Entergy

Indian Point Energy Center
450 Broadway, GSB
P.O. Box 249
Buchanan, N.Y. 10511-0249
Tel (914) 254-6700

John A. Ventosa
Site Vice President

NL-12-040

April 2, 2012

U.S. Nuclear Regulatory Commission
Attn: Document Control Desk
Mail Stop O-P1-17
Washington, D.C. 20555-0001

SUBJECT: Licensee Event Report # 2012-001-00, "Common Cause Inoperability of Both Trains of Motor Driven Auxiliary Feedwater (AFW) Pumps Due to Inability to Control AFW Regulating Valves After Isolation of Nitrogen Backup"
Indian Point Unit No. 3
Docket No. 50-286
DPR-64

Dear Sir or Madam:

Pursuant to 10 CFR 50.73(a)(1), Entergy Nuclear Operations Inc. (ENO) hereby provides Licensee Event Report (LER) 2012-001-00. The attached LER identifies an event where there was a common cause inoperability of both trains of motor driven auxiliary feedwater (AFW) pumps due to an inability to control AFW regulating valves after a loss of nitrogen backup, which is reportable under 10 CFR 50.73(a)(2)(vii). This condition was recorded in the Entergy Corrective Action Program as Condition Report CR-IP3-2011-04651.

There are no new commitments identified in this letter. Should you have any questions regarding this submittal, please contact Mr. Robert Walpole, Manager, Licensing at (914) 254-6710.

Sincerely,

JAV/cbr

cc: Mr. William Dean, Regional Administrator, NRC Region I
NRC Resident Inspector's Office, Indian Point 3
Mrs. Bridget Frymire, New York State Public Service Commission
LEREvents@inpo.org

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NRR

NRC FORM 366 (10-2010) U.S. NUCLEAR REGULATORY COMMISSION

APPROVED BY OMB NO. 3150-0104 EXPIRES: 10/31/2013

LICENSEE EVENT REPORT (LER)

1. FACILITY NAME:	2. DOCKET NUMBER	3. PAGE
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4. TITLE: Common Cause Inoperability of Both Trains of Motor Driven Auxiliary Feedwater (AFW) Pumps Due to Inability to Control AFW Regulating Valves After Isolation of Nitrogen Backup

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 05000
02	03	2012	2012-	001 -	00	4	03	2012	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)(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
☐ 20.2203(a)(2)(vi)	☐ 50.73(a)(2)(i)(B)	☐ 50.73(a)(2)(v)(D)	Specify in Abstract below or in NRC Form 366A

12. LICENSEE CONTACT FOR THIS LER

NAME	TELEPHONE NUMBER *(Include Area Code)*
Matthew Lewis, Assistant Operations Manager	(914) 254-6744

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

CAUSE	SYSTEM	COMPONENT	MANU-FACTURER	REPORTABLE TO EPIX	CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO EPIX
D	LK	RV	C711	Y					

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

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

On October 11, 2011, following completion of a 2 year inspection/overhaul of the Auxiliary Feedwater System (AFWS) nitrogen backup (BU) supply pressure regulator (IA-PCV-1276), the set pressure was increased to the set pressure of relief valve RV-1284 while performing the post maintenance (PM) test (PMT). RV-1284 lifted, chattered and the disc and seat were damaged. When valve PCV-1276 was returned to service, RV-1284 was found to be leaking and the system was isolated which resulted in the unavailability of the AFWS nitrogen BU system. An assessment was conducted on required actions as a result of isolating nitrogen BU. At 18:30 hours, a dedicated operator was stationed in the Auxiliary Boiler Feed Pump building for manual operation of the AFWPs discharge flow control valves (FCV) to mitigate any events that could result in loss of the normal instrument air (IA) supply. Under Design Basis Accident (DBA) events, the IA system (IAS) is not credited as its function to supply AFWS valves is not classified as safety related. Without IA, the BU nitrogen system is relied upon to operate the AFWS including the AFWP FCVs. When the AFWS nitrogen BU is unavailable, a dedicated operator is required to manually operate the AFWPs FCVs. The direct cause of the unavailable nitrogen BU was RV-1284 chattering due to inadequate PMT work order (WO) instructions for control of air regulator set-pressure following overhaul. The apparent cause of operators not recognizing the need to station an operator locally prior to isolating the AFWP nitrogen BU supply was inadequate procedural basis and licensing bases documents (UFSAR, TS Basis, TRM) from a missed opportunity from a previous event. Corrective actions include RV-1284 replacement, revision of model PMT WOs with guidance on regulator set pressures, revision of TS Basis, TRM, UFSAR, DBD, applicable System Descriptions, Operations procedures and lesson plans. The event had no significant effect on public health and safety.

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

Note: The Energy Industry Identification System Codes are identified within the brackets {}.

DESCRIPTION OF EVENT

On October 11, 2011, following completion of a 2 year inspection/overhaul of the Auxiliary Feedwater System (AFWS) {BA} nitrogen backup (BU) supply {LK} pressure regulator (IA-PCV-1276) {PCV}, the regulator set pressure was increased to the set pressure of relief valve RV-1284 {RV} while performing the post maintenance (PM) test (PMT). RV-1284 lifted, chattered and the disc and seat were damaged. When the nitrogen backup regulating valve IA-PCV-1276 was returned to service, relief valve RV-1284 was found to be leaking. The nitrogen BU to the AFWP flow control valves (FCVs) was isolated at approximately 17:45 hours which resulted in the unavailability of the AFWS nitrogen BU system. At 17:45 hours, a potential Technical Specification (TS) 3.7.5 (AFWS) Condition D was entered for three trains of AFW inoperable due to an unavailable nitrogen BU supply. At 18:30 hours, a dedicated operator was stationed in the AFWP Building {NF} for manual operation of the AFWPs discharge FCVs to mitigate any events that could result in loss of the normal instrument air (IA) {LD} supply. The AFWS FCVs and the turbine driven (TD) AFWP flow controller are pneumatic devices. Under Design Basis Accident (DBA) events, the IA system (IAS) is not credited as its function to supply AFWS valves is not classified as safety related. Without IA, the BU nitrogen system is relied upon to operate the AFWP FCVs. The nitrogen BU system provides 30 minutes additional time for controlling the AFWPs remotely until either recovery of IA occurs or a dedicated operator is stationed locally. When the AFWS nitrogen BU is unavailable, a dedicated operator is required to manually operate the AFWS including the AFWP FCVs. The loss of the nitrogen BU to the motor driven (MD) AFWPs would result in the pump FCVs to fail open and produce pump high flows. During a demand for the MD AFWPs, with reduced bus voltage, no IA available, and no manual operator action for the loss of the nitrogen BU system, the MD AFWPs could trip in approximately 400 seconds due to the high flows and resultant motor overcurrent and breaker amptector actuation. Additionally, should the MD AFWPs be run for an extended period of time with flow rates well above their controlled maximum, a pump trip may occur from bus breaker amptector due to a longer term motor overload condition. Operation of the MD AFWPs with their FCVs fully open could also result in overfill of the SGs. The condition of the loss of the nitrogen system was recorded in the Indian Point Energy Center (IPEC) Corrective Action Program (CAP) as Condition Report CR-IP3-2011-04651.

The AFW Nitrogen Backup System provides nitrogen backup for IA to pneumatic actuators of AFWS valves. There are 8 AFW regulating valves (FCVs); 4 for the MD AFWPs (FCV 406 A thru D), and 4 for the TD AFWP (FCV 405 A thru D). All the AFW FCVs are controlled from the Control Room by setting an air pressure (IA) to the valve positioner. All FCVs fail open on a loss of air. All of the AFW FCVs can be operated locally using the valves' handwheel. The basis for the nitrogen supply is to provide the capability to stroke 4 AFW FCVs, and provide for the steady state consumption of nitrogen by all 8 FCVs for thirty minutes plus 50 percent margin. The FCVs for the MD AFWPs are provided with a cutback controller feature that prevents overly high pump flows. High pump flow rates require high power output from the AFWP motors that can result in overheating and breaker amptector actuation. A pressure transmitter at the discharge of each pump provides a signal that is fed to its corresponding pressure controller (cutback). The controller set points are adjusted to provide a margin above minimum required flow rate at the lowest bus voltage conditions. A nitrogen bottle bank is located in the Auxiliary Boiler Feedwater Pump (ABFP) room to backup the IA to the AFWS. When nitrogen pressure at the supply header decreases to a specific alarm pressure, an alarm is provided to the control room.

The nitrogen bottle bank begins to supply backup nitrogen gas to AFWS components when the IA pressure falls below the pressure reducing regulator setting. Components include: TD AFWP FCV-405 (A-D), MD AFWPs FCV-406 (A-D), MS-HCV-1118 (speed controller for the TD AFWP with handwheel), PCV-1187, PCV-1189 (City Water supply to the suction of the two MD AFWPs). The nitrogen backup supply is designed to provide an additional 30 minutes of controlled operating time for the AFWPs after IA is lost. Turbine speed for the TD AFWP is maintained manually by a hand speed controller located in the control room and a mechanical governor. The electrical signal from the controller (HC-1118) controls a transducer that translates the demand signal to an air pressure which is supplied to a pneumatic operator that moves the turbine governor. On loss of air, HCV-1118 fails open and the TD AFWP will run to the mechanical governor maximum speed. HCV-1118 has nitrogen backup and a handwheel to allow manual control of the turbine. The actuation of the TD AFWP starts it at idle speed. The TD AFWP discharge FCVs are initially closed to prevent their injecting water into the SGs. Operator action is required to open the FCVs and increase the speed of the pump turbine. The MD AFWPs will start upon actuation and deliver flow through their FCVs which are initially closed because of low pump discharge pressure. The FCVs will open when pump discharge pressure increases to a limiting pressure but restricted to the cutback controller range setting.

Valve RV-1284 {RV} is a 1 x 1 ½ inch relief valve, manufactured by Crosby Valve Co. {C711}, Model # 9721134A.

An extent of condition review determined that the Unit 2 AFWS is also susceptible to the condition. Subsequent review of this issue determined that there was a previous identification of this issue (CR-IP3-2003-04717) but there was a missed opportunity to update the UFSAR on the nitrogen BU to IA for certain valves of the AFWS and describe how nitrogen supports operability of the AFWS. Had appropriate information been available, operators may have realized the need to station an operator locally prior to isolation of the BU nitrogen system. This condition was recorded in the CAP as Condition Report CR-IP3-2012-00393.

Cause of Event

The direct cause of the unavailable nitrogen BU was RV-1284 chattering due to inadequate PMT work order (WO) instructions for control of air regulator set-pressure following overhaul.

The apparent cause of operators not recognizing the need to station an operator locally to operate the AFWPs FCVs prior to isolating AFWP nitrogen BU supply was inadequate procedural basis and licensing bases documents (TS Basis, TRM, UFSAR, Design Basis Documents (DBDs), applicable System Descriptions, and Operations procedures) which did not sufficiently describe the relationship between the nitrogen BU system and IA and its impact on AFWS operability. There was a missed opportunity from a previous event in 2003 (CR-IP3-2003-04717) to implement corrective actions that would have revised appropriate procedures and bases documents.

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Corrective Actions

The following corrective actions have been or will be performed under Entergy's Corrective Action Program to address the cause:

- Replacement of RV-1284 and return of the nitrogen BU system to service.
- Revision of model PMT WOs with guidance on regulator set pressures.
- Revision of TS Basis, TRM, UFSAR to address the nitrogen BU system to IA and its support function for AFWS operability.
- Revision of DBD (IP3-DBD-303), System Description 21.2 (AFWS) and applicable Operations procedures (ARPs, AOPs, SOPs) to address the nitrogen BU system to IA and its support function for AFWS operability.
- Revision of associated Unit 2 basis documents (TS Basis, TRM, UFSAR), DBD (IP2-AFW), the Unit 2 System Description 21.0 (Feedwater System), and applicable Unit 2 Operations procedures (ARPs, AOPs, SOPs) to address the nitrogen BU system to IA and its support function for AFWS operability.
- Revision of applicable lesson plans due to changes in Operations procedures.

Event Analysis

The event is reportable under 10CFR50.73(a)(2)(vii). Any event where a single cause or condition caused at least one independent train or channel to become inoperable in multiple systems or two independent trains or channels to become inoperable in a single system designed to: (B) Remove residual heat, (D) Mitigate the consequences of an accident.

This event meets the reporting criteria because both MD AFWPs could become inoperable under a demand condition with the concurrent loss of IA; inability of the nitrogen BU system to operate the AFWP FCVs and no stationed operator. The situation could result in MD pump trip on high flow conditions with no operator stationed locally to manually operate the AFWPs FCVs. Overly high AFWP flow rates could result in pump trip due to bus amptector actuation. On October 11, 2011, the AFWP BU nitrogen regulator overhaul was completed. The nitrogen BU remained available during this work as there is a redundant regulated pathway for AFWP FCV operation. During the PMT it was discovered that a downstream RV in a common line was leaking. The BU nitrogen system for AFWS was isolated rendering it unavailable. The loss of the nitrogen BU system due to RV leakage was recorded in the CAP (CR-IP3-2011-04651) with a discovery time of 16:37 hours (EDT). At 17:45 hours, potential TS 3.7.5.D was entered for isolation of the nitrogen BU system due to a failed RV. After assessment of available information, a dedicated operator was stationed locally at 18:30 hours to operate the AFWPs FCVs if necessary. On October 13, 2011, at 16:04 hours, the BU nitrogen system RV was replaced and the BU nitrogen system returned to service. At 16:25 hours, operations exited potential TS 3.7.5.D.

There was no safety system functional failure (SSFF) reportable under 10CFR50.73(a)(2)(v) as the minimum required safeguards components were available to perform the function during the time the nitrogen BU system was not available. In accordance with reporting guidance in NUREG-1022, an additional random single failure need not be assumed in that system during the condition. At the time of the condition IA was available to operate the AFWPs FCVs and there was no reduced voltage condition. As the function of the AFWS is to supply water to the SGs to remove decay heat and supply enough makeup water to replace SG secondary inventory lost as the unit cools to Mode 4 conditions, the loss of the nitrogen BU system would not have prevented the AFWS from providing water to the SGs.

The condition was not a TS prohibited condition as the TS 3.7.5 Condition C (two AFW trains inoperable) allowed completion time of 6 hours to be in Mode 3 was not exceeded. However, the condition of the isolated nitrogen BU system and its impact on AFWS operability was not initially recognized as a reportable event under 10CFR50.73(a)(2)(vii). This missed reporting as an LER was recorded in the CAP as CR-IP3-2012-00394.

Past Similar Events

A review was performed of the past three years of Licensee Event Reports (LERs) for events reporting a common mode failure. No LERs were identified. There was one LER (LER-2011-003) that had non-safety components that impacted the safety function of a supported system. LER-2011-003 reported a TS required shutdown and a SSFF due to a leak in the conventional essential service water (SW) header that resulted in flooding of the SW valve pit. After review of documentation and further assessment of the condition it was determined that the condition was a SSFF because valves in the SW valve pit were required to be operated after a DBA during transfer to cold leg recirculation. Inability to close the SW pit valves due to flooding could result in a non-essential SW pump run out which is required to be started for accident mitigation. The cause for LER-2011-003 was not the same as this LER but similar to this LER as it required research and assessment to determine that the condition impacted a safety mitigation function.

Safety Significance

This event had no significant effect on the health and safety of the public. There were no actual safety consequences for the event because there were no accidents or transients requiring the AFWS. The IA System remained available during the time the nitrogen BU system was out of service and there was no reduced voltage condition.

The TD AFWP may operate indefinitely without manual operator action, and can be secured in accordance with system operating procedure 3-SOP-ESP-001. The increased speed of the TD AFWP due to loss of air to valve HCV-1118 and the overall speed of the turbine will then be governed and limited by the mechanical governor. When the TD AFWP discharge FCVs fail open (loss of pneumatic motive power), AFW flow is initiated to all four Steam Generators (SGs) when the developed pressure is higher than the SG pressure. With the TD AFWP in operation, the MD AFWPs would not be required to operate to provide adequate FW flow to the SGs. Procedure 3-SOP-ESP-001 contains guidance to locally operate HCV-1118, 32 TD AFWP speed controller if required. There are control room alarms for high steam generator (SG) level and procedures to respond to high SG level that include the response to isolate AFW flow by dispatching an operator to close the isolation valve for the applicable AFWP or by shutting down the operating pumps. In accordance with TS 3.7.5 Basis, the limiting events that require the AFWS are 1) Small Break LOCA (SBLOCA), 2) Loss of AC sources [Loss of offsite power (LOOP)], and 3) Loss of Feedwater (FW). The analysis for a SBLOCA assumes a LOOP and a single failure. This condition results in power to the MD AFWPs from the Emergency Diesel Generators (EDGs) which would not have reduced voltage conditions. A LOOP would result in start and load of the EDGs to power the MD AFWPs. A Station Blackout (SBO) would result in use of the TD AFWP. A loss of FW event is analyzed in UFSAR Section 14.1.9 assuming the loss of offsite AC power. The MD AFWPs would be powered by the EDGs which would not have a reduced voltage condition.

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In accordance with UFSAR Section 9.6.3 the IAS was designed such that IA shall be available under all operating conditions, all essential systems requiring air during or after an accident shall be self supporting, and after an accident the air system shall be re-established. Those items essential for safe operation and safe cooldown are provided with air reservoirs or gas bottles. These supplies will enable the equipment to function in a safe manner until the air supply is re-established or other means of control are made available. The IAS is backed up by the Station air system. The unavailability of both IA and the nitrogen backup for the AFWS results in the following: AFWP FCVs [FCV-405 (A-D) and FCV-406 (A-D) fail open ensuring AFW flow to the SGs. Amptectors trip of the MD AFWPs after several minutes under worst case conditions under high HP/amperage demand unless the FCVs are locally throttled. The pressure control valves for steam supply to the TD AFWP (PCV-1310A and 1310B) fail open insuring steam supply to the AFWP turbine. The TD AFWP steam supply pressure control valve (PCV-1139) fails open ensuring steam supply to the TD AFWP. TD AFWP speed control valve (HCV-1118) fails open to the mechanical governor maximum speed. The TD AFWP has a mechanical governor which will establish the design speed and prevent overspeed. The TD AFWP with no IA or nitrogen BU will provide adequate FW flow to the SGs to meet accident requirements. All the referenced valves have hand wheels for local control. Loss of IA (low pressure) and low nitrogen pressure will alarm in the control room alerting the operators for the need of manual actions.

Alternate shutdown capability to comply with 10CFR50, Appendix R has one scheme that makes use of the local control station in the Auxiliary Feedwater (AFW) Pump Room to shutdown the plant following a fire. For a safe shutdown following a postulated fire event, no credit is taken for the availability of the IA system to support operation of the AFWP FCVs. Further, no credit is taken for the availability of either the IA or nitrogen backup systems for a postulated fire event within the AFW Pump Room itself. Local operation of the AFWPs can be accomplished in the AFW Pump Room for the TD AFWP and at the emergency switchgear (in the Control Building), for the MD AFWPs, if necessary. Prompt Operator action to manually operate the FCVs would be available, except during an actual fire within the AFW Pump Room. The AFW Pump Room contains both MD AFWPs and the TD AFWP and is provided with automatic fire detection and a fixed suppression system, and a hose station outside the room. Fire suppression capability in the room is provided by an area wide automatic wet pipe sprinkler system, portable fire extinguishers, and by fire hose from nearby yard hydrants. For a loss of both IA and nitrogen supplies, the AFWPs would operate in the manner previously discussed, and AFW flow control valves for the selected AFW pump(s) would be manually operated in accordance with existing procedures following operator re-entry to the AFW Pump Room.

An assessment was performed to determine the impact of the condition on Incremental Core Damage Probability (ICDP) and Incremental Large Early Release Probability (ILERP). The assessment considered the case of both MD AFWPs being inoperable for a period of 2 hours to bound the time from initiation of the condition report for nitrogen BU system isolation to the time a dedicated operator was stationed at the AFWPs. The assessment yielded an ICDP of 1.18E-7 and an ILERP of 1.78E-8. Based on these results, the unavailability of the two MD AFWPs for the two hour period does not represent a significant risk impact when compared to the guidance provided in NUMARC 93-01 or Regulatory Guide 1.177.