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L-10-177

10 CFR 50.73(a)(2)(i)(A)
10 CFR 50.73(a)(2)(iv)(A)

ATTN: Document Control Desk
U. S. Nuclear Regulatory Commission
Washington, DC 20555-0001

SUBJECT:
Perry Nuclear Power Plant
Docket No. 50-440, License No. NPF-58
Licensee Event Report Submittal

Enclosed is Licensee Event Report (LER) 2010-003, "Loss of Control Rod Drive Header Pressure Results in Manual RPS Actuation." There are no regulatory commitments contained in this submittal.

If there are any questions or if additional information is required, please contact Mr. Robert Coad, Manager – Regulatory Compliance, at (440) 280-5328.

Sincerely,

Mark B. Bezilla

Enclosure:
LER 2010-003

cc: NRC Project Manager
NRC Resident Inspector
NRC Region III

IE22
NRR

NRC FORM 366 (9-2007) U.S. NUCLEAR REGULATORY COMMISSION

APPROVED BY OMB NO. 3150-0104 EXPIRES 8/31/2010

Estimated burden per response to comply with this mandatory collection request: 80 hrs. Reported lessons learned are incorporated into the licensing process and fed back to industry. Send comments regarding burden estimate to the Records and FOIA/Privacy Service Branch (T-5 F52), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by internet e-mail to infocollects@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 an 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

Loss of Control Rod Drive Header Pressure Results in Manual RPS Actuation

5. EVENT DATE			6. LER NUMBER			7. REPORT DATE			8. OTHER FACILITIES INVOLVED	
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REV NO.	MONTH	DAY	YEAR	FACILITY NAME	DOCKET NUMBER
05	11	2010	2010	- 003	- 00	07	12	2010	FACILITY NAME	DOCKET NUMBER

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

12. LICENSEE CONTACT FOR THIS LER

FACILITY NAME	TELEPHONE NUMBER *(Include Area Code)*
Perry Nuclear Power Plant, John Pelcic, Compliance Engineer	(440) 280-5824

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
B	JC	PDIS	R369	Y						

14. SUPPLEMENTAL REPORT EXPECTED

☐ YES *(If yes, complete EXPECTED SUBMISSION DATE).* ☒ NO

15. EXPECTED SUBMISSION DATE

MONTH	DAY	YEAR

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

On May 11, 2010, at 2318 hours, a manual Reactor Protection System actuation was inserted in accordance with Technical Specification (TS) 3.1.5, "Control Rod Scram Accumulators." Control Rod Drive (CRD) system charging water header pressure was less than 1520 pounds per square inch gauge and multiple accumulator fault alarms were received on withdrawn control rods.

A failed master trip unit caused an invalid Division 2 loss of coolant accident initiation signal and loss of electrical control power to the operating CRD pump and standby CRD pump. Control logic for the operating CRD pump was in an alternate electrical line-up at the time and could not be transferred to its normal source for a timely restart.

A replacement trip unit was installed and tested satisfactorily. Future replacement trip units will be required to have 100 hours burn-in prior to installation to reduce the potential for early failures. Plant procedures will be revised to improve recognition and evaluation of long-term alternate plant configurations and degraded conditions.

The safety significance of this event is considered to be low. This event is reported in accordance with 10 CFR 50.73(a)(2)(i)(A),completion of any nuclear power plant shutdown required by the plant's TS, and 10 CFR 50.73 (a)(2)(iv)(A), an event or condition that resulted in a manual or automatic actuation of plant systems listed in paragraph (a)(2)(iv)(B).

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Energy Industry Identification System Codes are identified in the text as [XX].

INTRODUCTION

On May 11, 2010, at 2318 hours, a manual Reactor Protection System (RPS) [JC] actuation was inserted as required by Technical Specification (TS), Limiting Condition for Operation (LCO) 3.1.5, "Control Rod Scram Accumulators." Control Rod Drive (CRD) system [AA] charging water header pressure was less than 1520 pounds per square inch gauge (psig) and multiple accumulator fault alarms were received on withdrawn control rods. The plant was operating in MODE 1 (Power Operation) and 100 percent rated thermal power (RTP) at the time of the event. A four hour non-emergency notification was made to the NRC Operations Center at 0312 hours on May 12, 2010, in accordance with 10 CFR 50.72(b)(2)(i) as an initiation of any nuclear plant shutdown required by the plant's TS and 10 CFR 50.72(b)(2)(iv)(B) as any event or condition that results in actuation of the reactor protection system when the reactor is critical (Event Notification 45918). This event is being reported in accordance with 10 CFR 50.73(a)(2)(i)(A) for completion of any nuclear power plant shutdown required by the plant's TS, and 10 CFR 50.73 (a)(2)(iv)(A) as an event or condition that resulted in a manual or automatic actuation of plant systems listed in paragraph (a)(2)(iv)(B).

EVENT DESCRIPTION

On May 11, 2010, the plant was operating at 100 percent RTP with all emergency core cooling systems (ECCS) operable and the Reactor Core Isolation Cooling (RCIC) system out of service for planned maintenance. At 2304 hours, an unexpected Division 2 Loss of Coolant Accident (LOCA) (i.e., High Drywell Pressure/Low Reactor Vessel Water Level) initiation signal was received. The LOCA initiation signal was invalid. No actual LOCA conditions or parameters were experienced in the power plant. The invalid LOCA signal caused the following system actuations to occur:

- Automatic start of the Division 2 Emergency Diesel Generator (EDG) [DG]. The EDG started but did not load onto the bus.
- Automatic start of the Low Pressure Coolant Injection (LPCI) B and C systems. The LPCI systems started but did not inject into the reactor vessel.
- Initiation of Suppression Pool Makeup system B [BT] and transfer of water from Containment upper pools to the suppression pool.
- Automatic start of the Control Room Emergency Recirculation system B.
- Isolation of Group 2B Containment isolation valves which included the Nuclear Closed Cooling (NCC) system Containment Return Isolation valve that was not already closed. As a result, NCC and CRD seal purge flows were interrupted for approximately 21 minutes to the Reactor Recirculation A and B pump seals.
- Automatic start of Emergency Service Water (ESW) system B and Emergency Closed Cooling (ECC) system B.
- Loss of stub bus XH12 and associated non-safety loads. The Division 2 initiation logic, by design, strips the non-safety loads off the bus on EDG start.
- CRD pump A [P] tripped on loss of electrical power to the control logic when the Division 2 LOCA signal was received. CRD pump B could not be started.

With no CRD pumps running, multiple control rod scram accumulator fault alarms (approximately 15-20 within three minutes) on withdrawn control rods came in and CRD charging water header

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pressure decreased to less than 1520 psig. The operators were unable to restart a CRD pump and restore header pressure.

At 2307 hours, the operators entered TS LCO 3.1.5, "Control Rod Scram Accumulators" Condition B, "Two or more control rod scram accumulators inoperable with reactor steam dome pressure >/= 600 psig." Required Action B.1 to restore charging water header pressure to >/= 1520 psig could not be implemented within the required completion time of 20 minutes. Since the Required Action and associated Completion Time of Required Action B.1 could not be met, the operators implemented Required Action D.1 at 2318 hours to immediately place the reactor mode switch in the shutdown position.

All control rods inserted into the core and the plant stabilized in Mode 3 (Hot Shutdown) with reactor pressure at approximately 924 psig and reactor water level at approximately 196 inches above the top of active fuel. No ECCS systems were required or utilized to respond to the event. There were no other reportable actuations. Reactor coolant level was maintained in its normal band by the feedwater system and decay heat removal was through the main condenser. The plant was maintained in a normal electrical line-up with all three divisional EDGs operable and available, if needed.

The Division 2 EDG was shutdown to standby readiness at 0128 hours on May 12, 2010. The reactor scram was reset at 0341 hours. Stub bus XH12 was re-energized and at 0522 hours, CRD pump A was returned to service. At 1642 hours, the suppression pool level was returned to its required band. On May 13, 2010, the plant entered Mode 4 (Cold Shutdown).

CAUSE OF EVENT

The event was caused by a combination of equipment failure, power supply configuration, and being in an alternate electrical line-up.

An input filter capacitor on Rosemount Type 710DU master trip unit (MTU) 1E31N0684B, RCIC Steam Line High Differential Pressure [PDIS] failed (i.e., short circuit) and caused a voltage perturbation in the Division 2 LOCA initiation circuitry. This was an infant mortality failure as the MTU was new from the manufacturer and installed in the power plant for less than 30 hours.

Both channels (MTUs) of Division 2 reactor low level 1 tripped momentarily and initiated the Division 2 LOCA logic. The MTUs for both channels of reactor low level 1 are powered by the same power supply. The power supply voltage perturbation associated with 1E31-N684B caused an invalid trip of both channels and satisfied the Division 2 LOCA logic. The LOCA signal caused numerous plant systems to actuate.

When the Division 2 EDG started, 4.16 KV stub bus XH12 was automatically de-energized by design and power to its non-safety loads including motor control center (MCC) F1C08 was lost. The XH12 stub bus is an extension of 4.16 KV bus EH12 which is diesel backed but normally powered through the plant electrical distribution system. The operating CRD pump A at the time tripped off because its control logic power was aligned to MCC F1C08. CRD pump B, also powered off XH12 could not be started because electric power to its control logic was no longer

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available.

The alignment of MCC F1C08 to stub bus XH12 was an alternate alignment in effect since June 2009. After a June 21, 2009, RPS actuation, MCC F1C08 automatically transferred to the emergency diesel backed power source (stub bus XH12), but could not be transferred back to its normal source due to a faulty automatic bus transfer (ABT) switch. The ABT switch serves to automatically transfer the bus power supply over to the diesel backed load center when an undervoltage condition exists on the normal supply. The vulnerability of being in this alternate electrical lineup for an extended period of time was not evaluated by plant personnel. The transfer of MCC F1C08 back to its normal supply would require shedding the loads from the busses prior to transfer and would have taken longer than 20 minutes to perform.

With degrading CRD hydraulic pressure, multiple CRD accumulator faults, and inability to restore an operable CRD pump in a timely manner, the operators inserted a manual RPS actuation to comply with TS LCO 3.1.5 Required Action D.1.

A contributing cause was an unrecognized single-point vulnerability in the CRD pump oil pressure control logic. Both the trip and pressure permissives for the CRD auxiliary oil pumps are powered by the same 120 volt power source. Loss of this power source caused a trip of the operating CRD pump and prevented start-up of the standby CRD pump.

EVENT ANALYSIS

This event is reported in accordance with 10 CFR 50.73(a)(2)(i)(A), "The completion of any nuclear power plant shutdown required by the plant's Technical Specifications." TS LCO 3.1.5 states that each control rod scram accumulator shall be operable in Modes 1 and 2. Condition B, "Two or more control rod scram accumulators inoperable with reactor steam dome pressure >/= 600 psig" contains Required Action B.1, "Restore charging water header pressure to >/= 1520 psig." The completion time for Required Action B.1 is 20 minutes from discovery of Condition B concurrent with charging water header pressure less than 1520 psig. Condition B was determined to exist with receipt of multiple accumulator fault alarms. Required Action B.1 and its associated completion time could not be implemented due to loss of power to the CRD pumps and an alternate electrical line-up which prevented CRD pump start and restoration of CRD hydraulic pressure. Since the Required Action and associated Completion Time of Required Action B.1 could not be met, the operators implemented Required Action D.1 to immediately place the reactor mode switch in the shutdown position. Therefore, this shutdown was implemented as required by TS.

Certain plant systems actuated automatically in response to the invalid Division 2 LOCA initiation. By placing the reactor mode switch in the shutdown position, the operators inserted a manual RPS actuation. These system actuations are reportable in accordance with 10 CFR 50.73(a)(2)(iv)(A), "Any event or condition that resulted in a manual or automatic actuation of plant systems listed in paragraph (a)(2)(iv)(B)." The following reportable system actuations occurred:

- RPS
- Group 2B Containment isolation valves
- LPCI B and C
- Division 2 EDG
- ESW B

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The manual RPS actuation was uncomplicated in that all control rods fully inserted, reactor coolant pressure and level were maintained within expected parameters, and no ECCS systems actuated in response. The RPS functioned as designed.

A probabilistic risk assessment was performed for this event. The analysis calculated the change in Core Damage Frequency (CDF) to be 1.69E-07. The Large Early Release Frequency (LERF) is on the order of 1E-08. Events with changes in CDF of less than 1.0E-06 and a LERF of less than 1.0E-07 are not considered to be significant risk events. Based on the probabilistic risk assessment results, this event is considered to be of low safety significance.

CORRECTIVE ACTIONS

A replacement trip unit was installed and tested satisfactorily. Procurement documents for Rosemount 710DU MTUs and slave trip units will be revised to require a 100 hour total burn-in time at the manufacturer's facility prior to delivery. Rosemount currently performs a 48 hour burn-in. For MTUs already on-site, restraints to replacement Orders were added to establish an additional 52 hour burn-in prior to installation.

MCC F1C08 was designated an Operator Work Around to heighten awareness of the electrical configuration and was added to the Margin Management database for development of a coping strategy. The configuration was reviewed under the Operational Decision Making process and the decision was made to leave the F1C08 transfer switch aligned to the alternate power source until the ABT switch is replaced in the next refueling outage which is scheduled to begin April 2011.

Plant administrative procedures will be revised to improve recognition and evaluation of long-term alternate configurations and degraded conditions in the power plant.

Additional long-term corrective actions for this event include:

- Removal of single point vulnerability for the control rod drive oil pressure control logic.
- Modifications to eliminate potential LOCA initiation signals on Divisions 1, 2, and 3 caused by card faults, rack faults, and power supply faults that affect both trip channels.
- Modifications to upgrade the ABT switches on MCCs F1B08 and F1D08 which are also powered off 4.16KV stub bus XH12.

PREVIOUS SIMILAR EVENTS

Five RPS actuations at Perry occurred in the past three years. Review of the associated LERs found that the events had different initiators and circumstances than the May 11, 2010 manual RPS actuation. With one exception, the corrective actions implemented for the events could not reasonably be expected to prevent occurrence of this event. A corrective action associated with a June 21, 2009, RPS actuation (reference LER 2009-001, MSR High Level Signal Causes Turbine Trip and RPS Actuation) was generated to correct the MCC F1C08 ABT switch inability to transfer to the normal supply. The planned maintenance work could not be performed on-line and was scheduled for the next refueling outage. Had the ABT functioned properly, the MCC could have been realigned to the normal source and CRD pump A could have been restarted to restore CRD header pressure.

LICENSEE EVENT REPORT (LER)
CONTINUATION SHEET

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COMMITMENTS

There are no regulatory commitments contained in this report. Actions described in this document represent intended or planned actions, are described for the NRC's information, and are not regulatory commitments.