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**Anthony J. Vitale**  
Site Vice President

PNP 2014-023

March 27, 2014

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

**SUBJECT: Degraded Condition Due to Crack Indications in Control Rod Drive  
Mechanism Housing Assemblies**

Palisades Nuclear Plant  
Docket 50-255  
License No. DPR-20

Dear Sir or Madam:

Licensee Event Report (LER) 2014-002-00 is enclosed. The LER describes the indication of cracks in several upper housing assemblies of control rod drive mechanisms. The condition is reportable in accordance with 10 CFR 50.73 (a)(2)(ii)(A).

This letter contains no new commitments and no revisions to existing commitments.

Sincerely,

A handwritten signature in black ink, appearing to read "Anthony J. Vitale".

ajv/tad

**Attachment: LER 2014-002-00, Degraded Condition Due to Crack Indications in  
Control Rod Drive Mechanism Housing Assemblies**

**CC Administrator, Region III, USNRC  
Project Manager, Palisades, USNRC  
Resident Inspector, Palisades, USNRC**

**ATTACHMENT**

**LER 2014-002-00**

**DEGRADED CONDITION DUE TO CRACK INDICATIONS IN CONTROL ROD DRIVE  
MECHANISM HOUSING ASSEMBLIES**

**3 Pages Follow**

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## LICENSEE EVENT REPORT (LER)

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

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.

<b>1. FACILITY NAME</b> PALISADES NUCLEAR PLANT	<b>2. DOCKET NUMBER</b> 05000255	<b>3. PAGE</b> 1 OF 3
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**4. TITLE** Degraded Condition Due to Crack Indications in Control Rod Drive Mechanism Housing Assemblies

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
01	29	2014	2014	- 002	- 00	03	27	2014	FACILITY NAME	DOCKET NUMBER 05000

<b>9. OPERATING MODE</b> Mode 6	<b>11. THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check all that apply)</b>			
<b>10. POWER LEVEL</b> 0%	<input type="checkbox"/> 20.2201(b)	<input type="checkbox"/> 20.2203(a)(3)(i)	<input type="checkbox"/> 50.73(a)(2)(i)(C)	<input type="checkbox"/> 50.73(a)(2)(vii)
	<input type="checkbox"/> 20.2201(d)	<input type="checkbox"/> 20.2203(a)(3)(ii)	<input checked="" type="checkbox"/> 50.73(a)(2)(ii)(A)	<input type="checkbox"/> 50.73(a)(2)(viii)(A)
	<input type="checkbox"/> 20.2203(a)(1)	<input type="checkbox"/> 20.2203(a)(4)	<input type="checkbox"/> 50.73(a)(2)(ii)(B)	<input type="checkbox"/> 50.73(a)(2)(viii)(B)
	<input type="checkbox"/> 20.2203(a)(2)(i)	<input type="checkbox"/> 50.36(c)(1)(i)(A)	<input type="checkbox"/> 50.73(a)(2)(iii)	<input type="checkbox"/> 50.73(a)(2)(ix)(A)
	<input type="checkbox"/> 20.2203(a)(2)(ii)	<input type="checkbox"/> 50.36(c)(1)(ii)(A)	<input type="checkbox"/> 50.73(a)(2)(iv)(A)	<input type="checkbox"/> 50.73(a)(2)(x)
	<input type="checkbox"/> 20.2203(a)(2)(iii)	<input type="checkbox"/> 50.36(c)(2)	<input type="checkbox"/> 50.73(a)(2)(v)(A)	<input type="checkbox"/> 73.71(a)(4)
	<input type="checkbox"/> 20.2203(a)(2)(iv)	<input type="checkbox"/> 50.46(a)(3)(ii)	<input type="checkbox"/> 50.73(a)(2)(v)(B)	<input type="checkbox"/> 73.71(a)(5)
	<input type="checkbox"/> 20.2203(a)(2)(v)	<input type="checkbox"/> 50.73(a)(2)(i)(A)	<input type="checkbox"/> 50.73(a)(2)(v)(C)	<input type="checkbox"/> OTHER
<input type="checkbox"/> 20.2203(a)(2)(vi)	<input type="checkbox"/> 50.73(a)(2)(i)(B)	<input type="checkbox"/> 50.73(a)(2)(v)(D)	Specify in Abstract below or in NRC Form 366A	

**12. LICENSEE CONTACT FOR THIS LER**

<b>FACILITY NAME</b> Barb Dotson, Regulatory Assurance Manager, Acting	<b>TELEPHONE NUMBER (Include Area Code)</b> 269-764-2265
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**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	AA	DRIV	C490	Y					

**14. SUPPLEMENTAL REPORT EXPECTED**☐ YES (If yes, complete 15. 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 January 24, 2014, during an internal examination of the upper housing assembly for control rod drive mechanism No.23 (CRDM-23), an axial crack indication was identified adjacent to an interior surface, non-structural, onlay weld (weld No.5). The examination of CRDM-23 upper housing assembly was performed as a corrective action from a 2012 event. On January 29, 2014, it was determined the crack indications in the upper housing assembly of CRDM-23 exceeded the acceptance criteria specified in the inspection plan. Subsequent examination of all 45 CRDM upper housing assemblies identified unacceptable crack indications on 17 assemblies. All crack indications were located in the proximity of the interior surface onlay weld No.5.

Crack indications in the upper housing assemblies of the CRDMs were caused by transgranular stress corrosion cracking (TGSCC). An accumulation of tensile stress, a susceptible material, and an environment that supports cracking are required for TGSCC to occur. Failure mode analyses are currently in-progress. It is suspected that manufacturing irregularities in surface onlay weld No.5 produced sufficient tensile stresses within the 316L stainless steel upper housing assemblies to initiate TGSCC.

The upper housing assemblies for 44 of the 45 total CRDM were removed and replaced with upper housing assemblies of modified design. Previously, in August 2012, the upper housing assembly of CRDM-24 was replaced with the same modified design. No crack indications were identified in the upper housing assembly of CRDM-24.

**LICENSEE EVENT REPORT (LER)  
CONTINUATION SHEET**

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](mailto: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.

1. FACILITY NAME	2. DOCKET	6. LER NUMBER			3. PAGE
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**NARRATIVE****BACKGROUND**

On August 12, 2012, a through-wall crack was identified in the type 316L stainless steel pipe section of the upper housing assembly for control rod drive mechanism No.24 (CRDM-24) [DRIV;AA]. Subsequent examinations revealed a total of nine axially oriented crack indications in the upper housing assembly, located in the proximity of interior surface onlay weld No.5.

The upper housing assembly of CRDM-24 was removed and replaced with an upper housing assembly of modified design. Examinations were performed on eight additional CRDM upper housing assemblies. No crack indications were noted on the eight additional assemblies.

The cause of the crack indications was determined to be transgranular stress corrosion cracking (TGSCC). An accumulation of tensile stresses, a material that is susceptible to the cracking phenomenon, and an environment that supports cracking are required for TGSCC to occur. It was determined the probable cause of the through-wall crack in the upper housing assembly of CRDM-24 was manufacturing irregularities in surface onlay weld No.5 causing stresses in the proximity of the weld, in addition to potential misalignments between CRDM-24 upper housing, support tube, seismic supports, and the associated reactor head penetration/CRDM nozzle. Based on lack of crack indications in the other eight upper housing assemblies tested, it was believed that the failed CRDM-24 upper housing assembly contained an unidentified additional stress that made it unique with respect to other control rod drive upper housings.

Onlay weld No.5 of the CRDM upper housing assemblies is not a pressure retaining weld (non-structural). Therefore, it does not fall within the in-service inspection testing scope for a surface or volumetric examination required by the American Society of Mechanical Engineers (ASME) Code, Section XI. To ensure potential crack indications in CRDM upper housing assemblies would be identified prior to reaching the point of a through-wall leak during future operating cycles, a qualitative risk informed inspection plan was developed. The inspection plan scope included examination of all welded areas in the 45 CRDM upper housing assemblies over the next four scheduled refueling outages. Twelve upper housing assemblies were scheduled for examination during the next refueling outage, 1R23. Eddy current testing was chosen as the inspection method to be used, based on the ability to readily examine the internal surface of the upper housing assemblies. This method results in a more accurate characterization of the depth and dimensions of potential crack indications. ASME Code Section XI was used as guidance to develop the acceptance criteria for the inspection plan. Additionally, any crack-like indication identified would require further evaluation as part of the corrective action program. Confirmation of a crack indication would result in inspection plan scope expansion.

**EVENT DESCRIPTION**

During refueling outage 1R23, on January 24, 2014, an internal examination of the upper housing assembly of CRDM-23 identified an axial crack indication adjacent to the interior surface onlay weld No.5. On January 29, 2014, with the plant in Mode 6 and 0% power, it was determined the crack indications in the upper housing assembly of CRDM-23 exceeded the acceptance criteria specified in the inspection plan.

(01-2014)

# **LICENSEE EVENT REPORT (LER) CONTINUATION SHEET**

1. FACILITY NAME	2. DOCKET	6. LER NUMBER			3. PAGE
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**NARRATIVE**

Due to the identification of crack indications in subsequent assemblies inspected, the inspection plan scope was expanded to examine all 45 CRDM upper housing assemblies during refueling outage 1R23. 17 of 45 CRDM upper housing assemblies contained crack indications that failed the acceptance criteria of the inspection plan. All crack indications were located in the proximity of the interior surface onlay weld No.5.

No structures, components, or systems were inoperable or contributed to the event at the time of discovery.

**CAUSE OF THE EVENT**

Crack indications in the upper housing assemblies of the CRDMs were caused by TGSCC. Failure mode analyses are currently in-progress. It is suspected that manufacturing irregularities in surface onlay weld No.5 produced sufficient tensile stresses within the 316L stainless steel upper housing assemblies to initiate TGSCC.

**CORRECTIVE ACTIONS**

A design change of the upper housing assemblies was implemented in 2012 that eliminated interior surface onlay weld No.5, the probable cause of the tensile stresses that initiated TGSCC. Upper housing assemblies were removed and replaced with upper housing assemblies of the modified design on 44 of the 45 total CRDMs. Previously, in August 2012, the upper housing assembly of CRDM-24 was replaced with the same modified design. No crack indications were identified in the upper housing assembly of CRDM-24.

**ASSESSMENT OF SAFETY CONSEQUENCES**

The crack indications identified did not represent an actual or likely increased challenge to nuclear safety. If a through-wall crack would have initiated from an indication, some leakage would have occurred. This leakage would be detected by Palisades (PNP) leak detection methodology presently used which is consistent with industry guidance. The methodology is compliant with NEI 03-08, "Guideline for the Management of Materials Issues," to improve leak detection capability. The PNP leak detection methodology requires the monitoring of seven-day rolling averages of reactor coolant system leak rates for adverse trend identification and subsequent actions to identify leakage sources. Additionally, there are administrative and technical specification limits on unidentified reactor coolant system leakage which require a unit shutdown to identify and repair leakage.

**PREVIOUS SIMILAR EVENTS**

LER 2012-001-00, Degraded Condition Due to Control Rod Drive Mechanism Housing Assembly Crack.