U.S. NUCLEAR REGULATORY COMMISSION

REGION III

Report No. 50-341/93028 (DRP)

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

Licensee: Detroit Edison Company
2000 Second Avenue
Detroit, MI 48226

Facility Name: Fermi 2

Inspection At: Fermi Site, Newport, Michigan

Inspection Conducted: December 13, 1993, through February 8, 1994

Inspectors: W. J. Kropp
K. Riemer
S. Stasek
R. Twigg

Approved By: _____ 2/22/94
M. P. Phillips, Chief Date
Reactor Projects Section 2B

Inspection Summary

Inspection from December 13, 1993, through February 8, 1994
(Report No. 50-341/93028 (DRP))
Areas Inspected: Routine, unannounced safety inspection by the resident inspectors of operational safety verification, cold weather preparations, engineered safety feature systems, onsite event follow-up, current material condition, housekeeping and plant cleanliness, radiological controls, security, corrective action improvement program, maintenance and surveillance activities, engineering and technical support, and review of licensee reports.

Results: Within the twelve areas inspected, no violations, deviations, or unresolved items were identified. Five inspection followup items were identified that pertained to a loss of off-site power (paragraph 2.d), an Unusual Event declared as a result of a fire in the turbine building (paragraph 2.d), oil intrusion into the turbine building HVAC system (paragraph 2.e), an EDG failure (paragraph 5.a), and a contractor control issue associated with cleanup evolutions (paragraph 5.b).

The following is a summary of the licensee's performance during this inspection period:

Operations:

The operators' response to the December 25 turbine-generator failure event is documented in Inspection Report 50-341/93029. Operators responded appropriately to the January 27 loss of Division 1 offsite power. The operators' response to the January 29 Unusual Event was also timely and correct. There were instances where contractor oversight should be improved. In the first case, material supplied by the contractor was found defective during post-installation testing. In the second case, the NRC inspectors found contractor personnel had hung personal clothing on station air system valve handwheels and noted a contract individual sitting on a run of station air system piping.

Maintenance and Surveillance:

The December 25 event resulted in severe damage to the Fermi 2 turbine-generator system and caused a discharge of large quantities of oil and water to the turbine and radwaste buildings. Maintenance personnel satisfactorily supported the initial clean-up and recovery efforts associated with the turbine-generator failure event.

Engineering and Technical Support:

Engineering personnel satisfactorily supported the scram investigation and turbine-generator assessment activities initiated as a result of the December 25 event and recovery and investigative efforts associated with plant restoration. Engineering's initial response and troubleshooting efforts associated with the December 16 EDG-13 test failure were timely.

DETAILS

1. Persons Contacted

Detroit Edison Company

*S. Bartman, Supervisor, Chemistry
J. Bragg, Group Leader, QA Audits
*R. Delong, Superintendent, Radiation Protection
R. Eberhardt, Assistant to Plant Manager
*P. Fessler, Director, Technical Manager
*L. Fron, Supervisor, Turbine
*D. Gipson, Senior Vice President, Nuclear Generation
L. Goodman, Director, Nuclear Quality Assurance
*E. Hare, Senior Compliance Engineer
*H. Higgins, Supervisor, Operations Support
*J. Korte, Director, Nuclear Security
J. Malaric, Supervisor, Modifications
*R. Matthews, Supervisor, Shift Testing
*R. McKeon, Plant Manager, Nuclear Production
*W. Miller, Technical Support
*R. Newkirk, Acting Director, Licensing
E. Nickolite, GS ICMA, Maintenance
*J. Nolloth, Superintendent, Maintenance
*J. Nyquist, Supervisor, Safety Engineering
*D. Ockerman, Director, Nuclear Training
J. Pendergast, Compliance Engineer
G. Pierce, Work Control
*J. Plona, Superintendent, Operations
*D. Powell, Nuclear Shift Supervisor, Operations
*T. Schehr, Supervisor, Work Planning
*G. Smith, Director, Nuclear Fuel
*R. Szkotnicki, Supervisor, Inspection & Surveillance
J. Tibai, Compliance, Licensing
*J. Walker, Director, Plant Engineering

*Denotes those attending the exit interview conducted on February 8, 1994.

The inspectors also had discussions with other licensee employees, including members of the technical and engineering staffs, reactor and auxiliary operators, shift supervisors, and electrical, mechanical and instrument maintenance personnel, and security personnel.

2. Plant Operations

Fermi 2 operated at power levels up to 93.5 percent until December 25, 1993, when a reactor trip occurred due to catastrophic failure of the turbine. The event is discussed in paragraph 2.d of this report with details documented in Inspection Report 50-341/93029. The plant was placed in a cold shutdown condition after the event and remained that way throughout the rest of the inspection period.

a. Operational Safety Verification (71707)

The inspectors verified that the facility was being operated in conformance with the license and regulatory requirements, and that the licensee's management control system was effective in ensuring safe operation of the plant. On a sampling basis, the inspectors verified proper control room staffing and coordination of plant activities; verified operator adherence with procedures and technical specifications; monitored control room indications for abnormalities; verified that electrical power was available; and observed the frequency of plant and control room visits by station management.

The inspectors reviewed applicable logs and conducted discussions with control room operators throughout the inspection period. The inspectors observed a number of control room shift turnovers. The turnovers were conducted in a professional manner and included log reviews, panel walkdowns, discussions of maintenance and surveillance activities in progress or planned, and associated LCO time restraints, as applicable.

During observations of work activities on the turbine deck, the inspector noted instances where contractors had hung personal clothing on station air system valve handwheels. The inspector also noted a contract individual sitting on a run of station air system piping. Although these examples were not, in themselves, safety significant, the inspector was concerned with the lack of sufficient control over contractor work activities that this demonstrated. The inspector immediately informed the Plant Manger, who issued a directive to all superintendents at the next morning meeting to ensure that contractor control was maintained.

b. Cold Weather Preparation (71714)

The inspectors completed a review of the licensee's process to ready the unit for cold weather operations. The inspector's review included direct observation of components or systems potentially affected by cold weather, log reviews to check for cold weather related problems, interviews with licensee personnel, and documentation review of the licensee's cold weather preparation procedure, NPP-27.000.04, "Freeze Protection Lineup Verification".

No substantive concerns were identified as a result of the review. Safety-related as well as balance-of-plant (BOP) equipment and systems that would be sensitive to cold weather conditions were adequately addressed by the licensee's procedures and preparations.

c. Engineered Safety Feature (ESF) Systems (71710)

During the inspection, the inspectors selected accessible portions of several ESF systems to verify status. Consideration was given to the plant mode, applicable Technical Specifications, Limiting Conditions for Operation requirements, and other applicable requirements.

Through observation, the inspectors verified that the following items were acceptable: installation of hangers and supports; housekeeping; freeze protection, if required, was installed and operational; valve position and conditions; potential ignition sources; and major component labeling, lubrication, cooling, etc. The inspectors also verified that instrumentation was properly installed, calibrated, and functioning and that significant process parameter values were consistent with expected values; that necessary support systems were operational; and that locally and remotely indicated breaker and valve positions were in agreement.

During the inspection, the accessible portions of the following ESF systems were walked down with no concerns identified:

- Division I Emergency Diesel Generators
- Divisions I and II Core Spray System
- Divisions I and II RHR/LPCI
- High Pressure Coolant Injection

d. Onsite Event Follow-up (93702)

During the inspection period, the licensee experienced several events, some of which required prompt notification of the NRC pursuant to 10 CFR 50.72. The inspectors pursued the events onsite with licensee and/or other NRC officials. In each case, the inspectors verified that any required notification was correct and timely. The inspectors also verified that the licensee initiated prompt and appropriate actions. The specific events were as follows:

December 25, 1993: While the plant was operating at 93 percent power, a turbine trip with subsequent reactor trip occurred at 1:15 p.m. The trip was caused by a catastrophic failure of the turbine, and resulted in the licensee declaring an Alert. The details of this event are documented in the NRC's Augmented Inspection Team report No. 50-341/93029.

January 27, 1994: At 1:05 p.m. (EST) offsite power was lost to the Division I switchyard, causing a loss of the Div. I reactor protection system (RPS) MG set and resulting Group IV isolation signal. The southern Michigan area had been experiencing an ice storm with freezing rain at the time of the failure. Division I Emergency Diesel Generators (EDG) also autostarted upon bus

undervoltage, and loaded vital equipment to the bus. By design, the inboard suction valve for shutdown cooling closed as part of the Group IV isolation. Shutdown cooling was lost for about 57 minutes, during which time the reactor coolant system temperature rose from 101°F to 116°F. Cooling was restored after repowering the RPS motor-generator set, clearing the isolations, and completing fill and vent procedures for the RHR pump. Division I offsite non-vital power was restored initially by starting the combustion gas turbines (CTG) that are connected to the Fermi 1 site, and backfeeding from there. Upon restoration of supply from the Luzon and Custer lines, Division I was powered from those sources and the CTG was turned off. When power was transferred from the diesel generators, a small frequency oscillation was observed (59.5 To 60 hertz) on EDG #12. The licensee conservatively declared the EDG inoperable while the frequency was adjusted. When the incoming 120 kV Swan Creek line experienced a fault, the isolation breaker failed to open. In addition a breaker failure relay also failed to operate correctly to trip the breaker. Preliminary analysis by the licensee indicated that the contacts for the timer on the relay had foreign material present which prevented the relay from opening. A subsequent, unrelated fault on another incoming line to the Division I switchyard then precipitated the loss of all offsite electrical power to Division I. The utility's System Maintenance division (non-Fermi specific) initiated an investigation of the breaker failure. The inspectors were concerned that component failures in conjunction with two line faults caused a loss of Division I Offsite Power. Pending licensee and NRC review of the results of the breaker inspection, this item is an Inspection Followup Item (341/93028-01(DRP)).

January 29, 1994: At 6:54 a.m. (EST) a fire occurred in the turbine building passenger elevator shaft. At 7:04 a.m., operators declared an Unusual Event based upon a fire in the plant not being brought under control within ten minutes. The fire was associated with power supply cables for the elevator and was extinguished at 7:14 a.m. with the Unusual Event terminated at 7:53 a.m. Initial licensee investigation into the root cause of the fire identified two possible causes for the cable fire: 1) a cable mounting bracket located on the underside of the elevator failed and allowed the cable to rub against metal braces on the guide rail for the elevator; or 2) a water/oil mixture that collected in the elevator shaft as a result of the December 25 event wet the cloth insulation on the cable resulting in degradation of the cable insulation. Licensee personnel had inspected the elevator subsequent to the December event and declared the elevator operable for unrestricted use. Subsequent to the January 29 fire, the licensee replaced the cable with new cable that did not utilize cloth for insulation and sent the old cable offsite for laboratory analysis to aid in root cause identification. Pending determination of the root cause of the cable failure and NRC review of corrective actions, this item is an Inspection Followup Item (341/93028-02(DRP)).

e. Current Material Condition (71707)

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 had been initiated for identified equipment problems, and to evaluate housekeeping. 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.

Subsequent to the December 25 event, oil was observed dripping from several locations in the turbine building HVAC (TBHVAC) exhaust ductwork. Chemical analysis of the oil showed that the oil was related to the turbine generator. An oil/water mixture was drawn into the suction of the ductwork when flooding of the turbine building basement occurred as a result of the December 25, 1993 event and deposited an oil/water residue throughout the entire run of exhaust ductwork. The licensee dammed off the suction to TBHVAC to prevent further oil intrusion into the system. At the end of the inspection period the licensee was working with several vendors to develop a method to clean the system of oil. The licensee also initiated an investigation to determine what affect the oil would have on the caulking and gasket materials located in the system. This item is an Inspection Followup Item pending review of the long term effects to the system and results of licensee cleanup efforts (341/93028-03(DRP)).

f. Housekeeping and Plant Cleanliness

The inspectors monitored the status of housekeeping and plant cleanliness for fire protection and protection of safety-related equipment from intrusion of foreign matter. The licensee responded expeditiously to the oil and water from the December 25 event and is continuing to clean the remaining portions of the Turbine building. No significant concerns were identified.

g. Radiological Controls (71707)

The inspectors verified that personnel were following health physics procedures for dosimetry, protective clothing, frisking, posting, etc., and when examined, determined that radiation protection instruments were properly used, operable, and calibrated. The inspectors identified no significant concerns and observed that the Radiation Protection Technicians responded well to the December 25 event and subsequent cleanup evolutions.

h. Security (71707)

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. The inspectors noted that persons within the protected area displayed proper photo-identification badges, and those individuals requiring escorts were properly escorted. Additionally, the inspectors also observed that personnel and packages entering the protected area were searched by appropriate equipment or by hand.

No violations or deviations were identified.

3. Safety Assessment/Quality Verification (40500)

The inspectors reviewed the licensee's Deviation Event Reports (DER) generated during the inspection period. This was done in an effort to monitor the conditions related to plant or personnel performance, potential trends, etc. DERs were also reviewed to ensure that they were generated appropriately and dispositioned in a manner consistent with the applicable procedures. The inspectors had no substantive concerns as a result of their reviews.

Corrective Action Improvement Program: The licensee provided the inspectors with an update of the status of the Corrective Action Improvement Program initiated in response to the Enforcement Conference on December 14, 1993. The inspectors did not identify any new concerns as a result of the update of the program status. The licensee stated that they intend to provide updates to the resident office on a regular basis until all program items are completed.

No violations or deviations were identified.

4. Maintenance/Surveillance

a. Maintenance Activities (62703)

Routinely, station maintenance activities were observed and reviewed to ascertain that they were conducted in accordance with approved procedures, regulatory guides and industry codes or standards, and in conformance with technical specifications. The following items were also considered during this review: limiting conditions for operation were met while components or systems were removed from service; approvals were obtained prior to initiating the work; functional testing or calibrations were performed prior to returning components or systems to service; quality control records were maintained; and activities were accomplished by qualified personnel.

Portions of the following maintenance activities were observed or reviewed:

- 000Z934314 Replace # 3 Low Pressure Stop Valve Unitized Actuator
- 000Z934737 Repair/refurbish HCU 22-15
- 000Z934738 Repair/refurbish HCU 6-39
- 000Z935879 EDG-13 Does Not Respond to Load Changes

No violations, deviations, or significant concerns were identified.

b. Surveillance Activities (61726)

During the inspection period, the inspectors observed technical specification required surveillance testing and verified that testing was performed in accordance with adequate procedures, that test instrumentation was calibrated, that results conformed with technical specifications and procedure requirements and were reviewed, and that any deficiencies identified during the testing were properly resolved.

The inspectors also witnessed or reviewed portions of the following surveillances:

- 54.000.03 Scram Time Testing
- 24.307.16 EDG-13 Start and Load Test - Slow Start
- 43.000.08 Pressure Test on Temporary Hose, Fittings, and Valves Used for CST Cleanup

No violations or deviations were identified.

5. Engineering & Technical Support (37700)

a. On December 16, 1993, the licensee started EDG-13 for performance of the monthly surveillance test (24.307.16, "Emergency Diesel Generator 13 Start and Load Test"). The engine was successfully started, synchronized, and loaded to 1800 kw. The operators observed load oscillations while increasing load to 2500-2600 kw. The engine settled out at 1800 kw and would not accept more load. While troubleshooting, the licensee found that the fuel rack linkage was disconnected from the governor actuator output terminal shaft. The clamp bolt that provides the force to hold the fuel rack linkage on the governor actuator output terminal shaft had come loose, apparently due to engine running vibration. The engine fuel racks failed to the as-is position. Operators shut down the engine and reconnected the fuel rack linkage to the governor actuator output terminal shaft. The licensee checked the three remaining EDGs to ensure that the fuel rack linkage connection was tight. No movement was noted on EDGs-11,12 and one flat movement of the clamp bolt was noted on EDG-14. The licensee formally notified the NRC of the test failure by letter dated

January 14, 1994, and planned to implement long term corrective action when each engine is taken out of service for its eighteen month surveillance inspection (scheduled for the spring of 1994). This is an Inspection Followup Item pending NRC review of the licensee's completion of long term corrective action (341/93028-04(DRP)).

b. During the fill and vent of the contractor supplied temporary equipment installed for the Condensate Storage Tank (CST) cleanup, a hose separated from a coupling device when the metal bands used to connect the hose to the device failed. Clean demineralized water was utilized for the system fill. However, the temporary hoses contained some internal contamination. Approximately 25 gallons of water spilled into the CST dike area and one individual was wetted as a result. A survey and whole body count of the individual showed no detectable activity and verified no uptake or ingestion. Radiation protection personnel performed smear surveys of the area which showed no detectable beta, gamma, or alpha activity. The licensee terminated all CST testing activities except for those actions necessary to isolate and drain the equipment.

   Prior to the hose failure on the CST equipment, the inspectors had questioned the licensee's receipt inspection of contractor supplied materials due to a leak that developed in a hose utilized for a different temporary modification. The licensee initiated a DER to address the issue and conducted a visual inspection of the hoses and equipment utilized for the CST cleanup evolution. After the hose/coupling connection failure, the licensee discovered defects on other metal bands within the same system. The licensee remade all hose connections prior to successfully completing the system pressure test at a later date. Pending NRC review of licensee receipt inspection activities for contractor supplied material, this is an Inspection Followup Item (341/93028-05 (DRP)).

c. Throughout most of the inspection period the licensee conducted a turbine generator investigation and disassembly activities as a result of the December 25th event. NRC regional and headquarters management relaxed some of the quarantine restrictions specified in Confirmatory Action Letter CAL No. 3-93-018 to enable the licensee to commence investigation and root cause activities associated with the event. The memoranda lifting portions of the quarantine are provided as attachments to this report. Followup and review of licensee actions and other items relating to the turbine generator failure will be documented in future inspections.

No violations or deviations were identified.

6. Report Review

During the inspection period, the inspector reviewed the licensee's Monthly Operating Status Reports for November and December, 1993. The inspector confirmed that the information provided met the requirements of Technical Specification 6.9.1.6 and Regulatory Guide 1.16.

No violations or deviations were identified.

7. Inspection Followup Items

Inspection Followup items are matters which have been discussed with the licensee, which will be reviewed by the inspector and which involve some action on the part of the NRC or licensee or both. Inspection Followup Items disclosed during the inspection are discussed in Paragraphs 2.d, 4.a, 5.a, and 5.b.

8. Exit Interview (30703)

The inspectors met with the licensee representatives denoted in paragraph 1 during the inspection period and at the conclusion of the inspection on February 8, 1994. The inspectors summarized the scope and results of the inspection and discussed the likely content of this inspection report. The licensee acknowledged the information and did not indicate that any of the information disclosed during the inspection could be considered proprietary in nature.

Attachments: As stated

Date: January 28, 1994

To: Bob Mckeon
Fermi 2 Plant Manager

From: Ken Riemer
Resident Inspector

Subject: Changes to Confirmatory Action Letter Quarantine Requirements.

With regard to the main turbine. Detroit Edison may open the access ports on all three LP hoods, may perform visual inspections of the accessible areas under the hoods. may pick up pieces of debris and remove them from the under hood area, may secure the large components as necessary to support removal of the hoods. In addition, Detroit Edison may identify and perform work necessary to prepare for the removal of the hoods. However, the actual lifting of any of the hoods may not be done until NRC authorization is granted and NRC inspectors are present.

The NRC desires to have a minimum of two days notice prior to lifting any of the hoods.

With regard to the generator. Detroit Edison may remove the hydrogen coolers for the purpose of inspecting these areas of the generator. Detroit Edison may perform inspections in the generator termination box areas. Debris may be bagged, tagged and removed. The NRC would like to be notified 12 hours in advance of the removal of the hydrogen coolers. This notification can be made through the resident's office (beeper 457-1208).

The exciter remains under quarantine.

Ken Riemer

DT WA #184

Date: February 2, 1994

To: Bob McKeon
Plant Manager

From: Ken Riemer
NRC Resident Inspector

Subject: Relaxation of Quarantine Requirements

With respect to the exciter, Detroit Edison may begin disassembly and removal of the exciter. The NRC desires to view, when possible, the following items:

- The condition of stator windings, especially if there is any evidence of melting or overheating.
- The condition of brush holders (also provide information on the type of brushes).
- The condition of the rotor.
- The condition of the permanent magnets at the end of the shaft.
- The condition of the bearings after the shaft is lifted.

The NRC (Ken Riemer) would like to have 8 hours advance notice prior to examining the above items. Detroit Edison is required to provide photographs to the NRC of each of the above items.

With respect to the generator, Detroit Edison may begin disassembly and inspection. As discussed in the January 28, 1994 letter to you, the hydrogen coolers may be removed to facilitate inspection of the generator. The NRC desires to view, when possible, the following items:

- The condition of the brush holders.
- Evidence of burns on the rotor or stator winding.
- The condition of plastic tubing for hydrogen cooling.
- The straightness of the rotor.
- Evidence of burns on laminations between bars on the rotor.
- The condition of insulation on stator windings.

- The condition of rotor shaft at bearings; check if shaft is scored.

- Evidence of glaze on the insulators.

- The condition of isolated phase bus duct.

The NRC (Ken Riemer) would like to have 8 hours advance notice prior to examining the above items. Detroit Edison is required to provide photographs to the NRC of each of the above items.

Ken Riemer 2/2/94