REGULATORY INFORMATION DISTRIBUTION SYSTEM (RIDS)

ACCESSION NBR:8409270176 DOC.DATE: 84/09/25 NOTARIZED: NO DOCKET #
FACIL:50-361 San Onofre Nuclear Station, Unit 2, Southern Californ 05000361
50-362 San Onofre Nuclear Station, Unit 3, Southern Californ 05000362
AUTH.NAME AUTHOR AFFILIATION
MEDFORD,M.O. Southern California Edison Co.
RECIP.NAME RECIPIENT AFFILIATION
KNIGHTON,G.W. Licensing Branch 3

SUBJECT: Responds to listed info requests re 10CFR50,App R fire protection issues,including safe shutdown instrumentation & control circuit separation & fire barrier wrap for cable protection.

DISTRIBUTION CODE: A006D COPIES RECEIVED:LTR 1 ENCL 1 SIZE: 48
TITLE: OR Submittal: Fire Protection

NOTES:J Hanchett 1cy PDR Documents. ELD Chandler 1cy. 05000361
OL:02/16/82
J Hanchett 1cy PDR Documents. ELD Chandler 1cy. 05000362
OL:11/15/82

	RECIPIENT ID CODE/NAME		COPIES LTTR	COPIES ENCL	RECIPIENT ID CODE/NAME		COPIES LTTR	COPIES ENCL
	NRR LB3 BC	01	3	3				
INTERNAL:	ADM/LFMB		1	0	ELD/HDS2		1	0
	IE FILE	06	1	1	IE/WHITNEY,L		1	1
	NRR FIORAVANT	07	2	2	NRR WAMBACH		1	0
	NRR/DE/CEB	09	2	2	NRR/DL DIR		1	1
	REG FILE	04	1	1	RGN5		1	1
EXTERNAL:	ACRS	11	3	3	LPDR	03	1	1
	NRC PDR	02	1	1	NSIC	05	1	1
	NTIS		1	1				
NOTES:			2	2				

TOTAL NUMBER OF COPIES REQUIRED: LTTR 24 ENCL 21

Southern California Edison Company

P. O. BOX 800
2244 WALNUT GROVE AVENUE
ROSEMEAD, CALIFORNIA 91770

M.O. MEDFORD
MANAGER, NUCLEAR LICENSING

TELEPHONE
(213) 572-1749

September 25, 1984

Director, Office of Nuclear Reactor Regulation
Attention: Mr. George W. Knighton, Branch Chief
Licensing Branch No. 3
U. S. Nuclear Regulatory Commission
Washington, D.C. 20555

Gentlemen:

Subject: Docket Nos. 50-361 and 50-362
San Onofre Nuclear Generating Station
Units 2 and 3

On March 19, 1984, Southern California Edison Company (SCE) transmitted the Updated Fire Hazards Analysis (FHA) for San Onofre Nuclear Generating Station, Units 2 and 3 (SONGS 2 and 3) to the Nuclear Regulatory Commission (NRC) in accordance with 10 CFR 50.71(e). As a result of the intensive program conducted by SCE in preparation of the Updated FHA, a number of changes to the SONGS 2 and 3 Operating License Conditions and Technical Specifications were identified. Concurrent with transmittal of the Updated FHA, SCE submitted proposed changes to the SONGS 2 and 3 Operating Licenses and Technical Specifications. In addition, eight (8) fire protection deviations from the requirements of 10 CFR 50, Appendix R were identified. These eight deviations pertain to the following fire protection issues:

1. Safe shutdown instrumentation and control circuit separation.
2. Associated circuits.
3. Fire barrier wrap for cable protection.
4. Safe shutdown cable and equipment separation inside containment.
5. Loss of offsite power coincident with a design basis fire.
6. Alternate shutdown panel instrumentation requirements.
7. Emergency lighting required for cold shutdown.
8. Unsealed penetrations in heavy concrete walls.

The eight deviations and proposed changes to the Operating Licenses and Technical Specifications were the subjects of a meeting SCE held with the NRC on May 23, 1984 in Bethesda, Maryland. Subsequent to discussion of the deviations, the NRC requested additional information on some of the above items in order to complete their review. This letter is provided in response to the above identified information requests. Enclosures 1 through 5 address items 2, 3, 4, 5 and 8, respectively, as requested. Additional information regarding items 1, 6 and 7 is not provided as the NRC considered the previous information submitted by SCE with the deviation requests sufficient for the Staff to conduct its review.

A006
1/1

It is our understanding that the NRC expects to complete the review of SCE submittals in relation to the Updated FHA by October 1984. If additional information or clarification is required to facilitate your review, SCE is available to provide the necessary support.

If you have any questions or comments, please let me know.

Very truly yours,

M O Medford

Enclosures

cc: Mr. H. Rood, Project Manager (w/encl)
Licensing Branch 3

J. B. Martin (w/encl)
Region V Administrator

A. E. Chaffee (w/encl)
Senior NRC Site Inspector

Associated Circuits

I. Introduction

The NRC clarification to Generic Letter 81-12 provided a functional definition of associated circuits of concern. Associated circuits are circuits which have physical separation less than that required by 10 CFR 50, Appendix R. Part III.G.2 and have one of the following:

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

b) a connection to circuits of equipment whose spurious operation would adversely affect the shutdown capability (e.g., RHR/RCS isolation valves, ADS valves, PORVs, steam generator atmospheric dump valves, instrumentation, steam bypass, etc.), or

c) a common enclosure (e.g., raceway, panel, junction) with the shutdown cables (redundant and alternative) and,

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

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

The following paragraphs discuss the San Onofre fire protection system, plant arrangement and specific design features as they relate to the NRC definition of associated circuits. This documentation supplements the basis for acceptability previously provided for approval of this deviation.

II. Treatment of Associated Circuits

A. General

The San Onofre fire protection program is a defense-in-depth program designed to the requirements of Branch Technical Position APCSB 9.5-1, Appendix A (1977), Plants Under Construction. The general plant arrangement is described in the Updated Final Safety Analysis Report (FSAR) and Updated Fire Hazards Analysis (FHA). Fire protection features provided include early warning fire detection, automatic suppression, fire barriers and manual fire suppression capability. A full time, paid fire brigade is available at all times to respond to any potential fire emergency. Additionally, alternate shutdown capability consisting of second points of (equipment) control and instrumentation independent of the control

room is provided. These fire protection features serve to rapidly identify, localize and extinguish any fire. Based upon the plant arrangement and features provided, the ability to acheive and maintain safe shutdown conditions is not adversly affected by any design basis fire.

The design criteria for San Onofre Units 2 and 3 is presented in the Updated FSAR. This design criteria includes guidance provided in Regulatory Guide 1.75 and IEEE Standard 384-1975. The San Onofre Units 2 and 3 design meets these criteria as discussed in the Updated FSAR. This separation between different divisions of Class 1E electrical equipment and circuits is maintained throughout the plant. Electrical design criteria governing cable and breaker sizing are utilized to provide adequate electrical circuit protection.

The San Onofre Units 2 and 3 fire hazards analysis demonstrates that the capability to achieve and maintain safe plant shutdown will not be impaired by any design basis fire. In addition to the FHA, a safe shutdown systems interaction review was performed. This review was performed for the minimum set of required safe shutdown systems and equipment consistent with the Updated FHA. This interaction review confirmed that fire-induced interactions would not result in loss of safe shutdown functions. The review also demonstrated the adequacy and separation of the alternate shutdown capability.

B. Common Power Supply

Included in the definition of associated circuits are those circuits sharing a common power source with shutdown equipment and which are not electrically protected. In the San Onofre design, safe shutdown can be achieved and maintained utilizing only Class 1E equipment meeting the requirements of IEEE Standard 308 as discussed in the Updated FSAR. Implementation of Regulatory Guide 1.75, Physical Independence of Electric Systems is discussed in the Updated FSAR.(1) Additionally, alternate shutdown capability consisting of second points of (equipment) control and instrumentation independent of the control room is provided. Since this design provides the capability to achieve and maintain safe shutdown in the event of any fire, instrumentation and control circuits need not be considered as (common power source) associated circuits.

The onsite power distribution systems are described in the Updated FSAR, Section 8.3. The systems include non-Class 1E and Class 1E systems. The Class 1E system is divided into two load groups per unit. Each load group includes one 4.16 kV bus, one 480 V load center, four 480 V motor control centers (MCCs) and low voltage AC supplies. No provisions exist for connecting one Class 1E load group to the redundant Class 1E load group or for automatically transferring loads between load groups.

Electrical distribution system design criteria and curcuit protection are discussed in the Updated FSAR.(2) Overcurrent protection is provided at the 4.16 kV bus for ground fault protection. The 480 V load centers are provided with inverse time overcurrent protection and those breakers which supply motors are equipped with long-time short circuit protection. Feeder breakers to MCCs are equipped with overcurrent protection. The MCC's are provided with overcurrent loads. Circuit breaker coordination is accomplished by ensuring that the proper breaker sizes and settings are provided for each voltage level within the load group.(3,4) These features serve to automatically isolate faulted circuits with a minimum of disturbance to the remainder of the distribution system. Thus, the combination of electrical design criteria, circuit protection and plant design features precludes the potential for common power source (associated) circuits to affect safe shutdown circuits.

C. Spurious Actuation

The mechanism responsible for spurious actuation of components and equipment is considered to be hot shorts or shorts to ground. Short circuits are considered to be one potential electrical circuit failure mode resulting from a fire. Spurious actuation of components or equipment is considered unlikely based upon plant design criteria. Additionally, the effects resulting from any postulated spurious actuation are not anticipated to adversely affect safe shutdown capability.

In addition to the spatial variation in location of safe shutdown equipment described in the Updated FHA, overcurrent and short circuit protection are provided for all circuits as discussed in Part B above. Additional design features which minimize the potential for spurious actuation are discussed in Subsection II.E below. These additional design features involve routing of plant power and control cables. Power and control cable routing meets the guidelines of Regulatory Guide 1.75 as described in the Updated FSAR. Additionally, power cables are segregated by voltage level; i.e., 6.9 kV, 4.16 kV and 480 V power cables are routed separately.(5) Control cables, when routed with power circuits, are routed only with low voltage power cables. Cables used for power and control cables meet the IEEE 383-1974 flame test requirements. Tray fill is generally limited to 30% for trays

containing power cables. These features minimize the potential for propagation of short circuits and fire damage which could result in spurious actuation.

Alternate shutdown capability includes fire isolation switches and an established second point of (equipment) control. In the event that fire damage in any fire zone causes loss of control room control circuits, the alternate shutdown capability remains available. Fire isolation switches electrically isolate the second point of control from the corresponding control room function. This precludes fault propagation such that potential short circuit conditions would not result in loss of safe shutdown equipment control. Additionally, circuit fusing is provided. Safe shutdown conditions can be achieved utilizing the equipment second point of control located in the load group switchgear room of the respective safe shutdown train.

Components which could be spuriously actuated fall into two categories: critical and noncritical components. Critical components are those components whose spurious actuation could result in adverse affects to the safe shutdown capability. Noncritical components are those components whose spurious actuation could otherwise affect the shutdown process.

Examples of critical components whose spurious actuation could result in adverse affects are the high-low pressure interfaces between the reactor coolant system (RCS) and residual heat removal system (RHR) as promulgated in NRC Generic Letter 81-12. Opening of these boundary valves at normal operating RCS pressure could potentially result in piping failure and loss of coolant. This event is not credible since the SONGS 2 and 3 RCS/RHR boundary valves are locked closed during normal operation. Thus, spurious actuation of these components resulting in a fire-initiated loss of coolant accident cannot occur.

Examples of noncritical components whose spurious actuation could otherwise affect the process of achieving or maintaining safe shutdown include steam generator atmospheric dump valves (ADV's), steam turbine stop valves and letdown system isolation valves. Spurious actuation of these noncritical components could result in increasing the reactor coolant system cooldown rate or complicating RCS inventory control. Spurious actuation of noncritical components is enveloped by the FSAR Chapter 15 safety analyses. Operator action at the second point of control (or at the component itself) is credited with mitigating the effects of noncritical component spurious actuation and restoration of plant conditions.

D. Spurious Indication

Short circuit conditions in instrumentation loop circuits could result in spurious control room instrument indications. Spurious indication would not of itself affect plant status or result in loss of safe shutdown function. The potential for spurious control room instrument indication is minimized by plant design features. Additionally, indications can be divided into two categories. These categories are key and non-key indications. Key indications are those indications utilized by the operators to achieve and maintain safe shutdown per plant procedures. Non-key indications are those indications which are not relied upon to assess plant conditions nor utilized to take positive action under fire conditions. Additionally, adequate alternate shutdown instrumentation is provided to achieve and maintain safe plant shutdown.

Instrumentation cable consists of low energy circuit loops servicing the main control room and Evacuation Shutdown (EVSD) panels. Throughout the plant, instrumentation circuits are routed in raceway and conduit separate from power and control cables. This routing precludes the possibility of short-circuit conditions involving high energy circuits from generating spurious indications. The energy levels utilized for instrument loops are considered sufficiently low to effectively eliminate the potential for instrument-to-instrument short circuits.

In the event of any fire, plant emergency procedures address required operator actions. These actions are based upon key plant parameters. Key plant parameters include pressurizer pressure and level, RCS hot leg temperature and steam generator pressure and level. Should fire-induced spurious indication of this instrumentation occur, alternate shutdown instruments are provided at the Essential Plant Paramenters Monitoring (EPPM) panel. The two EPPM panels are located in the respective unit penetration building, physically and electrically independent of the control room. The control room and EPPM panel instruments (except RCS hot leg temperature) are serviced by separate instrument loops. A separate junction box is provided to allow the operator to disconnect control room RCS hot leg instrument loop power and connect EPPM panel power to monitor this parameter. Thus, a single fire could not incapacitate both the control room and EPPM indications. The EPPM panel instrumentation meets the NRC performance goals for alternate shutdown instrumentation promulgated in 10 CFR 50, Appendix R, Part III.L.2, as described in SCE's original deviation request. Since the alternate shutdown capability would remain available, spurious control room instrument indication would not jeopardize the ability to achieve and maintain safe shutdown conditions.

E. Common Enclosure

Included in the definition of associated circuits are those circuits which share a common enclosure with safe shutdown cables. In addition, associated circuits of concern include circuits which are not electrically protected or means are not provided to preclude fire propagation into the enclosure. Common enclosures are considered to be raceways (tray and conduit), junction boxes and electrical panels. The combination of plant design features and electrical design criteria is adequate to ensure proper electrical protection or otherwise prevent fire propagation.

The switchgear, loadcenter and MCC panels are located within the respective safety division load group switchgear room. Power cable leaving the switchgear rooms is generally routed in cable tray through the cable riser galleries from which the trays diverge into the varied directions of the safe shutdown equipment. Individual power cables are routed in conduit from the cable tray to the respective equipment. This arrangement minimizes the distances over which power cables may be routed within the same fire area.

The San Onofre Units 2 and 3 electrical design criteria prevents routing of Class 1E with non-class 1E circuits in common raceway.(6) This criteria precludes non-Class 1E circuits from becoming associated with Class 1E safety related and safe shutdown circuits via common raceways. The electrical design criteria also governs the routing of Class 1E instrumentation, control and power cable. In raceways and junction boxes, instrumentation cable is routed separately from power and control cables. Instrument circuits are low energy and are therefore considered incapable of propagating faults into their respective enclosures. In some cases, control cable is routed with low voltage power cables. Power cable is segregated by voltage level; i.e., 6.9 kV, 4.16 kV and 480 V power cables are routed separately.(5) Separation between different load groups is maintained as follows.

1) The minimum spacing between trays of different separation groups within the control room and cable spreading room is one foot horizontally and three feet vertically. In all other areas, minimum tray to tray separation is nominally three feet horizontally and five feet vertically. If this spacing cannot be maintained, a barrier is attached to the tray to separate the circuits. Trays of different separation groups are at least one inch apart prior to installation of a separation barrier.

2) The minimum spacing between conduits of different separation groups is one inch.

3) The minimum spacing between a safety related conduit above the top of an opposite train tray and the tray is one foot horizontally and three feet vertically within the control room and cable spreading room. In all other areas, minimum safety related conduit spacing above the top of opposite train trays is nominally three feet horizontally and five feet vertically, If this spacing cannot be maintained, a barrier is attached to the tray or conduit for separation.

San Onofre Units 2 and 3 design features include alternate shutdown capability physically and electrically independent of the control room. This alternate shutdown capability consists of second points of (equipment) control and instrumentation. Second points of control include fire isolation switches which electrically isolate the control room control functions. The alternate shutdown instrumentation at the EPPM panel utilizes instrument loops and power supplies independent of the control room. Thus, potential circuit faults propagated by circuits associated with control and instrument functions will not adversely affect the ability to achieve and maintain safe shutdown conditions.

Electrical cable sizing is based upon the maximum short circuit current and the circuit breaker clearing times.(7) Thus, electrical cable is sized for a minimum of 1.25 times the full load current.(8,9) Additionally, circuit breakers are sized such that the maximum expected full load current does not exceed 80 percent of the breaker rating.(10) Thus, the electrical distribution system is adequately sized to handle short circuit fault currents which may occur as a result of fire damage. Additionally, the design process verifies that circuit breakers will clear a faulted condition prior to cable insulation ignition.(4) These design criteria thus minimize the potential for cable damage and propagation of fire in the unlikely event of faults involving circuits associated by common enclosure.

The electrical design criteria for main control boards and other electrical panels is provided in the Updated FSAR.(11) The following paragraphs summarize this criteria.

Within the main control boards, non-Class 1E wiring is run separately from Class 1E wiring except for low-energy cabling connecting position contacts from Class 1E switches with the non-Class 1E plant computer and annunciator. In these cases, it is specifically verified that the non-Class 1E cables are routed with only one Class 1E separation group. Within the other panels, however, non-Class 1E wiring is run and harnessed together with Class 1E wiring. The potential for the low-energy non-Class 1E wirings in the panels to provide a mechanism whereby a failure could affect the Class 1E wiring because of their close proximity to the Class 1E wiring is so low that a requirement for them to be

separated is not warranted. Harnesses of different separation groups are separated physically by a nominal distance of six inches; where physical separation is impracticable, metal barriers, metallic conduit, metallic gutter, or wire duct is used to maintain independence.

1) A six-inch minimum physical separation is maintained between field cables of different separation groups entering an enclosure (main control boards, switchboards, equipment cabinets, panels, and termination boxes, etc.), between any of these cables and the internal wiring of the separation groups within the enclosure and between the internal wiring of different separation groups within the enclosure.

2) When a non-Class 1E power cable circuit enters an enclosure with Class 1E wiring (field cabling or internal wiring), a nominal six-inch minimum physical separation is maintained between the non-Class 1E power cable circuit and any Class 1E wiring. Where a six-inch separation cannot be accomplished, the non-Class 1E power cable and/or the Class 1E wiring is barriered or installed in an enclosed raceway. This restriction does not apply to low energy circuits.

3) For Class 1E enclosures (main control boards, switchboards, equipment cabinets, panels, termination boxes, etc.), or devices which contain non-Class 1E wiring (field cabling or internal wiring), and wiring (field cabling or internal wiring) for two or more Class 1E separation groups, the "6-inch free air" separation is maintained between wiring for any separation group or any separation group wiring and non-Class 1E wiring. Exception to this criteria is permitted either by specific engineering instructions on wiring diagrams or for nuclear safety related cabinets (other than the main control boards) where low energy nonsafety related cabling or wiring of annunciator or computer circuitry is routed with safety related wiring of one or more separation groups in such a way that the nonsafety related cabling or wiring associated with one separation group is not crossing over to any other separation group within the cabinet.

   The separation criteria of this section applies to nonsafety related annunciator or computer cabling associated with one or more separation groups; i.e., a "6-inch free air" separation or a barrier shall separate nonsafety related annunciator or computer cabling associated with one separation group from nonsafety related annunciator or computer cabling associated with another group up to the point where all nonsafety related annunciator or computer cabling is no longer associated with any of the separation groups.

Where a six-inch minimum physical separation between wiring for two Class 1E separation groups, or between a Class 1E separation group and non-Class 1E wiring cannot be maintained, the wiring is barriered or installed in an enclosed raceway.

The above separation criteria within panels is implemented by means of a construction installation specification.[12] Thus, the electrical design and separation criteria employed for electrical panels minimizes the potential for propagation of circuit faults.

III. Summary and Conclusions

Associated circuits, as defined in NRC Generic Letter 81-12, are circuits which do not meet the separation requirements of 10 CFR 50, Appendix R, Part III.G.2 and have one of the following: (1) a common power source with the shutdown equipment, (2) a connection to circuits of equipment whose spurious operation would adversely affect the shutdown capability or (3) a common enclosure with the shutdown cables. The following summarizes the treatment of associated circuits relative to the San Onofre Units 2 and 3 design:

A. Common Power Source

1) Alternate shutdown capability provides adequate electrical protection and redundancy to ensure that a fire will not adversely affect the safe shutdown instrumentation and control functions.

2) Electrical design criteria (including breaker coordination) provides adequate protection for Class 1E power circuits.

B. Spurious Actuation

1) The potential for spurious actuation is minimized by general plant design features and electrical design criteria (including separation) which limit propagation of fire and fire damage.

C. Spurious Indication

1) Electrical design criteria minimize the potential for instrument circuit failures which could result in spurious indication.

2) By procedure, plant operators would rely solely upon key indications for achieving and maintaining safe shutdown in a fire emergency. Spurious indication for non-key parameters would not be of concern.

3) Alternate shutdown instrumentation physically and electrically independent of the control room provides key plant indications in the unlikely event of spurious (key) control room indication.

D. Common Enclosure

1) Electrical design criteria preclude non-Class 1E associated circuits of this type in raceway.

2) Electrical design criteria precludes Class 1E instrument circuits from propagating fire into raceway.

3) Alternate shutdown capability provides adequate electrical protection and redundancy to ensure that a fire will not adversely affect safe shutdown instrumentation and control functions.

4) Electrical design criteria (including breaker coordination and cable sizing) provides adequate protection for Class 1E power circuits in raceway.

5) Electrical design and separation criteria employed for electrical panels minimizes the potential for propagation of circuit faults.

The San Onofre electrical design criteria has been shown to generally preclude the existence of associated circuits of concern. In those cases where the existence of associated circuits is possible, the electrical design criteria provide adequate circuit protection or minimize the potential for propagation of fire. In the latter case, the San Onofre fire protection system provides fire protection features which serve to quickly identify, localize and extinguish any fire. In addition, features including alternate shutdown capability preclude spurious actuation and/or indication from impairing the safe shutdown capability. Thus, additional formal evaluation of associated circuits is not considered necessary.

IV. References

(1) San Onofre Units 2 & 3 Updated FSAR, Paragraph 8.1.4.3.14

(2) San Onofre Units 2 & 3 Updated FSAR, Section 8.3

(3) Studies: E4C-008, 4.16 kV Short Circuit Study
E4C-009, Low Voltage Short Circuit Study
E4C-010, DC Short Circuit Study

(4) Calculation: E4C-050, Low Voltage Power Circuit Breaker Settings

(5) San Onofre Units 2 & 3 Updated FSAR, Paragraph 8.3.1.4

(6) San Onofre Units 2 & 3 Construction Specification CS-E04, Electrical Cable and Raceway Identification

(7) Project Design Criteria Manual, Paragraph 3.16.3.3

(8) Calculation: E4C-031, Cable Sizing to Accommodate Available Short Circuit Currents

(9) Calculation: E4C-032, DC System Cable Sizing

(10) Electrical Standards, Section E2.11.1, Power Plant Medium Voltage Auxiliary System Short Circuit Calculation

(11) San Onofre Units 2 & 3 Updated FSAR, Paragraph 8.3.3.3.3

(12) San Onofre Units 2 & 3 Construction Specification CS-E03, Cable Splicing, Termination and Supports; Subsection entitled "Separation Requirement for Field Cabling Within Enclosures"

Fire Barrier Wrap for Cable Protection

I. Introduction

10 CFR 50, Appendix R, Part III.G.2 requires that, where cables or equipment (including associated non-safety circuits) of redundant trains of systems required for hot shutdown are located within the same fire area (outside primary containment), one of the following means of ensuring that one redundant train is free of fire damage shall be provided:

a) separation of cables and equipment by a fire barrier having a 3-hour rating;

b) separation of cables and equipment by a horizontal distance of more than 20 feet (with no intervening combustibles) with detection and suppression provided; or

c) enclosure of cables and equipment in a fire barrier having a 1-hour rating with detection and suppression provided.

Where the provisions of III.G.2.c. are maintained to meet the separation requirements of Appendix R, San Onofre Nuclear Generating Station, Units 2 and 3 (SONGS 2 and 3) utilitize Cerablanket, a ceramic fiber blanket manufactured by Johns-Manville, to provide cable protection. SCE considers that Cerablanket is acceptable as a 1-hour rated barrier based on:

1) A comparison of key properties of Kaowool versus Cerablanket which shows that the two products are almost identical, and

2) Kaowool has been tested and approved in accordance with the heating rate specified in ASTM E-119.

In the May 23, 1984 meeting regarding SCE fire protection deviation requests, the NRC expressed concern that it could not approve the use of Cerablanket as a 1-hour fire exposure barrier without SCE conducting a qualification test on the material.

In consideration of the NRC Staff concern, SCE has conducted a qualification test on Cerablanket. The following discussion supplements the basis for acceptability previously provided for approval of this deviation.

II. Discussion of Test Results

Exploratory fire tests were conducted on a protective envelope system for redundant essential electrical cables at Underwriters Laboratories in Northbrook, Illinois. The protective envelope was composed of two nominal 1" thicknesses of (eight pounds per cubic foot) Cerablanket, a ceramic fiber blanket manufactured by Johns-Manville, installed with 3/4" stainless steel banding. The two tests were conducted in accordance with the ASTM E-119

standard time-temperature curve. The purpose of these exploratory tests was to evaluate configurations and installation tolerances for the protective envelope system relative to the fire barrier performance (in minutes) during the ASTM E-119 fire exposure. These installation tolerances included blanket overlap (both longitudinal and circumferential) and band spacing.

Test configurations were selected to envelope the installation specification utilized at SONGS 2 and 3. Some test configurations were installed using significantly relaxed installation criteria relative to the original installation specification. The test criteria for acceptable performance were that the protective envelope systems maintain circuit integrity while being subjected to a standard ASTM E-119 time-temperature curve fire exposure for one hour.

The first test assembly consisted of a test slab with six 24" x 4" cable trays, one 2" diameter conduit and one 4" diameter conduit to which a protective envelope was applied. This envelope was installed using relaxed installation criteria. In all of the eight tested configurations the protective envelope system successfully protected the cables and raceways during the one hour ASTM E-119 Fire Exposure Test. Circuit integrity of all monitored cables remained intact throughout the test. There were no short circuits, either conductor to conductor or conductor to ground. Based on the monitored parameters, there was no loss of continuity in any of the circuits monitored during the test.

The second test assembly consisted of a test slab with six 24" x 4" cable trays, one 2" diameter conduit and two 1" diameter conduits to which a protective envelope was applied. This envelope was installed using significantly relaxed installation criteria. In all of the nine tested configurations, the protective envelope system successfully protected the cables and raceways during the ASTM E-119 Fire Exposure Test for approximately one hour. Two of the cable tray configurations, both of which were loaded to 30% fill, with no filler blankets inside the tray, experienced circuit integrity failures at times 58 minutes, 25 seconds and 58 minutes, 40 seconds. The remaining four cable tray configurations successfully protected the circuit integrity of the cables within for sixty (60) minutes. One 1" conduit, with two layers of protective blanket, experienced circuit integrity failure at 49 minutes, 20 seconds. The other two conduits, one 1" diameter and one 2" diameter, both of which were protected with a triple layer of protective blanket, successfully protected the integrity of the cables within for sixty (60) minutes.

Previously submitted information (in SCE's March 19, 1984 letter) illustrated the similarities between the key properties of Cerablanket and Kaowool, in addition to the similarities between the Cerablanket installation configuration used at SONGS 2 and 3 and the ASTM E-119 test configuration for Kaowool. This information coupled with the above test results, demonstrates that Cerablanket provides a fire barrier having a one-hour rating and, thus, satisfies the requirements of 10 CFR 50, Appendix R, Part III.G.2.c.

Enclosure 3

SAFE SHUTDOWN CABLE AND EQUIPMENT SEPARATION INSIDE CONTAINMENT

I. INTRODUCTION

10 CFR 50, Appendix R, Part III.G.2 provides requirements for separation of redundant trains of systems necessary to achieve and maintain hot shutdown. Outside primary containment these separation requirements include use of three hour rated fire barriers, 20 feet of horizontal distance (without intervening combustibles) with detection and suppression, or a combination of one hour barrier, detection and suppression. Inside noninerted containments one of the above or one of the following fire protection means should be provided:

a) separation of cables and equipment by a horizontal distance of more than 20 feet (with no intervening combustibles);

b) installation of fire detectors and automatic suppression in the fire area; or

c) separation of cables and equipment by a noncombustible radiant energy shield.

During the San Onofre licensing process, the NRC issued formal questions requesting specific clarifications of the licensee fire protection program. NRC question FQ015.38 provided the fire protection guidelines for inside containment. These guidelines are essentially identical to the separation requirements of 10 CFR 50, Appendix R. The NRC stated in the question that the San Onofre design should be modified to meet these guidelines. The Fire Hazards Analysis included the response to NRC question FQ015.38 which provided the technical basis for concluding that the existing design inside containment is adequate. The technical basis included discussion of the fire protection features and the general (in containment) arrangement as related to fire protection.

The safe shutdown cable and equipment located within containment includes the following:

A. Containment Emergency Cooling Systems

B. Pressurizer Backup Heaters and Power Cable

C. Reactor Coolant System (RCS) Instrumentation

- i RCS Temperature
- ii Pressurizer Level
- iii Pressurizer Pressure

D. Steam Generator (SG) Instrumentation

- i SG Level
- ii SG Pressure

The San Onofre Units 2 and 3 fire protection system design basis is Branch Technical Position APCSB 9.5-1, Appendix A (1977), Plants Under Construction. The purpose of the fire hazards analysis is to demonstrate that safe (hot and cold) shutdown conditions can be achieved and maintained for any design basis fire. The Fire Hazards Analysis, Section I, Paragraph O (Updated FHA, Appendix B) provides the criteria utilized for the safe shutdown analysis. This criteria states, in part, that:

> Transient fire loads inside [primary containment], when the plant is at power, are not credible. Fixed hazards which pose an exposure threat to equipment, components or circuits required for safe shutdown are [addressed by] the fire protection features. These features include a reactor coolant pump lube oil collection system which meets the requirements of 10 CFR 50, Appendix R, Part III.O.

The Updated Fire Hazards Analysis (FHA) discusses the fire protection features provided inside containment. The Updated FHA demonstrates that a design basis fire (including inside containment) will not adversely affect the ability to achieve and maintain safe shutdown conditions.

The attached drawings depict the relative separation between safe shutdown equipment and cables inside the Unit 2 containment. Although not identical, the separation shown inside the Unit 2 containment is representative of that provided inside the Unit 3 containment. The separation provided inside containment (with exception of the pressurizer backup heater cables) meets Regulatory Guide 1.75 and IEEE Standard 384-1974 as discussed in the Updated FSAR. These guidelines set forth the separation criteria for redundant circuits and equipment. The following discussion provides additional basis for concluding that the existing safe shutdown equipment and cable separation inside containment is adequate.

II. SAFE SHUTDOWN EQUIPMENT SEPARATION

The fire protection features provided inside containment are discussed in the Updated FHA. These fire protection features are a combination of seismically qualified standpipes with manual hose stations, smoke and fixed temperature rate of rise heat detectors, manual water spray systems for charcoal filters and reactor coolant pumps' lube oil collection systems. These features provide adequate protection for the fixed fire hazards thus minimizing the potential of a design basis fire in these areas. Additionally, power, control and instrumentation cable insulation installed in trays inside containment is flame-retardant in accordance with IEEE Standard 383-1974, as described in Updated FSAR, Section 9.5.1. Such cables, which in most cases comprise the intervening combustibles between redundant safe shutdown trains, will not propagate an electrically-induced fire, hence, only a transient fire need be considered. As discussed above, transient fire loads inside containment when the plant is at power are not considered credible. During shutdown, access to the containment is under strict administrative control thus minimizing the potential for a fire resulting from transient fire loads.

A. Containment Emergency Cooling System

A design basis fire could incapacitate normal (non-safety related, X-train) containment building cooling. As a result of RCS heat losses during shutdown, cooling is required to maintain the proper temperature inside containment. The containment emergency cooling system is credited with this function under design basis fire conditions. The containment emergency fan cooler system consists of four separate fan cooler units. The system is separated into two safety trains (train A and train B), consisting of two fan cooler units each. The two trains are supplied from separate component cooling water trains and separate Class 1E electrical power buses. Inside containment, each cooling unit is spatially separated by 90 degrees. Separation between train A and train B cables inside containment is greater than twenty feet and is depicted in Figures A-1 and A-2.

B. Pressurizer Backup Heaters

Two X-train pressurizer backup heaters are powered from the Class 1E train A and train B power supplies, respectively. The pressurizer backup heaters are utilized to control pressurizer and, hence, RCS pressure. Only one of the two redundant heaters is required to achieve and maintain safe shutdown conditions. The minimum set of safe shutdown equipment also includes one of the redundant (Class 1E) train A and train B Chemical and Volume Control System (CVCS) charging pumps. These pumps provide RCS makeup and inventory control. The operators can also utilize the charging pumps to control RCS pressure during reactor cooldown to cold shutdown conditions.

The Updated FHA depicts the separation of safe shutdown equipment and cables. Outside primary containment, the pressurizer backup heater cables are routed through separate fire zones and meet the intent of Appendix R, Part III.G.2. Thus, for any design basis fire outside containment, at least one of the pressurizer backup heaters would remain operable. In the unlikely event that both pressurizer backup heater power cables were lost inside containment, the charging pumps would remain available to control RCS pressure to achieve and maintain safe shutdown.

Thus, based upon the fire protection features provided and the diversity of safe shutdown equipment, separation of the pressurizer backup heater cables in accordance with the requirements of Appendix R, Part III.G.2, is not necessary. Separation of the pressurizer backup heater cables is depicted in Figures B-1 through B-3.

C. Reactor Coolant System Instrumentation

Reactor Coolant System (RCS) instrumentation required to achieve and maintain safe (hot and cold) shutdown conditions is comprised of RCS hot and cold leg temperature and pressurizer level and pressure indications. Four Class 1E safety channels (trains A, B, C and D)

for each parameter provide indication in the control room. Only one safety channel of each parameter is required to achieve and maintain safe shutdown from the control room. The Essential Plant Parameters Monitoring (EPPM) panel provides alternate shutdown instrumentation which is physically and electrically independent of the control room. EPPM panel instrumentation includes RCS hot leg temperature (provided by train A) and pressurizer level and pressure (provided by train X). These parameters are utilized by the operators to monitor the plant prior to establishing cold shutdown conditions.

Since each steam generator compartment is a separate fire zone, a fire in one steam generator compartment would result in the loss of only RCS temperature indication for that steam generator loop. The RCS temperature instrumentation in the other steam generator compartment will not be affected by the fire and will remain available. Outside the steam generator compartments, the RCS temperature instrumentation trains A and B which serve steam generator E-089 RCS loop are separated by over 20 feet at their closest point with limited intervening combustibles (Figure C-3). Pressurizer level instrumentation trains A and B are separated by 17 feet with no intervening combustibles at their closest point (Figure E-2), and pressurizer pressure instrumentation trains C and D are separated by a minimum of 20 feet with no intervening combustibles (Figure D-2). Due to the limited quantity of fixed combustibles and the fact that transient fire loads inside containment when the reactor is at power are not credible, at least one train of each of the above instruments will be unaffected by a postulated fire.

Separation of instrumentation circuits inside containment for reactor coolant temperature, pressurizer pressure and level indication is depicted in Figures C-1 through C-4, D-1 through D-4, and E-1 through E-4, respectively.

D. Steam Generator Instrumentation

Steam generator instrumentation includes steam generator pressure and level. Four Class 1E safety channels (trains A, B, C and D) for each parameter provide indication in the control room. Only one safety channel of each parameter is required to achieve and maintain safe shutdown from the control room. One (train X) channel of each parameter is routed to the EPPM panel which is physically and electrically independent of the control room. These parameters are utilized by the operators to monitor the plant prior to establishing hot and cold (safe) shutdown conditions.

Steam generator pressure and level instrumentation for each steam generator is routed outside the secondary shield wall. A fire incapacitating instrumentation for both steam generators is not credible based on the overall containment separation provided for each steam generator and its corresponding instrumentation. Train A and B pressure and level instrumentation for steam generator E-089

are separated by a minimum of 20 feet with limited intervening combustibles (Figures F-1 and G-1). Although highly unlikely, a fire could potentially result in a loss of instrumentation for steam generator E-088 which may subsequently result in a loss of the steam generator's capability as a heat sink. This scenario, however, is bounded by the Chapter 15 accident analysis in FSAR Section 15.2.3.1, and will not adversely affect the ability to achieve and maintain safe shutdown conditions.

Steam generator pressure and level instrumentation circuit separation inside containment is depicted in Figures F-1 and F-2, and G-1 through G-3, respectively.

III. CONCLUSION

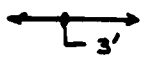
The San Onofre Units 2 and 3 fire protection system design basis is Branch Technical Position APCSB 9.5-1, Appendix A (1977), Plants Under Construction. The safe shutdown cable separation provided inside containment (with exception of the pressurizer backup heater cables) meets the physical separation guidelines of Regulatory Guide 1.75 and IEEE Standard 384-1974 as discussed in the Updated FSAR. The power, control and instrumentation cable insulation in tray inside containment is qualified to IEEE Standard 383-1974. The fire protection features provided inside containment for San Onofre Units 2 and 3 are discussed in the Updated FHA. The basis provided above supplements SCE's previous deviation request and provides further justification to support the conclusions presented in the Updated FHA that a fire will not adversely affect the ability to achieve and maintain safe shutdown conditions.

INDEX

NOTES

1. Heavy line represents raceway (conduit, tray, junction boxes).

2. Refers to embedded conduit.

3. 

Represents distance between raceway.

4. 

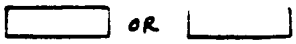
Circle refers to the vertical distance between raceway.

5. 

Terminal Box

6.  Indicator

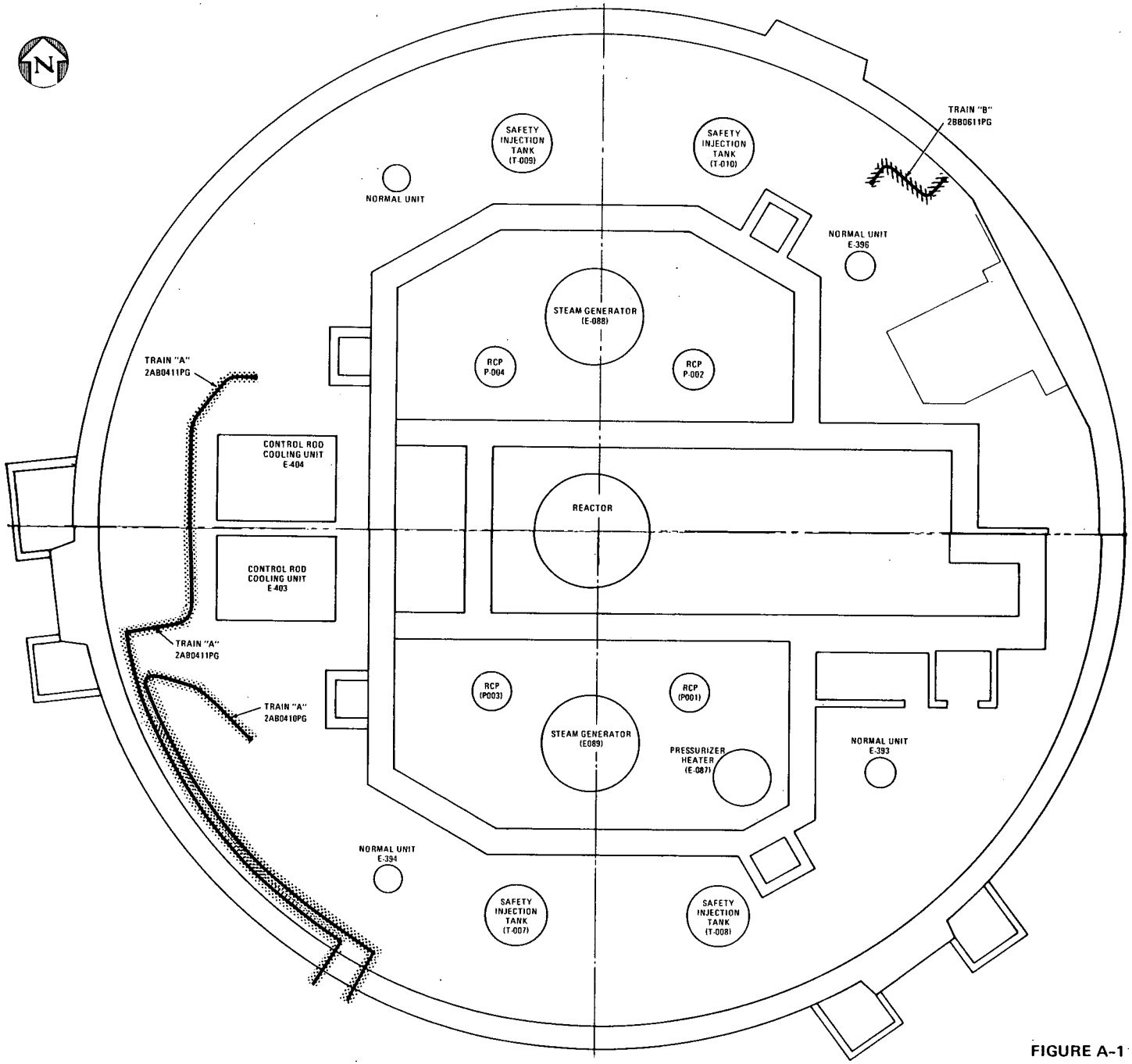
7. Vertical Conduit, Opening in Floor

8. 

Vertical Tray

9. Two types of marking are used to highlight the two trains of cables whose separation is being credited.

REFERENCE CONDUIT AND TRAY PLANS 35143
35150
35157
35163



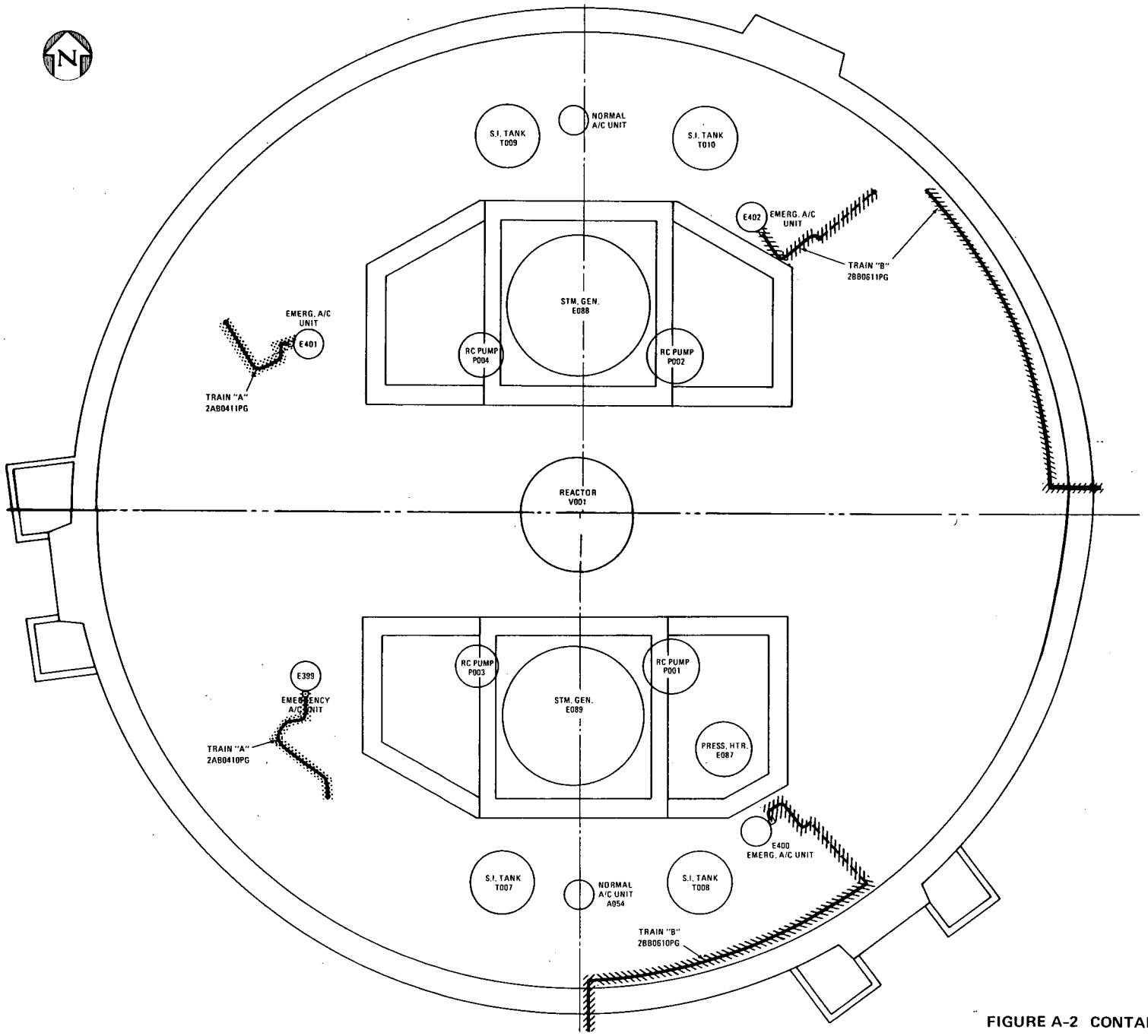
NOTE:

- ONE TRAIN REQUIRED FOR SAFE SHUTDOWN
- SEPARATION OF TRAINS A AND B INDICATED BY CROSS-HATCHING

PLAN EL. 45'-0" TO 63'-6"

FIGURE A-1 CONTAINMENT EMERGENCY COOLING UNITS

REFERENCE CONDUIT AND TRAY PLANS 35144
35151
35158
35164

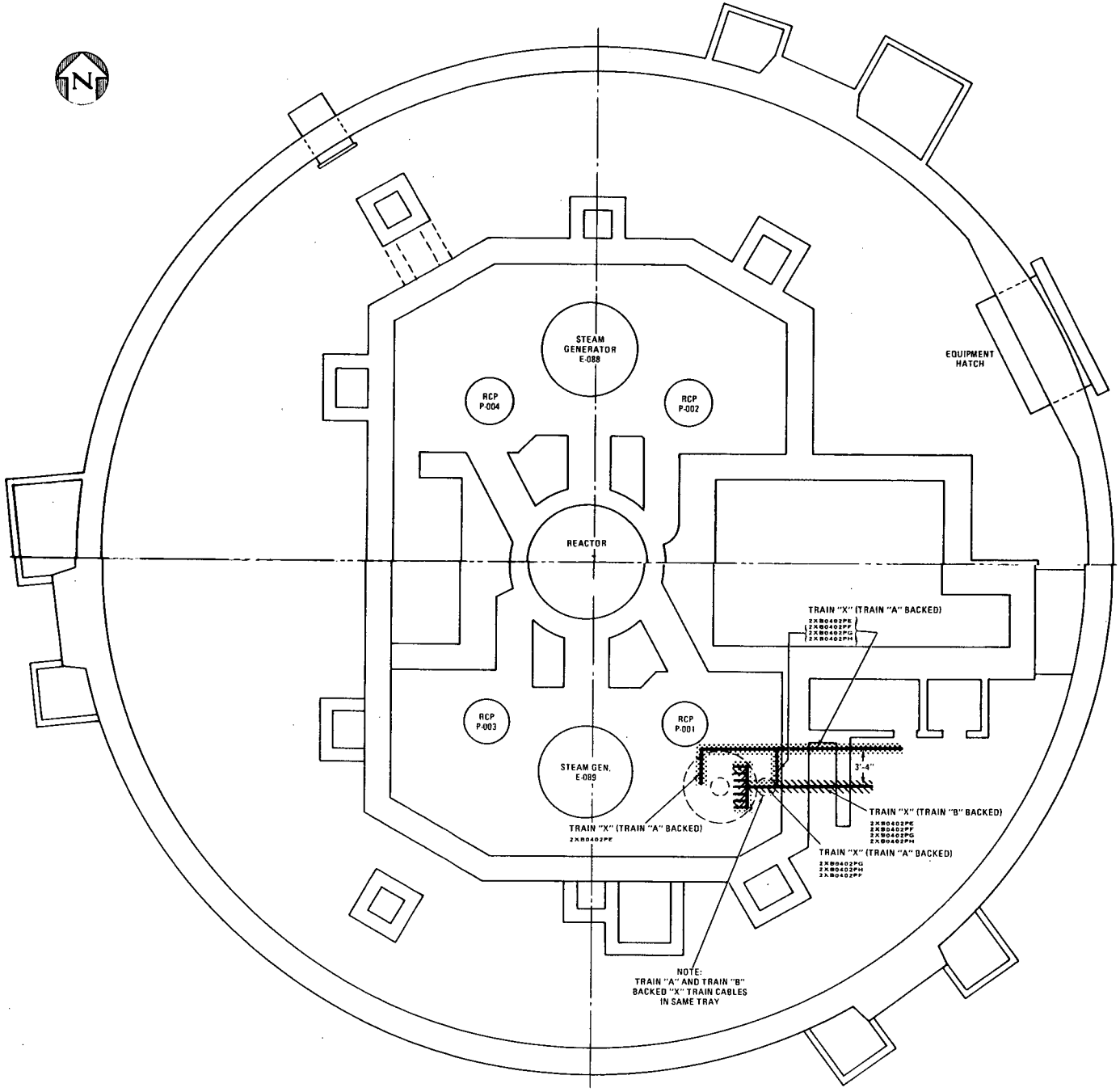


NOTE:

- ONE TRAIN REQUIRED FOR SAFE SHUTDOWN
- SEPARATION OF TRAINS A AND B INDICATED BY CROSS-HATCHING

PLAN EL. 63'-6" & ABOVE

FIGURE A-2 CONTAINMENT EMERGENCY COOLING UNITS

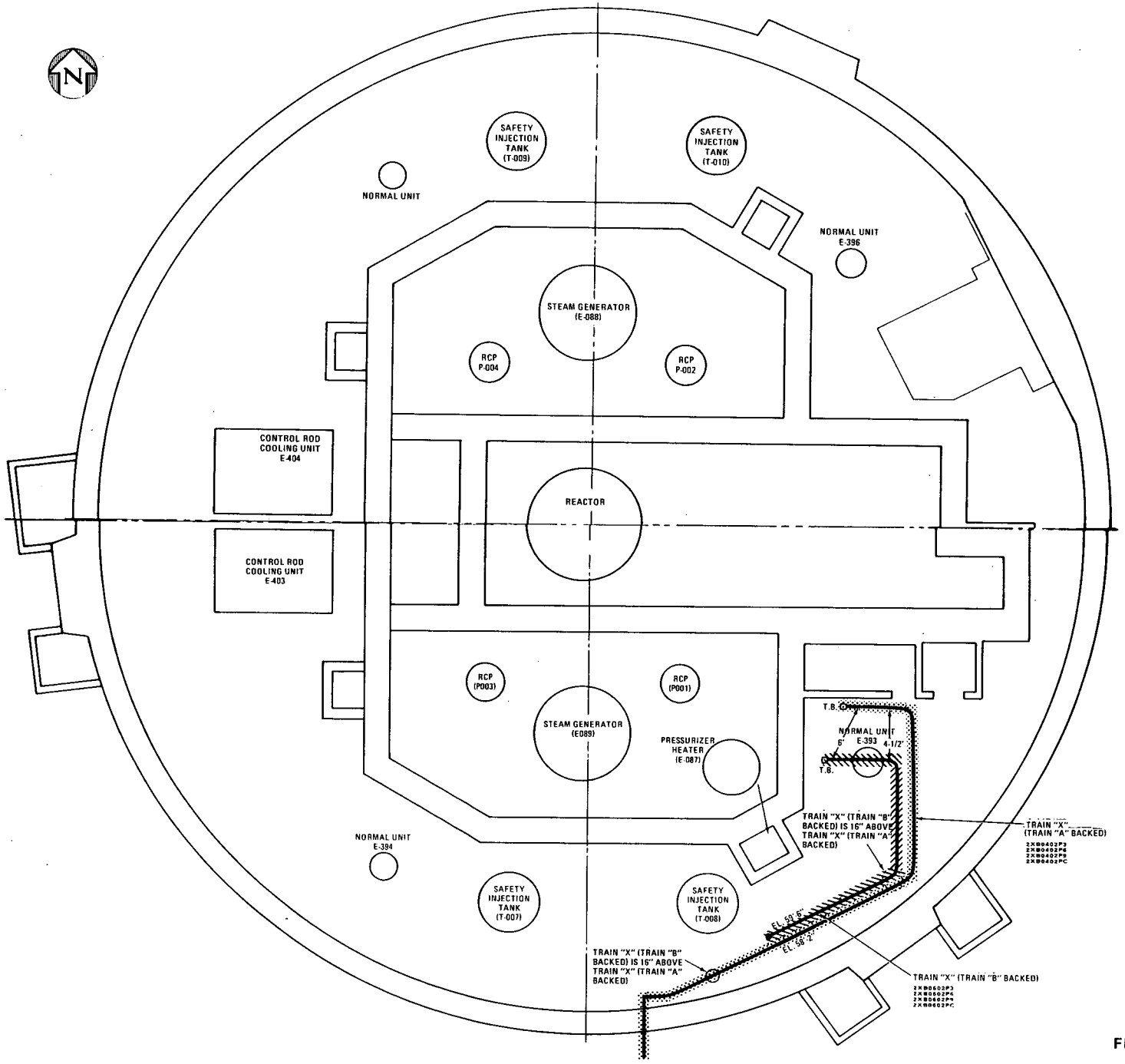


NOTE:

- ONE TRAIN REQUIRED FOR HEATER OPERATION, CHARGING PUMPS PROVIDE ALTERNATE SHUTDOWN CAPABILITY
- SEPARATION OF PRESSURIZER BACKUP HEATERS INDICATED BY CROSS-HATCHING

PLAN EL. 30'-0" TO 45'-0"

FIGURE B-1. PRESSURIZER BACKUP HEATERS

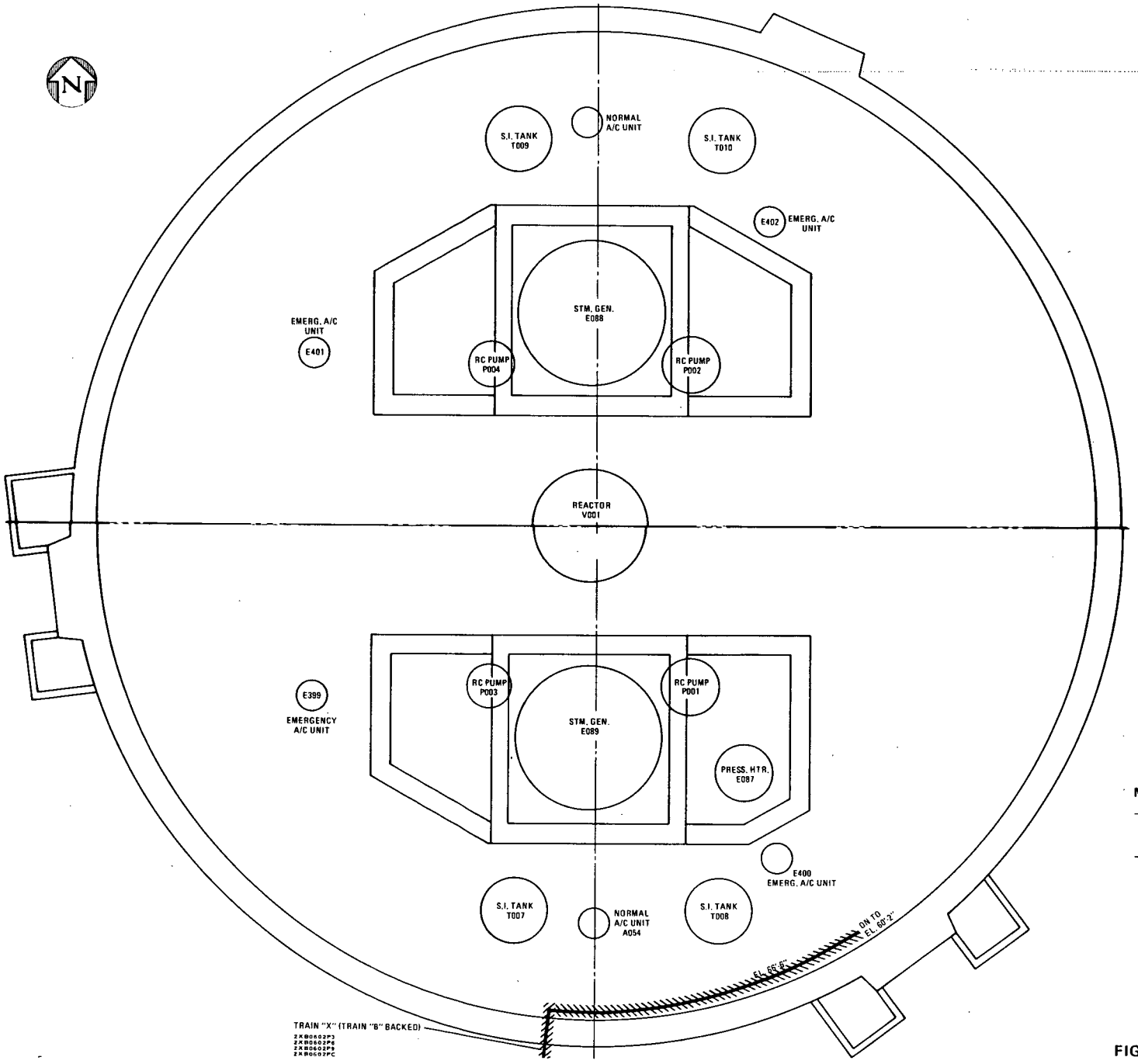


NOTE:

- ONE TRAIN REQUIRED FOR HEATER OPERATION, CHARGING PUMPS PROVIDE ALTERNATE SHUTDOWN CAPABILITY
- SEPARATION OF PRESSURIZER BACKUP HEATERS INDICATED BY CROSS-HATCHING

PLAN EL. 45'-0" TO 63'-6"

FIGURE B-2. PRESSURIZER BACKUP HEATERS



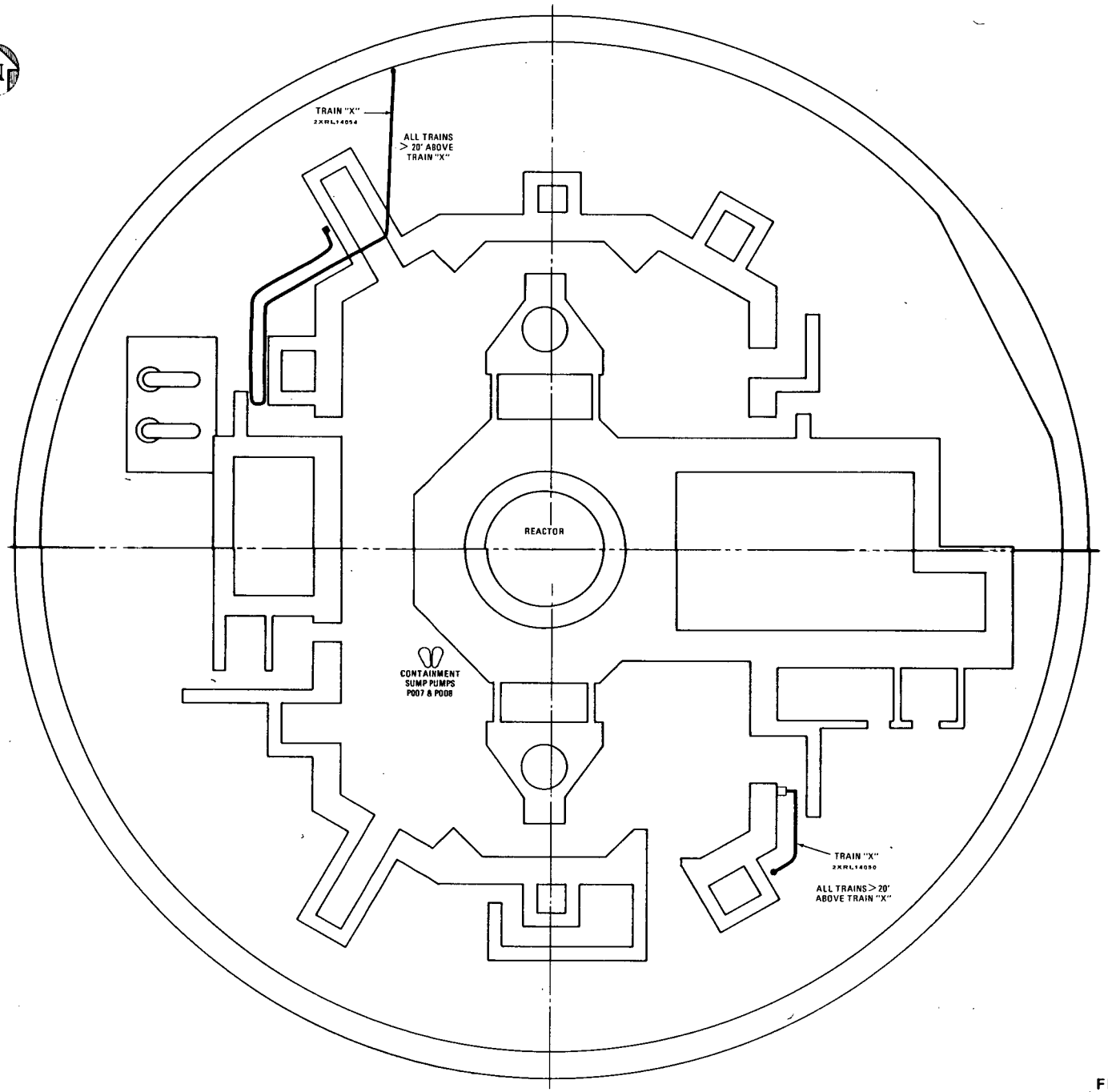
NOTE:

- ONE TRAIN REQUIRED FOR HEATER OPERATION, CHARGING PUMPS PROVIDE ALTERNATE SHUTDOWN CAPABILITY
- SEPARATION OF PRESSURIZER BACKUP HEATERS INDICATED BY CROSS-HATCHING

PLAN EL. 63'-6" & ABOVE

FIGURE B-3. PRESSURIZER BACKUP HEATERS

REFERENCE CONDUIT AND TRAY PLANS 35141
35155
35161

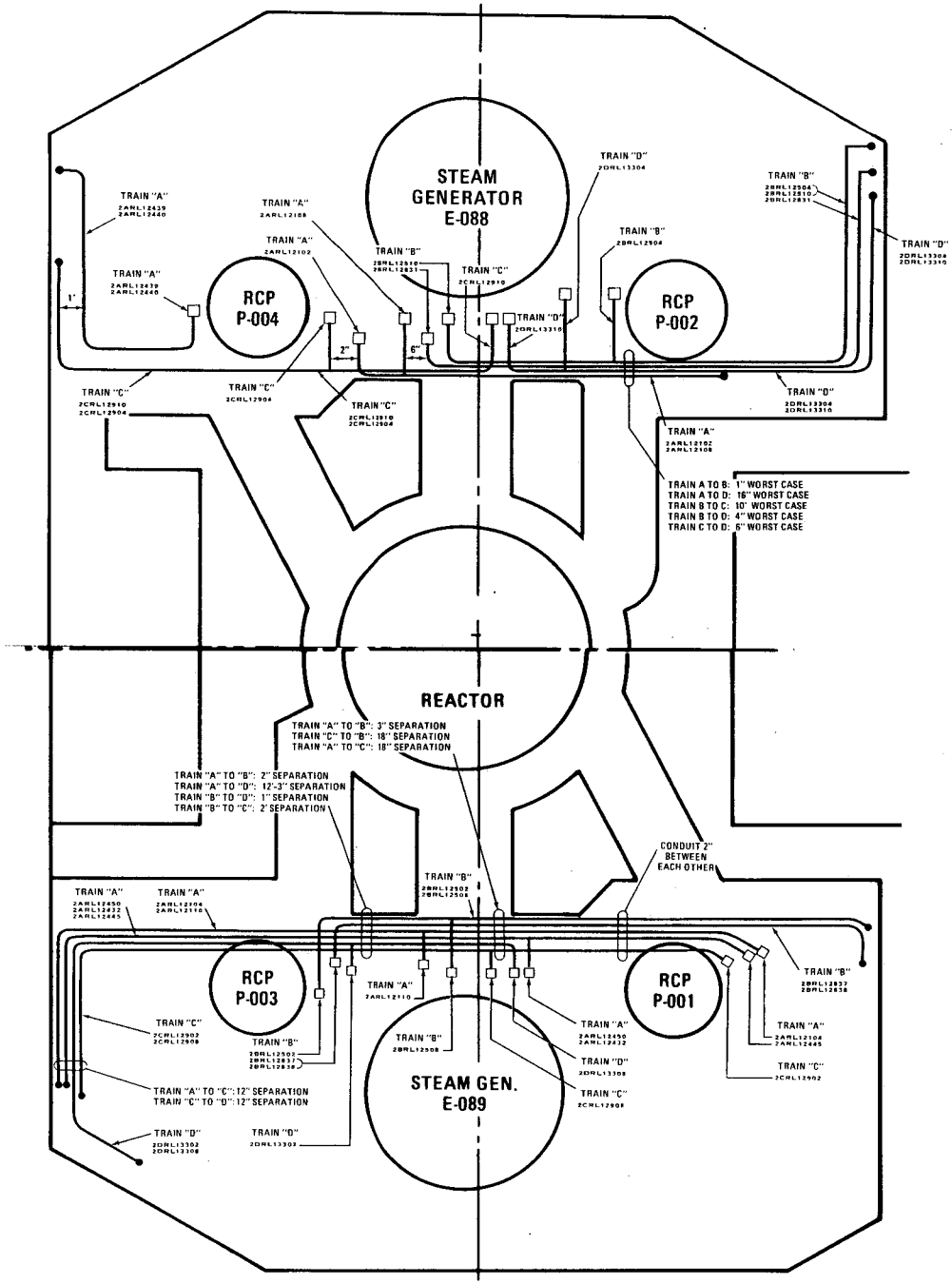


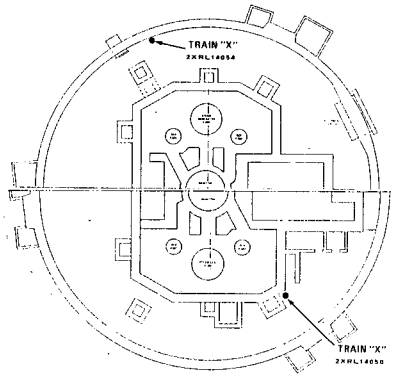
NOTE:

ONE TRAIN REQUIRED FOR SAFE SHUTDOWN
ADDITIONAL REDUNDANT TRAINS SHOWN ON
OTHER ELEVATIONS

PLAN EL. 15'-0" TO 30'-0"

FIGURE C-1. RCS TEMPERATURE INDICATION





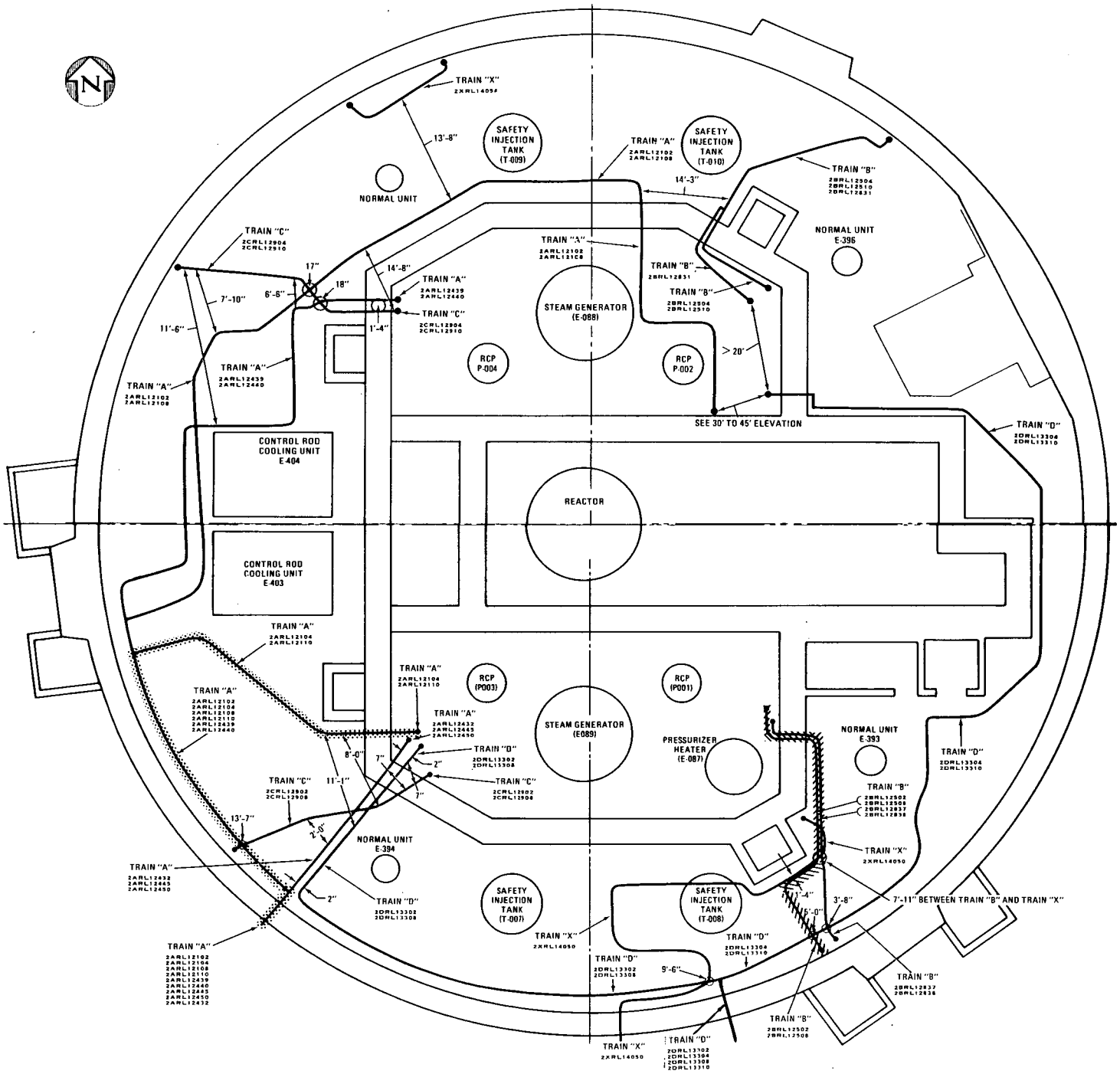
NOTE:

- RCS HOT LEG AND COLD LEG TEMPERATURE INDICATION REQUIRED FOR ONE STEAM GENERATOR LOOP
- STEAM GENERATORS ARE LOCATED IN SEPARATE FIRE ZONES

PLAN EL. 30'-0" TO 45'-0"

FIGURE C-2. RCS TEMPERATURE INDICATION

REFERENCE CONDUIT AND TRAY PLANS 35143
35150
35157
35163



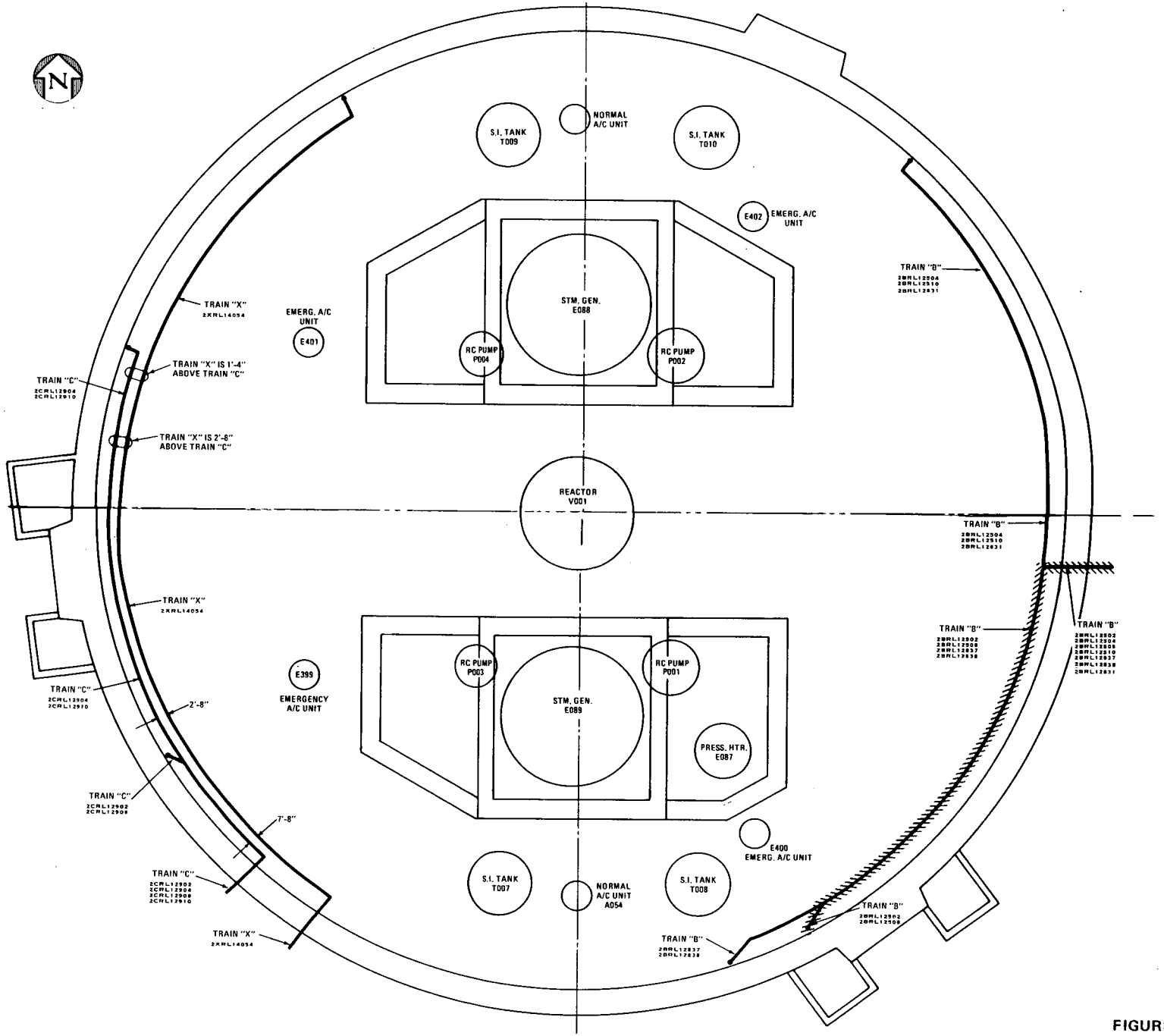
NOTE:

- ONE TRAIN REQUIRED FOR SAFE SHUTDOWN
- SEPARATION OF TRAINS A AND B INDICATED BY CROSS-HATCHING

PLAN EL. 45'-0" TO 63'-6"

FIGURE C-3. RCS TEMPERATURE INDICATION

REFERENCE CONDUIT AND TRAY PLANS 35144
35151
35158
35164

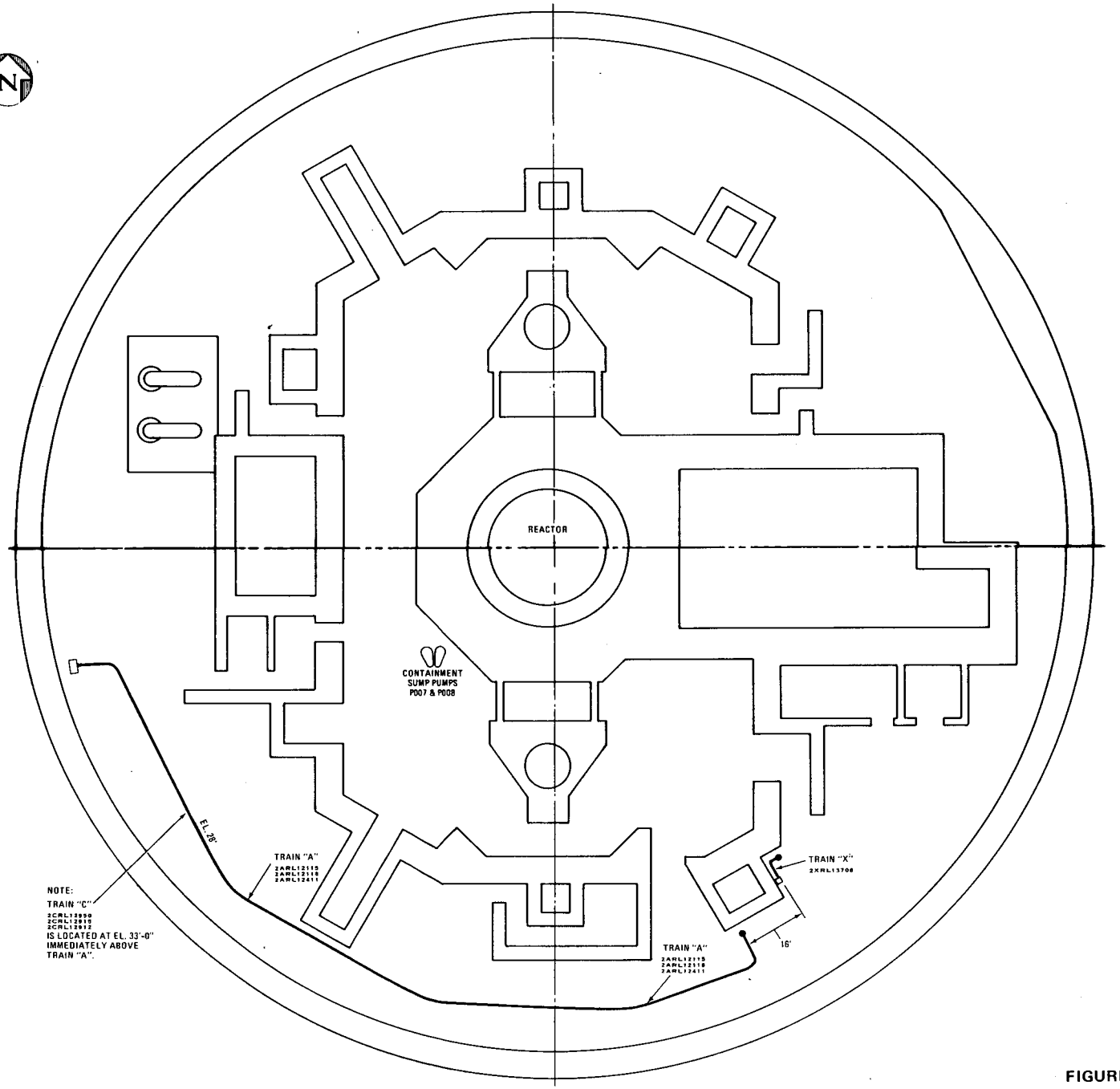


NOTE:

- ONE TRAIN REQUIRED FOR SAFE SHUTDOWN
- SEPARATION OF TRAINS A AND B INDICATED BY CROSS-HATCHING

PLAN EL. 63'-6" & ABOVE

FIGURE C-4. RCS TEMPERATURE INDICATION

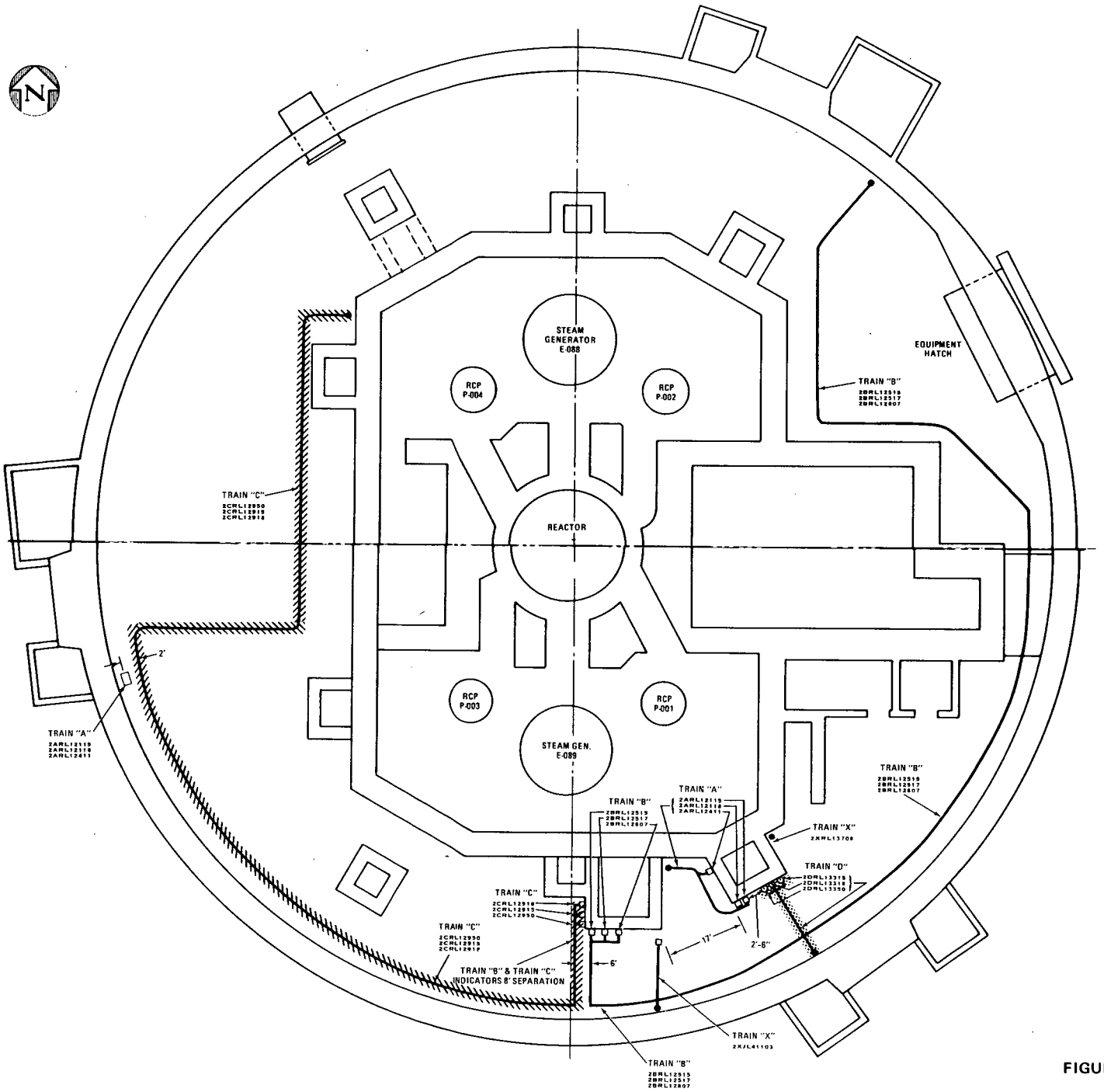


NOTE:
ONE TRAIN REQUIRED FOR SAFE SHUTDOWN
ADDITIONAL REDUNDANT TRAINS SHOWN ON
OTHER ELEVATIONS

PLAN EL. 15'-0" TO 30'-0"

FIGURE D-1. PRESSURIZER PRESSURE INDICATION

REFERENCE CONDUIT AND TRAY PLANS 35142
35149
35156
35152



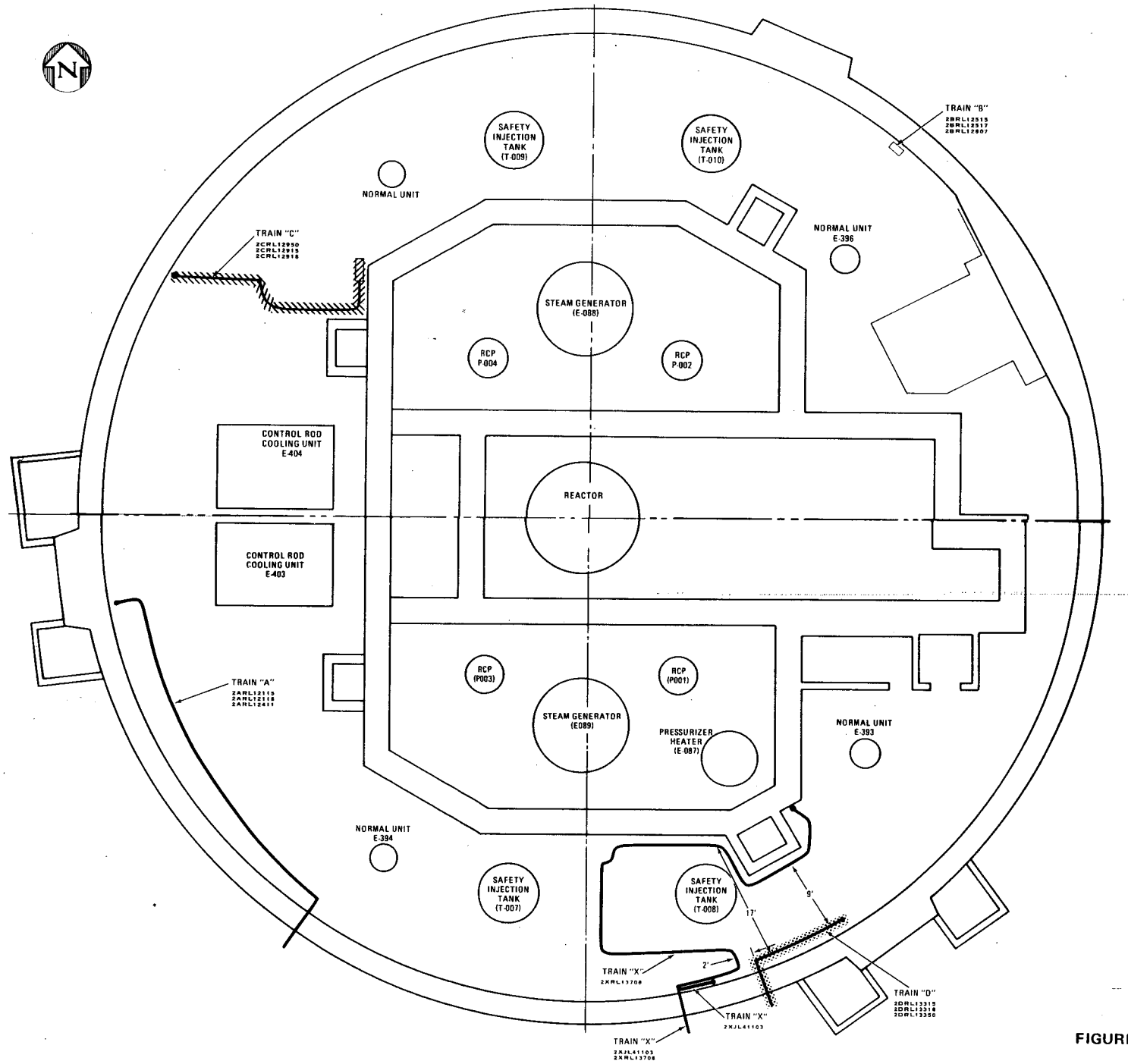
NOTE:

- ONE TRAIN REQUIRED FOR SAFE SHUTDOWN
- SEPARATION OF TRAINS C AND D INDICATED BY CROSS-HATCHING

PLAN EL. 30'-0" TO 45'-0"

FIGURE D-2. PRESSURIZER PRESSURE INDICATION

REFERENCE CONDUIT AND TRAY PLANS 35143
35150
35157
35163



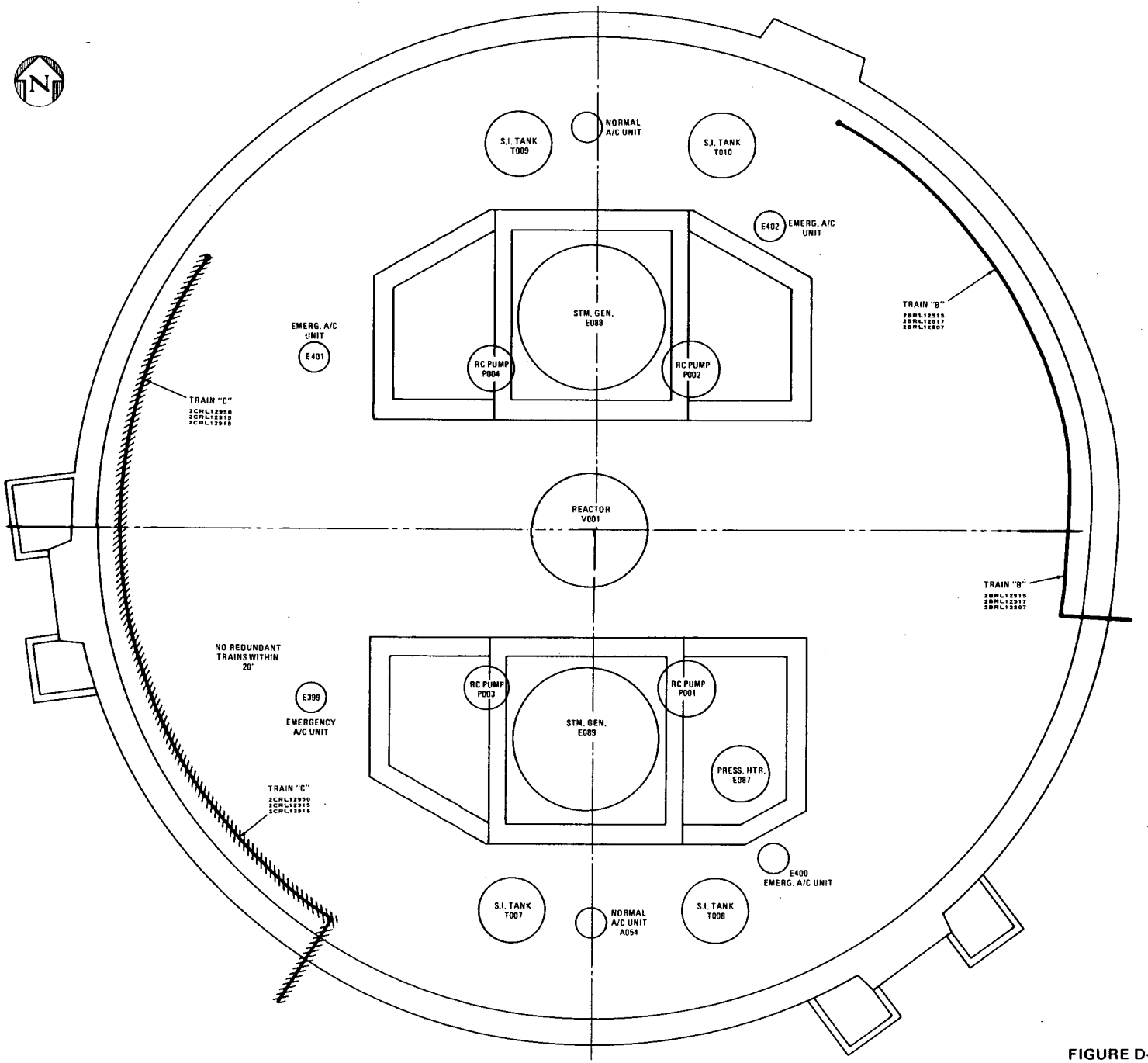
NOTE:

- ONE TRAIN REQUIRED FOR SAFE SHUTDOWN
- SEPARATION OF TRAINS C AND D INDICATED BY CROSS-HATCHING

PLAN EL. 45'-0" TO 63'-6"

FIGURE D-3. PRESSURIZER PRESSURE INDICATION

REFERENCE CONDUIT AND TRAY PLANS 35144
35151
35158
35164



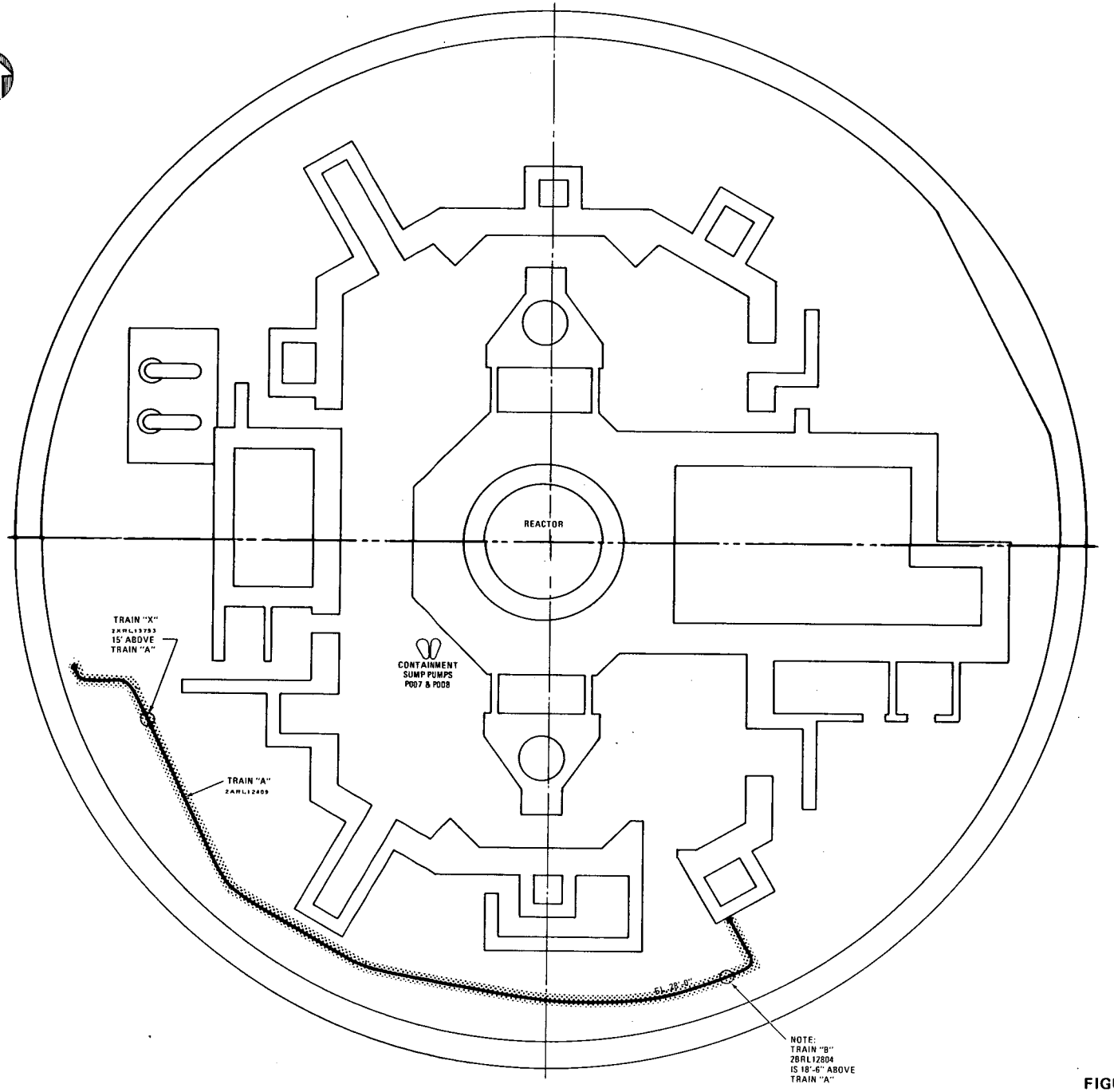
NOTE:

- ONE TRAIN REQUIRED FOR SAFE SHUTDOWN
- SEPARATION OF TRAINS C AND D INDICATED BY CROSS-HATCHING

PLAN EL. 63'-6" & ABOVE

FIGURE D-4. PRESSURIZER PRESSURE INDICATION

REFERENCE CONDUIT AND TRAY PLANS 35155
35161



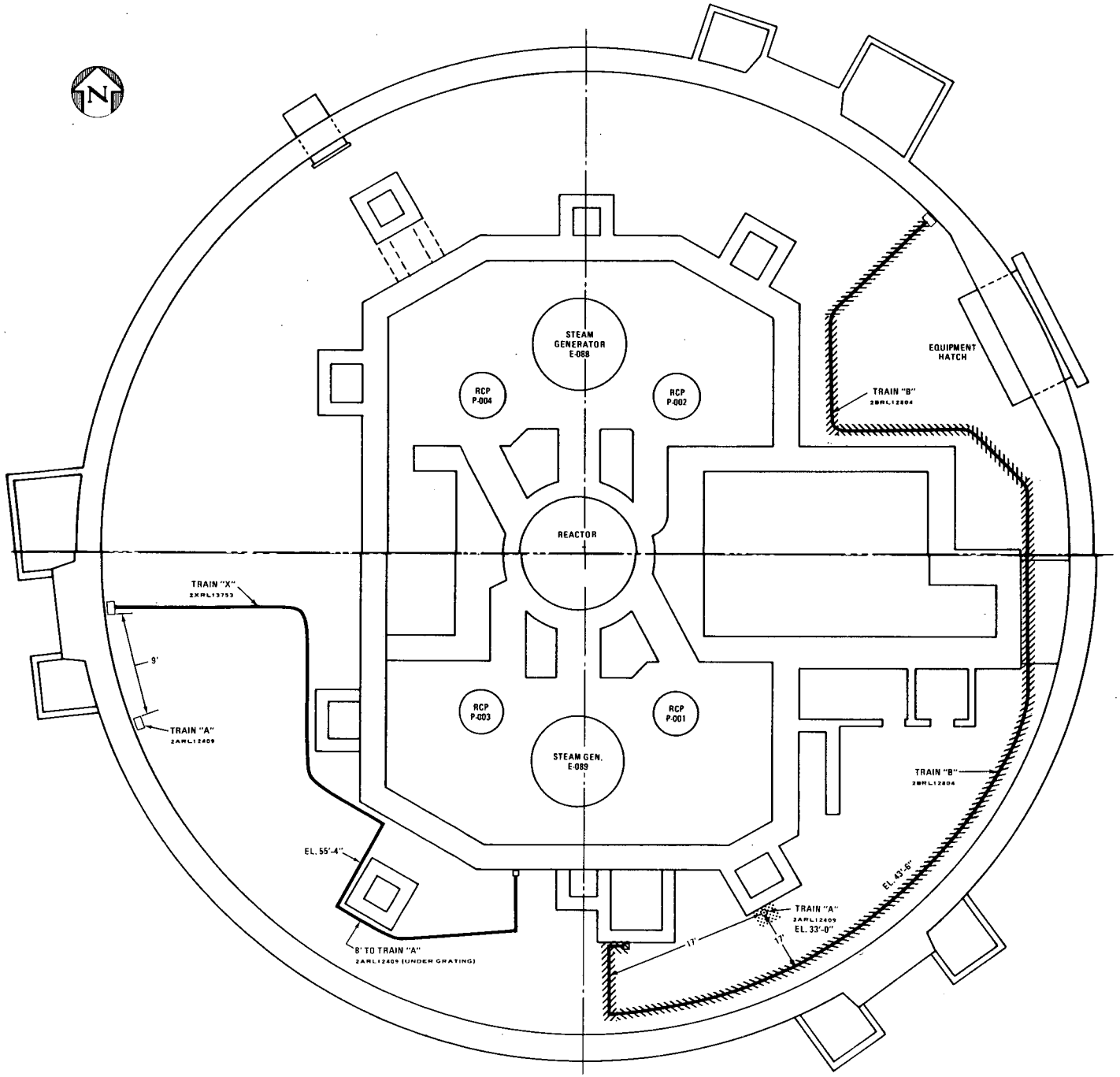
NOTE:

- ONE TRAIN REQUIRED FOR SAFE SHUTDOWN
- SEPARATION OF TRAINS A AND B INDICATED BY CROSS-HATCHING

PLAN EL. 15'-0" TO 30'-0"

FIGURE E-1. PRESSURIZER LEVEL INDICATION

REFERENCE CONDUIT AND TRAY PLANS 35142
35149
35156
35162



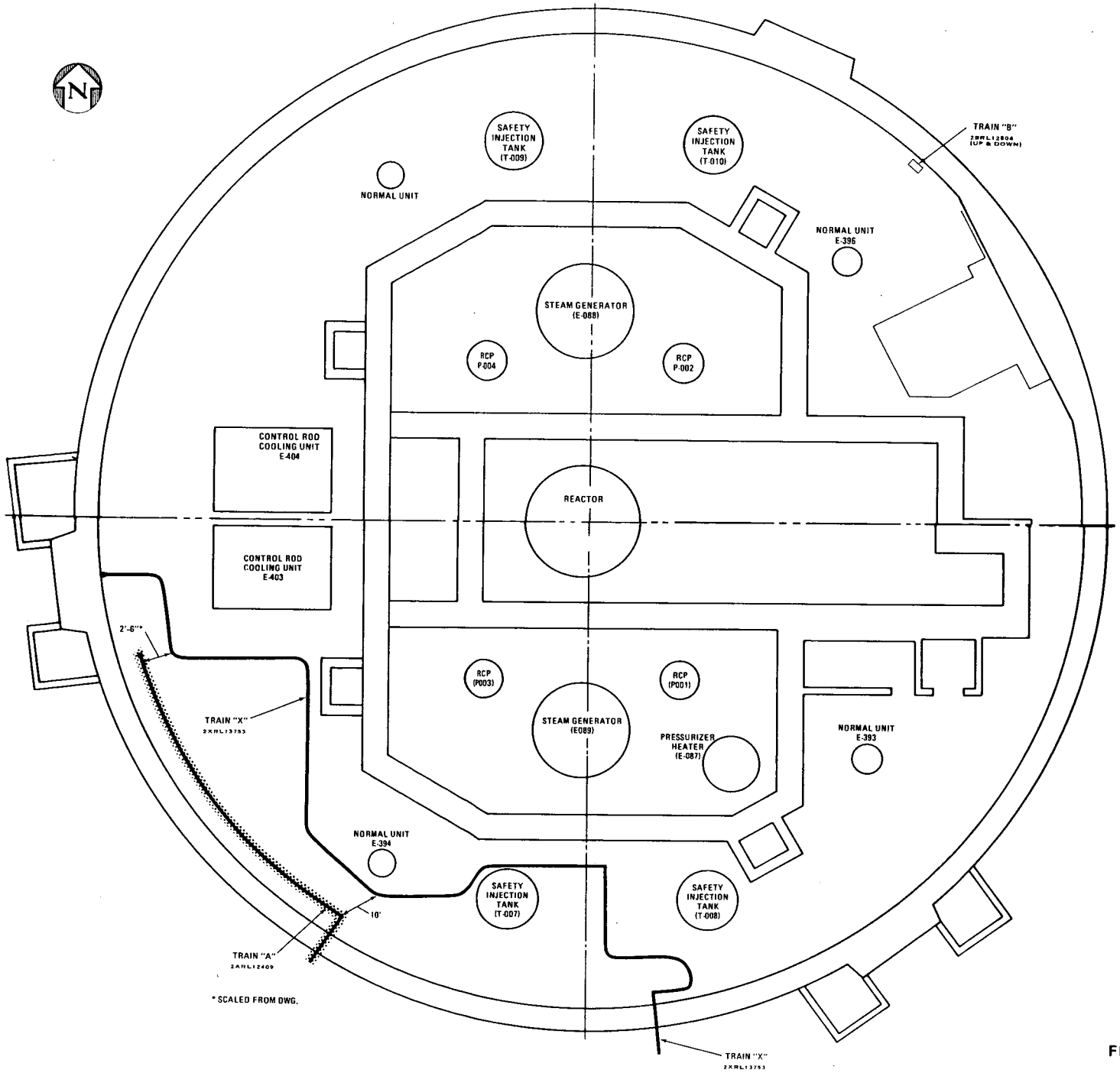
NOTE:

- ONE TRAIN REQUIRED FOR SAFE SHUTDOWN
- SEPARATION OF TRAINS A AND B INDICATED BY CROSS-HATCHING

PLAN EL. 30'-0" TO 45'-0"

FIGURE E-2. PRESSURIZER LEVEL INDICATION

REFERENCE CONDUIT AND TRAY PLANS 35143
35150
35157
35163



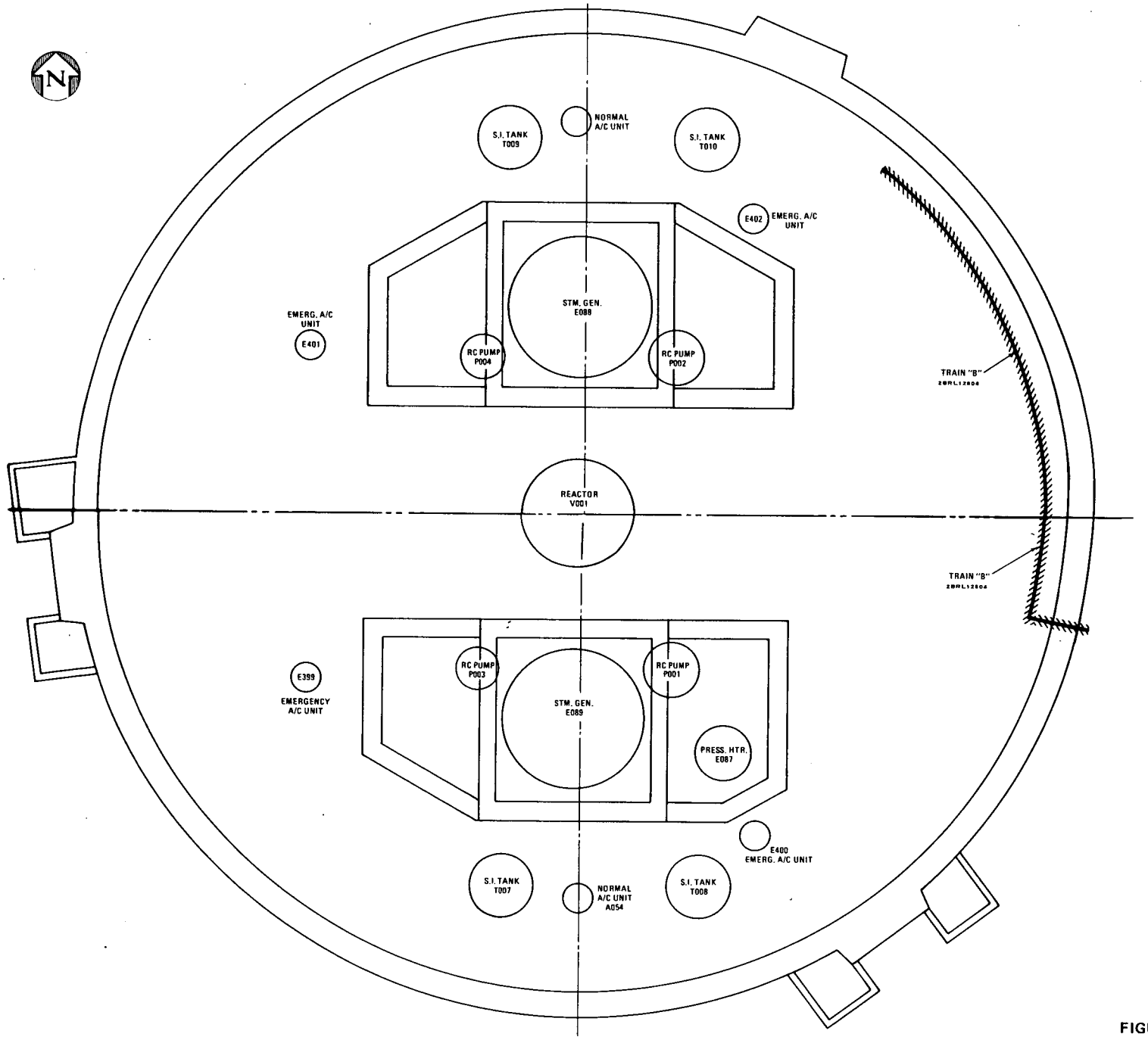
NOTE:

- ONE TRAIN REQUIRED FOR SAFE SHUTDOWN
- SEPARATION OF TRAINS A AND B INDICATED BY CROSS-HATCHING

PLAN EL. 45'-0" TO 63'-6"

FIGURE E-3. PRESSURIZER LEVEL INDICATION

REFERENCE CONDUIT AND TRAY PLANS 35144
35151
35158
35164



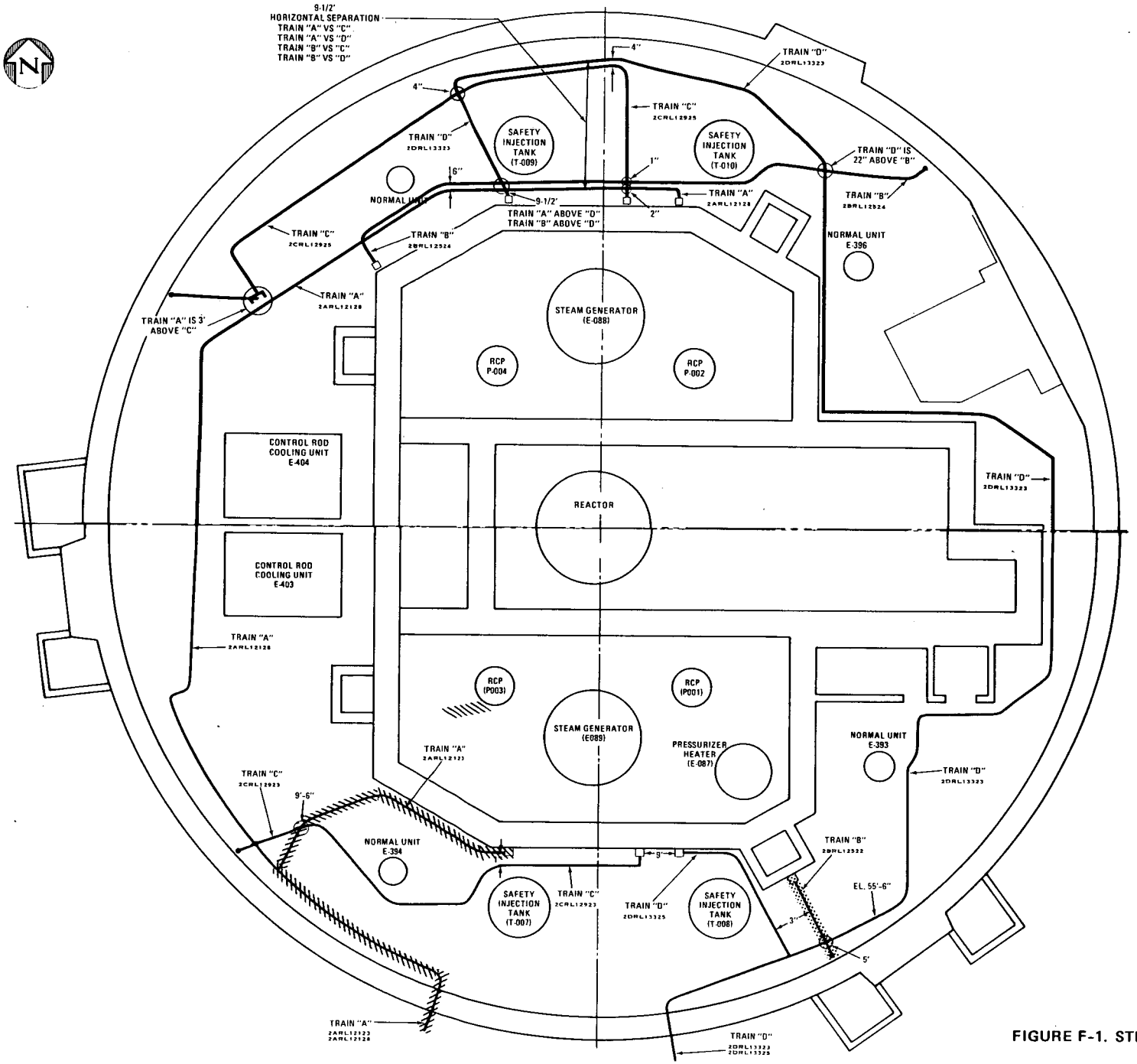
NOTE:

- ONE TRAIN REQUIRED FOR SAFE SHUTDOWN
- SEPARATION OF TRAINS A AND B INDICATED BY CROSS-HATCHING

PLAN EL. 63'-6" & ABOVE

FIGURE E-4. PRESSURIZER LEVEL INDICATION

REFERENCE CONDUIT AND TRAY PLANS 35143
35150
35157
35163



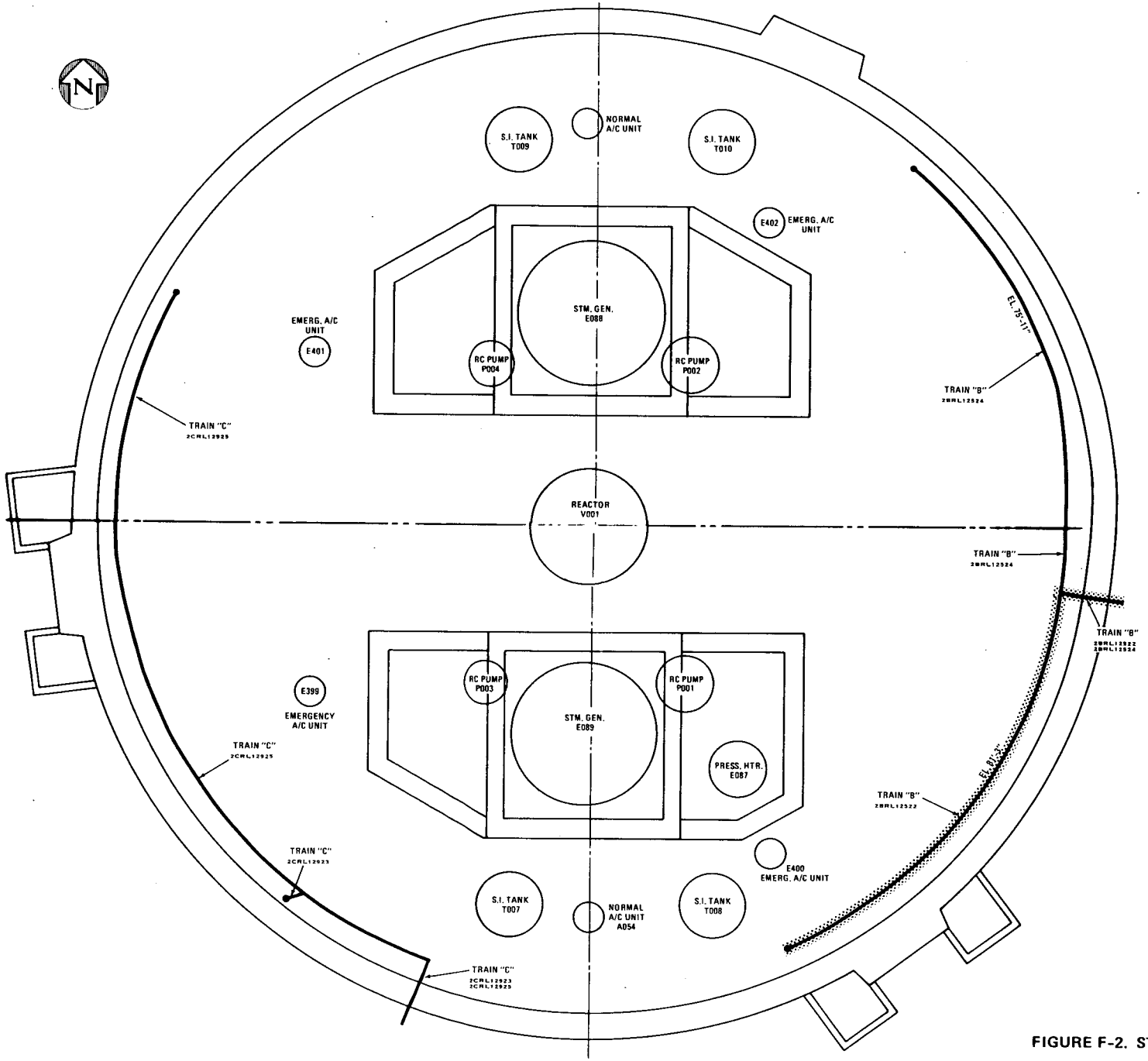
NOTE:

- ONE TRAIN REQUIRED FOR SAFE SHUTDOWN
- SEPARATION OF TRAINS A AND B INDICATED BY CROSS-HATCHING

PLAN EL. 45'-0" TO 63'-6"

FIGURE F-1. STEAM GENERATOR PRESSURE INDICATION

REFERENCE CONDUIT AND TRAY PLANS 35144
35151
35158
35164



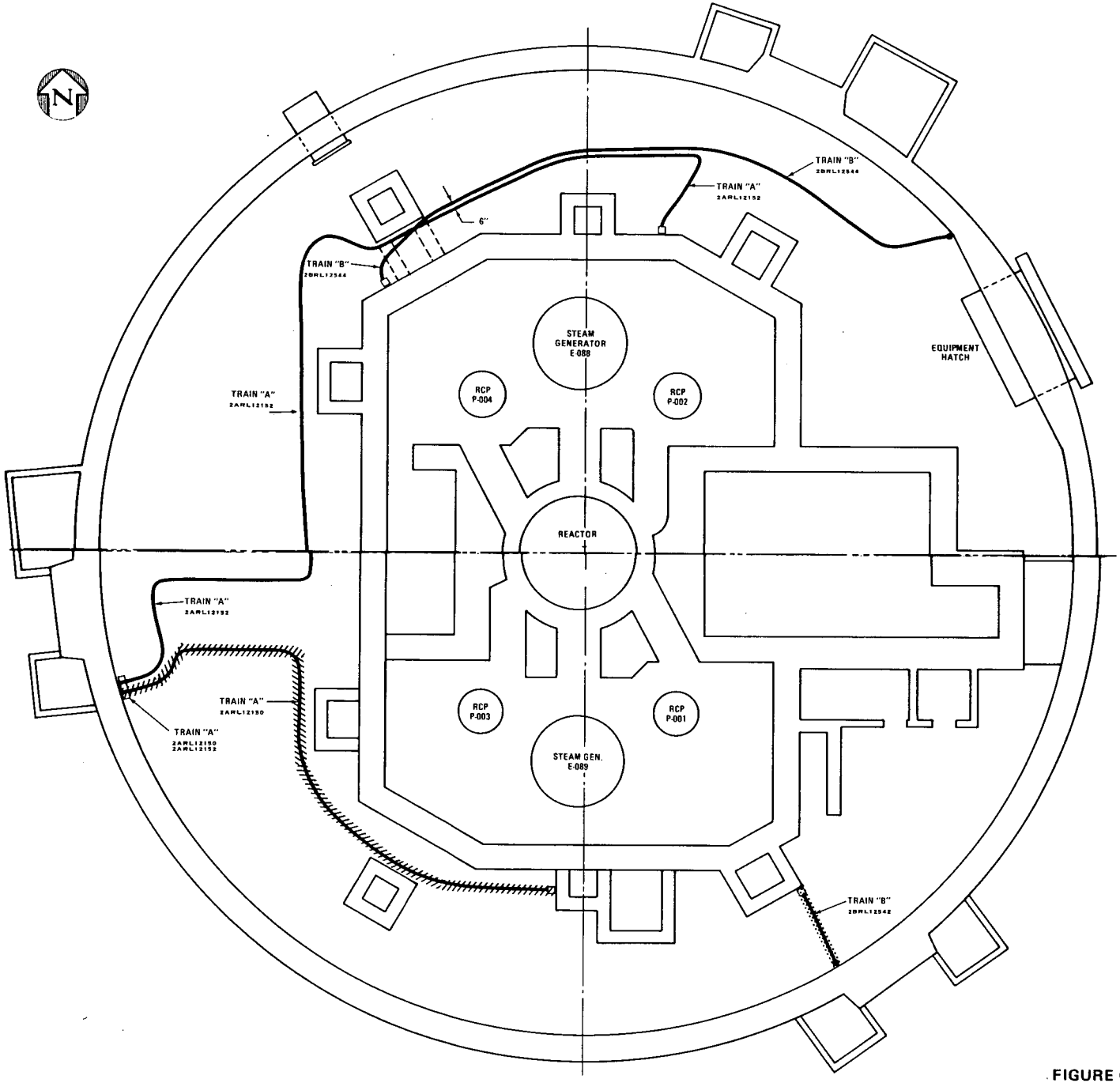
NOTE:

- ONE TRAIN REQUIRED FOR SAFE SHUTDOWN
- SEPARATION OF TRAINS A AND B INDICATED BY CROSS-HATCHING

PLAN EL. 63'-6" & ABOVE

FIGURE F-2. STEAM GENERATOR PRESSURE INDICATION

REFERENCE CONDUIT AND TRAY PLANS 35142
35149
35156
35162

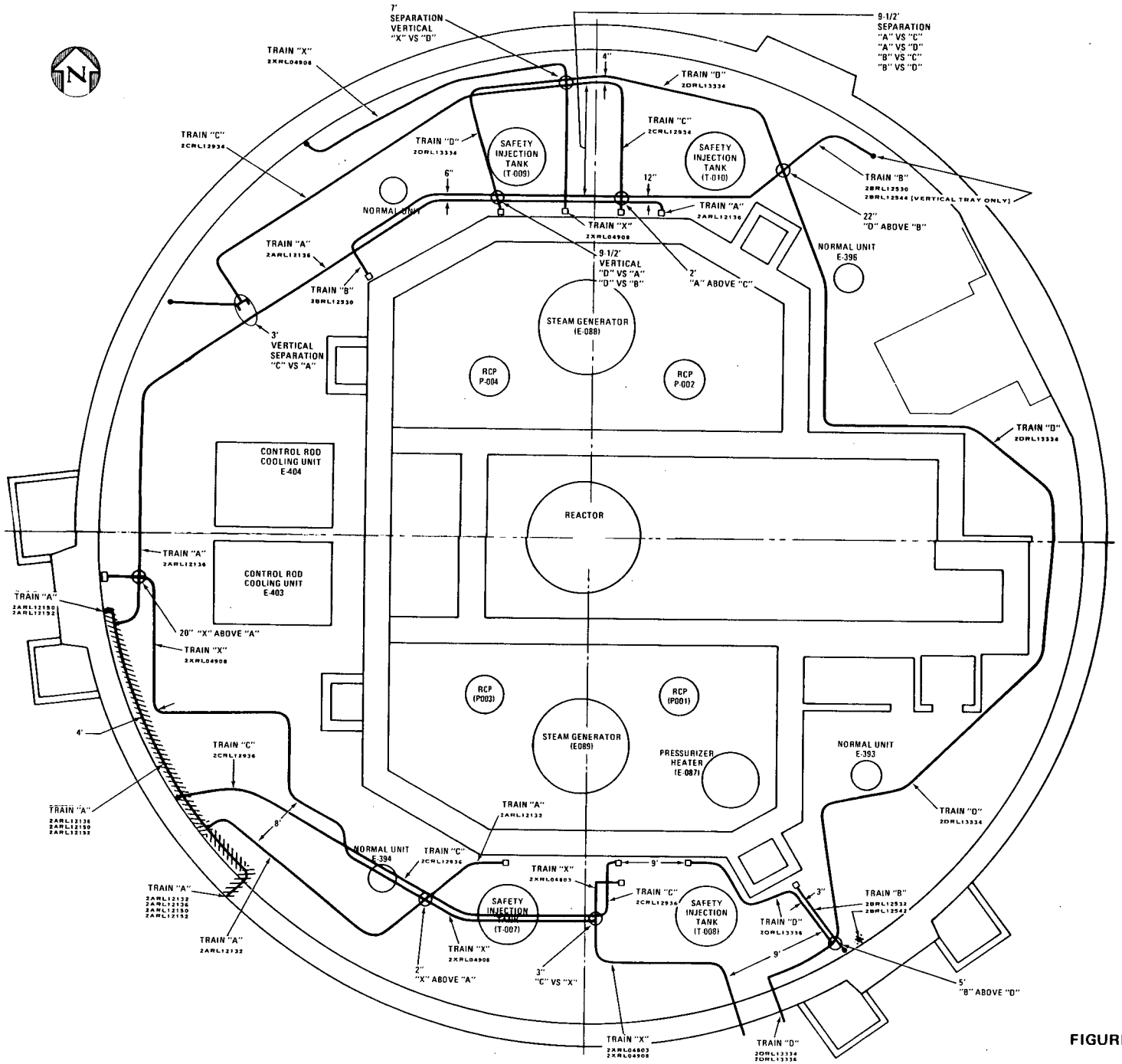


NOTE:

- ONE TRAIN REQUIRED FOR SAFE SHUTDOWN
- SEPARATION OF TRAINS A AND B INDICATED BY CROSS-HATCHING

PLAN EL. 30'-0" TO 45'-0"

FIGURE G-1. STEAM GENERATOR LEVEL INDICATION



REFERENCE CONDUIT AND TRAY PLANS 35143
35150
35157
35163

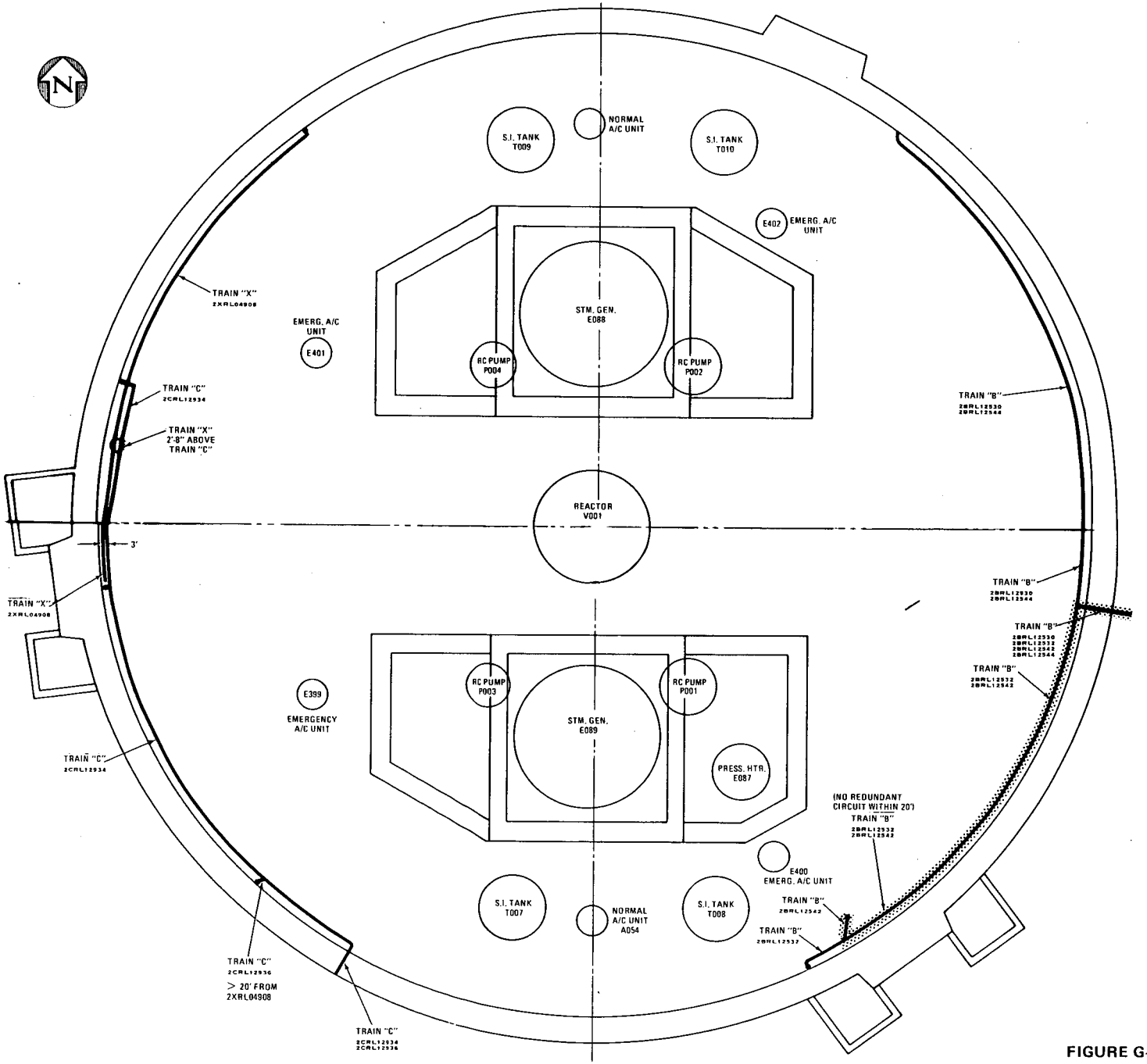
NOTE:

- ONE TRAIN REQUIRED FOR SAFE SHUTDOWN
- SEPARATION OF TRAINS A AND B INDICATED BY CROSS-HATCHING

PLAN EL. 45'-0" TO 63'-6"

FIGURE G-2. STEAM GENERATOR LEVEL INDICATION

REFERENCE CONDUIT AND TRAY PLANS 35144
35151
35158
35164



NOTE:

- ONE TRAIN REQUIRED FOR SAFE SHUTDOWN
- SEPARATION OF TRAINS A AND B INDICATED BY CROSS-HATCHING

PLAN EL. 63'-6" & ABOVE

FIGURE G-3. STEAM GENERATOR LEVEL INDICATION

Enclosure 4

LOSS OF OFFSITE POWER

I. BACKGROUND

The design basis for the San Onofre Nuclear Generating Station, Units 2 and 3 (SONGS 2 and 3) Updated FHA is Branch Technical Position APCSB 9.5-1, Appendix A (1977), Plants Under Construction, and 10 CFR 50, Appendix R, Section III, Parts G, J and O. Although Appendix A does not specify a loss of offsite power (LOOP) coincident with a design basis fire, Appendix R, Section III.L requires that alternate shutdown capability shall accommodate post-fire conditions where offsite power is not available for 72 hours. For certain fire areas, alternate shutdown capability is utilized at San Onofre such that the requirements of Section III.L apply. The following paragraphs provide justification for a deviation request for the SONGS 2 and 3 Updated FHA design basis regarding a LOOP event coincident with a design basis fire.

II. BASIS FOR ACCEPTABILITY

Given the existing SONGS 2 and 3 offsite power systems, the probability of a LOOP concurrent with a design basis fire is insignificant. The SCE and San Diego Gas and Electric (SDG&E) transmission systems are a highly reliable design, enhanced by a favorable climate in Southern California and design practices which make a disruption of power highly unlikely. There are minimal natural hazards as evidenced by practically no snow or ice, infrequent lightning storms, minimal transmission line contaminants, and an overall arid climate.

Conservative transmission facility design includes the use of self-supporting steel towers in lieu of guyed towers and full overhead ground wire protection from lightning and other aerial hazards. SCE utilizes a broken-phase wire criteria which allows the complete separation of one phase of the line without tower damage. The SCE transmission system allows for loss of two lines within the system without losing any load or generation source. The SCE and SDG&E transmission rights-of-way are separated sufficiently to preclude tower failures within one system from affecting the other system. The transmission lines from each system which serve the SONGS 2 and 3 switchyard are routed by diverse inland and coastal routes (as shown in Updated FSAR Figure 8.2-2, attached). Both SCE and SDG&E systems have structural design of transmission towers and lines based on design criteria that meet or exceed the standards of the California Public Utilities Commission.

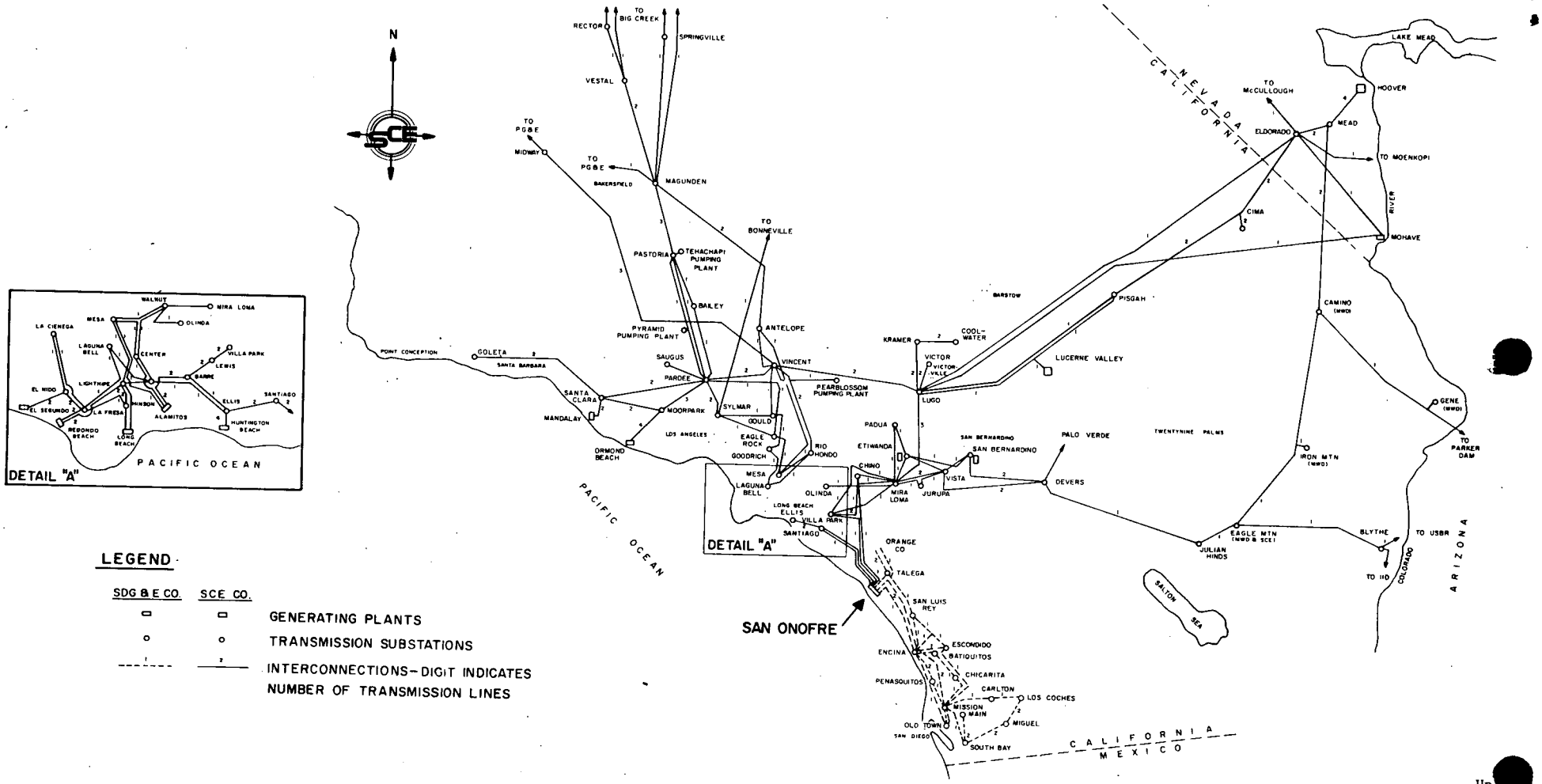
Inter-grid connections between SCE and other utilities include three-500 kV lines with Pacific Gas and Electric Company and the Pacific Intertie System, five-500 kV lines to Arizona, multiple ties with the Los Angeles Department of Water and Power, and four connections with SDG&E at San Onofre. The inter-system connections permit economical exchanges of power with neighboring utilities and provide emergency assistance when necessary. Interconnection studies have been performed in close coordination with other utilities that are members of the Western Systems Coordinating Council (WSCC). The primary purpose of the WSCC is to coordinate interconnected system planning to ensure reliable system operation.

SONGS is designed to be stable for a three-phase fault at the critical bus and simultaneous loss of two transmission lines. In the highly unlikely event of a loss of two major transmission lines and failure of associated primary relays, the sectionalized switchyard bus at SONGS would be isolated and the unit would trip in time to prevent equipment damage. Nonetheless, offsite power would still be available from the SDG&E system since four separate transmission lines serve different segments of the switchyard (i.e., four lines serve the switchyard from SCE and four from SDG&E). Each of the eight transmission lines provides sufficient capacity and reliability to ensure that safe shutdown conditions can be achieved and maintained.

The SONGS switchyard is a highly reliable, double bus design where each line is protected by two power circuit breakers. Additionally, the switchyard buses are sectionalized by circuit breakers such that any or all of the eight transmission lines serving the buses are potentially available. Control of switchyard circuit breakers for SCE and SDG&E interconnection facilities and offsite power facilities is in the SONGS control room. Electrical separation of the SCE and SDG&E systems at San Onofre is maintained by a pre-selected combination of circuit breaker operations from a separation panel.

In all its years of service, SCE has had no total blackouts. In case of a major disturbance, there are design features to automatically isolate the problem and rapidly restore loads. SCE's automatic load shedding program has been in service for 24 years and has operated successfully on 14 occasions. In addition to the load shedding program, SCE has an islanding system which separates its transmission system from those of other utilities during major disturbances to guard against a cascading power failure event. In addition, SCE maintains the capability for quick restart of generators which consists of approximately 2100 megawatts (MW) of hydro-generation and approximately 580 MW of peaking units.

Therefore, given the inherently reliable design features of the SCE and SDG&E transmission systems and based on SCE's transmission system operation experience to date, a loss of offsite power concurrent with a design basis fire at SONGS 2 and 3 is an incredible event and need not be postulated.



LEGEND

SDG&E CO.	SCE CO.	
▭	▭	GENERATING PLANTS
○	○	TRANSMISSION SUBSTATIONS
----- 1	—— 2	INTERCONNECTIONS – DIGIT INDICATES NUMBER OF TRANSMISSION LINES

SAN ONOFRE NUCLEAR GENERATING STATION
Units 2 & 3

BULK POWER GENERATION AND TRANSMISSION FACILITIES (1982)

Figure 8.2-2

Enclosure 5

Unsealed Penetrations in Heavy Concrete Walls

I. Introduction

An analysis was performed to determine if fire areas containing redundant safe shutdown components separated by heavy concrete (HC) walls with unsealed penetrations meet the separation criteria of 10 CFR 50, Appendix R, Section III.G.2. and Branch Technical Position APCSB 9.5-1. The "Industry Questions and Responses" reviewed during the NRC Regional Workshop in April, 1984 were used as a guideline for performing this analysis.

II. Basis for Acceptability

For each case analyzed, the HC wall provided a sufficient barrier to prevent the products of combustion from impairing the safe shutdown function of the redundant components in the adjacent fire area. Each fire area was found to have either a minimal amount or no fixed combustibles. To be conservative, transient combustibles were postulated in the analysis of each area; with the addition of the postulated transient combustibles, the heat rate and fire durations still remained small.

The analysis indicated the path taken by the products of combustion is tortuous, in that, flame, radiant heat, smoke, and hot gases must:

- travel an excessive distance
- pocket in the free air volume of one fire area before propagating to an adjacent fire area
- pass through penetrations in a reinforced concrete wall which range from eighteen to twenty-four inches thick
- pass through penetrations that represent a negligible percentage of the wall area

Most fire areas include an additional level of fire protection provided by either: an ionization smoke detection system, a wet pipe sprinkler system, or both. For all cases analyzed, the redundant safe shutdown train remains available such that safe shutdown conditions can be achieved and maintained in the event of a design basis fire.