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Licensing Manager
Waterford 3

W3F1-2011-0042

June 6, 2011

U.S. Nuclear Regulatory Commission

Attn: Document Control Desk

Washington, DC 20555-0001

Subject: Licensee Event Report 2011-002-00
Waterford Steam Electric Station, Unit 3 (Waterford 3)
Docket No. 50-382
License No. NPF-38

Dear Sir or Madam:

Entergy is hereby submitting Licensee Event Report (LER) 2011-002-00 for Waterford Steam Electric Station Unit 3. This report provides details associated with the "A" Main Feedwater Isolation Valve failing its timed stroke test during Inservice Testing.

Based on this failure, it was determined that Waterford 3 operated in a condition prohibited by the Limiting Condition for Operation (LCO) delineated in Technical Specification 3.7.1.6, which requires that each Main Feedwater Isolation Valve (MFIV) shall be operable in modes 1 through 4. The condition is reported herein as required by 10 CFR 50.73(a)(2)(i)(B).

This report contains no new commitments. Please contact William J. Steelman at (504) 739-6685 if you have questions regarding this information.

Sincerely,

A handwritten signature in dark ink, appearing to read "William J. Steelman", with a stylized flourish at the end.

WJS/MEM

Attachment: Licensee Event Report 2011-002-00

cc: Mr. Elmo E. Collins, Jr.
Regional Administrator
U. S. Nuclear Regulatory Commission
Region IV
612 E. Lamar Blvd., Suite 400
Arlington, TX 76011-4125

NRC Senior Resident Inspector
Waterford Steam Electric Station Unit 3
P.O. Box 822
Killona, LA 70066-0751

U. S. Nuclear Regulatory Commission
Attn: Mr. N. Kalyanam
Mail Stop O-8 E9
Rockville, MD 20852
Kaly.Kalyanam@nrc.gov

Attachment 1

W3F1-2011-0042

Licensee Event Report 2011-002-00

NRC FORM 366 U.S. NUCLEAR REGULATORY COMMISSION (10-2010)					APPROVED BY OMB NO. 3150-0104 EXPIRES 10/31/2013														
LICENSEE EVENT REPORT (LER) (See reverse for required number of digits/characters for each block)										Estimated burden per response to comply with this mandatory information 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 Section (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.									
1. FACILITY NAME					2. DOCKET NUMBER					3. PAGE									
Waterford 3 Steam Electric Station					05000 382					1 OF 5									
4. TITLE																			
Main Feedwater Isolation Valve "A" Failed Surveillance Requirement																			
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							
04	07	2011	2011 - 002 - 00			06	06	2011	FACILITY NAME			DOCKET NUMBER							
												05000							
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9. OPERATING MODE			11. THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check all that apply)																
			<div style="display: flex; flex-wrap: wrap;"> <div style="width: 50%;"><input type="checkbox"/> 20.2201(b)</div> <div style="width: 50%;"><input type="checkbox"/> 20.2203(a)(3)(i)</div> <div style="width: 50%;"><input type="checkbox"/> 50.73(a)(2)(i)(C)</div> <div style="width: 50%;"><input type="checkbox"/> 50.73(a)(2)(vii)</div> <div style="width: 50%;"><input type="checkbox"/> 20.2201(d)</div> <div style="width: 50%;"><input type="checkbox"/> 20.2203(a)(3)(ii)</div> <div style="width: 50%;"><input type="checkbox"/> 50.73(a)(2)(ii)(A)</div> <div style="width: 50%;"><input type="checkbox"/> 50.73(a)(2)(viii)(A)</div> <div style="width: 50%;"><input type="checkbox"/> 20.2203(a)(1)</div> <div style="width: 50%;"><input type="checkbox"/> 20.2203(a)(4)</div> <div style="width: 50%;"><input type="checkbox"/> 50.73(a)(2)(ii)(B)</div> <div style="width: 50%;"><input type="checkbox"/> 50.73(a)(2)(viii)(B)</div> <div style="width: 50%;"><input type="checkbox"/> 20.2203(a)(2)(i)</div> <div style="width: 50%;"><input type="checkbox"/> 50.36(c)(1)(i)(A)</div> <div style="width: 50%;"><input type="checkbox"/> 50.73(a)(2)(iii)</div> <div style="width: 50%;"><input type="checkbox"/> 50.73(a)(2)(ix)(A)</div> <div style="width: 50%;"><input type="checkbox"/> 20.2203(a)(2)(ii)</div> <div style="width: 50%;"><input type="checkbox"/> 50.36(c)(1)(ii)(A)</div> <div style="width: 50%;"><input type="checkbox"/> 50.73(a)(2)(iv)(A)</div> <div style="width: 50%;"><input type="checkbox"/> 50.73(a)(2)(x)</div> <div style="width: 50%;"><input type="checkbox"/> 20.2203(a)(2)(iii)</div> <div style="width: 50%;"><input type="checkbox"/> 50.36(c)(2)</div> <div style="width: 50%;"><input type="checkbox"/> 50.73(a)(2)(v)(A)</div> <div style="width: 50%;"><input type="checkbox"/> 73.71(a)(4)</div> <div style="width: 50%;"><input type="checkbox"/> 20.2203(a)(2)(iv)</div> <div style="width: 50%;"><input type="checkbox"/> 50.46(a)(3)(ii)</div> <div style="width: 50%;"><input type="checkbox"/> 50.73(a)(2)(v)(B)</div> <div style="width: 50%;"><input type="checkbox"/> 73.71(a)(5)</div> <div style="width: 50%;"><input type="checkbox"/> 20.2203(a)(2)(v)</div> <div style="width: 50%;"><input type="checkbox"/> 50.73(a)(2)(i)(A)</div> <div style="width: 50%;"><input type="checkbox"/> 50.73(a)(2)(v)(C)</div> <div style="width: 50%;"><input type="checkbox"/> OTHER</div> <div style="width: 50%;"><input type="checkbox"/> 20.2203(a)(2)(vi)</div> <div style="width: 50%;"><input checked="" type="checkbox"/> 50.73(a)(2)(i)(B)</div> <div style="width: 50%;"><input type="checkbox"/> 50.73(a)(2)(v)(D)</div> </div>																
10. POWER LEVEL																			
			Specify in Abstract below or in NRC Form 366A																
12. LICENSEE CONTACT FOR THIS LER																			
FACILITY NAME										TELEPHONE NUMBER (Include Area Code)									
Waterford 3 Steam Electric Station William Steelman										(504) 739-6685									
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										
E	SJ	VOP	A391	YES															
14. SUPPLEMENTAL REPORT EXPECTED										15. EXPECTED SUBMISSION DATE									
<input type="checkbox"/> YES (If yes, complete 15. EXPECTED SUBMISSION DATE) <input checked="" type="checkbox"/> NO										MONTH DAY YEAR									
ABSTRACT (Limit to 1400 spaces, i.e., approximately 15 single-spaced typewritten lines)																			
<p>On 4/7/2011, Main Feedwater Isolation Valve (MFIV) "A" failed the in-service test (IST) stroke time. Due to the failed stroke time, the plant operated in a condition prohibited by Technical Specifications. Technical Specification 3.7.1.6 requires MFIV "A" to be operable in Modes 1 through 4, with a surveillance requirement 4.7.1.6 that requires the closure time of less than or equal to 6 seconds.</p> <p>MFIV "A" uses a hydraulic actuator, which contains two separate hydraulic accumulators. An actuation signal results in both accumulators closing the valve. The Root Cause Evaluation determined that the hydraulic actuator four way valves are marginally designed to provide the motive force needed to overcome infrequent valve operation coupled with the condition that Fyrquel hydraulic fluid is susceptible to breakdown. Corrective actions included replacing the four way valves and replacing the hydraulic fluid for MFIV "A".</p>																			

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NARRATIVE

REPORTABLE OCCURRENCE

10CFR50.73(a)(2)(i)(B)

Waterford 3 operated in a condition prohibited by the limiting condition for operation (LCO) delineated in Technical Specification 3.7.1.6, which requires that each Main Feedwater Isolation Valve (MFIV) [SJ] shall be OPERABLE in MODES 1, 2, 3, and 4. MFIV "A" was not recognized as inoperable in cycle 17. The requirement was not met to close and deactivate, or isolate the inoperable valve within 72 hours and verify the inoperable valve closed and deactivated or isolated once every 7 days; otherwise, be in at least HOT STANDBY within the next 6 hours and in COLD SHUTDOWN within the following 30 hours.

The event date is 4/7/2011 based on failure of MFIV "A" to successfully pass Inservice Testing performed on 4/7/2011. Following an evaluation of information gathered in a root cause evaluation, it was established on 5/3/2011 that MFIV "A" did not meet its design closure time and was a reportable occurrence. The cause was due to the hydraulic actuator four way valves being marginally designed to provide the needed motive force to overcome infrequent valve operation coupled with the condition that Fyrquel hydraulic fluid is susceptible to breakdown over time.

INITIAL CONDITIONS

During the period of in-service testing on the MFIVs, the plant was in cold shutdown (Mode 5) conducting refueling operations for refueling outage 17. There was no requirement for the MFIVs to be operable in this plant condition. This plant condition did not contribute to this event. There were no other structures, systems, or components inoperable at the start of the event that contributed to the event.

The main feed water isolation valves isolate main feedwater flow to the secondary side of the steam generators and isolate the non-safety related main feedwater supply from the safety-related portion of the system. The MFIVs close on receipt of a Main Steam Isolation Signal (MSIS), generated by either low steam generator pressure or high containment pressure. The MFIVs may also be actuated manually from the control room.

The MFIV hydraulic actuator consists of two systems: the pneumatic system and the hydraulic system. The pneumatic system supplies the motive force to operate the air motor of the hydraulic pump and supplies motive air to position the 4-way hydraulic valves that direct hydraulic fluid flow to the piston actuator and the hydraulic accumulators. Each MFIV has a hydraulic reservoir with an associated pump providing hydraulic fluid to two in-parallel 4-way hydraulic valves (designated as 'M' and 'M1') that feed the MFIV's valve actuator. The design of each MFIV valve operator requires both of its accumulators to supply the motive force needed to achieve its designed closure stroke time. That is, both the 'M' and 'M1' 4-way valves must function in order to have both accumulators operate simultaneously. Failure of any one 4-way valve results in an MFIV not able to achieve its design closure time.

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EVENT DESCRIPTION

While in Mode 5 on 4/7/2011, in-service testing determined valve FW-184A (Steam Generator No. 1 MFIV) [SJ] closed in 28.6 seconds using the A accumulator, and failed to close using the B accumulator. Inservice Tests (IST) are performed at no Feedwater flow or pressure conditions with only one hydraulic train in service at a time. The IST limit is a maximum allowed closed stroke time of less than 6.6 seconds.

The last successful test of MFIV A closure was completed on November 21, 2009 using a single accumulator while the plant was shutdown in Refueling Outage 16.

It is a reasonable expectation that MFIV A could have failed to meet its required stroke time during Cycle 17 based on the Root Cause Evaluation results. Because of this, Waterford 3 operated in a condition prohibited by Technical Specification 3.7.1.6.

When discovered, this event did not affect the systems needed to remove residual heat, control the release of radioactive material, or mitigate the consequences of an accident. The systems needed to maintain Mode 5 were available and operating as required by plant conditions and the Technical Specifications.

CAUSAL FACTORS

The cause of MFIV A failing to meet IST requirements was due to the hydraulic actuator four way valves being marginally designed to provide the needed motive force to overcome infrequent valve operation coupled with the condition that Fyrquel fluid is susceptible to breakdown over time. Fyrquel hydraulic fluid degradation has contributed to wear and scoring between the cylindrical rods and the bushings within the valve. Additionally, the Fyrquel hydraulic fluid degradation has led to minor scoring in the 4-way valve cylinders resulting in sticking or sluggish motion.

CORRECTIVE ACTIONS

CR-WF3-2011-2005 corrective actions include:

- 1) Installed refurbished MFIV A "M" and "M1" hydraulic valves and corrected all deficiencies identified during disassembly and inspection during the recently completed refueling outage.
- 2) Corrective actions are in place to replace or rebuild the "M" and "M1" valves for MFIV A and B every refueling outage.
- 3) Options will be evaluated for increasing the supply air pressure to the actuator or for modifying the "M" and "M1" valves (i.e. air cylinders) to increase operating margin.

SAFETY SIGNIFICANCE

The risk associated with the 4/7/11 failure of MFIV A to meet its OP-903-033 stroke time requirement

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for maximum closing time is bounded by a risk assessment that assumes both feedwater isolation valves (FW-184A and FW-184B) fail to close, which is more severe than the failure of the single MFIV A valve. Failure to close the feedwater isolation valves (MFIVs) does not adversely affect the core damage risk, since availability of feedwater (i.e., the valves being open) maintains decay heat removal and contributes to prevention of core damage; the potential risk impact of failure to close either of the MFIVs is in terms of failure to isolate in a core damage sequence, measured by the Large Early Release Frequency (LERF). The impact of MFIV closure on large early release risk was assessed by modeling a feedwater line break with failure of the feedwater line to isolate. In order for a large release from containment following a core damage event to occur through the ruptured feedwater line, failure of the MFIV to close would require, in addition, failure to close the upstream check valves (FW-181A or FW-181B) and failure to close of either the main feedwater regulating valves (FW-173A or FW-173B) or the startup feedwater regulating valves (FW-166A or FW-166B). The probability of these failures was estimated using the Waterford 3 PSA model and combined with the Core Damage Frequency for a feedwater line break. The large early release risk impact (change in large early release frequency, delta-LERF) for both MFIVs failing to close was estimated to be an increase of $3.8E-14$ per reactor year, which is very small (the generally accepted LERF threshold for risk significance is $1E-7$; see for example Regulatory Guide 1.174.) Therefore, since the LERF increase was estimated to be extremely small, there is minimal risk significance to the condition of MFIV "A" failing to meet its OP-903-033 stroke time requirement for maximum closing time.

Closure of MFIVs is credited in several accident analyses that results in main steam isolation signal (MSIS). The two limiting events are the main steam line break (MSLB) and feedwater line break (FWLB). The main feedwater regulating valves (MFRV) and startup feedwater regulating valves (SFRV) are a backup to the MFIV to meet the single failure criterion, as stated in NUREG-0138 and Standard Review Plan (SRP) Section 15.1.5. The MFRV and SFRV are non-safety related equipment. The MFIV, MFRV and SFRV are designed to close when they receive a main steam isolation signal (MSIS). The MFRV and SFRV are furnished with emergency closure circuits so that the closure of these valves is actuated through override of their normal control signal.

MSLB is the limiting event with respect to containment pressure and temperature response. MSLB event with failure of one MFIV to close has been analyzed for Waterford 3. For this event the closure of feedwater regulating valve is credited to close to terminate the feedwater flow to the broken steam generator. Note that this condition is not an issue for the MSLB events. Also, note that containment pressure and temperature response to a MSLB event is more severe than the containment response to a FWLB event.

Based on above discussion, there is reasonable assurance that safety functions associated with the MFIV will be fulfilled and therefore this condition presents a minimal safety significance concern for accident analyses.

SIMILAR EVENTS

During Refueling Outage 16, MFIV B failed to stroke closed with accumulator A during IST testing; MFIV A exceeded surveillance stroke closed criteria with accumulator A. The cause was identified to be moisture intrusion during a previous plant shutdown which likely caused gel to form, restricting flow

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in the "A" train four way valves. Corrective actions included replacing the hydraulic fluid and implementing a process to routinely change hydraulic fluid on a periodic basis. This previous condition was reported to the NRC in LER 2009-006-00.

ADDITIONAL INFORMATION

Energy industry identification system (EIIIS) codes are identified in the text within brackets [].