



Commonwealth Edison

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December 4, 1985

Mr. Harold R. Denton, Director
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Washington, DC 20555

Subject: Quad Cities Station Units 1 and 2
10 CFR 50 Appendix R - Updated
Exemption Requests
NRC Docket Nos. 50-254 and 50-265

Reference (a): B. Rybak letter to H. R. Denton dated
December 18, 1984.

Dear Mr. Denton:

The referenced letter transmitted Commonwealth Edison's (CECo) 10 CFR 50, Appendix R Reverification Interim Compensatory Measures and Exemption Requests. As a result of our continuing evaluation of all the safe shutdown systems and equipment to meet the requirements of Appendix R, we have identified additional areas where exemptions are needed and where previous exemptions need to be modified or clarified. Enclosure A to this letter transmits Revision 1 to Enclosure III of the reference entitled "Appendix R Exemption Requests" which incorporates results of these evaluations and all previous Appendix R exemption requests. All technical changes are indicated by revision bars. A summary of the changes is provided in Enclosure B to this letter. The changes primarily reflect additional descriptions of fire zones, barriers and systems. In a number of these areas, the boundary of a fire zone has been modified. Items in Enclosure B marked with an asterisk reflect additional exemptions related to the corresponding section.

Enclosure C to this letter identifies new exemption requests resulting from our evaluation program. The section numbering in this enclosure is an extension of the numbering format used in Enclosure A.

Commonwealth Edison requests approval of the exemptions identified in the Enclosures under the provisions of 10 CFR 50.12. Although we feel that our 10 CFR Appendix R compliance effort is completed, CECO is committed to a continuing evaluation of all safe shutdown systems and equipment to meet the requirements of Appendix R, Section III.G, III.J, and III.L. Therefore, future compliance measures or exemptions may be necessary as a result of new plant modifications.

Please address any questions you may have regarding this matter to this office.

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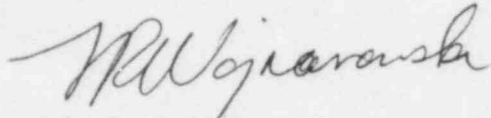
H. R. Denton

- 2 -

December 4, 1985

One signed original and forty (40) copies of this letter are provided for your use. Due to the size and nature of the attachments, only five (5) copies are provided.

Very truly yours,



J. R. Wojnarowski
Nuclear Licensing Administrator

lm

Attachments

cc: R. Bevan - NRR
Quad Cities Resident Inspector

0958K

QUAD CITIES 1&2

APPENDIX R EXEMPTION REQUEST

REVISION 1

NOVEMBER 1985

APPENDIX R EXEMPTION REQUESTS

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B-9	Fire Detection and Automatic Suppression Turbine Building Upper Basement Floor
B-10	Fire Detection and Automatic Suppression Cable Tunnels
B-11	Fire Detection and Automatic Suppression Turbine Building Ground Floor - Unit 1
B-12	Fire Detection and Automatic Suppression Turbine Building Ground Floor - Unit 2
B-13	Fire Detection and Automatic Suppression Turbine Building Mezzanine Floor - Unit 1
B-14	Fire Detection and Automatic Suppression Turbine Building Mezzanine Floor - Unit 2
B-15	Fire Detection and Automatic Suppression Turbine Building Main Floor - Unit 1
B-16	Fire Detection and Automatic Suppression Turbine Building Main Floor - Unit 2
B-17	Fire Detection and Automatic Suppression Vent Floor Elevation 678'-10"

LIST OF FIGURES (Cont'd)

<u>NUMBER</u>	<u>TITLE</u>
B-18	Fire Detection and Automatic Suppression Crib House
B-19	Fire Detection and Automatic Suppression Radwaste Building Floor Elevation 608'-11"
B-20	Fire Detection and Automatic Suppression Radwaste Building Floor Elevations 595'-0" and 572'-11"
B-21	Fire Detection and Automatic Suppression Off-Gas Recombiner Room Floor - Unit 1
B-22	Fire Detection and Automatic Suppression Off-Gas Recombiner Room Floor - Unit 2
B-23	Fire Detection and Automatic Suppression Outdoor Plan - Auxiliary Transformer Area Elevation 595'-0"
C-1	Division I and II RHR Cable Routing
D-1	Separation of Redundant Equipment on the Turbine Operating Floor

1.0 INTRODUCTION

In the Appendix R submittal dated July 1, 1982, CECo identified the need for a total of nine exemptions from the requirements of Appendix R Section III.G.3 for suppression in the vicinity of electrical equipment. CECo at that time believed that Appendix R required only suppression and detection over the major fire hazards. These areas already contained detection over the major fire hazards. Therefore, with these exemptions, CECo believed Quad Cities Station met the intent of Appendix R. Exemptions were requested for these plant locations in the vicinity of the equipment identified below:

1. All panels located in the control room
2. 4-kV SWGR's 13 and 14
3. 480-V SWGR's 18 and 19
4. 480-V MCC's 18-1A, 18-1B, 19-1, 19-4, 19-1-1, 19-6, and 18/19-5
5. 250-V MCC's 1A and 1B
6. 4-kV SWGR's 23 and 24
7. 480-V SWGR's 28 and 29
8. 480-V MCC's 28-1A, 28-1B, 29-1, 29-1-1, 29-4, 29-6, and 28/29-5
9. 250-V MCC's 2A and 2B.

CECo also identified the need for two exemptions from the requirements of Appendix R Section III.G.2a for 3-hour fire barriers in Fire Zone 1.1.1.1 of Unit 1 and Fire Zone 1.1.2.1 of Unit 2.

In its June 23, 1983 Safety Evaluation Report (SER) for Quad Cities 1 and 2, the NRC granted the exemptions requested for the plant locations in the vicinity of the equipment listed above and also granted the request for the 1-hour fire barriers.

Subsequent to the issuance of the SER, NRC clarification letters have been issued. Of particular importance is Generic Letter 83-33, "NRC Positions On Certain Requirements of Appendix R to 10 CFR 50" dated October 19, 1983. Comparison of the criteria contained in Generic Letter 83-33 against the bases for analysis performed in the July 1, 1982 submittal identified several issues that required clarification. Those issues include:

1. Full fire area detection and suppression, and
2. Fire area definitions.

CECo determined that reverification of the Quad Cities Station's Associated Circuit Analysis was prudent as a result of the clarifications provided in Generic Letter 83-33.

Since the July 1982 Associated Circuits Analysis was performed on a zone-by-zone basis, this Quad Cities 1&2 Appendix R reanalysis consisted of a zone interaction analysis to determine the potential for and effects of fire spreading from one zone to another. Where it was determined in the zone interaction analysis that the conditions of Appendix R were not met, then, a) the same alternate safe shutdown path was verified to be available for those adjacent fire zones, b) modifications were proposed, and/or c) exemptions were developed on the basis of a detailed fire hazards analysis to ensure satisfaction of the Appendix R concerns.

This attachment includes the requested exemptions and the supporting fire hazards analysis. These exemptions are written to reflect plant conditions after all proposed modifications are installed. The proposed modifications and corresponding interim compensatory measures are discussed in Attachment II of this submittal.

This reassessment has additionally addressed spurious operations of valves, cold shutdown, and exposed structural steel. However, these items will be the subject of subsequent submittals.

The following exemption requests were identified in the zone interaction analysis. These requests are justified by an accompanying fire hazards analysis on the basis of providing protection equivalent to the requirements of Appendix R.

A. Unit 1 Reactor Building

1. Lack of separation redundant RHR trains (Section 3.2). |
2. Complete 3-hour rated fire barriers between Unit 1 reactor building and turbine building are not provided (Section 3.3). |
3. Complete detection and suppression throughout the reactor building is not warranted (Section 3.4). |

B. Unit 2 Reactor Building

1. Lack of separation of redundant RHR trains (Section 4.2). |
2. Complete 3-hour rated fire barrier between Unit 2 reactor building and turbine building are not provided (Section 4.3). |
3. Complete detection and suppression throughout the reactor building is not warranted (Section 4.4). |

C. Turbine Building

1. Complete fire rated barriers between zone groups are not provided (Section 5.2).
2. Complete fire suppression and detection throughout the Southern Zone Group is not warranted (Section 5.3).
3. Complete suppression and detection throughout the Northern Zone Group is not warranted (Section 5.4).
4. Complete suppression and detection throughout the Central Zone Group is not warranted (Section 5.5).
5. Complete suppression and detection throughout the Turbine Operating Floor is not warranted (Section 5.6).
6. Complete detection is not necessary for all areas where enclosure of cable in a fire barrier having a 1-hour rating is provided (Section 5.7).
7. Separation of equivalent Fire Areas 8.2.8.A, 8.2.8.B, 8.2.8.C, and 8.2.8.D on the operating floor with a water curtain or partial barriers in lieu of complete fire barriers (Section 5.8).
8. Separation of Fire Zone 11.1.1.B from Fire Zone 8.2.1.A is with a watertight door instead of a fire rated door (Section 5.9).

D. Service Building

1. Lack of suppression in AEER.

These exemption requests and accompanying fire hazard analyses document the compliance with the intent of Appendix R Section III.G.1 to provide fire protection features that ensure one shutdown path necessary to achieve and maintain hot shutdown is free from fire damage. Figures to support these exemption requests are included in Appendices A, B, C, and D of this attachment. In addition, Quad Cities 1&2 Fire Protection General Arrangement (FPGA) Drawings have been developed which show the fire barriers and location of safe shutdown equipment and cabling. (These drawings are provided under separate cover.) The proposed modifications and exemption requests described herein do not change the original shutdown philosophy utilized in previously submitted Appendix R analyses. No major redesign of systems was required.

2.0 APPENDIX R SHUTDOWN PATHS

2.1 INTRODUCTION

There are four different (though not unrelated) Appendix R hot shutdown paths for Unit 1 and six paths for Unit 2. All of these paths utilize either the RCIC system or the safe shutdown makeup pump in conjunction with the RHR system to maintain hot shutdown. Two of the paths for Unit 1 and four of the paths for Unit 2 utilize the safe shutdown makeup pump. The operation of the safe shutdown makeup pump is described in Subsection 2.2.2. The different safe shutdown makeup pump and RCIC paths have been identified due to the use of different divisions of RHR, diesel generators, and operating methods. The other paths per unit use the RCIC method to shut down and are described in Subsection 2.2.1. Table 2.1-1 and Section 2.3 outline the differences between these Appendix R hot shutdown paths.

Different paths are used in the event of a fire in different areas of the plant based on the location of needed equipment and cabling and the various plant fire protection features available. For a fire in any given fire area, at least one shutdown path has been protected to satisfy the intent of Appendix R to remain free of fire damage, and ensure that hot shutdown can be achieved and maintained for a fire in any plant area. Table 2.1-2 indicates which path will be used for a fire in any given fire zone. Cold shutdown is discussed in Section 2.4.

All previous Quad Cities 1 and 2 submittals assumed that a fire would not spread from fire zone to fire zone. The subsequent zone interaction analysis evaluated the potential for fire spread between zones and its impact on the ability to safely shut down against the objectives of Appendix R and related clarifications. Adjoining zones which use the same shutdown path (i.e., cabling and/or equipment related to the path are independent of the zone) were grouped together into zone groups. (See Figures A-2, A-3, and A-4 for illustrations.) The criteria of III.G.2 of Appendix R was then used to evaluate the zone group boundaries which separated alternate shutdown capability. Consequently, where the reanalysis showed that the specific requirements of Appendix R were not satisfied, modifications were developed to ensure compliance or an engineering analysis was conducted to demonstrate that an equivalent level of fire protection exists. Where Quad Cities does not meet the requirements of Appendix R, formal exemptions are submitted as required.

TABLE 2.1-1

OUTLINE OF APPENDIX R SHUTDOWN PATHS

SHUTDOWN PATH	UNIT TO BE SHUT DOWN	MAJOR SHUTDOWN SYSTEM	DIVISION OF RHR	DIESEL GENERATOR TO BE USED	MANUAL OPERATION OF VALVES REQUIRED
A	Unit 1	Safe Shutdown Pump	II	Unit 1 and 2	Yes
B	Unit 2	Safe Shutdown Pump	II	Unit 1 and 2	Yes
C*	Unit 2	Safe Shutdown Pump	I***	Unit 1 and Swing	Yes
D*	Unit 1	Safe Shutdown Pump	I***	Unit 2 and Swing	Yes
E1**	Unit 1	RCIC	II	Unit 1	No
E2	Unit 1	RCIC	II	Unit 1	Yes
F	Unit 2	RCIC	II	Unit 2	No
H	Unit 2	RCIC	I	Swing	Yes
K	Unit 2	Safe Shutdown Pump	II	Unit 2	Yes
L	Unit 2	Safe Shutdown Pump	I	Unit 1 and Swing	Yes

*A manual action may be required to provide 125-Vdc local control of Division I 4-kV switchgear using the 125-Vdc crosstie between 4-kV switchgear 13-1 and 23-1. For a fire in Fire Zone 11.1.1.B, in which shutdown path D is used, the swing diesel generator cooling water pump could be exposed. Cooling water to the swing diesel can be supplied by diesel generator 1 cooling water pump via a piping crosstie.

**Shutdown paths E1 and E2 are similar to each other, the difference being that shutdown path E1 can be achieved from the control room while shutdown path E2 requires some manual control.

***Shutdown paths C and D use the unaffected units Division I RHR service water pump with flow through a piping crosstie, diesel generator 1/2 simultaneously energizes 4-kV switchgear 13-1 and 23-1.

2.1-2

QUAD CITIES 1&2

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TABLE 2.1-2

APPENDIX R SHUTDOWN PATHS BY FIRE ZONE

<u>FIRE ZONE</u>	<u>FIRE AREA</u>	<u>SHUTDOWN PATH</u>
1.1.1.1	RB-1	D (on south side) and A (on north side)
1.1.1.2	RB-1	A
1.1.1.3	RB-1	A
1.1.1.4	RB-1	A*
1.1.1.5	RB-1	A*
1.1.1.5.A	TB-IV	A*
1.1.1.6	RB-1	A*
1.1.1.6.A	TB-IV	*
1.1.2.1	RB-2	L (on south side) and B (on north side)
1.1.2.2	RB-2	B
1.1.2.3	RB-2	B
1.1.2.4	RB-2	B*
1.1.2.5	RB-2	B*
1.2.1	Unit 1 Primary Containment	**
1.2.2	Unit 2 Primary Containment	**
2.0	SB-I	E2 and K
3.0	SB-I	E2 and K
4.0	SB-I	E2 and K
5.0	TB-II	E2 (for Unit 1) and H (for Unit 2)
6.1.A	TB-III	D
6.1.B	TB-III	D

TABLE 2.1-2 (Cont'd)

<u>FIRE ZONE</u>	<u>FIRE AREA</u>	<u>SHUTDOWN PATH</u>
6.2.A	TB-I	C
6.2.B	TB-I	C
6.3	SB-I	E2 and K
7.1	TB-III	D
7.2	TB-I	C
8.1	TB-II	E2 and H*
8.2.1.A	TB-III	D
8.2.1.B	TB-I	C
8.2.1.C	TB-III	D*
8.2.1.D	TB-I	C*
8.2.2.A	TB-I	C
8.2.2.B	TB-I	C*
8.2.3.A	TB-III	D
8.2.3.B	TB-III	D*
8.2.4	TB-III	D
8.2.5	TB-I	C
8.2.6.A	TB-III	D
8.2.6.B	TB-III	D
8.2.6.C	TB-II	E2 and H
8.2.6.D	TB-I	C
8.2.6.E	TB-I	C
8.2.7.A	TB-III	D
8.2.7.B	TB-III	D
8.2.7.C	TB-II	E2 and H

TABLE 2.1-2 (Cont'd)

<u>FIRE ZONE</u>	<u>FIRE AREA</u>	<u>SHUTDOWN PATH</u>
8.2.7.D	TB-I	C
8.2.7.E	TB-I	C
8.2.8.A	TB-IV	D
8.2.8.B	TB-IV	A
8.2.8.C	TE-IV	C
8.2.8.D	TB-IV	K
8.2.8.E	TB-IV	*
8.2.10	TB-II	*
9.1	TB-III	D
9.2	TB-I	C
9.3	RB-1/2	E1 and F
11.1.1.A	TB-III	D
11.1.1.B	TB-III	D
11.1.1.C	TB-III	D
11.1.2.A	TB-I	C
11.1.2.B	TB-I	C
11.1.2.C	TB-I	C
11.1.3	RB-1	A
11.1.4	RB-2	L
11.2.1	RB-1	D
11.2.2	RB-1	D
11.2.3	RB-1	A

TABLE 2.1-2 (Cont'd)

<u>FIRE ZONE</u>	<u>FIRE AREA</u>	<u>SHUTDOWN PATH</u>
11.2.4	RB-1	A
11.3.1	RB-2	L
11.3.2	RB-2	L
11.3.3	RB-2	B
11.3.4	RB-2	B
11.4.A	Crib House	E1 and E2 (for Unit 1) and F and H (for Unit 2)
11.4.B	Crib House	E1 and E2 (for Unit 1) and F and H (for Unit 2)
13.1	Outside	*
14.1	Radwaste Building	*
14.1.1	TB-III	*
14.1.2	TB-I	*
14.3.1	Radwaste Building	*
15.1	Outside	*
16.1	Outside	*
16.2	Outside	*
17.1.1	Outside	*
17.1.2	Outside	*
17.1.3	Outside	*
17.2.1	Outside	*
17.2.2	Outside	*
17.2.3	Outside	*

TABLE 2.1-2 (Cont'd)

<u>FIRE ZONE</u>	<u>FIRE AREA</u>	<u>SHUTDOWN PATH</u>
19.1	SB-II	*
19.2	SB-II	
19.3	SB-II	*
20.1	Outside	*
21.1	Outside	*
22.1	Off-Gas Filter Building	*
23.1	SB-II	*
24.1	Outside	*

*No safe shutdown equipment or cabling is located in this zone. Therefore, all methods of shutdown are available. The shutdown path was selected on the basis of that utilized in adjacent zones containing safe shutdown cabling and/or equipment.

**The primary containment is inerted; thus, a fire cannot occur in this area and all methods of shutdown are available.

2.2 SHUTDOWN METHODS

2.2.1 Reactor Core Isolation Cooling (RCIC) Method

The RCIC method for achieving and maintaining hot shutdown is used for a fire in the swing diesel room, Central Zone Group in the turbine building, auxiliary electric equipment room, computer room, cable spread room, and control room. The RCIC pump will be used by the operator to control reactor pressure and maintain reactor water level. The RCIC can be operated locally or from the control room. (Figures A-5 and A-6 show system arrangement.) Differences in the alternate shutdown paths using RCIC are described in Table 2.1-1.

2.2.1.1 RCICS Operation

The RCIC system consists of a turbine driven pump unit with accessories and associated piping, valves, instrumentation, and controls. The turbine is driven by steam from the reactor which is condensed and exhausted to the suppression pool.

The pump can take suction from either the contaminated condensate storage tank or the suppression pool. The RCIC system provides sufficient flow to cool the reactor in the event the reactor becomes isolated from the main condenser simultaneously with a loss of the feedwater system.

To operate the RCICS, valve MO1(2)-1301-61 must be opened to allow steam flow to the turbine and valve MO1(2)-1301-49 must be opened to allow water flow to the reactor. Minimum flow line valve MO1(2)-1301-60 is opened as necessary. Valve MO1(2)-1301-62 is opened to allow flow through the turbine lube oil cooler to the barometric condenser. The RCIC vacuum and condensate pumps vent noncondensibles to the suppression pool and return condensate to the RCIC pump suction, respectively. RCICS initiation occurs automatically on receipt of a reactor low-low water level signal.

To manually initiate the RCICS if a fire has affected automatic operation, the operators will remove power at the appropriate motor control center. The valves may then be operated by use of the handwheels. Valve MO1(2)-1301-16 is located in the drywell and, therefore, is not accessible for manual operation. A local control station is provided at the MCC. If a fire causes the valve to close spuriously, the normal controls will be isolated and the valve opened. The operator will then deenergize the valve in the open position.

RCIC turbine speed is normally controlled by a flow controller and governing valve. If a fire affects the normal automatic control, the power supply to the governor will be deenergized and the valve will open completely by means of a spring. The turbine trip throttle valve will then be manually operated in the RCIC room to regulate turbine speed and obtain the desired flow rate. The RCIC turbine remote electrical trip causes valve 1(2)-1301-61 to close. Isolation of this remote trip signal is accomplished in the RCIC room. The turbine is protected by a mechanical overspeed trip that can be reset locally in the RCIC room.

To facilitate local operation of the RCIC vacuum and condensate pumps, local control stations are located in the RCIC room.

2.2.1.2 Support Systems and Instrumentation

The RCICS flow is normally monitored in the control room on flow-indicating controller FIC1(2)-1340-1. The operator can monitor locally the flow on a mechanical flow indicator in the RCIC room. The RCICS discharge pressure is normally monitored in the control room on pressure indicator PI1(2)-1340-7. The operator can monitor pump discharge pressure locally on mechanical indicator PI1(2)-1360-5. In addition, the RCIC turbine speed can be monitored locally.

Initial suction for the RCIC pump will be from the contaminated condensate storage tanks. Valve MO1(2)-1301-22 in the suction line from contaminated condensate storage is normally open and accessible for manual operation in the RCIC room. A minimum of 90,000 gallons of condensate storage is reserved for RCICS use. This amount is sufficient for at least 8 hours of RCICS operation. Condensate storage level is normally monitored in the control room on level indicators LI1/2-3340-3 and LI1/2-3340-4. The operator can monitor LI1/2-3341-77A and LI1/2-3341-77B located in the turbine building.

Should it become apparent that long-term operation (up to 72 hours) of the RCIC system is necessary, the operator will change the pump suction to the suppression pool by opening valves MO1(2)-1301-25 and MO1(2)-1301-26 (accessible for manual operation in the reactor building basement) and closing MO1(2)-1301-22. Suppression pool level is normally monitored in the control room on level indicator LI1(2)-1602-3. The operator can monitor the level glass LG1(2)-1602-10 and torus temperature can be locally monitored, by taking a grab sample or by using a surface pyrometer on the torus bottom.

The RCIC room emergency cooler operates automatically, receiving its cooling water supply from the diesel generator cooling water pump.

Initial pressure control for the reactor is normally supplied by the electromatic relief valves. However, the target rock valves (mechanical mode) on the steamlines will provide pressure control if operation of the relief valves has been affected by a fire. Power will be removed from the relief valves at the 125-Vdc distribution center to prevent a spurious depressurization of the reactor if automatic blowdown circuits are involved in a fire.

Since both the RCICS and the relief valves (including the target rock safety-relief valve) discharge steam to the suppression pool, continued operation of these systems will result in heatup of the suppression pool water. However, the operator will place the RHR system into operation in the torus cooling mode thus maintaining the water temperature within acceptable limits. One half of a train of the RHRS will provide sufficient suppression pool cooling if actuated within 3 hours of RCIC initiation.

To place the RHR system into service to cool the suppression pool, the operator will open RHR heat exchanger service water outlet valve MO1(2)-1001-5A and start RHR service water pump 1(2)-1001-65A or 1(2)-1001-65B. (This procedure describes Division I RHR operation. Division II operation is similar.) The operator then will verify that RHR pump suction valves MO1(2)-1001-7A or MO1(2)-1001-7B are open and that suppression chamber dump valve MO1(2)-1001-36A is closed. The operator will then open the suppression chamber test return valve MO1(2)-1001-34A and verify that minimum flow line valve MO1(2)-1001-18A is open. RHR pumps 1(2)A-1002 or 1(2)B-1002 will then be started and the suppression chamber dump valve opened. The operator will then close the minimum flow bypass valve and throttle the RHR discharge to maintain the pressure at least 20 psi less than RHR service water pressure. RHR heat exchanger bypass valve MO1(2)-1001-16A may be throttled if additional cooling is necessary. The operator will also verify that the appropriate RHR room cooler and RHR service water cubicle cooler are in service.

If necessary, the operator can open manual crosstie valve 1/2-1099-1A and supply one unit's RHR heat exchanger A using the other unit's RHR service water pumps A or B. A similar Division II mechanical cross-connection is provided. This valve and all of the necessary motor-operated valves are accessible for manual operation. Local control capability is provided for the RHRS pumps and RHR service water pumps.

RHR service water pressure is normally monitored in the control room on pressure indicator PI(2)-1040-3A. RHRS pressure is normally monitored in the control room on PI1(2)-1040-2A. RHRS flow is normally monitored in the control room on flow recorder FR1(2)-1040-7 and flow indicator FI1(2)-1040-11A.

The operator can locally monitor the necessary parameters on indicators as follows:

RHRS pressure, PI1(2)-1001-71A and PI1(2)-1001-71B.

Reactor level and pressure are normally monitored in the control room on various instruments. The operator can locally monitor these parameters on several reactor building instrument racks including 2201(2)-5 and 2201(2)-6 (level and pressure) Elevation 623 feet 0 inches, 2201(2)-7 and 2201(2)-8 (reactor level) Elevation 595 feet 0 inches, and in the RCIC room on rack 2201(2)-58 (reactor pressure and level). RHRSW/RHR differential pressure and RHRS flow can be monitored by an analog trip system indicator in the cable spreading room.

2.2.1.3 Electrical Distribution

Power for the RCIC shutdown method is provided by one of the diesel generators. The diesel will normally start automatically upon a loss of offsite power. In case a fire affects the automatic operation of a diesel generator, it can be isolated and started locally by the operator in the diesel generator room.

The diesel-generator cooling water pump, fuel oil transfer pump, and ventilation fan normally start automatically when the diesel is started. Provisions are made so that the operator can isolate and start these auxiliaries locally.

The switchgear breakers are normally closed, controlled from the control room or picked up automatically. However, a fire in the control room or auxiliary electric equipment room could affect breaker control for both units. Local breaker control capability is installed for the 4-kV SWGR diesel feed breakers, the 4-kV SWGR normal feed breakers, the 4-kV to 480-V SWGR feed breakers, the feeds to the RHR pumps and RHR service water pumps, and the 250-Vdc feeds to the RCIC vacuum and condensate pumps. Sufficient flexibility exists in the 125-Vdc system such that the operator can supply control power from either unit. 125-Vdc control power is only required for the operation of the 4-kV switchgear.

2.2.2 Safe Shutdown Makeup Pump Method

The safe shutdown makeup pump method for achieving and maintaining hot shutdown is used in several of the fire zones at Quad Cities 1 and 2. (Figure A-6 shows system arrangement.) This electric motor-driven pump will be used by the operator to provide makeup water to the reactor. This pump is capable of feeding either unit and, can be powered from either unit. Differences in the alternate shutdown paths using the safe shutdown makeup pump are described in Table 2.1-1.

2.2.2.1 Safe Shutdown Makeup Pump Operation

The new safe shutdown makeup pump is a motor-driven, multi-stage, 400-gpm pump equivalent in makeup capability to the RCIC system. The pump is located north of the CO₂ tank in the turbine building Central Zone Group on the ground floor at 11-12/G-H. The pump takes suction from the contaminated condensate storage tank with a provision for connection to the fire main. The pump discharge is piped to either unit's HPCI discharge line downstream of all active valves. A recirculation connection to the condensate storage tank is also provided.

To place the pump into operation, the operator will open the motor-operated discharge valves. The pump will be started from the control room or locally in the pump room. One discharge valve will be a throttling valve to allow the operator to adjust the flow rate. If long-term operation of the pump is necessary, the operator will close the valve in the line from condensate storage and connect the system to the fire main. Pump suction would not be required from the fire water system until well after extinguishment of the fire was accomplished. Fire main water is then available to provide pump suction as long as operation is necessary. The fire water system supply has been hydraulically evaluated to ensure it can satisfy both the maximum fire demand and simultaneous operation of the safe shutdown pump.

2.2.2.2 Support Systems and Instrumentation

The condensate storage level can be monitored in the control room or locally as discussed in Subsection 2.2.1.2. Local instrumentation for the safe shutdown makeup pump includes pump suction and discharge pressure indicators and a pump flow indicating controller.

For long-term pump operation, one of two diesel-driven fire main water pumps will be used to maintain pressure in the fire main. A local pressure indicator is available on the discharge of each of the two diesel-driven fire main water pumps, either of which may be used to feed the new pump.

Initial pressure control for the reactor is normally supplied by the electromatic relief valves. However, the target rock valve will provide pressure control if operation of the relief valves has been affected by a fire. Since steam is being discharged to the suppression pool, the RHR system will be used for suppression pool cooling as discussed in Subsection 2.2.1.2.

2.2.2.3 Electrical Distribution

Power for the safe shutdown makeup pump will be provided by either diesel generator 1 or 2. Redundant power cables are run from both switchgear 14-1 and 24-1 to switchgear 31, located in the safe shutdown makeup pump room. The feed from Unit 1 is normally energized to provide power, via 4160/480-V Transformer 30 and MCC 30, for lighting, HVAC, and local indication. Local control and isolation capability is provided in the safe shutdown makeup pump room for all breakers in the system. The normal or reserve feed cables can be isolated from the system by tripping the appropriate normal or reserve feed control breaker located in switchgear 31.

The diesel generators also provide power to the RHR system. Local control is provided for the diesel generators, their auxiliaries, and all necessary circuit breakers.

2.3 SAFE SHUTDOWN PATH DESCRIPTION

2.3.1 Path A

Path A is available for use to shut down Unit 1 for fires in Fire Area RB-1 (Fire Zones 1.1.1.1.N, 1.1.1.2, 1.1.1.3, 1.1.1.4, 1.1.1.5, 1.1.1.6, 11.1.3, 11.2.3, and 11.2.4 of the Unit 1 reactor building). These fire zones constitute the entire Unit 1 reactor building except in the southern portion of the torus level. It should be noted that no safe shutdown equipment or cables are located in Fire Zones 1.1.1.4, 1.1.1.5, or 1.1.1.6. If a fire occurs to these zones, all shutdown methods are available. This path is also used to shut down Unit 1 for a fire in equivalent Fire Area 8.2.8.B on the turbine operating floor. Equivalent Fire Area 8.2.8.B contains 4-kV switchgear 13-1 and 480-V switchgears 18 and 19.

Path A uses the safe shutdown makeup pump powered by diesel generator 2 to provide makeup water to the reactor vessel. Suppression pool cooling is provided by the Unit 1, Division II residual heat removal system powered by diesel generator 1. All equipment and cabling associated with Path "A" and its power train are located outside the Unit 1 reactor building with the exception of the Division II RHR pumps, power and room cooler cables. The RHR Division II pumps are located in the southeast corner room of the Unit 1 torus level. These pumps are powered by cables routed through the torus (Fire Zone 1.1.1.1.S) south of column line 16 near the south wall. If a fire occurs in the fire zones identified above, 4-kV switchgear 13-1 and 480-V switchgears 18 and 19 and associated Division II cables could be exposed. Since the Unit 1 480-V Division II cables are exposed, diesel generator 2 will be used to provide power to the RHR room cooler fan and also to the diesel generator 1 auxiliaries using alternate power feeds to the equipment from 480-V MCC's in Unit 2.

2.3.2 Path B

Path B is available for use to shut down Unit 2 for fires in Fire Area RB-2 (Fire Zones 1.1.2.1.N, 1.1.2.2, 1.1.2.3, 1.1.2.4, 1.1.2.5, 11.3.3, and 11.3.4 of the Unit 2 reactor building.) These fire zones constitute the entire Unit 2 reactor building except in the southern portion of the torus level. It should be noted that no safe shutdown equipment or cables are located in Fire Zones 1.1.2.4 and 1.1.2.5. If a fire occurs in these zones, all methods of shutdown are available. Path B uses the safe shutdown makeup pump powered by diesel generator 1 to provide makeup water to the reactor vessel.

Suppression pool cooling is provided by the Unit 2, Division II residual heat removal system powered by diesel generator 2. All equipment and cabling associated with Path "B" and its power

train are located outside the Unit 2 reactor building with the exception of the Division II RHR pumps, power and room cooler cables. The RHR Division II pumps are located in the southeast corner room of the Unit 2 torus level. These pumps are powered by cables routed through the torus (Fire Zone 1.1.2.1.S) south of column line 10 near the south wall. If a fire occurs in Fire Area RB-2, cables associated with 4-kV switchgear 23-1 and 480-V switchgears 28 and 29 could be exposed. Since the 480-V Division II cables are exposed, diesel generator 1 will be used to provide power to the RHR room cooler fan and also to the diesel generator 2 auxiliaries using alternate power feeds to the equipment from 480-V MCC's in Unit 1.

2.3.3 Path C

Path C is available for use to shut down Unit 2 for a fire in the turbine building northern zone group, Fire Area TB-I (Fire Zones 6.2.A, 6.2.E, 7.2, 8.2.1.B, 8.2.1.D, 8.2.2.A, 8.2.2.B, 8.2.5, 8.2.6.D, 8.2.6.E, 8.2.7.D, 8.2.7.E, 9.2, 11.1.2.A, 11.1.2.B, 11.1.2.C and 14.1.2) and equivalent Fire Area 8.2.8.C on the turbine operating floor. It should be noted that no safe shutdown equipment or cables are located in Fire Zones 8.2.1.D, 8.2.2.B and 14.1.2. If a fire is confined to these zones, all methods of shutdown are available. Path C uses the safe shutdown makeup pump powered by diesel generator 1 to provide makeup water to the reactor vessel.

Suppression pool cooling is provided by the Unit 2, Division I residual heat removal system powered by diesel generator 1/2. Because cable associated with RHR service water pumps is routed through the above fire zones it may be necessary to power Unit 1, Division I RHR service water pumps and supply RHR service water to the Unit 2 RHR heat exchangers through the Division I crosstie piping by opening manually-operated valve 1/2-1099-1A located in the Unit 1 RCIC room. An RHR pump for Unit 2 and an RHR service water pump for Unit 1 would be powered by the diesel generator 1/2. This could be done by powering both Unit 1 4-kV switchgear 13-1 and Unit 2 4-kV switchgear 23-1 Division I power trains with the diesel generator 1/2 simultaneously. If a fire occurs in equivalent Fire Area 8.2.8.C, 480-V switchgear 28 will be exposed. For this reason, a manual action may be required to power the Division I, RHR room cooler fan 2-5746A by closing a normally open breaker between Unit 1, Division II MCC 19-1 and Unit 2, Division I MCC 28-1A. In addition, another operator action may be required to provide cooling water to the Division I RHR room cooler by opening a manually-operated valve to allow the diesel generator 1/2 cooling water pump to provide the cooling water for the room cooler. The 125-Vdc power for control of the Unit 2 4-kV switchgear 23-1 will be provided through a normally open crosstie to 4-kV switchgear 13-1 from 23-1 using a manual action if normal 125-Vdc control power is not available.

2.3.4 Path D

Path D is available for use to shut down Unit 1 for a fire in the southern torus area of Unit 1 reactor building Fire Area RB-1 (Fire Zones 1.1.1.5, 11.2.1, and 11.2.2), Fire Area TB-III (Fire Zones 6.1.A, 6.1.B, 7.1, 8.2.1.A, 8.2.1.C, 8.2.3.A, 8.2.3.B, 8.2.4, 8.2.6.A, 8.2.6.B, 8.2.7.A, 9.1, 11.1.1.A, 11.1.1.B, 11.1.1.C, and 14.1.1), the turbine building southern zone group and equivalent Fire Area 8.2.8.B located on the turbine operating floor. It should be noted that no safe shutdown equipment or cables are located in Fire Zones 8.2.1.C, 8.2.3.B, and 14.1.1. If a fire is confined to these zones, all methods of shutdown are available. Path D uses the safe shutdown makeup pump powered by diesel generator 2 to provide makeup water to the reactor vessel.

Suppression pool cooling is provided by the Unit 1, Division I residual heat removal system powered by diesel generator 1/2. Because cable associated with the RHR service water pumps is routed through the above fire zone, it may be necessary to power Unit 2, Division I RHR service water pumps and supply RHR service water to the Unit 1 RHR heat exchangers through the Division I crosstie piping by opening a manually-operated valve 1/2-1099-1A located in the Unit 1 RCIC room. Both RHR pumps for Unit 1 and RHR service water pumps from Unit 2 would be powered by the diesel generator 1/2. This would be done by powering both Unit 1 4-kV switchgear 13-1 and Unit 2 4-kV switchgear 23-1 Division I power trains with the diesel generator 1/2 simultaneously. An operator action will be required to provide cooling water to the Division I RHR room cooler by opening manually-operated valve 1-3999-89 to allow the diesel generator 1/2 cooling water pump to provide the cooling water for the room cooler. The 125-Vdc power for control of the Unit 1 4-kV switchgear 13-1 will be provided through a normally open crosstie to 4-kV switchgear 23-1 from 13-1 routed on the main operating floor using manual action if normal 125-Vdc control power is not available. In addition, for a fire in Fire Area 11.1.1.B, which could expose the diesel generator 1/2 cooling water pump, cooling water to diesel generator 1/2 is available from diesel generator 1 cooling water pump by opening a normally closed manually-operated valve. The diesel generator 1 cooling water pump will be powered by an alternate feed from Unit 2.

2.3.5 Path E1

Path E1 is available for use to shut down Unit 1 for a fire in Fire Area RB-1/2 (Fire Zone 9.3 (diesel generator 1/2 room)). Path E1 uses the Unit 1 reactor core isolation cooling system (RCICS) to provide makeup water to the reactor vessel.

Suppression pool cooling is provided by the Unit 1, Division II residual heat removal system powered by diesel generator 1. This shutdown path is completely controlled from the control room and no manual actions are required.

2.3.6 Path E2

Path E2 is available for use to shut down Unit 1 for a fire in Fire Area SB-I (Fire Zones 2.0 (control room), 3.0 (cable spreading room), 4.0 (computer room), 6.3 (auxiliary electric equipment room)) and Fire Area TB-II the turbine building central zone group (Fire Zones 5.0, 8.2.6.C, and 8.2.7.C) located in the service building and turbine building, respectively. It should be noted that if the fire does not spread from Fire Zone 5.0 shutdown path E1 can be used to shutdown Unit 1. Path E2 uses the Unit 1 reactor core isolation cooling system (RCICS) to provide makeup water to the reactor vessel.

Suppression pool cooling is provided by the Unit 1, Division II residual heat removal system powered by diesel generator 1. Since the RCIC inboard steamline valve MO1-1301-16 and the RCIC emergency cooler 1-5748A are in the Division I power train, a manual action may be required to close the 480-V bus tie from Division II Bus 19 to Division I Bus 18 to provide power to this equipment. The RCIC inboard steamline valve MO1-1301-16 is normally open, therefore, power is needed only to correct a spurious closure of the valve. For a fire in Fire Zones 2.0, 3.0, 6.3, and 4.0, the 125-Vdc power for local control of the Division II 4-kV switchgear 14-1 is provided by the Unit 1 125-Vdc batteries from the 1A distribution panel by manually closing of a normally open breaker at the 125-Vdc No. 1 distribution panel in the reactor building. For a fire in Fire Zones 8.2.7.C and 8.2.6.C, manual action is required to close a breaker in the Unit 1 battery room between the 125-Vdc 1A distribution panel and the 1B panel to provide local control to 4-kV switchgear 14-1. The operator must perform all actions locally and/or manually at switchgear, MCC's, or equipment.

2.3.7 Path F

Path F is available for use to shut down Unit 2 for a fire in Fire Area RB-1/2 (Fire Zone 9.3 (diesel generator 1/2 room)). Path F uses the Unit 2 reactor core isolation cooling system (RCICS) to provide makeup water to the reactor vessel.

Suppression pool cooling is provided by the Unit 2, Division II residual heat removal system powered by diesel generator 2. Since the RCIC inboard steamline valve MO2-1301-16 is powered by the Division I power train, a manual action may be required to close the 480-V bus tie from Division II Bus 29 to Division I Bus 28 to provide power to this valve. The RCIC inboard steamline valve MO2-1301-16 is normally open, therefore, power is needed only to correct a spurious closure of the valve. This shutdown path is completely controlled from the control room.

2.3.8 Path H

Path H is available for use to shut down Unit 2 for a fire in Fire Area TB-II (Fire Zones 5.0, 8.2.7.C and 8.2.6.C) the turbine building central zone group. It should be noted that if the fire does not spread from Fire Zone 5.0 shutdown path F can be used to shut down Unit 2. Path H uses the Unit 2 reactor core isolation cooling system (RCICS) to provide makeup water to the reactor vessel.

Suppression pool cooling is provided by Unit 2, Division I residual heat removal system powered by diesel generator 1/2. Opening of a manually-operated valve is necessary to provide cooling water to the Unit 2 RCIC room cooler via the diesel generator 1/2 cooling water pump.

Unit 2 RCIC auxiliaries are powered by feeds from 250-Vdc MCC 2B in the Unit 2 reactor building. Normal power feeds from the turbine building 250-Vdc MCC #1 to 250-Vdc MCC 2B will be exposed for a fire in the Central Zone Group. An operator manual action will be necessary to close the bus tie between 250-Vdc MCC 2A and MCC 2B to ensure power is available to RCIC auxiliaries.

2.3.9 Path K

Path K is available for use to shut down Unit 2 for a fire in Fire Area SB-I (Fire Zones 2.0 (control room), 3.0 (cable spreading room), 4.0 (computer room), and 6.3 (auxiliary electric equipment room)) located in the service building and equivalent Fire Area 8.2.8.D located on the turbine operating floor. Path K uses the safe shutdown makeup pump powered by diesel generator 2 to provide makeup water to the reactor vessel.

Suppression pool cooling is provided by the Unit 2, Division II residual heat removal system powered by diesel generator 2. The 125-Vdc local control of the Division II 4-kV switchgear 24-1 is provided by the Unit 2 125-Vdc batteries from the 2A distribution panel. This requires manually closing of a normally open breaker at the 125-Vdc No. 2 distribution panel in the reactor building. All equipment and cabling associated with this shutdown path are independent of the service building. The operator must perform all actions locally and/or manually at the switchgear, MCC's, or equipment.

2.3.10 Path L

Path L is available for use to shut down Unit 2 for a fire in the southern torus area of the Unit 2 reactor building Fire Area RB-2 (Fire Zones 1.1.2.1.S, 1.1.1.4, 1.1.3.1, and 1.1.3.2). Path L uses the safe shutdown makeup pump powered by diesel generator 1 to provide makeup water to the reactor vessel.

Suppression pool cooling is provided by the Unit 2, Division I residual heat removal system powered by diesel generator 1/2. Opening of a manually-operated valve is necessary to provide cooling water to the RHR Division I room coolers by using the diesel generator 1/2 cooling water pump. The equipment and cabling used for this shutdown path are located north of column line 10.

TABLE 2.3-1COMPONENTS REQUIRED FOR SHUTDOWN PATH A

<u>MECHANICAL EQUIPMENT</u>	<u>LOCATION BY FIRE ZONE</u>
RHR VLV MO1-1001-18B	1.1.1.1.S
RHR VLV MO1-1001-28B	1.1.1.1.S
RHR VLV MO1-1001-29B	1.1.1.1.S
RHR VLV MO1-1001-34B	1.1.1.1.S
RHR VLV MO1-1001-36B	1.1.1.1.S
RHR VLV MO1-1001-37B	1.1.1.1.S
RHR VLV MO1-1001-23B	1.1.1.3
RHR VLV MO1-1001-26B	1.1.1.3
Target Rock VLV 1-203-3A	1.2.1
Electromatic Relief VLV 1-203-3B	1.2.1
Electromatic Relief VLV 1-203-3C	1.2.1
Electromatic Relief VLV 1-203-3D	1.2.1
Electromatic Relief VLV 1-203-3E	1.2.1
Safe Shutdown Pump 1/2-2901	5.0
SSP Air Cond Unit	5.0
SSP VLV MO1-2901-08	5.0
SSP VLV MO1/2-2901-06	5.0
SSP VLV MO1/2-2901-07	5.0
Diesel Generator 1	9.1
DG 1 Fuel Oil Transfer Pump	9.1
DG 1 Room Vent Fan	9.1
Diesel Generator 2	9.2
DG 2 Fuel Oil Transfer Pump	9.2
DG 2 Room Vent Fan	9.2
DG 1 Clg Water Pu Cubicle Cooler	11.1.1.A
DG 1 Cooling Water Pump	11.1.1.A
DG 2 Clg Water Pu Cubicle Cooler	11.1.2.A
DG 2 Cooling Water Pump	11.1.2.A
RHR SW Pu Cub Clr 1-5745D	11.1.1.A
RHR SW Pump 1-1001-65D	11.1.1.A
RHR SW Pu Cub Clr 1-5745C	11.1.1.B
RHR SW Pump 1-1001-65C	11.1.1.B
RHR Pump 1-1002C	11.2.2
RHR Pump 1-1002D	11.2.2
RHR Room Cooler 1-5746B	11.2.2
RHR VLV MO1-1001-16B	11.2.2
RHR VLV MO1-1001-185B	11.2.2
RHR VLV MO1-1001-186B	11.2.2
RHR VLV MO1-1001-187B	11.2.2
RHR VLV MO1-1001-19B	11.2.2
RHR VLV MO1-1001-43C	11.2.2
RHR VLV MO1-1001-43D	11.2.2

TABLE 2.3-1 (Cont'd)

<u>MECHANICAL EQUIPMENT</u>	<u>LOCATION BY FIRE ZONE</u>
RHR VLV MO1-1001-4B	11.2.2
RHR VLV MO1-1001-5B	11.2.2
RHR VLV MO1-1001-7C	11.2.2
RHR VLV MO1-1001-7D	11.2.2
 <u>ELECTRIC EQUIPMENT</u>	
480V MCC 29-1	1.1.2.3
480V MCC 14/24	5.0
125V DC Dist Pnl 1A	6.1.A
125V DC Dist Pnl 1B	6.1.B
125V DC Reserve Bus 1B-1	6.1.B
125V DC Dist Pnl 2A	6.2.A
125V DC Battery Charger 2	6.2.B
125V DC Dist Pnl 2B	6.2.B
125V DC Reserve Bus 2B-1	6.2.B
120/240V Ess Dist Pnl 901-49	6.3
120/240V Instr Bus 901-50	6.3
125V Battery #1	7.1
125V Battery #2	7.2
4kV SWGR 14	8.2.7.A
480V SWGR 29-2	8.2.7.E
4kV SWGR 14-1	8.2.8.A
480V SWGR 29	8.2.8.C
4kV SWGR 24-1	8.2.8.C
DG 1 Control/Excit/Mtrg	9.1
DG 2 Control/Excit/Mtrg	9.2

TABLE 2.3-2COMPONENTS REQUIRED FOR SHUTDOWN PATH B

<u>MECHANICAL EQUIPMENT</u>	<u>LOCATION BY FIRE ZONE</u>
RHR VLV MO2-1001-18B	1.1.2.1.S
RHR VLV MO2-1001-28B	1.1.2.1.S
RHR VLV MO2-1001-29B	1.1.2.1.S
RHR VLV MO2-1001-34B	1.1.2.1.S
RHR VLV MO2-1001-36B	1.1.2.1.S
RHR VLV MO2-1001-37B	1.1.2.1.S
RHR VLV MO2-1001-23B	1.1.2.3
RHF VLV MO2-1001-26B	1.1.2.3
Target Rock VLV 2-203-3	1.2.2
Electromatic Relief VLV 2-203-3B	1.2.2
Electromatic Relief VLV 2-203-3C	1.2.2
Electromatic Relief VLV 2-203-3D	1.2.2
Electromatic Relief VLV 2-203-3E	1.2.2
Safe Shutdown Pump 1/2-2901	5.0
SSP Air Cond Unit	5.0
SSP VLV MO1/2-2901-06	5.0
SSP VLV MO1/2-2901-07	5.0
SSP VLV MO2-2901-08	5.0
Diesel Generator 1	9.1
DG 1 Fuel Oil Transfer Pump	9.1
DG 1 Room Vent Fan	9.1
Diesel Generator 2	9.2
DG 2 Fuel Oil Transfer Pump	9.2
DG 2 Room Vent Fan	9.2
DG 1 Clg Water Pu Cubicle Cooler	11.1.1.A
DG 1 Cooling Water Pump	11.1.1.A
DG 2 Clg Water Pu Cubicle Cooler	11.1.2.A
DG 2 Cooling Water Pump	11.1.2.A
RHR SW Pu Cub Clr 2-5745C	11.1.2.B
RHR SW Pump 2-1001-65C	11.1.2.B
RHR SW Pu Cub Clr 2-5745D	11.1.2.C
RHR SW Pump 2-1001-65D	11.1.2.C
RHR Pump 2-1002C	11.3.2
RHR Pump 2-1002D	11.3.2
RHR Room Cooler 2-5746B	11.3.2
RHR VLV MO2-1001-16B	11.3.2
RHR VLV MO2-1001-185B	11.3.2
RHR VLV MO2-1001-186B	11.3.2
RHR VLV MO2-1001-187B	11.3.2
RHR VLV MO2-1001-19B	11.3.2
RHR VLV MO2-1001-43C	11.3.2
RHR VLV MO2-1001-43D	11.3.2

TABLE 2.3-2 (Cont'd)

<u>MECHANICAL EQUIPMENT</u>	<u>LOCATION BY FIRE ZONE</u>
RHR VLV MO2-1001-4B	11.3.2
RHR VLV MO2-1001-5B	11.3.2
RHR VLV MO2-1001-7C	11.3.2
RHR VLV MO2-1001-7D	11.3.2
 <u>ELECTRIC EQUIPMENT</u>	
480V MCC 19-1	1.1.1.3
208V MCC 29-1-1	1.1.2.3
480V MCC 29-1	1.1.2.3
480V MCC 29-4	1.1.2.3
480V MCC 14/24	5.0
125V DC Dist Pnl 1A	6.1.A
125V DC Dist Pnl 1B	6.1.B
125V DC Reserve Bus 1B-1	6.1.B
125V DC Dist Pnl 2A	6.2.A
125V DC Battery Charger 2	6.2.B
125V DC Dist Pnl 2B	6.2.B
125V DC Reserve Bus 2B-1	6.2.B
120/240V Ess Dist Pnl 902-49	6.3
120/240V Instr Bus 902-50	6.3
125V Battery #1	7.1
125V Battery #2	7.2
480V MCC 29-2	8.2.7.E
4kV SWGR 24	8.2.7.E
4kV SWGR 14-1	8.2.8.A
480V SWGR 19	8.2.8.B
480V SWGR 29	8.2.8.C
4kV SWGR 24-1	8.2.8.C
DG 1 Control/Excit/Mtrg	9.1
DG 2 Control/Excit/Mtrg	9.2

TABLE 2.3-3COMPONENTS REQUIRED FOR SHUTDOWN PATH C

<u>MECHANICAL EQUIPMENT</u>	<u>LOCATION BY FIRE ZONE</u>
RHR VLV MO2-1001-18A	1.1.2.1.N
RHR VLV MO2-1001-28A	1.1.2.1.N
RHR VLV MO2-1001-29A	1.1.2.1.N
RHR VLV MO2-1001-34A	1.1.2.1.N
RHR VLV MO2-1001-36A	1.1.2.1.N
RHR VLV MO2-1001-37A	1.1.2.1.N
RHR VLV MO2-1001-23A	1.1.2.2
RHR VLV MO2-1001-26A	1.1.2.2
Target Rock VLV 2-203-3A	1.2.2
Electromatic Relief VLV 2-203-3B	1.2.2
Electromatic Relief VLV 2-203-3C	1.2.2
Electromatic Relief VLV 2-203-3D	1.2.2
Electromatic Relief VLV 2-203-3E	1.2.2
Safe Shutdown Pump 1/2-2901	5.0
SSP Air Cond Unit	5.0
SSP VLV MO1/2-2901-06	5.0
SSP VLV MO1/2-2901-07	5.0
SSP VLV MO2-2901-08	5.0
Diesel Generator 1	9.1
DG 1 Fuel Oil Transfer Pump	9.1
DG 1 Room Vent Fan	9.1
Diesel Generator 1/2	9.3
DG 1/2 Fuel Oil Transfer Pump	9.3
DG 1/2 Vent Fan	9.3
DG 1 Clg Water Pu Cubicle Cooler	11.1.1.A
DG 1 Cooling Water Pump	11.1.1.A
DG 1/2 Clg Water Pu Cubicle Cooler	11.1.1.B
DG 1/2 Cooling Water Pump	11.1.1.B
RHR SW Pu Cub Clr 2-5745B	11.1.2.B
RHR SW Pump 2-1001-65B	11.1.2.B
RHR SW Pu Cub Clr 2-5745A	11.1.2.A
RHR SW Pump 2-1001-65A	11.1.2.A
RHR Pump 2-1002A	11.3.4
RHR Pump 2-1002B	11.3.4
RHR Room Cooler 2-5746A	11.3.4
RHR VLV MO2-1001-16A	11.3.4
RHR VLV MO2-1001-185A	11.3.4
RHR VLV MO2-1001-186A	11.3.4
RHR VLV MO2-1001-187A	11.3.4
RHR VLV MO2-1001-19A	11.3.4
RHR VLV MO2-1001-43A	11.3.4
RHR VLV MO2-1001-43B	11.3.4

TABLE 2.3-3 (Cont'd)

<u>MECHANICAL EQUIPMENT</u>	<u>LOCATION BY FIRE ZONE</u>
RHR VLV MO2-1001-4A	11.3.4
RHR VLV MO2-1001-5A	11.3.4
RHR VLV MO2-1001-7A	11.3.4
RHR VLV MO2-1001-7B	11.3.4
 <u>ELECTRIC EQUIPMENT</u>	
125V DC Dist Pnl 1	1.1.1.3
480V MCC 18-1A	1.1.1.3
480V MCC 19-1	1.1.1.3
125V DC Dist Pnl 2	1.1.2.3
480V MCC 28-1A	1.1.2.3
480V MCC 14/24	5.0
125V DC Battery Charger 1	6.1.B
125V DC Dist Pnl 1B	6.1.B
125V DC Dist Pnl 2A	6.2.A
120/240V Ess Dist Pnl 902-49	6.3
120/240V Instr Bus 902-50	6.3
125V Battery #1	7.1
480V MCC 18-2	8.2.7.A
480V MCC 19-2	8.2.7.A
4kV SWGR 13	8.2.7.A
4kV SWGR 14-1	8.2.8.A
480V SWGR 18	8.2.8.B
480V SWGR 19	8.2.8.B
4kV SWGR 13-1	8.2.8.B
480V SWGR 28	8.2.8.C
4kV SWGR 23-1	8.2.8.D
DG 1 Control/Excit/Mtrg	9.1
DG 1/2 Control/Excit/Mtrg	9.3

TABLE 2.3-4COMPONENTS REQUIRED FOR SHUTDOWN PATH D

<u>MECHANICAL EQUIPMENT</u>	<u>LOCATION BY FIRE ZONE</u>
RHR VLV MO1-1001-18A	1.1.1.1.N
RHR VLV MO1-1001-28A	1.1.1.1.N
RHR VLV MO1-1001-29A	1.1.1.1.N
RHR VLV MO1-1001-34A	1.1.1.1.N
RHR VLV MO1-1001-36A	1.1.1.1.N
RHR VLV MO1-1001-37A	1.1.1.1.N
RHR VLV MO1-1001-23A	1.1.1.2
RHR VLV MO1-1001-26A	1.1.1.2
Target Rock VLV 1-203-3A	1.2.1
Electromatic Relief VLV 1-203-3B	1.2.1
Electromatic Relief VLV 1-203-3C	1.2.1
Electromatic Relief VLV 1-203-3D	1.2.1
Electromatic Relief VLV 1-203-3E	1.2.1
Safe Shutdown Pump 1/2-2901	5.0
SSP Air Condx Unit	5.0
SSP VLV MO1-2901-08	5.0
SSP VLV MO1/2-2901-06	5.0
SSP VLV MO1/2-2901-07	5.0
Diesel Generator 2	9.2
DG 2 Fuel Oil Transfer Pump	9.2
DG 2 Room Vent Fan	9.2
Diesel Generator 1/2	9.3
DG 1/2 Fuel Oil Transfer Pump	9.3
DG 1/2 Vent Fan	9.3
DG 1/2 Clg Water Pu Cubicle Cooler	11.1.1.B
DG 1/2 Cooling Water Pump	11.1.1.B
DG 2 Clg Water Pu Cubicle Cooler	11.1.2.A
DG 2 Cooling Water Pump	11.1.2.A
RHR SW Pu Cub Clr 1-5745B	11.1.1.B
RHR SW Pump 1-1001-65B	11.1.1.B
RHR SW Pu Cub Clr 1-5745A	11.1.1.C
RHR SW Pump 1-1001-65A	11.1.1.C
RHR Pump 1-1002A	11.2.4
RHR Pump 1-1002B	11.2.4
RHR Room Cooler 1-5746A	11.2.4
RHR VLV MO1-1001-16A	11.2.4
RHR VLV MO1-1001-185A	11.2.4
RHR VLV MO1-1001-186A	11.2.4
RHR VLV MO1-1001-187A	11.2.4
RHR VLV MO1-1001-19A	11.2.4
RHR VLV MO1-1001-43A	11.2.4
RHR VLV MO1-1001-43B	11.2.4

TABLE 2.3-4 (Cont'd)

<u>MECHANICAL EQUIPMENT</u>	<u>LOCATION BY FIRE ZONE</u>
RHR VLV MO1-1001-4A	11.2.4
RHR VLV MO1-1001-5A	11.2.4
RHR VLV MO1-1001-7A	11.2.4
RHR VLV MO1-1001-7B	11.2.4
 <u>ELECTRIC EQUIPMENT</u>	
280V MCC 18-1A-1	1.1.1.3
480V MCC 18-1A	1.1.1.3
480V MCC 18-1B	1.1.1.3
125V DC Dist Pnl 2	1.1.2.3
480V MCC 29-1	1.1.2.3
480V MCC 14/24	5.0
125V DC Battery Charger 2	6.2.B
125V DC Reserve Bus 2B-1	6.2.B
125V DC Dist Pnl 2A	6.2.A
120/240V Ess Dist Pnl 901-49	6.3
120/240V Instr Bus 901-50	6.3
125V Battery #2	7.2
480V MCC 18-2	8.2.7.A
480V MCC 28-2	8.2.7.E
480V MCC 29-2	8.2.7.E
4kV SWGR 23	8.2.7.E
480V SWGR 18	8.2.8.B
4kV SWGR 13-1	8.2.8.B
480V SWGR 28	8.2.8.C
480V SWGR 29	8.2.8.C
4kV SWGR 24-1	8.2.8.C
4kV SWGR 23-1	8.2.8.D
DG 2 Control/Excit/Mtrg	9.2
DG 1/2 Control/Excit/Mtrg	9.3

TABLE 2.3-5COMPONENTS REQUIRED FOR SHUTDOWN PATH E1

(Note: This path is always used in conjunction with Path F.)

<u>MECHANICAL EQUIPMENT</u>	<u>LOCATION BY FIRE ZONE</u>
RCIC VLV M01-1301-25	1.1.1.1.N
RHR VLV M01-1001-18B	1.1.1.1.S
RHR VLV M01-1001-28B	1.1.1.1.S
RHR VLV M01-1001-29B	1.1.1.1.S
RHR VLV M01-1001-34B	1.1.1.1.S
RHR VLV M01-1001-36B	1.1.1.1.S
RHR VLV M01-1001-37B	1.1.1.1.S
RHR VLV M01-1001-23B	1.1.1.3
RHR VLV M01-1001-26B	1.1.1.3
RCIC VLV M01-1301-17	1.1.1.3
RCIC VLV M01-1301-49	1.1.1.3
RCIC VLV M01-1301-16	1.2.1
Target Rock VLV 1-203-3A	1.2.1
Electromatic Relief VLV 1-203-3B	1.2.1
Electromatic Relief VLV 1-203-3C	1.2.1
Electromatic Relief VLV 1-203-3D	1.2.1
Electromatic Relief VLV 1-203-3E	1.2.1
Diesel Generator 1	9.1
DG 1 Fuel Oil Transfer Pump	9.1
DG 1 Room Vent Fan	9.1
DG 1 Clg Water Pu Cubicle Cooler	11.1.1.A
DG 1 Cooling Water Pump	11.1.1.A
RHR SW Pu Cub Clr 1-5745D	11.1.1.A
RHR SW Pump 1-1001-65D	11.1.1.A
RHR SW Pu Cub Clr 1-5745C	11.1.1.B
RHR SW Pump 1-1001-65C	11.1.1.B
RHR Pump 1-1002C	11.2.2
RHR Pump 1-1002D	11.2.2
RHR Room Cooler 1-5746B	11.2.2
RHR VLV M01-1001-16B	11.2.2
RHR VLV M01-1001-185B	11.2.2
RHR VLV M01-1001-186B	11.2.2
RHR VLV M01-1001-187B	11.2.2
RHR VLV M01-1001-19B	11.2.2
RHR VLV M01-1001-43C	11.2.2
RHR VLV M01-1001-43D	11.2.2
RHR VLV M01-1001-4B	11.2.2
RHR VLV M01-1001-5B	11.2.2
RHR VLV M01-1001-7C	11.2.2
RHR VLV M01-1001-7D	11.2.2
RCIC Condensate Pump 1	11.2.3

TABLE 2.3-5 (Cont'd)

<u>MECHANICAL EQUIPMENT</u>	<u>LOCATION BY FIRE ZONE</u>
RCIC Emerg Rm Cooler 1-5478A	11.2.3
RCIC Vacuum Pump	11.2.3
RCIC VLV M01-1301-22	11.2.3
RCIC VLV M01-1301-26	11.2.3
RCIC VLV M01-1301-48	11.2.3
RCIC VLV M01-1301-53	11.2.3
RCIC VLV M01-1301-60	11.2.3
RCIC VLV M01-1301-61	11.2.3
RCIC VLV M01-1301-62	11.2.3
 <u>ELECTRIC EQUIPMENT</u>	
480V MCC 18/19-5	1.1.1.2
125V DC Dist Pnl 1	1.1.1.3
208V MCC 18-1A-1	1.1.1.3
480V MCC 18-1A	1.1.1.3
208V MCC 19-1-1	1.1.1.3
250V DC MCC 1B	1.1.1.3
480V MCC 19-1	1.1.1.3
480V MCC 19-4	1.1.1.3
125V DC Dist Pnl 1A	6.1.A
125V DC Battery Charger 1	6.1.B
125V DC Dist Pnl 1B	6.1.B
125V DC Reserve Bus 1B-1	6.1.B
250V DC Battery Charger 2	6.2.B
125V DC Dist Pnl 2A	6.2.A
250V DC MCC ?	6.2.B
120/240V Ess Dist Pnl 901-49	6.3
120/240V Instr Bus 901-50	6.3
125V Battery #1	7.1
125V Battery #2	7.2
250V Battery #2	7.2
480V MCC 19-2	8.2.7.A
4kV SWGR 14	8.2.7.A
4kV SWGR 14-1	8.2.8.A
480V SWGR 18	8.2.8.B
480V SWGR 19	8.2.8.B
DG 1 Control/Excit/Mtrg	9.1

TABLE 2.3-6

COMPONENTS REQUIRED FOR SHUTDOWN PATH E2

<u>MECHANICAL EQUIPMENT</u>	<u>LOCATION BY FIRE ZONE</u>
RCIC VLV MO1-1301-25	1.1.1.1.N
RHR VLV MO1-1001-18B	1.1.1.1.S
RHR VLV MO1-1001-28B	1.1.1.1.S
RHR VLV MO1-1001-29B	1.1.1.1.S
RHR VLV MO1-1001-34B	1.1.1.1.S
RHR VLV MO1-1001-36B	1.1.1.1.S
RHR VLV MO1-1001-37B	1.1.1.1.S
RHR VLV MO1-1001-23B	1.1.1.3
RHR VLV MO1-1001-26B	1.1.1.3
RCIC VLV MO1-1301-17	1.1.1.3
RCIC VLV MO1-1301-49	1.1.1.3
RCIC VLV MO1-1301-16	1.2.1
Target Rock VLV 1-203-3A	1.2.1
Electromatic Relief VLV 1-203-3B	1.2.1
Electromatic Relief VLV 1-203-3C	1.2.1
Electromatic Relief VLV 1-203-3D	1.2.1
Electromatic Relief VLV 1-203-3E	1.2.1
Diesel Generator 1	9.1
DG 1 Fuel Oil Transfer Pump	9.1
DG 1 Room Vent Fan	9.1
DG 1 Clg Water Pu Cubicle Cooler	11.1.1.A
DG 1 Cooling Water Pump	11.1.1.A
RHR SW Pu Cub Clr 1-5745D	11.1.1.A
RHR SW Pump 1-1001-65D	11.1.1.A
RHR SW Pu Cub Clr 1-5745C	11.1.1.B
RHR SW Pump 1-1001-65C	11.1.1.B
RHR Pump 1-1002C	11.2.2
RHR Pump 1-1002D	11.2.2
RHR Room Cooler 1-5746B	11.2.2
RHR VLV MO1-1001-16B	11.2.2
RHR VLV MO1-1001-185B	11.2.2
RHR VLV MO1-1001-186B	11.2.2
RHR VLV MO1-1001-187B	11.2.2
RHR VLV MO1-1001-19B	11.2.2
RHR VLV MO1-1001-43C	11.2.2
RHR VLV MO1-1001-43D	11.2.2
RHR VLV MO1-1001-4B	11.2.2
RHR VLV MO1-1001-5B	11.2.2
RHR VLV MO1-1001-7C	11.2.2
RHR VLV MO1-1001-7D	11.2.2
RCIC Condensate Pump 1	11.2.3
RCIC Emerg Rm Cooler 1-5478A	11.2.3

TABLE 2.3-6 (Cont'd)

<u>MECHANICAL EQUIPMENT</u>	<u>LOCATION BY FIRE ZONE</u>
RCIC Vacuum Pump	11.2.3
RCIC VLV MO1-1301-22	11.2.3
RCIC VLV MO1-1301-26	11.2.3
RCIC VLV MO1-1301-48	11.2.3
RCIC VLV MO1-1301-53	11.2.3
RCIC VLV MO1-1301-60	11.2.3
RCIC VLV MO1-1301-61	11.2.3
RCIC VLV MO1-1301-62	11.2.3
<u>ELECTRIC EQUIPMENT</u>	
480V MCC 18/19-5	1.1.1.2
125V DC Dist Pnl 1	1.1.1.3
208V MCC 18-1A-1	1.1.1.3
208V MCC 19-1-1	1.1.1.3
250V DC MCC 1A	1.1.1.3
250V DC MCC 1B	1.1.1.3
480V MCC 18-1A	1.1.1.3
480V MCC 19-1	1.1.1.3
480V MCC 19-4	1.1.1.3
125V DC Dist Pnl 1A	6.1.A
125V DC Battery Charger 1	6.1.B
125V DC Dist Pnl 1B	6.1.B
125V DC Reserve Bus 1B-1	6.1.B
250V DC Battery Charger 1	6.1.B
250V DC MCC 1	6.1.B
125V DC Dist Pnl 2A	6.2.A
120/240V Ess Dist Pnl 901-49	6.3
120/240V Instr Bus 901-50	6.3
125V Battery #1	7.1
250V Battery #1	7.1
480V MCC 19-2	8.2.7.A
4kV SWGR 14	8.2.7.A
4kV SWGR 14-1	8.2.8.A
480V SWGR 18	8.2.8.B
480V SWGR 19	8.2.8.B
DG 1 Control/Excit/Mtrg	9.1

TABLE 2.3-7COMPONENTS REQUIRED FOR SHUTDOWN PATH F

(Note: This path is always used in conjunction with Path El.)

<u>MECHANICAL EQUIPMENT</u>	<u>LOCATION BY FIRE ZONE</u>
RCIC VLV MO2-1301-25	1.1.2.1.S
RHR VLV MO2-1001-18B	1.1.2.1.S
RHR VLV MO2-1001-28B	1.1.2.1.S
RHR VLV MO2-1001-29B	1.1.2.1.S
RHR VLV MO2-1001-34B	1.1.2.1.S
RHR VLV MO2-1001-36B	1.1.2.1.S
RHR VLV MO2-1001-37B	1.1.2.1.S
RHR VLV MO2-1001-23B	1.1.2.3
RHR VLV MO2-1001-26B	1.1.2.3
RCIC VLV MO2-1301-17	1.1.2.3
RCIC VLV MO2-1301-49	1.1.2.3
RCIC VLV MO2-1301-16	1.2.2
Target Rock VLV 2-203-3A	1.2.2
Electromatic Relief VLV 2-203-3B	1.2.2
Electromatic Relief VLV 2-203-3C	1.2.2
Electromatic Relief VLV 2-203-3D	1.2.2
Electromatic Relief VLV 2-203-3E	1.2.2
Diesel Generator 2	9.2
DG 2 Fuel Oil Transfer Pump	9.2
DG 2 Room Vent Fan	9.2
DG 2 Clg Water Pu Cubicle Cooler	11.1.2.A
DG 2 Cooling Water Pump	11.1.2.A
RHR SW Pu Cub Clr 2-5745C	11.1.2.B
RHR SW Pump 2-1001-65C	11.1.2.B
RHR SW Pu Cub Clr 2-5745D	11.1.2.C
RHR SW Pump 2-1001-65D	11.1.2.C
RCIC Condensate Pump 2	11.3.1
RCIC Emerg Rm Cooler 2-5748B	11.3.1
RCIC Vacuum Pump 2	11.3.1
RCIC VLV MO2-1301-22	11.3.1
RCIC VLV MO2-1301-26	11.3.1
RCIC VLV MO2-1301-48	11.3.1
RCIC VLV MO2-1301-53	11.3.1
RCIC VLV MO2-1301-60	11.3.1
RCIC VLV MO2-1301-61	11.3.1
RCIC VLV MO2-1301-62	11.3.1
RHR Pump 2-1002C	11.3.2
RHR Pump 2-1002D	11.3.2
RHR Room Cooler 2-5746B	11.3.2
RHR VLV MO2-1001-16B	11.3.2
RHR VLV MO2-1001-185B	11.3.2

TABLE 2.3-7 (Cont'd)

<u>MECHANICAL EQUIPMENT</u>	<u>LOCATION BY FIRE ZONE</u>
RHR VLV MO2-1001-186B	11.3.2
RHR VLV MO2-1001-187B	11.3.2
RHR VLV MO2-1001-19B	11.3.2
RHR VLV MO2-1001-43C	11.3.2
RHR VLV MO2-1001-43D	11.3.2
RHR VLV MO2-1001-4B	11.3.2
RHR VLV MO2-1001-5B	11.3.2
RHR VLV MO2-1001-7C	11.3.2
RHR VLV MO2-1001-7D	11.3.2
<u>ELECTRIC EQUIPMENT</u>	
480V MCC 28/29-5	1.1.2.2
125V DC Dist Pnl 2	1.1.2.3
208V MCC 28-1A-1	1.1.2.3
208V MCC 29-1-1	1.1.2.3
250V DC MCC 2B	1.1.2.3
480V MCC 28-1A	1.1.2.3
480V MCC 29-1	1.1.2.3
480V MCC 29-4	1.1.2.3
125V DC Dist Pnl 1A	6.1.A
250V DC MCC 1	6.1.B
250V DC Battery Charger 1	6.1.B
125V DC Battery Charger 2	6.2.B
125V DC Dist Pnl 2A	6.2.A
125V DC Dist Pnl 2B	6.2.B
125V DC Reserve Bus 2B-1	6.2.B
120/240V Ess Dist Pnl 902-49	6.3
120/240V Instr Bus 902-50	6.3
125V Battery #1	7.1
250V Battery #1	7.1
125V Battery #2	7.2
480V MCC 29-2	8.2.7.E
4kV SWGR 24	8.2.7.E
480V SWGR 28	8.2.8.C
480V SWGR 29	8.2.8.C
4kV SWGR 24-1	8.2.8.C
DG 2 Control/Excit/Mtrg	9.2

TABLE 2.3-8COMPONENTS REQUIRED FOR SHUTDOWN PATH H

<u>MECHANICAL EQUIPMENT</u>	<u>LOCATION BY FIRE ZONE</u>
RHR VLV MO2-1001-18A	1.1.2.1.N
RHR VLV MO2-1001-28A	1.1.2.1.N
RHR VLV MO2-1001-29A	1.1.2.1.N
RHR VLV MO2-1001-34A	1.1.2.1.N
RHR VLV MO2-1001-36A	1.1.2.1.N
RHR VLV MO2-1001-37A	1.1.2.1.N
RCIC VLV MO2-1301-25	1.1.2.1.S
RHR VLV MO2-1001-23A	1.1.2.2
RHR VLV MO2-1001-26A	1.1.2.2
RCIC VLV MO2-1301-17	1.1.2.3
RCIC VLV MO2-1301-49	1.1.2.3
RCIC VLV MO2-1301-16	1.2.2
Target Rock VLV 2-203-3A	1.2.2
Electromatic Relief VLV 2-203-3B	1.2.2
Electromatic Relief VLV 2-203-3C	1.2.2
Electromatic Relief VLV 2-203-3D	1.2.2
Electromatic Relief VLV 2-203-3E	1.2.2
Diesel Generator 1/2	9.3
DG 1/2 Fuel Oil Transfer Pump	9.3
DG 1/2 Vent Fan	9.3
DG 1/2 Clg Water Pu Cubicle Cooler	11.1.1.B
DG 1/2 Cooling Water Pump	11.1.1.B
RHR SW Pu Cub Clr 2-5745A	11.1.2.A
RHR SW Pump 2-1001-65A	11.1.2.A
RHR SW Pu Cub Clr 2-5745B	11.1.2.B
RHR SW Pump 2-1001-65B	11.1.2.B
RCIC Condensate Pump 2	11.3.1
RCIC Emerg Rm Cooler 2-5748B	11.3.1
RCIC Vacuum Pump 2	11.3.1
RCIC VLV MO2-1301-22	11.3.1
RCIC VLV MO2-1301-26	11.3.1
RCIC VLV MO2-1301-48	11.3.1
RCIC VLV MO2-1301-53	11.3.1
RCIC VLV MO2-1301-60	11.3.1
RCIC VLV MO2-1301-61	11.3.1
RCIC VLV MO2-1301-62	11.3.1
RHR Pump 2-1002A	11.3.4
RHR Pump 2-1002B	11.3.4
RHR Room Cooler 2-5746A	11.3.4
RHR VLV MO2-1001-16A	11.3.4
RHR VLV MO2-1001-185A	11.3.4
RHR VLV MO2-1001-186A	11.3.4
RHR VLV MO2-1001-187A	11.3.4

TABLE 2.3-8 (Cont'd)

<u>MECHANICAL EQUIPMENT</u>	<u>LOCATION BY FIRE ZONE</u>
RHR VLV MO2-1001-19A	11.3.4
RHR VLV MO2-1001-43A	11.3.4
RHR VLV MO2-1001-43B	11.3.4
RHR VLV MO2-1001-4A	11.3.4
RHR VLV MO2-1001-5A	11.3.4
RHR VLV MO2-1001-7A	11.3.4
RHR VLV MO2-1001-7B	11.3.4
 <u>ELECTRIC EQUIPMENT</u>	
480V MCC 28/29-5	1.1.2.2
125V DC Dist Pnl 2	1.1.2.3
208V MCC 28-1A-1	1.1.2.3
250V DC MCC 2A	1.1.2.3
250V DC MCC 2B	1.1.2.3
480V MCC 28-1A	1.1.2.3
480V MCC 28-1B	1.1.2.3
250V DC Battery Charger 1/2	6.1.B
125V DC Battery Charger 2A	6.2.A
125V DC Dist Pnl 2A	6.2.A
250V DC MCC 2	6.2.B
120/240V Ess Dist Pnl 902-49	6.3
120/240V Instr Bus 902-50	6.3
125V Battery #2	7.2
250V Battery #2	7.2
480V MCC 28-2	8.2.7.E
4kV SWGR 23	8.2.7.E
480V SWGR 28	8.2.8.C
4kV SWGR 23-1	8.2.8.D
DG 1/2 Control/Excit/Mtrg	9.3

TABLE 2.3-9COMPONENTS REQUIRED FOR SHUTDOWN PATH K

<u>MECHANICAL EQUIPMENT</u>	<u>LOCATION BY FIRE ZONE</u>
RHR VLV MO2-1001-18B	1.1.2.1.S
RHR VLV MO2-1001-28B	1.1.2.1.S
RHR VLV MO2-1001-29B	1.1.2.1.S
RHR VLV MO2-1001-34B	1.1.2.1.S
RHR VLV MO2-1001-36B	1.1.2.1.S
RHR VLV MO2-1001-37B	1.1.2.1.S
RHR VLV MO2-1001-23B	1.1.2.3
RHR VLV MO2-1001-26B	1.1.2.3
Target Rock VLV 2-203-3A	1.2.2
Electromatic Relief VLV 2-203-3B	1.2.2
Electromatic Relief VLV 2-203-3C	1.2.2
Electromatic Relief VLV 2-203-3D	1.2.2
Electromatic Relief VLV 2-203-3E	1.2.2
Safe Shutdown Pump 1/2-2901	5.0
SSP Air Cond Unit	5.0
SSP VLV MO1/2-2901-06	5.0
SSP VLV MO1/2-2901-07	5.0
SSP VLV MO2-2901-08	5.0
Diesel Generator 2	9.2
DG 2 Fuel Oil Transfer Pump	9.2
DG 2 Room Vent Fan	9.2
DG 2 Clg Water Pu Cubicle Cooler	11.1.2.A
DG 2 Cooling Water Pump	11.1.2.A
RHR SW Pu Cub Clr 2-5745C	11.1.2.B
RHR SW Pump 2-1001-65C	11.1.2.B
RHR SW Pu Cub Clr 2-5745D	11.1.2.C
RHR SW Pump 2-1001-65D	11.1.2.C
RHR Pump 2-1002C	11.3.2
RHR Pump 2-1002D	11.3.2
RHR Room Cooler 2-5746B	11.3.2
RHR VLV MO2-1001-16B	11.3.2
RHR VLV MO2-1001-185B	11.3.2
RHR VLV MO2-1001-186B	11.3.2
RHR VLV MO2-1001-187B	11.3.2
RHR VLV MO2-1001-19B	11.3.2
RHR VLV MO2-1001-43C	11.3.2
RHR VLV MO2-1001-43D	11.3.2
RHR VLV MO2-1001-4B	11.3.2
RHR VLV MO2-1001-5B	11.3.2
RHR VLV MO2-1001-7C	11.3.2
RHR VLV MO2-1001-7D	11.3.2

TABLE 2.3-9 (Cont'd)

<u>MECHANICAL EQUIPMENT</u>	<u>LOCATION BY FIRE ZONE</u>
<u>ELECTRIC EQUIPMENT</u>	
480V MCC 28/29-5	1.1.2.2
208V MCC 29-1-1	1.1.2.3
480V MCC 29-1	1.1.2.3
480V MCC 29-4	1.1.2.3
480V MCC 14/24	5.0
125V DC Dist Pnl 1A	6.1.A
125V DC Battery Charger 2	6.2.B
125V DC Dist Pnl 2B	6.2.B
125V DC Reserve Bus 2B-1	6.2.B
120/240V Ess Dist Pnl 902-49	6.3
120/240V Instr Bus 902-50	6.3
125V Battery #2	7.2
480V MCC 29-2	8.2.7.E
4kV SWGR 24	8.2.7.E
480V SWGR 29	8.2.8.C
4kV SWGR 24-1	8.2.8.C
DG 2 Control/Excit/Mtrg	9.2

TABLE 2.3-10COMPONENTS REQUIRED FOR SHUTDOWN PATH L

<u>MECHANICAL EQUIPMENT</u>	<u>LOCATION BY FIRE ZONE</u>
RHR VLV MO2-1001-18A	1.1.2.1.N
RHR VLV MO2-1001-28A	1.1.2.1.N
RHR VLV MO2-1001-29A	1.1.2.1.N
RHR VLV MO2-1001-34A	1.1.2.1.N
RHR VLV MO2-1001-36A	1.1.2.1.N
RHR VLV MO2-1001-37A	1.1.2.1.N
RCIC VLV MO2-1301-23A	1.1.2.2
RHR VLV MO2-1001-26A	1.1.2.2
Target Rock VLV 2-203-3A	1.2.2
Electromatic Relief VLV 2-203-3B	1.2.2
Electromatic Relief VLV 2-203-3C	1.2.2
Electromatic Relief VLV 2-203-3D	1.2.2
Electromatic Relief VLV 2-203-3E	1.2.2
Safe Shutdown Pump 1/2-2901	5.0
SSP Air Cond Unit	5.0
SSP VLV MO1/2-2901-06	5.0
SSF VLV MO1/2-2901-07	5.0
SSP VLV MO2-2901-08	5.0
Diesel Generator 1	9.1
DG 1 Fuel Oil Transfer Pump	9.1
DG 1 Room Vent Fan	9.1
Diesel generator 1/2	9.3
DG 1/2 Fuel Oil Transfer Pump	9.3
DG 1/2 Vent Fan	9.3
DG 1 Clg Wtr Pu Cubicle Cooler	11.1.1.A
DG 1 Cooling Water Pump	11.1.1.A
DG 1/2 Clg Wtr Pu Cubicle Cooler	11.1.1.B
DG 1/2 Cooling Water Pump	11.1.1.B
RHR SW Pu Cub Clr 2-5745A	11.1.2.A
RHR SW Pump 2-1001-65A	11.1.2.A
RHR SW Pu Cub Clr 2-5745B	11.1.2.B
RHR SW Pump 2-1001-65B	11.1.2.B
RHR Pump 2-1002A	11.3.4
RHR Pump 2-1002B	11.3.4
RHR Room Cooler 2-5746A	11.3.4
RHR VLV MO2-1001-16A	11.3.4
RHR VLV MO2-1001-185A	11.3.4
RHR VLV MO2-1001-186A	11.3.4
RHR VLV MO2-1001-187A	11.3.4

TABLE 2.3-10 (Cont'd)

<u>MECHANICAL EQUIPMENT</u>	<u>LOCATION BY FIRE ZONE</u>
RHR VLV MO2-1001-19A	11.3.4
RHR VLV MO2-1001-43A	11.3.4
RHR VLV MO2-1001-43B	11.3.4
RHR VLV MO2-1001-4A	11.3.4
RHR VLV MO2-1001-5A	11.3.4
RHR VLV MO2-1001-7A	11.3.4
RHR VLV MO2-1001-7B	11.3.4
 <u>ELECTRIC EQUIPMENT</u>	
480V MCC 19-1	1.1.1.3
480V MCC 28/29-5	1.1.2.2
125V DC Dist Pnl 2	1.1.2.3
208V MCC 28-1A-1	1.1.2.3
480V MCC 28-1A	1.1.2.3
480V MCC 28-1B	1.1.2.3
480V MCC 14/24	5.0
125V DC Dist Pnl 1B	6.1.B
125V DC Reserve Bus 1B-1	6.1.B
125V DC Battery Charger 2A	6.2.A
125V DC Dist Pnl 2A	6.2.A
120/240V Ess Dist Pnl 902-49	6.3
120/240V Instr Bus 902-50	6.3
125V Battery #2	7.2
480V MCC 19-2	8.2.7.A
480V MCC 28-2	8.2.7.E
4kV SWGR 23	8.2.7.E
4kV SWGR 14-1	8.2.8.A
480V SWGR 19	8.2.8.B
480V SWGR 28	8.2.8.C
4kV SWGR 23-1	8.2.8.D
DG 1 Control Excit/Mtrg	9.1
DG 1/2 Control/Excit/Mtrg	9.3

2.4 COLD SHUTDOWN

The purpose of this section is to demonstrate that for a fire in any single plant fire area of Quad Cities Station at least one method exists to achieve and maintain a safe cold shutdown condition independent of that fire area. For the purpose of this evaluation, hot and cold shutdown are defined as follows:

Hot Shutdown

A plant condition in which the reactor is subcritical and the primary system temperature is sufficient to allow removal of decay heat by steam generation.

Cold Shutdown

A plant condition in which the reactor is subcritical and decay heat is removed by the residual heat removal system. The primary system temperature is reduced to below 212 F and the heat sink is a heat exchanger with a secondary coolant loop.

A safe hot shutdown condition is achieved when the following requirements are satisfied:

1. Reactivity controlled,
2. Decay heat removal established and reactor pressure controlled,
3. Reactor coolant inventory makeup provided, and
4. System status monitoring provided.

Once the reactor is placed in a hot shutdown condition, station personnel are able to provide valve realignment, connections, and/or temporary repairs as needed to achieve and maintain a cold shutdown condition within 72 hours.

To bring the reactor to cold shutdown condition, depressurization to 100 psig or less is necessary so that the RHR system can be shifted to the shutdown cooling mode from the torus cooling mode. This can be done by steam release to the suppression pool either via the RCIC steamlines or the target rock or electromatic relief valves. If electromatic control cables are damaged due to a fire or disabled to prevent spurious activation during hot shutdown, a repair to the power cables to the target rock or the electromatic relief valve may be necessary before depressurization of the reactor can be initiated.

In order to shift the RHR system from the torus cooling mode used for hot shutdown to the shutdown cooling mode of operation after the reactor pressure is lowered to an acceptable level, some RHR valves must be realigned and two additional valves, RHR suction cooling containment isolation valves MO1(2)-1001-47 and MO1(2)-1001-50, not evaluated in the hot shutdown analysis, must be opened (see Table 2.4-1). RHR suction valve MO1(2)-1001-47 is readily accessible in Fire Zone 8.2.7.B (8.2.7.D) and can be manually repositioned after the postulated fire is extinguished. RHR suction valve MO1(2)-1001-50, however, is inside primary containment and is not readily accessible even though entry into primary containment may be possible to manually operate the valve. Therefore, an attempt would normally be made to remotely operate the valve. A fire in Fire Zones 1.1.1.2 and/or 1.1.1.3 (1.1.2.2 and/or 1.1.2.3) could damage a power cable or MCC 18-1B (28-1B) for this valve thus nullifying its remote operability and therefore requiring either a field repair to provide power to this valve or entry into the primary containment to manually open this valve.

TABLE 2.4-1

LIST OF VALVES THAT MUST BE
REALIGNED FOR COLD SHUTDOWN

MO1(2)-1001-7A/B/C/D
MO1(2)-1001-43A/B/C/D
MO1(2)-1001-29A/B
MO1(2)-1001-34A/B
MO1(2)-1001-47
MO1(2)-1001-50
MO1(2)-0202-5B

3.0 UNIT 1 REACTOR BUILDING APPENDIX R EXEMPTION REQUESTS

Per the provisions of 10 CFR 50.12, Commonwealth Edison Company (CECo) requests exemption from the requirements of Sections II.G.2, II.G.3, and III.L of Appendix R. This analysis will demonstrate that the existing separation and fire protection features meet the intent of Appendix R. CECo specifically requests exemption from:

1. The requirement of III.G.2 for separation of redundant RHR trains.
2. The requirements of III.G.3 and III.L that the reactor building and turbine building fire areas be separated from each other by complete 3-hour rated fire barriers.
3. The requirement of III.G.3 that fire areas relying on alternate or dedicated shutdown capability be provided with fire detection and fixed area fire suppression throughout the area.

The justification for these exemptions are presented in the following sections.

SECTION

JUSTIFICATION FOR

- | | |
|-----|---|
| 3.2 | Equivalent separation of redundant RHR trains. |
| 3.3 | Lack of complete 3-hour rated fire barriers between Unit 1 reactor building and turbine building. |
| 3.4 | Lack of complete detection and suppression throughout the reactor building. |

A previous exemption for fixed water suppression above major pieces of electrical equipment in Zones 1.1.1.2 and 1.1.1.3 was granted in 1983 by the D. B. Vassallo, USNRC, letter to D. L. Farrar dated June 23, 1983, subject: Request for Exemption from Requirements of Appendix R to 10 CFR 50, Section III.G.

3.1 REACTOR BUILDING INTRODUCTION

The Unit 1 and Unit 2 reactor buildings are separated by a 3-hour rated fire barrier except on the refueling floor, elevation 690 feet 6 inches, which is open between units.

The Unit 1 reactor building is separated from the turbine building by a 3-hour rated fire barrier except for a partial section of 2-hour rated fire barrier from the 658-foot to 663-foot elevation and HVAC ducts above the 666-foot-6-inch floor elevation that lack fire dampers. In addition, some unrated penetration seals and removable concrete plugs exist between the turbine building ground floor and the reactor building torus basement level. Furthermore, the shield walls between the steam pipe chase and Fire Zone 8.2.7.E are unrated. (Further discussion is contained in Section 3.3.) Fire Zone 9.3 (diesel generator 1/2 room) is separated from the reactor building by 3-hour rated fire barriers.

Since the reactor building contains equipment and cabling associated with the RCIC system and its associated auxiliaries, the dedicated safe shutdown pump (SSP) will be utilized for a fire in the reactor building. The SSP auxiliaries and associated cabling are completely independent of the reactor building.

In the event of a reactor building fire, RHR Division I or II equipment, auxiliaries, and associated cabling, the 1/2 diesel generator feed to 4-kV SWGR 13-1 and 23-1, and the diesel generator 1/2 auxiliaries are utilized to support the SSP shutdown path and are needed within 3 hours. Therefore, as indicated by Figure A-1, if RHR Division II has been affected, RHR Division I will be unaffected and vice versa.

3.2 JUSTIFICATION FOR EQUIVALENT SEPARATION OF REDUNDANT RHR TRAINS

3.2.1 Area Description

Reactor building Unit 1 floor elevations 623 feet, 595 feet, and the torus basement area are the only levels which contain any safe shutdown cabling or equipment. The south portion of the torus level (Fire Zone 1.1.1.1.S) contains necessary Division II cabling and equipment. The north portion of the torus level (Fire Zone 1.1.1.1.N) and the two floor elevations above contain necessary Division I cabling and equipment. Concrete floors separate each elevation and all cable penetrations are sealed. Mechanical penetrations, hatches, stairwells, and HVAC, are unsealed. However, a sprinkler system is provided in Fire Zone 11.2.2, which has the highest combustible loading. Torus level corner rooms are enclosed with reinforced concrete walls with watertight doors to the central torus area.

3.2.2 Fire Protection Systems

Fixed automatic water suppression is provided in the southeast corner room (Fire Zone 11.2.2) and at the single vertical cable riser below the 595-foot 0-inch floor elevation. Fire detection is provided throughout each torus level corner room (Fire Zones 11.2.1, 11.2.2, 11.2.3, and 11.2.4), except above the reactor building equipment drain tank in Fire Zone 11.2.1. Linear thermal detection is located in and beneath cable trays routed through the torus area (Fire Zone 1.1.1.1). Division I and II cables and cable trays are provided with a 1-hour fire resistant wrap where they are routed within 20 feet of one another. This wrap isolates the only combustibles within a 20-foot distance between the north and south portions of the torus. Manual fire fighting capability is available from hose reels located on the northern and southern ends of the torus (see Drawing F-2-1).

Fire detection is provided throughout Fire Zones 1.1.1.2 and 1.1.1.3 (595-foot and 623-foot elevations, respectively) with the exception of the regenerative and nonregenerative heat exchanger room, the cleanup recirculation pump rooms and the cleanup decant pump phase separator pump room. No safe shutdown cabling or equipment is located above this elevation.

Local automatic water suppression systems are provided over the ACAD and air compressor units in Fire Zone 1.1.1.2 (see Drawing F-3-1). Fire detection and automatic water suppression are provided over HPCI pump and turbine in Fire Zone 11.1.3.

Manual hose reels are located on each elevation in the reactor building with a hose reel in each quadrant of the floor area. A number of portable fire extinguishers are also strategically located throughout the reactor building to support manual fire suppression operations.

3.2.3 Safe Shutdown Capability

The new safe shutdown pump powered by diesel generator 2 is used to shut down the unit for a fire in any portion of the reactor building. All of the cabling and equipment associated with this shutdown capability is located only in the turbine building. Only redundant RHR related cabling and equipment is located in the reactor building torus level, 595-foot and 623-foot elevations. The RHR pumps are located in the northeast and southeast torus basement level corner rooms. Division II RHR powered by diesel generator 1 is used to shut down Unit 1 for a fire in any portion of the reactor building except the south portion of the torus level. Division II RHR power cabling for the pumps and room cubicle cooler fan is routed along the south wall of the torus basement level only. Division I RHR power cabling for the pumps and room cubicle cooler fan is routed from the ground floor level directly into the northeast corner room. RHR Division I is powered by diesel generator 1/2.

3.2.4 Fire Hazards Analysis

The objective of this evaluation is to demonstrate an adequate level of protection for the redundant RHR related cabling in the reactor building. Figure C-1 shows the approximate routings of redundant RHR related cabling. There are three specific instances where the configuration deviates from the protection prescribed in Appendix R Section III.G.2.

1. Equipment hatches, open stairway, and unsealed mechanical penetrations between Fire Zones 1.1.1.2 and 11.2.2,
2. The unsealed mechanical penetrations and HVAC ducts without fire rated dampers passing through the concrete floor between Fire Zones 1.1.1.1.S and 1.1.1.2, and
3. The separation between the southern and northern torus level along column line 16.

3.2.4.1 Equipment Hatches, Open Stairway, and Unsealed Mechanical Penetrations Between Fire Zones 1.1.1.2 and 11.2.2

Sealing the penetrations in the ceiling of Fire Zone 11.2.2 to obtain a fire rated barrier is unwarranted. The objective of the barrier is to prevent a fire in Fire Zone 11.2.2 from propagating upward affecting redundant RHR related cables in Fire Zone 1.1.1.2.

This barrier separates the RHR Division II pump room (Fire Zone 11.2.2) from the 595-foot 0-inch ground floor elevation (Fire Zone 1.1.1.2). The average combustible loading in the room is less than 20,000 Btu/ft².

No combustibles pass through unsealed penetrations. The main fire hazard is from cabling and the oil in the pumps. Transient combustibles and potential ignition sources in the zone are controlled administratively.

The 595-foot 0-inch elevation also has a light combustible loading of less than 25,000 Btu/ft². Cable trays are routed near the ceiling of this elevation.

A fire in Fire Zone 1.1.1.2 would not propagate downward into Fire Zone 11.2.2 since the heat and products of combustion would rise and there is no continuity of combustibles into the floor below. A fixed fire detection and automatic water suppression system is installed throughout Fire Zone 11.2.2. The fire detection system provides warning of any fire condition in the zone. Fixed detection is also provided throughout Fire Zone 1.1.1.2. These systems will allow the fire brigade to respond quickly to any fire and support the fixed sprinkler system as necessary.

The automatic sprinkler system will provide additional cooling of the gases to further ensure that cable integrity would not be affected on the ground floor by a fire in Fire Zone 11.2.2. In addition, a fire in Fire Zone 11.2.2 would be confined to the fire zone because of the construction separating the corner room from the remainder of the torus level.

3.2.4.2 Unsealed Mechanical Penetrations and HVAC Ducts Without Fire Rated Dampers Passing Through the Concrete Floor Between Fire Zones 1.1.1.1 and 1.1.1.2

Fire rated penetration seals for mechanical penetrations and fire rated dampers in HVAC ducts passing through the concrete barrier separating the ground floor (Fire Zone 1.1.1.2) and the torus (Fire Zone 1.1.1.1) are unwarranted. It will not significantly increase the level of fire protection for plant safe shutdown capability to protect these openings.

This barrier separates the torus from the ground floor elevation. The portion of the barrier which separates alternate shutdown cabling and equipment from the floor above is south of column line 16. The combustible loading in the torus is negligible (less than 8,000 Btu/ft²) and consists solely of one level of cable trays. Only one cable riser passes through the barrier and is located at K/19. This is the only location where combustibles pass through the barrier. This cable penetration and those from the Unit 1 cable tunnel are sealed at the barrier with fire resistive materials.

The mechanical penetrations are relatively small (a 2-foot by 2-foot ladder access is the largest) and most are covered by steel checker plate. In the majority of cases, a single hole has been core bored with less than 1-inch clearance between the pipe and floor. Transient combustibles and ignition sources in the torus are strictly controlled and cannot be practically introduced due to access limitations. (The combustible loading in Fire Zone 1.1.1.2 is described in Subsection 3.2.4.1.)

A fire in Fire Zone 1.1.1.1 is the main concern regarding this barrier since a fire in Fire Zone 1.1.1.2 would not propagate downward. The objective of the barriers is to prevent a fire in Fire Zone 1.1.1.1 from propagating upward and affecting redundant cable integrity. Fixed linear thermal detection is installed in, and adjacent to, the cable trays routed in the torus. This system will identify a fire in or exposing the cable trays. The heat generated by a cable tray fire with such a small combustible loading and dissipated in such a large volume (e.g., the torus) will not be sufficient to affect combustibles on the floor above with the HVAC ducts and mechanical penetrations unprotected.

The only potential for fire propagation to the floor above could be by combustibles in direct contact with the barrier. Only one vertical cable riser penetrates from the south portion of the torus basement to the ground floor. This riser is sealed at the barrier with fire resistive material. In addition, an automatic water suppression system is installed in the immediate vicinity of this riser below the floor slab at the 595-foot elevation to control and cool products of combustion from a potential cable fire. This will prevent flames and hot gases from passing through any unsealed mechanical penetrations in the vicinity of the cable riser. A fire in the torus can be controlled and extinguished using manual fire fighting equipment.

3.2.4.3 Separation Between the Southern and Northern Torus Level Along Column Line 16

Additional separation of the southern torus and the northern torus along column line 16 is impractical and unnecessary.

Cables associated with the RHR Division II are routed in the southern torus. Cabling related to functional redundancy of the two RHR divisional paths is separated by more than 125 feet. In addition, the Division I cables are located inside the northeast corner room and under Fire Zone 1.1.1.2 directly via a riser (Fire Zone 11.2.4). This zone is separated from the redundant RHR cabling by a reinforced concrete barrier and watertight door.

The combustible loading throughout the torus is negligible as described in Subsections 3.2.4.1 and 4.2.4.2. Transient combustibles are strictly controlled in the torus and are not likely to be introduced due to access limitations. Cable trays are routed around the northern and southern portions of the torus to approximately column line 16. The cable trays are not continuous across the boundary. However, a few cables are routed across this point in conduit.

The objective of having separation of redundancy along column line 16 would be to prevent fire propagation from one side of the torus to the other. Given the limited combustibles (cable in cable trays), an equivalent level of fire protection is provided to satisfy this objective.

The intervening cable trays are protected with a 1-hour fire resistive material for a minimum distance of 20 feet between the northern and southern torus around column line 16. This eliminates any intervening combustibles between the two divisions. The postulated fire in the cable trays on one side of the torus will not have sufficient heat energy to transfer over 20 feet to the nearest combustibles on the other side. The volume for heat dissipation is very large and the combustible loading and expected heat release rate is insignificant. This is also the reason water suppression was not installed throughout the torus level. Fixed linear thermal detection is installed in and adjacent to all cable trays throughout the torus. This will identify a fire in or exposing the cable trays and allow adequate time for response by the fire brigade. Manual fire fighting equipment is located throughout the torus.

3.2.5 Conclusions

The existing fire protection features are equivalent to those required in Appendix R Section III.G.2. These fire protection features in the reactor building will ensure that a fire will not propagate between the two divisions of equipment or affect circuit integrity of the redundant RHR related cable. On the basis of the plant conditions, fire protection features, and fire hazards analysis, an exemption from the Appendix R requirements of III.G.2 is warranted for the following:

1. Mechanical penetrations, stairways, and hatches between Fire Zones 1.1.1.2 and 11.2.2,
2. Unsealed mechanical penetrations and HVAC ducts without fire rated dampers passing through the concrete floor between Fire Zones 1.1.1.1 and 1.1.1.2, and
3. Separation between the southern and northern torus level along column line 16.

3.3 JUSTIFICATION FOR LACK OF COMPLETE 3-HOUR RATED FIRE BARRIERS BETWEEN THE UNIT 1 REACTOR BUILDING AND TURBINE BUILDING

3.3.1 Area Description

The reactor building and turbine building are generally separated by a 3-hour fire barrier. There are, however, certain fire zones (11.1.3, 11.2.3, 11.2.1, 1.1.1.1, 1.1.1.4, 1.1.1.5 and the steam chase in 1.1.1.2) within the Unit 1 reactor building which do not have complete 3-hour rated barriers between those zones and the turbine building.

Fire Zone 11.1.3 contains Unit 1 HPCI cabling and equipment.

Fire Zone 11.2.3 contains the RCIC pump and cabling. The floor and the north wall of Fire Zone 11.2.3 are 3-hour rated fire barriers. The southeast wall is a 3-foot thick concrete interior wall with a nonlabeled watertight door.

The torus level ceiling is heavy, reinforced concrete with removable concrete slabs that allow equipment access to Fire Zones 11.1.3, 11.2.1, and 11.2.3 from Fire Zones 8.2.6.A and 8.2.6.C in the turbine building. This barrier provides a secondary containment seal between the reactor and turbine buildings but is not necessarily a 3-hour rated fire barrier.

Mechanical penetrations passing from the torus basement ceiling (Fire Zones 11.1.3, 11.2.3, 11.2.1, and the western portion of 1.1.1.1) to the turbine building are sealed with noncombustible materials. There are no HVAC duct or electrical penetrations passing through this barrier.

Fire Zone 1.1.1.2 contains no cabling or equipment associated with the safe shutdown pump method. All of the walls, except the barrier separating the steam pipe chase (part of Fire Zone 1.1.1.2) from Fire Zone 8.2.6.A, are 3-hour fire-rated barriers. The steam chase is separated from the turbine building by shield walls with metal access doors. Reactor building Fire Zone 1.1.1.4 (elevation 647 feet 6 inches) is separated from the turbine building by a 3-hour rated fire barrier except for a 2-hour rated fire barrier from the 658-foot to 663-foot elevation, column lines 13 to 15.

Reactor building Fire Zone 1.1.1.5 (elevation 666 feet 6 inches) is separated from the turbine building by a 3-hour rated fire barrier except for HVAC ducts that lack fire dampers.

3.3.2 Fire Protection Systems

Fire Zones 11.2.3 and 11.2.1 contain complete fire detection throughout the zone, except above the reactor building equipment drain tank in Fire Zone 11.2.1. Linear thermal detection is provided in, and adjacent to, all cable trays in the general

torus basement area (Fire Zone 1.1.1.1). Turbine building Fire Zones 8.2.6.A and 8.2.6.C contain fire detection and automatic water suppression in the area above the concrete plugs and sealed mechanical penetrations. Manual hose stations and portable fire extinguishers are also provided to support manual fire fighting operations. Automatic detection and water suppression protect the HPCI pump in Zone 11.1.3.

Fixed fire detection is provided throughout reactor building Fire Zone 1.1.1.2 to provide early warning of fire conditions. Manual hose stations and portable extinguishers are located in this zone to support manual fire suppression operations. Fixed automatic water suppression systems are provided in the turbine building fire zones (8.1, 8.2.6.A, 8.2.6.C, and 8.2.7.B) adjacent to the steam pipe chase.

3.3.3 Safe Shutdown Capability

Fire Zone 11.2.3 contains the RCIC pump and Division I cabling associated with the alternate shutdown path E2 used for a fire in Fire Zone 8.2.6.C.

Fire Zone 8.2.6.C contains safe shutdown pump cabling and equipment associated with shutdown path A which is used for a fire in the RCIC room. Tables 2.3-1 and 2.3-6 list the safe shutdown equipment utilized in each of these shutdown paths. (See Drawings F-12-2 through F-12-5.)

Appendix R Sections III.G.3 and III.L require that alternate shutdown paths be separated by a complete 3-hour rated fire barrier. The barrier separating Fire Zones 8.2.6.A and 8.2.6.C from the reactor building is not a complete fire barrier only because of the concrete slabs and mechanical penetrations in the barrier (described in Subsection 3.3.1).

The safe shutdown path A is available for a fire in Fire Zone 1.1.1.2. This path uses the safe shutdown pump method. Table 2.3-1 lists the safe shutdown equipment used for this path. Cabling and equipment associated with this path are independent of Fire Zone 1.1.1.2 and the steam pipe chase. In addition, there is no safe shutdown equipment or cabling in the steam chase.

3.3.4 Fire Hazards Analysis

Upgrading the penetration seals in the barrier between the torus basement and turbine building is not warranted.

The main objective of the fire barrier is to prevent a fire in the reactor building torus basement level from spreading upward into the turbine building. A fire starting on the turbine building ground floor would not propagate downward

into the torus basement. Heat and products of combustion from such a fire would rise and no combustible materials pass through this barrier. The barrier is completely sealed (not necessarily with material having 3-hour fire resistance) as part of secondary containment preventing any radiative heat transmission.

The potential heat exposure to the barrier from below would be extremely light. The combustibles in Fire Zone 11.2.3 consist of 10 gallons of lube oil associated with the RCIC pump and cabling material. This results in a light average combustible loading in the zone of less than 10,000 Btu/ft². Transient combustibles and ignition sources are strictly controlled at this floor level. In the unlikely event of fire in the torus basement level, the concrete barrier at the ceiling will provide a significant barrier to fire. Fire detection installed at this level will provide warning of any fire conditions allowing for a timely response of the fire brigade. The removable concrete plugs, provided for access to major equipment in the torus basement, provide sufficient fire resistance. The mechanical penetration seal material is noncombustible. This material is not 3-hour fire rated, however, it will provide substantial fire resistance. The expected fire scenario will not release sufficient heat to degrade this seal material. Heat transmission through the barrier would not threaten combustibles in the zone above. In addition, automatic water suppression is installed in the area above the unrated penetrations. This system would provide additional cooling of the barrier and penetration seals.

The main objective of the fire barrier between the reactor and turbine buildings is to prevent fire spread from one to another. This barrier is 3-hour fire rated, except for the unrated walls separating the steam pipe chase from Fire Zone 8.2.6.A.

The walls separating the steam pipe chase from Fire Zone 8.2.6.A are shield walls with access gained through an airlock consisting of two metal doors. Fixed automatic water suppression systems are provided in the turbine building adjacent to the steam pipe chase. There are no combustibles in the steam pipe chase.

Heat transfer from any fixed combustible fire in Fire Zone 1.1.1.2 to the steam chase would be limited. Convective forces would drive heat and products of combustion to the ceiling. The ceiling construction is of deep reinforced concrete beams. The beam pocket above the fixed combustibles is approximately 22-foot x 25-foot x 3-foot. The smoke layer would first have to fill this pocket and spill over into the adjacent pocket to a depth of 2 feet before products of combustion would pass

through the small vent opening in the wall between the ground floor of the reactor building and the steam pipe chase into the pipe chase. Radiative effects would be negligible. A fire could not propagate into the steam chase because of the lack of combustibles.

A fire also could not spread from the turbine building into the pipe chase to the reactor building because of the enclosure around the pipe chase, the lack of fixed combustibles in the pipe chase, and the small opening in the barrier between the turbine building and pipe chase.

The fixed fire detection would provide early warning of any fire in Fire Zone 1.1.1.2 allowing the fire brigade ample time for response with available manual equipment. The local water suppression system above the air compressor would provide cooling for any fire near the air compressor. Automatic water suppression is provided in the HP heater bay in the turbine building adjacent the steam pipe chase enclosure and over the floor above the enclosure.

A small portion of the wall between reactor building Fire Zone 1.1.1.4 (from 658-foot to 663-foot elevation, column lines 13 to 15) and the 480-V switchgear in turbine building Fire Zone 8.2.8.B is 2-hour rated. Combustible loading in Fire Zone 1.1.1.4 is very light (less than 5,000 Btu/ft²). The combustibles in turbine building Fire Zone 8.2.8.B consist almost entirely of oil in the MG sets which are protected by both automatic wet pipe sprinklers and foam-water sprinklers. The existing 2-hour rated barrier provides sufficient fire resistance to prevent fire spread through the barrier.

The HVAC ducts without dampers are located in the wall between Fire Zone 1.1.1.5 and Fire Zone 1.1.1.5.A. Neither of these fire zones contain safe shutdown cables or equipment and the combustible loading for both fire zones is very light (less than 5000 Btu/ft²). Thus, installation of fire dampers will not significantly increase the level of fire protection.

3.3.5 Conclusions

The existing configuration provides an adequate level of fire protection equivalent to satisfy the intent of Appendix R Sections III.G.3 and III.L.

On the basis of the plant conditions, fire protection features, and fire hazards analysis, an exemption from the Appendix R requirements of Sections III.G.3 and III.L is warranted for:

1. Replacement of seals for mechanical penetrations and concrete plugs with materials specifically tested and given a 3-hour fire resistive rating to provide a complete 3-hour barrier between fire areas using alternate shutdown

paths. Upgrading the seals around the concrete plugs and mechanical penetrations with materials specifically tested and given a 3-hour fire resistive rating is unwarranted. All penetrations in the barrier are sealed because the barrier borders secondary containment. Penetration seal materials used for any seals are noncombustible and sprinklers are provided above the seals. Replacing the seals in the barrier with materials specifically tested and rated to the standard 3-hour fire exposure will not increase the level of fire protection.

2. Lack of complete 3-hour fire barriers between the steam pipe chase and turbine building, Fire Zone 8.2.6.A which uses a different shutdown path. Lack of combustibles in the steam pipe chase and the presence of automatic suppression systems in the turbine building areas outside the steam chase would prevent a fire from spreading between the two buildings.
3. Provisions of a small section of 2-hour barriers in the predominantly 3-hour wall between the turbine and reactor buildings at elevations 658 feet to 663 feet only. Upgrading this portion of the wall would not significantly improve the passive fire protection provided considering the light combustible loading.
4. Lack of fire dampers in the HVAC duct between Fire Zones 1.1.1.5 and 1.1.1.5.A. Since the combustible loading of this fire zone is light and because there are no safe shutdown cables and equipment in this fire zone, installation of fire dampers will not increase the level of fire protection.

3.4 JUSTIFICATION FOR LACK OF COMPLETE DETECTION AND SUPPRESSION THROUGHOUT THE REACTOR BUILDING

3.4.1 Area Description

The Unit 1 reactor building is a separate fire area separated from the Unit 2 reactor building and turbine building by 3-hour rated fire barriers (with the few exceptions discussed in Section 3.3). The Unit 1 inerted drywell is a complete fire area separated from the surrounding reactor building by complete 3-hour rated fire barriers. The Unit 1 reactor building is subdivided into a number of fire zones. The fire zone boundaries were established using existing substantial barriers and floor elevations, however, these barriers are not rated fire barriers. The fire zones in this Unit 1 reactor building include:

<u>FIRE ZONE</u>	<u>DESCRIPTION</u>
1.1.1.1	Reactor Building Elevation 554 feet 6 inches Basement Floor
1.1.1.2	Reactor Building Elevation 595 feet 0 inches Ground Floor
1.1.1.3	Reactor Building Elevation 623 feet 0 inches Mezzanine floor
1.1.1.4	Reactor Building Elevation 647 feet 6 inches Main Floor
1.1.1.5	Reactor Building Elevation 666 feet 6 inches Reactor Floor
1.1.1.6	Reactor Building Elevation 690 feet 6 inches Refueling Floor
11.1.3	Turbine Building Elevation 554 feet 0 inches HPCI Room

<u>FIRE ZONE</u>	<u>DESCRIPTION</u>
11.2.1	Reactor Building Elevation 554 feet 0 inches Southwest Corner Room
11.2.2	Reactor Building Elevation 554 feet 0 inches Southeast Corner Room
11.2.3	Reactor Building Elevation 554 feet 0 inches Northwest Corner Room
11.2.4	Reactor Building Elevation 554 feet 0 inches Northeast Corner Room

These fire zones are shown on Figure A-1. The description of the torus elevation fire zones (1.1.1.1, 11.2.1, 11.2.2, 11.2.3, 11.2.4, and 11.1.3) along with the fire protection evaluation for the lack of fixed water suppression throughout this elevation is discussed as part of Subsections 3.2.2 and 3.2.4.

3.4.1.1 Reactor Building - Ground Floor Elevation 595 feet 0 inches
(Fire Zone 1.1.1.2)

The south and east walls are reinforced concrete exterior walls, except for a 3-hour barrier to a turbine building access corridor with a Class A fire door in the south wall and the 3-hour barrier that separates the reactor building from the diesel generator 1/2 room. The north wall separates Fire Zone 1.1.1.2 (Unit 1) from Fire Zone 1.1.2.2 (Unit 2) and is a 3-hour rated reinforced concrete wall with all penetrations sealed with materials having a 3-hour fire rating. The west wall separates the reactor building from the turbine building and is a 3-hour fire rated reinforced concrete wall (with the one exception discussed in Subsection 3.3.4). The floor of Fire Zone 1.1.1.2 is the ceiling of Fire Zone 1.1.1.1 (see Subsection 3.3.4).

The ceiling of Fire Zone 1.1.1.2 is the floor of Fire Zone 1.1.1.3 and is made of structural concrete. The ceiling has open stairwells, hatches, and unsealed mechanical penetrations. The electrical penetrations through the ceiling are sealed with noncombustible material. This fire zone surrounds the drywell (Fire Zone 1.2.1).

3.4.1.2 Reactor Building - Mezzanine Floor Elevation 623 feet
0 inches (Fire Zone 1.1.1.3)

The south and east walls are reinforced concrete exterior walls.

The north wall separates Fire Zone 1.1.1.3 (Unit 1) from Fire Zone 1.1.2.3 (Unit 2) and is a 3-hour rated reinforced concrete wall with Class A fire doors and all penetrations sealed with materials having a 3-hour fire rating. The west wall separates the reactor building from the turbine building and is a 3-hour fire rated reinforced concrete wall. The floor of Fire Zone 1.1.1.3 is the ceiling of Fire Zone 1.1.1.2.

The ceiling of Fire Zone 1.1.1.3 is the floor of Fire Zone 1.1.1.4 and is made of structural concrete. The ceiling has open stairwells, hatches, and unsealed mechanical penetrations. The electrical penetrations through the ceiling are sealed with noncombustible material. This zone surrounds the drywell (Fire Zone 1.2.1).

3.4.2 Fire Protection Systems

Fixed fire detection is provided throughout Fire Zones 1.1.1.2 and 1.1.1.3 to provide early warning of fire conditions in these fire zones. Fixed automatic water suppression systems are provided directly above the two air compressors located in Fire Zone 1.1.1.2. Manual hose stations and portable extinguishers are located on each elevation of the reactor building to support manual fire suppression operations.

3.4.3 Safe Shutdown Capability

The safe shutdown path A is available for a fire in Fire Zones 1.1.1.2, 1.1.1.3, 1.1.1.4, 1.1.1.5, or 1.1.1.6. This path uses the safe shutdown pump method using RHR Division II and the dedicated Unit 1 diesel generator. Table 2.3-1 lists the safe shutdown equipment used for this path. The RHR Division II equipment is located in Fire Zone 11.2.2. The cabling for this equipment is routed through the southern half of the torus (Fire Zone 1.1.1.1.S) from Fire Zone 11.2.1. The safe shutdown pump and diesel generator and related cabling are routed only in the turbine building.

3.4.4 Fire Hazards Analysis

The addition of a complete fixed water suppression system throughout Fire Zones 1.1.1.2, 1.1.1.3, 1.1.1.4, 1.1.1.5, and 1.1.1.6 (in addition to Fire Zones 11.2.1, 11.2.3, 11.2.4, and 1.1.1.1 discussed in Section 3.3) and fire detection throughout Fire Zones 1.1.1.3, 1.1.1.4, 1.1.1.5, and 1.1.1.6 is unwarranted.

These fire zones utilize the safe shutdown pump method path A for shutdown. Equipment and cabling associated with this path is independent of these fire zones and is located in the turbine building and southern half of the torus. There is no safe shutdown cabling or equipment in Fire Zones 1.1.1.4, 1.1.1.5 or 1.1.1.6.

A fire in any of these fire zones must propagate downward into the southern torus or into the turbine building before the identified shutdown path is affected by the fire.

3.4.4.1 Fire Zone 1.1.1.2

The combustibles in Fire Zone 1.1.1.2 consist mostly of 151,600 ft of cable. This zone is the ground floor of the reactor building. It is frequently traveled and occasionally used as a staging area. Transient combustibles in the fire zone include RWP clothing and limited lubricating and cleaning fluids. These transient combustibles are controlled to minimal quantities by station administrative procedures. Lubricating and cleaning fluids are only used in approved containers. The combustible loading in the fire zone is less than 30,000 Btu/ft².

The worst case postulated fire could involve the transients and cable insulation material. Any fire on this elevation would not expose the safe shutdown cables or equipment in the southern half of the torus below since heat and products of combustion of the buoyant fire plume will use the ceiling and floors away from the torus. All mechanical, hatch, and stairwell openings in the southern half of the floor in Fire Zone 1.1.1.2 (south of column line 16) are sealed liquid tight with noncombustible material or curbed to prevent a liquid spill from flowing into the torus below. All electrical penetrations are sealed in the floor and ceiling with a noncombustible material.

Available test data found in the FMRC/EPRI test reports, "Categorization of Cable Flammability" NP-1881, August 1982, provides information describing the burning characteristics of PE/PVC cable in horizontal cable trays.

The heat of combustion of PE/PVC is less than 11,000 Btu/lb. The EPRI tests show that flame spread along horizontal cable trays is very slow. The test reports for horizontal fire spread in deep stacks of horizontal cable trays agrees with observations of the rate of fire spread in similar tray arrays in the reactor building at the Browns Ferry fire. The horizontal spread rate for cable tray fires is about 6 to 7 ft/hr.

Although the cable tray arrangement in Fire Zone 1.1.1.2 is far less severe than that tested in the EPRI report, the parameters from those tests can be used to show a conservative fire scenario. These parameters would indicate that only about 21 feet of cable would be consumed in a 3-hour fire. The heat would be dissipated into an extremely large room volume. Heat would also be lost to the surrounding enclosure and floor above. Convective and radiative heat transfer effects from such a fire would obviously not affect cables in Fire Zones 1.1.1.1 or 1.1.2.2 below.

Fire detection throughout Fire Zone 1.1.1.2 will provide early warning of fire conditions in the zone. This will provide ample time for manual fire fighting operations to control fire spread in the trays to much less than postulated above. Manual fire fighting equipment is available in the fire zone to allow the brigade to perform this function.

3.4.4.2 Fire Zone 1.1.1.3

The combustibles in Fire Zone 1.1.1.3 consist mostly of 75,700 ft of cable. This fire zone is normally not heavily traveled during operation. Transient combustibles are controlled to minimal quantities by station administrative procedures. The combustible loading in the fire zone is less than 20,000 Btu/ft².

This fire zone (1.1.1.3) is two elevations above the torus area of concern where RHR Division II cables and equipment are located. The fire scenario for this zone will be somewhat similar to that for Fire Zone 1.1.1.2. Heat and products of combustion of the buoyant fire plume from a fire involving combustibles on this floor will disperse to the ceiling and floors away from the torus. Electrical penetrations in the floor and ceiling of the fire zone are sealed with noncombustible material. Again, a fire on this floor would not expose the cabling or equipment related with the identified shutdown path (A).

Fire detection is provided throughout the fire zone with the exception of the regenerative and nonregenerative heat exchanger room and the cleanup decant pump phase separator pump room. This detection system will provide early warning of fire conditions which will allow the fire brigade ample time for manual suppression operations using available fire fighting equipment in the fire zone.

3.4.4.3 Fire Zones 1.1.1.4, 1.1.1.5, and 1.1.1.6

There is no safe shutdown equipment or cabling associated with any plant shutdown method in these zones. The total average combustible loadings for these fire zones are less than 3,000 Btu/ft², 2,000 Btu/ft², and 1,000 Btu/ft², respectively. These zones are located at least 50 feet above the ground floor. Fires in these fire zones would not propagate downward since the heat and products of combustion would rise to the ceiling and floors above and all electrical penetrations in the floor and ceiling of these fire zones are sealed with noncombustible materials.

Fire detection is not warranted in these fire zones because there is no safe shutdown cabling or equipment in these zones. Although fire brigade response would be delayed, there is no potential for exposure to safe shutdown functions.

3.4.5 Conclusions

The existing fire protection features are equivalent to those required in Appendix R Sections III.G.2 and III.G.3. These fire protection features in the reactor building will ensure that a fire will not propagate between the two divisions of equipment or affect circuit integrity of the redundant RHR related cable or spread outside the reactor building fire area to access of alternate shutdown equipment (i.e., turbine building, Unit 2 reactor building). On the basis of the plant conditions, fire protection features, and fire hazards analysis, an exemption from the Appendix R requirements of Sections III.G.2, III.G.3, and III.L is warranted for:

1. Fixed automatic fire suppression throughout Fire Zones 11.2.1, 11.2.3, 11.2.4, 1.1.1.1, 1.1.1.2, 1.1.1.3, 1.1.1.4, 1.1.1.5, and 1.1.1.6 in the Unit 1 reactor building fire area.
2. Fixed fire detection throughout Fire Zones 1.1.1.3, 1.1.1.4, 1.1.1.5, and 1.1.1.6. |

A previous exemption was granted for water suppression over major pieces of electrical equipment in Fire Zones 1.1.1.2 and 1.1.1.3. See the D. B. Vassallo, USNRC, letter to D. L. Farrar, dated June 23, 1983, subject: Request for Exemption from Requirements of Appendix R to 10 CFR 50, Section III.G.

4.0 UNIT 2 REACTOR BUILDING APPENDIX R EXEMPTION REQUEST

Per the provision of 10 CFR 50.12, Commonwealth Edison Company (CECo) requests exemption from the requirements of Sections III.G.2, III.G.3, and III.L of Appendix R. This analysis will demonstrate that the existing separation and fire protection features meet the intent of Appendix R. CECO specifically requests exemption from:

1. The requirement of III.G.2 for separation of redundant RHR trains.
2. The requirements of III.G.3 and III.L that the reactor building and turbine building fire areas be separated from each other by complete 3-hour rated fire barriers.
3. The requirement of III.G.3 that fire areas relying on alternate or dedicated shutdown capability be provided with fire detection and automatic fire suppression throughout the area.

The justification for these exemptions are presented in the following sections:

<u>SECTION</u>	<u>JUSTIFICATION FOR</u>
4.2	Equivalent separation of redundant RHR trains
4.3	Lack of complete 3-hour rated fire barriers between the Unit 2 reactor building and the turbine building
4.4	Lack of complete fire detection and suppression throughout the reactor building

A previous exemption for fixed water suppression above major pieces of electrical equipment in Fire Zones 1.1.2.2 and 1.1.2.3 was granted in 1983 by the D. B. Vassallo, USNRC, letter to D. L. Farrar dated June 23, 1983, subject: Request for Exemption from Requirements of Appendix R to 10 CFR 50, Section III.G.

4.1 REACTOR BUILDING INTRODUCTION

The Unit 1 and Unit 2 reactor buildings are separated by a 3-hour rated fire barrier except on the refueling floor, Elevation 690 feet 6 inches, which is open between units.

The reactor building is separated from the turbine building by a 3-hour rated fire barrier except for a 2-hour rated fire barrier from the 658-foot to 663-foot elevation and HVAC ducts above the 666-foot-6-inch floor elevation that lack fire dampers. In addition, some unrated penetration seals and removable concrete plugs exist between the turbine building ground floor and the reactor building torus basement level. Furthermore, the shield walls between the steam pipe chase and Fire Zone 8.2.7.E are unrated. (See further discussion in Sections 3.3 and 3.4.) Fire Area 9.3 (diesel generator 1/2 room) is separated from the reactor building by 3-hour rated fire barriers.

Since the reactor building contains equipment and cabling associated with the RCIC system and its associated auxiliaries, the dedicated safe shutdown pump (SSP) will be utilized for a fire in the reactor building. The SSP auxiliaries, associated cabling, and power source are completely independent of the reactor building.

In the event of a reactor building fire, RHR Division I or II equipment, auxiliaries, and associated equipment (the 1/2 diesel generator feed to 4-kV SWGR 13-1 and 23-1, and the 1/2 diesel generator auxiliaries) are utilized to support the SSP shutdown path. This equipment is needed within 3 hours. Therefore, as indicated by Figure A-1, if RHR Division II has been affected, RHR Division I will be unaffected and vice versa.

4.2 JUSTIFICATION FOR EQUIVALENT SEPARATION OF REDUNDANT RHR TRAINS

4.2.1 Area Description

Reactor building Unit 2 floor elevations 623 feet and 595 feet and the torus basement area are the only levels which contain any safe shutdown cabling or equipment. The southern portion of the torus level (Fire Zone 1.1.2.1.S) contains necessary Division II cabling and equipment. The northern portion of the torus level (Fire Zone 1.1.2.1.N) and the two floor elevations above contain necessary Division I cabling and equipment. Concrete floors separate each elevation and all cable penetrations are sealed. Mechanical penetrations, hatches, stairwells, and HVAC penetrations are unsealed. However, a sprinkler system is provided in Fire Zone 11.2.2 which has the highest combustible loading. Torus level corner rooms are enclosed with reinforced concrete walls with watertight doors to the central torus area.

4.2.2 Fire Protection Systems

Fixed automatic water suppression is provided in the southeast corner room (Fire Zone 11.3.2) and at the single vertical cable riser below the 595-foot 0-inch floor elevation. Fire detection is provided throughout each torus level corner room (Fire Zones 11.3.1, 11.3.2, 11.3.3, and 11.3.4), except above the reactor building equipment drain tank in Fire Zone 11.3.3. Linear thermal detection is located in and adjacent to cable trays routed through the torus area (Fire Zone 1.1.2.1). Cables and cable trays located within 10 feet to the north and south of column line 10 are provided with a 1-hour fire resistant wrap. This wrap isolates the only combustibles within a 20-foot distance between the north and south portions of the torus. Manual fire fighting capability is available from hose reels located in the torus basement level (see Drawing F-2-1).

Fire detection is provided throughout Fire Zones 1.1.2.2 and 1.1.2.3 with the exception of the regenerative and nonregenerative heat exchanger room, the cleanup recirculation pump rooms, and the cleanup decant pump phase separator pump room (595-foot and 623-foot elevations, respectively). No safe shutdown cabling or equipment is located above these elevations.

Local automatic water suppression systems are provided over the ACAD and air compressor units in Fire Zone 1.1.2.2 (see Drawing F-3-1).

Manual hose reels are located on each elevation in the reactor building with hose reels in each quadrant of the floor area. A number of portable fire extinguishers are also strategically located through the reactor building to support manual fire suppression operations.

4.2.3 Safe Shutdown Capability

The new safe shutdown pump powered by diesel generator 1 is used to shut down the unit for a fire in any portion of the reactor building. All of the cabling and equipment associated with this shutdown capability is located only in the turbine building. Only redundant RHR related cabling and equipment is located in the reactor building torus level, 595-foot and 623-foot elevations. The RHR pumps are located in the northeast and southeast torus basement level corner rooms. Division II RHR powered by diesel generator 2 is used to shut down Unit 2 for a fire in any portion of the reactor building except the south portion of the torus level. Division II RHR power cabling for the pumps and room cubicle cooler fan is routed along the south wall of the torus basement level. Division I RHR power cabling for the pumps and room cubicle cooler fan is routed from the ground floor level directly into the northeast corner room. RHR Division I is powered by diesel generator 1/2.

4.2.4 Fire Hazards Analysis

The objective of this evaluation is to demonstrate an adequate level of protection for the redundant RHR related cabling in the reactor building. Figure C-2 shows the approximate routings of redundant RHR related cabling. There are three specific instances where the configuration deviates from the protection prescribed in Appendix R Section III.G.2:

1. Equipment hatches, open stairway, and unsealed mechanical penetrations between Fire Zones 1.1.2.2 and 11.3.2,
2. The unsealed mechanical penetrations and HVAC ducts, without fire rated dampers, passing through the concrete floor between Fire Zones 1.1.2.1.S and 1.1.2.2, and
3. The separation between the southern and northern torus level along column line 10.

4.2.4.1 Equipment Hatches, Open Stairway, and Unsealed Mechanical Penetrations Between Fire Zones 1.1.2.2 and 11.3.2

Sealing the penetrations in the ceiling of Fire Zone 11.3.2 to obtain a fire rated barrier is unwarranted. The objective of the barrier is to prevent a fire in Fire Zone 11.3.2 from propagating upward thus affecting redundant RHR related cables in Fire Zone 1.1.2.2.

This barrier separates the RHR Division II pump room (Fire Zone 11.3.2) from the 595-foot 0-inch ground floor elevation (Fire Zone 1.1.2.2). The average combustible loading in the room is less than 20,000 Btu/ft². No combustibles pass through unsealed penetrations. The main fire hazard is from cabling and the oil in the pumps. Transient combustibles and potential ignition sources in the fire zone are administratively controlled.

The 595-foot 0-inch elevation also has a light combustible loading of less than 25,000 Btu/ft². Cable trays are routed near the ceiling of this elevation.

A fire in Fire Zone 1.1.2.2 would not propagate downward into Fire Zone 1.1.3.2 since the heat and products of combustion would rise. There is no continuity of combustibles between Fire Zone 1.1.1.2 and the floor below. A fixed fire detection and automatic water suppression system is installed throughout Fire Zone 1.1.3.2. The fire detection system provides early warning of any fire condition in the fire zone. Fixed detection is also provided throughout Fire Zone 1.1.2.2. These systems will allow the fire brigade to respond quickly to any fire and support the fixed sprinkler system as necessary.

The automatic sprinkler system will provide additional cooling of the gases to further ensure that cable integrity would not be affected on the ground floor by a fire in Fire Zone 1.1.3.2. In addition, a fire in Fire Zone 1.1.2.2 would be confined to the zone because of the construction separating the corner room from the remainder of the torus level.

4.2.4.2 Unsealed Mechanical Penetrations and HVAC Ducts Without Fire Rated Dampers Passing Through the Concrete Floor Between Fire Zones 1.1.2.1.S and 1.1.2.2

Fire rated penetration seals for mechanical penetrations and fire rated dampers in HVAC ducts passing through the concrete barrier separating the ground floor (Fire Zone 1.1.2.2) and the torus (Fire Zone 1.1.2.1) are unwarranted. It will not significantly increase the level of fire protection for plant safe shutdown capability to protect these openings.

This barrier separates the torus from the ground floor elevation. The portion of this barrier which separates alternate shutdown cabling and equipment is south of column line 10. The combustible loading in the torus is negligible (less than 5,000 Btu/ft²) and consists solely of one level of cable trays. Only one cable riser passes through the barrier and is located at K/13. This is the only location where combustibles pass through the barrier. This cable penetration and those from the Unit 2 cable tunnel into the torus are sealed at the barrier with fire resistive materials.

The mechanical penetrations are relatively small (a 2-foot by 2-foot ladder access is the largest) and most are covered by steel checkerplate. In the majority of cases, a single hole has been core bored with less than 1-inch clearance between the pipe and floor. Transient combustibles and ignition sources in the torus are strictly controlled and cannot be practically introduced due to access limitations. (The combustible loading in Fire Zone 1.1.2.2 is described in Subsection 4.2.4.)

A fire in Fire Zone 1.1.2.1 is the main concern regarding this barrier since a fire in Fire Zone 1.1.2.2 would not propagate downward. The objective of the barrier is to prevent a fire in Fire Zone 1.1.2.1 from propagating upward and affecting redundant cable integrity. Fixed linear thermal detection is installed in, and adjacent to, the cable trays routed in the torus. This system will identify a fire in or exposing the cable trays. The heat generated by a cable tray fire with such a negligible combustible loading and dissipated in such a large volume (e.g., the torus) will not be sufficient to affect combustibles on the floor above even with the HVAC ducts and mechanical penetrations unprotected.

The only potential for fire propagation to the floor above could be by combustibles in direct contact with the barrier. Only one vertical cable riser penetrates from the south portion of the torus basement to the ground floor. This riser is sealed at the barrier with fire resistive material. In addition, an automatic water suppression system is installed in the immediate vicinity of this riser below the floor slab at the 595-foot elevation to control and cool products of combustion from a potential cable fire. This will prevent flame and hot gases from passing through any unsealed mechanical penetrations in the vicinity of the cable riser. A fire in the torus can be controlled and extinguished using manual fire fighting equipment.

4.2.4.3 Separation Between the Southern and Northern Torus Level Along Column Line 10

Additional separation of the southern and northern torus along column line 10 is impractical and unnecessary.

Cables associated with the RHR Division II are routed in the southern half of the torus. Cabling related to functional redundancy of the two RHR divisional paths is separated by more than 125 feet. In addition, the Division I cables are located inside the northeast corner room and under Fire Zone 1.1.2.2 directly via a riser (Fire Zone 11.3.4). This zone is separated from the redundant RHR cabling by a reinforced concrete barrier and watertight door.

The combustible loading throughout the torus is negligible as described in Subsections 4.2.4 and 3.2.4. Transient combustibles are strictly controlled in the torus and not likely to be introduced due to access limitations. Cable trays are routed around the northern and southern portions of the torus to approximately column line 10. The cable trays are not continuous across the boundary. However, a few cables are routed across this point in conduit.

The objective of having separation of redundancy along column line 10 would be to prevent fire propagation from one side of the torus to the other. Given the limited combustibles (cable in cable trays), an equivalent level of fire protection is provided to satisfy this objective.

The intervening cable trays are protected with a 1-hour fire resistive material for a minimum distance of 20 feet between the northern and southern torus around column line 10. This eliminates any intervening combustibles between the two divisions. The postulated fire in the cable trays on one side of the torus will not have sufficient heat energy to transfer over 20 feet to the nearest combustibles on the other side. The volume for heat dissipation is very large and the combustible loading and expected heat release rate is insignificant. This is also the reason that water suppression was not installed throughout the torus level. Fixed linear thermal detection is installed in and adjacent to all cable trays throughout the torus. This will identify a fire in or exposing the cable trays and allow adequate time for response by the fire brigade. Manual fire fighting equipment is located throughout the torus.

4.2.5 Conclusions

The existing fire protection features are equivalent to those required in Appendix R Section III.G.2. These fire protection features in the reactor building will ensure that a fire will not propagate between the two divisions of equipment or affect circuit integrity of the redundant RHR related cable. On the basis of the plant conditions, fire protection features, and fire hazards analysis, an exemption from the Appendix R requirements of Section III.G.2 is warranted for:

1. Mechanical penetrations, stairways, and hatches between Fire Zones 1.1.2.2 and 11.3.2.
2. Unsealed mechanical penetrations and HVAC ducts without fire rated dampers passing through the concrete floor between Fire Zones 1.1.2.2 and 1.1.2.1.
3. Separation between the southern and northern torus level along column line 10.

4.3 JUSTIFICATION FOR LACK OF COMPLETE 3-HOUR RATED FIRE BARRIERS BETWEEN THE UNIT 2 REACTOR BUILDING AND THE TURBINE BUILDING

4.3.1 Area Description

The reactor building and the turbine building are generally separated by a 3-hour fire barrier. There are, however, certain fire zones (11.1.4, 11.3.3, 11.3.1, 1.1.2.1, 1.1.2.4, 1.1.2.5, and the steam chase in 1.1.2.2) within the Unit 2 reactor building which do not have complete 3-hour rated fire barriers between those fire zones and the turbine building.

Fire Zone 11.1.4 contains Unit 2 HPCI cabling and equipment.

Fire Zone 11.3.1 contains the RCIC pump and cabling. The floor and the south wall of Fire Zone 11.3.1 are 3-hour rated fire barriers. The northeast wall is a 3-foot thick concrete interior wall with an unlabeled watertight door.

The torus level ceiling is heavy reinforced concrete with removable concrete slabs that allow equipment access to Fire Zone 11.1.4, 11.3.1, and 11.3.3 from Fire Zone 8.2.6.C and 8.2.6.E in the turbine building. This barrier provides a secondary containment seal between the reactor and turbine buildings but is not necessarily a 3-hour rated fire barrier.

Mechanical penetrations passing from the torus basement ceiling (Fire Zones 11.1.4, 11.3.3, 11.3.1, and the western portion of 1.1.2.1) to the turbine building are sealed with noncombustible materials. There are no unsealed HVAC duct or electrical penetrations passing through this barrier.

Fire Zone 1.1.2.2 contains no cabling or equipment associated with the safe shutdown pump method B. All of the walls at this elevation, except the barrier separating the steam pipe chase (part of Fire Zone 1.1.2.2) from Fire Zone 8.2.6.E, are 3-hour rated fire barriers. The steam chase is separated from the turbine building by substantial, reinforced concrete shield walls in the turbine building at this elevation with locked metal access doors.

Reactor building Fire Zone 1.1.2.4 (657-foot 6-inch elevation) is separated from the turbine building by a 3-hour rated fire barrier except for a 2-hour rated fire barrier from the 658-foot to 663-foot elevation, column lines 11 to 13.

Reactor building Fire Zone 1.1.2.5 (elevation 666 feet 6 inches) is separated from the turbine building by a 3-hour rated fire barrier except for HVAC ducts that lack fire dampers.

4.3.2 Fire Protection Systems

Fire Zones 11.3.1 and 11.3.3 contain complete fire detection throughout the zone, except above the reactor building equipment drain tank in Fire Zone 11.3.3. Linear thermal detection is provided in, and adjacent to, all cable trays in the general torus basement area (Fire Zone 1.1.2.1). Turbine building Fire Zones 8.2.6.C and 8.2.6.E contain fire detection and automatic water suppression in the area above the concrete plugs and sealed mechanical penetrations. Manual hose stations and portable fire extinguishers are also provided to support manual fire fighting operations.

Fixed fire detection is provided throughout reactor building Fire Zone 1.1.2.2 to provide early warning of fire conditions. Manual hose stations and portable extinguishers are located in this zone to support manual fire suppression operations. Fixed automatic water suppression systems are provided in the turbine building adjacent to the steam pipe chase in Fire Zones 8.2.6.D, 8.2.6.E, and 8.2.7.D. The only other turbine building fire zone (5.0) adjacent to the steam pipe chase is separated from it by a 3-hour rated wall.

4.3.3 Safe Shutdown Capability

Fire Zone 11.3.1 contains the RCIC pump and Division 1 cabling associated with the alternate shutdown path H used for a fire in Fire Zone 8.2.6.C.

Fire Zone 8.2.6.C contains safe shutdown pump cabling and equipment associated with the shutdown path B which is used for a fire in the RCIC room. Tables 2.3-2 and 2.3-8 list the safe shutdown equipment utilized in each of these shutdown paths (see also Drawings F-13-2 through F-13-5).

Appendix R Sections III.G.3 and III.L require that alternate shutdown paths be separated by a complete 3-hour rated fire barrier. The barrier separating Fire Zones 8.2.6.E and 8.2.6.C from the reactor building torus is not a complete fire barrier only because of the concrete slabs and sealed mechanical penetrations in the barrier (described in Subsection 4.3.1).

The safe shutdown path B is available for a fire in Fire Zone 1.1.2.2. This path uses the safe shutdown pump method. Table 2.3-2 lists the safe shutdown equipment used for this path. Cabling and equipment associated with this path are independent of Fire Zone 1.1.2.2 and the steam pipe chase. In addition, there is no safe shutdown equipment or cabling in the steam chase.

4.3.4 Fire Hazards Analysis

Upgrading the penetration seals in the barrier between the torus basement and turbine building is not warranted. The main objective of this fire barrier is to prevent a fire in the reactor building torus basement level from spreading upward into the turbine building. A fire starting on the turbine building ground floor would not propagate down into the torus basement. Heat and products of combustion from such a fire would rise and no combustible materials pass through this barrier. The barrier is completely sealed (not necessarily with material having 3-hour fire resistance) as part of secondary containment preventing any radiative heat transmission.

The potential heat exposure to the barrier from below would be extremely light. The combustibles in Fire Zone 11.3.1 consist of 10 gallons of lube oil associated with the RCIC and core spray pumps and cabling material. This results in a light combustible loading in the fire zone of less than 30,000 Btu/ft². Transient combustibles and ignition sources are strictly controlled at this floor level. In the unlikely event of fire in the torus basement level, the concrete barrier at the ceiling will provide a significant barrier to fire. Fire detection installed at this level will provide warning of any fire conditions allowing for a timely response of the fire brigade. The removable concrete plugs which provide access to major equipment in the torus basement provide sufficient fire resistance. The mechanical penetration seal material is noncombustible. This material is not 3-hour fire rated, however, it will provide substantial fire resistance. The expected fire scenario will not release sufficient heat to degrade this seal material. Heat transmission through the barrier would not threaten combustibles in the fire zone above. In addition, automatic water suppression is installed in the area above the unrated penetrations. This system would provide additional cooling of the barrier and penetration seals.

The main objective of the fire barrier between the reactor and turbine buildings is to prevent fire spread from one to another. This barrier is complete in Fire Zone 1.1.2.2 except for the walls separating the steam pipe chase from Fire Zone 8.2.6.E.

The walls separating the steam pipe chase from Fire Zone 8.2.6.E are shield walls with access gained through an airlock consisting of two metal doors. Except in Fire Zone 5.0, which is separated from the steam pipe chase by a 3-hour fire rated barrier, fixed automatic water suppression systems are provided in the turbine building adjacent to the steam pipe chase. There are no combustibles in the steam chase.

Heat transfer from any fixed combustible fire in Fire Zone 1.1.2.2 to the steam chase would be limited. Convective forces would drive heat and products of combustion to the ceiling.

The ceiling construction is of deep reinforced concrete beams. The beam pocket above the fixed combustibles is roughly 22 feet x 25 feet x 3 feet. The smoke layer would first have to fill this pocket and spill over into the adjacent pocket to a depth of 2 feet before products of combustion would pass through the small vent opening in the wall between the ground floor of the reactor building and the steam pipe chase into the pipe chase. Radiative effects would be negligible. A fire could not propagate into the steam chase because of the lack of combustibles.

A fire also could not spread from the turbine building into the pipe chase to the reactor building because of the enclosure around the pipe chase, the lack of fixed combustibles in the pipe chase, and the small opening in the barrier between the turbine building and the steam chase.

The fixed fire detection would provide early warning of any fire in Fire Zone 1.1.2.2 allowing the fire brigade ample time for response with available manual equipment. The local water suppression system above the air compressor would provide cooling for any fire near the air compressor. Automatic water suppression is provided in the HP heater bay in the turbine building adjacent to the steam pipe chase enclosure and over the elevation above the enclosure.

A small portion of the wall between reactor building Fire Zone 1.1.2.4 (from the 658-foot to 663-foot elevation, column lines 11 to 13) and the 480-V switchgear in turbine building Fire Zone 8.2.8.C is 2-hour rated. Combustible loading in Fire Zone 1.1.2.4 is very light (less than 5,000 Btu/ft²). Zone 8.2.8.C consists almost entirely of oil in the MG sets which are protected by both automatic wet pipe sprinklers and foam-water sprinklers. The existing 2-hour barrier provides sufficient fire resistance to prevent fire spread through the barrier.

The HVAC ducts without dampers are located in the wall between Fire Zone 1.1.2.5 and Fire Zone 1.1.1.5.A. Neither of these fire zones contain safe shutdown cables or equipment and the combustible loading for both fire zones is very light (less than 5000 Btu/ft²). Thus, installation of fire dampers will not significantly increase the level of fire protection.

4.3.5 Conclusions

The existing configuration provides an adequate level of fire protection equivalent to satisfy the intent of Appendix R Sections III.G.3 and III.L. On the basis of the plant conditions, fire protection features, and fire hazards analysis, the exemption from the Appendix R requirements of Sections III.G.3 and III.L is warranted for:

1. Not replacing seals for mechanical penetrations and concrete plugs with materials specifically tested and given a 3-hour fire resistive rating to provide a complete 3-hour barrier between fire areas using alternate shutdown paths. Upgrading the seals around the concrete plugs and mechanical penetrations with materials specifically tested and given a 3-hour fire resistive rating is unwarranted. All penetrations in the barrier are sealed because the barrier borders secondary containment. Penetration seal materials used for any seal are noncombustible and sprinklers are provided above the seals. Replacing the seals in the barrier with materials specifically tested and rated to the standard 3-hour fire exposure will not increase the level of fire protection.
2. Lack of complete 3-hour fire barrier between the steam pipe chase and turbine building Fire Zone 8.2.6.E which uses a different shutdown path. Lack of combustibles in the steam pipe chase and the presence of automatic suppression systems in the turbine building areas outside the steam chase would prevent a fire from spreading between the two buildings.
3. Provision of partial 2-hour barriers in the predominantly 3-hour wall between the turbine and reactor buildings at elevation 658 feet to 663 feet only. Upgrading this portion of the wall would not significantly improve the passive fire protection provided.
4. Lack of fire dampers in the HVAC duct between Fire Zones 1.1.2.5 and 1.1.1.5.A. Since the combustible loading of this fire zone is light and because there are no safe shutdown cables and equipment in this fire zone, installation of fire dampers will not increase the level of fire protection.

4.4 JUSTIFICATION FOR LACK OF COMPLETE FIRE DETECTION AND SUPPRESSION THROUGHOUT THE REACTOR BUILDING

4.4.1 Area Description

The Unit 2 reactor building is a separate fire area separated from the Unit 1 reactor building and turbine building by 3-hour rated fire barriers (with the few exceptions discussed in Section 4.3). The Unit 2 inerted drywell is a complete fire area separated from the surrounding reactor building by complete 3-hour rated fire barriers. The Unit 2 reactor building is subdivided into a number of fire zones. The fire zone boundaries were established using existing substantial barriers and floor elevations, however, these barriers are not fire rated barriers in all cases. The fire zones in the Unit 2 reactor building include:

<u>FIRE ZONE</u>	<u>DESCRIPTION</u>
1.1.2.1	Reactor Building Elevation 554 feet 6 inches Basement Floor
1.1.2.2	Reactor Building Elevation 595 feet 0 inches Ground Floor
1.1.2.3	Reactor Building Elevation 623 feet 0 inches Mezzanine Floor
1.1.2.4	Reactor Building Elevation 647 feet 6 inches Main Floor
1.1.2.5	Reactor Building Elevation 666 feet 6 inches Reactor Floor
1.1.1.6	Reactor Building Elevation 690 feet 6 inches Refueling Floor
11.1.4	Turbine Building Elevation 554 feet 0 inches HPCI Room
11.3.1	Reactor Building Elevation 554 feet 0 inches Southwest Corner Room

<u>FIRE ZONE</u>	<u>DESCRIPTION</u>
11.3.2	Reactor Building Elevation 554 feet 0 inches Southeast Corner Room
11.3.3	Reactor Building Elevation 554 feet 0 inches Northwest Corner Room
11.3.4	Reactor Building Elevation 554 feet 0 inches Northeast Corner Room

These fire zones are shown on Figure A-2. The description of the torus elevation, Fire Zones 1.1.2.1, 11.3.1, 11.3.2, 11.3.3, 11.3.4, and 11.1.4, along with the fire protection evaluation for the lack of fixed water suppression throughout this elevation is discussed as part of Subsections 4.2.2 and 4.2.4.

4.4.1.1 Reactor Building - Ground Floor Elevation 595 feet
0 inches (Fire Zone 1.1.2.2)

The north and east walls are reinforced concrete exterior walls, except for a 3-hour barrier to a turbine building access corridor with a Class A fire door in the north wall and the 3-hour barrier that separates the reactor building from the diesel generator 1/2 room. The south wall separates Fire Zone 1.1.1.2 (Unit 1) from Fire Zone 1.1.2.2 (Unit 2) and is a 3-hour rated reinforced concrete wall with all penetrations sealed with materials having a 3-hour fire rating. The west wall separates the reactor building from the turbine building and is a 3-hour fire rated reinforced concrete wall (with the one exception discussed in Subsection 4.3.4). The floor of Fire Zone 1.1.2.2 is the ceiling of Fire Zone 1.1.2.1 (see Subsection 4.3.4).

The ceiling of Fire Zone 1.1.2.2 is the floor of Fire Zone 1.1.2.3 and is made of structural concrete. The ceiling has open stairwells, hatches, and unsealed mechanical penetrations. The electrical penetrations through the ceiling are sealed with noncombustible material. This zone surrounds the drywell (Fire Zone 1.2.2).

4.4.1.2 Reactor Building - Mezzanine Floor Elevation 623 feet
0 inches (Fire Zone 1.1.2.3)

The north and east walls are reinforced concrete exterior walls. The south wall separates Fire Zone 1.1.2.3 (Unit 2) from Fire Zone 1.1.1.3 (Unit 1) and is a 3-hour rated reinforced concrete wall with Class A fire door and all penetrations sealed with materials having a 3-hour fire rating. The west wall separates the reactor building from the turbine building and is a 3-hour fire rated reinforced wall. The floor of Fire Zone 1.1.2.3 is the ceiling of Fire Zone 1.1.2.2.

The ceiling of Fire Zone 1.1.2.3 is the floor of Fire Zone 1.1.2.4 and is made of structural concrete. The ceiling has open stairwells, hatches, and unsealed mechanical penetrations. The electrical penetrations through the ceiling are sealed with noncombustible material. This zone surrounds the drywell (Fire Zone 1.2.2).

4.4.2 Fire Protection Systems

Fire detection is provided throughout Fire Zones 1.1.2.2 and 1.1.2.3 to provide early warning of fire conditions in these zones. Fixed automatic water suppression systems are provided directly above the two air compressors located in Fire Zone 1.1.2.2. Manual hose stations and portable extinguishers are located on each elevation of the reactor building to support manual fire suppression operations.

4.4.3 Safe Shutdown Capability

The safe shutdown path B is available for a fire in Fire Zones 1.1.2.1.N, 1.1.2.2, 1.1.2.3, 1.1.2.4, or 1.1.2.5. This path is the safe shutdown pump method which uses RHR Division II and the dedicated Unit 2 and Unit 1 diesel generators. Table 2.3-2 lists the safe shutdown equipment used for this path. The RHR Division II equipment is located in Fire Zone 11.3.2. The cable for this equipment is routed through the southern half of the torus (Fire Zone 1.1.2.1.S) from 11.3.1. The safe shutdown pump and diesel generator and related cabling is routed only in the turbine building.

4.4.4 Fire Hazards Analysis

The addition of a complete fixed water suppression system throughout Fire Zones 1.1.2.2, 1.1.2.3, 1.1.2.4, and 1.1.2.5 (in addition to Fire Zones 11.3.1, 11.3.3, 11.3.4, and 1.1.2.1 discussed in Section 4.3) and fire detection throughout Fire Zones 1.1.2.3, 1.1.2.4, and 1.1.2.5 is unwarranted.

These fire zones utilize the safe shutdown pump methods path B for shutdown. Equipment and cabling associated with this path are independent of these zones and located in the turbine building and southern half of the torus. There is no safe shutdown cabling or equipment in Fire Zones 1.1.2.4 or 1.1.2.5.

A fire in any of these fire zones must propagate downward into the southern torus or into the turbine building before the identified shutdown path is affected by the fire.

4.4.4.1 Fire Zone 1.1.2.2

The combustibles in Fire Zone 1.1.2.2 consist mostly of 126,200 feet of cable. This fire zone is the ground floor of the reactor building. It is frequently traveled and occasionally used as a staging area. Transient combustibles in the fire zone include anti-contamination clothing and limited lubricating and cleaning fluids. These transient combustibles are controlled to minimal quantities by station administrative procedures. Lubricating and cleaning fluids are only used in approved containers. The average combustible loading in the fire zone is less than 25,000 Btu/ft².

The worst case postulated fire could involve the transients and cable insulation material. Any fire on this elevation would not expose the safe shutdown cables or equipment in the southern half of the torus below since heat and products of combustion of the buoyant fire plume will rise to the ceiling and away from the torus. All mechanical, hatch, and stairwell openings in the southern half of the floor in Fire Zone 1.1.2.2 (south of column line 10) are sealed liquid tight with noncombustible material or curbed to prevent a liquid spill from flowing into the torus below. All electrical penetrations are sealed in the floor and ceiling with a noncombustible material.

Available test data found in the FMRC/EPRI test reports, "Categorization of Cable Flammability" NP-1881, August 1982, provides information describing the burning characteristics of PE/PVC cable in horizontal cable trays.

The heat of combustion of PE/PVC is less than 11,000 Btu/lb. The EPRI tests show that flame spread along horizontal cable trays is very slow. The test reports for horizontal fire spread in deep stacks of horizontal cable trays agree with observations of the rate of fire spread in similar tray arrays in the reactor building at the Browns Ferry fire. The horizontal spread rate for cable tray fires is about 6 to 7 ft/hr.

Although the cable tray arrangement in Fire Zone 1.1.2.2 is far less severe than that tested in the EPRI report, the parameters from those tests can be used to show a conservative fire scenario. These parameters would indicate that only about 21 feet of cable would be consumed in a 3-hour fire. The heat would be dissipated into an extremely large room volume. Heat would also be lost to the surrounding enclosure and floors above. Convective and radiative heat transfer effect from such a fire would not affect cables in Fire Zones 1.1.2.1 or 1.1.3.3 below.

Fire detection throughout Fire Zone 1.1.2.2 will provide early warning of fire conditions in the fire zone. This will provide ample time for manual fire fighting operations to control fire

spread in the trays to much less than that postulated above. Manual fire fighting equipment is available in the fire zone to allow the brigade to perform this function.

4.4.4.2 Fire Zone 1.1.2.3

The combustibles in Fire Zone 1.1.2.3 consist mostly of 76,060 feet of cable. This fire zone is not heavily traveled during operation. Transient combustibles are controlled to minimal quantities by station administrative procedures. The total average combustible loading in the fire zone is less than 20,000 Btu/ft².

This fire zone (1.1.2.3) is two elevations above the torus area of concern where RHR Division II cables and equipment are located. The fire scenario for this fire zone will be somewhat similar to that for Fire Zone 1.1.2.2. Heat and products of combustion of the buoyant fire plume from a fire involving combustibles on this floor will disperse to the ceiling and floors above. Electrical penetrations in the floor and ceiling of the zone are sealed with noncombustible material. A fire on this floor would not expose the cabling or equipment related with the identified shutdown path B.

Fire detection is provided throughout the fire zone with the exception of the regenerative and nonregenerative heat exchanger room and the cleanup decant pump phase separator pump room. This detection system will provide early warning of fire conditions which allow the fire brigade ample time for manual suppression operations using available fire fighting equipment in this fire zone.

4.4.4.3 Fire Zones 1.1.2.4, 1.1.2.5, and 1.1.1.6

There is no safe shutdown equipment or cabling associated with any plant shutdown method in these fire zones. The total average combustible loadings for these fire zones are less than 3,000 Btu/ft², 2,000 Btu/ft², and 1,000 Btu/ft², respectively. These fire zones are located at least 50 feet above the ground floor. Fires in these fire zones would not propagate downward since the heat and products of combustion would rise to the ceiling and floors above and all electrical penetrations in the floor and ceiling of these zones are sealed with noncombustible materials.

Fire detection is not warranted in these fire zones because there is no safe shutdown cabling or equipment in these fire zones. Although fire brigade response would be delayed, there is no potential for exposure to safe shutdown functions.

4.4.5 Conclusions

The existing fire protection features are equivalent to those required in Appendix R Sections III.G.3 and III.L. These fire

protection features in the reactor building will ensure that a fire will not propagate between the two divisions of equipment, or affect circuit integrity of the redundant RHR related cable, or spread outside the reactor building fire area to areas of alternate shutdown equipment (i.e., turbine building, Unit 1 reactor building). On the basis of the plant conditions, an exemption from the Appendix R requirements of Sections III.G.2, III.G.3, and III.L is warranted for:

1. Fixed automatic water suppression throughout Fire Zones 11.3.1, 11.3.3, 11.3.4, 1.1.2.1, 1.1.2.2, 1.1.2.3, 1.1.2.4, and 1.1.2.5 in the Unit 2 reactor building fire area.
2. Fixed fire detection throughout Fire Zones 1.1.2.3, 1.1.2.4, and 1.1.2.5.

A previous exemption was granted for water suppression over major pieces of electrical equipment in Fire Zones 1.1.2.2 and 1.1.2.3. See the D. B. Vassallo, USNRC, letter to D. L. Farrar, dated June 23, 1983, subject: Request for Exemption from Requirements of Appendix R to 10 CFR 50, Section III.G.

5.0 TURBINE BUILDING APPENDIX R EXEMPTION REQUEST

Per the provisions of 10 CFR 50.12, Commonwealth Edison Company (CECo) requests exemption from the requirements of Sections III.G and III.L of Appendix R to 10 CFR 50 to the extent that the alternate shutdown capability criteria of Sections III.G.2, III.G.3, and III.L would have to be met for the fire areas of the Quad Cities 1&2 turbine building. CECo specifically requests exemptions from:

1. The requirements of Sections III.G.3 and III.L that the turbine building Northern, Central, and Southern Zone Groups be separated from each other by complete 3-hour rated fire barriers.
2. The requirements of Section III.G.3 that all zone groups be provided with complete fire detection and fixed fire suppression.
3. The requirement of Section III.G.2 that cables of one redundant train of systems be enclosed in a 1-hour rated fire barrier with suppression and detection.
4. The requirements of Sections III.G.3 and III.L that fire areas be separated by a 3-hour fire barrier (water curtain and partial barriers on operating floor and watertight hatch for Fire Zone 11.1.1.B).

The justifications for these exemptions are presented in the following sections:

SECTION

JUSTIFICATION FOR

5.2

Lack of complete 3-hour fire barriers between zone groups

5.3

Lack of complete suppression and detection in the Southern Zone Group

5.4

Lack of complete suppression and detection in the Northern Zone Group

5.5

Lack of complete suppression and detection in the Central Zone Group

5.6

Lack of complete suppression and detection on the operating floor

5.7

Lack of complete suppression and detection for enclosure of cable in a fire barrier having a 1-hour rating

SECTION

JUSTIFICATION FOR

5.8

Lack of complete 3-hour fire barriers between the equivalent Fire Areas 8.2.8.A, 8.2.8.B, 8.2.8.C, and 8.2.8.D on the operating floor (water curtain and partial barriers)

5.9

Lack of complete 3-hour barriers between Fire Zone 11.1.1.B and the Southern Zone Group (watertight door).

5.1 TURBINE BUILDING AREA DESCRIPTION

The turbine building is typical of configurations found in BWR's. The building is subdivided by extensive reinforced concrete shield walls but formal fire walls are limited to very few building sections. In general, the turbine building is one large fire area. It is made up of three major floor elevations and two partial basement elevations. Figures B-4, B-8 through B-17, B-21 and B-22 show the fire protection systems. The turbine building is separated from the reactor building by 3-hour rated barriers except as described in Sections 3.0 and 4.0.

The turbine building with the exception of the operating floor has been divided into three zone groups: the Northern Zone Group (Fire Area TB-I), the Central Zone Group (Fire Area TB-II), and the Southern Zone Group (Fire Area TB-III) as shown on Figure A-3 and Figure A-4.

The operating floor is open between units. The major equipment located on this floor includes the turbine generators, MG sets, and both divisions of 4-kV and 480-V switchgears for each unit. The switchgears are the only safe shutdown equipment. Automatic fixed water suppression and foam-water systems are provided over the MG sets.

The divisions of 4-kV switchgear for each unit are separated by a partial, 3-hour, floor to ceiling fire barrier. The 4-kV switchgears for Unit 1 are separated from those in Unit 2 by a water curtain (open head water spray system actuated by smoke detection). A curb and drain are provided beneath the water curtain. This water curtain and a 3-hour wall (from the 647-foot 6-inch floor to the ceiling), physically between the 480-V switchgears, provide separation between the Unit 1 and Unit 2 480-V switchgear. These fire barriers set the boundaries for the fire zones on the operating floor (Fire Zones 8.2.8.A, 8.2.8.B, 8.2.8.C, 8.2.8.D, and 8.2.8.E).

The turbine building operating floor has a floor constructed of concrete supported on exposed structural steel. The floor has numerous penetrations for stairwells, equipment removal hatches, and pipe and electrical penetrations. The electrical penetrations are sealed with noncombustible materials. Penetrations into the bottom of the switchgear are 3-hour rated seals. No unsealed floor penetrations are located near the switchgear. Given the existing low fire loading, the spacial separation and partial fire barriers, an adequate impediment to the spread of fire exists on the operating floor.

A different shutdown path has been identified for a fire in each separate fire zone on the operating floor. If a fire were to occur in Fire Zone 8.2.8.A, only Unit 1 would be affected. Shutdown of this unit could be accomplished by utilizing the safe shutdown makeup pump path D. If a fire were to occur in Fire Zone 8.2.8.B, only Unit 1 would be affected. Shutdown of this unit could be accomplished by utilizing the safe shutdown makeup pump path A. If a fire were to occur in Fire Zone 8.2.8.C, only Unit 2 would be affected. Shutdown of this unit could be accomplished by utilizing the safe shutdown makeup pump path C. If a fire were to occur in Fire Zone 8.2.8.D, only Unit 2 would be affected. Shutdown of this unit could be accomplished by utilizing the safe shutdown makeup pump path K. If a fire were to occur in Fire Zone 8.2.8.E all methods of shutdown would be available since no equipment or cable required by any of the shutdown paths are located in this fire zone.

All floors of the Northern Zone Group (Fire Zones 6.2.A, 6.2.B, 7.2, 8.2.1.B, 8.2.1.D, 8.2.2.A, 8.2.2.B, 8.2.5, 8.2.6.D, 8.2.6.E, 8.2.7.D, 8.2.7.E, 9.2, 11.1.2.A, 11.1.2.B, 11.1.2.C, and 14.1.2) contain Unit 2 cabling and equipment. If a fire were to occur in this zone group, only Unit 2 would be affected. Shutdown of this unit could be accomplished by utilizing the safe shutdown makeup pump path C.

The Central Zone Group (Fire Zones 5.0, 8.1, 8.2.6.C, 8.2.7.C, and 8.2.10) on the ground and mezzanine floor levels of the turbine building contains some cabling related to both Units 1 and 2. However, necessary cabling and equipment related to RCIC shutdown path E2 for Unit 1 and RCIC shutdown path H for Unit 2 are unaffected by a fire in this zone group. The Unit 1 diesel generator supplies power to the equipment required to shut down Unit 1 and the swing diesel generator powers the equipment required to shut down Unit 2.

All floors of the Southern Zone Group (Fire Zones 6.1.A, 6.1.B, 7.1, 8.2.1.A, 8.2.1.C, 8.2.3.A, 8.2.3.B, 8.2.4, 8.2.6.A, 8.2.6.B, 8.2.7.A, 8.2.7.B, 9.1, 11.1.1.A, 11.1.1.C, and 14.1.1) contain Unit 1 cabling and equipment. If a fire were to occur in this portion of the station, only Unit 1 would be affected. Shutdown of this unit could be accomplished by utilizing the safe shutdown makeup pump path D.

The Central Zone Group is separated from the Northern and Southern Zone Groups by complete shield walls on the ground and mezzanine floors with the exception of the corridor that penetrates these barriers on the ground level (595-foot 0-inch elevation) at column/rows 11 and 14/G and on the west fan floor. The Central Zone Group is also separated from the Northern and Southern Zone Groups by the floor at elevation 595 feet 0 inches which is the ceiling of the radwaste pipe

tunnel (Fire Zones 8.2.2.A and 8.2.3.B). The shield walls are not specifically fire rated but are substantial, reinforced concrete construction with cable penetrations sealed with noncombustible material. Personnel access between zone groups is through substantial, locked, unlabeled metal doors. Automatic detection and water suppression are utilized to prevent fire spread down the corridors. These corridors (which extend from column/row G/9 to 12 and G/14 to 17) contain no equipment or cabling associated with adjacent zone group shutdown paths. The presence of the fire detection, general sprinklers, and water spray for major hazards ensures that a fire in the Central Zone Group could not spread to affect cabling or equipment in the adjacent zone groups or vice versa.

The Unit 1 and Unit 2 cable tunnels run below the Southern Zone Group. The Unit 1 cable tunnel has an access point in the auxiliary electric equipment room and at G/25. Another access point is located at column/row G/17.5 and is covered with a heavy metal checker plate. The Unit 2 cable tunnel passes from the auxiliary electric equipment room below all three zone groups with an access point into each (F/25, F/17, F/12, and F/9). Each point is covered with heavy metal checker plate. Each tunnel is constructed of reinforced concrete with all electrical penetrations sealed with materials having a 3-hour fire rating. The tunnels are also protected by complete detection and water suppression for the cable trays. For a fire in the Unit 1 cable tunnel, the safe shutdown makeup pump path D could be used to shut down Unit 1 while safe shutdown makeup pump path C could be used to shut down Unit 2 for a fire in the Unit 2 cable tunnel.

5.2 JUSTIFICATION FOR LACK OF COMPLETE 3-HOUR FIRE BARRIERS BETWEEN ZONE GROUPS

5.2.1 Introduction

The three major zone groups in the turbine building - the Northern, Central, and Southern Zone Groups - are comprised of individual fire zones on several elevations. Tables 5.2-1, 5.2-2, and 5.2-3 detail which zones make up the Northern, Central, and Southern Zone Groups, respectively. The zone groups are shown schematically on Figure A-3.

For a fire in one of these three zone groups, the affected unit (or units) is to be taken to hot shutdown using alternative shutdown methods which utilize equipment and cables that are located in the other two zone groups or are protected by a 1-hour barrier and suppression and detection as required by Appendix R except as identified in Section 5.7 in the zone group for which they are used. An exemption to Appendix R is required for this configuration since the boundaries between the zone groups are not complete fire barriers. As the subsequent analysis demonstrates, sufficient protection is provided between the zone groups to ensure that a fire in one zone group will not propagate to the adjacent zone group.

The interfaces between the Northern and Central Zone Groups are on the ground and mezzanine floor elevations, on the west fan floor and below the ground floor level where the Unit 2 cable tunnel and the radwaste tunnel crosses underneath the Central Zone Group and the radwaste tunnel where Fire Zones 8.2.2.B and 8.2.3.B meet. The fire protection features of this interface are discussed in Subsection 5.2.4.

The interface between the Northern and Southern Zone Groups involves the Unit 2 cable tunnel (Fire Zone 8.2.5) which is part of the Northern Zone Group and runs underneath Fire Zones 8.2.6.A and 8.2.6.B of the Southern Zone Group and the radwaste tunnel where Fire Zones 8.2.2.B and 8.2.3.B meet. The fire protection features of this interface are discussed in Subsection 5.2.4.

The interfaces between the Southern and Central Zone Groups are on the ground and mezzanine floor elevations and below the ground floor level where the Unit 2 cable tunnel and the radwaste tunnel cross underneath the Central Zone Group. The fire protection features of these interfaces are discussed in Subsection 5.2.4.

The turbine building operating floor is the upper boundary of these three zone groups. The fire protection features of the operating floor are discussed in Subsection 5.2.4.

5.2.2 Fire Protection System

The extensive fire protection systems in the turbine building are shown on Figures B-4, B-8 through B-17, B-21, and B-22. They are described in detail in Subsection 5.2.4 of this request, and in the remaining sections concerning the turbine building.

5.2.3 Safe Shutdown Equipment

Appendix R hot shutdown equipment located in the Northern, Central, and Southern Zone Groups is listed in Tables 5.2-4, 5.2-5, and 5.2-6, respectively. Also listed in the tables are the shutdown paths for which the equipment is utilized.

The following alternate shutdown path(s) are available for a fire in a given zone group:

<u>LOCATION OF FIRE</u>	<u>SHUTDOWN PATH AVAILABLE FOR UNIT 1</u>	<u>SHUTDOWN PATH AVAILABLE FOR UNIT 2</u>
Northern Zone Group	Normal	C
Central Zone Group	E2	H
Southern Zone Group	D	Normal

Adequate manpower is available to accomplish simultaneous shutdown.

5.2.4 Fire Hazards Analysis

In the event of a fire in any one of the three major turbine building zone groups - Northern, Southern, and Central - the affected unit (or units) could be shut down using an alternate shutdown path which utilizes equipment and/or cabling in the other two zone groups and the main operating floor except in certain instances where protection of cables is provided in accordance with Appendix R Section III.G.2. Specifically:

1. For a fire in the Northern Zone Group, only Unit 2 would be affected. This unit could be shut down using the safe shutdown makeup pump alternate shutdown path C. All equipment and cables required by this shutdown path are independent of the Northern Zone Group.

2. For a fire in the Southern Zone Group, only Unit 1 would be affected. This unit could be shut down using the safe shutdown makeup pump alternate shutdown path D. All equipment and cables required by this shutdown path are independent of the Southern Zone Group with the exception of certain cables which are routed through this zone group. However, these cables will be protected in the Southern Zone Group with cable wrap in accordance with Appendix R Section III.G.2 requirements.
3. For a fire in the Central Zone Group, provisions have been made to ensure that it is possible to shut down both units simultaneously by alternate means. Given this situation, Unit 1 could be shut down using RCIC alternate shutdown path E2 and Unit 2 could be shut down using RCIC alternate shutdown path H. All equipment and cables required by these shutdown paths are independent of the Central Zone Group.

It is important to ensure that, for a fire in one zone group, the other two zone groups are free of fire damage. Due to operating considerations, especially the need for unimpeded access along the turbine building ground floor corridor, providing complete fire barriers between the zone groups is not possible. Instead, the boundaries between the zone groups are protected by a combination of shield walls and fire suppression and detection systems (shown on Figures B-11 through B-14) which provide significant protection and ensure that fire damage will be limited to only one zone group.

5.2.4.1 Northern and Central Zone Group Boundary

The Northern and Central Zone Groups have common boundaries on the mezzanine and ground floor levels, on the west fan floor, and below the ground floor where the radwaste tunnel crosses. Figures B-9, B-12, B-14 and B-22 show the configurations of these zone groups and the suppression and detection systems on these levels.

On the mezzanine level they are separated by continuous, substantial, reinforced concrete shield walls which are not specifically fire rated. Personnel access between zone groups is through substantial, locked, unlabeled, metal doors. All penetrations through these walls are sealed with noncombustible material. Extensive sprinkler protection is provided throughout Fire Zones 8.2.7.D and 8.2.7.C with the exception of the area west of row D in Fire Zone 8.2.7.C of the Central Zone Group. This area contains only a minor amount of combustibles. These extensive suppression systems ensure that any fire near the boundary would be quickly controlled and therefore, would not affect the other zone group. Smoke detection exists throughout this fire zone. Spot detection is also provided in the western portion of the Central Zone Group on this level. This combination of substantial walls with suppression systems on both sides of the wall provides a level of protection on the mezzanine level between the Northern and Central Zone Groups which is equivalent to a 3-hour barrier.

On the ground floor level, the Northern and Central Zone Groups are separated everywhere by substantial shield walls with the exception of the corridor running along row line G. These shield walls are not specifically fire rated but are substantial reinforced concrete with cable penetrations sealed with noncombustible materials. Smoke detection is provided above major electrical safe shutdown related equipment and also throughout the corridor of Fire Zone 8.2.6.E. This corridor which runs between the Northern and Southern Zone Groups through the Central Zone Group is not provided with a physical barrier to fire. However, the entire corridor, from column/rows 9-17/G, is protected with water suppression and smoke detection systems to prevent fire spread down these corridors. The fire protection provided will establish a fire protection buffer of more than 50 feet down the corridors between the Central and Northern Zone Groups.

There is no door provided on the opening between the western portion of the Central Zone Group (Fire Zone 8.2.6.C) and the Unit 2 CRD Fire Zone 8.2.2.A in the Northern Zone Group. However, there is no continuity of combustibles between the zone groups near this opening and automatic sprinkler protection is provided for Fire Zone 8.2.2.A. This combination of shield walls, water suppression systems, and fire detection provide a level of protection on the ground floor between the Northern and Central Zone Groups which is equivalent to that prescribed in Appendix R Section III.G.2.

The western end of the ground floor separates the Central Zone Group from the Units 1 and 2 radwaste tunnel (Fire Zones 8.2.3.B and 8.2.2.B, respectively). The floor is an unrated concrete slab with open hatchway and pipe chases. There are no safe shutdown cables and equipment located in the radwaste tunnel or any combustibles of significant quantity. Thus a fire cannot spread through this fire zone to other fire zones in the Northern and Southern Zone Groups or to the Central Zone Group.

The Northern and Central Zone Groups also share a boundary on the 626-foot 6-inch elevation, where Fire Zones 8.2.10 (of the Central Zone Group) and 14.1.2 (of the Northern Zone Group) are separated by substantial, reinforced concrete shield walls that are not specifically fire rated. Personnel access between zone groups is through substantial, unlabeled, metal doors. There are no safe shutdown cables or equipment in either of these fire zones. The combustible loading of Fire Zone 14.1.2 is less than 1000 Btu/ft² and that of Fire Zone 8.2.10 is less than 3000 Btu/ft². The combination of shield walls and low combustible loading assures that a fire cannot propagate between the Central and Northern Zone Groups on this elevation.

The Northern Zone Group also borders the Central Zone Group along portions of the Unit 2 cable tunnel (Fire Zone 8.2.5). The cable tunnel, which is a part of the Northern Zone Group, runs underneath the Central Fire Zone 8.2.6.C approximately along row F. The tunnel is separated from Fire Zone 8.2.6.C by a reinforced concrete barrier except for a checkered plate covered hatch at approximately F/12. The cable tunnel has a complete smoke detection system and water suppression in the cable trays. The cable penetration area at F/12 into the Central Zone Group is curbed and fire detection and fixed automatic water suppression are also provided at the 595-foot elevation above the access points at F/12 and F/9 for additional protection. All electrical penetrations are sealed with fire resistive materials. This combination of suppression, detection, and barrier provides a level of protection equivalent to a complete fire barrier and assures that no fire can propagate between the Northern and Central Zone Groups and the Unit 2 cable tunnel.

5.2.4.2 Northern and Southern Zone Group Boundary

The Northern Zone Group borders the Southern Zone Group only along portions of the Unit 2 cable tunnel (Fire Zone 8.2.5) and in the radwaste tunnel. The Unit 2 cable tunnel passes below each of the three zone groups with an access point into each. The cable tunnel is constructed of reinforced concrete with all electrical penetrations sealed with materials having a 3-hour fire rating. The cable tunnel is provided with complete detection and water suppression in the cable trays. Where the Unit 2 cable tunnel passes beneath the Southern Zone Group, fire protection features are provided that are equivalent to Appendix R criteria. The curbed access at F/17 and F/25 into the Southern Zone Group is covered with heavy metal checkered plate. In addition, fire detection and fixed automatic water suppression is provided at the 595-foot elevation above the access points for additional protection. This combination of fire protection features above and below the metal plate will prevent any fire spread between the Southern Zone Group and the Unit 2 cable tunnel and adequately ensures separation of the zones.

There is no wall separating Unit 1 and Unit 2 portions of the radwaste tunnel (Fire Zones 8.2.3.B and 8.2.2.B, respectively). However, there are no safe shutdown cables or equipment located in these fire zones and there are no combustible materials of significant quantity located in these fire zones. While no suppression or detection systems are provided in the radwaste tunnel, suppression systems are provided in the fire zones of the Northern and Southern Zone Groups that are adjacent to the radwaste tunnel. Thus a fire cannot spread through the radwaste tunnel and into either the Northern or Southern Zone Group.

5.2.4.3 Southern and Central Zone Group Boundary

The Southern and Central Zone Groups have common boundaries on the mezzanine and ground floor levels, on the west fan floor, and below the ground floor where the radwaste tunnel crosses the Central Zone Group. Figures B-9, B-12, B-14, and B-22 show the configurations of these zone groups and the suppression and detection systems on these levels.

On the mezzanine level they are separated by continuous, substantial, reinforced concrete shield walls which are not specifically fire rated. Personnel access between zone groups is through substantial, locked, unlabeled, metal doors. All penetrations through these walls are sealed with noncombustible material. Extensive sprinkler protection is provided throughout Fire Zones 8.2.7.D and 8.2.7.B with the exception of the area west of row D in Fire Zone 8.2.7.C of the Central Zone Group. This area contains a minor amount of combustibles. These extensive suppression systems ensure that any fire near the boundary would be quickly controlled and therefore, would not affect the other zone group.

Smoke detection is provided throughout most of Fire Zone 8.2.7.A. Spot detection is also provided in the western portion of the Central Zone Group (8.2.7.C) on this level. This combination of substantial walls with suppression systems on both sides of the wall provides a level of protection on the mezzanine level between the Southern and Central Zone Groups which is equivalent to a 3-hour barrier.

On the ground floor level, the Southern and Central Zone Groups are separated by substantial shield walls with the exception of the corridor running along row line G. These shield walls are not specifically fire rated but are substantial reinforced concrete with cable penetrations sealed with noncombustible materials. Smoke detection is provided above major electrical safe shutdown related equipment and also throughout the corridor of Fire Zone 8.2.6.A. This corridor which runs between the Northern and Southern Zone Groups through the Central Zone Group is not provided with a physical barrier to fire. However, the entire corridor, from column/rows G/9-17, is protected with fixed water suppression and smoke detection systems to prevent fire spread down these corridors. The fire protection provided will establish a fire protection buffer of more than 50 feet down the corridors between the Central and Southern Zone Groups.

There is no door provided on the opening between the western portion of the Central Zone Group (Fire Zone 8.2.6.C) and the Unit 1 CRD Fire Zone 8.2.3.A in the Southern Zone Group. However, there is no continuity of combustibles between the zone groups near this opening and automatic sprinkler protection is provided for Fire Zone 8.2.3.A. This combination of shield walls, water suppression systems, and fire detection provide a level of protection on the ground floor between the Southern and Central

Zone Groups which is equivalent to that prescribed in Appendix R Section III.G.2.

The Southern Zone Group also borders the Central Zone Group along the Unit 1 radwaste tunnel (Fire Zone 8.2.3.B). The radwaste tunnel runs underneath the Central Zone Group at the western end of Fire Zone 8.2.6.C along row C. The floor of Fire Zone 8.2.6.C is an unrated concrete slab with open hatchway and pipe chases. There are no safe shutdown cables or equipment located in the radwaste tunnel or any combustibles of significant quantity. Thus a fire cannot spread through this fire zone to other fire zones in the Southern Zone Group or into the Central Zone Group.

The Southern and Central Zone Groups also share a boundary on the 626-foot 6-inch elevation, where Fire Zones 8.2.10 (of the Central Zone Group) and 14.1.1 (of the Southern Zone Group) are separated by substantial, reinforced concrete shield walls that are not specifically fire rated. Personnel access between zone groups is through substantial, unlabeled, metal doors. There are no safe shutdown cables or equipment in either of these fire zones. The combustible loading of Fire Zone 14.1.1 is less than 1000 Btu/ft² and that of Fire Zone 8.2.10 is less than 3000 Btu/ft². The combination of shield walls and low combustible loading assures that a fire cannot propagate between the Central and Southern Zone Groups on this elevation.

5.2.4.4 Operating Floor Boundary

The turbine building operating floor is the upper boundary of the Northern, Central, and Southern Zone groups. This floor is constructed of concrete supported on exposed structural steel. The floor has numerous penetrations for stairwells, equipment removal hatches, and pipe and electrical penetrations. The electrical penetrations are sealed with noncombustible materials. Penetrations into the bottom of the switchgear are 3-hour rated seals. No unsealed floor penetrations are located near the switchgear. The existing low fire loading on the operating floor, the spacial separation of equipment and the floor barrier provide an adequate impediment to the spread of a fire from the Northern, Central, or Southern Zone Group to the operating floor switchgear. The fire barriers of the operating floor are discussed in detail in Section 5.8.

5.2.5 Conclusions

Based on this analysis, an exemption is requested for the Quad Cities Units 1 and 2 turbine building for the requirement of 10 CFR 50, Appendix R Sections III.G.3 and III.L that alternative shutdown capability be located in a separate fire area from the area, room, or zone for which it is used. The technical bases that justify the exemption request are summarized as follows.

1. Alternative safe shutdown equipment is separated from zones for which it would be used by a combination of substantial shield walls and automatic water suppression systems.
2. Extensive automatic sprinkler protection is provided on at least one side of all zone group boundaries and on both sides of most boundaries on the mezzanine floor and ground floor levels.
3. The corridor on the ground floor is the only area where the three zone groups are not separated by substantial reinforced concrete barriers. However, the corridor is covered throughout by automatic detection and suppression systems.
4. The installation of fire rated barriers throughout would not significantly increase plant safety and would impede plant access.
5. The lack of combustible materials in the radwaste tunnel would prevent fire propagation through the tunnel to adjacent fire zones.

TABLE 5.2-1

FIRE ZONES IN THE NORTHERN ZONE GROUP

<u>FIRE ZONE</u>	<u>DESCRIPTION</u>
11.1.2.A	Unit 2 Turbine Building, basement floor, elevation 547 feet 0 inches, RHR service water pump 2D room
11.1.2.B	Unit 2 Turbine Building, basement floor, elevation 547 feet 0 inches, RHR service water pump 2B and 2C room
11.1.2.C	Unit 2 Turbine Building, basement floor, elevation 547 feet 0 inches, RHR service water pump 2A room
8.2.1.B	Unit 2 Turbine Building, basement floor, condensate pump room, elevation 558 feet 6 inches
8.2.1.D	Unit 2 Turbine Building, basement floor, turbine foundation, elevation 558 feet 6 inches
8.2.2.A	Unit 2 Turbine Building, upper basement floor, elevation 572 feet 6 inches
8.2.2.B	Unit 2 Radwaste Pipe Tunnel, elevations 580 feet 0 inches and 584 feet 6 inches
8.2.5	Unit 2 Cable Tunnel, elevation 588 feet 0 inches
8.2.6.D	Unit 2 Turbine Building, ground floor northwest end, elevation 595 feet 0 inches
8.2.6.E	Unit 2 Turbine Building, ground floor northeast end including reactor feed pumps, elevation 595 feet 0 inches
8.2.7.D	Unit 2 Turbine Building, mezzanine floor, northwest end, elevation 615 feet 6 inches
8.2.7.E	Unit 2 Turbine Building, mezzanine floor north end including reactor feed pump ventilation fans, elevation 615 feet 6 inches
6.2.A	Unit 2 Division I 125-Vdc distribution room
6.2.B	Unit 2 Division II 125-Vdc distribution room
7.2	Unit 2 Battery Room
9.2	Unit 2 Diesel Generator Room
14.1.2	Unit 2 Off-Gas Recombiner Room

TABLE 5.2-2

FIRE ZONES IN THE CENTRAL ZONE GROUP

<u>FIRE ZONE</u>	<u>DESCRIPTION</u>
5.0	Safe Shutdown Makeup Pump Room
8.1	Clean and Dirty Oil Tank Room
8.2.6.C	Turbine Building - Ground Floor Elevation 595 feet 0 inches Common Area
8.2.7.C	Turbine Building - Mezzanine Elevation 615 feet 6 inches Common Area
8.2.10	West Turbine Building Fan Floor - Elevation 626 feet 6 inches

TABLE 5.2-3

FIRE ZONES IN THE SOUTHERN ZONE GROUP

<u>FIRE ZONE</u>	<u>DESCRIPTION</u>
11.1.1.A	Unit 1 Turbine Building, basement floor, elevation 547 feet 0 inches, RHR service water pump 1D room
11.1.1.B	Unit 1 Turbine Building, basement floor, elevation 547 feet 0 inches, diesel generator 1/2 cooling water pump and RHR service water pump 1B and 1C room
11.1.1.C	Unit 1 Turbine Building, basement floor, elevation 547 feet 0 inches, RHR service water pump 1A room
8.2.1.A	Unit 1 Turbine Building, basement floor, elevation 547 feet 0 inches, condensate pump room
8.2.1.C	Unit 1 Turbine Building, basement floor, turbine foundation, elevation 547 feet 0 inches
8.2.3.A	Unit 1 Turbine Building, upper basement floor, elevation 572 feet 6 inches
8.2.3.B	Unit 1 Radwaste Pipe Tunnel
8.2.4	Unit 1 Cable Tunnel, elevation 588 feet 0 inches
8.2.6.A	Unit 1 Turbine Building, ground floor, south end including reactor feed pumps, elevation 595 feet 0 inches
8.2.6.B	Unit 1 Turbine Building, ground floor, northwest end, elevation 595 feet 0 inches
8.2.7.A	Unit 1 Turbine Building, mezzanine floor, south end including reactor feed pump ventilation fans, elevation 615 feet 6 inches
8.2.7.B	Unit 1 Turbine Building, mezzanine floor, southwest end, elevation 615 feet 6 inches
6.1.A	Unit 1 Division I 125-Vdc distribution room
6.1.B	Unit 1 Division II 125-Vdc distribution room
7.1	Unit 1 Battery Room
9.1	Unit 1 Diesel Generator Room
14.1.1	Unit 1 Off-Gas Recombiner Room

TABLE 5.2-4

APPENDIX R HOT SHUTDOWN EQUIPMENT
LOCATED IN THE NORTHERN ZONE GROUP

<u>EQUIPMENT</u>	<u>SHUTDOWN PATH</u>
<u>Fire Zone 8.2.1.B</u>	
None	Not Applicable
<u>Fire Zone 8.2.1.D</u>	
None	Not Applicable
<u>Fire Zone 8.2.2.A</u>	
None	Not Applicable
<u>Fire Zone 8.2.2.B</u>	
None	Not Applicable
<u>Fire Zone 11.1.2.A</u>	
DG2 Cooling Water Pump	A, B, D, F, K
DG2 Cooling Water Pump Cubicle Cooler	A, B, D, F, K
RHR SW Pump 2A	H, L
RHR SW Pump Cubicle Cooler 2A	H, L
<u>Fire Zone 11.1.2.B</u>	
RHR SW Pump 2B	H, L
RHR SW Pump 2C	B, F, K
RHR SW Pump Cubicle Cooler 2B	H, L
RHR SW Pump Cubicle Cooler 2C	B, F, K
<u>Fire Zone 11.1.2.C</u>	
RHR SW Pump 2D	B, F, K
RHR SW Pump Cubicle Cooler 2D	B, F, K

TABLE 5.2-4 (Cont'd)

EQUIPMENTSHUTDOWN PATHFire Zone 8.2.5

None

Not Applicable

Fire Zone 8.2.6.D

None

Not Applicable

Fire Zone 8.2.6.E

None

Not Applicable |

Fire Zone 8.2.7.D

None

Not Applicable |

Fire Zone 8.2.7.E

4-kV SWGR 23

D, H, L

4-kV SWGR 24

B, F, K

480-V MCC 28-2

D, H, L

480-V MCC 29-2

A, B, D, F, K

Fire Zone 6.2.A

125-Vdc Distribution Panel 2A

A, B, C, D, E1,
E2, F, H, L

125-Vdc Battery Charger 2A

H, L |

TABLE 5.2-4 (Cont'd)

EQUIPMENTSHUTDOWN PATHFire Zone 6.2.B

125-Vdc Distribution Panel 2B

A, B, F, K

250-Vdc Battery Charger 2

E1

125-Vdc Battery Charger 2

A, B, D, F, K

250-Vdc MCC 2

E1, H

125-Vdc Reserve Bus 2B-1

A, B, D, F, K

Fire Zone 7.2

125-V Battery #2

A, B, D, E1, F,
H, K, L

250-V Battery #2

E1, H

Fire Zone 9.2

Diesel Generator 2

A, B, D, F, K

Diesel Generator 2 Room Vent Fan

A, B, D, F, K

Diesel Fuel Oil Transfer Pump 2

A, B, D, F, K

Diesel Oil Day Tank 2

A, B, D, F, K

Fire Zone 14.1.2

None

Not Applicable

TABLE 5.2-5

APPENDIX R HOT SHUTDOWN EQUIPMENT
LOCATED IN THE CENTRAL ZONE GROUP

<u>EQUIPMENT</u>	<u>SHUTDOWN PATH</u>
<u>Fire Zone 5.0</u>	
Safe Shutdown Makeup Pump	A, B, C, D, K, L
SSMP Valve MO1/2-2901-6	A, B, C, D, K, L
SSMP Valve MO1/2-2901-7	A, B, C, D, K, L
SSMP Valve MO1-2901-8	A, D
SSMP Valve MO2-2901-8	B, C, K, L
SSMP Room Cooler	A, B, C, D, K, L
480-V MCC 30	A, B, C, D, K, L
4-kV SWGR 31	A, B, C, D, K, L,
<u>Fire Zone 8.1</u>	
None	Not Applicable
<u>Fire Zone 8.2.6.C</u>	
None	Not Applicable
<u>Fire Zone 8.2.7.C</u>	
None	Not Applicable
<u>Fire Zone 8.2.10</u>	
None	Not Applicable

TABLE 5.2-6

APPENDIX R HOT SHUTDOWN EQUIPMENT
LOCATED IN THE SOUTHERN ZONE GROUP

<u>EQUIPMENT</u>	<u>SHUTDOWN PATH</u>
<u>Fire Zone 8.2.1.A</u>	
None	Not Applicable
<u>Fire Zone 8.2.1.C</u>	
None	Not Applicable
<u>Fire Zone 8.2.3.A</u>	
None	Not Applicable
<u>Fire Zone 8.2.3.B</u>	
None	Not Applicable
<u>Fire Zone 11.1.1.A</u>	
DG1 Cooling Water Pump	A, B, C, E1, E2, L
DG1 Cooling Water Pump Cubicle Cooler	A, B, C, E1, E2, L
RHR SW Pump 1D	A, E1, E2
RHR SW Pump Cubicle Cooler 1D	A, E1, E2
<u>Fire Zone 11.1.1.B</u>	
DG 1/2 Cooling Water Pump	C, D, H, L,
DG 1/2 Cooling Water Pump Cubicle Cooler	C, D, H, L
RHR SW Pump 1B	C, D
RHR SW Pump 1C	A, E1, E2
RHR SW Pump Cubicle Cooler 1B	C, D
RHR SW Pump Cubicle Cooler 1C	A, E1, E2

TABLE 5.2-6 (Cont'd)

<u>EQUIPMENT</u>	<u>SHUTDOWN PATH</u>
<u>Fire Zone 11.1.1.C</u>	
RHR SW Pump 1A	C, D
RHR SW Pump Cubicle Cooler 1A	C, D
<u>Fire Zone 8.2.4</u>	
None	Not Applicable
<u>Fire Zone 8.2.6.A</u>	
None	Not Applicable
<u>Fire Zone 8.2.6.B</u>	
None	Not Applicable
<u>Fire Zone 8.2.7.A</u>	
4-kV SWGR 13	C
4-kV SWGR 14	A, E1, E2
480-V MCC 18-2	C, D
480-V MCC 19-2	C, E1, E2, L
<u>Fire Zone 8.2.7.B</u>	
None	Not Applicable
<u>Fire Zone 6.1.A</u>	
125-Vdc Distribution Panel 1A	A, B, E1, E2, F, K

TABLE 5.2-6 (Cont'd)

<u>EQUIPMENT</u>	<u>SHUTDOWN PATH</u>
<u>Fire Zone 6.1.B</u>	
250-Vdc MCC 1	E2, F
250-Vdc Battery Charger 1	E2, F
125-Vdc Distribution Panel 1B	A, B, C, E1, E2, L
125-Vdc Battery Charger 1	C, E1, E2
250-Vdc Battery Charger 1/2	H
125-Vdc Reserve Bus 1B-1	A, B, E1, E2, L
<u>Fire Zone 7.1</u>	
125-V Battery #1	A, B, C, E1, E2, F, K
250-V Battery #1	E2, F
<u>Fire Zone 9.1</u>	
Diesel Generator 1	A, B, C, E1, E2, L
Diesel Generator 1 Room Vent Fan	A, B, C, E1, E2, L
Diesel Fuel Oil Transfer Pump 1	A, B, C, E1, E2, L
Diesel Oil Day Tank 1	A, B, C, E1, E2, L
<u>Fire Zone 14.1.1</u>	
None	Not Applicable

5.3 JUSTIFICATION FOR LACK OF COMPLETE SUPPRESSION AND DETECTION IN THE SOUTHERN ZONE GROUP

5.3.1 Introduction

The Southern Zone Group of the turbine building is composed of 17 fire zones in the southern portion of the turbine building. These fire zones are listed and briefly described in Table 5.2-3.

Because alternate shutdown is utilized for the Southern Zone Group, Appendix R requires that fire detection and fixed fire suppression be present throughout. As seen in Figures B-8, B-9, B-10, B-11, B-13, and B-21 only detection or suppression is present in most portions of this zone group. However, these fire protection features provide a level of protection which ensures that any fire will be quickly detected and controlled and additional detection and suppression systems would not significantly enhance the level of safety at Quad Cities.

5.3.2 Fire Protection System

All 17 fire zones of the Southern Zone Group, except for the Unit 1 radwaste tunnel (Fire Zone 8.2.3.A) and the Unit 1 off-gas recombiner room (Fire Zone 14.1.1), are provided with some form of automatic fire protection system - detection, suppression, or a combination of both - as shown on Figures B-8, B-9, B-10, B-11, B-13, and B-21. These systems were selected and designed to match the specific fire hazards in and safety and operational concerns associated with the particular zone. In addition, fire hose stations and portable extinguishers are available for manual fire fighting throughout the zone group.

The specific fire protection systems for the 17 fire zones are as follows.

5.3.2.1 Fire Zone 8.2.1.A (Elevation 547 feet 0 inches)

This fire zone is protected throughout by an automatic wet pipe sprinkler suppression system. No separate detection is provided.

5.3.2.2 Fire Zone 8.2.1.C (Elevation 558 feet 6 inches)

This fire zone is protected throughout by an automatic wet pipe sprinkler suppression system. No separate detection is provided.

5.3.2.3 Fire Zone 8.2.4 (Elevation 588 feet 0 inches)

This fire zone, the Unit 1 cable tunnel, is protected throughout by both an automatic wet pipe sprinkler suppression utilizing directional nozzles and a fire detection system.

5.3.2.4 Fire Zone 8.2.6.A (Elevation 595 feet 0 inches)

Major fire hazards in this fire zone are protected by automatic water suppression and/or fire detection. Wet pipe sprinkler

systems protect the feedwater pump system (column/rows 19-22/G-H) and the high pressure heater bay (column/rows 17-19/G-H). A preaction system activated by ionization detectors protects the Unit 1 trackway at the south end of the fire zone (column/lines 24-25/D-H). Smoke detectors are located throughout the corridor along row F from column 17 to column 24 and between the Unit 1 diesel generator room and the reactor feed pump room. Also, smoke detection and sprinkler protection are provided throughout the corridor which connects Fire Zone 8.2.6.A with 8.2.6.C and 8.2.6.E. (This protection extends north from column/row 17/G to 9/G.)

5.3.2.5 Fire Zone 8.2.6.B (Elevation 595 feet 0 inches)

The entire fire zone except in the corridor along row C and over the condenser is protected by an automatic wet pipe sprinkler system. Automatic suppression is also provided in the corridor along row C in the form of water spray systems activated by thermal fire detectors.

5.3.2.6 Fire Zone 8.2.7.A (Elevation 615 feet 6 inches)

Major fire hazards in this fire zone are protected by automatic water suppression and/or fire detection. Ionization detectors are provided above 4-kV switchgear buses 13 and 14 and thermal detectors are provided above the hydrogen seal oil unit. The rest of the fire zone, except above the equipment removal hatches and the feeds from the generator to the main power transformer, is protected by smoke detectors. Automatic suppression systems are installed in the area between rows F and G and column lines 22 and 23. Both a water spray system and a wet pipe sprinkler system are provided. The water spray system protects the hydrogen seal oil unit and the wet pipe sprinkler system protects the general area defined by the above coordinates.

5.3.2.7 Fire Zone 8.2.7.B (Elevation 615 feet 6 inches)

This zone is protected by an automatic wet pipe sprinkler system throughout except over the low pressure heaters and in the corridor along row C. Separate detection is provided only around cable risers in the high pressure heater bay.

5.3.2.8 Fire Zone 11.1.1.A (Elevation 547 feet 0 inches)

This fire zone is provided throughout with a fire detection and automatic wet pipe suppression system.

5.3.2.9 Fire Zone 11.1.1.C (Elevation 547 feet 0 inches)

This fire zone is provided throughout with a fire detection and automatic wet pipe suppression system.

5.3.2.10 Fire Zone 6.1.A (Elevation 615 feet 6 inches)

This fire zone is provided throughout with fire detection.

5.3.2.11 Fire Zone 6.1.B (Elevation 615 feet 6 inches)

This fire zone is provided throughout with fire detection.

5.3.2.12 Fire Zone 7.1 (Elevation 628 feet 6 inches)

This fire zone is provided throughout with fire detection.

5.3.2.13 Fire Zone 8.2.3.A (Elevation 572 feet 6 inches)

This fire zone is protected throughout by both an automatic wet pipe sprinkler suppression system and a fire detection system.

5.3.2.14 Fire Zone 8.2.3.B (Elevation 580 feet 0 inches and 584 feet 6 inches)

No fire detection or automatic suppression systems are provided in this fire zone, which is the Unit 1 radwaste pipe tunnel.

5.3.2.15 Fire Zone 11.1.1.B (Elevation 547 feet 0 inches)

This fire zone is provided throughout with a fire detection and automatic wet pipe suppression system.

5.3.2.16 Fire Zone 9.1 (Elevation 595 feet 0 inches)

This fire zone is protected throughout by an automatic CO₂ suppression system activated by thermal detectors. A wet pipe sprinkler system is also provided in the day tank room.

5.3.2.17 Fire Zone 14.1.1 (Elevations 626 feet 0 inches, 648 feet 6 inches, and 668 feet 0 inches)

Fire detection and automatic suppression systems are not provided in this fire zone.

5.3.3 Safe Shutdown Equipment

Safe shutdown equipment located in the Southern Zone Group and the shutdown path(s) which employ the equipment are listed in Table 5.2-6.

Cabling required by the alternate shutdown path D (which is available for shutdown related to a fire in the Southern Zone Group) is routed independent of this zone group with the exception of the alternate feed to diesel generator 1/2 cooling water pump which is protected everywhere in this zone by a 1-hour rated fire barrier.

5.3.4 Fire Hazards Analysis

5.3.4.1 Fire Zone 8.2.1.A (Elevation 547 feet 0 inches)

This fire zone has a floor area of approximately 4,300 ft² and a ceiling height of approximately 25 feet. The total average fire loading in this fire zone from fixed combustibles is approximately 1,000 Btu/ft². The four condensate/condensate booster pump units in the fire zone contain 6 gallons of lubricating oil and 2 pounds of grease each. The condensate transfer pumps and the sump pumps contain a total of approximately .75 gallons of lubricating oil and 3 pounds of grease. There are cables routed in the cable trays through the zone. The zone is protected throughout by an automatic wet pipe sprinkler system and the addition of fire detection is not warranted considering the light combustible loading. This zone is separated from Fire Zones 8.2.1.C, 11.1.1.A, 11.1.1.B, and 11.1.1.C by a concrete interior wall. Personnel access to Fire Zones 11.1.1.A, 11.1.1.B and 11.1.1.C is gained via unlabeled watertight bulkhead doors. Unsealed penetrations connect Fire Zone 8.2.1.A with adjacent Fire Zones 8.2.3.A and 8.2.1.C. Fire Zone 8.2.1.C contains no equipment required by shutdown path D. However, this zone contains cabling for the swing diesel cooling water pump and cubicle cooler. This diesel generator 1/2 cooling water pump cable is protected by a 1-hour rated fire barrier everywhere it is routed in this fire zone.

5.3.4.2 Fire Zone 8.2.1.C (Elevation 558 feet 6 inches)

This fire zone has a floor area of approximately 4,500 ft² and a ceiling height of approximately 37 feet. The total fire loading from fixed combustibles in this fire zone is negligible. The fire zone is protected throughout by an automatic sprinkler system and the addition of fire detection would not significantly increase the level of protection in this fire zone. This fire zone is separated from adjacent Fire Zone 8.2.1.A by a reinforced concrete wall. Personnel access to Fire Zone 8.2.1.C from Fire Zone 8.2.1.A is gained via a nonlabel door. It is separated from Fire Zone 8.2.6.B by a reinforced concrete ceiling which has unsealed penetrations. This fire zone contains no equipment or cabling required by shutdown path D.

5.3.4.3 Fire Zone 8.2.4 (Elevation 588 feet 0 inches)

This fire zone, the Unit 1 cable tunnel, is provided with both fixed water suppression and fire detection throughout. No exemption is required in regard to this fire zone.

5.3.4.4 Fire Zone 8.2.6.A (Elevation 595 feet 0 inches)

This fire zone has a floor area of approximately 15,440 ft² and a ceiling height of approximately 20 feet. The total fire load from fixed combustibles is less than 25,000 Btu/ft². The major hazards in this fire zone are the three reactor feed pumps, electrical equipment and cabling. The feed pumps and high pressure heater bay are protected with an automatic water suppression system. Fire detectors are provided throughout the corridor along row G between columns 17-24. Suppression and detection are provided for the Unit 1 trackway and between column rows 9 to 17 along row G in the corridor that leads to the common area of the turbine building and communicates between Unit 1 and Unit 2. This combination of suppression and detection systems ensures that, were a fire to start in this fire zone, it would be quickly detected and controlled. Therefore, the installation of additional fire protection systems is unwarranted. No equipment required by shutdown path D is present in this fire zone.

5.3.4.5 Fire Zone 8.2.6.B (Elevation 595 feet 0 inches)

This fire zone has a floor area of approximately 14,700 ft² and a fire loading of less than 5,000 Btu/ft². The only significant combustible material in this fire zone is the cable insulation of cables routed through this fire zone. In light of the extremely low combustible loading in this fire zone and the existing water suppression, the installation of a detection system in addition to the thermal detectors along column line C is unwarranted. No equipment or cabling required by shutdown path D is present in this fire zone.

5.3.4.6 Fire Zone 8.2.7.A (Elevation 615 feet 6 inches)

This fire zone has a floor area of approximately 9,400 ft² and a ceiling height of approximately 24 feet. The total fire loading from fixed combustibles is less than 40,000 Btu/ft². The hydrogen seal oil unit, which contains 425 gallons of oil, and cable insulation are the major sources of combustibles in the fire zone. The hydrogen seal oil unit area is protected by an automatic water spray system. Detection is provided throughout this fire zone, except above the equipment removal hatches and the feeds from the generator to the main power transformer.

4-kV Switchgears 13 and 14 are located in this fire zone. The installation of a fixed fire suppression system above these switchgears will not significantly increase the level of fire protection in Fire Zone 8.2.7.A since the combustible loading of the fire zone is light, there is alternate safe shutdown capability and fire detection and manual suppression equipment are installed. Also, the installation of any type of fixed suppression system other than water, such as cardox, halon or foam would be ineffective or inappropriate for the areas in which these switchgear are

located and the inadvertent actuation of any fixed water suppression system located over this equipment could result in the fault or failure of that equipment. Due to the existence of detection and manual suppression equipment there is reasonable assurance that a fire in any of these areas would be promptly detected and extinguished. Thus, the level of fire protection in this fire zone is equivalent to the technical requirements of Section III.G.2 of Appendix R to 10 CFR 50.

5.3.4.7 Fire Zone 8.2.7.B (Elevation 615 feet 6 inches)

This fire zone has a floor area of approximately 6,100 ft² and a ceiling height of approximately 24 feet. The only fixed combustible material present is cable insulation associated with cabling in cable trays which results in a total fire loading of less than 35,000 Btu/ft². This fire zone is protected by an automatic wet pipe sprinkler system throughout the fire zone, except over the low pressure heaters and in the corridor along row C. Separate detection is provided only around cable risers in the high pressure heater bay. Installation of an additional fire detection system is not justified due to the fire loading and lack of major fire hazards, and the existing fire protection systems in this fire zone. No equipment associated with shutdown path D is present in this fire zone.

5.3.4.8 Fire Zone 11.1.1.A (Elevation 547 feet 0 inches)

This fire zone is provided with both fixed automatic water suppression and fire detection throughout. No exemption is required in regard to this fire zone.

5.3.4.9 Fire Zone 11.1.1.C (Elevation 547 feet 0 inches)

This fire zone is provided with both fixed automatic suppression and fire detection throughout. No exemption is required in regard to this fire zone.

5.3.4.10 Fire Zones 6.1.A and 6.1.B (Elevation 615 feet 6 inches)

These two fire zones have a total floor area of 671 ft² and a ceiling height of approximately 13 feet. The only fixed combustible material present is cable insulation associated with cabling in cable trays and panels which results in a total fire loading of less than 22,000 Btu/ft². These fire zones are protected throughout with fire detection. Installation of an automatic water suppression system is not justified due to the electrical equipment in the rooms, low fire loading, lack of major fire hazards, and the existing fire detection in these fire zones. No equipment associated with shutdown path D is present in these fire zones.

5.3.4.11 Fire Zone 7.1 (Elevation 628 feet 6 inches)

This fire zone has a floor area of approximately 671 ft² and a ceiling height of approximately 10 feet 6 inches. The only fixed combustible material present is plastic associated with the battery casings and battery rack rail insulation which results in a total fire loading of less than 52,000 Btu/ft². This zone is protected throughout with fire detection. Installation of an automatic water suppression system is not justified due to the low fire loading and lack of major fire hazards, and the existing fire detection in this fire zone. No equipment associated with shutdown path D is present in this fire zone.

5.3.4.12 Fire Zone 8.2.3.A (Elevation 572 feet 6 inches)

This fire zone is provided with both fixed water suppression and fire detection throughout. No exemption is required in regard to this fire zone.

5.3.4.13 Fire Zone 8.2.3.B (Elevation 580 feet 0 inches and 584 feet 6 inches)

This fire zone has a floor area of approximately 1600 ft² and a ceiling height that varies from 7 feet 10 inches to 12 feet 4 inches. The total fire loading from fixed combustibles in this fire zone is negligible. No safe shutdown equipment or cabling is located in this zone. Due to the low fire loading and lack of fire hazards, installation of fire detection or suppression systems is unwarranted.

5.3.4.14 Fire Zone 11.1.1.B (Elevation 547 feet 0 inches)

This fire zone is provided with both fixed automatic water suppression and fire detection throughout. No exemption request is required in regard to the fire zone.

5.3.4.15 Fire Zone 9.1 (Elevation 595 feet 0 inches)

This fire zone is provided with both fixed automatic suppression and fire detection throughout. No exemption is required in regard to this fire zone.

5.3.4.16 Fire Zone 14.1.1 (Elevation 626 feet 0 inches, 648 feet 0 inches, and 668 feet 0 inches)

This fire zone has a total floor area, combining the three elevations, of approximately 8100 ft². The total fire loading in the zone due to fixed combustibles is less than 1000 Btu/ft². No safe shutdown equipment is located in this zone. Due to the low fire loading and lack of major fire hazards, installation of fire detection or suppression systems is not warranted.

5.3.5 Conclusions

Based on this analysis, an exemption is requested for the Southern Zone Group of the Quad Cities Units 1 and 2 turbine building from the requirements of Appendix R Section III.G.3 that fire detection and fixed water suppression be provided throughout those zones for which an alternative shutdown method is utilized. The technical bases that justify the exemption request are summarized as follows:

1. Most fire zones in the Southern Zone Group are provided with some form of fixed fire protection - automatic fire detection, automatic water suppression, or a combination of both - as follows:

<u>FIRE ZONE</u>	<u>FIXED PROTECTION</u>
8.2.1.A	Automatic water suppression throughout
8.2.1.C	Automatic water suppression throughout
8.2.4	Automatic water suppression and fire detection throughout (No exemption requested)
8.2.6.A	Automatic water suppression and/or fire detection throughout most sections
8.2.6.B	Automatic water suppression throughout
8.2.7.A	Automatic water suppression and/or detection throughout most sections
8.2.7.B	Automatic water suppression throughout most sections
11.1.1.A	Automatic water suppression and fire detection throughout (No exemption requested)
11.1.1.C	Automatic water suppression and fire detection throughout (No exemption requested)
6.1.A and 6.1.B	Fire detection throughout
7.1	Fire detection throughout
8.2.3.A	Automatic water suppression and fire detection throughout (No exemption requested)
8.2.3.B	No automatic fire detection or suppression
11.1.1.B	Automatic water suppression and fire detection throughout (No exemption requested)

9.1 Automatic gaseous suppression and fire detection throughout supplemented by automatic water suppression in the day tank room (No exemption requested)

14.1.1 No automatic fire detection or suppression

2. Major fire hazards are protected with an automatic water suppression system and/or fire detection system.
3. The fire zones within the Southern Zone Group, though not separated from one another by 3-hour rated fire barriers, are separated in most instances by reinforced concrete walls, ceilings, or floors which would significantly inhibit the spread of any fire.
4. In those fire zones where maloperation of a zone-wide water suppression system could damage important electrical equipment, such a system has not been installed. Other fire zones where automatic suppression systems are not provided (Fire Zones 8.2.3.B and 14.1.1) have low combustible loadings (less than 1000 Btu/ft²) and, as a result, the potential for fire ignition and spread is considered too low to justify installation of automatic suppression systems.
5. The level of protection provided by the fire protection features ensures that damage from a fire in the Southern Zone Group would be limited in extent and not adversely impact the capability to safely shut down the plant.
6. Fire zones in the Southern Zone Group utilize the same alternate shutdown path.
7. The installation of additional fire detection and/or suppression systems would not significantly enhance fire safety in this zone group.

5.4 JUSTIFICATION FOR LACK OF COMPLETE SUPPRESSION AND DETECTION IN THE NORTHERN ZONE GROUP

5.4.1 Introduction

The Northern Zone Group of the turbine building is composed of 17 fire zones in the northern portion of the turbine building. These fire zones are listed and briefly described in Table 5.2-1.

Because alternate shutdown is utilized for the Northern Zone Group, Appendix R requires that fire detection and fixed fire suppression be present throughout. As seen in Figures B-8, B-9, B-10, B-12, B-14, and B-22 only detection or suppression is present in most portions of this zone group. However, these fire protection features provide a level of protection which ensures that any fire will be quickly detected and controlled and additional detection and suppression systems would not significantly enhance the level of safety at Quad Cities.

5.4.2 Fire Protection System

All 17 fire zones of the Northern Zone Group, except for the Unit 2 Radwaste Tunnel (Fire Zone 8.2.2.B) and the Unit 2 Off-Gas Recombiner Room (Fire Zone 14.1.2), are provided with some form of automatic fire protection system - detection, water suppression, or a combination of both - as shown on Figures B-8, B-9, B-10, B-12, B-14, and B-22. These systems were selected and designed to match the specific fire hazards in and safety and operational concerns associated with the particular fire zone. In addition, fire hose stations and portable extinguishers are available for manual fire fighting throughout the zone group.

The specific fire protection systems for the 17 fire zones are as follows.

5.4.2.1 Fire Zone 8.2.1.B (Elevation 547 feet 0 inches)

This fire zone is protected throughout by an automatic wet pipe sprinkler suppression system. No separate detection is provided.

5.4.2.2 Fire Zone 8.2.1.D (Elevation 558 feet 6 inches)

This fire zone is protected throughout by an automatic wet pipe sprinkler suppression system. No separate detection is provided.

5.4.2.3 Fire Zone 8.2.5 (Elevation 588 feet 0 inches)

This fire zone, the Unit 2 cable tunnel, is protected throughout by both an automatic wet pipe sprinkler suppression utilizing directional nozzles and a fire detection system throughout.

5.4.2.4 Fire Zone 8.2.6.E (Elevation 595 feet 0 inches)

Major fire hazards in this fire zone are protected by automatic water suppression and/or fire detection. A wet pipe sprinkler system protects the feedwater pump system (column/rows 4-7/G-H) and the high pressure heater bay (column/rows 7-9/G-H). A pre-action system activated by ionization detectors protects the Unit 2 trackway at the north end of the fire zone. Smoke detectors are located throughout the corridor along row F from column 2 to column 9 and between the Unit 2 diesel generator room and the reactor feed pump room. Also, smoke detection and sprinkler protection are provided throughout the corridor which connects Fire Zone 8.2.6.A with 8.2.6.C and 8.2.6.E. (This protection extends north from column/row G/17 to G/9.)

5.4.2.5 Fire Zone 8.2.6.D (Elevation 595 feet 0 inches)

The entire fire zone except in the corridor along row C and over the condenser is protected by an automatic wet pipe sprinkler system. Automatic suppression is also provided in the corridor along row C in the form of a water deluge system activated by thermal fire detectors.

5.4.2.6 Fire Zone 8.2.7.E (Elevation 615 feet 6 inches)

Major fire hazards in this fire zone are protected by automatic water suppression and/or fire detection. Ionization fire detectors are installed above 4-kV switchgear buses 23 and 24 and thermal detectors are provided above the hydrogen seal oil unit to activate an open head water spray system. The rest of the fire zone, except above the equipment removal hatches and the feeds from the generator to the main power transformer, is protected by smoke detectors. Automatic wet pipe suppression systems are installed in the area between rows F and G and column lines 3 and 5.

5.4.2.7 Fire Zone 8.2.7.D (Elevation 615 feet 6 inches)

This fire zone is protected by an automatic wet pipe sprinkler system throughout, except over the low pressure heaters and in the corridor along row C. Separate detection is provided only around cable risers in the high pressure heater bay.

5.4.2.8 Fire Zone 11.1.2.A (Elevation 547 feet 0 inches)

This fire zone is provided with smoke detection and an automatic wet pipe suppression system throughout.

5.4.2.9 Fire Zone 11.1.2.B (Elevation 547 feet 0 inches)

This fire zone is provided with smoke detection and an automatic wet pipe suppression system throughout.

5.4.2.10 Fire Zone 11.1.2.C (Elevation 547 feet 0 inches)

This fire zone is provided with smoke detection and an automatic wet pipe suppression system throughout.

5.4.2.11 Fire Zone 6.2.A (Elevation 615 feet 6 inches)

This fire zone is provided with fire detection throughout.

5.4.2.12 Fire Zone 6.2.B (Elevation 615 feet 6 inches)

This fire zone is provided with fire detection throughout.

5.4.2.13 Fire Zone 7.2 (Elevation 628 feet 6 inches)

This fire zone is provided with fire detection throughout.

5.4.2.14 Fire Zone 8.2.2.A (Elevation 572 feet 6 inches)

This fire zone is provided with smoke detection and an automatic wet pipe suppression system throughout.

5.4.2.15 Fire Zone 8.2.2.B (Elevations 580 feet 0 inches and 584 feet 6 inches)

No fire detection or automatic suppression systems are provided in this fire zone, which is the Unit 2 Radwaste Pipe Tunnel.

5.4.2.16 Fire Zone 9.2 (Elevation 595 feet 0 inches)

This fire zone is protected throughout by an automatic CO₂ suppression system activated by thermal detectors. A wet pipe sprinkler system is also provided in the day tank room.

5.4.2.17 Fire Zone 14.1.2 (Elevations 626 feet 6 inches, 648 feet 6 inches, and 668 feet 0 inches)

Fire detection and automatic suppression systems are not provided in this fire zone.

5.4.3 Safe Shutdown Equipment

Safe shutdown equipment located in the Northern Zone Group and the shutdown path(s) which employ the equipment are listed in Table 5.2-4.

Cabling required by the alternate shutdown path C (which is available for shutdown related to a fire in the Northern Zone Group) is routed independent of this zone group.

5.4.4 Fire Hazards Analysis

5.4.4.1 Fire Zone 8.2.1.B (Elevation 547 feet 0 inches)

This fire zone has a floor area of approximately 4,300 ft² and a ceiling height of approximately 25 feet. The total fire loading in this zone from fixed combustibles is only about 1,000 Btu/ft². The four condensate/condensate booster pump units in the fire zone contain 6 gallons of lubricating oil and 2 pounds of grease each. The condensate transfer pumps and the sump pumps contain a total of approximately 0.75 gallons of lubricating oil and 5 pounds of grease. There are cables routed in the cable trays through the fire zone. The fire zone is protected throughout by an automatic sprinkler system. The addition of fire detection is not warranted considering the light combustible loading. This fire zone is separated from Fire Zones 11.1.2.A, 11.1.2.B, and 11.1.2.C by a concrete interior wall with a nonlabeled watertight bulkhead door through it into each fire zone. Fire Zone 8.2.1.B is separated from Fire Zone 8.2.2.A by a reinforced concrete ceiling which has unsealed penetrations. Fire Zone 8.2.1.B is separated from adjacent Fire Zone 8.2.1.D by a reinforced concrete wall that contains an unlabeled door. This fire zone contains no equipment required by shutdown path C.

5.4.4.2 Fire Zone 8.2.1.D (Elevation 558 feet 6 inches)

This fire zone has a floor area of approximately 4,500 ft² and a ceiling height of approximately 37 feet. The total fire loading from fixed combustibles in this fire zone is negligible. The fire zone is protected throughout by an automatic sprinkler system. The addition of fire detection would not significantly increase the level of protection in this zone. This zone is not separated from adjacent Fire Zone 8.2.1.B by a rated fire barrier. It is separated from Fire Zone 8.2.6.D by a reinforced concrete ceiling which has unsealed penetrations. This fire zone contains no equipment or cabling required by shutdown path C.

5.4.4.3 Fire Zone 8.2.5 (Elevation 588 feet 0 inches)

This fire zone, the Unit 2 cable tunnel, is provided with both a fixed automatic water suppression utilizing directional nozzles and a fire detection system throughout. No exemption is required in regard to this fire zone.

5.4.4.4 Fire Zone 8.2.6.E (Elevation 595 feet 0 inches)

This fire zone has a floor area of approximately 14,700 ft² and a ceiling height of approximately 20 feet. The total fire load from fixed combustibles is less than 30,000 Btu/ft². The major hazards in this fire zone are the three reactor feed pumps, electrical equipment, and cabling. The feed pumps and the high pressure heater bay are protected with an automatic water suppression system. Smoke detectors are provided throughout the corridor along row G between columns 2 through 9. Suppression and detection are provided for the Unit 2 trackway and in the corridor that leads to the common area of the turbine building. This combination of water suppression and fire detection systems ensures that, were a fire to start in this fire zone, it would be quickly detected and controlled. Therefore, the installation of additional fire protection systems is unwarranted. No equipment required by shutdown path C is present in this zone.

5.4.4.5 Fire Zone 8.2.6.D (Elevation 595 feet 0 inches)

This fire zone has a floor area of approximately 14,700 ft² and a fire loading of less than 5,000 Btu/ft². The only significant combustible material in this fire zone is the cable insulation on cables routed through this zone. In light of the extremely low combustible loading and the existing automatic water suppression, the installation of a fire detection system, in addition to the thermal detectors provided along column line C, is unwarranted. No equipment or cabling required by shutdown path C is present in this zone.

5.4.4.6 Fire Zone 8.2.7.E (Elevation 615 feet 6 inches)

This fire zone has a floor area of approximately 9,500 ft² and a ceiling height of approximately 24 feet. The total fire loading from fixed combustibles is less than 30,000 Btu/ft². The hydrogen seal oil unit, which contains 425 gallons of oil, and cable insulation, associated with electrical panels and cabling, are the major sources of combustibles in the fire zone. The hydrogen seal oil unit is protected by an automatic water suppression system. Fire detection is provided throughout this zone, except above the equipment removal hatches and the feeds from the generator to the main power transformer. No equipment required by shutdown path C is present in this fire zone.

4-kV Switchgears 23 and 24 are located in this fire zone. The installation of a fixed fire suppression system above these switchgears will not significantly increase the level of fire protection in Fire Zone 8.2.7.E since the combustible loading of the fire zone is light, there is alternate safe shutdown capability, and fire detection and manual suppression equipment are installed. Also, the installation of any type of fixed suppression system other than water, such as carbox, halon or foam, would be ineffective or inappropriate for the areas in which these switchgears

are located and the inadvertent actuation of any fixed water suppression system located over this equipment could result in the fault or failure of that equipment. Due to the existence of detection and manual suppression equipment, there is reasonable assurance that a fire in any of these areas would be promptly detected and extinguished. Thus the level of fire protection in this fire zone is equivalent to the technical requirements of Section III.G.2 of Appendix R to 10 CFR 50.

5.4.4.7 Fire Zone 8.2.7.D (Elevation 615 feet 6 inches)

This fire zone has a floor area of approximately 6,100 ft² and a ceiling height of approximately 24 feet. The only fixed combustible material present is cable insulation associated with cabling in cable trays which results in a total fire loading of less than 30,000 Btu/ft². This zone is protected by a wet pipe sprinkler system throughout, except over the low pressure heaters and in the corridor along row C. Separate detection is provided only around cable risers in the high pressure heater bay. Installation of additional fire protection systems in this fire zone is not justified due to the low fire loading and lack of major fire hazards and the existing suppression system in this fire zone. No equipment associated with shutdown path C is present in this fire zone.

5.4.4.8 Fire Zone 11.1.2.A (Elevation 547 feet 0 inches)

This fire zone is provided with both fixed automatic water suppression and fire detection throughout. No exemption is required in regard to this fire zone.

5.4.4.9 Fire Zone 11.1.2.B (Elevation 547 feet 0 inches)

This fire zone is provided with both fixed automatic water suppression and fire detection throughout. No exemption is required in regard to this fire zone.

5.4.4.10 Fire Zone 11.1.2.C (Elevation 547 feet 0 inches)

This fire zone is provided with both fixed automatic water suppression and fire detection throughout. No exemption is required in regard to this fire zone.

5.4.4.11 Fire Zones 6.2.A and 6.2.B (Elevation 615 feet 6 inches)

These two fire zones have a total floor area of 660 ft² and a ceiling height of approximately 13 feet. The only fixed combustible material present is cable insulation associated with cabling in cable trays and panels which results in a total fire loading of less than 40,000 Btu/ft². These fire zones are protected throughout with fire detection. Installation of an automatic

water suppression system in these fire zones is not justified due to the low fire loading and lack of major fire hazards and the existing fire detection.

5.4.4.12 Fire Zone 7.2 (Elevation 628 feet 6 inches)

This fire zone has a floor area of approximately 660 ft² and a ceiling height of approximately 10 feet 6 inches. The only fixed combustible materials present are plastic associated with the battery casings and the battery rack rail insulation, which results in a total fire loading of less than 50,000 Btu/ft². This fire zone is protected throughout with fire detection. Installation of an automatic water suppression system in this zone is not justified due to the low fire loading and lack of major fire hazards and the existing fire detection. No equipment associated with shutdown path C is present in this fire zone.

5.4.4.13 Fire Zone 8.2.2.A (Elevation 572 feet 0 inches)

This fire zone is provided with both automatic fixed water suppression and fire detection throughout. No exemption is required in regard to this zone.

5.4.4.14 Fire Zone 8.2.2.B (Elevations 580 feet 0 inches and 584 feet 6 inches)

This fire zone has a floor area of approximately 1600 ft² and a ceiling height that varies from 7 feet 10 inches to 12 feet 4 inches. The total fire loading from fixed combustibles in this zone is negligible. No safe shutdown equipment or cabling is located in this zone. Due to the low fire loading and lack of fire hazards, installation of fire detection or suppression systems is unwarranted.

5.4.4.15 Fire Zone 9.2 (Elevation 595 feet 0 inches)

This fire zone is provided with both fixed automatic suppression and fire detection throughout. No exemption is required in regard to this zone.

5.4.4.16 Fire Zone 14.1.2 (Elevations 626 feet 0 inches, 648 feet 0 inches, and 668 feet 0 inches)

This fire zone has a total floor area, combining the three elevations, of approximately 8100 ft². The total fire loading in the zone due to fixed combustibles is less than 1000 Btu/ft². No safe shutdown equipment or cabling is located in this zone. Due to the low fire loading and lack of major fire hazards, installation of fire detection or automatic suppression systems is not warranted.

5.4.5 Conclusions

Based on this analysis, an exemption is requested for the Northern Zone Group of the Quad Cities Units 1 and 2 turbine building from the requirements of Appendix R Section III.G.3 that fire detection and fixed suppression be provided throughout those zones for which an alternative shutdown method is utilized. The technical bases that justify the exemption request are summarized as follows:

1. Most fire zones in the Northern Zone Group are provided with some form of fixed fire protection - automatic detection, suppression, or a combination of both - as follows:

<u>FIRE ZONE</u>	<u>FIXED PROTECTION</u>
8.2.1.B	Automatic water suppression throughout
8.2.1.D	Automatic water suppression throughout
8.2.5	Automatic water suppression and fire detection throughout (No exemption requested)
8.2.6.E	Automatic water suppression and/or fire detection throughout most sections
8.2.6.D	Automatic water suppression throughout
8.2.7.E	Automatic water suppression and/or fire detection throughout most sections
8.2.7.D	Automatic water suppression throughout most sections
11.1.2.A	Automatic water suppression and fire detection throughout (No exemption requested)
11.1.2.B	Automatic water suppression and fire detection throughout (No exemption requested)
11.1.2.C	Automatic water suppression and fire detection throughout (No exemption requested)
6.2.A and 6.2.B	Fire detection throughout
7.2	Fire detection throughout
8.2.2.A	Automatic water suppression and fire detection throughout (No exemption requested)
8.2.2.B	No automatic fire detection or suppression

9.2 Automatic gaseous suppression and fire detection throughout supplemented by automatic water suppression in the day tank room (No exemption requested)

14.1.2 No automatic fire detection or suppression

2. Major fire hazards are protected with an automatic water suppression system and/or fire detection system.
3. The fire zones within the Northern Zone Group, though not separated from one another by complete 3-hour barriers, are separated in most instances by reinforced concrete walls, ceilings, or floors which would inhibit the spread of any fire effects. (See exemption 5.2.)
4. In those fire zones where maloperation of a zone-wide water suppression system could damage important electrical equipment, such a system has not been installed. Other fire zones where automatic suppression systems are not provided (Fire Zones 8.2.2.B and 14.1.2) have low combustible loadings (less than 1000 Btu/ft²) and, as a result, the potential for fire ignition and spread is considered too low to justify installation of automatic suppression systems.
5. The level of protection provided by the fire protection features ensures that damage from a fire in the Northern Zone Group would be limited in extent and not adversely impact the capability to safely shut down the plant.
6. Fire zones in the Northern Zone Group utilize the same alternate shutdown path.
7. The installation of additional fire detection and/or suppression systems would not significantly enhance fire safety in this zone group.

5.5 JUSTIFICATION FOR LACK OF COMPLETE SUPPRESSION AND DETECTION IN THE CENTRAL ZONE GROUP

5.5.1 Introduction

The Central Zone Group of the turbine building is composed of five fire zones. These fire zones are listed and briefly described in Table 5.2-2. Each fire zone contains equipment and cabling associated with both Units 1 and 2.

Because alternative shutdown is utilized for the Central Zone Group, Appendix R requires that fire detection and fixed fire suppression be present throughout. As seen in Figures B-11, B-12, B-13, B-14, B-21 and B-22, only suppression or detection is present in most portions of this zone group. However, these fire protection features provide a level of protection which ensures that any fire in this zone group will be quickly detected and controlled. Any additional detection and suppression systems would not significantly enhance the level of safety at Quad Cities.

5.5.2 Fire Protection System

5.5.2.1 Fire Zone 8.2.6.C (Elevation 595 feet 0 inches)

Automatic detection and water suppression systems protect the corridors (which extend from 9-12/G and 14-17/G) between the central and each adjoining zone group. Fire detection is present throughout the central portion of this fire zone (bounded by column/row 12-14/C-H). Fixed water suppression is present in the vicinity of the EHC units and in the far eastern portion of this fire zone (bounded by column/row 12-14/G-H). Fire detection is installed above the instrument air compressor and EHC fluid reservoir. This zone also contains equipment for use in manual fire fighting.

5.5.2.2 Fire Zone 8.2.7.C (Elevation 615 feet 6 inches)

Fire detection is installed above the cable penetrations from the reactor to the turbine building.

Fire detection is also present in the far western portion of the fire zone bounded by column/row 12-14/C-D and above the MG set oil coolers and pumps. Fixed water suppression is present throughout the fire zone with the exception of an area bounded by column/row 9-17/C-D where the combustible loading is minimal. Additional local automatic water spray systems are available around the turbine oil reservoirs. This zone also contains equipment for use in manual fire fighting.

5.5.2.3 Fire Zone 5.0 (Elevation 595 feet 0 inches)

This fire zone is provided with fire detection throughout. No automatic suppression system is provided.

5.5.2.4 Fire Zone 8.1 (Elevation 595 feet 0 inches)

This fire zone is protected by a wet pipe sprinkler system throughout. No separate detection is provided.

5.5.2.5 Fire Zone 8.2.10 (Elevation 626 feet 0 inches)

No fire detection or automatic fire suppression systems are provided in this zone.

5.5.3 Safe Shutdown Equipment

Safe shutdown equipment located in the Central Zone Group and the shutdown path(s) which employ the equipment are listed in Table 5.2-5.

No cabling or equipment required for shutdown paths E2 and H, which could be used for a fire in the Central Zone Group, is located in Fire Zones 8.2.6.C, 8.2.7.C, 5.0, 8.1, or 8.2.10.

5.5.4 Fire Hazards Analysis

5.5.4.1 Fire Zone 8.2.6.C (Elevation 595 feet 0 inches)

This fire zone has a floor area of approximately 17,600 ft² and a ceiling height of approximately 20 feet. The total fire loading due to fixed combustibles is about 20,000 Btu/ft² with the major combustible material being cable insulation associated with electrical panels and cabling. Fire retardant electro-hydraulic control (EHC) fluid is also located in this fire zone. It has not been included in the fire loading for this fire zone because of the high flash point and local water spray systems around the EHC units. Much of this zone is provided with either fixed suppression or detection, or both. (Figures B-11 and B-12 illustrate the fire protection systems for this fire zone.) An automatic detection and water suppression system protects the corridors (which extend from 9-12/G and 14-17/G) between the central and each adjoining zone group. Fire detection is installed above the instrument air compressor, EHC fluid reservoir, and throughout the central portion of this fire zone (bounded by column/row 12-14/C-H). Fixed water suppression is present in the vicinity of the EHC units and in the eastern portion of this fire zone (bounded by column/row 12-14/D-H). The northwest section (between column/row 9-12/C-D) and the southwest section (between column/row 14-17/C-D) of the fire zone do not contain any safe shutdown equipment or cabling. No suppression or detection is provided in these sections of the fire zone due to the low level of combustibles and lack of safe shutdown equipment. The level of protection provided is sufficient to ensure that any fire would be quickly detected

and contained. Installation of additional suppression and detection systems would not substantially enhance the level of safety at Quad Cities. No equipment or cabling required for the E2 and H shutdown paths is located in this zone.

5.5.4.2 Fire Zone 8.2.7.C (Elevation 615 feet 6 inches)

This fire zone has a floor area of approximately 14,100 ft² and a ceiling height of approximately 24 feet. The total fire loading due to fixed combustibles is approximately 310,000 Btu/ft².

However, approximately 95% of this fire loading is attributable to the two turbine oil reservoirs located in this fire zone, each of which contains a maximum of 13,000 gallons of lubricating oil. The oil reservoirs are each protected by an automatic water spray system actuated by thermal detectors. Also, open gratings around the reservoirs, which empty into a drain system, prevent any oil spill from affecting other parts of the fire zone. Therefore, any fire originating from the reservoirs would be contained. The remaining combustibles in the fire zone give a fire loading of less than 25,000 Btu/ft². The rest of Fire Zone 8.2.7.C (Figures B-13 and B-14 illustrate the fire protection systems in this fire zone) is provided with a wet pipe sprinkler system with the exception of the area bounded by column/row 9-17/C-D. Separate detection systems are present over the MG set oil coolers and pumps, in the area bounded by column/rows 14-15/G-H and 11-12/G-H, and in the western portion of the zone bounded by column/rows 12-14/C-D. The level of protection provided is sufficient to ensure that any fire would be quickly detected and contained. Installation of additional detection or suppression would not substantially enhance the level of safety at Quad Cities. No equipment or cabling required for the E2 and H shutdown paths is located in this zone.

5.5.4.3 Fire Zone 5.0 (Elevation 595 feet 0 inches)

This fire zone has a floor area of approximately 600 ft² and a ceiling height of approximately 15 feet. The total fire loading due to fixed combustibles is about 6000 Btu/ft² with major combustibles being cables associated with electrical panels. Fire detection is provided throughout the zone. Automatic suppression systems have not been installed, however, manual suppression equipment is located just outside this zone in Fire Zone 8.2.6.C. The level of protection provided is sufficient to ensure that any fire would be quickly detected and contained. Installation of automatic suppression systems would not substantially enhance the level of safety at Quad Cities. No equipment or cabling required for the E2 and H shutdown paths is located in this zone.

5.5.4.4 Fire Zone 8.1 (Elevation 595 feet 0 inches)

This fire zone has a floor area of approximately 900 ft² and a ceiling height of 20 feet. The total fire loading due to the

fixed combustibles is about 4.8×10^6 Btu/ft² with the major combustibles being the oil in the clean and dirty oil tanks. An automatic wet pipe sprinkler system is installed throughout the fire zone and the doors entering the zone are on 4-foot 0-inch curbs to prevent oil spills from spreading beyond the zone. The walls and doors surrounding this fire zone are 3-hour fire rated. Installation of a separate fire detection system would not substantially enhance the level of safety at Quad Cities. No equipment or cabling required by the E2 and H shutdown paths is located in this zone.

5.5.4.5 Fire Zone 8.2.10 (Elevation 626 feet 0 inches)

This fire zone has a floor area of approximately 8500 ft² and a ceiling height of approximately 20 feet. The total fire loading due to fixed combustibles is less than 2500 Btu/ft² with the major combustibles being ventilation filters. No fire detection or automatic suppression systems have been installed in this fire zone, however, manual suppression equipment is located throughout the zone. Installation of an automatic suppression system or a fire detection system would not substantially enhance the level of safety at Quad Cities because of the low fire loading of this fire zone and the fact that no equipment or cabling required for the E2 and H shutdown paths is located in this zone.

5.5.5 Conclusions

Based on this analysis, an exemption is requested for the Central Zone Group of the Quad Cities Units 1 and 2 turbine building from the requirements of 10 CFR 50, Appendix R Section III.G.3 to the extent that detection and fixed suppression be provided throughout those fire zones for which an alternative shutdown method is utilized. The technical bases that justify the exemption request are as follows.

1. Each of the five fire zones in the Central Zone Group are provided with extensive automatic suppression and/or detection systems, except for Fire Zone 8.2.10. The only portions of Fire Zones 8.2.6.C and 8.2.7.C (see Figures B-11, B-12, B-13 and B-14) not provided with suppression or detection are in the northwest and southwest sections of the zones. These areas contain primarily equipment associated with the turbine building cooling water.
2. The fire zones in the Central Zone Group contain no equipment or cabling required for shutdown paths E2 or H, the paths utilized for a fire in this zone group.
3. Major fire hazards are protected with both automatic water suppression and detection systems, with the exception of the clean and dirty oil tanks in Fire Zone 8.1 which are not protected with detection. However, Fire Zone 8.1 is enclosed by 3-hour rated fire barriers.

4. The five zones comprising the zone group are separated by reinforced concrete barriers which would inhibit the spread of any fire in the area.
5. The five zones of the zone group, with the exception of Fire Zone 8.1, have low fire loadings (excluding the turbine oil reservoirs which are protected by additional automatic water suppression systems) and additional suppression and detection systems are unwarranted. Although the fire loading of Fire Zone 8.1 is high, the zone is completely enclosed by a 3-hour rated fire barrier.
6. The level of protection provided by the fire protection features ensures that damage from a fire in the Central Zone Group would be limited in extent and not adversely impact the capability to safely shut down the plant.

5.6 JUSTIFICATION FOR LACK OF COMPLETE SUPPRESSION AND DETECTION ON THE OPERATING FLOOR

5.6.1 Introduction

The turbine building operating floor is composed of four equivalent fire areas and one fire zone. These fire areas and zone are listed and briefly described in Table 5.6-1.

Because alternative shutdown is utilized for each of the equivalent fire areas, Appendix R requires that fire detection and fixed fire suppression be present throughout. As seen in Figures B-15 and B-16, only detection or suppression is present in most portions of these fire areas. However, these fire protection features provide a level of protection which ensures that any fire will be quickly detected and controlled and additional detection and suppression systems would not significantly enhance the level of safety at Quad Cities.

5.6.2 Fire Protection System

The four equivalent fire areas on the operating floor are provided with some form of automatic fire protection system - detection or suppression - as shown on Figures B-15 and B-16. These were selected and designed to match the specific fire hazards in, and safety and operational concerns associated with, the particular area. In addition, fire hose stations and portable extinguishers are available for manual fire fighting throughout these fire areas.

The specific fire protection system provided for the four fire areas is as follows:

5.6.2.1 Equivalent Fire Area 8.2.8.A (Elevation 639 feet 0 inches)

The fire hazards in this equivalent fire area are protected by automatic water suppression or detection. The reactor recirculation MG set 1B-202-51 is protected by a wet pipe sprinkler system and an automatic foam-water sprinkler system. MG set 1B and 4-kV switchgear 14-1 are protected by an automatic detection system.

5.6.2.2 Equivalent Fire Area 8.2.8.B (Elevation 639 feet 0 inches)

The fire hazards in this equivalent fire area are protected by automatic water suppression or detection. The reactor recirculation MG set 1A-202-51 is protected by a wet pipe sprinkler system and automatic foam-water sprinkler system, and MG set 1A, 4-kV switchgear 13-1, and 480-V switchgears 18 and 19 are protected by a detection system. A water curtain

(automatic, open head water spray system) designed to deliver a minimum of 3 gallons per linear foot of opening is provided between Fire Areas 8.2.8.B and 8.2.8.C. The system is actuated by smoke detection. The ceiling height in this area is about 20 feet and the spray nozzles are shielded to prevent spray of the electrical equipment in the vicinity. A curb and drain are provided below the water curtain.

5.6.2.3 Equivalent Fire Area 8.2.8.C (Elevation 639 feet 0 inches)

The fire hazards in this equivalent fire area are protected by automatic fire suppression or detection. The reactor recirculation MG set 2B-202-51 is protected by a wet pipe sprinkler system and automatic foam-water sprinkler system. The MG set 2B, 4-kV switchgear 24-1, and 480-V switchgears 28 and 29 are protected by a detection system. The water curtain described above separates Fire Zones 8.2.8.B and 8.2.8.C.

5.6.2.4 Equivalent Fire Area 8.2.8.D (Elevation 639 feet 0 inches)

The fire hazards in this equivalent fire area are protected by automatic fire suppression or detection. The reactor recirculation MG set 2A-202-51 is protected by a wet pipe sprinkler system and automatic foam-water sprinkler system and MG set 2A and 4-kV switchgear 23-1 are protected by a detection system.

5.6.3 Safe Shutdown Equipment

The safe shutdown equipment located in these equivalent fire areas and the shutdown path(s) which employs the equipment are listed in Table 5.6-2.

No cabling or equipment required for each alternate shutdown path (D for Fire Area 8.2.8.A, A for Fire Area 8.2.8.B, C for Fire Area 8.2.8.C, and K for Fire Area 8.2.8.D) is located in the affected equivalent fire area with the exception of Fire Area 8.2.8.C where 480-V Switchgear 28 is located. Since both 480-V Switchgears 28 and 29 could be exposed by a fire in Fire Area 8.2.8.C. An alternate feed from Unit 1, Division II motor control center 19-1 has been installed to provide power to the Unit 2, Division I RHR room cooler fan.

5.6.4 Fire Hazards Analysis

5.6.4.1 Equivalent Fire Area 8.2.8.A (Elevation 639 feet 0 inches)

This equivalent fire area has a floor area of approximately 1,500 ft² and a total fire loading from fixed combustibles of less than 135,000 Btu/ft². The major sources of combustibles are the MG sets, and the very minor cabling located within 4-kV switchgear 14-1. The MG set is protected by automatic

suppression systems. Detection is provided over the switchgear and MG set. Installation of a fixed water suppression system above 4-kV Switchgear 14-1 could result in the fault or failure of the switchgear if the system actuated inadvertently. Fixed suppression systems other than water, such as cardox, halon or foam, would be ineffective for this fire area. No equipment or cabling associated with shutdown path D is present in this equivalent fire area. A 3-hour rated fire barrier is provided from column lines G to H at column line 15 to separate this equivalent fire area from Fire Area 8.2.8.B. In order for a fire in an adjacent fire area to threaten safe shutdown equipment here, the fire would have to overpower the redundant fire suppression systems in the adjacent fire area as well as independent wet pipe and foam-water sprinklers in this fire area to reach the important switchgear.

Due to the existence of fire detection and manual suppression equipment in this equivalent fire area there is a reasonable assurance that a fire in any of these areas would be promptly detected and extinguished. Thus, the level of fire protection in this fire zone is equivalent to the technical requirements of Section III.G.2 of Appendix R to 10 CFR 50.

5.6.4.2 Equivalent Fire Area 8.2.8.B (Elevation 639 feet 0 inches)

This equivalent fire area has a floor area of approximately 2,150 ft², a ceiling height of about 20 feet, and a total fire loading from fixed combustibles of less than 100,000 Btu/ft². The major sources of combustibles are the MG set, the very minor cabling located within 4-kV switchgear 13-1, and the 480-V switchgears 18 and 19. The MG set is protected by both foam-water sprinklers and wet pipe sprinkler systems. Detection is provided over the switchgears and MG set. Installation of a fixed water suppression system above 4-kV Switchgear 13-1 and 480-V Switchgears 18 and 19 could result in the fault or failure of these switchgears if the system actuated inadvertently. Fixed suppression systems other than water, such as cardox, halon or foam, would be ineffective for this fire zone. No equipment or cabling associated with shutdown path A is present in this fire area. A 3-hour rated fire barrier is provided from column line G to H at column line 15 to separate this fire area from Fire Area 8.2.8.A.

An automatic, open head water spray system is installed to separate Fire Areas 8.2.8.B and 8.2.8.C by providing a water curtain along column line 13 (see Subsection 5.6.2.2). For a fire in an adjacent fire area to threaten safe shutdown equipment (switchgear) here, the fire would have to overpower the redundant fire suppression systems in the adjacent fire area as well as independent wet pipe and foam-water sprinklers over the MG set or breach the partial 3-hour fire barrier or automatic water curtain between Fire Areas 8.2.8.B and 8.2.8.C.

Due to the existence of fire detection and manual fire suppression equipment in this equivalent fire area there is a reasonable assurance that a fire in any of these areas would be promptly detected and extinguished. Thus, the level of fire protection in this fire zone is equivalent to the technical requirements of Section III.G.2 of Appendix R to 10 CFR 50.

5.6.4.3 Equivalent Fire Area 8.2.8.C (Elevation 639 feet 0 inches)

This equivalent fire area has a floor area of approximately 2,150 ft² and a total fire loading from fixed combustibles of less than 100,000 Btu/ft². The major sources of combustibles are the MG set, the very minor cabling located within 4-kV switchgear 24-1, and the 480-V switchgears 28 and 29. The MG set is protected by both foam-water sprinklers and wet pipe sprinkler systems. Detection is provided over the switchgears and MG set. Installation of a fixed water suppression system above 4-kV Switchgear 24-1 and 480-V Switchgears 28 and 29 could result in the fault or failure of these switchgear if the system actuated inadvertently. Fixed suppression systems other than water, such as carbox, halon or foam, would be ineffective for this equivalent fire area. No equipment or cabling associated with shutdown path C is present in this fire area with the exception of a 125-Vdc crosstie between 4-kV switchgears 23-1 and 13-1 which is only used for fires in the Northern Zone Group and 480-V Switchgear 28. Since both 480-V Switchgears 28 and 29 could be exposed by a fire in Fire Area 8.2.8.C an alternate feed from Unit 1, Division II motor control center 19-1 has been installed to provide power to the Unit 2, Division I RHR room cooler fan.

A 3-hour rated fire barrier is provided from column lines G to H at column line 11 to separate this equivalent fire area from Fire Area 8.2.8.D.

An automatic, open head water spray system is installed to separate Fire Areas 8.2.8.B and 8.2.8.C by providing a water curtain along column line 13 (see Subsection 5.6.2.2). For a fire in an adjacent fire area to threaten safe shutdown equipment (switchgear) here, the fire would have to overpower the redundant fire suppression systems in the adjacent fire area as well as independent wet pipe and foam-water sprinklers over the MG set or breach the partial 3-hour fire barrier or automatic water curtain between Fire Areas 8.2.8.B and 8.2.8.C.

Due to the existence of fire detection and manual fire suppression equipment in this equivalent fire area there is a reasonable assurance that a fire in any of these areas would be promptly detected and extinguished. Thus, the level of fire protection in this fire zone is equivalent to the technical requirements of Section III.G.2 of Appendix R to 10 CFR 50.

5.6.4.4 Equivalent Fire Area 8.2.8.D (Elevation 639 feet 0 inches)

This equivalent fire area has a floor area of approximately 1,500 ft² and a total fire loading from fixed combustibles of less than 135,000 Btu/ft². The major sources of combustibles are the MG sets and the very minor cabling located within 4-kV switchgear 23-1. The MG set is protected by a water suppression system and a foam-water sprinkler system is also provided for the MG set. Detection is provided over the switchgear and MG set. Installation of a fixed water suppression system above 4-kV Switchgear 23-1 could result in the fault or failure of the switchgear if the system actuated inadvertently. Fixed suppression systems other than water, such as cardox, halon or foam, would be ineffective for this equivalent fire area. No equipment or cabling associated with shutdown path K is present in this fire area.

A 3-hour rated fire barrier is provided from column line G to H along column line 11 to separate this fire area from Fire Area 8.2.8.C. In order for a fire in an adjacent fire area to threaten safe shutdown equipment here, the fire would have to overpower the redundant fire suppression systems in the adjacent fire area as well as independent wet pipe and foam-water sprinklers in this fire area to reach important switchgear.

Due to the existence of fire detection and manual suppression equipment in this equivalent fire area there is a reasonable assurance that a fire in any of these areas would be promptly detected and extinguished. Thus, the level of fire protection in this fire zone is equivalent to the technical requirements of Section III.G.2 of Appendix R to 10 CFR 50.

5.6.5 Conclusions

Based on this analysis, an exemption is requested for the equivalent fire areas on the operating floor of the Quad Cities, Units 1 and 2, turbine building from the requirements of Appendix R Section III.G.3 that detection and fixed suppression be provided throughout those fire areas for which an alternative shutdown method is utilized. The technical bases that justify the exemption request are summarized as follows:

1. All major fire hazards are provided with a fire suppression or detection system.
2. The maloperation of an area-wide fixed suppression system could damage important electrical equipment.
3. The level of protection provided by the fire protection features ensures that damage from a fire in any of these fire areas would be limited in extent and not adversely impact the capability to safely shut down the plant.

4. The installation of additional fire detection and/or suppression systems would not significantly enhance fire safety in these fire areas.
5. It is impractical to build a wall at column line 15 where the water curtain is proposed because of maintenance requirements for the 4-kV switchgear.
6. Equivalent Fire Areas 8.2.8.A, 8.2.8.B, 8.2.8.C, and 8.2.8.D are separated from Fire Zone 8.2.8.E by automatic suppression systems over the MG-sets.

TABLE 5.6-1

FIRE AREAS IN THE OPERATING FLOOR ZONE GROUP

<u>FIRE AREA</u>	<u>DESCRIPTION</u>
8.2.8.A	Unit 1 Turbine Building, main floor, elevation 639 feet 0 inches, south end includes 4-kV switchgear 14-1
8.2.8.B	Unit 1 Turbine Building, main floor, elevation 639 feet 0 inches and 647 feet 6 inches, north end includes 480-V switchgears 18 and 19 and 4-kV switchgear 13-1
8.2.8.C	Unit 2 Turbine Building, main floor, elevation 639 feet 0 inches and 647 feet 6 inches, south end includes 480-V switchgears 28 and 29 and 4-kV switchgear 24-1
8.2.8.D	Unit 2 Turbine Building, main floor, elevation 639 feet 0 inches, north end includes 4-kV switchgear 23-1

TABLE 5.6-2

APPENDIX R HOT SHUTDOWN EQUIPMENT
LOCATED ON THE OPERATING FLOOR

<u>EQUIPMENT</u>	<u>SHUTDOWN PATH</u>
<u>Fire Area 8.2.8.A</u>	
4-kV Bus 14-1	A, B, C, E1, E2, L
<u>Fire Area 8.2.8.B</u>	
4-kV Bus 13-1	C, D
480-V SWGR 18	C, D, E1, E2
480-V SWGR 18 tie to 19	E2
480-V SWGR 19	B, C, E1, E2, L
<u>Fire Area 8.2.8.C</u>	
4-kV Bus 24-1	A, B, D, F, K
480-V SWGR 28	C, D, F, H, L
480-V SWGR 29	A, B, D, F, K
<u>Fire Area 8.2.8.D</u>	
4-kV Bus 23-1	C, D, H, L
<u>Fire Zone 8.2.8.E</u>	
None	Not Applicable

5.7 JUSTIFICATION FOR LACK OF COMPLETE SUPPRESSION AND DETECTION FOR ENCLOSURE OF CABLE IN A FIRE BARRIER HAVING A 1-HOUR RATING

5.7.1 Introduction

The turbine building contains certain cables which are required to be wrapped in a 1-hour fire barriers because they are routed through fire zones which have alternative shutdown methods that take credit for equipment fed by the cable running through the zone. Section III.G.2 of Appendix R requires that a 3-hour barrier or 1-hour fire barrier with detection and automatic fire suppression be provided throughout the area. An exemption to Appendix R is required for these cables since there is not complete detection and suppression in the affected fire zones. However, as the subsequent analysis demonstrates, there will be sufficient protection provided for these cables to ensure that a fire in the fire zone in which they are routed will not damage the cables. The cables for which an exemption is requested are described as follows:

1. The alternative 480-V power feed to the diesel generator 1/2 cooling water pump is wrapped in a 1-hour barrier where it passes through Fire Zones 8.2.1.A and 11.1.1.A in the Southern Zone Group. The detection and automatic suppression utilized to protect this cable is discussed in Subsection 5.7.4.1.
2. The 4-kV bus duct to switchgear 23-1 has been wrapped in a 1-hour barrier where it passes through Fire Zone 8.2.7.D of the Northern Zone Group. The automatic suppression utilized to protect this cable is discussed in Subsection 5.7.4.3.

5.7.2 Fire Protection System

The extensive fire protection systems in the turbine building are shown on Figures B-4, B-8 through B-17, B-21 and B-22. They are described in detail in Subsection 5.7.4 of this request.

5.7.3 Safe Shutdown Equipment

The following power feeds are routed in areas which require their use for safe shutdown during a fire:

- Diesel generator 1/2 cooling water pump alternate feed,

- 4-kV switchgear 23-1 4-kV feed from diesel generator 1/2.

5.7.4 Fire Hazards Analysis

5.7.4.1 Alternate 480-V Power Feed to the Diesel Generator 1/2 Cooling Water Pump

The alternate 480-V power feed to the diesel generator 1/2 cooling water pump is routed through Fire Zones 8.2.1.A and 11.1.1.A in the Southern Zone Group. The Southern Zone Group uses alternative shutdown path D for hot shutdown. Shutdown path D uses the swing diesel generator to power Division I RHR pumps and consequently the diesel generator 1/2 cooling water pump must be utilized for this shutdown path. This cable is protected with at least automatic suppression throughout its routing through the Southern Zone Group.

The cable is protected with complete automatic suppression where it passes through Fire Zone 8.2.1.A. The fire loading in this fire zone is approximately 1,000 Btu/ft². There are also hose reels and portable extinguishers in Fire Zone 8.2.1.A which could be utilized by the fire brigade to extinguish a fire. The cable enters Fire Zone 8.2.1.A from the Central Zone Group where the cable does not require a wrap. Where this cable is routed through Fire Zone 11.1.1.A, it is completely protected by detection, which alarms locally and in the control room, and automatic suppression.

This combination of 1-hour wraps, detection, and automatic suppression provide a level of protection to this alternate 480-V power feed to the diesel generator 1/2 cooling water pumps which is equivalent or meets that prescribed in Appendix R Section III.G.2.

5.7.4.2 4-kV Bus Duct to Switchgear 23-1

The 4-kV bus duct from diesel generator 1/2 to switchgear 23-1 is routed through Fire Zone 8.2.7.D of the Northern Zone Group. The Northern Zone Group uses alternate shutdown path C for hot shutdown. Shutdown path C uses equipment powered by switchgear 23-1. This bus duct is protected with complete automatic suppression where it passes through Fire Zone 8.2.7.D. The fire loading in Fire Zone 8.2.7.D is less than 30,000 Btu/ft². There are also hose reels and portable extinguishers in Fire Zone 8.2.7.D which could be used by the fire brigade to fight the fire. This combination of complete automatic suppression and a 1-hour cable wrap provides a level of protection for this 4-kV duct to switchgear 23-1 that is equivalent to that prescribed in Appendix R Section III.G.2.

5.7.5 Conclusions

Based on this analysis, an exemption is requested for the cables analyzed in the Northern and Southern Zone Groups of the turbine building from the requirements of 10 CFR 50, Appendix R Section III.G.2 that cables wrapped in a 1-hour barrier be protected by complete automatic suppression and detection. The technical bases that justify the exemption request are as follows:

1. Wherever the important cables are routed in the fire zones discussed in the analysis, there is at least automatic water suppression provided to protect the cables.
2. Major fire hazards are protected with a water suppression and/or detection system.
3. The fire zones discussed in the analysis generally have low fire loadings and detection systems are unwarranted.
4. All of the fire zones have hose reels and portable extinguishers located in them for the use of the fire brigade.

5.8 JUSTIFICATION FOR LACK OF COMPLETE 3-HOUR FIRE BARRIERS
BETWEEN THE EQUIVALENT FIRE AREAS 8.2.8.A, 8.2.8.B, 8.2.8.C,
AND 8.2.8.D ON THE OPERATING FLOOR

5.8.1 Introduction

The turbine building operating floor is divided into four distinct, equivalent fire areas which are 8.2.8.A, 8.2.8.B, 8.2.8.C, and 8.2.8.D and one Fire Zone, 8.2.8.E. Fire Zone 8.2.8.E contains no safe shutdown equipment or cabling. These fire areas are shown schematically on Figure A-3 and Figure A-4.

For a fire in one of these fire areas, the affected unit (or units) is to be taken to hot shutdown using alternative shutdown methods which utilize equipment and cables that are located outside the area under consideration. An exemption to Appendix R is required for this configuration because the boundaries between the fire areas are not complete fire barriers. As the subsequent analysis demonstrates, sufficient protection is provided between the fire areas to ensure that for a fire in one fire area, the other three equivalent fire areas will be free of fire damage and are, therefore, treated as fire areas.

The turbine building operating floor is open between the units. The major equipment located on this floor includes the turbine generators, MG sets, and both divisions of 4-kV and 480-V switchgear for each unit. The switchgear is the only safe shutdown equipment on the floor.

The operating floor has been divided by three partial 3-hour rated barriers to provide protection to vital safe shutdown switchgear and to define the boundaries of each fire area on the floor. The main barrier between Units 1 and 2 is an automatic, open head water curtain running along column line 13 from the MG sets to column line H, which separates the 4-kV switchgear, and a 3-hour rated fire barrier which separates each unit's 480-V switchgear at column line 13 east of column line H. This water curtain will prevent a fire from exposing both units' 480-V switchgear. Each division of 4-kV switchgear for each unit is separated by a partial fire barrier. (The ceiling height in this area is approximately 20 feet.) These barriers are located from column line G to H at column 15 separating the Unit 1 4-kV switchgear divisions and column 11 for Unit 2. The 480-V switchgear area is separated from the reactor building by a complete 2-hour and 3-hour fire barrier with Class A fire doors.

Separation of the equivalent fire areas from Fire Zone 8.2.8.E is accomplished by the foam-water spray protecting the curbed area surrounding the MG sets and the wet pipe sprinkler systems above the MG sets.

The turbine building operating floor has a floor constructed of concrete supported on exposed structural steel. This floor has numerous penetrations for stairwells, equipment removal hatches, and pipe and electrical penetrations. The electrical penetrations are sealed with noncombustible materials. Penetrations into the bottom of the switchgear are 3-hour rated seals. No unsealed floor penetrations are located near the switchgear. Given the existing low fire loading, the spatial separation and floor barrier provide an adequate impediment to the spread of fire so that a fire on the operating floor will not have an adverse effect on equipment or combustibles in adjacent fire areas.

5.8.2 Fire Protection System

The fire protection systems on the operating floor are shown on Figures B-16 and B-17. They are described in detail in Subsection 5.8.4.

5.8.3 Safe Shutdown Equipment

Appendix R hot shutdown equipment located in equivalent Fire Areas 8.2.8.A, 8.2.8.B, 8.2.8.C, and 8.2.8.D of the operating floor is listed in Table 5.6-2. (There is no safe shutdown equipment in Fire Zone 8.2.8.E.) Also listed in the table is the shutdown path(s) for which the equipment is utilized.

The following alternate shutdown path is available for a fire in a given fire area:

<u>LOCATION OF FIRE</u>	<u>SHUTDOWN PATH AVAILABLE FOR UNIT 1</u>	<u>SHUTDOWN PATH AVAILABLE FOR UNIT 2</u>
8.2.8.A	D	Normal
8.2.8.B	A	Normal
8.2.8.C	Normal	C
8.2.8.D	Normal	K

5.8.4 Fire Hazards Analysis

In the event of a fire in any one of the four operating floor equivalent fire areas, the affected unit could be shut down

using an alternate shutdown path which utilizes equipment and/or cabling in the other three fire areas. Specifically:

1. For a fire in Fire Area 8.2.8.A, only Unit 1 would be affected. This unit could be shut down using safe shutdown makeup pump method D. All equipment and cables required for this shutdown path are independent of Fire Area 8.2.8.A.
2. For a fire in Fire Area 8.2.8.B, only Unit 1 would be affected. This unit could be shut down using safe shutdown makeup pump method A. All equipment and cables required for this shutdown path are independent of Fire Area 8.2.8.B.
3. For a fire in Fire Area 8.2.8.C, only Unit 2 would be affected. This unit could be shut down using safe shutdown makeup pump method C. All equipment and cables required for this shutdown path are independent of Fire Area 8.2.8.C, except for 480-V Switchgear 28. Since both 480-V Switchgears 28 and 29 could be exposed by a fire in this equivalent fire area an alternate feed from Unit 1, Division II motor control center 19-1 has been installed to provide power to the Unit 2, Division I RHR room cooler fan.
4. For a fire in Fire Area 8.2.8.D, only Unit 2 would be affected. This unit could be shut down using safe shutdown makeup pump method K. All equipment and cables required for this shutdown path are independent of Fire Area 8.2.8.D.

It is important to ensure that, for a fire in one operating floor fire area, the adjacent fire areas are free of fire damage. Due to operating considerations, especially the need for unimpeded access for 4-kV breaker removal and maintenance providing complete fire barriers between the operating floor fire areas and fire zone is not possible. Instead, the boundaries between the fire areas and fire zone are protected by a combination of partial fire barriers an open head automatic water curtain, and foam-water and wet pipe sprinkler systems which provide significant protection and ensure that fire damage will be limited to only one fire area.

5.8.4.1 Equivalent Fire Areas 8.2.8.A and 8.2.8.B Boundary

Fire Areas 8.2.8.A and 8.2.8.B are separated by a 3-hour rated full height partial fire barrier which is located at column line G to H column 15. This partial barrier provides separation between the two, Unit 1 4-kV switchgear divisions. The area of the operating floor west of column line G (Fire Zone 8.2.8.E) is open space with no solid barriers between Fire Areas 8.2.8.A and 8.2.8.B. However, the combustible loading of the operating floor is negligible and there is no continuity of combustibles between the fire areas west of column line G. There are no

intervening combustibles, such as cables in trays, between the two divisions of switchgear. The MG sets adjacent to the 4-kV switchgear are curbed to confine any liquid spill. In addition, a thermally actuated foam-water sprinkler system provides local suppression and a separate automatic wet pipe sprinkler system is installed at the ceiling providing protection for the MG sets. Suppression systems of the MG sets are provided with spray shields to prevent water damage to the 4-kV switchgear. Smoke detection is installed above the 4-kV switchgear. Smoke detection is also provided at the ceiling for an early warning of a fire in or around the 480-V switchgear. Several manual hose stations are located in the vicinity of these fire areas which ensure that any fire which started would be quickly extinguished by the fire brigade. This combination of substantial partial barriers between safe shutdown equipment plus detection and suppression systems on both sides of the partial barriers provides a level of protection between Fire Areas 8.2.8.A and 8.2.8.B equivalent to a complete 3-hour barrier.

5.8.4.2 Equivalent Fire Areas 8.2.8.B and 8.2.8.C Boundary

During a fire in the vicinity of these two fire areas, an automatic, open head water curtain extending along column line 13 from the MG sets to H will be actuated to prevent a fire from exposing both units' 480-V switchgear or other equipment. The open head water spray system is actuated by separate smoke detection. The ceiling height in this area is approximately 20 feet in height. The water curtain is designed to deliver a minimum of 3 gallons per linear foot. The nozzles are shielded to prevent spray of the switchgear. The area beneath the water curtain is curbed and drained. The 480-V switchgear is also separated along column line 13 by a 3-hour rated fire barrier. The area of the operating floor west of column line G (Fire Zone 8.2.8.E) is open space with no solid barriers between Fire Areas 8.2.8.B and 8.2.8.C. However, the combustible loading of the operating floor is negligible and there is no continuity of combustibles between the fire areas west of column line G. There are no intervening combustibles, such as cables in trays, between each units' switchgear. In addition, there is at least 40 feet of spatial separation between Units' 1 and 2 4-kV switchgear. The MG sets adjacent to the 4-kV switchgear are curbed to confine any liquid spill. In addition, a thermally actuated foam-water sprinkler provides local suppression and a separate automatic wet pipe sprinkler system is installed at the ceiling providing protection for the MG sets. Suppression systems for the MG sets are provided with baffles to prevent water damage to the 4-kV switchgear. Smoke detection is installed above the 4-kV switchgear to provide early warning of a fire in or around the switchgear.

Smoke detection is also provided at the ceiling for an early warning of a fire in or around the 480-V switchgear. The two divisions of switchgears are located approximately 3 feet on each side of the 3-hour wall. Several manual suppression stations are located in the vicinity of these fire areas which ensure that any fire which started would be quickly extinguished by the fire brigade. This combination of a water curtain which was endorsed as an acceptable alternative to a 3-hour rated wall (see Subsection 5.8.6, Reference 1), combined with a 3-hour rated fire barrier between Units' 1 and 2 480-V switchgear, plus suppression and detection on both sides of the fire barriers provides a level of protection between Fire Areas 8.2.8.B and 8.2.8.C equivalent to a 3-hour barrier.

5.8.4.3 Equivalent Fire Areas 8.2.8.C and 8.2.8.D Boundary

Equivalent Fire Areas 8.2.8.C and 8.2.8.D are separated by a 3-hour rated full height partial fire barrier which is located at column line G to H at column 11. This partial barrier provides separation between the 4-kV switchgear division. The area of the operating floor west of column line G (Fire Zone 8.2.8.E) is open space with no solid barriers between Fire Areas 8.2.8.C and 8.2.8.D. However, the combustible loading of the operating floor is negligible and there is no continuity of combustibles between the fire areas west of column line G. There are no intervening combustibles, such as cables in trays, between the divisions of switchgear. The MG sets adjacent to the 4-kV switchgear are curbed to confine any liquid spill. In addition, a thermally actuated foam-water sprinkler system provides local suppression and a separate automatic fixed sprinkler system is installed at the ceiling providing protection for the MG sets. Suppression systems for the MG sets are provided with baffles to prevent water damage to the 4-kV switchgear. Smoke detection is installed above the 4-kV switchgear to provide early warning of a fire in or around the switchgear. Smoke detection is also provided at the ceiling for an early warning of a fire in or around the 480-V switchgear. Several manual hose stations are located in the vicinity of these fire areas which ensure that any fire which started would be quickly extinguished by the fire brigade. This combination of substantial partial barriers between safe shutdown equipment plus detection and suppression systems on both sides of the partial barrier provides a level of protection between Fire Areas 8.2.8.C and 8.2.8.D equivalent to a complete 3-hour barrier.

5.8.4.4 Discussion of Switchgear Redundancy

The purpose of this section is to discuss the safe shutdown of both units at Quad Cities if a fire was to destroy both division's 480-V switchgear for one unit. Fire Area 8.2.8.B, on the turbine operating floor, contains both Division I and

Division II 480-V switchgear (18 and 19) for Unit 1. Fire Area 8.2.8.C contains both Division I and Division II 480-V switchgears (28 and 29) for Unit 2.

These zones are separated by a 3-hour rated barrier from H.5 to H and an automatic water curtain from H to G.5 (see Figure D-1). In addition, the MG sets are protected by a foam-water suppression and a sprinkler system. Table 5.8-1 explains which switchgear would be used to safely shut down both units for fires at various locations.

5.8.4.4.1 Equivalent Fire Area 8.2.8.B

See Figure D-1 for a layout of this zone. This fire zone is bounded by column rows 13 and 15 from column row G to H.5 on the north and south side and by column rows G and H.5 from column rows 13 to 15 on the west and east side. Three sides of this zone have physical barriers marking the boundaries. The fourth side, the west side, of this zone is physically open, except for the MG set, to the rest of the turbine operating floor. The south and east sides of this zone are enclosed by 3-hour rated fire walls with the exception of the east wall which is 2-hour rated from the 658-foot to 663-foot elevation.

This zone contains a Unit 1 reactor recirculation MG set (1A-202-51), 4-kV switchgear 13-1 and 480-V switchgear 18 and 19. The area in which the 480-V switchgears are located (H-H.5/13-15) is approximately eight feet six inches higher in elevation than the rest of the zone. The 480-V switchgears are set back approximately four feet from the edge of this drop. The 4-kV switchgear is approximately four feet west of this edge.

If a fire occurred in this zone, the affected unit, Unit 1, may be shut down by using alternate shutdown path A. This path uses the Unit 1 Division II RHR system, powered by 4-kV SWGR 14-1 which is separated from this zone by a 3-hour wall, to provide suppression pool cooling. Since the 480-V Division II switchgear 19 will be exposed to a fire in this zone, 480-V SWGR 29 powered by diesel generator 2 can be used to provide power to the Unit 1, Division II RHR room cooler fan and the diesel generator 1 auxiliaries using alternate feeds to the equipment.

Unit 2, the unaffected unit, can be shut down by normal procedures. Unit 2, Division II RHR system, powered by diesel generator 2, can be used to provide suppression pool cooling.

For a fire in Fire Area 8.2.8.B to affect the Division II 480-V switchgear 29 it must circumvent the fire wall at column row 13. In addition to the rated fire wall, there is a minimum of approximately 10 feet with no intervening combustible between 480-V SWGR 18 and 480-V SWGR 29. West of the fire wall is

the water curtain that will confine the fire to Fire Area 8.2.8.B. There is approximately 26 feet of separation with no intervening combustibles between 480-V switchgear 29 and 4-kV switchgear 13-1. There is over 40 feet of separation with no intervening combustibles between 4-kV switchgears 13-1 and 14-1. There is an 8-foot 6-inch change in elevation between the 480-V switchgear area and the 4-kV switchgears 13-1 and 14-1. The MG sets are protected by redundant suppression systems. There are detectors over the switchgear.

5.8.4.4.2 Equivalent Fire Area 8.2.8.C

See Figure D-1 for a layout of this zone. This fire zone is bounded by column rows 11 and 13 from column row G to H.5 on the north and south side and by column rows G and H.5 from column row 11 to 13 on the west and east side. Three sides of this zone have physical barriers marking the boundaries. The fourth side, the west side, of this zone is physically open, except for the MG set, to the rest of the turbine operating floor (Fire Zone 8.2.8.E).

The north and east sides of this zone are enclosed by 3-hour rated fire walls, with the exception of the east wall which is 2-hour rated from the 658-foot to 663-foot elevation.

This zone contains a Unit 2 reactor recirculation MG set (2B-202-51), 4-kV switchgear 24-1 and 480-V switchgear 28 and 29. The area in which the 480-V switchgears are located (H-H.5/11-13) is approximately eight feet six inches higher in elevation than the rest of the zone. The 480-V switchgears are set back approximately 4 feet from the edge of this drop. The 4-kV switchgear is approximately 4 feet west of this edge.

If a fire occurred in this zone, the affected unit, Unit 2, may be shut down by using alternate shutdown path C. This path uses the Unit 2 Division I RHR system, powered by Unit 1's 4-kV switchgear 13-1 (RHR service water pumps) and Unit 2's 4-kV switchgear 23-1 (RHR pumps) which are separated from this zone by a water curtain (13-1) and a 3-hour wall (23-1), to provide suppression pool cooling. Since the 480-V Division I switchgear 28 will be exposed to a fire in this zone, a manual action may be required to power the Unit 2 Division I RHR room cooler fan 2-5746A by closing a normally open breaker between Unit 1 Division II MCC 19-1 powered by diesel generator 1 and Unit 2 Division I MCC 28-1A.

Unit 1, the unaffected unit, can be shut down by normal procedures. A half train of the Unit 1, Division II RHR system, powered by diesel generator 1, can be used to provide suppression pool cooling.

For a fire in Fire Zone 8.2.8.C to affect 4-kV switchgear 13-1, it must travel over 40 feet from 4-kV switchgear 24-1. There are no intervening combustibles between these switchgears. Between the switchgears at column row 13 is the automatic water curtain actuated by smoke detectors that will confine the fire to Fire Zone 8.2.8.C. For the fire to affect the Division II 480-V switchgear 19, need to shutdown Unit 2, it must circumvent the fire wall at column row 13 and damage 480-V switchgear 18 and then spread to the switchgear 19. In addition to the rated fire wall, there is a minimum of approximately 10 feet with no intervening combustibles between 480-V switchgear 18 and 29. West of the fire wall is the water curtain. There is approximately 48 feet of separation with no intervening combustible between 480-V switchgear 19 and 4-kV switchgear 24-1. There is an 8-foot 6-inch change in elevation between the 480-V switchgear area and the 4-kV switchgear area. The MG sets are protected by redundant suppression systems. There are detectors over the switchgear.

5.8.5 Conclusions

Based on this analysis, an exemption is requested for the Quad Cities Units 1 and 2 turbine building operating floor from the requirement of 10 CFR 50, Appendix R Sections III.G.3 and III.L that alternative shutdown capability be located in a separate fire area from the area, room or zone for which it is used. The technical bases that justify the exemption request are summarized as follows:

1. Alternative safe shutdown equipment is separated from areas for which it would be used by a combination of 3-hour rated partial fire barriers and an automatically actuated water curtain.
2. Redundant automatic wet pipe and foam-water sprinkler systems are provided above the MG sets to protect and prevent the spread of fire from this equipment and prevent fire exposure from adjacent fire areas to essential switchgear.
3. The use of a water curtain to substitute for a 3-hour rated barrier has been endorsed by the NRC in their Generic Letter 83-33 (see Subsection 5.8.6, Reference 1).
4. The open area of the operating floor west of column line G (Fire Zone 8.2.8.E) is the only area not separated by a substantial partial barrier or a water curtain. However, this open area contains negligible combustibles and there is no continuity of combustibles between fire areas. The open area is separated from the switchgear by the MG sets and the automatic protection over the MG sets.

5. The installation of fire rated barriers throughout the operating floor would not significantly increase plant safety and would impede access to vital equipment on the operating floor.

5.8.6 References

1. D. G. Eisenhut, USNRC, Generic Letter 83-33 to all Licensees of Nuclear Power Reactors dated October 19, 1983, subject: NRC Positions on Certain Requirements of Appendix R to 10 CFR 50.

TABLE 5.8-1

DISCUSSION OF FIRE PROTECTION FEATURES USED
TO PRESERVE REDUNDANT SWITCHGEAR

<u>FIRE LOCATION</u>	<u>SWITCHGEAR USED FOR SAFE SHUTDOWN</u>	<u>FIRE PROTECTION FEATURES BETWEEN AFFECTED SWITCHGEAR AND SSD SWITCHGEAR</u>
Water Curtain Area	13-1 (4-kV)	Approximately 20 feet separation with no intervening combustibles
	24-1 (4-kV)	Approximately 20 feet separation with no intervening combustibles
	480-V Area	8½-foot change in elevation between the 480-V and 4-kV SWGR areas
18 (480-V)	14-1 (4-kV) (Used by affected unit only)	3-hour rated barrier 8½-foot change in elevation between the 480-V and 4-kV SWGR areas Detection
	24-1 (4-kV) (Used by affected and unaffected unit)	Water curtain Approximately 25 feet separation 8½-foot change in elevation between the 480-V and 4-kV SWGR areas Detection
	29 (480-V) (Used by affected and unaffected unit)	3-hour rated barrier Approximately 7 feet separation with no intervening combustibles Detection

5.8-10

QUAD CITIES 1&2

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TABLE 5.8-1 (Cont'd)

<u>FIRE LOCATION</u>	<u>SWITCHGEAR USED FOR SAFE SHUTDOWN</u>	<u>FIRE PROTECTION FEATURES BETWEEN AFFECTED SWITCHGEAR AND SSD SWITCHGEAR</u>
19 (480-V)	14-1 (4-kV) (Used by affected unit only)	3-hour rated barrier 8½-foot change in elevation between the 480-V and 4-kV SWGR areas Detection
	24-1 (4-kV) (Used by affected and unaffected unit)	Water curtain Approximately 50 feet separation 8½-foot change in elevation between the 480-V and 4-kV SWGR areas Detection
	29 (480-V) (Used by affected and unaffected unit)	3-hour rated barrier Approximately 25 feet separation Detection
28 (480-V)	13-1 (4-kV) (Used by affected unit only)	Water curtain Approximately 50 feet separation 8½-foot change in elevation between the 480-V and 4-kV SWGR areas Detection

TABLE 5.8-1 (Cont'd)

<u>FIRE LOCATION</u>	<u>SWITCHGEAR USED FOR SAFE SHUTDOWN</u>	<u>FIRE PROTECTION FEATURES BETWEEN AFFECTED SWITCHGEAR AND SSD SWITCHGEAR</u>
28 (480-V) (Continued)	14-1 (4-kV) (Used by affected and unaffected unit)	3-hour rated barrier Water curtain Over 100 feet separation 8½-foot change in elevation between the 480-V and 4-kV SWGR areas Detection
	23-1 (4-kV) (Used by affected unit only)	3-hour rated barrier 8½-foot change in elevation between the 480-V and 4-kV SWGR areas Detection
	19 (480-V) (Used by affected and unaffected unit)	3-hour rated barrier Approximately 50 feet separation Detection
29 (480-V)	13-1 (4-kV) (Used by affected unit only)	Water curtain Approximately 25 feet separation 8½-foot change in elevation between the 480-V and 4-kV SWGR areas Detection

TABLE 5.8-1 (Cont'd)

<u>FIRE LOCATION</u>	<u>SWITCHGEAR USED FOR SAFE SHUTDOWN</u>	<u>FIRE PROTECTION FEATURES BETWEEN AFFECTED SWITCHGEAR AND SSD SWITCHGEAR</u>
29 (480-V) (Continued)	14-1 (4-kV) (Used by affected and unaffected unit)	3-hour rated barrier Water curtain Over 100 feet separation 8½-foot change in elevation between the 480-V and 4-kV SWGR areas Detection
	23-1 (4-kV) (Used by affected unit only)	3-hour rated barrier 8½-foot change in elevation between the 480-V and 4-kV SWGR area Detection
	19 (480-V) (Used by affected and unaffected unit)	3-hour rated barrier Approximately 25 feet separation Detection

5.9 JUSTIFICATION FOR LACK OF COMPLETE 3-HOUR BARRIERS BETWEEN FIRE ZONE 11.1.1.B AND THE REST OF THE SOUTHERN ZONE GROUP

5.9.1 Introduction

Fire Zone 11.1.1.B contains one Division I and one Division II RHR service water pump, the swing (1/2) diesel generator cooling water pump and their auxiliaries. The floor, ceiling, and all walls are 3-hour rated fire barriers. The east wall contains a nonlabeled, watertight door that opens to Fire Zone 8.2.1.A of the Southern Zone Group of the turbine building. Appendix R Sections III.G.3 and III.L require that alternate shutdown paths be separated by complete 3-hour rated fire barriers. The shutdown path for Fire Zone 11.1.1.B and adjacent Fire Zones 8.2.1.A, 11.1.1.A and 11.1.1.C is the same (shutdown path D). Cooling water to diesel generator 1/2 must be provided either by the diesel generator 1/2 cooling water pump or the diesel generator 1 cooling water pump. The two pumps are located in Fire Zones 11.1.1.B and 11.1.1.A, respectively. Thus, a fire in Fire Zone 11.1.1.B cannot be allowed to spread to Fire Zone 11.1.1.A and vice versa. The subsequent analysis provides justification for an exemption to these requirements with regard to the substantial watertight door in Fire Zone 11.1.1.B.

5.9.2 Fire Protection System

Fire Zone 11.1.1.B contains complete fire detection and fixed water suppression systems. Fire Zone 8.2.1.A contains a complete wet pipe sprinkler system.

5.9.3 Safe Shutdown Equipment

The only Appendix R hot shutdown components contained in Fire Zone 11.1.1.B are a Division I and a Division II RHR service water pump, the swing (1/2) diesel generator cooling water pump and their auxiliaries. Fire Zone 8.2.1.A contains the main and reserve power feeds to the swing (1/2) diesel generator cooling water pump. The reserve feed is protected with a 1-hour rated fire wrap (see Section 5.7).

5.9.4 Fire Hazards Analysis

The floor, ceiling, and walls of Fire Zone 11.1.1.B are 3-hour rated fire barriers. The east wall contains a substantial non-labeled, watertight door that opens to Fire Zone 8.2.1.A. A labeled door installed in place of the existing one would not increase the protection of the RHR service water pumps, swing

(1/2) diesel generator cooling water pump and their auxiliaries because of the existing suppression systems on both sides of the door, the detection system in Fire Zone 11.1.1.B, and the substantial, multiple latch type door now in place.

In addition, the combustible loadings for Fire Zone 11.1.1.B and Fire Zone 8.2.1.A are less than 2,500 Btu/ft² and 1,500 Btu/ft², respectively. All equipment and cabling associated with shutdown path D, which is used for a fire in Fire Zone 11.1.1.B, are independent of this fire area.

5.9.5 Conclusions

Based on this analysis, the intent of Appendix R requirements is met. The justifications for an exemption from complete 3-hour fire barriers are summarized as follows:

1. Fire Zone 11.1.1.B has complete detection and fixed water suppression. Fire Zone 8.2.1.A has complete water suppression.
2. The combustible loading is very light; Fire Zone 11.1.1.B is less than 2,500 Btu/ft² and Fire Zone 8.2.1.A is less than 1,500 Btu/ft².
3. The level of protection provided by the existing fire protection features ensures that damage from a fire in Fire Zone 11.1.1.B would be limited in extent and not adversely impact the capability to safely shut down the plant.
4. The construction and latching arrangement for the watertight door provides a very substantial barrier to fire and will prevent spread of fire between Fire Zone 11.1.1.B and Fire Zone 8.2.1.A.

6.0 SERVICE BUILDING APPENDIX R EXEMPTION REQUEST

Per the provision of 10 CFR 50.12, Commonwealth Edison Company (CECo) requests exemption from the requirements of Section III.G of Appendix R to 10 CFR 50 to the extent that the alternate shut-down capacity criteria of III.G.3 would have to be met for the auxiliary electric equipment room of the service building. CECo specifically requests exemption from:

1. The requirements of III.G.3 that the auxiliary electric equipment room be provided with complete fixed fire suppression in addition to the existing fire detection system and fire walls. The justification for this exemption is presented in the following section:

SECTION

JUSTIFICATION

6.2

Lack of complete suppression in the auxiliary electric equipment room.

6.1 SERVICE BUILDING AREA DESCRIPTION

The service building is located adjacent to the far south side of the turbine building and is divided into two fire areas (SB-I and SB-II). The service building consists of three primary floor elevations. In addition to a maintenance area, new computer room and administrative office facilities, the control room, cable spreading room, auxiliary electric equipment room (AEER), and old computer room (Fire Zones 2.0, 3.0, 6.3, and 4.0, respectively which are part of Fire Area SB-I) are located in this building. The plant computer room is surrounded by the AEER on three sides. Its fourth side is a 3-hour fire rated barrier. The control room, cable spreading room, and AEER are located on top of one another. The northern wall of each room borders the Unit 1 turbine building trackway. Each room is separated from the remaining areas of the service building and the turbine building by 3-hour fire rated barriers.

Each of these fire areas is provided with a complete early warning fire detection system and the cable spreading room is provided with a water suppression system.

The safe shutdown paths identified for each of these fire zones are E2 for Unit 1 shutdown and K for Unit 2 shutdown. Therefore, the same shutdown path will be used for a fire anywhere in Fire Area SB-I. Each path utilizes manual control of equipment and local monitoring of instrumentation outside of Fire Area SB-I.

All equipment and cabling associated with these shutdown paths are independent of Fire Area SB-I.

6.2 JUSTIFICATION FOR LACK OF COMPLETE SUPPRESSION IN THE AUXILIARY ELECTRIC EQUIPMENT ROOM OF THE SERVICE BUILDING

6.2.1 Introduction

The auxiliary electric equipment room (AEER) is located in the service building at floor elevation 595 feet 0 inches (Fire Zone 6.3) and is part of Fire Area SB-I. The AEER is separated from the turbine building and remaining areas of the service building by 3-hour fire barriers. In addition, the Unit 1 and 2 cable tunnels (which pass below and have access into the AEER) are separated from the AEER by reinforced concrete with penetrations sealed by material having a 3-hour fire rating and substantial fire resistive manhole covers over access points.

Because alternate shutdown is utilized for the AEER, Appendix R requires that fire detection and automatic fire suppression be present throughout the fire zone. As seen in Figure B-7, only detection is present throughout the AEER. However, this detection provides a level of protection which ensures that any fire will be quickly detected. The addition of an automatic suppression system would not significantly enhance the level of safety at Quad Cities.

6.2.2 Fire Protection System

The AEER is provided with a complete early warning fire detection system throughout. In addition, this fire zone contains portable extinguishers and easily accessible hose stations just outside the entrances to this room.

6.2.3 Safe Shutdown Equipment

The safe shutdown paths identified for the AEER are E2 for Unit 1 and K for Unit 2. These shutdown paths are used for a fire anywhere in Fire Area SB-I. Each of these paths utilize manual control of equipment and local monitoring of instrumentation outside of Fire Area SB-I. All equipment and cabling associated with safe shutdown paths E2 and K are independent of Fire Area SB-I.

6.2.4 Fire Hazards Analysis

The AEER has a floor area of approximately 3,275 ft² and a ceiling height of approximately 14 feet. The total fire loading in this fire zone from fixed combustibles is less than 75,000 Btu/ft². The combustibles in this zone include insulation of HVAC ducting, cable insulation associated with cable routed in cable trays, and cable insulation associated with the electrical panels in this area.

The AEER is protected throughout with a complete early warning fire detection system which alarms locally and in the control room. If a fire is detected in the AEER, the fire brigade could respond quickly due to the close proximity of the control room. Several manual hose stations are located in or in the vicinity of the AEER and ensure that any fire would be quickly extinguished by the fire brigade. The AEER is separated from the remaining service building and turbine building by walls with a fire rating of at least 3-hours. In addition, the Unit 1 and Unit 2 cable tunnels (which pass below and have access into the AEER) are separated from the AEER by reinforced concrete with penetrations sealed by material having a 3-hour fire rating and substantial fire resistive manhole covers over access points. The addition of automatic fire suppression is not warranted considering the complete fire detection system, the administrative procedures that strictly control access to this area, and the administrative controls concerning the admission of transient combustibles and use of fire ignition sources.

6.2.5 Conclusions

Based on this analysis, an exemption is requested for the AEER of the Quad Cities 1&2 service building from the requirements of Appendix R Section III.G.3 that fire detection and fixed suppression be provided throughout those areas for which an alternative shut-down method is utilized. The technical bases that justify the exemption request are summarized as follows:

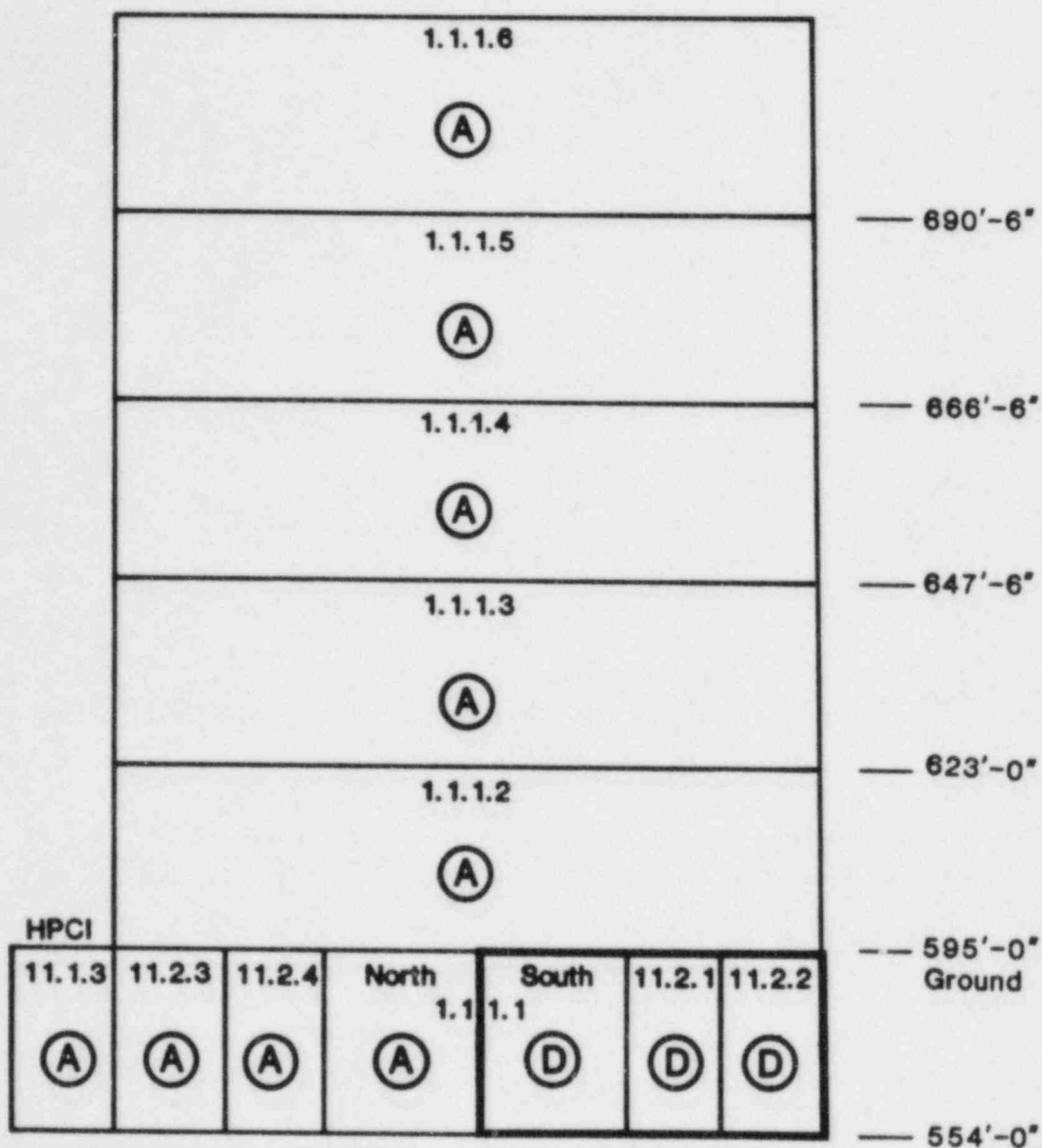
1. The AEER is surrounded by complete 3-hour fire rated barriers separating the area from the remaining areas of the service building, turbine building, and cable tunnels.
2. All fire zones in Fire Area SB-I use the same alternate shut-down paths.
3. Alternate shutdown paths E2 and K utilize manual control of equipment and local monitoring of instrumentation outside the service building.
4. The AEER is provided with a complete early warning fire detection system throughout the area.
5. The installation of additional automatic suppression would not significantly enhance fire safety in this fire area.

QUAD CITIES 1&2

APPENDIX A

SCHEMATIC DIAGRAMS OF ALTERNATE SHUTDOWN PATH
AVAILABILITY AND SHUTDOWN PATH PIPING SYSTEMS

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NOVEMBER 1985

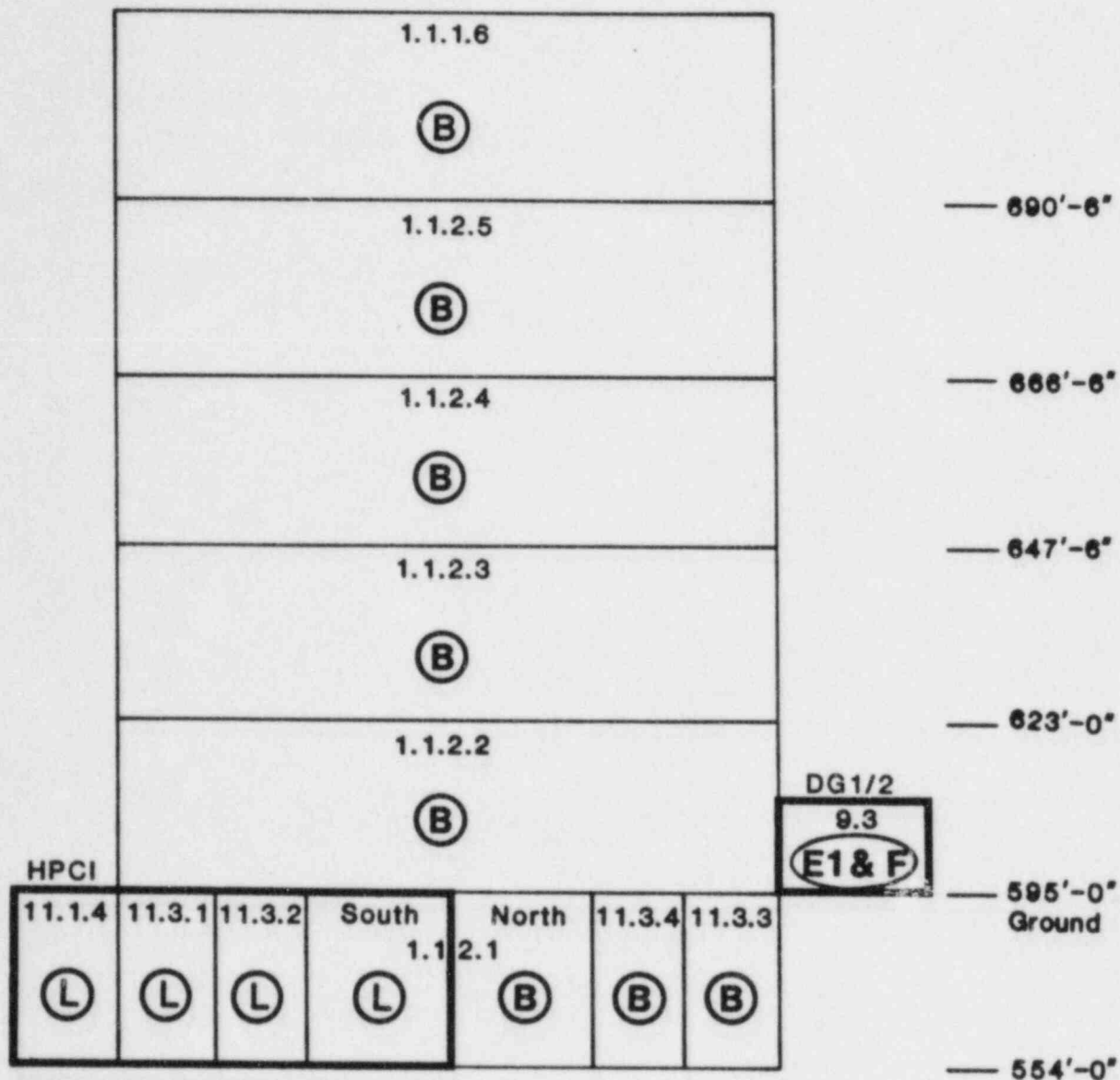


QUAD-CITIES STATION
Units 1 & 2

FIGURE A-1

PROPOSED APPENDIX R SHUTDOWN PATHS
FOR QUAD-CITIES UNIT 1
REACTOR BUILDING

REVISION 1
NOVEMBER 1985

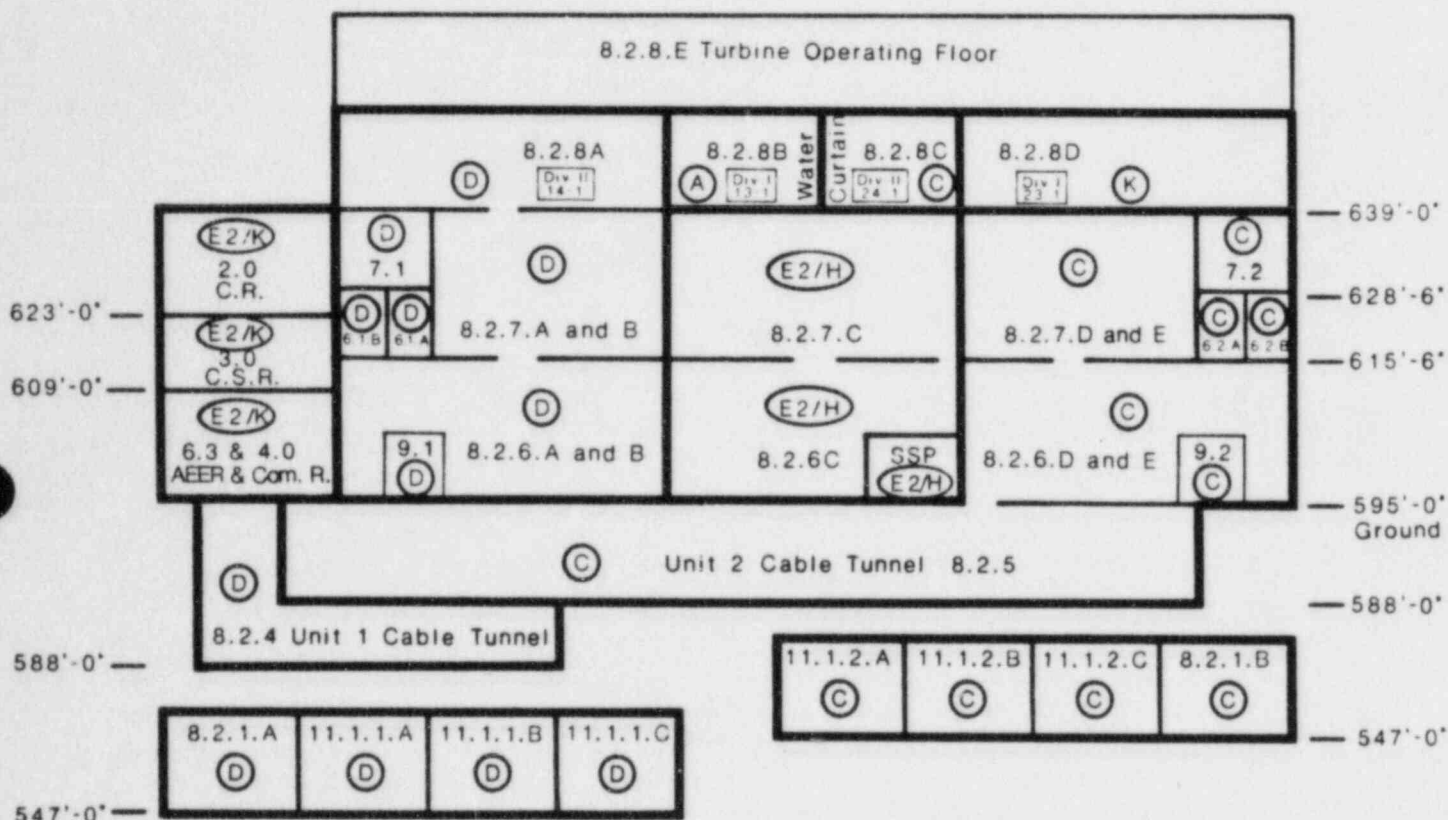


QUAD-CITIES STATION
Units 1 & 2

FIGURE A-2

PROPOSED APPENDIX R SHUTDOWN PATHS
FOR QUAD-CITIES UNIT 2
REACTOR BUILDING

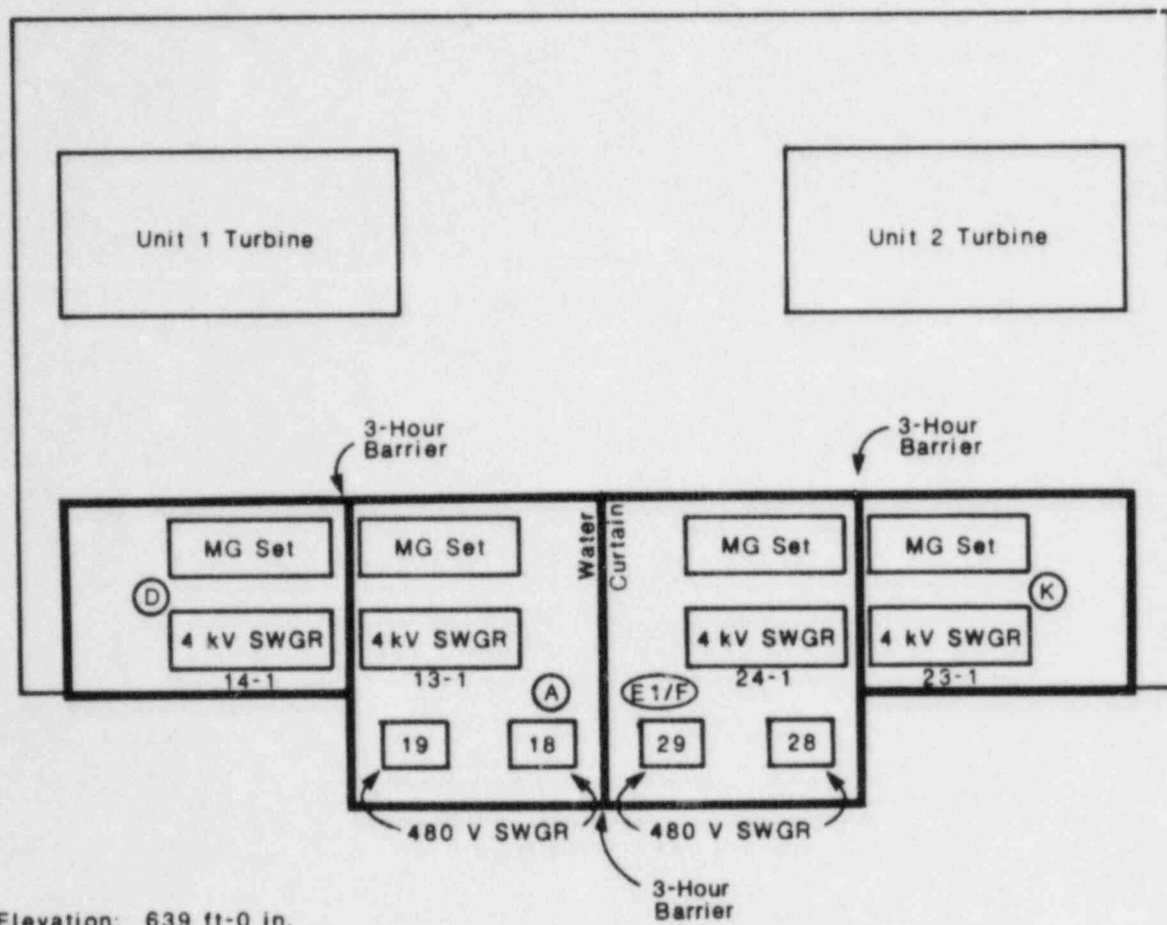
REVISION 1
NOVEMBER 1985



Units 1&2
Elevation
Hot Shutdown Turbine Building

QUAD-CITIES STATION
Units 1 & 2
FIGURE A-3
PROPOSED APPENDIX R SHUTDOWN PATHS
FOR QUAD-CITIES UNITS 1 & 2
TURBINE BUILDING

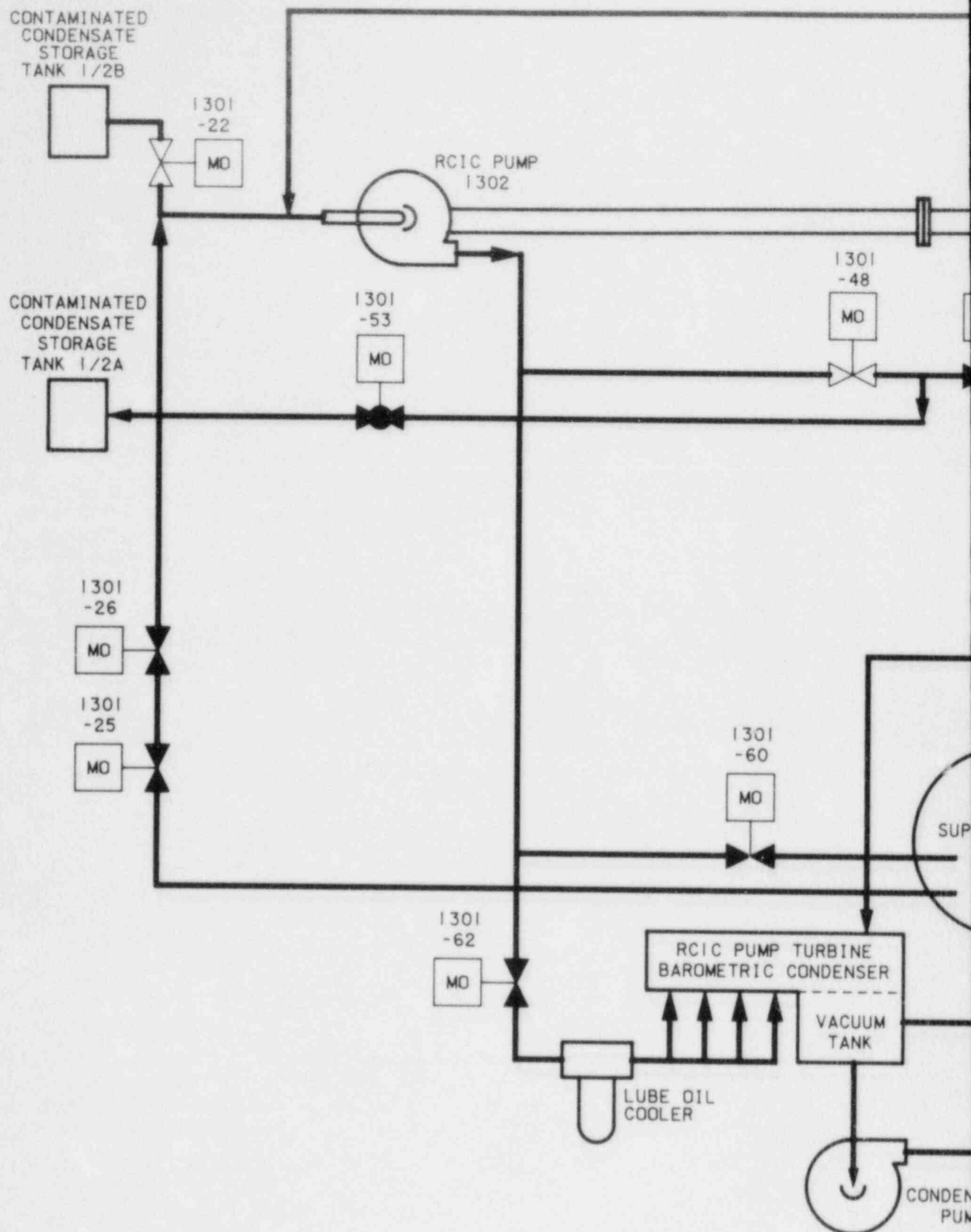
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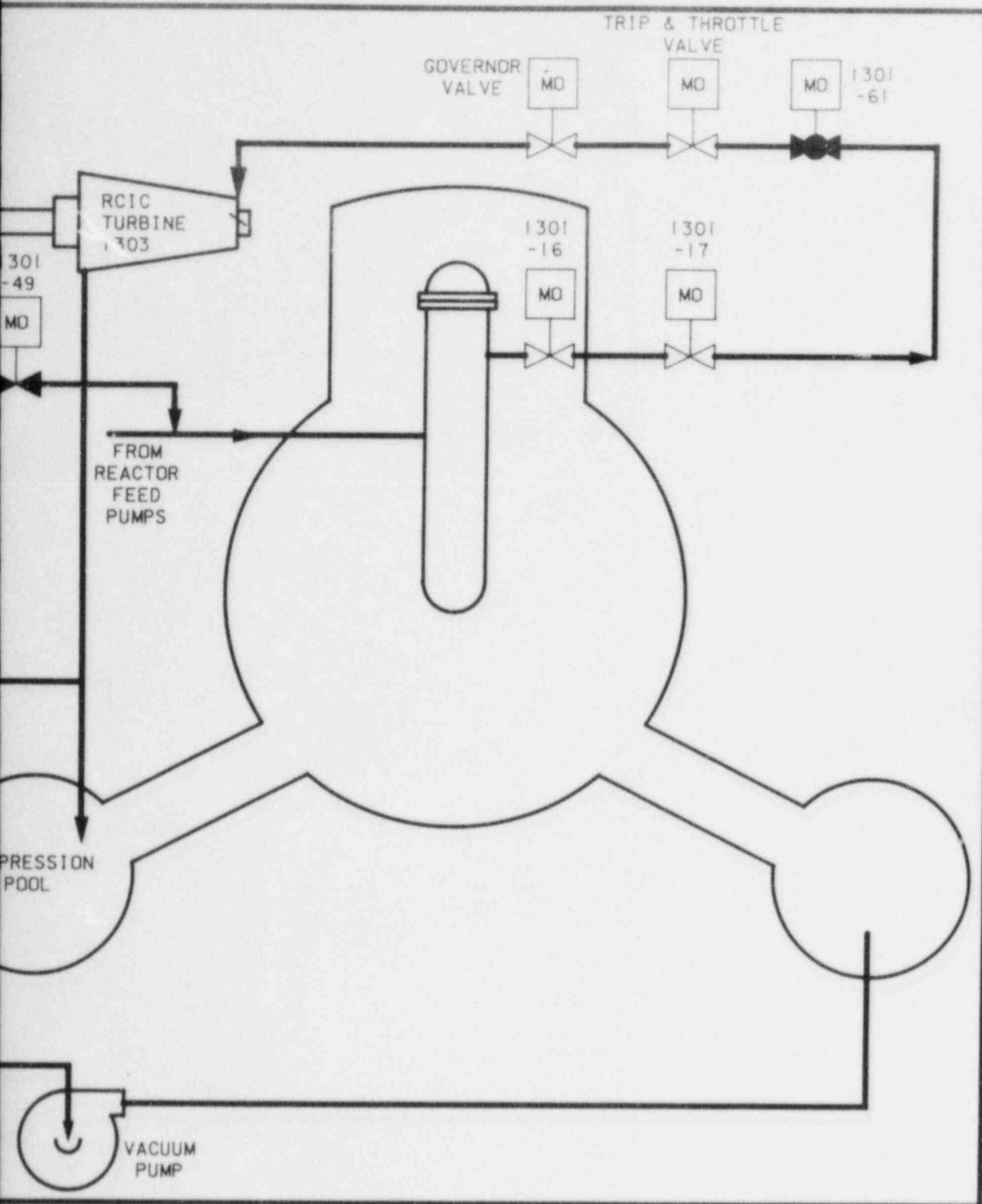


QUAD-CITIES STATION
Units 1 & 2

FIGURE A-4

PROPOSED APPENDIX R SHUTDOWN PATHS
FOR QUAD-CITIES UNITS 1 & 2
TURBINE BUILDING OPERATING FLOOR





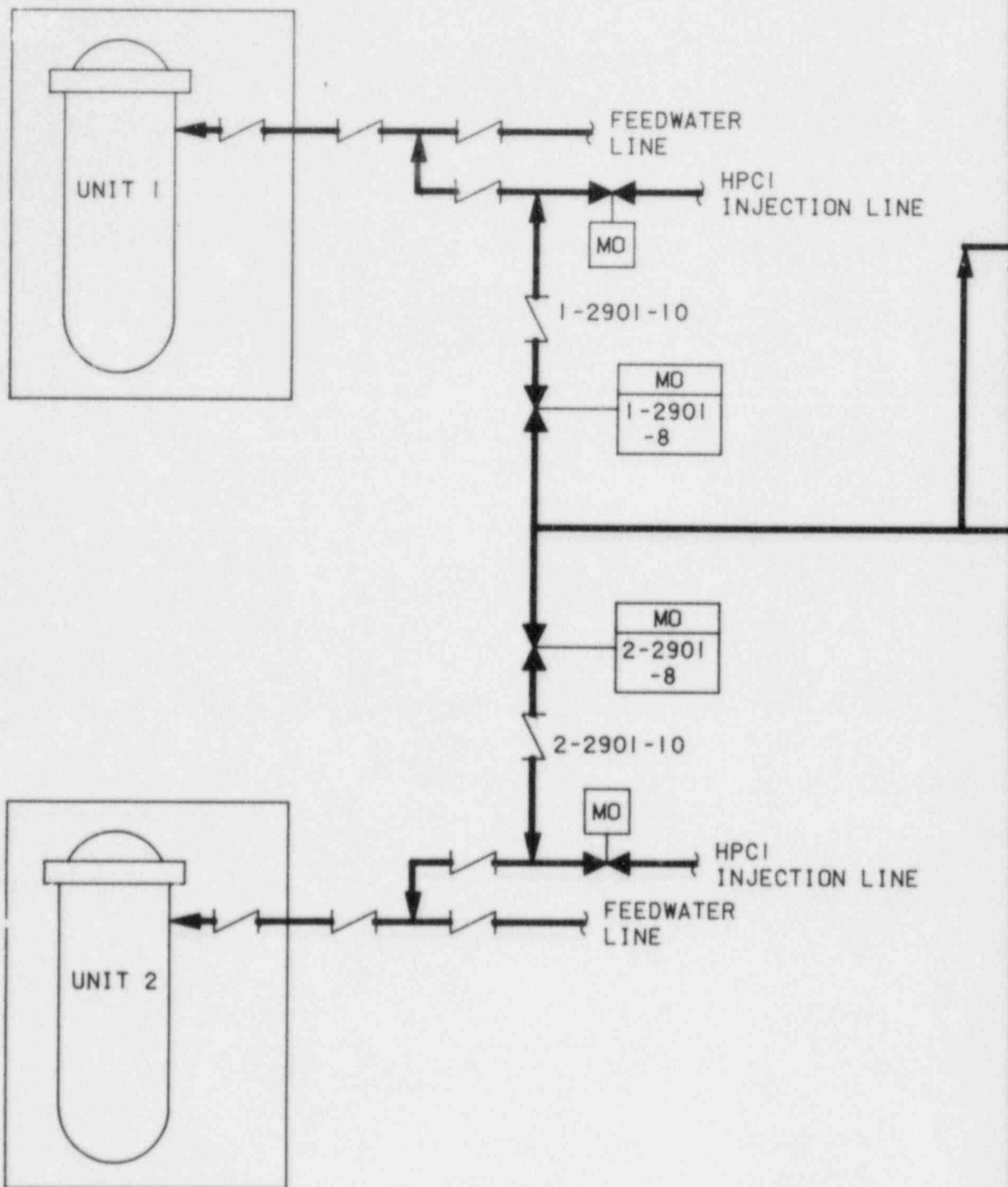
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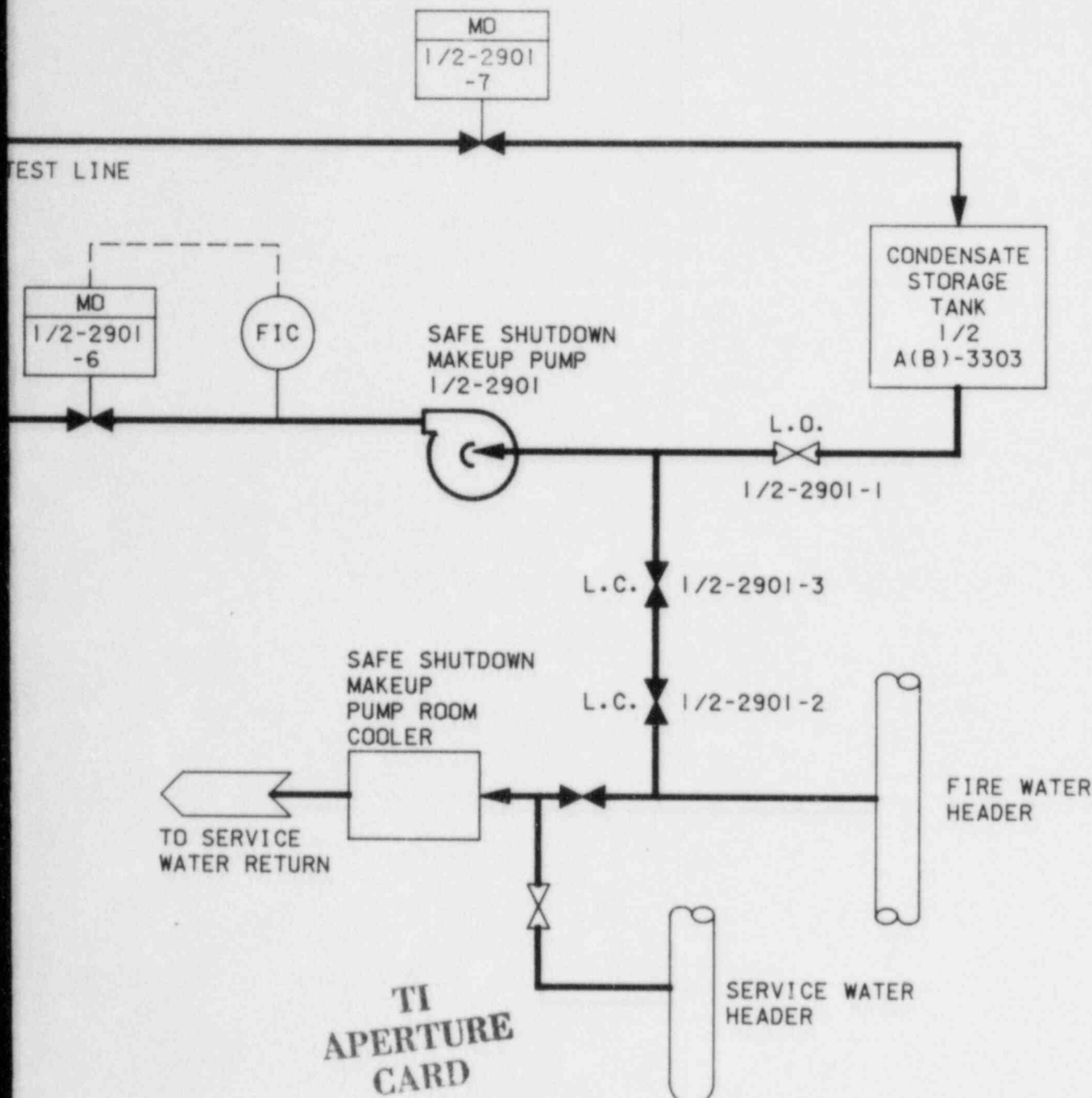
QUAD-CITIES STATION
Units 1 & 2

FIGURE A-5
RCIC SYSTEM

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QUAD-CITIES STATION
Units 1 & 2

FIGURE A-6

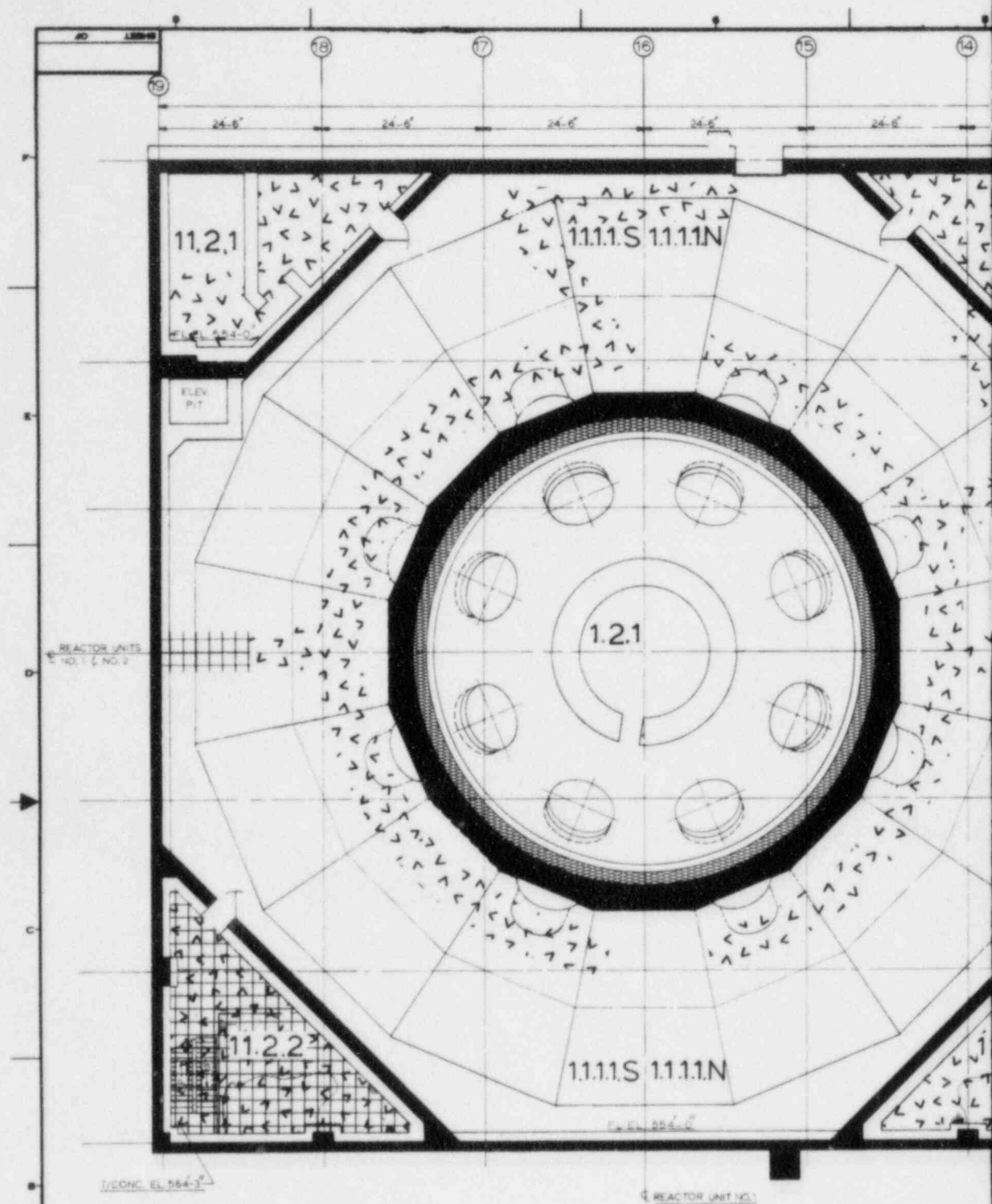
SAFE SHUTDOWN MAKEUP PUMP SYSTEM

8512100085-02

QUAD CITIES 1&2

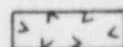

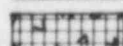
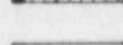
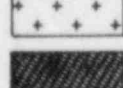
APPENDIX B

FIRE PROTECTION DIAGRAMS



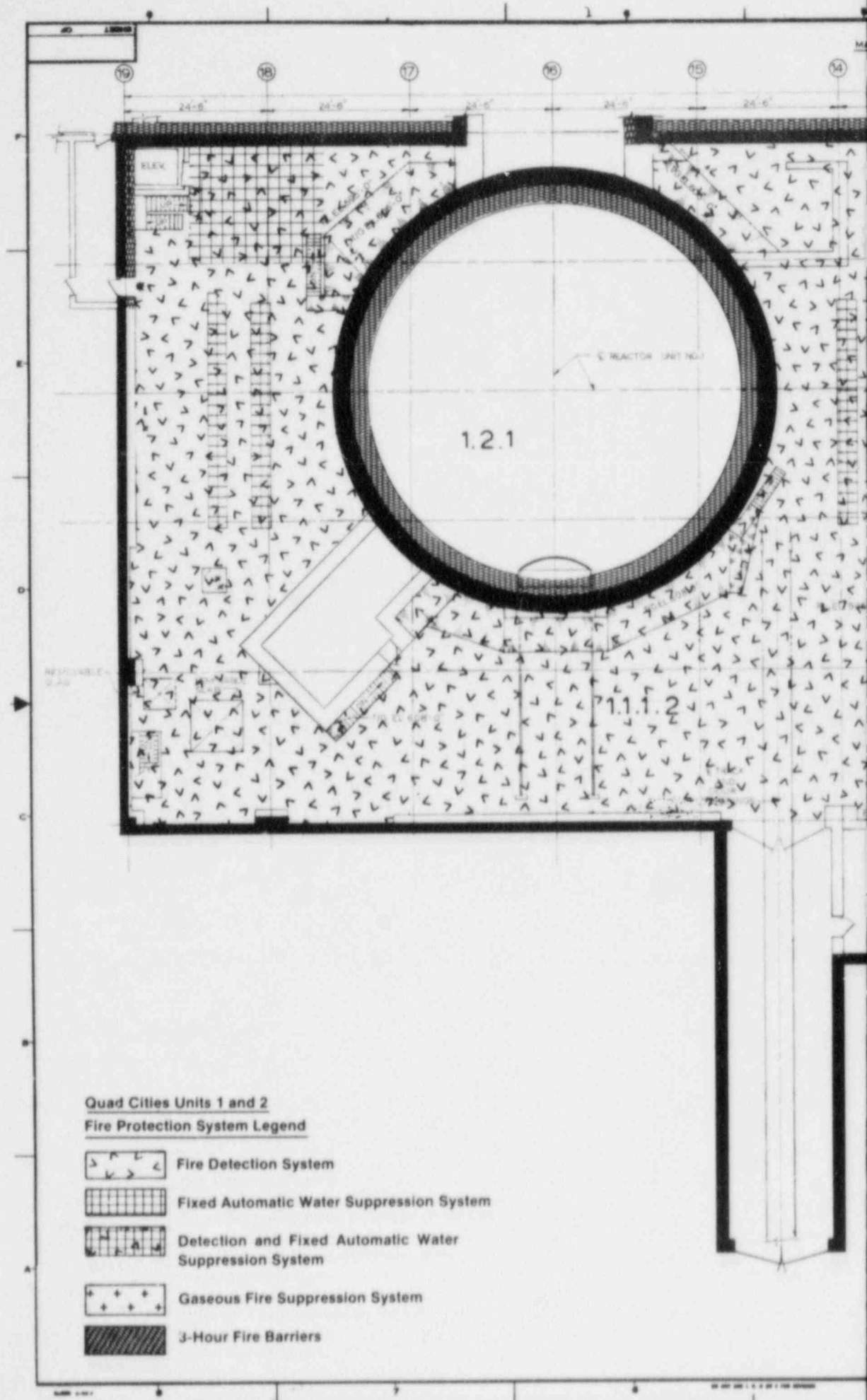
Quad Cities Units 1 and 2

Fire Protection System Legend

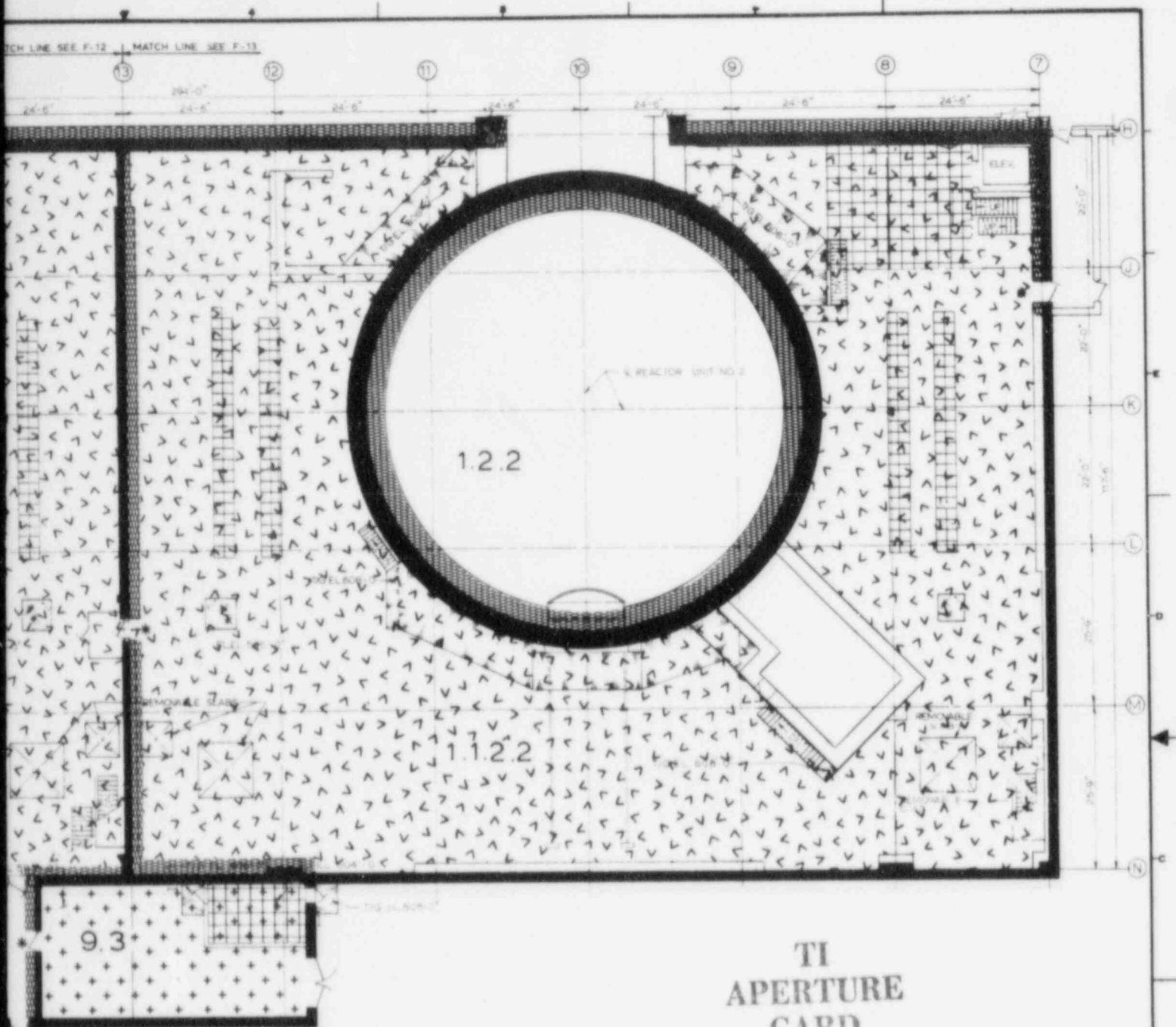
-  Fire Detection System
-  Fixed Automatic Water Suppression System
-  Detection and Fixed Automatic Water Suppression System
-  Gaseous Fire Suppression System
-  3-Hour Fire Barriers



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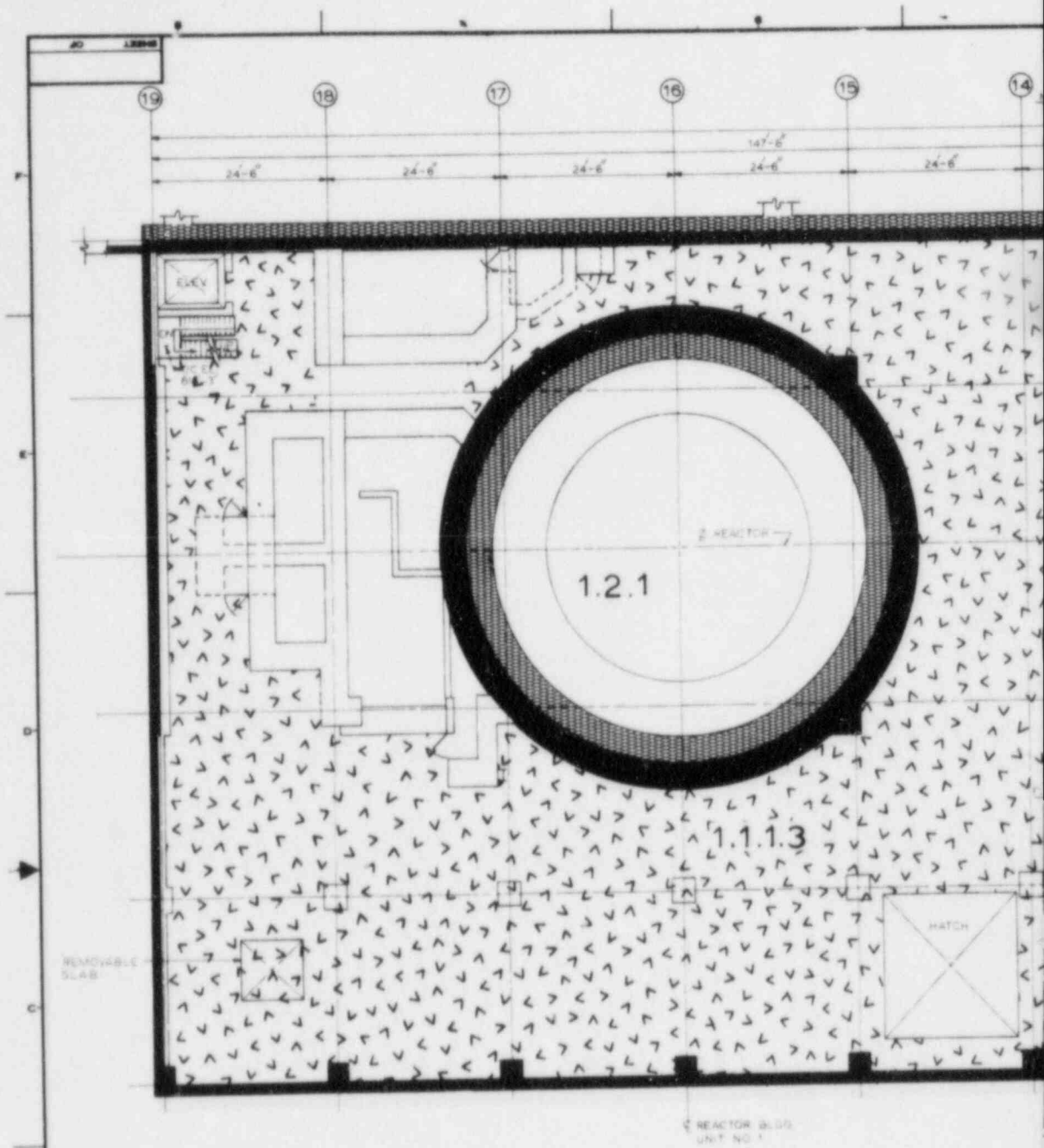
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Aperture Card

QUAD-CITIES STATION
Units 1 & 2

FIGURE B-2

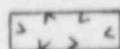

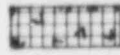


FIRE DETECTION AND AUTOMATIC SUPPRESSION
REACTOR BUILDING FLOOR ELEV. 595'-0"

8512100065-04

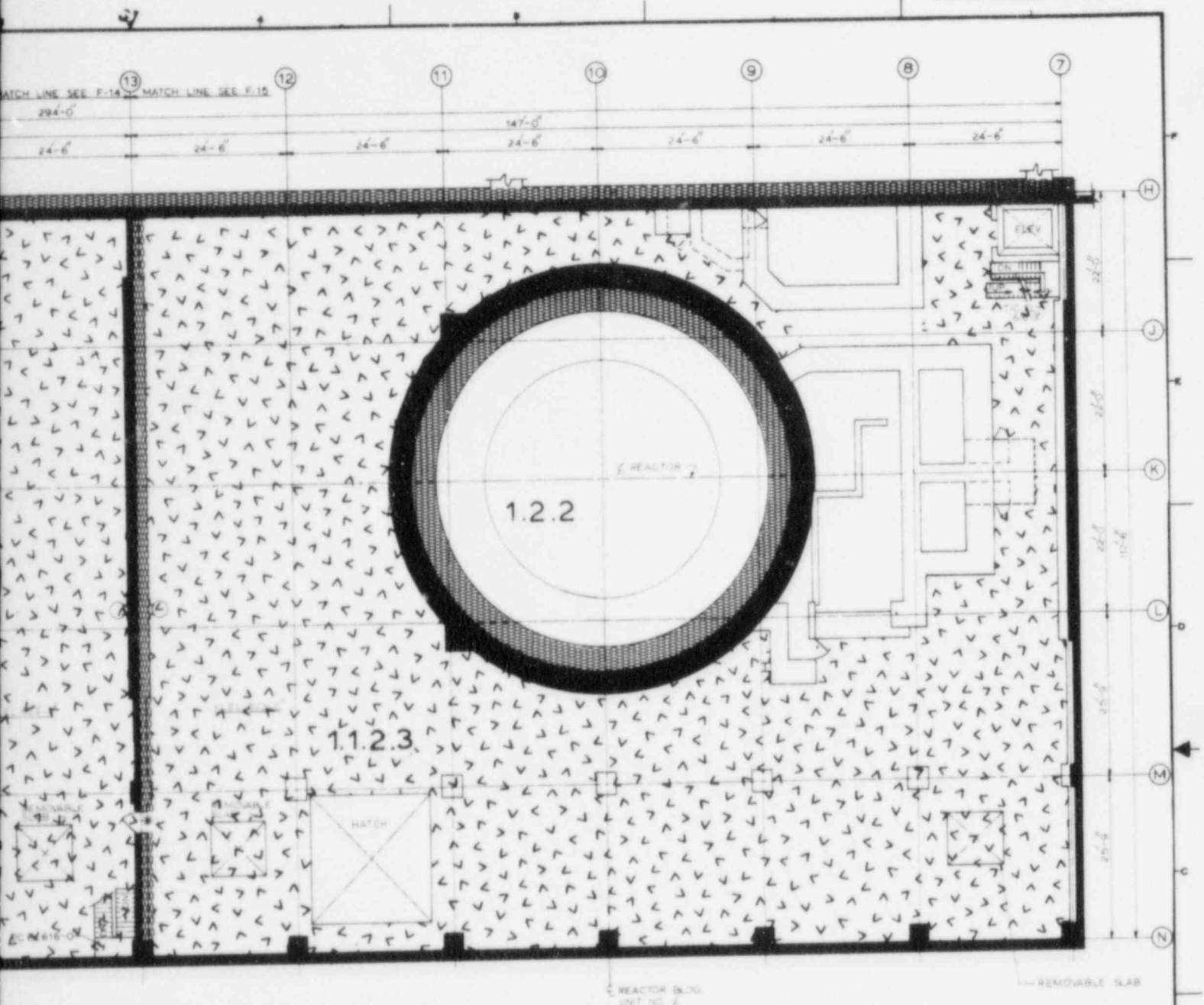


Quad Cities Units 1 and 2

Fire Protection System Legend

-  Fire Detection System
-  Fixed Automatic Water Suppression System
-  Detection and Fixed Automatic Water Suppression System
-  Gaseous Fire Suppression System
-  3-Hour Fire Barriers

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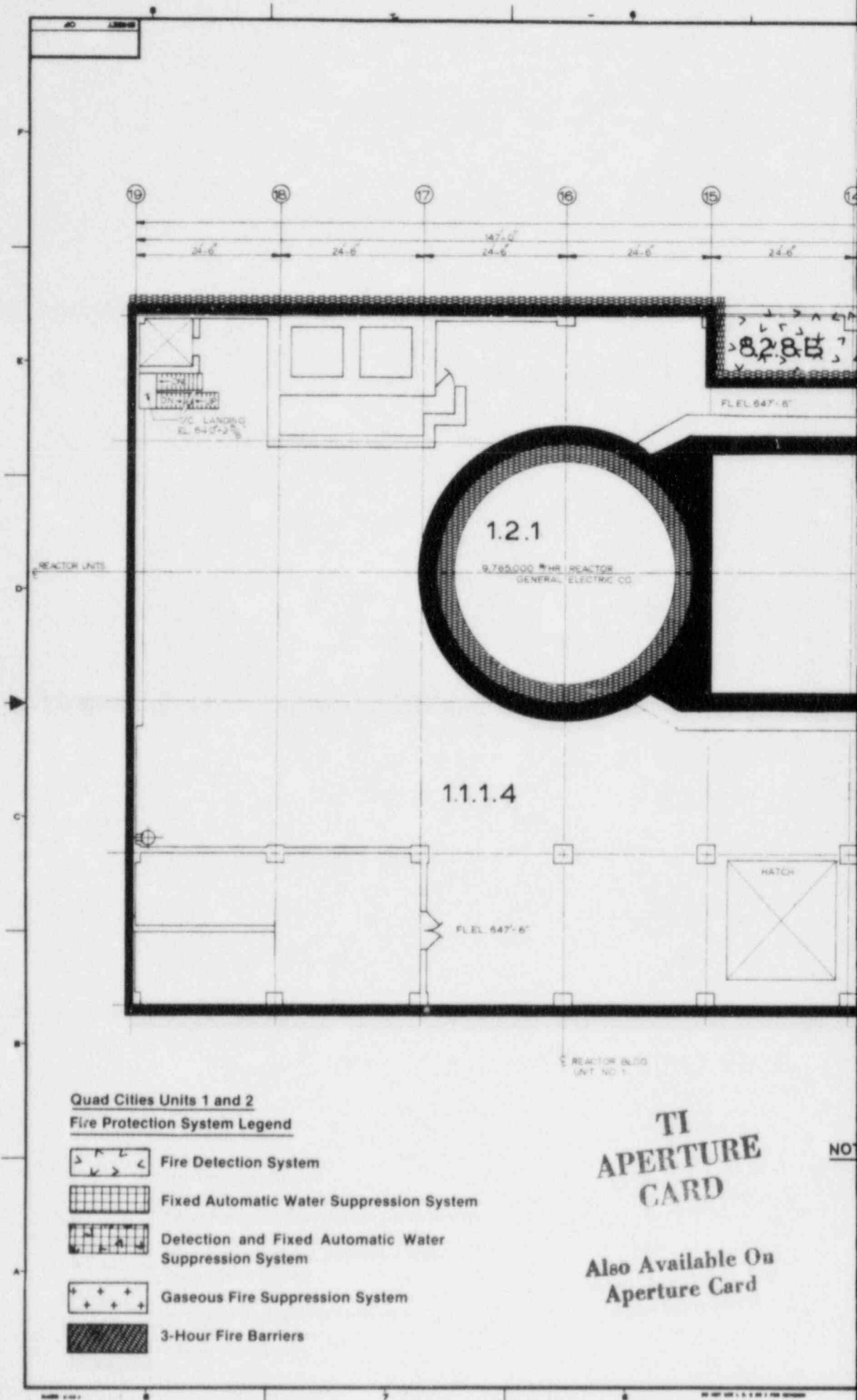


QUAD-CITIES STATION
Units 1 & 2

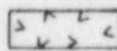

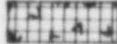
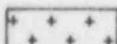

FIGURE B-3

FIRE DETECTION AND AUTOMATIC SUPPRESSION
REACTOR BUILDING FLOOR ELEV. 623'-0"

8512100065-05



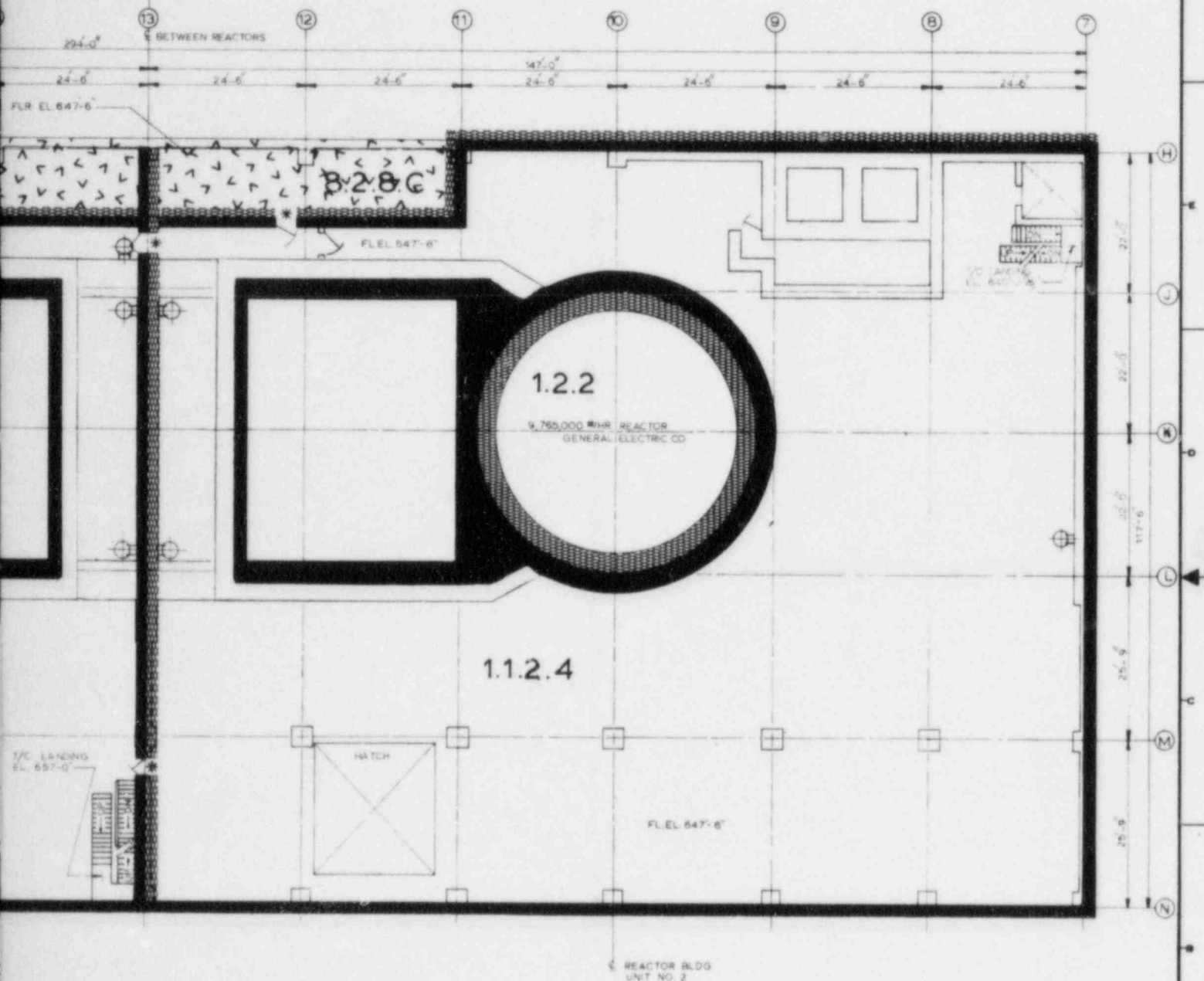
Quad Cities Units 1 and 2
Fire Protection System Legend

-  Fire Detection System
-  Fixed Automatic Water Suppression System
-  Detection and Fixed Automatic Water Suppression System
-  Gaseous Fire Suppression System
-  3-Hour Fire Barriers

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MATCH LINE SEE F-17 MATCH LINE SEE F-18



2 HOUR CONCRETE BLOCK WALL
FROM COLUMN LINE 11 TO 15
EL. 658'-0" TO 663'-0"
BETWEEN 480V SWGR & RX.BLDG

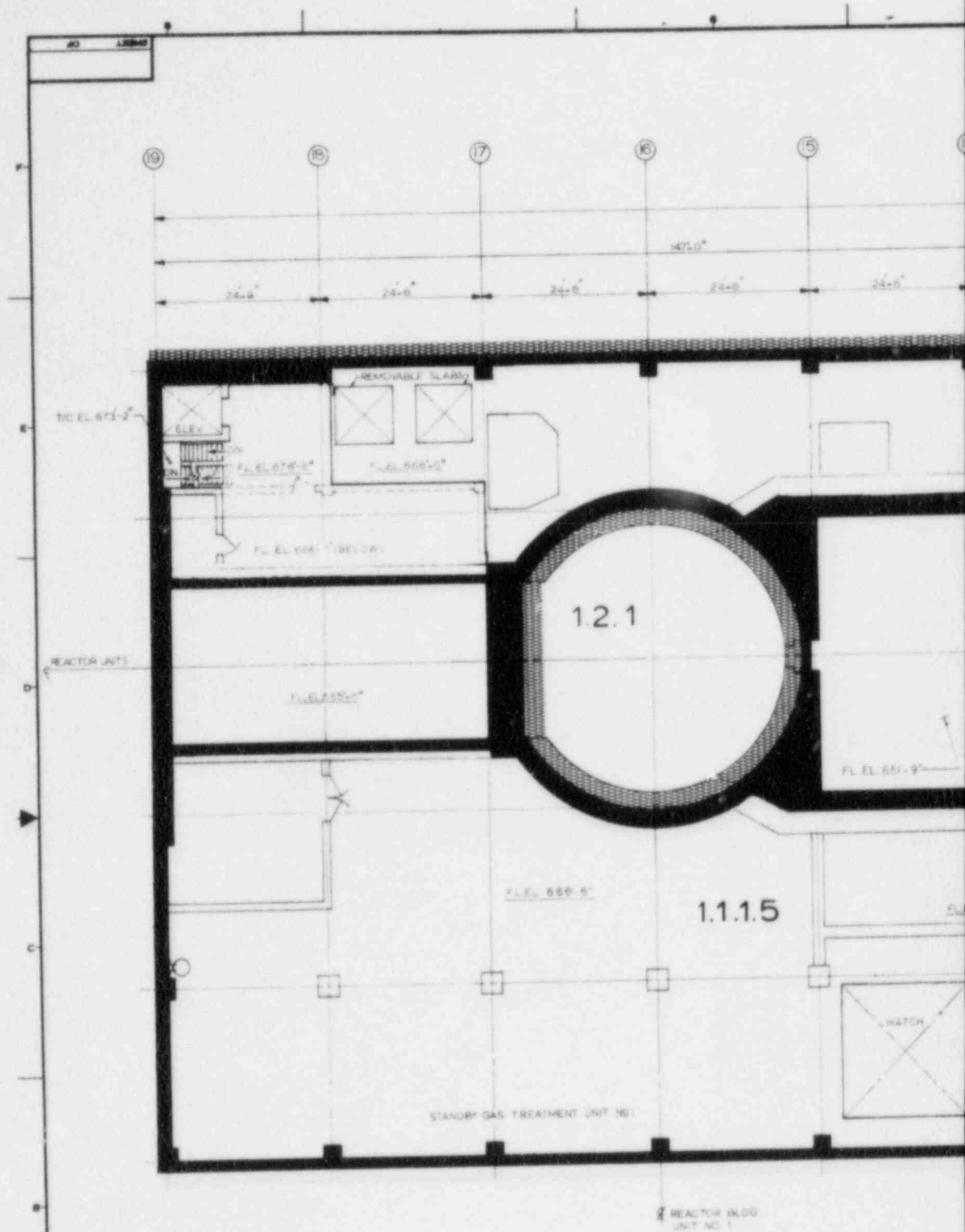


QUAD-CITIES STATION
Units 1 & 2

FIGURE B-4

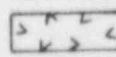

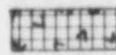
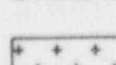

FIRE DETECTION AND AUTOMATIC SUPPRESSION
REACTOR BUILDING FLOOR ELEV. 647'-6"

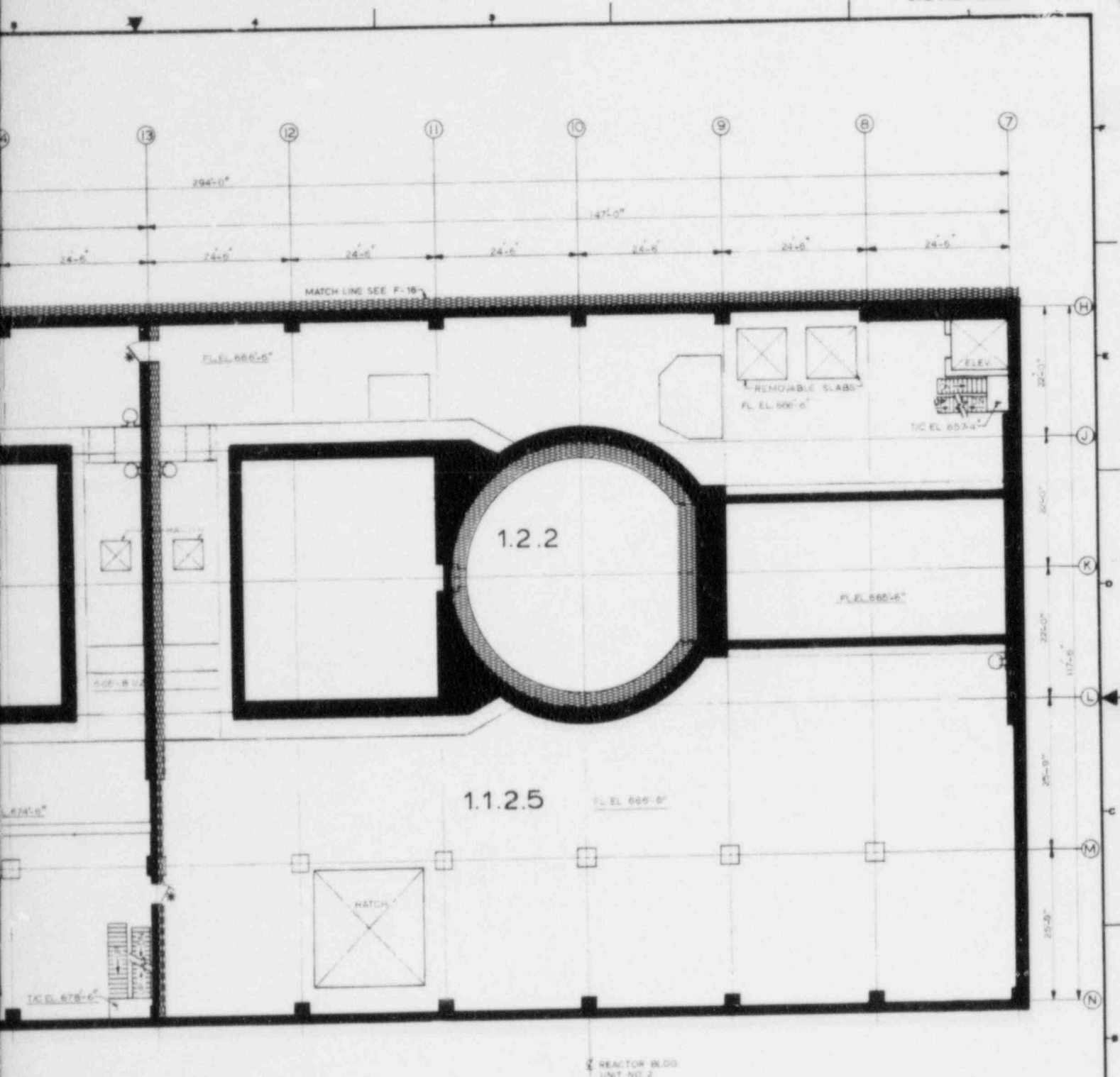
8512100065-06



Quad Cities Units 1 and 2

Fire Protection System Legend

-  Fire Detection System
-  Fixed Automatic Water Suppression System
-  Detection and Fixed Automatic Water Suppression System
-  Gaseous Fire Suppression System
-  3-Hour Fire Barriers



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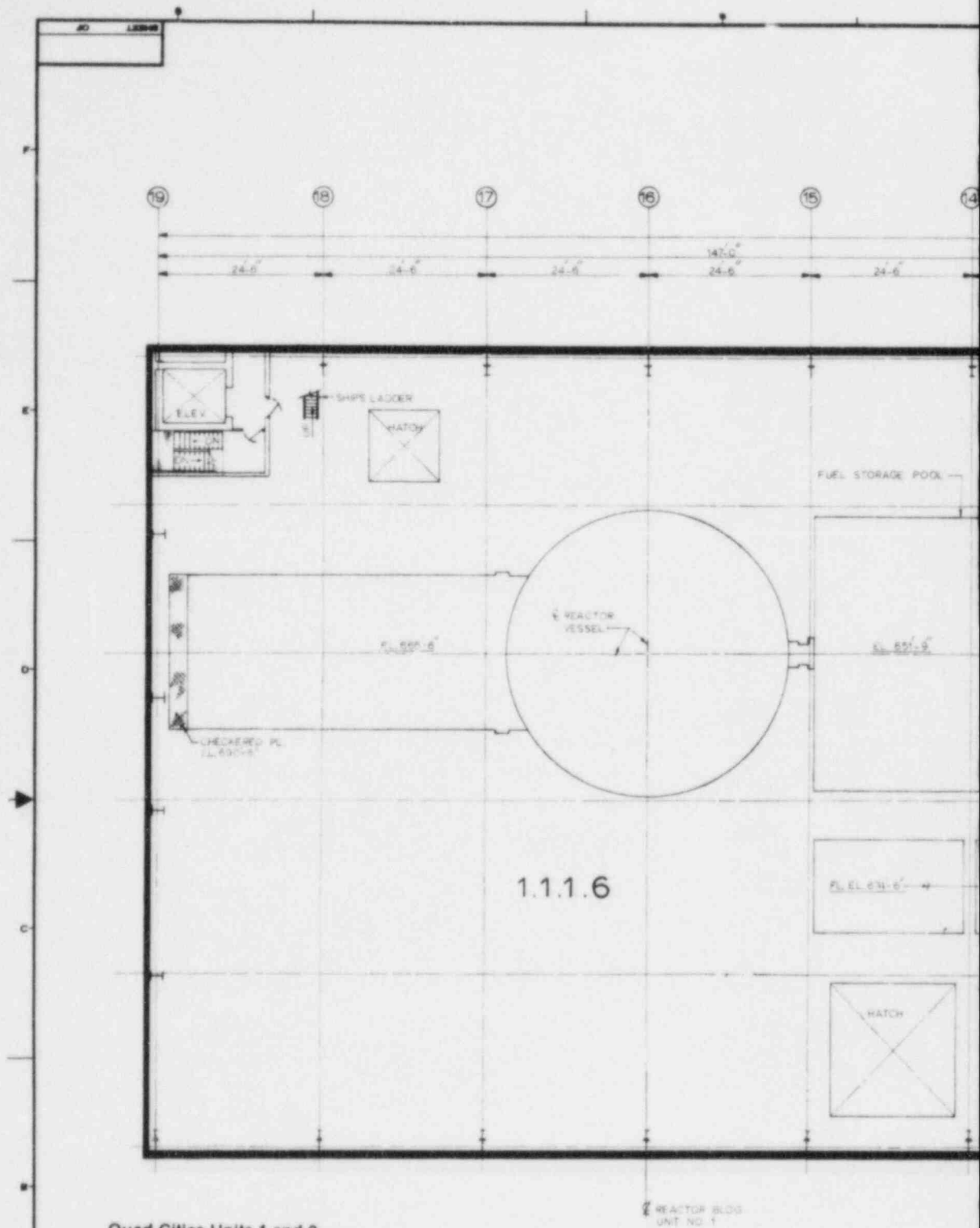


QUAD-CITIES STATION
Units 1 & 2

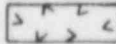

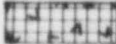
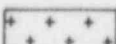

FIGURE B-5

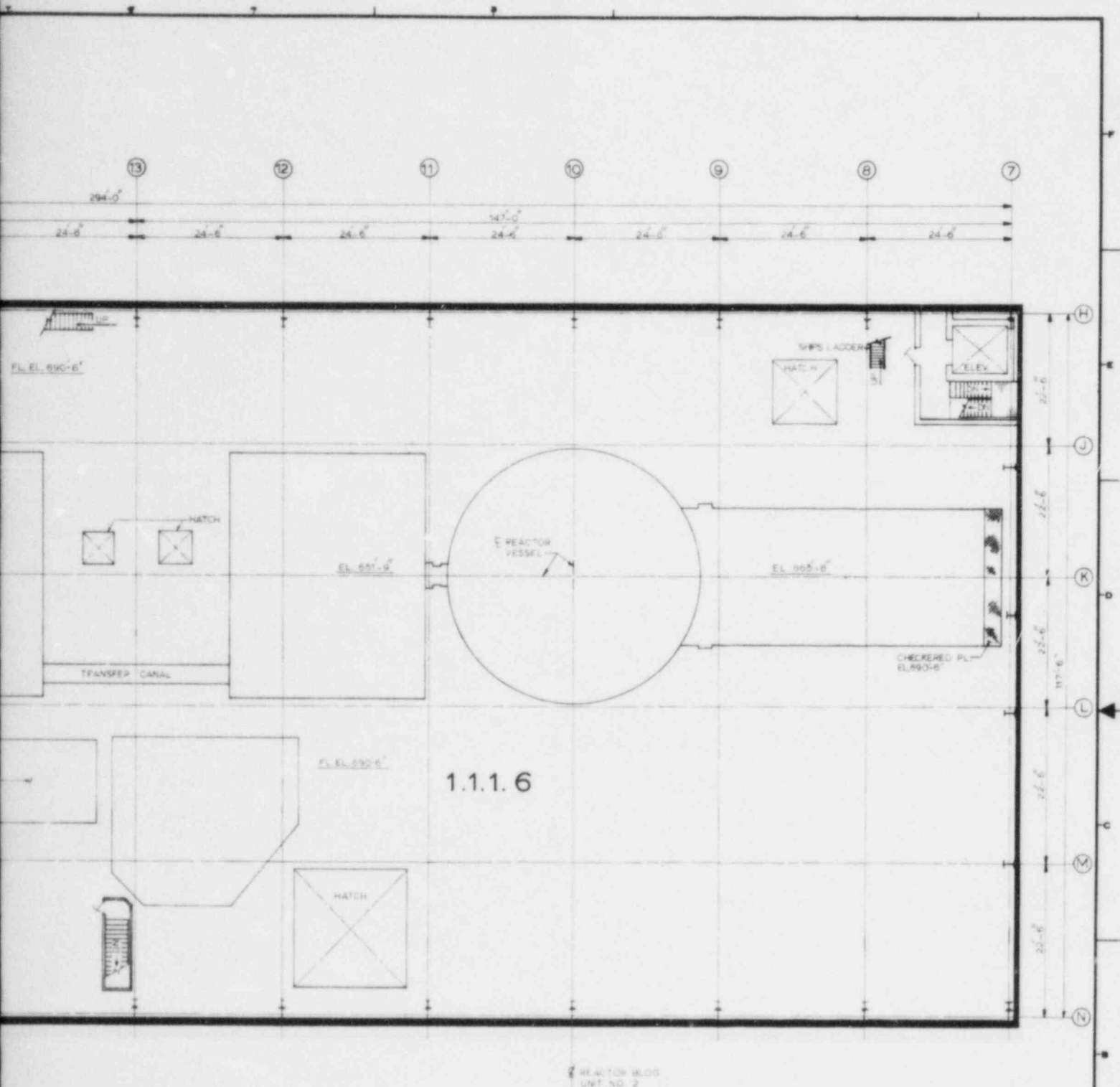
FIRE DETECTION AND AUTOMATIC SUPPRESSION
REACTOR BUILDING FLOOR ELEV. 666'-6"

8512100065-07



Quad Cities Units 1 and 2
 Fire Protection System Legend

-  Fire Detection System
-  Fixed Automatic Water Suppression System
-  Detection and Fixed Automatic Water Suppression System
-  Gaseous Fire Suppression System
-  3-Hour Fire Barriers



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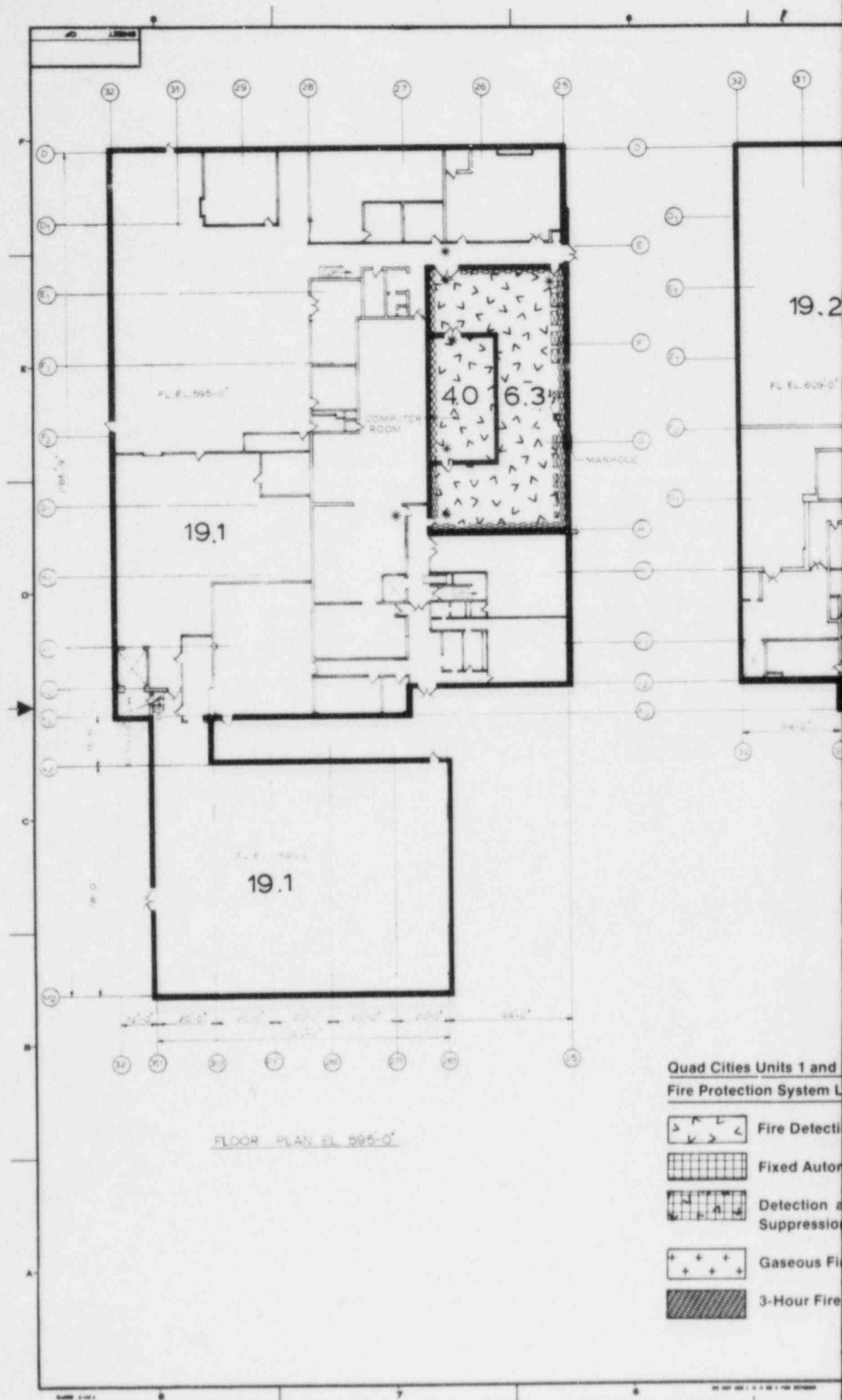


QUAD-CITIES STATION
Units 1 & 2

FIGURE 3-6

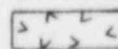
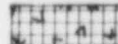
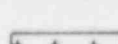

FIRE DETECTION AND AUTOMATIC SUPPRESSION
REACTOR BUILDING FLOOR ELEV. 690'-6"

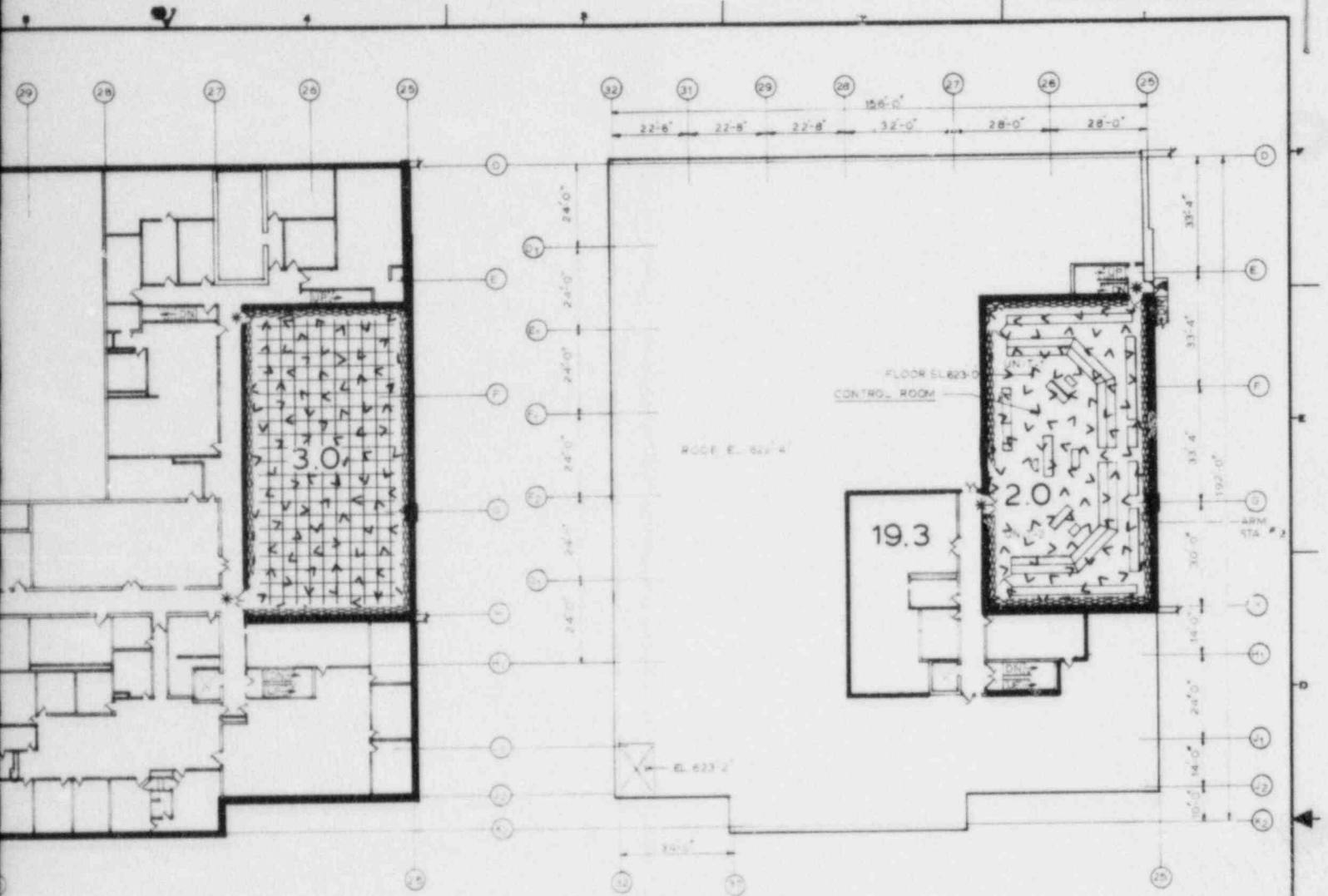
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FLOOR PLAN EL. 595'-0"

Quad Cities Units 1 and 2
Fire Protection System Legend

-  Fire Detection
-  Fixed Automatic
-  Detection and Suppression
-  Gaseous Fire
-  3-Hour Fire



FLOOR PLAN EL. 609'-0"

FLOOR PLAN EL. 623'-0"

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Legend

on System

Automatic Water Suppression System

and Fixed Automatic Water
System

Suppression System

Barriers

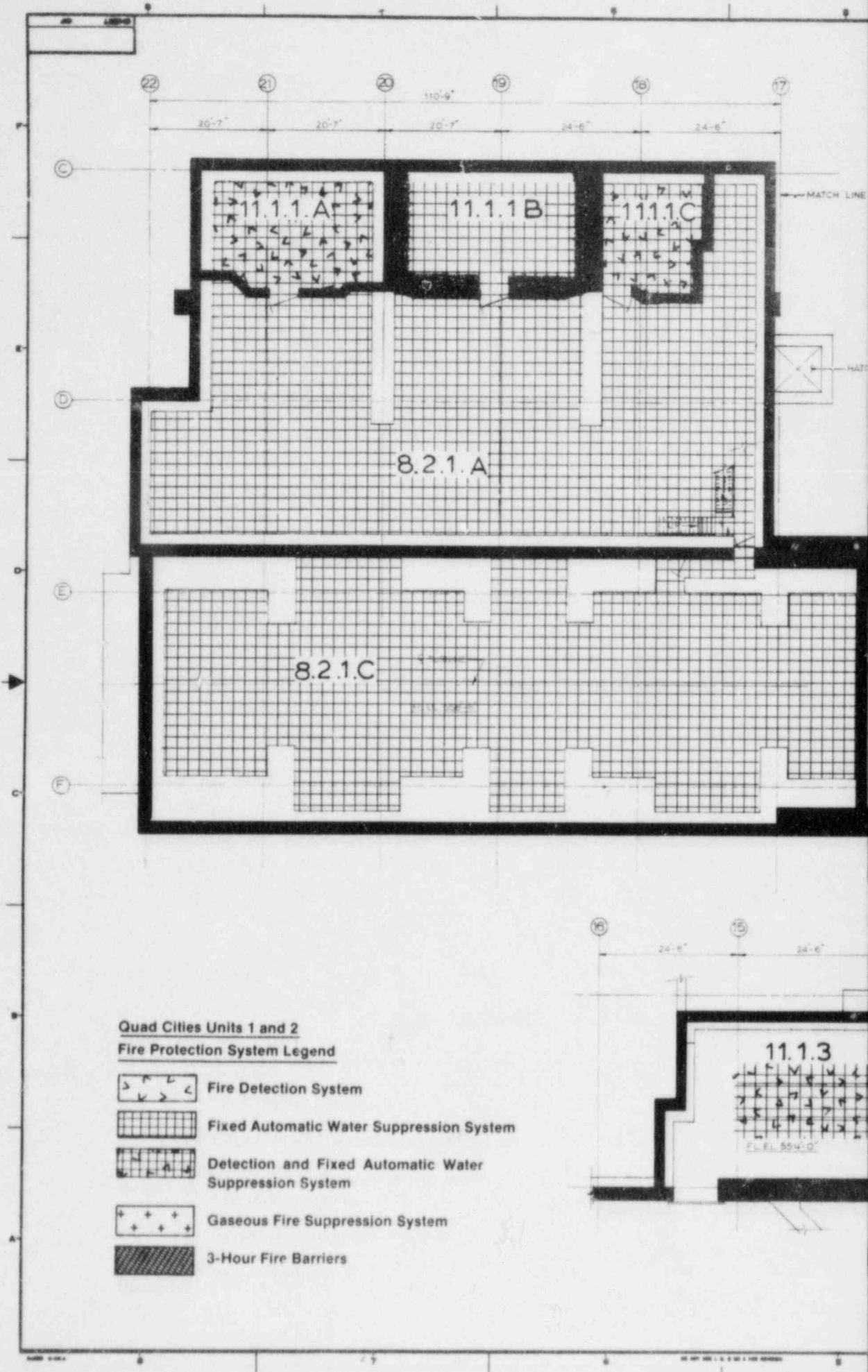


QUAD-CITIES STATION
Units 1 & 2

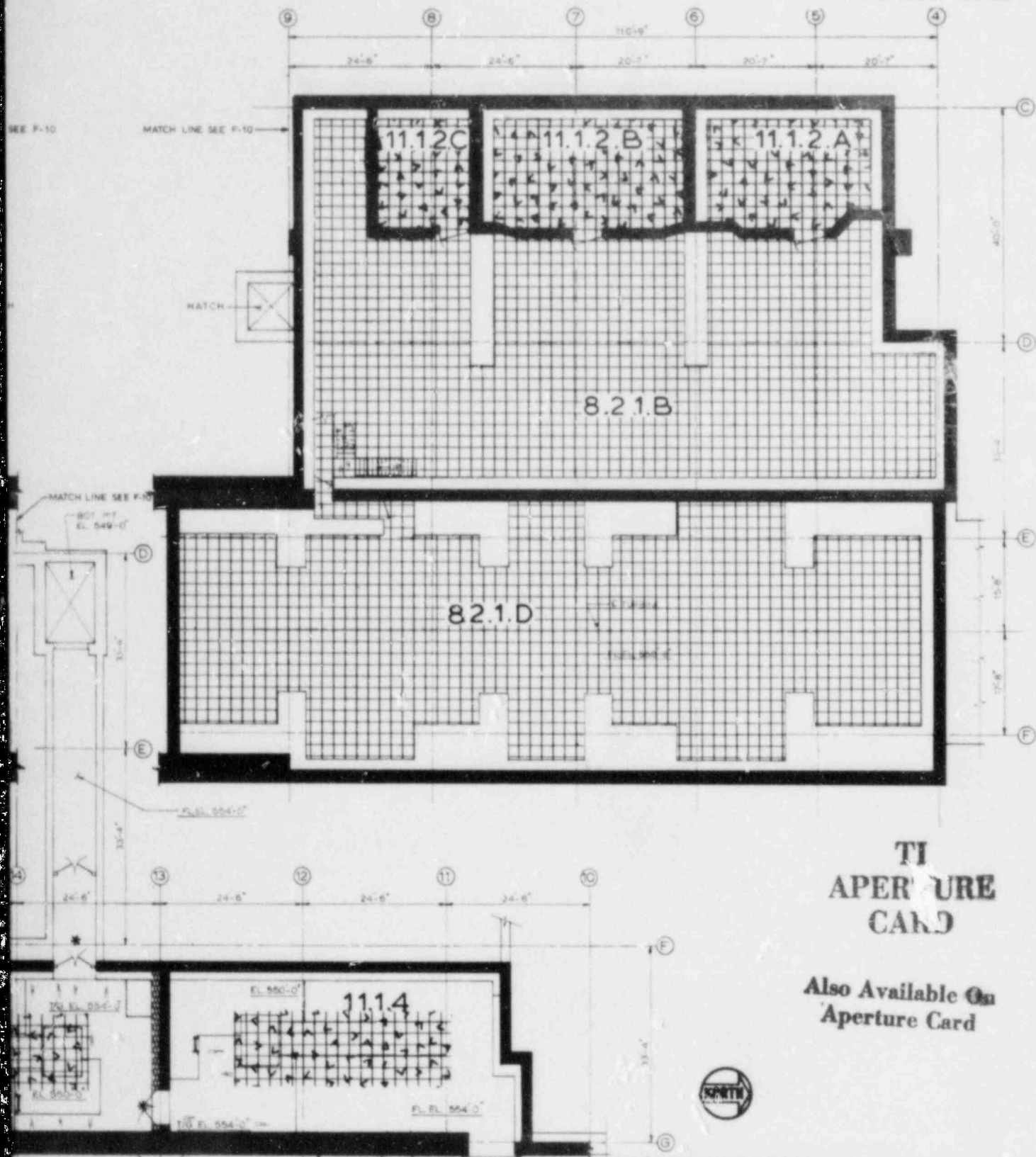
FIGURE B-7

FIRE DETECTION AND AUTOMATIC SUPPRESSION
SERVICE BUILDING AND WAREHOUSE

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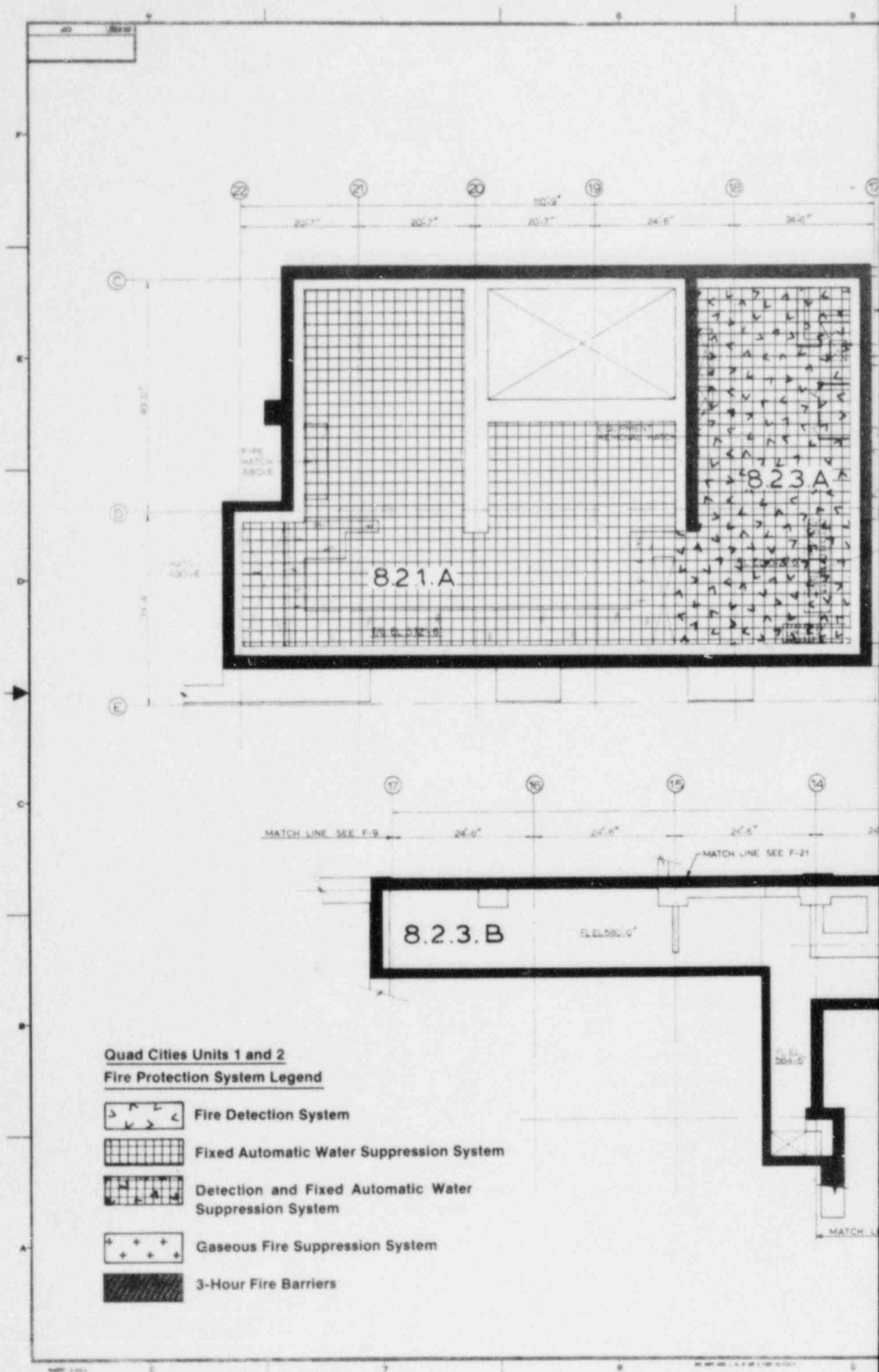
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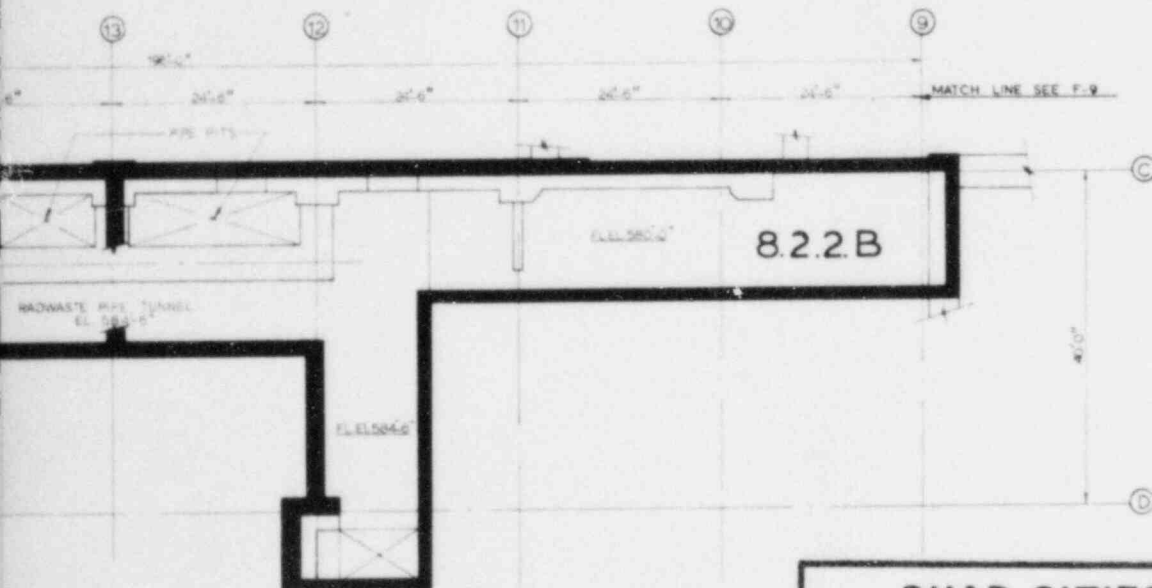
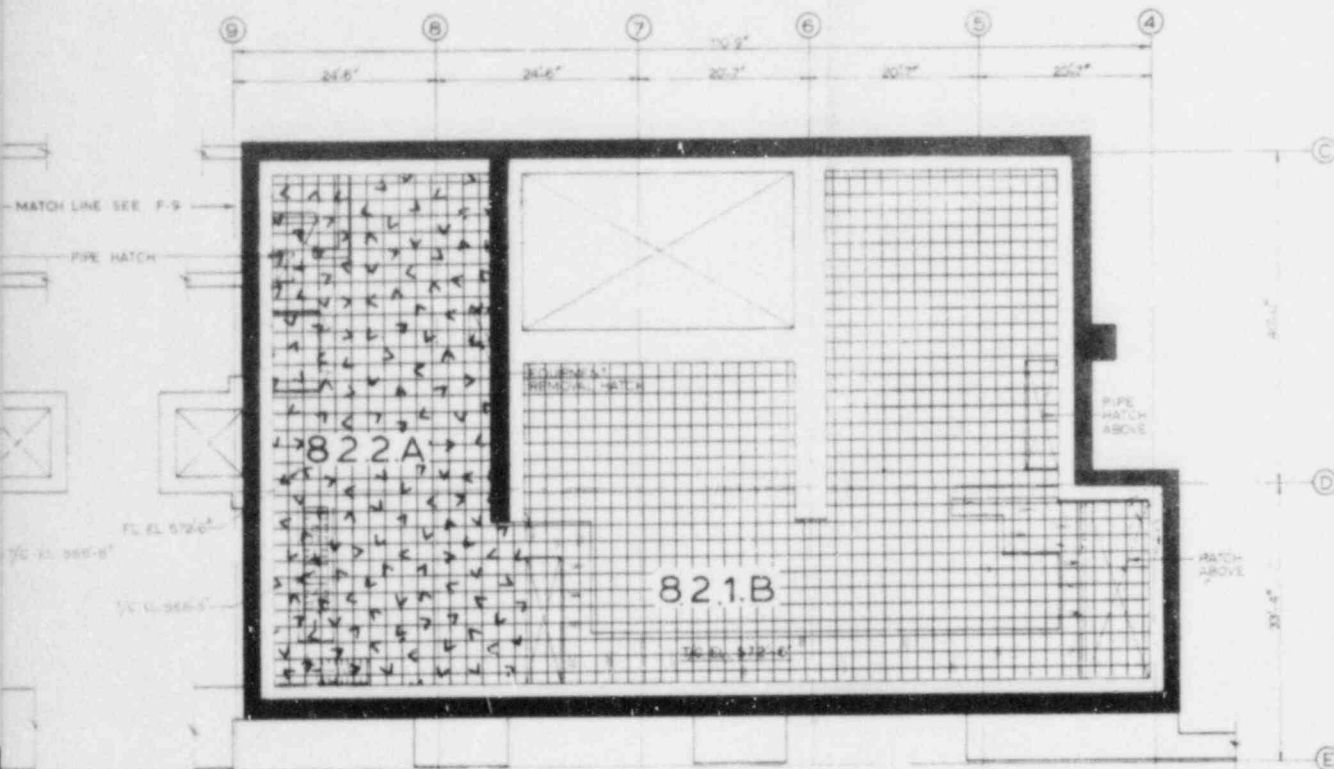
QUAD-CITIES STATION
Units 1 & 2

FIGURE B-8
FIRE DETECTION AND AUTOMATIC SUPPRESSION
TURBINE BUILDING BASEMENT FLOOR

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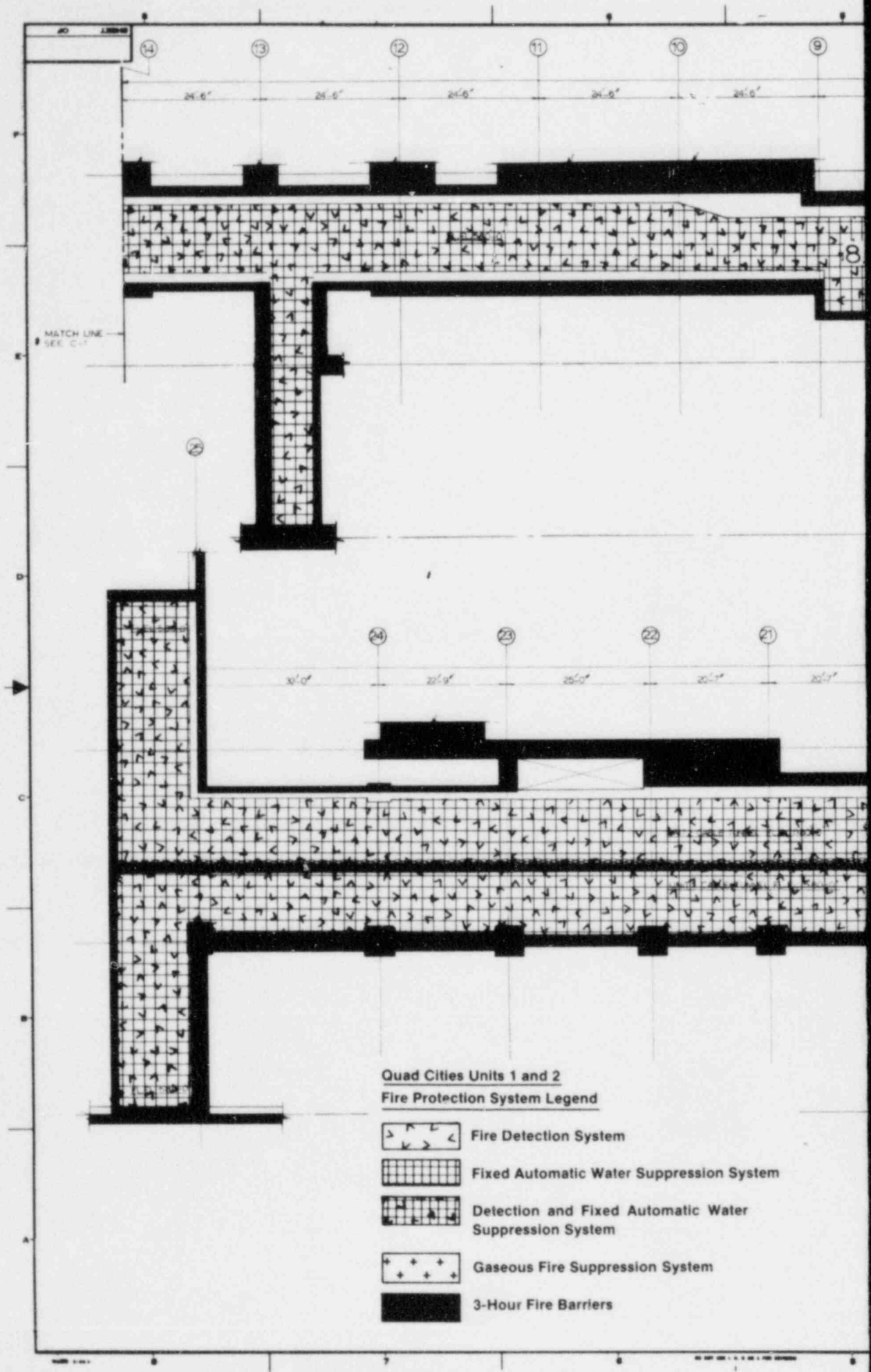
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QUAD-CITIES STATION
Units 1 & 2

FIGURE B-9

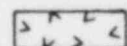

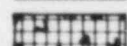
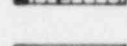

FIRE DETECTION AND AUTOMATIC SUPPRESSION
TURBINE BUILDING UPPER BASEMENT FLOOR

8512100065 -11

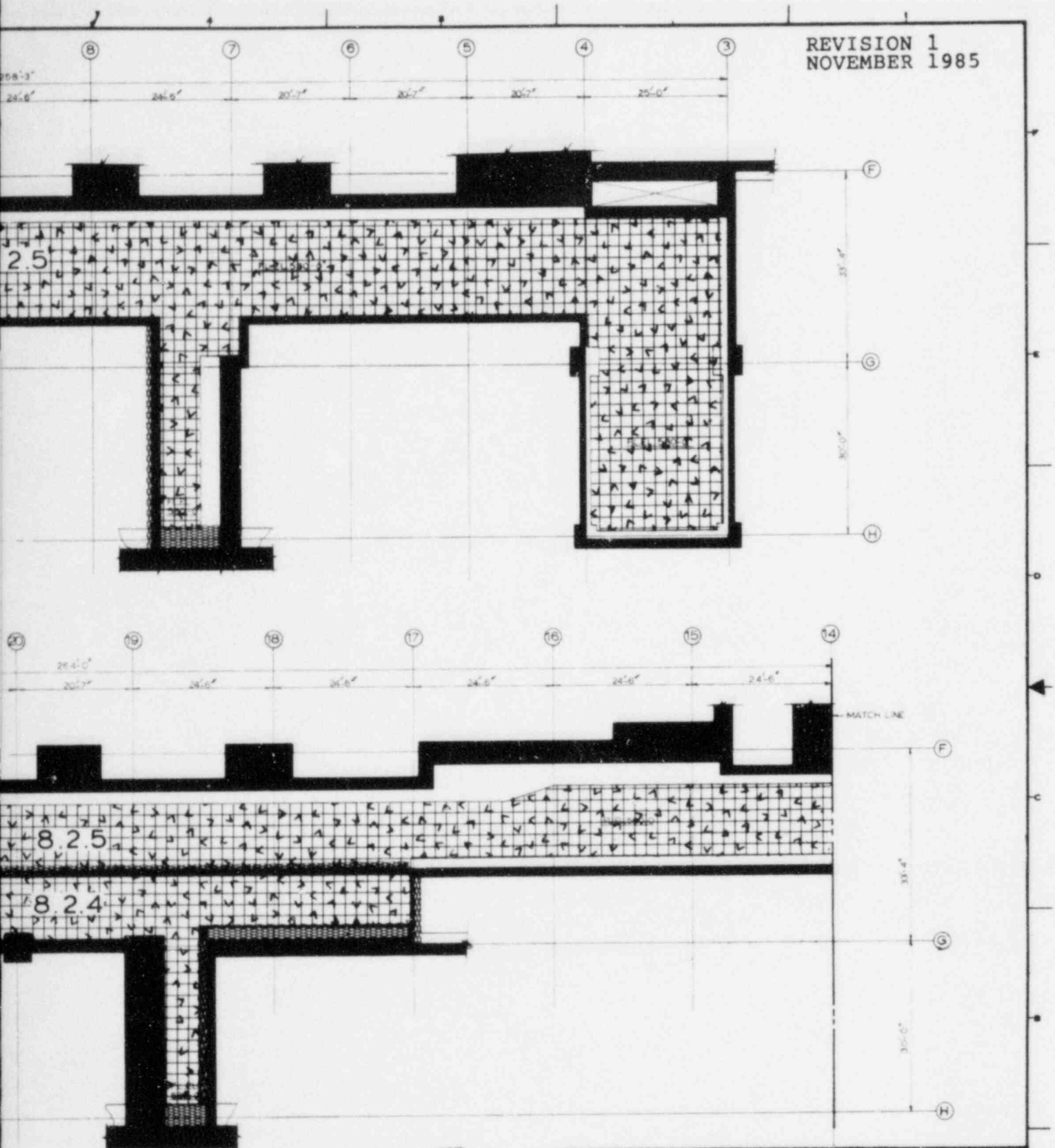


Quad Cities Units 1 and 2

Fire Protection System Legend

-  Fire Detection System
-  Fixed Automatic Water Suppression System
-  Detection and Fixed Automatic Water Suppression System
-  Gaseous Fire Suppression System
-  3-Hour Fire Barriers

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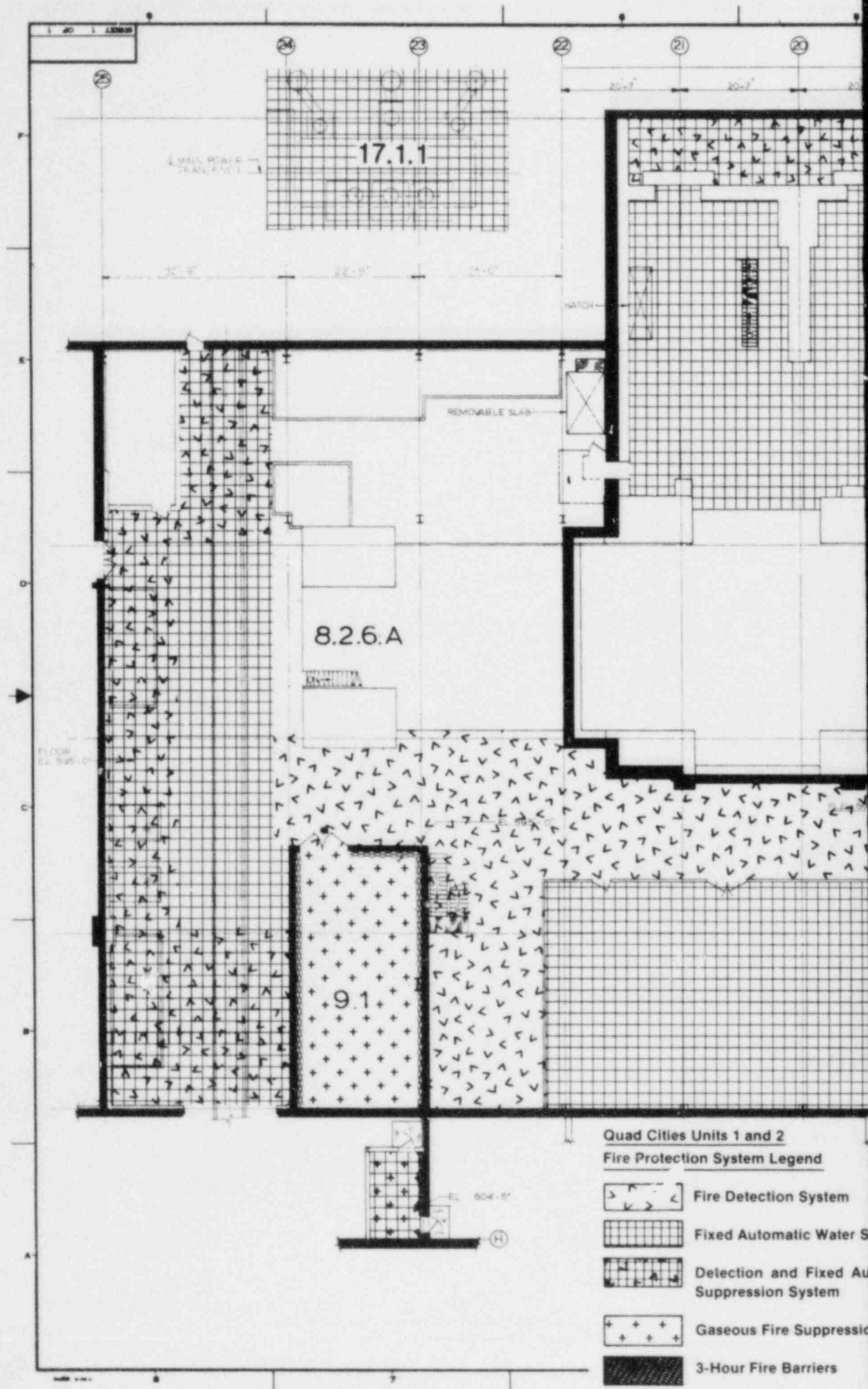
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QUAD-CITIES STATION
Units 1 & 2

FIGURE B-10

FIRE DETECTION AND AUTOMATIC SUPPRESSION
CABLE TUNNELS

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Automatic Water

n System

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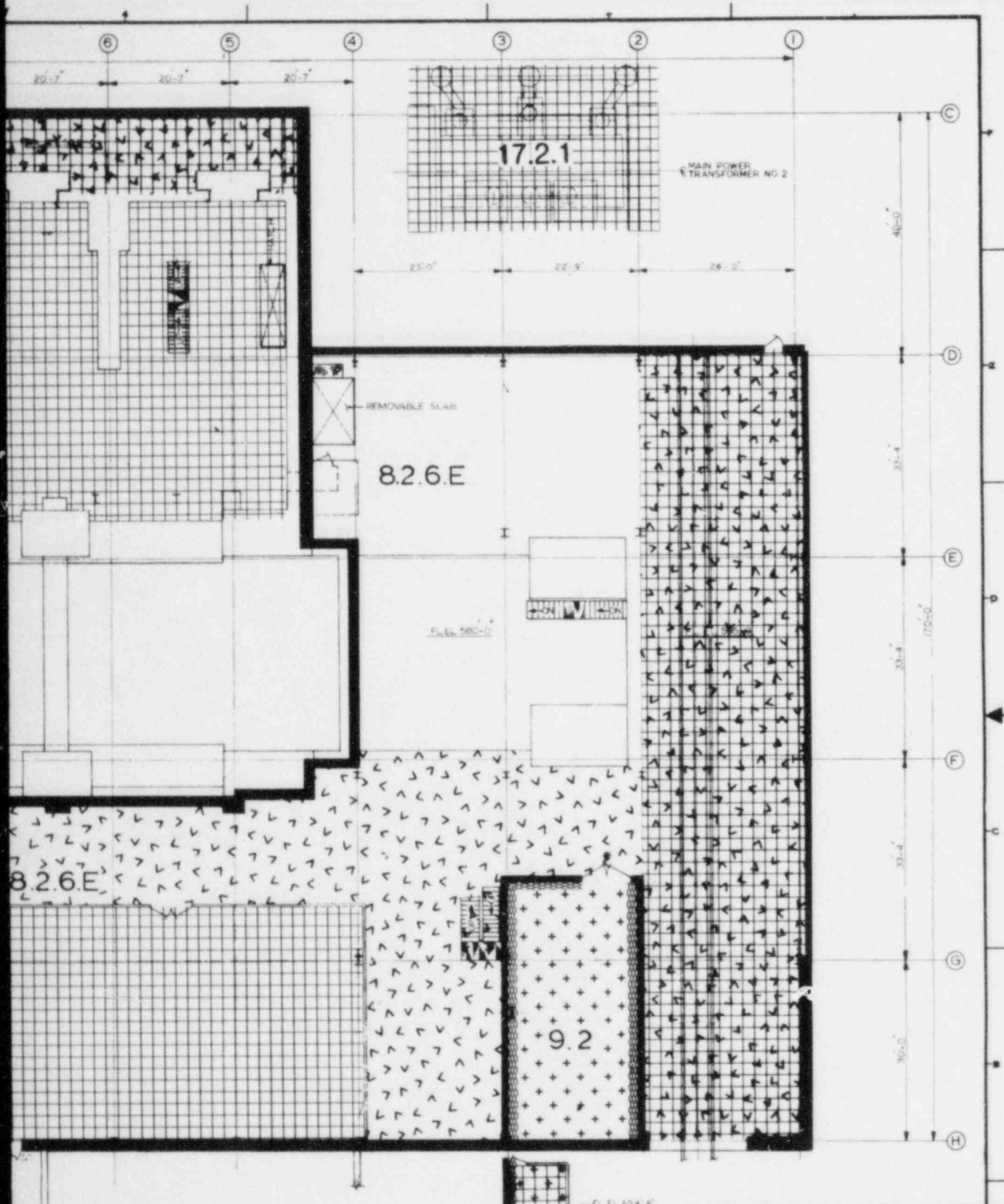
QUAD-CITIES STATION
Units 1 & 2

FIGURE B-11

FIRE DETECTION AND AUTOMATIC SUPPRESSION
TURBINE BUILDING GROUND FLOOR - UNIT 1

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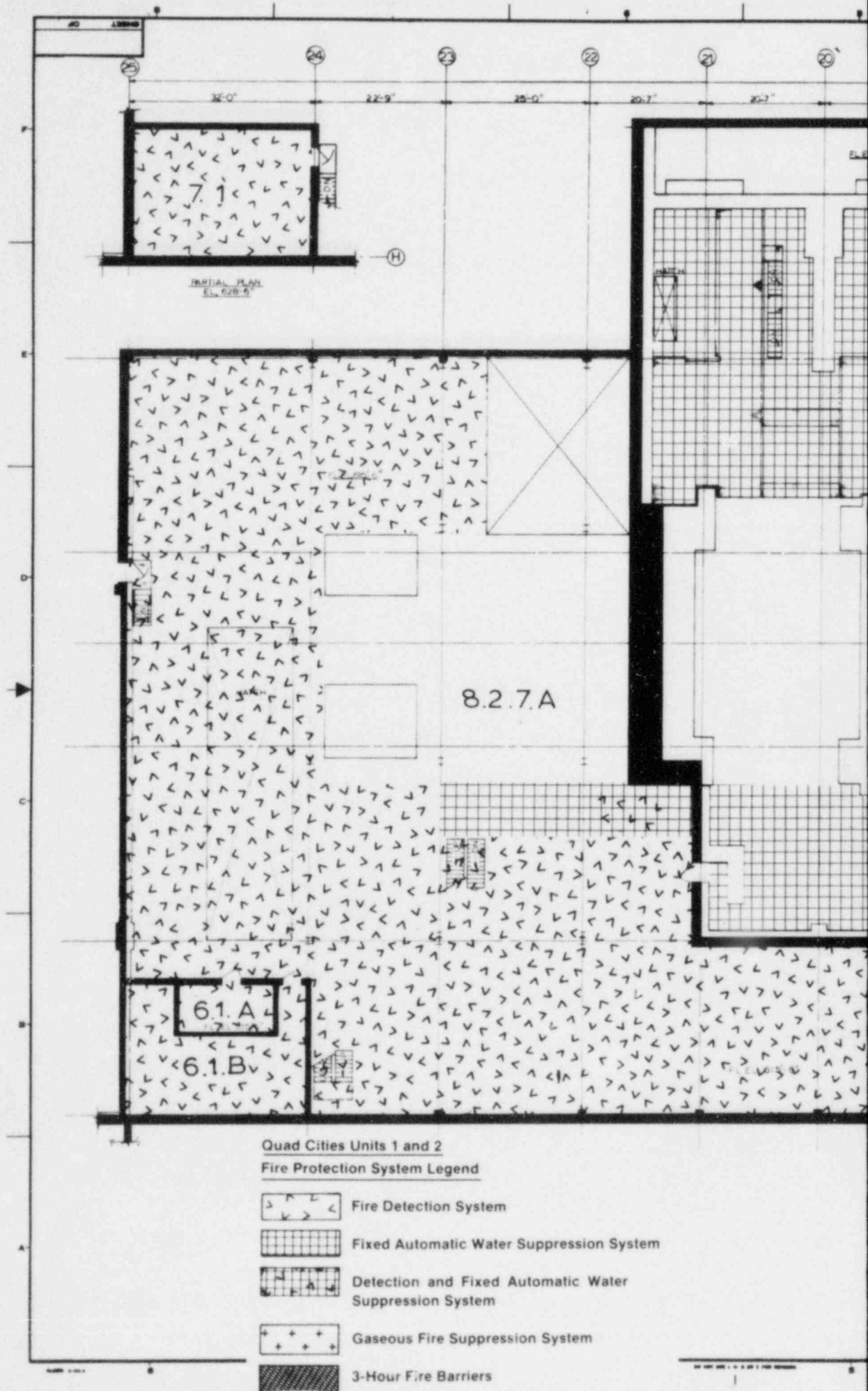
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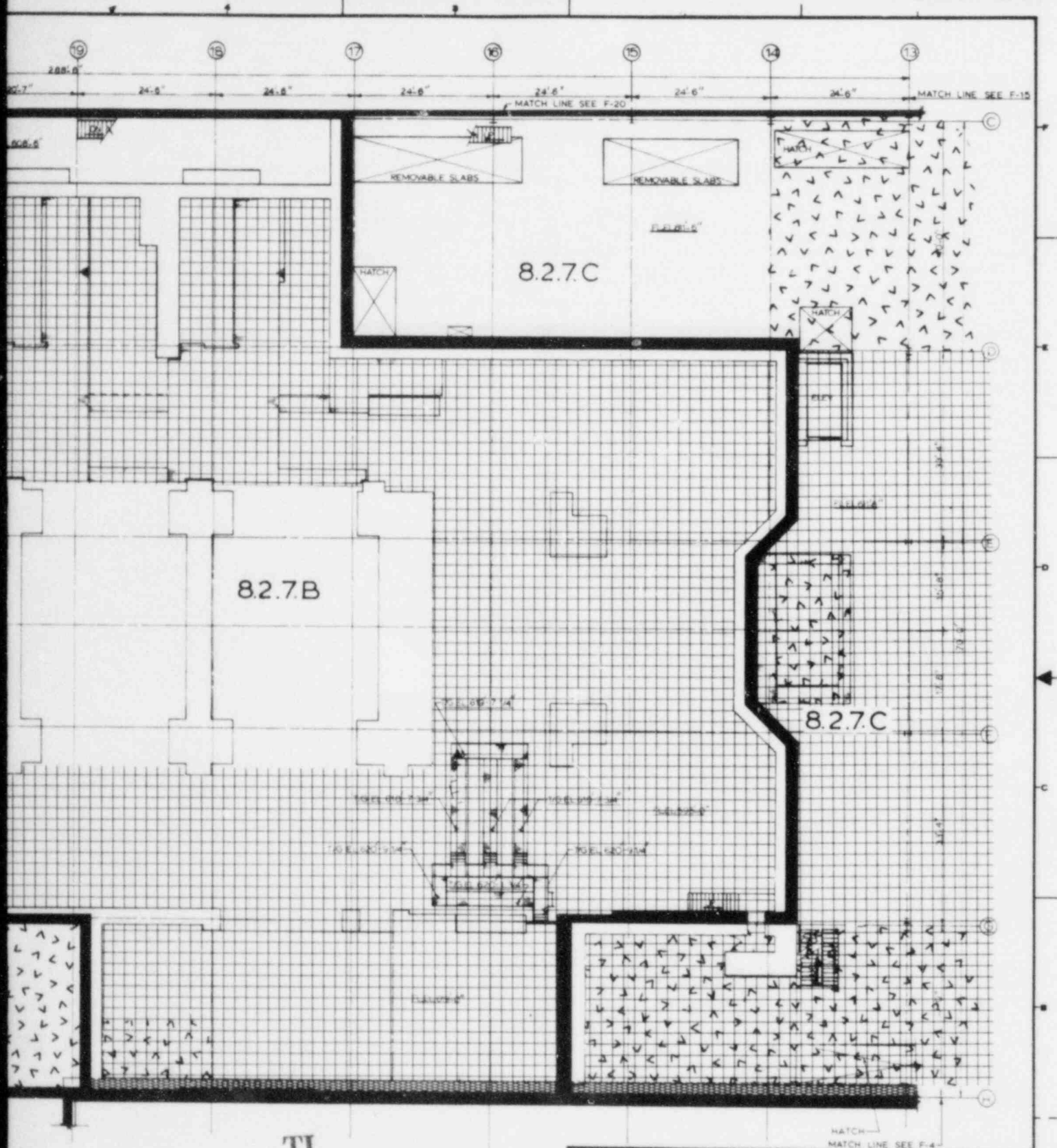
QUAD-CITIES STATION
Units 1 & 2

FIGURE B-12

FIRE DETECTION AND AUTOMATIC SUPPRESSION
TURBINE BUILDING GROUND FLOOR - UNIT 2

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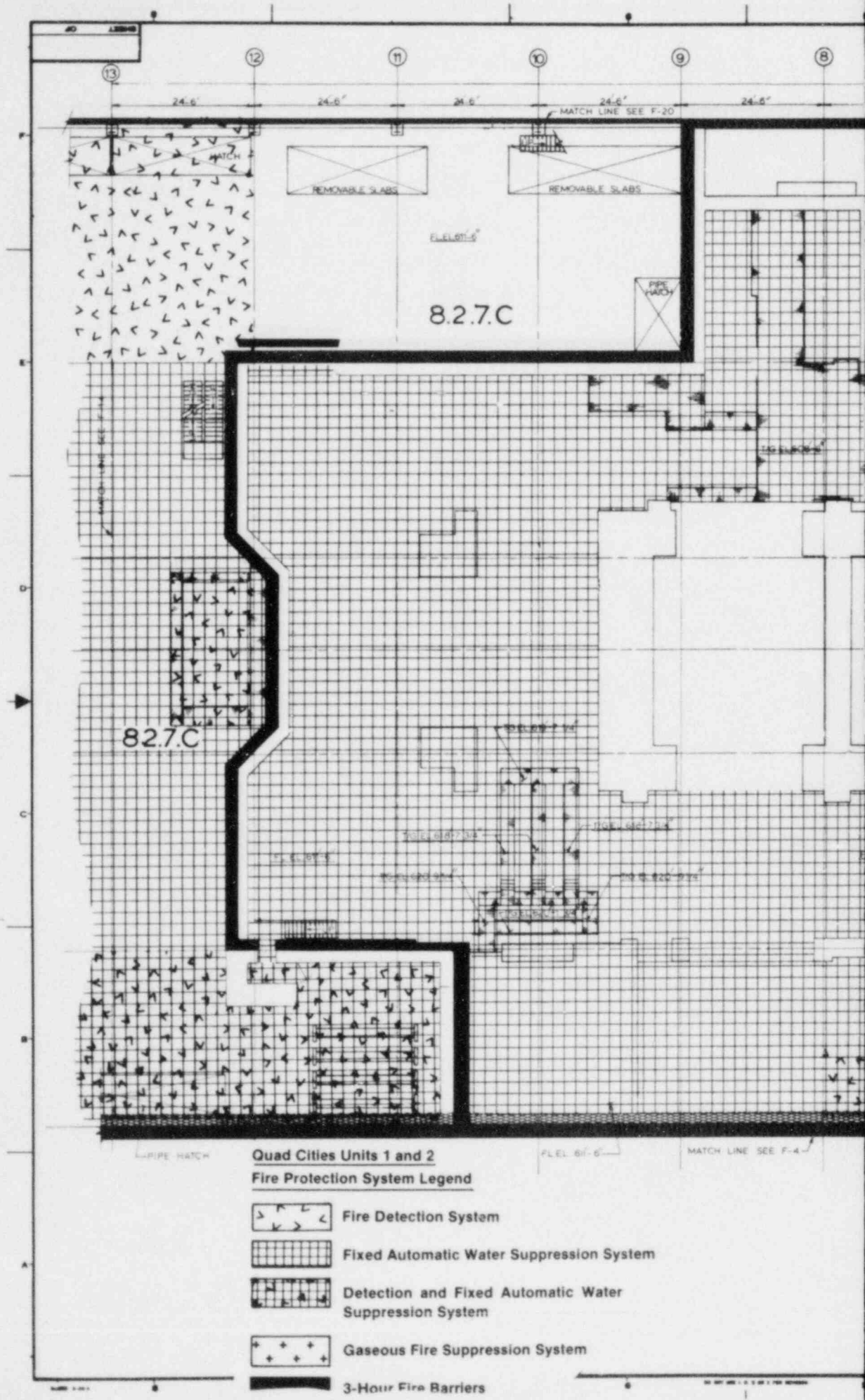
**Also Available On
Aperture Card**

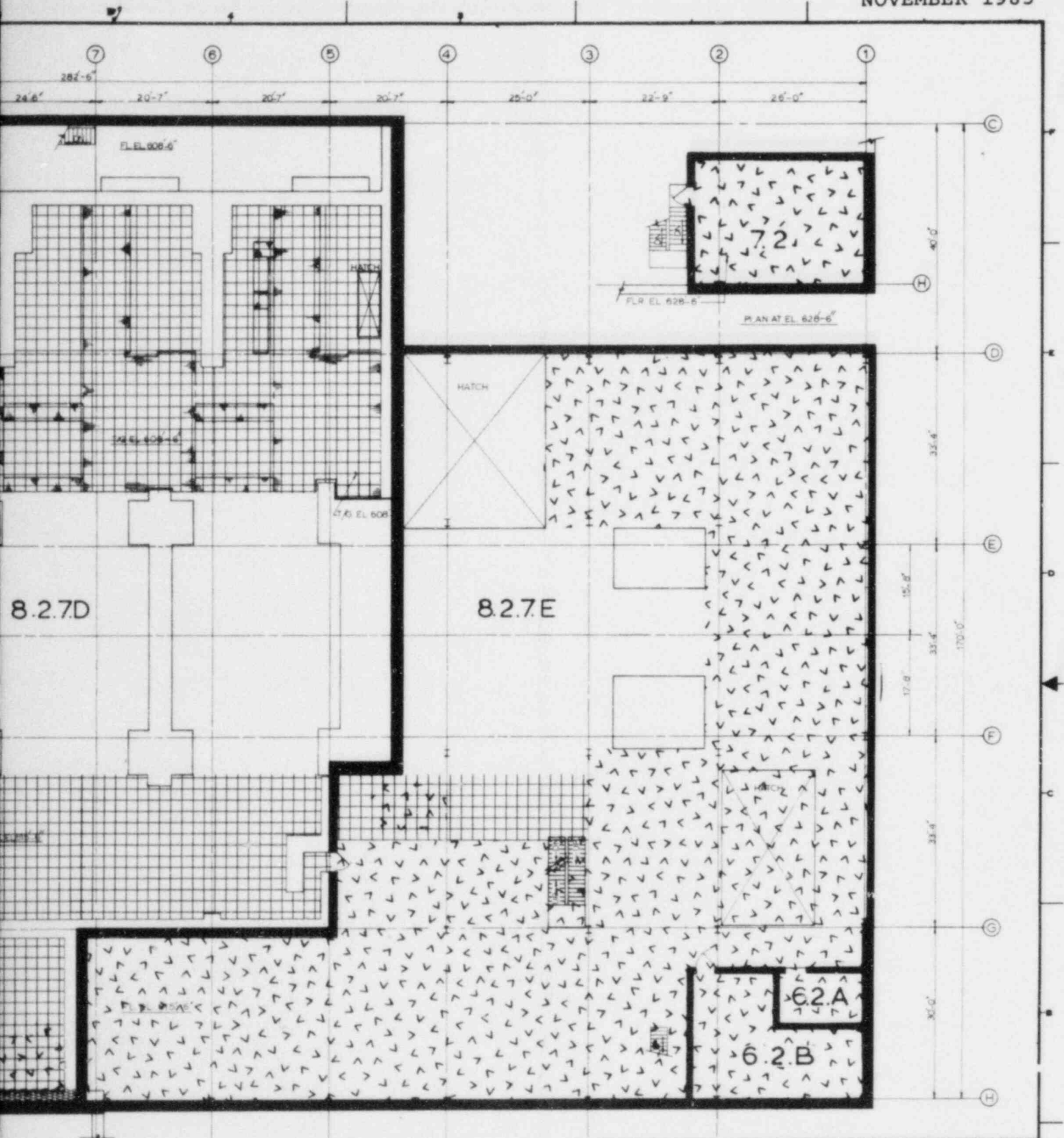
QUAD-CITIES STATION
Units 1 & 2

FIGURE B-13

FIRE DETECTION AND AUTOMATIC SUPPRESSION
TURBINE BUILDING MEZZANINE FLOOR - UNIT 1

8512100065-15





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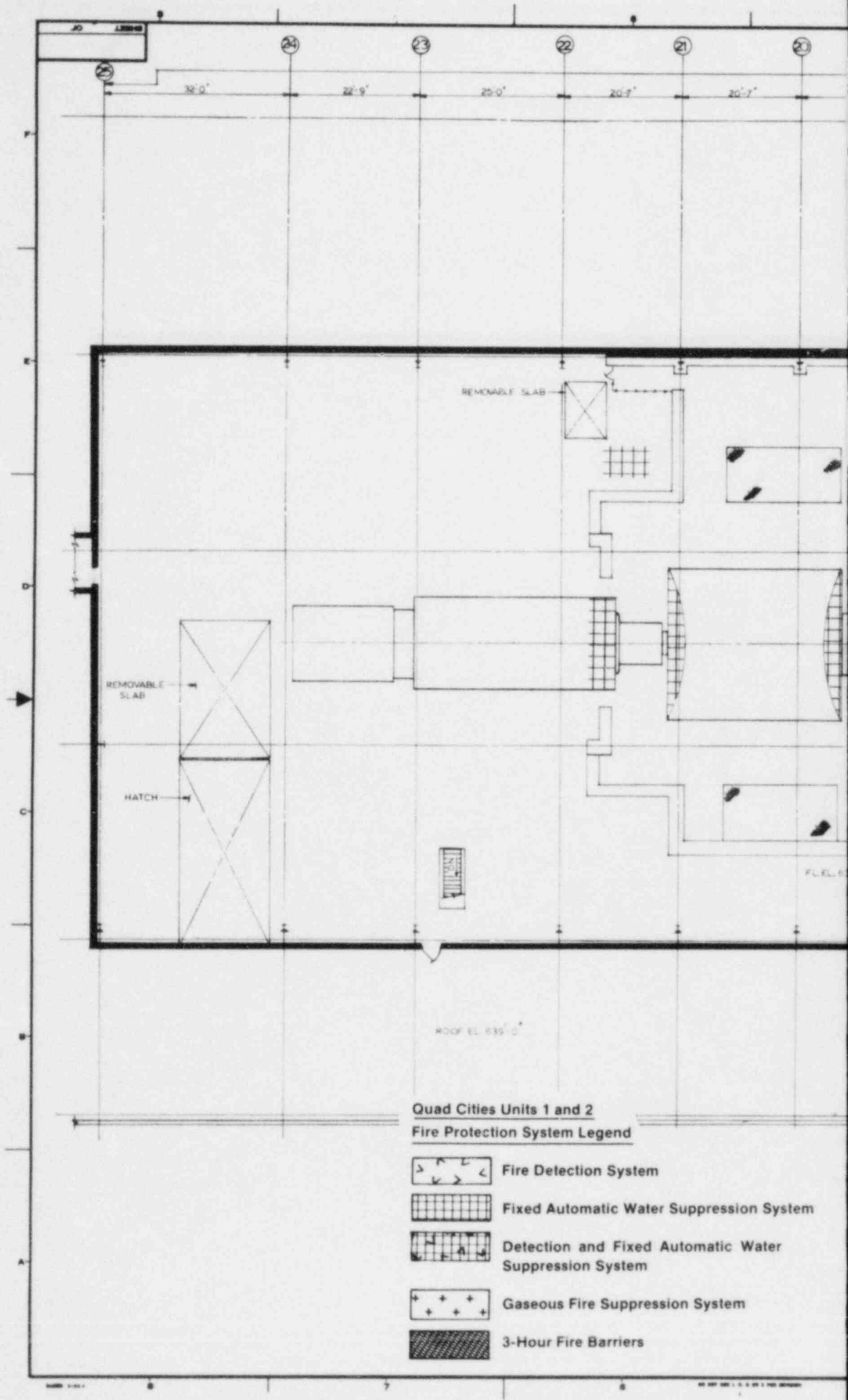
Also Available On
Aperture Card

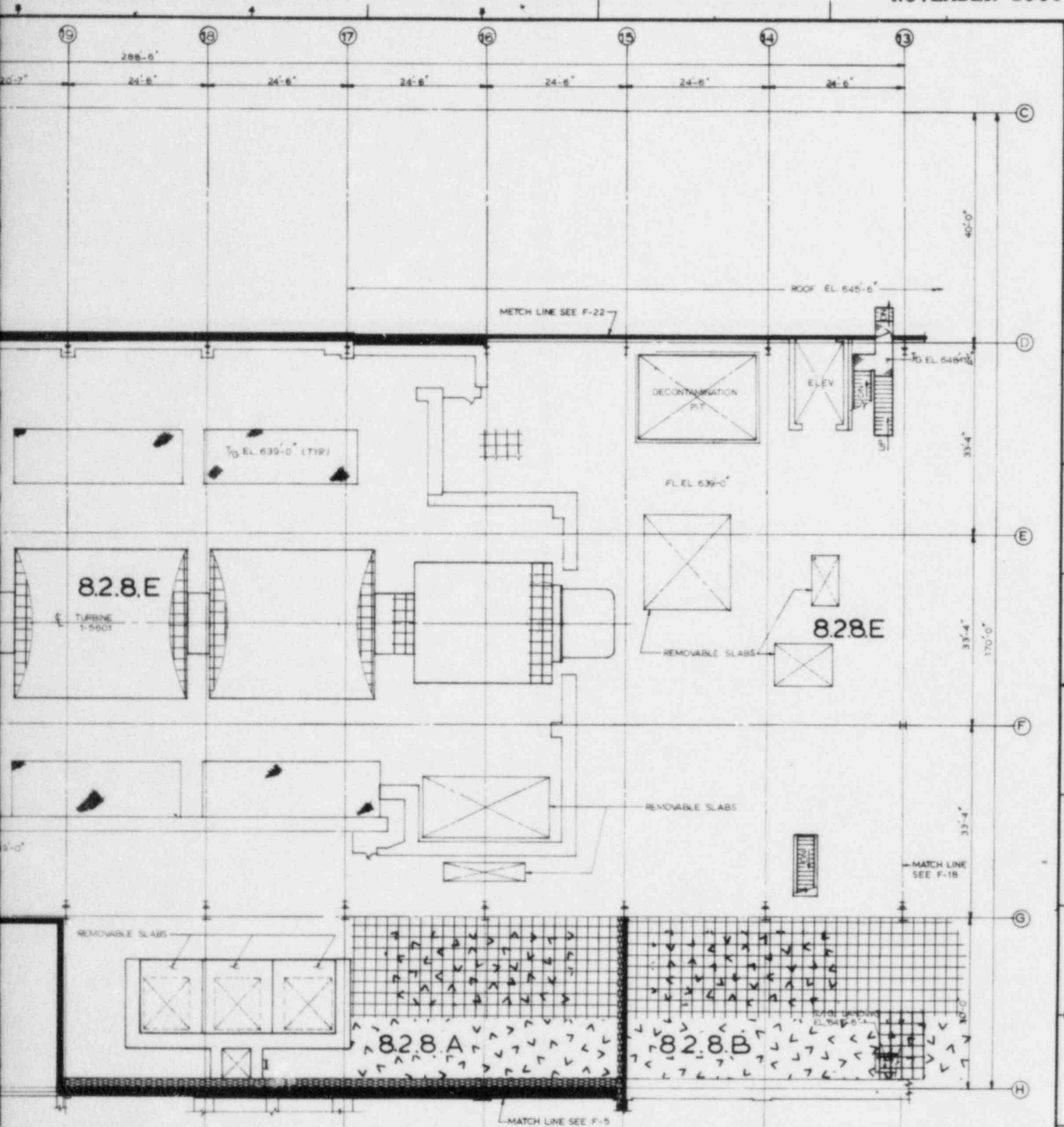


QUAD-CITIES STATION
Units 1 & 2

FIGURE B-14

FIRE DETECTION AND AUTOMATIC SUPPRESSION
TURBINE BUILDING MEZZANINE FLOOR - UNIT 2





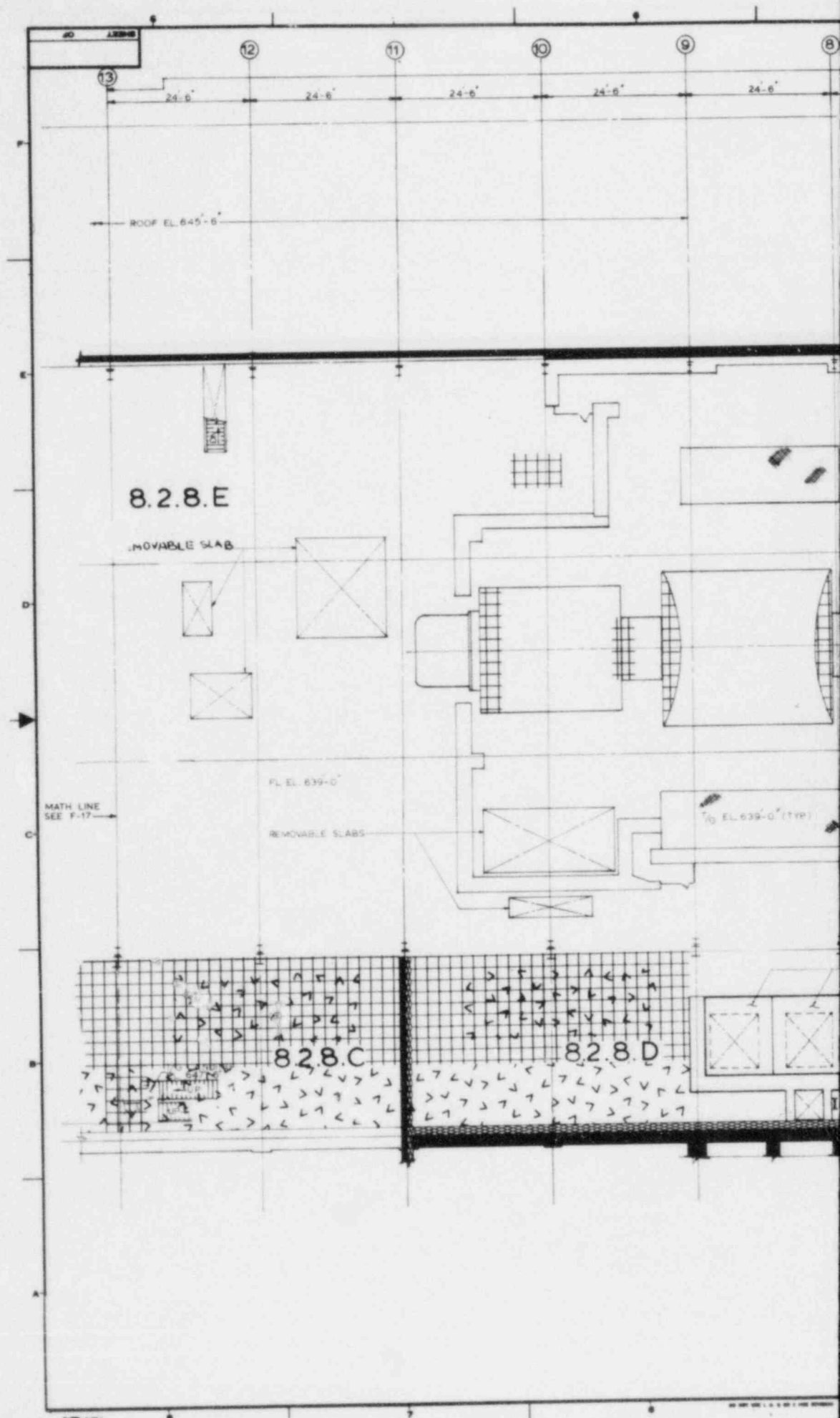
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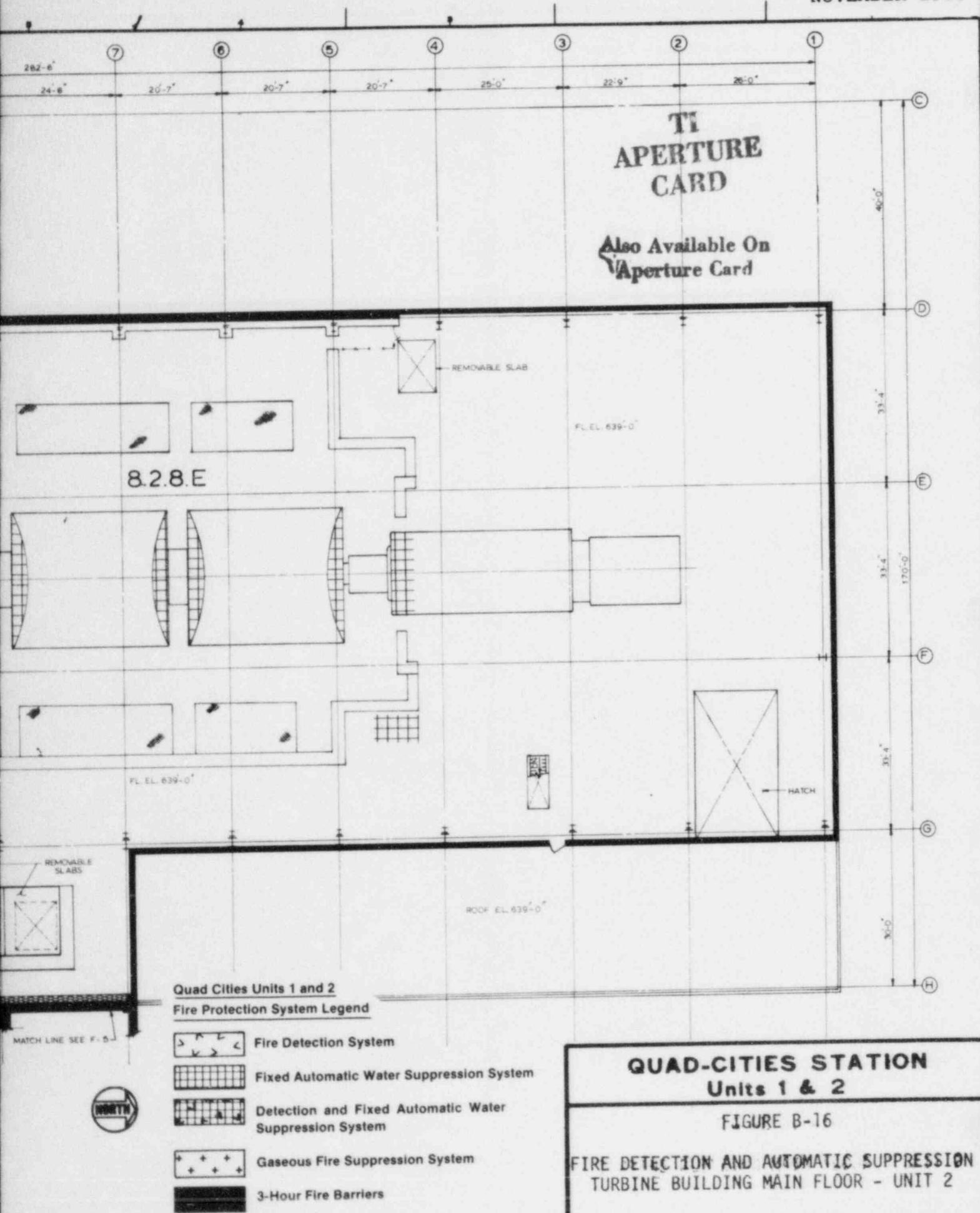
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Aperture Card

QUAD-CITIES STATION
Units 1 & 2

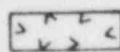
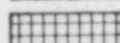
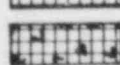
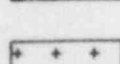

FIGURE B-15

FIRE DETECTION AND AUTOMATIC SUPPRESSION
TURBINE BUILDING MAIN FLOOR - UNIT 1





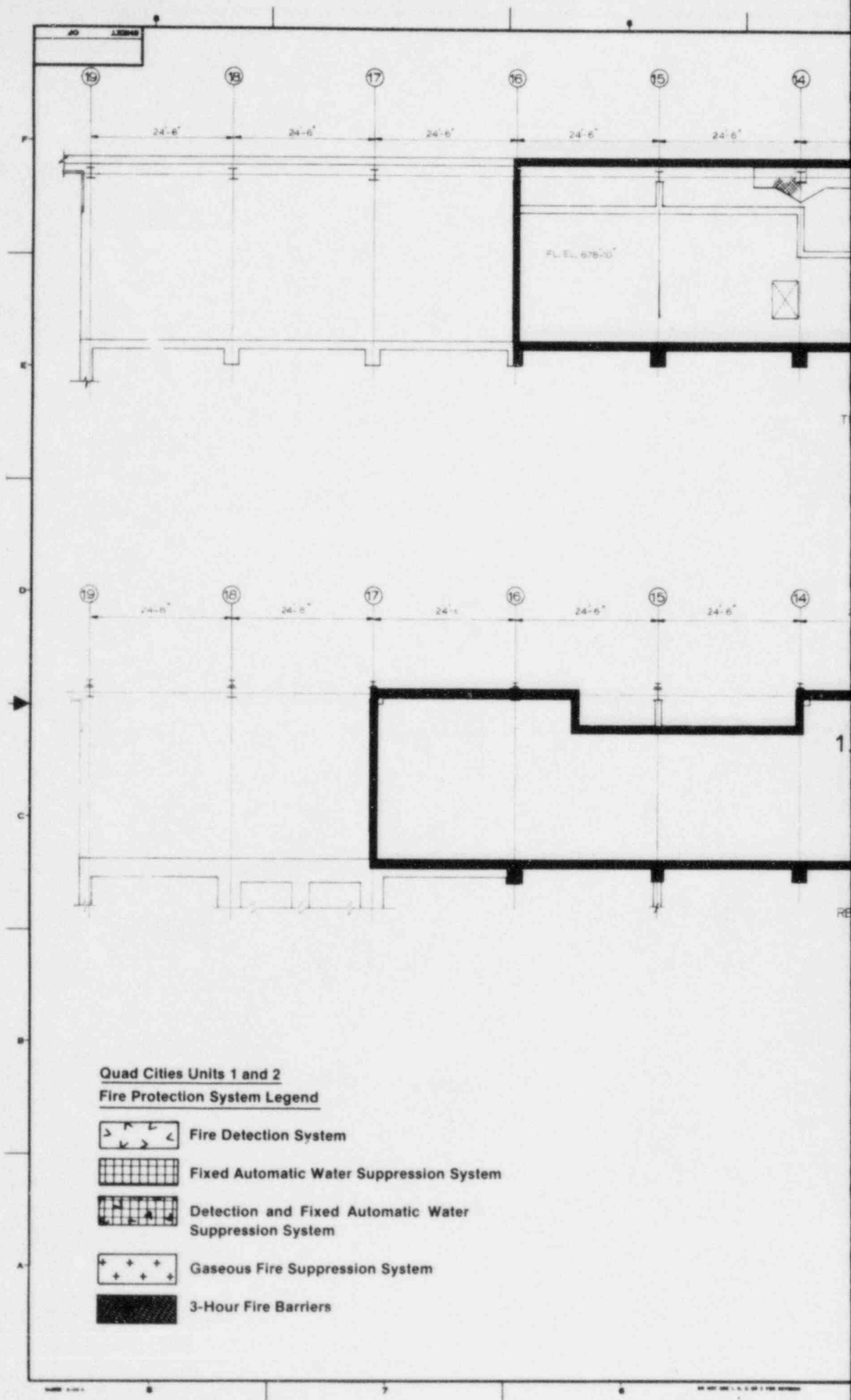
**Quad Cities Units 1 and 2
Fire Protection System Legend**

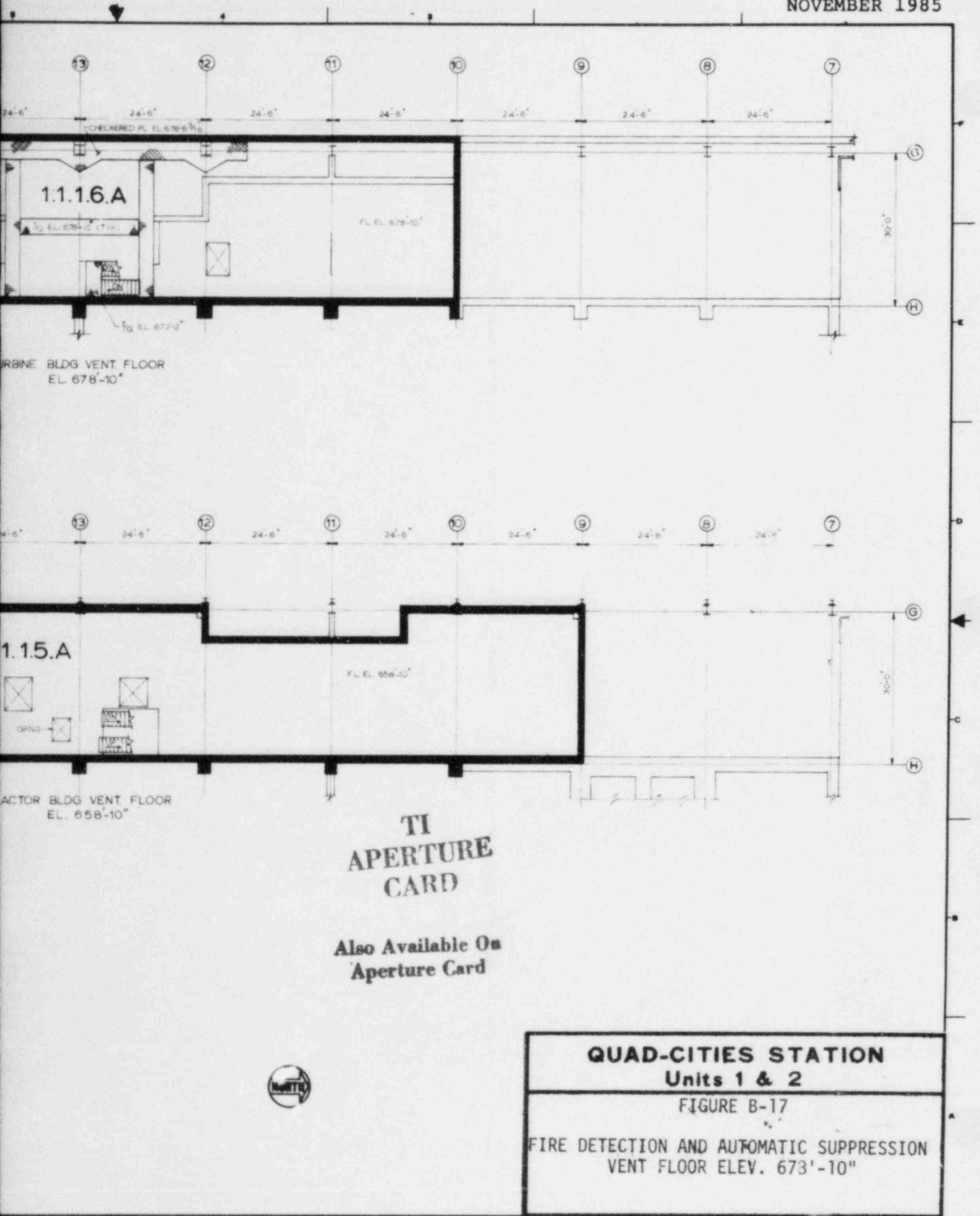
-  Fire Detection System
-  Fixed Automatic Water Suppression System
-  Detection and Fixed Automatic Water Suppression System
-  Gaseous Fire Suppression System
-  3-Hour Fire Barriers

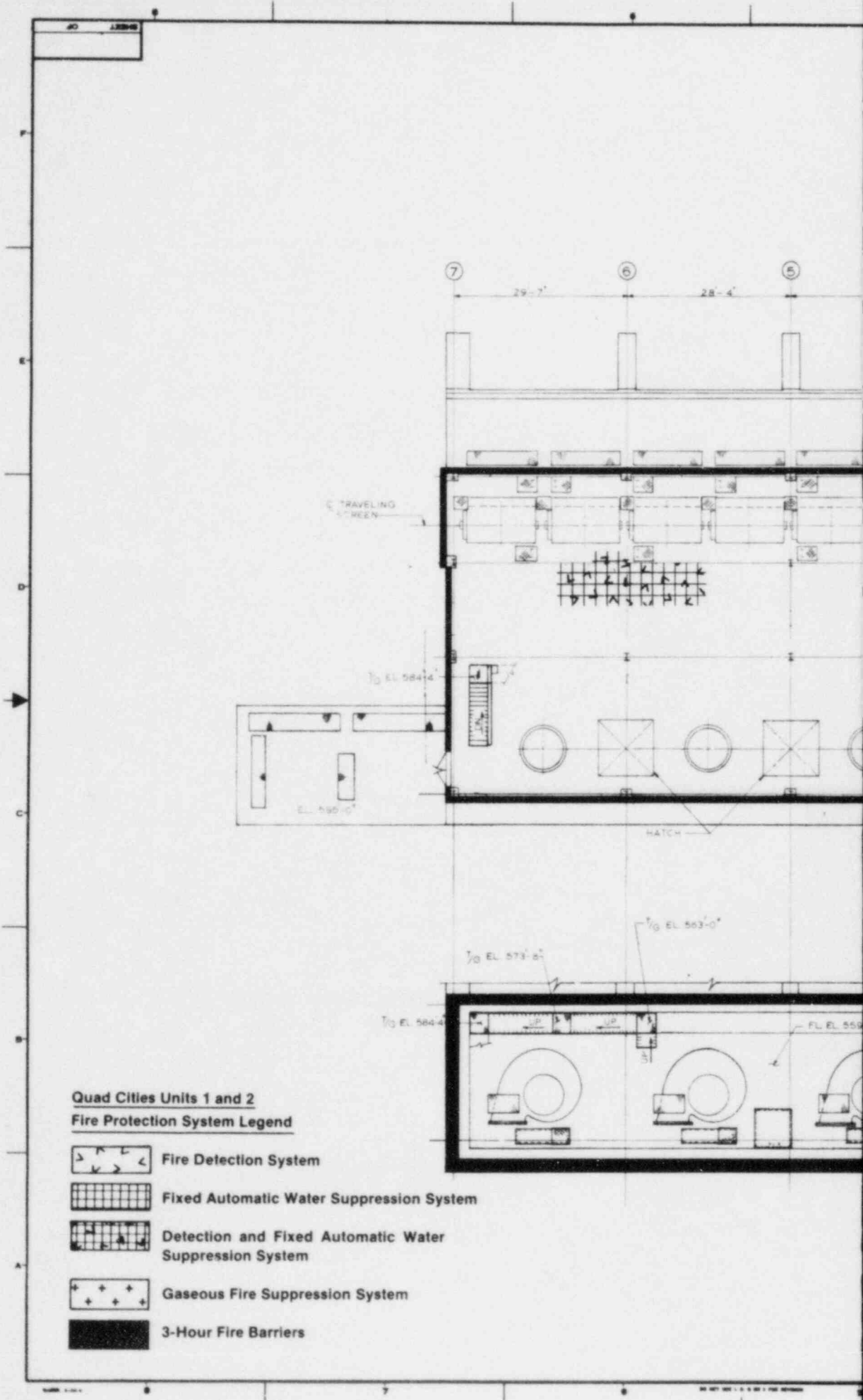
**QUAD-CITIES STATION
Units 1 & 2**

FIGURE B-16

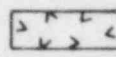


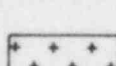

**FIRE DETECTION AND AUTOMATIC SUPPRESSION
TURBINE BUILDING MAIN FLOOR - UNIT 2**



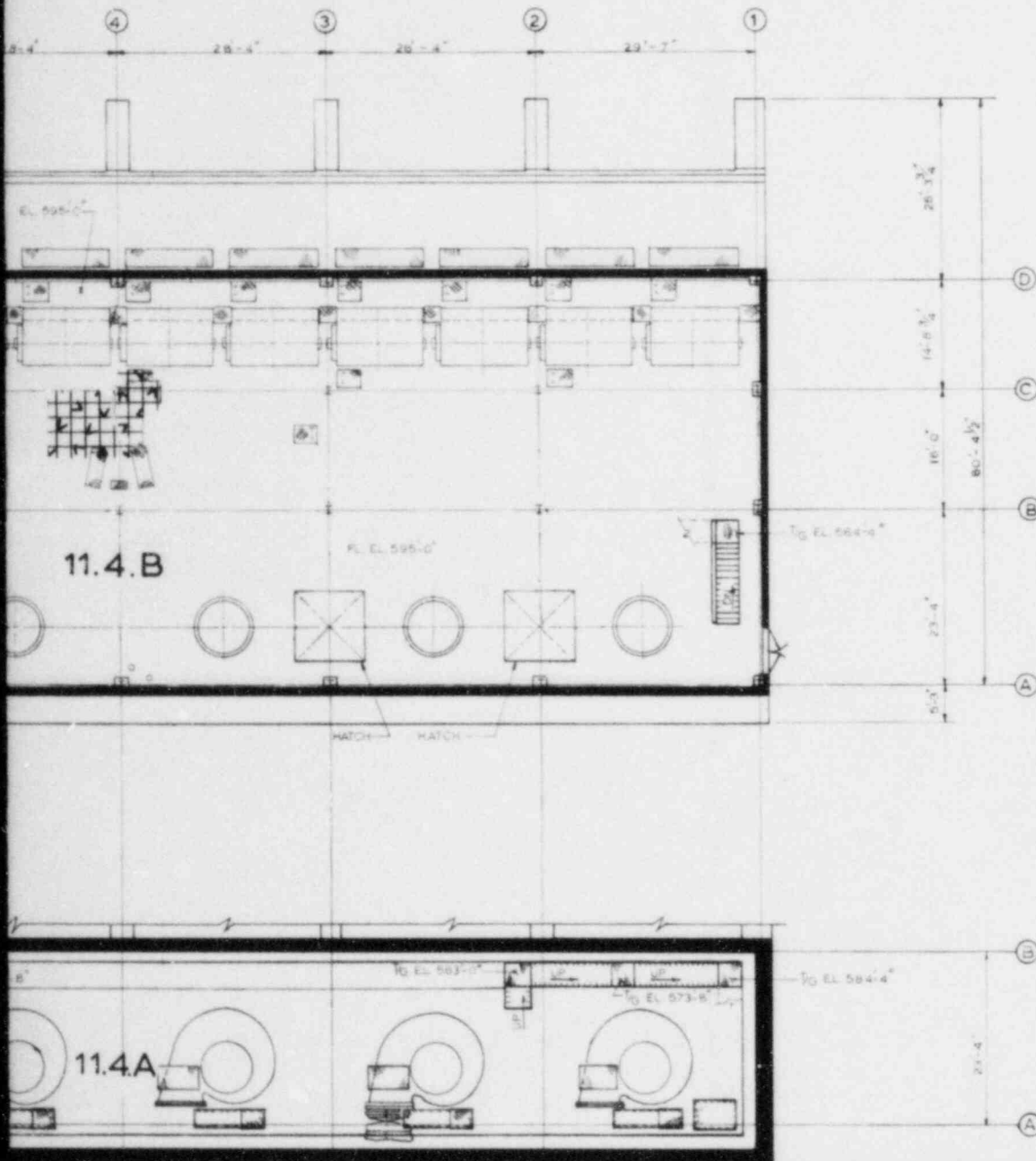




Quad Cities Units 1 and 2
Fire Protection System Legend

-  Fire Detection System
-  Fixed Automatic Water Suppression System
-  Detection and Fixed Automatic Water Suppression System
-  Gaseous Fire Suppression System
-  3-Hour Fire Barriers

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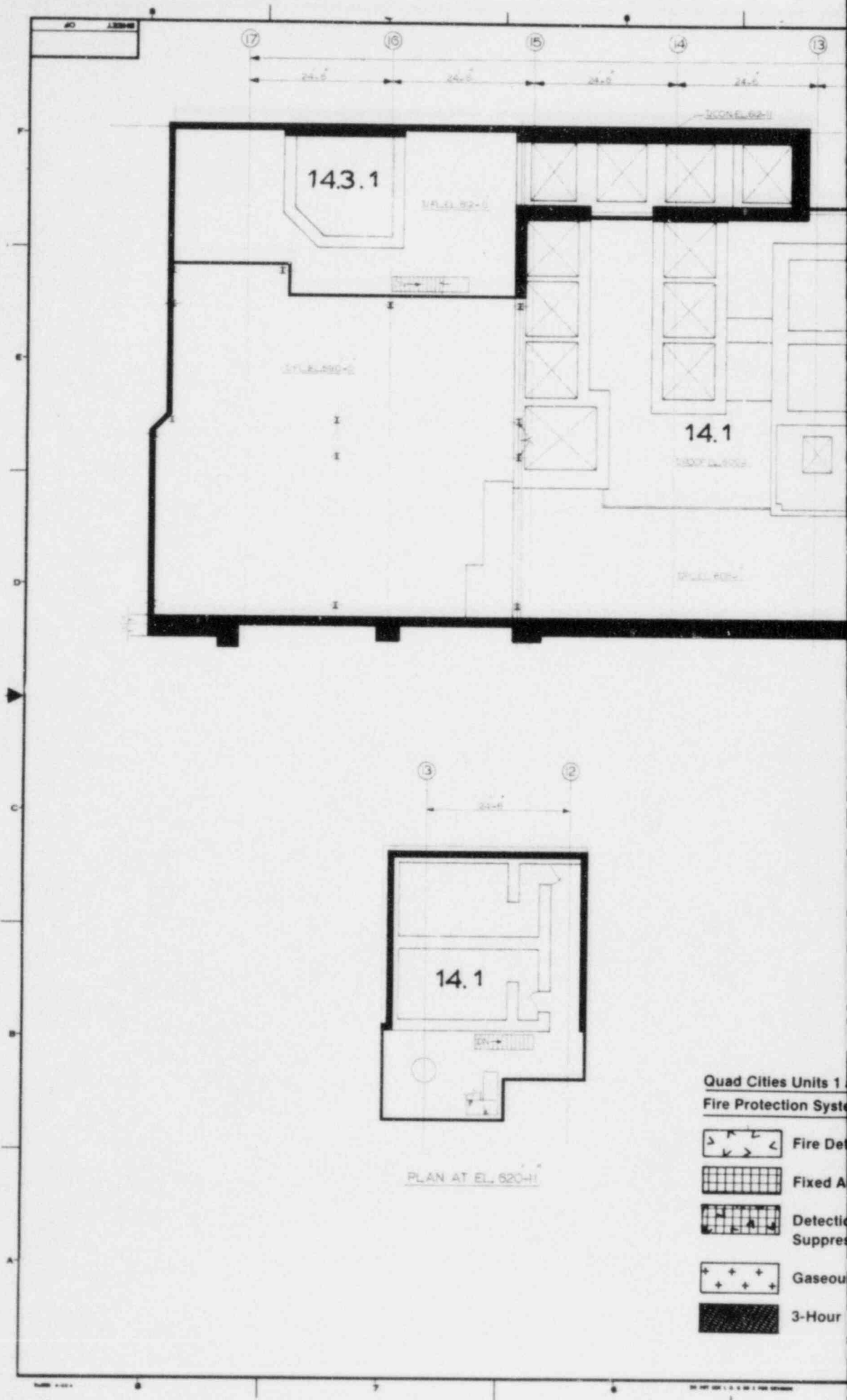
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QUAD-CITIES STATION
Units 1 & 2

FIGURE B-18

FIRE DETECTION AND AUTOMATIC SUPPRESSION
CRIB HOUSE

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Automatic Water Suppression System
n and Fixed Automatic Water
ision System
Fire Suppression System
Fire Barriers

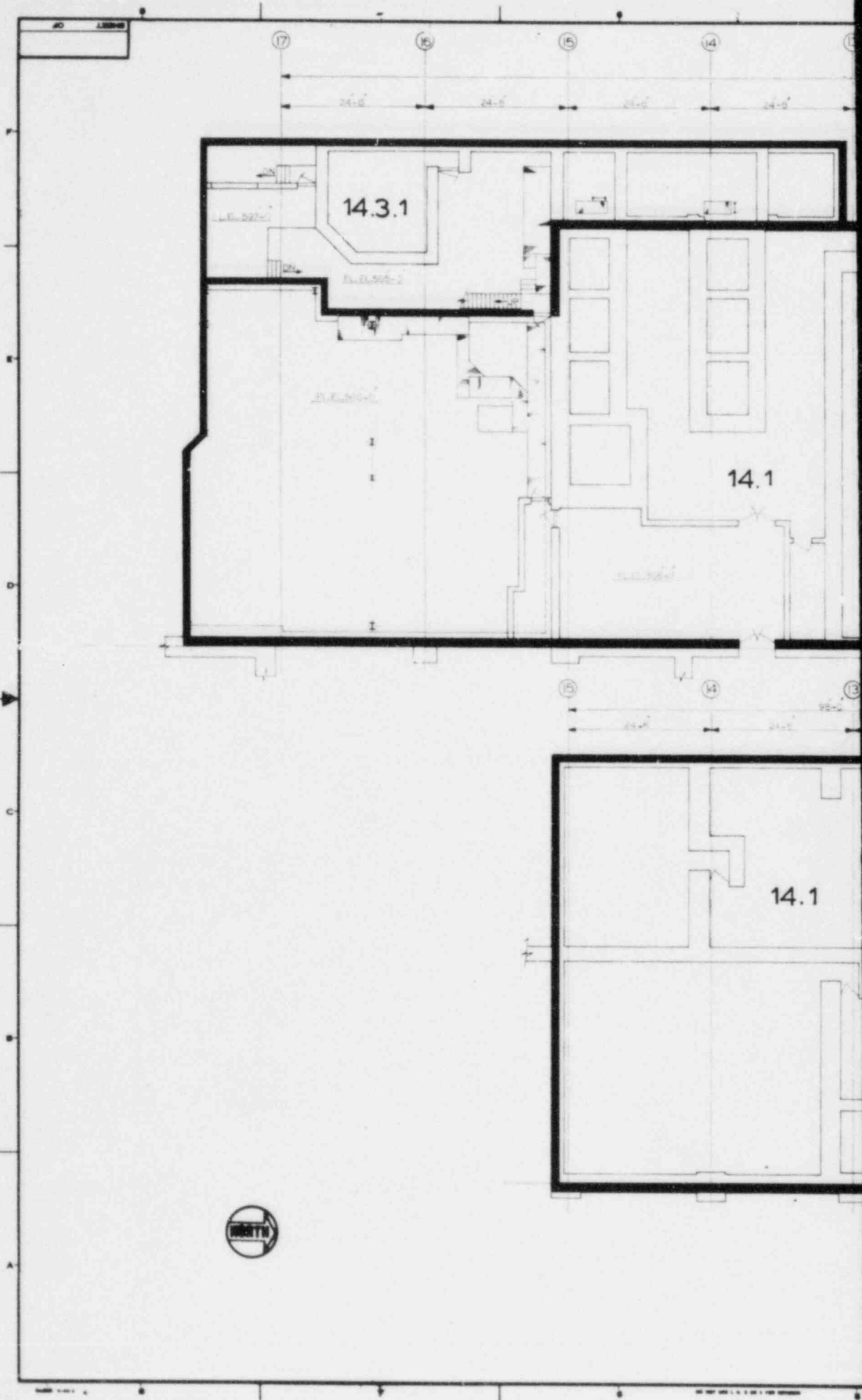


QUAD-CITIES STATION
Units 1 & 2

FIGURE B-19

FIRE DETECTION AND AUTOMATIC SUPPRESSION
RADWASTE BUILDING FLOOR ELEV. 608'-11"

8512100065-21

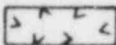


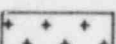



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Quad Cities Units 1 and 2
Fire Protection System Legend

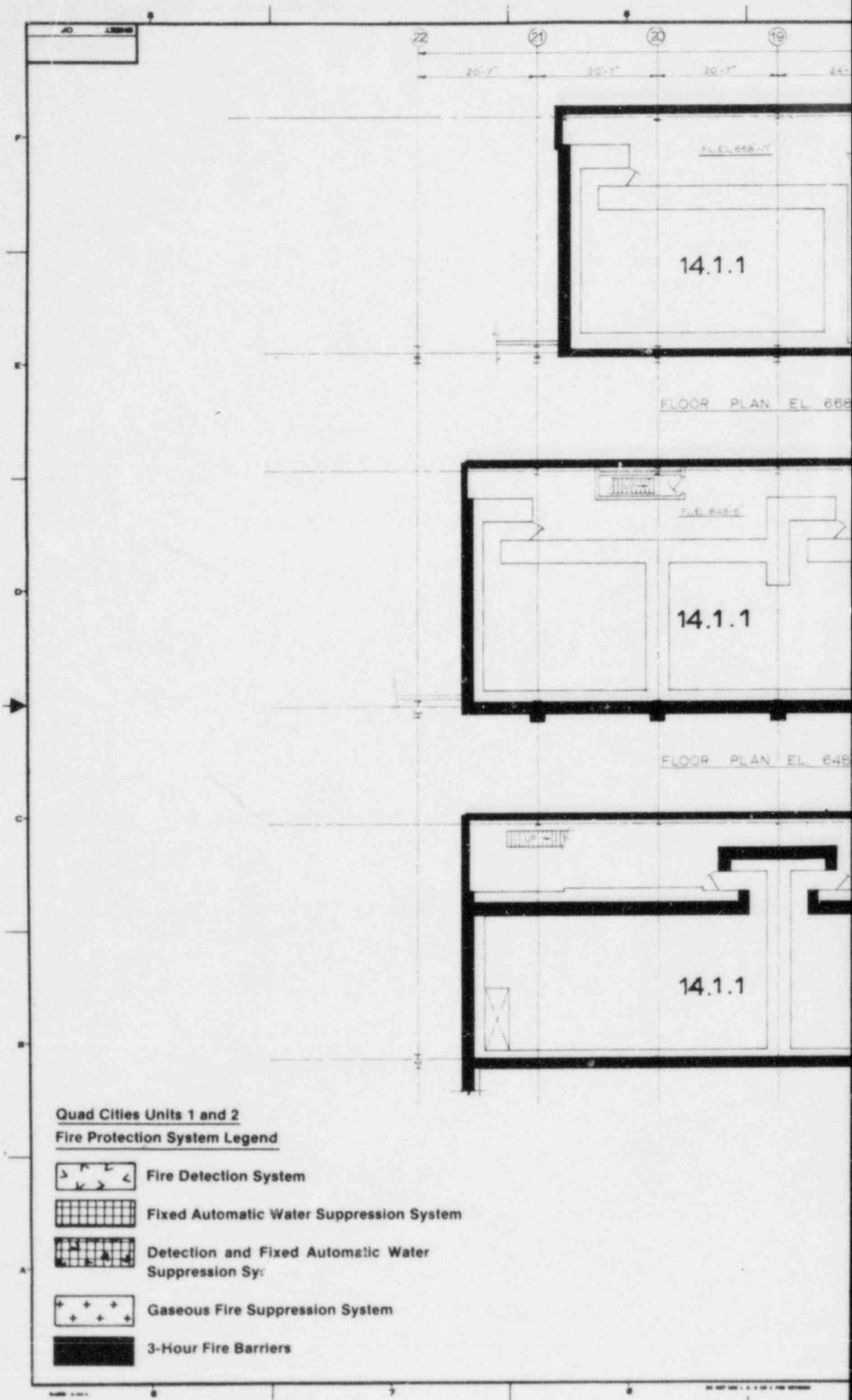
-  Fire Detection System
-  Fixed Automatic Water Suppression System
-  Detection and Fixed Automatic Water Suppression System
-  Gaseous Fire Suppression System
-  3-Hour Fire Barriers

QUAD-CITIES STATION
Units 1 & 2

FIGURE B-20

FIRE DETECTION AND AUTOMATIC SUPPRESSION
RADWASTE BUILDING FLOOR ELEV. 595'-0"
AND 572'-11"

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8.2.10

FLOOR PLAN EL. 626'-6"

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Units 1 & 2

FIGURE B-21

FIRE DETECTION AND AUTOMATIC SUPPRESSION
OFF-GAS RECOMBINER ROOM FLOOR - UNIT 1

8512100065-23

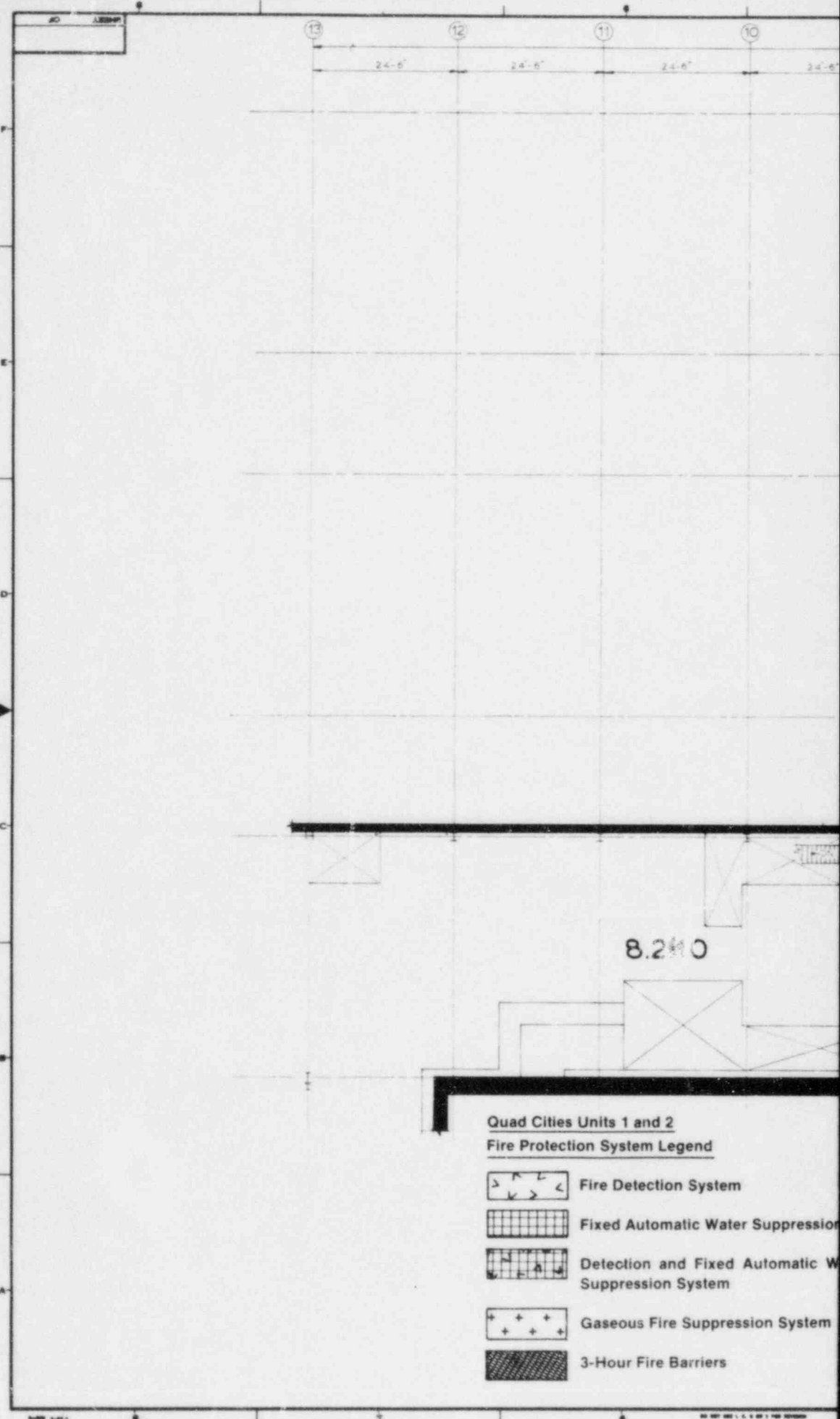


QUAD-CITIES STATION
Units 1 & 2

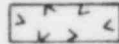

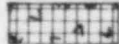
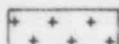

FIGURE B-21

FIRE DETECTION AND AUTOMATIC SUPPRESSION
OFF-GAS RECOMBINER ROOM FLOOR - UNIT 1

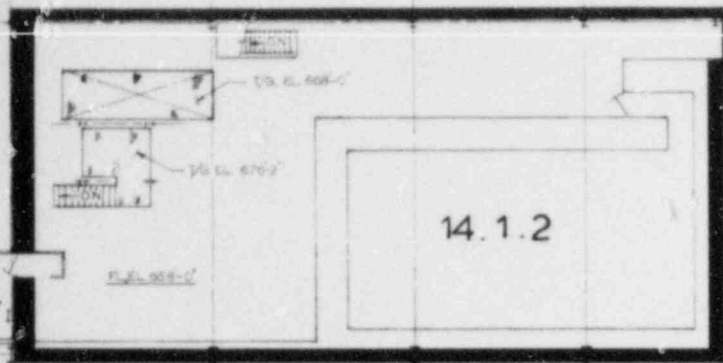
8512100065-23



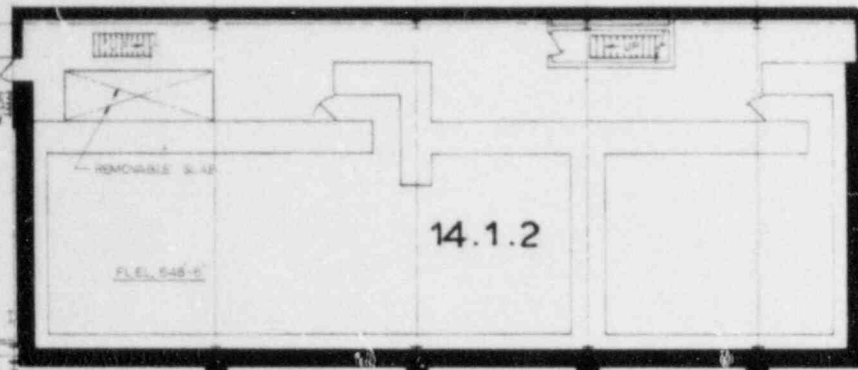
Quad Cities Units 1 and 2
Fire Protection System Legend

-  Fire Detection System
-  Fixed Automatic Water Suppression
-  Detection and Fixed Automatic Water Suppression System
-  Gaseous Fire Suppression System
-  3-Hour Fire Barriers

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FLOOR PLAN EL. 668-0



FLOOR PLAN EL. 648-0



FLOOR PLAN EL. 626-0

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**Also Available On
Aperture Card**

System
ater

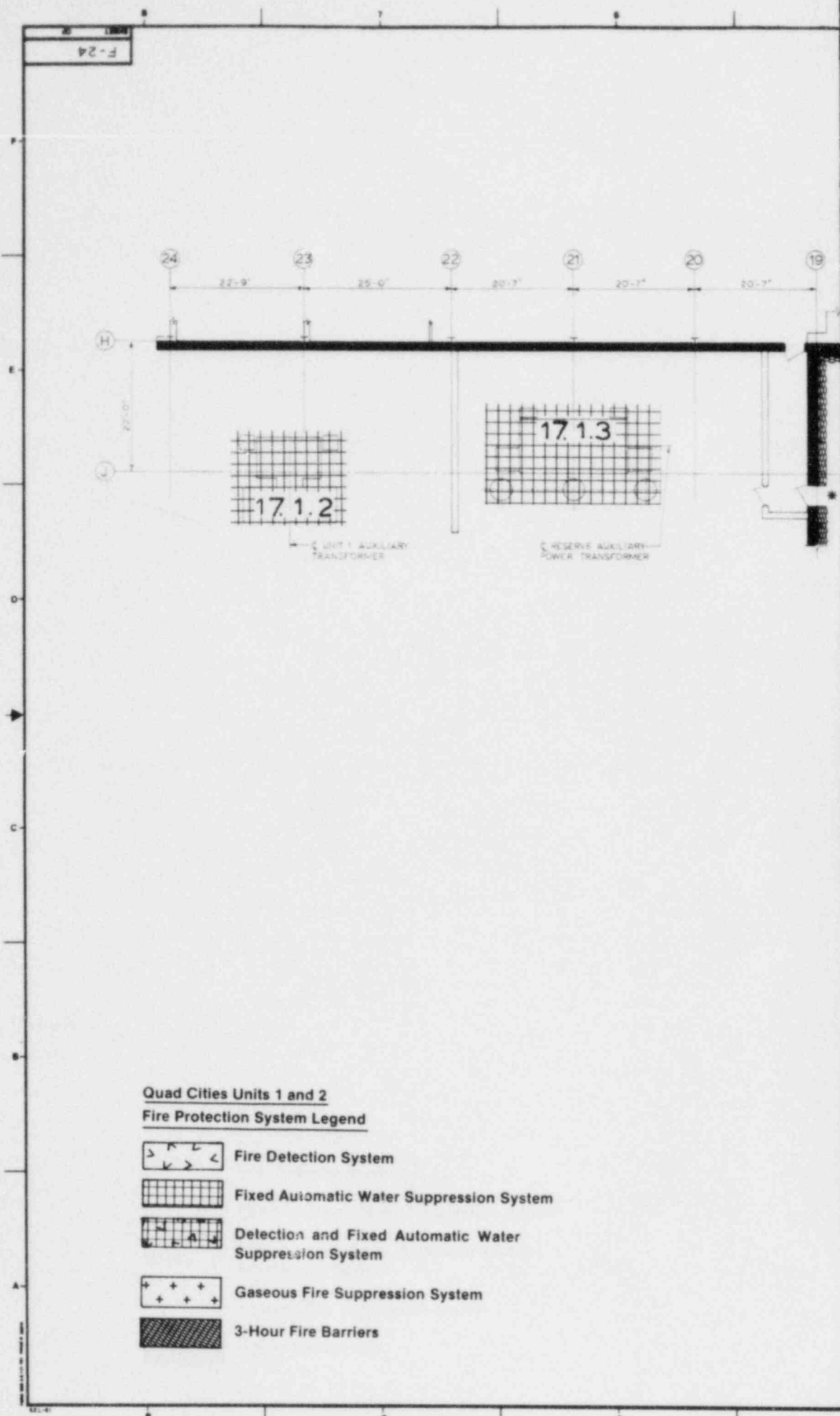


**QUAD-CITIES STATION
Units 1 & 2**

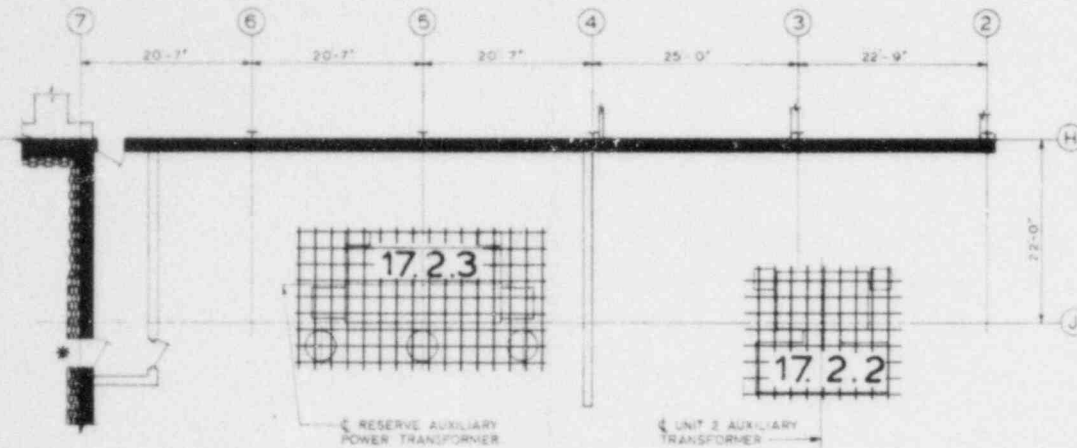
FIGURE B-22

FIRE DETECTION AND AUTOMATIC SUPPRESSION
OFF-GAS RECOMBINER ROOM FLOOR - UNIT 2

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**QUAD-CITIES STATION
Units 1 & 2**

FIGURE B-23

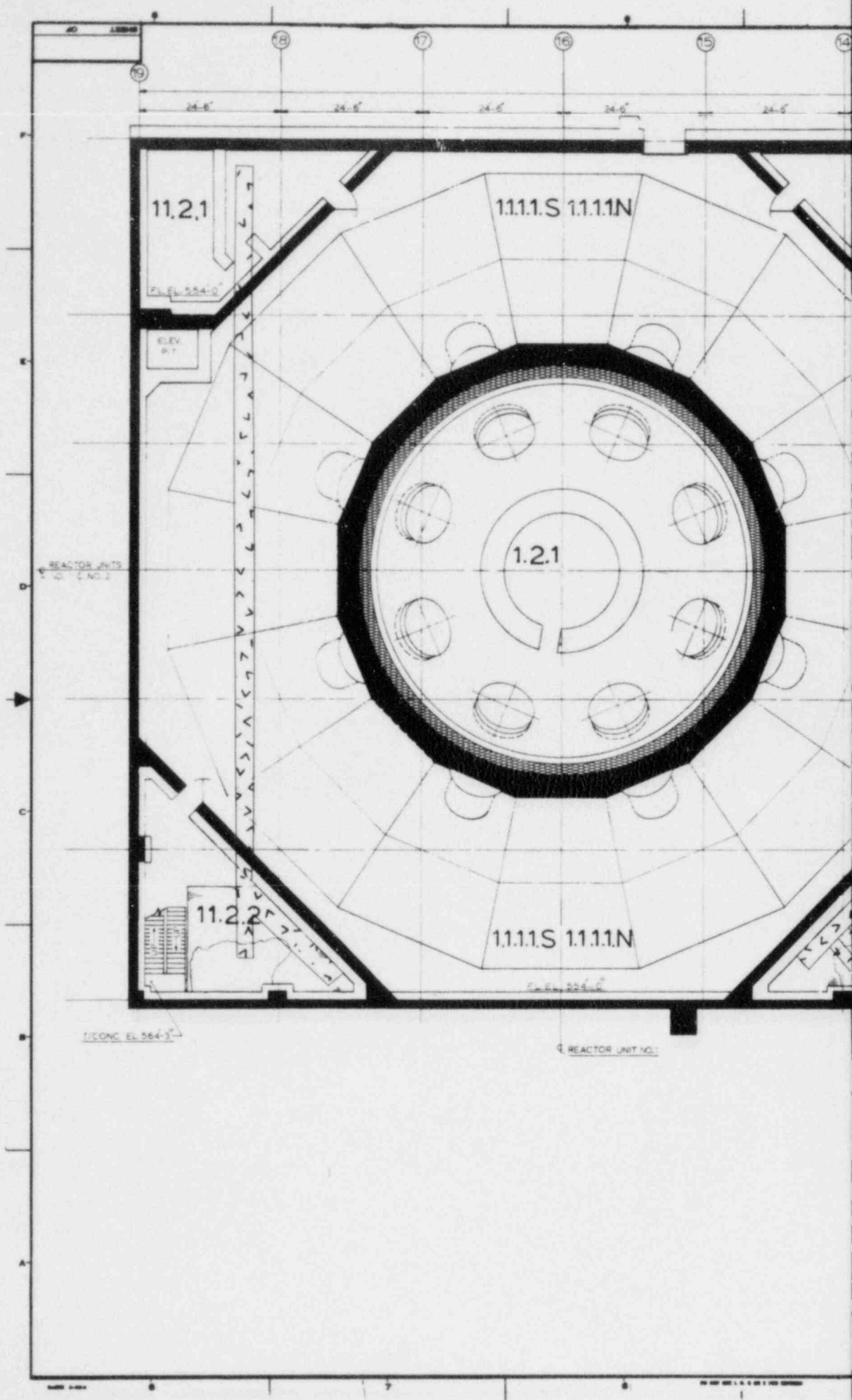
FIRE DETECTION AND AUTOMATIC SUPPRESSION
OUTDOOR PLAN - AUXILIARY TRANSFORMER
AREA ELEV. 595'-0"

8512100065-25

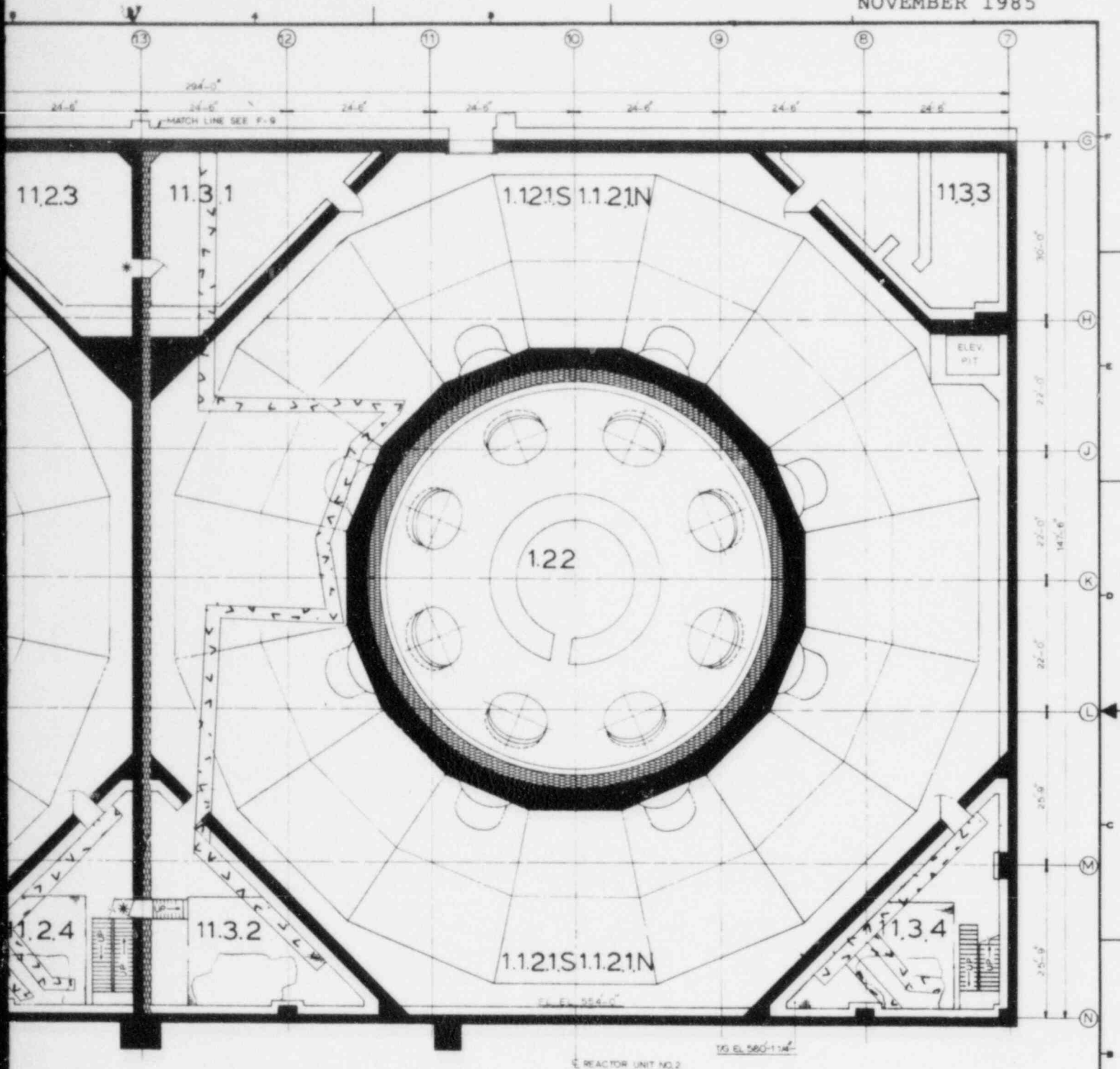
QUAD CITIES 1&2

APPENDIX C

REDUNDANT RHR CABLE ROUTING



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**QUAD-CITIES STATION
Units 1 & 2**

FIGURE C-1

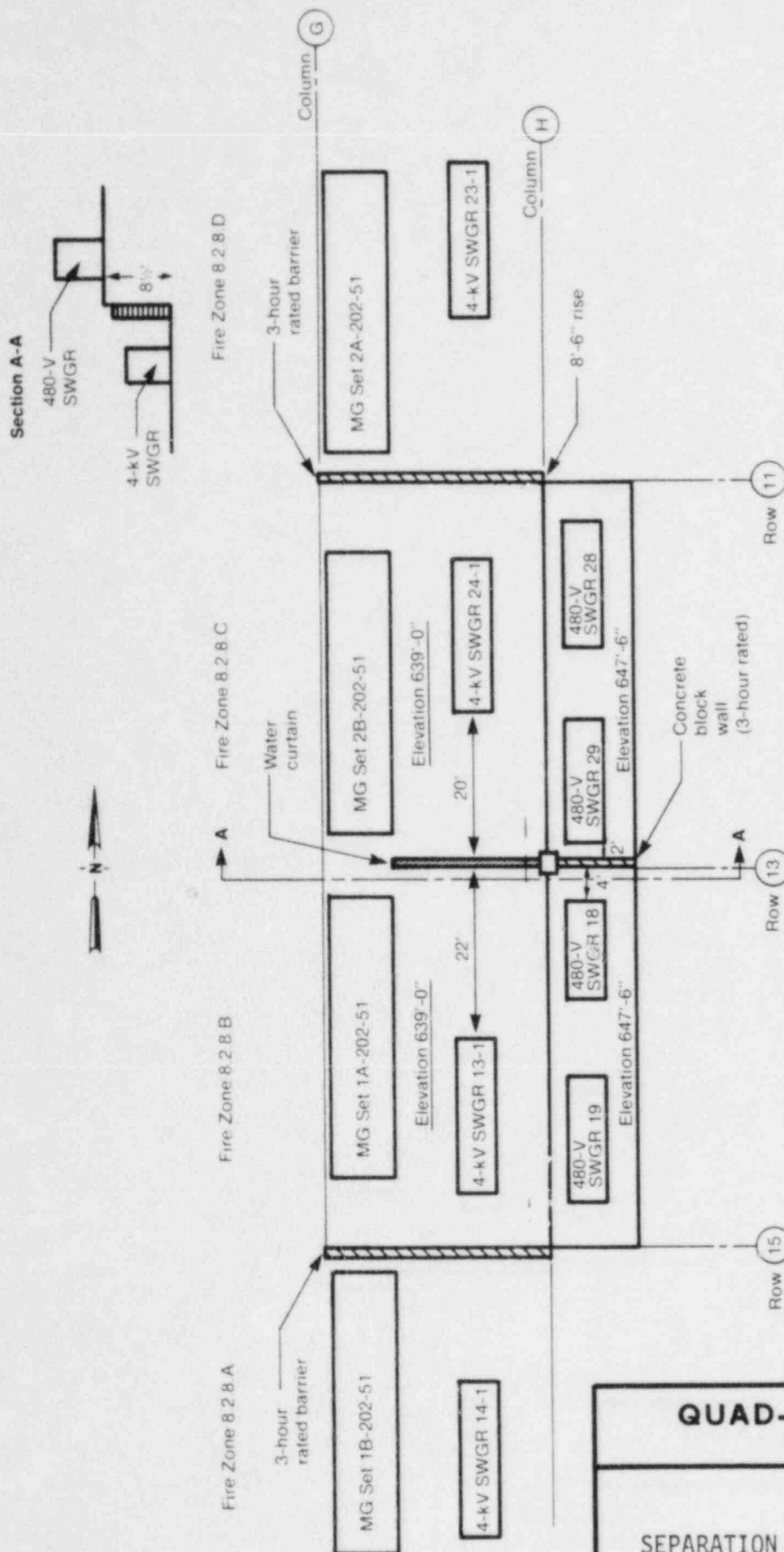
DIVISION I AND II RHR CABLE ROUTING

8512100065-26

QUAD CITIES 1&2

APPENDIX D

SKETCH OF 4-kV AND 480-V SWITCHGEAR AREAS



QUAD-CITIES STATION
Units 1 & 2

FIGURE D-1

SEPARATION OF REDUNDANT EQUIPMENT ON
THE TURBINE OPERATING FLOOR

ENCLOSURE B

SUMMARY OF CHANGES TO ENCLOSURE III OF DECEMBER 18, 1984 SUBMITTAL

SECTION

CHANGES

2.1

Remove Fire Zone 14.2.1 from Table 2.1-2 since this fire zone has been merged into Fire Zone 14.1.

The shutdown path for several of the fire zones was revised in Table 2.1-2.

Several new fire zones were added to Table 2.1-2.

2.3

Description of Shutdown Paths A, B, C, D, E1, E2, F, H, and K.

The equipment lists for each shutdown path have been added.

2.4

Table 2.4-1 has been revised.

3.1

Reference to the HPCI system has been removed.

3.2

Description of the fire detection system in the corner rooms on the torus level and on the mezzanine floor.

Description of the cable tray fire wrap on the torus level.

SECTIONCHANGES

- 3.3.1 Description of Fire Zone 1.1.1.2
- 3.3.2 Description of fire detection in Fire Zone 1.1.2.1.
- Addition of description of the automatic suppression systems adjacent to the steam pipe chase.
- 3.3.4 Description of barrier between the reactor building and the turbine building at the ground floor.
- Addition of description of the automatic suppression systems adjacent to the steam pipe chase.
- * Addition of discussion on the HVAC ducts in the wall between Fire Zone 1.1.1.5 and 1.1.1.5.A that lack fire dampers.
- 3.3.5 Revision of Item 2.
- * Revision of Item 5 which discusses HVAC ducts in the wall between Fire Zone 1.1.1.5 and 1.1.1.5.A that lack fire dampers.
- 3.4 Description of the barriers around Fire Zone 1.1.1.2.
- Description of the barriers around Fire Zone 1.1.1.3.
- Description of the fire detection system in Fire Zone 1.1.1.3.
- 4.1 Description of the barrier between the reactor building and turbine building on the ground floor.
- Reference to the HPCI system has been removed.

* Indicates an additional exemption request

SECTIONCHANGES

4.2

Description of fire detection system in the Fire Zones 11.3.3 and 1.1.2.3.

Description of the cable tray fire wrap on the torus level.

4.3.1

Description of Fire Zone 1.1.2.2.

4.3.2

Description of the fire detection system in Fire Zone 11.3.3.

Addition of description of the automatic suppression systems adjacent to the steam pipe chase.

4.3.4

Description of the barrier between the reactor building and the turbine building on the ground floor.

Addition of description of the automatic suppression systems adjacent to the steam pipe chase.

* Addition of discussion on HVAC ducts in the wall between Fire Zone 1.1.1.5 and 1.1.1.5.A that lack fire dampers.

4.3.5

Revision of Item 2.

* Addition of Item 5 which discusses HVAC ducts in the wall between Fire Zone 1.1.1.5 and 1.1.1.5.A that lack fire dampers.

4.4

Description of barriers around Fire Zone 1.1.2.3.

Description of fire detection system in Fire Zone 1.1.2.3.

* Indicates an additional exemption report

SECTION

CHANGES

5.1

Description of the fire areas in the turbine building.

5.2

Description of the boundary between the Northern and Central Zone Groups.

Description of the boundary between the Northern and Southern Zone Groups.

Description of the boundary between the Central and Southern Zone Groups.

Addition of a fifth technical justification for an exemption for the separation of the turbine building zone groups.

5.3

Addition of a description of the fire protection systems for Fire Zones 8.2.3.A, 8.2.3.B, 9.1, 11.1.1.B, and 14.1.1.

Description of fire protection system for Fire Zones 8.2.6.A, 8.2.6.B, 8.2.7.A, and 8.2.7.B.

Revision to the fire hazards analysis for Fire Zones 8.2.1.A, 8.2.6.A, 8.2.6.B, 8.2.7.B, 6.1.A, and 6.1.B.

SECTION

CHANGES

- Addition of a fire hazards analysis for Fire Zones 8.2.3.A, 8.2.3.B, 9.1, 11.1.1.B, and 14.1.1.
- 5.4 Addition of a description of the fire protection systems for Fire Zones 8.2.2.A, 8.2.2.B, 9.2, and 14.1.2.
- Description of the fire protection systems for Fire Zones 8.2.6.E, 8.2.6.D, and 8.2.7.D.
- Revision of the fire hazards analysis for Fire Zones 8.2.1.B, 8.2.6.E, 8.2.6.D, 8.2.7.E, 8.2.7.D, 6.2.A, 6.2.B, and 7.2.
- Addition of a fire hazards analysis for Fire Zones 8.2.2.A, 8.2.2.B, 9.2, and 14.1.2.
- 5.5 Addition of a fire hazards analysis for Fire Zones 5.0, 8.1, and 8.2.10.
- 5.6 Description of the operating floor into one fire zone and four equivalent fire areas.
- Justification for not installing suppression above the 4-KV and 480-V switchgears.
- Discussion for the safe shutdown equipment on the operating floor.

SECTION

CHANGES

5.7.1

Removal of Item 2.

5.7.3

Removal of the second item.

5.7.4

Removal of Subsection 5.7.4.2.

5.8.4

Description of the barrier between the equivalent
fire areas and Fire Zone 8.2.8.E.

5.9.1

Additional information explaining the necessity
of a 3-hour barrier around Fire Zone 11.1.1.B.

QUAD CITIES 1&2

NEW APPENDIX R
EXEMPTION REQUESTS

NOVEMBER 1985

QUAD CITIES 1&2

NEW APPENDIX R EXEMPTION REQUESTS

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6.3.1 Introduction	6.3-1
6.3.2 Fire Protection System	6.3-1
6.3.3 Safe Shutdown Equipment	6.3-1
6.3.4 Fire Hazards Analysis	6.3-1
6.3.5 Conclusions	6.3-2
7.0 APPENDIX R EXEMPTION REQUEST FOR 4-kV BUS DUCT PENETRATIONS AND STANDBY GAS TREATMENT SYSTEM AND REACTOR BUILDING VENT PIPING PENETRATIONS	7.0-1
7.1 JUSTIFICATION FOR APPENDIX R EXEMPTION REQUEST FOR 4-kV BUS DUCT PENETRATIONS	7.1-1
7.2 APPENDIX R EXEMPTION REQUEST FOR STANDBY GAS TREATMENT AND REACTOR BUILDING VENT SYSTEM PIPING PENETRATIONS	7.2-1

QUAD CITIES 1&2

LIST OF TABLES

<u>NUMBER</u>	<u>TITLE</u>	<u>PAGE</u>
7.1.1	4-kV Bus Duct Penetrations	7.1-2
7.2-1	Standby Gas Treatment and Reactor Building Vent System Penetrations	7.2-2

6.3 JUSTIFICATION FOR LACK OF COMPLETE SUPPRESSION IN THE CONTROL ROOM

6.3.1 Introduction

The control room is located in the service building at floor elevations 623 feet 0 inches (Fire Zone 2.0) and is part of Fire Area SB-I. Except for the boundary with the cable spread room (Fire Zone 3.0), all of the boundary walls are 3-hour fire rated.

Because alternate shutdown is utilized for the control room, Appendix R requires that fire detection and automatic suppression be present throughout the fire zone. As seen in Figure B-7, only a detection system is present throughout the control room. However, this system provides a level of protection which ensures that any fire will be quickly detected. The addition of an automatic suppression system would not significantly enhance the level of safety at Quad Cities.

6.3.2 Fire Protection System

The control room is provided with a complete early warning fire detection system throughout. In addition, this fire zone contains portable extinguishers and easily accessible hose stations just outside the entrances to this room.

6.3.3 Safe Shutdown Equipment

The safe shutdown paths identified for the control room are E2 for Unit 1 and K for Unit 2. These shutdown paths are used for a fire anywhere in Fire Area SB-I. Each of these paths utilize manual control of equipment and local monitoring of instrumentation outside of Fire Area SB-I. All equipment and cabling associated with safe shutdown paths E2 and K are independent of Fire Area SB-I.

6.3.4 Fire Hazards Analysis

The control room has a floor area of approximately 4161 ft² and a ceiling height of approximately 14 feet. The total fire loading in this fire zone from fixed combustibles is less than 25,000 Btu/ft². The combustibles in this zone include HVAC duct insulation and cable insulation associated with cables routed through this zone and electrical panels that are located in this zone.

The control room is continuously manned and is protected throughout with a complete early warning fire detection system that alarms locally. The control room is also separated from adjacent

fire areas by 3-hour fire-rated barriers. If a fire is detected, the fire brigade could respond instantly. A manual hose station is located just outside the control room, and several portable extinguishers are located in the room to ensure that any fire would be quickly extinguished.

Installation of a fixed water suppression system above the electrical panels could result in fault or failure of the panels if the system inadvertently actuated. Fixed fire suppression systems other than water, such as cardox, halon or foam would be inappropriate for the control room.

Due to the existence a complete fire detection system, administrative procedures that strictly control access to control room, the administrative controls concerning the admission of transient combustibles, and the fact that the control room is continuously manned, the addition of an automatic fire suppression system is not warranted.

6.3.5 Conclusions

Based on this analysis, an exemption is requested for the control room of the Quad Cities 1&2 service building from the requirements of Appendix R Section III.G.3 that fire detection and fixed suppression be provided throughout those areas for which an alternative shutdown method is utilized. The technical bases that justify the exemption request are summarized as follows:

1. The control room is separated from adjacent fire areas by complete 3-hour fire rated barriers.
2. Alternate shutdown paths E2 and K utilize manual control of equipment and local monitoring of instrumentation outside of Fire Area SB-I.
3. The control room is provided with complete early warning fire detection system.
4. The control room is continuously manned.
5. The installation of additional automatic suppression would not significantly enhance safety in the control room and inadvertent operation of a suppression system could result in fault or failure of electrical panels.

7.0 APPENDIX R EXEMPTION REQUEST FOR 4-kV BUS DUCT PENETRATIONS
AND STANDBY GAS TREATMENT SYSTEM AND REACTOR BUILDING
VENT PIPING PENETRATIONS

Per the provisions of 10 CFR 50.12, Commonwealth Edison Company (CECo) requests exemption from the requirement of Section III.G of Appendix R to 10 CFR 50 to the extent that separation of cables and equipment and associated non-safety-related circuits of redundant trains would require a 3-hour rated fire barrier. CECO specifically requests exemption from the requirement from Section III.G that the drywell, secondary containment, and turbine building be separated from each other and other fire areas by 3-hour rated barriers with respect to 4-kV bus ducts and standby gas treatment system piping.

The justifications for these exemptions are given in the following sections:

<u>SECTION</u>	<u>JUSTIFICATION FOR</u>
7.1	4-kV Bus Duct Penetrations
7.2	Standby Gas Treatment and Reactor Building Vent. System Piping Penetra- tions

A description of the fire areas and safe shutdown equipment involved has been presented earlier in this report.

7.1 JUSTIFICATION FOR APPENDIX R EXEMPTION REQUEST FOR 4-kV
BUS DUCT PENETRATIONS

Certain 4-kV bus ducts penetrate fire barriers in the Quad Cities Station. These buses run from the emergency diesel generators to associated switchgear. Table 7.1-1 lists the 4-kV bus duct penetrations in the plant, barriers through which the ducts penetrate, and the fire zones and areas associated with each penetration.

There have been no tests performed to ensure that the bus duct fire stops provide 3-hour fire resistance per ASTM E-119. There are, however, four basic reasons that these bus duct fire stops possess adequate fire resistance:

1. The bus duct collar is 1/4 inch thick steel at the wall attachment point and the bus duct itself is approximately 1/8 inch thick.
2. The bus duct is mechanically fastened to each side of the wall. If the bus duct were to fail on either side of the wall, no pathway for smoke or flame would result on the opposite side.
3. No combustibles are in contact with the bus duct near the fire barrier penetration.
4. There is no continuity of combustibles through the bus duct penetration.

It should also be noted that on each side of the barriers listed in Table 7.1-1 fire detection and/or automatic suppression is available.

Based on these reasons, installation of a 3-hour rated fire stop would not increase the level of protection, and exemption from the requirements of Section III.G of Appendix R is justified.

QUAD CITIES 1&2

TABLE 7.1-1

4-kV BUS DUCT PENETRATIONS

<u>BUS DUCT PENETRATIONS</u>	<u>BARRIER</u>	<u>FIRE ZONES</u>	<u>FIRE AREAS</u>
SWGR 13-1 feed from DG 1/2	Unit 1 Reactor Building West Wall	1.1.1.3/8.2.7.C	RB-1/TB-II
	Turbine Operating Floor	8.2.7.C/8.2.8.B	TB-II/TB-IV
SWGR 23-1 feed from DG 1/2	Unit 2 Reactor Building East Wall	1.1.2.3/8.2.7.D	RB-2/TB-I
	Turbine Operating Floor	8.2.7.D/8.2.8.D	TB-I/TB-IV
SWGR 14-1 feed from DG 1	Turbine Operating Floor	8.2.7.B/8.2.8.A	TB-III/TB-IV
SWGR 24-1 feed from DG 2	Turbine Operating Floor	8.2.7.C/8.2.8.C	TB-II/TB-IV

7.2 APPENDIX R EXEMPTION REQUEST FOR STANDBY GAS TREATMENT
AND REACTOR BUILDING VENT SYSTEM PIPING PENETRATIONS

The standby gas treatment and reactor building vent systems consist of piping which runs from the Unit 1 and 2 reactor buildings and drywells through the turbine building and out through the stack. Table 7.2-1 lists the penetrations associated with the system, size of the penetration, and the fire zones and areas associated with each penetration.

These penetrations possess an adequate resistance to fire for the following reasons:

1. There are no combustibles inside the piping and no continuity of combustibles through the penetrations.
2. Each fire zone with the exception of the inerted drywell and Fire Zones 1.1.1.4 and 1.1.2.4 has fire suppression or detection available. As mentioned in Chapters 3 and 4, Fire Zones 1.1.1.4 and 1.1.2.4 and all fire zones in the reactor building above them do not contain any safe shutdown equipment or cables.
3. Manual hose stations are available in all of the fire zones with the exception of the inerted drywell.
4. The piping is constructed of steel that is at least 1/8 inch thick.

For these reasons, installation of rated fire dampers in the SBT and reactor building vent systems at fire area boundaries would not increase the level of protection. Also, if installed SBT dampers were to fail closed, a degradation of the system would occur which increases the likelihood of a radioactive release following an accident. Therefore, an exemption request from the requirements of Appendix R Section III.G is justified.

QUAD CITIES 1&2

TABLE 7.2-1

STANDBY GAS TREATMENT AND REACTOR BUILDING
VENT SYSTEM PENETRATIONS

<u>PENETRATION</u>	<u>SIZE (in.)</u>	<u>FIRE ZONES</u>	<u>FIRE AREAS</u>
Unit 1 and 2 SBGTS Suction Crosstie	24	1.1.1.5/1.1.2.5	RB-1/RB-2
Unit 2 SBGTS Fan Discharge Line	24	1.1.1.5/1.1.2.5	RB-1/RB-2
Unit 1 and 2 SBGTS Fan Suction Crosstie	8	1.1.1.5/1.1.2.5	RB-1/RB-2
Unit 1 SBGTS Turbine Building Suction	6	1.1.1.3/8.2.7.C	RB-1/TB-II
Unit 2 SBGTS Turbine Building Suction	6	1.1.2.3/8.2.7.C	RB-2/TB-II
Unit 1 and 2 SBGTS Discharge Line	24	1.1.1.3/8.2.8.B	RB-1/TB-IV
Unit 1 SBT and Reactor Building Vent System Drywell Suction	18	1.1.1.4/1.2.1	RB-1/Unit 1 Primary Containment
Unit 2 SBT and Reactor Building Vent System Drywell Suction	18	1.1.2.4/1.2.2	RB-2/Unit 2 Primary Containment
Unit 1 Reactor Building Vent Exhaust Fan Suction	18	1.1.1.4/8.2.8.A	RB-1/TB-IV
Unit 2 Reactor Building Vent Exhaust Fan Suction	18	1.1.2.4/8.2.8.C	RB-2/TB-IV