The Light company Houston Lighting & Power P.O. Box 1700 Houston, Texas 77001 (713) 228-9211

May 13, 1985
ST-HL-AE-1239
PFN: G4.2

Mr. George W. Knighton, Chief
Licensing Branch No. 3
Division of Licensing
U. S. Nuclear Regulatory Commission
Washington, DC 20555

South Texas Project
Units 1 & 2
Docket Nos. STN 50-498, STN 50-499
Notes from Review Meeting with
Instrumentation & Controls Systems Branch

Dear Mr. Knighton:

During the week of March 26 through March 29, 1985, Houston Lighting & Power Company (HL&P) representatives met with members of the NRC staff in the Houston offices and at the jobsite to discuss issues and questions regarding the South Texas Project (STP) instrumentation and controls design features and program implementation.

The attachments listed below describe the details of the week's activities including agenda, attendees, summary sheets of each agenda item, list of handouts, and action items.

New agenda items which were raised and discussed during the week are also shown in Attachment 1 and are provided with a summary sheet in Attachment 3.

On March 29 the meeting was summarized and the open items and action items were listed and reviewed. This is provided in Attachment 5.

As a result of the discussions the NRC staff requested that one set of all of the drawings reviewed during the week be provided to them. One complete set of drawing packages (sub-sets) arranged by agenda items has since been provided to the NRC staff via the HL&P Bethesda licensing office during the week of April 8, 1985.

B001
1/1

W2/NRC2/m

Limited Distribution

If you should have any questions concerning this matter, please contact Mr. Michael E. Powell at (713) 993-1328.

Very truly yours,

M. R. Wisenburg
Manager, Nuclear Licensing

CAA:yd

Attachments:
(1) Meeting Agenda
(2) List of Attendees
(3) Summary Sheets for each Agenda Item
(4) Handouts
(5) Action Items Listing/Schedule

Houston Lighting & Power Company

cc:

Hugh L. Thompson, Jr., Director
Division of Licensing
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Washington, DC 20555

Robert D. Martin
Regional Administrator, Region IV
Nuclear Regulatory Commission
611 Ryan Plaza Drive, Suite 1000
Arlington, TX 76011

N. Prasad Kadambi, Project Manager
U.S. Nuclear Regulatory Commission
7920 Norfolk Avenue
Bethesda, MD 20814

Claude E. Johnson
Senior Resident Inspector/STP
c/o U.S. Nuclear Regulatory Commission
P. O. Box 910
Bay City, TX 77414

Dan Carpenter
Resident Inspector/South Texas Project
c/o U.S. Nuclear Regulatory Commission
P. O. Box 2010
Bay City, TX 77414

M. D. Schwarz, Jr., Esquire
Baker & Botts
One Shell Plaza
Houston, TX 77002

J. R. Newman, Esquire
Newman & Holtzinger, P.C.
1615 L Street, N.W.
Washington, DC 20036

Director, Office of Inspection
and Enforcement
U.S. Nuclear Regulatory Commission
Washington, DC 20555

E. R. Brooks/R. L. Range
Central Power & Light Company
P. O. Box 2121
Corpus Christi, TX 78403

H. L. Peterson/G. Pokorny
City of Austin
P. O. Box 1088
Austin, TX 78767

J. B. Poston/A. vonRosenberg
City Public Service Board
P.O. Box 1771
San Antonio, TX 78296

Brian E. Berwick, Esquire
Assistant Attorney General for
the State of Texas
P. O. Box 12548, Capitol Station
Austin, TX 78711

Lanny A. Sinkin
3022 Porter Street, N.W. #304
Washington, D. C. 20008

Oreste R. Pirfo, Esquire
Hearing Attorney
Office of the Executive Legal Director
U.S. Nuclear Regulatory Commission
Washington, DC 20555

Charles Bechhoefer, Esquire
Chairman, Atomic Safety & Licensing Board
U.S. Nuclear Regulatory Commission
Washington, DC 20555

Dr. James C. Lamb, III
313 Woodhaven Road
Chapel Hill, NC 27514

Judge Ernest E. Hill
Hill Associates
210 Montego Drive
Danville, CA 94526

Mr. Ray Goldstein, Esquire
1001 Vaughn Building
807 Brazos
Austin, TX 78701

Citizens for Equitable Utilities, Inc.
c/o Ms. Peggy Buchorn
Route 1, Box 1684
Brazoria, TX 77422

Docketing & Service Section
Office of the Secretary
U.S. Nuclear Regulatory Commission
Washington, DC 20555

ATTACHMENT 1

REVISED
SOUTH TEXAS PROJECT
ICSB REVIEW MEETING

AGENDA

Tuesday, March 26, 1985 Time 8:00 a.m. - End of Agenda

NRC Item	Subject
-	Introduction
1	Design Status
4	Electrical Distribution System
23	Loss of Instrument Power
32	Auxiliary Feedwater System
38	RCS Boration
42	VCT Level Interlock
44	CVCS Seal Injection Interlock
46	Reactor Coolant Purity Control Interlock
37	RCS Letdown
45	Letdown Valves Interlock
36	RHR System
41	RHR Interlock
26	PORV and Block Valve
39	Shutdown Outside Control Room
13	Bypass/Inop Monitoring
22	ECCS Switchover
43	Spray Additive Tank Interlock
34	Control Room HVAC
-	Summary of Day's Open Items

ATTACHMENT 1

REVISED
SOUTH TEXAS PROJECT
ICSB REVIEW MEETING

AGENDA

Wednesday, March 27, 1985 — Time 8:00 a.m. - End of Agenda

NRC Item	Subject
-	Review of Any Open Items from Previous Day
35	FHB HVAC
31	HVAC-ESF Support/Safe Shutdown Areas
21/47	Power Lockout
7	Non-IE to IE Control
48	Control System Failures
28	Common Sensing Lines
20	RCS Pressure Sensors
6	Sensing Lines/Freeze Protection
49	Control System Malfunctions due to HELB
2	Open TMI Items
3	PAM (II.F.1) Accuracies
40	QDPS Status
8	QDPS Control Functions
New	SI Signal to MSIVs (in Attachment 3, behind Item 19)
19	MSIV Failure on MSLB
18	Excessive Cooldown Protection
33	SSPS Slave Relay Undetectable Failure
14	Single Failure Criterion (RG 1.53)
30	FMEAs
27	Interlocks - Range and Accuracy
25	RCP Undervoltage and Underfrequency
New	MSIVs (in Attachment 3, behind Item 19)
-	Summary of Day's Open Items

5291N:0230N/2

ATTACHMENT 1

SOUTH TEXAS PROJECT
ICSB REVIEW MEETING

AGENDA

Thursday, March 28, 1985 — Time 7:00 a.m. - 12:45 p.m.

STP Site Visit

Time 1:30 p.m. - End of Agenda

NRC Item	Subject
-	Review of Any Open Items from Previous Day
24	P-4
17	SSPS 2/3 Testing
16	SSPS Urgent Alarm
15	Auto Shunt Trip
29	RTD Manifold FIS
5	Isolation Devices
10	Equipment Testing
11	Testing (RG 1.118)
9/12	Setpoint Methodology
New	CCW System (in Attachment 3, behind Item 49)
-	Summary of Day's Open Items

ATTACHMENT 1

SOUTH TEXAS PROJECT
ICSB REVIEW MEETING

AGENDA

Friday, March 29, 1985 Time 8:00 a.m. - 10:00 a.m.

NRC Item	Subject
-	Review of Any Open Items from Previous Day
New	ECW System (in Attachment 3, behind Item 49)
New	MFIVs (in Attachment 3, behind Item 49)
New	Testing Procedures (in Attachment 3, behind Item 49)
-	Wrap-Up/Exit

ATTACHMENT 2

Attendance Sheet

Tom Dunning	NRC/ICSB
N. Prasad Kadambi	NRC/NRR/DL
Hulbert Li	NRC/NRR/ICSB
Mary B. Moreton	Bechtel - Control Systems
Tony DiPerna	Bechtel - Control Systems
Juan Botello	Bechtel - Control Systems
Yvonne I. Williams	Bechtel - Control Systems
George Boghosian*	Bechtel - Control Systems
Uzy Giveon*	Bechtel - Control Systems
R. Paulson*	Bechtel - Control Systems
R. H. Pence *	Bechtel - Control Systems EGS
G. Jones*	Bechtel - Deputy Project Manager
M. Moiduddin	Bechtel - Electrical
J. Polu*	Bechtel - Electrical
D. F. Cherry	Bechtel - Electrical
Charles Radnoty*	Bechtel - Electrical
Fred Y. Tajaddodi	Bechtel - Electrical
John G. Singer*	Bechtel - L.A. Chief Engineer - Control Systems
Lee Barrett*	Bechtel - Mechanical
C. J. Robertson*	Bechtel - Mechanical
Wayne Varnell*	Bechtel - Mechanical
V. Starks*	Bechtel - Mechanical
Bruce D. Moreton*	Bechtel - Mechanical EGS
Paul G. Trudel*	Bechtel - Nuclear Group Supervisor
William W. Watson	Bechtel - Nuclear Licensing
Ronald L. Everett	Bechtel - Nuclear Licensing
Roger G. Smith*	Bechtel - Project Engineer - E&IC
Don H. Ashton*	Bechtel - Project Engineer - Systems
E. W. Dotson*	HL&P - Manager, Engineering
T. Crawford	HL&P - I&C Engineering
M. R. Wisenburg*	HL&P - Licensing
Mark McBurnett*	HL&P - Site Licensing
Pete VandeVisse	HL&P - Lead I&C Eng.
Michael E. Powell*	HL&P - Licensing
Charlie A. Ayala	HL&P - Licensing
Glen Lang*	W - I&C Licensing
Andrea Sterdis*	W - Licensing
Phil Marasco*	W - I&C Licensing
George Madden*	W - Process Control Engineering
Ken Slaby*	W - Systems Engineering
Jim McNamara*	W - Nuclear Control Systems Eng.
Bill Miller*	W - Nuclear Control Systems Eng.
Kathy Handerhan	W - Licensing
J. C. Mesmeringer	W - I&C Licensing

*Part-time attendees

5374N:0232N

ATTACHMENT 3

SUMMARY SHEETS FOR

EACH AGENDA ITEM

1. (7.1) Identify any plant safety related system or portion thereof, for which the design is incomplete at this time.

Resolution: See STP Response (Handout for Topic No. 1).

The status of design as far as W FCNs was questioned. BEC took an action item to review the design status list. (The item discussed in particular was the Auto Shunt Trip.)

Status: Closed (Revised list was provided.)

2. (7.1) As called for in Section 7.1 of the Standard Review Plan, provide information as to how your design conforms with the following:

a) II.D.3 - Relief and Safety Valve Position Indication

b) II.E.1.2 - Auxiliary Feedwater System Automatic Initiation and Flow Indication

c) II.K.3.10 - Proposed Anticipatory Trip Modification

In FSAR Appendix 7A, responses to NUREG-0737 requirements, the above 3 items are indicated "later." Please provide the current status.

Resolution: Handout for Topic No. 2 was provided with responses to each item.

The items were discussed, with no open items. Item a is in Am. 44. SAR changes are forthcoming; Item b will be included in Am. 46; Item c will be included in a later amendment.

Status: Closed

Action - Provide formal submittal noted above.

3. (7.5) In your response to NUREG-0737, item II.F.1 Accident Monitoring Instrumentation Position (4), (5) and (6), you have not addressed the instrument accuracy requirements. This information should be provided and justified to be adequate for their intended function.

Resolution: Approximate accuracies and functions were provided as follows:

Containment Pressure: accuracy approximately 2-3%
Function: determine potential for breach of containment

Containment Water Level: accuracy approximately ±6 inches
Function: diagnosis of LOCA

Containment Hydrogen Monitors: accuracy approximately 5%
Function: input for manual actuation of hydrogen recombiners

Status: Closed

Action - Update FSAR to include enveloping values of accuracy and functions.

4. Provide a brief overview of the plant electrical distribution
(7.1) system, with emphasis on vital buses and separation divisions
(8.3) as background for addressing various Chapter 7 concerns.
Describe the backup power source for the plant annunciator system.

Resolution: The design was reviewed using the handouts for Topic No. 4 and plant arrangements. No open issues were identified.

Status: Closed

5. (7.1) Describe design criteria and tests performed on the isolation devices in the Balance-of-plant systems. Address results of analysis or tests performed to demonstrate proper isolation between separation groups and between safety and non-safety systems.

Resolution: For QDPS, the WCAP will be available as discussed in Topic No. 40.

A handout for Topic No. 5 was provided and discussed for the remaining BOP isolators.

NRC Question: Have isolators been tested for maximum credible voltages applied to the output? (for items C, D and G on the handout.)

Status: Open Item. Provide results of tests or, if no testing has been performed, provide rationale for testing not being done.

6. (7.1) Describe features of the South Texas Units 1 and 2 environmental control system which insure that instrumentation sensing and sampling lines for systems important to safety are protected from freezing during extremely cold weather. Discuss the use of environmental monitoring and alarm systems to prevent loss of, or damage to systems important to safety upon failure of the environmental control system. Discuss electrical independence of the environmental control and monitoring system circuits. Please address your conformance with R.G. 1.151 which reflects current staff practice.

Resolution: No safety-related sensing lines require freeze protection.

RWST is inside a building (MAB). AFST level sensors are in a bunkered compartment; freeze protection is not required.

Based upon this, no further questions or issues.

Status: Closed

7. (7.1) Provide a list of any non-Class 1E control signals that provide input to Class 1E control circuits. Discuss how these non-Class 1E control signal circuits are designed so that they do not degrade the capability of safety components to perform their safety function.

Resolution: A handout was provided for discussion purposes. CCW items were deferred into the discussion of the CCW System (Thursday).

RMW System - remarks for non-essential valves item should be revised to more closely identify why there is no problem.

In general, for these interfaces, the SI overrides or SI sends to same position.

Open Item

1) Revise handout to clarify safety impact

2) Provide discussion on pressurizer heaters

3) Provide discussion on RMW isolation valves

Resolution of Open Items

1) Handout was revised and reviewed during review of CCW System. (Note: Subsequently handout was revised after the meeting and is included in Attachment 3.)
2) Further review of pressurizer heater controls/logic was provided. No unresolved issues remain.

7. (Cont'd)

3) Further review of interface to RMW isolation valves was provided. No unresolved issues remain.

Status: Closed

DRAWINGS

CCW/ECW:	P&ID'S:	9F05038	Rev. 4
		9F05017	Rev. 4
		9F05018	Rev. 4
		9F05019	Rev. 4
		9F05020	Rev. 4
		9F05021	Rev. 3
	LOGICS:	9Z42040	Rev. 3
		9Z42045	Rev. 2
		9Z42053	Rev. 2
		9Z42054	Rev. 3
		9Z42061	Rev. 2
	ELECTRICAL:	9-E-CC30-01	Rev. 2
		9-E-CC19-01	Rev. 2
		9-E-CC15-01	Rev. 3
		9-E-CC36-01	Rev. 2
		9-E-CC01-01	Rev. 2
RMW:	P&IDS:	9F05033	Rev. 2
	LOGICS:	9Z40070	Rev. 3
		9Z40071	Rev. 2
		9Z40072	Rev. 3
	ELECTRICAL:	9-E-RM01-01	Rev. 1
		9-E-RM03-01	Rev. 2

CONTROL ROOM HVAC:	P&ID'S:	9V25004	Rev. 4
		9V25005	Rev. 3
	LOGICS:	9Z40065	Rev. 0
		9Z41597	Rev. 3
		9Z41702	Rev. 2
	ELECTRICAL:	9-E-HE02-02	Rev. 1
		9-E-FP20-01	Rev. 2
		9-E-HE07-01	Rev. 2
		9-E-HE07-02	Rev. 2
RCS:	P&ID'S:	9F05003	Rev. 2 (see item 26)
	LOGICS:	9Z42151	Rev. 4
		9Z42160	Rev. 4 (see item 26)
CVCS:	P&ID'S:	9F05009	Rev. 4
	LOGICS:	9Z42401	Rev. 2
	ELECTRICAL:	9-E-CV27-01	Rev. 2
FEEDWATER:	P&ID'S:	9F00063	Rev. 3
	LOGICS:	9Z40116	Rev. 2
	ELECTRICAL:	9-E-FW07-01	Rev. 1
		9-E-FW07-02	Rev. 0
		9-E-FW07-03	Rev. 0

8. (7.1) (7.3) Discuss the computer based Qualified Display Processing System (QDPS) to perform the Class 1E control functions such as: Auxiliary feedwater control, main steam PORV control and address the conformance with IEEE-279 requirements.

Resolution: SG PORV - P&ID and OIM (operator interface module) drawings (preliminary) were reviewed as typical. Control from main control room and ASP.

AFW Control - No OIM on control board. As shown on logic for AFW regulating valve, reset capability is provided.

Conformance with IEEE-279 requirements is given in FSAR Section 7.5.6.2. Section is being updated at this time to provide more discussion of conformance.

There is a bumpless transfer between control room and ASP.

No unresolved items remained.

Status: Closed

Action - Update FSAR to amplify conformance to IEEE-279.

9. (7.1) We will request that the setpoint methodology for each Reactor Protection System (RPS) and Engineered Safeguard Features (ESF) trip setpoint values be provided for both NSSS and BOP scope of supply at the time the Technical Specifications are submitted for review. Discuss the approach you are taking to establish the basis for trip setpoints.

Resolution: Item was discussed in conjunction with Item 12. The correct equations and values will be provided in the Tech Specs.

Status: Closed. [Note: The BOP parameter setpoint values will be shown in the final Tech Specs.]

10. (7.1) Identify and justify any Balance-of-plant scope safety related equipment (other than those 6 items listed in FSAR Section 7.1.2.5) that cannot be tested during reactor operation. Include auxiliary relays and other components in the safety-related systems.

Resolution: HL&P is currently reviewing draft Tech Specs and developing surveillance testing procedures. Specific equipment which cannot be reasonably expected to be actuate-tested during operation will be identified during this time. HL&P will identify and provide justification for equipment which should not be actuate-tested during operation; this review will be completed and a list provided by September, 1985. Update to FSAR commitments will be provided as required.

Status: Closed

Action - A list of equipment which should not be actuate-tested during plant operation (according to the guidelines of Reg. Guide 1.22, position D.4) will be provided to the NRC by September, 1985.

11. (7.1) Regulatory Guide 1.118 Rev. 2, "Periodic Testing of Electrical Power and Protection Systems", endorsed IEEE Standard 338-1977, "Criteria for the Periodic Testing of Nuclear Power Generating Station Safety System". This guide reflects current NRC staff practice. FSAR Section 7.1.2.11 only stated conformance to IEEE Std. 338-1971. Please address your conformance to this guide.

Resolution: A response to Q430.14N was provided (by Handout). This response will be provided formally in Amendment 45. Surveillance test program development is expected to identify areas where design changes or exceptions would be needed. Draft procedures will be finished by the 1st quarter of 1986. Any exceptions or clarifications would be identified as changes to the FSAR; design changes would be made where feasible. (HL&P has committed to conform to the intent of R.G. 1.118; however, STP was not designed to meet Rev. 2 of R.G. 1.118.)

Status: Closed

12. (7.1) FSAR Table 3.12 Note 28 states that instrument spans and setpoints are discussed in Sections 7.2.7.5 and in the Technical Specifications. However, there is no section 7.2.7.5 in FSAR. Please address your conformance with R.G. 1.105 on instrument setpoints. This guide reflects current NRC staff practice.

Resolution: FSAR table in Section 3.12 will be corrected to show proper reference sections, i.e., 7.1.2.1.9 and 7.2.2.2.1.

STP is using the W Statistical Setpoint Methodology. Results of this methodology will be reflected in the Tech Specs. Similar methodology will be used for safety-related BOP setpoints.

A handout for Topic No. 12 was provided listing the W scope setpoints covered by this methodology.

NRC wants to see the output tables of the setpoint methodology (not Tech Spec tables, but methodology tables).

Status: Closed. [Note: a copy of the output tables (channel error allowances) will be made available at the HL&P Bethesda Licensing Offices.]

Action - correct references in Section 3.12.

13. FSAR Table 3.12 states the STP design conforms to the intent of
(7.1) R.G. 1.47, rather than conforms to R.G. 1.47. Use schematic and
(7.5) panel layout drawings to discuss your design of the bypass and inoperable status monitoring system.

Resolution: This table will be revised to state we conform to RG 1.47. ESF status monitoring drawings were reviewed.

Status: Closed

Action - Update FSAR Table 3.12.

DRAWINGS:	Indicator Light Panels:	9-Z-47528 Sh. 1	Rev. 1
		9-Z-47528 Sh.1-1	Rev. 0
		9-Z-47528 Sh.1-2	Rev. 0
	Logics:	9-Z-41810	Rev. 2
		9-Z-41811	Rev. 2
		9-Z-41812	Rev. 2

14. (7.1) (7.2) FSAR Table 3.12 states that STP design conforms to the intent of R.G. 1.53, rather than conforms to R.G. 1.53. Use schematic drawings to discuss your design of plant protection systems with respect to the R.G. 1.53 recommendations.

Resolution: BOP conforms to R.G. 1.53, in that BOP safety-related systems (1E) conform to R.G. 1.53. W uses alternate approach (see Section 7.1.2.7).

Status: Closed

15. (7.2) Using detailed plant design drawings, discuss the reactor trip breaker and undervoltage relay testing procedures, and the capability of independent verification of the operability of reactor trip breaker shunt and undervoltage coils.

Resolution: Bypass breaker position indication lights are provided in the control room, as shown on design drawings.

Generic Letter 83-28: Next submittal to NRC is scheduled for June, 1985.

Status: Closed (subject to response to Generic Letter 83-28)

DRAWINGS:

Logic: 9Z42110 Rev. 4

Electrical: 9-E-SP18-01 Rev. 1

16. Describe the Solid State Logic Protection System Urgent Alarm
(7.2) logic which was shown on FSAR Fig. 7.2-2.

Resolution: Covered with Item 17

Status: Closed

17. (7.2) Describe the reactor trip logic when 2/3 actuation trains or safeguards test cabinets are inadvertently tested simultaneously (refer to FSAR statement in Section 7.3.1.2.2.5.1).

Resolution: Using Handout for Topic No. 17 a description of the circuit was provided. There were no open items regarding the logic.

Status: Closed. [Note: A copy of the SSPS and Safeguards Test Cabinet Technical Manuals will be made available at the HL&P Bethesda Licensing offices.]

18. Using schematic drawings, discuss the excessive cooldown protection system (refer to FSAR Figure 7.2-9 and Table 7.1-2).
(7.2)
(7.3)

Resolution: No credit was taken in FSAR Chapter 15 analyses for the low-low compensated T_{cold}, which is an anticipatory feature provided for commercial considerations to avoid extra stress on equipment. Sensors are fast-response RTD's in the RCS loop (not manifold).

Status: Closed

19. (7.3) Your response to 032.11 does not address the signal that would assure the closure of turbine stop valves or any other steam valves for an MSLB, should the MSIV fail to close. Please discuss this concern.

Resolution: STP specific analysis has been performed to address blowdown of two SG's following a MSLB. Because STP has 3 trains of safety injection, the Chapter 15 analyses bound this case of failure of an MSIV after a MSLB.

Copy of letter given to NRC (ST-HL-AE-1124, dated 9/28/84)

The staff asked that an item be added to the agenda for a review of the MSIV closure on SI and controls. See next two pages.

Status: Closed

NEW ITEM

SI SIGNAL TO MSIV's

Discussion

The MSIV's are isolated by the SI signal for two reasons: 1) Isolation on an SI signal will give less mass/energy/radiation release to secondary system, and 2) internal W criteria (since modified) on subcriticality. The NRC noted that spurious actuations of the MSIV's would possibly result in commercial considerations.

For SGTR, the main steam bypass valve could be used to allow steam dump and cooldown.

Some concern could be raised on more frequent MSIV closures, potentially resulting in more safety valves lifting and possibly sticking, over-pressurization of the SG, weakening of the SG tubes, etc.

RSB apparently has same concern.

Resolution: Concern noted. No further formal action. HL&P will take under advisement.

Status: Closed

NEW ITEM

MSIV CIRCUIT

Resolution: Using design drawings, the MSIV operation was discussed. During review of the MSIV schematic, concern was raised about a possible failure detection in the circuit, specifically in the "open permissive" switch contact remaining closed. This closed contact is not detected during block testing, and would only be detected during the actuate test, which is performed at a less frequent interval. This closed contact would prevent the safeguards signal of its train from effecting closure of the MSIV.

Status: Open Item. Address potential failure detection.

DRAWINGS:

Logic: 9Z40076 Rev. 3

Electrical: 9-E-MS13-01 Rev. 1
9-E-MS13-02 Rev. 1
9-E-MS13-03 Rev. 1

20. Your response to Q32.29 is inadequate. Using instrument layout
(7.2) drawings, discuss conformance of the RCS pressure sensors, which
(7.6) are located outside the containment, to the recommendations of R.G. 1.11 - Instrumentation Lines Penetrating Reactor Containment.

Resolution: Response to Q32.29 references Section 7.6, which refers to Section 6.2.4 for containment isolation provisions. In Section 6.2.4, it states that the RCS pressure sensors are handled in a manner similar to the containment pressure sensors, i.e., using double bellows design and hydraulic isolators.

The equipment drawings were reviewed, showing the design. No open items.

Status: Closed

21. (7.3) Using schematic drawings, discuss the power lockout design for certain ESF system valves which are listed in your response to Q32.32.

Resolution: A) CCW valves - The design and circuit were reviewed. Power lockout for spurious actuation due to flooding is not required because of circuit design. Power lockout is retained however. Question response for Q32.32 will be revised to delete these valves. No open items (FSAR change to follow).

B) Accumulator isolation valves - The design and circuit were reviewed. The annunciator and bypass/inop alarms were reviewed.

C) Hot leg isolation valves - see item 47

Open Items

1. Provide discussion on power lockout breaker motor
2. Provide discussion on need for bypass/inop of power lockout

Resolution of Open Items

1. Switches for breaker motor are snap-action. Indication and breaker actual position are the same. No further questions or issues were raised.

2. Power lockout and valve positions are monitored frequently (draft Tech Specs were also examined).

21. (Cont'd)

Status: Closed

Action - Revise formal response to Q32.32.

DRAWINGS:

P&IDS:	9F05018	Rev. 4	(CCW)
	9F05013	Rev. 3	(SI)
	9F05014	Rev. 3	(SI)
	9F05015	Rev. 3	(SI)
	9F05016	Rev. 3	(SI)
	9F20000	Rev. 3	(SI)
Logics:	9Z42043	Rev. 2	(CCW)
	9Z42005	Rev. 3	(SI)
	9Z42028	Rev. 4	(SI)
	9Z42029	Rev. 4	(SI)
Electrical:	9-E-CC26-01	Rev. 2	
	9-E-SI03-01	Rev. 2	
	9-E-SI34-01	Rev. 2	
	9-E-SI14-01	Rev. 1	
	9-E-SI14-02	Rev. 1	

22. Using schematic drawings, discuss the automatic switchover design
(7.3) from ECCS injection mode to recirculation mode. Address the
(7.6) design in conformance with the IEEE Std. 279 requirements.

Resolution: The system design was reviewed with no open items.

Status: Closed

DRAWINGS:

<u>P&ID's</u>

9F05013	Rev. 3
9F05014	Rev. 3
9F05015	Rev. 3

<u>Logics</u>

9Z42001	Rev. 2
9Z42002	Rev. 3
9Z42004	Rev. 2
9Z42114	Rev. 5
9Z42115	Rev. 4
9Z42117	Rev. 3
9Z42123	Rev. 2

22. (Cont'd)

Elementary

9-E-SI04-01 Rev. 2

9-E-SI07-01 Rev. 1

9-E-SI08-01 Rev. 2

9-E-SI09-01 Rev. 2

9-E-SI11-01 Rev. 1

9-E-SI12-01 Rev. 2

23. (7.5) Please provide the response to Q32.42 on IE Bulletin 79-27 concerns.

Resolution: The response was reviewed and a copy of the response given to the NRC reviewers. No open items were identified.

Status: Closed

Action - Submit formal response to Q32.42. (Completed by Letter ST-HL-AE-1220, dated April 3, 1985.)

24. (7.3) Discuss the testing provision in the engineered safety feature P-4 interlocks.

Resolution: P-4 is reactor tripped interlock. The concern is based on a W reportable deficiency. HL&P is currently developing surveillance testing procedures. HL&P has some concerns relative to the W proposed solution (voltmeter).

Status: Open Item. NRC position is that new plants must have permanently installed test features. HL&P will address this concern by July 15, 1985, as noted in Attachment 5.

25. (7.2) Using instrument installation drawings, discuss the sensors installation and signal cable routing arrangement for RCP undervoltage and underfrequency measurements and their conformance to safety grade requirements.

Resolution: Cubicles for the RCP UV/UF relays are Class 1E. The pump switchgear is non-Class 1E.

Status: Closed

DRAWINGS:

Logic: 9Z42111 Rev. 4

Electrical: 9-E-SP28-01 Rev. 0

Vendor: 14926-4151-01016-AGX

Single Line: 9-E-PCAA-01 Rev. 2

26. Using schematic drawings, describe the design of pressurizer PORV
(7.2) control and the block valve control, and verify that no single
(7.6) failure will preclude the automatic actuation logic for all modes of operation.

Resolution: Westinghouse and Bechtel went through the design with no open items.

Status: Closed

DRAWINGS:

P&IDs

9F05003	Rev. 2

Logics

9Z42160	Rev. 4
9Z42155	Rev. 4

Elementary

9-E-RC13-01	Rev. 2
9-E-RC05-01	Rev. 0

27. (7.2) Please expand Table 7.2-3 to include typical ranges and trip accuracy for protection system interlocks P6, P7, P8, P9, P10, and P13.

Resolution: Westinghouse recommends leaving this information in the Tech Specs rather than adding to Table 7.2-3. Interlock ranges and trip accuracies are specifically addressed in the Tech Spec Table 3.3-4. NRC agrees to review this information with the Tech Specs.

Status: Closed

28. Identify where instrument sensors or transmitters supplying
(7.2) information to more than one protection channel are located in
(7.3) a common instrument line or connected to a common instrument tap. The intent of this item is to verify that a single failure in a common instrument line or tap (such as break or blockage) cannot defeat required protection system redundancy.

Resolution: See response to Q32.45 (Item 48)

Different protection channels only applies to loop flow transmitters, which is addressed in response to QC32.45.

No BOP sensors/transmitters in this issue.

Status: Closed

29. (7.2) FSAR Fig. 5.1-2 indicates that the flow indicator (FIS) for RCS bypass loop RTD manifold is located outside the containment. Please address that the design is in conformance with R.G. 1.11 "Instrument lines penetrating primary reactor containment." Also please verify that technical specifications will include surveillance requirements for these indications. (Ref: IE Information Notice 83-65).

Resolution: Symbol on P&ID is for shielding, not containment wall. The location drawings were reviewed to show that these devices are inside containment.

Tech Specs is not the proper place to address surveillance requirements for these instruments.

HL&P is committed to inclusion of surveillance requirements (addressing IE Information Notice 83-65) in the STP preventive maintenance program.

Status: Closed

DRAWINGS:

P&ID:	9F05002	Rev. 2
Instrument Piping:	9Z00209	Rev. 5
	9Z00210	Rev. 6
	9Z00211	Rev. 3
	9Z00212	Rev. 5

30. (7.3) Provide Failure Modes and Effects Analyses on the ESFAS as by R.G. 1.70 "Standard Format and Content of FSAR". Please note that the FMEA of the ESFAS should be addressed on actuation system including the NSSS & BOP scope of supply. The interfaces with power sources, instrument air system and the cooling water system to vital equipment should also be addressed. In Amendment 41 Section 7.3.2.1, there was a statement on this subject, however, in Amendment 43, that section and Tables 7.3-12, 13 and 14 were deleted. The staff finds that this further deviates from the R.G. 1.70 requirements.

Resolution: Amendment 43 - W and BOP FSAR sections are split.
7.3.1 - W ESFAS
7.3.2 - Control Room HVAC ESFAS
7.3.3 - Fuel Handling Building HVAC ESFAS

BOP FMEA's cover loss of power, failure of air supply, etc. (Handout for Topic No. 30 lists FMEA's)

Concern: The ICSB raised a question concerning WCAP's on the FMEAs which relate to 2 train (not 3 train) design being applicable to STP. The NRC requested additional 3 train information.

30. (Cont'd)

Westinghouse subsequently addressed the question of FMEA WCAP applicability to STP. Using overviews (handout), Westinghouse reviewed the 2 train SSPS design for safeguards components and for reactor trip breakers. For STP, the reactor trip function is handled in the same way, except R = A and S = B. For safeguards components, the voting logics in R and S each drive up to 3 relay drivers, one for each actuation train (A, B and C). The relay drivers then interface with master relays, which then interface with slave relays. Reliability is improved in that testing of a logic train leaves all 3 actuation trains operable; testing of an actuation train leaves both logic trains and the other actuation trains operable.

The hardware used is the same; it is tested in a similar fashion. The only real difference is an additional contact used in actuating the slave relays.

The SSPS design drawings were reviewed, including provisions for testing, separation, etc.

Based upon this review, the WCAP is seen by the staff reviewers as applicable to STP.

Status: Closed.

Action Item: Reference the WCAPs in Chapter 7, with justifying words for applicability. Address interface criteria being met also.

31. (7.3) (7.4) Using detailed drawings, describe the ventilation systems used to support engineered safety features areas including areas containing systems required for safe shutdown. Discuss the design bases for these systems including redundancy, testability, etc.

Resolution: The systems (listed in Handout for Topic No. 31) were reviewed with P&ID's and logics.

No open items were identified.

The staff asked that an item be added to the agenda for an overview of the ECW system.

Status: Closed

DRAWINGS:

P&ID'S:	9V10001	Rev. 4
	9V10002	Rev. 3
	9V10020	Rev. 3
	9V10003	Rev. 4
	9V00008	Rev. 4
	9V10004	Rev. 3
	9V00009	Rev. 3
	9V00012	Rev. 3
	9V25008	Rev. 4
	9V00013	Rev. 3
	9V00015	Rev. 4
	9V00017	Rev. 4
	9V00016	Rev. 3
	9V00027	Rev. 4

31. (Cont'd.)

Logics:	9-Z-41553	Rev. 3
	9-Z-41554	Rev. 3
	9-Z-41724	Rev. 2
	9-Z-41725	Rev. 1
	9-Z-41726	Rev. 1
	9-Z-41570	Rev. 1
	9-Z-41592	Rev. 2
	9-Z-41593	Rev. 1
	9-Z-41634	Rev. 2
	9-Z-41621	Rev. 3
	9-Z-41622	Rev. 1
	9-Z-41674	Rev. 2
	9-Z-41675	Rev. 2
	9-Z-41630	Rev. 3
	9-Z-41657	Rev. 3
	9-z-41572	Rev. 3
	9-Z-41703	Rev. 2
	9-Z-41573	Rev. 3
	9-Z-41700	Rev. 2
	9-Z-41581	Rev. 3
	9-Z-41708	Rev. 1
	9-Z-41705	Rev. 1
	9-Z-41770	Rev. 0
Electrical:	9-E-HM08-01	Rev. 2
	9-E-HM12-01	Rev. 2
	9-E-HM18-02	Rev. 2
	9-E-HM19-01	Rev. 2

31. (Cont'd.)

Electrical (Cont'd)	9-E-HM18-01	Rev. 2
	9-E-HM20-01	Rev. 2
	9-E-HM17-01	Rev. 2
	9-E-HM22-01	Rev. 2
	9-E-HC01-01	Rev. 2
	9-E-HC01-02	Rev. 2
	9-E-HG01-01	Rev. 2
	9-E-HG01-02	Rev. 1
	9-E-HZ01-01	Rev. 2
	9-E-HZ02-01	Rev. 2
	9-E-HZ03-01	Rev. 1
	9-E-HC11-01	Rev. 2
	9-E-HC12-01	Rev. 1
	9-E-HC13-01	Rev. 2
	9-E-HC14-01	Rev. 1
	9-E-HC28-01	Rev. 2
	9-E-HE09-01	Rev. 1
	9-E-HE03-01	Rev. 2
	9-E-HE09-02	Rev. 2
	9-E-HE11-03	Rev. 1
	9-E-HE11-01	Rev. 0

32. (7.3) (7.4) Using detailed system schematic drawings, describe how the auxiliary feedwater system design meets the requirements of NUREG-0737, item II.E.1.2. Include the following information in the discussion:

a) the effects of all switch positions on system operation.

Status - no open issues identified

b) the effects of single power supply failures on auxiliary feedwater control after automatic initiation circuits have been reset in a post accident sequence.

Status - no open issues identified

c) the interface between non-safety-grade manual speed control for the AFW pump turbine to the safety grade initiation system.

Action - Update FSAR and Drawings (Logic and Elementary)

d) the adequacy of steam supply to the turbine driven auxiliary feedwater pump which is supplied by a single main steam line.

Status - no open issues identified

e) any bypasses within the system.

Status - no open issues identified

f) the water sources of the auxiliary feedwater system and the capability to transfer from one source to the other.

32. (Cont'd)

Resolution: The AFST is the single source of water.

Status - No open issues identified

g) design features provided to terminate auxiliary feedwater flow to a steam generator affected by either a steam line or feed line break.

Resolution: Operator action to trip pumps within 30 minutes.

Status - no open issues identified

h) system features associated with shutdown from outside the control room.

Status - no open issues identified

Resolution: The design was reviewed using system design drawings. Responses to items specifically questioned earlier by NRC are noted above. No open issues for item a, b, d, e, f, g, and h were identified. BEC took an action item to update the FSAR to reflect design changes for the auxiliary feedwater turbine driven pump control and provide logics and elementaries to the NRC.

Status: Closed

Action - The FSAR will be revised to reflect the auxiliary feedwater turbine control design. Updated drawings will be provided as part of Section 1.7 package.

DRAWINGS

P&ID	9F00024	Rev. 4
	9F00020	Rev. 5
LOGICS	9Z40131	Rev. 2
	9Z40132	Rev. 2
	9Z40133	Rev. 2
	9Z40134	Rev. 2
	9Z40140	Rev. 1
	9Z40142	Rev. 0
	9Z40136	Rev. 2
	9Z40141	Rev. 2
ELEMENTARY	9-E-AF01-01	Rev. 1
	9-E-AF06-01	Rev. 1
	9-E-AF08-01	Rev. 2
	9-E-AF13-01	Rev. 1
	9-E-AF05-01	Rev. 1
	9-E-AF14-01	Rev. 1
	9-E-AF03-01	Rev. 2
	9-E-AF07-01	Rev. 2

33. (7.3) On August 6, 1982, Westinghouse notified the staff of a potential undetectable failure in online tests circuitry for the master relays in the engineered safeguards systems. The undetectable failure involves the output (slave) relay continuity proving lamps and their associated shunts provided by test pushbuttons. If after testing, a shunt is not provided for any lamp because of a switch contact failure, any subsequent safeguards actuation could cause the lamp to burn out before its associated slave relay is energized. This would then prevent actuation of any associated safeguards devices for that slave relay. Until an acceptable circuit modification is designed, Westinghouse has provided test procedures that ensure that the slave relay circuits operate normally when testing of the master relays is completed. Discuss this issue as applied to South Texas Units 1 and 2.

Resolution: W discussed the undetectable failure issue as it applies to STP.

No open items for ICSB; HL&P committed to incorporating the W wiring fix.

FCN's will be issued in April, 1985.

Status: No open item for ICSB; HL&P to update response for 50.55e item.

34. Using detailed plant design drawings, discuss the control room
(7.3) HVAC system.

Resolution: The system was reviewed using P&ID's and logics.

No open items were identified.

Status: Closed

DRAWINGS:

P&ID'S:	9F25003	Rev. 4
	9F25004	Rev. 5
	9F25005	Rev. 4
Logics:	9-Z-41901	Rev. 2
	9-Z-42124	Rev. 3
	9-Z-41571	Rev. 2
	9-Z-41587	Rev. 3
	9-Z-41707	Rev. 2
	9-Z-41706	Rev. 0
	9-Z-41597	Rev. 3
	9-Z-41599	Rev. 2
	9-Z-41594	Rev. 2
	9-Z-41574	Rev. 3
	9-Z-41575	Rev. 2

34. (Cont'd.)

Logics (Cont'd)	9-Z-41595	Rev. 3
	9-Z-41598	Rev. 3
	9-Z-41596	Rev. 2
	9-Z-41702	Rev. 2
Electrical:	9-E-HE14-01	Rev. 2
	9-E-HE14-02	Rev. 2
	9-E-HE17-01	Rev. 0
	9-E-HE02-02	Rev. 1
	9-E-HE06-01	Rev. 1
	9-E-HE04-01	Rev. 2
	9-E-HE05-01	Rev. 2
	9-E-HE15-01	Rev. 2
	9-E-HE01-01	Rev. 1
	9-E-HE05-02	Rev. 1
	9-E-HE02-01	Rev. 2
	9-E-HE07-01	Rev. 2
	9-E-HE07-02	Rev. 2

35. (7.3) Using detailed plant design drawings, discuss the Fuel Handling Building HVAC system.

Resolution: The system was reviewed using P&ID's and logics.

No open items were identified.

Status: Closed

DRAWINGS:

P&ID'S:	9V00012	Rev. 4
	9V00013	Rev. 2
Logics:	9-Z-41903	Rev. 2
	9-Z-42125	Rev. 2
	9-Z-41601	Rev. 2
	9-Z-41602	Rev. 2
	9-Z-41617	Rev. 1
	9-Z-41609	Rev. 1
	9-Z-41608	Rev. 1
	9-Z-41618	Rev. 2
	9-Z-41600	Rev. 2
	9-Z-41614	Rev. 3
	9-Z-41741	Rev. 1
	9-Z-41740	Rev. 2

35. (Cont'd.)

Electrical:	9-E-HF05-01	Rev. 2
	9-E-HF06-01	Rev. 2
	9-E-HF11-02	Rev. 2
	9-E-HF07-02	Rev. 2
	9-E-HF07-01	Rev. 1
	9-E-HF03-01	Rev. 2
	9-E-HF12-01	Rev. 1
	9-E-HF18-01	Rev. 2

36. (7.4) (7.6) Using detailed plant design drawings, discuss the residual heat removal system inlet isolation valves power sources and interlocks arrangements. Since all three RHR loops are located inside the containment, please demonstrate the operability of the RHR system assuming a single failure. What is the design basis for RHR system safety function capability? If only one RHR train is available, what is the impact on long term cooling?

Resolution: BEC went through the P&IDs, logics, and schematics, with no open items. There is no automatic actuation of the RHR pumps and they are not required for safety injection.

Status: Closed. (Power lockout addressed by Topic No. 21/47)

DRAWINGS:

P&ID's

9F20000	Rev. 3

Logics

9Z42180	Rev. 4
9Z42181	Rev. 2
9Z42182	Rev. 4
9Z42183	Rev. 3
9Z42185	Rev. 3

Elementary

9-E-RH05-01	Rev. 1
9-E-RH04-01	Rev. 2
9-E-RH03-01	Rev. 1
9-E-RH02-01	Rev. 2
9-E-RH08-01	Rev. 2
9-E-RH01-01	Rev. 2

37. (7.4) Using detailed plant drawings, discuss RCS letdown capability including the reactor vessel head vent system.

Resolution: The drawings were reviewed with no open items.

Status: Closed

DRAWINGS:

	Normal/Excess Letdown		Head Vent	
P&ID	9F05005	Rev. 4	9F05001	Rev. 3
	9F05006	Rev. 2	9F05004	Rev. 2
Logics	9Z42408	Rev. 3	9Z42163	Rev. 3
	9Z42411	Rev. 3		
	9Z42410	Rev. 3		
Elementary	9-E-CV13-01	Rev. 2	9-E-RC19-01	Rev. 1
	9-E-CV13-02	Rev. 2		
	9-E-CV12-01	Rev. 2		
	9-E-CV12-02	Rev. 1		
	9-E-CV29-01	Rev. 1		
	9-E-CV32-01	Rev. 1		

38. (7.4) Using detailed plant drawings, discuss the boration of RCS for all modes of operation.

Resolution: Using system design drawings, the design for RCS boration was reviewed with one open concern identified.

Status: Closed - STP analysis on boron dilution is ongoing and due to be complete in mid-August 1985. (This is an open issue with RSB.)

DRAWINGS:

P&IDs

9F05005	Rev. 4
9F05007	Rev. 4
9F05009	Rev. 4

39. (7.4) Using detailed plant drawings, discuss the safe shutdown from outside the control room. Address the design in conformance with GDC-19.

Resolution: Safe shutdown from outside the control room was discussed. No open items were identified.

Status: Closed

DRAWINGS:

Equipment Layout

5Z349Z44511	Rev. 1
5Z349Z44512	Rev. 1
4Z359Z44532	Rev. 1
4Z359Z44533	Rev. 2
4Z359Z44534	Rev. 1
4Z359Z44535	Rev. 1
4Z359Z44536	Rev. 1
4Z359Z44537	Rev. 2

Elementaries

9-E-AF03-01	Rev. 2
9-E-HC12-01	Rev. 1
9-E-AF01-01	Rev. 1
9-E-AF01-20	Rev. 1

40. (7.5) Provide status of Qualified Display Processing System (QDPS) (Hardware installation and software development).

Resolution: Handout for Topic No. 40 was provided on the QDPS status.

Suggested NRC audit dates were proposed:

June 15, 1985	Verification of Software
November 15, 1985	System Validation Testing Audit
February 15, 1986	Final V&V Audit

Formal transmittal of the V&V Plan Rev. 2 was provided (ST-HL-AE-1214 dated 3/28/85). (A copy was given to the reviewers.)

Status: Closed

41. Using schematic drawings, discuss the RHR pump low flow interlock
(7.6) and its effect on RHR system reliability.

Resolution: The drawings and interlock were discussed with no open items.

Status: Closed

DRAWINGS: Same as 36.

42. Using schematic drawings, discuss the Volume Control Tank level
(7.6) interlock and its effect on Charging pump reliability.

Resolution: BEC walked through the design. The charging pumps are not started on SI for ECCS. It was concluded there was no concern related to the design.

Status: Closed

DRAWINGS:

P&IDs

9F05007 Rev. 4

Logics

9-Z-42414 Rev. 2
9-Z-42415 Rev. 2

Elementary

9-E-CV05-01 Rev. 2
9-E-CV31-01 Rev. 2

43. (7.6) Using schematic drawings, discuss the Spray Additive Tank level interlock.

Resolution: The design drawings and process block diagrams were reviewed with no open items.

Status: Closed

DRAWINGS:

P&ID

9F05037 Rev. 4

Logics

9Z42131 Rev. 4

Elementary

9-E-CS03-01 Rev. 2

44. (7.6) Using schematic drawings, discuss the CVCS Seal Injection Isolation Valves Charging Header Pressure interlock.

Resolution: BEC walked through the design. The CVCS Seal Injection Isolation Valves are isolated on Containment Isolation Phase A coincident with low charging header pressure. No action or open items were identified.

Status: Closed

DRAWINGS:

P&IDs

9F05005 Rev. 4

9F05007 Rev. 4 (See Item 42)

Logic

9-Z42413 Rev. 2

Elementary

9-E-CV08-01 Rev. 2

45. (7.6) Using schematic drawings, discuss the Letdown Valves Pressurizer low level interlock.

Resolution: The drawings were reviewed with no concerns identified.

Status: Closed

DRAWINGS:

P&ID

9F05003	Rev. 2
9F05005	Rev. 4 (See Item 44)

Logics

9Z42408	Rev. 3
9Z42411	Rev. 3
9Z42410	Rev. 3

Elementary

9-E-CV13-01	Rev. 2
9-E-CV13-02	Rev. 2
9-E-CV32-01	Rev. 1
9-E-CV29-01	Rev. 1
9-E-CV12-02	Rev. 1
9-E-CV12-01	Rev. 2

46. (7.6) Using schematic drawings, discuss the Reactor Coolant Purity Control interlock.

Resolution: BEC walked through the design. No concerns were identified.

Status: Closed

DRAWINGS:

P&ID

9F05009 Rev. 4

Logics

9Z42449 Rev. 1

Elementary

9-E-CV43-01 Rev. 1

47. (7.6) Using schematic drawings, discuss the Hot Leg Recirculation Operated valves power lockout design.

Resolution: The design and circuit were reviewed. Review was done in conjunction with Item 21. No remaining open issues.

Status: Closed

48. (7.7) Please provide the response to Question 32.45 on Control System Failures.

Resolution: A response was provided to the ICSB; the response will be provided formally.

Status: Closed

Action - Submit formal response to Q32.45. (Completed by Letter ST-HL-AE-1220, dated April 3, 1985.)

49. (7.7) Please provide the response to Question 32.44 on IE Information Notice 79-22 concern.

Resolution: Response provided

Status: Closed

Action - Submit formal response to Q32.44. (Completed by Letter ST-HL-AE-1220, dated April 3, 1985.)

NEW ITEM

CCW SYSTEM OVERVIEW

Resolution: Using system design drawings, the operation of the CCW system was reviewed.

No open issues were identified.

Status: Closed

DRAWINGS:

P&ID'S:

9F05017 Rev. 4
9F05018 Rev. 4
9F05019 Rev. 4
9F05020 Rev. 4
9F05021 Rev. 3

Level Setting Diagrams: 9Z45101

Sht. 4 Rev. 1
Sht. 5 Rev. 1
Sht. 6 Rev. 1
Sht. 7 Rev. 0

Logics:

9Z42040 Rev. 3
9Z42041 Rev. 2
9Z42042 Rev. 2
9Z42043 Rev. 2

<u>Logics</u> (Cont'd)	9Z42044	Rev. 2
	9Z42045	Rev. 2
	9Z42046	Rev. 2
	9Z42047	Rev. 2
	9Z42049	Rev. 3
	9Z42050	Rev. 2
	9Z42051	Rev. 3
	9Z42052	Rev. 3
	9Z42053	Rev. 2
	9Z42054	Rev. 3
	9Z42055	Rev. 2
	9Z42056	Rev. 2
	9Z42057	Rev. 2
	9Z42058	Rev. 3
	9Z42059	Rev. 3
	9Z42060	Rev. 1
	9Z42061	Rev. 2
	9Z42062	Rev. 2
	9Z42064	Rev. 0
	9Z42065	Rev. 0
	9Z42066	Rev. 0
	9Z42067	Rev. 0

NEW ITEM

ECW SYSTEM OVERVIEW

Resolution: Using system design drawings, operation of the ECW System was discussed. Particular attention was paid to the control (by QDPS) of the essential chiller ECW control valves and ECW pump discharge valves use for venting.

No open issues were identified.

Status: Closed

DRAWINGS

P&ID 9F05038 Rev. 4 (with DCNs and IDCNs)
9F05039 Rev. 4
IDCN's for 9V10001 (Essential Chilled Water System) also used

NEW ITEM

MFIV CIRCUIT

Resolution: Using design drawings, the valve operation was reviewed.

Open Concern: During testing, operation of both solenoids for venting the hydraulic fluid (causing valve to fail in closed position) is not being monitored to assure proper operation.

Status: Open Item to address concern.

DRAWINGS

Logic:	9Z40116	Rev. 2
Electrical:	9-E-FW07-01	Rev. 1
	9-E-FW07-02	Rev. 0
	9-E-FW07-03	Rev. 0

NEW ITEM

TESTING PROCEDURES

Provide a list of cases where leads are lifted or jumpers are used during surveillance testing. Provide justification for performing these actions. (For example, administrative checks and controls could be followed by testing after reconnection to verify that system has been restored to normal status.)

Resolution: Question was asked during last day of review meeting, and was recognized as an item for which no response could be available during the meeting.

Status: Open Item. List to be provided as indicated in question.

ATTACHMENT 4
LIST OF HANDOUTS
(By Topic Number)

1	Design Status
2	Open TMI Items
4	Electrical Distribution System
5	Isolation Devices
6	Sensing Lines/Freeze Protection
7	Non-IE to IE Control
11	Testing (RG 1.118)
12	Setpoint Methodology
17	SSPS 2/3 Testing
23	Loss of Instrument Power
30	FMEAs
31	HVAC-ESF Support/Safe Shutdown Areas
40	QDPS Status
48	Control System Failures
49	Control System Malfunctions due to HELB

HANDOUT FOR TOPIC 1

DESIGN COMPLETION STATUS

SUBJECT	DESIGN STATUS
High Energy Line Break and Hazards Reviews	Ongoing effort to determine zones of influence and appropriate protection of instrumentation. Design changes approved and partially implemented to terminate auxiliary steam flow in MAB on detection of high flows and high room temperatures and to terminate letdown flow in MAB on high room temperatures.
P-9/Anticipatory Trip Modification (NUREG-0737 II.K.3.10)	Design change approved and implemented on STP Functional Diagrams. Incorporation in design documents ongoing. CCP/FCN in preparation.
Urgent Alarm	Design change initiated to incorporate alarm into plant annunciator.
Non-1E input to IE Control of CCW pumps (STP 10CFR50.55e Item)	Design change identified to modify CCW pump protective logic to upgrade flow switches to 1E qualification and to delete non-1E level switches from pump logic.
Power lockout implementation of Train B CCW RCFC Isolation Valves	Design change identified to delete redundant valve position indication. Valve control circuit design currently alleviates need for power lockout to prevent spurious valve operation due to flooding. Power lockout design will not be modified, to prevent degradation of Class 1E power source following flooding of valve.
Emergency Containment Sump pH Control	Design change approved to add NaOH tank and discharge valves inside containment. Instrumentation and control systems design ongoing. CCP/FCN activities initiated.

SUBJECT	DESIGN STATUS
Qualified Display Processing System (QDPS)	Design ongoing.
ECW Chiller Control	Design change approved. Incorporation of design into QDPS and STP design documents ongoing. CCP in preparation.
ECW Pump Discharge Valve Control (Protection against water hammer)	Design change approved. Incorporation in design documents ongoing. CCP in preparation.
AFW Turbine Speed Control	Design change approved to delete Non-1E speed control. Incorporation in design documents ongoing.
Emergency Response Facilities Data Acquisition and Display System (ERF DADS)/Safety Parameter Display System (SPDS) Displays	Display development ongoing.
Solid State Protection System (SSPS) relays and wiring changes for sequencer and STP specific interfaces	Design changes approved. Incorporation in design documents ongoing. FCN in preparation.
SSPS Undetectable failure	Design change approved. Incorporation in design documents ongoing. FCN in preparation.
Auto Shunt Trip	Design change approved. Incorporation in design documents ongoing. FCN in preparation.
Closure of Letdown Isolation Valves on Containment Isolation Phase A	Design change approved and incorporated in design documents. FCN in preparation.
HVAC Electrohydraulic Controllers for Dampers (Control Room and Fuel Handling Building)	Design Change approved to: A) FHB: Remove closed loop control on flow and incorporate vendor design interface B) Control Room: Incorporate vendor design interface Incorporation in design documents ongoing. CCP in preparation.

HANDOUT ITEM 2

2. (7.1) As called for in Section 7.1 of the Standard Review Plan, provide information as to how your design conforms with the following:

a) II.D.3 - Relief and Safety Valve Position Indication

b) II.E.1.2 - Auxiliary Feedwater System Automatic Initiation and Flow Indication

c) II.K.3.10 - Proposed Anticipatory Trip Modification

In FSAR Appendix 7A, responses to NUREG-0737 requirements, the above 3 items are indicated "later." Please provide the current status.

II.D.3 DIRECT INDICATION OF RELIEF AND SAFETY VALVE POSITION

Position (NUREG 0737)

Reactor coolant system relief and safety valves shall be provided with a positive indication in the control room derived from a reliable valve position detection device or a reliable indication of flow in the discharge pipe.

Clarification

(1) The basic requirement is to provide the operator with unambiguous indication of valve position (open or closed) so that appropriate operator actions can be taken.

(2) The valve position should be indicated in the control room. An alarm should be provided in conjunction with this indication.

(3) The valve position indication may be safety grade. If the position indication is not safety grade, a reliable single-channel direct indication powered from a vital instrument bus may be provided if backup methods of determining valve position are available and are discussed in the emergency procedures as an aid to operator diagnosis of an action.

(4) The valve position indication should be seismically qualified consistent with the component or system to which it is attached.

(5) The position indication should be qualified for its appropriate environment (any transient or accident that would cause the relief or safety valve to lift) and in accordance with Commission Order, May 23rd, 1980 (CLI-20-81). 44

(6) It is important that the displays and controls added to the control room as a result of this requirement not increase the potential for operator error. A human-factors analysis should be performed, taking the following into consideration:

(a) The use of this information by an operator during both normal and abnormal plant conditions.

(b) The integration into emergency procedures.

(c) The integration into operator training.

(d) Other alarms during emergency and need for prioritization of alarms.

STP Response

Position indication is provided for each safety valve and power-operated relief valve (PORV) that indicates when the valve is not in its fully closed position. The position detectors are seismically and environmentally qualified. Position indication for each valve is displayed in the control room, and an alarm is provided if any of the PORVs or safety valves is not fully closed. Relief and safety valve position indication is further described in Sections 5.4.13, 7.5, and Appendix 7B.

Other nonsafety-related instrumentation is provided on the valve discharge piping and the pressurizer relief tank to provide alternate means of assessing the status of the safety valves and PORVs (see Figures 5.1-3 and 5.1-4). 44

The integration of the position indication and alarms into the control room design was performed taking into consideration human factors concerns as described in Appendix 7A, Items I.D.1 and S.5.

II.E.1.2 AUXILIARY FEEDWATER SYSTEM AUTOMATIC INITIATION AND FLOW INDICATION

PART 1: Auxiliary Feedwater System Automatic Initiation

Position (NUREG 0737)

Consistent with satisfying the requirements of General Design Criterion 20 of Appendix A to 10CFR50 with respect to the timely initiation of the auxiliary feedwater system (AFWS), the following requirements shall be implemented in the short term:

(1) The design shall provide for the automatic initiation of the AFWS.

(2) The automatic initiation signals and circuits shall be designed so that a single failure will not result in the loss of AFWS function.

(3) Testability of the initiating signals and circuits shall be a feature of the design.

(4) The initiating signals and circuits shall be powered from the emergency buses.

(5) Manual capability to initiate the AFWS from the control room shall be retained and shall be implemented so that a single failure in the manual circuits will not result in the loss of system function.

(6) The ac motor-driven pumps and valves in the AFWS shall be included in the automatic actuation (simultaneous and/or sequential) of the loads onto the emergency buses.

(7) The automatic initiating signals and circuits shall be designed so that their failure will not result in the loss of manual capability to initiate the AFWS from the control room.

In the long term, the automatic initiation signals and circuits shall be upgraded in accordance with safety-grade requirements.

Clarification

The intent of this recommendation is to assure a reliable automatic initiation system. This objective can be met by providing a system that meets all the requirements of IEEE Standard 279-1971.

The staff has determined that the following salient paragraphs of IEEE 279-1971 should be addressed as a minimum:

IEEE 279-1971, Paragraph	
4.1	General Functional Requirements
4.2	Single Failure
4.3 & 4.4	Qualification
4.6	Channel Independence

4.7	Control and Protection System Interaction
4.9 & 4.10	Capability for Testing
4.11	Channel Bypass
4.12	Operating Bypass
4.13	Indication of Bypass
4.17	Manual Initiation

STP Response

Safety-grade automatic initiation of the Auxiliary Feedwater System is provided as described in Sections 7.3 and 10.4.9. The automatic initiation meets the appropriate requirements of IEEE 299-1971.

II.E.1.2 PART 2: Auxiliary Feedwater System Flowrate Indication

Position (NUREG 0737)

Consistent with satisfying the requirements set forth in General Design Criterion 13 to provide the capability in the control room to ascertain the actual performance of the AFWS when it is called to perform its intended function, the following requirements shall be implemented:

(1) Safety-grade indication of auxiliary feedwater flow to each steam generator shall be provided in the control room.

(2) The auxiliary feedwater flow instrument channels shall be powered from the emergency buses, consistent with satisfying the emergency power diversity requirements of the auxiliary feedwater system set forth in Auxiliary Systems Branch Technical Position 10-1 of the Standard Review Plan, Section 10.4.9.

Clarification

The intent of this recommendation is to assure a reliable indication of AFWS performance. This objective can be met by providing an overall indication system that meets the following appropriate design principles:

(1) For Babcock and Wilcox Plants (not applicable to STP)

(2) For Westinghouse and Combustion Engineering Plants

 (a) To satisfy these requirements, W and C-E plants must provide as a minimum one auxiliary feedwater flowrate indicator and one wide range steam generator level indicator for each steam generator or two flow rate indicators.

 (b) The flow indication system should be:

  (i) Environmentally qualified
  (ii) Powered from highly reliable, battery-backed non-Class 1E power source
  (iii) Periodically testable
  (iv) Part of plant quality assurance program
  (v) Capable of display on demand

It is important that the displays and controls added to the control room as a result of this requirement not increase the potential for operator error. A human factors analysis should be performed taking into consideration:

(1) The use of this information by an operator during both normal and abnormal plant conditions.

(2) The integration into emergency procedures.

(3) The integration into operator training.

(4) Other alarms during emergency and need for prioritization of alarms.

STP Response

Safety-grade auxiliary feedwater flow indication to each steam generator is provided as described in Sections 7.5 and 10.4.9 and Appendix 7B.

Safety-grade wide range steam generator water level indication is provided as described in Section 7.5 and Appendix 7B.

The integration of the auxiliary feedwater and wide range steam generator water level displays into the control room was performed taking into consideration human factors concerns as described in Appendix 7A (Items I.D.1 and S.5) and Appendix 7B.

II.K.3.10 PROPOSED ANTICIPATORY TRIP MODIFICATION

Position (NUREG 0737)

The anticipatory trip modification proposed by some licensees to confine the range of use to high-power levels should not be made until it has been shown on a plant-by-plant basis that the probability of a small-break loss-of-coolant accident (LOCA) resulting from a stuck-open power-operated relief valve (PORV) is substantially unaffected by the modification.

Clarification

The evaluation is required for only those licensees/applicants who propose the modification.

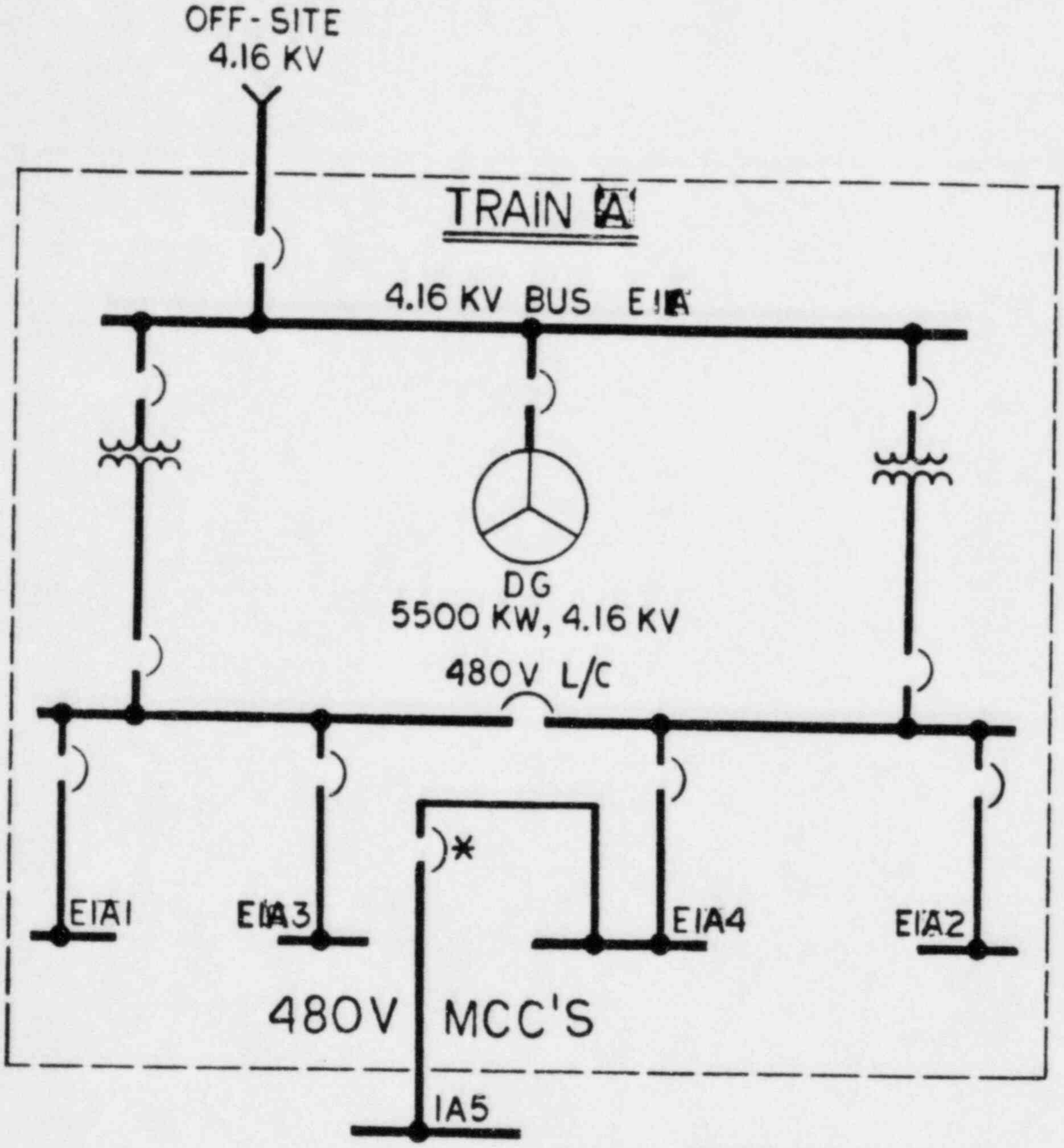
STP Response

This anticipatory trip modification (deletion of reactor trip on turbine trip below 50% power) is included in the STP design.

The Westinghouse analysis report, in response to Three Mile Island action item II.K.3.10, shows that the design for South Texas is such that a turbine trip without a direct or immediate reactor trip presents no hazard to the reactor coolant system or the main steam supply system.

The analysis will be submitted in a near-future amendment to the FSAR.

HANDOUT FOR TOPIC 4



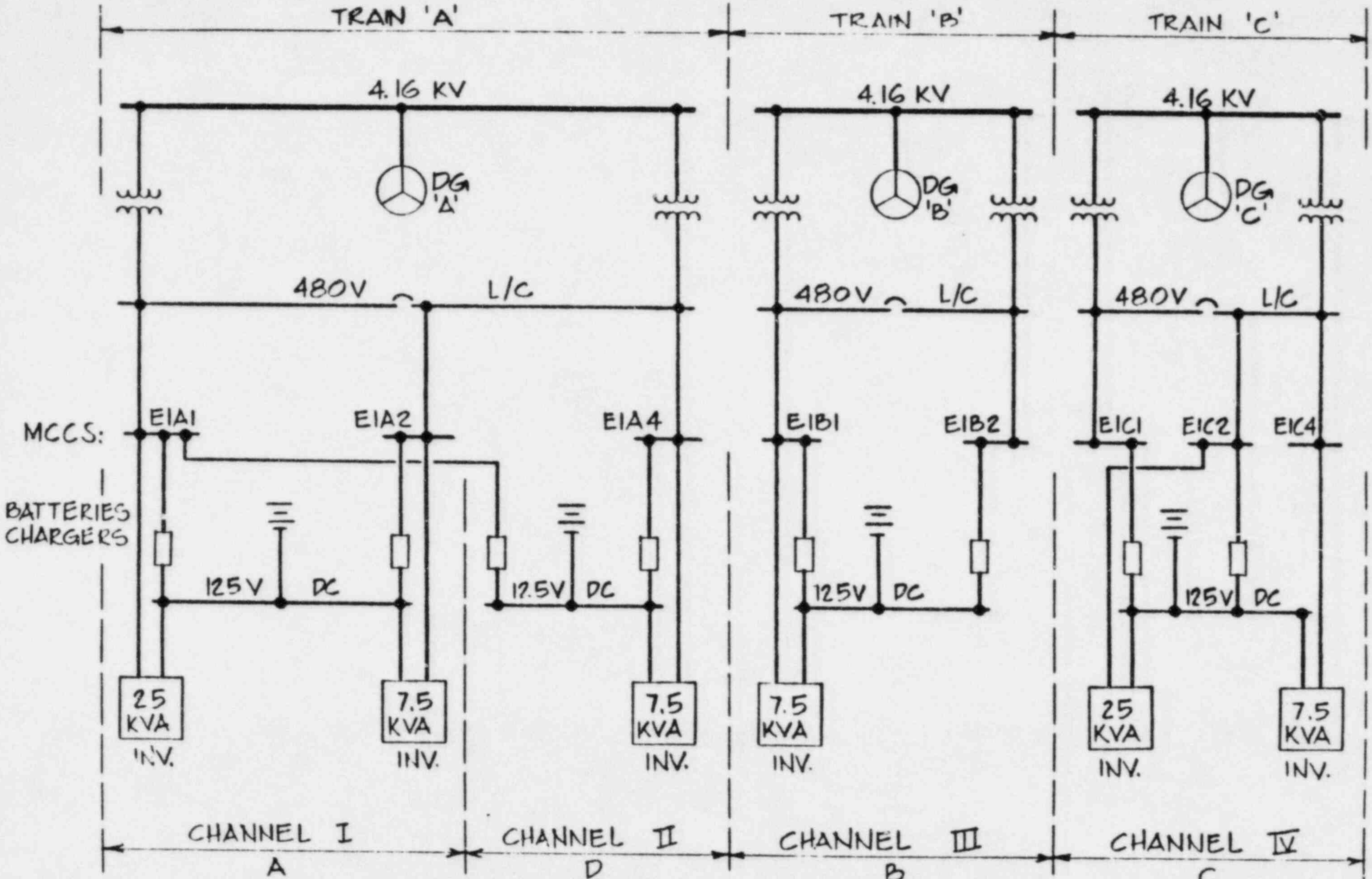
* TRIPS ON SI SIGNAL

TRAIN A = RED

TRAIN B = BLUE

TRAIN C = YELLOW

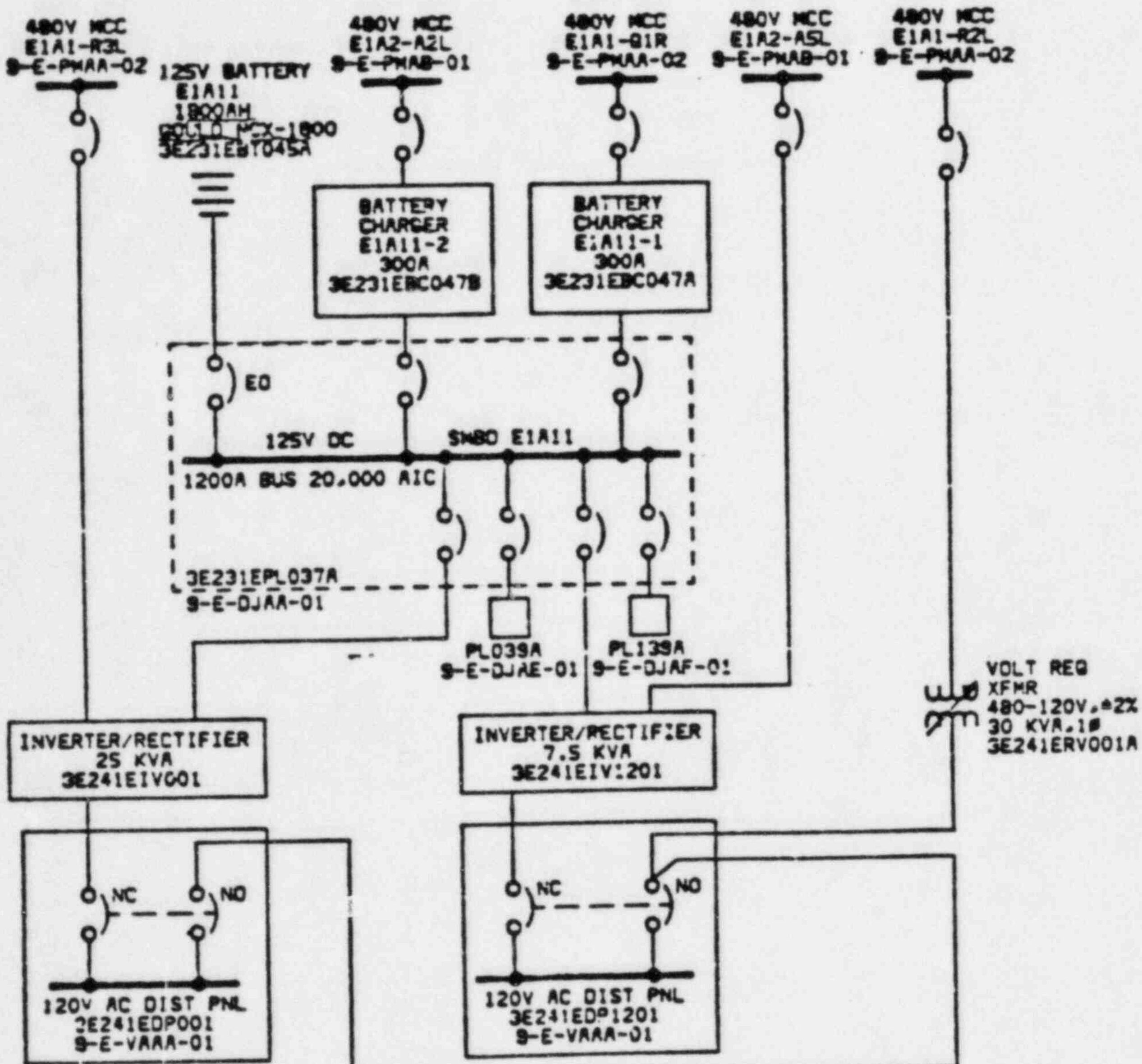
SIMPLIFIED STP THREE TRAIN-FOUR CHANNEL ALIGNMENT



SEPARATION GROUPS

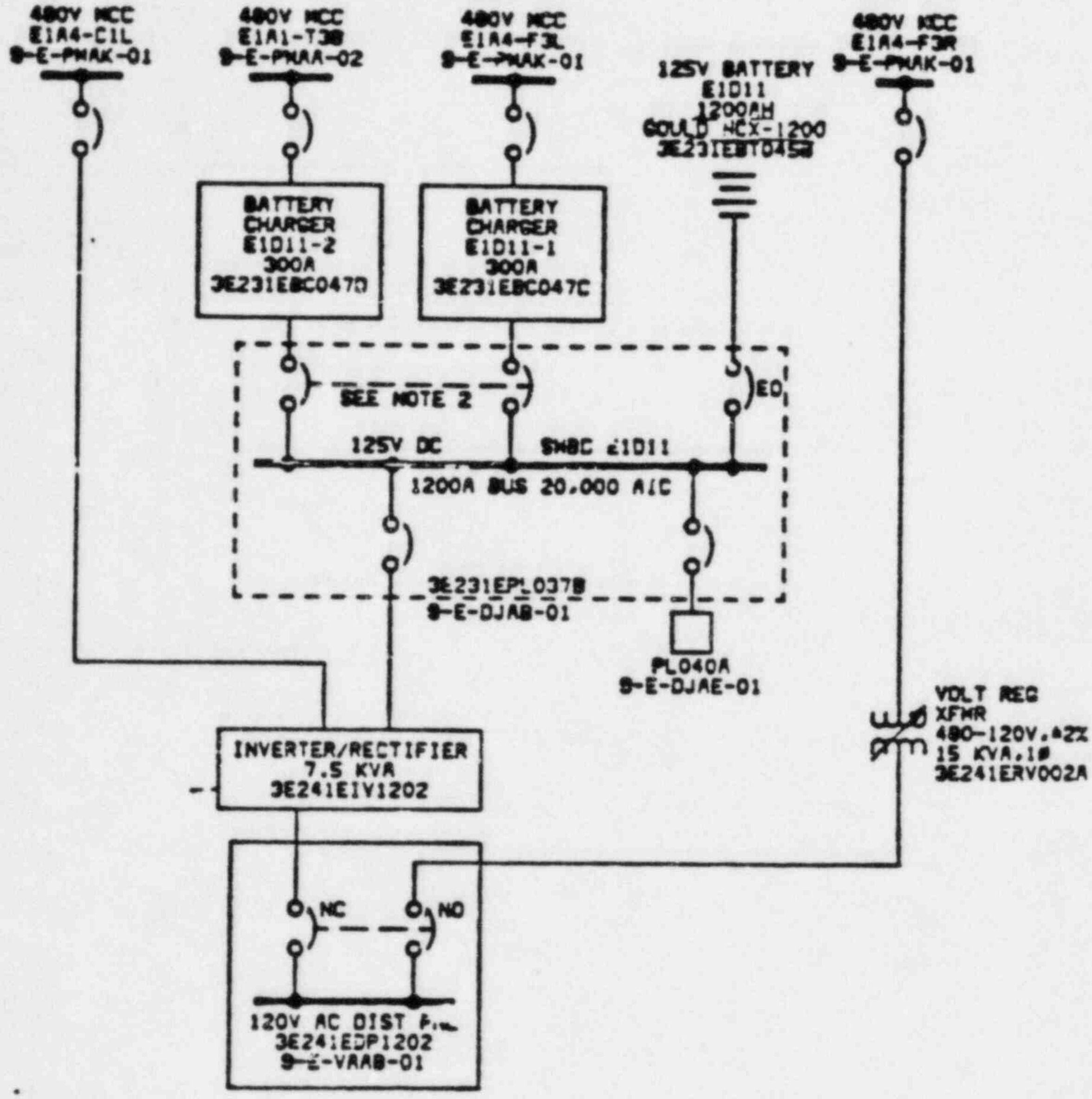
1A.

CLASS 1E
(RED)



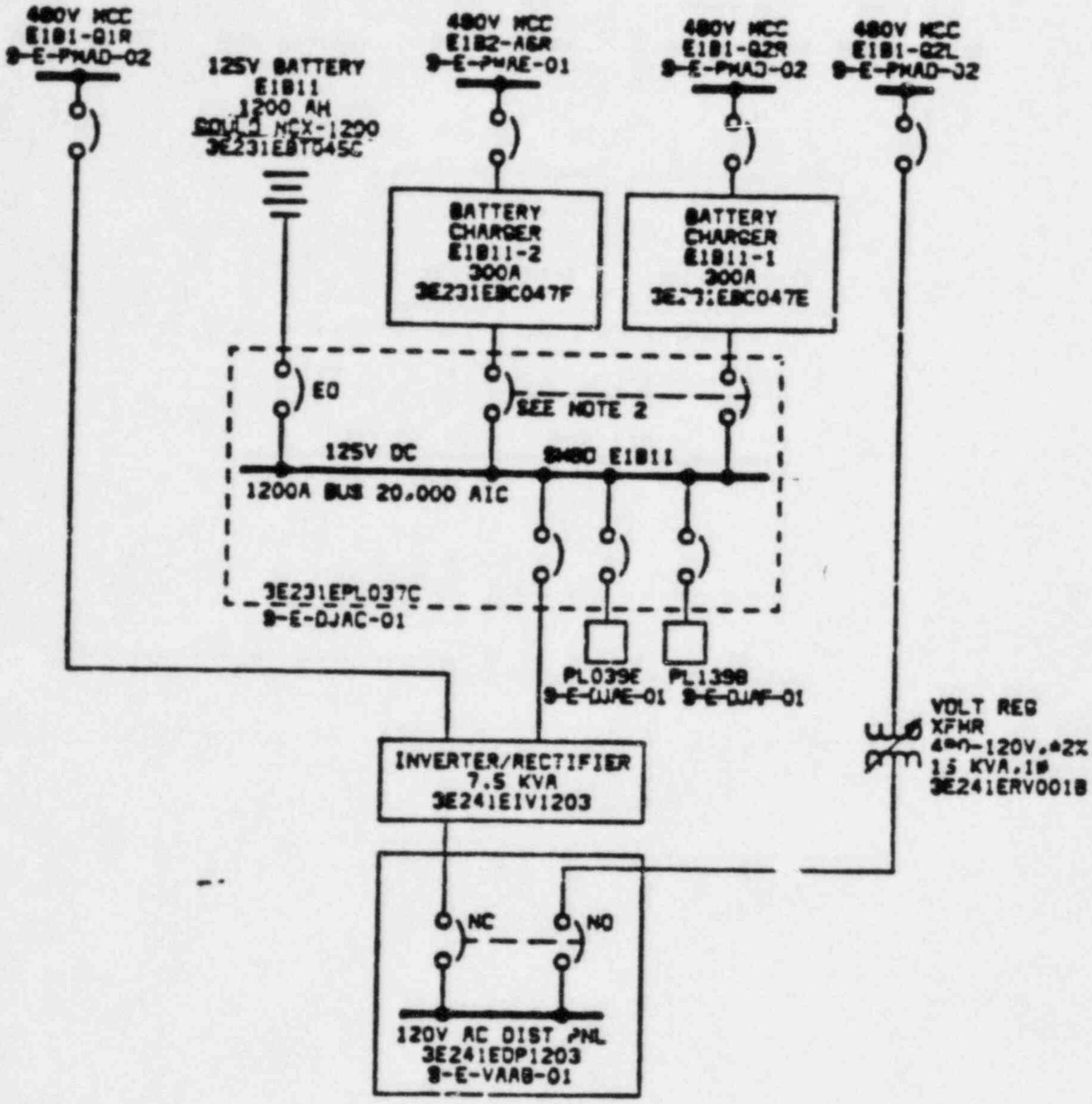
120V VITAL AC INST POWER DIST
CHANNEL I

CLASS 1E
(WHITE)



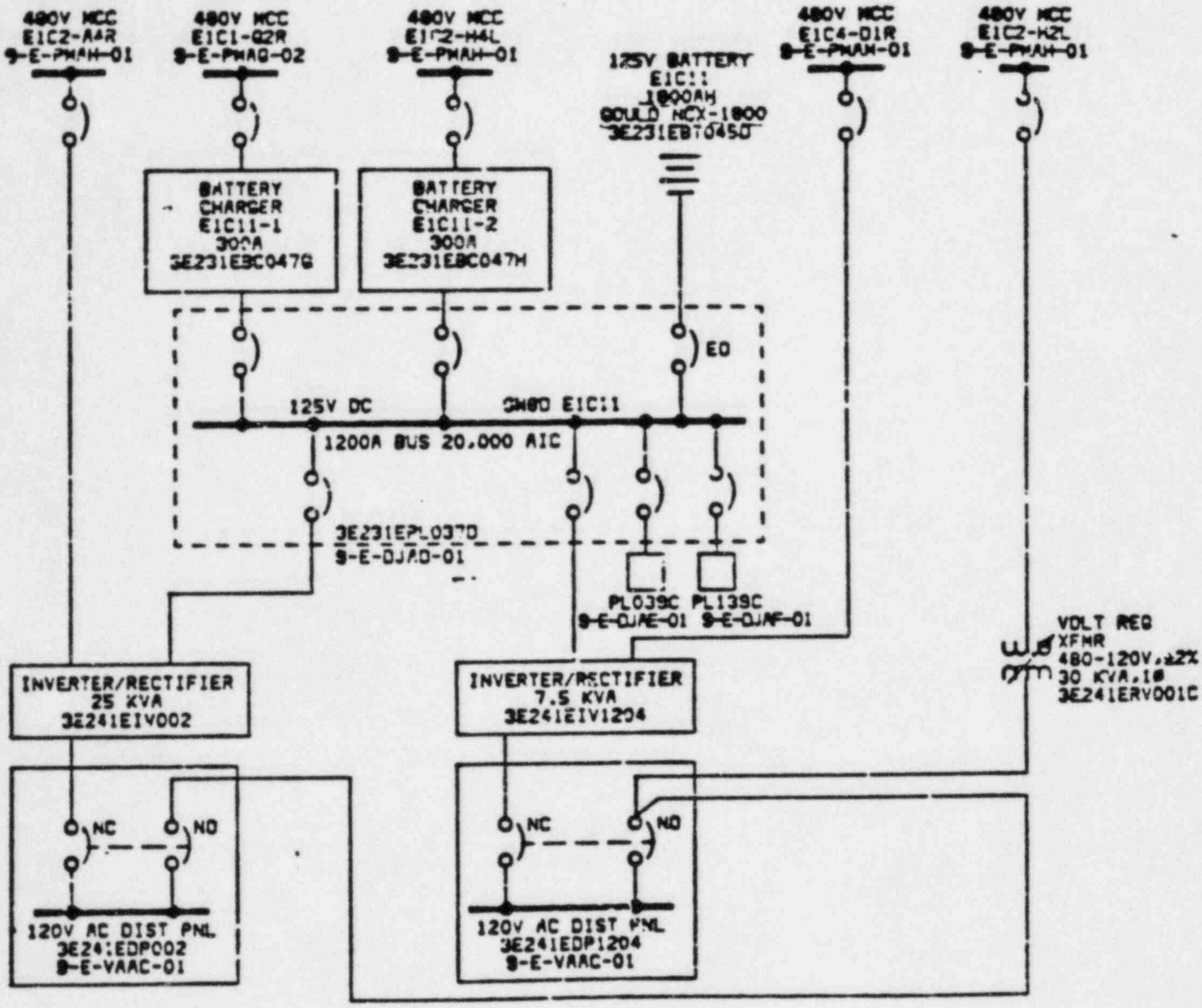
120V VITAL AC INST POWER DIST
CHANNEL II

CLASS 1E
(BLUE)



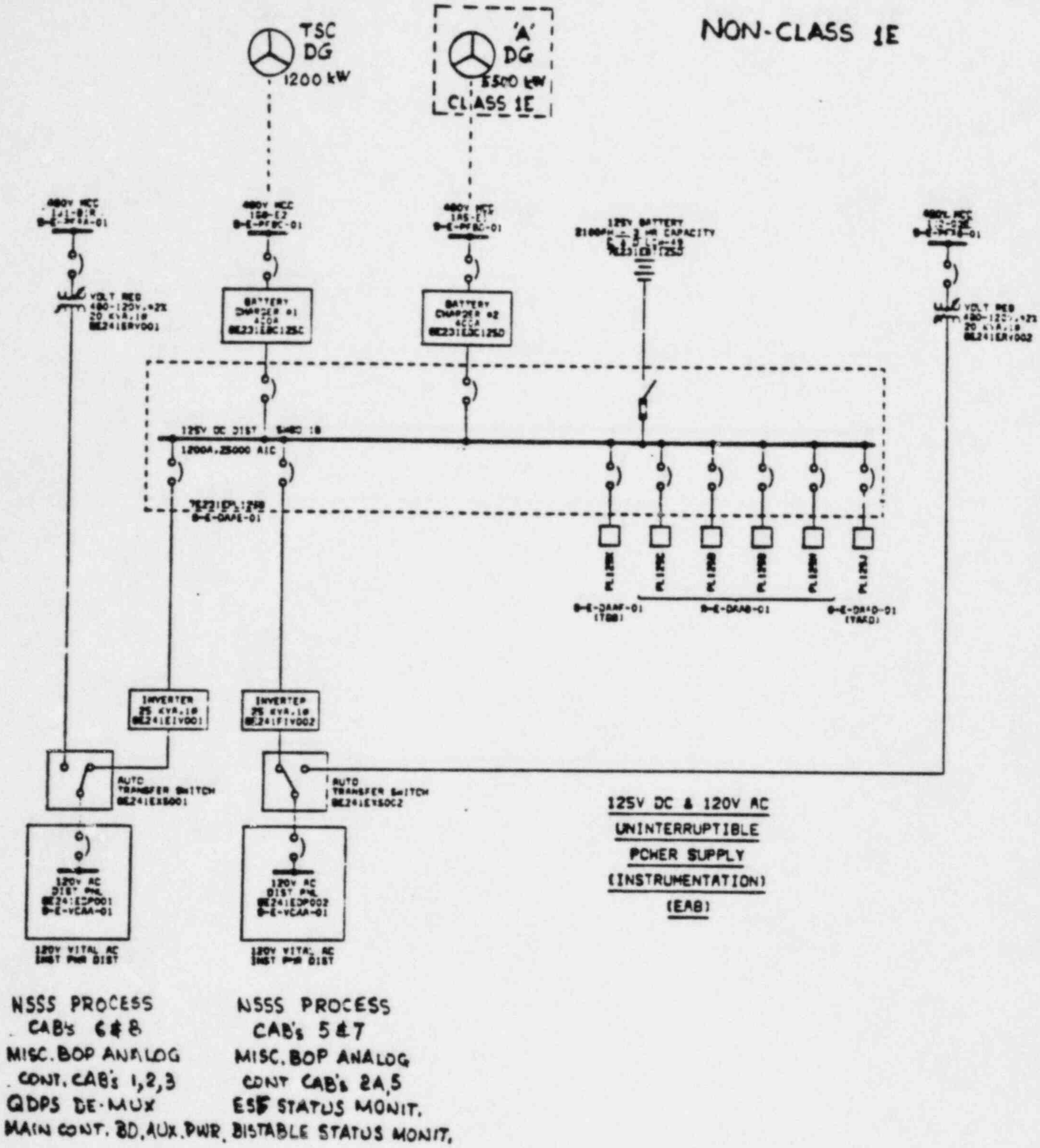
120V VITAL AC INST POWER DIST
CHANNEL III

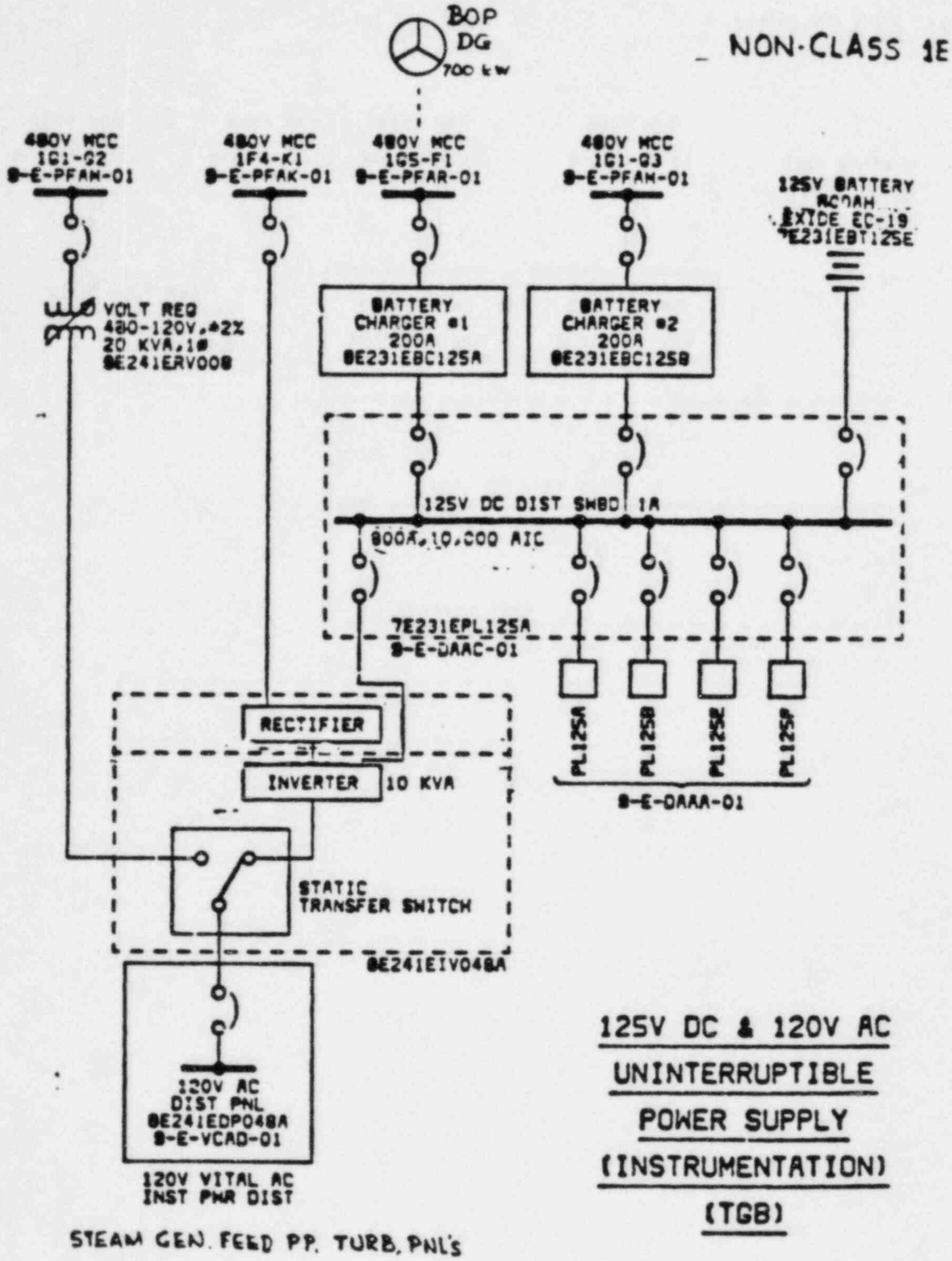
CLASS 1E
(YELLOW)



120V VITAL AC INST POWER DIST
CHANNEL IV

NON-CLASS 1E

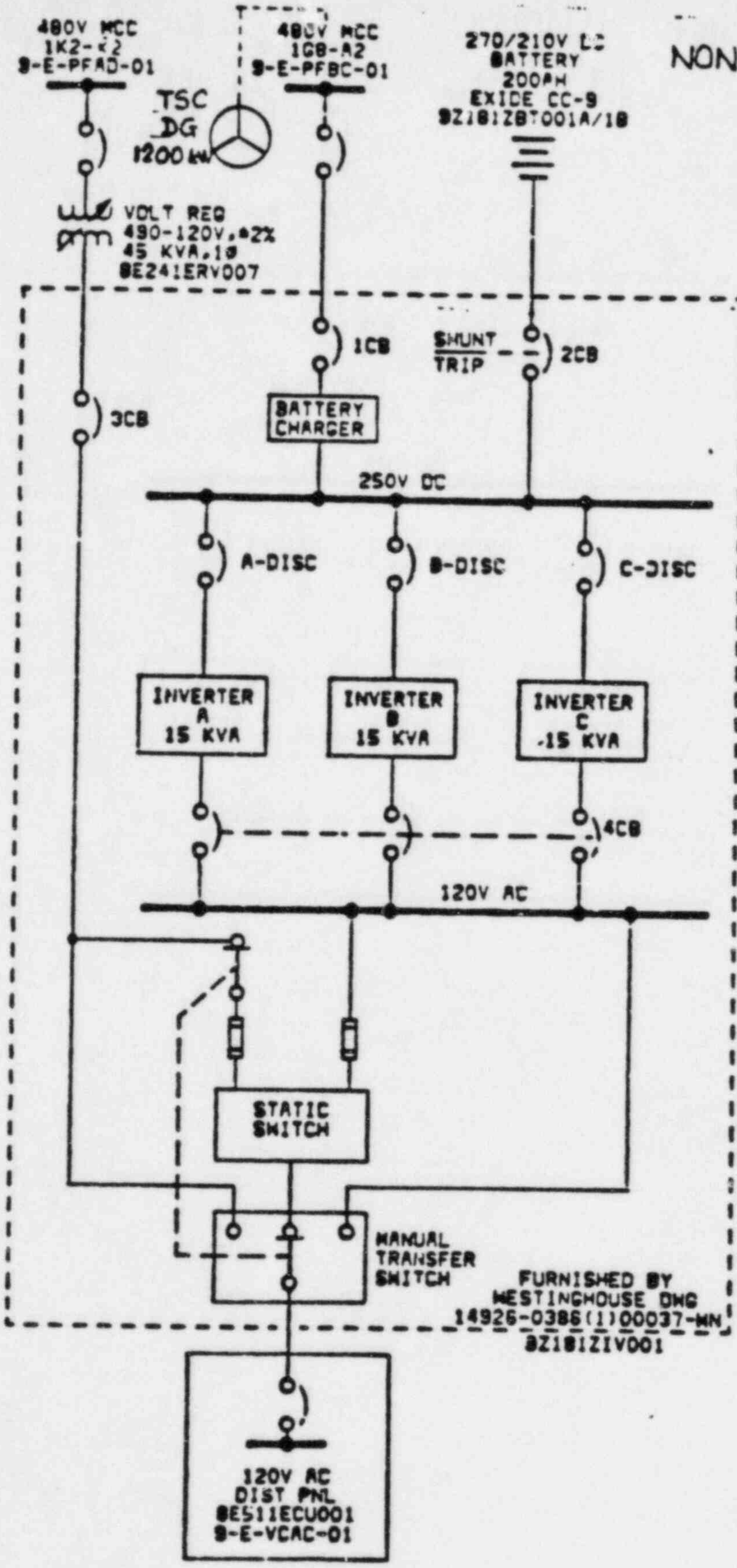

TSC
DG
1200 kW
'A'
DG
5500 kW
CLASS 1E
BATTERY CHARGER #1
BATTERY CHARGER #2
125V BATTERY
125V DC DIST SWBD 1B
INVERTER
INVERTER
AUTO TRANSFER SWITCH
AUTO TRANSFER SWITCH
120V AC DIST PNL
120V AC DIST PNL
120V VITAL AC INST PWR DIST
120V VITAL AC INST PWR DIST
125V DC & 120V AC
UNINTERRUPTIBLE
POWER SUPPLY
(INSTRUMENTATION)
(EAB)
NSSS PROCESS
CAB's 6&8
MISC. BOP ANALOG
CONT. CAB's 1,2,3
QDPS DE-MUX
MAIN CONT. BD. AUX. PWR.
NSSS PROCESS
CAB's 5&7
MISC. BOP ANALOG
CONT CAB's 2A,5
ESF STATUS MONIT.
BISTABLE STATUS MONIT.



125V DC & 120V AC
UNINTERRUPTIBLE
POWER SUPPLY
(INSTRUMENTATION)
(TGB)

NON-CLASS 1E

8.



120V AC

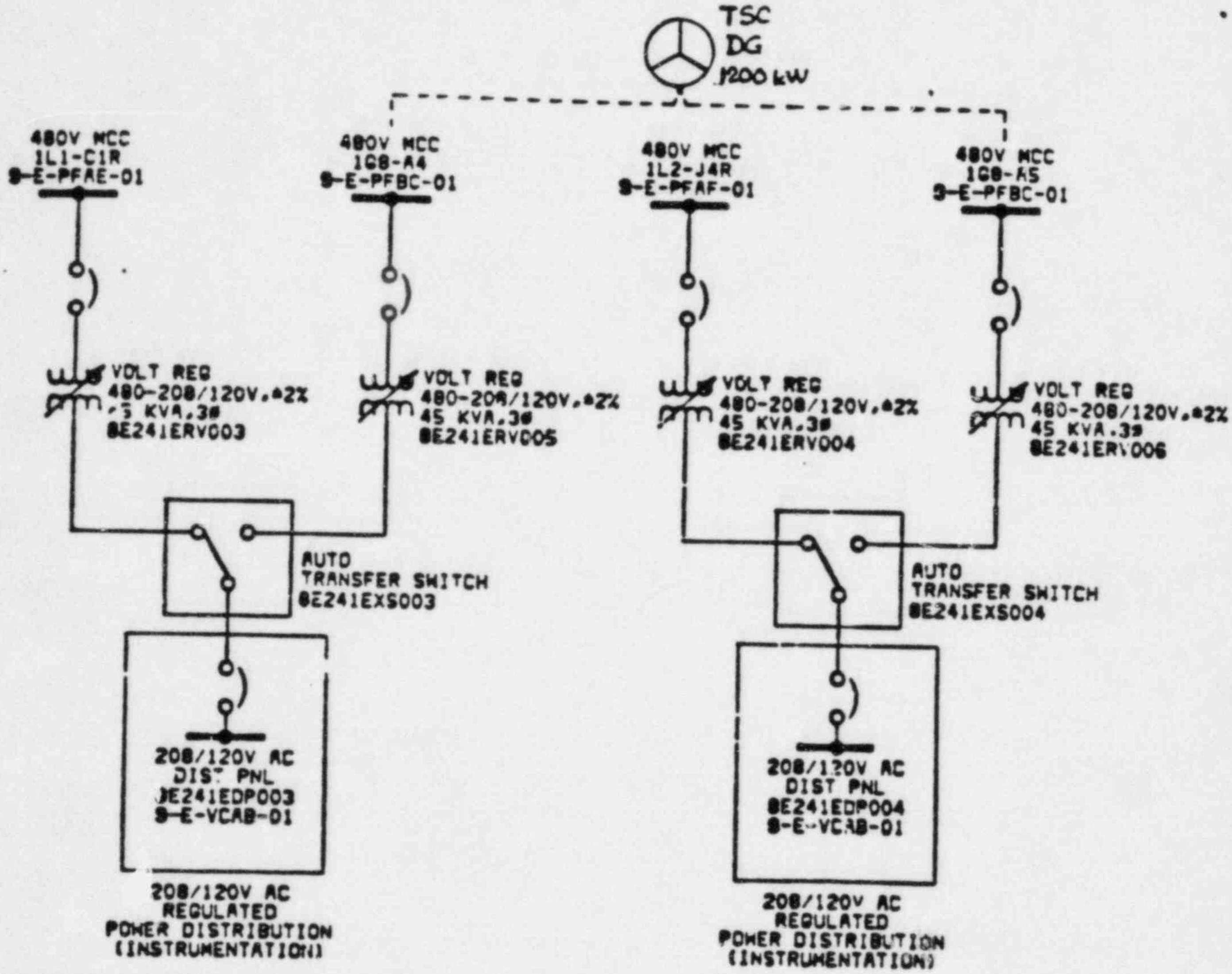
UNINTERRUPTIBLE

POWER SUPPLY

(PLANT COMPUTER)

(EAB)

NON-CLASS 1E



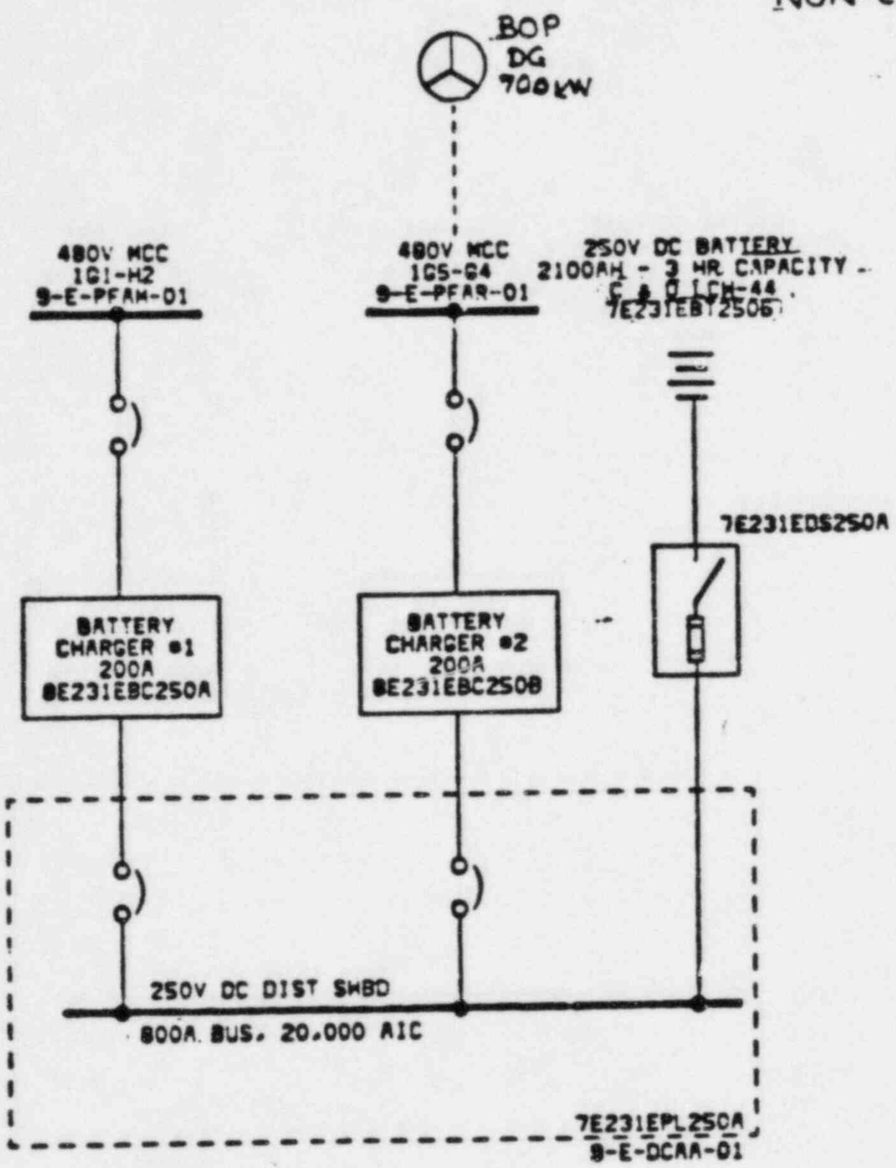
RAD. MONITORS
FLUX. MAPPING PNL.
LOOSE PARTS MON. PNL.
VIBRATION MON. PNL.
CONTROL BOARD INST.
DIGITAL ROD POS. IND. PNL.

RAD. MONITORS
BORON CONC. MON. CONT. UNIT
DRPI DATA CABINETS
ROD CONTROL PWR. CAB (BACK-UP)
ROD CONTROL LOGIC CAB (BACK-UP)
LIQUID RADW. EVAP. PNL.
CONTROL BOARD INST.

208/120V AC REGULATED

(EAB)

NON-CLASS 1E

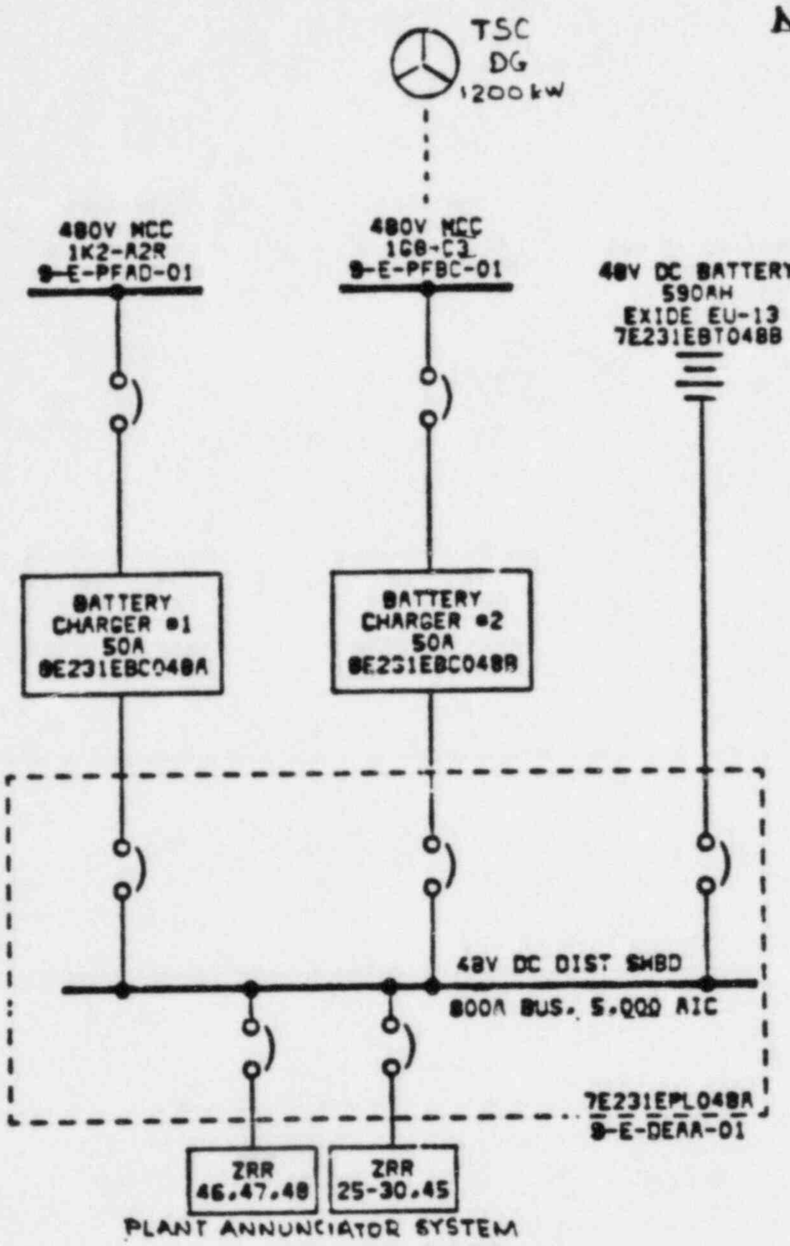


GEN. BRKR. CONT. PNL

250V DC DIST

(TGB)

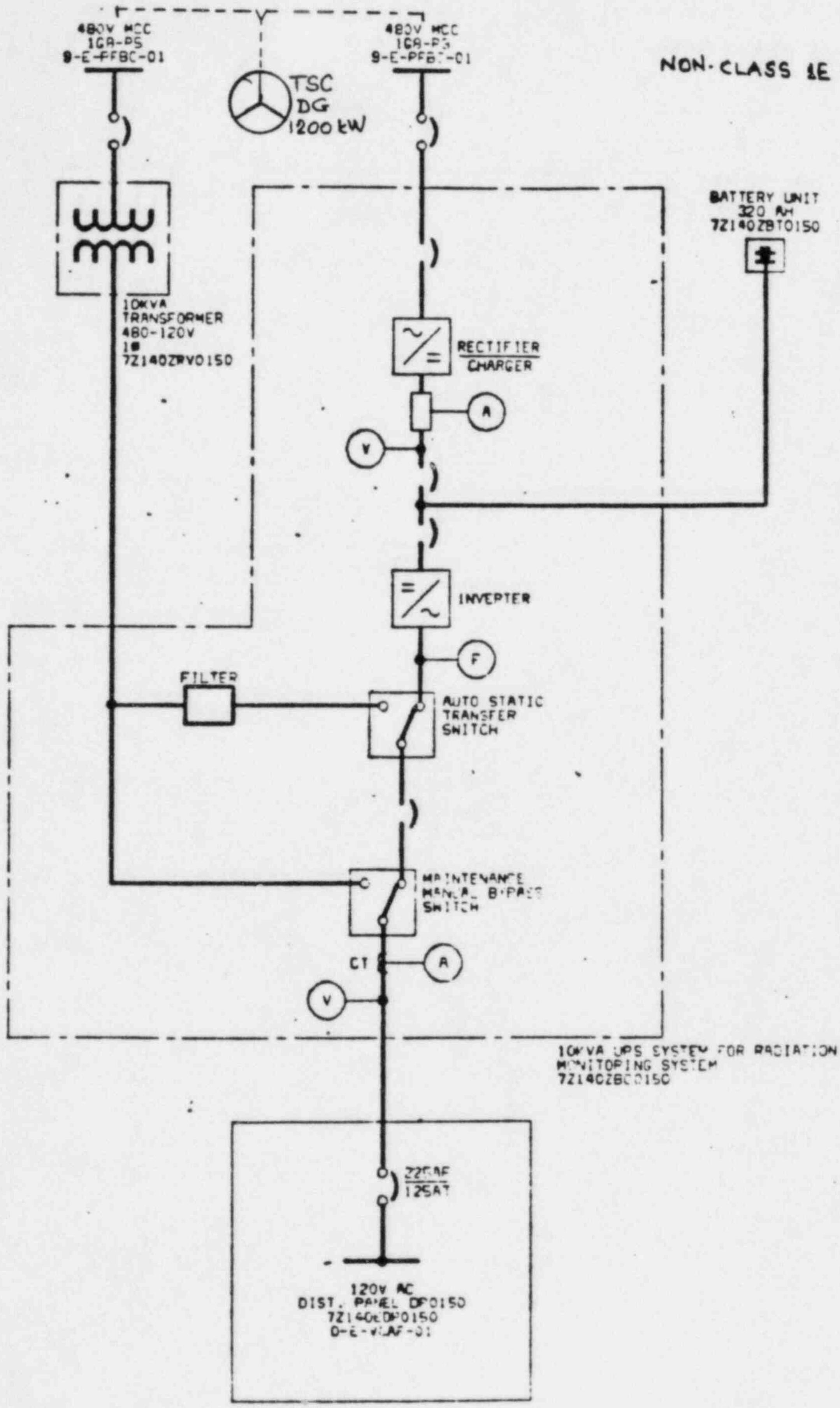
NON-CLASS IE



48V DC DIST

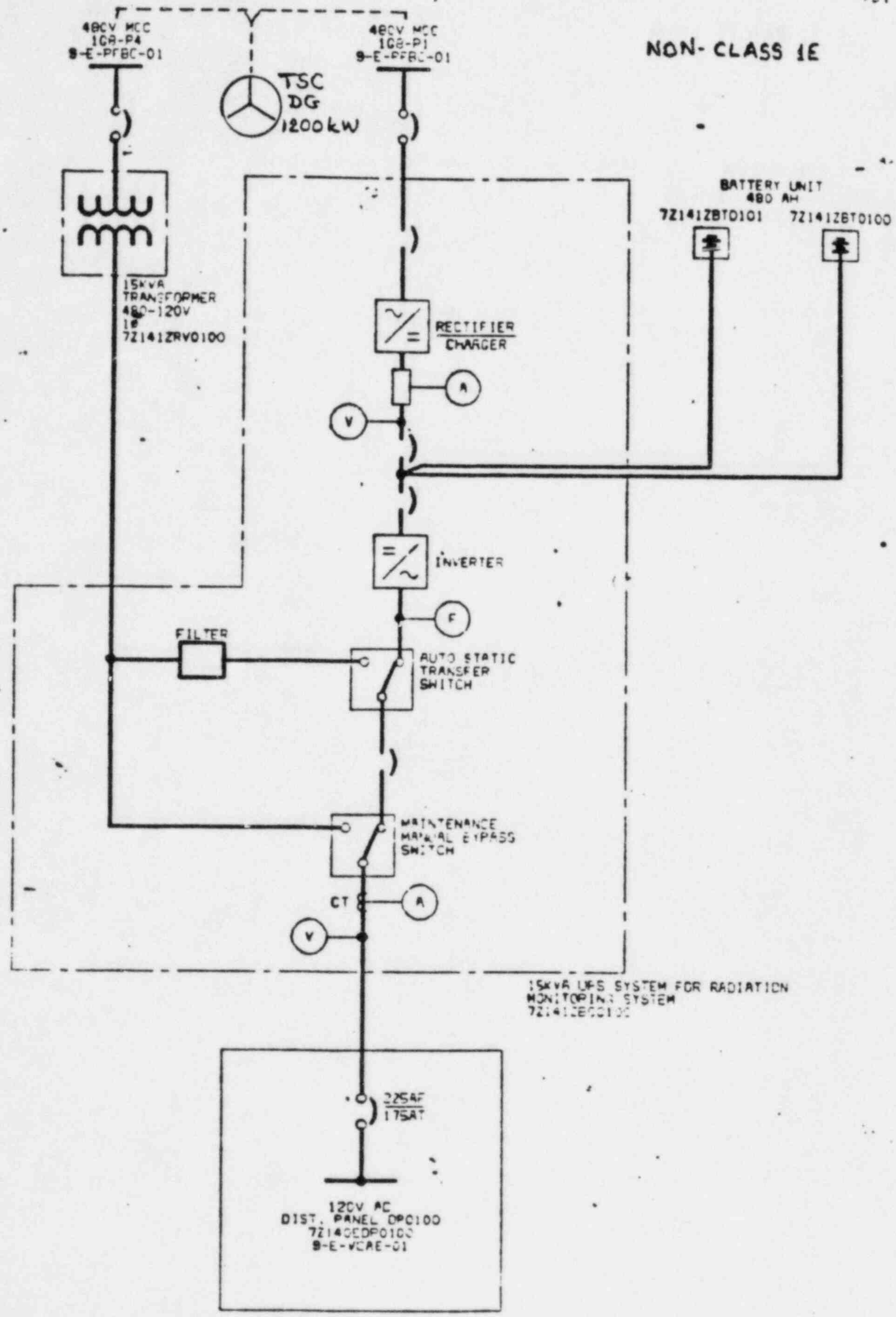
(EAB)

NON-CLASS 1E



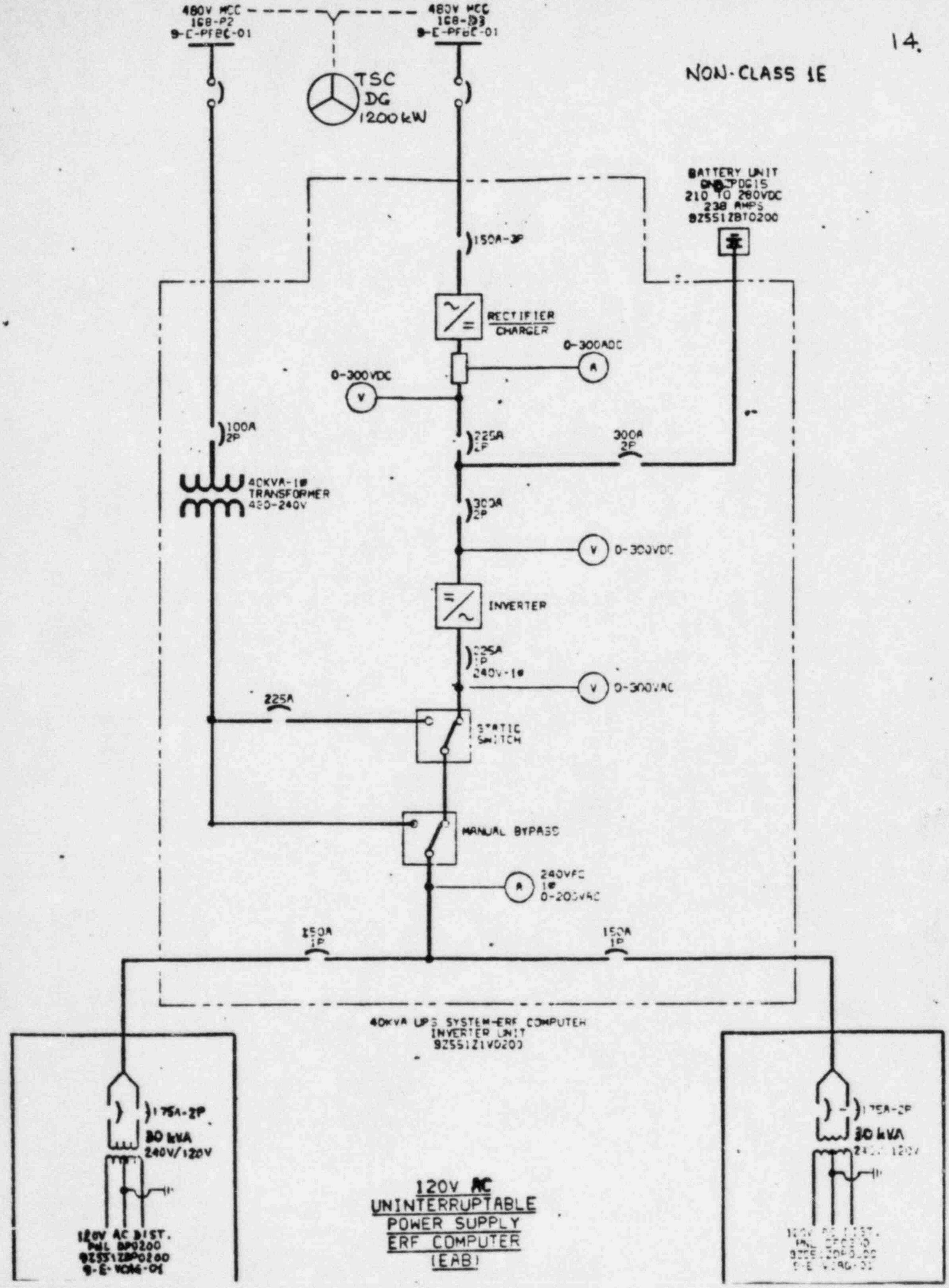
120V AC
UNINTERRUPTABLE
POWER SUPPLY
(RMS COMPUTER RM-21A)
(EAB)

NON- CLASS 1E



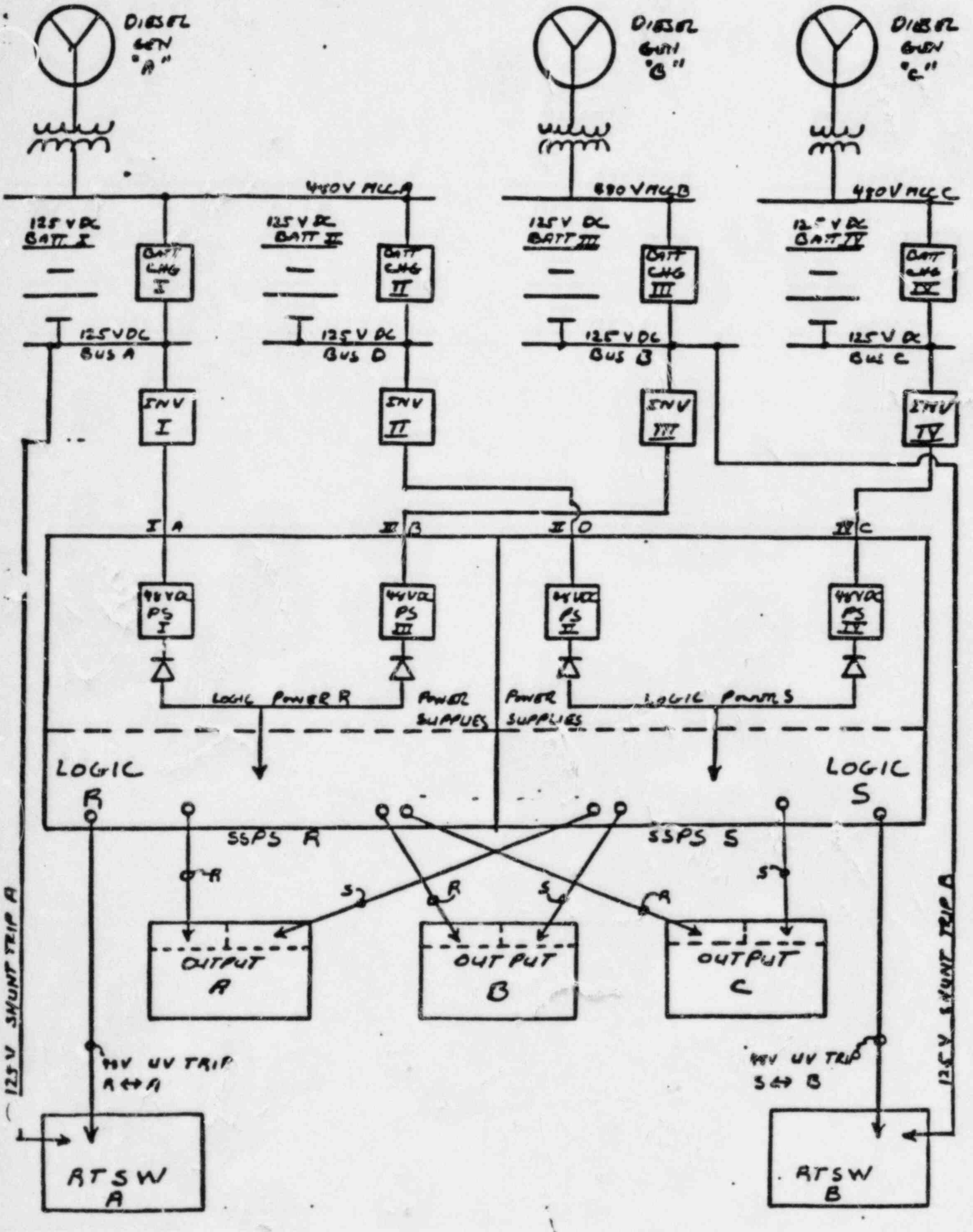
120V AC
UNINTERRUPTABLE
POWER SUPPLY
(RMS COMPUTER RM-11)
(EAB)

NON-CLASS 1E



120V AC
UNINTERRUPTABLE
POWER SUPPLY
ERF COMPUTER
(EAB)

STP THREE TRAIN SIMPLIFIED SSPS



HANDOUT FOR ITEM 5

B.O.P. SYSTEMS

The various class-1E isolation devices used between separation groups and/or between safety and nonsafety systems are:

A. FERRO RESONANT TRANSFORMERS
FOR: Essential lighting

B. CIRCUIT BREAKERS (TRIPPED ON SI SIGNAL)
FOR: 480 V sys. press, HTR's and non-class 1E MCC's.

C. DIGITAL ISOLATORS (OPTICAL)
FOR: Emergency response facility data acquisition display (ERF/DAD) sys. computer inputs, and class 1E DG panels, rad. mon. sys.

D. ANALOG ISOLATORS (TRANS. COUPLED)
FOR: ERF/DAD sys. computer inputs.

E. CONTROL SWITCHES (WITH 6" SEPARATION OR BARRIERS)
FOR: Class 1E DG panels.

F. CONTROL CIRCUIT FUSES
FOR: Class 1E DG panels, 4.16 kV swgr. and ECW traveling water screens.

G. RELAYS (POTTER AND BRUMFIELD TYPE MDR ROTARY)
FOR: aux. relay ISO panels for process systems.

H. CURRENT TRANSFORMERS (DONUT TYPE)
FOR: main control board indication.

TESTS ON ISOLATION DEVICES
(PROCEDURES OR PERFORMED)

The isolation devices are seismically [R.G. 1.100 (IEEE 344-1975)] and environmentally [R.G. 1.89 (IEEE 323-1974)] qualified. Additional information:

FERRO RESONANT TRANSFORMERS
Routine test included short circuit and surge withstand test.

DIGITAL ISOLATORS
Burn-in, functional, hi-pot (3 kV dc and 1.5 kV ac)

ANALOG ISOLATORS (ERF/DADS)
Burn-in, functional, hi-pot (3kV dc and 1.5 kV ac), linearity, power drift, saturation, failure modes

DIGITAL AND ANALOG ISOLATORS (ERF/DADS)
As part of the isolation device panel testing (Energy Incorporated) IEEE 472 surge withstand capability test was performed

CONTROL CIRCUIT FUSES
Test program is under development, vendors are being asked to provide fuse resistance values, including tolerance and temperature condition

RELAYS
Test procedure includes; hi-pot (1000 volt + 2 times nominal voltage for 1 minute, or the above + 20% for 1 second)

SOUTH TEXAS PROJECT

DESIGN COMPARISONS ON POSITIONS FOR REGULATORY GUIDE 1.151, INSTRUMENT SENSING LINES

Regulatory Position	STP Position
	Section 5.1 - A single process tap is used in cases where it is impracticable to have redundant process pipe taps (e.g., reactor coolant flow). A single failure in a common tap will not defeat required protection system redundancy. Section 6.1.8 - Conform, except: o Pipe thread connections at instruments may be used, and are normally 3/4" NPT or less. o Pipe thread connections may be used for connections to valves and/or other accessories. Section 6.3.2 - Conform, except the restriction device is installed in the outlet of the root valve. The root valve is the same piping classification as the process pipe. Section 6.3.3 - The instrument lines that penetrate containment are containment pressure and reactor coolant wide range pressure (RCWRP) sensing lines. These lines are sealed systems with bellow seals inside containment with sealed, liquid-filled capillaries between these seals and the sensing element outside containment. RCWRP includes a secondary isolation seal outside the containment. Containment atmosphere sample lines are equipped with remote-operated isolation valves inside and outside containment. Section 6.4 - Flow check valves are not used on STP instrument sensing lines.

SOUTH TEXAS PROJECT

DESIGN COMPARISONS ON POSITIONS FOR REGULATORY GUIDE 1.151, INSTRUMENT SENSING LINES

Regulatory Position	STP Position
1. The requirements for instrument sensing lines in section 4.1 of ISA-S67.02 should be supplemented with the following: a single instrument sensing line should not be used to perform both a safety-related function and a nonsafety-related function unless it can be shown that:	1. Conform.
a. The failure of the common sensing line would not simultaneously (1) cause an action in a nonsafety-related system that results in a plant condition requiring protective action and (2) also prevent proper action of a protection system channel designed to protect against the condition; or	
b. If the failure of the common sensing line can cause an action in a nonsafety-related system that results in a plant condition requiring protective action and can also prevent proper action of a protection system channel designed to protect against the condition, the remaining redundant protection channels are capable of providing the protective action even when degraded by a second random failure. The rupture of a second instrument sensing line need not be considered as a second random failure.	
Provisions should be included so that this requirement can still be met if a channel is bypassed or removed from service for test or	

Regulatory Position	STP Position
maintenance purposes. Acceptable provisions include reducing the required coincidence, defeating the signals taken from the same sensing line in nonsafety-related systems, or initiating a protective action from the bypassed channel.	
2. The mechanical design requirements in tables 1 and 2 and figures 1, 2, 3, 4, 7, and 8 of ISA-S67.02 for instrument sensing lines connected to ASME Class 1 and 2 process piping and vessels should be supplemented with the following:	2. Conform, except as noted above.
a. Instrument sensing lines that are connected to ASME Class 1 or 2 process piping or vessels should not be less than ASME Class 2, Seismic Category 1, from their connections to the process piping or vessel to and including the accessible isolation valve.	2.a. Conform.
b. Instrument sensing lines that are connected to ASME Class 1 or 2 process piping or vessels and that are used to actuate or monitor safety-related systems should not be less than ASME Class 2, Seismic Category 1, from their connections to the process piping or vessel to the sensing instrumentation.	2.b. Conform.
3. The mechanical design requirements in tables 1 and 2 and figures 5, 6, and 9 of ISA-S67.02 for instrument sensing lines connected to ASME Class 3 process piping and vessels should be supplemented with the following:	3. Conform, except as noted above.

SOUTH TEXAS PROJECT

DESIGN COMPARISONS ON POSITIONS FOR REGULATORY GUIDE 1.151, INSTRUMENT SENSING LINES

Regulatory Position	STP Position
Instrument sensing lines that are connected to ASME Class 3 process piping and vessels and that are used to actuate or monitor safety-related systems should not be less than ASME Class 3, Seismic Category 1, from their connection to the process piping or vessel to the sensing instrumentation.	
4. Freezing temperatures should be added to the environmental and installation conditions listed in section 5.2.1(5) of ISA-S67.02 that sensing lines should be able to withstand and continue to perform their function.	4. Conform.
5. The special considerations in section 5.2.2 of ISA-S67.02 that should be addressed in the design and installation of instrument sensing lines should be supplemented with the following: a. Instrument sensing lines that can be exposed to freezing temperatures and that contain or can be expected to contain a condensable mixture or fluid that can freeze should be provided an environmental control system (heating and ventilation or heat tracing) to protect the lines from freezing during extremely cold weather. b. The environment associated with those instrument sensing lines in item a that are safety related should be monitored and alarmed so that appropriate corrective action can be taken to prevent loss of or damage to the lines from freezing in the event of loss of the environmental control system.	5. Regulatory position C.5 does not apply to STP in that no safety-related instruments have sensing lines that are considered to be subject to freezing.

SOUTH TEXAS PROJECT

DESIGN COMPARISONS ON POSITIONS FOR REGULATORY GUIDE 1.151, INSTRUMENT SENSING LINES

Regulatory Position	STP Position
c. The environmental control system recommended in item a, and for which item b applies, should be electrically independent of the monitoring and alarm system so that a single failure in either system, including their power sources, does not affect the capability of the other system.	
d. The environmental control and monitoring systems of items a and b should be designed to standards commensurate with their important to safety and with administrative controls that are implemented to address events or conditions that could render the systems inoperable.	
6. The Summer 1981 Addenda to Section III of the ASME Boiler and Pressure Vessel Code deleted Paragraphs NB-3676, NC-3676, and ND-3676 in their entirety. References to these paragraphs in sections 4.2.1, 6.2, and 7 of ISA-S67.02 should be disregarded.	6. STP conforms to an earlier, more stringent edition of ASME Section III for design and installation of instrument sensing lines.

Conclusion

While the implementation statement of this guide specifically excludes the South Texas Project, the design and installation of STP instrument sensing lines does comply with R.G. 1.151 and ISA-S67.02, as described above.

HANDOUT FOR ITEM 7

NON 1E/1E DEVICE INTERFACE SUMMARY

SYSTEM	INTERFACING COMPONENT(S)	FUNCTION(S)	FAILURE RESULT(S)	REMARKS
Component Cooling Water	Component Cooling Water Pump 1A	Trip Pump on Low Surge Tank Level/Trip Pump on Low Flow - pump protection	Trip & Possibly Maintain Trip on CCW Pump	Delete Surge Tank Low Level Trip Upgrade or Delete Flow Loop
Component Cooling Water	Component Cooling Water Pump 1B	Trip Pump on Low Surge Tank Level/Trip Pump on Low Flow - pump protection	Trip & Possibly Maintain Trip on CCW Pump	Delete Surge Tank Low Level Trip Upgrade or Delete Flow Loop
Component Cooling Water	Component Cooling Water Pump 1C	Trip Pump on Low Surge Tank Level/Trip Pump on Low Flow - pump protection	Trip & Possibly Maintain Trip on CCW Pump	Delete Surge Tank Low Level Trip Upgrade or Delete Flow Loop
Component Cooling Water/Essential Cooling Water	Component Cooling Water Pump 1A/Essential Cooling Water Pump 1A	Auto Start Standby Pumps	Failure to Auto Start Standby Pump(s) on Low Pressure	o Pumps can be manually operated from CR or Relay Room o Pumps Auto Start on SI o Pumps Start on LOOP
Component Cooling Water/Essential Cooling Water	Component Cooling Water Pump 1B/Essential Cooling Water Pump 1B	Auto Start Standby Pumps	Failure to Auto Start Standby Pump(s) on Low Pressure	o Pumps can be manually operated from CR or Relay Room o Pumps Auto Start on SI o Pumps Start on LOOP
Component Cooling Water/Essential Cooling Water	Component Cooling Water Pump 1C/Essential Cooling Water Pump 1C	Auto Start Standby Pumps	Failure to Auto Start Standby Pump(s) on Low Pressure	o Pumps can be manually operated from Control Room or Relay Room o Pumps Auto Start on SI o Pumps Start on LOOP
Component Cooling Water	Component Cooling Water to NNS Loads Isolation Valves	Close Valves on Low Surge Tank Level - anticipatory NNS load isolation	Failure to Close Valves on Low Surge Tank Level	o Valves can be manually operated from Control Room o Header Isolated by 1E Surge Tank Low-3 Level Sensors
Reactor Makeup Water System	Reactor Makeup Water Pumps	Auto Start RMW Pump(s) from CVCS	Failure to Auto Start RMW Pump(s)	Pump(s) can be manually operated from Control Room - not safety function
Reactor Makeup Water System	Reactor Makeup Water Pumps	Stop RMW Pump(s) on 10-10 Tank Level	Stop & Possibly Prevent Start of RMW Pump(s) from Control Room	Both pumps can be manually operated from Relay Room - System requirements allow adequate time for action outside Control Room
Reactor Makeup Water System	Reactor Makeup System Non-Essential Services Valves	Close Valves on Low Tank Level - anticipatory NNS services isolation	Failure to Close Valves on Low Tank Level	o Valves can be manually operated from Control Room o Calculated leakage is much less than maximum makeup into tank o Tank level indication and low level alarm

NON 1E/1E DEVICE INTERFACE SUMMARY

SYSTEM	INTERFACING COMPONENT(S)	FUNCTION(S)	FAILURE RESULT(S)	REMARKS
Control Room Envelope HVAC	Control Room Makeup Isolation Dampers	Close Control Room Isolation Dampers on Smoke or Chemical Release	Failure to Close Dampers	o Dampers can be manually operated from Control Room o Failure cannot defeat safety action
Control Room Envelope HVAC	Relay Room Fire Protection Dampers	Close Control Room Fire Protection Dampers on Halon release to computer room	Failure to Close Dampers	o Dampers can be manually operated from Control Room o Failure cannot defeat safety action; SI signal opens dampers
Reactor Coolant System	Pressurizer Heaters (Backup Group 1A, 1B)	Operate Backup Heaters on Pressure & Level for normal control (Auto Mode/Manual Mode)	Failure to Operate Heaters	o Manual Operation of Backup Heaters from Auxiliary shutdown panel to re-load onto ESF bus. o Breaker position indication in Control Room (lights and ERFDADS display)
Reactor Coolant System	Reactor Coolant Pressurizer Power Operated Relief Valves	Open Pressurizer PORV for normal pressure control	Failure to Open Pressurizer PORV	o Valves can be manually operated from Control Room or Switchgear Room o Manually operated valve in series can be used if required
Chemical & Volume Control System	Boric Acid Transfer Pumps 1A, 1B	Auto Start Boric Transfer Pumps in Reactor Coolant Makeup Mode	Failure to Auto Start Pumps 1A, 1B	Pumps can be manually operated from Control Room or Switchgear Room - not a safety function
Feedwater	Feedwater Isolation Valves	Valve open permissive on: o SG Water Level o SG Pressure o Feedwater Temperature o Bypass Flow (Anti-water hammer protection)	Failure to Close Valves	o Valves can be manually operated from Control Room o Valves Close Automatically on Feedwater Isolation Signal o Failure cannot defeat safety action
RCB HVAC Normal & Supplementary Purge	RCB Normal & Supplementary Purge Isolation Valves	Close valves on HI RCB Atmosphere Radiation	Failure to Close Valves	o Valves can be manually operated from Control Room o Valves also provided with close signals from qualified, redundant purge monitors or from SI signal

HANDOUT FOR ITEM 11

Question 430.14N

In Table 3.12-1 you state that Regulatory Guide 1.108, 1.118 and 1.128 are not applicable to STP due to implementation date. These Regulatory Guides reflect staff practice used in evaluating plants for a year or more prior to implementation dates. Provide a detailed discussion of compliance or justification for noncompliance. Your discussion of Regulatory Guide 1.108 should include the criteria for first out alarm for diesel generator protection and the testability of the protection system for the diesel generator. Modify your FSAR accordingly.

Response

As stated in Section 8.3.2.2.5, the Class 1E DC System at STP is in compliance with Regulatory Guide (RG) 1.128.

STP will conform to the intent of R.G. 1.118 concerning IEEE 338-77, Section 6, "Testing Program," however, during procedures development, exceptions and clarifications may be identified. Table 3.12-1 and applicable FSAR sections shall be revised to reflect any exceptions.

STP will comply with the intent of RG 1.108 with the interpretations and exceptions presented in Section 8.3.1.2.10.

Section 8.3.1.2.10 and Table 3.12-1 have been revised to incorporate the above changes.

Surveillance test requirements will be incorporated into the STP Technical Specifications.

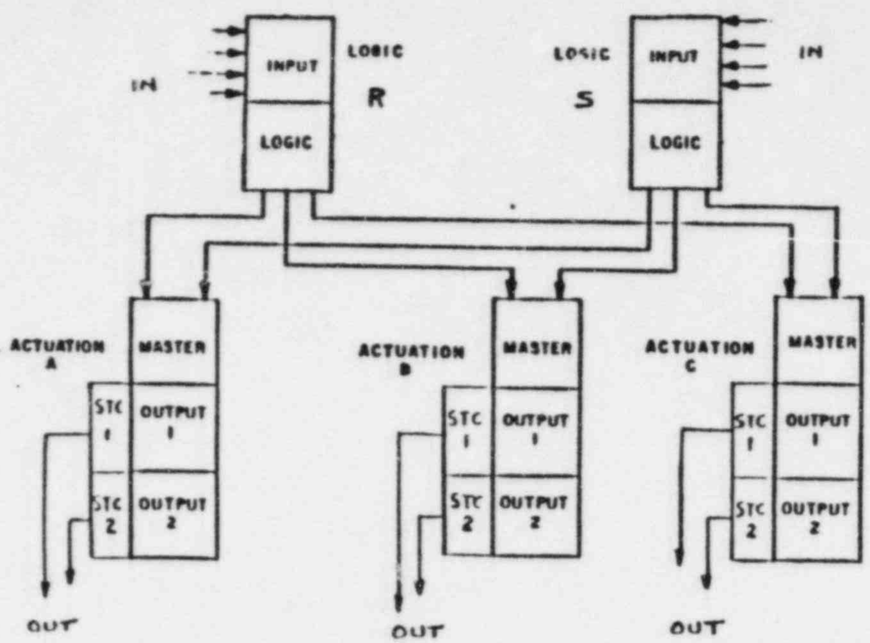
HANDOUT FOR ITEM 12

WESTINGHOUSE SETPOINT METHODOLOGY
REACTOR PROTECTION SYSTEM AND ENGINEERED SAFEGUARDS FEATURES
TRIP SETPOINT CALCULATIONS UTILIZING STATISTICAL SETPOINT METHODOLOGY

1. POWER RANGE, NEUTRON FLUX-HIGH AND LOW SETPOINTS
2. POWER RANGE, NEUTRON FLUX-HIGH POSITIVE RATE AND HIGH NEGATIVE RATE
3. INTERMEDIATE RANGE, NEUTRON FLUX
4. SOURCE RANGE, NEUTRON FLUX
5. OVERTEMPERATURE ΔT
6. OVERPOWER ΔT
7. PRESSURIZER PRESSURE - LOW AND HIGH, REACTOR TRIPS
8. PRESSURIZER WATER LEVEL - HIGH
9. LOSS OF FLOW
10. STEAM GENERATOR WATER LEVEL - LOW-LOW
11. CONTAINMENT PRESSURE - HIGH AND HIGH-HIGH-HIGH
12. PRESSURIZER PRESSURE - LOW, SAFETY INJECTION
13. STEAMLINE PRESSURE - LOW
14. NEGATIVE STEAMLINE PRESSURE RATE - HIGH
15. STEAM GENERATOR WATER LEVEL - HIGH-HIGH
16. TAVG - LOW
17. LOW AND LOW-LOW COMPENSATED TC
18. HIGH FEEDWATER FLOW
19. RWST LEVEL - LOW-LOW

HANDOUT FOR ITEM 17

FUNCTIONAL BLOCK DIAG



Logic Train

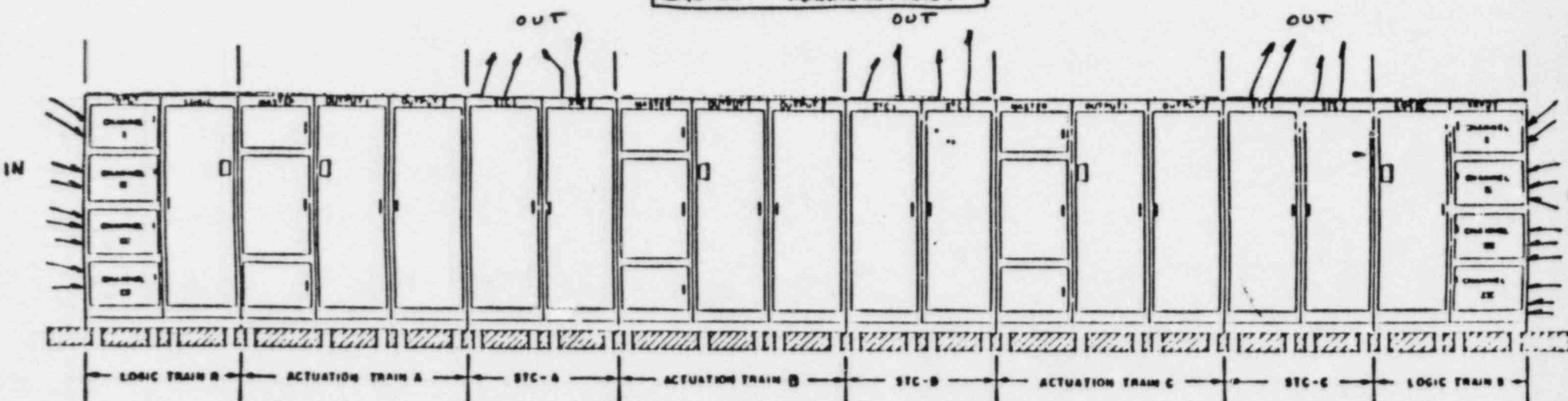
URGENT ALARM CONDITIONS

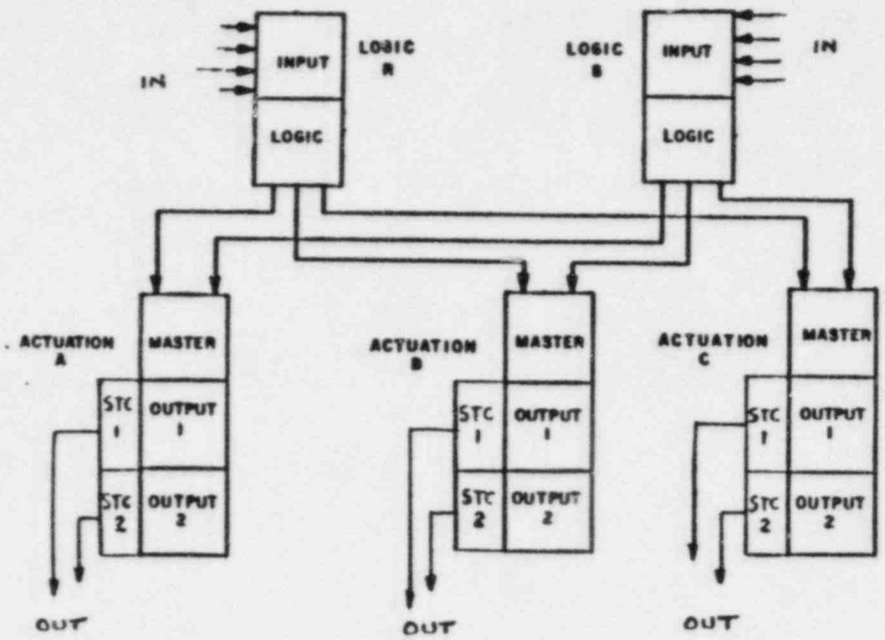
- PC BOARD REMOVED
- PC BOARD IMPROPERLY INSERTED
- BYPASS BKR CLOSED
- TRAIN TEST SWITCHES
- CORRESPONDING ACTUATION TRAIN IN URGENT ALARM (ACT TR A = LOGIC R)(ACT TR B = LOGIC S)

ALARMED LOCALLY AND AT CONTROL BOARD

URGENT ALARM IN BOTH LOGIC TRAINS = AUTOMATIC REACTOR TRIP

CABINET ARRANGEMENT





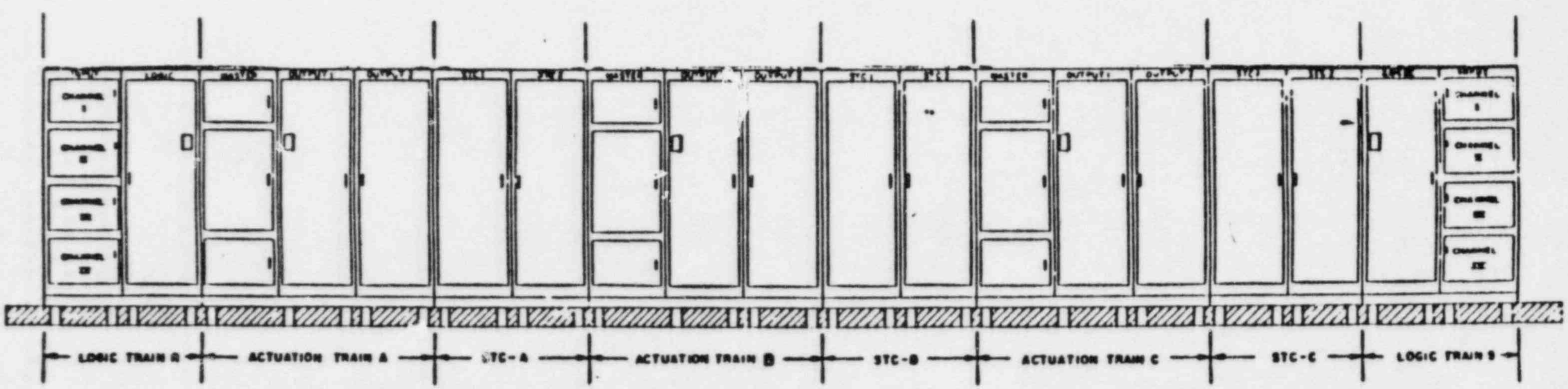
Actuation Train

URGENT ALARM CONDITIONS

- TRAIN IN TEST
- TRAIN LOSS OF AC
- TRAIN STC IN TEST
- TRAIN STC LOSS OF AC

ALARMED AT CONTROL BOARD

URGENT ALARM IN 2/3 ACTUATION TRAINS = AUTOMATIC REACTOR TRIP



HANDOUT TOPIC 23

23. Please provide tne response to Q32.42 on IE Bulletin 79-27
(7.5) concerns.

Question 032.42

If reactor controls and vital instruments derive power from common electrical distribution systems, the failure of such electrical distribution systems may result in an event requiring operator action concurrent with failure of important instrumentation upon which these operator actions should be based. This concern was addressed in IE Bulletin 79-27 (enclosed). On November 30, 1979, IE Bulletin 79-27 was sent to operating license (OL) holders, the near term OL applicants (North Anna 2, Diablo Canyon, McGuire, Salem 2, Sequoyah, and Zimmer), and other holders of construction permits (CP), including South Texas Project. Of these recipients, the CP holders were not given explicit direction for making a submittal as part of the licensing review. However, they were informed that the issue would be addressed later.

You are requested to address these issues by taking IE Bulletin 79-27 Actions 1 thru 3 under "Actions to be Taken by Licensees". Within the response time called for in the attached transmittal letter, complete the review and evaluation required by Actions 1 thru 3 and provide a written response describing your reviews and actions.

RESPONSE

The responses to each action item of IE Bulletin 79-27 are given below by action item number.

1. A review of the instrumentation and control systems which could affect the ability to achieve a hot standby condition (see Section 7.4) and a cold shutdown condition (see Appendix 5.4A) has been performed. Each of these systems is supplied power from one of the redundant Class 1E 120 vac or 125 vdc buses. Refer to Figure 8.3-3.

The Class 1E 120 vac power is provided from one of the six 120 volt vital ac channel distribution panels. Each panel is supplied power through manual transfer circuit breakers from an individual inverter. There are two panels each for Channels I and IV and one panel each for Channels II and III. See also Section 8.3.1.1.4.5.

The Class 1E 125 vdc power is provided from one of the four 125 vdc distribution switchboards. Each switchboard is connected to a separate battery and two battery chargers. See also Section 8.3.2.1.1.

Turbine, non-safety-related reactor and other non-safety-related instrumentation and control systems are provided power from non-Class 1E panels and switchboards. Refer to Figure 8.3-3. The non-Class 1E 120 vac power for the EAB is provided from one of two 120 volt vital ac distribution panels, each connected to an automatic transfer switch and an individual inverter. Another 120 volt vital ac distribution panel is provided in the TGB; this panel is connected to an inverter package with an internal static transfer switch. Two 120 vac regulated power distribution panels are also provided for non-Class 1E instrumentation and control systems.

The non-Class 1E 125 vdc power is provided from two 125 vdc distribution switchboards, each connected to one battery and two battery chargers. A 48 vdc distribution switchboard supplying power only to the plant annunciator system is connected to one battery and two battery chargers. A non-Class 1E 250 vdc distribution switchboard is provided in the TGB, serving motors and the main generator breaker control panels; it is connected to one battery and two battery chargers.

A separate non-Class 1E uninterruptible power supply system (120 vac) is provided for the plant computer. The ERF computer is powered from non-Class 1E 480 vac and has an uninterruptible power supply system to support its functions during a loss of power.

The Radiation Monitoring System (RMS) computer is powered from non-Class 1E 480 vac and has an uninterruptible power supply system to support its functions during a loss of power.

Non-Class 1E power is not required to support the ability to achieve hot standby or cold shutdown conditions. However, the non-Class 1E power supports indications to the operator (such as computer alarms and annunciation) of abnormal conditions and control systems normally used during plant operating modes.

1a. Loss of power to each of the six Class 1E 120 volt vital ac distribution panel buses is alarmed individually in the control room on a window of the ESF status monitoring system. A ground fault on any of these panel buses is alarmed individually on a window of the plant annunciator as Panel Trouble. The ERF computer also indicates that a loss of power or a ground fault has occurred. Alarms are provided for each inverter through the ERF computer and either the annunciator or the ESF status monitoring system.

Loss of power to each of the four Class 1E 125 vdc distribution switchboard buses is alarmed individually in the control room on a reflash window of the plant annunciator, along with other bus and battery charger alarms, as System Trouble. The ERF computer indicates whether bus or charger trouble has occurred.

Loss of power or a ground fault to the two EAB non-Class 1E 120 volt vital ac distribution panel buses is alarmed individually in the control room through the plant computer. Alarms are provided for each inverter through the annunciator and the plant computer.

Loss of power or a ground fault to the TGB non-Class 1E 120 volt vital ac distribution panel bus is alarmed in the control room through the plant computer. Inverter/rectifier alarms are provided through the plant computer and the annunciator.

Loss of power to either of the two non-Class 1E 120 vac regulated power distribution panel buses is alarmed in the control room through the plant computer.

Loss of power to either of the two non-Class 1E 125 vdc switchboard buses is alarmed individually in the control room on a reflash window of the plant annunciator, along with other bus and battery charger alarms, as System Trouble. The plant computer indicates whether bus or charger trouble has occurred.

Loss of power to the non-Class 1E 48 vdc switchboard bus is alarmed in the control room via the plant computer. Other bus and battery charger alarms are provided on a reflash window of the plant annunciator as System Trouble. The plant computer indicates whether bus or charger trouble has occurred.

Loss of power to the non-Class 1E 250 vdc switchboard bus is alarmed in the control room on a reflash window of the plant annunciator, along with other bus and battery charger alarms, as System Trouble. The plant computer indicates whether bus or charger trouble has occurred.

Loss of power or a ground fault to the non-Class 1E 120 vac distribution panel bus for the plant computer is alarmed in the control room. Various battery, charger and inverter alarms for the computer UPS are given in the control room on two reflash windows of the plant annunciator, one for Battery/Charger Trouble and one for Inverter Failure. The ERF computer indicates which signal caused the annunciator alarm.

A description of the alarms for loss of power to the ERF computer and to the RMS computer will be provided later.

1b. The review and evaluation of the Class 1E and non-Class 1E buses described above indicate that loss of power to any one instrumentation and control bus will not inhibit the ability to achieve a cold shutdown condition.

1c. The review and evaluation indicate that design modifications are not required.

2. The operating procedures used by control room operators will be reviewed with respect to loss of power to each Class 1E and non-Class 1E bus supplying power to instrumentation and control systems.

2a. The procedures will define symptoms and specify actions to be taken by the operators upon loss of power to Class 1E or non-Class 1E instrumentation and control systems.

2b. Where necessary, the procedures will specify alternate instrumentation and control circuits for use by operators.

2c. The procedures will include methods and precautions for restoring power to each Class 1E and non-Class 1E bus supplying power to instrumentation and control systems.

Should any design modifications or administrative controls be required as a result of the development of these procedures, descriptions of these will be provided.

3. IE Circular No. 79-02 has been reviewed in relation to the safety-related power supply inverters. All safety-related power supply inverters are Class 1E. For these inverters, relative to the Circular requirements:

a. Class 1E inverters do not use time delay circuitry.

b. The ac input to each Class 1E inverter is to a transformer/rectifier section. The transformer has taps that will be set according to the recommendations of the manufacturer. A relay trips the transformer/rectifier supply circuit breaker if overvoltage occurs.

c. The alternate 120 volt source is supplied by manual operation of interlocked circuit breakers. This manual bypass of the Class 1E inverters allows maintenance to be performed.

d. Administrative controls will confirm the position of transformer taps and manual bypass circuit breakers when maintenance or testing have been completed.

No design modifications or additional administrative controls are required.

HANDOUT FOR ITEM 30

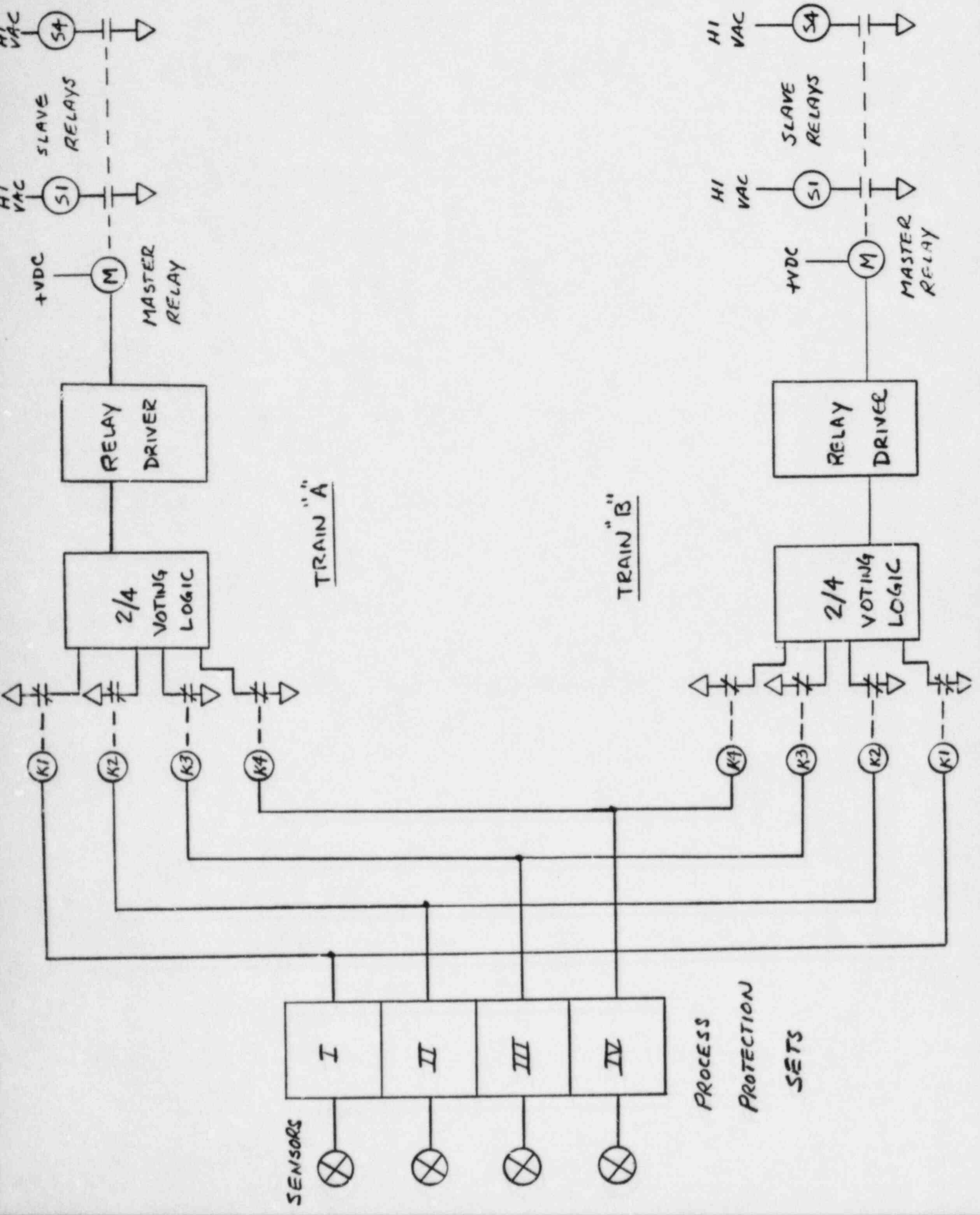
FAILURE MODES AND EFFECTS ANALYSES APPLICABLE TO STP

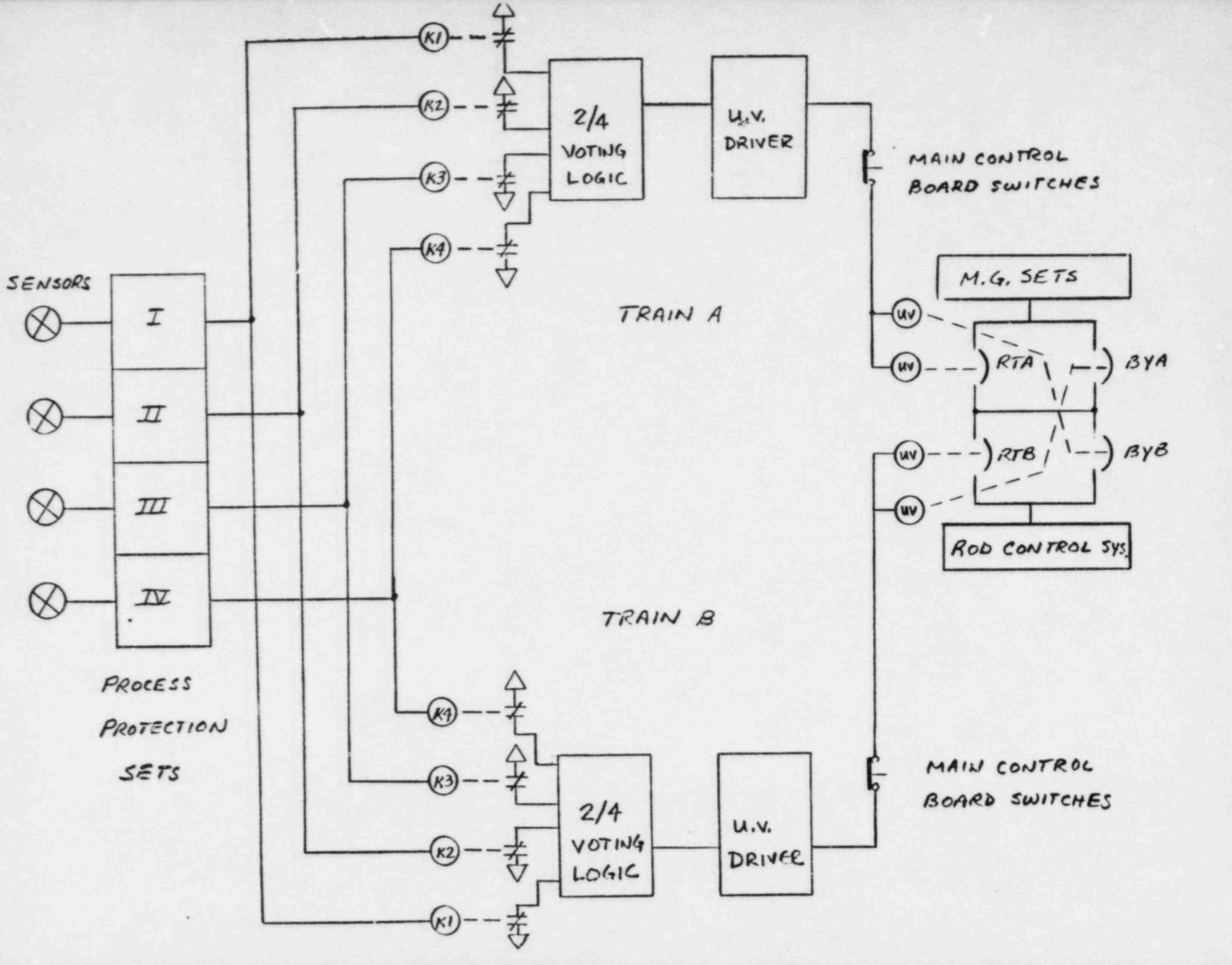
ANALYSIS TITLE	LOCATION
Reactor Trip System	WCAP-7706-L
W ESF Actuation System	WCAP-8584
Control Rod Drive System	WCAP-8976
Cold Shutdown -- including boration capability, reactor vessel head vent system, accumulator isolation, Residual Heat Removal System, and pressurizer power-operated relief valves	Table 5.4.9-2
Containment Heat Removal Systems -- including Containment Spray System and Reactor Containment Fan Coolers	Table 6.2.2-3
Containment Isolation System	Table 6.2.4-1
Hydrogen Recombiners	Table 6.2.5-2
Emergency Core Cooling (Safety Injection) System	Table 6.3-5 Table 6.3-6 Table 6.3-10
Post Accident Monitoring System -- including the Qualified Display Monitoring System	Table 7.5-4
Class 1E DC System	Table 8.3-8
Class 1E AC System (except 120 vac Vital)	Table 8.3-9
Class 1E Vital 120 vac System	Table 8.3-13
Spent Fuel Pool Cooling and Cleanup System	Table 9.1-5
Essential Cooling Water System	Table 9.2.1-2
Component Cooling Water System	Table 9.2.2-3
Air-Operated Valves	Table 9.3-2
Chemical and Volume Control System	Table 9.3-12

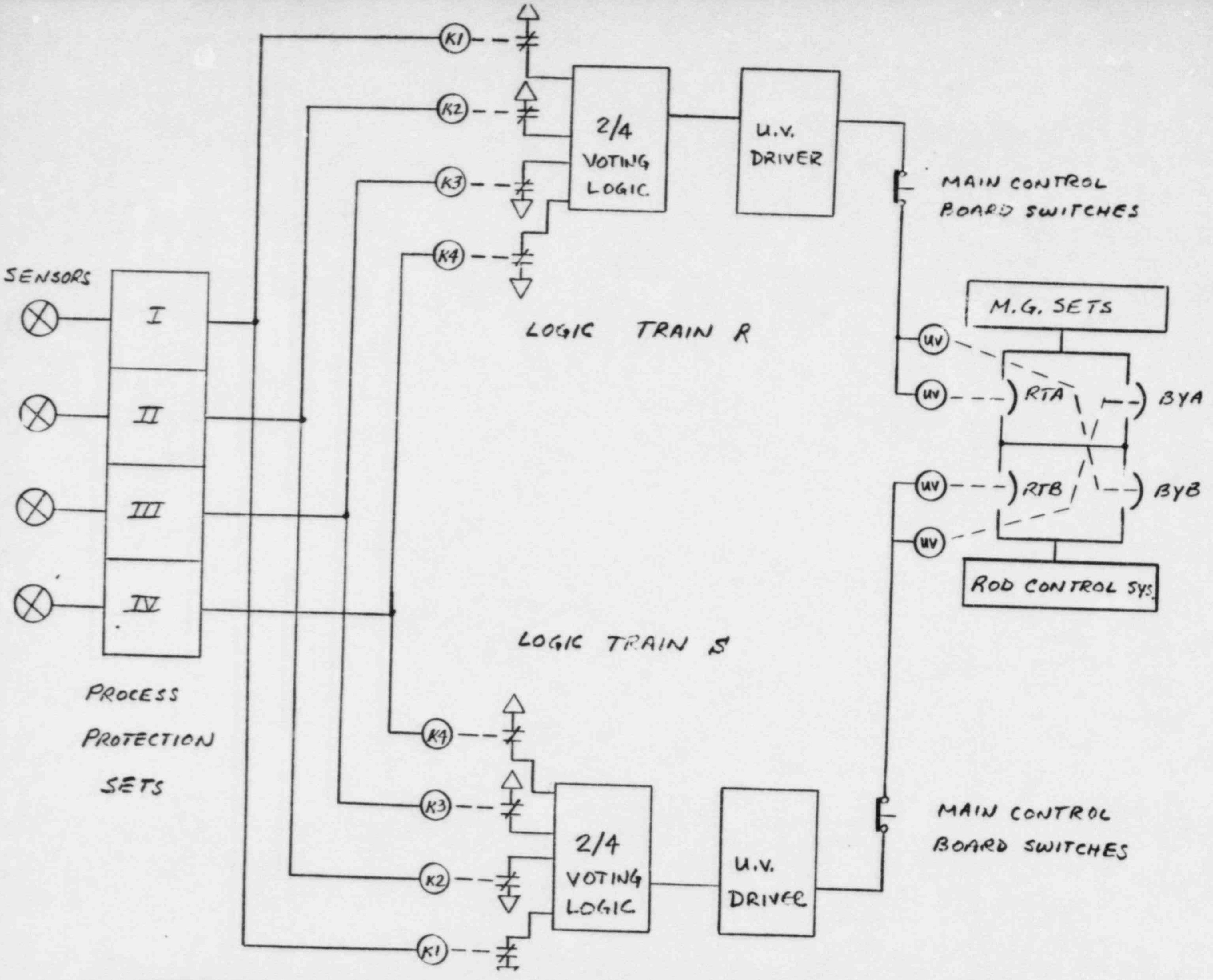
FAILURE MODES AND EFFECTS ANALYSES
APPLICABLE TO STP

ANALYSIS TITLE	LOCATION
Reactor Trip System	WCAP-7706-L
W ESF Actuation System	WCAP-8584
Control Rod Drive System	WCAP-8976
Cold Shutdown -- including boration capability, reactor vessel head vent system, accumulator isolation, Residual Heat Removal System, and pressurizer power-operated relief valves	Table 5.4.A-2
Containment He[illegible] Removal Systems -- including Containmer[illegible] [illegible]ray System and Reactor Containment Fan Coolers	Table 6.2.2-3
Containment Isolation System	Table 6.2.4-1
Hydrogen Recombiners	Table 6.2.5-2
Emergency Core Cooling (Safety Injection) System	Table 6.3-5 Table 6.3-6 Table 6.3-10
Post Accident Monitoring System -- including the Qualifi[illegible] Display Monitoring System	Table 7.5-4
Class 1E DC System	Table 8.3-8
Class 1E AC System (except 120 vac Vital)	Table 8.3-9
Class 1E Vital 120 vac System	Table 8.3-13
Spent Fuel Pool Cooling and Cleanup System	Table 9.1-5
Essential Cooling Water System	Table 9.2.1-2
Component Cooling Water System	Table 9.2.2-3
Air-Operated Valves	Table 9.3-2
Chemical and Volume Control System	Table 9.3-12

HANDOUT FOR ITEM 30




SENSORS
I
II
III
IV
PROCESS
PROTECTION
SETS
K1
K2
K3
K4
2/4
VOTING
LOGIC
U.V.
DRIVER
MAIN CONTROL
BOARD SWITCHES
TRAIN A
TRAIN B
UV
M.G. SETS
RTA
BYA
RTB
BYB
ROD CONTROL SYS.


SENSORS
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LOGIC TRAIN R
LOGIC TRAIN S
M.G. SETS
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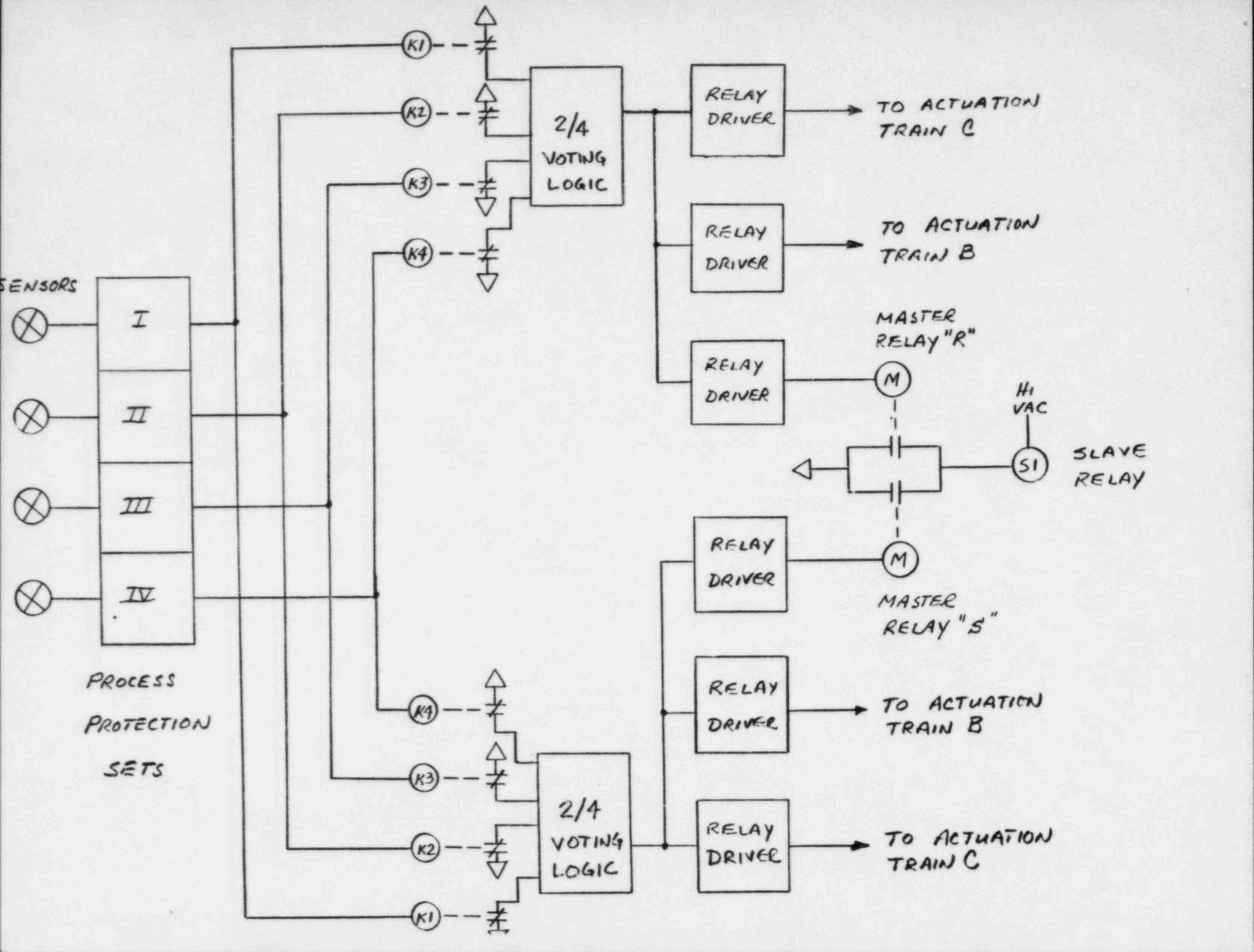
RTB
BYB
ROD CONTROL SYS.
U.V.
DRIVER
MAIN CONTROL
BOARD SWITCHES


SENSORS
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K2
K3
K4
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VOTING
LOGIC
RELAY
DRIVER
TO ACTUATION
TRAIN C
TO ACTUATION
TRAIN B
MASTER
RELAY "R"
M
HI
VAC
S1
SLAVE
RELAY
MASTER
RELAY "S"

HANDOUT FOR ITEM 31

ESF HVAC COOLING SYSTEMS

A. ESSENTIAL CHILLED WATER SYSTEM:

AREAS SERVED —

EAB: ELECT PENETRATION AREA
CONTROL RM ENVELOPE
EAB MAIN AREA.

MAB: ESS CHILLER ROOMS
CVCS VALVE CUBICLES
BORIC ACID PUMP ROOMS
REACTOR MAKE UP TANK RM
RADIATION MONITOR ROOM

FHB: ESF PUMP ROOMS
ISOLATION VALVE CUBICLES
SPENT FUEL POOL PUMP RMS.

B ECW SYSTEM.

AREAS SERVED —

MAB: CCW PUMP ROOMS

NOTE. ESS CHILLER CONDENSERS ARE COOLED BY ECW

C CCW SYSTEM

AREAS SERVED —

MAB: CENTRIFUGAL CHARGING PUMP RMS
RCB: RCFC SERVING ALL AREAS (EMERG. ONLY)

D VENTILATION SYSTEMS

AREAS SERVED —

DGB: ALL AREAS EXCEPT OIL TANK RM
MSIVC: AFW PUMP ROOMS
MS & FW ISOLATION VALVE CUBICLES
ECWIS: ALL AREAS

HANDOUT FOR ITEM 40

STATUS OF THE QUALIFIED DISPLAY PROCESSING SYSTEM (QDPS)

MILESTONE	DATE
Ship Unit 1 Cabinets	RECEIVED
Finalize details of the V&V plan	02/28/85
Verification program begins	03/01/85
Complete generic test plan for noise and isolation testing	05/01/85
Complete hardware integration	05/30/85
Complete software test plans	06/01/85
Complete isolation tests	08/01/85
Complete subsystem tests	08/26/85
Start factory acceptance tests	08/27/85
Ship Unit 1 hardware	09/04/85
Issue WCAP on noise and isolation	10/04/85
Complete system validation test plan	10/14/85
System validation testing begins	10/15/85
Testing complete	01/31/86
Final Report	04/02/86
Ship Unit 2 hardware	05/86

HANDOUT FROM ITEM 48

Question 032.45

The analyses reported in Chapter 15 of the FSAR are intended to demonstrate the adequacy of safety systems in mitigating anticipated operational occurrences and accidents.

Based on the conservative assumptions made in defining these design-basis events and the detailed review of the analyses by the staff, it is likely that they adequately bound the consequences of single control system failures.

To provide assurance that the design basis event analyses adequately bound other more fundamental credible failures you are requested to provide the following information:

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

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

(3) Indicate which, if any, of the control systems identified in (1) receive input signals from common sensors. The sensors considered should include, but should not necessarily be limited to, common hydraulic headers or impulse lines feeding pressure, temperature, level or other signals to two or more control systems.

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

Response

The evaluation required to answer this question consists of postulating failures which affect the major NSSS control systems and demonstrating that for each failure the resulting event is within the bounds of existing accident analyses. The events which are considered are:

a) Loss of any single instrument
b) Break of any single common instrument line
c) Loss of power to all systems powered by a single power supply system (i.e. single inverter)
d) Loss of power to individual protection, control, or auxiliary process cabinets

The analysis is conducted for all five major NSSS control systems:

1) Reactor control system
2) Steam dump system
3) Pressurizer pressure control system
4) Pressurizer level control system
5) Feedwater control system

The initial conditions for the analysis are assumed to be anywhere within the full operating power range of the plant (i.e. 0-100%), where applicable.

The results of the analysis indicate that, for any of the postulated events considered in a) through d) above, the ANS Condition II accident analyses given in Chapter 15 of the South Texas FSAR are bounding.

LOSS OF ANY SINGLE INSTRUMENT (Item a)

Table Q032.45-1, Loss of Any Single Instrument, is a sensor-by-sensor evaluation of the effect on the control systems itemized above caused by a sensor failing either high or low. The particular sensor considered is given, along with the number of channels which exist, the failed channel, the control systems impacted by the sensor, the effects on the control systems for failures in both directions, and the bounding FSAR accident. Where no control action occurs or where control action is in a safe direction, no bounding accident is given.

The table clearly shows that for any single instrument failure, either high or low, the Condition II events itemized in FSAR Chapter 15 are bounding.

LOSS OF POWER (Items c and d)

The South Texas NSSS instrument power supply consists of eight instrument distribution panels receiving power through eight inverters hereafter labelled I through VIII for convenience. Figure Q032.45-1 provides a schematic of the power distribution arrangement. As shown, the instrumentation which comprises Protection Set I is housed in Protection Cabinets 1 and 1A. Similarly, the instrumentation for Protection Sets II and III is assigned to Protection Cabinets 2/2A and 3/3A respectively. Protection Set IV instrumentation resides in a single cabinet. The Control Groups are assigned to four separate cabinets powered from two non Class 1E inverters. Finally, four additional Auxiliary Process Cabinets are shown. These cabinets are part of the Qualified Display Processing System (QDPS). They are considered in this analysis because a few of the signals of interest (specifically, charging flow, pressurizer water level, and narrow range steam generator water level) are routed from the field to these cabinets first and are then passed on to the NSSS 7300 process cabinets. As indicated in the schematic, the Auxiliary Process Cabinets are aligned in a channel oriented manner corresponding to the associated protection channels so as to maintain separation; the signal channels are assigned and routed accordingly.

Tables Q032.45-13 through Q032.45-20, Loss of Power to Inverters I through VIII respectively, analyze the effects on the control systems caused by the most limiting failure, loss of power to an entire instrument distribution panel. The control systems affected, the sensors affected, the failure direction, the control system responses, and the bounding FSAR accident are given in the tables. Where no control action occurs or where control action is in a safe direction, no bounding accident is given.

Besides the loss of an inverter, there is also a chance of losing power to a single control cabinet, protection cabinet, or auxiliary process cabinet (for example, through the failure of a fuse or circuit breaker). The consequences of a loss of power to a protection cabinet are tabulated in Tables Q032.45-2 through Q032.45-8. Loss of power to a control cabinet (group) is addressed in Tables Q032.45-9 through Q032.45-12. Finally, Tables Q032.45-21 and Q032.45-22 consider loss of power to the individual auxiliary process cabinets not covered by the loss of an inverter analyses. In each case, the data is presented in a similar manner to that for the loss of an inverter described in the previous paragraph. Loss of power to individual NIS channels is not explicitly considered since the responses are identical to the low failure of an individual NIS instrument in Table Q032.45-1.

Besides the loss of power to an entire cabinet, there is the chance of having an electrical fault on one of the control system circuit cards. The control systems are designed so that each card is used in only one control system. A circuit card failure cannot directly impact more than one control system. A failure on a control card would cause the controller to generate either an "off" or a "full on" output, depending on the type of failure. This result would be similar to having a fault in a sensor feeding the control system. Therefore, the failure of or loss of power in any control system circuit card would be bounded by the Loss of Any Single Instrument analysis described in Table Q032.45-1.

The tables show that for a loss of power to any inverter, protection cabinet, control cabinet, or auxiliary process cabinet, the Condition II events analyzed in FSAR Chapter 15 are bounding.

BREAK OF COMMON INSTRUMENT LINES (Item b)

Table Q032.45-23, Loss of Common Instrument Lines, considers the scenario whereby an instrument line which supplies more than one signal ruptures, causing faulty sensor readings.

Two sets of sensors are located in common lines as indicated below:

1) Loop steam flow (control groups 1 and 2 for each steam generator) and narrow range steam generator water level (Protection Sets I and II for each steam generator). Each control group 1 flow sensor considered shares a tap with a Protection Set I level sensor; each control group 2 flow sensor shares a tap with a Protection Set II level sensor.

2) Pressurizer water level and pressurizer pressure (Protection Sets I, II, III, or IV). The level and pressure sensors on common taps are in the same protection set.

Table Q032.45-23 shows that in the event of a common instrument line break, the Condition II events itemized in FSAR Chapter 15 are bounding.

Not shown on the table since they are not part of the plant control system but are used just for protection are the RCS loop flow transmitters. There are three flow transmitters in each loop, with each transmitter having a common high pressure tap but separate and unique low pressure taps. Therefore, a break at the high pressure flow transmitter tap would result in disabling all three flow transmitters in one loop, resulting in a low flow reading for all three transmitters. This would result in a reactor trip if the plant is above the P-8 setpoint, or an annunciation if it is below P-8.

The only malfunction mode explicitly analyzed was a break in the common instrument line at the tap. Another possibility is to have a complete blockage in the sensor tap, causing the sensor to read a constant (before blockage) value. However, this last failure mode is not analyzed since it is

really not a credible event. There is no anticipated agent available that would cause a tap blockage. The Reactor Coolant System piping and fittings and the instrument impulse line tubing are all stainless steel, so no products of corrosion are expected. Also the water chemistry is of high quality which, along with high temperature operation, precludes the presence of solids in the water and assures the maintenance of the solubility of chemicals in the water. In addition, prior to startup, and during any shutdown as well, it is routine maintenance and servicing practice for instrument lines to be blown down to a canister. Since the building of sludge is a slow process, any buildup would be detected during response time testing done during shutdown. Therefore, the hypothesis of complete blockage of the sensor tap is not sufficiently credible to warrant its consideration as a design basis.

In the extremely unlikely event that a complete instrument line blockage were to occur, the condition is detectable because the reading would become static (no variations over time). In an unblocked channel, a reading would always vary somewhat due to noise (e.g. flow induced noise in flow channels) or slight controller action (e.g. cycling operation of spray and heaters in the pressurizer). By a comparison of the static channel to the redundant unblocked channels, the operator would be informed that a blockage in one channel has occurred.

CONCLUSIONS

The accompanying tables have illustrated that failures of individual sensors, losses of power to inverters, losses of power to individual protection, control, and auxiliary process cabinets, or breaks in common instrument lines all result in events which are bounded by FSAR Chapter 15 analyses. Therefore, the FSAR adequately bounds the consequences of these fundamental failures.

LIST OF TABLES

Table No.

FIGURE Q032.45-1

SIMPLIFIED SCHEMATIC OF SOUTH TEXAS NSSS POWER DISTRIBUTION ARRANGEMENT
(note 3)

```
| INVERTER  I    |                  | INVERTER  II   |
|   Class 1E     |                  |   Class 1E     |
|   7.5 KVA      |                  |   7.5 KVA      |
|(3E241EIV1201)  |                  |(3E241EIV1202)  |
  |                                   |
  |--Protection Cabinet 1 (note 1)    |--Protection Cabinet 2
  |                                   |
  |--Protection Cabinet 1A            |--Protection Cabinet 2A
  |                                   |
  |--NIS Channel I                    |--NIS Channel II
                                      |
                                      |--Aux. Process Cabinet II

| INVERTER  III  |                  | INVERTER  IV   |
|   Class 1E     |                  |   Class 1E     |
|   7.5 KVA      |                  |   7.5 KVA      |
|(3E241EIV1203)  |                  |(3E241EIV1204)  |
  |                                   |
  |--Protection Cabinet 3             |--Protection Cabinet 4
  |                                   |
  |--Protection Cabinet 3A            |--NIS Channel IV
  |
  |--NIS Channel III
  |
  |--Aux. Process Cabinet III

| INVERTER  V    |                  | INVERTER  VI   |
|   Non 1E       |                  |   Class 1E     |
|   25 KVA       |                  |   25 KVA       |
| (8E241EIV002)  |                  | (3E241EIV001)  |
  |                                   |
  |--Control Cabinet 1 (note 2)       |--Aux. Process Cabinet I
  |
  |--Control Cabinet 3

| INVERTER  VII  |                  | INVERTER  VIII |
|   Class 1E     |                  |   Non 1E       |
|   25 KVA       |                  |   25 KVA       |
| (3E241EIV002)  |                  | (8E241EIV001)  |
  |                                   |
  |--Aux. Process Cabinet IV          |--Control Cabinet 2
                                      |
                                      |--Control Cabinet 4
```

NOTES:
1) Protection cabinets 1/1A,2/2A,3/3A comprise Protection Sets I/II/III respectively.
2) Control cabinets also referred to as 'Control Groups'.
3) Only cabinets of interest are shown.

TABLE Q032.45-1

LOSS OF ANY SINGLE INSTRUMENT

(Sheet 1 of 15)

SENSOR	NUMBER OF CHANNELS	FAILED CHANNEL	SYSTEM	ASSUMED FAILURE DIRECTION	EFFECT	BOUNDING EVENT
Feedpump Discharge Pressure	1 per plant	———	o Feedwater Control	Lo	FW pump speed increases if in auto mode. (FW control valves close due to increased flow if in auto mode.)	If FW pump in manual - no event. If FW pump and FCVs in auto - new steady state w/higher pump speed and decreasing FCV lift. If FW pump in auto and FCVs in manual - bounding event is FW System Malfunction Resulting in an Increase in FW Flow (Section 15.1.2)
				Hi	FW pump speed decreases if in auto mode. (FW control valves open due to decreased flow if in auto mode).	If FW pump in manual- no event. Other modes result in a decreased FW flow over time, hence bounding event is Loss of Normal FW Flow (Section 15.2.7)
Steam Header Pressure	1 per plant	———	o Feedwater Control o Steam Dump (T_{avg} Mode)	Lo	FW pump speed decreases if in auto mode. (FW control valves open due to decreased flow if in auto mode).	If FW pump in manual - no event. Other modes result in a decreased FW flow over time, hence bounding event is Loss of Normal FW Flow (Section 15.2.7)

TABLE Q032.45-1 (Continued)

LOSS OF ANY SINGLE INSTRUMENT
(Sheet 2 of 15)

SENSOR	NUMBER OF CHANNELS	FAILED CHANNEL	SYSTEM	ASSUMED FAILURE DIRECTION	EFFECT	BOUNDING EVENT
				Hi	FW pump speed increases if in auto mode. (FW control valves close due to increased flow if in auto mode).	If FW pump in manual - no event. If FW pump and FCVs in auto - new steady state w/higher pump speed and decreasing FCV lift. If FW pump in auto and FCVs in manual - bounding event is FW System Malfunction Resulting in an Increase in FW Flow (Section 15.1.2)
Steam Header Pressure	1 per plant	———	o Feedwater Control o Steam Dump (Pressure Mode)	Lo	FW pump speed decreases if in auto mode. (FW control valves open due to decreased flow if in auto mode).	If FW pump in manual - no event. Other modes result in a decreased FW flow over time, hence bounding event is Loss of Normal FW Flow (Section 15.2.7)

TABLE Q032.45-1 (Continued)

LOSS OF AN SINGLE INSTRUMENT

(Sheet 3 of 15)

SENSOR	NUMBER OF CHANNELS	FAILED CHANNEL	SYSTEM	ASSUMED FAILURE DIRECTION	EFFECT	BOUNDING EVENT
				Hi	FW pump speed increases if in auto mode. (FW control valves close due to increased flow if in auto mode). Dump valves open unless steam dump blocked on lo-lo T_{avg} (P-12).	Steam dump in pressure mode at hot standby or very low power only. Hence, dump valves will open for only a very short time, until lo-lo T_{avg} (P-12) is reached. If FW pump is in manual or FW pump and FCVs in auto, then this event is bounded by Excessive Increase in Secondary Steam Flow (Section 15.1.3). If FW pump in auto and FCV in manual, result is increase in FW flow causing excessive cooling. Bounding event is FW System Malfunction Resulting in an Increase in FW Flow (Section 15.1.2)

TABLE Q032.45-1 (Continued)

LOSS OF ANY SINGLE INSTRUMENT
(Sheet 4 of 15)

SENSOR	NUMBER OF CHANNELS	FAILED CHANNEL	SYSTEM	ASSUMED FAILURE DIRECTION	EFFECT	BOUNDING EVENT
Loop Steam Flow	2 per loop	1 selected for control	o Feedwater Control	Lo	FW pump speed decreases if in auto mode. FW control valves close if in auto mode.	If FW pump and FCV in manual - no event. Other modes result in decreased FW flow; bounding event is Loss of Normal FW Flow (Section 15.2.7)
				Hi	FW pump speed increases if in auto mode. FW control valves open if in auto mode.	If FW pump and FCV in manual - no event. Other modes result in increased FW flow; bounding event is FW System Malfunction Resulting in an Increase in FW Flow (Section 15.1.2)
Loop FW Flow	2 per loop	1 selected for control	o Feedwater Control	Lo	FW control valve opens if in auto mode	If FCV in manual - no event. If FCV in auto, result is bounded by FW System Malfunction Resulting in an Increase in FW Flow (Section 15.1.2)

TABLE Q032.45-1 (continued)

LOSS OF ANY SINGLE INSTRUMENT
(Sheet 5 of 15)

SENSOR	NUMBER OF CHANNELS	FAILED CHANNEL	SYSTEM	ASSUMED FAILURE DIRECTION	EFFECT	BOUNDING EVENT
				Hi	FW control valve closes if in auto mode	If FCV in manual - no event. If FCV in auto, result is decreased FW flow. Bounding event is Loss of Normal FW Flow (Section 15.2.7)
Steam Generator Narrow Range Water Level	4 per Steam Generator (two available for control)	1 selected for control (I or II)	o Feedwater Control	Lo	FW control valve opens if in auto mode	If FCV in manual - no event. If FCV in auto, bounding event is FW System Malfunction Resulting in an Increase in FW Flow (Section 15.1.2)
				Hi	FW control valve closes if in auto mode.	If FCV in manual - no event. If FCV in auto, result is decreased FW flow. Bounding event is Loss of Normal FW Flow (Section 15.2.7)
Pressurizer Water Level (Control)	4 per plant	1 selected for control (I or III)	o Pressurizer Level Control	Lo	Charging flow increases. Heaters turn off (except for local control). If Channel I is failed, letdown isolated by Channel I protection signal (VCT empties, charging pumps take suction from RWST.)	Bounding event is CVCS Malfunction That Increases Reactor Coolant Inventory (Section 15.5.2)

TABLE Q032.45-1 (continued)

LOSS OF ANY SINGLE INSTRUMENT
(Sheet 6 of 15)

SENSOR	NUMBER OF CHANNELS	FAILED CHANNEL	SYSTEM	ASSUMED FAILURE DIRECTION	EFFECT	BOUNDING EVENT
				Hi	Charging flow decreases. Backup heaters on (Later, let-down isolation from Channel IV protection signal,heaters blocked from interlock channel.)	While heaters are on, no net depressurization of RCS. After heaters are blocked, decreased charging flow acts to depressurize RCS. Depressurization event is therefore bounded by Inadvertent Opening of a Pressurizer Safety or Relief Valve (Section 15.6.1)
Pressurizer Water Level (Interlock)	3 per plant	1 selected for control (II or III)	o Pressurizer Level Control	Lo	Pressurizer heaters blocked (except for local control).	No event.
				Hi	No control action, get high level annunciation.	Not applicable
Pressurizer Water Level (Protection Grade Action Only)	4 per plant	IV	o Pressurizer Level Control (Letdown (Isolation)	Lo	Letdown isolated.	Bounding event is CVCS Malfunction That Increases Reactor Coolant Inventory (Section 15.5.2)
				Hi	No control action.	Not applicable.

TABLE Q032.45-1 (continued)

LOSS OF ANY SINGLE INSTRUMENT
(Sheet 7 of 15)

SENSOR	NUMBER OF CHANNELS	FAILED CHANNEL	ASSUMED FAILURE SYSTEM	DIRECTION	EFFECT	BOUNDING EVENT
Charging Flow	1 per plant	I	o Pressurizer Level Control	Lo	Charging flow increases until integral controller on level error generates zero flow demand.	New steady state reached at high level. Depending on magnitude of level increase, bounding event is CVCS Malfunction That Increases Reactor Coolant Inventory (Section 15.5.2).
				Hi	Charging flow decreases until integral controller on level error generates maximum flow demand; possibly letdown isolation on low level.	New steady state reached at low level; transient mitigated on letdown isolation. No event.
Pressurizer Pressure	4 per plant	I	o Pressurizer Pressure Control (Pos. 1 or 2)*	Lo	PORV PCV-655A blocked. Spray remains off. All back-up heaters on.	Heaters being on causes increase in pressurizer pressure to PORV PCV-656A actuation. No event.
				Hi	Variable heaters turned off. PORV PCV-655A opens, blocked on low pressure due to interlock. Spray turned on.	Result is bounded by Inadvertent Opening of a Pressurizer Safety or Relief Valve (Section 15.6.1)

TABLE Q032.45-1 (continued)

LOSS OF ANY SINGLE INSTRUMENT
(Sheet 8 of 15)

SENSOR	NUMBER OF CHANNELS	FAILED CHANNEL	ASSUMED FAILURE SYSTEM	DIRECTION	BOUNDING EFFECT	EVENT
Pressurizer Pressure	4 per plant	II	o Pressurizer Pressure Control (Pos. 2 or 3)*	Lo	No control action. PORV PCV-656A blocked from opening. PORV PCV-655A still available for normal control.	Not applicable
				Hi	PORV PCV-656A opens, closes when pressure falls below interlock setpoint.	Result is bounded by Inadvertent Opening of a Pressurizer Safety or Relief Valve (Section 15.6.1)
Pressurizer Pressure	4 per plant	III	o Pressurizer Pressure Control	Lo	PORV PCV-656A blocked. If channel III selected for control, PORV PCV-655A also blocked, spray remains off, and all back-up heaters turn on.	Heaters being on causes increase in pressurizer pressure possibly to safety valve actuation. Result is bounded by Inadvertent Opening of a Pressurizer Safety or Relief Valve (Section 15.6.1).
				Hi	PORV PCV-656A unblocked. If channel III selected for control, PORV PCV-655A opens, blocked on low pressure due to interlock, spray turned on and variable heaters turned off.	Result is bounded by Inadvertent Opening of a Pressurizer Safety or Relief Valve (Section 15.6.1)

TABLE Q032.45-1 (continued)

LOSS OF ANY SINGLE INSTRUMENT
(Sheet 9 of 15)

SENSOR	NUMBER OF CHANNELS	FAILED CHANNEL	SYSTEM	ASSUMED FAILURE DIRECTION	EFFECT	BOUNDING EVENT
Pressurizer Pressure	4 per plant	IV	o Pressurizer Pressure Control	Lo	No control action. PORV PCV-655A blocked from opening. If channel IV selected for control, PORV PCV-656A also blocked.	Not applicable
				Hi	PORV PCV-655A unblocked. If channel IV selected for control, PORV PCV-656A opens, closes when pressure falls below interlock setpoint.	Result is bounded by Inadvertent Opening of a Pressurizer Safety or Relief Valve (Section 15.6.1)
T_{avg}	one per loop	Any Auct. Lo	o Turbine Loading	Lo	Stop turbine loading (C-17); annunciation occurs.	Not applicable
		Auct. Hi	o Steam Dump (T_{avg} Mode) o Reactor Control o Pressurizer Level Control	Hi	Rods in (safe direction). Charging flow increases until full power pressurizer water level is reached (if at reduced power). If reactor trips, steam dump enabled and dump valves open. Steam dump stops when low-low Tavg is reached.	No event unless reactor trips, then dump valves open and bounding event is Excessive Increase in Secondary Steam Flow (Section 15.1.3)

TABLE Q032.45-1 (continued)

LOSS OF ANY SINGLE INSTRUMENT
(Sheet 10 of 15)

SENSOR	NUMBER OF CHANNELS	FAILED CHANNEL	SYSTEM	ASSUMED FAILURE DIRECTION	EFFECT	BOUNDING EVENT
T_{avg}	one per loop	Any Auct. Lo	o Turbine Loading	Lo	Stop turbine loading (C-17); annunciation occurs	Not applicable
		Auct. Hi	o Steam Dump o Reactor Control o Pressurizer Level Control	Hi Hi	Rods in (safe direction). Charging flow increases until full power pressurizer water level is reached (if at reduced power).	Steady state reached at full power pressurizer water level. No event.
Turbine Impulse Chamber Pressure	2 per plant	I (Control)	o Steam Dump (T_{avg} Mode) o Reactor Control o FW Control	Lo	Rods in (safe direction). Steam dump signaled to open but is blocked by interlock. (If reactor trip occurs, steam dump unblocked and dump valves modulate until no load T_{avg} is reached). No effect on FW Control since SG level program is constant. If selector switch in normal position, auto rod withdrawal blocked (C-5). If switch in	Not applicable

TABLE Q032.45-1 (continued)

LOSS OF ANY SINGLE INSTRUMENT
(Sheet 11 of 15)

SENSOR	NUMBER OF CHANNELS	FAILED CHANNEL	SYSTEM	ASSUMED FAILURE DIRECTION	EFFECT	BOUNDING EVENT
					alternate position, no effect on rod block.	
				Hi	Stop turbine loading (C-17). Rods out until blocked by high flux, overpower or over-temperature rod stop, or until programmed T_{ref} limit is reached. If reactor trip occurs, steam dump unblocked and dump valves open until no load T_{avg} is reached. No effect on FW Control since SG level program is constant.	Result is bounded by Uncontrolled Rod Cluster Control Assembly Bank Withdrawal at Power (Section 15.4.2)
Turbine Impulse Chamber Pressure	2 per plant	I (Control)	o Steam Dump (Pressure Mode) o Reactor Control o FW Control	Lo	Rods in, (safe direction). No effect on FW control since SG level program is constant. If selector switch in normal position, auto rod withdrawal blocked (C-5). If switch in alternate position, no effect on rod block.	Not applicable

TABLE Q032.45-1 (continued)

LOSS OF ANY SINGLE INSTRUMENT
(Sheet 12 of 15)

SENSOR	NUMBER OF CHANNELS	FAILED CHANNEL	SYSTEM	ASSUMED FAILURE DIRECTION	EFFECT	BOUNDING EVENT
				Hi	Stop turbine loading (C-17). Rods out until blocked by high flux, overpower or over-temperature rod stop. (Steam dump valves open if required to keep steam header pressure at or below setpoint.) No effect on FW control since SG level program is constant.	Result is bounded by Uncontrolled Rod Cluster Control Assembly Bank Withdrawal at Power (Section 15.4.2).
Turbine Impulse Chamber Pressure	2 per plant	II (Interlock)	o Steam Dump (T_{avg} Mode)	Lo	Unblock steam dump. If selector switch in alternate position, auto rod withdrawal blocked (C-5). If switch in normal position, no effect on rod block.	Not applicable
				Hi	Steam dump on turbine trip only; steam dump blocked on load rejection.	Not applicable
Turbine Impulse Chamber Pressure	2 per plant	II (Interlock)	o Steam Dump (Pressure Mode)	Lo or Hi	Steam dump functions normally. If selector switch in alternate position, auto rod withdrawal blocked (C-5). If switch in normal position, no effect on rod block.	Not applicable

TABLE Q032.45-1 (continued)

LOSS OF ANY SINGLE INSTRUMENT
(Sheet 13 of 15)

SENSOR	NUMBER OF CHANNELS	FAILED CHANNEL	SYSTEM	ASSUMED FAILURE DIRECTION	EFFECT	BOUNDING EVENT
Power Range Flux	4 per plant	Any	o Reactor Control o FW Control	Lo	No control action.	Not applicable
				Hi	Auto and manual rod withdrawal blocked (C-2), rods in (safe direction). FW bypass control valves open if in auto. (If reactor trip occurs, dump valves open until no-load T_{avg} is reached.) Rising SG water level causes main FW valves to close until steam and feed flows match.	Steady-state reached with higher SG water level. No event.
T_{avg} High Auctioneer	1 per plant	———	o Steam Dump o Reactor Control o Pressurizer Level Control	Lo	Steam dump blocked (T_{avg} mode). Backup htrs. on, charging flow decreases till no-load pressurizer water level reached. Rods out, T_{avg} and core power increase until blocked by high flux, overpower or overtemperature rod stop.	Result is bounded by Uncontrolled Rod Cluster Control Assembly Bank Withdrawal at Power (Section 15.2.2)
				Hi	Identical to T_{avg} channel failing high, see analysis above (sheet 9).	See above

TABLE Q032.45-1 (continued)

LOSS OF ANY SINGLE INSTRUMENT
(Sheet 14 of 15)

SENSOR	NUMBER OF CHANNELS	FAILED CHANNEL	SYSTEM	ASSUMED FAILURE DIRECTION	EFFECT	BOUNDING EVENT
Power Range Flux High Auctioneer	1 per plant	———	o Reactor Control o Feedwater Control (bypass valves)	Lo	Rods out, T_{avg} and core power increase until blocked by high flux, overpower or overtemperature rod stop. If FW bypass control valve in auto (typically low power levels, 0-25%), valve closes initially; SG water level restored by automatic re-opening of bypass control valve on level error.	Result is bounded by Uncontrolled Rod Cluster Control Assembly Bank Withdrawal at Power (Section 15.2.2); FW flow transient is small in comparison.
				Hi	Identical to Power Range Flux channel failing high; see analysis above (sheet 13).	See above.
Condenser Available	1 per plant	———	o Steam Dump	Lo	No control action-steam dump blocked, condenser unavailable.	Not applicable
				Hi	No control action-steam dump unblocked, condenser available.	Not applicable
Steam Flow Pressure Compensator	2 per loop	Control Channel	o Steam Flow	Lo	Identical to Loop Steam Flow channel failing low. See analysis above (sheet 4).	See above

TABLE Q032.45-1 (continued)

LOSS OF ANY SINGLE INSTRUMENT
(Sheet 15 of 15)

SENSOR	NUMBER OF CHANNELS	FAILED CHANNEL	SYSTEM	ASSUMED FAILURE DIRECTION	EFFECT	BOUNDING EVENT
				Hi	Identical to Loop Steam Flow channel failing high. See analysis above (sheet 4).	See above

* Signals for pressurizer water level, pressurizer pressure, and turbine impulse chamber pressure can be obtained from different channels. Channel selection is achieved by manual switches in the control room. Resulting effect due to failed instrument is dependent on switch positions.

TABLE Q032.45-2

LOSS OF POWER TO PROTECTION CABINET 1

CONTROL SYSTEMS AFFECTED	SIGNALS AFFECTED	FAILURE DIRECTION	ITEMIZED EFFECTS	BOUNDING EVENT
Steam Dump	o Turbine Impulse Chamber Pressure (Control) o T_{avg} (Loop 1)	Low Low	Steam dump demanded but blocked from interlock. (If reactor trips, steam dump performs as designed). No control action from T_{avg} due to auctioneer.	Bounding event for loss of cabinet power is either FW System Malfunction Resulting in an Increase in FW Flow (Section 15.1.2), or Loss of Normal Feedwater Flow (Section 15.2.7), depending on channels used. Increased charging flow and pressurizer transients have little effect in comparison.
Reactor Control	o Turbine Impulse Chamber Pressure (Control) o TAVG (Loop 1)	Low Low	Rods in (safe direction), power decreases. Stop turbine loading (C-17). If turbine impulse chamber pressure switch in normal position, auto rod withdrawal blocked (C-5).	
FW Control	o Narrow Range SG Water Level (Any Loop) o Steam Flow Pressure Compensation (Any Loop)	Low Low	Depending on the relative switch positions in each loop for steam flow and narrow-range SG water level, FW valves could open, close, or remain fixed; thus, a FW transient may occur in these loops.	

TABLE Q032.45-2 (Continued)

LOSS OF POWER TO PROTECTION CABINET 1

CONTROL SYSTEMS AFFECTED	SIGNALS AFFECTED	FAILURE DIRECTION	ITEMIZED EFFECTS	BOUNDING EVENT
Pressurizer Level	o Pressurizer Water Level (Control)	Low	No control action on T_{avg} due to auctioneer. If affected level signal used for control, charging flow increases and heaters blocked. Otherwise, level channel not connected. Due to low flow signal, charging flow increases until integral controller on level error generates zero flow demand and a new steady state is reached.	
	o T_{avg} (Loop 1)	Low		
	o Charging Flow	Low		
Pressurizer Pressure	o Pressurizer Pressure (PORV PCV-655A)	Low	If affected pressure signal used for control, PORV PCV-655A stays closed, back-up heaters on (but could be blocked on level signal, see above). Spray off. (PORV PCV-656A available if required.) Otherwise, channel not connected, no control action.	

TABLE Q032.45-3

LOSS OF POWER TO PROTECTION CABINET 1A

CONTROL SYSTEMS AFFECTED	SIGNALS AFFECTED	FAILURE DIRECTION	ITEMIZED EFFECTS	BOUNDING EVENT
Steam Dump	o None	---	No signals affected, no control action.	
Reactor Control	o None	---	No signals affected, no control action.	Bounding event for loss of cabinet power is FW System Malfunction Resulting in an Increase in FW Flow (Section 15.1.2)
FW Control	o Feedwater Flow (any loop)	Low	If failed FW channel selected for control, FCV opens. Otherwise, no control action.	
Pressurizer Level	o None	---	No signals affected, no control action.	
Pressurizer Pressure	o None	---	No signals affected, no control action.	

TABLE Q032.45-4

LOSS OF POWER TO PROTECTION CABINET 2

CONTROL SYSTEMS AFFECTED	SIGNALS AFFECTED	FAILURE DIRECTION	ITEMIZED EFFECTS	BOUNDING EVENT
Steam Dump	o Turbine Impulse Chamber Pressure (Interlock) o T_{avg} (Loop 2)	Low Low	Steam dump unblocked. (If reactor trips, steam dump performs as designed.) No control action from T_{avg} due to auctioneer.	Bounding event for loss of cabinet power is either FW System Malfunction Resulting in an Increase in FW Flow (Section 15.1.2), or Loss of Normal FW Flow (Section 15.2.7), depending on channels used.
Reactor Control	o T_{avg} (Loop 2)	Low	No control action due to auctioneering of T_{avg}. Stop turbine loading (C-17).	
FW Control	o Narrow Range SG Water Level (Any Loop) o Steam Flow Pressure Compensation (Any Loop)	Low Low	Depending on the relative switch positions in each loop for steam flow and narrow-range SG water level, FW valves could open, close, or remain fixed; thus, a FW transient may occur in these loops.	
Pressurizer Level	o Pressurizer Water Level (Interlock) o T_{avg} (Loop 2)	Low Low	If affected level signal used for interlock, block heaters; otherwise, channel not connected, no control action. No control action on T_{avg} due to auctioneer.	
Pressurizer Pressure	o Pressurizer Pressure (PORV PCV-656A)	Low	If affected pressure signal used for control, PORV PCV-656A stays closed. (PORV PCV-655A available if required.) Otherwise, channel not connected, no control action.	

TABLE Q032.45-5

LOSS OF POWER TO PROTECTION CABINET 2A

CONTROL SYSTEMS AFFECTED	SIGNALS AFFECTED	FAILURE DIRECTION	ITEMIZED EFFECTS	BOUNDING EVENT
Steam Dump	o None	--	No signals affected, no control action.	Bounding event for loss of cabinet power is FW System Malfunction Resulting in an Increase in FW Flow (Section 15.1.2)
Reactor Control	o None	--	No signals affected, no control action.	
FW Control	o Feedwater Flow (any loop)	Low	If failed FW channel selected for control, FCV opens. Otherwise, no control action.	
Pressurizer Level	o None	--	No signals affected, no control action.	
Pressurizer Pressure	o None	--	No signals affected, No control action.	

TABLE Q032.45-6

LOSS OF POWER TO PROTECTION CABINET 3

CONTROL SYSTEMS AFFECTED	SIGNALS AFFECTED	FAILURE DIRECTION	ITEMIZED EFFECTS	BOUNDING EVENT
Steam Dump	o T_{avg} (Loop 3)	Low	No control action due to auctioneer.	
Reactor Control	o T_{avg} (Loop 3)	Low	No control action due to auctioneer. Stop turbine loading (C-17).	Combining effects of pressurizer level and pressure control systems, could have either increasing charging flow with heater off causing a depressurization, or else heaters cause pressure to increase until safety valve opens. In one case, event is bounded by Inadvertent Opening of a Pressurizer Safety or Relief Valve (Section 15.6.1).For the other case, bounding event for loss of cabinet power is CVCS Malfunction That Increases Reactor Coolant Inventory (Section 15.5.2).
FW Control	o None	--	No signals affected, no control action.	
Pressurizer Level	o Pressurizer Water Level (Control or Interlock) o T_{avg} (Loop 3)	Low	If affected level signal used for control, charging flow increases and heaters blocked. If used for interlock, heaters blocked. Otherwise, channel not connected, no control action. No control action on T_{avg} due to auctioner.	
Pressurizer Pressure	o Pzr. Pressure (PORV PCV-655A Control, PORV PCV-656A Interlock)	Low	PORV PCV-656A stays closed. If signal selected for control, pressurizer heaters on (if allowed by level signal, see above), spray off, and PORV PCV-655A stays closed.	

TABLE Q032.45-7

LOSS OF POWER TO PROTECTION CABINET 3A

CONTROL SYSTEMS AFFECTED	SIGNALS AFFECTED	FAILURE DIRECTION	ITEMIZED EFFECTS	BOUNDING EVENT
Steam Dump	o None	--	No signals affected, no control action.	
Reactor Control	o None	--	No signals affected, no control action.	
FW Control	o None	--	No signals affected, no control action.	Not applicable
Pressurizer Level	o None	--	No signals affected, no control action.	
Pressurizer Pressure	o None	--	No signals affected, No control action.	

TABLE Q032.45-8

LOSS OF POWER TO PROTECTION CABINET 4

CONTROL SYSTEMS AFFECTED	SIGNALS AFFECTED	FAILURE DIRECTION	ITEMIZED EFFECTS	BOUNDING EVENT
Steam Dump	o T_{avg} (Loop 4)	Low	No control action due to auctioneer.	
Reactor Control	o T_{avg} (Loop 4)	Low	No control action due to auctioneer. Stop turbine loading (C-17).	
FW Control	o None	--	No signals affected, no control action.	No event is initiated due to loss of power to this cabinet, therefore bounding event is not applicable.
Pressurizer Level	o T_{avg} (Loop 4) o Pressurizer Level	Low	No control action due to auctioneer. No letdown isolation since bistables are energize to actuate.	
Pressurizer Pressure	o Pressurizer Pressure (PORV PCV-656A Control or PORV PCV-655A Interlock)	Low	PORV PCV-655A stays closed. If signal selected for control, PORV PCV-656A also stays closed.	

TABLE Q032.45-9

LOSS OF POWER TO CONTROL GROUP 1

CONTROL SYSTEMS AFFECTED	SIGNALS AFFECTED	FAILURE DIRECTION	ITEMIZED EFFECTS	BOUNDING EVENT
Steam Dump	o All (System Deenergized) except Condenser Available	Off/Closed	No initiating event, steam dump system unavailable. (If reactor trip occurs, SG power-operated relief valves available.)	
Reactor Control	o None	--	No signals affected, no control action	Bounding event for loss of cabinet power is Loss of Normal FW Flow (Section 15.2.7). (Plant trips on low-low water level in SG 1.)
FW Control and FW Pump Speed Control	o All (System Deenergized, SG 1) o Steam flow (any loop)	FW Control Valve closes, pumps' speed decreases (all pumps, Auto mode only) Low	Loss of main FW in SG 1 If FW pumps in auto mode, pumps' speed decreases causing FCV's to open in SG 2, 3 and 4 unless failed steam flow selected for control, in which case FCV's may close on steam flow/feedwater flow mismatch. (Plant trips on low-low water level in SG 1)	
Pressurizer Level	o Pressurizer Water Level (LB 666A)	Off	No control action (bistable is energize to actuate).	
Pressurizer Pressure	o Pressurizer Pressure (PORV PCV-655A Control) o Spray and Heater Actuation	Closed Off	No initiating event, PORV PCV-655A remains closed, heaters and spray remain off. (PORV PCV-656A available if needed.)	

TABLE Q032.45-10

LOSS OF POWER TO CONTROL GROUP 2

CONTROL SYSTEMS AFFECTED	SIGNALS AFFECTED	FAILURE DIRECTION	ITEMIZED EFFECTS	BOUNDING EVENT
Steam Dump	o None	--	No signals affected, no control action.	
Reactor Control	o None	--	No signals affected, no control action.	
FW Control	o All (System Deenergized, SG 2) o Steam flow (any loop)	FW Control Valve Closes Low	Loss of main FW in SG 2. (Plant trips on low-low water level in SG 2.) If failed steam flow channel selected for control, FCV's close in remaining loops and FW pump speed decreases.	Bounding event for loss of cabinet power is Loss of Normal FW Flow (Section 15.2.7) (Plant trips on low-low water level in SG 2.)
Pressurizer Level	o All (System Deenergized) (Except LB 666A)	Off	Charging flow increases, backup heaters off.	
Pressurizer Pressure	o Pressurizer Pressure (PORV PCV-656A Control)	Closed	PORV PCV-656A blocked closed. (PORV PCV-655A available if needed.)	

TABLE Q032.45-11

LOSS OF POWER TO CONTROL GROUP 3

CONTROL SYSTEMS AFFECTED	SIGNALS AFFECTED	FAILURE DIRECTION	ITEMIZED EFFECTS	BOUNDING EVENT
Steam Dump	o None	--	No signals affected, no control action.	
Reactor Control	o None	--	No signals affected, no control action.	
FW Control (SG 3)	o All (System Deenergized)	FW Control Valve Closes	Loss of main FW in SG 3. (Plant trips on low-low water level in SG 3.)	Bounding event for loss of cabinet power is Loss of Normal FW Flow (Section 15.2.7) (Plant trips on low-low water level in SG 3.)
Pressurizer Level	o None	--	No signals affected, no control action.	
Pressurizer Pressure	o Pressurizer Pressure Interlock (PORV PCV-656A, bistable PB 657)	Deactuated	No control action. PORV PCV-656A blocked, PORV PCV-655A still available.	

TABLE Q032.45-12

LOSS OF POWER TO CONTROL GROUP 4

CONTROL SYSTEMS AFFECTED	SIGNALS AFFECTED	FAILURE DIRECTION	ITEMIZED EFFECTS	BOUNDING EVENT
Steam Dump	o Auctioneered T_{avg} o T_{ref} (from Rod Control)	Low Low	No initiating event, steam dump system unavailable. (If reactor trip occurs, SG power-operated relief valves available.)	
Reactor Control	o All (System Deenergized)	Off	Rods stay stationary. Stop turbine loading (C-17).	
FW Control (SG 4)	o All (System Deenergized)	FW Control Valve Closes	Loss of main FW in SG 4. (Plant trips on low-low water level in SG 4.)	Bounding event for loss of cabinet power is Loss of Normal FW Flow (Section 15.2.7) since increased charging flow has little effect in comparison. (Plant trips on low-low SG 4 water level.)
Pressurizer Level	o Auctioneered T_{avg} o Charging Flow Controller	Low Low	Charging flow increases.	
Pressurizer Pressure	o Pressurizer Pressure Interlock (PORV PCV-655A, bistable PB 658)	Deactuated	PORV PCV-655A blocked from automatic opening. PORV PCV-656A still available. No control action.	

TABLE Q032.45-13

LOSS OF POWER TO INVERTER I
(PROTECTION CABINETS 1 AND 1A, NIS CHANNEL I)

CONTROL SYSTEMS AFFECTED	SIGNALS AFFECTED	FAILURE DIRECTION	ITEMIZED EFFECTS	BOUNDING EVENT
Steam Dump	o Turbine Impulse Chamber Pressure (Control) o T_{avg} (Loop 1)	Low Low	Steam dump demanded but blocked from interlock. (If reactor trips, steam dump performs as designed).	Bounding event for loss of inverter power is either FW System Malfunction Resulting in an Increase in FW Flow (Section 15.1.2), or Loss of Normal Feedwater Flow (Section 15.2.7), depending on channels used. Increased charging flow and pressurizer transients have little effect in comparison.
Reactor Control	o Power Range Flux (Ch. I) o Turbine Impulse Chamber Pressure (Control) o T_{avg} (Loop 1)	Low Low Low	Rods in (safe direction), power decreases. Stop turbine loading (C-17). If turbine impulse chamber pressure selector switch in normal position, auto rod withdrawal blocked (C-5).	
FW Control	o Narrow Range SG Water Level (Any Loop) o Steam Flow Pressure Compensation (Any Loop) o Feedwater Flow (Any Loop) o Power Range Flux (Ch. I)	Low Low Low Low	Depending on the relative switch positions in each loop for steam flow, feedwater flow, and narrow-range SG water level, FW valves could open, close, or remain fixed; thus, a FW transient may occur in these loops.	

TABLE Q032.45-13 (Continued)

LOSS OF POWER TO INVERTER I
(PROTECTION CABINETS 1 AND 1A, NIS CHANNEL I)

CONTROL SYSTEMS AFFECTED	SIGNALS AFFECTED	FAILURE DIRECTION	ITEMIZED EFFECTS	BOUNDING EVENT
Pressurizer Level	o Pressurizer Water Level (Control) o T_{avg} (Loop 1) o Charging Flow	Low Low Low	If affected level signal used for control, charging flow increases and heaters blocked. No control action on T_{avg} due to auctioneer. On low flow signal, charging flow increases until integral controller on level error generates zero flow demand. New steady state reached at higher level.	
Pressurizer Pressure	o Pressurizer Pressure (PORV PCV-655A)	Low	If affected pressure signal used for control, PORV PCV-655A stays closed, back-up heaters on (but could be blocked on level signal, see above). Spray off. (PORV PCV-656A available if required.) Otherwise, channel not connected, no control action.	

TABLE Q032.45-14

LOSS OF POWER TO INVERTER II
(PROTECTION CABINETS 2 AND 2A, NIS CHANNEL II, AUX. PROCESS CABINET II)

CONTROL SYSTEMS AFFECTED	SIGNALS AFFECTED	FAILURE DIRECTION	ITEMIZED EFFECTS	BOUNDING EVENT
Steam Dump	o Turbine Impulse Chamber Pressure (Interlock) o T_{avg} (Loop 2)	Low Low	Steam dump unblocked. (If reactor trips, steam dump performs as designed.)	Bounding event for loss of inverter power is either FW System Malfunction Resulting in an Increase in FW Flow (Section 15.1.2), or Loss of Normal FW Flow (Section 15.2.7), depending on channels used.
Reactor Control	o Power Range Flux (Channel II) o T_{avg} (Loop 2)	Low Low	No control action due to auctioneering of flux and T_{avg}. Stop turbine loading (C-17).	
FW Control	o Narrow Range SG Water Level (Any Loop) o Steam Flow Pressure Compensation (Any Loop) o Feedwater Flow (Any Loop) o Power Range Flux (Channel II)	Low Low Low Low	Depending on the relative switch positions in each loop for steam flow and narrow-range SG water level, FW control valves could open, close, or remain fixed; thus, a FW transient may occur in these loops.	
Pressurizer Level	o Pressurizer Water Level (Interlock) o T_{avg} (Loop 2)	Low Low	If affected level signal used for interlock, block heaters; otherwise, channel not connected, no control action. No control action on T_{avg} due to auctioneer.	

TABLE Q032.45-14 (Continued)

LOSS OF POWER TO INVERTER II
(PROTECTION CABINETS 2 AND 2A, NIS CHANNEL II, AUX. PROCESS CHANNEL II)

CONTROL SYSTEMS AFFECTED	SIGNALS AFFECTED	FAILURE DIRECTION	ITEMIZED EFFECTS	BOUNDING EVENT
Pressurizer Pressure	o Pressurizer Pressure (PORV PCV-656A)	Low	If affected pressure signal used for control, PORV PCV-656A stays closed. (PORV PCV-655A available if required.) Otherwise, channel not connected, no control action.	

TABLE Q032.45-15

LOSS OF POWER TO INVERTER III
(PROTECTION CABINETS 3 AND 3A, NIS CHANNEL III, AUX. PROCESS CABINET III)

CONTROL SYSTEMS AFFECTED	SIGNALS AFFECTED	FAILURE DIRECTION	ITEMIZED EFFECTS	BOUNDING EVENT
Steam Dump	o T_{avg} (Loop 3)	Low	No control action due to auctioneer.	
Reactor Control	o Power Range Flux (Channel III) o T_{avg} (Loop 3)	Low Low	No control action due to auctioneers. Stop turbine loading (C-17).	Combining effects of pressurizer level and pressure control systems, could have either increasing charging flow with heater off causing a depressurization, or else heaters cause pressure to increase until safety valve opens. In one case, event is bounded by Inadvertent Opening of a Pressurizer Safety or Relief Valve (Section 15.6.1). For the other case, bounding event for loss of inverter power is CVCS Malfunction That Increases Reactor Coolant Inventory (Section 15.5.2).
FW Control	o Power Range Flux (Channel III)	--	No control action due to auctioneer.	
Pressurizer Level	o Pressurizer Water Level (Control or Interlock) o T_{avg} (Loop 3)	Low	If affected level signal used for control, charging flow increases and heaters blocked. If used for interlock, heaters blocked. Otherwise, channel not connected, no control action. No control action on T_{avg} due to auctioneer.	
Pressurizer Pressure	o Pressurizer Pressure (PORV PCV-655A Control, PORV PCV-656A Interlock)	Low	PORV PCV-656A stays closed. If signal selected for control, pressurizer heaters on (if allowed by level signal, see above), spray off, and PORV PCV-655A stays closed.	

TABLE Q032.45-16

LOSS OF POWER TO INVERTER IV
(PROTECTION CABINET 4, NIS CHANNEL IV)

CONTROL SYSTEMS AFFECTED	SIGNALS AFFECTED	FAILURE DIRECTION	ITEMIZED EFFECTS	BOUNDING EVENT
Steam Dump	o T_{avg} (Loop 4)	Low	No control action due to auctioneer.	
Reactor Control	o Power Range Flux (Channel IV) o T_{avg} (Loop 4)	Low Low	No control action due to auctioneers. Stop turbine loading (C-17).	
FW Control	o Power Range Flux (Channel IV)	--	No control action due to auctioneer.	No event is initiated due to loss of power to this inverter; therefore bounding event is not applicable.
Pressurizer Level	o T_{avg} (Loop 4) o Pressurizer Level	Low	No control action due to auctioneer. No letdown isolation since bistables are energize to actuate.	
Pressurizer Pressure	o Pzr. Pressure (PORV PCV-656A Control or PORV PCV-655A Interlock)	Low	PORV PCV-655A stays closed. If signal selected for control, PORV PCV-656A also stays closed.	

TABLE Q032.45-17

LOSS OF POWER TO INVERTER V
(CONTROL GROUPS 1 AND 3)

CONTROL SYSTEMS AFFECTED	SIGNALS AFFECTED	FAILURE DIRECTION	ITEMIZED EFFECTS	BOUNDING EVENT
Steam Dump	o All (System deenergized) except Condenser Available	Off/Closed	No initiating event, steam dump system unavailable. (If reactor trip occurs, SG power-operated relief valves available.)	
Reactor Control	o None	________	No signals affected; no control action.	
FW Control (SG 1 and 3) and FW pump speed control	o All (System deenergized, SG 1 and 3)	FW Control Valves close, pumps' speed decreases (all pumps, AUTO mode only)	Loss of main FW in SG 1 and 3. If FW pumps in auto mode, pumps' speed decreases causing FCV's to open in SG 2 and 4 unless failed steam flow selected for control, in which case FCV's may close on steam flow/feedwater flow mismatch. (Plant trips on low-low water level in SG 1 and 3).	Bounding event for loss of inverter power is Loss of Normal FW Flow (Section 15.2.7). (Plant trips on low-low water level in SG 1 and 3)
	o Steam flow (any loop)	Low		
Pressurizer Level	o Pressurizer Water Level (LB666A)	Off	No control action (bistable is energize to actuate).	

TABLE Q032.45-17 (Continued)

LOSS OF POWER TO INVERTER V
(CONTROL GROUPS 1 AND 3)

CONTROL SYSTEMS AFFECTED	SIGNALS AFFECTED	FAILURE DIRECTION	ITEMIZED EFFECTS	BOUNDING EVENT
Pressurizer Pressure	o Pressurizer Pressure (PORV PCV-655A Control; Interlock on PORV PCV-656A, bistable PB 657) o Spray and Heater Actuation	Off/closed Off	PORVs PCV-655A and PCV-656A remain closed, heaters and spray remain off. (Manual PORV and heater actuation available if needed.)	

TABLE Q032.45-18

LOSS OF POWER TO INVERTER VI
(AUX. PROCESS CABINET I)

CONTROL SYSTEMS AFFECTED	SIGNALS AFFECTED	FAILURE DIRECTION	ITEMIZED EFFECTS	BOUNDING EVENT
Steam Dump	o None	---	No signals affected, no control action.	
Reactor Control	o None	---	No signals affected, no control action.	
FW Control	o Narrow Range SG Water Level (Any loop)	Low	If failed level channel selected for control, FCV opens and SG water level increases. Otherwise, no control action.	
Pressurizer Level	o Pressurizer Level (Control) o Charging Flow	Low Low	Letdown isolated (protection grade). If affected level signal used for control, charging flow increases and heaters blocked. Otherwise, level channel not connected; due to low flow signal, charging flow increases until integral controller on level error generates zero flow demand; new steady state reached.	Bounding event for loss of inverter power is FW System Malfunction Resulting in an Increase in FW Flow (Section 15.1.2) since increased charging flow has little effect in comparison.
Pressurizer Pressure	o None	---	No signals affected, no control action.	

TABLE Q032.45-19

LOSS OF POWER TO INVERTER VII
(AUX. PROCESS CABINET IV)

CONTROL SYSTEMS AFFECTED	SIGNALS AFFECTED	FAILURE DIRECTION	ITEMIZED EFFECTS	BOUNDING EVENT
Steam Dump	o None	---	No signals affected, no control action.	
Reactor Control	o None	---	No signals affected, no control action.	
FW control	o None	---	No signals affected, no control action.	Bounding event for loss of inverter power is CVCS Malfunction That Increases Reactor Coolant Inventory (Section 15.5.2).
Pressurizer Level	o Pressurizer Level (Control)	Low	Letdown isolation. (protection grade).	
Pressurizer Pressure	o None	---	No signals affected, no control action.	

TABLE Q032.45-20

LOSS OF POWER TO INVERTER VIII
(CONTROL GROUPS 2 AND 4)

CONTROL SYSTEMS AFFECTED	SIGNALS AFFECTED	FAILURE DIRECTION	ITEMIZED EFFECTS	BOUNDING EVENT
Steam Dump	o Auctioneered T_{avg} o T_{ref} (from Rod Control)	Low Low	No initiating event, steam dump system unavailable. (If reactor trip occurs, SG power-operated relief valves available.)	
Reactor Control	o All (System Deenergized)	Off	Rods stay stationary. Stop turbine loading (C-17).	
FW Control	o All (System Deenergized, SG 2 and 4) o Steam flow (any loop)	FW Control Valve closes Low	Loss of main FW in SG 2 and 4. (Plant trips on low-low water level in these loops.) If failed steam flow channel selected for control, FCV's close in remaining loops and FW pump speeds decrease.	Bounding event for loss of inverter power is Loss of Normal FW Flow (Section 15.2.7) since increased charging flow has little effect in comparison. (Plant trips on low-low water level in SG 2 and 4.)
Pressurizer Level	o All (System Deenergized, except LB 666A) o Auctioneered T_{avg} o Charging FCV Control	Off Low Low	Charging flow increases, backup heaters off.	
Pressurizer Pressure	o Pressurizer Pressure (PORV PCV-656A control; Interlock on PORV PCV-655A, bistable PB 658)	Closed	PORVs PCV-655A and PCV-656A remain closed. Manual actuation available if needed.	

TABLE Q032.45-21

LOSS OF POWER TO AUX. PROCESS CABINET II

CONTROL SYSTEMS AFFECTED	SIGNALS AFFECTED	FAILURE DIRECTION	ITEMIZED EFFECTS	BOUNDING EVENT
Steam Dump	o None	---	No signals affected, no control action.	
Reactor Control	o None	---	No signals affected, no control action.	Bounding event for loss of cabinet power is FW System Malfunction Resulting in an Increase in FW Flow (Section 15.1.2).
FW Control	o Narrow Range SG Water Level (any loop)	Low	If failed level channel selected for control, FCV opens and SG water level increases. Otherwise, no control action.	
Pressurizer Level	o Pressurizer Level (Interlock)	Low	If failed level channel selected, heaters blocked. Otherwise, no control action.	
Pressurizer Pressure	o None	---	No signals affected, no control action.	

TABLE Q032.45-22

LOSS OF POWER TO AUX. PROCESS CABINET III

CONTROL SYSTEMS AFFECTED	SIGNALS AFFECTED	FAILURE DIRECTION	ITEMIZED EFFECTS	BOUNDING EVENT
Steam Dump	o None	---	No signals affected, no control action.	
Reactor Control	o None	---	No signals affected, no control action.	
FW Control	o None	---	No signals affected, no control action.	
Pressurizer Level	o Pressurizer Level (Control or Interlock)	Low	If failed level channel selected for control, charging flow increases, heaters blocked; if selected for interlock, heaters blocked. Otherwise, no control action.	Bounding event for loss of cabinet power is CVCS Malfunction That Increases Reactor Coolant Inventory (Section 15.5.2).
Pressurizer Pressure	o None	---	No signals affected, no control action.	

TABLE Q032.45-23

LOSS OF COMMON INSTRUMENT LINES

(ASSUMED BREAK IN LINE)

SENSORS	FAILED CHANNELS	SYSTEM	FAILURE DIRECTION	EFFECT	BOUNDING ACCIDENT
Loop Steam Flow and Narrow Range SG Water Level	I or II	Feedwater Control	Lo Hi	If steam flow and/or narrow-range SG water level selectors switched to failed channel, FW control valve closes in affected SG(s). All FW pump speeds decrease if in auto mode.	Bounding event is Loss of Normal FW Flow (Section 15.2.7)
Pressurizer Level (Control) and Pressurizer Pressure (PORV PCV-655A, Control	I	Pressurizer Level Control (Sw. Pos. 2 or 3) Pressurizer Pressure Control (Sw. Pos. 1 or 2)	Hi Lo	If switch positions not as shown, no control actions. If level selector switch in position shown: charging flow decreases, backup heaters on. (Later, on low level, heaters blocked and letdown isolated from interlock channel.) If pressure selector switch in position shown: PORV PCV-655A stays closed, spray unavailable, backup heaters on.	These effects at worst result in a depressurization which is bounded by Inadvertent Opening of a Pressurizer Safety or Relief Valve (Section 15.6.1).

TABLE Q032.45-23 (Continued)

LOSS OF COMMON INSTRUMENT LINES

(ASSUMED BREAK IN LINE)

SENSORS	FAILED CHANNELS	SYSTEM	FAILURE DIRECTION	EFFECT	BOUNDING ACCIDENT
Pressurizer Level (Interlock) and Pressurizer Pressure (PORV PCV-656A, Control)	II	Pressurizer Level Control (Sw. Pos. 1 or 2) Pressurizer Pressure Control (Sw. Pos. 2 or 3)	Hi Lo	If switch positions not as shown, no control actions. If level selector switch in position shown: no control action, get high level annunciation. If pressure selector switch in position shown: PORV PCV-656A stays closed.	Not applicable.
Pressurizer Level (Control or Interlock) and Pressurizer Pressure (PORV PCV-655A, Control; PORV PCV-656A, Interlock)	III	Pressurizer Level (Control or Interlock, switch positions 1 or 3 respectively) Pressurizer Pressure Interlock, also Control (Sw. Pos. 3)	Hi Lo	Regardless of switch positions, PORV PCV-656A blocked closed (by PB 657). If level selector switch in position 1 (control), charging flow decreases, backup heaters on. (Later, on low level, letdown isolated and heaters blocked from interlock channel.) If level selector switch in position 3 (interlock): no control action, get high level annunciation. If pressure selector switch in position 3, PORV PCV-655A also stays closed, spray unavailable, backup heaters on.	These effects at worst result in a depressurization which is bounded by Inadvertent Opening of a Pressurizer Safety or Relief Valve (Section 15.6.1).

TABLE Q032.45-23 (Continued)

LOSS OF COMMON INSTRUMENT LINES

(ASSUMED BREAK IN LINE)

SENSORS	FAILED CHANNELS	SYSTEM	FAILURE DIRECTION	EFFECT	BOUNDING ACCIDENT
Pressurizer Level (Protection Grade Action Only) and Pressurizer Pressure (PORV PCV-655A, Interlock PORV PCV-656A, Control)	IV	Pressurizer Level Control (Letdown Isolation)	Hi	No action (protection or control) resulting from level sensor failing high.	Not applicable.
		Pressurizer Pressure Interlock, also Control (Sw. Pos. 1)	Lo	PORV PCV-655A blocked closed. If pressure selector switch in position 1, PORV PCV-656A also blocked.	

HANDOUT ITEM 49

49. (7.7) Please provide the response to Question 32.44 on IE Information Notice 79-22 concern.

Question 032.44

Operating reactor licensees were informed by IE Information Notice 79-22, issued September 19, 1979, that certain non-safety grade or control equipment, if subjected to the adverse environment of a high energy line break, could impact the safety analyses and the adequacy of the protection functions performed by the safety grade equipment. Enclosed is a copy of IE Information Notice 79-22, and reprinted copies of an August 20, 1979 Westinghouse letter and a September 10, 1979 Public Service Electric and Gas Company letter which address this matter. Operating Reactor licensees conducted reviews to determine whether such problems could exist at operating facilities.

We are concerned that a similar potential may exist at light water facilities now under construction. You are, therefore, requested to perform a review to determine what, if any, design changes or operator actions would be necessary to assure that high energy line breaks will not cause control system failures to complicate the event beyond your FSAR analysis. Provide the results of your reviews including all identified problems and the manner in which you have resolved them to NRR.

The specific "scenarios" discussed in the above referenced Westinghouse letter are to be considered as examples of the kinds of interactions which might occur. Your review should include those scenarios, where applicable, but should not necessarily be limited to them. Applicants with other LWR designs should consider analogous interactions as relevant to their designs.

Response

IE Information Notice 79-22 specifically identified four (4) potential interaction scenarios between non-safety grade and safety grade equipment which could occur because of the effect of an adverse environment following a high energy line break. The four systems identified are:

- Steam Generator PORV Control System
- Pressurizer PORV Control System
- Main Feedwater Control System
- Automatic Rod Control System

A discussion of each scenario and affected system and its applicability to STP follows.

It has been postulated that a failure of the steam generator PORV control system, due to adverse environment following a feedline rupture, could cause a depressurization of the unaffected steam generators. The STP steam generator PORV system is a Class 1E system. In addition, all portions of the steam generator PORV system that could be exposed to an

adverse environment are isolated in the IVC structure on a loop-by-loop basis. Only one PORV could be affected by adverse conditions and that PORV would be in the affected steam generator loop. For these reasons, the scenario concerning the steam generator PORV control system is not applicable to STP.

The second scenario assumes that the pressurizer PORV's fail in the open position, due to an adverse environment following a feedline rupture. This would cause a depressurization of the Reactor Coolant System, which may result in a voiding of the RCS and potentially uncovering the core. However, all portions of the pressurizer PORV control system located inside Containment have been environmentally qualified for the adverse environment. For this reason, the scenario involving the pressurizer PORV control system is not applicable to STP.

The third scenario assumes a failure of the main feedwater control system, due to adverse environment following a small feedline rupture which occurs between the main feedline check valve and the Containment penetration. Such a failure could cause the liquid mass in the intact steam generators at the time of reactor trip to be less than was assumed in the FSAR analysis. The STP steam flow and steam generator water level transmitters are located within the Containment and are environmentally qualified for the adverse environment. The feedwater flow transmitters are located inside the Turbine Generator Building and the feedwater process controls are located in the Mechanical and Electrical Auxiliary Building. Because of their respective locations, the transmitters and the feedwater controls would not be exposed to an adverse environment following a feedline rupture between the main feedline check valve and the Containment penetration. In addition, the feedwater isolation valves and associated instrumentation are compartmentalized by loop within the isolation valve cubicle, thus restricting exposure to the harsh environment to the loop with the break. For these reasons, the scenario involving a failure of the main feedwater control system is not applicable to STP.

The fourth scenario assumes that the automatic rod control system fails, due to adverse environment following a small steamline rupture, in such a way that the control rods begin stepping out prior to receipt of a reactor trip signal on overpower delta-T. This could result in a DNB ratio less than the limiting value. For a steamline rupture, the excore detectors which supply input to the rod control system could be exposed to the adverse environment and initiate rod withdrawal. In STP, these excore detectors (and associated safety-related equipment) are part of the reactor trip system and have been environmentally qualified for a limited period of time (5 minutes) after a MSLB. For this reason, the scenario involving the automatic rod control system for a steamline rupture is not applicable to STP.

ACTION ITEMS

ITEM	ACTION	SCHEDULE
2	FSAR change to provide response to TMI Item II.E.1.2	FSAR Amendment 46 5/3/85
2	FSAR change to provide response to TMI Item II.K.3.10	FSAR Amendment 49 7/15/85
3	FSAR change required to add instrument accuracies and functions (App. 7A, II.F.1)	FSAR Amendment 49 7/15/85
5	Provide test results for isolators or justify not testing	Letter 6/30/85
8	FSAR change to update IEEE-279 conformance (Section 7.5.6.2)	FSAR Amendment 49 7/15/85
9	Final Technical Specifications to include BOP parameter setpoints	Tech. Specs. 12/31/85
10	List of equipment which should not be actuate-tested during plant operation	Letter 9/30/85
11	Response to Q430.14N	Complete (FSAR Amendment 45)
12	Channel error allowances table will be available at HL&P Bethesda office	12/31/85
12	Correct references in Section 3.12 for RG 1.105	FSAR Amendment 49 7/15/85
13	FSAR change to revise conformance to RG 1.47 in Section 3.12	FSAR Amendment 49 7/15/85
15	Respond to Generic Letter 83-28	Next report 6/30/85
17	Provide SSPS and Safeguards Test Cabinet Technical Manuals at the HL&P Bethesda Office	Complete
21	FSAR change to revise response to NRC Q32.32	FSAR Amendment 49 7/15/85
23	FSAR change to revise response to NRC Q32.42	Complete (ST-HL-AE-1220)

ITEM	ACTION	SCHEDULE
24	Testing provision for P-4 interlocks	Letter 7/15/85
30	FSAR change to reference WCAPS in FSAR Chapter 7 and address interface criteria being met	FSAR Amendment 49 7/15/85
32	FSAR change to reflect the auxiliary feed-water turbine control design	FSAR Amendment 49 7/15/85
33	Revise response to 50.55(e) item (IRC #129)	Letter 8/30/85
48	FSAR change to response to NRC Q32.45	Complete (ST-HL-AE-1220)
49	FSAR change to respond to NRC Q32.44	Complete (ST-HL-AE-1220)
New MSIV	Address potential failure detection in "open permissive" switch, with contact remaining closed	Letter 6/15/85
New MFIV	Address concern regarding unmonitored operation of solenoids for venting hydraulic fluid during testing	Letter 6/15/85
New Testing	Provide safety related I&C tests where leads are lifted or jumpers are used during surveillance testing; provide justification for the acceptability of these actions	Letter 6/30/86
Gen.	Update FSAR Section 1.7 list to provide (as minimum) all safety-related instrumentation and electrical drawings needed for FSAR review	FSAR Amendment 49 7/15/85
Gen.	Provide all safety-related instrumentation and electrical drawings needed for FSAR review by letter to NRC	Letter 5/17/85