NRC Form 366
(9-83)

U.S. NUCLEAR REGULATORY COMMISSION
APPROVED OMB NO. 3150-0104
EXPIRES: 8/31/88

LICENSEE EVENT REPORT (LER)

FACILITY NAME (1)	DOCKET NUMBER (2)	PAGE (3)
Fermi 2	0 5 0 0 0 3 4 1	1 OF 0 8

TITLE (4)
Recirculation Pump B Discharge Valve Failure to Close

EVENT DATE (5)			LER NUMBER (6)			REPORT DATE (7)			OTHER FACILITIES INVOLVED (8)	
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	MONTH	DAY	YEAR	FACILITY NAMES	DOCKET NUMBER(S)
0 8	2 0	8 8	8 8	0 3 2	0 0	0 9	1 9	8 8	N/A	0 5 0 0 0
									N/A	0 5 0 0 0

OPERATING MODE (9)	1	THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more of the following) (11)							
POWER LEVEL (10)	0 4 0		20.402(b)		20.405(c)		50.73(a)(2)(iv)		73.71(b)
			20.405(a)(1)(i)		50.36(c)(1)	X	50.73(a)(2)(v)		73.71(c)
			20.405(a)(1)(ii)		50.36(c)(2)		50.73(a)(2)(vii)		OTHER (Specify in Abstract below and in Text, NRC Form 366A)
			20.405(a)(1)(iii)	X	50.73(a)(2)(i)		50.73(a)(2)(viii)(A)		
			20.405(a)(1)(iv)		50.73(a)(2)(ii)		50.73(a)(2)(viii)(B)		
			20.405(a)(1)(v)		50.73(a)(2)(iii)		50.73(a)(2)(x)		

LICENSEE CONTACT FOR THIS LER (12)

NAME	TELEPHONE NUMBER
Gordon Nader, Licensing Engineer	AREA CODE 3 1 3 5 8 6 - 4 5 1 3

COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT (13)

CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPRDS		CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPRDS	

SUPPLEMENTAL REPORT EXPECTED (14)		EXPECTED SUBMISSION DATE (15)	MONTH	DAY	YEAR
X YES (If yes, complete EXPECTED SUBMISSION DATE)	NO		1 2	3 1	8 8

ABSTRACT (Limit to 1400 spaces, i.e., approximately fifteen single-space typewritten lines) (16)

On August 20, 1988 and again on August 28, 1988, Reactor Recirculation Pump B Discharge Valve failed to close at power when required to do so as part of the Reactor Recirculation Pump Startup Test Procedure. Because this valve is part of the LPCI Loop select logic, both loops of the Low Pressure Coolant Injection (LPCI) system were conservatively declared inoperable and the plant was subsequently shutdown following both valve failures.

Initial valve inspection after the August 20, 1988 failure found 3 out of 4 connections on the valve's torque switch loose. These connections were tightened and the valve stroked in cold conditions three times to ensure electrical continuity and function. The plant was restarted on August 23, 1988.

Further testing and investigation following the August 28 failure revealed that the valve's torque switch was set at an incorrect value and was improperly installed.

Remedial actions include improving the program that controls torque switch settings, improving installation training and procedures, comparing field settings to design settings, and resolution of any discrepancies.

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Initial Plant Condition, August 20, 1988:

Operational Condition: 1 (Power Operations)
Reactor Power: 39.9 percent
Reactor Pressure: 935 psig

Initial Plant Condition, August 28, 1988:

Operational Condition: 1 (Power Operations)
Reactor Power: 34.5 percent
Reactor Pressure: 930 psig

Description of Event:

At 1640 hours on August 20, 1988, Reactor Recirculation (AD) Pump B Discharge Valve B31-F031B failed to close when an operator depressed the close pushbutton in the main control room. Closure of this valve was required as a prerequisite to restarting Reactor Recirculation Pump B. Reactor Recirculation Pump B had been tripped earlier at 1040 hours as a requirement of Reactor Recirculation Pump Startup Test Procedure STUT.06B.030. Because valve B31-F031B closure function is part of the Low Pressure Coolant Injection (LPCI) Loop Select Logic both loops of the LPCI system were conservatively declared inoperable and Action statement 3.5.1.b.4 was entered. This required the plant to be in Hot Shutdown by 0440 hours on August 21, 1988. However, at 0322 hours on August 20, 1988, Special Test Exception 3.10.4 had been entered when Reactor Recirculation Pump A was tripped as required by STUT.06B.030. Special Test Exception 3.10.4 requires that both reactor recirculation pumps be returned to service within 24 hours or, in accordance with Action 3.10.4a, insert all control rods. This Action required placing the plant in Hot Shutdown by 0322 hours on August 21, 1988. Thus, because the Special Test Exception reactor shutdown requirements were more restrictive than Action statement 3.5.1.b.4, the plant was placed in Hot Shutdown at 0315 hours on August 21, 1988. The plant was placed in Cold Shutdown at 2315 hours on August 21, 1988.

The initial valve inspection found 3 out of 4 connections on the valve's torque switch loose. These connections were tightened and the valve was successfully tested three times under cold conditions. Based on the inspection of 14 other valves it was determined that the loose connections on valve B31-F031B were an isolated case and the plant was subsequently restarted at 1340 hours on August 23, 1988.

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TEXT (If more space is required, use additional NRC Form 366A's) (17)

At 1445 hours on August 28, 1988, Recirculation Pump B Discharge Valve B31-F031B failed to close again, when an operator depressed the close pushbutton in the main control room. As in the August 20, 1988, valve closure failure, closure of valve B31-F031B was required in accordance with STUT.06B.030. STUT.06B.030 was being performed in an attempt to complete testing that was not completed because of the August 20, 1988, valve closure failure and subsequent plant shutdown. Because the High Pressure Coolant Injection (HPCI) system (BJ) was in a preventive maintenance outage and both loops of LPCI (BO) were declared to be inoperable due to the B31-F031B failure, the plant entered Technical Specification 3.0.3. HPCI was restored to service at 1818 hours on August 28, 1988. The plant was placed in Hot Shutdown at 0139 hours on August 29, 1988. The plant was placed in Cold Shutdown at 1156 on August 29, 1988.

Cause of Event:

The motor operator of Valve B31-F031B was inspected by maintenance personnel on August 21, 1988. The inspection found 3 out of the 4 connections on the torque switch of the valve operator to be loose. The 3 loose screws, which had lockwashers, were tightened. The valve was electrically stroked three times during reactor shutdown and operated properly each time.

The loose connections on the torque switch had apparently prevented the valve "CLOSE" contactor from energizing thus preventing the valve from closing. (Note: B31-F031B was not stroked tested between the time the reactor was shutdown and the loose torque switch terminations tightened on August 21, 1988). To determine if the loose torque switch connections found on B31-F031B was an isolated case or a generic problem, a sample inspection of 14 valves in the plant was performed. The inspection consisted of verifying proper tightness and the presence of lockwashers on the torque switch connections and the tightness of all other connections at the valve operator. The 14 valves were chosen based on a review of approximately 50 work packages performed on valves during the past year.

The criteria used for choosing the 14 sample valves were as follows:

1. Other valves which are subjected to the same flow dynamics as the B31-F031B (i.e., B31-F031A and B31-F023B)

2. Valves which were subjected to the same work that the B31-F031B was subjected (28 valves fell into this category).

3. Review of the above (item 2) 28 valve work packages to determine if termination verification was performed.

4. Ease of valve access for inspection.

5. A review of other high speed valves similar in operation to B31-F031B.

Based on inspections of the 14 valves it was determined that the loose torque switch connections found on B31-F031B was an isolated case and not a generic problem. Because 2 of the 3 loose connections found on B31-F031B were on the "CLOSE" torque switch, there was convincing evidence to believe, at the time, that the failure to close was due to loose torque switch wires. This was substantiated at the time by stroking of the valve during reactor shutdown after tightening the loose connections. The reactor was then restarted at 1340 hours on August 23, 1988.

However, valve B31-F031B failed to close again on August 28, 1988, during reperformance of STUT.06B.030 with the reactor at 34.5 percent power and Reactor Recirculation Pump A operating. This failure was the first attempt to close the valve with the Reactor at pressure and Recirculation Pump A operating since the original failure on August 20, 1988.

Valve B31-F031B was tested under normal operating temperature by depressing the close pushbutton from the main control room. The close contactor stayed closed for only approximately one-half second. (Normal valve stroke time is 30 seconds). The close contactor was then manually closed for 2.5 seconds and released. The close contactor immediately reopened. If the valve were operating properly the close contactor would have sealed-in until the valve completed its full stroke at which time the torque or limit switches would open the close contactor stopping the valve. Motor currents were normal during this test. Initial investigation implied that either the limit or torque switches were improperly set causing the close contactor to open thus stopping the valve prior to completion of its full stroke.

On August 29, 1988, the plant was shutdown and cooled down, and further testing was conducted. Tests were performed on valve B31-F031B and its sister valve, B31-F031A, Reactor Recirculation Pump A Discharge Valve. These tests were conducted under both static and dynamic conditions. Both valves opened and closed normally when their associated control room pushbuttons were depressed. Running motor currents and stroke times were normal except that there was no current increase as valve B31-F031B was closed into its valve seat. Current should have increased as the gate made contact with the valve seat. The valve motor's

increasing torque is sensed by the torque switch that subsequently opens the close contactor in the valve's control circuitry stopping the valve's stroke in its closed position.

On August 30, 1988, a visual inspection was conducted of valve B31-F031B. All wires were tight and all contacts appeared satisfactory. It was found that the torque switch was set at 2.00 vs. the manufacture's recommended setting of 2.75 for the original motor operator. It was subsequently identified that the correct manufacturer's torque switch setpoint is 4.75. The torque switch setpoint should have changed (from 2.75 to 4.75) in October, 1984 when the motor operator was replaced as a result of environmental qualification concerns. The torque switch was also found to have been improperly installed i.e., it was not properly centered resulting in a preloaded condition. Thus for a given switch setting actuation in the closed direction, it took less displacement of the springpack than in the open direction. It is believed that the valve's torque switch was incorrectly installed following springpack cleaning during the Spring 1988 outage. Therefore, the B31-F031B valve was prevented from fully closing under normal operating conditions because the torque switch was set and installed incorrectly.

Motor Operator Valve Analysis Testing (MOVAT) was then performed on both recirculation discharge valves. Valve B31-F031B testing validated that the generated stem thrust was lower than the specified target thrust and the torque switch was improperly installed. The torque switch was replaced and the torque switch setting was increased to the value specified by Nuclear Engineering (4.75). MOVATS testing was reperformed and the results were determined to be acceptable. Valve B31-F031A testing determined that its torque switch was also incorrectly set.

However, field verification indicated that the torque switch was installed correctly (i.e., not preloaded) for B31-F031A.

Therefore, the root cause of the August 20 and August 28, 1988, B31-F031B valve failures are:

1. The torque switch recommended setting was not properly changed when the Motor Operator was changed out (i.e., the actual switch setting was not increased). No approved data base exists to track recommended, actual and maximum torque switch settings.

2. The torque switch was improperly installed (it was not properly centered, i.e., it was preloaded).

Safety Analysis:

Failure of valve B31-F031B to close is bounded by UFSAR analysis (Section 6.3.3.3) for a large break LOCA coincident with a LPCI injection valve failure. No credit is taken for LPCI, but both trains of the Core Spray System are required.

This analysis lists HPCI (UFSAR Table 6.3-5) as a system "Remaining" after a large break. As indicated above, during the second recirculation discharge valve failure (August 28, 1988) HPCI was in an outage. The fact that HPCI was temporarily out of service does not invalidate this analysis because HPCI does not significantly contribute during a large break since the rapid depressurization results in a loss of steam pressure to drive the HPCI turbine.

Corrective Actions:

The corrective actions are divided into two categories - Short Term and Long Term. Short Term actions are underway and will be completed prior to restart of the reactor.

The following are Short Term actions:

A. An Engineering list of torque switch settings for safety related valves is being generated. The following related actions will be completed:

1. Nuclear Engineering will validate torque switch setting data by a design review.

2. Field inspection of the below listed categories of MOVs includes torque switch settings, torque switch installation and determination of which operators have limiter plates; MOVATS testing is being performed on selected valves based on the as found condition:

   Eight MOVs are being inspected which had their motor operators replaced in 1984 for environmental qualification concerns.

   Ten MOVs are being inspected which had springpack work performed on them during the Spring 1988 outage.

Torque Switch documentation was reviewed on thirty two MOVs for which MOVATS testing had been previously performed. As a result of this review a sample of four valves from the thirty two is being inspected.

One MOV is being inspected based on a review of its maintenance history.

Nineteen MOVS are being inspected as an additional sample.

3. Reconciliation of any identified discrepancies.

4. Determine if additional Engineering review or field inspection is required based on discrepancies discovered during actions 1 and 2 above.

5. Torque switch settings will be specified as controlled information and placed under the current design control program.

B. Engineering to determine if other design changes have been implemented which could have impacted torque switch settings or torque switch installation. Additional actions may be developed based on the review.

C. Maintenance Procedures used for torque switch installation have been reviewed by site, Limitorque and Stone & Webster personnel. Procedures have been revised.

D. Key Maintenance & QC personnel have been trained, with Limitorque representatives present, in the proper torque switch installation methods and adjustments.

E. Applicable industry and site documentation has been reviewed to identify related experiences. The documents identified will be used to ensure that the Long Term corrective actions address all identified problems

F. During the torque switch inspections a problem was identified with some limit switch settings. Based on an engineering review, torque switch bypass limit switches on forty two MOVs are being inspected and adjusted as necessary.

The following are the Long Term actions:

A. Torque switch settings for non-safety related MOVs will be reviewed by Engineering. After validation of settings, the information will be included as controlled information under the existing design control program.

B. Preventive/Corrective Maintenance programs will be reviewed with respect to work activities and controls for MOVs. Procedures will be revised as necessary to ensure activities which can affect torque switch or limit switch settings are correct and comply with current configuration control practices. This activity is currently underway.

C. The post maintenance testing program will be reviewed and revised as necessary to provide confidence of valve operability after maintenance.

D. The root cause analysis for the first B31-F031B stroke failure will be assessed to determine if any improvements to our root cause analysis methodology are necessary.

E. All applicable procedures will be reviewed to assure that MOVs and their settings will be properly controlled from procurement to installation.

F. The ongoing training program for maintenance personnel will be updated to incorporate applicable lessons learned.

Note: Further information on the results of these investigations and actions taken will be provided in our response to the NRC Confirmatory Action Letter dated August 30, 1988 (Due September 29, 1988).

Previous Similar Events:

No previous LERs were written on torque switches. Our internal tracking system has been reviewed and reports on torque switch problems are being examined as part of the corrective action program.

William S. Orser
Vice President
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10CFR50.73

Nuclear Operations

September 19, 1988
NRC-88-0214

U. S. Nuclear Regulatory Commission
Attention: Document Control Desk
Washington, D.C. 20555

Reference: Fermi 2
NRC Docket No. 50-341
Facility Operating License No. NPF-43

Subject: Licensee Event Report (LER) No. 88-032-00

Please find enclosed LER No. 88-032-00, dated September 19, 1988, for reportable events that occurred on August 20, 1988 and August 28, 1988. A copy of this LER is also being sent to the Regional Administrator, USNRC Region III.

If you have any questions, please contact Gordon Nader at (313) 586-4513.

Sincerely,

Enclosure: NRC Forms 366, 366A

cc: A. B. Davis
J. R. Eckert
R. C. Knop
T. R. Quay
W. G. Rogers

Wayne County Emergency
Management Division

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