



Exelon Generation®

Oyster Creek  
Route 9 South  
P.O. Box 388  
Forked River, NJ 08731

10 CFR 50.73

RA-17-004

January 24, 2017

U.S. Nuclear Regulatory Commission  
Attn: Document Control Desk or O-8B1  
One White Flint North  
11555 Rockville Pike  
Rockville, MD 20852

Oyster Creek Nuclear Generating Station  
Renewed Facility Operating License No. DPR-16  
NRC Docket No. 50-219

Subject: Licensee Event Report (LER) 2016-001-01, "Failure of the #1 Emergency Diesel Generator During Surveillance Testing due to a Cooling Water System Leak."

Enclosed is LER 2016-001-01, reporting the failure of the #1 Emergency Diesel Generator during surveillance testing due to a cooling water system leak which occurred on January 4, 2016.

This event did not affect the health and safety of the public or plant personnel. This event did not result in a safety system functional failure. There are no regulatory commitments made in this LER submittal.

Should you have any questions concerning this report, please contact Michael McKenna, Regulatory Assurance Manager, at (609) 971-4389.

Respectfully,

Michael F. Gillin  
Plant Manager  
Oyster Creek Nuclear Generating Station

Enclosure: NRC Form 366, LER 2016-001-01

cc: Administrator, NRC Region I  
NRC Senior Resident Inspector - Oyster Creek Nuclear Generating Station  
NRC Project Manager - Oyster Creek Nuclear Generating Station

IE22  
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> Oyster Creek, Unit 1	<b>2. DOCKET NUMBER</b> 05000219	<b>3. PAGE</b> 1 OF 4
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**4. TITLE**  
Failure of the #1 Emergency Diesel Generator During Surveillance Testing due to a Cooling Water System Leak

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
01	04	2016	2016	- 001	- 01	01	24	2017	N/A	N/A
									FACILITY NAME	DOCKET NUMBER
									N/A	N/A

**9. OPERATING MODE** N

**11. THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check all that apply)**

<input type="checkbox"/> 20.2201(b)	<input type="checkbox"/> 20.2203(a)(3)(i)	<input type="checkbox"/> 50.73(a)(2)(ii)(A)	<input type="checkbox"/> 50.73(a)(2)(viii)(A)
<input type="checkbox"/> 20.2201(d)	<input type="checkbox"/> 20.2203(a)(3)(ii)	<input type="checkbox"/> 50.73(a)(2)(ii)(B)	<input type="checkbox"/> 50.73(a)(2)(viii)(B)
<input type="checkbox"/> 20.2203(a)(1)	<input type="checkbox"/> 20.2203(a)(4)	<input type="checkbox"/> 50.73(a)(2)(iii)	<input type="checkbox"/> 50.73(a)(2)(ix)(A)
<input type="checkbox"/> 20.2203(a)(2)(i)	<input type="checkbox"/> 50.36(c)(1)(i)(A)	<input type="checkbox"/> 50.73(a)(2)(iv)(A)	<input type="checkbox"/> 50.73(a)(2)(x)
<b>10. POWER LEVEL</b> 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)(v)(A)
	<input type="checkbox"/> 20.2203(a)(2)(iii)	<input type="checkbox"/> 50.36(c)(2)	<input type="checkbox"/> 50.73(a)(2)(v)(B)
	<input type="checkbox"/> 20.2203(a)(2)(iv)	<input type="checkbox"/> 50.46(a)(3)(II)	<input type="checkbox"/> 50.73(a)(2)(v)(C)
	<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)(D)
	<input type="checkbox"/> 20.2203(a)(2)(vi)	<input checked="" type="checkbox"/> 50.73(a)(2)(i)(B)	<input type="checkbox"/> 50.73(a)(2)(vii)
		<input type="checkbox"/> 50.73(a)(2)(i)(C)	<input type="checkbox"/> OTHER Specify in Abstract below or in NRC Form 366A

**12. LICENSEE CONTACT FOR THIS LER**

LICENSEE CONTACT Michael McKenna, Regulatory Assurance Manager	TELEPHONE NUMBER (Include Area Code) (609)971-4389
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**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
E	EK	DG	E147	Y	N/A	N/A	N/A	N/A	N/A

**14. SUPPLEMENTAL REPORT EXPECTED**  YES (If yes, complete 15. EXPECTED SUBMISSION DATE)  NO

**15. EXPECTED SUBMISSION DATE**

MONTH	DAY	YEAR
N/A	N/A	N/A

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

On January 4, 2016, during the biweekly load test surveillance, the Emergency Diesel Generator (EDG) #1 tripped after 26 minutes of operation and an unexpected Main Control Room alarm was received.

Locally, at the EDG enclosure, it was discovered that the rubber pipe coupling that connects the coolant surge tank to the right bank cooling water pump inlet tee had ruptured and that the EDG #1 control circuitry processed the trip on low coolant pressure.

EDG #1 was declared inoperable and in accordance with Technical Specification (TS) 3.7.C.2 Limiting Condition for Operation (LCO), the unit entered a seven day action period. The EDG #1 was returned to service on January 5, 2016, at 0130 hours, following successful hose replacement and completion of the load test surveillance.

The Root Cause investigation determined that an activity to replace the rubber pipe coupling on a 12-year frequency was not established during the initial implementation of Exelon's Electro-Motive Division Diesel Generator Performance Centered Maintenance (PCM) template.

This event resulted in an Operation or Condition that was Prohibited by the Plant's Technical Specifications and is therefore being reported under 10CFR50.73(a)(2)(i)(B).

NRC FORM 366A  
(11-2015)

U.S. NUCLEAR REGULATORY COMMISSION

APPROVED BY OMB: NO. 3150-0104

EXPIRES: 10/31/2018



## LICENSEE EVENT REPORT (LER) CONTINUATION SHEET

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1. FACILITY NAME	2. DOCKET NUMBER	3. LER NUMBER		
		YEAR	SEQUENTIAL NUMBER	REV NO.
Oyster Creek, Unit 1	05000-219	2016	- 001	- 01

### NARRATIVE

#### Description of Event

On January 4, 2016, at approximately 0412 hours, the Oyster Creek Nuclear Generating Station (OCNGS) Emergency Diesel Generator (EDG) #1 was started for the normal biweekly load test surveillance in accordance with Procedure 636.4.003 (Diesel Generator 1 Load Test). At 0414 hours, the EDG #1 came up to rated load and at 0440 hours an unexpected alarm (T-4-b EDG 1 DISABLED), was received in the Main Control Room (MCR) when the EDG #1 controls processed a trip on low coolant pressure. MCR Operators noted the EDG #1 output breaker opened, the UNIT START light was not lit, and the UNIT IDLING light was briefly lit, then extinguished.

Operators discovered locally at the EDG enclosure that the rubber pipe coupling that connects the coolant surge tank to the right bank cooling water pump inlet tee had ruptured. The following local alarms were annunciated in the EDG #1 cubicle: ENG TRIP, GEN BKR TRIP, and LOW COOLANT PRESS. These indications were expected based on the "as found" condition of the hose and the mode of engine operation.

Following the trip, the EDG #1 was declared inoperable in accordance with the Technical Specification 3.7.C.2 LCO, which placed the plant in a 7-day action and resulted in an unplanned risk change from GREEN to YELLOW.

EDG #1 was declared operable at 0130 hours on January 5, 2016, and plant risk was returned to Green, following the replacement of the rubber pipe coupling and successful post maintenance testing.


#### Equipment Description

OCNGS is equipped with two identical EDG units. The function of the EDGs is to provide AC power to the Class 1E buses upon a loss of off-site power. The EDGs must be able to provide this power rapidly, within 10 seconds, upon demand. This condition is referred to as a fast start signal. If started with a fast start signal, a high jacket water temperature condition will not trip the EDG.

The EDG units are General Motors Corporation, Electromotive Division (EMD) Model EMD 20-645E4, 20-cylinder, 2-cycle, turbo-intercooled diesel engines, which drive their respective EMD A20C AC generators. Each unit is normally operated bi-weekly to demonstrate the ability to carry rated loading upon loss of offsite power to their respective buses. The EDG units are self-contained in enclosures inside the EDG vaults and are provided with air-cooled radiators to remove waste heat.

Each engine is equipped with two engine-driven cooling water pumps to provide jacket water coolant flow to the power assemblies in each cylinder bank and the turbocharger after coolers. The cooling water, which is demineralized water treated with Nalcool 2000 corrosion inhibitor, is maintained in a closed loop with a surge tank connected to a tee in the suction side of the pumps. The tank is equipped to accommodate the volume of coolant that drains from the radiators in the standby condition and provides adequate coolant level for pump net positive suction head during operation. The rubber pipe coupling which failed on EDG #1 was one of two on that engine, which provided a flexible connection between the tee and the bottom of the tank.

To minimize the stress of a fast start, each engine is provided with an immersion heater in the coolant system and auxiliary oil pumps to circulate warm oil. The coolant system is designed for reverse natural circulation flow to provide for oil heating in standby conditions. In standby, the water level in the tank is approximately 14 inches higher than during operation, where the water is displaced into the piping above the radiator.

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**NARRATIVE**

**Analysis of Event**

The failed rubber pipe coupling was sent to Exelon's PowerLabs for functional testing and analysis. PowerLabs' Failure Analysis Report (OYS-34217) concluded that the observations and data from the EDG #1 ruptured rubber pipe coupling and the EDG #2 non-failed rubber provided support that the progression of degradation took place from the inner diameter of the rubber coupling to the outer diameter. The most likely failure scenario of the EDG #1 rubber coupling began with thermal degradation of the inner nitrile layer which caused it to harden and crack. This cracking allowed the coolant to come in contact with the rayon fabric reinforcement which degraded and weakened it. With the inner nitrile layer and the reinforcing layers compromised, the nitrile outer layer eventually became thermally degraded to a point that it could no longer withstand the pressure of the coolant during operation and the hose ruptured.

**Assessment of Safety Consequences**

Two EDG units serve as the Standby Power Supply for OCNCS by providing an emergency source of power to the 4.16 kV buses 1C and 1D in the event of a loss of normal power. The EDG units are designed to start and load automatically, if required. Non-essential loads are automatically shed by undervoltage sensing devices on loss of offsite power to ensure that the units are not overloaded. The capacity of the EDG units is sufficient to sequentially energize for starting all safety-related pumps and auxiliaries required for a safe shutdown of the reactor in the event of a Design Basis Accident. The EDG units are independent of each other, with the exception of a common bulk fuel storage supply, and are provided with auxiliary systems to ensure reliable starting and continuous operation with no Operator attention. Power to start the EDG units is self-contained and is not dependent on the availability of any other source of normal plant power at the moment of initiation.

There are two types of automatic start signals to the EDG units. The first signal will cause the EDGs to start and idle. The second signal is considered the Fast Start Signal. The EDG allowable time response to a Loss of Offsite Power (LOOP) event is 20 seconds as a basis for Core Spray System response to accident conditions. The time response period includes undervoltage (UV) sensor pick-up time, Emergency Bus logic to isolate and actuate the EDGs and the period to bring the Emergency Buses to normal voltage level.

The failure of the rubber pipe coupling on the cooling water system could have precluded EDG #1 from being able to start, load, and operate without interruption in the event of a degraded or loss of voltage condition. EDG #2 would have continued to operate and would have supplied the 1D 4160V bus as required to ensure power to the components required to achieve cold shutdown. Since the common cause for EDG #2 operability could not be clearly demonstrated based on available data, EDG #2 load test was successfully completed per TS Section 3.7.C., for common mode applicability requirements, and was maintained in an operable condition in accordance with station procedures.

**Cause of Event**

The Root Cause investigation determined that an activity to replace the rubber pipe coupling on a 12-year frequency was not established during the initial implementation of Exelon's Electro-Motive Division Diesel Generator Performance Centered Maintenance (PCM) template.

Additionally subsequent reviews following the implementation of the PCM templated missed the opportunity to identify that the cooling water expansion tank inner tee hoses were not captured as part of the Preventive Maintenance (PM) program.

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**NARRATIVE**

**The following immediate actions were taken:**

- Complex Troubleshooting was commenced.
- The #2 EDG was placed in service to eliminate the potential for a common cause failure.
- The failed rubber pipe coupling was replaced on EDG #1. (The opposite coupling was replaced in 2014)

**Corrective Actions**

- Replaced both of the similar couplings on EDG #2.
- Reviewed PM program for EDGs to ensure preventive maintenance is consistent with PCM template and vendors recommendations.

**Previous Occurrences**

There have been no similar, previous events resulting from a failure of a flexible fluid coupling on an EDG at Oyster Creek.

**Component Data**

Component	IEEE 805 System ID	IEEE 803A Function
Emergency Diesel Generator	EK	DG