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W3F1-2010-0043

May 20, 2010

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

Subject: Licensee Event Report 2010-003-00  
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) 2010-003-00 for Waterford Steam Electric Station Unit 3. This report provides the details concerning a worn fuel oil supply line to the A Train Emergency Diesel Generator. The condition is reported herein pursuant to 10CFR50.73(a)(2)(i)(B) and 10CFR50.73(a)(2)(v)(D).

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 black ink, appearing to read "William J. Steelman".

WJS/RJP/ssf

Attachment: Licensee Event Report 2010-003-00

JEAS  
NLR

cc: Mr. Elmo E. Collins, Jr.  
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**Attachment**

**W3F1-2010-0043**

**Licensee Event Report 2010-003-00**

<b>NRC FORM 366 U.S. NUCLEAR REGULATORY COMMISSION</b> (9-2007)	<b>APPROVED BY OMB NO. 3150-0104</b> <span style="float: right;"><b>EXPIRES 8/31/2010</b></span> 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 Records Management Branch (T-6 E6), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by internet e-mail to <a href="mailto:bj1@nrc.gov">bj1@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 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>LICENSEE EVENT REPORT (LER)</b>	
(See reverse for required number of digits/characters for each block)	

<b>1. FACILITY NAME</b> Waterford 3 Steam Electric Station, Unit 3	<b>2. DOCKET NUMBER</b> 05000382	<b>3. PAGE</b> 1 OF 7
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**4. TITLE**  
Worn Fuel Oil Line on A Train Emergency Diesel Generator Caused by Inadequate Mounting Clamp

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
02	08	2010	2010	003	00	05	20	2010	NA	05000
									FACILITY NAME	DOCKET NUMBER
									NA	05000

<b>9. OPERATING MODE</b>  1	<b>11. THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §:</b> (Check all that apply)			
<b>10. POWER LEVEL</b>  100%	<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 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 checked="" type="checkbox"/> 50.73(a)(2)(i)(B)	<input checked="" type="checkbox"/> 50.73(a)(2)(v)(D)	Specify in Abstract below or in NRC Form 366A	

**12. LICENSEE CONTACT FOR THIS LER**

FACILITY NAME  Waterford 3 Steam Electric Station, William Steelman	TELEPHONE NUMBER (Include Area Code)  (504) 739-6685
---------------------------------------------------------------------------	------------------------------------------------------------

**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	EK	TBG	C634	N					

<b>14. SUPPLEMENTAL REPORT EXPECTED</b> <input type="checkbox"/> YES (If yes, complete 15. EXPECTED SUBMISSION DATE) <input checked="" type="checkbox"/> NO	<b>15. EXPECTED SUBMISSION DATE</b> MONTH:      DAY:      YEAR:
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**ABSTRACT** (Limit to 1400 spaces, i.e., approximately 15 single-spaced typewritten lines)

On February 8, 2010, at approximately 14:47, with the plant operating at 100% power (Mode 1), Waterford 3 commenced a post-surveillance cooldown on Emergency Diesel Generator A (EDG A) [EK]. The local Nuclear Auxiliary Operator noted the one inch main fuel oil supply line support clamp was loose and the supply line tubing had circumferential wear indication under the clamp. An engineering review of the wear indication found the wall thickness at 0.0132" remaining from a nominal wall thickness of 0.060". An Engineering calculation determined a tubing wear rate that showed a design basis 30 day run by the EDG A would not have been met since approximately August 31, 2005 without mitigating actions. Since August 2005, there were several occurrences when EDG B was also out of service. This condition represents operation not in compliance with Technical Specifications and a safety system functional failure. Additionally, Technical Specification (TS) requirements were not met when the steam driven EFW pump was periodically unavailable while EDG A was in this condition. The tubing was replaced on February 10, 2010. The event did not compromise the health and safety of the general public.

(9-2007)

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**NARRATIVE****REPORTABLE OCCURRENCE**

The event date is 02/08/2010 based on initial identification of circumferential wear indication on a one inch main fuel oil supply line tubing on Emergency Diesel Generator A (EDG A) [EK]. An engineering review of the wear indication on 02/10/2010 found the wall thickness at 0.0132" remaining from a nominal wall thickness of 0.060". Following an evaluation of information provided in a draft engineering evaluation from an engineering contractor, it was established on 03/24/2010 that the worn tubing on EDG A was a reportable condition. The 60 day report due date was determined to be 5/23/2010.

The engineering calculation determined a tubing wear rate that showed a design basis 30 day run by the EDG A would not have been met without mitigating actions since August 31, 2005. Since August 2005, there were several occurrences when EDG B was also out of service. This condition represents periods of Waterford 3 operation that were not in compliance with Technical Specifications (TS) allowed outage time and a safety system functional failure. Additionally, Technical Specification (TS) requirements were not met when the steam driven EFW pump was periodically unavailable while EDG A was in this condition.

Reporting criteria 10CFR50.73(a)(2)(i)(B), operation prohibited by Waterford 3's Technical Specification

Technical Specification (TS) 3.8.1.1 indicates with one diesel generator of 3.8.1.1b inoperable: demonstrate the OPERABILITY of the remaining A.C. circuits by performing Surveillance Requirements 4.8.1.1.1a (separately for each offsite A.C. circuit) within 1 hour and at least once per 8 hours thereafter. With one diesel generator inoperable, verify that: (1) All required systems, subsystems, trains, components, and devices that depend on the remaining OPERABLE diesel generator as a source of emergency power are also OPERABLE, and (2) When in MODE 1, 2, or 3, the steam-driven emergency feed pump is OPERABLE. If these conditions are not satisfied within 2 hours be in at least HOT STANDBY within the next 6 hours and in COLD SHUTDOWN within the following 30 hours.

With two of the above required diesel generators inoperable, demonstrate the OPERABILITY of two offsite A.C. circuits by performing Surveillance Requirement 4.8.1.1.1a within 1 hour and at least once per 8 hours thereafter; restore one of the inoperable diesel generators to OPERABLE status within 2 hours or be in at least HOT STANDBY within the next 6 hours and in COLD SHUTDOWN within the following 30 hours.

The above Technical Specifications allowed outage times were exceeded.

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**NARRATIVE**

REPORTABLE OCCURRENCE continued

Reporting criteria 10CFR50.73(a)(2)(v)(D), a condition that alone could have prevented the fulfillment of a safety function needed to mitigate the consequences of an accident. This condition is a safety system functional failure.

There were several periods when EDG B was taken out of service since August 2005 while EDG A was incapable of performing its 30 day mission time without mitigating action. The worn fuel oil line on EDG A could have prevented the fulfillment of a safety function needed to mitigate the consequences of an accident because there were periods that EDG A could have been relied upon to provide power for 30 days when it could not without mitigating actions.

**INITIAL CONDITIONS**

The plant was operating in Mode 1 at 100% power. EDG A had completed a successful surveillance test and a post-surveillance cooldown was being performed when the local Nuclear Auxiliary Operator noted the one inch main fuel oil supply line support clamp was loose and the supply line tubing had circumferential wear indication under the clamp.

**BACKGROUND**

Waterford 3 has two Emergency Diesel Generators supplied by Cooper-Bessemer. The two diesels provide emergency AC power needed to supply safety loads following an accident coincident with a loss of off-site power. The EDG has a 30 day mission time based upon accident analyses requirements. This condition could have prevented this mission time from being met without mitigating actions.

A contracted Engineering vendor calculated the minimum tube wall thickness required to prevent failure of the tubing pressure boundary and release of diesel fuel oil from the supply line as approximately 0.91 mil. This minimum wall thickness is based on the engine-driven diesel fuel oil pump producing a design discharge pressure of 50 psig. The minimum tube wall thickness was determined as the point at which the hoop stress in the tube from the internal diesel fuel oil pressure is equal to the yield stress of the stainless steel tube material. The calculation determined a tubing wear rate showing that there was 14 days of run time left on the tube prior to its postulated failure due to through-wall wear. This through-wall wear could have produced a diesel fuel oil leak and caused a reduction of diesel fuel delivery to the Cooper-Bessemer Model KSV-16T diesel engine. Using the wear rate and historical run times, it was calculated that a design basis 30 day run by the EDG A would not have been met due to through-wall wear since approximately August 31, 2005.

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**NARRATIVE****EVENT DESCRIPTION**

On 02/08/2010, procedure OP-903-068 was being used to perform a monthly surveillance on EDG A. There were no anomalies noted by operations during the surveillance run until EDG A was placed in cooldown mode and an Auxiliary Operator noted a rattling sound in the vicinity of the fuel oil line. The operator determined that the main fuel oil supply line tubing from the fuel oil filters to the fuel oil header support clamp was loose and noted a wear ring. He did not perceive the wear ring as a structural challenge and there was no initial indication that the tubing was an operability concern.

On 02/10/2010 the System Engineer and EFIN Civil Engineer investigated the condition. Non-Destructive Examination was performed by NDE personnel to determine wall thickness. Based on nominal tubing thickness of 0.060" and a measured wall loss of 0.0468" the remaining wall in the affected area was estimated at 0.0132". Waterford 3 Condition Report CR-WF3-2010-0889 was initiated.

The System Engineer performed a walkdown of the remainder of the fuel line to determine if similar wear was on the other clamps installed. No other clamp to tube wear indications were noted.

The System Engineer performed an extent of condition walkdown of EDG B. The System Engineer determined that the EDG B tubing was not worn at the same clamp location and that the configuration (clamp type) was different. EDG A utilized a dual tube clamp with a bolt connection between the two tube spaces and the EDG B utilized a single tube clamp with a single bolt connection.

At 15:50 hours on 02/10/2010, the shift manager declared EDG A INOPERABLE in order to repair the worn fuel oil supply piping. Technical Specifications 3.8.1.1.b and d were entered and it was verified all required systems, subsystems, trains, components, and devices that depend on the remaining operable diesel generator as a source of emergency power were OPERABLE.

At approximately 17:00 hrs on 02/10/2010, Maintenance was performed per WO 225889 to replace the tubing. Inspection of the clamp did not reveal any clamp damage; therefore, the clamp was reused.

At 23:27 on 02/10/2010, EDG A was declared operable and the Limiting Conditions for Operation of TS 3.8.1.1 were exited.

A review of the maintenance history determined that the clamp was installed in 1993. There was no documentation indicating the tubing had ever been replaced, so it is likely the tubing is from original plant construction.

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**NARRATIVE****CAUSAL FACTORS**

The tube wall thinning was due to the wear of the tubing outer wall by sliding friction between the tube and clamp during periods of running EDG A. The bracket that was installed in 1993 and was not per the vendor's specifications. The EDG B clamp was not the same type, was per the vendor's specifications, and has shown no sign of wear since 2003.

**CORRECTIVE ACTIONS**

On 02/10/2010, maintenance was performed per WO 225889 to replace the tubing as immediate corrective action. Inspection of the clamp did not reveal any clamp damage; therefore, the clamp was reused. On 04/01/2010, long term corrective action was taken when maintenance was performed per WO 231070 to replace the unapproved clamp with an approved clamp that met the manufacturer's original configuration specification.

No additional actions are required to address the 1993 inadequate configuration change as the historic processes have been superseded by more robust procedures and processes. Current practices will ensure that the proper design documentation is adequate utilizing proper design inputs, including tube support and tube wear consideration.

**SAFETY SIGNIFICANCE**

Relative to the as-found condition there were no actual or likely nuclear, radiological, or industrial safety implications that occurred as the tubing wear condition was discovered prior to compromising the structural integrity of the tubing. Furthermore, an analytical analysis was performed which calculates wear based on the duration of the tubing's installed life to determine the as-found remaining run time on the worn tube. This calculation concluded that EDG A would have been capable of completing rated load operation in support of a 24-hour mission (used in Probabilistic Risk Analysis (PRA)) without the diesel fuel oil supply tube developing a through-wall leak. This evaluation considers the leak-before-break potential and any surplus capacity available at the engine-driven diesel fuel oil pump. The analysis also addresses the potential adverse impact on continued EDG operation and risk of fire in the event the tube did develop a fuel oil leak, and concluded that neither condition was credible.

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**NARRATIVE****SAFETY SIGNIFICANCE (Continued)****Nuclear and Radiological Safety:**

Based on the calculation, the tube was capable of supporting more than the 24-hour (PRA) mission time and could continuously operate for at least 14 days in the as-found condition. The PRA used a more conservative 10 day run time assumption. Using this remaining run time, the risk impact of EDG A wear causing the diesel run life to decrease from 30+ days to 10 days is very small.

The Waterford 3 PRA uses an EDG mission time of 24 hours, so this EDG mission time of 10 days is far beyond the mission time analyzed in the PRA. The longest loss of offsite power (LOOP) event in industry experience is the 5.5 day loss when Hurricane Andrew hit Turkey Point in 1995. The LOOP recovery curve used in the W3 PRA is not suitable for extrapolation past the range of data (e.g., the LOOP non-recovery probability calculated for 10 days is  $8.5E-10$ , compared to  $8.3E-3$  at 24 hours). Therefore, the risk impact of this reduction of EDG run time from 30 days to 10 days can not be calculated using the W3 PRA, but is expected to be very small.

A bounding risk calculation can be made using NRC LOOP data in NUREG/CR-5496. Using the NRC's LOOP recovery curves (Figure 3-8 in the NUREG), which are log-normal fits to the LOOP recovery times for three categories of LOOP events, the increase in the probability of LOOP non-recovery in going from 30 days to 10 days was calculated. A bounding Core Damage Frequency (CDF) increase of  $1.64E-09$  per year results. This is a very small risk increase; CDF increases of less than  $1.0E-6$  are considered by NRC to be very small. Therefore, had a demand occurred, the nuclear and radiological risk impact of the condition is very unlikely given the calculated remaining run time in the as-found state prior to tubing replacement.

**Industrial Hazard:**

The fire risk to the EDG was assessed based on the location of the potential leakage from the diesel fuel oil supply tube with respect to diesel fuel oil flammability, the engine block temperatures and engine exhaust manifold temperatures. The assessment addresses the various conditions that would need to exist in order for a fire scenario to be credible. Technical information from other sources (e.g., National Fire Protection Association and American Petroleum Institute) was used to support this evaluation. This evaluation concludes that if the supply tube did develop a leak, there is sufficient fuel flow to support EDG operation at rated load until operators became aware of the leak and take scenario dependent action to address the condition. There were no injuries or associated industrial safety incidents associated with performing the required corrective actions (i.e. maintenance) associated with this event.

**Safety Significance Conclusion:**

Based on the completed analysis and the Risk Impact, it is concluded that there is no likely safety implication relative to this condition had the EDG been required for a demand. Per the completed action plan, the EDG A subject fuel line tubing has been replaced with the vendor approved clamp which has demonstrated successful operation on EDG B since 2003 without any indication of tube wear. Periodic inspection of the fuel oil line has been added to a Performance Monitoring plan until the corrective action plan is completed and there is high confidence in the ability of the current configuration to prevent tube wear.

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### NARRATIVE

#### SIMILAR EVENTS

Waterford 3 Condition Report CR-WF3-2010-0911 identified that during the extent of condition review on 02/10/2010, two tubes on EDG B were observed in contact with each other. The smaller diameter tube showed no indication of wear due to rubbing. The larger diameter tube is the same vertical fuel oil piping run that was in worn at its support clamp on EDG A. The larger diameter tube exhibited minor wear indication at the contact point. The two tubes were separated to prevent further wear. Engineering evaluated the degradation of the fuel oil line on EDG B and concluded that the piping has sufficient design margin that it remains capable of performing its function.

Licensee Event Report 2003-002-00 (ADAMS accession number ML033350268) reported that on September 29, 2003, EDG A was started to perform the monthly surveillance run in accordance with station operating procedures. With the machine running loaded, the left/right bank cross connect tubing failed. This event rendered EDG A inoperable. The root cause was that maintenance was performed incorrectly. To prevent recurrence, the tubing installed on EDG A after the event on September 29, 2003 was replaced with an alternate design. The alternate cross connect design is assembled with 1-1/2" pipe and flexible hose. The alternate design eliminates compression fittings and includes flexible hose which provides vibration damping. The alternate configuration is equivalent in fit and function to the original. Work standards for compression fitting installations were updated and improved. Training was provided to address improved work standards for compression fitting installations.

Waterford 3 Condition Report CR-WF3-2005-3840 identified on 08/31/05 during Emergency Diesel Generator operations subsequent to a loss of offsite power due to hurricane Katrina, a fuel oil leak was discovered at the outlet of the fuel oil duplex filter on EDG A. The immediate action was to repair the 3/4" close pipe nipple which had failed. The long term solution was modification of the fuel oil filter and strainer.

These are considered similar in that configuration of fuel oil supply to an EDG was not adequately maintained.

#### ADDITIONAL INFORMATION

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