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**Ken Peters**  
Director, Nuclear Safety Assurance  
Waterford 3

W3F1-2003-0100

November 26, 2003

U.S. Nuclear Regulatory Commission  
Attn: Document Control Desk  
Washington, D.C. 20555

Subject: Waterford 3 SES  
Docket No. 50-382  
License No. NPF-38  
Reporting of Licensee Event Report (LER 2003-002-00)

Gentlemen:

Attached is Licensee Event Report (LER) 2003-002-00 for Waterford Steam Electric Station Unit 3. This report provides details of an event where EDG 'A' tubing that supplies fuel oil from the left cylinder bank fuel oil header to the right cylinder bank fuel oil header failed. EDG 'A' was promptly secured. This event rendered EDG 'A' inoperable.

This condition is being reported pursuant to 10 CFR50.73(a)(2)(i)(B) as a condition prohibited by Technical Specifications. This condition was determined to have minimal safety significance. The event did not affect the health and safety of the public, and the plant operated safely and maintained the capability to achieve safe shutdown.

There are no commitments contained in this submittal. Actions herein described are controlled and tracked via the Waterford 3 Corrective Action Program.

Sincerely,

A handwritten signature in black ink, appearing to read "K. J. Peters".

K. J. Peters  
Director, Nuclear Safety Assurance  
Waterford Steam Electric Station, Unit 3

KJP/RJM/rjm  
Attachment

IE22

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cc: Mr. Thomas P. Gwynn  
Acting Regional Administrator  
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1. FACILITY NAME: **Waterford Steam Electric Station, Unit 3**

2. DOCKET NUMBER: **05000 382**

3. PAGE: **1 OF 4**

4. TITLE: **Failure of Emergency Diesel Generator A Fuel Oil Line**

5. EVENT DATE			6. LER NUMBER			7. REPORT DATE			8. OTHER FACILITIES INVOLVED	
MO	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REV NO	MO	DAY	YEAR	FACILITY NAME	DOCKET NUMBER
09	29	2003	2003	002	00	11	26	2003	N/A	N/A
									FACILITY NAME	DOCKET NUMBER
									N/A	N/A

9. OPERATING MODE	10 POWER LEVEL	11. THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check all that apply)									
1	90	20.2201(b)	20.2203(a)(3)(ii)	50.73(a)(2)(ii)(B)	50.73(a)(2)(ix)(A)						
		20.2201(d)	20.2203(a)(4)	50.73(a)(2)(iii)	50.73(a)(2)(x)						
		20.2203(a)(1)	50.36(c)(1)(i)(A)	50.73(a)(2)(iv)(A)	73.71(a)(4)						
		20.2203(a)(2)(i)	50.36(c)(1)(ii)(A)	50.73(a)(2)(v)(A)	73.71(a)(5)						
		20.2203(a)(2)(ii)	50.36(c)(2)	50.73(a)(2)(v)(B)	OTHER Specify in Abstract below or in NRC Form 366A						
		20.2203(a)(2)(iii)	50.46(a)(3)(ii)	50.73(a)(2)(v)(C)							
		20.2203(a)(2)(iv)	50.73(a)(2)(i)(A)	50.73(a)(2)(v)(D)							
		20.2203(a)(2)(v)	x 50.73(a)(2)(i)(B)	50.73(a)(2)(vii)							
		20.2203(a)(2)(vi)	50.73(a)(2)(i)(C)	50.73(a)(2)(viii)(A)							
		20.2203(a)(3)(i)	50.73(a)(2)(ii)(A)	50.73(a)(2)(viii)(B)							

12. LICENSEE CONTACT FOR THIS LER

NAME: **Robert J. Murillo, Senior Staff Engineer**

TELEPHONE NUMBER (Include Area Code): **(504) 739-6715**

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	DG	Cooper ES	Y					

14. SUPPLEMENTAL REPORT EXPECTED				15. EXPECTED SUBMISSION DATE		
YES (if yes, complete EXPECTED SUBMISSION DATE)	NO	MONTH	DAY	YEAR		

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

On September 29, 2003 at about 1020 hrs with the plant in Mode 1 and at about 90 % power coasting down for Refuel 12, Emergency Diesel Generator (EDG) 'A' was started to perform the monthly surveillance run in accordance with station operating procedures. At approximately 1309 hrs with the machine running loaded, the left/right bank cross connect tubing failed. This event rendered EDG 'A' inoperable. Although, EDG 'A' testing surveillances were successfully completed prior to September 29, 2003, there is firm evidence that after the last successful surveillance on September 2, 2003 EDG 'A' may not have been able to complete a mission run time of 24 hours. The allowed outage time for EDG 'A' is 72 hours. Therefore, this condition is reported as a condition prohibited by Technical Specifications pursuant to 10CFR50.73(a)(2)(i)(B).

This event did not affect the health and safety of the public. There was no fire that resulted from the event. The fuel oil spill was contained within the EDG 'A' room and sump for EDG 'A' in Reactor Auxiliary Building. The spill was cleaned in about 45 minutes. The EDG 'A' was promptly restored to operable status. The Root Cause Analysis determined there were no generic implications from the event. Waterford 3 conducted a probabilistic evaluation for the event. The probability risk was determined to be low and to meet the threshold for low safety significance.

In conclusion, the plant operated safely and maintained the capability to achieve safe shutdown.

LICENSEE EVENT REPORT (LER)

FACILITY NAME (1)	DOCKET (2)	LER NUMBER (6)			PAGE (3)
Waterford Steam Electric Station, Unit 3	05000-382	YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	2 OF 4
		2003	002	00	

TEXT (If more space is required, use additional copies of NRC Form 366A) (17)

**REPORTABLE OCCURRENCE**

On September 29, 2003 at about 1020 hrs with the plant in Mode 1 and at about 90 % power coasting down for Refuel 12, Emergency Diesel Generator (EDG) 'A' [EK] was started to perform the monthly surveillance run in accordance with station operating procedures. At approximately 1309 hrs with the machine running loaded, the left/right bank cross connect tubing failed. The failure was a 360° sheared break located where the tube inserts into the Swagelok fitting on the left bank fuel oil header. This event rendered EDG 'A' inoperable. Although EDG 'A' testing surveillances were successfully completed prior to September 29, 2003, there is firm evidence that after the last successful surveillance on September 2, 3003 EDG 'A' may not have been able to complete a mission run time of 24 hours. The allowed outage time for EDG 'A' is 72 hours. Therefore, this condition is reported as a condition prohibited by Technical Specifications pursuant to 10 CFR50.73(a)(2)(i)(B).

**INITIAL CONDITIONS**

At the time of the event, Waterford 3 was operating in Mode 1 and at about 90 % power coasting down for Refuel 12. There were no major systems, structures, or components that were inoperable at the time of the event that contributed to the event.

**SYSTEM DESCRIPTION**

The Emergency Diesel Generator System is arranged in two separate divisions, each functionally identical to the other. Each system carries out its function of supplying standby electrical power by starting on receipt of either a "manual" or "automatic" command signal, accelerating to rated speed, and accepting load as determined by the safety system requirements. When the generator is no longer required to supply power, it may be shut down manually.

The EDG left/right bank fuel oil cross connect tube supplies fuel oil from the left cylinder bank fuel oil header to the right cylinder bank fuel oil header. The tubing is three quarter inch OD stainless steel and connects to the EDG with compression fittings. The tubing has several bends and spans a length of approximately 5 feet between the banks. The fuel oil supply system is designed for 50 psig. The system maintains between 35 and 50 psig by relief valves. The system operates at temperatures between 50°F to 122°F. The primary booster pump supplies approximately 12.5 gpm at 50 psig.

**EVENT DESCRIPTION**

On January 21, 2003, a work request was initiated that identified a less than 1 drop per minute fuel oil leak from the compression fitting threaded connection (left bank) where the tube inserts into the fitting. The leak was active only when EDG 'A' was operating. The tubing is 316 grade stainless steel, 3/4 inch OD with a nominal wall thickness of .049 inches. The replacement compression fittings provided are manufactured by Swagelok. The original compression fittings were manufactured by Imperial. Safety-related Imperial fittings are no longer available. The EDG vendor endorses the use of Swagelok fittings as a suitable replacement.

On May 15, 2003, during the planned on-line EDG maintenance outage the fuel oil header left/right bank cross connect tubing and associated fittings were removed from EDG 'A' and taken to the maintenance shop by mechanical maintenance technicians. A piece of new replacement stainless steel tubing was obtained and bent into a configuration replicating the original tube shape. The tube bends were performed by the technicians with a hand operated tube bender. Subsequently, the new replacement tubing and fittings were installed.

**LICENSEE EVENT REPORT (LER)**

FACILITY NAME (1)	DOCKET (2)	LER NUMBER (6)			PAGE (3)
Waterford Steam Electric Station, Unit 3	05000-382	YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	3 OF 4
		2003	002	00	

TEXT (If more space is required, use additional copies of NRC Form 366A) (17)

On May 16, 2003 day shift, during turnover, the System Engineer discussed a concern over the internal cleanliness of the recently installed fuel oil tubing with the night shift maintenance technician. To remove any doubts concerning the internal cleanliness of the tube, the new tubing was removed by mechanical maintenance technicians on day shift. The tubing was taken to the shop, and the ID was cleaned with an approved solvent. Subsequently, the tubing was re-installed. Later that same day, the new tubing and fittings were inspected for leakage with EDG 'A' running as part of post maintenance testing. There was no leakage observed. Subsequent EDG operation to complete the operability surveillance following the maintenance outage was performed without incident.

On September 2, 2003, EDG 'A' ran for about 5.3 hours, and EDG 'A' successfully completed the monthly surveillance pursuant to OP-903-068. EDG 'A' successfully ran and completed prior monthly surveillances after the tubing installation of May 16, 2003 on May 16, 2003, June 9, 2003, July 8, 2003, and August 4, 2003.

On September 29, 2003 at 1020 hrs, EDG 'A' was started to perform the monthly surveillance run in accordance with station operating procedures. At approximately 1309 hrs with EDG 'A' running loaded, the left/right bank cross connect tubing failed. The failure was a 360° sheared break located where the tube inserts into the Swagelok fitting on the left bank fuel oil header. The break appeared to be immediate, that is, none or very little leak before break. The resulting discharge of fuel oil was observed by the Nuclear Auxiliary Operator (NAO) who was in the EDG room monitoring the surveillance test. The NAO immediately shut down the EDG by pressing the emergency stop button. When the break occurred, the NAO observed a solid unobstructed stream of fuel being pumped out of the fitting on the left side fuel oil header. Approximately 55 gallons of fuel oil was pumped into the diesel room. The fuel oil was contained inside the diesel room and the Reactor Auxiliary Building Sump. EDG 'A' was immediately secured and declared inoperable. Cleanup efforts were initiated and completed within about 45 minutes. EDG 'A' was promptly restored to operable status.

**CAUSAL FACTORS**

The root cause was that maintenance was performed incorrectly. The failure mode was introduced during the replacement installation of the tubing on May 16, 2003. The tube bends and fit-up were not precise. This impreciseness caused an uneven swage and significant scoring of the tube wall when the fitting was installed. The scoring and induced stress riser combined with the normal vibration of the tubing resulted in a crack that propagated until the tubing eventually failed. The tubing that failed was cut circumferentially along the tube wall about 15 % on one side and about 25 % on the opposite side. Waterford 3 installed Swagelok fittings on mockup tubing installations. The results indicated that for a typical Swagelok fitting, the ferrule should cut into the tubing about 8 %.

**CORRECTIVE ACTIONS**

A Root Cause Analysis Team was convened immediately, and immediate actions as well as actions to prevent recurrence were taken or are planned.

The immediate actions taken were the following: (1) the fuel oil spill in EDG 'A' room was cleaned in about 45 minutes, (2) the EDG 'A' tubing was replaced, and the EDG 'A' was promptly restored to operable status, (3) the event and consequences were discussed with mechanical and instrument control technicians, and (4) a vibration analysis was performed on the EDG 'A' and 'B' left/right fuel oil cross connect tubing, and confirmation was made there was no abnormal vibration.

**LICENSEE EVENT REPORT (LER)**

FACILITY NAME (1)	DOCKET (2)	LER NUMBER (6)		PAGE (3)
Waterford Steam Electric Station, Unit 3	05000-382	YEAR	SEQUENTIAL NUMBER	REVISION NUMBER
		2003	002	00
				4 OF 4

TEXT (If more space is required, use additional copies of NRC Form 366A) (17)

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.

To prevent recurrence, additional actions will be taken. Work standards for compression fitting installations will be updated and improved. Training will be evaluated to address improved work standards for compression fitting installations. The design adequacy of single wall tubing used in critical applications of the EDGs will be evaluated.

At the time of the event, the EDG 'A' fuel oil booster pump started on low oil pressure as designed. The NAO had the booster pump secured by having operations open the breaker that supplies power to the pump instead of securing the pump by pressing the reset button on the local control panel. To enhance understanding of the operation of the booster pump, Operations will be provided a description of the operation of the booster pump, and procedures for the booster pump will be evaluated and changed if necessary.

**SAFETY SIGNIFICANCE**

This event did not affect the health and safety of the public. There was no fire that resulted from the event. The fuel oil spill was contained within the EDG 'A' berm and sump for EDG 'A' in Reactor Auxiliary Building, except for a small amount of fuel oil film that accumulated in the adjacent EDG 'A' room floor area. The spill was cleaned in about 45 minutes. EDG 'A' was promptly restored to operable status.

The failure was not a common mode failure, and the failure only affected EDG 'A'. During May 25, 2003 though May 31, 2003, EDG 'B' was not available due to planned maintenance. During this time, the Temporary Emergency Diesels (TEDs) were available as a backup to the out of service EDG 'B', and the TEDs would have been started in the event of an emergency with failure of offsite power and EDG 'A' in accordance with plant procedures. Also, based on the time of failure of the EDG 'A' tubing and prior successful surveillances for EDG 'A', it is estimated EDG 'A' would have run for 22 hours prior to the tubing on EDG 'A' failing. The Root Cause Analysis determined there were no generic implications from the event.

Waterford 3 conducted a probabilistic evaluation for the event accounting for the estimated run time since the maintenance performed on May 16, 2003. The Incremental Core Damage Probability (ICDP) due to this condition for the time period from May 16, 2003 to September 30, 2003 is 4.73E-07. The Incremental Large Early Release Probability (ILERP) is estimated to be 6.12E-8. The ICDP and ILERP meet the threshold for low safety significance.

This event is not considered a Safety System Functional Failure (SSFF). In conclusion, the plant operated safely and maintained the capability to achieve safe shutdown.

**SIMILAR EVENTS**

A review of LERs and Condition Reports did not identify any similar events.

**ADDITIONAL INFORMATION**

Energy Industry Identification System (EIIS) codes are identified in the text within brackets [ ].