Entergy

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Anthony J. Vitale
Site Vice President

NL-16-086

August 23, 2016

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

SUBJECT: Licensee Event Report # 2016-008-00 "Technical Specification (TS) Required Shutdown Due to Not Completing Weld Repairs to a Defect in a Service Water Pipe Elbow to Inlet Nozzle of the Component Cooling Water Heat Exchanger Within the TS AOT"
Indian Point Unit No. 2
Docket No. 50-247
DPR-26

Dear Sir or Madam:

Pursuant to 10 CFR 50.73(a)(1), Entergy Nuclear Operations Inc. (ENO) hereby provides Licensee Event Report (LER) 2016-008-00. The attached LER identifies an event where the plant was required to shutdown to comply with the Technical Specifications (TS) due to failure to complete repairs to a weld defect in a Service Water elbow to the 21 Component Cooling Water Heat Exchanger inlet nozzle within the TS Allowed Outage Time (AOT). This event is reportable under 10 CFR 50.73(a)(2)(i)(A). This condition was recorded in the Entergy Corrective Action Program as Condition Report CR-IP2-2016-04118.

IE22
NRR

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,

AJV/cbr

cc: Mr. Daniel H. Dorman, Regional Administrator, NRC Region I
NRC Resident Inspector's Office
Ms. Bridget Frymire, New York State Public Service Commission

NRC FORM 366
(11-2015)

U.S. NUCLEAR REGULATORY COMMISSION

LICENSEE EVENT REPORT (LER)

(See Page 2 for required number of digits/characters for each block)

APPROVED BY OMB: NO. 3150-0104 EXPIRES: 10/31/2018

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4. TITLE: Technical Specification Required Shutdown Due to Not Completing Repairs to a Defect in a Service Water Pipe to the 21 Component Cooling Water Heat Exchanger Within the TS AOT

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
6	24	2016	2016	- 008	- 00	8	23	2016	FACILITY NAME	DOCKET NUMBER

9. OPERATING MODE	11. THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: *(Check all that apply)*			
1	☐ 20.2201(b)	☐ 20.2203(a)(3)(i)	☐ 50.73(a)(2)(ii)(A)	☐ 50.73(a)(2)(viii)(A)
	☐ 20.2201(d)	☐ 20.2203(a)(3)(ii)	☐ 50.73(a)(2)(ii)(B)	☐ 50.73(a)(2)(viii)(B)
	☐ 20.2203(a)(1)	☐ 20.2203(a)(4)	☐ 50.73(a)(2)(iii)	☐ 50.73(a)(2)(ix)(A)
	☐ 20.2203(a)(2)(i)	☐ 50.36(c)(1)(i)(A)	☐ 50.73(a)(2)(iv)(A)	☐ 50.73(a)(2)(x)
10. POWER LEVEL	☐ 20.2203(a)(2)(ii)	☐ 50.36(c)(1)(ii)(A)	☐ 50.73(a)(2)(v)(A)	☐ 73.71(a)(4)
94%	☐ 20.2203(a)(2)(iii)	☐ 50.36(c)(2)	☐ 50.73(a)(2)(v)(B)	☐ 73.71(a)(5)
	☐ 20.2203(a)(2)(iv)	☐ 50.46(a)(3)(ii)	☐ 50.73(a)(2)(v)(C)	☐ 73.77(a)(1)
	☐ 20.2203(a)(2)(v)	☒ 50.73(a)(2)(i)(A)	☐ 50.73(a)(2)(v)(D)	☐ 73.77(a)(2)(i)
	☐ 20.2203(a)(2)(vi)	☐ 50.73(a)(2)(i)(B)	☐ 50.73(a)(2)(vii)	☐ 73.77(a)(2)(ii)
		☐ 50.73(a)(2)(i)(C)	☐ OTHER Specify in Abstract below or in NRC Form 366A	

12. LICENSEE CONTACT FOR THIS LER

LICENSEE CONTACT	TELEPHONE NUMER *(Include Area Code)*
Charles Bristol, Maintenance Engineer	(914) 254-6665

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	BI	PSP	U080	Yes					

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

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

On November 30, 2015, a leak was discovered on Service Water (SW) weld F-1924, which joins a cement-lined carbon steel elbow to a Copper/Nickel (Cu/Ni) Heat Exchanger pipe nozzle on the 21 Component Cooling Water Heat Exchanger. Code case N-513-3 was applied to the pipe defect to justify continued operability and preparations initiated for a weld repair during the upcoming spring refueling outage (RO) starting March 7, 2016. On March 19, 2016, weld repair was performed on the weld F-1924 and satisfactory non-destructive examination was completed. On June 12, 2016, a new leak was discovered in the same SW pipe repair area. During the subsequent repair, cracking was experienced in the ERCuNi filler metal which extended the duration of the repair and forced a Unit shutdown to comply with the TS 72 hour AOT. The direct cause was recurring longitudinal solidification cracks that developed during welding of copper-nickel to carbon steel pipe. The apparent cause was that the team assigned to prepare and execute the weld repair plan failed to ensure all risks and issues were identified and managed properly. Key corrective actions included weld repair using a new vendor weld procedure and ERNiCu-7 filler material, communication of the lessons learned to all site personnel reinforcing standards and expectations for readiness for critical work. Incorporate recommendations for improving risk management process effectiveness by incorporating actions taken in response to INPO IER L2-16-9. The event had no effect on public health and safety.

NRC FORM 366A U.S. NUCLEAR REGULATORY COMMISSION
(11-2015)

APPROVED BY OMB: NO. 3150-0104 EXPIRES: 10/31/2018

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Indian Point 2	05000-247	2016	- 008	- 00

NARRATIVE

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

DESCRIPTION OF EVENT

On November 30, 2015, a 1 drop per second leak was discovered on Service Water (SW) {BI} weld F-1924 on SW line #411, which joins a carbon steel elbow to a 90/10 Copper/Nickel (Cu/Ni) Heat Exchanger {HX} pipe nozzle on the 21 Component Cooling Water (CCW) {CC} Heat Exchanger {HX}. In accordance with Generic Letter 89-13 program guidance and ASME Code case N-513-3 the weld was evaluated and determined acceptable but required to be repaired prior to start-up from the 2016 spring refueling outage (RO) (2R22). The degradation mechanism leading to the leak was likely crevice corrosion. Leakage was seen to emanate at the weld toe, on the carbon steel side. The leak was recorded in Indian Point Energy Center (IPEC) corrective action program (CAP) as CR-IP2-2015-05358 and repairs scheduled to be performed during the upcoming spring refueling outage (RO) starting March 7, 2016. The copper-nickel to carbon steel weld joints in the CCW to SW piping are the only known welds on site with this configuration. A flaw characterization and full pipe circumference examination of this weld found that the leak was a localized area of corrosion. Another area of thinning at one other circumferential location on the same weld was identified, but the weld thickness in that area met minimum wall thickness requirements and was designated for continued monitoring with no immediate action necessary.

To support the weld repair plan, from December 17, 2015 to February 8, 2016, a draft Entergy Welding Procedure Specification (WPS) was developed for welding P34 90/10 copper-nickel base material to P1 carbon steel base material. ERNiCu-7 was chosen as the filler metal. Two separate weld test coupons were prepared to qualify the procedure and were shipped to the weld test lab (Lucius Pitkin Inc.) for procedure qualification testing. Test results were obtained on March 3, 2016, which showed one of the four bend tests failed due to inclusions in the root of the weld joint resulting in a failure to qualify the procedure. On March 4, 2016, vendors are contacted to determine if they have a qualified welding procedure for copper-nickel to carbon steel. Only one vendor (Westinghouse PCI) had a qualified procedure using the ERCuNi filler metal. Due to the limited time available to repeat the procedure qualification testing prior to scheduled work, the weld repair was contracted to the vendor with the approved qualified procedure for welding P34 90/10 copper-nickel to P1 carbon steel using the ERCuNi filler metal.

On March 7, 2016, the Unit 2 Refueling Outage (RO) started. Repairs to the 21 CCW Heat Exchanger SW line #411 pinhole leak were scheduled to be performed on March 18 through March 19, 2016. On March 19, 2016, weld repairs, including excavation, weld build-up, and post-repair non-destructive examination (NDE) of the flaw on weld F-1924 was completed. On June 4, 2016, a In-service Leak Test (ISLT) of the SW system was completed satisfactorily. No leaks identified.

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NARRATIVE

On June 12, 2016, CR-IP2-2016-03818 recorded a new leak that was discovered in the same SW pipe line #411 repair area. The leak was estimated at 1 drop per 5 seconds in the SW System piping supplying the 21 CCW HX. The leak was on the elbow side at the toe of the elbow to inlet nozzle weld of the 21 CCW HX on 20 inch SW line #411, weld number F-1924. This line is the SW supply to the 21 CCW HX. SW line #411 is a standard wall (schedule STD) cement-lined carbon steel pipe having a nominal wall thickness of 0.375 inches. The nozzle/pipe of the 21 CCW HX is 90/10 copper/nickel with a thickness of 0.500 inches. Its function is the inlet pipe to the 21 CCW HX. SW line #411 is fed from either 20 inch SW line #411 (1-2-3 SW Header), or 20 inch line #407 (4-5-6 SW Header). At the time of discovery, the 1-2-3 SW header was the essential header supplying the 21 CCW HX. Leaking weld F-1924 is a dissimilar metal butt-weld between a carbon steel cement-lined elbow and a copper-nickel heat exchanger inlet nozzle/pipe. The weld location is ASME Section XI Class 3 and is nuclear safety related. The SW pipe with the weld defect is located in the Primary Auxiliary Building (PAB) on the 80 foot elevation downstream of valve SWN-34. Engineering performed an Operability Evaluation using the methodology and structural margins provide in ASME Code case N-513-3. The pipe weld degradation was determined to be within the Code Case limits. The affected pipe section was considered structurally acceptable therefore Operable DNC. An outage emergent team designated to address the leak determined after discussions with site departments that the leak did not have to be repaired until the next outage (2R23). The Mode 1 hold was removed from the leak repair Work Order and the repair was designated to be scheduled as soon as the work was ready to be performed.

On June 13, 2016, weld repairs were scheduled to be performed beginning June 21, 2016. Work migrated from the refueling outage schedule to the online schedule. The preliminary schedule included 24 hours for the weld repair based on vendor input and time estimates from the original 2R22 outage repair window. A leadership challenge meeting discussed the weld plan because the online weld repair requires entry into a Technical Specification (TS) 72 hour shutdown LCO due to removal of the 21 CCW HX from service.

On June 16, 2016, a conference call was held with the weld vendor to discuss the repair approach. The weld vendor and the Indian Point welding engineer concluded the failure of the original weld repair was caused by contamination of the weld and not as a result of any metallurgical issues with the vendor weld procedure. Subsequent follow-up correspondence with the weld vendor questioned the possibility of hot cracking of the ERCuNi filler metal due to iron dilution from the carbon steel base material. The weld vendor's opinion was that using this process on this configuration would not result in hot cracking. Peer review by another Entergy site made the same conclusion. An Engineering Change was approved to repair the weld defect from both the inner diameter and outer diameter of the pipe using the vendor weld procedure on June 16, 2016. On June 16, 2016, at 23:30 hours, the unit returns to service following an extended refueling outage.

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NARRATIVE

On June 17, 2016, a management challenge and critical evolution meeting (CEM) was held for the 21 CCW HX leak repair. At the CEM it was presented that the 2R22 outage repair failed due to weld contamination that occurred because the repair was attempted from the outside of the pipe only and since the cement lining surrounding the repair cavity was not accessible for adequate cleaning around the weld joint, resulting in contaminants becoming trapped in the weld that were not evident in the final exam. In addition, a surface exam of the root pass was not specified to be performed to ensure proper weld integrity below the surface of the finished weld. Assurance was provided that the new plan would be successful due to a change in work scope (internal access to the defect area, allow proper removal of cement lining, clean affected area, perform a surface exam, weld build-up, adequate access for purging and inspection/repair). The CEM also identified that the contingency Enecon coating of internal piping following weld repairs was an excessive time contributor. Therefore, the plan was altered to use a quick curing waterplug coating repair to the inner piping wall.

On June 21, 2016, the TS 3.7.7 LCO was entered when the 21 CCW HX was declared inoperable for scheduled maintenance. Work to repair the weld commenced. On June 22, 2016, during installation of the remainder of the copper-nickel to carbon steel weld, workers identified repeated cracking problems and could not successfully complete the weld. A leadership team conference was held to discuss the cracking problem and determine a resolution plan. A decision was made to implement a revised plan to grind out the defective copper-nickel to carbon steel weld area, perform a PT exam on the excavated area, weld out the excavated area using a modified transverse technique across the root gap and perform a final PT and UT.

On June 23, 2016, weld repairs were completed in accordance with the revised plan. During the final inspection of the weld, the qualified inspector rejected the weld based on incomplete weld penetration and appearance on the inside diameter (ID) of the piping in the weld area. CR-IP2-2016-04085 recorded the unsatisfactory condition of poor weld quality. Follow-up engineering discussions with the fleet welding engineer and qualified inspector determined that the internal weld could not be accepted and the weld would have to be removed and re-welded. At 14:30 hours, the outage control center (OCC) issued a schedule update indicating that the 72 hour TS AOT will expire prior to completing the revised plan for weld repairs and restoration of the 21 CCW HX.

On June 24, 2016, at 04:00 hours, the TS 3.7.7 AOT expired forcing a unit shutdown.

The SW System (SWS) is designed to supply cooling water from the Hudson River to various heat loads in both the primary and secondary portions of the plant. The design ensures a continuous flow of cooling water to those systems and components necessary for plant safety during normal operation and under abnormal or accident conditions. The SWS consists of two separate, 100% capacity, safety related cooling water headers. Each header is supplied by 3 pumps to include pump strainers, with SWS heat loads designated as either essential or non-essential. The essential SWS heat loads are those which must be supplied with cooling water immediately in the event of a Loss of Cooling Accident (LOCA) and/or Loss of Offsite Power (LOOP). The essential SWS heat loads can be cooled by any two of the three SW pumps on the essential header. Either of the two SWS headers can be aligned to supply the essential heat loads or the non-essential SWS heat loads.

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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 FOIA, Privacy and Information Collections 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-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.

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NARRATIVE

The CCW System (CCWS) is a closed loop cooling system that provides cooling water for systems and components important to safety. The CCWS transfers its heat load to the SWS via heat exchangers. The SWS is a once through cooling system that transfers its heat load to the ultimate heat sink (Hudson River). The CCWS consists of three pumps and two heat exchangers. These components are divided into two independent, full capacity cooling loops with each loop consisting of one pump and one heat exchanger.

The principal safety related function of the CCW System is the removal of decay heat from the reactor via the Residual Heat Removal (RHR) System during a normal or post accident cooldown and shutdown. The design basis of the CCW System is for one CCW train to remove the post loss of coolant accident (LOCA) heat load from the containment sump during the recirculation phase of a LOCA.

An extent of condition (EOC) review determined that the copper-nickel to carbon steel dissimilar weld configuration is unique to the 21 and 22 CCW HX inlet and outlet SW piping. The 31 and 32 CCW HX inlet and outlet nozzles are rubber-lined carbon steel flanged piping and are not susceptible to the same failure mechanism. CCW HX SW piping weld EOC inspections at five similar locations were completed. No new problems or degraded conditions were identified.

CAUSE OF EVENT

The direct cause was recurring longitudinal solidification cracks that developed during welding of copper-nickel to carbon steel pipe. The primary degradation mechanism leading to the November 30, 2015 leak was likely crevice corrosion, caused by small holidays in the internal coating at the field weld that allowed SW to contact the internal piping base metal. The corrosion promoted thinning in the affected area, which resulted in the development of a pin hole at the weakened toe of the carbon steel elbow to copper-nickel inlet nozzle field weld on the carbon steel. Surface exams performed during the RO repairs did not identify any defects. However, potential subsurface flaws would not be detected using the surface exam technique.

During the RO and the June 2016 post outage repair work, repairs to the leaking indication initially used ERCuNi filler metal to restore the weld integrity. This method resulted in strain-induced longitudinal cracking in the highly restrained joint due to the relatively low tensile strength of the material, its thermal conductivity differences with carbon steel, and its susceptibility to iron dilution from steel, which can increase the tendency for brittle fracture. Standard industry practices to reduce cracking tendencies prior to joining dissimilar metals with filler material were not identified in the repair plan.

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NARRATIVE

The apparent cause was that the team assigned to prepare and execute the weld repair plan failed to ensure all risks and issues were identified and managed properly. This apparent cause resulted in this condition because risks were not identified and work planning and scheduling did not include effective contingencies or back-out criteria. Key team members contributing to work preparations did not effectively perform their roles and responsibilities. There was inadequate preparation and lack of rigor during planning and challenge reviews for the critical work activity.

CORRECTIVE ACTIONS

The following corrective actions have been or will be performed under the Corrective Action Program (CAP) to address the causes of this event:

- A vendor (PCI) qualified a new copper-nickel to carbon steel weld procedure using a different filler metal (ERNiCu-7) with better performance characteristics based on industry best practices. An Engineering Change (EC) was developed to eliminate the weld stresses that were contributing to the observed in-process weld cracking. The defective weld and degraded piping section was cut out and replaced with a flush welded patch according to the new EC using the new filler metal (ERNICu-7) and the newly qualified vendor (PCI) welding procedure. All welds were inspected according to the code-required visual and surface examinations. The completed weld was leak tested and the 21 CCW HX returned to service.

- The lessons learned from this event were discussed at the work week critique and were communicated site-wide during all-hands meetings and through distribution of the weekly newsletter. The message reinforced standards and expectations for ensuring readiness.

- A System Outage Critique will be performed in accordance with EN-FAP-WM-003 to communicate lessons learned with individuals involved with the weld repair outage.

- Incorporate recommendations for improving risk management process effectiveness by incorporating actions taken in response to INPO IER L2-16-9 Revision 0.

EVENT ANALYSIS

The event is reportable under 10CFR50.73(a)(2)(i)(A). The licensee shall report the completion of any nuclear plant shutdown required by the plant's Technical Specification (TS). The event meets the reporting requirement because on June 24, 2016, at 04:00 hours, operations implemented actions to commence reactor shutdown to comply with TS 3.7.7 (CCW System).

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TS 3.7.7 LCO requires two CCW trains to be Operable. TS 3.7.7 Condition A (One CCW train inoperable) required action A.1 is to restore the inoperable CCW train to operable within 72 hours. TS 3.7.7 Condition A was entered on June 21, 2016, at 02:30 hours, when the 21 CCW HX was declared inoperable for scheduled maintenance. On June 24, 2016, at 04:00 hours, the TS 3.7.7 AOT window expired forcing a unit shutdown to comply with TS 3.7.7 Condition B which requires the plant to be in Mode 3 within 6 hours and Mode 4 within 12 hours. On June 24, 2016, at 7:59 hours, a manual reactor shutdown was completed and the plant entered Mode 3. At 12:58 hours, the plant entered Mode 4. On June 24, 2016, at 04:05 hours, a four hour non-emergency notification was made to the NRC (Log Number 52039) for a TS required shutdown. On June 26, 2016, at 14:11 hours, the 21 CCW HX was declared operable and TS 3.7.7 Condition B exited. Operations commenced plant start-up. Unit entered Mode 1 on June 27, 2016, at 15:01 hours. The event was recorded in the Indian Point Energy Center corrective action program (CAP) as CR-IP2-2016-04118.

PAST SIMILAR EVENTS

A review of the past three years of Licensee Event Reports (LERs) for events that involved a TS required shutdown due to faulty SW pipe repair. No applicable LERs were identified.

SAFETY SIGNIFICANCE

This condition had no effect on the health and safety of the public.
There were no actual safety consequences for the event because there were no events impacting redundant components.

There were no significant potential safety consequences of this condition. The CCW System provides a heat sink for the removal of process and operating heat from safety related components during a design basis accident (DBA) or transient. The CCW System consists of three pumps and two heat exchangers. The CCW pumps are connected to a common discharge header that is arranged so that any of the three pumps will supply either CCW heat exchanger and the heat exchangers are connected to a common discharge header so that both heat exchangers supply all CCW System heat loads. Any one of the three CCW pumps in conjunction with any one of the two CCW heat exchangers is sufficient to accommodate the normal and post-accident heat load. For this event one CCW Heat Exchanger was removed from service to perform a weld repair. The remaining redundant CCW HX and associated components were operable and available to perform their safety function.

A risk evaluation was performed to estimate the increase in core damage probability (CDP) and large early release probability (LERP) using a baseline zero maintenance plant configuration and the 21 CCW HX outage time of 5 days. The results of the risk evaluation concluded the risk impact associated with the inoperability of the 21 CCW Heat Exchanger is non-risk significant per NRC Regulatory Guide 1.177 (i.e., the increase in CDP is less than 1E-6/year and the increase in LERP is less than 1E-7/year)