

Power Reactor

Event # 51492

<b>Site:</b> WATERFORD		<b>Notification Date / Time:</b> 10/23/2015 12:04 (EDT)	
<b>Unit:</b> 3	<b>Region:</b> 4	<b>State :</b> LA	<b>Event Date / Time:</b> 10/23/2015 (CDT)
<b>Reactor Type:</b> [3] CE		<b>Last Modification:</b> 10/23/2015	
<b>Containment Type:</b> DRY AMB			
<b>NRC Notified by:</b> SCOTT MEIKLEJOHN		<b>Notifications:</b> GREG WERNER R4DO	
<b>HQ Ops Officer:</b> DANIEL MILLS		PART 21/50.55 REACTOREMAIL	
<b>Emergency Class:</b> NON EMERGENCY			
<b>10 CFR Section:</b>			
21.21(d)(3)(i)		DEFECTS AND NONCOMPLIANCE	

  

Unit	Scram Code	RX Crit	Init Power	Initial RX Mode	Curr Power	Current RX Mode
3	N	Yes	100	Power Operation	100	Power Operation

PART 21 - WESTINGHOUSE TYPE KIR-60 CURRENT TRANSFORMER

The following is excerpted from LER 2015-007 submitted by the licensee:

"On October 9, 2015, Waterford 3 received information from the external evaluation concerning the Generator Differential Current Transformer. The evaluation concluded that a manufacturing defect internal to the current transformer was the cause of the failure. On October 22, 2015, engineering evaluation determined the manufacturing defect could create a substantial safety hazard, as defined in 10 CFR 21, and provided the site vice president information of the defect the same day. Additional information identified in the report is as follows:

"Constructor - Westinghouse Type KIR-60 current transformer, style 7524A01G16, serial number 28218571; Defect and safety hazard - There were voids found in the insulation, and the thickness of the insulation material around the fault area appeared reduced when compared to the other areas of the current transformer. There is only one transformer of this type remaining installed in the plant. Scheduled replacement is no later than November 15, 2015."

\*\*\*\*\*

IEI9  
NRR



**LICENSEE EVENT REPORT (LER)**  
(See Page 2 for required number of digits/characters for each block)

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, Privacy and Information Collections Branch (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.

<b>1. FACILITY NAME</b> Waterford 3 Steam Electric Station	<b>2. DOCKET NUMBER</b> 05000382	<b>3. PAGE</b> 1 OF 5
---	-------------------------------------	--------------------------

**4. TITLE**  
Both Emergency Diesel Generators Declared Inoperable

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
08	26	2015	2015	007	00	10	23	2015		05000
									FACILITY NAME	DOCKET NUMBER
										05000

<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)(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)
10. POWER LEVEL  100	<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 checked="" 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 checked="" type="checkbox"/> OTHER 10CFR Part 21
	<input type="checkbox"/> 20.2203(a)(2)(vi)	<input 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**

LICENSEE CONTACT John Jarrell	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	XCT	C634	Y	B	EK	SOL	A610	Y

<b>14. SUPPLEMENTAL REPORT EXPECTED</b> <input checked="" type="checkbox"/> YES (If yes, complete 15. EXPECTED SUBMISSION DATE) <input type="checkbox"/> NO	<b>15. EXPECTED SUBMISSION DATE</b>	MONTH	DAY	YEAR
		02	28	2016

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

On August 26, 2015, both the 'A' and 'B' Emergency Diesel Generators were declared inoperable, causing entry into Technical Specification 3.8.1.1 action f.

On August 26, 2015, Emergency Diesel Generator (EDG) 'A' was declared inoperable following a trip of EDG 'A' on Generator Differential. Technical Specification (TS) 3.8.1.1 actions b. and d. were entered. Investigation later determined that EDG 'A' tripped on Generator Differential due to a failed Current Transformer. EDG 'B' was subsequently started per TS 3.8.1.1 action b.(1). EDG 'B' was declared inoperable due to the room exhaust fan not starting when the diesel engine was started, and TS 3.8.1.1.f. was entered. Troubleshooting determined that the EDG 'B' room exhaust fan did not start due to HVR-501B (EG B ROOM OUTSIDE AIR INTAKE DAMPER) not opening. Action was taken to isolate air and fail HVR-501B to its open safety position. EDG 'B' was declared operable and TS 3.8.1.1.f. was exited following verification of proper operation of the EDG 'B' exhaust fan. For the EDG 'A' Generator Differential trip, the Apparent Cause was determined to be manufacturer fabrication that was less than adequate to preclude component failure, based on external vendor input. For the EDG 'B' room exhaust fan failure, the direct cause was determined to be that solenoid valve HVR-ISV-501B failed mechanically, resulting in damper HVR-501B not opening. An Equipment Apparent Cause Evaluation is being performed and the vendor evaluation is in progress to determine the cause of the solenoid valve failure.



**LICENSEE EVENT REPORT (LER)  
CONTINUATION SHEET**

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, Privacy and Information Collections Branch (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	6. LER NUMBER			3. PAGE
Waterford 3 Steam Electric Station	05000382	YEAR	SEQUENTIAL NUMBER	REV NO.	2 OF 5
		2015	- 007 -	00	

**NARRATIVE**

**INITIAL CONDITIONS**

Waterford 3 was in Mode 1 at approximately 100% power. There were no structures, components, or systems that were inoperable at the start of the event that contributed to the event.

**EVENT DESCRIPTION**

On August 26, 2015, at 0111 CDT, EDG [DG] 'A' was declared inoperable following a trip of EDG 'A' on Generator Differential [87]. TS 3.8.1.1 actions b. and d. were entered. EDG 'A' was being run in accordance with OP-903-115, "Train A Integrated Emergency Diesel Generator/Engineering Safety Features Test," Section 7.4, "24 hr EDG 'A' Run with Subsequent Diesel Start" to satisfy TS Surveillance Requirement (SR) 4.8.1.1.2.e.6. EDG 'B' was subsequently started per TS 3.8.1.1 action b.(1) which requires the demonstration of Operability of the remaining Operable EDG to preclude common mode failure of the remaining EDG. At 0740 CDT, EDG 'B' was declared inoperable and TS 3.8.1.1.f. (restore one of the inoperable EDGs to Operable status within 2 hours or be in at least Hot Standby within the following 6 hours) was entered due to the EDG 'B' room exhaust fan [FAN] not starting when the diesel engine was started. Troubleshooting determined that the EDG 'B' room exhaust fan did not start due to HVR-501B (EG B ROOM OUTSIDE AIR INTAKE DAMPER) [DMP] not opening. Action was taken to isolate air and fail HVR-501B to its open safety position. At 1001 CDT, EDG 'B' was declared operable and TS 3.8.1.1.f. was exited following verification of proper operation of the EDG 'B' room exhaust fan. The station remained in TS 3.8.1.1.b. and d. with EDG 'A' remaining inoperable.

The amount of time that both EDGs were inoperable was 2 hours and 20 minutes. During this time, a brief was conducted and preparations for a plant shutdown were completed. Prior to exceeding the allowed outage time, EDG 'B' damper HVR-501B was failed open and the room exhaust fan started.

EDG 'A' Generator Differential

EDG 'A' was being run in accordance with OP-903-115, "Train A Integrated Emergency Diesel Generator/Engineering Safety Features Test," Section 7.4, "24 hr EDG 'A' Run with Subsequent Diesel Start" to satisfy TS SR 4.8.1.1.2.e.6. The EDG function of supplying standby electrical power on receipt of a "test" or "emergency" command signal are different in that during an Emergency Mode start of the EDG, all Test Mode trips and alarms are bypassed with the exception of overspeed and generator differential.

The direct cause for EDG 'A' tripping on GENERATOR DIFFERENTIAL was the internal shorting of EG ECT2316 C TRANSF, NB8 Current Transformer, due to insulation failure.

The EG ECT2316 C TRANSF is a Westinghouse type KIR-60 current transformer style 7524A01G16 with serial number 28218571. There are no lot or date codes printed on the current transformer or its nameplate. The current transformer is only energized when EDG 'A' is supplying the 3A bus.

A vendor performed a failure analysis of the failed EG ECT2316 C TRANSF, current transformer and issued a failure analysis report dated October 9, 2015. The report concluded that the failure was due to a manufacturing defect. Specifically, there were voids found in the insulation and the thickness of the insulation material around the fault area appeared reduced when compared to the other areas of the current transformer. It is believed that the thinner insulation in combination with voids increased the electrical stresses causing the insulation to break down. This eventually resulted in a fault. The insulation breakdown and resultant fault created a ground condition on the Diesel Generator bus.

**LICENSEE EVENT REPORT (LER)  
CONTINUATION SHEET**

1. FACILITY NAME	2. DOCKET	6. LER NUMBER			3. PAGE
Waterford 3 Steam Electric Station	05000382	YEAR	SEQUENTIAL NUMBER	REV NO.	3 OF 5
		2015	- 007	- 00	

**NARRATIVE**

Investigation to determine if any other current transformers of this make and model were installed in the plant identified that the EDG 'B' Generator Differential Current Transformer was the same. Additionally, there are power current "donut style" transformers for EDG 'A' and EDG 'B', nine per EDG, feeding the regulator circuit. These are a different manufacturer, model, and construction, but are bus type current transformers that are the same age and in the same cabinet environment as the EG ECT2316 C TRANSF, NB8 Current Transformer.

EDG 'B' HVR 501B failure

On August 26, 2015, EDG 'B' was started per TS 3.8.1.1 action b.(1) which requires the demonstration of Operability of the remaining Operable EDG to preclude common mode failure of the remaining EDG. At 0740 CDT, EDG 'B' was declared inoperable and TS 3.8.1.1.f. (restore one of the inoperable EDG's to Operable status within 2 hours or be in at least Hot Standby within the following 6 hours) was entered due to the room exhaust fan not starting when the diesel engine was started. Troubleshooting determined that the EDG 'B' room exhaust fan did not start due to HVR-501B (EG B ROOM OUTSIDE AIR INTAKE DAMPER) not opening. The solenoid on HVR-501B was replaced and tested satisfactorily. The solenoid was inspected on site both externally and internally and it was determined that there was mechanical wear on the inside of the solenoid, the air inlet valve plug was bound up inside the solenoid coil, and that the solenoid coil itself appeared to be good. Photographs of the condition were sent to an offsite vendor who concluded that rapid cycling of the solenoid valve might be the cause of the excessive wear and damage to the components.

The design of the exhaust fan inlet damper for EDG 'A' (HVR-501A) (EG A ROOM OUTSIDE AIR INTAKE DAMPER) is different than for EDG 'B'. HVR-501A is located on the side wall of the EDG 'A' Room and HVR-501B is located in the overhead outside of EDG 'B' Room. These inlet dampers will open whenever the associated fan starts whether in manual or in the event of an emergency start. HVR-501A is a large wall-mounted damper that is divided into four sections. HVR-501B is a single damper installed in its associated ductwork. There are four inlet damper sections that make up HVR-501A. Each damper set has its own air actuator and an air supply solenoid valve. The failure of a single solenoid valve will not prevent the starting of the EDG 'A' Exhaust Fan.

An equipment apparent cause evaluation and an additional investigation is ongoing to determine the cause of the failure of HVR-501B from opening.

**REPORTABLE OCCURRENCE**

TS 3.8.1.1 requires that two separate and independent diesel generators shall be operable, each with diesel oil feed tanks containing a minimum volume of 339 gallons of fuel, a separate diesel generator fuel oil storage tank, and a separate fuel transfer pump.

TS 3.8.1.1 Action b: With one diesel generator of 3.8.1.1.b. inoperable: (1) Demonstrate the OPERABILITY of the remaining A.C. circuits by performing SR 4.8.1.1.1.a. (separately for each offsite A.C. circuit) within 1 hour and at least once per 8 hours thereafter. If the diesel generator became inoperable due to any cause other than an inoperable support system, an independently testable component, or preplanned maintenance or testing, demonstrate the OPERABILITY of the remaining OPERABLE diesel generator (unless it has been successfully tested in the last 24 hours) by performing SR 4.8.1.1.2.a.4. within 8 hours unless the absence of any potential common mode failure for the remaining diesel generator is demonstrated.

TS 3.8.1.1 Action f: With two of the above required diesel generators inoperable, demonstrate the OPERABILITY of two offsite AC circuits by performing SR 4.8.1.1.a. 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. Following restoration of one diesel generator follow Action statement b. with the time requirement of that action statement based on the time of initial loss of the remaining inoperable diesel generator.

**LICENSEE EVENT REPORT (LER)  
CONTINUATION SHEET**

1. FACILITY NAME	2. DOCKET	6. LER NUMBER			3. PAGE
Waterford 3 Steam Electric Station	05000382	YEAR	SEQUENTIAL NUMBER	REV NO.	4 OF 5
		2015	- 007	- 00	

**NARRATIVE**

This event is reportable under 10 CFR 50.73 (a)(2)(v)(A) and 10 CFR 50.73 (a)(2)(v)(D) "Any event or condition that could have prevented the fulfillment of the safety function of structures or systems that are needed to: (A) Shut down the reactor and maintain it in a safe shutdown condition, and (D) Mitigate the consequences of an accident."

**10 CFR 21 IDENTIFICATION**

On October 9, 2015, Waterford 3 received information from the external evaluation concerning the Generator Differential Current Transformer. The evaluation concluded that a manufacturing defect internal to the current transformer was the cause of the failure. On October 22, 2015, engineering evaluation determined the manufacturing defect could create a substantial safety hazard, as defined in 10 CFR 21, and provided the site vice president information of the defect the same day. Additional information identified in the report is as follows: Constructor - Westinghouse Type KIR-60 current transformer, style 7524A01G16, serial number 28218571; Defect and safety hazard - There were voids found in the insulation, and the thickness of the insulation material around the fault area appeared reduced when compared to the other areas of the current transformer. There is only one transformer of this type remaining installed in the plant. Scheduled replacement is no later than November 15, 2015.

**SYSTEM DESCRIPTION**

The purpose of the EDGs is to provide an emergency source of AC power to safety buses [EB] 3A and 3B during a loss of the preferred (offsite) and standby (onsite) AC power supplies to permit the ESF systems to perform their safety functions.

There are two "operating" modes of the EDGs - TEST mode and EMERGENCY mode. Any manual diesel start signal places the diesel in TEST mode. TEST mode is used for post-maintenance testing or routine surveillance. In TEST mode, the engine employs a large number of shutdown features which protect the engine for use during emergency situations. Any automatic diesel start places the diesel in EMERGENCY mode. In this mode, most of the TEST mode protective trips are bypassed to ensure the diesel runs continuously and reliably. Automatic start signals include safety injection actuation, safety bus undervoltage, and safety bus degraded voltage.

The purpose of the EDG Ventilation System is to remove the heat associated with diesel operation from the EDG 'A' and 'B' Rooms. During normal plant operations, the Reactor Auxiliary Building (RAB) Normal Ventilation System [VF] maintains temperature in the EDG rooms between 50°F and 120°F, while the EDG Ventilation System remains in standby and starts in conjunction with a diesel start. The RAB Normal Ventilation System is not required to operate following a design basis accident. The EDG Ventilation System is designed to maintain the temperature in the diesel generator rooms at a minimum of 50°F and a maximum of 120°F whenever the EDGs are in operation.

**APPARENT CAUSE**

The apparent cause of the EDG 'A' trip on generator differential is manufacturer fabrication that is less than adequate to preclude component failure. This apparent cause resulted in the condition where thinner insulation in the current transformer in combination with voids created during the manufacturing process increased the electrical stresses, thereby causing the insulation to break down. This condition eventually resulted in a fault. The insulation breakdown and resulting fault created a ground condition on the Diesel Generator bus which tripped EG EGEN0001-A, EDG 'A' on GENERATOR DIFFERENTIAL.

**LICENSEE EVENT REPORT (LER)  
CONTINUATION SHEET**

1. FACILITY NAME	2. DOCKET	6. LER NUMBER			3. PAGE
Waterford 3 Steam Electric Station	05000382	YEAR	SEQUENTIAL NUMBER	REV NO.	5 OF 5
		2015	- 007	- 00	

**NARRATIVE**

**CORRECTIVE ACTIONS**

For Failed Current Transformer on EDG 'A':

Completed Actions

1. Replace Current Transformer in EDG 'A'
2. Failure analysis on the failed EDG 'A' Current Transformer

Actions

1. Replace remaining "donut style" transformers on EDG 'A' and 'B' (nine per EDG)
2. Replace Current Transformer for Generator Differential on EDG 'B'
3. Create a preventive maintenance task to replace the EG ECT2316 C TRANSF, NB8 Current Transformer
4. Create a preventive maintenance task to replace power current "donut style" transformers for EDG 'A' and EDG 'B'

For EDG 'B':

Completed Actions

1. Replace Solenoid [SOL] associated with HVR-501B

Based on the initial evaluation, an Equipment Apparent Cause Evaluation is being performed to determine the cause of the rapid cycling of the solenoid. Once this evaluation is completed, and depending on the determination of the testing, the root cause will be revised. This LER will be revised to include the Root Cause and Contributing Causes.

**SAFETY SIGNIFICANCE**

Industrial Safety: There was no industrial safety significance associated with this issue.

Radiological Safety: There was no radiological safety significance associated with this issue.

Environmental Safety: There was no environmental safety significance associated with this issue.

Nuclear Safety: The equipment apparent cause evaluation is still in progress and has not been approved by site management. The safety significance determination is not yet completed. Nuclear safety significance will be included as a planned update to this LER.

**ADDITIONAL INFORMATION**

Energy industry identification system (EIIIS) codes and component function identifiers are identified in the text with brackets [ ].