U. S. NUCLEAR REGULATORY COMMISSION
REGION I

Docket No.:	50-293
Report No.:	50-293/91-24
Licensee:	Boston Edison Company 800 Boylston Street Boston, Massachusetts 02199
Facility:	Pilgrim Nuclear Power Station
Location:	Plymouth, Massachusetts
Dates:	October 1 - November 11, 1991
Inspectors:	J. Macdonald, Senior Resident Inspector D. Kern, Resident Inspector A. Keller, Intern
Approved by:	John Rogge, Chief, Reactor Projects Section 3A — Date: 12/4/91

Inspection Summary:

Areas Inspected: Routine safety inspection of plant operations, radiological controls, maintenance and surveillance, emergency preparedness, security, safety assessment and quality verification, and engineering and technical support.

Results: Inspection results are summarized in the Executive Summary.

EXECUTIVE SUMMARY

Pilgrim Inspection Report 50-293/91-24

Plant Operations: The plant was shut down on October 30, to investigate the cause of a "B" recirculation pump lower bearing low oil level alarm. The shutdown was expedited due to main condenser fouling and vacuum degradation resulting from storm related insurgence of seaweed and other marine debris. The Nuclear Watch Engineer and Nuclear Operations Supervisor maintained outstanding command and control during the plant shutdown, which was complicated by the effects of the storm. While in the process of completing the plant shutdown, the station experienced an unanticipated loss of all offsite power. Operator response to the loss of offsite power was well controlled and sound safety practices were demonstrated.

Radiological Controls: Spent fuel pool storage and licensee critique of a maintenance activity during which workers received minor levels of internal exposure were reviewed. No discrepancies were noted.

Maintenance and Surveillance: Seismic modifications to the turbine building/battery room heating, ventilation, and air conditioning system were completed during this reporting period. Prior to final acceptance of the work, several maintenance deficiencies were identified. Licensee corrective actions appropriately addressed the noted deficiencies. Final verification of the quality and completeness of seismic modification work was thorough.

Emergency Preparedness: On October 30, the station experienced a loss of all offsite power during a severe northeastern storm. At 8:03 pm, the licensee initiated a Notification of Unusual Event (NOUE) in accordance with emergency action level procedures, due to the inability to power any 4160 VAC electrical bus from an offsite power source. Offsite power was restored and the licensee terminated the NOUE at 10:30 pm. Notifications to NRC, State, and Local officials were prompt. Senior plant management was present in the control room throughout the event. Licensee actions during the event were conservative, well controlled, and demonstrated a good knowledge of emergency plan requirements.

Security: The severe northeastern storm experienced during the period of October 29-31, 1991, caused damage to security structures and equipment and caused the normal security system power supply to be lost. Compensatory measures were promptly implemented. Affected structures and equipment and the normal security power supply were restored in an expeditious manner. The licensee demonstrated an appropriate level of attention to station security during and following the storm.

Safety Assessment and Quality Verification and Engineering and Technical Support: Station management provided excellent safety and regulatory perspectives to the reactor core isolation cooling system operability issue. Station management involvement was necessitated in part due to difficulties experienced by plant staff in the development of an effective operability evaluation. The subsequent licensee waiver of compliance request was comprehensive and enabled prompt NRR staff review.

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DETAILS

1.0 SUMMARY OF FACILITY ACTIVITIES

At the start of the report period Pilgrim Nuclear Power Station was operating at approximately 100% of rated power.

On October 9, the Reactor Core Isolation Cooling (RCIC) system was declared inoperable based on having insufficient information available to verify that the RCIC inverter would not trip under certain voltage transient conditions. On October 15, the licensee requested an NRR temporary waiver of compliance from associated RCIC technical specification requirements. Following a thorough safety evaluation the NRC issued the waiver.

A severe ocean storm created heavy weather conditions including gale force winds, driving rain, and extremely high tides during the period of October 29-31. On October 30, reactor power was reduced to 47 percent to help restore proper main condenser vacuum which had been hampered by storm related insurgence of seaweed and other marine debris.

On October 30, the reactor was shutdown to investigate the cause of a lower bearing low oil level alarm for the "B" recirculation pump. Degraded main condenser vacuum was a contributing factor to the decision to expedite the shutdown.

After the reactor had been shutdown, the station experienced an unanticipated loss of the 355 KV offsite power supply lines at 7:42 pm. The emergency diesel generators started and supplied the safety related 4160 VAC busses as designed. At 7:53 the incoming line to the remaining offsite power source, the shutdown transformer, was downed. The cause of the loss of offsite power was related to the severe storm conditions. The licensee initiated a Notification of Unusual Event (NOUE) at 8:03 pm due to the inability to power any AC electrical bus from an offsite power source. At 10:30 pm, on October 30, offsite power was restored and the licensee terminated the NOUE.

At the close of the reporting period, the plant remained in cold shutdown. The licensee was evaluating plant response to the loss of offsite power event. Testing was being conducted to resolve the RCIC operability issue.

On October 30 and 31, the licensee notified the NRC Operations Center via the Emergency Notification System (ENS) of unplanned engineered safety feature system actuations which occurred during the loss of offsite power event and subsequent plant restoration. The notifications were completed in accordance with the requirements of 10 CFR 50.72 reporting criteria.

2.0 PLANT OPERATIONS (71707, 71710, 40500, 90712)

2.1 Plant Operations Review

The inspector observed plant operations during regular and backshift hours of the following areas:

Control Room	Fence Line
Reactor Building	(Protected Area)
Diesel Generator Building	Turbine Building
Switchgear Rooms	Screen House
Security Facilities	

Control room instruments were observed for correlation between channels, proper functioning and conformance with Technical Specifications. Alarms received in the control room were reviewed and discussed with the operators. Operator awareness and response to these conditions were reviewed. Operators were found cognizant of board and plant conditions. Control room and shift manning were compared with Technical Specification requirements. Posting and control of radiation, contamination and high radiation areas were inspected. Use of and compliance with radiation work permits and use of required personnel monitoring devices were checked. Plant housekeeping controls, including control of flammable and other hazardous materials, were observed. During plant tours, logs and records were reviewed to ensure compliance with station procedures, to determine if entries were correctly made and to verify correct communication of equipment status. These records included various operating logs, turnover sheets, tagout and lifted lead and jumper logs. Inspections were performed on backshifts including: October 1-3, 7-11, 15-16, 22, 24-25, 28-30, and November 4-5. Deep backshift inspection was performed on the following dates and times:

October 12 (12:55 - 6:40 pm)	October 26 (7:10 - 9:10 am)
October 13 (8:55 - 9:30 am)	October 30 (10:00 - 12:00 pm)
October 14 (7:55 am - 1:00 pm)	October 31 (00:01 - 00:35 am)

Pre-evolution briefings were noted to be thorough with appropriate questions and answers. The operators appeared to have good knowledge of plant conditions. No unauthorized reading material was observed. Food, beverages and hard hats were kept away from control panels.

2.2 Plant Shutdown to Investigate Cause of "B" Recirculation Pump Lower Bearing Low Oil Level Alarm

On October 30, 1991, reactor power was reduced from 100 to approximately 47 percent in order to improve main condenser vacuum. While reducing reactor power, a recirculation pump "B" lower bearing low oil level alarm was received in the control room. Initial troubleshooting verified the electrical components for the alarming annunciator to be operating correctly. The licensee made a conservative decision to initiate a plant shutdown to further investigate the cause of the low oil level alarm. Recirculation pump "B" was secured at 11:54 am as a precautionary measure.

At 3:30 pm, the control room was notified of a loud and visible flash in the vicinity of the construction transformer (See Section 6.1). The fire brigade responded to the scene and reported smoke and minor arcing. The construction transformer was deenergized and assessed for damage. The flash reported earlier was determined to be from a ground fault across the

transformer insulators which damaged a 23 KV primary fuse assembly. The resultant loss of a phase from the construction transformer also caused a downstream ventilation system fan motor in a building located outside the protected area to overheat. The overheated fan motor produced light visible smoke within the building. The fan motor was deenergized and no further smoke or signs of overheating were detected. Fire brigade response to both the construction transformer and the fan motor electrical degradation was prompt. Communications established and corrective actions taken by the fire brigade were appropriate.

A manual scram was initiated at 5:20 pm in accordance with single loop operation shutdown procedures. The shutdown had been expedited due to main condenser fouling and vacuum degradation resulting from storm related insurgence of seaweed and other marine debris. The severe weather also resulted in significant offsite power grid instability, causing several 345 KV supply breakers to open repeatedly, during and shortly after the shutdown. The Nuclear Watch Engineer and Nuclear Operations Supervisor maintained outstanding command and control during the plant shutdown, which was complicated by the effects of the storm.

Troubleshooting of the "B" recirculation pump following plant shutdown found that the oil level had decreased to the low oil level alarm setpoint. No specific leak was detected. Maintenance history indicated that the oil level had been only slightly above the low level alarm setpoint prior to startup from the recent refueling outage. The licensee refilled the lower bearing oil sump and modified maintenance procedures to ensure that the recirculation pump lower bearing oil sumps are properly refilled to an established value above the low level setpoint at the conclusion of routine maintenance activities. Troubleshooting of the low oil level alarm and corrective maintenance actions was thorough.

2.3 Loss of Offsite Power during Severe Storm

On October 30, 1991 at 7:42 pm, while in the process of completing a plant shutdown, the station experienced an unanticipated loss of both 355 KV offsite power lines. The emergency diesel generators started and supplied the safety related 4160 VAC busses as designed. Operators utilized the reactor core isolation cooling (RCIC) system to control reactor vessel water level and placed the high pressure coolant injection (HPCI) system in the full flow test mode to control reactor vessel pressure. Pressure control was also supplemented by cycling one (of four) safety relief valve (SRV). The torus water high temperature emergency operating procedure was entered due to elevated temperatures which resulted from HPCI, RCIC, and SRV steam discharge. The torus cooling mode of the residual heat removal system was initiated and effectively stabilized torus temperature. The response to the loss of offsite power was well controlled and demonstrated sound safety practices. Operators effectively employed available systems to remove decay heat from the reactor and maintain the plant in a stable condition.

At 7:53 the remaining offsite power source was lost and the licensee initiated a Notification of Unusual Event (NOUE) as described in section 5.1. At 10:30 pm, on October 30, offsite power was restored and the licensee terminated the NOUE.

3.0 RADIOLOGICAL CONTROLS (71707)

3.1 Spent Fuel Pool Storage

A NRC:Region I temporary instruction (TI) was issued to review and assess the condition of spent fuel pool (SFP) extraneous material inventory and controls. The inspector reviewed the licensee pre-refueling outage inventory list, which closely reflected the items currently stored in the SFP. The licensee has a long term plan to reduce the number of items in the pool. Ownership of the SFP was recently assigned to a specific department in order to ensure positive controls on SFP inventory. No discrepancies were noted.

3.2 Minor Internal Contamination Event

A licensee radiological occurrence report was written in response to three workers receiving minor intake of radioactive material during the October 18, 1991 disassembly of a recirculation pump seal. The seal had been replaced during the refueling outage. At the time of the contaminations, maintenance personnel were conducting a failure analysis of the seal. Radiological protection personnel performed an estimated exposure report and determined that intake to each individual was well below the regulatory limit as established in 10 CFR part 20. The licensee conducted a detailed and thorough critique of the event and took appropriate corrective action to prevent recurrence.

4.0 MAINTENANCE AND SURVEILLANCE (37828, 61726, 62703, 93702)

4.1 Seismic Qualification of Turbine Building/Battery Room Heating, Ventilation and Air Conditioning (HVAC) System

An NRC issue regarding the operability of safety-related equipment located in the switchgear and battery rooms following a loss of non safety-related HVAC was previously discussed in NRC inspection reports 50-293/91-17, 50-293/91-23 and 50-293/91-80. A structural evaluation identified specific modifications which were necessary to validate the seismic capability of compensatory measures established by the licensee. During the previous reporting period the inspector had conducted a walkdown of the completed structural modifications. A significant number of discrepancies were noted and discussed with licensee personnel. Similar discrepancies were independently noted by quality control personnel.

Review of work packages and interviews with licensee personnel revealed several factors which contributed to the discrepancies initially noted by the inspector. Maintenance personnel performing the work were not experienced in Hilti bolt installation. This type of construction work had previously been done by contractors. In addition, the maintenance supervisors who initially inspected the installed Hilti bolts were not familiar with the installation acceptance criteria. The Pilgrim Station specification for Hilti bolt installation (C-86-ER-Q-E6) was referenced, but was not included in the work package. Maintenance supervisor walkthrough of the work package, prior to implementation, did not provide feedback to work planners to add

the installation specification to the work package. Post work feedback from maintenance personnel was not effectively communicated to work planners. With regard to this work package, training, work planning policies, and maintenance work practices were not effectively implemented.

The licensee identified several current policies which were not properly implemented and which would be reemphasized to the appropriate personnel. Additional corrective actions planned by the licensee include: Maintenance Department seminar sessions to stress the responsibilities of the maintenance supervisor regarding independent assurance of quality and completeness of work. The station work planning instruction (WP 2000) is being revised to better define the standards for information to be included in work packages. Mechanical maintenance training will be modified as appropriate to include Hilti bolt installation. An organizational restructuring under which the Work Planning Division would report to the Maintenance Department is under consideration. A recently developed work planner training program will begin in December of 1991. All maintenance disciplines are scheduled to begin receiving "Team Concept" training in December of 1991 which is intended to provide more indepth technical training to the maintenance supervisors.

During this reporting period quality assurance, maintenance, and nuclear engineering department personnel coordinated their efforts and fully resolved all discrepancies regarding the seismic modification installation. By letter dated October 24, 1991, the licensee reported that the seismic modifications had been completed. Licensee final verification of quality and completeness of the final completed seismic modification work was thorough. The inspector had no further questions regarding the quality of the completed seismic modifications.

5.0 EMERGENCY PREPAREDNESS (40500)

5.1 Notification of Unusual Event (NOUE) Due to Loss of All Offsite Power

On October 30, 1991 at 7:42 pm, with the reactor subcritical and the licensee in the process of completing a plant shutdown, the station experienced an unanticipated loss of the Canal and Bridgewater (355 KV) offsite power lines. Loss of these two offsite power sources was associated with the heavy weather conditions that accompanied a severe northeastern storm. The "A" and "B" emergency diesel generators (EDG) started and supplied power to the safety related 4160 VAC busses as designed.

At 7:53 pm, the Manomet (23 KV) supply line to the remaining offsite power source, the shutdown transformer, was disrupted. The storm had blown a large tree down across the Manomet power lines approximately 200 yards offsite. At 8:03 pm, the licensee declared an NOUE in accordance with emergency action level procedures, due to the inability to power any 4160 VAC electrical bus from an offsite power source. Notifications of NRC, State and Local officials were prompt and informative.

Power to the shutdown transformer via the Manomet line was restored at 10:10 pm. At 10:16 pm, the Bridgewater offsite power supply line was restored to the startup transformer. At 10:30 pm. all 4160 VAC busses were being supplied by the startup transformer via offsite power and the NOUE was terminated. Normal plant shutdown configuration was established and the emergency diesel generators were secured. Senior plant management was present in the control room throughout the event. Licensee actions during the event were conservative, well controlled, and demonstrated a good safety perspective.

6.0 SECURITY (71707)

The inspector conducted a walkdown of security facilities including the armory, the central alarm station, the secondary alarm station, and the protected area perimeter. Staffing, guard force responsibilities and operation of security equipment was discussed with security managers. Material condition of the security perimeter was excellent. Security shift supervisors and perimeter guards were found to be alert and highly knowledgeable of their duties.

6.1 Security Response to Effects of Severe Storm

The severe northeastern storm experienced during the period October 29-31, 1991, caused damage to station security structures and equipment. On October 30, salt buildup and resultant phase-to-ground electrical arcing caused a transformer which normally supplies power to security equipment to fail. An uninterruptable power supply properly assumed security loads. The security diesel generator started as designed and promptly assumed station security loads without interruption of power.

Heavy shoreline waves (20-30 feet in height, and winds in excess of 60 miles per hour damaged a large section of the protected area perimeter fencing and intrusion detection system. Compensatory measures were promptly implemented. Security management anticipated well in advance this potential need for the increased staff. Station management placed strong emphasis on civil restoration and security perimeter repair immediately following cessation of the storm. Perimeter integrity and the normal security power supply were restored in an expeditious manner. The licensee demonstrated an appropriate level of attention to station security during and following the storm.

7.0 SAFETY ASSESSMENT AND QUALITY VERIFICATION (92701)

7.1 Reactor Core Isolation Cooling System Inoperability

As previously discussed in NRC inspection reports 50-293/91-04, 12, 17, 23, and 80, a concern was identified regarding the ability of the reactor core isolation cooling (RCIC) and high pressure coolant injection (HPCI) system flow inverters to withstand voltage transients resulting from the start of large AC electrical loads without tripping. The inverters are powered by the 125 vdc system via either an associated battery charger or in its absence a battery bank (refer to Attachment 1). During the refueling outage, the licensee conducted extensive testing of

battery charger and DC bus response to large AC electrical load starts with the AC distribution system in various configurations. Ultimately, through engineering analysis and actual testing, the licensee concluded the most limiting electrical transient with the potential to affect inverter performance was the automatic start of a core spray pump during emergency diesel generator load sequencing in a loss of offsite power with concurrent loss of coolant accident scenario (LOOP/LOCA). The licensee concluded, based on the results of the test data that, with battery charger float voltages set at 132 vdc and the inverter trip setpoints reset to 150 vdc, the inverters would not trip during a concurrent LOOP/LOCA event. The plant was subsequently restarted from the outage on August 11, 1991.

Subsequent to plant startup, several inspector meetings and conference calls were conducted to discuss this issue. Ultimately on October 2, 1991, due to the complexity of the inverter testing and data analysis, a management meeting was conducted at the NRC Region I offices. On October 6-7, 1991, new information was provided to the inspector regarding electrical distribution system configuration and initial plant conditions during testing event 14. Previously, it was believed that event 14 was a core spray pump "A" start during EDG "A" load sequencing. However, it was actually a core spray pump start after the EDG had assumed the existing electrical load. The affect of the actual configuration was that the peak voltage experienced would have been potentially dampened and therefore not representative of the limiting LOOP/LOCA transient voltage.

The licensee correlated bus "B" test data, which indicated a 5.0 vdc difference between the two test configurations above, to determine that a similar increase in bus "A" peak voltage would remain below 150 vdc. Therefore previous operability assumptions remained valid. However, continuing inspector review of the test data indicated sufficient variations in train responses, such that the licensee correlation of test results between trains appeared inappropriate. This concern was immediately discussed with the licensee. Subsequently on October 9, 1991, station management declared RCIC inoperable due to the uncertainty of the RCIC inverter ability to withstand a LOOP/LOCA scenario without tripping.

During the ensuing seven day technical specification limiting condition of operation period, the licensee developed and presented to the onsite review committee (ORC) several iterations of engineering evaluations assessing RCIC operability. Initial operability assessments did not address the impact of potential RCIC inoperability upon HPCI technical specification assumptions and were not accepted by ORC. On October 13, 1991, the ORC approved an engineering evaluation which concluded RCIC was operable. The evaluation was largely predicated on accident analysis which assumes no credit or mitigation contribution by RCIC during a LOOP/LOCA scenario. The evaluation was appropriate from a design accident analysis perspective. However, it did not effectively address basic technical specification operability requirements for RCIC. As such, station management did not accept the ORC approved operability evaluation and directed plant personnel to evaluate the appropriateness of a request for NRR waiver of compliance from the requirements of the RCIC technical specification limiting condition of operation.

On October 16, 1991, the licensee formally requested the NRR waiver of compliance. The request was properly supported by design bases and accident analysis information and had been reviewed and approved by the ORC. The waiver was requested for 97 days or until the next reactor shutdown at which time further testing would be conducted. The waiver was granted on October 17, 1991, by NRR prior to the conclusion of a 24 hour verbal waiver granted on October 16. The waiver was terminated effective October 30, 1991, when the reactor was shutdown. As discussed previously in this report, the plant experienced a LOOP following reactor shutdown. The EDGs started and assumed electrical loads as designed. It should be noted a train "A" residual heat removal (RHR) pump aligned in the torus cooling mode of operation was started during the LOOP. The ensuing pump start voltage transient, recorded at 152.7 vdc, caused the RCIC inverter to trip. Operators were required to reset the inverter in order to utilize RCIC to provide reactor vessel water level control.

The licensee staff experienced difficulty in the development of a RCIC operability evaluation prior to the station management directed request for a NRR waiver of compliance. Engineering personnel extensively utilized accident analysis data in the evaluation development which effectively enveloped RCIC unavailability consequence, however the evaluation did not address basic technical specification operability assumptions. Station management exhibited outstanding regulatory and safety perspectives by declining to accept the ORC approved operability evaluation thus maintaining RCIC technically inoperable and necessitating the waiver request. This position was significant in that the system was properly considered inoperable during the October 30, 1991, LOOP when the RCIC inverter tripped upon start of an RHR pump.

8.0 ENGINEERING AND TECHNICAL SUPPORT (71707)

8.1 Followup of Previously Identified NRC Items

8.1.1 (Closed) Unresolved Item 87-53-01.2, Review of Communication and Coordination Improvements

The November 1987 loss of offsite power event revealed several instances in which the licensee organization experienced communications difficulties. Subsequently, Nuclear Organization Procedure (NOP) 88A2 was issued which described administrative policies and mechanisms to notify management personnel of abnormal events which do not fulfill emergency action level entry condition requirements. Inspector review of NOP88A2, revised April 2, 1990 determined that appropriate instruction was included to ensure plant management would be properly informed of abnormal events. Additionally, the inspector determined the NOP was consistent with emergency preparedness implementation procedure guidance. This procedure has been effectively utilized during several abnormal events at the station since its development. This item is closed.

9.0 NRC MANAGEMENT MEETINGS AND OTHER ACTIVITIES (30703)

9.1 Routine Meetings

At periodic intervals during this inspection, meetings were held with senior plant management to discuss licensee activities and areas of concern to the inspectors. Following completion of the inspection period, the resident inspector staff conducted an exit meeting with BECo management summarizing inspection activity and findings for this report period. No proprietary information was identified as being included in the report.

9.2 Management Meetings

On October 2, NRC Management Meeting Number 91-117 was conducted at the NRC Region I offices in King of Prussia, Pennsylvania to discuss corrective actions regarding inverter and battery charger performance. The licensee presentation slides are attached.

On October 15, 16 and 17, conference calls were conducted between representatives of NRC:Region I, NRR, and the licensee to discuss operability of the RCIC system, a related Temporary Waiver of Compliance (TWOC) request and a related exigent Technical Specification Change request. These subjects are discussed further in section 7.1 of this report.

On October 16, 1991 representatives from NRC: Region I, NRR and the licensee met at the Region I offices in King of Prussia, Pennsylvania to discuss implementation of the Emergency Response Data System.

On November 6, 1991 Mr. George Davis, Senior Vice President-Nuclear and Mr. Roy Anderson, Vice President-Nuclear and Station Director met with Mr. Ivan Selin, Chairman of the NRC and Mr. James Taylor, Executive Director of NRC Operations at the NRC headquarters in Rockville, Maryland. The purpose of this meeting was to discuss items of mutual interest at PNPS and to provide an opportunity for BECo executives to meet with NRC senior management.

9.3 Other NRC Activities

On October 3, the Director, Division of Reactor Projects, NRC: Region I toured PNPS and met with licensee management to discuss current licensee performance.

On November 4-8, a NRC: NRR special inspection team conducted the preliminary phase of a Instrumentation and Controls Setpoint inspection.

Boston Edison

Pilgrim Nuclear Power Station

Resolution Of

HPCI/RCIC Inverter Issue

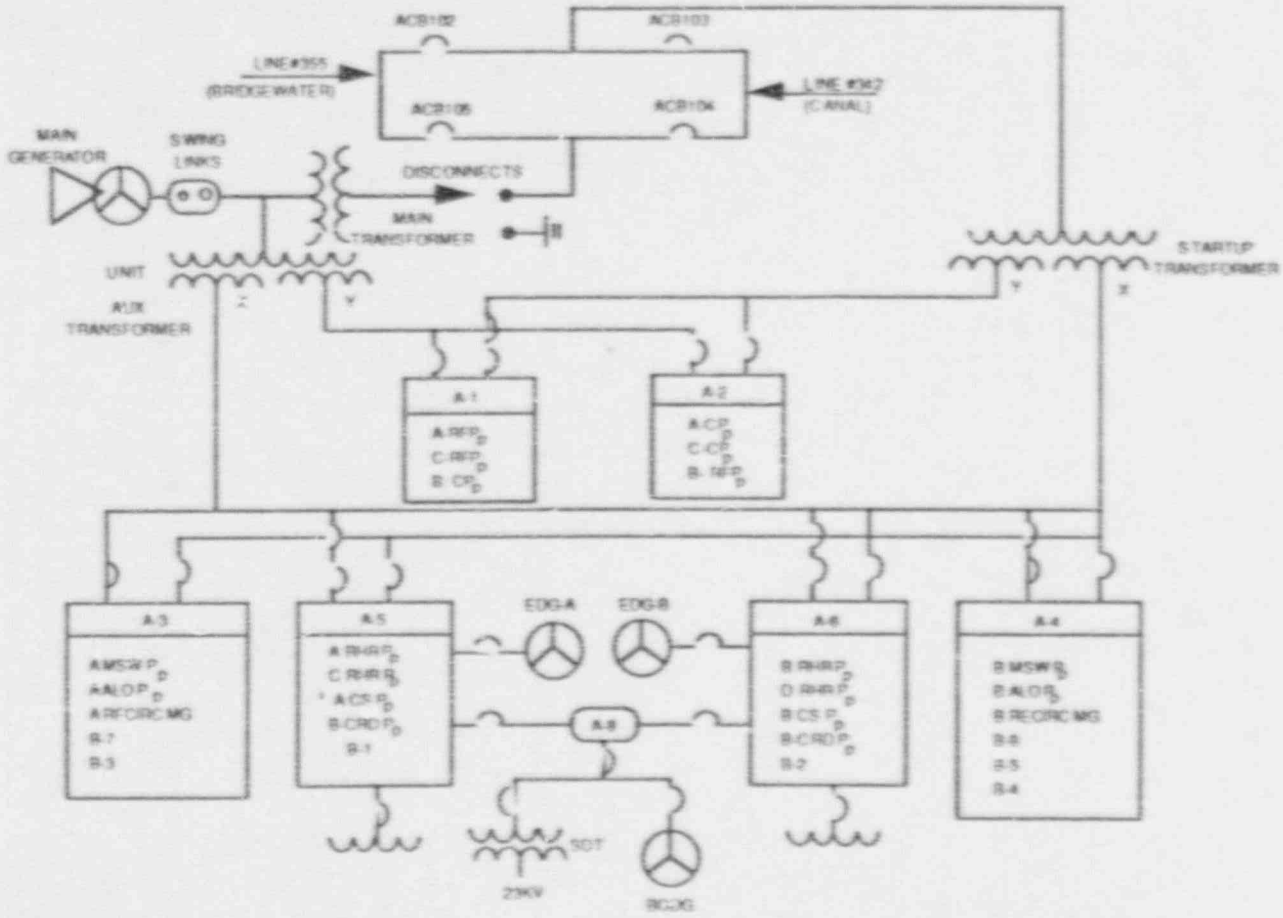
October 2, 1991

ATTACHMENT

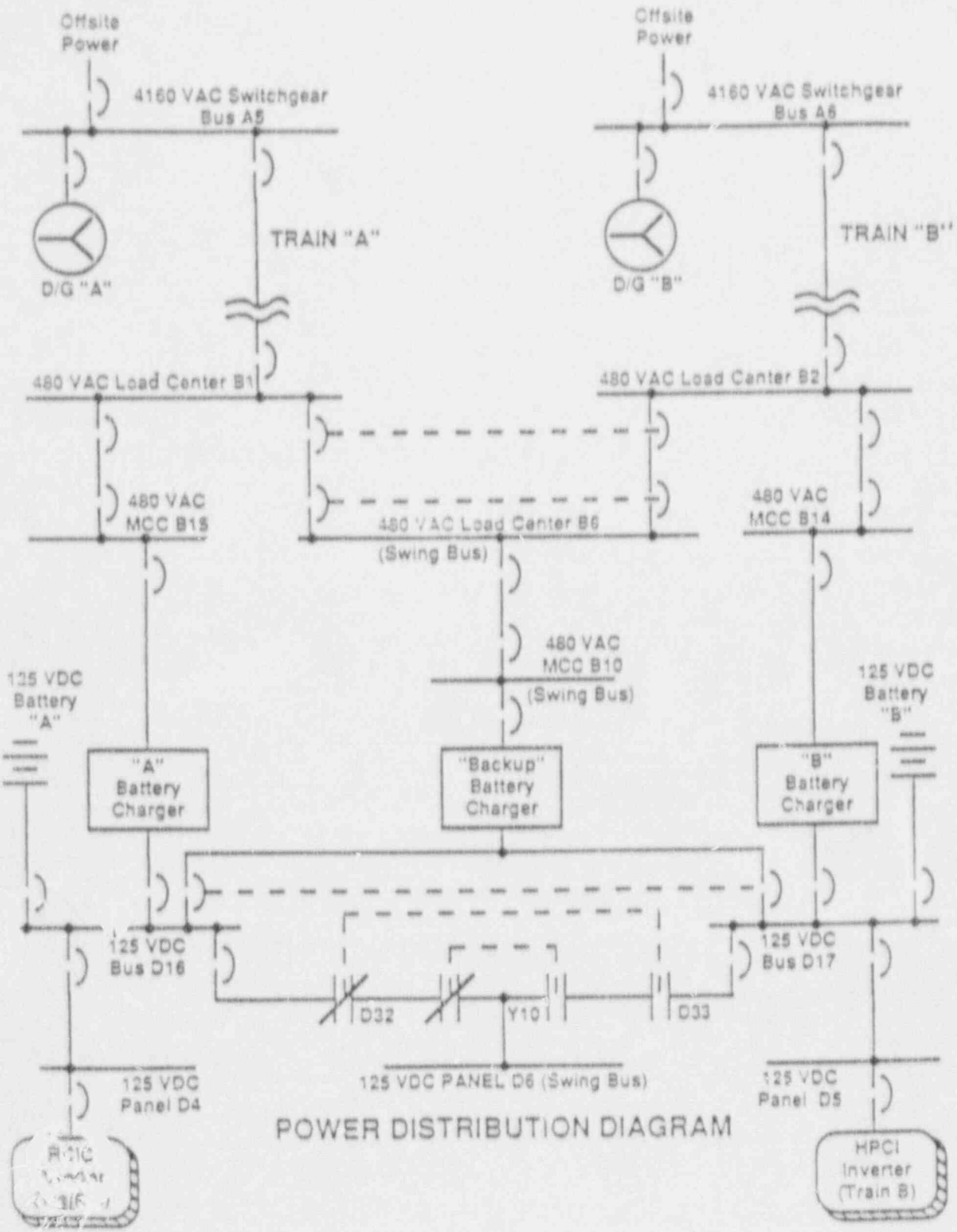
Agenda

- Discuss complex issue of HPCI/RCIC inverter response to DC voltage
- Discuss basis for operability
- Outline future actions
- Discuss process investigation

4160V Distribution

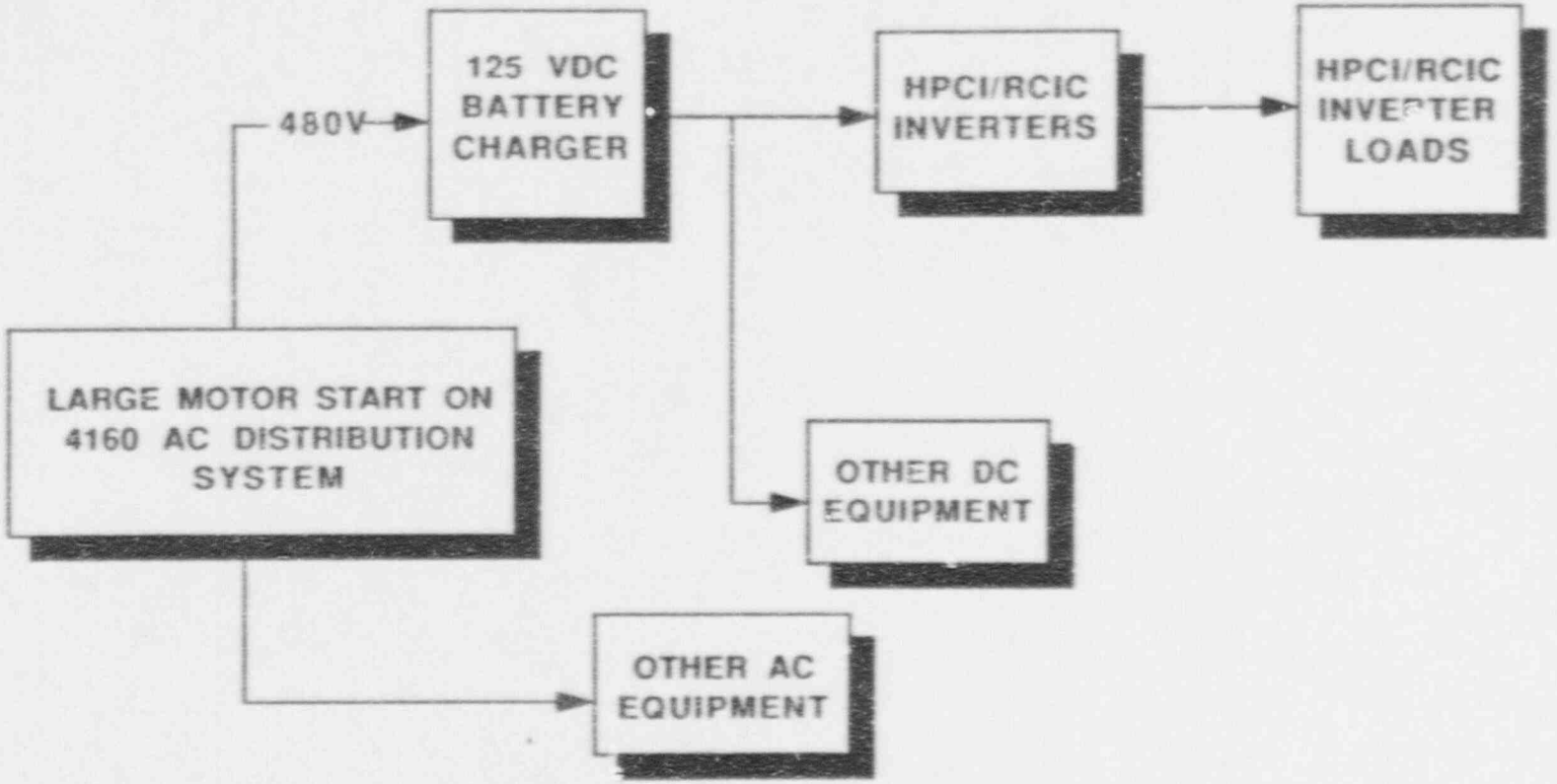


BOSTON EDISON



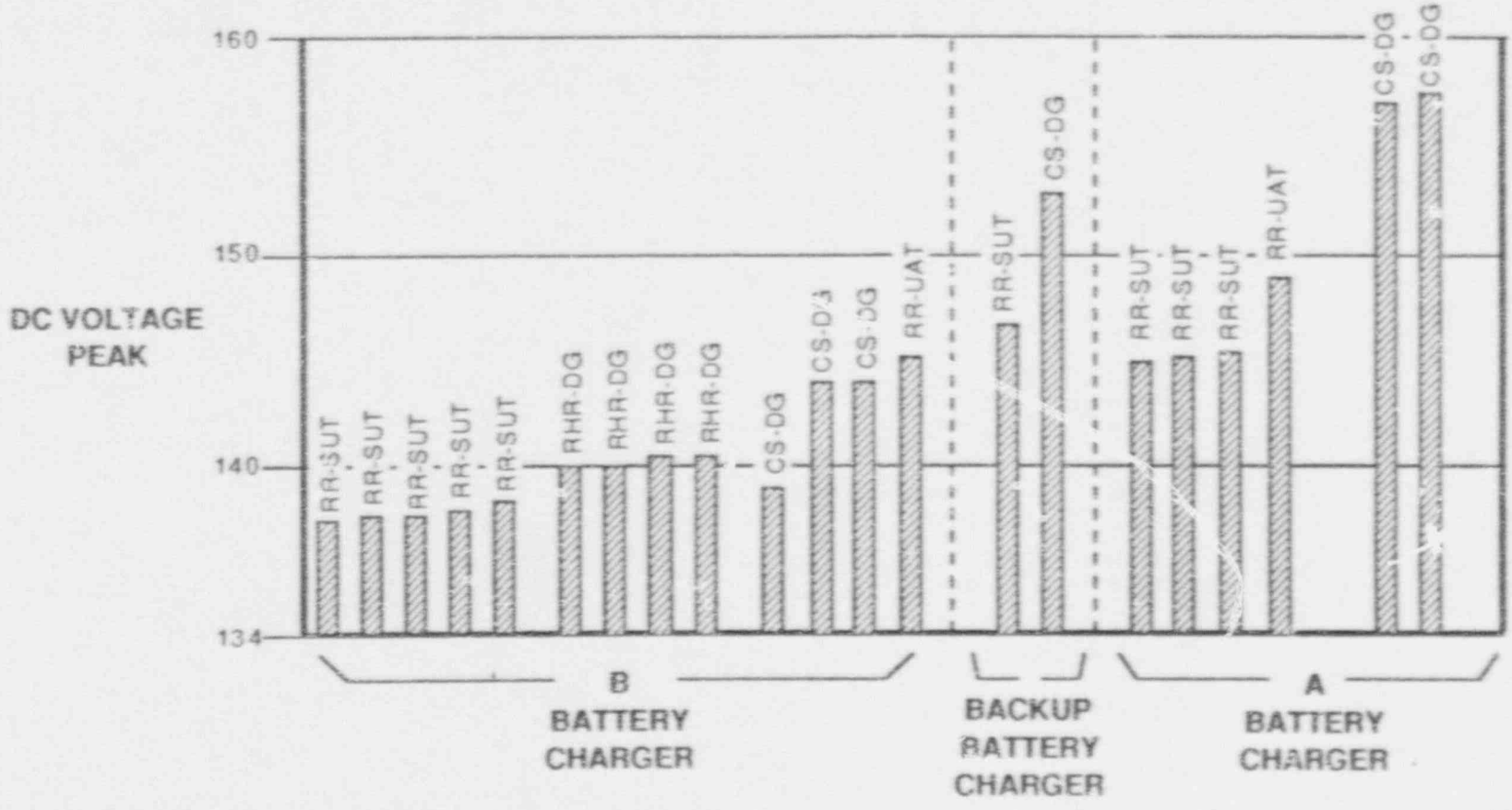
POWER DISTRIBUTION DIAGRAM

Effect Of Transients Understood



- BATTERIES MEET 8HR MISSION TIME
- HPCI/RCIC OPERABLE WHEN REQUIRED

Peak DC Voltage At 134v Float Voltage



CHARGER RESPONSE IS REPEATABLE

BOSTON EDISON

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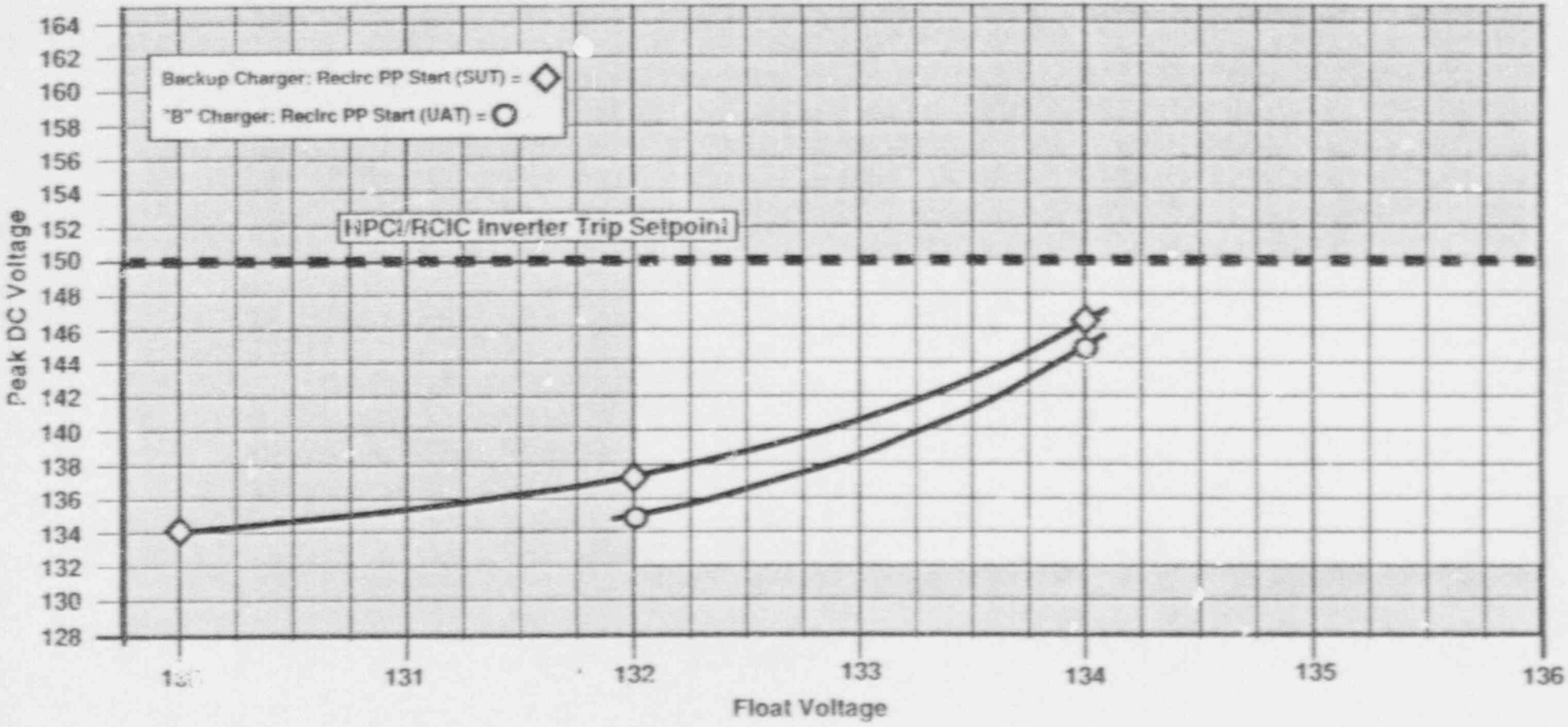
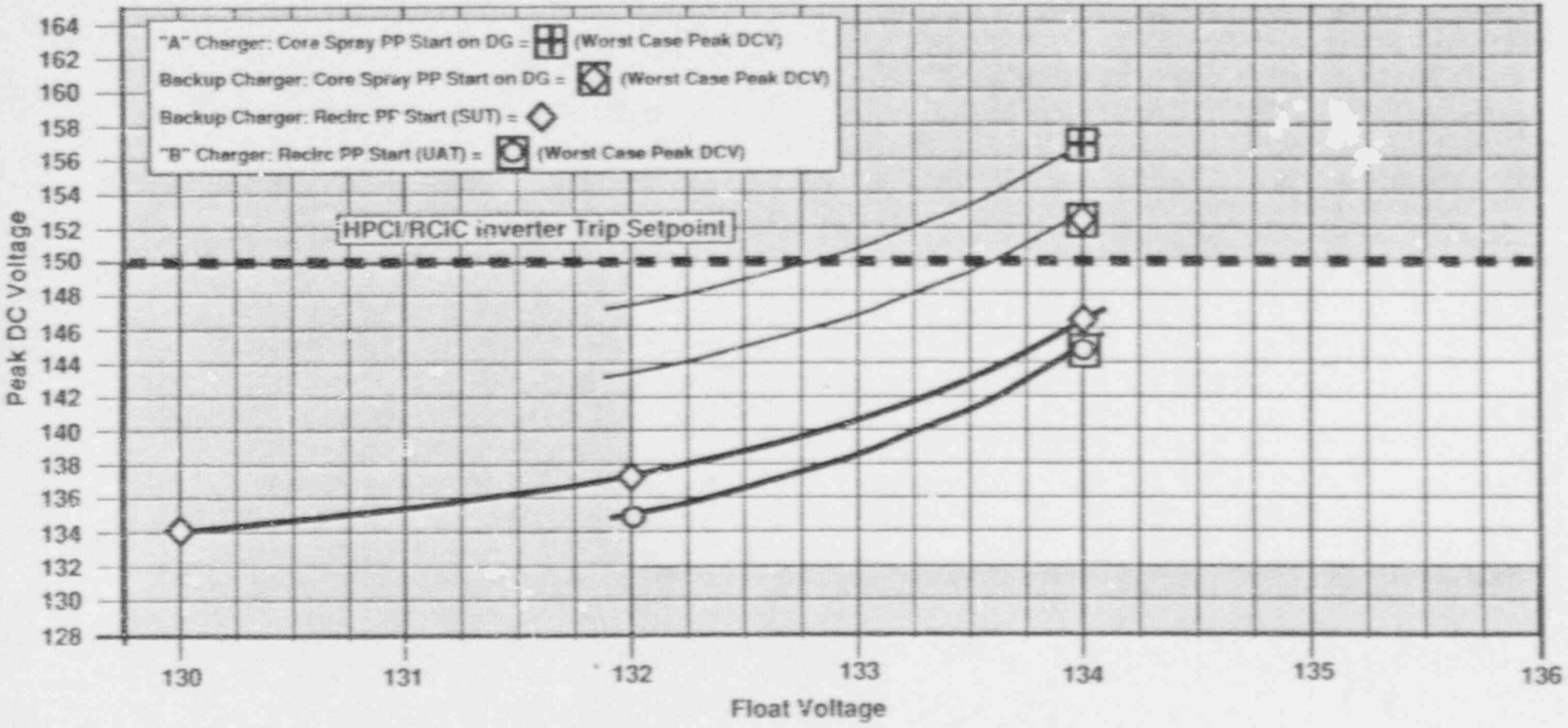
Battery Charger Response Profile for Float Voltage Change



Battery Charger Response to Float Voltage Similar by Test as Well as Vendor Review

Peak Voltage vs Float Voltage

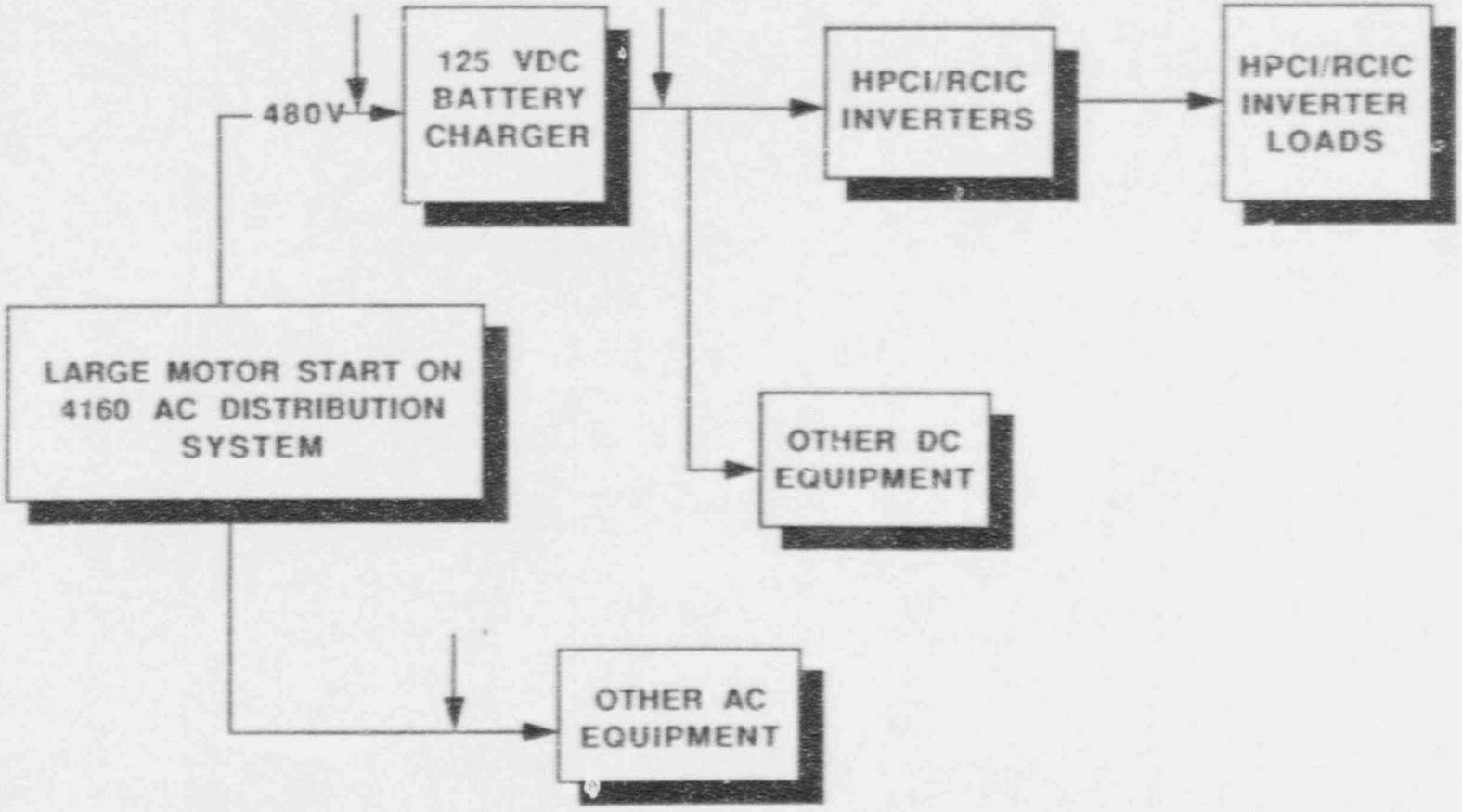


DC Float Voltage Satisfies Battery Charger Criteria And Inverter Trip Setpoint

Future Plans

- Test "A" battery charger for response profile and adjust float voltage
- Further test system response to establish modifications to allow battery float voltage in mid band (approx. 134v)
- Target schedule
  - "A" Battery charger return to service 4th quarter 1991
  - Response testing in MCO 1992
  - Modification if required for RFO 9

Multiple Solutions Available



Investigation Assessment

- Drive out root cause
- Trouble shooting procedure
- Use of ORC reviews
- Control on major/minor FRNs

Action Plan To Optimize Design And Operating Margin

- Broad range of resolution alternatives available
- Test results necessary to pick best choice
- Goals are:
  - Increased margin
  - Improve battery reliability
  - Maximize benefit of solution

Focus On Safe Plant Operations Throughout Issue Resolution

- HPCI/RCIC inverter trips exposed complex electrical system issue
- Safe operation ensured
- Action plans to resolve thorough and aggressive
- Plant safety top priority throughout investigation
- Management committed to resolve issue

ATTACHMENT 1

RESPONSE OF BATTERY CHARGERS TO LARGE MOTOR STARTS AND CONCLUSIONS

Event	Date	Time	Motor Starting	Batt.Chgr. Power Source	Peak DC Bus A Volts	Peak DC Bus B Volts	Min. Volt Margin To Trip (Set at 150V)	Remarks
Initial Conditions - Battery Charger D11 feeding "A" DC Bus, Battery Charger D12 feeding "B" DC Bus, Float at 134V both BCs; RCIC OV Trip Set at 146V DC (A Bus), HPCI OV Set at 141V DC (B Bus)								
0	3/26/91	00:41:41	Reac Recirc Pump P201B	Offsite	149 ***	145 ***	1	Epic Trace, Scan Rate = 250ms
RCIC & HPCI OV Trip Setpoints reset to 150V DC as a result of this PDC								
1	7/16/91	5:49:35	Reac Recirc Pump P201A	Offsite	145.25	137.4	4.75	Epic, SR = 250ms
2	7/20/91	12:49:00	Reac Recirc Pump P201A	Offsite	Not Recorded	137.65	Not Recorded	Epic, SR = 20ms
3	7/23/91	13:25:55	Reac Recirc Pump P201A	Offsite	Not Recorded	137.6	Not Recorded	Epic, SR = 20ms
4	8/01/91	18:49:16	Reac Recirc Pump P201A	Offsite	145.00	137.75	5	Epic, SR = 20ms
5	8/03/91	11:54:48	Reac Recirc Pump P201A	Offsite	144.75	138	5.25	Epic, SR = 20ms
6	8/07/91	05:04:05	CS P215B	DG B	Invalid Tracing	144	6	Epic, SR = 20ms
7		05:04:11	RHR P203B	DG B	Invalid Tracing	140	10	Epic, SR = 20ms
8		05:04:16	RHR P203D	DG B	Invalid Tracing	140.5	9.5	Epic, SR = 20ms
9	8/07/91	12:34:34	CS P215B	DG B	Invalid Tracing	144	6	Epic, SR = 20ms
10		12:34:40	RHR P203B	DG B	Invalid Tracing	140	10	Epic, SR = 20ms
11		12:34:45	RHR P203D	DG B	Invalid Tracing	140.5	9.5	Epic, SR = 20ms
12	8/07/91	12:37:25	CS P215A Restart	DG A	156.6	N/A	-6.6	Epic, SR = 20ms
13		12.38:17	CS P215B Restart	DG B	N/A	139	11	Epic, SR = 20ms
14	8/09/91	03:28	CS P215A	DG A	157*	N/A	-7	Chart Recorder (Rec 011)

ATTACHMENT 1

RESPONSE OF BATTERY CHARGERS TO LARGE MOTOR STARTS AND CONCLUSIONS

Event	Date	Time	Motor Starting	Batt.Chgr. Power Source	Peak DC Bus A Volts	Peak DC Bus B Volts	Min. Volt Margin To Trip (Set at 150V)	Remarks
"Backup" Battery Charger D14 was aligned to feed "A" D.C. Bus								
15	8/09/91	03:45	CS P215A	DG B	134	N/A	16	Invalid test, Batt. Chgr. Power source should have been DG A
16	8/09/91	04:10	CS P215A	DG B	134	N/A	16	Invalid test, Batt. Chgr.Power source should have been DG A
17	8/09/91	16:15:53	Reac Recirc Pump P201A	Offsite	146.5	136	3.5	Epic, SR = 20ms
18	8/10/91	00:59:19	CS P215A	DG A	152.4**	NA	-2.4	Epic, SR = 20ms
Float Voltage on D14 set from 134V down to 130V ("B" Battery Charger still at float of 134V)								
19	8/10/91	08:45:26	Reac Recirc Pump P201A	Offsite	134.25	137.6	12.40	Epic, SR = 20ms
Float Voltage on D14 set from 130V up to 132V ("B" Battery Charger still at float of 134V)								
20	8/10/91	19:33:34	Reac Recirc Pump P201A	Offsite	137.34	137.5	12.50	Epic, SR = 20ms
Float Voltage on D12 set from 134V down to 132V								
21	8/22/91	22:19:50	Reac Recirc Pump P201A	Offsite	143.9	134.75	6.1	Epic, SR = 20ms

Notes:

1. *** RCIC and HPCI Inverters both tripped during Event 0. This is the precipitating event and is the subject of LER 91-006-000 & ESR 91-0249 ;which resulted in this PDC.
2. * RCIC Inverter tripped during event #14. Data from TP 91-148 was used for event 14. F&MR #91-363 was written to declare charger D11 inoperable. Backup charger #D14 was aligned to the "A" D.C. Bus.
3. ** RCIC Inverter tripped during event #18.
4. Events #17 thru #20 were tests conducted to trouble shoot the problem resulting in the successful test (Event #20, Voltage Tracing attached to this FRN).