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NL-13-073

June 24, 2013

U.S. Nuclear Regulatory Commission
Document Control Desk
11545 Rockville Pike, TWFN-2 F1
Rockville, MD 20852-2738

SUBJECT: Licensee Event Report # 2013-003-00, "Technical Specification Prohibited Condition Due to Turbine Driven Auxiliary Feedwater Pump Failure to Meet Test Acceptance Criteria"
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) 2013-003-00. The attached LER identifies an event where there was a Technical Specification prohibited condition for failure of the Turbine Driven Auxiliary Feedwater Pump to meet test acceptance criteria, which is reportable under 10 CFR 50.73(a)(2)(i)(B). This condition was recorded in the Entergy Corrective Action Program as Condition Report CR-IP3-2013-00887.

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
Ms. 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

Estimated burden per response to comply with this mandatory collection request: 80 hours. 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 F53), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by internet e-mail to infocollects.resource@nrc.gov, and to the Desk Officer, Office of Information and Regulatory Affairs, NEOB-I0202, (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)

1. FACILITY NAME:	2. DOCKET NUMBER	3. PAGE
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4. TITLE: Technical Specification Prohibited Condition Due to Turbine Driven Auxiliary Feedwater Pump Failure to Meet Test Acceptance Criteria

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
3	03	2013	2013	003 -	00	06	24	2013		05000
									FACILITY NAME	DOCKET NUMBER
										05000

9. OPERATING MODE

1

10. POWER LEVEL

97%

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)*
Tat Chan, System Engineer Supervisor-Primary Systems	(914) 254-6873

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
X	BA	65	W318	Y					

14. SUPPLEMENTAL REPORT EXPECTED

☐ YES *(If yes, complete 15. EXPECTED SUBMISSION DATE)* ☐ NO

15. EXPECTED SUBMISSION DATE

MONTH	DAY	YEAR

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

On March 3, 2013, the Turbine Driven (TD) Auxiliary Boiler Feedwater Pump (ABFP) failed to meet the Inservice Test (IST) Program full flow test acceptance criteria during performance of 3-PT-R007B (32 ABFP Full Flow Test). An investigation on March 16, 2013, identified that the ability of the steam admission valve to stroke properly to regulate the amount of steam to the turbine and the ability to change turbine/pump speed was directly affected by the thrust bearing housing being restrained in an extruded position. An assessment of past operability on April 25, 2013, concluded that although the 32 ABFP would not meet IST acceptance criteria, the 32 ABFP would remain functional for analyzed transients and accidents. Sealant was applied on the thrust bearing housing which caused additional frictional forces limiting the movement of the thrust bearing housing thus restraining it in an extruded position. Sealants are to be used on the mating surfaces when the upper and lower governor housing are being joined together but not on the thrust bearing housing. The apparent cause was maintenance practices during reassembly of the TD ABFP during previous maintenance. Corrective actions included troubleshooting the TD AFWP and steam admission valve and repairing deficient conditions. The quarterly and full flow tests will be revised or a PM created to require the steam admission valve to be stroked via the use of the governor valve. A Training Evaluation & Action Request (TEAR) will be performed to determine if additional training is required. Maintenance procedure 0-TUR-403-AFP was revised to emphasize not to apply sealant to the thrust bearing housing.

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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 March 3, 2013, while at approximately 97% reactor power, performance of 3-PT-R007B (32 Auxiliary Boiler Feedwater Pump Full Flow Test) was initiated at approximately 04:40 hours. At 5:05 hours, operators started the TD Auxiliary Boiler Feedwater Pump (ABFP) {BA}. At 06:17 hours, Technical Specification (TS) 3.7.5 (Auxiliary Feedwater System) Condition B (One train inoperable in Mode 1, 2 or 3 for reasons other than Condition A) was entered due to failure of the Turbine Driven (TD) ABFP to meet the full flow test acceptance criteria during performance of 3-PT-R007B. The 32 ABFP was unable to attain the required flow, discharge pressure and turbine {TRB} pump speed. Procedure 3-PT-R007B establishes the requirements for performing a comprehensive (full flow) test of the TD ABFP (32 ABFP) in accordance with the Inservice Test (IST) Program and demonstrates operability of the 32 ABFP. The test results were total maximum flow to the SGs of approximately 400 gpm with an acceptance criteria of 726 to 754 gpm, a turbine speed of 2800 rpm with an acceptance criteria of 3232 to 3297 rpm, and a discharge pressure of approximately 900 psig with an acceptance criteria of greater than 923 psid (differential pressure across pump). An investigation on March 16, 2013 by Entergy personnel and the turbine vendor revealed sealant on the thrust bearing housing upper portion of its outer diameter, which is housed in the turbine governor {65}. Sealants are used on the mating surfaces when the upper and lower governor housing are being joined together, but not used on the thrust bearing housing. The thrust bearing housing is supposed to move freely with unrestricted motion. The thrust bearing housing will move axially and will have a direct impact on the movement of the steam admission valve and turbine operating speed. The application of sealant would have occurred during the last maintenance activity when the turbine governor was last reassembled. The previous time intrusive maintenance was performed on the TD AFWP was during the last refueling outage in the spring of 2011 (3R16). The post maintenance full flow test in 2011 and subsequent quarterly testing done in accordance with the IST code were satisfactory. Contributing to the condition was a speed changer spring that was significantly looser than in the past. The speed changer spring applies a force to the governor lever to support opening of the steam admission valve. The lack of adequate pre-load on the speed changer spring may have contributed to the inability of the steam admission valve to further open and increase turbine speed. The condition was recorded in the Indian Point Energy Center (IPEC) Corrective Action Program (CAP) as Condition Report CR-IP3-2013-00887.

The Auxiliary Feedwater System (AFWS) is designed to supply auxiliary feedwater (AFW) to the Steam Generators (SGs) {AB} during times the normal feedwater is unavailable. The AFWS is required during normal (startup and shutdown) and accident scenarios, including station blackout and fire scenarios. The AFWS provides sufficient AFW flow to maintain the SGs as effective heat sinks. The AFWS consists of two motor driven (MD) Auxiliary Feedwater pumps (AFWP) and one steam turbine driven (TD) AFWP configured into three trains. In accordance with the TS Basis, each MD AFWP provides 100% of AFW flow capacity (near best estimate analysis) and the TD AFWP approaches 200% of the required capacity. The MD ABFPs are credited for automatic delivery of AFW to the SGs but the TD ABFP does not provide automatic delivery and is not assumed in the accident analysis until 10 minutes after an event as a result of required operator action to increase turbine speed and pump output. The limiting transient for the AFWS is loss of main feedwater (FW). For this event, the licensing analysis credits 343 gpm delivered automatically to two SGs and the minimum of an additional 343 gpm delivered to the other two SGs in 10 minutes. A near best estimate analysis is also credited which demonstrates that acceptance criteria are satisfied with supplying 375 gpm in 60 seconds without assuming additional AFW flow in 10 minutes.

The 32 ABFP is a turbine {TURB} driven centrifugal pump manufactured by Worthington Pump Corp. {318} Model T2RA. The TD ABFP supplies a common header capable of feeding all four SGs. The TD AFWP receives steam from two main steam lines upstream of the main steam isolation valves. The TD ABFP will be throttled manually in order to bring the turbine up to speed after a start signal through the use of an air operator. Once the air operator is in a full open position, turbine speed is controlled by the turbine's mechanical governor. The TD ABFP discharge flow control valves will be manually opened as necessary to provide adequate auxiliary feedwater flow. After maintenance of the ABFP in the spring of 2011, a full flow test was performed satisfactorily with no issues noted. Quarterly surveillance tests performed since the full flow test were all satisfactory. Quarterly surveillance tests are at low loads which require little movement from the steam admission valve to meet the test capacity requirement. Under this condition, the governor lever roller may not engage the thrust bearing housing. As such, engagement of the mechanical governor is not assured and the condition may not be detected. However, full flow testing requires more movement of the turbine components and any operational issues therefore more likely to be detected. The quarterly surveillance testing performed did not identify any issue with the full movement of the thrust bearing housing. There was no test action to verify full stroke of the steam admission valve and freedom of movement of the thrust bearing housing. Industry operating experience identified that performing these actions may have identified the condition.

An extent of condition review determined there is only one other similar AFWP component that would be susceptible to the condition. Unit 2 has the same turbine as unit 3 and maintenance requirements therefore could be susceptible to the same performance issues. The unit 2 ABFP turbine governor lever, governor valve, steam admission valve, and thrust bearing housing have been inspected. The thrust bearing housing showed no sticking and has freedom of movement.

Cause of Event

Sealant was applied on the thrust bearing housing which caused additional frictional forces limiting the movement of the thrust bearing housing and limiting the stroking of the steam admission valve. Sealants are used on the mating surfaces when the upper and lower governor housing are being joined together but not on the thrust bearing housing. The ability of the steam admission valve to stroke properly to regulate the amount of steam to the turbine and the ability to change turbine/pump speed was directly affected by the thrust bearing housing being restrained in an extruded position. The apparent cause was maintenance practices during reassembly of the TD ABFP in the last refueling outage.

Corrective Actions

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

- Troubleshooting was performed on the TD AFWP and steam admission valve and deficient conditions repaired. Subsequently, a full flow test was performed satisfactorily.
- Maintenance procedure 0-TUR-403-AFP was revised to specifically state not to apply sealant to the thrust bearing housing when applying sealant to the upper and/or lower turbine governor housings.

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

- The quarterly and full flow tests will be revised or PMs will be created to require the stroking of the steam admission valve via the use of the governor valve to ensure full valve travel as part of surveillance testing activities.
- A Training Evaluation & Action Request (TEAR) will be performed to determine if additional training is required.

Event Analysis

The event is reportable under 10CFR50.73(a)(2)(i)(B). The licensee shall report any operation or condition which was prohibited by the plant TS. The 32 ABFP was unable to attain the required Steam Generator (SG) flow, discharge pressure and turbine pump speed in accordance with procedure 3-PT-R007B which establishes the requirements for performing a comprehensive (full flow) test of the TD ABFP (32 ABFP) in accordance with the Inservice Test (IST) Program and demonstrates operability of the 32 ABFP. The TD ABFP is a code component with required testing in accordance with the IST program which was not met. Therefore, the TS 3.7.5 Limiting Condition for Operation (LCO) which requires three AFW trains to be operable was not met. The TS actions required in response to the test failure were met and no TS completion time was violated. The condition was determined not to be a safety system functional failure based on best estimate analysis which concluded minimum requirements would be met and the AFWS would be functional although not operable in accordance with the TS (IST program). Turbine disassembly and inspection by Entergy personal and the turbine vendor identified on March 16, 2013 conditions that were likely causes of the 32 AFWP test failure. A past operability evaluation was completed on April 25, 2013 concluding the 32 TD AFWP may have been inoperable during past operation and the condition was reportable. However, although the 32 ABFP may not have met IST acceptance criteria, the 32 ABFP was determined to remain functional for analyzed transients and accidents. The specific time when the condition resulted in an inoperable pump was indeterminate. The condition was a result of maintenance which was last performed during the previous refueling outage, but questions remained regarding turbine steam admission valve seat parts and idle speed anomalies. The TD ABFP satisfied its post maintenance full flow test in 2011 and subsequent quarterly testing performed in accordance with the IST code were satisfactory and did not identify a degraded condition. Further evaluations were initiated for past operability to allow resolution of the past operability questions following the April 25, 2013 evaluation.

Past Similar Events

A review was performed of Licensee Event Reports (LERs) for the past three years for failure of the AFWS to meet the TS LCO. No LERs were identified. Further review was performed to identify any LERs reporting component failures due to faulty maintenance. LER-2011-003 reported a TS required shutdown and a safety system functional failure for a leaking service water (SW) pipe causing flooding in the SW valve pit preventing access to valves used in accident mitigation. The root cause was an inadequate installation plan and repair of a pipe flaw identified in 1992. The Work Order that was planned for the repair in 1992 could not be properly implemented and resulted in inadequately coated carbon steel piping. The event reported in LER-2011-003 had a different cause therefore the corrective actions for that event would not have prevented this event.

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Safety Significance

There were no actual safety consequences for the event because there were no accidents or transients that required the TD ABFP during the time of the condition.

The AFWS mitigates the consequences of any event with loss of normal feedwater. The design basis of the AFWS is to supply water to the SG to remove decay heat and other residual heat by delivering at least the minimum required flow rate to the SGs at pressures corresponding to the lowest SG safety valve set pressure plus accumulation. The AFWS is required during normal (startup and shutdown) and accident scenarios including station blackout and fire scenarios. The AFWS provides sufficient AFW flow to maintain the SGs as effective heat sinks. The AFWS consists of two motor driven (MD) Auxiliary Feedwater pumps (AFWP) and one steam turbine driven (TD) AFWP configured into three trains. Each MD AFWP provides 100% of AFW flow capacity (near best estimate analysis) and the TD AFWP approaches 200% of the required capacity.

The limiting transient for the AFWS is loss of normal feedwater (LONF). For this event, the design basis analysis credits 343 gpm delivered automatically to two SGs and the minimum of an additional 343 gpm delivered to the other two SGs in 10 minutes. A near best estimate analysis is also credited which demonstrates that acceptance criteria are satisfied with supplying 375 gpm in 60 seconds without assuming additional AFW flow in 10 minutes. The MD ABFPs are relied upon to provide AFW to the SGs during plant cooldown, and startup and during accident conditions. Each MD ABFP (design rated capacity of 400 gpm) is capable of supplying the required amounts of AFW for all of the normal and accident conditions.

The TD ABFP is normally isolated from the SGs and has no normal or automatic operating functions. The TD ABFP provides FW to the SGs in the event of a complete loss of all AC power (station blackout) and Appendix R when the MD ABFPs are unavailable. The TD ABFP was designed to supply approximately 800 gpm of AFW to the SGs. During various Appendix R scenarios the MD or TD ABFP provides AFW to the SGs. The TD AFWP starts automatically on loss of power on 480 volt buses 3A or 6A, a low-low level signal in any 2 of 4 SGs, or an AMSAC signal, but does not automatically deliver flow to the SGs. Initiation of AFW flow to the SGs from the TD AFWP is performed by manual operator action. During various Appendix R and SBO scenarios, the TD AFWP solely provides AFW to the SGs via manual operator action. Evaluations of the as-found condition determined the 32 ABFP would meet functional requirements.

The specific time when the condition resulted in an inoperable pump is indeterminate. Evaluations determined the 32 ABFP would remain functional for analyzed transients and accidents. The TD ABFP satisfied its post maintenance full flow test therefore degraded over the operating cycle. Quarterly testing performed in accordance with the IST code that was performed since the previous full flow test were satisfactory and did not identify a degraded condition for failure to meet test acceptance criteria. During the time that the TD ABFP may have been in a degraded condition and deemed inoperable from the aspect of a surveillance test failure, the AFW system would have been able to provide high pressure FW to the SGs to remove RCS thermal energy during normal and accident conditions, including station blackout or Appendix R fire scenarios. Furthermore, during the time the TD ABFP may have been in a degraded condition at least one MD ABFP was available.