

U. S. NUCLEAR REGULATORY COMMISSION

REGION III

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

Report No.: 50-341/96012(DRS)

Licensee: Detroit Edison Company

Location: 6400 North Dixie Highway
Newport, MI 48166

Dates: October 7-10, 28-31,
November 4-7, 18-21, and
December 12, 1996

Inspector: J. H. Neisler, Reactor Inspector

Approved by: R. N. Gardner, Chief
Engineering Specialists Branch 2
Division of Reactor Safety

III. Engineering

E1 Conduct of Engineering

E1.1 Main Turbine Rebuild

a. Inspection Scope (37551)

The inspector observed the licensee's activities associated with the rebuild of the low pressure sections of the main turbine and replacement of the generator coolers.

b. Observations and Findings

On December 25, 1993, Fermi 2 experienced a failure of the turbine generator. During this event, an eighth stage turbine blade was ejected through the turbine casing of low pressure turbine No. 3. Several other blades from the same stage were ejected into the condenser. Other components in the power generation system also suffered extensive damage. Because of long lead times to procure new rotors for the low pressure turbines, the licensee opted to remove the seventh and eighth stages of the low pressure turbines and operate the repaired turbine generator for one refueling cycle while new turbine components were being manufactured.

During the Fall 1996 refueling outage, the licensee rebuilt the low pressure turbines. Included in the rebuild project was a modification to improve the rigidity of the turbine bearing boats between low pressure turbines 1 and 2, and 2 and 3. This was accomplished by welding massive square steel bars at either side of the bearing boats while the bearings and their housings were removed. The inspector ascertained that the weld procedure specifications were qualified and that the welders were qualified to weld to that procedure.

The licensee replaced the original, damaged rotors on the three low pressure turbines. The original rotors, diaphragms and other components were removed and shipped off site for decontamination and disposal. The new rotors differ from the original in that they are integral cast with the shaft and disks being one forging, not a shaft with shrink fit disks as were the original rotors. The additional stiffness in the rotor assembly is presumed to improve the turbine vibration problems that were experienced with the original rotors.

The inspector observed portions of the removal of the original low pressure turbine rotors, diaphragms, smaller components and the refurbishment with new components. The shells and casings were cleaned and reworked. New diaphragms were installed and aligned. The new rotors were set in place and preliminary alignment checks performed. After the turbine casings were installed, the turbine generator final alignment was performed. The turbine was assembled and on the turning gear at the end of the inspection.

Concurrent with the turbine refurbishment, the licensee disassembled and inspected the turbine control valves. During the inspection, they discovered the stem (arm) to disk (bucket) connection was out of tolerance. The tolerance for movement

between the two components is 3-5 mils. Actual measurements on control valve 4 observed by the inspector were about 138 mils. The other three valves were worse. The licensee's analysis determined the out of tolerance condition was caused by improperly heat treated collars holding the disk to the stem. The softer collars were more susceptible to wear.

The licensee replaced the stem and disk assembly with spare assemblies on turbine control valves 1, 2, and 3 after having the new collars heat treated. Valve 4 was repaired with a new heat treated collar. All four valves were within specified tolerance when reassembled.

c. Conclusions

The inspector concluded that the licensee's turbine generator refurbishment project was well planned and implemented.

E1.2 Station Blackout, Appendix R Generator

a. Inspection Scope (37551)

Review and observation of refurbishment activities of combustion turbine generator (CTG) 11-1 including disassembly, reassembly and post-refurbishment testing prior to returning the CTG to service.

b. Observation and Findings

In May 1996, the licensee began the refurbishment of CTG 11-1. This generator is the designated alternate AC power source for station blackout and the power source for the alternate shutdown capability required for Fermi to comply with 10 CFR 50, Appendix R. CTG 11-4 was modified and tested to provide backup power while CTG 11-1 was out of service. Refurbishment included returning the turbine and compressor rotors to the manufacturer for rebuild, having the generator rotor cleaned and reinsulated, designing and installing a new cooling system, replacing the generator excitation system and replacing the control system with a new digital control system.

Subsequent to the reassembly of the unit, numerous problems were encountered during testing and startup of the unit. The turbine generator vibration exceeded the licensee's specifications. A ground was discovered in the generator field during testing that appeared to contribute to excessive vibration in the unit. The generator rotor was replaced with a factory rebuilt rotor. Licensee representatives informed the inspector that the cause of the vibration was determined to be the removal of the original exciter and subsequent replacement with a new excitation system. This removed several hundred pounds from the generator end which created an imbalance in the unit. In addition, logic problems were found in the control system that prevented completion of testing. Troubleshooting was in progress at the end of this inspection.

c. Conclusion

Based on the inspector's observation of activities throughout the duration of the combustion turbine generator refurbishment project, including disassembly, modifications, reassembly and testing, the inspector concluded that the licensee's oversight of their contractor was weak in the areas of design reviews, installation, inspection, and testing. This led to dependance on an alternate power source for station blackout and Appendix R shutdown power for twice as long as originally planned.

E1.3 Main Steam System

a. Inspection Scope (37751)

Observation of licensee activities relative to analysis and root cause determination of main steam system pipe and valve vibration.

b. Observations and Findings

During a previous inspection, the inspector observed excessive vibration at the turbine stop and control valves. The excessive vibration was also present in the main steam lines and the 52 inch diameter steam manifold. In response to the inspector's stated concern that the vibration could cause a failure of the main steam piping system, the licensee stated that the steam system vibration problem was being analyzed to determine the cause of the vibration.

During the Fall 1996 refueling outage, the licensee instrumented the pipe and valves to try to determine the source of the system vibration. In addition, the licensee installed vibration dampers on the 24 inch lines between the control valves and the turbine to alleviate some of the vibration in these lines.

While walking down the pipe, the inspector noted rust beneath snubber N30-3259-G68 on the 52 inch manifold pipe. The licensee removed the snubber to the test facility. Although the snubber tested satisfactorily, and the rust was only on the outer sleeve, the thrust ring showed extensive wear caused by vibration. The snubber was rebuilt and replaced.

On two of the four pipes between the control valves and the turbine, the inspector noted cracked welds on the spring hanger supports beneath the pipe. The welds were repaired before the end of the inspection.

c. Conclusion

The licensee's efforts to reduce or eliminate the excessive vibration in the steam system piping were not successful prior to the current outage. The inspector will evaluate the licensee's corrective actions during a future inspection.

E1.4 Configuration Control Equivalency Evaluations

a. Inspection Scope (37751)

Review and examination of the licensee's practices regarding manufacturing changes in parts and components used as replacements for originally installed equipment. Included were procurement documents, technical service requests, potential design change analyses, deviation event reports, quality assurance audits and work requests.

b. Observation and Findings

The inspector examined the process used to assure that replacement parts met the design requirements of the original part. The original plant components were ordered 25 years ago and many are no longer in production or have been changed by the manufacturer. Minor changes or improvements may impact the operation of the component when that part is installed.

The inspector reviewed potential design change (PDC) 10060, dated November 9, 1990, that evaluated vendor part number changes to updated, printed circuit control boards in the battery chargers. The PDC determined that the change would not impact the operation of the battery chargers. During the performance of Work Request (WR) RO35921116 on March 23, 1994, circuit boards CB-A and CB-C in battery charger 2A-1 were replaced with the vendor updated circuit boards. Board CB-B was not replaced. When the charger was re-energized, the battery charger output could not be controlled within limits. After further troubleshooting, old board CB-B was replaced with an updated board and the charger output control function restored to specified limits. Technical Service Requests TSR-28323 and TSR-28324 were issued by materials engineering to address the battery charger control card problems. Although TSR-28324 mentioned the field problems documented in work request RO35921116 relative to parts interchangeability between old and new part numbers, the TSR did not prohibit circuit board interchange.

In response to circuit boards problems encountered during RO35921116, the licensee initiated Deviation Event Report (DER) 94-0497 on September 9, 1994. The DER identified that the old and newer parts were not interchangeable. New instructions relative to replacing and balancing battery charger control boards were obtained from the vendor. These instructions were then incorporated into the battery charger procedure 35.309.001, "130/260 Battery Charger Testing, Calibration, and General Maintenance," Revision 32. Electrical maintenance personnel have been trained to use the revised procedure.

Purchase Request (PR) 9022487, dated December 20, 1995, in the comment section warned that mixing of boards can cause oscillations.

The inspector questioned whether information relative to mixing the old and new part numbered control boards had been inserted into the central component data base (CECO) for the battery chargers so that planners and installers would have

access to the information. The licensee representatives stated that the information had not been included in CECO.

The inspector reviewed three Quality Assurance Audits of configuration control activities that had been performed in 1996. Audit Report 96-0105, "Comprehensive Integrated Technical Assessment of Engineering," February 5-23, 1996, identified a need for improvement in Technical Service Request Handling. Audit Report 96-0132, "Design Control," July 22 through August 9, 1996, identified three deficiencies in handling the CECO data base including checking of TSRs. None of the audits specifically addressed the subject of equivalent parts evaluation.

The licensee identified and corrected the problem with the battery charger control board equivalent parts evaluation; however, there was no indication that the corrective action included comprehensive evaluations of the program. At the end of the inspection on November 24, 1996, the licensee initiated DER 96-1708 to effect review of the handling of equivalent parts and to correct any identified weaknesses in their program.

c. Conclusion

The inspector concluded that weaknesses in design control relative to equivalent parts evaluation resulted in non-interchangeable parts being issued to maintenance personnel for installation in the battery chargers. This was caused by inadequate instructions in the maintenance procedure and the vendor's instruction manual.

However, the licensee subsequently issued DERs 94-0497 and 96-1708 that corrected the battery charger parts in interchangeability problems and initiated corrective action to discover and eliminate weaknesses in the equivalent parts evaluation program.

V. Management Meetings

X.1 Exit Meeting Summary

The inspector presented the inspections results to licensee representatives at the conclusion of the inspection on November 21, 1996. The licensee acknowledged the findings presented.

The inspector asked the licensee whether any materials examined during the inspection were proprietary. No proprietary information was identified.

PARTIAL LIST OF PERSONS CONTACTED

Licensee

J. Doblets, Materials Engineering
P. Fessler, Plant Manager
D. Gipson, Senior Vice President, Nuclear Operations
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N. Peterson, Supervisor, Compliance
W. Romberg, Assistant Vice President, Technical
M. Williams, Plant Support Engineering
R. Wittschen, Compliance/Licensing Engineer

LIST OF ITEMS CLOSED

50-341/95009-05 VIO failure to identify and take prompt corrective action for a high failure rate of emergency lighting units needed for operation of safe shutdown equipment

LIST OF ACRONYMS

CECO Central Component Data Base
CTG Combustion Turbine Generator
DER Deviation Event Report
NRC Nuclear Regulatory Commission
PDC Potential Design Change
PR Purchase Request
TSR Technical Service Request
WR Work Request

LIST OF DOCUMENTS REVIEWED

Audit Report 96-0105	"Comprehensive Integrated Technical Assessment of Engineering"
Audit Report 96-0108	"Procurement of Material, Equipment and Services"
Audit Report 96-0132	"Design Control"
DER 94-0497	"Three Versions of 130VDC Battery Charger Control Cards Are Not Interchangeable"
DER 96-1708	"Concern Regarding Proper Implementation of Equivalent Part TSRs"
TSR 28323	"Configuration Control - Various C&D Power Vendor Drawings"
TSR 28324	"Equivalency Evaluation - C&D Charter Power PC Card Holder/Unit Control Boards A&B, Part Numbers MBC-1970 & MPC 1971-1"
PDC 10060	"C&D Battery PC Boards"
PDC 12341	"Part Number Change for C&D Battery Charger Circuit Boards"
WR R035921116	"130 Volt Battery Charger 2B-1"
MES 11, Revision 5	"Technical Service Request"
MES 02, Revision 4	"Design Configuration Management"
MES 04, Revision 4	"Identification and Control of Component Data"