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Manager, Regulatory Assurance

10 CFR 50.73

W3F1-2019-0070

September 26, 2019

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

Subject: Licensee Event Report (LER) 2019-007-00  
Plant Shutdown Required by Technical Specifications Due to Charging Pump  
Suction Line Flaw

Waterford Steam Electric Station, Unit 3 (Waterford 3)  
NRC Docket No. 50-382  
Renewed Facility Operating License No. NPF-38

The enclosed report is being sent pursuant to 10 CFR 50.73.

This letter contains no new regulatory commitments.

If you have any questions or require additional information, please contact Paul Wood,  
Regulatory Assurance Manager, at 504-464-3786.

Respectfully,

A handwritten signature in black ink that reads "Paul Wood".

Paul Wood

PIW/jkb

Enclosure: Waterford 3 Licensee Event Report 2019-007-00


cc: NRC Region IV Regional Administrator  
NRC Senior Resident Inspector – Waterford Steam Electric Station, Unit 3  
NRR Project Manager

**ENCLOSURE**

**W3F1-2019-0070**

**Entergy Operations, Inc.**

**Waterford 3 Licensee Event Report 2019-007-00**

<b>NRC FORM 366</b> (04-2018)		<b>U.S. NUCLEAR REGULATORY COMMISSION</b>			<b>APPROVED BY OMB: NO. 3150-0104</b>		<b>EXPIRES: 03/31/2020</b>			
<div style="display: flex; justify-content: space-between; align-items: center;"> <div style="text-align: center;">  <p><b>LICENSEE EVENT REPORT (LER)</b> (See Page 2 for required number of digits/characters for each block)</p> <p>(See NUREG-1022, R.3 for instruction and guidance for completing this form  <a href="http://www.nrc.gov/reading-rm/doc-collections/nuregs/staff/sr1022/r3/">http://www.nrc.gov/reading-rm/doc-collections/nuregs/staff/sr1022/r3/</a>)</p> </div> <div style="font-size: small;">           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 <a href="mailto:InfoCollects.Resource@nrc.gov">InfoCollects.Resource@nrc.gov</a>, 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.         </div> </div>										
<b>1. FACILITY NAME</b> Waterford Steam Electric Station, Unit 3					<b>2. DOCKET NUMBER</b> 05000382		<b>3. PAGE</b> 1 OF 3			
<b>4. TITLE</b> Plant Shutdown Required by Technical Specifications Due to Charging Pump Suction Line Flaw										
<b>5. EVENT DATE</b>			<b>6. LER NUMBER</b>			<b>7. REPORT DATE</b>			<b>8. OTHER FACILITIES INVOLVED</b>	
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REV NO.	MONTH	DAY	YEAR	FACILITY NAME	DOCKET NUMBER
07	31	2019	2019	007	00	09	26	2019	FACILITY NAME	DOCKET NUMBER
<b>9. OPERATING MODE</b>			<b>11. THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check all that apply)</b>							
1			<input type="checkbox"/> 20.2201(b)			<input type="checkbox"/> 20.2203(a)(3)(i)			<input type="checkbox"/> 50.73(a)(2)(ii)(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"/> 20.2203(a)(1)			<input type="checkbox"/> 20.2203(a)(4)			<input type="checkbox"/> 50.73(a)(2)(iii)	
			<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)	
100			<input type="checkbox"/> 20.2203(a)(2)(ii)			<input type="checkbox"/> 50.36(c)(1)(ii)(A)			<input checked="" type="checkbox"/> 50.73(a)(2)(v)(A)	
			<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"/> 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"/> 20.2203(a)(2)(v)			<input checked="" type="checkbox"/> 50.73(a)(2)(i)(A)			<input checked="" type="checkbox"/> 50.73(a)(2)(v)(D)	
			<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"/> 50.73(a)(2)(i)(C)			<input type="checkbox"/> OTHER Specify in Abstract below or in NRC Form 366A	
<b>12. LICENSEE CONTACT FOR THIS LER</b>										
LICENSEE CONTACT Paul Wood - Manager, Regulatory Assurance								TELEPHONE NUMBER (Include Area Code) (504) 464-3786		
<b>13. COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT</b>										
CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO ICES	CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO ICES	
B	CB	PSP	D236	Y						
<b>14. SUPPLEMENTAL REPORT EXPECTED</b>						<b>15. EXPECTED SUBMISSION DATE</b>		MONTH	DAY	YEAR
<input type="checkbox"/> YES (If yes, complete 15. EXPECTED SUBMISSION DATE) <input checked="" type="checkbox"/> NO										
ABSTRACT (Limit to 1400 spaces, i.e., approximately 15 single-spaced typewritten lines)										
<p>On June 30, 2019, at 2112 Central Daylight Time, Reactor Coolant System (RCS) unidentified leakage experienced a step increase from 0.02 gpm to 0.24 gpm. During the subsequent leak investigation, leakage was identified in a Chemical and Volume Control (CVC) system drain line upstream of valve CVC-186. CVC-186 provides a drain path from the Volume Control Tank and Charging Pump suction header to the Equipment Drain Tank. This line is on the suction path to all three charging pumps and is part of the boration flow path to the Charging Pumps.</p> <p>Radiography was performed and determined that the line had a 1.162-inch-long circumferential flaw. The flaw was located on the approximate 1/8-inch exposed portion of the line between weld toes. Analysis was performed and determined that the maximum allowable flaw size for the piping configuration was 1.7 inches. Daily monitoring of the piping flaw was established. On 7/31/2019, the flaw size was measured to be 1.75 inches. The flaw growth resulted in all three Charging Pumps and the associated boration flow path being inoperable. Operations entered Technical Specification 3.0.3 and commenced a plant shutdown. Repairs were attempted in Mode 3 but were unsuccessful. The plant entered Mode 5 and replaced the damaged section of pipe. After the repairs were completed the system was successfully returned to service.</p>										

**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/>)

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		
		YEAR	SEQUENTIAL NUMBER	REV NO.
Waterford Steam Electric Station, Unit 3	05000382	2019	- 007 -	00

**NARRATIVE****EVENT DESCRIPTION****A. Plant Status**

At the time of this event Waterford 3 was operating at 100% reactor power. No structures, systems or components were out of service at the start of the event that contributed to the event.

**B. Event Chronology and Description of Event**

06/30/2019 – RCS [AB] unidentified leakage step increase from 0.02 gpm to 0.24 gpm. Leak investigation initiated.  
07/02/2019 – Flaw discovered in the spool piece between socket welds of drain line containing valve CVC-186 (Volume Control Tank Outlet Header Drain to Equipment Drain Tank Sump).  
07/05/2019 – Analysis was performed and determined that the maximum allowable flaw size for the piping configuration was 1.7 inches.  
07/08/2019 – Visual and radiographic examination identified a pipe flaw on charging line [CB] 2CH1-30 [at the 1" diameter schedule 80 stainless steel spool piece between socket welds of the elbow and weld-o-let (toe of weld) upstream of drain valve CVC-186 [ISV]. Radiography determined the flaw to be a 1.162-inch-long fatigue-related through wall circumferential crack in the spool member. The flaw was located on the approximate 1/8-inch exposed portion of the line between weld toes. Daily monitoring of the piping flaw was established.  
07/25/2019 – Engineering change for on-line repair completed. This change included an approved ASME Code relief request and supporting activities of stress analysis and flaw size evaluation.  
07/30/2019 – No change in flaw size was observed in daily non-destructive examination from 07/08/2019 to 07/30/2019.  
07/31/2019 – At 1108 CDT, while weld mock-up activities were underway, the flaw grew and exceeded established operability limits on flaw size. This condition rendered all charging pumps and the required boron injection flow paths inoperable. Technical Specification (TS) 3.0.3 was entered due to action statements not being met for TS 3.1.2.2, "Reactivity Control Systems, Flow Paths - Operating" and TS 3.1.2.4, "Reactivity Control Systems, Charging Pumps - Operating." This required a plant shutdown. The plant shutdown was initiated at 1206 CDT. This event is reportable per 50.73(a)(2)(i)(A) due to the completion of a nuclear plant shutdown required by Technical Specifications and 50.73(a)(2)(v) due to event or condition that could have prevented fulfillment of a safety function.  
07/31/2019 – At 1706 CDT, the reactor shutdown was completed and the plant entered Mode 3. Repair of the charging pump suction line was attempted while the plant was in Mode 3, but the repairs were unable to be completed with charging in-service.  
07/31/2019 – At 2320 CDT, the plant entered Mode 4.  
08/01/2019 – At 2009 CDT, the plant entered Mode 5.  
08/03/2019 – At 0535 CDT, repairs of the charging pump suction header were completed; charging and letdown was restored to service.  
08/08/2019 – At 2134 CDT, the plant returned to 100% power.

**C. Event Causes**

The Root Cause of this condition is the design of the 2CH1-30 piping was inadequate for the fatigue stress induced by the positive displacement charging pumps. This resulted in the development of a piping flaw that exceeded the allowable limit.

**CORRECTIVE ACTIONS**

Completed Actions: The damaged section of line 2CH1-30 was replaced and a weld build-up was performed to strengthen the line. Extent of condition inspections were performed on other susceptible locations on the CVC system. No indications of flaws or leakage were identified.

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CONTINUATION SHEET**

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**NARRATIVE**

Planned Actions: Perform weld build-up or other activity to harden the CVC suction lines that are susceptible to fatigue failure. These activities are planned to be completed by the end of the next scheduled refueling outage.

**SAFETY EVALUATION**

The actual consequences were all three Charging Pumps and the associated boration flow path were declared inoperable. This resulted in a potential loss of safety function, entry into Technical Specification 3.0.3, and a plant shutdown. There were no other actual consequences to safety of the general public, nuclear safety, industrial safety and radiological safety for this event. While the line was determined to be inoperable due to the crack size, the line did not fail and the boric acid makeup suction path to the Charging Pumps was not lost.

The potential consequence to safety of the general public, nuclear safety, industrial safety and radiological safety of this event if the line would have failed is a loss of the suction path to the Charging Pumps.

The risk if no action is taken is low. The basis for this determination is as follows:

Probabilistic Risk Analysis (PRA) does not specifically model the CVC drain line in the station model but the impact would be to the boric acid inventory through the charging system. The loss of the boric acid makeup tank capacity would result in a change in the core damage frequency ( $\Delta$ CDF) of  $1.57E-7$ /year. This change in core damage frequency falls within the Regulatory Guide 1.174 acceptance guidelines for very small changes to CDF.

The immediate/interim/mitigating actions to reduce the frequency or consequence (pending implementation of final actions) are: 1) The line was replaced; and, 2) weld buildup was performed to increase the connection strength and prevent future fatigue failures.

**PREVIOUS OCCURRENCES**

In 2007 and 2013, Entergy identified a cracked weld in an instrument line connected to the outlet of the Chemical Volume Control System Volume Control tanks. The leak was caused by high-cycle low-stress fatigue which initiated at the root of the weld (inside diameter of the pipe) at an area of Lack of Fusion. Cantilever design resulted in a stress riser and fatigue failure. The source of cyclic stress is believed to be flow induced vibration due to Chemical and Volume Control system operation. A support was added to reduce the vibration level at the failure location.

In 2000, Entergy identified a cracked socket weld on a Chemical Volume Control piping connection that is part of the common header for all three charging pumps. The leak was determined to be caused by high-cycle low-stress fatigue due to vibrations induced by the nearby charging pump pulsations.

*Note: Energy Industry Identification System (EIIIS) codes and component codes are identified in the text as [XX].*