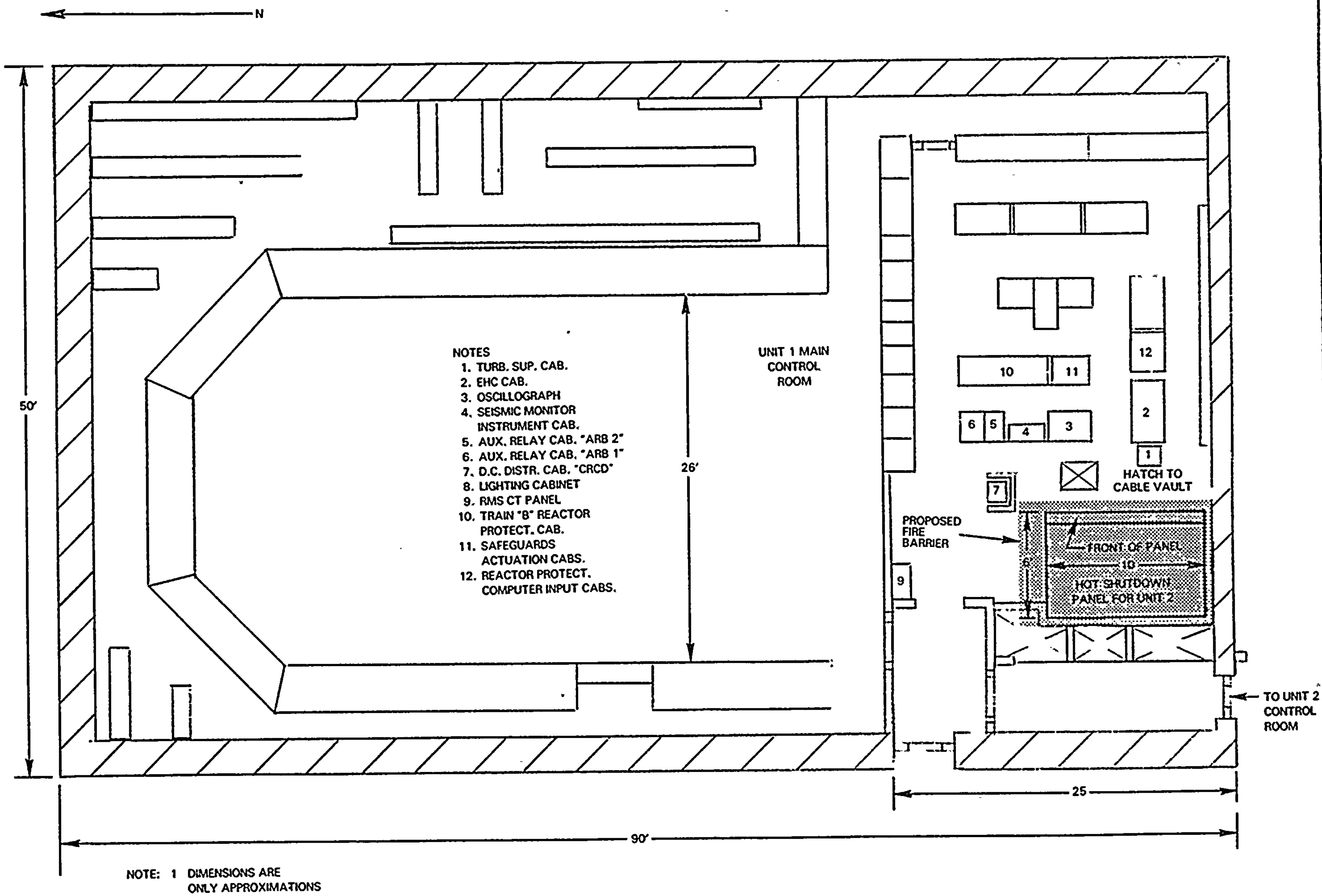


FIGURE 7.11 CONTROL ROOM UNIT 1

ZONE 53 ELEV. 633'

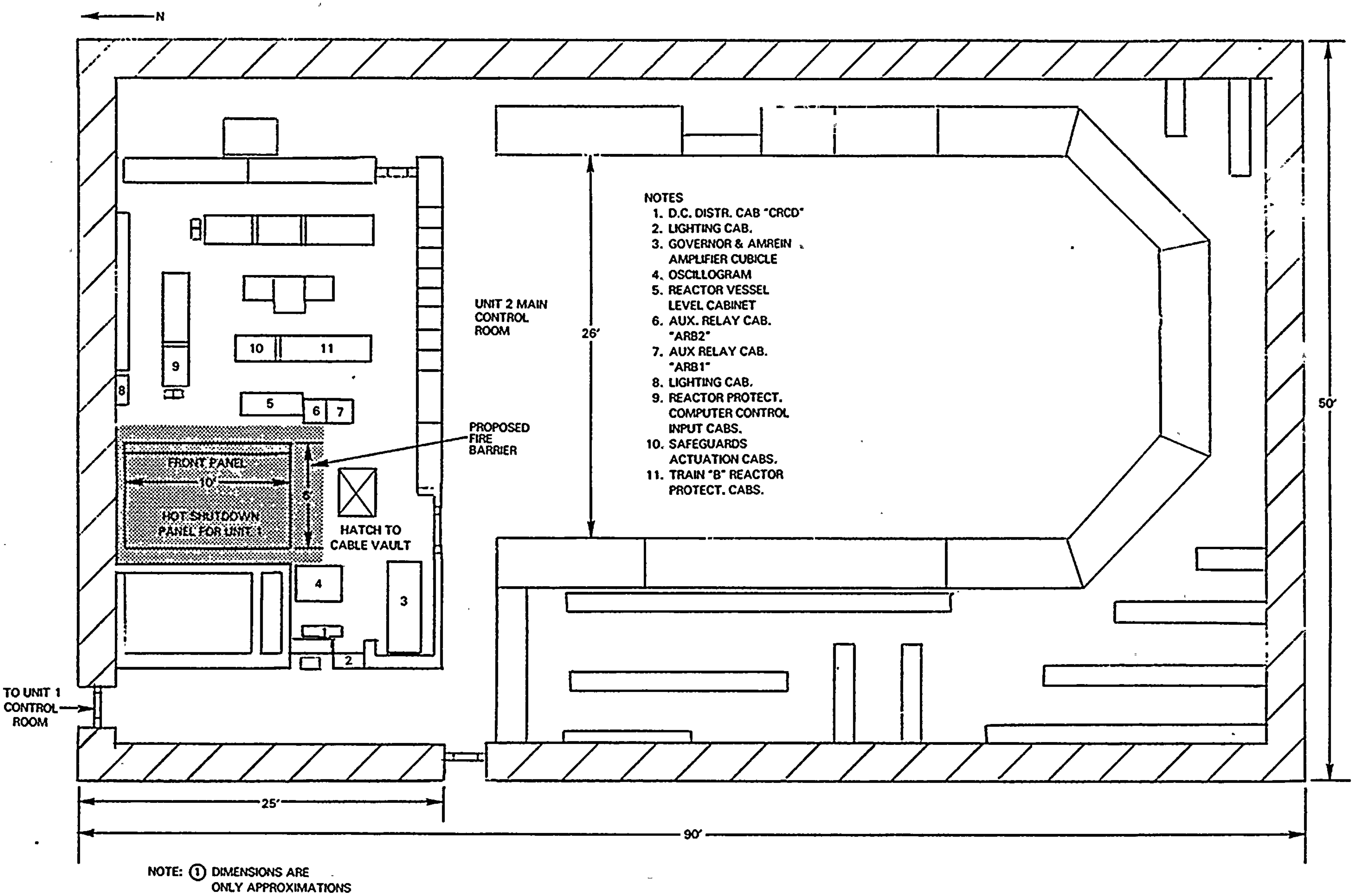


FIGURE 7.12 CONTROL ROOM UNIT 2

ZONE 54 ELEV. 633'

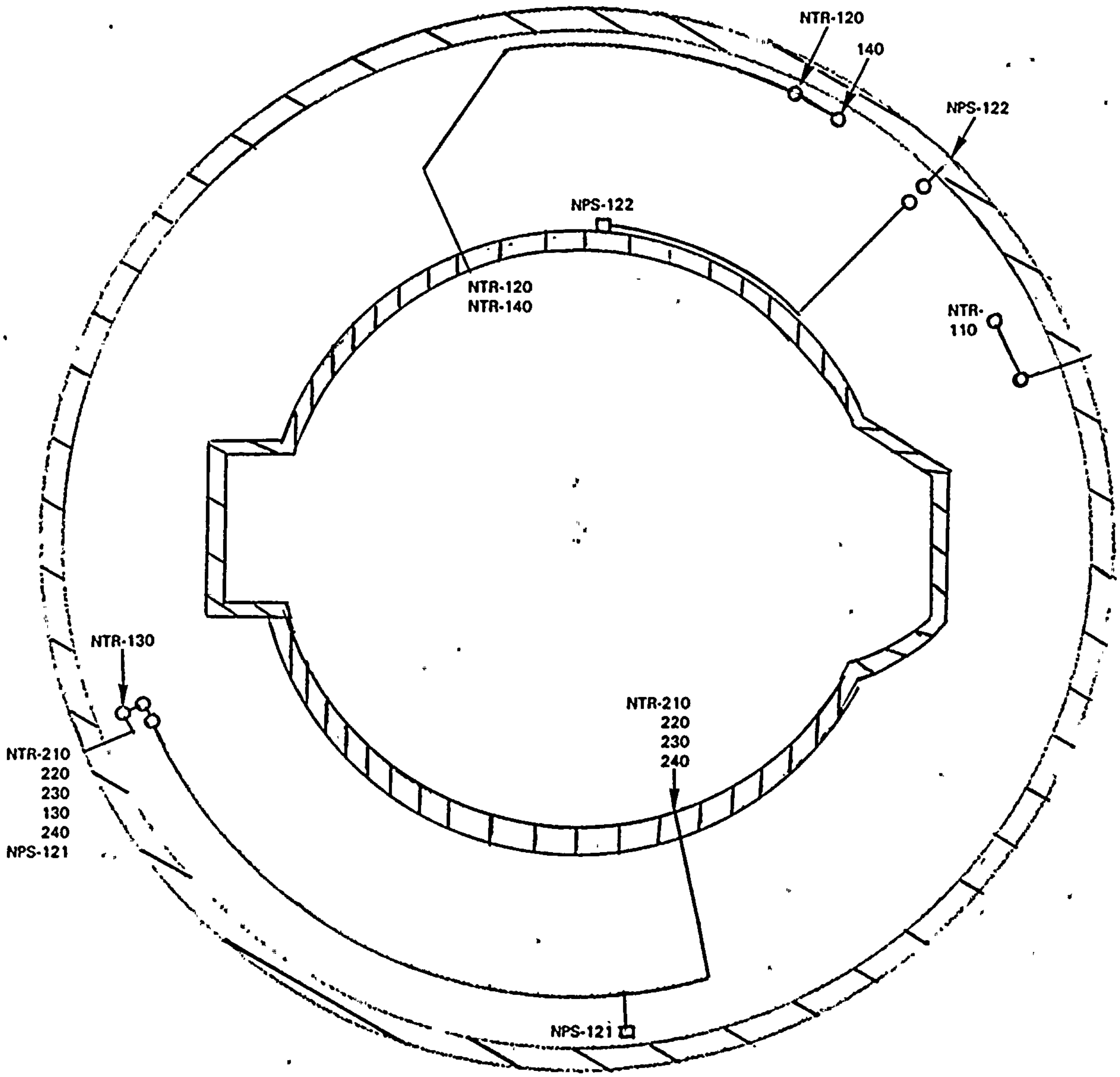


FIGURE 7.13 CONTAINMENT PIPING ANNULUS UNIT 1

FIRE ZONE 66 ELEV. 587'

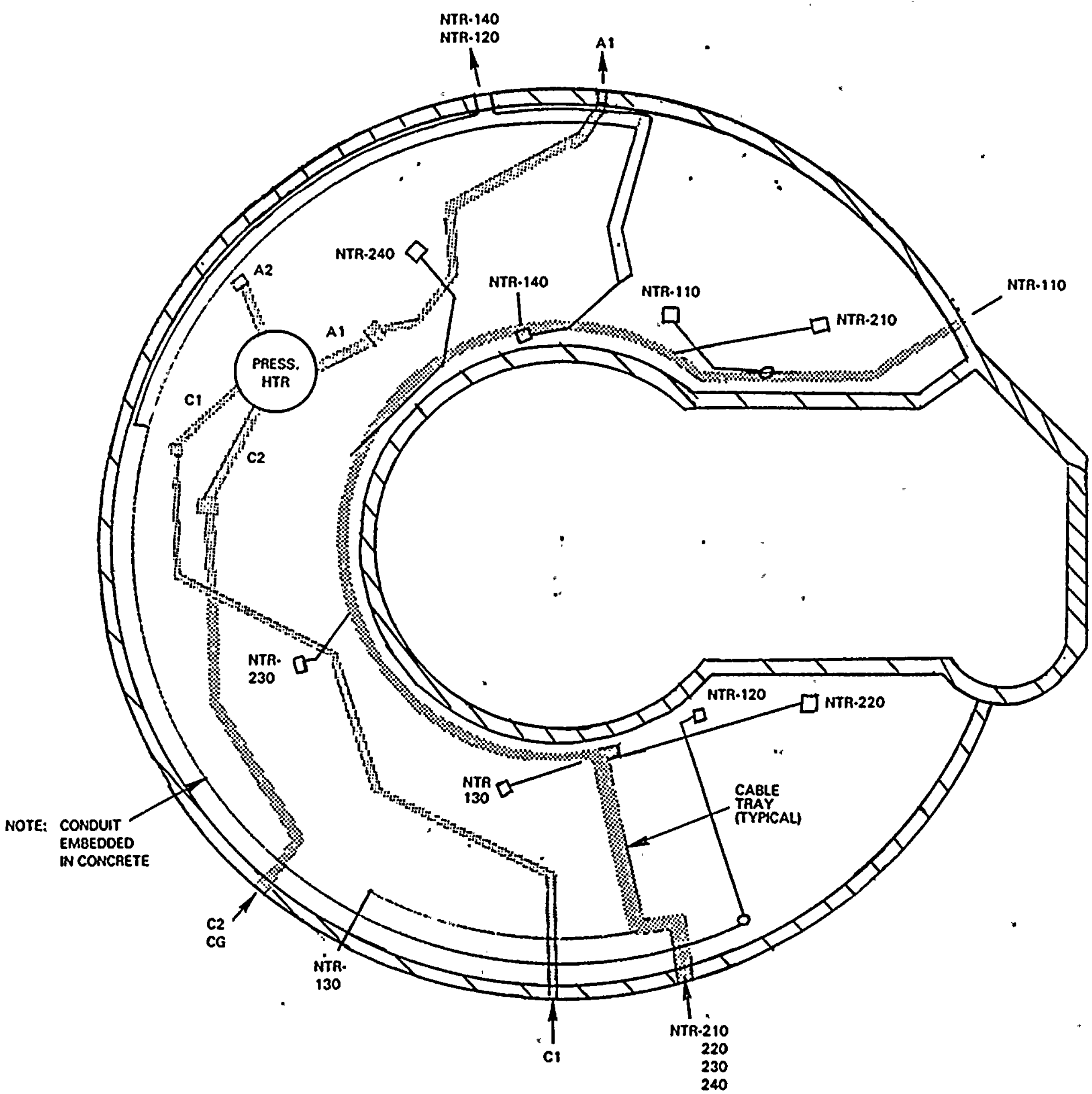


FIGURE 7.14 CONTAINMENT LOWER VOLUME UNIT 1

FIRE ZONE 67 ELEV. 587'

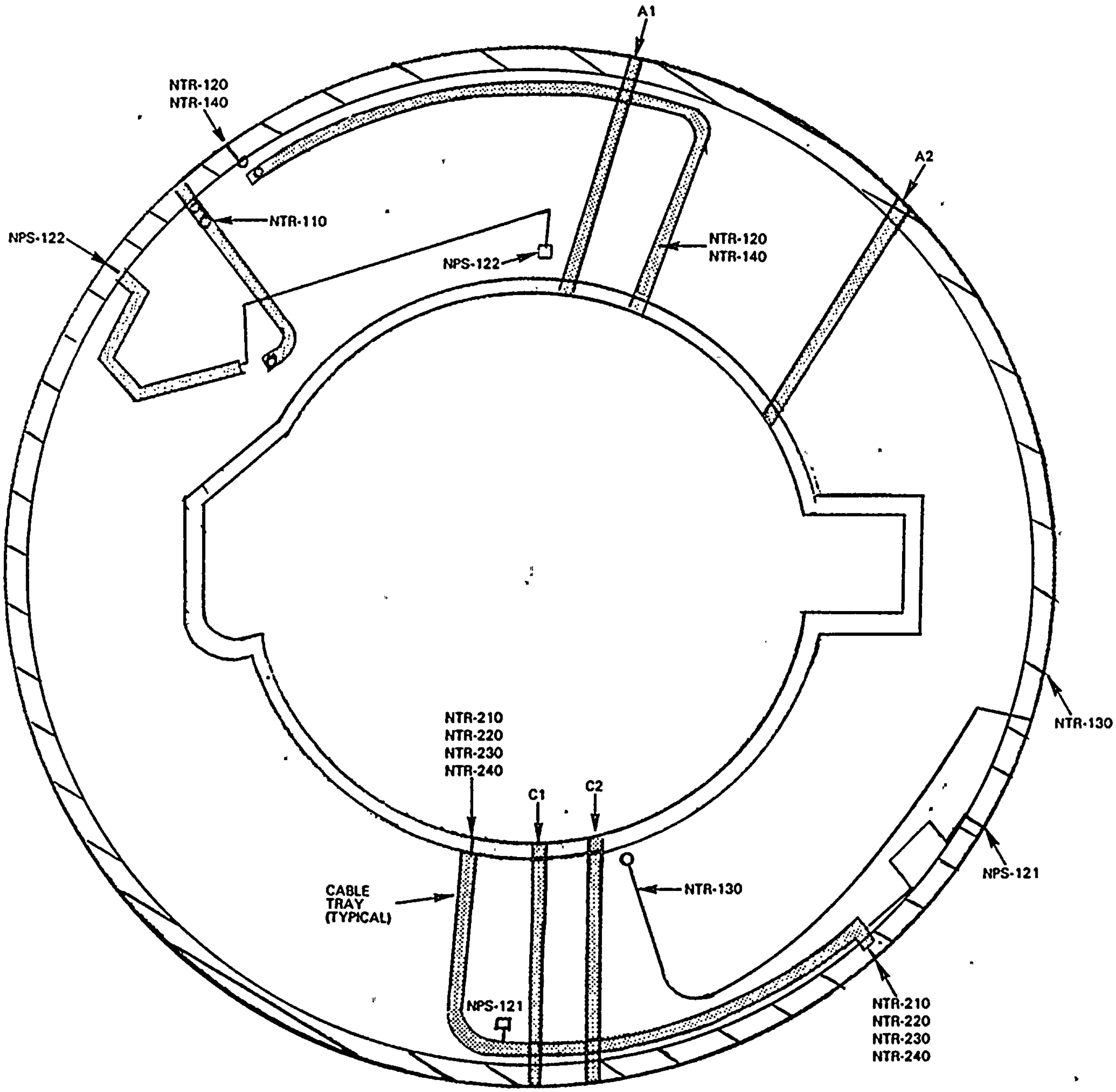


FIGURE 7.15 CONTAINMENT PIPING ANNULUS UNIT 2.

FIRE ZONE 74 ELEV. 587′

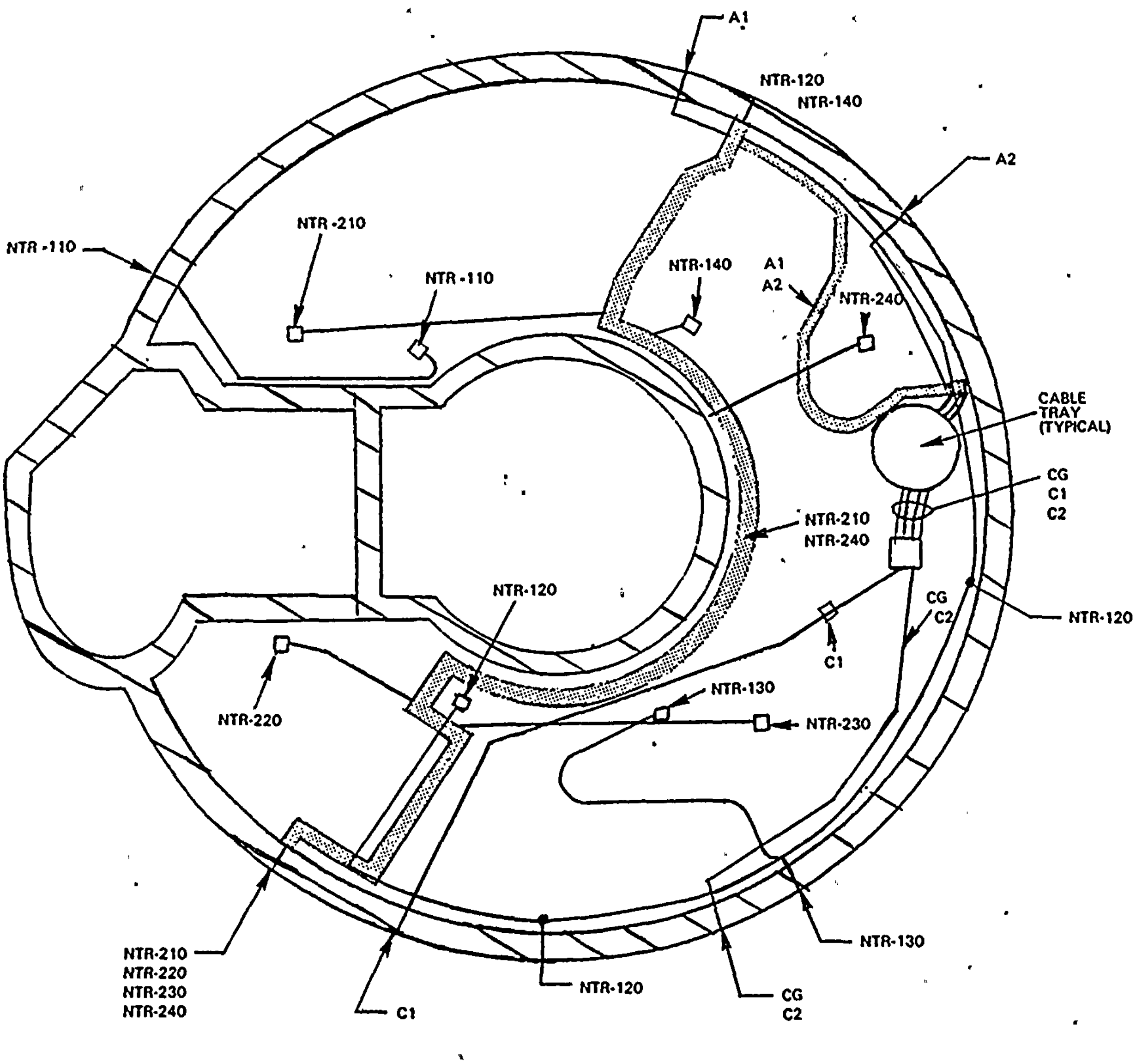


FIGURE 7.16 CONTAINMENT LOWER VOLUME UNIT 2

FIRE ZONE 75 ELEV. 587′

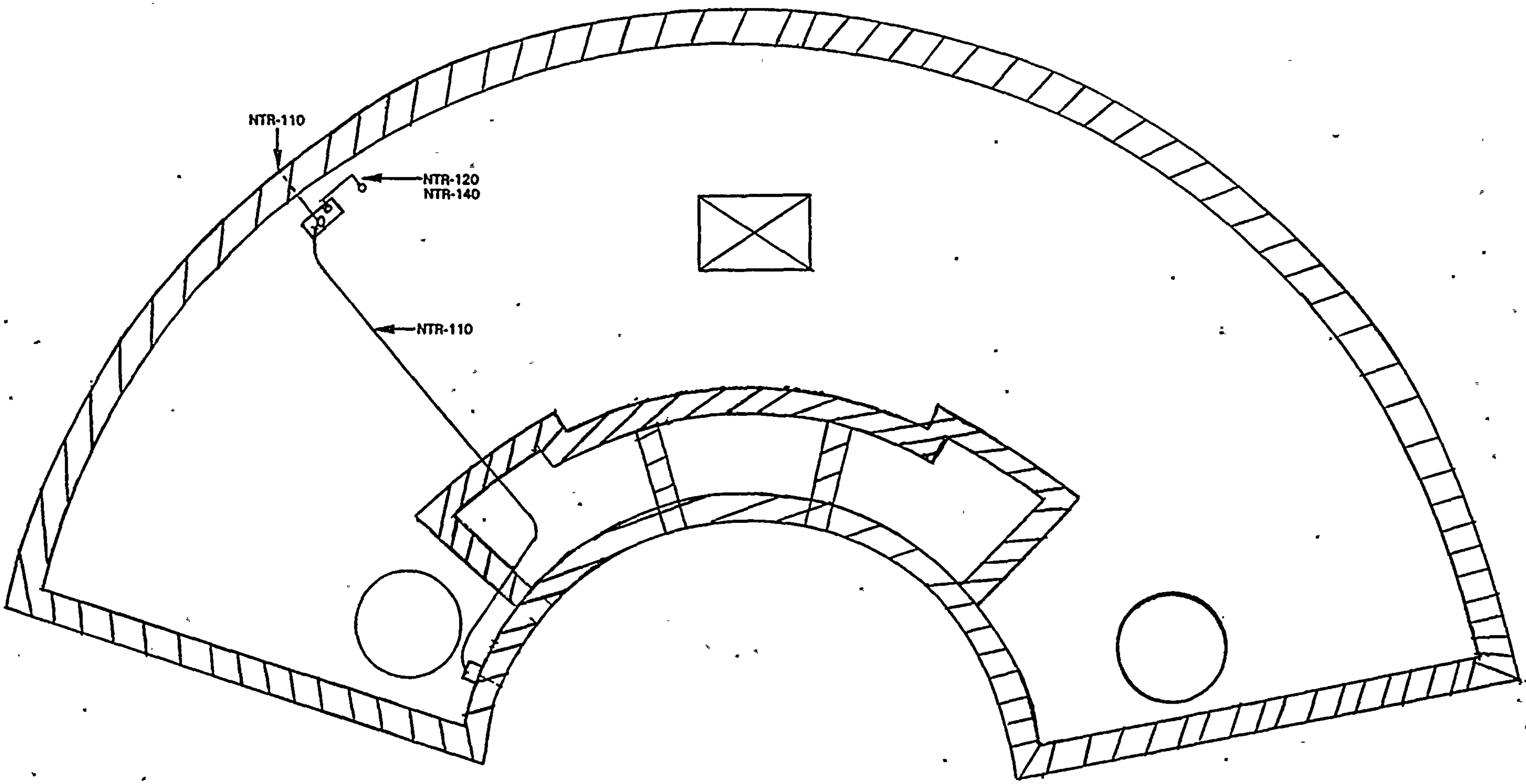


FIGURE 7.17 CONTAINMENT EAST ACCUMULATOR ENCLOSURE UNIT 2

FIRE ZONE 121 ELEV. 609′

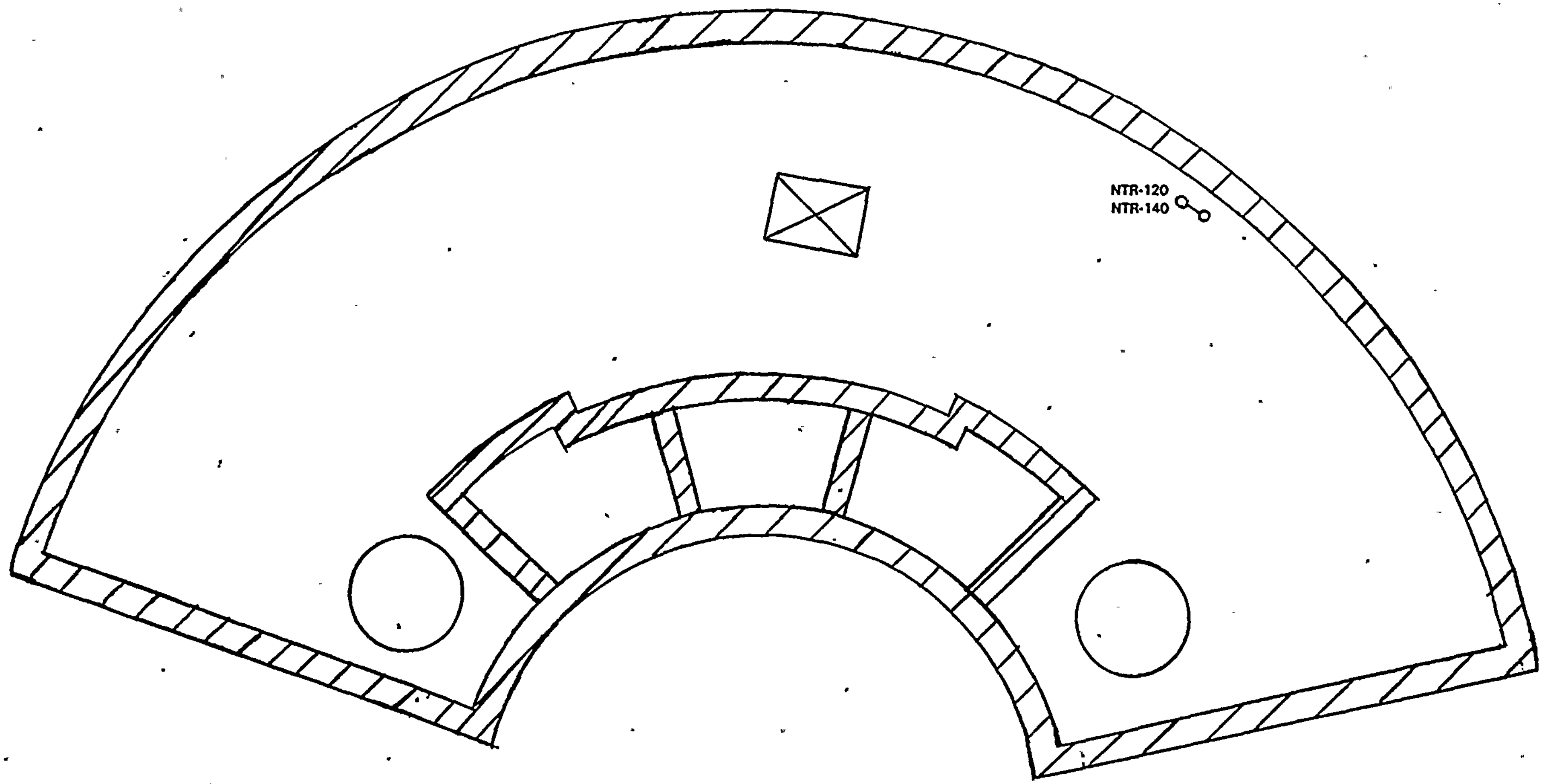


FIGURE 7.18 CONTAINMENT EAST ACCUMULATOR ENCLOSURE UNIT 1

FIRE ZONE 120 ELEV.609

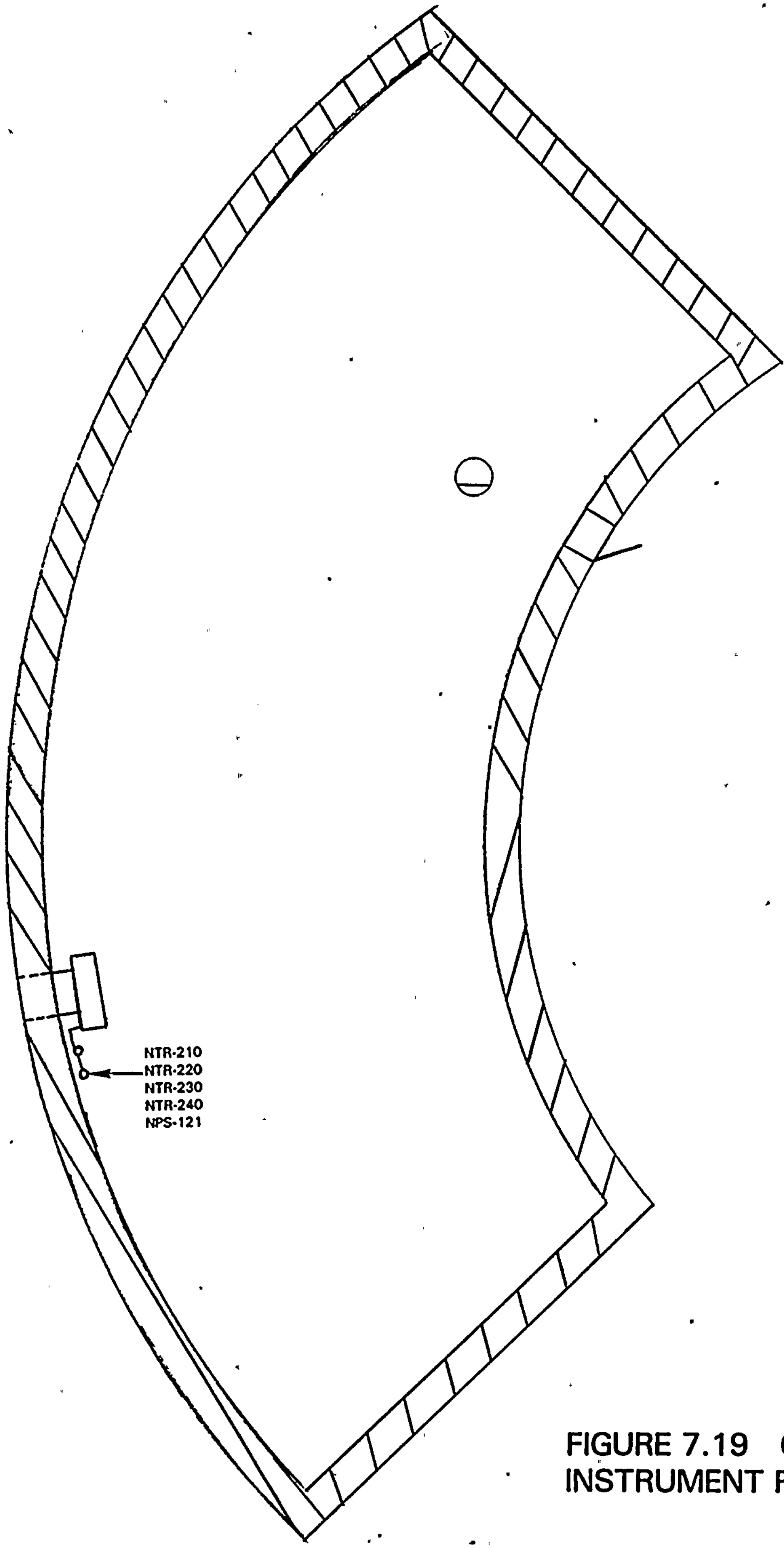


FIGURE 7.19 CONTAINMENT INSTRUMENT ROOM UNIT 1

FIRE ZONE 122 BELOW ELEV. 609′

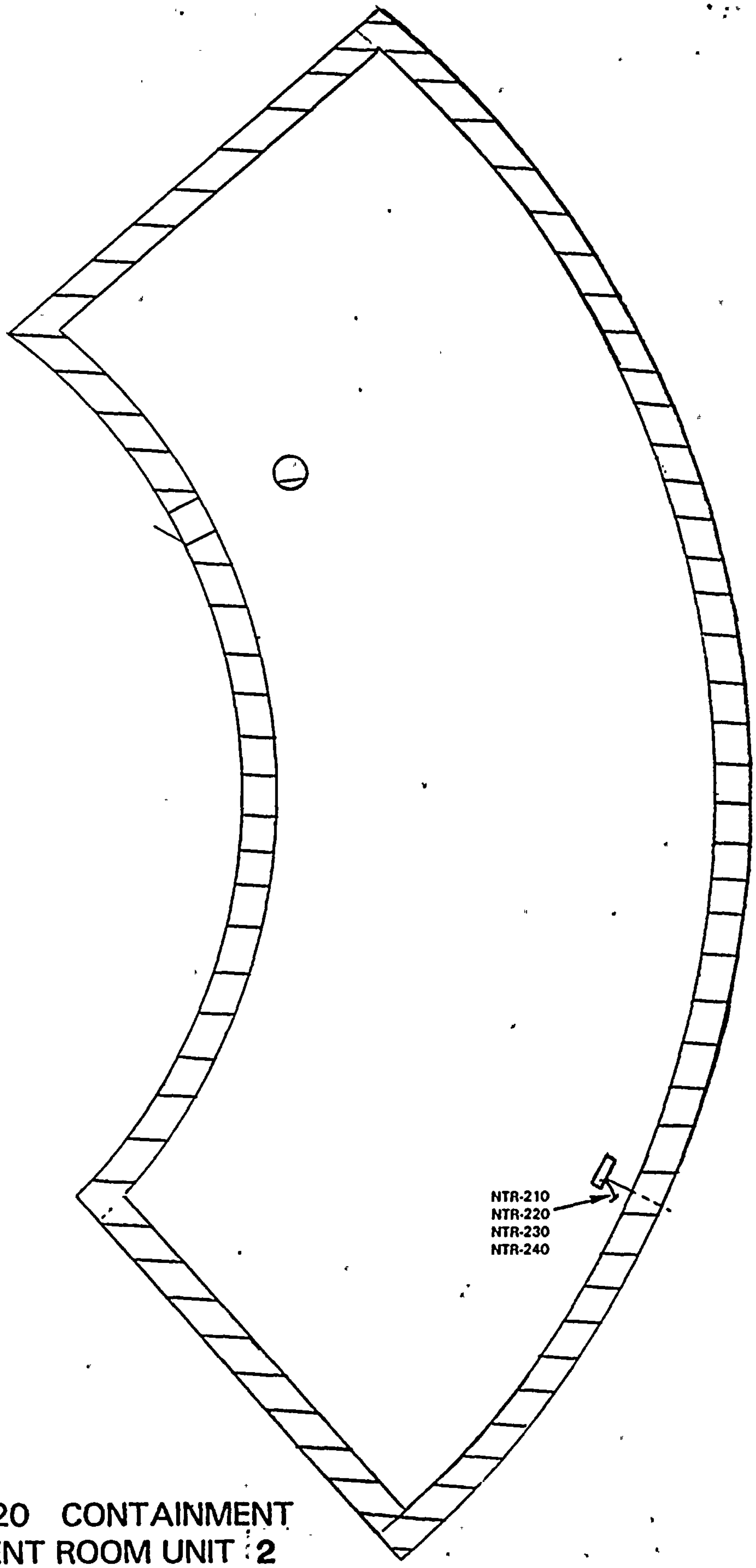


FIGURE 7.20 CONTAINMENT
INSTRUMENT ROOM UNIT 2

FIRE ZONE 123 BELOW ELEV. 609'

8. PROPOSED MODIFICATIONS

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. The balance of 19 fire areas, or zones, require exemption requests and will be modified to the greatest extent practicable to ensure at least one train of safe shutdown circuits and components remain free of fire damage. The specific exemption requests are discussed in Section 7.

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 7.0 for each exemption from the provisions of Section III.G requested.

In addition to the fire protection modifications proposed in this section, certain mechanical and electrical system modifications will be performed. 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. 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 proposed, are contingent upon either the NRC acceptance of the alternative shutdown capability or the granting of the exemptions discussed in Section 7.

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 afforded, will provide a fire rating equivalent to one hour and protect at least one redundant train of systems in the zone or area. 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(A-1H) RHR/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. The conduits are located in the extreme northwest and southwest corners of the fire area entering from conduit embedded in concrete.

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.

8.1.3 Boundary Modifications

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.

The ventilation duct connecting the east and west RHR pumps of both units (two individual ducts) will be provided with three-hour-rated dampers to separate the two trains of each unit's RHR pumps.

The stairway between the pump cubicles will be provided with automatic suppression from the modifications proposed in Fire Zone 5. (See Section 8.2.2.)

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) 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.

8.2.2 Suppression and Detection

The existing automatic suppression system will be extended to provide protection to the stairway which leads to Fire Zone 1(A-H) below.

8.2.3 Boundary Modifications

The access control gates to the charging pump cubicles will be modified as described in Section 8.23.3. The penetrations to Fire Zone 44 will be provided with seals equivalent to the rating of the concrete slab.

8.3 Fire Zone 6 Auxiliary Building Elevation 587 ft

8.3.1 Conduit and Cable Tray Protection

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, 2AC-15, 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. The open cable trays traversing the zone from the north side to the south side will be appropriately fire stopped to prevent fire propogation from one section of the fire zone to the other.

8.3.2 Suppression and Detection

The existing suppression system in the north end of the fire zone will be extended to provide coverage for the exposed floor surface of normally accessible areas.

8.3.3 Boundary Modifications

The penetrations in the ceiling to the elevation above Fire Zone 44 will be provided with seals equivalent to the rating of the concrete slab.

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

The ventilation duct between Fire Zone 33B and Fire Area 12 will be provided with a damper rated to an equivalent fire protection of 1-1/2 hours.

8.5 Fire Zone 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.

8.5.3 Boundary Modifications

None proposed

8.6 Fire Area 17C Auxiliary Feedwater Vestibule

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, 9847R-1, 9874R-1, and 9848R-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.

8.6.2 Suppression and Detection

The existing fire suppression system in the turbine-driven feed pump rooms will be extended to provide area coverage to Fire Area 17C.

The fire area will be equipped with an automatic detection system which provides alarms in the Control Room.

8.6.3 Boundary Modifications

None proposed

8.7 Fire Area 20 Unit 2 Transformer Room

8.7.1 Conduit and Cable Tray Protection

None proposed

8.7.2 Suppression and Detection

The area will be equipped with an automatic fire detection system which provides alarms in the Control Room.

8.7.3 Boundary Modifications

None proposed

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

The ventilation duct between Fire Zone 6 and Fire Area 22 will be provided with a damper having an equivalent fire rating of 1-1/2 hours.

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.

8.9.3 Boundary Modifications

None proposed

8.10 Fire Zone 29(C,D,F) Unit 2 ESW Pump Area Including the MCCs

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 which provides alarms in the Control Room.

8.10.3 Boundary Modifications

The hatch to Fire Zone 29G will be modified as indicated in Section 8.11.3.

8.11 Fire Zone 29G Unit 1 and Unit 2 Screen House MCC Room

8.11.1 Conduit and Cable Tray Protection

The following conduit 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

Pull Box #4 and 8977G-1, 9987G-2, 8929G-2, 8627G-2

The following conduit 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 for Valve WMO-701 9232G-1.

8.11.2 Suppression and Detection

The fire zone will be equipped with an automatic detection system providing alarms in the Control Room.

8.11.3 Boundary Modifications

The hatch for the ladder adjoining Fire Zone 29(C,D,F) will be provided with a hatch door to prevent hot combustible gases from entering the Unit 2 ESW pump area as a result of a fire in Zone 29G.

8.12 Fire Area 33,33A,33B Unit 1 East Main Steam Enclosure, Main Steam Piping Area, and West NESW Valve Area

8.12.1 Conduit and Cable Tray Protection

None proposed

8.12.2 Suppression and Detection

The fire area will be provided with an automatic detection system which provides alarms in the Control Room.

8.12.3 Boundary Modifications

A fire-rated enclosure will be provided for the grate in the floor to Fire Zone 8 below.

8.13 Fire Area 34,34A,34B Unit 2 East Main Steam Enclosure, Main Steam Piping Area, and West NESW Valve Area

The proposed modifications are the same as those in Fire Area 33, 33A, 33B of Unit 1.

8.14 Fire Area 40(A and B) and 41 4 kV Switchgear Room and ESS MCC Room for Unit 1

8.14.1 Conduit and Cable Tray Protection

None proposed

8.14.2 Suppression and Detection

None proposed

8.14.3 Boundary Modifications

The hatches from Fire Zone 40B and Fire Area 41 up to Fire Area 55 are presently coated with pyrocrete. Provide additional protection or justify equivalence to a fire rating of 1-1/2 hours for the hatches.

8.15 Fire Area 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 Modifications

The hatch to Fire Zone 56 will be provided with a 1-1/2 hour rating, or justification that the existing configuration is the equivalent.

8.16 Fire Zone 44 Auxiliary Building Component Cooling Water System Area Elevation 609 ft

8.16.1 Conduit 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-3E); 2AZ-C58 (previously noted) for Unit 2 CVCS (PP-50WLO and QMO-226).

The open cable trays traversing the zone from the north side to the south side will be appropriately fire stopped to prevent fire propogation from one section of the fire zone to the other.

8.16.2 Suppression and Detection

The north and south ends of the fire zone will be provided with extended automatic water suppression and detection to provide total area coverage. 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 suppression head location. The design of the system will provide added assurance that the suppression and detection systems will prevent any damage to CCW pumps as the result of a fire. The extended suppression system will also provide coverage for stairways leading to and from other adjacent fire zones.

8.16.3 Boundary Modifications

The penetrations from Fire Zone 44 to Fire Zone 52 will be sealed to the equivalent rating of the concrete slab.

Provide justification for equivalence to 1-1/2 hour fire rating for the door connecting Fire Zone 44 to Fire Zone 43.

The area of the CCW pumps will be provided with a steel construction fire barrier which is coated with an intumescent material or its equivalent to be located between 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 4 operational pumps.

8.17 Fire Areas 45,47 (A and B) Unit 2 4 kV Switchgear Room and ESS and MCC Room

8.17.1 Conduit and Cable Tray Protection

None proposed

8.17.2 Suppression and Detection

None proposed

8.17.3 Boundary Modifications

The hatches from Fire Area 45 and Fire Zone 47B to Fire Area 60 are presently coated with pyrocrete. Provide additional protection or justify equivalence to a fire rating of 1-1/2 hour for the hatches.

8.18 Fire Zone 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

Provide fire-rated seals in the penetration in the ceiling to Fire Zone 69 equivalent to the fire rating of the concrete slab.

8.19 Fire Zone 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 suppression system which will include stairwells to the level below (Fire Zone 44) and the normally accessible areas in the fire zone.

8.19.3 Boundary Modifications

The hatch to Fire Area 59 will be upgraded to a 1-1/2 hour fire rating, or justification made for existing equivalence to 1-1/2 hour rating.

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

The Unit 2 hot shutdown panel 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.

The door connecting to Fire Area 54 will be upgraded to three-hour rating.

8.21 Fire Area 54 Unit 2 Control Room

The Unit 2 Control Room will be treated in the same manner as the Unit 1 Control Room in that a fire barrier having an equivalence to three-hour rating will be constructed around the Unit 1 hot shutdown panel.

8.22 Fire Area 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

The hatch to Fire Area 53 (Unit 1 Control Room) will be provided with a three-hour rating or justification that the existing configuration is the equivalent.

8.23 Fire Area 58 Unit 2 Control Room Cable Vault

The fire area will be upgraded in the same manner as Fire Area 57.

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 (approximately 3 ft x 3 ft) in the wall to Fire Zone 5 will be provided with a damper having an equivalent fire rating of 1-1/2 hours. The penetrations to Fire Zone 5 will be sealed to an equivalent rating of the concrete wall.

The access control gate from Fire Zone 5 will be fitted with a normally open fusible locked door, having a fire protection rating equivalent to 1-1/2 hours.

8.25 <u>Fire Zone 79 Unit 1 Turbine Room Between the Unit 1 Emergency Diesels</u>

8.25.1 <u>Conduit and Cable Tray Protection</u>

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.

8.25.2 <u>Suppression and Detection</u>

The existing suppression system in Fire Zone 79 will be extended to include the ramp area between the Unit 1 EDGs. A detection system will be added which provides alarms in the Control Room.

8.25.3 <u>Boundary Modifications</u>

None proposed

8.26 <u>Fire Zone 85 Unit 2 Turbine Room Between Unit 2 Emergency Diesels</u>

8.26.1 <u>Conduit and Cable Tray Protection</u>

The cable trays 2AZ-C55 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.

8.26.2 <u>Suppression and Detection</u>

The existing suppression system in Fire Zone 85 will be extended to include the ramp area between the Unit 2 EDGs. A detection system will be added which provides alarms in the Control Room.

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.

8.27.2 Suppression and Detection

The area will be provided with an automatic detection system which provides alarms in the Control Room.

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

The fire zones will be provided with an automatic detection system providing alarms in the Control Rooms.

8.29.3 Boundary Modifications

None proposed