William T. O'Connor, Jr.
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DTE Energy

10CFR50.73

May 7, 2003
NRC-03-0026

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

References: 1) Fermi 2
NRC Docket No. 50-341
NRC License No. NPF-43

2) Detroit Edison Letter to NRC, "Licensee Event Report (LER) No. 02-004, "Reactor Scram Due To Loss of Condenser Vacuum," NRC-02-0075, dated November 14, 2002.

Subject: Licensee Event Report (LER) No. 02-004, Revision 1, "Reactor Scram Due To Loss of Condenser Vacuum"

In Reference 2, Detroit Edison submitted Licensee Event Report (LER) No. 02-004, "Reactor Scram Due To Loss of Condenser Vacuum."

Detroit Edison is hereby submitting Revision 1 of LER No. 02-004. This revision provides the cause analysis of the failure of Circulating Water Pump 2 and revises the scram initiation signal from turbine stop valve closure to turbine control valve fast closure.

No Commitments are being made in this LER.

Should you have any questions or require additional information, please contact Mr. Norman K. Peterson of my staff at (734) 586-4258.

Sincerely,

William T. O'Connor

IE22

cc: M. A. Ring
J. F. Stang, Jr.
M. V. Yudasz, Jr.
NRC Resident Office
Region III
Regional Administrator, Region III
Wayne County Emergency Management Division

NRC FORM 366 (7-2001)

U.S. NUCLEAR REGULATORY COMMISSION

APPROVED BY OMB NO. 3150-0104 EXPIRES 7-31-2004

Estimated burden per response to comply with this mandatory information collection request: 50 hours. Reported lessons learned are incorporated into the licensing process and fed back to industry. Send comments regarding burden estimate to the Records Management Branch (T-6 E6), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by Internet e-mail to bjs1@nrc.gov, and to the Desk Officer, Office of Information and Regulatory Affairs, NEOB-10202 (3150-0104), Office of Management and Budget, Washington, DC 20503. If a means used to impose information collection does not display a currently valid OMB control number, the NRC may not conduct or sponsor, and a person is not required to respond to, the information collection.

LICENSEE EVENT REPORT (LER)

(See reverse for required number of digits/characters for each block)

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4. TITLE

Reactor Scram Due To Loss of Condenser Vacuum

5. EVENT DATE			6. LER NUMBER			7. REPORT DATE			8. OTHER FACILITIES INVOLVED	
MO	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REV NO	MO	DAY	YEAR	FACILITY NAME	DOCKET NUMBER
										05000
10	02	2002	2002	– 004	– 01	05	07	03	FACILITY NAME	DOCKET NUMBER 05000

9. OPERATING MODE	1
10. POWER LEVEL	100

11. THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check all that apply)

20.2201(b)	20.2203(a)(3)(ii)	50.73(a)(2)(ii)(B)	50.73(a)(2)(ix)(A)
20.2201(d)	20.2203(a)(4)	50.73(a)(2)(iii)	50.73(a)(2)(x)
20.2203(a)(1)	50.36(c)(1)(i)(A)	X 50.73(a)(2)(iv)(A)	73.71(a)(4)
20.2203(a)(2)(i)	50.36(c)(1)(ii)(A)	50.73(a)(2)(v)(A)	73.71(a)(5)
20.2203(a)(2)(ii)	50.36(c)(2)	50.73(a)(2)(v)(B)	OTHER Specify in Abstract below or in NRC Form 366A
20.2203(a)(2)(iii)	50.46(a)(3)(ii)	50.73(a)(2)(v)(C)	
20.2203(a)(2)(iv)	50.73(a)(2)(i)(A)	50.73(a)(2)(v)(D)	
20.2203(a)(2)(v)	50.73(a)(2)(i)(B)	50.73(a)(2)(vii)	
20.2203(a)(2)(vi)	50.73(a)(2)(i)(C)	50.73(a)(2)(viii)(A)	
20.2203(a)(3)(i)	50.73(a)(2)(ii)(A)	50.73(a)(2)(viii)(B)	

12. LICENSEE CONTACT FOR THIS LER

NAME	TELEPHONE NUMBER (Include Area Code)
Jerome Flint – Principal Specialist, Licensing	734-586-5212

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

CAUSE	SYSTEM	COMPONENT	MANU-FACTURER	REPORTABLE TO EPIX	CAUSE	SYSTEM	COMPONENT	MANU-FACTURER	REPORTABLE TO EPIX
X	KE	P	I075	Y	X	KE	ISV	P340	Y

14. SUPPLEMENTAL REPORT EXPECTED				15. EXPECTED SUBMISSION DATE	MONTH	DAY	YEAR
	YES (If yes, complete EXPECTED SUBMISSION DATE).	X	NO				

16. ABSTRACT (Limit to 1400 spaces, i.e., approximately 15 single-spaced typewritten lines)

On October 2, 2002, at 1453 hours, the reactor scrammed from 100 percent power. Condenser pressure increased when Circulating Water Pump (CWP) 2, one of four running CWPs, failed. Condenser pressure exceeded the main turbine trip setpoint. The main turbine tripped, resulting in a reactor scram. Prior to the scram at 1452 hours the Circulating Water Header Low Pressure annunciator was received. The Condenser Pressure High annunciator was received and control room operators (licensed, utility) entered the Abnormal Operating Procedure for Loss of Condenser Vacuum. The main turbine automatically tripped causing a reactor scram on main turbine control valve fast closure. All safety systems responded as expected. All rods fully inserted into the core. Reactor level decreased below Level 3, resulting in expected isolation signals. After the reactor scram, condenser vacuum recovered. Reactor level was recovered with the Feedwater/Condensate System. No Emergency Core Cooling Systems initiated and no Safety Relief Valves lifted. The cause of the event was a failure of CWP 2. This event is being reported in accordance with 10 CFR 50.73(a)(2)(iv)(A), as an event that resulted in manual or automatic actuation of any systems listed in paragraph (a)(2)(iv)(B), i.e., actuation of the Reactor Protection System including reactor scram or reactor trip. The cause of the CWP failure was fatigue failure of the diffuser casing to column bolts due to insufficient or loss of pre-load.

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17. NARRATIVE *(If more space is required, use additional copies of NRC Form 366A)*

Initial Plant Conditions:

Mode	1 (Power Operation)
Reactor Power	100 Percent
Reactor Pressure	1023 psig
Reactor Temperature	537 Degrees Fahrenheit

Description of the Event

On October 2, 2002, at 1453 hours, the reactor scrammed from 100 percent power. Condenser pressure increased when Circulating Water Pump (CWP) 2 (P), one of four running CWPs, failed. Condenser pressure exceeded the main turbine trip setpoint. The main turbine (TA) tripped, resulting in a reactor scram.

Prior to the scram at 1452 hours the Circulating Water Header Low Pressure annunciator (ANN) was received in the control room. CWP 2 was observed running with reduced amperage. The Condenser Pressure High annunciator was received and control room operators (licensed, utility) entered the Abnormal Operating Procedure for Loss of Condenser Vacuum. As operators were preparing to reduce reactor power, the main turbine automatically tripped causing a reactor scram on main turbine control valve fast closure. All safety systems responded as expected. All rods fully inserted into the core. Reactor level decreased below Level 3 (approximately 173 inches above the top of active fuel) as expected, resulting in Primary Containment Isolation (JM) of Group 13, Drywell Sumps (WK). Primary Containment Isolation Group 4, Residual Heat Removal Shutdown Cooling and Head Spray (BO), and Group 15, Traversing Incore Probe System (IG), received isolation signals, but were already isolated per normal lineup. After the reactor scram condenser vacuum recovered allowing continued use of the main condenser (SG) as a heat sink. Reactor level was recovered with the Feedwater/Condensate System (SG, SJ). No Emergency Core Cooling Systems initiated and no Safety Relief Valves lifted.

This event is being reported in accordance with 10 CFR 50.73(a)(2)(iv)(A), as an event that resulted in manual or automatic actuation of any systems listed in paragraph (a)(2)(iv)(B), i.e., Reactor Protection System (RPS) (JC) including reactor scram or reactor trip.

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17. NARRATIVE *(If more space is required, use additional copies of NRC Form 366A)*

Cause of the Event

The turbine trip/reactor scram on main turbine control valve fast closure was due to high condenser pressure. The cause of the high condenser pressure was failure of CWP 2. When CWP 2 stopped pumping (motor still running), a reverse flowpath was established from the Circulating Water System discharge header back to the Circulating Water Reservoir resulting in reduced Circulating Water System discharge pressure and flow to the main condenser. This resulted in main condenser pressure increasing to the main turbine trip setpoint. Subsequent to the turbine trip/reactor scram, steam flow to the main condenser was reduced to within the remaining Circulating Water System flow capability. Condenser vacuum quickly recovered.

Following the scram, initial closure of the CWP 2 discharge valve (ISO) failed to trip CWP 2 as designed. The discharge valve close pushbutton was held in the close position by the operator, tripping CWP 2. It was later determined the CWP 2 discharge valve motor operator shear pin had broken, allowing the valve motor operator to provide closed indication. The CWP 2 discharge valve remained open.

Routine periodic monitoring of vibration levels is performed on the CWPs. The vibration levels for CWP 2 were observed slowly trending up over time. In August 2002, an increase in vibration levels on CWP 2 was noted and entered into the site corrective action program. The trend in vibration and specific vibration levels of August 2002 were reviewed and discussed with the Circulating Water System Engineer. A Preventative Maintenance (PM) activity requiring pump overhaul for CWP 2 was rescheduled so that CWP 2 would be the next CWP undergoing this PM. Observed vibration levels were low enough there was no immediate concern with continuing to operate CWP 2.

The cause of failure of CWP 2 was fatigue failure of the diffuser casing to column bolts due to insufficient bolt tension or loss of pre-load. The diffuser casing to column bolts initially failed on one side of the diffuser casing causing it to separate slightly from the pump column. This caused a misalignment of the bearings on the shaft resulting in severe wear to the bearings. This progressed until the diffuser housing began to rub on the impeller. At this point either the pump shaft failed or the bolting continued to fail until the diffuser caused the shaft to fail. With the failure of the shaft and bolts, the diffuser casing broke away from the pump. Contributing factors were corrosion of the bolt heads and the casting surfaces causing the loss of preload and fatigue failure of the bolts. An additional factor is corrosion found on the bolts that may have prevented the nuts from obtaining the desired bolt tension.

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17. NARRATIVE *(If more space is required, use additional copies of NRC Form 366A)*

Analysis of the Event

This report is required by 10 CFR 50.73(a)(2)(iv)(A) because of the unplanned actuation of reportable systems. Specifically, the reactor protection system was actuated as a result of a turbine trip on main turbine control valve fast closure due to high condenser pressure.

A scram from turbine trip is an analyzed transient for which the plant is designed. All systems responded as expected. All rods fully inserted into the core. Reactor water level was maintained above the top of active fuel by the Condensate/Feedwater Systems and pressure was maintained below design by the Turbine BypassValves. Reactor water level decreased below Level 3 (approximately 173 inches above the top of active fuel) as expected, but above level 2 (approximately 110 inches above the top of active fuel) resulting in Primary Containment Isolation of Group 13, Drywell Sumps. Primary Containment Isolation Group 4, Residual Heat Removal Shutdown Cooling and Head Spray, and Group 15, Traversing Incore Probe System, received isolation signals, but were already isolated per normal lineup. No Emergency Core Cooling Systems initiated and no Safety Relief Valves lifted.

The failure of the CWP 2 discharge valve to fully close allowed circulating water reverse flow from the Circulating Water System discharge header back to the Circulating Water Reservoir, but there was sufficient Circulating Water System pressure and flow to maintain condenser vacuum after the turbine trip/reactor scram.

The Updated Final Safety Analysis Report (UFSAR) contains "Loss of Condenser Vacuum at Two Inches Per Second" as part of the accident analysis. The transient that actually occurred was much less significant than that described in the UFSAR in that the Main Turbine Bypass Valves and Main Steam Isolation Valves did not isolate. Condenser vacuum recovered immediately after the turbine trip. Safety Relief Valves were not required to open. There was no discharge of normal coolant activity into the suppression pool.

This event did not affect the ability of systems required to maintain safe shutdown conditions, remove residual heat, control the release of radioactive material, or mitigate the consequences of an accident. Based on the preceding, it is concluded that there was no adverse impact on safety as a result of this event.

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17. NARRATIVE *(If more space is required, use additional copies of NRC Form 366A)*

Corrective Actions

The discharge valve for CWP 2 was closed and the remainder of the Circulating Water System restored to normal prior to startup.

Vibration levels were taken on all remaining CWPs. No other pumps indicated any adverse trends in vibration.

PM and Corrective Maintenance activities for all CWPs were reviewed and those items that would enable the Circulating Water System to run trouble free until Refueling Outage 9 (RF09) were performed. Items included replacement of motor air filters, oil samples, repacking pump seals on CWP 4, and oil replacement for CWP 3.

CWP 2 is being rebuilt. Replacement of casing bolts on CWPs 1, 3, 4, and 5 was performed during RF09.

Additional corrective actions have, and are continuing to be developed for other underwater pumps and will be implemented commensurate with established priorities and processes of the Fermi 2 corrective action program.

This event is documented in the Fermi 2 corrective action program in CARD 02-16210.

Additional Information

A. Failed Components

Component: Circulating Water Pump 2
Description: Single stage centrifugal pump, 180,000 gallons per minute design
Manufacturer: Ingersoll Rand
Type: Model number 89APH

Component: Circulating Water Pump 2 Discharge Valve
Description: Motor Operated Valve
Manufacturer: Henry Pratt Co.
Type: 78 inch Butterfly

B. Previous LERs On Similar Problems

LER 93-004, "Automatic Reactor Shutdown on Turbine Trip Due to Loss of Condenser Vacuum" describes an event where a personnel error caused a loss of electrical power to two CWP's and their discharge valves.