



*Entergy*

Entergy Nuclear Operations, Inc.  
Palisades Nuclear Plant  
27780 Blue Star Memorial Highway  
Covert, MI 49043  
Tel 269 764 2000

**Jeffery A. Hardy**  
Regulatory Assurance Manager

PNP 2018-056

January 3, 2019

10 CFR 50.73

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

SUBJECT: LER 2018-003-00 – Indications Identified in Reactor Pressure Vessel  
Head Nozzle Penetrations

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

Dear Sir or Madam:

Entergy Nuclear Operations, Inc., submits the enclosed Licensee Event Report (LER), 2018-003-00, for the Palisades Nuclear Plant. The event is reportable in accordance with 10 CFR 50.73(a)(2)(ii)(A) as a degraded condition. The LER describes a condition in which through-wall and axial flaw indications were identified in reactor vessel head penetrations by inspections performed during a refueling outage.

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

Should you have any questions concerning this report, please contact Mr. Jeffery Hardy, Regulatory Assurance Manager, at (269) 764-2011.

Sincerely,

JAH/bed

Attachment: LER 2018-003-00, Indications Identified in Reactor Pressure Vessel Head  
Nozzle Penetrations

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

**ATTACHMENT**

**LER 2018-003-00**

**INDICATIONS IDENTIFIED IN REACTOR PRESSURE VESSEL  
HEAD NOZZLE PENETRATIONS**

3 Pages Follow



## LICENSEE EVENT REPORT (LER)

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

(See NUREG-1022, R.3 for instruction and guidance for completing this form  
<http://www.nrc.gov/reading-m/doc-collections/nuregs/staff/sr1022/r3/>)

APPROVED BY OMB: NO. 3150-0104

EXPIRES: 03/31/2020

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 Information Services Branch (T-2 F43), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by 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.

1. FACILITY NAME  
 PALISADES NUCLEAR PLANT

2. DOCKET NUMBER  
 05000255

3. PAGE  
 1 OF 3

## 4. TITLE

## Indications Identified in Reactor Pressure Vessel Head Nozzle Penetrations

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
11	10	2018	2018	003	00	01	03	2019		05000
9. OPERATING MODE 6			11. THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check all that apply)							
			<input type="checkbox"/> 20.2201(b)		<input type="checkbox"/> 20.2203(a)(3)(i)		<input checked="" type="checkbox"/> 50.73(a)(2)(ii)(A)		<input type="checkbox"/> 50.73(a)(2)(viii)(A)	
			<input type="checkbox"/> 20.2201(d)		<input type="checkbox"/> 20.2203(a)(3)(ii)		<input type="checkbox"/> 50.73(a)(2)(ii)(B)		<input type="checkbox"/> 50.73(a)(2)(viii)(B)	
			<input type="checkbox"/> 20.2203(a)(1)		<input type="checkbox"/> 20.2203(a)(4)		<input type="checkbox"/> 50.73(a)(2)(iii)		<input type="checkbox"/> 50.73(a)(2)(ix)(A)	
10. POWER LEVEL 0			<input type="checkbox"/> 20.2203(a)(2)(i)		<input type="checkbox"/> 50.36(c)(1)(i)(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)(ii)		<input type="checkbox"/> 50.36(c)(1)(ii)(A)		<input type="checkbox"/> 50.73(a)(2)(v)(A)		<input type="checkbox"/> 73.71(a)(4)	
			<input type="checkbox"/> 20.2203(a)(2)(iii)		<input type="checkbox"/> 50.36(c)(2)		<input type="checkbox"/> 50.73(a)(2)(v)(B)		<input type="checkbox"/> 73.71(a)(5)	
			<input type="checkbox"/> 20.2203(a)(2)(iv)		<input type="checkbox"/> 50.46(a)(3)(ii)		<input type="checkbox"/> 50.73(a)(2)(v)(C)		<input type="checkbox"/> 73.77(a)(1)	
			<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)(D)		<input type="checkbox"/> 73.77(a)(2)(i)	
			<input type="checkbox"/> 20.2203(a)(2)(vi)		<input type="checkbox"/> 50.73(a)(2)(i)(B)		<input type="checkbox"/> 50.73(a)(2)(vii)		<input type="checkbox"/> 73.77(a)(2)(ii)	
		<input type="checkbox"/> 50.73(a)(2)(i)(C)		<input type="checkbox"/> OTHER		Specify in Abstract below or in NRC Form 366A				

## 12. LICENSEE CONTACT FOR THIS LER

LICENSEE CONTACT

Jeffery Hardy, Regulatory Assurance Manager

TELEPHONE NUMBER (Include Area Code)

269-764-2011

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

CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO EPIX	CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO EPIX
B	AB	RPV	C490	Y					

## 14. SUPPLEMENTAL REPORT EXPECTED

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

## 15. EXPECTED SUBMISSION DATE

MONTH	DAY	YEAR
07	01	2019

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

On November 10, 2018, with the plant in Mode 6, during bare metal visual inspections of the reactor pressure vessel head (RPVH), dried boric acid was identified in the area of reactor head nozzle 25, indicative of a through-wall flaw. The flaw had not been identified during review of the original ultrasonic test (UT) data. During re-evaluation of the ultrasonic test (UT) data, analysts identified a leak-path indication and an axially oriented flaw characteristic of primary water stress corrosion cracking (PWSCC). As a result of the discovery in the UT data re-evaluation for reactor head nozzle 25, Framatome extended the UT characteristics to a re-evaluation of the data for the other relevant RPVH nozzles. This extent-of-condition review identified an additional four nozzles, 33, 34, 35, and 36, that required further review. UT analysis determined that reactor head nozzle 33 contained an indication consistent with PWSCC and that reactor head penetration 35 was acceptable. Supplemental eddy current testing (ECT) was performed on reactor head nozzles 34 and 36. ECT inspection of nozzle 34 did not reveal any PWSCC indications and was determined to be acceptable. ECT inspection of nozzle 36 revealed surface breaking PWSCC-type indications.

The plant was in cold shutdown at 0% power and Mode 6 for a refueling outage at the time of discovery. Reactor head nozzles 25, 33 and 36 were repaired and the RPVH was returned to service. The safety significance of this event was minimal. This event is reportable in accordance with 10 CFR 50.73(a)(2)(ii)(A) as a condition that resulted in a principle safety barrier being seriously degraded.



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

(See NUREG-1022, R.3 for instruction and guidance for completing this form  
<http://www.nrc.gov/reading-rm/doc-collections/nuregs/staff/sr1022/r3/>)

APPROVED BY OMB: NO. 3150-0104

EXPIRES: 3/31/2020

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 Information Services Branch (T-2 F43), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by 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.

1. FACILITY NAME	2. DOCKET NUMBER	3. LER NUMBER		
PALISADES NUCLEAR PLANT	05000-255	YEAR 2018	SEQUENTIAL NUMBER - 003	REV NO. - 00

**NARRATIVE**

**EVENT DESCRIPTION**

On November 10, 2018, with the plant in Mode 6, at 0% power, during bare metal visual inspections of the reactor pressure vessel [RPV;AB] head (RPVH), dried boric acid was identified in the area of reactor head nozzle [NZL;AB] 25, indicative of a through-wall flaw. The flaw had not been identified during review of the original ultrasonic test (UT) data. Dried boric acid was not observed during the previous inspection in 2017.

During re-evaluation of the UT data, analysts identified a leak-path indication and an axially oriented flaw characteristic of primary water stress corrosion cracking (PWSCC). The Palisades RPVH nozzles are Inconel Alloy 600 material which is known to be susceptible to PWSCC.

As a result of the discovery in the UT data re-evaluation for reactor head nozzle 25, Framatome extended the UT characteristics to a re-evaluation of the data for the other 52 RPVH nozzles. The reactor head vent was not re-performed as it had already been examined using eddy current testing (ECT). This extent-of-condition review identified an additional four reactor head nozzles, 33, 34, 35, and 36, that required further analysis. Of the four additional, reactor head nozzle 33 was determined to contain an indication with characteristics consistent with PWSCC.

In addition to the Framatome extent-of-condition review, the data for reactor head nozzles 25, 33, 34, 35, and 36 was sent to the Electric Power Research Institute (EPRI) for an independent third party review. EPRI provided concurrence with the Framatome conclusions for reactor head nozzles 25 (through-wall flaw), 33 (flaw), and 35 (no flaw). EPRI also concluded that the UT data alone was insufficient to make a definitive determination on reactor head nozzles 34 and 36. As a result, Entergy, Framatome, and EPRI determined that a supplemental inside diameter (ID) surface examination, in the form of ECT, was required to adequately evaluate the condition of these two reactor head nozzles.

On November 21, 2018, Framatome completed ECT on reactor head nozzles 36 and 34. The ECT confirmed that reactor head nozzle 36 contained surface breaking PWSCC-type indications. Reactor head nozzle 34 was determined to be satisfactory.

Framatome provided an in-depth summary of the prior data reviews on reactor head nozzles 25, 33, and 36. The result of this review shows that the ID-initiated axial flaws were present and detectable with the demonstrated inspection method in 2007, 2009, 2010, and 2012. However, ID initiation has not been seen by Framatome since the 2001-2002 timeframe, and outside diameter (OD) initiation is the primary industry focus of inspection. As a result, these flaws were previously mischaracterized.



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

(See NUREG-1022, R.3 for instruction and guidance for completing this form  
<http://www.nrc.gov/reading-rm/doc-collections/nuregs/staff/sr1022/13/>)

APPROVED BY OMB: NO. 3150-0104

EXPIRES: 3/31/2020

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 Information Services Branch (T-2 F43), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by 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 NUMBER	3. LER NUMBER		
PALISADES NUCLEAR PLANT	05000-255	YEAR	SEQUENTIAL NUMBER	REV NO.

### **CAUSE OF THE EVENT**

Based on previous internal and industry operating experience (OE), coupled with the analysis of the data, the cause is PWSCC. In addition, Framatome notes a bias for OD initiation due to almost exclusive OD surface flaws over the last 10-15 years in the industry. As a result, OD initiation is a primary focus during RPVH examinations. Framatome's cause evaluation of this event is not yet complete.

### **ASSESSMENT OF SAFETY CONSEQUENCES**

The safety significance of the flaw's presence during operation was minimal. There was no appreciable reactor head wastage due to the boric acid found. The Palisades' RPVH inspection program is in accordance with the requirements of ASME Code Case 729-4, as modified by the additional limitations set forth in 10 CFR 50.55a(g)(6)(ii)(D). This provides assurance against any credible PWSCC degradation event that would challenge nuclear safety. There were no consequences to the general safety of the public, nuclear safety, industrial safety, or radiological safety for this event.

### **CORRECTIVE ACTIONS**

Just-in-Time Training was conducted on the flaw characteristics observed in nozzles 25 and 33. The training was applied to re-inspection of the remainder of the reactor head nozzle population to ensure all flawed nozzles were identified.

Framatome executed half-nozzle replacements using the inside diameter temper bead welding process to repair the flawed reactor head nozzles, and the RPVH was returned to service.

Future inspections will require prior training on the OE from this event, along with the requirement to identify the reactor head "nozzles of interest" population similar to that completed during the Extent of Condition review. Once nozzles of interest are identified, techniques up to and including ECT, will be used to resolve indications in that population to ensure all flawed reactor head nozzles are addressed appropriately.

The cause evaluation being completed by Framatome will be reviewed. If warranted, this LER will be supplemented to incorporate appropriate conclusions from that evaluation.

### **PREVIOUS SIMILAR EVENTS**

LER 2004-002 – Leak Path Indications Identified in Reactor Pressure Vessel Head Nozzle Penetrations, Palisades Nuclear Plant, dated December 9, 2004.