U. S. NUCLEAR REGULATORY COMMISSION

REGION III

Report No. 50-341/89024(DRS)

Docket No. 50-341 License No. NPF-43

Licensee: The Detroit Edison Company
2000 Second Avenue
Detroit, Michigan 48224

Facility Name: Enrico Fermi 2

Inspection At: Fermi 2 Site, Newport, Michigan

Inspection Conducted: September 28 and 29 and October 30 through November 30, 1989.

Inspectors:

F. J. Jablonski F. J. Jablonski, Team Manager	1-19-90 Date
F. J. Jablonski for S. D. Burgess	1-19-90 Date
N. C. Choules N. C. Choules	1-19-90 Date
F. J. Jablonski for P. N. Eng	1-19-90 Date
R. A. Hasse R. A. Hasse, Engineering Team Leader	1/19/90 Date
M. P. Huber M. P. Huber	1/19/90 Date
R. A. Hasse for V. P. Lougheed	1/19/90 Date
F. J. Jablonski for R. A. Paul	1-22-90 Date
J. F. Smith J. F. Smith	1-19-90 Date
F. J. Jablonski for H. A. Walker, Maintenance Team Leader	1-19-90 Date
I. T. Yin I. T. Yin	1/19/90 Date

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PDR ADOCK 05000341
Q PDC

Contractor: M. A. Wastlund

Approved By: R. W. Cooper, Chief (signed F. J. Jablonski for)
Engineering Branch

1-22-90
Date

Inspection Summary

Inspection on October 30 through November 3 and November 13 through 17, 1989 (Report No. 50-341/89024(DRS)).

Areas Inspected: Special announced team inspection of maintenance, engineering, in-service testing, support of maintenance, and related management activities. The inspection was conducted utilizing Temporary Instruction 2515/97, the attached Maintenance Inspection Tree, and selected portions of Inspection Modules 37700, 37828, 38703, 62700, 62702, 62704, 62705, 73756, and 92701 to ascertain whether maintenance was effectively accomplished and assessed by the licensee.

Results: Based on the items inspected during the timeframe that the inspection was conducted overall performance in maintenance and engineering was considered satisfactory. Areas of strength and weakness were identified as discussed in the Executive Summary. A synopsis of the overall implementation of the maintenance program is provided in Section 4.0 of the report. There were two violations: failure to follow procedures, with ten examples; and failure to provide adequate and timely corrective action, with three examples. Also, there was one open item that dealt with the review of post modification testing results.

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DETAILS

1.0 Principal Persons Contacted

Detroit Edison Company

*W. McCarthy, Chairman and Chief Executive Officer
*S. Catola, Vice President, Nuclear Engineering and Services
*D. Gipson, Plant Manager
*L. Goodman, Director, Nuclear Licensing
*A. Kowalczuk, Superintendent, Maintenance and Modifications
*R. Matthews, Assistant Superintendent, Maintenance and Modifications
*P. McComish, Maintenance Support
*W. Orser, Vice President, Nuclear Operations
*R. May, Director, Nuclear Materials Management
*R. Stafford, General Director, Nuclear Quality Assurance

U.S. Nuclear Regulatory Commission

*E. Greenman, Director, Reactor Projects, Region III
*R. Cooper, Chief, Engineering Branch, Region III
*P. Eng, Licensing Project Manager, Nuclear Reactor Regulation
*S. Stasek, Resident Inspector

* Denotes those present at the exit meeting on November 30, 1989.

2.0 Licensee Action on Previous Inspection Items

2.1 (Closed) Unresolved Item (341/87022-02): This item noted a possible problem in the back-seating of valves on the open stroke. This was reviewed in Section 3.8.7 of this report; this item is closed.

2.2 (Closed) Unresolved Item (341/87028-03): This item noted possible inadequate scope of the trend program. This was reviewed in Sections 3.2, 3.6.1, and 3.8.3 of this report; this item is closed.

2.3 (Open) Unresolved Item (341/ 87028-06): This item noted possible inadequate trending of maintenance related problems or hardware failures. This was reviewed in Section 3.6.1 of this report. The item remains open pending further review of action taken to correct possible negative trends.

2.4 (Closed) Open Item (341/88007-01): This item noted there were no evaluations and justifications for the postponing or rescheduling of preventive maintenance items. This was reviewed in Section 3.4.1.2 of this report; this item is closed.

2.5 (Closed) Violation (341/88007-03A): This violation documented a problem with inadequate maintenance procedures. This was reviewed in Sections 3.4.2.1, 3.4.2.2, and 3.4.2.3 of this report; this item is closed.

2.6 (Closed) Violation (341/88007-03B): This violation documented a problem with not following maintenance procedures. This was reviewed in Section 3.9.3 of this report; this item is closed.

2.7 (Closed) Violation (341/88007-03C): This violation documented a problem with not following maintenance procedures. This was reviewed in Section 3.9.3 of this report; this item is closed.

2.8 (Closed) Violation (341/88007-03D): This violation documented a problem with not following maintenance procedures. This was reviewed in Section 3.9.3 of this report; this item is closed.

2.9 (Closed) Open Item (341/88008-01): This item documented the failure of the Materials Engineering Group (MEG) to evaluate the use of non-safety related parts in safety related applications. This was reviewed in Section 3.6.3 of this report; this item is closed.

2.10 (Closed) Open Item (341/88008-02): This item noted that in some cases, differing shelf lives were specified for the same component. This was reviewed in Section 3.3.4.1 of this report; this item is closed.

2.11 (Closed) Violation (341/88008-03): This violation noted the failure to identify critical characteristics of non-safety related materials, parts and equipment used in safety related applications. This was reviewed in Section 3.6.3 of this report; this item is closed.

2.12 (Closed) Open Item (341/88008-04): This item noted a failure of MEG to follow procurement program administrative controls. This was reviewed in Section 3.6.3 of this report; this item is closed.

2.13 (Closed) Violation (341/88008-05): This violation documented the failure to identify and separate limited life material. Based on the licensee action discussed in Section 3.3.4.1 of this report, this item is closed.

2.14 (Closed) Violation (341/88025-01): This violation documented the failure to have adequate design control measures for ensuring proper torque switch settings for motor-operated valves (MOV). This was reviewed in Sections 3.4.2.2 and 3.8.6 of this report; this item is closed.

2.15 (Closed) Violation (341/88025-02): This violation documented the failure to specify the requirements necessary to assure adequate MOV maintenance capability in the procurement of contractor personnel. This was reviewed in Sections 3.3.2.2 and 3.4.2.2 of this report; this item is closed.

2.16 (Closed) Violation (341/88025-03): This violation documented the failure to have adequate and accurate procedure steps for reassembly and proper torque and limit switch settings for MOVs. This was reviewed in Sections 3.4.2.2 and 3.8.6 of this report; this item is closed.

2.17 (Closed) Violation (341/88025-04): This violation documented the failure to take prompt corrective action for previously identified MOV problems. This was reviewed in Sections 3.4.2.2 and 3.8.6 of this report; this item is closed.

2.18 (Closed) Violation (341/88030-01A): This violation documented an inadequate material control review. This was reviewed in Section 3.6.3 of this report; this item is closed.

2.19 (Closed) Violation (341/88030-01B): This violation documented the failure to perform a written evaluation for dedication of non-safety related material for safety related applications. This was reviewed in Section 3.6.3 of this report; this item is closed.

2.20 (Closed) Violation (341/88031-01A): This violation documented an example of the failure to follow approved procedures. This was reviewed in Section 3.9.3 of this report; this item is closed.

2.21 (Closed) Violation (341/88031-01B): This violation documented an example of the failure to follow approved procedures. This was reviewed in Section 3.9.3 of this report; this item is closed.

2.22 (Closed) Unresolved Item (341/88037-13): This item noted inadequate engineering response in developing a program to provide assurance that safety related check valves would function properly under all design conditions. This was reviewed in Sections 3.8.4.and 3.8.5 of this report; this item is closed.

2.23 (Closed) Unresolved Item (341/89004-01): This item noted that full stroke testing of check valves was not being performed as required. This was reviewed in Section 3.8 of this report and has been upgraded to a violation. This item is closed.

3.0 Introduction to the Evaluation and Assessment of Maintenance

An announced NRC combined team inspection of maintenance and engineering was conducted during the first refueling outage at the Enrico Fermi 2 Nuclear Power Plant during the period of October 30 through November 3, and November 13 through 17, 1989. The inspection was conducted to address fundamental issues in the broad areas of maintenance, engineering, and technical support where the team looked at plant performance, management support, and implementation. The team goal was to consolidate several common concerns from past inspections and observe current conditions to determine if corrective actions to maintenance and engineering programs had been implemented to assure the safe operation and reliability of plant structures, systems, and components to operate on demand. This inspection was based on the guidance provided in NRC Temporary Instruction 425767-C, "Maintenance Inspection," and Drawing 425767-C, "Maintenance Inspection Tree." The drawing, which is attached to this report, was used as a visual aid during the exit meeting to depict the results of the inspection. Acronyms used in this report are defined in Appendix A.

Results of this inspection were derived from data obtained by observation of current plant conditions and work in progress, by review of completed work, and by evaluation of the licensee's attempt at self assessment of maintenance and correction of weaknesses. Major areas of interest included electrical, mechanical, instrument and control and the support areas of radiological control, engineering, quality control, training, procurement, and operations. Problems identified by the inspectors were evaluated for effect on Technical Specification operability and technical or managerial weakness.

3.1 Performance Data and System Selection

3.1.1 Historic Data

The inspectors considered the latest Systematic Assessment of Licensee Performance (SALP) report, completed NRC inspection reports including the Diagnostic Evaluation Team (DET) and Safety System Outage Modification Inspection (SSOMI). Primarily, the inspectors were sensitive to technical and managerial problems that appeared to be maintenance related. Results of this review indicated that there were potential weaknesses with the Preventive Maintenance (PM) program, motor-operated valves (MOVs), in-service testing (IST), parts and material controls, trending, root cause analysis, and engineering involvement.

The inspectors also reviewed plant operations historic data since January 1989, including Licensee Event Reports (LERs). The minimum capacity factor was 61%, slightly better than the goal of 60%; the forced outage rate of 10.5% slightly exceeded the goal of 10%. The goal to not exceed four automatic reactor trips was met; there were three unplanned manual and one automatic reactor trips, all from balance of plant (BOP) components. None of the trips was caused by maintenance personnel nor to ineffective or lack of maintenance. It was noted that corrective actions taken during this outage should help reduce problems with excessive turbine bearing vibration and leakage of hydrogen into the stator water system of the main turbine generator. Safety system availability goals for high pressure core injection (HPCI), residual heat removal (RHR), and emergency diesel generators (EDG) appeared reasonable and achievable although still in somewhat of a developmental stage.

There were 14 emergency safety features actuations with the following causes: 4 equipment, 2 design, 1 operations, 3 maintenance, and 4 Instrument and Control (I&C). One equipment problem, a transformer failure, was indirectly caused by an improper repair. The events caused by maintenance personnel happened after the plant was shut down and involved non plant personnel, which appeared to be a continuation of a problem with control of contractors. The events caused by I&C occurred at power when technicians were attempting to take permanent corrective action to preclude further actuations of this type. A comparison between 1988 and 1989 Deviation Event Reports (DERs) associated with I&C personnel indicated a significant reduction.

3.1.2 System Selection

The systems and components selected for this inspection were based on a review of data from the Nuclear Plant Reliability Data System (NPRDS) and the Probabilistic Risk Assessment (PRA) study furnished to the team by the Reliability Applications Section of the Office of Nuclear Reactor Regulation. As described throughout this report, emphasis was placed on inspection of specific electrical, mechanical, and instrumentation components of the ac/dc power, control rod drive (CRD), RHR, and HPCI systems. Components from several other systems were also inspected.

3.2 Description of Maintenance Philosophy

The inspectors reviewed site policy statements, administrative procedures, organization charts, established goals, and documents that described improvement programs for the maintenance process. The licensee had a documented comprehensive maintenance plan that included milestones and completion dates for its improvement programs and goals. Discussions by the inspectors with selected managers indicated that those personnel were knowledgeable and aware of established performance goals.

The inspectors determined that the licensee's maintenance program was balanced between corrective maintenance (CM) and preventive maintenance (PM). The licensee appeared to adequately address PM requirements for equipment.

In the area of predictive maintenance the licensee's maintenance program was at a level commensurate with the rest of the industry. The licensee's philosophy of maintenance included some aspects of the principles of Reliability Centered Maintenance (RCM). The inspectors determined that the maintenance philosophy, in all disciplines, included some concepts of RCM. Corrective maintenance was normally performed when equipment failed; however, the maintenance selection system allowed identification of functionally significant items and determination of maintenance items based partially on function and likely failures. These items would be included in the PM program. Generally these significant items do not become identified until repeated failures or significant problems occur. Maintenance history and vendor recommendations were used as a source of this information. The inspectors verified that vendor recommendations were included in the PM program or deviations were technically justified. Despite management's verbal commitment to RCM, available trend data continued to be disseminated without evaluation for common problems or poor practices. For components that failed repetitively or often, progress in identifying a final fix was sometimes slow. Although the licensee had a defined maintenance philosophy in the maintenance plan, the ongoing problems in the maintenance area indicated that the philosophy, or the maintenance plan, had not been effectively communicated to the plant staff.

3.3 Observations of Current Plant Conditions & Ongoing Work

3.3.1 Current Material Condition

The inspectors performed general plant as well as selected system and component walkdowns to assess the general and specific material condition of the plant to verify that work requests (WRs) had been initiated for identified equipment problems, and to evaluate housekeeping. The selected systems and components are identified in Section 3.1.2 of this report.

Walkdowns included an assessment of the buildings, components, and systems for proper identification and tagging, accessibility, fire and security door integrity, scaffolding, radiological controls, and any unusual conditions.

Unusual conditions included but were not limited to water, oil or other liquids on the floor or equipment; indications of leakage through ceiling, walls or floors; loose insulation; corrosion; excessive noise; unusual temperatures; and abnormal ventilation and lighting. However, since the plant was in a refueling outage at the time of the inspection, many systems were not subject to normal operating conditions. Therefore, the inspectors could not fully assess the material operating condition. Results follow:

- The inspectors determined that cognizant plant management were assigned responsibilities for specific areas and were required to perform periodic walkdowns of those assigned areas. The inspectors concluded that management walkdowns did not include work in progress.

- Housekeeping appeared to be acceptable for a plant in an outage, however, it was inconsistent throughout the plant even though signs were conspicuously posted in specific areas of the plant which included the name and telephone number of the person assigned. Some areas appeared to be well kept, while others appeared to be disorderly and in disarray even for an outage. In some areas, materials such as rags, scaffolding, wire scraps, and other consumable items used during previous maintenance were not removed after the work was complete. The inspectors became aware that operations personnel were provided with a pocket size training aid and reminder for walking assigned spaces, which explained objectives and methods and provided reminders. It was not apparent that maintenance supervisors had been provided with the aid and, therefore, did not use the aid. Most areas, however, were acceptable. Housekeeping matters are discussed further in Section 3.3.3 and 3.9.2.

- During the walkdown of the HPCI system, areas appeared to have been recently painted and work being performed in the areas was controlled and good housekeeping practices were observed. However, areas in the drywell were noted where less than adequate housekeeping conditions could have affected equipment. Because the drywell was extremely congested with maintenance activities, walking paths included snubbers, small bore piping, instruments, electrical flex conduit and sometimes debris from previous work. Precautions were not in place to protect installed equipment. The inspectors noted a broken instrument and damaged flex conduit that appeared to be caused by using such items as foot holds. The inspectors noted the absence of Quality Control (QC) inspectors conducting material/housekeeping inspections; however, it was determined that QC had conducted several surveillances and reported findings to management. As discussed in Section 3.9.2, corrective action to the findings was slow in coming. Work requests were written to repair the anomalies noted during the walkdowns.

- During a walkdown of the reactor building, the inspector noted 19 barrels of oil for the RRP MG sets stored on the fourth floor. In discussions with licensee personnel, the inspector learned that storage of the oil had not been approved for this area; a Transient Combustible Review Worksheet had not been prepared and approved for storage of this oil as required by procedure NPP-FP1-01, "Fire Protection," Revision 2. The oil was, therefore, inappropriately transported and stored in the reactor building. Failure to follow approved procedures is an example of a violation 10 CFR 50, Appendix B, Criterion V (341/89024-01A).

After the inspector had noted this problem, a Transient Combustible Review Worksheet was completed and approved for the oil movement and storage. In addition, a DER was written on the failure to follow approved procedures.

- Since there was a requirement to tag components that needed maintenance, the inspectors selected 22 tags from equipment in the plant to evaluate the effectiveness of the licensee's deficiency tag program. None of the tags appeared to be excessively old. Open WRs existed for all but one of the tags selected. Two instances were identified where deficiencies existed and no work requests were written. The licensee's program for the identification of required maintenance appeared to be effectively implemented. Identification of components and equipment was located on or near the equipment.

Generally, equipment problems identified by the inspectors during plant and system walkdowns had already been identified by the licensee's WR program. The material condition of the plant was considered acceptable to maintain the operability of components at a level commensurate with the components' function. However, based on slow corrective action to QC housekeeping findings, management emphasis in this area was weak.

3.1.2 Ongoing Work

The inspectors observed ongoing work in electrical, I&C, and mechanical maintenance areas. The inspectors selected these activities from the plan of the day listings, work assignments in individual maintenance shops and through discussions with individual foremen. Where possible, safety significant activities were chosen for follow-up.

Maintenance activities were witnessed/observed to determine if those activities were performed in accordance with required administrative and technical requirements. Work activities were assessed in the following areas:

Work control and planning

Management presence, involvement, and knowledge

Quality Control (QC) presence and involvement

Health Physics (HP) support and hazards

Procedures available, adequate, and used

Personnel trained and qualified

Materials available, adequate, and used

Measuring & Test Equipment (M&TE) and tools proper, calibrated, and used

Post Maintenance Testing (PMT) acceptance criteria; performed as specified

3.3.2.1 Ongoing Electrical Maintenance

The inspectors observed portions of three electrical maintenance activities as discussed below:

WR B611890530	Inspect electric heaters for reactor recirculation pump (RRP) B motor.
Surveillance AD31891025	Battery capacity test
EDP-4271	Pull cable for reactor building feeder

The inspectors concluded that electrical maintenance activities in the pertinent areas described in 3.3.2 were adequate and accomplished by skilled maintenance personnel. The maintenance personnel appeared to be knowledgeable and adequately trained in the work performed; however, concerns with procedures and planning were identified during the following work:

- WR B611890530 - Procedure NPP 35.319.001, "Electric Space Heater Preventive Maintenance", Revision 20, which was included in this package, required that connections to the motor heater be verified. The work step specified that the junction box cover be removed and the connections to the terminal board be verified tight; however, the connections to the RRP heaters were made using Raychem splices, which does not require verification of tightness for EQ integrity. Although this appeared minor, the procedure was not correct for spliced connections. The procedure was corrected during the inspection.

  During performance of work, the electricians went into the drywell and were unable to find the junction box for the RRP "B" motor heaters. After approximately one hour in the contaminated area, the job was discontinued and the area was exited. After obtaining further direction about the junction box location, the electricians reentered the area, located the junction box and completed the work. Not obtaining the proper location of the junction box prior to entering the contaminated drywell is considered inadequate planning at the journeymen level, which resulted in time delays and potential additional radiation exposure. As described in Sections 3.3.3 and 3.5, poor planning and inattention to detail were identified as pervasive problems that contributed to radiological concerns and inefficient work practices.

3.3.2.2 Ongoing Mechanical Maintenance

The inspectors observed portions of eleven mechanical maintenance activities as discussed below:

WR E747890509	PM on CRD valve N1100F608
WR W408021788	Change out HPCI booster pump impeller
WR W840890525	PM on Diesel Generator 12

WR W954890710	HPCI main pump maintenance
WR 016C890124	Repair oil leaks on RRP MG Set
WR 030C890322	Modification of Nitrogen Purge to TOP
WR 004C890721	Repair valve B2100F436
WR 004C891011	Repair Drywell Pneumatic Nitrogen Supply valve
WR 002C891012	Repair Drywell Pneumatic Nitrogen Supply valve
NPP-24.203.03	Test CS pump and valve operability
NPP-35.306.010	Set MOV switches
NPP-43.000.002	Test accumulator relief valves

The inspectors concluded that the mechanical activities in the pertinent areas described in 3.3.2 were adequate and accomplished by skilled maintenance personnel. Maintenance personnel appeared to be knowledgeable and adequately trained in the work performed; however, concerns were identified with unavailability of work packages, operator actions, issuance of expired M&TE, and control during the observation of the following work:

- W40B021788 / W954890710 - The inspectors reviewed the packages for both maintenance activities that were worked simultaneously. The WR package for work on the HPCI main pump was at the jobsite; however, the WR package for the HPCI booster pump was not. The inspectors were told that the package was in the mechanical shop. The inspectors observed work on the booster pump and questioned why a WR package was not available to control the work. Craft personnel explained to the inspector that rigging and setup for pump alignment were considered preliminary work and the WR was not needed. The mechanical maintenance supervisor who was present throughout most of the initial rigging preparation, agreed that the WR should have been present at the work area. Although the WR was not used for the rigging and set up phases of the pump alignment, the work appeared to be correctly completed.

- WR 025C890721 - The inspector reviewed work by I&C technicians to set the position indicator for the RHR LPCI line check valve E1100F050B. The valve would not stroke. While trouble shooting the technicians determined that the valve had been improperly assembled by contractor personnel. Steps 4.1.5 and 4.5.11 of Procedure NPP-35.000.231, "Exercisable and Spring Assist Closing Check Valves", Revision 21, required that the valve actuator lever and disk shaft be match marked to assure proper orientation during reassembly. The valve had been previously disassembled and previous match marks existed that resulted in duplicate match marks. Even though match marks were used, the valve was improperly assembled since the previous set of match marks existed. Failure to provide adequate instructions to ensure proper assembly of the valve is another example of a violation of 10 CFR 50, Appendix B, Criterion V (341/89024-01B).

- WR 016C89012 - This WR was written to stop oil leaks from a RRP MG set that required the removal of some components in order to replace gaskets. The inspector noted that the oil in the RRP MG had been changed earlier in the outage and the leaks could have been corrected at that time. Although in an outage condition, poor planning such as this could result in an increased amount of equipment unavailability.

- WRs 002C89011 and 002C89102 - Repair of the Drywell Pneumatic Nitrogen Supply valves involved grinding of welds, which required a fire watch; however, the assigned person did not have a fire extinguisher. This activity did not appear to have been properly planned and the personnel were not attentive to detail. The fire watch obtained an extinguisher that was located in the general area after the inspector inquired about the extinguisher.

  After grinding was completed, the valve seats were to be replaced. At this point, personnel determined that the valve seats had been placed "on hold" because required tests had not been performed. The need for testing had not been communicated to the appropriate QC receiving inspector. QA was aware of the requirement and had placed a "hold" on the material. The maintenance work was discontinued to be completed at a later date. This was another example of poor planning and inadequate attention to detail.

- NPP-24.203.03 - The inspectors witnessed performance of the operability test for Division II CSS Pump and Valve Operability, and Automatic Actuation. Near the beginning of the test, the flow indicating needle dragged on the faceplate of the flow meter for the CS train with pump B and D, which prevented an accurate reading of flow. The operator removed the meter bezel and moved the meter face out of contact with the needle. The operator indicated that a WR would be written to recalibrate the meter after the test and this information was noted on the test document. The inspectors reviewed completed PM Package E00989110 for recalibration of the flowmeter. Additional movement of the meter face was necessary during calibration to allow free needle movement over the range of the scale and additional correction was necessary before the meter could be calibrated. However, the as-found calibration in the range used for the Core Spray Operational Test was within tolerance (Needle stuck at 8400 GPM); all readings below this were in tolerance. Target Flow was in acceptable range of 6600 GPM. As a result, the values previously recorded for the flow of pumps B and D were correct. The inspectors reviewed the CS operability test package and found that the processing of the test had been placed on "hold" pending completion of the meter calibration. Upon satisfactory completion of the meter calibration, processing of the test package resumed.

  The manipulation of the meter face by the operator is considered poor practice, although no deleterious consequences resulted in this instance. In a worst-case scenario, the operator might have affected the calibration of the instrument.

  The error would have been detected during meter recalibration, at which time the previous test would be declared invalid and the B and D pumps declared inoperable. The principal disadvantage of the delayed meter calibration is that any LCO generated as a result of pump inoperability would start at the performance of the pump test, rather than after the calibration test. The time available to complete corrective action would be reduced by delaying calibration.

Vibration readings were taken on the pumps at clearly marked locations, however, a problem was noted with a temporary gauge installed on the pump suction piping in order to measure the pump suction pressure.

The operator performing the vibration testing also installed a temporary suction pressure test gauge at the CS Pump "D" suction. This was necessary to meet the licensee's program requirements. During the testing, a leak was noted at the connection between the temporary gauge and the pressure top. It was noted by the operator, who then proceeded to terminate the leak by torquing the connection to provide a tighter seal. The team observed that the course of water for the pumps, which was from the condensate storage tank, might be contaminated and no precautions were being taken by the operator to guard himself against possible contamination. During installation of the gauge the operator came in contact with water, which was not contaminated. During further discussions with the operator, it was determined that the operator was working under a specific RWP for the job, RWP 89-001, as required by procedure FIP-RC1-01 "Accessing and Working in Radiologically Controlled Areas." The RWP required gloves to be worn when installing the gauge. Failure of the operator to wear gloves and follow the requirements of the RWP is an example of a violation of 10 CFR 50, Appendix B, Criterion V. (341/89024-01C).

- NPP-43.000.002 - The inspectors witnessed the setpoint testing of Air Accumulator Relief Valves BZ1-F031B, C, and D in accordance with the requirements of procedure NPP-43.000.002, "ASME Section XI Relief Valve Setpoint Test," Revision 21. The pressure gauge initially obtained for use was beyond the calibration date and was replaced. (See Paragraph 3.3.4.2 for further discussion of M&TE.) The stopwatch used was SW-023-M, bearing a calibration sticker indicating that it was acceptable to November 28, 1989. The tests were performed without incident. All valves met the setpoint requirements.

- NPP-35.306.010 - The inspector observed the performance of MOV analysis and testing using contractor personnel and equipment on a MSIV in the steam tunnel in accordance with procedure NPP-35.306.010, Revision 21. The crew, consisting of licensee and contractor personnel, moved into position without hesitation, set up a lighting system, which was brought in by the crew, and effectively implemented the procedure. There were no interruptions to locate special tools or ladders and the crew effectively worked together. When finished, the crew removed all tools, hardware, and debris, and left the area as-found. This crew presented a good example of licensee personnel working effectively with contractor personnel.

As described in Sections 3.3.3 and 3.5, poor planning and inattention to detail were found to be a pervasive problems that contributed to radiological concerns and inefficient work practices.

3.3.2.3 Ongoing Instrument and Control Maintenance

The inspectors observed portions of eight I&C maintenance activities as discussed below:

WR B992890509	PM of solenoid valve B2100F434
WR 012C890109	Inspect MSIVLC isolation valves
WR 025C890721	Repair RHR LPCI line check valve
WR 002C890725	Repair/inspect primary containment head vent solenoid valve
WR 004C890917	Repair reactor water level transmitter
WR 007C890929	Change Nitrogen Inerting System Recorder Changeover
WR 001C891104	Repair drywell and steam tunnel conduit and cable repair
NPP 23.107.01	Standby feedwater system instrument lineup
EDP-4271	Reactor Building Feeder Cables
EDP-5546	MSIV Control Manifolds
EDP-8483	Primary Containment Water Monitoring System

The inspectors concluded that I&C maintenance activities in the pertinent areas described in 3.3.2 were satisfactorily accomplished by skilled maintenance personnel. The maintenance personnel appeared knowledgeable and adequately trained in the work performed; however, concerns were identified with control of materials, initiating DERs, planning, and inadequate work packages during the observation of the following work:

- WR 012C890109 - The work performed to inspect MSIVLC Solenoid Valves was observed and the work package reviewed. During review it was noted that an unqualified heat shrink tubing, provided by the Target Rock Corporation, was used during the procedure. Because of the sequence of events, it was confusing to the inspectors to precisely determine the purpose of the heat shrink. When questioned, the licensee determined that this heat shrink was qualified for use in environmental qualification (EQ) related components by the MEG. Further investigation showed that there were numerous restrictions on the use of this heat shrink not known by the planners, foremen or supervisors. In fact, the only authorized use of this item was for color coding of electrical leads inside specific solenoid operated valves.

  In discussions with plant personnel, it was noted that the process of determining suitable substitution of repair parts partially consisted of the planners, schedulers and foremen consulting a computer system for assistance. On this system the area delegated for MEG review and acceptance of repair parts in EQ systems or components does not reflect any restrictions placed on its use. Because of this, there is a high potential of using restricted use repair parts in an unrestricted basis on EQ and safety related systems/components. Further investigation revealed the heat shrink in question was not used as color coding but as a protective coating over solder joint repairs which is not an authorized use as determined by the MEG.

- WR 025C890721 required I&C personnel to set testable check valve E1100F050B position indication switches. The check valve is located in the drywell and performs a pressure isolation function between the reactor coolant system and the lower pressure LPCI system. The valve is in a location with approximately a 25 mrem/hr radiation field. Several delays were encountered during accomplishment of this work. First, contracted mechanical maintenance personnel, who had previously worked on the valve, had reassembled the valve actuator incorrectly and had to correct the situation. Second, due to plant conditions, the valve could not be stroked to allow setting of the position switches. Third, due to additional work on the valve actuator, maintenance personnel debated whether the local leak rate test (LLRT) on the valve had been invalidated. No attempt to contact LLRT personnel or the system engineer was made. Fourth, once plant conditions permitted, the valve to be stroked I&C technicians discovered that the correct wrench to set the switches was not at the location. Once the position switches had been set, the valve was acceptably tested and returned to service.

- WR 002C890725 detailed the reassembly and calibration of the Primary Containment Head Vent and Isolation Valves B21F403/B21F404. During the performance of maintenance the craftsmen were required to stop work in order to obtain additional tools necessary for the completion of the work. Additionally, previous work performed under this work request by the electrical department under DER 89-0676 to replace electrical wiring from the junction box to solenoid with new high temperature wire resulted in leaving a large supply of wire that, after retermination, would have to be coiled inside the valve cap. The craftsmen concluded that excessive wire length could hinder valve operations and again stopped work to request allowances for shortening the wire. Discussion with the engineer resulted in the decision to leave the wire length "as is" even after a repeated request. There was no attempt by the technical engineer to enter the area for a visual inspection prior to declining the second request. The craftsmen then consulted with the lead foreman who authorized changing the wire length as necessary ensuring proper documentation of the actions.

  While awaiting decisions, a close inspection of the solenoid area was performed by the inspector and licensee personnel. It was noted that the solenoid lead wires had deteriorated and the insulation was cracked. Work stopped and the craftsmen exited the area for further corrective action determination by supervisory personnel. Subsequently, in accordance with Engineering Design Package (EDP) 10792, the head vent line was permanently plugged which should prevent further leaking and high temperature problems.

- WR 007C890929 - The work package was inaccurate for the changeover of obsolete Bailey recorders with Tracor Westronic units for the nitrogen inerting system temperature and pressure recorders under EDP 9755. Work was stopped due to field prints and system cable pull cards not agreeing with each other or with field conditions. Additionally there were typographical errors in the EDP itself concerning cable numbering between the procedure and the cable pull cards. Once work was stopped, craftsmen were directed by the foreman to perform a walkdown of the remaining procedure in order to detect any further discrepancies prior to a revision submittal.

Discussion with the foreman and craftsmen revealed that these discrepancies had been identified previously in January 1984 under Field Modification Request (FMR) S-6743. System prints 5I721-2052-14 "Miscellaneous Instrument Cabinet H11-P873 Terminal Allocation Sticks "A" and "B" Unit 2", Revision R, the cable pull card for cable 227541-OK and the actual field conditions were in error regarding conductor color coding. A review of this FMR showed that only the first two conductors of cable 22751-OK were addressed by the FMR. The conductors in question under EDP 9755 were not addressed by this FMR and Nuclear Engineering was not aware of this problem. The inspector questioned PQA about the above items and other areas of concern in this WR. DER 89-1343 was written and submitted by PQA to address this problem and to check for similar problems in the plant. In addition Engineering Change Request (ECR) 9755-1 was submitted to correct prints and pull cards.

- WR 001C891104 addressed the repair of various cables, conduits and associated items in the drywell and steam tunnel that were damaged in the performance of maintenance throughout the outage. Although a detailed comprehensive walkdown and repair effort was conducted by the licensee, many discrepancies were noted.

  According to the sequence of events documented by the craftsmen and the Plant Quality Assurance (PQA), there were several cable repairs made with butt splices followed by Raychem heat shrink; however, only one was documented. A review of the "Detroit Edison Nuclear Requisition on Stores - Charge" forms in the work package indicated that 32 butt splice kits were acquired from the plant stores. There was no evidence that any of the 28 remaining kits were used in the conduct of maintenance or were returned to stock.

  Statements in the introduction section of Detroit Edison's electrical specification 3071-128 Std. ET-3-1, "Electrical Cable Damage and Evaluation Repair Procedure - QA1 and Non-QA1", Revision AH requires initiation of a DER whenever jacket or insulation damage is found. Section 3.0 states that conductor damage shall always require Engineering evaluation and implementation of a Design Change Request (DCR). Furthermore, a log of these repaired/spliced cables was required to be maintained by engineering and cable splices were to be documented as changes to schematics or wiring diagrams.

  The licensee had not submitted the required DER, conducted an engineering evaluation, initiated a DCR, considered changes to wiring diagrams or schematics. In addition according to nuclear engineering, there was no log kept or any traceability of repaired/spliced cables in the plant.

Failure to write DERs was observed in other areas and was not considered an isolated case. In addition none of the I&C or PQA personnel interviewed were aware of these requirements. Failure to identify and document the non-conforming conditions regarding the use of butt splice kits and Raychem repair in the DER process and failure to follow established procedures in maintaining traceability of repaired/spliced cables, implementation of DCRs and documenting such changes on plant wiring or schematic diagrams is considered a violation of 10 CFR 50, Appendix B, Criterion V (341/89024-01D).

- EDP-5546, "Replacement of MSIV Pneumatic Control Manifold Assemblies," approved on July 11, 1989, was based on GE SIL No. 473, dated October 11, 1989, "Atwood and Morrill MSIV Stem Failures," and the licensee's own valve design enhancement program. A number of concerns were raised during observation of installation and review of documentation.

  The team observed the four manifolds that had been installed onto the four outboard MSIVs inside the steam tunnel. According to the AVCo valve assembly drawing C5140-300, dated October 29, 1986, specified in EDP-5546, Revision 0, dated July 5, 1989, both 1 1/4" 4-way pneumatic valve exhaust ports were to be open; however, one of the two ports was observed at each MSIV to be plugged. Followup review and discussion with the responsible groups identified additional control and implementation problems.

  The team reviewed the package for WR 011C890721 for MS line C outboard MSIV No. B2103F028C, and found superseded drawings, such as valve assembly drawing C5140, Revision C, dated May 19, 1975, and the corresponding 4-way, 3-way, and 2-way pneumatic valve drawings. The vendor "Installation Instructions for MSIV Pneumatic Manifold with Opening Speed Controls," D298-60684, Revision 2, dated December 4, 1985, was in conflict with the vendor installation drawing C5140-300, specified in EDP-5546. Figure 5 of the instruction showed a steel plug installed at one of the 4-way exhaust ports; however, the drawing stated not to plug this exhaust port. The figure was consistent with the superseded drawing, C5140, Revision C.

  In discussion with the installation crew, the team was told that the craft unscrewed one of the steel plugs from each removed MSIV manifold, and installed the plugs in the new manifolds. There was no written instruction for this action, and the action was done without prior consultation with the responsible engineers. Furthermore, installation procedure D298-60684, Revision 2, Steps 8.4, and 8.5 were skipped without written engineering concurrence or procedure revision. These steps involved purging of the air supply system after modification of the air system was made, and filter inspection and cleaning if required. The installers' justification for skipping the steps was that no modification was made to the air supply tubing and piping. The inspector was concerned that all MSIV air cylinders had been overhauled during RF01 and purging of the cylinder, a part of the air supply system, should have been considered. Although subsequent review of the air cylinder leak tests indicated adequate purging may have been accomplished during that evaluation, skipping procedure requirements rather than revising the procedure was inappropriate.

The inspectors noted that there had been no QC inspection of the installation activity. Such an inspection may have identified the deficiencies identified by the inspection team. The licensee issued a DER during the inspection documenting the installation deficiencies.

Failure to follow the installation procedure by performing actions not specified, deleting others that were specified, and using the wrong installation drawing is considered a violation of 10 CFR 50, Appendix B, Criterion V (50-341/89024-01E).

As described in Sections 3.3.3 and 3.5, poor planning and inattention to detail were considered to be pervasive problems that contributed to radiological concerns and inefficient work practices.

3.3.3 Radiological Controls

Maintenance work was observed in contaminated and radiation areas as were movements of tools/equipment to and from these areas; interactions of workers with radiological protection personnel were also observed.

Cleanliness and housekeeping appeared generally good for outage conditions. Radiological controls and posting and labeling were good; however, control of tools in the radiological controlled area (RCA) was poor. Chewing gum, candy wrappers, and cigarette butts were found in the RCA.

Through observations of work in the planning and implementation phase, and discussions with licensee personnel, the inspector determined that radiological controls were integrated into the maintenance process as follows:

The as low as reasonably achieveable (ALARA) staff appeared to have the necessary size, expertise, experience, and dedication to implement effective ALARA oversight of maintenance activities. The ALARA staff had strong management support.

A Radiation Protection Work Coordinator (RPWC) from the HP staff, was assigned to the maintenance department and scheduling group. This individual worked closely with the ALARA Coordinator.

Members of the ALARA staff attended planning meetings, reviewed engineered designed work modifications, and maintenance work packages that involved dose producing jobs, administered the shielding program, and conducted pre and post-job surveys. The HP staff wrote radiation work permits (RWPs) with ALARA input where applicable. Proposed facility changes were reviewed by the ALARA staff.

The licensee was developing job history files, a photo library of equipment, components, and video tapes of certain tasks, and dose saving documentation to factor lessons learned into the planning process.

Dose savings were achieved through extensive use of shielding, tenting and venting enclosures, use of remote welding and cutting machines, flushing of valves, lines, and mockups during pre-job training, and use of previous lessons learned.

Audits by the onsite QA organization and the corporate office of the radiation program were performed. Findings of a recent audit performed of radiation protection activities associated with the current outage were reviewed; identified problems were discussed with the inspector and plant manager.

Realistic job and station dose goals were established; work group doses were tracked. The HP and ALARA staffs are pro-active which allowed implementation of good ALARA reviews and radiological controls. Without a pro-active staff, radiological controls could be degraded for certain jobs as a result of poor planning/scheduling/outage management activities.

Monitoring to support RWP issuance, RWP job coverage, and use of dosimetry appeared good. There appeared to be good coordination and data exchange between health physics and mechanical maintenance for non-emergent high dose or dose rate jobs; RWPs were adequately developed, and the RWPs and/or the work request and procedure were adequately detailed to assure adequate job coverage. Sufficient advanced notice was given to the radiation protection department so that adequte radiological controls were implemented.

Weaknesses in this area were also identified as follows:

- For emergent work, sufficient communication, planning, and adequate advanced notice to HP was not always evident. As a result, overall ALARA pre-job planning could be rushed, and radiation protection surveys degraded. However, there was no indication that sufficient radiological controls had not been implemented as a result of this weakness.

- For work in radiologically significant areas, work packages did not always contain sufficient tool/equipment/staging and location instructions which caused unnecessary delays in dose rate areas. There appeared to be a need for the work planners to walk down the job to enable them to prepare more sufficiently detailed packages, and to improve communication between planners, foreman, and workers.

- Some work planning was completed without the planner having knowledge of all conditions that could affect radiological controls. Although a RPWC was assigned to mechanical maintenance to ensure health physics involvement in the package planning phase, it appeared that the RPWC received the completed package without having an opportunity to provide input.

- During the first refueling there were an inordinately high number of personal contaminations, many of which were on first time radiation workers; it appeared that better training in personnel contamination control is needed.

The weaknesses described were not caused by the HP group but by the maintenance department. Low personal doses during the first major refueling outage, the extent of low contamination areas, and the pro-active nature of the HP group is evidence of management support for the radiological control and ALARA programs.

3.3.4 Material Control and Control of Tools and M&TE

3.3.4.1 Material Control

Control of materials was generally acceptable. The inspectors observed conditions in the main receiving warehouse, and the cable and pipe yards. No problems were identified with expired shelf life material or with differing shelf life material, problems which had previously occurred. Based on this review, and review of the governing shelf life procedure FIP-PM2-02, Revision 2, which greatly extended shelf lives in accordance with guidelines issued by Electric Power Research Institute (EPRI) in Nuclear Construction Issues Group (NCIG) NP-6408.

Inspection of the cable and pipe yards disclosed some instances where cable ends and pipe ends were not properly covered to prevent moisture intrusion. This was discussed with management. Prompt and immediate action was taken by the licensee to ensure that the ends were covered. Root cause was determined to be due to high activity and contractor personnel not familiar with the necessity of recovering ends after material was used. To prevent recurrence, surveillance walkdowns were increased from monthly to weekly, and personnel were made aware of the requirements to recover the ends. The inspectors were satisfied with the actions taken by the licensee, and this matter is considered resolved.

Warehouse personnel had issued a part even though the MEG had placed the part on a hold, pending issuance of an EDP, which was later cancelled and the part was returned to the warehouse prior to use. MEG took immediate action to ensure that the warehouse was aware of the hold and also to review other cancelled EDPs to ensure that any parts procured would not be issued. This issue was considered an isolated case and is resolved. Continued effort is needed to ensure that parts are not issued while in a hold status.

3.3.4.2 Control and Calibration of Measuring and Test Equipment

Control of M&TE was adequate. Defective or "calibration due"instruments were stored in a separate room away from those that were in calibration and acceptable for use. However, there were some instruments noted that required calibration or other disposition which were not properly tagged as required by NPP-MTI-01, "Measuring and Test Equipment Program," Revision 0. Required tags were either missing or improperly completed. No problems were noted as a result of the improper tagging.

Procedures were satisfactorily developed and implemented for the issue, return, and recall of M&TE. The individual checking out an instrument, the use of the instrument, the date issued and date returned were recorded for permanent records. Technicians in all disciplines were required to be trained prior to being issued specific types of controlled equipment. The facility clerk had access to instrument qualification records of plant and contract personnel. Instrument qualification was verified prior to the issuance of controlled M&TE. This training and qualification was specific and satisfactory training in one qualification course did not qualify the technician in all areas of M&TE usage.

Two weaknesses were noted in implementation of an otherwise good M&TE program.

- During preparation for the performance of NPP 43.000.002, "ASME Section XI Relief Valve Setpoint Test," Revision 21, pressure gauge PG-127-M was issued to maintenance personnel by the M&TE issue facility. Prior to performing the work, maintenance personnel noted that the gauge was past the required calibration date. The maintenance technician returned the gauge to the M&TE issue facility and obtained another pressure gauge that was appropriately calibrated.

  Procedure NPP-MTI-01, "Measuring and Test Equipment Program," Revision 0, Section 6.9.2.4, required the Issue Facility Clerk to verify that the calibration due date had not expired. This was not accomplished and the gauge was issued even though it was 32 days overdue for calibration. Failure to follow documented procedures is an example of a violation of Criterion V of 10 CFR 50, Appendix B (341/89024-01F).

- Pressure gauge PG-127-M was previously issued on September 28, 1989, under WR 001C890616 for testing Relief Valve B21F031A. The gauge was not returned until October 21, 1989, which was 11 days past the calibration due date. On October 5, 1989, this gauge appeared on the overdue M&TE list. The gauge should have been recalled from use at that time. Procedure NPP-MTI-01, "Measuring and Test Equipment Program," Revision 0, Section 6.10.1.3 required that users who obtain M&TE are to ". . . ensure that the equipment's calibration has not expired or will not expire during its use." Although there was no record that this gauge was actually used during this 11 day period, failure to follow procedures to ensure calibrated equipment is properly controlled is another example of a violation of Criterion V of 10 CFR 50, Appendix B (341/89024-01G).

  The problems discussed above were examples of what appeared to be a casual attitude on the part of supervision and maintenance personnel. Management involvement was weak in the area of assuring that approved procedures were adequately implemented.

3.4 Review and Evaluation of Maintenance Accomplished

3.4.1 Backlog Assessment and Evaluation

The inspectors reviewed the amount of work accomplished compared to the amount of work scheduled. Emphasis was placed on work that could affect the operability of safety-related equipment or equipment considered important to safety, which included some BOP components. Maintenance work item backlogs were evaluated for cause and impact on safety.

3.4.1.1 Corrective Maintenance Backlog

The backlog of both outage and non-outage CM WRs was tracked by the use of a computerized system. Backlog information could be ascertained from the system, however, the time required for this effort was sometimes lengthy. Backlog status reports were issued to management weekly and monthly. The current as well as previous backlog totals were included in these reports so that increasing or decreasing trends could be readily determined. Changes in the backlogs were apparent to management and deferrals or reschedules were technically justified.

The licensee also tracked the number of non outage CM WRs older than 90 days, which has been 4 to 9.4% greater than the licensee goal of 50% except for March and April when the percentage was 4 and 5% below the 50% goal. A periodic list is published of non outage and outage CM and PM WRs on hold for parts. The list published on November 10, 1989, showed that 137 WRs were on hold for parts.

The licensee indicated that the number of WRs on hold for parts had decreased from about 500 just prior to the refueling outage. Discussions with with maintenance personnel indicated there had been a big improvement in the availability of parts.

Based on licensee information, the non-outage CM WR backlog was determined to be 882 on November 12, 1989. Based on past completion rates, this was more than four months backlog. This is high but appeared to be within the capabilities of the current maintenance staff. The inspectors reviewed a number of selected non-outage CM WRs and determined that the CM WRs in the backlog did not appear to have a detrimental effect on the operability of plant systems.

3.4.1.2 Preventive Maintenance(PM) Backlog

The PM backlog and program were reviewed. The program had significantly improved from the conditions noted in previous inspections. Mechanical, electrical, and I&C PM backlogs were tracked by computerized systems. Tracking controls and reporting systems were working well. Backlogs in the mechanical and I&C areas were slightly high, apparently due to higher priority outage work, but none of the items exceeded the 25% grace period allowed by procedures. The electrical PM backlog was low. Prompt completion of the backlog appeared to be within the capabilities of the current maintenance staff.

A deferral system was in place that required an evaluation of failure history, past PM performance, and possible operability impact prior to deferring or rescheduling PM. The inspector reviewed a selected sample of past evaluations, which appeared to be adequate.

The current PM program only included safety related and important to safety items. These items were classified as priority "A" PMs; other PMs were classified as priority "B" PMs. Procedure NPP-MA1-02, "Preventive Maintenance and Periodic Calibration and Testing", revision 2, still required justification prior to performing priority "B" PMs. Licensee personnel stated that all priority "B" PMs in the electrical and mechanical areas had been reviewed and evaluated to determine if the PM should be deleted or remain in the program. Vendor recommendations were considered a part of this review. Priority "B" items would be included in the priority "A" PM program based this evaluation. This action would be taken as the priority "B" items came due. Review of I&C PM items that were non-safety related, non-technical specification related and considered unimportant to safety was only approximately 25% complete. Licensee personnel indicated that these evaluations would not be completed before the end of 1990. Overall the PM program appeared to be well controlled and properly implemented.

3.4.2 Review and Evaluation of Completed Maintenance

The inspectors selected the equipment and systems identified in Section 3.1.2 of this report for further review. The purpose of this review was to determine if specified electrical, mechanical, and I&C maintenance on those selected systems/components was accomplished as required. This review included:

Application of risk-based priority to the performance and intent of maintenance.

Evaluation of the extent that RCM was factored into the established maintenance process.

Evaluation of the extent that vendor manual recommendations, IE Bulletins, (IEB), IE Notices (IEN), Service Information Letter (SILs), Significant Operating Experience Record (SOERs), and other outside source information was utilized.

Evaluation of the extent that maintenance histories, NPRDS information, LERs, negative trends, rework, extended time for outage, frequency of maintenance, and results of diagnostic examinations were analyzed for trends and root causes for modification of the PM process to preclude recurrence of equipment or component failures.

Evaluation of completed CM and PM for use of qualified personnel, proper prioritization, Quality Control (QC) involvement, quality of documentation for machinery history, description of problems and resolutions, and post maintenance testing.

Evaluation of work procedures for inclusion of QC hold points, acceptance criteria, ease of use, and general conformance to NUREG/CR-1369.

3.4.2.1 Past Electrical Maintenance

The inspectors reviewed the following completed WRs for adequate work instructions, proper prioritization, proper work authorization, use of qualified personnel, QC involvement, documentation of work performed, understanding of problems, post maintenance testing and appropriate review and sign offs.

WR 007B010388 HPCI thermal overloads E91-F006 tripped

WR 006B032388 RPS Motor generator (MG) sets A & B test of overloads

WR 001B072688 HPCI valve E4150F006 would not stroke

WR 019B102788 BOP battery charger implement PDC 9289

WR 013B881215 EPA breaker would not reset

WR E284890603 Check time delay relays

WR F494890602 Perform periodic inspection of valve motor operator

The inspectors reviewed the following procedures for adequacy of work instructions, acceptance criteria, inclusion of QC hold points, ease of use and post maintenance testing requirements:

NPP-35.306.003, "Limitorque Motor Operator - Periodic Inspection", revision 24.

NPP-35.309.001, "Testing and Calibration of 130 Volt Battery Chargers", revision 20

NPP-35.318.007, "Time Delay Relays", revision 21.

NPP-35.319.001, "Electric Space Heater Preventive Maintenance", revision 20.

In general, the procedures were detailed and contained numerous sign off steps, PQA sign offs, acceptance criteria for "as found" and "as left" conditions within the procedure steps, and post maintenance testing requirements that were component repair related. Incorporation of vendor recommendations and plant and industry experiences was evident; however, during observations of work one minor inadequacy was noted with procedure NPP-35.319.001, which is discussed in Section 3.3.2.1 of this report.

3.4.2.2 Past Mechanical Maintenance

The inspectors reviewed selected IEBs, vendor source documents and SOERs to determine if the requirements specified were incorporated into the appropriate maintenance procedures. The source documents were:

VME 2-9	Anchor/Darling Valves
VMG 2-24.0	Limitorque Valve Actuations
VMR 4-2.0	HPCI Terry Steam Turbine
VMR 4-2.2	Woodward Governor
VMR 4-3.0	Byron Jackson Pump
VMR 4-3.1	Byron Jackson Booster Pump
VMR 4-3.2	Byron Jackson Main Coolant Pump
VMR 4-3.3	Western Gear Corporation/Speedmaster High Speed Gear Box
VMS 22-1.0	Gould Pumps
VMS 22-1.1	Gould Model VIT Pumps
VMS 22-1.2	Allis-Chamber Large Frame Vertical Induction Motor
VMRI-45.0	RHR Pump Assembly

Based on this review the inspectors concluded that vendor recommendations were included in the PM program or deviations were technically justified.

Since December 1988, the licensee has been implementing an extensive long term action plan for Q Level-1 (QA-1) and BOP MOVs. The implementation schedule for the overall program extends through 1993. The program that controlled minimum and maximum torque switch settings for QA-1 MOVs was documented in Design Calculation 5109, Revision 0. Design Calculation 5109 also included thrust and torque data provided by Limitorque Corporation, actuator order number, and actuator serial number. The licensee conducted diagnostic tests using the Motor Operated Valve Analysis and Testing System (MOVATS) for valves included in Bulletin 85-03 and frequent problem valves, a detailed discussion of which is provided in Section 3.8.6 of this report. Visicorder traces were used on all other valves for baseline data. Visicorder traces were made after all limit and torque switch adjustments, to record limit switch bypass, and to diagnose anomalies such as cyclic loading caused by bent stems.

Technical issues and MOV subprograms included in the MOV program included MOV packing and live loading, actuator tee-drains and grease reliefs, spring pack sizing and preload, and MOV backseating and leak control which is discussed further in Section 3.8.7.

To eliminate some of the past problems with MOVs, the following changes were made: primary responsibility for MOV work was assigned to electrical maintenance, contractors were not used in the disassembly or rework of any MOV operator; MOV procedures were revised to incorporate lessons learned, industry experience, and technical issues such as vendor and NRC notices and bulletins; and MOV failures and anomalies, in most cases, were closely monitored and evaluated for root cause and possible generic implications under the DER system. Although the MOV program and its implementation improved it appeared that the driving force was in response to NRC commitments and Generic Letter (GL) 89-10 and were not necessarily attributed to management initiative.

Component failure history for the mechanical components and systems selected were reviewed to determine whether methods had been established and implemented for detecting repetitive failures and adverse trends, and whether appropriate corrective action had been taken to address adverse trends. The inspectors also utilized NPRDS and LERs in the review to ascertain the effectiveness of the licensee's trend analysis and root cause analysis. A further discussion about trending is included in Section 3.8.3; concerns with trending were noted and are addressed in section 3.6.1 of this report. No other concerns were identified.

The inspectors reviewed the following completed WRs for adequate work instructions, proper prioritization, proper work authorization, use of qualified personnel, QC involvement, documentation of work performed, understanding of problems, post maintenance testing and appropriate reviews and sign offs. Also, several completed surveillance records were reviewed.

WR 006B891218 Repair leak on HCU 06-27

WR 009C890612 Repair seal and bearing leak on RWCU pump B

WR 012B040488 Repair leak on RCIC valve E5150F084

WR 012B880316 Incorporate PDC 8534 on RHR motors

WR 014C890608 Perform inservice inspection of ECW valve P44-F116A

WR 016B021988 Repair and adjust CRD valve C1100F010

WR 016C890616 Perform pressure test on relief ECW valve P44-F125A

WR 017B881102 Replace switches

WR 018B021988 Repair and adjust valve C1100F180

NPP-24.202.01, "HPCI Pump Time Response and Operability test at 1000 PSI," Revision 30, performed February 25, 1989, and Revision 31 performed on May 21, 1989, and August 5, 1989.

NPP-24.204.01, "Div. 1 LPCI and Suppression Pool Cooling/Spray Pump and Valve Operability Test," Revision 21, performed June 27, 1989.

NPP-24.204.06, "Div. II LPCI and Suppression Pool Cooling/Spray Pump and Valve Operability Test," Revision 21, performed April 20, 1989.

The following observations were made:

- The inspector reviewed completed WR 012B880316 that implemented PDC 8534. The work involved replacing the B RHR pump motor terminal box cover and bolts. With verbal engineering approval, craftsmen reused the old cover with new bolts. QA refused to approve the work package on July 12, 1989, because the PDC had not been officially changed to allow the use of the original cover. On October 10, 1988, revision A to the PDC specified changing the bolts and fabricating and using a new cover. QA inappropriately approved and closed the PDC package based on revision to PDC 8534, which did not allow the use of the original cover. Procedure FIP-CM1-01, "Potential Design Changes", Revision 2, requires that changes to PDCs be documented and approved. The failure to document the change to PDC 8534, as required by procedure, is an example of a violation of 10 CFR 50, Appendix B, Criterion V (341/89024-01H).

- The inspector reviewed completed WR 025C890721 for the repair of the RHR LPCI line check valve (E1100F050B). Step 4.5.15 of procedure NPP-35.000.231, "Exercisable and Spring Assist Closing Check Valves", Revision 21, for the disassembly and reassembly of the valve required that the valve be stroked several times after assembly to ensure proper operation. Operations personnel did not stroke the check valve prior to accepting the work performed as required. The valve was incorrectly assembled and would not stroke as discussed in Section 3.3.2.2 of this report. This failure to follow plant procedures to ensure operability of the valve is an example of a violation of 10 CFR 50, Appendix B, Criterion V (341/89024-01I).

The inspector reviewed the IST procedures and data in the applicable portions of the above surveillance procedures. Acceptance criteria for the allowable ranges for the different test parameters were specified and were in accordance with the approved Fermi 2 IST program. M&TE used to measure IST parameters were recorded in the procedures and were within the specified calibration due dates. Precautions and limitations were specified to ensure safe operation of the pump and action required when test parameters exceeded IST limits.

Test data recorded from the February 25, 1989, HPCI pump surveillance NPP-24.202.01 indicated that the HPCI pump differential pressure was in the alert range, which required additional performance testing of the pump. Subsequent testing was done on April 14, 1989, at which time pump performance was acceptable.

The inspectors reviewed the following procedures for adequacy of work instructions, acceptance criteria, inclusion of QC hold points, ease of use and post maintenance testing requirements:

NPP-35.LIM.003, "Limitorque SMB-0 Through SMB-4 and 4T Operator Maintenance," Revision 22

NPP-35.LIM.004, "Limitorque SMB-000 Operator Maintenance," Revision 21

NPP-35.LIM.005, "Limitorque SMB-00 Operator Maintenance," Revision 22

NPP-35.306.006, "Motor Operated Valve Electrical Testing'" Revision 22

NPP-35.LIM.007, "Limitorque Operator Removal and Installation," Revision 22

In general, the procedures were detailed and contained numerous sign off steps, PQA signoffs, acceptance criteria for "as found" and "as left" conditions within the procedure steps, and post-maintenance testing requirements that were component repair related. Incorporation of vendor recommendations and plant and industry experiences was evident. However, one concern was noted as discussed below.

- NPP-35.LIM.004 / NPP-35.LIM.005 - Both procedures contained a step that resulted in installation of a spring pack grease relief kit as shown on an enclosure to the procedure. The enclosure included a simple illustration of an MOV operator with tubing that indicated the position of the relief kit modification. There were no detailed instructions, drawings, or other information. Further review showed that the original Potential Design Request (PDC) 7019, written on February 9, 1987, was cancelled February 1, 1988. A history of all possibly affected valves was conducted and revealed that a spring pack grease relief kit had been installed on CRD valve C1152F003 per WR F4940108. This work was performed February 15, 1988, after the PDC was cancelled. The grease relief kit was obtained through the warehouse even though a notice had been received not to issue the materials until PDC 7019 had been approved. The MEG incorrectly approved the installation of the modification kit siting that wrong documentation was used for approval. DER 89-1350 was issued from MEG to address the inappropriate approval and issuance of the modification kit, and DER 89-1349 was written by the maintenance department to address the installation of the spring pack grease relief kit without modification documents. DER 89-1349 also addressed the grease relief already installed on valve C1152F003 and requested that a "hold" be placed on the kits in the warehouse. Incorrect steps and enclosures were deleted from both procedures before the inspection concluded. No safety-related valves were modified; however, the potential existed since nine of these valves were referenced by procedures NPP-35.LIM.004 and NPP-35.LIM.005, which indicated that the modifications were to be made. These procedures were considered by the maintenance department to be all that was necessary to perform the modification. The inspectors were concerned that other modifications may have been installed based on procedures above, that is, without an engineering modification package; however, no other instances were identified during the inspection.

3.4.2.3 Past Instrumentation and Control Maintenance

The inspectors evaluated the extent that vendor recommendations, IEBs, IENs, SILs and other outside source information were utilized in I&C maintenance for the components selected. The following documents were reviewed:

10 CFR 21 report from Rosemount, Inc., dated February 9, 1989 IEN 89-42, "Failure of Rosemount Models 1153 and 1154 Transmitters"

Vendor manual 4302, "Model 1153 Series B Alphaline Pressure Transmitters for Nuclear Service", Revision E

NPP 44.020.223(SQ), "NSSS - HPCI Turbine Exhaust Diaphragm Pressure, Division I, Channel A Calibration", Revision 20

NPP 46.000.011, "Checkout of the Process Loop/Scheme", Revision 20

MWR 004C890917 - Repair Reactor Water Level Transmitter B21N091D Connection

The inspector reviewed the listed documents and verified that the vendor recommended or required actions were included or adequately addressed in the appropriate maintenance procedures or adequate evaluations for deviations had been made.

The licensee had reviewed degradation and other problems associated with Rosemont transmitters. The monitoring program and attention given by the licensee in this area should detect potential failures before response time degradation levels lead to failures or significant problems. In addition, actions between license personnel and Rosemont had resulted in a substantial reduction in required curing time for the sealant for the hermetic seal located on the electronic housing sensor module interface. This should result in a substantial savings in man-hours and equipment down time.

The inspectors reviewed the component failure history for selected I&C components and systems to determine whether methods had been established and implemented for detecting repetitive failures and adverse quality trends, and whether appropriate corrective action had been taken to address noted adverse trends. Concerns were identified with the licensee's approach to both trending and root cause analysis and are discussed in Section 3.8.3 of this report.

The inspectors reviewed 24 completed CM and PM WRs for use of qualified personnel, proper prioritization, QC involvement, quality of documentation for work history and understanding of problems and post maintenance testing. The following concern was identified:

- There were some instances noted where work packages were required to be returned to PQA for missed inspection signatures in procedural steps. All instances were adequately documented, however, it was apparent that lack of attention to detail by PQA and craft personnel contributed to this problem.

The inspectors reviewed the following procedures for adequacy of work instructions, acceptance criteria, inclusion of QC hold points, ease of use, and post maintenance testing requirements:

NPP 44.020.007, "NSSS - Reactor Vessel Low Water Level (Levels 1 and 2), Division 1, Channel A Calibration/Functional", Revision 23

NPP 44.020.223(SQ), "NSSS - HPCI Turbine Exhaust Diaphragm Pressure, Division I, Channel A Calibration", Revision 1

NPP 44.190.001, "Feedwater/Main Turbine Trip System - Logic Functional Test", Revision 20

NPP 44.220.103, "Reactor Recirculation Instrument Lines Excess Flow Check Valves Functional Test", Revision 23

NPP 44.220.301, "Reactor Recirculation System MG Set Scoop Tube Positioner Operability Test", Revision 21

NPP 46.000.001, "Checkout of the Process Loop/Scheme", Revision 20

The procedures were detailed, contained vendor recommendations, acceptance criteria, and were user friendly. However, QC checks were not included in the procedures and some procedures that could cause potential Engineered Safety Features (ESF) actuations due to varying transients did not include precautions to that effect, such as manipulation of instrument root and bypass valves.

The inspectors reviewed the current backlog of open WRs for the RPS. The inspectors determined that maintenance was adequately accomplished and there was no backlog of the RPS system that could immediately affect component operability.

Based on the review of completed CMs and PMs backlog, and work history of PRA selected components, maintenance procedures, and the licensee's actions in source documents, such as IENs, the inspectors concluded that past performed I&C maintenance had been accomplished in a satisfactory manner.

3.5 Maintenance Work Control

The inspectors reviewed several maintenance activities to evaluate the effectiveness of the maintenance work control process to assure that plant safety, operability, and reliability were maintained. Areas evaluated were control of maintenance work requests, equipment maintenance records, job planning, prioritization and scheduling of work, control of maintenance backlog, maintenance procedures, post maintenance testing, completed documentation, and review of work in progress.

The inspectors reviewed the method used by the licensee to schedule and prioritize maintenance work. The inspectors discussed the matter with work scheduling personnel and reviewed information used in this area. WRs were routed to operations who established work priorities, which indicated to both planning and scheduling the urgency of the work.

A 48 week rotating maintenance schedule was utilized that included safety-related and technical specification related systems. The system was very effective in meeting the surveillance calendar; however, it appeared that BOP work was used as "filler" work unless urgent.

The inspectors reviewed the area of maintenance planning to determine if maintenance work activities were adequately controlled. Most of the work packages reviewed contained procedures to be used as opposed to written steps developed by the planner. The planners specified the steps to be performed on the cover of the work request and lined out inappropriate steps contained in the procedure. There appeared to be a conscious decision to take the worker out of the decision-making process as to which steps, procedures, or data sheets were appropriate for job performance. This was considered a strength.

- Work packages contained a "Feedback" sheet that was to indicate to planners any information which would be useful in future planning of the event or a similar event. Planners stated that the feedback sheets were not effectively used. The inspectors reviewed work packages that contained the feedback sheets and agreed. Typically, the sheets were completed without any suggestions or mention of planning related problems encountered, even though known problems existed.

- "Runners" were utilized during the outage to expedite the work control process. Tasks such as part staging and obtaining walk-through signature approvals were done by runners. These jobs were normally performed by the planner during non-outage periods and could occupy much of the planners time. Runners were not planned to be continued after the outage; however, the inspectors considered the use of runners as a strength because the number of planners in all disciplines was low. After the outage, the electrical department will have six planners, the mechanical department will have seven planners, and the I&C department will have three planners.

- While witnessing work, the inspectors observed many instances when workers were not adequately prepared to perform the maintenance task. Examples included: inadequate lighting, required tools were not brought to the job site, and lack of electrical power needed to perform testing. The poor planning appeared to be inadequate scoping and briefing on the part of the workers and the supervisor. As described above, feedback sheets about completed work were not effectively utilized. Some of the poor planning resulted in unnecessary exposure to the workers while waiting in RCAs for tools and lighting. This is discussed in more detail in Section 3.3.3.

Poor planning and inattentiveness to detail were considered significant weaknesses that have been discussed throughout this report.

3.6 Engineering and Technical Support

The inspectors reviewed the activities of the engineering organizations related to the field activities of modification installation and testing, maintenance support, and material qualification. The organizations involved were Systems Engineering, Nuclear Engineering, and Materials Engineering. Procedure F10-FMP-03, "Organizational Responsibilities and Interfaces on Technical and Engineering Matters," Revision 0, defined the overall Nuclear Generation organizational responsibilities and interfaces for technical and engineering activities and functions. A matrix was included in the procedure that clearly delineated the group which had lead and support responsibility for specific activities. For example, although clear definition of responsibility was established, the inspectors noted an apparent hesitancy of maintenance personnel to consult members of the engineering staff to resolve problems. The inspectors also noted that communications between the System Engineers and the Nuclear Engineers was not fully developed.

- Post maintenance testing requirements were delineated in Procedure NPP-CT1-06, which provided excellent guidance and criteria; however, as specified by the planner the test that was referenced usually pertained to a system operational surveillance instead of a component type test. Per procedure NPP-PSI-01, "Planning of Maintenance Activities", the "Maintenance Engineer" was to assure that the PMT assigned by the planner was correct and appropriate. However, in discussing this with the licensee, it was determined that a position description of Maintenance Engineer did not exist. Verification of the correct PMT was usually performed by the planner's supervisor, which is considered a weakness.

  Post maintenance testing appeared adequate for minor CM items; however, questions of equipment reliability arose after reviews of completed major actions. Some WR packages were extremely large and cumbersome and were not well organized which raised questions about what had actually been accomplished and what was left to do. Because of the complexity of some work, a simple surveillance or a group of surveillances was all that was required for post maintenance testing. This approach did not always meet the intent of post maintenance testing. Supporting systems/components that were not worked on, but were affected by the work performed, were not considered. Additionally, with the exception of a limited number of components, a program did not exist to compare post maintenance equipment parameters with those attained during previous tests to ensure that repaired equipment had not significantly degraded. A related subject, post modification testing, is discussed in Section 3.6.2 of this report.

3.6.1 Systems Engineering

The system engineer concept was functionally implemented in March 1989. Procedure NPO-FMP-06, "Technical Engineering Organization," Revision 1, which was in final review at the time of the inspection, clearly delineated the responsibilities of systems engineer.

- Interviews with several systems engineers indicated that neither WRs nor surveillance tests were reviewed by the systems engineers on the assigned systems unless requested by the maintenance staff.

- During the ongoing outage, system engineers were directed to perform system walkdowns rather than maintain day-to-day status of the assigned systems. The inspector interviewed the system engineer for the LPCI system and determined that the engineer was unaware that significant problems had been encountered on the RHR LPCI check valve as discussed in paragraph 3.3.2.3. The engineer was primarily responsible for nine systems and served as backup for nine additional systems.

- In the case of the RHR LPCI check valve, which is discussed in paragraph 3.3.2.3, I&C maintenance personnel did not contact engineering personnel to determine whether adjustment of the valve actuator effectively invalidated the LLRT for the valve until work had been completed. Although it was ultimately determined that the adjustment did not affect the LLRT for the valve, maintenance personnel delayed work and debated the issue for several hours. Also, deficiencies in communications between Nuclear Engineering and Technical Engineering resulted in the issuance of two PDCs for actuators on testable check valves. Neither group was aware that the other had initiated a PDC even though all outstanding PDCs had been identified and assigned after the system engineer concept was implemented in March 1989.

- The inspectors noted that only 1 of the 24 system engineers had qualified on 1 primary system assignment. The licensee stated that qualification on systems would be aggressively pursued after the outage. The inspector reviewed licensee procedure ST-TS-046, Revision 1, "Technical Engineer System Qualification Course" which defined the requirements for system engineer qualification on a given system. The qualification course appeared to be comprehensive and acceptable. The licensee intends to qualify each system engineer on each assigned primary system within three years. There were no plans to qualify system engineers on backup system assignments.

- With regard to trending and failure analysis, the inspectors noted that maintenance issued three reports on a quarterly basis to highlight those components requiring repetitive or excessive corrective maintenance. The licensee stated that use of these reports by the systems engineers had yet to be defined. At the time of the inspection, many of the system engineers were not familiar with the reports. The inspectors also noted that a compilation of DERs with common cause codes attributed to Technical Engineering was issued on a monthly basis; however, evaluation of the reports was not currently conducted by systems engineers. Trending of IST data is discussed in Section 3.8.3 of this report.

While observing plant startup, following the outage, inspectors noted troubleshooting efforts where engineers appeared to lack familiarity and understanding of the systems and expended considerable time in locating components and resolving problems. The average power plant experience of the system engineers was slightly over eight years. The inspectors concluded that the system engineering function had been adequately defined and staffed; however, fully effective implementation required further effort.

3.6.2 Testing of Modifications

The inspectors reviewed nine modifications for adequacy of post-modification testing.

EDP-0122 "ADS Logic Modification"
EDP-5546 "MSIV Control Manifold Replacement"
EDP-7838 "MSIV Last Command"
EDP-8239 "Chlorine Detector Replacement"
EDP-8355 "EDG Start Logic Modification"
EDP-10127 "RPS Manual Scram Modification"
EDP-10487 "Installation of Seismically Qualified Relays
PDC-7042 "HPCI Booster Pump Impeller Replacement"

- Design package EDP-5546 and associated purchase specification 3071-F00-PVR-123, Revision A, dated December 23, 1987, stated that the design basis and technical requirements were based on General Electric (GE) Specification 21A9257, Revision 4, dated September 1, 1972, "General Requirements for Main Steam Isolation Valves." There were a number of specific design verification testing requirements stated in the GE specification, including:

  (1) Paragraph 4.3.7.5, Valve (MSIV) shall open at a rate of one inch, plus or minus half inch, per second as measured at the valve stem.

  (2) Paragraph 4.3.7.6, the valve operator shall open the valve with a 200 psi differential pressure tending to hold the valve closed, utilizing 90 psig air pressure to the valve actuator.

  (3) Paragraph 4.3.7.9, (a) the valve operator shall be provided with equipment for exercising the valve from 100% open to full closed position in 45 to 60 seconds, and (b) from 100% open to 90% open at the same speed.

  (4) Paragraph 5.2.9, the complete valve shall be tested to demonstrate that the closing time against line pressure of 1000 psig (non-flowing) is adjustable between three and ten seconds (Fermi T.S. calls for 3 and 5 seconds).

  The team reviewed the latest AVCo instructions D298-60684, Revision C, dated August 31, 1989, issued by the licensee with revisions, dated November 9, 1989, to verify that the above GE design verification testing was included. This review indicated that while items (1), (3a), and (4) above were satisfied, items (2) and (3b) were not addressed.

- The opening test at differential line pressure and low air pressure condition, and the partial valve closure test were considered to be important as a part of the PMT because there had been significant MSIV internal modifications done on the inboard MSIVs involving new valve poppet, backseating, valve stem, packing, and guide ribs design as prescribed in EDP-5958 as well as overhaul of all the air cylinders.

The change of MSIV internal configuration and possible increase of friction between the MSIV internal components warranted these tests. The team position was concurred with by GE during a telephone conversation. Subsequent to the inspection, the licensee informed the team that plant specific operation procedures prohibit inboard MSIV opening if there is more than 50 psi differential pressure at the valve, and the licensee was not convinced that the differential pressure test for MSIVs was required. The team concluded that the lack of adequate interface between the two EDPs, 5546 and 5958, could have resulted in overlooking some of the PMT requirements. The review of the completed PMT for EDP-5546 will be tracked as an open item (50-341/89024-02).

- Four of the EDPs 1022, 10127, 8355, and PDC-7042 reviewed contained no explicit acceptance criteria for PMT as required by procedures NEP-CMI-03, "Engineering Design Packages" and FIP-CMI-01," Design Change Process". This concern had been previously identified by the licensee as the result of an internal audit. In response, the General Director of Nuclear Engineering issued a letter dated January 25, 1989, which clarified the requirement. For those modifications already issued for installation a second letter was issued in March 1989 that required a review of these modifications for adequacy of explicit PMT requirements or the adequacy of NPP-CTI-06, "Post Maintenance Testing" to define the appropriate testing. In the latter case, a letter was to be written to file by the design engineer attesting to the fact. This was the case for the four modifications noted above. The inspectors were concerned that this bypassed the normal engineering review chain and did not result in the explicit engineering identification of the acceptance criteria. Since adequate testing was completed as planned for these modifications and the concern involved an interim situation, the inspectors concluded no further action was necessary.

While there appears to have been some improvements, these problems indicate that there is still a lack of a "sense of ownership" for all aspects of modification work. This includes specifying post-modification testing requirements and giving close support to maintenance performed during installation.

3.6.3 Materials Engineering

The inspectors reviewed the activities of the Materials Engineering Group (MEG) with respect to control of the use of commercial grade materials in safety related applications.

The inspectors reviewed the procedures for commercial grade procurement and dedication to safety-related application: FIP-PM1-01, "Procurement Process," Revision 1, and MMP-PM1-01, "Technical Review of Procurement Documents," Revision 1. These procedures generally follow the guidelines of EPRI NP-5652, "Guideline for the Utilization of Commercial Grade Items in Nuclear Safety Related Applications." The inspectors had no concerns with the procedures.

Discussions with the procurement management indicated that they were well informed about problems in the industry regarding commercial grade items. The stated philosophy was to ensure that items used in safety related applications were qualified for the use intended. Management was cognizant of the need to determine critical characteristics before ordering the commercial grade item. Management stated that commercial grade items were dedicated based on ensuring that the critical characteristics were met either by supplier audits or inspections or by testing following receipt. Acceptance based on vendor documentation was allowed only where supplier audits or inspections had been performed.

A sample was reviewed of commercial grade items that were dedicated for safety related applications. The sample was obtained from three different sources: The first was obtained during a walkdown of the main receiving warehouse; secondly, commercial grade items were reviewed based on inputs from various modifications on-going at the time of the inspection; and finally, commercial grade items were reviewed based on inputs from various maintenance work requests on-going during the inspection. In all cases reviewed, the licensee's commercial grade procurement was adequate. Critical characteristics were specified prior to the item being procured and were identified based on the manufacturer's original drawings or specifications. Testing for critical characteristics upon receipt inspection was done frequently. Completed receipt inspections showed that critical characteristics were identified to the Quality Control organization and were inspected. Commercial grade procurement was considered a strength.

3.7 Maintenance and Support Personnel Control

The licensee utilized a training program for managers and supervisors called "STEPS," which advocated an accountability/victim model. STEPS provided the framework for taking any situation and showing how individuals chose success or failure. Most upper management personnel showed understanding and support of STEPS principles but some middle managers and supervisors did not.

At the senior level of maintenance management, there was a high turnover rate, 3 persons in 18 months. As perceived in the field and during several outage related meetings, competitiveness between maintenance groups, operations, and engineering was extreme in some cases to the point team work appeared to be affected. Two mechanical planners terminated their employment during the inspection.

The inspectors noted that training mockups were utilized at the Fermi 1 facility. Maintenance personnel appeared to be qualified and trained, but were not always attentive to detail. Based on the high number of personnel contaminations to first time radiation workers, it appeared that more or better radiation protection training was warranted.

Inservice testing of pumps and valves is ordinarily performed by Shift Engineering Technicians who are part of the Operations Staff and are formally trained, tested, and certified to perform IST functions. Course requirements were established by the Inservice Inspection Plant Equipment Performance (ISI) (PEP) Group and the course was designed and administered by the IRD Corporation, which manufactures vibration measuring equipment. After three days of classroom training, each trainee performs field vibration testing under the supervision of a vibration expert. The testing is performed on at least five pieces of equipment of each type found in the plant. After successful completion of the course, the trainee is certified to independently perform IST work.

3.8 Pump and Valve Inservice Testing (IST) Program

The licensee's second 10 IST year program was written to comply with the rules and regulations of 10 CFR 50.55a and Section XI of the ASME Boiler and Pressure Vessel Code, 1980 Edition including the addenda through Winter 1980. The program was reviewed by NRC and a SER was issued before GL 89-04 was issued.

The inspector reviewed the procedure governing the conduct of IST including the scope and associated relief requests. The licensee is in the process of revising the IST program to conform to the requirements of GL 89-04.

Implementation of the program was assessed by the inspectors to verify compliance with "Inservice Testing Program (Plan) for Pumps and Valves," NE-5.6-IST, Revision 2, Change 6. The assessment included all phases from development of an organization and administrative controls through performance of testing, analysis of results, and trending of data.

3.8.1 Administrative Control of Inservice Testing

The inspectors confirmed that administrative controls were in place to satisfy the requirements of the Inservice Testing (IST) Program and that specific duties had been assigned to personnel. Although IST procedures may be originated by any Technical Group Systems Engineer, the procedures are subject to review by the IST PEP Program Manager before implementation.

All IST is under the control of the ISI PEP Manager and is supervised jointly by the ISI and the PEP groups. Because of the need to coordinate performance of pumps and valve tests with Operations, the personnel who normally perform the tests are Shift Engineering Technicians from the Operations Group. The data from those tests are reviewed and approved, or anomalies are resolved by ISI/PEP personnel, who extract the necessary information for trending. The ISI/PEP Group analyzes data, checks for compliance with required acceptance criteria, initiates appropriate action when equipment falls into the "alert range" or "required action range" and maintains trending data.

The inspectors reviewed the "Inservice Testing Program for Pumps and Valves," NE-5.6-IST, Revision 2, Change 5, and "Surveillance/Performance Program for Testing Plant Equipment," NPP-CTI-01, Revision 1. Both conformed to the requirements of the IST program.

3.8.2 Establishing Component Inoperability

Position 8 of Attachment 1 to GL 89-04 Guidance on Developing Acceptable Inservice Testing Programs, indicated that a pump or valve shall be declared inoperable as soon as the data is recognized to be outside the IST acceptance criteria. However, ASME Section XI allows deferring the declaration of inoperabiity of valves for 24 hours (IWV-3417) after recognizing the problem. Although IWP-3230 requires that pumps with test data deviations which fall within the Required Action Range be declared immediately inoperable, the effect of this guidance is nullified by IWP-3220, which permits a delay of up to 96 hours to analyze the data after completing the test. The licensee previously adhered to this philosophy, but now declares the valve inoperable before taking steps to correct the problem. Current procedures reflect this change and conform to the guidance of GL 89-04.

3.8.3 Scheduling, Records Retention, and Trending

The inspector reviewed the system of scheduling IST with cognizant personnel and by reviewing procedure "Surveillance/Performance Scheduling and Tracking," NPP-CT1-02, Revision 0. Results of scheduling is a computer printout identified, for example, as PSN.GEN.RPT.4.8.1.4, "Surveillance, Scheduling, and Tracking, Periodic Report for January 23-29, 1989, Events to be Scheduled for January 23, 1989," which was reviewed and found to satisfy requirements for scheduling IST.

Results of IST surveillances are reviewed by the ISI/PEP group for analysis and initiation of appropriate action if the data falls into the "alert range" or the "required action range." A copy of the data is retained and the original is sent to the licensee's Nuclear Operations Center for storage. The inspector reviewed procedure "Performance Evaluation," NPP-RE1-01, Revision 0, and observed the results of its implementation in the form of recorded trend data of selected equipment. The inspector determined that for selected equipment the trending data were readily accessible, coherently assembled, and current. Data are currently computerized for storage of data, to plot curves, and calculate trends. By providing a best fit curve, the trending program is capable of predicting when the component will exceed its required action range value. This may eventually be used as the basis for a predictive maintenance program if it proves to be effective. Implementation of a Computerized Trending System is considered a strength.

3.8.4 SOER 8603 - Check Valve Failure or Degradation

Check valves are included as a part of routine IST programs and are not normally isolated for separate evaluation. However, information from several sources including SECY-88-297, "Program for Testing and Inspecting Check Valves," and previous inspection results indicated that additional attention would be appropriate. In order to determine the surveillance effort assigned to check valves by the licensee, the team reviewed the activities and program in place at Fermi 2.

In addition to the testing required by the IST program, the team reviewed the licensee's actions to address check valve testing to detect degradation and preclude failure. Fermi 2 addressed these problems in response to industry initiatives that indicated that the major causes of check valve failures were misapplication and inadequate preventive maintenance activities. The licensee conducted a review of check valves in systems that had the potential to produce valves for performance monitoring. The systems encompassed by the review were based on the EPRI Report No. NP 5479, "Application Guidelines for Check Valves in Nuclear Power Plants." Check valves that were addressed in this review and were found to fail one or more of the EPRI review guidelines were then classified as candidates for performance monitoring. The performance monitoring would be accomplished by either periodic testing, surveillance monitoring, or visual inspection. The inspector reviewed letters concerning this subject, including NE-PJ-88-0565 which references pertinent documents on this subject.

The licensee categorized the valves for the appropriate performance monitoring. Subsequently, the licensee implemented the results of the review to perform the respective performance monitoring. The team reviewed the licensee's listing of valves that were candidates for performance testing to determine if those valves were incorporated into the recommended performance monitoring (testing) program, based on the licensee's criteria.

Of the valves reviewed, testing had been incorporated and performed on the equipment. Data sheets were provided to record information on the valve and its condition based on observations from the maintenance of testing activity. These data sheets are routed with the work packages for trending of the valve performance. Test records and records of failures were maintained through the use of data sheets. All manual trending records were duplicated and copies were stored in the fireproof vaults of the Nuclear Operations Center.

This review demonstrated that the testing of check valves is recognized as essential by licensee personnel. Additionally, the licensee stated that further review of check valves for function and testing was to be conducted as required by GL 89-04.

3.8.5 <u>IST of Standby Liquid Control Pump Discharge Check Valves</u>

The inspector reviewed the SLC system functional description including the design basis outlined in the Fermi 2 Safety Analysis Report (SAR), and the licensee's IST program to determine if functional testing requirements for various SLC system components were met. Functional testing requirements were reviewed for the inspection check valves, squib valves, and the pump discharge check valves.

Based on the review conducted, no problems were noted with the exception of the SLC system pump discharge check valves, numbers C41-F033A and B, with the function of preventing bypass flow from one pump in the event that a pump relief valve failure occurs in the line from the other pump, which would result in a partial or complete loss of SLC. The inspector noted that the IST program for these valves did not include testing in the reverse direction. Previous testing has verified that the SLC system has performed as required and system operability is not in question. However, the current testing of the SLC system did not verify the closure function of the check valves. Section XI of the ASME Code requires that Category C check valves, which perform a safety function in the closed position to prevent reversed flow, be tested in a manner to prove the disk travels to the seat promptly on cessation or reversal of flow. Verification that a valve is in the closed position can be done by visual observation, by an electrical signal initiated by a position indicating device, by observation of appropriate pressure indication in the system by leak testing, or by other position means.

During a review of a QA audit, No. 88-02, performed by the licensee in November 1988, the NRC inspector noted that this finding was made by the licensee and DER 88-1990 was issued to evaluate the previous tests to determine if the closure function of the check valve had been adequately tested; and revise IST program and surveillance procedures to document testing of the check valves in the closed direction. The evaluation of the DER concluded that verification of valve closure function of the valve was not necessary because a failure of the valve did not meet the single failure criterion for the system. That is, in order to render the SLC system inoperable, a failure of the relief valve and the check valve was required and therefore, testing of the check valves was not necessary. This disposition did not appear to adequately respond to the licensee's findings in the QA audit. The inspector also considers the response inappropriate since the check valves should be included in the IST program to verify closure function. The licensee was still in the process of addressing Generic Letter 89-04, which provided the licensee with guidance on developing an acceptable IST program. The licensee indicated that the testing of the valves to verify closure function would be developed and incorporated into the IST program.

3.8.6 Full Stroke Testing Of Testable Check Valves

Four testable check valves in the RHR and core spray systems are committed to full stroke testing by the IST Program. The program indicated that full stroke testing was to be performed in procedures 24.203.04, "Core Spray Valve Operability and Position Verification Test," Rev. 20, and 24.204.04, "RHR Shutdown Cooling and Head Spray Valve Operability Test," Rev. 20. A review of these procedures disclosed that they included only stroke testing by means of the test actuator, which provided only a partial stroke. When notified of this inconsistency, the licensee provided objective evidence of full stroking of the valves through alternate methods, such as full flow testing. However, the procedures in which the full stroking was accomplished were not those identified in the program for that purpose.

The licensee has committed to perform future stroke testing in strict compliance with the IST program. Previous tests have met the intent of the program, although the licensee did not comply with the manner in which the requirements were proposed to be met. The failure to have adequate procedures to perform full stroke testing as prescribed in the IST program is an example of a violation of 10 CFR 50, Appendix B, Criterion V (341/89024-01J).

3.8.7 IEB 85-03 (TI 2515/73; 50-341/85003-BB)

MOV Common Mode Failure During Plant Transients Due to Improper Switch Settings.

Action Item a of IEB 85-03 requests a review and documentation of the design basis for the operation of each valve addressed, including an evaluation of limiting differential pressure conditions; Action Items b through d require actions to assure that the MOV switch settings are set, tested, and maintained properly; and Action Item e requires a 180 day report of the results of Action Item a and a program to accomplish Action Items b through d.

Supplement 1 to IEB 85-03 was written to request that licensee's review the design basis operation of valves and to test these valves against differential pressures calculated during the design basis review. Where this testing could not be accomplished, justification for alternate testing was to be developed and documented.

The licensee developed a response to IEB 85-03 to use a means of testing the valves in the IEB 85-03 program other than testing them against dp conditions.

The licensee calculated the pressures that would occur in the system and that would act on the valves. Using this design basis information, thrust and torque requirements were obtained from the valve and motor-operator vendor. These thrust and torque valves that were calculated had corresponding torque switch settings (the torque switch setting that corresponded to the output thrust based on the valve and operator design which were also provided by the vendor).

Once the thrusts and corresponding torque switch settings were provided by the vendor, the licensee performed verification testing. Diagnostic testing equipment was employed at Fermi 2 to verify that at the given torque switch setting, the operator would develop the corresponding thrust (based on the valve operator design) to meet the design basis requirements for valve operation.

The licensee performed the testing to verify that the torque switch setting corresponded to the vendor calculated thrusts. Problems were noted with some of the valves by the licensee during the testing, however, the licensee corrected the noted discrepancies to ensure that the valves met the vendor recommended thrusts (to meet the design basis).

No problems with the testing program were noted by the inspector. However, the licensee's philosophy of using the vendor recommended settings to verify valve operability is generally considered to be the least effective way to determine that a valve will perform its design basis function. The method used by the vendor for calculating desired thrusts has been seen to be less conservative than expected and sometimes did not adequately predict the thrusts required for a valve to operate against dp.

The licensee's testing methodology for implementing IEB 85-03 was seen as a weakness by the NRC inspector. The methodology is not as conservative as testing against differential pressures that the valve will be required to perform against. This issue should be addressed when the licensee addresses the requirements of GL 89-10, which mandates differential pressure testing for all safety related valves.

3.8.8 Valve Backseating

During design and construction of the Fermi 2 plant, the licensee planned to ensure that MOVs fully opened by opening them until an enlarged section of the stem contacted the mating seat in the bonnet. In order to assure that the valves were capable of withstanding the stresses of the proposed backseating, the licensee included a requirement that the valves of at least one manufacturer be capable of such "Power Backseating" in the purchase order for the valves.

Field experience with the backseating of valves at other plants provided strong arguments against the backseating practice. This experience included broken stems and dropped disks.

Based on this industry experience, the licensee decided to eliminate power backseating of valves by stopping all valves on the open stroke through use of the limit switch, rather than the torque switch. In every case, the power is now interrupted before the steam contacts the backseat. In most cases, there is very little coasting of the stem after the power is interrupted. In some cases, the stem will coast into the backseat with considerable force. Because the magnitude of this force had not been quantified, an NRC item on this subject has remained open for an extended period. The licensee recently contracted with Wm. Powell Valve Company to calculate the stress induced by torque backseating. In Detroit Edison Letter NE-PJ-89-0299, dated May 9, 1989, the results are tabulated and the writer concludes, "Therefore coasting against the backseats in these valves is considered unconditionally acceptable." The writer continues, "The concern for coast-in backseating is then restricted to large, 'fast-acting' valves." Coincidentally, all of Fermi 2's large, "fast-acting" valves were manufactured by Wm. Powell Valve Company.

The licensee appears to have acted diligently and responsibly in justifying this position through the services of a competent third party. There is no known comparable study to challenge the position taken by the licensee, therefore, there is no reason to delay resolution of the NRC item. In the absence of any compelling arguments to the contrary, there appears to be no reason why the licensee may not continue to terminate the opening strokes of MOVs by operation of the limit switch at some point short of the fully open position without taking measures to avoid coasting into the backseat.

3.9 Review of Licensee's Assessment of Maintenance

The inspector evaluated the licensee's quality verification process in the maintenance area by the review of audit reports and surveillance reports. The documents were reviewed to assess technical adequacy, root cause analysis, and timeliness of corrective actions.

3.9.1 Audit Reports

The inspector reviewed audit 89-0142, which was performed during May and June 1989, and had the most current results of maintenance activities. The audit was performance oriented, a strength, and of otherwise good quality. Some of the most significant observations included poor communications between craft workers, failure to solicit input from system engineers for planning corrective maintenance, and minimal or lacking pre-job briefing by foremen of electrical and mechanical craft personnel. The last item was a repeat from a 1988 audit number 88-0113. Corrective action in this case was ineffective. As described elsewhere in this report, the condition still existed at the time of this inspection and is considered a major contributor to some of the weaknesses that were identified during the inspection. Management was not aggressive in response to this significant self identified problem.

The inspector reviewed audit 89-0166, which was performed during June and July 1989, and had the most current results of the evaluation of the corrective action program. The audit was performance oriented, a strength, and of otherwise good quality. The most significant aspect of the audit was in the executive summary which stated in part that "the completeness of corrective actions taken in ALL (emphasis added) cases is less than effective." Some of the more significant observations pertained to the ineffectiveness or problems with the handling of Deviation Event Reports including observations 1, 2, 3, 5, 7, and 11.

3.9.2 Surveillance Reports

During plant and system walkdowns the inspectors observed that housekeeping was very inconsistent even though signs were conspicuously posted in specific areas of the plant which included the name and telephone number of the person assigned. The team observed chewing gum, cigarette butts, and candy wrappers in the RCA. The team also noted that precautions were not in place to protect installed equipment such as snubbers, sensing lines, and electrical conduits from damage by workers. The team was concerned by the absence of QC inspectors in the plant especially with all of the ongoing activities. Subsequently, it was determined that QC had in fact conducted several quality surveillances known as "Roving Inspection/Surveillance." Of the 199 QC surveillances, 26% were devoted to observation and attempted corrective action to plant material/housekeeping problems. However, based on the observations made by the team, corrective action was not effective.

3.9.3 Effectiveness of Corrective Action

Overall, the licensee's self-assessment of maintenance was effective. QA audit and surveillance programs were performance oriented and provided a good assessment of identified deficiencies, however, poor performance in response to the self identified problems as described above in 3.9.1 and 3.9.2 is considered a significant weakness. Ineffective programs for problem identification or correction are unacceptable and considered to be in violation of 10 CFR 50, Appendix B, Criterion XVI. (50-341/89024-03A)

During this inspection there were several incidents noted where DERs were apparently required but were not written. For example, a transmitter failure associated with LCO 890583, an indicating switch failure associated with LCO 890273, and the EDG insulation fire associated with LCO 890288. In discussing this matter with licensee personnel, the inspectors noted there appeared to be some confusion as to when a DER should be written. In reviewing procedure NPP-MA1-04, "Conduct of Maintenance," Revision 1, the inspectors noted that Section 5.10 of the procedure contained the following statement. "Any person identifying a Condition Adverse to Quality (CAQ) while performing a maintenance activity shall initiate a Deviation Event Report (DER)." Subsection 5.10.1 states "Conditions adverse to quality are defined as problems such as failures other than (emphasis added) normal wear and tear, malfunctions, deficiencies, deviations, defective material and equipment, abnormal occurrences, out-of-calibration measuring and test equipment known to have adversely or potentially adversely affected equipment or activities important to safety, procedural noncompliance including violations of procedures having nuclear safety significance, missed or late highest priority preventive maintenance tasks, and material and equipment deviations from approved specifications, codes, regulations, orders, drawings, standards, and evaluation of violations of personnel safety rules, practices including failure to use personal safety equipment."

The words "other than" in the above statement indicated to most maintenance personnel that a DER was almost never required. The inspector noted that DERs were not written in a number of cases, where engineering evaluation or investigation for cause with corrective action appeared to be appropriate. Examples of the failure to write DERs are noted above and in Sections 3.3.2.3

and 3.4.2.2 of this report. This failure to document significant conditions adverse to quality on appropriate documents so that appropriate and timely evaluations and corrective actions can be taken is another example of a violation of Criterion XVI of 10 CFR 50, Appendix B (341/89024-03B).

During this inspection, the team identified nine examples of fa..ure to follow procedures. Similar findings were made during previous NRC inspections of maintenance; for example during inspection 50-341/88007 there were three instances noted where procedures were not followed and during inspection 50-341/88031, there were two instances noted where procedures were not followed. The licensee's corrective action program appears to be too narrowly focused to correct specifics noted in violations rather than addressing the broad generic aspects of noted problems. Failure to provide prompt and effective corrective action in following procedures is another example of a violation of 10 CFR 50, Appendix B, Criterion XVI (341/89024-03C).

4.0 Synopsis

4.1 Overall Plant Performance

4.1.1 Historic Data

(+) Operating record since January 1989 indicated that the problems encountered were not directly attributed to maintenance personnel, nor to the lack of or ineffective maintenance.

(-) Reactor trips continued to be caused by BOP systems/components; however, corrective actions taken during the outage should help reduce those problems.

4.1.2 Plant Walkdowns

(-) Housekeeping was inconsistent; good in some areas and bad in others. Examples included chewing gum, cigarette butts, and candy wrappers in the RCA.

(-) Precautions were not in place to protect installed equipment such as snubbers, sensing lines, and electrical conduits, from damage by workers; there was a bent thermocouple on CS motor lower bearing and possible over greasing of the RCP MG set motor bearings.

4.2 Management Support of Maintenance

4.2.1 Management Commitment and Involvement

(+) OSRO used a final check off system to assure operational readiness; overall experience level of upper management was high; QA audits were performance oriented; managers and supervisors were trained in the course "Steps to Effective Plant Supervision," (STEPS) which advocated an accountability/victim model; operations personnel were provided with a pocket size training aid and reminder for walking assigned spaces, which improved accountability.

(-) Pre-job briefings by maintenance foremen were ineffective or absent; some supervisors, especially in the mechanical area, even though on the job, were not always effective in supervising.

4.2.2 Organization and Administration

(+) The PM program had significantly improved from past inspections.

(-) Corrective action to some self identified findings, such as housekeeping and poor pre-job planning, was not effective. Similar concerns were again identified during this inspection.

4.2.3 Technical Support

(+) MOV program and its implementation have improved; system engineer technical backgrounds and working experience were greater than the norm; implementation of a computer based trending program for trending and analyzing IST data; radiation protection job coverage and ALARA support for major maintenance activities resulted in maintaining overall low personal doses during the first refueling outage.

(-) System engineers lacked system "ownership," some system engineers were not aware of the status of assigned systems, system engineers were not actively involved with trending and root cause analysis, system engineers had not received specified training.

(-) Routine review and analysis was not done of data that indicated repetitive root causes for recurring work described on completed deficiency evaluation reports and work requests.

(-) QC inspectors were conspicuously absent in the plant especially with all of the ongoing activity; QC conducted surveillances and reported findings to management, however, corrective actions were slow in coming.

(-) Poor planning of minor maintenance jobs by some supervisors and craft alike lead to unnecessary radiation dose and inefficient work; there was an inordinately high number of personal contaminations, many to first time radiation workers.

(-) Response to Bulletin 85-03, MOV common mode failures, was ineffective in meeting the Bulletin's intent of testing against differential pressure; full stroke testing was not performed on RHR and CS testable check valves; and the SLCS pump discharge check valves were not included in the IST program for testing in the closed direction.

4.3 Implementation of Maintnance

4.3.1 Work Control

(+) MOV testing personnel, MOVATS, were efficient; "runners" were used to expedite and improve work planning; outage/start up planning meetings were well run and organized; maintenance procedures for MOVs were very comprehensive, detailed, and user friendly; maintenance procedures for I&C activities included statements of how the activity would impact plant operations; the post maintenance testing procedure provided excellent guidance and criteria.

(-) Management lacked control over subordinates, work attitude was casual, some personnel were not attentive to detail, and did not critically look at plant conditions to focus on performance improvement; there were several instances when procedures were not followed; an operator violated a radiation work permit by not using gloves when operating potentially contaminated system; an operator moved the needle by hand to free a stuck indicating device; an incorrect lubricant was used on threads for solenoid valves on the MSIVs; lack of review of contractor work on the LPCI system discharge check valve; inconsistent assignment of safety classification for WRs; slow retrieval time for computerized information which affects planning; copies of microfilmed work requests difficult to read, hard copies stored off site.

(-) Poor planning by some supervisors and workers resulted in problems with tools, materials, working conditions such as lighting, ALARA concerns; inadequate use of post job "feedback" sheets. Incorrect rigging of HPCI booster pump job; poor work control package for LPCI discharge check valve; poor planning of oil change and leak repair of RR pump MG set.

(-) Inadequate procedure for installation of EDP 9755; many work packages were cumbersome and difficult to use; modification made to motor-operator without design change package; inadequate review of MOV procedure which incorrectly called for installation of spring pack modification kit for more than 40 valve operators.

(-) Clear cut responsibility was not assigned for establishing post maintenance testing requirements; personnel were not sure who really had responsibility for assignment of post maintenance testing requirements, responsibility assigned to an undefined "maintenance engineer"; inadequate post modification testing acceptance criteria for timing valves and testing under dynamic conditions such as differential pressure.

(-) Documentation of work performed was inadequate; post maintenance feedback sheets not always completed for future planning; system engineers were not in the WR review cycle and did not get completed WRs for close out.

4.3.2 Plant Maintenance Organization

(+) Contractors that performed work on MOVs were trained, qualified, and experienced; there was a course in corrective action; there was a trending program to evaluate IST data.

(-) Inadequate control of contracted valve repair personnel who worked on the LPCI discharge check valve; corrective action not timely for some audit findings; check valves not tested in closed position; improper action accepted on DERs; unclear guidance and understanding of when to write a DER.

(-) Limited communication from maintenance to system engineers but rarely from system engineers to maintenance; poor interface by engineering with maintenance in regard to modifications; poor interface by maintenance with engineering in regard to seeking help in resolving chronic positioning problems with the LPCI system discharge check valve; no communication between engineering, maintenance, (MEG) warehouse with regard to MOV spring pack modification.

4.3.3 Maintenance Facilities, Equipment, and Material Control

(+) The dedication process for commercial grade equipment adequately demonstrated the concept of "critical characteristics" for safety-related applications.

(-) Unqualified insulating materials were used on Target Rock solenoid valve leads; snubbers were removed for testing, temporarily stored in walkways, and not properly protected; storage of lubricating oil, pipe, and electrical cable was inadequate; a gauge was issued with an expired calibration sticker.

4.3.4 Personnel Control

(-) Systems engineers had not received specified training; competitiveness between electrical, mechanical, and I&C was extreme to the point that team work was affected; high turnover rate in maintenance management, 3 in 18 months; two mechanical planners quit during the inspection due to differences with mechanical maintenance management; there were an inordinately high number of personal contamination to first time radiation workers, which indicated that more/better training is required.

5.0 Open Items

Open items are matters that have been discussed with the licensee, which will be reviewed further and involve some action on the part of the NRC the licensee or both. Open items identified during the inspection are discussed in Paragraph 3.6.2 of this report.

6.0 Exit Meeting

The inspectors met with licensee representatives (denoted in Paragraph 1) on November 30, 1989, at the Fermi 2 Power Plant and summarized the purpose, scope, and findings of the inspection. The inspectors discussed the likely informational content of the inspection report with regard to documents or processes reviewed by the inspectors during the inspection. The licensee did not identify any such documents or processes as proprietary.

Appendix A

ACRONYMS

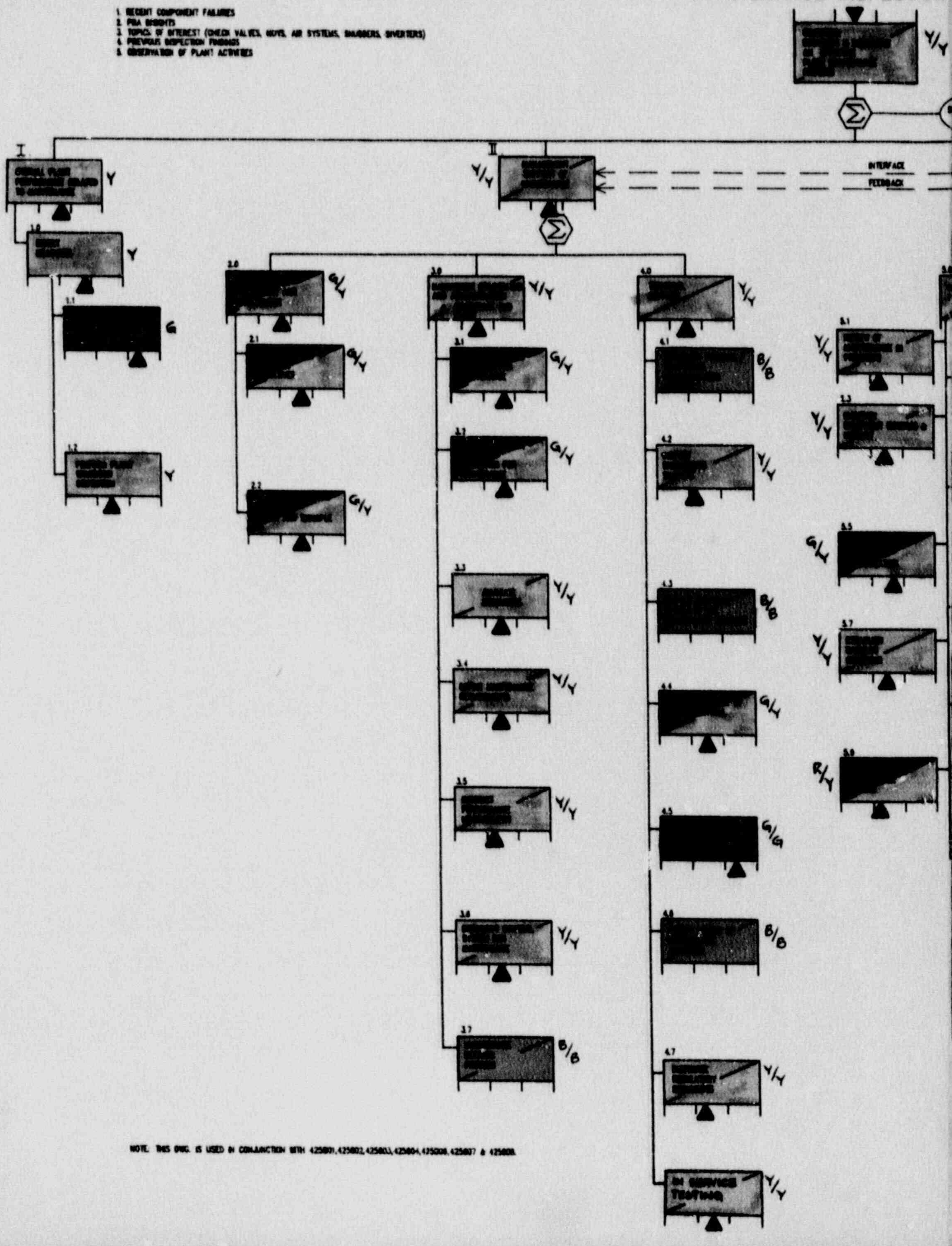
ALARA	As Low As Reasonably Achievable
ASME	American Society of Mechanical Engineers
BOP	Balance of Plant
CECO	(SIC) (Computer Program)
CM	Corrective Maintenance
CRD	Control Rod Drive (System)
CS	Core Spray (System)
DET	Diagnostic Evaluation Team
DER	Deviation Event Report
ECR	Engineering Change Request
ECW	Emergency Cooling Water (System)
EDG	Emergency Diesel Generator (System)
EDP	Engineering Design Package
EPRI	Electric Power Research Institute
EQ	Environmental Qualification
ESF	Engineered Safety Feature
FMR	Field Modification Request
GE	General Electric
GL	Generic Letter
HCU	Hydraulic Control Unit
HP	Health Physics
HPCI	High Pressure Core Injection (System)
I&C	Instrument & Control
IEB	NRC Bulletins
IEN	NRC Notices
INPO	Institute for Nuclear Power Operations
IST	In Service Testing
LER	Licensee Event Reports
LCO	Limiting Condition of Operation
LLRT	Local Leak Rate Test
LPCI	Low Pressure Core Injection (System)
M&TE	Measuring and Test Equipment
MEG	Materials Engineering Group
MG	Motor Generator
MOV	Motor Operated Valve
MOVATS	Motor Operated Valve Analysis and Testing System
MS	Main Steam
MSIV	Main Steam Isolation Valve
MSIVLC	Main Steam ISolation Valve Leakage Control (System)
NCIG	Nuclear Construction Issues Group
NPRDS	Nuclear Plant Reliability Data System
NRC	Nuclear Regulatory Commission
OSRO	Onsite Review Organization
PDC	Potential Design Change
PM	Preventive Maintenance
PMT	Post Maintenance/Modification Testing
PMWR	Preventive Maintenance Work Request
PQA	Project Quality Assurance
PRA	Probabilistic Risk Assessment
Q	Quality

QA	Quality Assurance
QC	Quality Control
RCA	Radiological Controlled Area
RCIC	Reactor Core Isolation Cooling (System)
RCM	Reliability Centered Maintenance
RHR	Residual Heat Removal (System)
RPS	Reactor Protection System
RPWC	Radiation Protection Work Coordinator
RRP	Reactor Recirculation Pump
RWCU	Reactor Water Cleanup (System)
RWP	Radiation Work Permit
SALP	Systematic Assessment of Licensee Performance
SAR	Safety Analysis Report
SER	Safety Evaluation Report
SIL	Service Information Letter
SLC	Standby Liquid Control (System)
SOER	Significant Operating Experience Report
SSOMI	Safety Systems Outage Modifications Inspection
STEPS	Steps to Effective Plant Supervision
TS	Technical Specification
WR	Work Request

TREE INITIATORS

1. RECENT COMPONENT FAILURES
2. PRA INSIGHTS
3. TOPICS OF INTEREST (CHECK VALVES, MOVS, AIR SYSTEMS, SNUBBERS, INVERTERS)
4. PREVIOUS INSPECTION FINDINGS
5. OBSERVATION OF PLANT ACTIVITIES

PRESENTATION TREE
MAINTENANCE INSPECTION

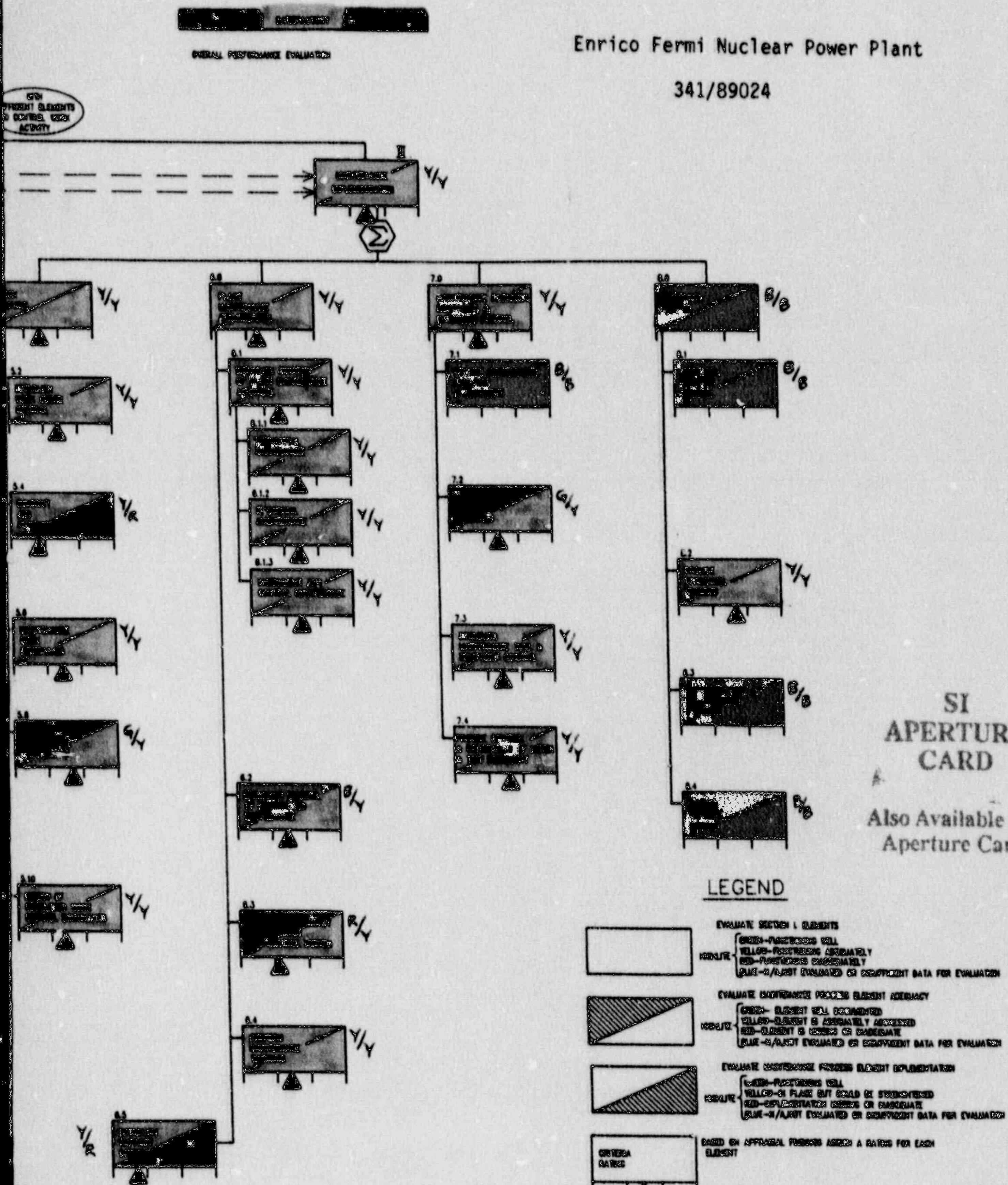


NOTE: THIS DWG. IS USED IN CONJUNCTION WITH 425801, 425802, 425803, 425804, 425806, 425807 & 425808.

TREE

Enrico Fermi Nuclear Power Plant

341/89024



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