John Twarog
Manager
Regulatory Assurance
504-739-6747

W3F1-2023-0053 10 CFR 50.73

December 30, 2023

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

Subject: Licensee Event Report 50-382/2023-003-00, Steam Generator Tube Degradation Indicated by Failed In-Situ Pressure Testing
Waterford Steam Electric Station, Unit 3
NRC Docket No. 50-382
Renewed Facility Operating License No. NPF-38

Entergy Operations, Inc. (Entergy) submits the enclosed Licensee Event Report (LER) 50-382/2023-03-00 for Waterford Steam Electric Station, Unit 3 (Waterford 3). The event reported herein is reportable in accordance with 10 CFR 50.73(a)(2)(ii)(A) - A condition of the nuclear power plant, including its principal safety barriers, being seriously degraded.

The LER describes the Steam Generator Tube failures during planned inspection of Steam Generator tubes.

This letter contains no new commitments.

Should you have any questions concerning this issue, please contact John Twarog, Manager, Regulatory Assurance, at 504-739-6747.

Respectfully,

John Twarog

Digitally signed by John Twarog
DN: cn=John Twarog, c=US, o=Waterford 3 Nuclear Independent Oversight, ou=Nuclear Independent Oversight, email=jtwarog@entrgy.com
Date: 2023.12.30 16:12:22 -06'00'

John Twarog

JRT/mrp

Enclosure: Licensee Event Report 50-382/2023-003-00

cc: NRC Region IV Regional Administrator
NRC Senior Resident Inspector – Waterford Steam Electric Station, Unit 3
NRC Project Manager – Waterford Steam Electric Station, Unit 3
Louisiana Department of Environmental Quality

Enclosure

W3F1-2023-0053

Licensee Event Report 50-382/2023-003-00

NRC FORM 366 (10-01-2023) U.S. NUCLEAR REGULATORY COMMISSION

APPROVED BY OMB: NO. 3150-0104 EXPIRES: 03/31/2024

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, Library, and Information Collections Branch (T-6 A10M), U. S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by email to Infocollects.Resource@nrc.gov, and the OMB reviewer at: OMB Office of Information and Regulatory Affairs, (3150-0104), Attn: Desk Officer for the Nuclear Regulatory Commission, 725 17th Street NW, Washington, DC 20503; email: oira_submission@omb.eop.gov. The NRC may not conduct or sponsor, and a person is not required to respond to, a collection of information unless the document requesting or requiring the collection displays a currently valid OMB control number.

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-rm/doc-collections/nuregs/staff/sr1022/r3/)

1. Facility Name		2. Docket Number	3. Page
Waterford Steam Electric Station, Unit 3	■ 050 ☐ 052	00382	1 OF 3

4. Title

Steam Generator Tube Degradation Indicated by Failed In-Situ Pressure Testing

5. Event Date			6. LER Number			7. Report Date			8. Other Facilities Involved		
Month	Day	Year	Year	Sequential Number	Revision No.	Month	Day	Year	Facility Name	☐ 050	Docket Number
11	05	2023	2023	- 003 -	00	12	30	2023	N/A		
									Facility Name: N/A	☐ 052	Docket Number

9. Operating Mode	10. Power Level
D	000

11. This Report is Submitted Pursuant to the Requirements of 10 CFR §: *(Check all that apply)*

10 CFR Part 20	☐ 20.2203(a)(2)(vi)	**10 CFR Part 50**	☑ 50.73(a)(2)(ii)(A)	☐ 50.73(a)(2)(viii)(A)	☐ 73.1200(a)
☐ 20.2201(b)	☐ 20.2203(a)(3)(i)	☐ 50.36(c)(1)(i)(A)	☐ 50.73(a)(2)(ii)(B)	☐ 50.73(a)(2)(viii)(B)	☐ 73.1200(b)
☐ 20.2201(d)	☐ 20.2203(a)(3)(ii)	☐ 50.36(c)(1)(ii)(A)	☐ 50.73(a)(2)(iii)	☐ 50.73(a)(2)(ix)(A)	☐ 73.1200(c)
☐ 20.2203(a)(1)	☐ 20.2203(a)(4)	☐ 50.36(c)(2)	☐ 50.73(a)(2)(iv)(A)	☐ 50.73(a)(2)(x)	☐ 73.1200(d)
☐ 20.2203(a)(2)(i)	**10 CFR Part 21**	☐ 50.46(a)(3)(ii)	☐ 50.73(a)(2)(v)(A)	**10 CFR Part 73**	☐ 73.1200(e)
☐ 20.2203(a)(2)(ii)	☐ 21.2(c)	☐ 50.69(g)	☐ 50.73(a)(2)(v)(B)	☐ 73.77(a)(1)	☐ 73.1200(f)
☐ 20.2203(a)(2)(iii)		☐ 50.73(a)(2)(i)(A)	☐ 50.73(a)(2)(v)(C)	☐ 73.77(a)(2)(i)	☐ 73.1200(g)
☐ 20.2203(a)(2)(iv)		☐ 50.73(a)(2)(i)(B)	☐ 50.73(a)(2)(v)(D)	☐ 73.77(a)(2)(ii)	☐ 73.1200(h)
☐ 20.2203(a)(2)(v)		☐ 50.73(a)(2)(i)(C)	☐ 50.73(a)(2)(vii)		

☐ **OTHER** (Specify here, in abstract, or NRC 366A).

12. Licensee Contact for this LER

Licensee Contact	Phone Number (Include area code)
John Twarog	504-739-6747

13. Complete One Line for each Component Failure Described in this Report

Cause	System	Component	Manufacturer	Reportable to IRIS	Cause	System	Component	Manufacturer	Reportable to IRIS
B	AB	SG	W120	Y					

14. Supplemental Report Expected		15. Expected Submission Date	Month	Day	Year
☑ No	☐ Yes (If yes, complete 15. Expected Submission Date)				

16. Abstract (Limit to 1326 spaces, i.e., approximately 13 single-spaced typewritten lines)

On November 5, 2023, at 1033 CST, while in a refueling outage with the reactor defueled, the first of two Steam Generator (SG) tubes failed in-situ testing. At the time of this event, Waterford Steam Electric Station (WF3) was performing a planned inspection of 100-percent of the SG tubes. Eddy current testing revealed that four SG1 tubes contained flaws that failed to satisfy Condition Monitoring assessment. In accordance with EPRI Guidelines, the tubes required in-situ pressure testing. During in-situ testing, two of the tubes failed pressure testing. WF3 did not meet the performance criteria for SG structural integrity in accordance with Technical Specification 6.5.9.b.1, Steam Generator Program, due to two tube failures in SG1. Specifically, WF3 Steam Generator Program structural integrity performance criterion which includes retaining a safety factor of 3.0 against burst under normal steady state full power operation primary to secondary pressure differential and a safety factor of 1.4 against burst applied to the design basis accident primary to secondary pressure differentials. The affected tubes have been plugged and additional analysis is ongoing. This condition is being reported pursuant to 10 CFR 50.73(a)(2)(ii)(A), A condition of the nuclear power plant, including its principal safety barriers, 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/)

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1. FACILITY NAME		2. DOCKET NUMBER	3. LER NUMBER		
			YEAR	SEQUENTIAL NUMBER	REV NO.
Waterford Steam Electric Station, Unit 3	■ 050 ☐ 052	00382	2023	- 003	- 00

NARRATIVE

EVENT DESCRIPTION

On November 5, 2023, with Waterford Steam Electric Station Unit 3 (WF3) shutdown and defueled for Refueling Outage (RF) 25, it was determined that a condition existed where safety barriers were seriously degraded.

While performing 100-percent Inservice Inspection of the steam generator [AB:SG] tubes, Eddy Current Testing (ECT) on Steam Generator 1 (SG 1) identified four tubes with wear flaws exceeding the Condition Monitoring (CM) structural limit at the Tube Support Plates (TSP). The four deficient SG 1 tubes were R1 C4, R1 C112, R1 C138, and R2 C35. EPRI Guidelines required in-situ pressure testing of these tubes based on the identified flaws.

Tubes R1 C4 and R2 C35 were in-situ pressure tested on November 5, 2023. Tube R1 C4 met all hold points through 5000 psi and then experienced pop-through (burst) at 5243 psi when transitioning to the final "3 times delta normal operating pressure" of 5500 psi.

Tube R2 C35 reached the "3 times delta normal operating pressure" test pressure of 5500 psi, which was maintained for 41 seconds before briefly dropping below 5500 psi. Once re-established and stabilized at 5500 psi it held for 90 seconds prior to experiencing pop-through (burst) at 5504 psi.

Both tubes were later stabilized as applicable and plugged on both the cold and hot legs.

Tubes R1 C112 and R1 C138 were in-situ pressure tested on November 6, 2023, and both successfully reached and maintained the structural limit test pressure of 5500 psi for the two-minute hold period. Both tubes were later stabilized and plugged on both the Cold Leg and Hot Leg.

The event described in this LER is reportable under 10 CFR 50.73(a)(2)(ii)(A), any event or condition that resulted in the condition of the nuclear power plant including its principal safety barriers, being seriously degraded.

ANAL YSIS OF EVENT

Timeline

SG Pre-installation History:

Original steam generators SG1 and SG2 were replaced in Fall 2012 during RF18, due to age and degradation of Alloy-600 tubing. The replacement SGs use Alloy 690 tubing, which is not susceptible to primary water stress corrosion cracking (PWSCC), which was common industry wide on SGs with Alloy 600 tubing.

RF18 Fall 2012 -

Replacement SGs Installed/Pre-outage internal and secondary side inspections performed

RF19 Spring 2014 - First ISI Performed

The first in service inspection (ISI) was performed post-installation of new steam generators in RF19 with 100-percent ECT for all tubes on SG1 and SG2. Each generator also had Foreign Objects Search and Retrieval (FOSAR) performed to inspect for possible loose parts. An operational assessment concluded the next inspection would be performed in RF21. The only observed tube degradation during RF19 inspection was anti-vibration bar (AVB) wear. Zero tubes in SG1 and four tubes in SG2 were plugged due to AVB wear.

RF20 Fall 2015

No testing was performed in RF20.

LICENSEE EVENT REPORT (LER) CONTINUATION SHEET

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Waterford Steam Electric Station, Unit 3	■ 050 ☐ 052	00382	2023	- 003	- 00

NARRATIVE

RF21 Spring 2017 - Second ISI Performed
In RF21, 100-percent ECT testing was performed with FOSAR and secondary inspections. An operational assessment was performed and determined that it was acceptable to perform next testing and inspection in 3 cycles (RF24). AVB wear and TSP wear were identified in RF21. A total of three tubes in SG1 and 24 tubes in SG2 were plugged.

RF22 Winter 2019
No testing was performed in RF22 based on RF21 operational assessment. A skip inspection evaluation was completed with EPRI SG Integrity Assessment Guidelines which reviewed the prior degradation assessment, operational assessment, internal and external operating experience, and plant operating history to justify the planned inspection interval.

RF23 Fall 2020
No testing was performed based on RF21 operational assessment.
Operating Cycle 24 2021-2022
The NRC approved TSTF-577, " Revised Frequencies for Steam Generator Tube Inspections," dated December 8, 2021 (ML21313A008). The Vendor was contracted to update the RF21 Operational Assessment for an additional extension to the SG inspection interval at RF24.

RF24 Spring 2022
No testing was performed in RF24 based on revised RF21 operational assessment.

RF25 Fall 2023 - Third ISI Performed
100-percent ECT testing was performed, wear flaws exceeded condition monitoring structural limits in four tubes requiring in-situ pressure testing. Tubes R1 C4 and R2 C35 failed during in-situ pressure testing.

EVENT CAUSES
The direct cause of the in-situ pressure testing failure was tube-to-tube support plate wear. Additional causal factors were attributed to steam generator design that is susceptible to low-radius tube wear due to high velocity flow conditions, inadequate level of TSP support and vendor's use of nonconservative assumptions in the SG Operational Assessments.

CORRECTIVE ACTIONS
• WF3 utilized vendor condition monitoring and operational assessment to select tubes for plugging in accordance with Integrity Assessment Guidelines.
• The selected tubes for SG1 and SG2 were plugged on November 13, 2023, and November 7, 2023, respectively.
• An operational assessment for RF25 will be performed to determine frequency for inspections and testing.
• A third-party vendor has been contracted and will perform a review of the operational assessment for accuracy.

SAFETY ASSESSMENT
This condition had no actual safety consequences impacting the plant or public safety.
The potential consequence is the steam generators inability to maintain a pressure boundary which could impact off-site dose in the event of an accident scenario. A tube rupture scenario was assessed utilizing quantitative risk assessment and conservative modeling techniques. This scenario was determined to have a very low safety consequence.

PREVIOUS SIMILAR EVENTS
None