U. S. NUCLEAR REGULATORY COMMISSION

REGION III

Docket No:	50-346
License No:	NPF-3
Report No:	50-346/99012(DRP)
Licensee:	Toledo Edison Company
Facility:	Davis-Besse Nuclear Power Station
Location:	5501 N. State Route 2 Oak Harbor, OH 43449-9760
Dates:	October 29 - December 6, 1999
Inspector:	K. Zellers, Senior Resident Inspector
Approved by:	Thomas J. Kozak, Chief Reactor Projects Branch 4 Division of Reactor Projects

EXECUTIVE SUMMARY

Davis-Besse Nuclear Power Station
NRC Inspection Report 50-346/99012(DRP)

This inspection included aspects of licensee operations, maintenance, engineering, and plant support. The report covers a 6-week period of resident inspection.

Operations

- The inspector concluded that the licensee properly conducted and appropriately evaluated the results of equipment surveillance tests. However, two operator attention-to-detail issues which occurred during surveillance tests detracted from this otherwise good performance. On one occasion, an operator failed to identify a slightly out-of-specification reading during an emergency diesel generator (EDG) run, and in another case, operators failed to rotate the air start side during the start of an EDG (Section M1.2).

Maintenance

- Work management personnel effectively adjusted the maintenance schedule to minimize short duration relatively high risk profiles that were caused by emergent conditions (Section M1.1).

- Two safety-related air-operated valves did not stroke as expected during recent surveillance tests; however, these problems did not cause their respective systems to be inoperable. The licensee is in the process of upgrading the air-operated valve program and plans to conduct performance trending of safety-significant valves (Section M3.1).

Engineering

- Engineering personnel demonstrated good use of operating experience information to detect degrading wall thickness on a high pressure feedwater heater (Section E1.1).

- Engineering personnel developed thorough corrective actions to address potential extent of condition issues pertaining to a failure of a breaker mechanical interlock (Section E1.2).

Report Details

Summary of Plant Status

The plant was operated at a nominal power level of 100 percent except for brief, small reductions in power in order to conduct test activities.

I. Operations

O1 Conduct of Operations

O1.1 General Comments (71707)

The inspector reviewed plant operations routinely by attending management meetings, observing operators in the control room, reviewing operating logs and problem reports, and conducting other activities prescribed by Inspection Procedure 71707. No significant operator challenges and no significant operator performance events occurred during the reporting period. Shift turnovers included mention of events at other facilities so that operators had heightened sensitivity to error-likely situations. Chemistry personnel knowledge of the status of chemistry processes was much improved over the last inspection period due in part to the use of a standardized turnover sheet. Operations management demonstrated good day-to-day knowledge of and sensitivity to higher risk evolutions. The inspectors concluded that station personnel operated the plant in a conservative, risk informed manner.

O2 Operational Status of Facilities and Equipment

O2.1 System Walkdowns (71707)

The inspector walked down the accessible portions of the following engineered safety features (ESF) and important-to-safety systems during the inspection period:

- high pressure injection
- auxiliary feedwater
- motor driven feed pump
- emergency diesel generators

No substantive concerns were identified as a result of the walkdowns. System lineups and major flow-paths were verified to be consistent with plant procedures/drawings and the Updated Safety Analysis Report (USAR). Pump/motor fluid levels were within their normal bands. Vibration and temperatures of running equipment were normal. Only very minor oil and fluid leaks were noted on occasion.

O8 Miscellaneous Operations Issues (92700)

O8.1 (Closed) Licensee Event Report (LER) 50-346/1999-005: Failure to perform Technical Specification (TS) required action after opening breaker. This LER pertains to the failure to verify that offsite AC sources were available within the TS-required time of 1 hour following the removal of a transformer from service. This item was discussed in Inspection Report 50-346/99011(DRP) and was dispositioned as a Non-Cited Violation.

II. Maintenance

M1 Conduct of Maintenance

M1.1 General Comments (62707)

The inspector reviewed station personnel adherence to the maintenance schedule and weekly risk summary report. Maintenance on higher risk equipment received more management attention and scrutiny. The work schedule was changed on several occasions in order to minimize a high aggregate risk to the plant. For example, Ohio Edison line troubleshooting was deferred on two occasions due to emergent conditions. Additionally, a troubleshooting activity on valve DH-2733 was deferred due to an emergent condition. The inspectors concluded that work management personnel effectively adjusted the maintenance schedule to minimize short duration, relatively high risk profiles that were caused by emergent conditions.

M1.2 Maintenance and Surveillance Activities

a. Inspection Scope (61726, 62707)

The following maintenance and surveillance testing activities were observed/reviewed during the inspection period:

- emergency diesel generator #2 monthly, DB-SC-03071
- decay heat pump #2 quarterly, DB-SP-03137
- pressure and augmented leakage test, DB-PF-03065
- channel functional test and calibration of steam generator actuation channel #1 differential pressure inputs, DB-MI-03203
- stroke time test of CC-1495, DB-PF-03071
- station air compressor temperature calibrations, MWO-99-4139-000

b. Observations and Findings

Maintenance activities were performed by qualified personnel using approved procedures and test equipment. Tested equipment met the acceptance criteria and appeared to run as expected and in accordance with Updated Safety Analysis Report (USAR) assumptions. Equipment was operated by operators following the governing procedure and equipment performance was monitored throughout the testing activities.

During the performance of an emergency diesel generator (EDG) surveillance test, the inspector observed that the engine-driven fuel oil pump strainer inlet pressure was slightly out-of-specification (76 psig instead of the specification of 75 psig). After being informed of this anomaly by the inspector, the system engineer determined that the out-of-specification log reading had no impact on EDG operation. Operations management generated Condition Report (CR) 1999-2140 when they were informed of the observation.

The EDGs have two independent air start systems, but only one air start side per EDG is required to be functional for the EDG to be operable. In order to demonstrate that each air start side was capable of starting an EDG, one of the air start sides was to be isolated during the start of an EDG. Consequently, the licensee promulgated guidance to operators to alternate the air start sides for EDG starts. However, the inspector reviewed the #2 EDG run log and determined that operators had not alternated the air start side on subsequent starts of #2 EDG on one occasion. A potential problem that this could cause is that a particular air start side may not have been exercised for about 90 days instead of the usual 60 days. This could result in air start system moisture (the air start system did not have air dryers) causing surface corrosion on the air start motors for one of the air start sides to the extent that the air start motors would not be able to function properly. As a corrective action, the system engineer intended to provide operators more clear guidance on alternating the air start sides.

Recently, operations management emphasized supervisory oversight and peer checks of critical activities in order to promote error-free operations. The inspector noted that no operations supervisory personnel were present nor were any peer checks performed at the EDG control panel during the EDG shutdown.

c. Conclusions

The inspector concluded that the licensee properly conducted and appropriately evaluated the results of equipment surveillance tests. However, two operator attention-to-detail issues detracted from this otherwise good performance. On one occasion, an operator failed to identify a slightly out-of-specification reading during an EDG run, and in another case, operators failed to rotate the air start side during the start of an EDG.

M3 Maintenance Procedures and Documentation

M3.1 Air Operated Valve Stroke Time Testing Problems

a. Inspection Scope (61726, 62707)

The inspector reviewed the circumstances surrounding two separate examples of air operated valves not operating as expected.

b. Observations and Findings

CCW-1495

Component cooling water (CCW) system valve CC-1495 is an air-operated valve that functions to shut on a safety features actuation system (SFAS) actuation so that non-essential portions of the CCW system will be isolated from essential portions of the system thus allowing the essential portions to receive sufficient cooling water flow. Valve CC-1495 is a normally open,16 inch, air-operated butterfly valve. During a loss of instrument air, the valve can still be closed with air from a small accumulator. Stroke time testing of the valve is performed by isolating instrument air to the valve actuator and then closing the valve with the accumulator air reserve.

When the valve was recently shut for American Society of Mechanical Engineers (ASME) stroke time testing, it could not be stroke timed because the closed limit switch did not actuate. Locally, the valve appeared to be closed, but some flow noise was heard past the valve seat. Operators then declared the valve inoperable, and the train of CCW that supplied its flow was declared inoperable. Engineering personnel subsequently reviewed the condition and determined that although the valve did not close enough to engage the close limit switch for the valve, it closed enough so that the CCW train was able to perform its design function. Therefore, the CCW system was determined to be operable.

Engineering personnel were aware of several past stroke time test failures. The cause of the past failures was attributed to a closed position limit switch that was out-of-adjustment. Subsequent to this particular failure, engineering personnel observed the performance of the valve by hooking up diagnostic test equipment to the valve actuator and collecting data during a subsequent valve stroke. The valve appeared to stroke properly, actuated its limit switch, and stroked within the acceptance criteria limit. However, the test results indicated that the actuation pressure decreased after the valve stroked, which indicated that an air leak existed in the actuator. Previous engineering documentation asserted that balanced disk butterfly valves tended to stay shut when the actuating force was lost; therefore, the valve remained operable.

Upon a closer review of the valve performance, engineering personnel attributed the stroke time failures to other potential causes. One potential cause was that the valve was tested under a more extreme pressure condition than what the valve actuator was designed for. During the test, the valve was closed at the normal CCW system operating pressure of about 80 psid across the valve rather than at 40 psid across the valve, which is the pressure at which the valve was designed to operate. Consequently, engineering personnel planned to develop a change to the test so that the valve differential pressure would more closely approximate the conditions under which it was designed to operate. Engineering personnel also considered the actuator leakage to be a contributor to the initial stroke time failure and were developing corrective actions to correct the condition.

DH-13A

Decay heat removal (DHR) system valve DH-13A provides control of bypass flow around #2 DHR system cooler. It is a normally closed, 6 inch, air-operated butterfly valve. It is designed to close (if it was open) during an SFAS actuation so that all of the flow from the #2 low pressure injection pump goes through the #2 DHR cooler. During recent stroke time testing, its open limit switch failed to actuate for over 6 minutes when the valve was opened. Although the valve did not open within the expected time frame, there was no requirement for the valve to open within a prescribed period of time. When the valve was subsequently closed, it closed in 6.97-seconds which was well within the 22.8-second acceptance criteria time, and the valve remained operable. Although the valve was operable, licensee personnel stroked the valve open again to see if the long opening stroke time was repeatable. The valve stroked open in 22.3 seconds. The licensee was in the process of determining the cause for the valves initial long stroke time at the end of the inspection.

AOV Program Enhancements

The licensee was in the process of developing enhancements to its maintenance and monitoring of air-operated valves. The population of valves have been categorized into three different importance categories. Category one is for active, high safety-significant valves; category two is for passive, high safety-significant valves; and category three is for passive, quality assurance program valves. For category one valves, a review of the design basis capability and the preventive maintenance program will be conducted, and a diagnostic test program to trend performance is under development. For category two valves, preventive maintenance will be reviewed and a diagnostic valve test program will be developed using best available data. Category three valves will be diagnostically tested to vendor recommendations.

c. Conclusions

Two safety-related air-operated valves did not stroke as expected during recent surveillance tests; however, these problems did not cause their respective systems to be inoperable. The licensee is in the process of upgrading the air-operated valve program and plans to conduct performance trending of safety-significant valves.

III. Engineering

E1 Conduct of Engineering

E1.1 Steam System Wall Thinning Initiative (37551)

Station engineering management initiated a steam erosion detection program in response to industry events where steam ruptures occurred because of flow-induced erosion of carbon steel. As a result of the licensee's program, a portion of the shell of high pressure feedwater heater 5-1 was measured and found to have thinned to .577 inches which was below the ASME code minimum of .611 inches at design pressure. The licensee determined that wall thickness was adequate for normal operating pressure and that the heater was safe to operate until repairs could be performed during the next refueling outage. The inspectors concluded that engineering personnel demonstrated good use of operating experience information to detect degrading wall thickness on a high pressure feedwater heater.

E1.2 Extent of Condition for Failure of Valve MS-106 Interlock (37551)

The inspector reviewed the corrective actions taken to address a failure of a mechanical interlock associated with the electrical breaker for valve MS-106 (steam isolation valve for #1 auxiliary feedwater pump turbine). The licensee determined that the mechanical interlock mounting configuration in DC breakers could cause the mechanical interlock to become misaligned which, in turn, could cause the interlock to fail. The licensee's immediate corrective action was to replace the failed interlock and to adjust the mounting configuration. During an extent of condition review, the licensee identified that the breakers for two DC-powered motor-operated valves had interlock mounting configuration problems. The mechanical interlocks for AC-powered motor-operated valves did not have mounting configuration issues; however, the licensee planned to test the operation of all breaker mechanical interlocks as an enhancement to the motor operated valve testing program. The inspectors determined that engineering personnel performed thorough corrective actions to address potential extent of condition issues pertaining to a failure of a breaker mechanical interlock.

E8 Miscellaneous Engineering Issues (92903)

E8.1 (Closed) Licensee Event Report 50-346/1998-008: Post loss of coolant accident (LOCA) boron dilution flow path analysis and procedural guidance. The licensee identified that plant emergency procedure, DB-OP-02000, "Reactor Protection System, Safety Features Actuation System, Steam and Feedwater Rupture Control System Trip or Steam Generator Tube Rupture," allowed initiation of a post-LOCA boron dilution flow path under pressurized, saturated liquid conditions that, for a limited range of small break LOCAs, could theoretically cause steam binding and voiding in the suction piping of both operating low pressure injection (LPI) pumps. The inspectors reviewed this issue and determined that control room operators would have been able to immediately recognize steam voiding of the LPI pumps due to pump low flow annunciators which would activated and by observing abnormal pump amperage indications. Adequate procedural guidance existed to immediately stop the source of the steam, secure the

LPI pumps to prevent damage, and fill and vent the LPI pump suctions and restart the pumps before the core would be uncovered. Therefore, the LPI pumps would have been able to perform their safety function.

Technical Specification 6.8.1.a. states, in part, that written procedures shall be established, implemented and maintained covering the applicable procedures recommended in Appendix "A" of Regulatory Guide 1.33, November 1972. Paragraph F.1. of Appendix "A" of Regulatory Guide 1.33 recommends that procedures for combating emergencies such as LOCAs be implemented. Prior to September 1, 1998, Procedure DB-OP-02000, a procedure used to combat LOCAs, was inadequate in that for certain small break LOCAs. Specifically, step 10.14.1 allowed initiation of the post-LOCA boron dilution flow path through the decay heat removal system drop line under pressurized, saturated liquid conditions. Under these conditions, the liquid would flash to steam and enter the low pressure injection flow path which could have caused steam binding of the LPI pumps. This is a violation of TS 6.8.1.a. This Severity Level IV violation is being treated as a Non-Cited Violation, consistent with Appendix C of the NRC Enforcement Policy. This violation is in the licensee's corrective action program as LER 1998-008 **(NCV 50-346/1999012-01)**. To address this condition, the licensee modified the procedure to ensure the boron dilution flow path is initiated only when reactor coolant system pressure drops to approximately equal to the containment pressure. Adequate alternate means are available to ensure proper boron dilution occurs under higher pressure conditions.

IV. Plant Support

R1 Radiological Protection and Chemistry (RP&C) Controls

R1.1 General Comments (71750)

The inspector toured the radiological restricted area on several occasions. Radiation and contamination areas were marked in accordance with requirements. Radiation dose rates were consistent with posted values. Radiation protection personnel were sensitive to potentially changing radiological conditions as demonstrated by radiation protection personnel who conducted radiation surveys of emergency core cooling systems (ECCS) piping during an ECCS system pump run to verify that no radiological "hot spots" had migrated to different portions of the piping.

S1 Conduct of Security and Safeguards Activities

S1.1 General Comments (71750)

The inspector evaluated the conduct of security guard personnel on a daily basis and alarm station operators on an occasional basis. Security guards encouraged station personnel to remember to close doors behind them in the plant in an effort to raise the sensitivity to the proper control of plant doors. The inspector noted that some security cameras had some distortion that degraded their performance; however, this condition had been previously recognized and was to be corrected by vendor technicians. The

inspector concluded that security force personnel conducted their duties in a professional manner.

S8 Miscellaneous Security and Safeguards Issues (71750)

S8.1 (Closed) Inspection Follow-Up Item 50-346/98008-04(DRP): An additional component was required to provide adequate protection for a vehicle gate that formed part of the vehicle barrier system. The inspector verified installation and operability of this component on November 30, 1999.

F8 Miscellaneous Fire Protection Issues (92904)

F8.1 (Closed) Violation 50-346/96304-01013(DRP): The licensee failed to provide adequate protection to ensure operation of equipment for systems necessary to achieve and maintain hot shutdown conditions or provide alternate or dedicated safe shutdown capability. Specifically, 16 motor-operated valves (MOVs), necessary to achieve and maintain hot shutdown conditions, were potentially unable to perform their post-fire safe shutdown function, because their control circuits were susceptible to fire-induced hot shorts. The inspector reviewed Inspection Report 50-346/1996008, the licensee's response to the violation, and the licensee's LER. Three MOVs had their circuits modified, one MOV was de-powered, and shutdown procedures were modified to use alternate valves for six other MOVs. The remaining valves were not time sensitive and were dispositioned accordingly. Some of these were analyzed and determined to not be required in the fire areas where the circuits may be damaged. Some of these valves were dispositioned by changing procedures to remove their actuators so that they could be repositioned or to use an alternate valve. The inspector concluded that the issues concerning all of the valves affected by this condition were appropriately dispositioned.

F8.2 (Closed) Violation 50-346/96304-02014(DRP): Fire barriers located in the containment and containment annulus were inoperable, and compensatory actions were not taken per the requirements of the fire hazards analysis report (FHAR), resulting in a severity level IV violation. Although Thermo-lag was determined to be combustible, the licensee did not consider radiant energy heat shields containing Thermo-lag to be inoperable. Therefore, compensatory actions were not instituted. Once the problem was identified to the licensee, compensatory measures were instituted until longer term corrective actions could be completed. Subsequently, the licensee removed all Thermo-lag in the plant and replaced it with suitable fire protection material.

V. Management Meetings

X1 Exit Meeting Summary

The inspector presented the inspection results to members of licensee management on December 3, 1999. The licensee acknowledged the findings presented. The inspector asked the licensee whether any materials examined during the inspection should be considered proprietary. No proprietary information was identified.

PARTIAL LIST OF PERSONS CONTACTED

Licensee

Larry Bonker, Manager (Acting), Radiation Protection
G. G. Campbell, Vice President, Nuclear
Tim Chambers, Supervisor, Quality Assurance
S. A. Coakley, Manager, Work Management
L. M. Dohrmann, Manager, Quality Services
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John Messina, Director, Work Management
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NRC

K. S. Zellers, Senior Resident Inspector, Davis-Besse

INSPECTION PROCEDURES USED

IP 37551:	Onsite Engineering
IP 61726:	Surveillance Observations
IP 62707:	Maintenance Observation
IP 71707:	Plant Operations
IP 71750:	Plant Support Activities
IP 92700:	Onsite Follow-up of Written Reports of Nonroutine Events at Power Reactor Facilities
IP 92903:	Followup - Engineering
IP 92904:	Followup - Plant Support

ITEMS OPENED, CLOSED, AND DISCUSSED

Opened

50-346/1999012-01(DRP)	NCV	Procedure violation in that for certain small break LOCAs, Procedure DB-OP-02000 required the initiation of a boric acid dilution flow that could have resulted in both LPI pumps being temporarily unavailable due to the introduction of steam to the pump suctions.

Closed

50-346/1998-008	LER	Post loss of coolant accident (LOCA) boron dilution flow path analysis and procedural guidance.
50-346/1999-005	LER	Failure to perform TS required action after opening breaker.
50-346/1999012-01(DRP)	NCV	Procedure violation in that for certain small break LOCAs, Procedure DB-OP-02000 required the initiation of a boric acid dilution flow that could have resulted in both LPI pumps being temporarily unavailable due to the introduction of steam to the pump suctions.
50-346/98008-04(DRP)	IFI	An additional component was required to provide adequate protection for a vehicle gate that formed part of the vehicle barrier system.
50-346/96304-01013(DRP)	VIO	The licensee failed to provide adequate protection to ensure operation of equipment for systems necessary to achieve and maintain hot shutdown conditions or provide alternate or dedicated safe shutdown capability.

50-346/96304-02014(DRP)	VIO	Fire barriers located in the containment and containment annulus were inoperable and compensatory actions were not taken per the requirements of the fire hazards analysis report (FHAR).

LIST OF ACRONYMS AND INITIALISMS USED

ASME	American Society of Mechanical Engineers
CCW	Component Cooling Water
CFR	Code of Federal Regulations
CR	Condition Report
DHR	Decay Heat Removal
ECCS	Emergency Core Cooling Systems
EDG	Emergency Diesel Generator
ESF	Engineered Safety Feature
FHAR	Fire Hazards Analysis Report
IFI	Inspection Followup Item
IR	Inspection Report
LER	Licensee Event Report
LOCA	Loss of Coolant Accident
LPI	Low Pressure Injection
MWO	Maintenance Work Order
MOV	Motor Operated Valve
NCV	Non-Cited Violation
NRC	Nuclear Regulatory Commission
PDR	Public Document Room
SFAS	Safety Features Actuation System
TS	Technical Specification
USAR	Updated Safety Analysis Report
VIO	Violation