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Indiana Michigan Power
Cook Nuclear Plant
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Bridgman, MI 49106
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October 4, 2016

AEP-NRC-2016-75
10 CFR 50.73

Docket No.: 50-316

U. S. Nuclear Regulatory Commission
ATTN: Document Control Desk
11555 Rockville Pike
Rockville, MD 20852

Donald C. Cook Nuclear Plant Unit 2
LICENSEE EVENT REPORT 316/2016-001-01
Manual Reactor Trip Due to Moisture Separator Heater Expansion Joint Failure

In accordance with 10 CFR 50.73, Licensee Event Report (LER) System, Indiana Michigan Power Company, the licensee for Donald C. Cook Nuclear Plant Unit 2, is submitting as an enclosure to this letter the following report:

LER 316/2016-001-01: Manual Reactor Trip Due to Moisture Separator Heater Expansion Joint Failure

There are no commitments contained in this submittal.

Should you have any questions, please contact Mr. Michael K. Scarpello, Regulatory Affairs Manager, at (269) 466-2649.

Sincerely,

Q. Shane Lies
Site Vice President

MPH/mll

Enclosure: Licensee Event Report 316/2016-001-01: Manual Reactor Trip Due to Moisture Separator Heater Expansion Joint Failure

IE22
NRR

c: R. J. Ancona – MPSC
A. W. Dietrich – NRC Washington, DC
MDEQ – RMD/RPS
NRC Resident Inspector
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Enclosure to AEP-NRC-2016-75

Licensee Event Report 316/2016-001-01
Manual Reactor Trip Due to Moisture Separator Heater Expansion Joint Failure

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

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

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.

LICENSEE EVENT REPORT (LER)

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

1. FACILITY NAME	2. DOCKET NUMBER	3. PAGE
Donald C. Cook Nuclear Plant Unit 2	05000316	1 OF 4

4. TITLE

Manual Reactor Trip Due To Moisture Separator Heater Expansion Joint Failure

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
07	06	2016	2016	- 001	- 01	10	04	2016		05000
									FACILITY NAME	DOCKET NUMBER
										05000

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)(B)
	☐ 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)
	☐ 20.2203(a)(2)(iii)	☐ 50.36(c)(2)	☐ 50.73(a)(2)(v)(B)	☐ 73.71(a)(5)
100	☐ 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 NUMBER *(Include Area Code)*
Michael K. Scarpello, Regulatory Affairs Manager	(269) 466-2649

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	SB	BLL	Senior Flexonics Pathway	Y					

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 July 6, 2016, with the Donald C. Cook Nuclear Plant Unit 2 Reactor operating in Mode 1 at 100 percent power, the control room received a report of a steam leak on the Unit 2 B Right Moisture Separator Reheater (MSR) crossover piping and damage to the turbine building structure. This information resulted in a decision by the crew to manually trip the Unit 2 Reactor at 0038. The cause of the steam leak was the sudden failure of the balance bellows on the Unit 2 B Right MSR crossover expansion joint, which also resulted in damage to the west wall of the turbine building.

The Root Cause was determined to be an organizational failure to recognize the risk significance of, and to adequately correct or mitigate, previously identified vibration issues with the Unit 2 B Right MSR crossover expansion joint tie rod and bellows in a timely fashion.

This event is being reported in accordance with 10CFR 50.73(a)(2)(iv)(A) as a manual actuation of the Reactor Protection System and an automatic actuation of the Auxiliary Feedwater system.

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

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

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LICENSEE EVENT REPORT (LER) CONTINUATION SHEET

1. FACILITY NAME	2. DOCKET	3. LER NUMBER		
		YEAR	SEQUENTIAL NUMBER	REV NO.
Donald C. Cook Nuclear Plant Unit 2	05000316	2016	001	01

NARRATIVE

INTRODUCTION

On July 6, 2016, Donald C. Cook Nuclear Plant Unit 2 Reactor [RCT] was operating at 100 percent power. At 0038, the Unit 2 Reactor was manually tripped due to the sudden failure of the balance bellows on the Unit 2 B Right Moisture Steam Reheater (MSR) [RHTR] crossover expansion joint [EXJ], which also resulted in damage to the west wall of the turbine building. As a result of damage to the MSR, main condenser [COND] vacuum slowly degraded and heat removal was accomplished through the Steam Generator Power Operated Relief Valves (PORVs) [SB][RV].

EVENT DESCRIPTION

On July 6, 2016, at 0038, Donald C. Cook Nuclear Plant Unit 2 Reactor was manually tripped from 100 percent power, after operators heard a loud noise and observed a large steam leak in the vicinity of the B Right MSR crossover line. This information resulted in the operators' decision to manually trip the Unit 2 Reactor. The Auxiliary Feedwater System [BA] automatically initiated to maintain Steam Generator levels within acceptable control limitations, and the steam release immediately dissipated upon trip of the main turbine [TRB]. Due to the B Right MSR crossover expansion joint damage, main condenser vacuum slowly degraded and heat removal was accomplished through the steam generator PORVs. However, main feedwater flow could have been established, if needed, and therefore this trip is considered to be "uncomplicated". Plant response was within acceptable control limitations and all system parameters stabilized at normal post-trip levels. The Emergency Plan was entered at 0050 due to declaration of an Unusual Event based on EAL N-7, Explosion (Report by plant personnel of an unanticipated EXPLOSION within the protected area boundary resulting in visible damage to permanent structures or equipment). The Unusual Event was terminated at 0207.

COMPONENT

2-XJ-113-6: B Right MSR Reheat Steam to Low Pressure Turbine B Outlet Elbow Expansion Joint Bellows.

ASSESSMENT OF SAFETY CONSEQUENCES

NUCLEAR SAFETY

This event was not significant with respect to the health and safety of the general public since all safety systems functioned per design during this event.

INDUSTRIAL SAFETY

No personnel injuries occurred as a result of this event. However, this event was significant with respect to the safety of plant personnel due to the potential for personnel injury resulting from the bellows failure.

RADIOLOGICAL SAFETY

There was no actual or potential radiological safety hazard resulting from the bellows failure.

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NARRATIVE

PROBABILISTIC RISK ASSESSMENT (PRA)

This event was low risk significant from a PRA perspective because the MSR is not a risk significant component in the PRA. Reactor trips with a loss of main feedwater or condenser heat sink have a Conditional Core Damage Probability of approximately 7E-7 and a Conditional Large Early Release Probability of 9.5E-8, which is considered low in comparison to other risk significant events.

ROOT CAUSE

The Root Cause was determined to be an organizational failure to recognize the risk significance of, and to adequately correct or mitigate, previously identified vibration issues with the Unit 2 B Right MSR crossover expansion joint tie rod and bellows in a timely fashion.

CONTRIBUTING CAUSES

Tack welds were inappropriately applied to nuts on the tie rod areas under tensile load. This was inconsistent with the intent of the Engineering Change which installed the threaded tie rods and was the result of poor communication between engineering workgroups. These tack welds on ASTM A193 B7 material created stress risers which accelerated tie rod high cycle fatigue failure.

The B crossover lines are subject to higher levels of vibration than the A and C crossover lines. The vibration amplitudes produced stresses in the B tie rods that led to the tie rod high cycle fatigue failure.

The B crossover line vibration issue was removed from the plant high priority list following U2C22 before the vibration condition was resolved. Unit 2 returned to service and operated for several months with elevated vibration levels on the MSR B crossover lines before vibration amplitudes were addressed. Since the issue was no longer on the plant high priority list, the issue was no longer a station priority and workgroups lost focus on the issue.

CORRECTIVE ACTIONS

Immediate Corrective Action Taken

The Unit 2 Reactor was manually tripped and the steam release immediately dissipated upon trip of the main turbine. Repairs to the expansion joint bellows were completed on July 11, 2016.

Additional Corrective Actions Planned

Perform a detailed vibration analysis on the MSR crossover lines and expansion joints at 100 percent power, after the next Unit 2 Refueling Outage (U2C23) to determine if any vibration concerns remain, which may result in tie rod failure or premature bellows failures, as well as to fully understand the system vibration and reactions, and to provide input to support expansion joint redesign.

NRC FORM 366A (11-2015) U.S. NUCLEAR REGULATORY COMMISSION APPROVED BY OMB: NO. 3150-0104 EXPIRES: 10/31/2018

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NARRATIVE

Replace the tie rods in the A-Left, C-Left, and C-Right expansion joints (with the same type or redesigned tie rods) during U2C23 to eliminate existing stress risers created by tie rod nut tack welds.

Analyze the long-term health of the existing 2.5 inch all thread tie rods in the A-Left, C-Left, and C-Right expansion joints to determine if the existing design is acceptable for system conditions.

Design and install more robust tie rods in B-Left and B-Right crossover lines, and A-Left, C-left, and C-Right crossover lines if necessary, during U2C23 to reduce or eliminate fatigue failure concerns.

Revise the Plant Health Committee (PHC) procedure, to require the risk associated with an issue on the high priority list, to be considered and eliminated, adequately mitigated, or residual risk accepted by the PHC, prior to removal of the items from the high priority list.

PREVIOUS SIMILAR EVENTS

LERs for both units for the past three years were reviewed for similar events related to 10 CFR 50.73(a)(2)(iv)(A) reporting criteria for system actuation. The following event was identified:

LER-316-2013-001-00 "Unit 2 Manual Reactor Trip due to Lowering Steam Generator Level"
LER-315-2014-001-00 "Manual Reactor Trip Due to Lake Debris Intrusion Causing Degraded Forebay Conditions"
LER-316-2015-001-00 "Manual Reactor Trip Due to a Secondary Plant Transient"

Although these three events were similar with respect to Manual Reactor Trips, the Corrective Actions resulting from these LERs are not expected to have prevented this occurrence.