U.S. NUCLEAR REGULATORY COMMISSION

REGION 3

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Licensee:	Detroit Edison Company (DECo)
Facility:	Enrico Fermi, Unit 2
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EXECUTIVE SUMMARY

Enrico Fermi, Unit 2
NRC Inspection Report 50-341/96-04

This integrated inspection included aspects of licensee operations, engineering, maintenance, and plant support. The report covers a 6-week period of resident inspection; in addition, it includes the results of announced inspections by a headquarters human performance specialist and a regional operations inspector.

Operations

- Operators demonstrated good command and control during performance of a plant shutdown and startup (1.2)

- Four examples of inadequate operator performance involving inadequate procedure compliance occurred (1.1). This is a continuing concern as identified in the previous inspection report (No. 96002).

- A water hammer event occurred during post maintenance testing of the Emergency Equipment Cooling Water system. Operators' failure to fill and vent the system contributed to the event (1.4.1).

Material Condition

- Material condition of safety equipment remained good. Balance of plant equipment condition improved due to the maintenance activities performed during the forced outage, reducing operator distractions (1.4, 2.2).

- Drywell and torus cleanliness conditions were good, indicating that increased licensee emphasis on improving housekeeping conditions in these areas have been effective (1.4).

Maintenance

- Four examples of foreign material exclusion deficiencies were identified by the licensee and the NRC, three in safety systems. These examples indicated a weakness in the adequacy of licensee foreign material exclusion controls (2.4).

- The wrong control rod drive mechanism was detorqued during replacement activities. Contractor control and procedural adherence weaknesses contributed to the occurrence of the event (2.5).

Engineering

- The failure to adequately monitor system performance resulted in drain lines on the safety related service water system becoming plugged without the condition being recognized. As a result of the plugging, the potential existed for the service water lines to freeze during cold weather conditions (3.2).

- Investigation of degraded safety related service water flow was inadequate in that the cause for the abnormal condition was not aggressively pursued and as a result the cause was not identified (3.3).

- A water hammer event occurred in the Residual Heat Removal Service Water System (RHRSW). Engineering investigation of the cause was not coordinated well with operations or among engineering groups (3.5).

- A repeat failure of a primary plant sample station flow glass was experienced, resulting in a personnel contamination (3.6).

Plant Support

- Following inspector identification of an example of weak contaminated area boundary control, corrective action by reactor protection personnel was prompt and aggressive (4.1.2).

Self Assessment

- Two Quality Assurance audits reviewed indicated a continuing trend of improved assessments by QA, including good findings and recommendations to management (5.0)

Report Details

1.0 OPERATIONS

NRC Inspection Procedure 71707 was used in the performance of an inspection of ongoing plant operations. At the start of this inspection period, the plant was in a forced outage to repair emergency closed cooling water (EECW) system design deficiencies. Following completion of engineering work and maintenance activities, the reactor was restarted on April 18. Reactor core isolation cooling (RCIC) and potential high pressure coolant injection (HPCI) system problems were identified, and the reactor was shutdown on April 19. On April 22, the reactor was again restarted and the plant was returned to 96 percent reactor power. The plant remained at or near 96 percent power for the remainder of the inspection period, except during brief power reductions for power suppression testing on May 3-5, and for turbine control valve corrective maintenance on May 8.

1.1 Operator Performance Problems

Operator errors due to inattention to detail and poor procedural compliance was identified as a concern in Inspection Reports 95014 and 96002. During this inspection period events continued to occur due to poor operator performance.

(a) On March 30, during performance of Emergency Diesel Generator (EDG) 14 surveillance testing, an operator opened a disconnect and electricians installed a jumper on the wrong motor control center cabinet position. As a result, an unexpected alarm was received and the Residual Heat Removal (RHR) Pump "D" Suppression Pool Suction Valve lost position indication. Deviation Event Report (DER) 96-0368 was issued to document event occurrence and track corrective actions. Licensee preliminary investigation results determined that the cause for the event was the operators' failure to follow procedures and inattention to detail. In addition, the operators, electricians, and engineers involved in the surveillance were distracted by disconnect switches not working properly due to inadequate lubrication.

Licensee immediate corrective actions included counseling of personnel involved and development of a training module on this event for both maintenance and operations personnel.

The failure to follow procedures was an additional example of a violation of 10 CFR Part 50, Appendix B, Criterion V "Instructions, Procedures and Drawings" and will not be cited separately. (341/96002-14).

(b) On April 3, while cross-tying divisions of the non-interruptible instrument air system (NIAS), operators failed to open the Non-interruptible Control Air System Division 1 and Division 2 Cross Tie Isolation Valve (P50-F221B) in accordance with the safety

tagging record (STR). Both the initial positioner and the independent verifier failed to ensure that the valve was open. As a result, the Division 1 NIAS system began to depressurize when the normal supply was isolated. Control room operators noted the pressure decrease and dispatched an operator to investigate. Valve P50-F221B was found shut; the operator opened the valve, restoring the system to the required line up. The licensee initiated DER 96-0395 to document event occurrence and track corrective actions. The licensee investigation determined that the event was caused by the operators' failure to follow safety tagging instructions.

Licensee corrective actions included counseling of personnel involved. In addition, special training was conducted by the Operations Superintendent on management expectations for component manipulation and safety tagging requirements. Operations management also planned additional training, including hands-on and classroom instruction on this issue.

The failure to follow procedures was an additional example of a violation of 10 CFR Part 50, Appendix B, Criterion V "Instructions, Procedures and Drawings" and will not be cited separately. (341/96002-15).

(c) On April 11, during the Division 1 EECW surveillance test, the EECW pump did not start and received a tripped indication. Licensee investigation revealed that the breaker charging spring toggle switch was in "off," which prevented the charging spring from being recharged following the previous operation. As a result the breaker would not shut. The licensee initiated DER 96-0427 to document event occurrence and track corrective action. Licensee investigation determined that the individuals involved failed to follow the System Operating Procedure (SOP) 23.300 "Breaker Operations" during breaker restoration.

Licensee corrective actions included counseling the individuals, discussing the event during the next operator training cycle, and revision of the standard breaker STR to include verification of this toggle switch position.

The failure to follow procedures was an additional example of a violation of 10 CFR Part 50, Appendix B, Criterion V "Instructions, Procedures and Drawings" and will not be cited separately. (341/96002-16).

(d) On April 16, while performing a licensed operator walkdown of the Control Rod Drive (CRD) Hydraulic Control Units (HCUs) following maintenance activities, the Charging Water Isolation Valve (C11-F113) for HCU 38-51 was found closed when required to be open. Licensee immediate corrective actions included conducting a valve line up verification on all HCUs; no other problems were identified. The licensee initiated DER 96-0449 to document event

occurrence and track corrective actions. The CRD SOP (23.106), Section 6.11, Step 6.11.2.13, required Valve C11-F113 to be opened when restoring an HCU to service. The license determined the cause for this event was failure to follow this procedure.

Licensee corrective actions included counseling the individuals involved, discussing the event during the next operator training cycle, and discussion of management expectations with respect to restoring equipment to service using SOPs and STRs.

The failure to follow procedures was an additional example of a violation of 10 CFR Part 50, Appendix B, Criterion V "Instructions, Procedures and Drawings" and will not be cited separately. (341/96002-17).

Due to the similar nature of the above examples to those identified in inspection report 96002, these examples of procedure compliance violations will be tracked as additional examples of the previously cited violation.

Licensee corrective actions to address operations the procedure compliance problems documented in inspection report 96002 were in the process of being implemented at the conclusion of this inspection period. These included taking aggressive actions to investigate and determine the root cause of the decline in operator performance reflected by the above events. The Vice President, Operations met with the licensed and non-licensed operations staff to clarify management expectations and to receive feedback on potential actions to improve performance.

1.2 Startup and Shutdown Observations

The inspectors observed startup and shutdown activities in the control room from April 16 through 19. Overall, the evolutions were well performed. Operator control of activities was good with respect to communications and utilization of procedures, with the quality of turnovers and shift evolution briefs being noted strengths. In addition to management oversight of the evolution, Quality Assurance and training personnel observed the startup and shutdown.

Though the operators performed the startup well, they were challenged by frequent equipment problems, including:

- Unexpected automatic start of Emergency Main Lube Oil Pump;
- South Turbine Building Exhaust Fan failure;
- Rod Worth Minimizer (RWM) anomalies;
- East Gland Seal Exhauster tripped on three start attempts;
- Water in the South Reactor Feed Pump Turbine oil;
- Reactor water sample panel flow glass failure;
- RCIC turbine shaft packing leak;
- Unexpected swap from No. 1 to No. 2 Main Steam Pressure Regulator.

Operator response to each of the above problems was prompt and in accordance with alarm response procedures. Communication and coordination with maintenance and engineering to investigate and correct the problems, for the most part, was also prompt and effective.

Though each of the equipment problems was effectively dealt with, they did present a challenge to the operating crews performing the startup. The effectiveness of engineering support for the RWM problems is further discussed in Section 3.9 of this report.

The reactor startup, which commenced on April 18, was stopped on April 19 due to RCIC and HPCI system problems compounded by pressure regulator problems. The decision to shutdown the reactor was conservative. However, due to weak support from other organizations, including inadequate planning, the operators were placed in a situation where insufficient time was allotted to adequately analyze and overcome problems. As a result, the plant was shutdown until the problems could be resolved.

The inspectors concluded that individual operator performance in conducting activities in support of the plant startup and shutdown was good, even though the operators were challenged by equipment problems, planning inadequacies, and in the case of the RWM anomalies, less than adequate engineering support.

During the subsequent restart on April 21 and 22, the impact of plant equipment on the startup was minimal, and the startup was performed smoothly without significant distractions.

1.3 RCIC and HPCI Inoperability

On April 19, with the plant in Operational Condition 2 (Startup), the RCIC system was declared inoperable due to turbine shaft gland leakage caused by leakage past the RCIC Turbine Steam Admission Valve (E5150-F045). Unexpected indications with the reactor pressure regulator during the startup caused the operators to stop raising reactor pressure and not perform the HPCI system surveillance test until the cause of the pressure regulator discrepancies were understood. As a result, the HPCI system was not tested within the time required by the Technical Specifications (TS) and was also declared inoperable. With both HPCI and RCIC inoperable, TS 3.0.3 actions were taken and the plant was shutdown.

Corrective actions included the repair of the RCIC turbine steam admission valve, troubleshooting and repair of the main steam pressure regulator, and successful performance of the HPCI system surveillance test during the plant startup on April 22. Licensee actions to resolve the RCIC turbine steam admission valve problem is further discussed in Section 3.8 of this report. The licensee issued Licensee Event Report (LER) 95007 to document event occurrence. Inspector review of licensee corrective actions will be tracked under this LER.

1.4 Engineered Safety Feature Systems Material Condition

During inspection of engineered safety feature systems, the accessible portions of the following systems were walked down.

- Emergency Diesel Generators 11, 12, 13, and 14;
- Emergency Equipment Cooling Water;
- Emergency Equipment Service Water;
- Control Center Heating, Ventilation and Air Conditioning.

In addition, the inspectors walked down the primary containment suppression chamber and drywell in company with plant personnel when these areas were ready for final closeout. During the forced outage, the licensee inspected the suppression chamber for foreign material and the emergency core cooling system suction strainers for clogging per NRC Bulletin 95-02, "Unexpected Clogging Of a Residual Heat Removal Pump Strainer While Operating in Suppression Pool Cooling Mode." No strainer clogging or significant foreign material was found; however, following the walkdown with the inspectors, senior management conservatively decided to vacuum portions of the suppression pool that had small accumulations of rust sediment. The inspectors concluded that recent efforts to control materials entering primary containment and post-work cleanup were effective; only a small amount of minor debris was found by the inspectors in the drywell.

During walkdown of EDGs on March 31, the inspectors noted numerous oil leaks, particularly beneath EDG 11. Though emergency diesel availability has been high, the material condition of the EDGs, as reflected in the number of leaks, appears to be declining.

1.4.1 Water Hammer Event During Post Maintenance Testing of the Emergency Equipment Cooling Water (EECW) System

On April 10, following modifications to Division 1 of the EECW system and heat exchanger cleaning, the system was started for testing. A water hammer event was witnessed by operators and engineers present.

Engineering walked down the portion of the system which had the highest potential for damage, and found no problems. The licensee determined that no fill and vent of the system was performed, contributing to the occurrence of this water hammer event. No previous occurrence of water hammer in this system was identified by the licensee.

1.5 Lubrication Program Review

As previously documented in Inspection Report 95014, the licensee identification of incorrect lubricating oil in the RCIC pump bearing indicated a weakness in the licensee lubrication program. During this inspection period, inspectors reviewed licensee corrective actions to prevent problem recurrence.

The licensee initiated DER 96-003 to document event occurrence and investigation results. Licensee investigation determined that the cause for the incorrect oil being added to the RCIC pump was inadequate control of oil cans in the turbine building second floor (TB-2) oil storage area. Licensee corrective actions included the following:

- reorganization of the TB-2 oil storage area;
- better labelling of oil cans stored in the TB-2 oil storage area;
- an audit of performance scheduling and tracking events verified that correct oil was being utilized;
- development of training for maintenance and warehouse personnel to disseminate corrective actions related to the control of oil storage areas;
- revising Operations Conduct Manual to clarify oil storage and usage requirements.

The inspectors concluded that licensee review of the lubrication program was thorough and corrective actions were adequate.

1.6 Balance of Plant Material Condition

During the forced outage, the inspectors toured areas of the plant normally inaccessible during power operation. Most of these areas were found to be in good condition, in regard to both equipment material condition and housekeeping. A notable exception was the 6-North and 6-South feedwater heater rooms, where ventilation fan failures led to heat-related damage and subsequent replacement to a number of balance-of-plant components, including such items as limit switches, wiring insulation, and terminator blocks. Also in poor condition was the second floor turbine building steam tunnel area below the high pressure turbine and turbine steam admission valves. Due to vibration of steam piping, pieces of insulation and lagging dust were much in evidence immediately following plant shutdown.

1.7 Followup on Previously Opened Items A review of previously opened items (violations, unresolved items, and inspection follow-up items) was performed per NRC Inspection Procedure 92901. One non-cited violation was identified.

1.7.1 (Closed) Violation 341/94011-01: Locked Valve Discrepancy. The inspector identified that RHR Pump D Recirculation Isolation Valve (E11 F018D) was not locked as required. The licensee performed operator training on locked valve verification, which included a hands-on portion. No further examples of similar errors have been identified. This item is closed.

1.7.2 (Closed) Inspection Followup Item 341/96003-01: Torus Sample not Taken Prior to Purging. Following reactor shutdown, the drywell atmosphere was sampled. Primary containment was then vented through the torus. Before purging was commenced, operators realized the torus had not been sampled as required by prerequisite 8.1.1 of Primary Containment SOP 23.406 and Offsite Dose Calculation Manual Surveillance Requirement

4.11.2.8.1. The reactor building ventilation process radiation monitor was in service during the venting and detected no increase in radiation. The licensee will include this event in their 1996 Effluent Report to the NRC. Corrective actions included procedure changes to more clearly identify sample locations required prior to purging the primary containment, and operator training.

The failure to follow procedures was an example of a violation of 10 CFR Part 50, Appendix B, Criterion V "Instructions, Procedures and Drawings." However, this licensee identified and corrected violation is being treated as non-cited violation, consistent with section VII.B.1 of the NRC Enforcement Policy. (341/96004-01).

2.0 MAINTENANCE

NRC Inspection Procedures 62703 and 61726 were used to perform an inspection of maintenance and testing activities. Overall, maintenance activities were planned and executed well.

2.1 Observation of Work and Testing

The following maintenance and surveillance activities were observed:

- Residual Heat Removal Service Water (RHRSW) System Check Valve Repairs;
- EECW system modification;
- EECW System Sequence of Events testing;
- Alternate Station Blackout Generator testing;
- Combustion Turbine Generator (CTG) 11-1 refurbishment work;
- RCIC system testing;
- HPCI system testing;
- Division 1 Channel Functional Test of Undervoltage Relays;
- Main Steam Isolation Valve Stroke Time Testing;
- RHRSW drain line replacement.

For all activities observed, the inspectors noted safe work practices. The activities observed were performed satisfactorily in accordance with procedures. Some problems were identified as discussed Section 2.5 below.

2.2 Forced Outage Maintenance

Following the reactor shutdown on March 27, the plant commenced a forced outage to correct EECW design deficiencies. During the outage, the licensee completed approximately 460 work activities, addressing numerous equipment concerns. Some of the major work activities performed included:

- replacement of seven control rod drive mechanisms (CRDMs);
- repair or replacement of 79 control rod position indicating probes (PIPs) and/or cables;
- repair of the Southeast Hydrogen Cooler on the Main Generator;

- removal of Furmanite and permanent repair of five steam leaks;
- repair of 17 other minor leaks;
- chemical and mechanical cleaning of EECW heat exchangers;
- correcting of 30 of a total of 43 control room indication problems (CRIS dots).

Following the second reactor startup on April 22, the decrease in the number of equipment problems which impacted operators was noticeable. In particular, the performance of control rod position indication was much improved. Licensee efforts during the outage to alleviate some of the operator distractions were successful.

2.3 Combustion Turbine Generator (CTG) 11-1 Refurbishment

The inspector observed activities involving the refurbishment of CTG 11-1. The Station Blackout and 10 CFR Part 50, Appendix R, functions of CTG 11-1 were transferred to CTG 11-4 for the duration of the CTG 11-1 refurbishment. This temporary transfer required circuitry modification and installation of a temporary diesel generator to provide "black start" capability to CTG 11-4. The inspector observed testing of the modified CTG 11-4 to verify that the unit would start and assume station blackout loads within the specified time. The portions of the tests observed by the inspector had acceptable results.

2.4 Foreign Material Exclusion

During this inspection period, several examples of poor foreign material exclusion practices were identified.

- On April 1, during Division 2 EECW Heat Exchanger cleaning, the licensee identified a wad of fibrous material stuck to the tube sheet on the emergency equipment service (EESW) water side of the heat exchanger. The material appeared to be impeding flow on five tubes, with probable total blockage of two tubes. Licensee investigation determined that the material was most likely a filter bag. DER 96-0426 was initiated to document event occurrence, investigation results and track corrective actions. The licensee determined that even though some of the EECW Heat Exchanger tubes were blocked, the heat exchanger remained operable.

- On April 3, during disassembly of the North Feedwater Heater Drain Valve (N2200-F021A), the licensee identified that foreign material (a 2-1/2" long threaded stud and a 1/2" pin) were found inside the valve body. The licensee initiated DER 96-0394 to document the problem and investigation results. Preliminary investigation determined that the material found in the valve may have been there for several years. In addition, the licensee determined that it was very unlikely that the pieces could have migrated to the reactor vessel based on system configuration.

- On March 28, the licensee discovered a piece of wire lodged near the disc and seat of Safety Relief Valve (SRV) Vacuum Breaker (B21-F037A). The licensee initiated DER 96-0356 to document the problem occurrence and investigation results. Licensee investigation determined that the wire did not impact the operation of the vacuum breaker. However, the inspectors considered that a potential existed for the wire to have been drawn into the disc seat had the vacuum breaker been required to perform its function. The inspectors verified that the other SRV vacuum breakers were free of wire and debris.

- On May 2, during NRC walkdown of the RHR complex with a system engineer, a plastic bottle and a piece of wood were found floating in the Division 2 Ultimate Heat Sink Reservoir. In addition, numerous grating clamps were found missing or broken. Some of the missing clamps most likely had fallen into the reservoir. Inside the pump rooms, two floor penetrations were not covered, allowing the possibility for debris to fall into the reservoir. The licensee initiated work requests to correct the deficiencies. However, no evaluation was conducted to evaluate the material in the reservoir by the close of this inspection report. Maintenance Conduct Manual, Chapter 10, "Plant Housekeeping," Section 4.2, Area Zone Cleanliness Requirements, stated in part, that "an evaluation will be done for any item known to have fallen into the RHR reservoir that is not planned to be removed." Contrary to the above, a poly bottle, wood, and grating clamps had fallen into the reservoir and were not promptly evaluated.

  Following the exit meeting, the licensee removed accessible material, evaluated the remaining material, and determined that the operation of the RHR complex pumps was not affected. Based on inspector review of this evaluation, the failure to follow procedures and perform a prompt evaluation was determined to be of minor safety significance and will not be cited in accordance with Section IV of the NRC Enforcement Policy (341/96004-02).

The occurrence of the above events indicated a weakness in the licensee's program to ensure that foreign materials are adequately controlled. Continued emphasis on ensuring adequate system cleanliness, especially in safety related systems which take suction from the RHR reservoir appeared warranted.

2.5 Wrong Control Rod Drive Mechanism (CRDM) Loosened

On April 1, contract workers were under the reactor vessel preparing CRDM 30-51 for removal when they identified that they had loosened 6 of the 8 bolts on the wrong CRDM (34-51). The workers promptly reported the error to the control point. All bolts were retorqued, and work was eventually stopped. DER 96-0374 was written to document event occurrence and track corrective actions.

The licensee concluded that the following factors contributed to the error:

- Flags were hung on the CRDMs to be replaced; however, the workers preparing to remove CRDM 30-51 incorrectly removed the flag before they were to unbolt it, removing the most visible cue for identifying the CRDM to be worked.

- The contractor workers involved had each performed this type of work only once before, and neither had recent experience. Additionally, the workers were unfamiliar with the Fermi procedure because they had not been required to read it.

- The procedure being used was a "Reference Use" procedure, and, thus, was not required to be at the job site or referred to during job performance. This contributed to violating the procedure regarding cutting lockwire and bolt detorquing.

- The workers involved were near the end of a 12-hour shift, after having worked 12 to 16-hour shifts the three previous days.

- The procedure being used had never been validated.

- Inadequate self-checking was performed by the workers.

The licensee relied on contractor experience, but failed to ensure that their expectations of worker experience and familiarity with the local procedure were met. The licensee identified that the workers failed to follow procedures in unbolting the CRDM, in that they should have cut the lockwire on only 2 bolts, and detorqued and retightened them before proceeding. This could have resulted in catching the error sooner when tools were changed. Also, despite early removal of the flag, the workers had also removed the control rod position indication probe and cable. This provided a second indication of the CRDM to be removed, as only one CRDM had the probe and cable removed at a time.

Licensee corrective actions included improving pre-job briefings, visual indications, self-checking, and control and communications from the control point.

The inspectors determined that there were sufficient barriers in place to have prevented actually removing the wrong CRDM in this case. The inspectors also considered the licensee investigation to be thorough. However, increased emphasis on control of contractors appeared warranted, particularly in evaluating experience and training of workers. The failure of the workers to follow procedure 35.106.013 was a violation of 10 CFR Part 50, Appendix B, Criterion V "Instructions, Procedures and Drawings." However, this licensee identified and corrected violation is being treated as non-cited violation, consistent with section VII.B.1 of the NRC Enforcement Policy. (341/96004-03).

2.6 Turbine Valve Hydraulic Oil Leak Necessitates Power Reduction

On the evening of May 8-9, the licensee reduced power to about 65 percent in order to repair a hydraulic oil leak in the unitized actuator for the Number 3 High Pressure Control Valve. Operator performance during the power reduction was good, and good coordination between maintenance and operations resulted in a short repair time and prompt return to full power.

2.7 Follow-up on Previously Opened Items A review of previously opened items (violations, unresolved items, and inspection followup items) was performed per NRC Inspection Procedure 92902. One non-cited violation was identified.

2.7.1 (Closed) Apparent Violation 341/95013-01: This issue concerned a potential deliberate action by a Refuel Floor Coordinator (RFC) crossing a contaminated area barrier without donning the required clothing. Further review determined that the individual was not in a supervisory position when the violation occurred. Additionally, once the violation was identified, the station took prompt actions by restricting access to both the individual and the individual's immediate supervisor. The individuals completed appropriate training to prevent recurrence. Since the safety significance was minor, the individual was not a supervisor, and appropriate corrective actions were taken, this violation will not be subject to enforcement action because the criteria in Section IV of the NRC Enforcement Policy were met. (341/96004-04). This item is closed.

2.7.2 (Closed) Violation 341/95013-02: Unauthorized changes to refuel floor structures by a RFC did not meet procedural requirements for configuration control. In June 1991 the RFC removed anchor bolts that were installed on the refueling floor for the New Fuel Uprighting Stand mounts and the New Fuel Storage Crate Stop. The licensee reviewed this issue and verified that the appropriate configuration control, including as-built drawings, had been updated. The licensee counselled the individual and verified that additional unauthorized changes did not exist. Appropriate training was also conducted. This item is closed.

2.7.3 (Closed) Violation 341/95013-03: Unauthorized maintenance on the New Fuel Transfer Crane done on August 30, 1992, by a RFC. The licensee counselled the individual and conducted appropriate training to prevent recurrence. In addition, the licensee verified that additional unauthorized maintenance had not occurred. This item is closed.

2.7.4 (Closed) Unresolved Item 341/95013-04: The RFC potentially modified the above-vessel control rod blade unlatching tool. The licensee reviewed the incident and determined that the individual had modified a general tool and not the control rod blade unlatching tool. The licensee procedures allowed modification of general tools without using configuration control measures. Therefore, this action was not in violation of procedures or requirements. The licensee determined that

the change to the general tool did not impact safety. This item is closed.

3.0 ENGINEERING

NRC Inspection Procedure 37551 was used to perform an onsite inspection of the engineering function.

3.1 Turbine Building South Exhaust Fan Failure

On April 16, the south turbine building heating ventilation and air conditioning (TBHVAC) exhaust fan was found to be making a rattling noise and was secured. An inspection found a bolt used to secure the pitch control arm for one blade had broken off, causing minor damage to four blades. DER 96-0454 was written to document the event and track corrective actions. This was the fourth TBHVAC fan failure in two years.

An inspection performed by the vendor identified unexpected wear in the pitch control plate. The licensee was investigating the cause, and was considering the possibility that high winds caused excessive cycling of fan pitch control. Additionally, inspections of the other TBHVAC exhaust fans were planned.

TBHVAC fan failures have significant impact on plant operation by requiring securing of ventilation in the turbine building for fan removal and replacement. The licensee had determined that securing TBHVAC was one of the most significant conditions causing increased main turbine vibration, resulting in frequent alarms and distracting operators in the control room. Management involvement and planning for a system outage and inspection were good, and a good focus was maintained on minimizing the effects on the main turbine.

3.2 RHRSW Cooling Tower Drain Line Plugging

On March 31, during a walkdown of the RHR complex, an inspector discovered that the drain lines on the Division 1 combined return lines to the mechanical draft cooling towers (MDCT) from RHRSW, diesel generator service water (DGSW) and EESW were plugged or partially plugged. The RHRSW system was running at the time. The purpose of the 1-inch drain lines was to drain the portion of the piping that goes outside to prevent freezing following system shutdown. At the time of discovery, the reactor was shutdown and freezing conditions did not exist.

DER 96-0365 was issued to document the event and track corrective actions. Licensee preliminary investigation of the impact of the plugged drain lines on the operability of the MDCTs determined that in the event of prolonged, extremely cold weather conditions the return lines to the MDCT could freeze, rendering the MDCT inoperable. On April 2, the licensee notified the NRC Operations Center of the event. The potential for freezing of the MDCT inlet lines was considered a

condition found while the reactor was shutdown, that had it been found while the reactor was in operation, could have resulted in the plant being seriously degraded or being in an unanalyzed condition that significantly compromises plant safety.

Further investigation of the four drain lines revealed that each division had one drain line completely blocked and the other one partially blocked by corrosion products. The blockages were removed and all drain lines were replaced. Inspection of the MDCTs by the licensee and vendor did not identify any damage due to potential past freezing.

The licensee performed calculation TMFR-96-0073, which determined the length of time it would take the 18" residual heat removal service water lines to the cooling towers to freeze, providing their associated drain lines were plugged. A tabulation of past weather conditions was performed to determine if freezing could potentially occurred during previous winters using site meteorological data from January 1985 through March 1996. This effort concluded that at no time did conditions exist where the lines could have potentially frozen solid. Since the drain lines were unplugged and the MDCT lines were no longer susceptible to complete freezing, it was determined that this event was not reportable, and the event notification was retracted on April 29.

Licensee calculations of time and conditions to cause complete freezing of the 18-inch MDCT return line were independently checked by the NRC using a computer program based on licensee calculation TMFR-96-0073, and it was determined that complete freezing of this pipe was possible in February 1994 during an extended period of severe cold weather. While the licensee had identified this as the most significant period of cold weather, their analysis was not sufficiently rigorous to identify this potential. Also, the NRC considered that the licensee's use of temperature inside the MDCT of 10 degrees higher than outside temperature was nonconservative. The assumption was based on measured temperatures in a different location which was more protected from the weather than the inside of the MDCTs. However, there was no evidence that the drain lines were plugged at that time.

The drain lines were last verified to function during initial startup testing. Since that time, the drain lines were not tested or verified to be functional until the inspectors discovered them to be blocked on March 31, 1996. 10 CFR Part 50 Appendix B, Criteria XI, "Test Control," requires that testing required to demonstrate that structures, systems, and components will perform satisfactorily in service be identified and performed. The failure to test the 1-inch drain line is considered a violation (341/96004-05).

3.3 Inadequate Investigation of RHRSW Flow Reduction

NRC investigation of the above event identified that DER 95-0158, dated February 23, 1995, reported that a flow reduction of about 10 percent occurred while running RHRSW, DGSW and EESW simultaneously when operators shifted flow to the MDCTs by shutting the MDCT bypass valve.

When a low flow alarm for the DGSW pump associated with the running EDG 13 was received, operators reopened the MDCT bypass valve and flow was observed to return to normal. Licensee investigation determined that the flow reduction was anomalous, but failed to determine the cause; icing was not considered despite the sustained cold conditions present at the time. This event was not reviewed by the licensee as part of the investigation into the effects of the drain line plugging or the DGSW pump icing event discussed in Inspection Report 96002.

As of May 2, 1996, the licensee had not determined the cause for the flow restriction identified in February 1995. The degraded flow experienced on a division of safety related service water was a significant condition adverse to quality. 10 CFR Part 50, Appendix B, Criteria XVI "Corrective Actions" requires, for significant conditions adverse to quality, that the cause of the condition is determined and corrective action are taken to preclude repetition. The failure to identify the cause of the February 1995 flow restriction is considered a violation (341/96004-06).

3.4 EECW System Modification Implementation

As previously documented in inspection report 96003, during the performance of a licensee-conducted service water systems operational performance inspection, the licensee identified a condition that could render both trains of EECW inoperable under accident or seismic conditions. The licensee designed and installed a modification to correct the condition and return EECW to an operable status. Subsequent to the modification, the inspector accompanied by two licensee design engineers, performed a walkdown inspection of the as-built modification. The inspector concluded that the modification had been installed and tested according to the approved drawings and specifications.

The modification added a seismically mounted nitrogen source and a connection to EESW to supply EECW makeup water. Engineering calculations showed that running the EESW system should have been sufficient to establish makeup flow. Confirmatory testing, however, revealed that additional pumps in the DGSW and/or RHRSW systems were required to be run in combination with EESW to supply sufficient pressure to establish flow to the EECW system. As a result, EECW system operability became dependent upon the operability of other safety system cooling water systems. Administrative controls to cover system operability appeared adequate. The inspectors were concerned that the initial modification design calculations were inadequate. Pending inspector review of the engineering calculations this issue will be tracked as an Inspection Followup Item (341/96004-07).

3.5 RHRSW System Post Maintenance Testing Problems

RHRSW Pump Discharge Check Valve Problems

On April 13, during a surveillance run of the B RHRSW pump, the licensee determined that the RHRSW Pump D Discharge Check Valve (E1100-F148D) was

not seated properly, resulting in some backflow and reverse rotation of the D RHRSW pump. The licensee declared Division 2 of RHR inoperable and performed an inspection of the valve internals. DER 96-0434 was written to document this event and track corrective actions.

The licensee found that the valve disc was not seating properly due to elongation of the disc stud hole and abnormal stud wear. The valve was repaired and was restored to service. The licensee inspected the A and B trains and identified that the check valves were also worn, requiring repair. The C train was not inspected since that valve was repaired in November 1995 due to similar wear problems.

The licensee had intended to inspect the A, B, and D check valves during the next refueling outage, based on the analysis of the November failure of the C valve indicating the valve failed somewhat earlier than expected. Historical information indicated the remaining valves should have performed properly until the refueling outage.

Water Hammer Event During Post-Maintenance Testing

On April 15 the licensee performed the post maintenance test for the repaired Division 2 check valves by running Division II RHRSW Pump and Valve Operability Test (24.205.06). Upon completion of Section 5.1.22, RHRSW Pump D was secured and fluttering of the B check valve was heard by the operators. The flow path through the RHR heat exchanger was then secured by shutting RHRSW Division 2 Heat Exchanger B SW Outlet Isolation Valve (E1150-F068B) and the B pump was started to verify operation of the associated minimum flow valve; a water hammer event was witnessed by operators near the RHRSW pumps. DER 96-0443 was written to document this event and track corrective actions.

Engineering determined that the most likely cause of the water hammer was the creation of a void by the normal draining of the discharge header of the D pump. The pressure in the common discharge header was lowered sufficiently to open the B discharge check valve, allowing air from the drained B pump casing to enter the discharge header. When the B pump was subsequently started, a water hammer event resulted.

No similar events were identified during previous performances of this surveillance. Engineering postulated that this was because the surveillance was recently changed to record flow data for the RHRSW pumps separately; these pumps were normally run together, and so would normally be secured nearly simultaneously, avoiding the above scenario.

Engineering performed a walkdown of accessible piping and determined that no damage occurred. Design calculation DC-5474 dated July 14, 1992, considered RHRSW pipe voiding due to leakage through the discharge check valves, and concluded that the system should be able to perform its intended safety function following this event.

While the inspectors considered the licensee's response to the failure of the D check valve to be prompt and thorough, the investigation and

root cause determination of the water hammer event that occurred during the post-maintenance test were not well-coordinated or aggressive. The investigation did not include interviewing the operators that witnessed the event, and as a result did not promptly identify the location of the water hammer (i.e., inside the reactor building or in the RHR complex) to help identify the initiating event.

3.6 Repeat Primary Coolant Sample Flow Gage Glass Failure

During a plant pressure increase as part of plant startup on April 18, the flow gage glass associated with Sample Point 37 (from Reactor Recirculation Loop B) ruptured and caused a spill while the sample point was in service. The leak was identified when a chemistry technician went to the sample sink to check its operation, stepped in the spill, and was contaminated. The leak was promptly reported to the control room and isolated remotely using the associated containment isolation valves.

The same flow glass had cracked and leaked on August 1, 1995, as documented in Inspection Report 95009. That failure occurred while placing the sample point in service, and had been attributed to age or material defect.

As a result of the second failure, the licensee was investigating the possibility of vibration induced failure or overpressure. Some chemistry technicians reported that, while attempting to place Sample Point 37 in service, a flow resonance region was sometimes exhibited, causing vibrations and noise. The chemistry technicians' report of pipe vibrations and flow resonance was apparently not considered in the investigation of the first failure. At the end of this inspection period, licensee investigation for the cause for the repeat failure of the sight glass was still in progress. Pending inspector review of licensee investigation results and corrective actions this issue will be tracked as an Inspection Followup Item (341/96004-08).

3.7 Active Seismic Monitoring System

During a review of testing requirements for a modification package involving the plant's active seismic monitoring system, the license determined that the existing system surveillance test may not satisfy TS requirements for the channel functional test or channel calibration. Specifically, the 0.01g trigger setpoint was not tested.

Licensee short term corrective action was to send the instruments offsite for calibration one at a time. The long term corrective action was to replace the currently installed active seismic monitoring system with a digital system later in 1996.

The licensee planned to submit a special report on this issue as required by TS 3.3.7.2. This will be considered an Inspection Followup Item pending review of the licensee's report (341/96004-09).

3.8 RCIC Turbine Steam Inlet Valve Leakage

The inspectors reviewed Fermi's actions in response to the RCIC Turbine Steam Inlet Valve (E5150-F045) seat leakage. Following the April 18 startup surveillance testing, the licensee observed that the valve failed to seat tightly, allowing steam to leak by the seat. This globe valve was refurbished during the fourth refueling outage, and was inspected during the forced outage due to repeated problems with seat leakage.

Valve seat leakage was previously reduced by manually shutting the valve. Subsequent disassembly and reinspection of the valve, including a seat contact blue-check examination, did not clearly identify a root cause for the leakage. Subsequent increased torque switch settings controlled the seat leakage. The resulting torque and thrust values were above the actuator design values but were permissible based on application of Kalsi test-based overthrust and overtorque allowables (approximately 182 percent and 129 percent, respectively, of the actuator's thrust and torque ratings). However, this action resulted in actuator stroke cycles being administratively limited to approximately 31 cycles as of May 15.

The inspectors noted that the root cause determination for the seat leakage was inconclusive, but the overall actions taken were initially considered acceptable in view of licensee's plans to replace the valve during the fifth refueling outage (RF05). However, the inspectors were concerned with a subsequent change in plans to defer the valve replacement until the sixth refueling outage (RF06). The licensee considered that there was insufficient time before the RF05 outage to do a thorough engineering design package, and believed that there would be enough stroke life available to ensure actuator operability through RF06. Of primary concern was that the plant did not have any definite plans to, as a minimum, inspect the actuator during RF05 as recommended by the actuator vendor.[1] In response to these concerns, the licensee MOV staff stated that the vendor-recommended inspection would be considered during the RF05 outage. Pending inspector review of the results of the licensees evaluation of the RCIC turbine steam inlet valve actuator this issue will be tracked as Inspection Followup Item (341/96004-10).

3.9 Rod Worth Minimizer Problems Delayed Startup

On April 18 prior to startup from the forced outage, operators performed the RWM Functional Test (24.608) and identified two anomalies in system messages. In each case, engineering was contacted and the vendor

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[1]As addressed in Limitorque Maint. Update 92-1 and the NRC inspection of Limitorque (IR 99900100/93-01, Sect. 3.3.7) Limitorque recommends inspection of the actuator if 1) thrusts above 162% of the thrust rating are imposed on the actuator more than once or 2) torques above 120% of the torque rating are imposed on the actuator more than once.

consulted. The vendor recommended removing and restoring power to reboot the program. This was performed and the functional test was re-performed without observing any anomalies.

Startup was commenced, but operators found that the second rod on the control rod pull sheet was supposed to be bypassed because it was inserted for power suppression near a fuel leak. It was realized at that time that rebooting the RWM removed the bypasses that existed before rebooting. As a result, no other control rods could be withdrawn.

The licensee concluded that they should have realized RWM bypasses would be lost; however, the system engineer had recently taken over the system, and turnover was not complete. Corrective actions included vendor training and finishing turnover for the system engineer, changing procedures to identify this system characteristic, and having the nuclear engineer check RWM user-defined functions before and after rebooting.

While prompt engineering support for problems identified by operators was provided, the final result was marred by lack of system knowledge and sensitivity to the special conditions (i.e., control rod bypasses) existing at the time of the problem.

3.10 Followup on Previously Opened Items NRC Inspection Procedure 92903 was used to perform a review of previously opened items (violations, unresolved items, and inspection followup items). No problems were identified, and the following items were closed:

3.10.1 (Closed) Inspection Followup Item 341/95012-06: In October 1995, the licensee identified problems with CRDM 30-23. The problems exhibited included slightly degraded scram times and difficulty in withdrawing the control rod following a scram. CRD 30-23 exhibited some symptoms similar to those exhibited by CRDs which had improperly sized flange check valve balls installed. Although the licensee had evidence that CRDM 30-23 potentially had a small ball, an extensive effort was exerted to justify continued operability of the CRDM, as documented in Inspection Report 96002.

During the forced outage this inspection period, CRDM 30-23 was removed from the reactor vessel. The licensee subsequently identified that an undersized flange check valve ball was installed, thereby explaining the performance anomalies.

In May 1995, the licensee recognized that CRDM 30-23 might have had an undersized CRDM flange check valve ball installed. This was based on the fact that the CRDM was rebuilt at the same time three other CRDs with confirmed undersized balls were rebuilt. Though work documentation for CRDM 30-23 did not indicate a small ball was installed, inventory of parts used during the rebuild activity indicated that a small ball was unaccounted for. The failure to inspect CRDM 30-23 when the opportunity existed in

June 1995 resulted in the engineering and operations staffs exerting much effort to justify operability of the CRDM. The inspectors confirmed that the safety function of CRDM 30-23 was not affected, based on licensee scram time data. This item is closed.

3.10.2 (Closed) Inspection Followup Item 341/96003-04: The licensee identified increased radiation levels in the off-gas system. The forced outage delayed plans to determine if the change was from the known fuel leak or due to a new one.

During the weekend of May 4-5, the licensee performed power suppression testing and identified a second minor fuel leak on the periphery of the core on the opposite side from the original leak. Two adjacent control rods were inserted to locally suppress power to minimize the chances of increasing the leak rate.

Station personnel, particularly engineering and operations, coordinated well in performing testing and suppressing power near the leak. This was consistent with actions taken in identifying and suppressing the original leak in October 1995. Station personnel continued to exhibit a questioning attitude and conservative actions toward fuel leaks. This item is closed.

3.10.3 (Closed) Unresolved Item 341/93023-02: Inadequate Vendor Manual Document Control Program. This item discussed the excessive time between when vendor manuals were received and when they were reviewed and approved for use. The licensee implemented action to improve vendor manual control. As a result, the vendor manual review backlog has been reduced. This item is closed.

4.0 PLANT SUPPORT

NRC Inspection Procedures 71750 and 83750 were used to perform an inspection of Plant Support Activities.

4.1 Performance in Radiological Controls

The inspectors verified that personnel were following health physics procedures for dosimetry, protective clothing, frisking, posting, etc., and randomly examined radiation protection instrumentation for use, operability, and calibration. No deficiencies were identified, although some problems are discussed below.

Radiation protection support of work inside the primary containment was very good. However, decontamination and equipment removal work under the reactor vessel was performed before control rod post-maintenance tests (PMTs) were performed. A number of control rod PIP problems were identified during the PMTs that management conservatively decided to fix before ending the outage. This lack of coordination/planning resulted in some increased radiation dose because some equipment had to be reinstalled under the reactor.

4.1.1 Personnel Contaminated During Reactor Water Cleanup (RWCU) Pump Maintenance

On April 30, while attempting to remove the South RWCU Pump casing for seal replacement, a spiral wound gasket unexpectedly unwound causing airborne contamination levels higher than expected. The pre-job ALARA review had concluded that the use of respirators would increase total dose, so they were not used. When the gasket uncoiled, 4 workers were contaminated, including minor injestions. This is considered an inspection followup item (341/96004-11) pending review of the licensee's investigation.

4.1.2 Inadequate Contamination Boundary Control

On May 1 during a routine plant tour, an inspector identified several contamination boundary control problems in the turbine building second floor decontamination room. Specific problems identified included:

- a plastic bag with contaminated tools laid across contaminated area boundary;
- a plastic bag with contaminated hose stored across contaminated area boundary;
- a dolly stored across contaminated area boundary;
- step-off pad inaccessible due to improper material storage;
- gloves and tape laying adrift on boundary, and;
- a contaminated area boundary rope not hung across entire contaminated area.

Following inspector identification of the above problems, licensee radiation protection response was aggressive and prompt. Actions were taken immediately to survey the affected areas and restore the contaminated area boundaries. In a memorandum dated May 7, 1996, radiation protection supervision reiterated their expectations on ensuring that boundaries are adequately maintained. No contamination was found outside the boundaries.

4.2 Safeguards

Each week during routine activities or tours, the inspectors monitored the licensee's security program to ensure that observed actions were being implemented according to the approved security plan. No problems or deviations were identified.

5.0 SAFETY ASSESSMENT AND QUALITY VERIFICATION

Inspectors used Inspection Procedure 40500 to evaluate licensee self-assessment activities. Inspectors reviewed Quality Assurance (QA) audits of Maintenance Rule implementation and the Corrective Action program.

Maintenance Rule Audit

This audit was conducted on the Maintenance Rule Program preliminarily implemented at Fermi in January 1996. The audit identified that higher level administrative conduct procedures did not exist for the Maintenance Rule, making it difficult to develop plant implementing procedures. Also, the report indicated that Maintenance Rule Monitoring Reports were in some cases showing good system performance while System Health Reports characterized the same system as a poor performer.

Corrective Action Program Audit

The QA audit on Evaluations and Corrective Actions Program provided a detailed and critical review of the corrective actions process. The audit team concluded that root cause evaluations were often ineffective, and were frequently conducted by personnel unqualified to perform root cause evaluations, then checked at the last minute by a qualified individual. Additionally, the audit team concluded that corrective actions needed to be strengthened to avoid recurrence, noting that only "soft" corrective actions (e.g., conducting training or lessons learned meetings) were sometimes used in cases which more solid action was appropriate.

The inspectors concluded that these two audits were effective assessments. Additionally, the depth and critical nature of the audits and reports provided effective information and clear recommendations for plant management. These two audits reflected the continued recent improving trend noted in QA products.

6.0 PERSONS CONTACTED AND MANAGEMENT MEETINGS

6.1 Exit Meeting

The inspectors presented the inspection results to member of licensee management at the conclusion of the inspection of May 15, 1996. The licensee acknowledged the findings presented.

The inspectors asked the licensee whether any materials examined during the inspection should be considered proprietary. No proprietary information was identified.

6.2 Senior Management Visit

On April 24, B. Beach, Deputy Regional Administrator, Region III, and W. Axelson, Director, Division of Reactor Projects, Region III, were on site to observe plant activities and conduct meetings with the licensee staff.

6.3 Pre-decisional Enforcement Conference

On April 15, a pre-decisional enforcement conference was held at the NRC Region III office to discuss potential enforcement issues identified in Inspection Report 50/341-96002. The issues related to the icing of diesel generator service water pumps. Slides used in the licensee's presentation at the conference are enclosed with this report.

PARTIAL LIST OF PERSONS CONTACTED

Licensee

S. Booker, Assistant Supervisor, Maintenance
W. Colonnello, Director, Safety Engineering
R. Delong, Superintendent, Rad/Chem
T. Dong, System Engineering Supervisor, NSSS
R. Eberhardt, Director, Nuclear Training
P. Fessler, Plant Manager
D. Gipson, Senior Vice President
L. Goodman, Director, Nuclear Licensing
T. Haberland, Superintendent, Work Control
M. Hoffmann, Supervisor, Audits, NQA
R. Johnson, Acting Director, NQA
E. Kokosky, Assistant RPM
J. Korte, Director, Nuclear Security
R. McKeon, Assistant Vice President, Operations
W. Miller, Director, System Engineering
J. Nolloth, Superintendent, Maintenance
D. Ockerman, Superintendent, Operations
J. Plona, Technical Director
W. Romberg, Assistant Vice President, Technical
J. Thorson, Supervisor, Reactor Engineering
E. Vinsko, Supervisor, I&C

NRC

A. Vegel, Senior Resident Inspector
C. O'Keefe, Resident Inspector

ITEMS OPENED AND CLOSED

Opened

50-341/96002-14	NCV	Disconnect opened and jumper installed on wrong motor control cabinet position
50-341/96002-15	NCV	Failure to open NIAS cross tie valve
50-341/96002-16	NCV	Failure to follow breaker operation procedure
50-341/96002-17	NCV	Charging water isolation valve left closed
50-341/96004-01	NCV	Torus sample not taken prior to purging
50-341/96004-02	NCV	Failure to evaluate debris in UHS reservoir
50-341/96004-03	NCV	Failure to follow CRDM removal sequence
50-341/96004-04	NCV	Individual crossing contamination barrier without proper clothing
50-341/96004-05	VIO	Failure to test one inch RHRSW drain line
50-341/96004-06	VIO	Failure to identify cause for RHR flow degradation
50-341/96004-07	IFI	Review of design calculation for EECW modification
50-341/96004-08	IFI	Repeat primary coolant sample flow gage glass failure
50-341/96004-09	IFI	Review of testing requirements for seismic monitoring system
50-341/96004-10	IFI	Review results of RCIC steam admission valve actuator inspection
50-341/96004-11	IFI	Personnel contaminations during RWCU maintenance

Closed

50-341/93023-02	URI	Inadequate vendor manual document control program
50-341/94011-01	VIO	Locked valve discrepancy
50-341/95012-06	IFI	Problem associated with control rod drive
50-341/95013-01	VIO	Individual crossing contamination barrier without proper clothing
50-341/95013-02	VIO	Unauthorized changes to refuel floor structures
50-341/95013-03	VIO	Unauthorized maintenance on new fuel transfer crane
50-341/95013-04	URI	potential modification of control rod blade unlatching tool
50-341/96002-14	NCV	Disconnect opened and jumper installed on wrong motor control cabinet position
50-341/96002-15	NCV	Failure to open NIAS cross tie valve
50-341/96002-16	NCV	Failure to follow breaker operation procedure
50-341/96002-17	NCV	Charging water isolation valve left closed
50-341/96003-01	IFI	torus sample not taken prior to purging
50-341/96003-04	IFI	increased radiation levels in the off-gas system
50-341/96004-01	NCV	Torus sample not taken prior to purging
50-341/96004-02	NCV	Failure to evaluate debris in UHS reservoir
50-341/96004-03	NCV	Failure to follow CRDM removal sequence
50-341/96004-04	NCV	Individual crossing contamination barrier without proper clothing
50-341/96004-12	NCV	Failure to control contamination boundary

Detroit Edison

Enforcement Conference

Design Issues Associated With DGSW Pumps

April 15, 1996

Agenda

- Introduction.....Doug Gipson
- Description And Cause Of Event.....Paul Fessler
- Corrective Actions.....Paul Fessler
- Management Issues.....Paul Fessler
- Mitigating Factors For The Violation.....Bill O' Connor
- Summary.....Doug Gipson

Description And Cause Of Event

- February 5, 1996
  - 0837: Started Division I RHRSW Pumps
    - No Anomalies Noted
  - 1324: Started DGSW Pump 'A' For Surveillance Test
    - No Anomalies Noted
  - 1431: Started DGSW Pump 'C' For Surveillance Test
    - Several Anomalies Noted During Pump Start
    - Declared EDG 12 Inoperable
    - Commenced Troubleshooting DGSW Pump 'C'
      - Several Pump Start Attempts To Gather Data
      - Manual Pump Shaft Rotation
      - Air Purge Of Pump Column And Inlet

Description And Cause Of Event

(continued)

- February 5, 1996 (continued)
  - 1455: Verified Division II EDGs, Required Equipment Powered By Division II EDGs, And Offsite Power Sources Operable
  - 2021: DGSW Pump 'C' Successfully Run
    - EDG 12 Still Considered Inoperable
- February 6, 1996
  - 0332: DGSW Pump 'A' Successfully Tested
  - 1321: DGSW Pump 'C' Successfully Tested
  - 1640: Started Division I EESW Pump
    - No Anomalies Noted

Description And Cause Of Event

(continued)

- February 6, 1996 (continued)
  - 1910: Declared DGSW Pump 'C' And EDG 12 Operabie
  - 1926: Began Starting Division II SW Pumps
  - 1926: Started DGSW Pump 'B'
    - Initially Showed Same Symptoms As DGSW Pump 'C'
    - Normal Pump Parameters After 90 Seconds
  - 1945: Completed Running Remaining Division II SW Pumps
    - No Other Anomalies Noted

Description And Cause Of Event

(continued)

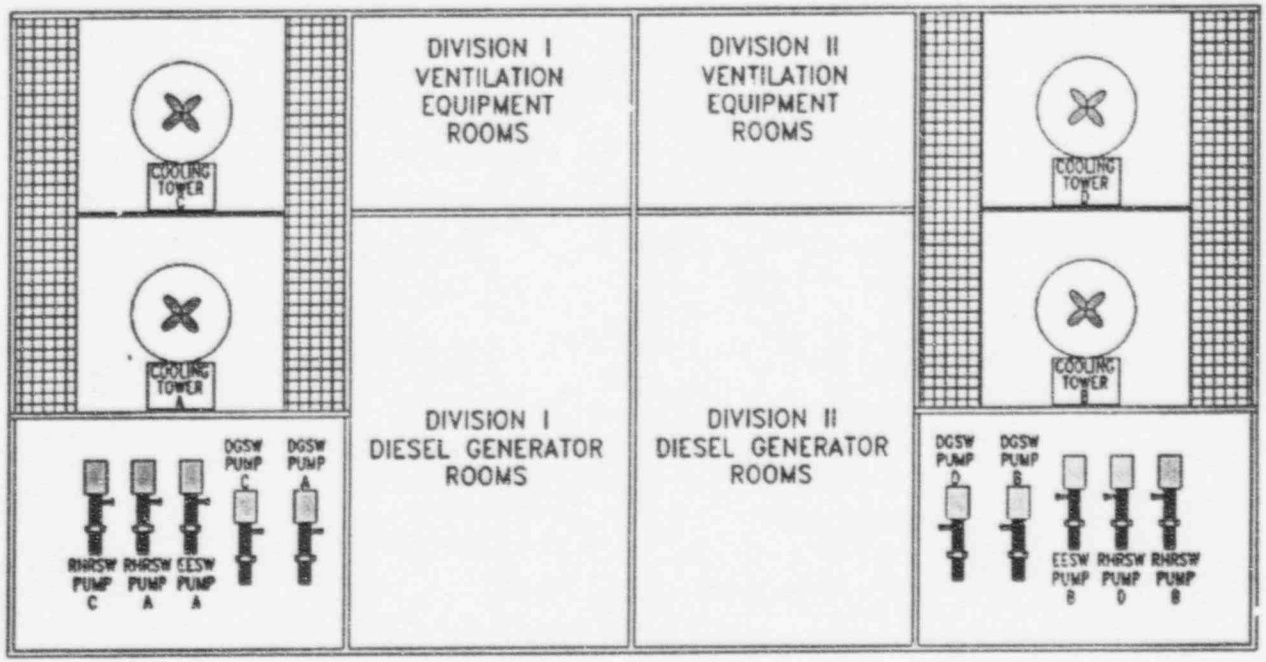
- RHR Complex Designed To Protect Safety Related Components At Sustained Freezing Temperatures
- Concern About Sub-Freezing Reservoir Water Temperatures In December 1983
  - Technical Specification To Maintain Reservoir Water Above 41 Degrees Fahrenheit
  - Engineering Study Addressed Freezing Of Water Inside Pump Casing At Or Below Reservoir Surface If Reservoir Temperature Is Allowed To Fall Below 39 Degrees Fahrenheit

Description And Cause Of Event

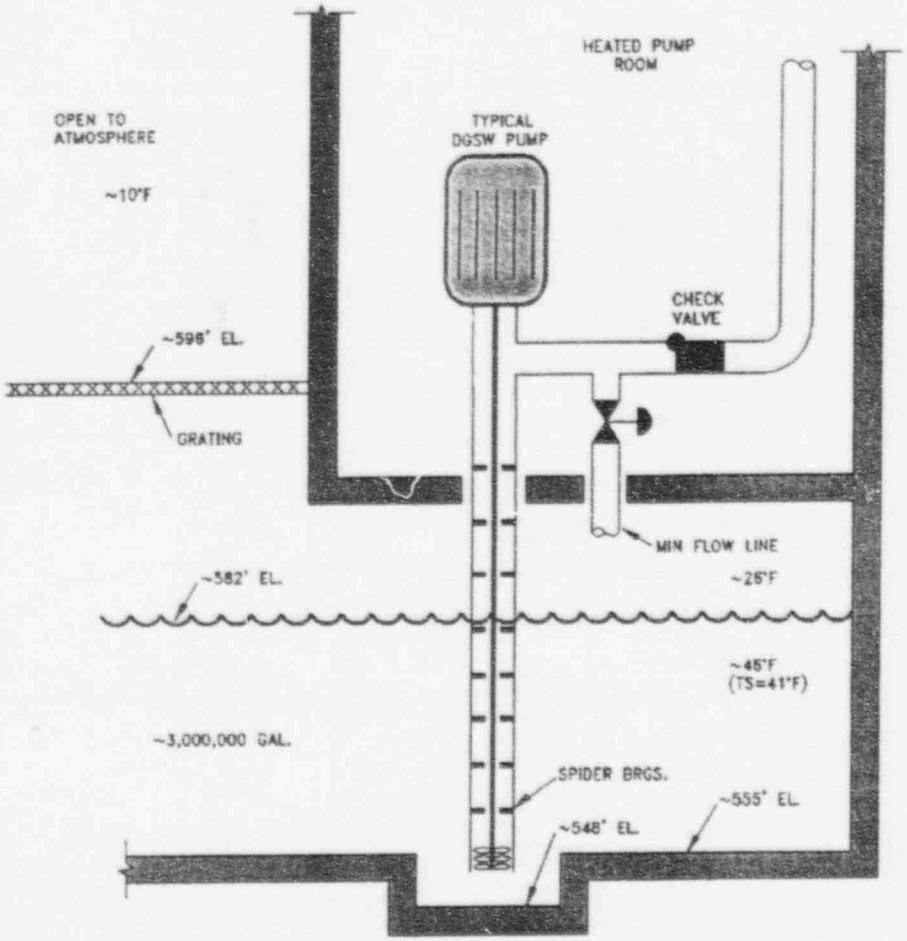
(continued)

- Design Issues
  - Effects Of Sub-Freezing Temperatures In Air Space Above Reservoir And Below Pump Room Floors
  - DGSW Check Valve Back Leakage
    - Pump Column Designed To Drain Upon Stopping Pump

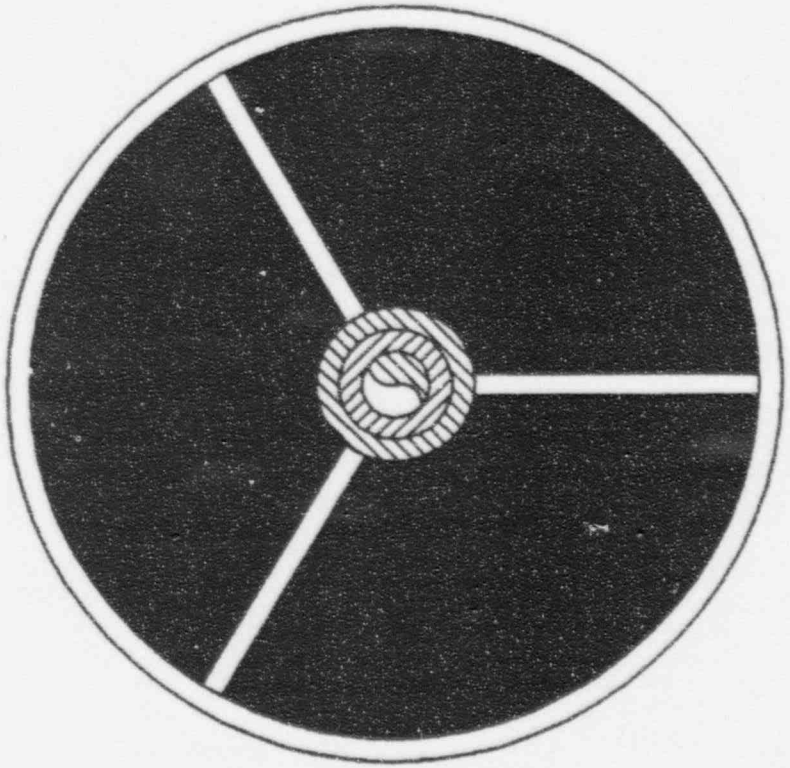
Simplified RHR Complex Layout



Simplified RHR Complex Elevation



Typical View Of Spider Bearing Looking Axially Down Pump Column



Description And Cause Of Event

(continued)

- Cause Of DGSW Pump 'C' Inoperability
  - Initial Pump Shaft Binding Caused By Ice Formation On Pump Bearing
  - Subsequent Pump Problems Caused By Ice Blockage In Pump Column Or Casing
- Significant Conclusions
  - Other Similarly Designed SW Pumps Were Susceptible To This Common Cause Failure Mechanism
  - Design Inadequacies In RHR Complex Design

Corrective Actions

- Established Team To Determine Cause Of DGSW Pump 'C' Anomalies
- Restored DGSW Pump 'C' To Functional Status
- Confirmed Operability Of Other Safety Related SW Pumps In RHR Complex
- Air Space Temperature Monitoring
  - Requirement To Run All Affected SW Pumps To Confirm Operability If Air Space Temperature Falls Below 36 Degrees Fahrenheit For Three Consecutive Shifts
  - Established In Night Orders On February 8, 1996

Corrective Actions (continued)

- Air Space Temperature Monitoring (continued)
  - Later Reviewed By Onsite Review Committee
- Senior Management Critique Of Event
- Staff Required Reading Of Memorandum From Senior Vice President
  - Lessons Learned From Event
  - Recognition Of And Sensitivity To Potential Common Cause Failures
- Assessment Of Staff Training Needs Based On Event

Corrective Actions *(continued)*

* RHR Complex Temperature Monitoring Proceduralized
* Evaluating Design Changes For RHR Complex
* Evaluating Similar Safety Related And Non-Safety Related Equipment Configurations

Management Issues

- Failure To Take Conservative Action Upon Recognition Of Potential Common Cause Failures
  - Excerpt From Senior Vice President Memorandum
    - "If the potential for a common mode failure exists, is it possible to assure ourselves that it's not a common mode failure by demonstrating the other division actually works and is OK? In this case the potential common mode considered was cold weather effects on the structure, reservoir and pumps in the RHR Complex. A conservative simplistic approach to verify it was not a common mode failure potential would have been to ensure the pumps would all start and develop rated flow and pressure."

Management Issues (continued)

- Focus Was On Solving Problem With DGSW Pump 'C'
- Rationalization Of Course Of Action
  - No History Of Pump Inoperability During Cold Weather Conditions
  - DGSW Pump 'A' Had Been Successfully Tested Immediately Prior To Testing DGSW Pump 'C'
  - Belief That Design Of RHR Complex And SW Pumps Had Accounted For Cold Weather Operations

Management Issues (continued)

- Rationalization Of Course Of Action (continued)
  - Higher Temperatures Measured In Other Division Of RHR Complex Air Space
  - Division II SW Pumps Had Been Run More Recently Than Division I Pumps
- Prevailing Mindset Of Management And Staff
  - Desire To Fully Understand Failure Mechanism Before Applying Information To Similar Situations
    - Criticism Of Adequacy Of Past Root Cause Evaluations And Corrective Actions
    - Common Cause Failure Mechanism Judged Unlikely And Was Not Aggressively Pursued

Management Issues (continued)

- Prevailing Mindset Of Management And Staff (continued)
  - Belief That Full Surveillance Tests Needed To Be Performed On Redundant Equipment To Confirm Operability
    - Could Have Led To Delays In Determining Root Cause Of DGSW Pump 'C' Inoperability
  - Documentation Review Sufficient To "Verify" Operability Of Redundant Equipment
    - Literal Compliance With Technical Specifications Implies Adequacy Of This Practice
    - Practice May Not Be Applicable In All Situations

Management Issues (continued)

- Corrective Actions
  - Additional Staff And Management Training
    - Geared Toward Licensed Operators, Engineering And Plant Staff, And Management
    - Case Study Format
      - Interrelationship Between Plant Design Basis, UFSAR, Technical Specifications And Plant Procedures
      - Examples Of Potential Common Cause Failures And Appropriate Actions To Take Upon Identification
      - Senior Management Perspective On Event And Its Significance

Mitigating Factors For The Violation

- Licensee Identified
  - Found During Scheduled Surveillance Testing
- No Missed Opportunities To Identify Deficiency
  - No Prior Known Occurrences At Fermi 2
  - Little Industry Information On The Identified Pump Failure Mechanism
  - Cause Of Event Was Not Readily Apparent
    - Cold Air Space Between Two Warmer Bodies In RHR Complex
    - Meteorological Conditions During Event
    - Nine Of Ten SW Pumps Were Capable Of Performing Their Intended Functions

Mitigating Factors For The Violation (continued)

- No Escalated Enforcement Actions For Two Years
- Effective Corrective Actions
  - Prompt Actions After Complete Understanding Of Event
  - Sufficiently Comprehensive To Preclude Similar Common Cause Failure Recognition Problems
    - Recent Events
      - EDG Fuel Oil Contamination
      - Plant Shutdown Due To EECW System Design Inadequacies
      - Blockage Of RHR Complex Cooling Tower Inlet Piping Drain Lines