



**UNITED STATES  
NUCLEAR REGULATORY COMMISSION**  
REGION I  
2100 RENAISSANCE BOULEVARD, SUITE 100  
KING OF PRUSSIA, PA 19406-2713

May 11, 2018

Mr. Bryan C. Hanson  
Senior Vice President, Exelon Generation Company, LLC  
President and Chief Nuclear Officer, Exelon Nuclear  
4300 Winfield Road  
Warrenville, IL 60555

SUBJECT: LIMERICK GENERATING STATION – INTEGRATED INSPECTION REPORT  
05000352/2018001 AND 05000353/2018001

Dear Mr. Hanson:

On March 31, 2018, the U.S. Nuclear Regulatory Commission (NRC) completed an inspection at Limerick Generating Station (LGS), Units 1 and 2. On April 12, 2018, the NRC inspectors discussed the results of this inspection with Rick Libra, Site Vice-President, and other members of your staff. The results of this inspection are documented in the enclosed report.

NRC inspectors documented two findings of very low safety significance (Green) in this report. These findings involved violations of NRC requirements. The NRC is treating these violations as non-cited violations (NCVs) consistent with Section 2.3.2.a of the Enforcement Policy.

If you contest the violations or significance of these NCVs, you should provide a response within 30 days of the date of this inspection report, with the basis for your denial, to the U.S. Nuclear Regulatory Commission, ATTN: Document Control Desk, Washington, DC 20555-0001; with copies to the Regional Administrator, Region I; the Director, Office of Enforcement; and the NRC Resident Inspector at LGS. In addition, if you disagree with a cross-cutting aspect assignment, you should provide a response within 30 days of the date of this inspection report, with the basis for your disagreement, to the U. S. Nuclear Regulatory Commission, ATTN: Document Control Desk, Washington, DC, 20555-0001; with copies to the Regional Administrator, Region I, and the NRC Resident Inspector at LGS.

This letter, its enclosure, and your response (if any) will be made available for public inspection and copying at <http://www.nrc.gov/reading-rm/adams.html> and the NRC's Public Document Room in accordance with Title 10 of the *Code of Federal Regulations* (10 CFR), Part 2.390, "Public Inspections, Exemptions, Requests for Withholding."

Sincerely,

/RA/

James A. Krafty, Acting Chief  
Reactor Projects Branch 4  
Division of Reactor Projects

B. Hanson

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Docket Numbers: 50-352 and 50-353  
License Numbers: NPF-39 and NPF-85

Enclosure:  
Inspection Report 05000352/2018001  
and 05000353/2018001

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SUBJECT: LIMERICK GENERATING STATION – INTEGRATED INSPECTION REPORT  
05000352/2018001 AND 05000353/2018001 DATED MAY 11, 2018

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**U.S. NUCLEAR REGULATORY COMMISSION  
Inspection Report**

Docket Numbers: 50-352 and 50-353

License Numbers: NPF-39 and NPF-85

Report Numbers: 05000352/2018001 and 05000353/2018001

Enterprise Identifier: I-2018-001-0071

Licensee: Exelon Generation Company, LLC

Facility: Limerick Generating Station, Units 1 & 2

Location: Sanatoga, PA 19464

Inspection Dates: January 1, 2018 through March 31, 2018

Inspectors: S. Rutenkroger, PhD, Senior Resident Inspector  
M. Fannon, Resident Inspector  
H. Anagnostopoulos, Senior Health Physicist  
J. Furia, Senior Health Physicist

Approved By: J. Krafty, Acting Chief  
Reactor Projects Branch 4  
Division of Reactor Projects

Enclosure

## SUMMARY

The U.S. Nuclear Regulatory Commission (NRC) continued monitoring Exelon's performance at Limerick Generating Station Units 1 and 2 by conducting the baseline inspections described in this report in accordance with the Reactor Oversight Process. The Reactor Oversight Process is the NRC's program for overseeing the safe operation of commercial nuclear power reactors. Refer to <https://www.nrc.gov/reactors/operating/oversight.html> for more information. NRC identified and self-revealed findings, violations, and additional items are summarized in the table below.

### List of Findings and Violations

Failure of Emergency Diesel Generator Lube Oil Pipe Nipple Fitting			
Cornerstone	Significance	Cross-cutting Aspect	Report Section
Mitigating Systems	Green NCV 05000353/2018001-01 Opened/Closed	[P.1] – Identification	71153
A self-revealed Green non-cited violation (NCV) of 10 CFR 50, Appendix B, Criterion XVI, "Corrective Action," and LGS Unit 2 technical specification (TS) 3.8.1.1 was identified when Exelon failed to correct a degraded lube oil pipe nipple fitting on the 'D22' emergency diesel generator (EDG) when maintenance was performed to address leakage which caused inoperability of the EDG for greater than its TS allowed outage time.			

Emergency Diesel Generator Combustion Air Overheating			
Cornerstone	Significance	Cross-cutting Aspect	Report Section
Mitigating Systems	Green NCV 05000352/2018001-02 Opened/Closed	[P.3] – Resolution	71153
A self-revealed Green NCV of LGS Unit 1 TS 6.8.1 and TS 3.8.1.1 was identified when Exelon failed to properly maintain an operating procedure to maintain a fail-safe design feature for the EDGs which led to the 'D12' EDG combustion air overheating and caused the EDG to be inoperable for greater than its TS allowed outage time.			

### Additional Tracking Items

Type	Issue number	Title	Report Section	Status
LER	05000353/2017-008-00 05000353/2017-008-01	EDG Inoperable for Greater Than 30 Days Resulting in a Condition Prohibited by Technical Specifications	71153	Closed
LER	05000352/2018-001-00	D12 EDG Inoperable for Greater than 30 Days Resulting in a Condition Prohibited by TS	71153	Closed

## PLANT STATUS

Unit 1 began the inspection period at rated thermal power. On March 25 to 26, 2018, the unit was down powered and shutdown for a planned refueling outage. The unit remained shutdown for the refueling outage for the remainder of the inspection period.

Unit 2 began the inspection period at rated thermal power. On March 17, 2018, the unit was down powered to 64 percent to repair a main condenser tube leak. The unit was returned to rated thermal power the same day and remained at or near rated thermal power for the remainder of the inspection period.

## INSPECTION SCOPES

Inspections were conducted using the appropriate portions of the inspection procedures (IPs) in effect at the beginning of the inspection unless otherwise noted. Currently approved IPs with their attached revision histories are located on the public website at <http://www.nrc.gov/reading-rm/doc-collections/insp-manual/inspection-procedure/index.html>. Samples were declared complete when the IP requirements most appropriate to the inspection activity were met consistent with Inspection Manual Chapter (IMC) 2515, "Light-Water Reactor Inspection Program - Operations Phase." The inspectors performed plant status activities described in IMC 2515 Appendix D, "Plant Status" and conducted routine reviews using IP 71152, "Problem Identification and Resolution." The inspectors reviewed selected procedures and records, observed activities, and interviewed personnel to assess Exelon's performance and compliance with Commission rules and regulations, license conditions, site procedures, and standards.

## REACTOR SAFETY

### 71111.01 - Adverse Weather Protection

#### Impending Severe Weather (2 samples)

- (1) The inspectors evaluated readiness for impending adverse weather conditions for the onset of winter weather, including high winds, on January 5, 2018.
- (2) The inspectors evaluated readiness for impending adverse weather conditions for the onset of winter weather, including high winds, on March 2, 2018.

### 71111.04 - Equipment Alignment

#### Partial Walkdown (5 samples)

The inspectors evaluated system configurations during partial walkdowns of the following systems/trains:

- (1) Unit 2 high pressure coolant injection on January 16 and 17, 2018
- (2) Unit 1 'D11' and 'D13' emergency diesel generators (EDGs) on February 5, 2018
- (3) Unit 2 '2A' batteries and chargers during '2BD101' battery planned maintenance on February 5 through 9, 2018
- (4) Unit 1 'B' residual heat removal subsystem in shutdown cooling during the 'A' emergency core cooling subsystem maintenance window on March 27, 2018
- (5) Unit 1 'D12' EDG during the division 1 and 3 direct current bus maintenance window on March 28, 2018

71111.05 - Fire ProtectionQuarterly Inspection (5 samples)

The inspectors evaluated fire protection program implementation in the following selected areas:

- (1) Fire area 2, Unit common 13.2kV switchgear room, elevation 217', on January 8, 2018
- (2) Fire area 8, Unit 1 class 1E battery room, elevation 239', on January 23, 2018
- (3) Fire area 10, Unit 2 class 1E battery rooms, elevation 239', on February 5, 2018
- (4) Fire area 28, Unit common standby gas treatment area rooms, elevation 332', on February 27, 201
- (5) Fire area 43, Unit 1 safeguard isolation valve area room 309, elevation 217', on March 28, 2018

71111.11 - Licensed Operator Regualification Program and Licensed Operator PerformanceOperator Regualification (1 sample)

The inspectors observed and evaluated licensed operator simulator training scenarios on February 20, 2018.

Operator Performance (1 sample)

The inspectors observed the downpower and normal plant shutdown of Unit 1 for a planned refueling outage on March 25 and 26, 2018

71111.12 - Maintenance EffectivenessRoutine Maintenance Effectiveness (2 samples)

The inspectors evaluated the effectiveness of routine maintenance activities associated with the following equipment and/or safety significant functions:

- (1) Unit 1 reactor manual control system
- (2) Unit 2 reactor manual control system

71111.13 - Maintenance Risk Assessments and Emergent Work Control (6 samples)

The inspectors evaluated the risk assessments for the following planned and emergent work activities:

- (1) Unit 2 reactor core isolation cooling relay replacements on January 16 and 17, 2018
- (2) Unit common 'B' control room emergency fresh air system testing on February 7, 2018
- (3) Unit 2 'A' residual heat removal maintenance on February 26 and 27, 2018
- (4) Unit common 'A' standby gas treatment system maintenance on February 27, 2018
- (5) Unit common 'A' emergency service water, 'A' standby gas treatment system, and Unit 2 'A' reactor enclosure recirculation system maintenance on March 1, 2018
- (6) Unit 1 'A' emergency core cooling system maintenance during reduced core inventory in the refueling outage on March 27 and 28, 2018

#### 7111.15 - Operability Determinations and Functionality Assessments (6 samples)

The inspectors evaluated the following operability determinations and functionality assessments:

- (1) Unit 2, 'D21' EDG room low temperature alarm on December 31, 2017
- (2) Unit 2 high pressure coolant injection condensate pump discharge check valve failure on January 25, 2018
- (3) Unit 2 high pressure coolant injection vacuum breaker check valve oversized disc on January 31, 2018
- (4) Unit common 'A' emergency service water pump motor step voltage test leakage current on January 31, 2018
- (5) Unit 2 'D21' EDG multiple battery ground alarms while raising speed during the slow start surveillance test on February 2, 2018
- (6) Unit common, 'B' control room air supply controller not properly maintaining room temperature on February 4, 2018

#### 7111.18 - Plant Modifications (2 samples)

The inspectors evaluated the following temporary or permanent modifications:

- (1) Engineering change package 622647 – Inflatable Seal – Secondary Containment
- (2) Engineering change request 433952, 'D23' Repair of the Blower Inspection Cover Bolt Holes Using Stainless Steel Heli-Coil Thread Inserts

#### 7111.19 - Post Maintenance Testing (6 samples)

The inspectors evaluated post maintenance testing for the following maintenance/repair activities:

- (1) Unit 2 'D24' EDG fuse replacement following an intermittent issue in the automatic start logic circuit on December 6, 2017
- (2) Unit 2 reactor core isolation cooling relay replacements on January 16 and 17, 2018
- (3) Unit 1 'D12' EDG air cooler temperature indicator controller pressure control valve (PCV) replacement on February 5, 2018
- (4) Unit 2 'B2' battery cell replacements on February 5 and 6, 2018
- (5) Unit 2 'B2' battery charger current adjustment on February 15, 2018
- (6) Unit 2 'D24' EDG heating, ventilation, and cooling fan controller replacement on February 22, 2018

#### 7111.20 - Refueling and Other Outage Activities

The inspectors evaluated the Unit 1 refueling outage 1R17 from March 26, 2018, through the end of the inspection period. The following portions of the inspection procedure were not performed during this period.

- (1) Fatigue Management
- (2) Startup



71111.22 - Surveillance Testing

The inspectors evaluated the following surveillance tests:

Routine (3 samples)

- (1) ST-6-092-113-2, 'D23' EDG 24 hour endurance run on January 18 and 19, 2018
- (2) RT-6-051-320-1, Unit 1 'B' residual heat removal remote operation test on February 7, 2018
- (3) ST-2-074-642-1, Unit 1 source range and intermediate range neutron monitors pre-shutdown testing on March 18, 2018

In-service (2 samples)

- (1) ST-6-052-231-1, Unit 1 'A' core spray pump, valve, and flow test on January 4, 2018
- (2) ST-6-052-232-1, Unit 1 'B' core spray pump, valve, and flow test on March 10, 2018

Containment Isolation Valve (2 samples)

- (1) ST-4-LLR-031-1, Unit 1 main steam line 'A' inboard and outboard isolation valves' leakage rate testing on March 29, 2018
- (2) ST-4-LLR-041-1, Unit 1 main steam line 'B' inboard and outboard isolation valves' leakage rate testing on March 29, 2018

**RADIATION SAFETY**71124.02 - Occupational As Low As Reasonably Achievable (ALARA) Planning and ControlsRadiological Work Planning (1 sample)

The inspectors evaluated Exelon's radiological work planning by reviewing the following activities:

- (1) ALARA Plan 2017-101
- (2) ALARA Plan 2017-050
- (3) ALARA Plan 2017-052

Verification of Dose Estimates and Exposure Tracking Systems (1 sample)

The inspectors evaluated dose estimates and exposure tracking.

71124.08 - Radioactive Solid Waste Processing and Radioactive Material Handling, Storage, and TransportationRadioactive Material Storage (1 sample)

The inspectors observed radioactive waste container storage areas and verified the postings and controls and that Exelon had established a process for monitoring the impact of long-term storage of the waste.

Radioactive Waste System Walkdown (1 sample)

The inspectors walked down the following:

- Accessible portions of liquid and solid radioactive waste processing systems to verify current system alignment and material condition
- Abandoned in place radioactive waste processing equipment to review the controls in place to ensure protection of personnel
- Changes made to the radioactive waste processing systems since the last inspection
- Processes for mixing and transferring radioactive waste resin and/or sludge discharges into shipping/disposal containers
- Current methods and procedures for dewatering waste

Waste Characterization and Classification (1 sample)

The inspectors identified radioactive waste streams and reviewed radiochemical sample analysis results to support radioactive waste characterization. The inspectors reviewed the use of scaling factors and calculations to account for difficult-to-measure radionuclides.

Shipment Preparation (1 sample)

The inspectors reviewed the records of shipment packaging, surveying, labeling, marking, placarding, vehicle checks, emergency instructions, disposal manifest, shipping papers provided to the driver, and Exelon's verification of shipment readiness.

Shipping Records (1 sample)

The inspectors reviewed selected non-excepted package shipment records.

**OTHER ACTIVITIES – BASELINE**71151 - Performance Indicator Verification (6 samples)

The inspectors verified Exelon's performance indicator submittals listed below for the period January 1, 2017 through December 31, 2017.

- (1) Unit 1 and Unit 2 Unplanned Power Changes per 7000 Critical Hours
- (2) Unit 1 and Unit 2 High Pressure Injection Systems
- (3) Unit 1 and Unit 2 Heat Removal Systems

71153 - Follow-up of Events and Notices of Enforcement DiscretionLicensee Event Reports (LER) (2 samples)

The inspectors evaluated the following licensee event reports which can be accessed at <https://lersearch.inl.gov/LERSearchCriteria.aspx>:

- (1) LER 05000353/2017-008-00 and 05000353/2017-008-01, EDG Inoperable for Greater Than 30 Days Resulting in a Condition Prohibited by Technical Specifications, on December 11, 2017, and February 22, 2018. The review for this event is documented in the inspection results section.
- (2) LER 05000352/2018-001-00, D12 EDG Inoperable for Greater than 30 Days Resulting in

a Condition Prohibited by TS, on February 5, 2018. The review for this event is documented in the inspection results section.

## INSPECTION RESULTS

Failure of Emergency Diesel Generator Lube Oil Pipe Nipple Fitting			
Cornerstone	Significance	Cross-cutting Aspect	Report Section
Mitigating Systems	Green NCV 05000353/2018001-01 Opened/Closed	[P.1] – Identification	71153
<p>A self-revealed Green non-cited violation (NCV) of 10 CFR 50, Appendix B, Criterion XVI, “Corrective Action,” and LGS Unit 2 technical specification (TS) 3.8.1.1 was identified when Exelon failed to correct a degraded lube oil pipe nipple fitting on the ‘D22’ EDG when maintenance was performed to address leakage which caused inoperability of the EDG for greater than its TS allowed outage time.</p>			
<p><u>Description:</u> The EDG systems are safety related standby emergency power systems for LGS Units 1 and 2 consisting of four diesel generator sets per unit. Each EDG has a lube oil system that cools the diesel engine, lubricates the engine wear surfaces (moving parts), and captures friction wear products. On October 11, 2017, during testing of the ‘D22’ EDG, Exelon personnel identified a lube oil leak from a 0.5 inch tapered thread pipe nipple fitting between the lube oil filter and the lube oil filter vent valve. The personnel estimated the leak to be approximately 0.03125 gallons per minute (gpm) (about one-half cup per minute), and Exelon declared the EDG inoperable.</p> <p>Exelon performed an equipment corrective action program evaluation and identified that the same fitting was found to be leaking and/or weeping on August 31, 2010, and October 3, 2012. After identifying leakage on August 31, 2010, Exelon removed, cleaned, visually inspected, and reinstalled the fitting with thread sealant on November 29, 2011. After the second identification of leakage on October 3, 2012, Exelon performed a similar repair for a second time on August 29, 2013. Exelon planned a similar repair when the fitting leaked for a third time on September 7, 2017. The repair was initially planned for October 6, 2017, but was subsequently rescheduled for November 3, 2017. Exelon identified three through-wall cracks and irregular threads in the fitting and concluded the apparent cause of the failure on October 11, 2017, was age related cyclic fatigue induced by diesel engine vibration. Exelon also determined that the repairs made in 2011 and 2013 contributed to the stresses and crack development and propagation rate based on galling of the threads, wrench marks on the exterior of the fitting, and deeper thread engagement.</p> <p>The inspectors determined that a rework investigation was required by Exelon procedure MA-AA-716-017, “Station Rework Reduction Program,” when leakage was identified the second time. Exelon was unable to find evidence that a rework investigation was performed or provide a basis for not performing one. The inspectors concluded a rework investigation would have reasonably provided additional focus and oversight on the subsequent maintenance performed on August 29, 2013. The inspectors determined that additional focus would have provided an opportunity to identify the galled threads on the pipe nipple, the high installation torque required to insert the nipple, and the deeper thread engagement of the nipple following the repair (the nipple was essentially fully inserted into the housing). The fitting’s condition indicated additional tightening of at least two additional threads beyond original installation which is outside the tolerances of ASME B1.20.1, “Pipe Threads, General Purpose (Inch).” Based on these conditions, the inspectors determined that Exelon had a</p>			

reasonable opportunity to foresee and correct the degraded fitting as required by Exelon procedure PI-AA-125, "Corrective Action Program (CAP) Procedure," when the second repair was performed.

The inspectors also noted that when maintenance personnel fabricated a replacement fitting after the October 11, 2017, failure, the new fitting leaked during post-maintenance testing. Maintenance personnel responded by tightening the fitting further, and the fitting leaked again during post-maintenance testing. Exelon then removed the fitting, determined the threads of the new fitting were not satisfactory, that personnel had not verified the threads were properly cut, and fabricated a second new fitting. Although the performance deficiency occurred on August 29, 2013, the inspectors considered the above and determined the applicable cross-cutting aspect of not recognizing deviations from ASME standards, training, and skill of the craft when taking action to address leakage was indicative of current performance.

Corrective Action(s): Exelon replaced the fitting and restored operability of the EDG on October 15, 2017, revised equipment data to require replacement of a pipe nipple fitting instead of reusing if a future leak is identified, and initiated actions to replace similar fittings for extent of condition.

Corrective Action Reference(s): Issue Report (IR) 4070641

Performance Assessment:

Performance Deficiency: The inspectors determined that the failure to correct a degraded lube oil pipe nipple fitting on the 'D22' EDG when maintenance was performed to address leakage was reasonably within Exelon's ability to foresee and correct and should have been prevented.

Screening: The inspectors determined the performance deficiency was more than minor because it adversely affected the equipment performance attribute of the mitigating systems cornerstone to ensure the availability of systems that respond to initiating events to prevent undesirable consequences (i.e. core damage). Specifically, the issue caused the 'D22' EDG to be inoperable from September 7 to October 15, 2017.

Significance: The inspectors assessed the significance of the finding using IMC 0609, Appendix A, Exhibit 2, and determined that this finding was of very low safety significance (Green). Specifically, the inspectors, in consultation with a Region I senior reactor analyst (SRA), determined that the condition did not represent an actual loss of the 'D22' EDG probabilistic risk assessment safety function, i.e. the capability to provide power for up to 24 hours. The lube oil storage tank contained over 216 gallons during the period. The lube oil consumption rate was less than 0.05 gpm. The leak rate was consistent at about 0.03125 gpm. Therefore, at a minimum the lube oil storage tank contained sufficient oil to make up to the 'D22' EDG oil reservoir for over 40 hours of EDG operation.

Cross-Cutting Aspect: The inspectors determined that this finding has a cross-cutting aspect in the area of Problem Identification and Resolution, Identification, because Exelon personnel did not recognize deviations from standards, training, and skill of the craft when addressing leakage. [P.1]

Enforcement:

Violation: 10 CFR 50, Appendix B, Criterion XVI, "Corrective Action", requires, in part, that measures shall be established to assure that conditions adverse to quality, such as deficiencies, defective material, and non-conformances are promptly identified and corrected.

LGS Unit 2 TS 3.8.1.1 requires that an inoperable diesel generator be restored to an operable status within 30 days or the unit be in at least hot shutdown within the next 12 hours and in cold shutdown within the following 24 hours. Contrary to the above, from August 29, 2013 to October 15, 2017, a condition adverse to quality was not promptly corrected. Specifically, repairs made to the 'D22' lube oil filter housing to vent valve pipe nipple fitting failed to correct the cracked fitting which caused the leakage. This caused the 'D22' EDG to be inoperable from September 7, 2017, to October 15, 2017. The action to restore the diesel within 30 days was not met on October 7, 2017, and Unit 2 was not in at least hot shutdown within the next 12 hours and in cold shutdown within the following 24 hours.

Disposition: This violation is being treated as an NCV, consistent with Section 2.3.2 of the Enforcement Policy.

Emergency Diesel Generator Combustion Air Overheating			
Cornerstone	Significance	Cross-cutting Aspect	Report Section
Mitigating System	Green NCV 05000352/2018001-02 Opened/Closed	[P.3] – Resolution	71153
<p>A self-revealed Green NCV of LGS Unit 1 TS 6.8.1 and TS 3.8.1.1 was identified when Exelon failed to properly maintain an operating procedure to maintain a fail-safe design feature for the EDGs which led to the 'D12' EDG combustion air overheating and caused the EDG to be inoperable for greater than its TS allowed outage time.</p> <p><u>Description:</u> The EDG systems are safety related standby emergency power systems for LGS Units 1 and 2. Each EDG has an air cooler coolant heat exchanger that cools the water that cools the combustion air entering the engine. A three-way thermostatic control valve maintains combustion air temperature between 115 degrees Fahrenheit (°F) and 145 °F by controlling how much emergency service water flows through this heat exchanger.</p> <p>On December 7, 2017, during surveillance testing of the 'D12' EDG, Exelon personnel recognized that the combustion air temperature was abnormally high at 220 °F, with an expected band of 115 °F to 145 °F. The 'D12' EDG had run unloaded for about two hours, then fully loaded for about one hour when the condition was recognized. Exelon shutdown and declared the 'D12' EDG inoperable and entered TS Limiting Condition for Operation 3.8.1.1. As part of troubleshooting, the temperature indicating controller (TIC) was removed, bench tested satisfactorily, re-installed, and recalibrated to a setpoint temperature of 130°F. Exelon found the cooling water controller's setpoint dial set at 200°F instead of at the required setpoint of 130°F. On December 12, 2017, Exelon restored and declared the 'D12' EDG operable.</p> <p>Exelon performed a past operability review and root cause evaluation and determined that the past functionality of the 'D12' EDG was adversely impacted such that the EDG was inoperable since performance of the 24-hour endurance run that began on November 6, 2017. Specifically, Exelon determined that on November 6, 2017, while performing a routine running check of engine operation, an equipment operator identified that the air cooler temperature controller setpoint was not at 130°F with process temperatures off-scale low. The low temperatures were previously identified with an existing IR, initiated on June 12, 2017. The operator adjusted the dial in order to adjust the temperature controller setpoint, in accordance with operating procedure S92.9.N, "Routine Inspection of the Diesel Generators." However, Exelon determined that an intermittent malfunction of the PCV in the supply air to the temperature controller caused the TIC setpoint to be lower and fail to</p>			

respond. During the next engine run on December 7, 2017, the PCV delivered proper air pressure after three hours of runtime which resulted in the TIC setpoint being at 200 °F based on the as-left dial position that was established on November 6, 2017.

Exelon determined the root cause of the issue was the intermittent condition of the PCV that caused intermittent combustion air low temperature operation. Exelon further determined the contributing cause of the issue was the operating procedure directing action which introduced a failure mechanism for the cooling system that was otherwise designed to fail safe (i.e. loss of supply air results in maximum cooling with no loss of diesel function). Finally, Exelon determined the most significant organizational contributor to the issue was the organization's failure to take effective corrective action to address the known low temperature condition which was caused by the degraded pressure control valve.

Corrective Action(s): Exelon recalibrated and reinstalled the TIC, revised the operating procedure to ensure EDG functionality is maintained, and replaced the degraded PCV.

Corrective Action Reference(s): IR 4081882

Performance Assessment:

Performance Deficiency: The inspectors determined that the failure to properly maintain an operating procedure for the EDGs to maintain a fail-safe design feature was reasonably within Exelon's ability to foresee and correct and should have been prevented. Specifically, there was a reasonable ability to ensure the operating procedure was appropriate to the circumstances given the previously identified intermittent combustion air low temperature operation and the failure of the TIC to respond to the dial adjustment that was directed by the operating procedure.

Screening: The inspectors determined the performance deficiency was more than minor because it adversely affected the equipment performance attribute of the mitigating systems cornerstone to ensure the availability of systems that respond to initiating events to prevent undesirable consequences (i.e. core damage). Specifically, the inadequate procedure resulted in the 'D12' EDG being inoperable from November 6 to December 12, 2017.

Significance: The inspectors screened the significance of the finding using IMC 0609, Appendix A, Exhibit 2, and determined that this finding required a detailed risk evaluation (DRE) since the inoperability exceeded the TS allowed outage time of 30 days. A Region I SRA completed the DRE and estimated the increase in core damage frequency (CDF) associated with this performance deficiency to be 8.8E-8/yr, or of very low safety significance (Green). To perform the DRE, the SRA used the Systems Analysis Programs for Hands-On Evaluation (SAPHIRE), Revision 8.1.6, Standardized Plant Analysis Risk (SPAR) Model, version 8.50 for LGS Unit 1. This model was determined to require an update to appropriately modify logic and power dependencies associated with the low pressure injection motor operated valve logic. These modifications were assessed and performed by an Idaho National Labs (INL) SPAR model contractor. A limited use updated SPAR model version was posted on the INL website and used by the SRA to run the conditional assessment assuming a failure to run for the 'D12' EDG. The failure was assumed given the unexpected high intercooler air outlet temperatures. As noted in Exelon's review of the issue, the concern with these higher temperatures was related to blower degradation and engine degradation which was determined to challenge the operability of the EDG.

The SRA reviewed procedures E-1, "Loss of All AC Power," and E-10/20, "Loss of Offsite Power," and determined that a best estimate value for the ability to cross-tie power from

Unit 2 safety busses to Unit 1 safety busses was 6E-2. This failure probability to take cross-tie actions was calculated through the use of a SPAR-H calculation conservatively assuming barely adequate time exists, high stress, and low experience for the task. Basic event EPS-XHE-XM-DGXT, was therefore changed from TRUE to 6E-2. An exposure time of 36 days was used based on the inoperable time determined for the 'D12' EDG. Additionally, no recovery credit was given for the high temperature condition. This was considered a conservative assumption by the SRA given that procedure S92.9.N existed and if used during a postulated event may have resulted in observation of the nonconforming condition and subsequent action to dial back the temperature setpoint. The SRA determined this action would have returned temperatures to the normal band.

The dominant core damage sequence involved a weather related loss of offsite power, with failure of the 'D12' EDG, common cause failure of the remaining Unit 1 EDGs, failure to cross-tie a Unit 2 EDG to a Unit 1 safety bus, failure to depressurize given the eventual loss of direct current (DC) power, and failure to recover either offsite power or an EDG within 5 hours. In accordance with IMC 0609 guidance a review of the external event risk or large early release frequency was not performed given the increase in internal event CDF was below the 1E-7/yr threshold and would not be expected to change the risk estimation.

Cross-Cutting Aspect: The inspectors determined that this finding has a cross-cutting aspect in the area of Problem Identification and Resolution, Resolution, because Exelon did not take effective corrective action when the intermittent low temperature condition caused by the degraded PCV was identified. Specifically, Exelon did not take appropriate interim corrective action to address the operating procedure's TIC adjustments in order to mitigate the issue while more fundamental causes were being addressed. [P.3]

#### Enforcement:

Violation: LGS Unit 1 TS 6.8.1, requires, in part, written procedures to be established, implemented, and maintained covering applicable procedures recommended in Appendix A of Regulatory Guide 1.33, Revision 2, February 1978. Regulatory Guide 1.33, Revision 2, Appendix A, Section 1, requires procedures with instructions prepared as appropriate for the operation of onsite emergency power sources (e.g. diesel generators). In addition, LGS Unit 1 TS 3.8.1.1 requires that an inoperable diesel generator be restored to an operable status within 30 days or the unit be in at least hot shutdown within the next 12 hours and in cold shutdown within the following 24 hours. Contrary to the above, Exelon did not properly maintain EDG operating procedure S92.9.N as appropriate for the operation of the EDGs. This caused the 'D12' EDG to be inoperable from November 6, 2017, to December 12, 2017. The action to restore the diesel within 30 days was not met on December 6, 2017, and Unit 1 was not in at least hot shutdown within the next 12 hours and in cold shutdown within the following 24 hours.

Disposition: This violation is being treated as an NCV, consistent with Section 2.3.2 of the Enforcement Policy.

## **EXIT MEETINGS AND DEBRIEFS**

The inspectors verified no proprietary information was retained or documented in this report.

- On April 12, 2018, the inspectors presented the quarterly resident inspector inspection results to Rick Libra, Site Vice-President, and other members of the Exelon staff.

**THIRD PARTY REVIEWS**

Inspectors reviewed Institute on Nuclear Power Reactor reports that were issued during the inspection period.



**DOCUMENTS REVIEWED**

71111.01

Procedures

GP-7, Cold Weather Preparation and Operation, Revision 53  
SE-14, Snow, Revision 21  
SE-9, Preparation for Severe Weather, Revision 45

Condition Reports

4088765

71111.04Q

Procedures

1S92.1.N (COL-2), Equipment Alignment for 1B Diesel Generator Operation, Revision 32  
2S55.1.A (COL), Equipment Alignment for Automatic Operation of HPCI System, Revision 19  
GP-6.2, Shutdown Operations – Shutdown Cooling Tech Spec Actions, Revision 54  
S51.6.A, Swapping RHR Pumps in RHR SDC Mode, Revision 18  
S51.8.B, Shutdown Cooling/Reactor Coolant Recirculation Operation Start-Up and Shutdown, Revision 81  
S55.1.A, Normal HPCI Line-Up for Automatic Operation, Revision 37  
ST-6-095-905-2, Unit 2 Safeguard Battery Weekly Inspection, Revision 23  
ST-6-095-911-2, Div I 125/250 Vdc 2A1D101/2A2D101 Safeguard Battery Quarterly Inspection, Revision 36  
ST-6-095-915-2, Div I 125/250 Vdc 2A1D101/2A2D101 Safeguard Battery Monthly Inspection, Revision 15

71111.05Q

Procedures

F-A-336, Pre-Fire Plan Common, 13.2kV Switchgear Room 336, Revision 15  
F-A-425, Pre-Fire Plan Common, Unit 1, Class 1E Battery 5, Revision 13  
F-A-426, Pre-Fire Plan Common, Unit 2, Class 1E Battery 426 and 454, Revision 9  
F-A-624, Pre-Fire Plan Common, Standby Gas Treatment Area Rooms 624 and 625, Revision 7  
F-R-309, Unit 1, Safeguard Isolation Valve Area Room 309 (EI 217), Revision 11

Condition Reports

4120254      4120452

71111.11Q

Procedures

GP-3, Normal Plant Shutdown, Revision 164  
S91.6.B, Transferring House Loads to S/U Buses, Revision 19

71111.12Q

Condition Reports

2632557	2655420	2663432	3986074	3988302	3991456
4003680	4011371	4076445	4106926		

Miscellaneous

Engage System Health Reports

71111.13

Procedures

ER-AA-600-1042, On-Line Risk Management, Revision 11  
OP-LG-108-117-1000, Limerick Protected Equipment Program, Revision 6  
WC-AA-101-1006, On-Line Risk Management and Assessment, Revision 2

Condition Reports

4102016      4102082

Miscellaneous

E2 Work Schedule for Week of 2/25/18  
Protected Equipment Scheme on 2/27/18  
Protected Equipment Scheme on 3/1/18  
Protected Equipment Scheme on 3/27/18 and 3/28/18

71111.15

Procedures

OP-AA-102-103, Operator Work-Around Program, Revision 4  
OP-AA-102-106, Operator Response Time Program, Revision 4  
ON-115, Loss of Control Enclosure Cooling, Revision 25

Condition Reports

4082004      4088765      4089921      4099141      4099223      4100277  
4100294      4100598      4117844

Work Order

4308130

Miscellaneous

L-S-29, Chilled Water System, Revision 14

71111.18

Procedures

CC-AA-10, Configuration Control Process, Revision 9  
CC-AA-101, Engineering Change Requests, Revision 5  
IP-ENG-001, Standard Design Process, Revision 0  
ST-6-076-310-2, SGTS Reactor Enclosure Secondary Containment Integrity Test, Revision 21

Condition Reports

4085733      4105709      4121117

Work Orders

4703263      4727391      4733863      4738484      4750273

Miscellaneous

EC 622647, Inflatable Seal – Secondary Containment, Revision 2  
ECR 433952

71111.19Procedures

M-095-005, Replacement of Station Battery Cells, Revision 10  
PES-S-004, Sampling Plan, Revision 2  
ST-2-049-100-2, RCIC Logic System Functional: Simulated Automatic Actuation Test, Revision 13  
ST-2-049-101-2, RCIC Logic System Functional: Isolation Logic Test, Revision 16  
ST-6-092-312-1, D12 Diesel Generator Slow Start Operability Test Run, Revision 103

Condition Reports

0379493	0381794	4081625	4094240	4103817	4104251
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Work Orders

1382270	4243506	4255083	4595702	4699475
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Miscellaneous

CGIFU01, EPRI CGI Joint Utility Task Group Commercial Grade Item Evaluation for UL 198E  
Inspection Report 0101903  
LIM-72331, Failure Analysis of Fuses, 12/27/17  
Listed Fuses, 7/9/91

71111.22ISTProcedures

ST-6-052-231-1, A Loop Core Spray Pump, Valve, and Flow Test, Revision 83  
ST-6-052-232-1, B Loop Core Spray Pump, Valve, and Flow Test, Revision 74

RoutineProcedures

RT-6-051-320-1, B RHR Remote Operability Test, Revision 7  
ST-2-074-642-1, Source Range and Intermediate Range Neutron Monitor Pre-Shutdown  
Functional Test, Revision 8  
ST-6-092-113-2, D23 Diesel Generator 24 Hour Endurance Test, Revision 43

Condition Reports

4116219

Containment Isolation ValveProcedures

ST-4-LLR-031-1, Main Steam Line "A," Revision 13  
ST-4-LLR-041-1, Main Steam Line "B," Revision 12

Work Orders

4309668 4310968

71124.08Procedures

RP-AA-600, Radioactive Material/Waste Shipments, Revision 16  
 RP-AA-600-1001, Exclusive Use and Emergency Response Information, Revision 9  
 RP-AA-600-1002, Highway Route Controlled Quantity/Advanced Notification for Radioactive/Waste Shipments, Revision 6  
 RP-AA-600-1003, Radioactive Waste Shipments to Barnwell and the Defense Consolidation Facility (DCF), Revision 10  
 RP-AA-600-1004, Radioactive Waste Shipments to Energy Solution's Clive Utah Disposal Site Containerized Waste Facility, Revision 13  
 RP-AA-600-1005, Radioactive Material and Non Disposal Site Waste Shipments, Rev 19  
 RP-AA-600-1006, Shipment of Category 1 Quantities of Radioactive Material or Waste (Category 1 RAMQC), Revision 11  
 RP-AA-600-1007, Radioactive Waste Shipments to Energy Solution's Clive Utah Disposal Facility Bulk Waste Facility (BWF), Revision 8  
 RP-AA-600-1008, Radioactive Waste Shipments to Waste Control Specialists (WCS) Disposal Facility, Revision 5  
 RP-AA-600-1009, Shipment of Category 2 Quantities of Radioactive Material or Waste (Category 2 RAMQC), Revision 2  
 RP-AA-600-1010, Use and Operation of WMG Software for Creating Containers, Samples, Waste Streams and Waste Types, Revision 2  
 RP-AA-600-1011, Use and Operation of WMG Software for Gross Gamma Characterization and Generation of Shipping Paperwork, Revision 4  
 RP-AA-600-1012, Use and Operation of WMG Software for Direct Sample Characterization and Generation of Shipping Paperwork, Revision 2  
 RP-AA-600-1014, Use and Operation of WMG Software Filter Module, Revision 2  
 RP-AA-600-1015, Use and Operation of WMG Software for Outage Service Module, Revision 3  
 RP-AA-600-1016, Use and Operation of the WMG Software for Characterization of Miscellaneous Items, Revision 0  
 RP-AA-601, Surveying Radioactive Material Shipments, Revision 20  
 RP-AA-602, Packaging of Radioactive Material Shipments, Revision 20  
 RP-AA-602-1001, Packaging of Radioactive Material/Waste Shipments, Revision 17  
 RP-AA-602-1002, Loading Dry Active Waste and Other Waste Forms for Energy Solutions Waste Acceptance Guide (WAG-501), Revision 0  
 RP-AA-602-1003, Radioactive Materials/Waste Shipments Transported Via Rail, Revision 1  
 RP-AA-603, Inspection and Loading of Radioactive Material Shipments, Rev 10  
 RP-AA-605, 10 CFR 61 Program, Revision 7  
 RP-AA-607, Radioactive Material Shipped in Accordance With IATA requirements, Revision 5  
 RW-AA-100, Process Control Program for Radioactive Wastes, Revision 12  
 RW-AA-605, 10 CFR 61 Program, Revision 7

Quality Assurance

NOSA-LIM-16-04, Chemistry, Radwaste, Effluent and Environmental Monitoring Audit Report EnergySolutions Internal Audit CORP-16-004, Clive Facility  
 NUPIC 24365, EnergySolutions  
 NUPIC 24515, Waste Control Specialists, LLC

10 CFR Part 61 Scaling Factors

Waste Sludge Tank; Deep Bed; Dry Active Waste; Fuel Floor; Reactor Water Clean-Up

Condition Reports

3955208  
4028930  
4085448  
4092536  
4092545  
4092549  
4092556  
4092578

Training

RC-102, Use of WMG Programs and Regulatory Interface  
RC-300, Transportation of Radioactive Material by Air

Shipments

MW-16-010; MW-16-045; MW-16-059; MW-17-006; MW-17-031

71151Procedures

LS-AA-2200, Mitigating System Performance Index Data Acquisition and Reporting, Revision 5  
NEI 99-02, Regulatory Assessment Performance Indicator Guideline, Revision 7

Miscellaneous

MSPI Data  
Operation Narrative Logs  
Power History Graphs

71153Procedures

ARC-BOP-1BC514 C1, Lube Oil Temp High, Revision 1  
ARC-BOP-2BC514 B2, J.W. Temp High, Revision 1  
E-1, Loss of All AC Power (Station Blackout), Revision 51  
E-1, Loss of All AC Power (Station Blackout), Revision 51  
E-10/20, Loss of Offsite Power, Revision 56  
E-10/20, Loss of Offsite Power, Revision 56  
MA-AA-716-017, Station Rework Reduction Program, Revision 7  
S92.9.N, Routine Inspection of the Diesel Generators, Revision 73  
S92.9.N, Routine Inspection of the Diesel Generators, Revision 74  
ST-2-020-401-1, Electrical Power Systems 1BG501 Diesel Generator Critical and Non-Critical  
Instruments Calibration / Functional Test, Revision 31  
ST-6-092-112-1, D12 Diesel Generator 24 Hour Endurance Test, Revision 39  
ST-6-092-312-1, D12 Diesel Generator Slow Start Operability Test Run, Revision 103  
ST-6-092-316-1, D12 Diesel Generator Fast Start Operability Test Run, Revision 54  
ST-6-092-362-2, D22 Diesel Generator Operability Verification, Revision 40  
ST-6-092-362-2, D22 Diesel Generator Operability Verification, Revision 40

Condition Reports

1108417	1422131	2924515	4021268	4049989	4062096
4069001	4070641	4073004	4081882	4082219	

Work Orders

2075815	2079589	4292476	4318057	4642785	4650838
4650858	4652385	4652410	4652412	4663824	4672813
4686262	4697246				

Miscellaneous

ANSI/ASME B1.20.1, Pipe Threads, General Purpose (Inch), 1983  
LIM-64785, Failure Analysis of a Threaded Pipe Nipple from Limerick Station, 12/5/2017  
L-S-07, Diesel Generator and Auxiliary Systems, Revision 15  
L-S-07, Diesel Generator and Auxiliary Systems, Revision 15  
PES-S-006, Code Reconciliation, Revision 6