



**UNITED STATES
NUCLEAR REGULATORY COMMISSION**

REGION I
2100 RENAISSANCE BOULEVARD, SUITE 100
KING OF PRUSSIA, PENNSYLVANIA 19406-2713

October 22, 2019

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

SUBJECT: PEACH BOTTOM ATOMIC POWER STATION, UNITS 2 AND 3 –
INTEGRATED INSPECTION REPORT 05000277/2019003 AND
05000278/2019003

Dear Mr. Hanson:

On September 30, 2019, the U.S. Nuclear Regulatory Commission (NRC) completed an inspection at Peach Bottom Atomic Power Station, Units 2 and 3. On October 4, 2019, the NRC inspectors discussed the results of this inspection with Mr. Matthew Herr, Plant Manager, and other members of your staff. The results of this inspection are documented in the enclosed report.

One finding of very low safety significance (Green) is documented in this report. This finding involved a violation of NRC requirements. We are treating this violation as a non-cited violation (NCV) consistent with Section 2.3.2 of the Enforcement Policy.

If you contest the violation or significance or severity of the violation documented in this inspection report, 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 Peach Bottom.

If you disagree with a cross-cutting aspect assignment in this report, 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 Peach Bottom.

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 at the NRC Public Document Room in accordance with 10 CFR 2.390, "Public Inspections, Exemptions, Requests for Withholding."

Sincerely,

/RA/

Jonathan E. Greives, Chief
Reactor Projects Branch 4
Division of Reactor Projects

Docket Nos. 05000277 and 05000278
License Nos. DPR-44 and DPR-56

Enclosure:
As stated

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SUBJECT: PEACH BOTTOM ATOMIC POWER STATION, UNITS 2 AND 3 –
 INTEGRATED INSPECTION REPORT 05000277/2019003 AND
 05000278/2019003 DATED OCTOBER 22, 2019

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

Docket Numbers: 05000277 and 05000278

License Numbers: DPR-44 and DPR-56

Report Numbers: 05000277/2019003 and 05000278/2019003

Enterprise Identifier: I-2019-003-0038

Licensee: Exelon Generation Company, LLC

Facility: Peach Bottom Atomic Power Station, Units 2 and 3

Location: Delta, Pennsylvania

Inspection Dates: July 1, 2019 to September 30, 2019

Inspectors: J. Heinly, Senior Resident Inspector
P. Boguszewski, Resident Inspector
J. DeBoer, Reactor Inspector
N. Floyd, Senior Reactor Inspector
J. Furia, Senior Health Physicist
C. Roettgen, Resident Inspector
J. Schoppy, Senior Reactor Inspector
B. Smith, Resident Inspector
A. Turilin, Reactor Inspector
R. Vadella, Project Engineer

Approved By: Jonathan E. Greives, Chief
Reactor Projects Branch 4
Division of Reactor Projects

SUMMARY

The U.S. Nuclear Regulatory Commission (NRC) continued monitoring the licensee's performance by conducting an integrated inspection at Peach Bottom Atomic Power Station, Units 2 and 3 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.

List of Findings and Violations

E-1 Emergency Diesel Generator Failure Due to a Cable Fault			
Cornerstone	Significance	Cross-Cutting Aspect	Report Section
Mitigating Systems	Green NCV 05000277,05000278/2019003-01 Open/Closed	[P.3] - Resolution	71152
The inspectors identified a self-revealing, Green non-cited violation (NCV) associated with Title 10 of the <i>Code of Federal Regulations</i> (10 CFR) Part 50, Appendix B, Criterion XVI, "Corrective Action," because Exelon did not identify and correct a condition adverse to quality associated with the E-1 emergency diesel generator (EDG). Specifically, Exelon did not implement their cable monitoring program testing on the E-1 diesel and, as a result, did not identify a condition adverse to quality associated with an underground cable prior to its failure during a surveillance test on May 29, 2019, which resulted in the E-1 diesel being declared inoperable.			

Additional Tracking Items

None.

PLANT STATUS

Unit 2 began the inspection period at full rated thermal power. On September 13, 2019, the unit was reduced to 77 percent thermal power for routine maintenance and was returned to full rated thermal power on September 14, 2019. Unit 2 remained at or near full rated thermal power for the remainder of the inspection period.

Unit 3 began the inspection period at full rated thermal power. On July 22, 2019, the unit was reduced to 70 percent thermal power for routine maintenance and was returned to full rated thermal power on July 23, 2019. On August 6, 2019, the unit began end of cycle coast-down from full rated thermal power and ended the inspection period at 86 percent thermal power.

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 licensee performance and compliance with Commission rules and regulations, license conditions, site procedures, and standards.

REACTOR SAFETY

71111.01 - Adverse Weather Protection

Seasonal Extreme Weather Sample (IP Section 03.02) (1 Sample)

The inspectors evaluated readiness for seasonal extreme weather conditions prior to the onset of seasonal hot temperatures for the following system:

- (1) Hot weather alert and 100 degree temperatures on July 18 and July 19, 2019

External Flooding Sample (IP Section 03.04) (1 Sample)

The inspectors evaluated readiness to cope with external flooding for the following area:

- (1) Diesel generator building and safety-related pump house on September 19, 2019

71111.04Q - Equipment Alignment

Partial Walkdown Sample (IP Section 03.01) (3 Samples)

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

- (1) Unit 2 and Unit 3 'B' emergency cooling tower (ECT) on July 11, 2019

- (2) Unit 2 'C' high-pressure service water (HPSW) with E-2 diesel inoperable on August 8, 2019
- (3) Unit 3 'B' and 'D' core spray (CS) during Unit 3 'A' and 'C' CS in-service testing on August 27, 2019

71111.05Q - Fire Protection

Quarterly Inspection (IP Section 03.01) (5 Samples)

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

- (1) Diesel generator building on July 24, 2019
- (2) Unit 2 high-pressure coolant injection room on August 12, 2019
- (3) Unit 2 'B' and 'D' residual heat removal (RHR) pump and heat exchanger room on August 14, 2019
- (4) Unit 3 'A' and 'C' CS pump room on August 28, 2019
- (5) Control room on September 4 and 5, 2019

71111.06 - Flood Protection Measures

Inspection Activities - Internal Flooding (IP Section 02.02a.) (1 Sample)

The inspectors evaluated internal flooding mitigation protections in the following:

- (1) Torus room on August 22 and 23, 2019

71111.11Q - Licensed Operator Regualification Program and Licensed Operator Performance

Licensed Operator Performance in the Actual Plant/Main Control Room (IP Section 03.01) (1 Sample)

- (1) The inspectors observed and evaluated licensed operator performance in the control room during a containment atmosphere dilution surveillance on September 20, 2019.

Licensed Operator Regualification Training/Examinations (IP Section 03.02) (1 Sample)

- (1) The inspectors observed and evaluated a licensed operator regualification training scenario and critique that involved a seismic event, a recirculation loop leak, and an anticipated transient without SCRAM on September 9, 2019.

71111.12 - Maintenance Effectiveness

Routine Maintenance Effectiveness Inspection (IP Section 02.01) (2 Samples)

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

- (1) Unit 2 and Unit 3 ECT on August 21, 2019
- (2) Unit 2 and Unit 3 EDGs on September 11, 2019

71111.13 - Maintenance Risk Assessments and Emergent Work Control

Risk Assessment and Management Sample (IP Section 03.01) (3 Samples)

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

- (1) Unit 2 and Unit 3 'A' emergency service water (ESW) out of service on July 16, 2019
- (2) Unit 2 and Unit 3 E-2 EDG out of service on August 5, 2019
- (3) Unit 2 ESW clam control on September 17, 2019

71111.15 - Operability Determinations and Functionality Assessments

Operability Determination or Functionality Assessment (IP Section 02.02) (4 Samples)

The inspectors evaluated the following operability determinations and functionality assessments:

- (1) Unit 2 and Unit 3 E-4 jacket coolant leak on August 19, 2019
- (2) Unit 2 and Unit 3 emergency diesel output cables on August 21, 2019
- (3) Unit 2 and Unit 3 ESW radiation monitor on August 22, 2019
- (4) Unit 2 and Unit 3 SCRAM discharge level switch on August 22, 2019

71111.17T - Evaluations of Changes, Tests, and Experiments

Sample Selection (IP Section 02.01) (29 Samples)

The inspectors reviewed the following evaluations, screenings, and/or applicability determinations for 10 CFR 50.59 from September 23 through September 26, 2019:

- (1) PB-2016-001-E, Compensatory Measures for Operability Evaluation for 2K Automatic Depressurization System (ADS)
- (2) PB-2016-006-E, Change in TRMS 3.11 Applicability for RHR Cooler/Fan Units
- (3) PB-2016-007-E, Changes to the Analytical Limits in the Neutron Monitoring System
- (4) PB-2016-011-E, Level 3 and Level 4 Reactor Pressure Vessel Water Level Analytical Limit Change
- (5) PB-2017-005-E, Seismic Monitoring System Replacement
- (6) PB-2017-007-E, Revision 7 to NE-164 Specification for Environmental Service Conditions
- (7) PB-2018-001-E, Increase Maximum Permissible Containment Purge Valve Closure Time
- (8) PB-2019-001-E, Defeat of Reactor Building Closed-Cooling Water (RBCCW) to Drywell Chilled Water Swap
- (9) PB-2016-001-S, Relocate DPS-4519
- (10) PB-2016-006-S, Relocate Sensing Lines Associated with Shutdown Cooling Pressure Switch PS-2-02-128A(B) and Replace Switch with a Transmitter/Trip Unit Instrument Loop
- (11) PB-2016-010-S, Unit 2 CST Cross-Connect Pipe
- (12) PB-2016-011-S, Revision to TS Bases 3.3.3-2 Remote Shutdown System
- (13) PB-2016-013-S, LPCI Valve Interposing Relay Pickup Voltage Testing Frequency Change

- (14) PB-2016-016-S, Emergency Core Cooling System (ECCS) Air Void Acceptance Criteria
- (15) PB-2016-026-S, GP-20 Temporarily Defeating ECCS Auto Initiation Signal during Outages
- (16) PB-2016-058-S, Replace AO-3-07B-3519 Operator with Hold-Closed Gag
- (17) PB-2016-064-S, Remove Single Point Vulnerability in Fuel Pool Cooling and Cleanup System
- (18) PB-2017-030-S, Bypassing and Restoring Main Control Room Chiller Trips
- (19) PB-2017-036-S, Temporary Defeat of CW System Auto Transfer to RBCCW
- (20) PB-2017-052-S, Use RI-0761 (Radwaste Vent Radiation Indicator) to Replace RI-2979B (Vent Stack Wide Range Radiation Indicator)
- (21) PB-2018-004-S, Minimum Wall Determinations Using Finite Element Analysis Method
- (22) PB-2018-005-S, Revise TS 3.7.1 Bases to Provide Clarity Regarding When HPSW is Considered Operable When Using Cross-Tie Capability
- (23) PB-2018-011-S, Defeat of a Main Turbine Trip Signal
- (24) PB-2018-017-S, Revise TR 3.1.3 Frequency to 24 Months
- (25) PB-2018-018-S, HPSW/ESW Pipe Barrier and Monitoring
- (26) PB-2018-035-S, Upgrade Main Control Room Lighting
- (27) PB-2018-036-S, Heavy Load Lifts Over Fuel – Procedure Revisions
- (28) PB-2018-040-S, Revision 13 of PE-0166 EDG Loading for Cases Defined by 8.5.2 C/L
- (29) PB-2019-018-S, High Area Temperature Alarm Setpoint Change

71111.18 - Plant Modifications

Temporary Modifications and/or Permanent Modifications (IP Section 03.01 and/or 03.02) (1 Sample)

The inspectors evaluated the following temporary or permanent modification:

- (1) Unit 2 and Unit 3 E-1 cable replacement on August 1, 2019

71111.19 - Post-Maintenance Testing

Post-Maintenance Test Sample (IP Section 03.01) (4 Samples)

The inspectors evaluated the following post-maintenance tests:

- (1) Unit 2 and Unit 3 'B' ECT on July 12, 2019
- (2) Unit 2 'B' CS level switches on July 23, 2019
- (3) Unit 2 and Unit 3 E-1 diesel generator cable replacement on August 2, 2019
- (4) Unit 2 and Unit 3 ESW radiation monitor on August 26, 2019

71111.22 - Surveillance Testing

The inspectors evaluated the following surveillance test:

Surveillance Tests (other) (IP Section 03.01) (3 Samples)

- (1) Calibration of Unit 2 LT-2804A on September 17, 2019
- (2) Unit 2 average power range monitor surveillance test on September 30, 2019
- (3) Unit 2 4kV undervoltage relays surveillance test on September 27, 2019

71114.06 - Drill Evaluation

Select Emergency Preparedness Drills and/or Training for Observation (IP Section 03.01) (1 Sample)

- (1) The inspectors observed an emergency preparedness drill that involved a radioactive release outside containment and fuel failure on September 19, 2019.

RADIATION SAFETY

71124.08 - Radioactive Solid Waste Processing and Radioactive Material Handling, Storage, and Transportation

Radioactive Material Storage (IP Section 02.01) (1 Sample)

The inspectors evaluated radioactive material storage.

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

Radioactive Waste System Walkdown (IP Section 02.02) (1 Sample)

The inspectors evaluated the following radioactive waste processing systems [and processes] during plant walkdowns:

- (1) The inspectors walked down: accessible portions of liquid and solid radioactive waste processing systems; abandoned in place radioactive waste processing equipment; and, current methods and procedures for dewatering waste.

Waste Characterization and Classification (IP Section 02.03) (1 Sample)

The inspectors evaluated the radioactive waste characterization and classification for the following waste streams:

- (1) 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 (IP Section 02.04) (1 Sample)

The inspectors evaluated [and observed] the following radioactive material shipment preparation processes:

- (1) 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 licensee verification of shipment readiness.

Shipping Records (IP Section 02.05) (1 Sample)

The inspectors evaluated the following non-excepted package shipment records:

- (1) PW-18-0002; PW-19-0004; PW-18-0027; PW-18-0025; PW-18-0006

OTHER ACTIVITIES – BASELINE

71152 - Problem Identification and Resolution

Annual Follow-up of Selected Issues (IP Section 02.03) (1 Sample)

The inspectors reviewed the licensee’s implementation of its corrective action program (CAP) related to the following issue:

- (1) Cable monitoring program on September 19, 2019

INSPECTION RESULTS

E-1 Emergency Diesel Generator Failure Due to a Cable Fault			
Cornerstone	Significance	Cross-Cutting Aspect	Report Section
Mitigating Systems	Green NCV 05000277,05000278/2019003-01 Open/Closed	[P.3] - Resolution	71152
The inspectors identified a self-revealing, Green non-cited violation (NCV) associated with Title 10 of the <i>Code of Federal Regulations</i> (CFR) Part 50, Appendix B, Criterion XVI, “Corrective Action,” because Exelon did not identify and correct a condition adverse to quality associated with the E-1 emergency diesel generator (EDG). Specifically, Exelon did not implement their cable monitoring program testing on the E-1 diesel and, as a result, did not identify a condition adverse to quality associated with an underground cable prior to its failure during a surveillance test on May 29, 2019, which resulted in the E-1 diesel being declared inoperable.			
<u>Description:</u> Peach Bottom has four EDGs that supply emergency power (4kV) to both Unit 2 and Unit 3. The electricity is transferred from the generator through nine aluminum conductors, underground from the EDG building to the turbine building. The E-1 diesel provides emergency power to the E-11 and E-12 safety busses.			
During a monthly surveillance run of the E-1 EDG on May 29, 2019, the engine was running for approximately 30 seconds, unloaded with the field flashed, when it unexpectedly tripped			

from an overcurrent protection relay. The E-1 diesel was immediately declared inoperable and Exelon commenced troubleshooting. Exelon determined, through cable testing, that the cause of the trip was a faulted 'B' phase cable that connected the generator to the 4kV breaker. Due to parts availability and limiting condition for operation time constraints, Exelon performed a temporary modification to abandon the 'B' phase cables and reduce the number of energized conductors from nine to six. Exelon performed an engineering analysis to conclude that the remaining six conductors had sufficient capacity to support the maximum diesel loading. Exelon restored the diesel to operable on June 2, 2019.

Exelon entered the E-1 cable fault condition into the CAP under issue report (IR) 4256520 and performed a root cause evaluation. The root cause evaluation determined that the direct cause of the failure was degraded cable insulation likely due to the cables being exposed to adverse environmental conditions for an extended period of time. It further concluded that the engineering cable program owners and their managers did not effectively use the CAP to identify and resolve gaps in the cable program prior to the E-1 EDG cable failure.

Specifically, the cable monitoring program, ER-AA-300-150, requires the station to perform tan-delta testing of the EDG cables and at the time of failure, these cables had not yet been tested in accordance with the frequency required by the program. Tan-delta testing is an industry-accepted method of testing the health of insulation for electrical power cables. The station had originally attempted testing of the cables in 2013; however, they were unsuccessful due to perceived interference with the test equipment as documented in IR 1511027. This IR was closed to a work order (WO) that was never performed. Furthermore, in 2016, a self-assessment discovered that the 2013 WO was inappropriately closed out and created IR 2651755; however, no WO was created from this IR. Again, in 2017, Exelon identified that the 2016 WO was not created and created IR 3963696. Under this IR, Exelon created an action tracking assignment to reschedule the cable testing, and this action was rescheduled 16 times until the cable ultimately failed in May 2019.

Corrective Actions: Exelon abandoned the faulted E-1 diesel cables and performed an engineering analysis to support E-1 operability using only six conductors. In addition, Exelon determined through their extent of condition review that the E-2, E-3, and E-4 cables had not been tested. Therefore, Exelon expedited the replacement of cables for all four EDGs and all cables were replaced by August 2019.

Corrective Action References: IR 4252679

Performance Assessment:

Performance Deficiency: The inspectors determined that failing to identify and correct a condition adverse to quality associated with the E-1 EDG through implementation of their cable monitoring program was a performance deficiency that was within Exelon's ability to foresee and correct. Specifically, Exelon did not perform cable testing on the E-1 EDG, in accordance with their cable monitoring program, which resulted in the station not identifying the degraded E-1 cable. This resulted in the unexpected cable failure on May 29, 2019, during the E-1 EDG surveillance test and the E-1 EDG being declared inoperable.

Screening: The inspectors determined the performance deficiency was more than minor because it was associated with the Equipment Performance attribute of the Mitigating Systems cornerstone and adversely affected the cornerstone objective to ensure the availability, reliability, and capability of systems that respond to initiating events to prevent undesirable consequences. Specifically, the E-1 EDG was unavailable to perform its safety function when it tripped on over-current due to a faulted output cable.

Significance: The inspectors assessed the significance of the finding using Appendix A, "The Significance Determination Process (SDP) for Findings At-Power." The inspectors determined that the finding resulted in the actual loss of a function of a single train (E-1 EDG) for longer than its technical specification (TS) allowed outage time and required a detailed risk evaluation.

The senior reactor analyst (SRA) used the guidance in the Risk Assessment Standardization Project (RASP) handbook Volume I, Revision 2.0, section 2.3, to determine an exposure time of 31 days. The E-1 EDG tripped during a startup with a differential and ground alarm while running unloaded after the field was flashed. This trip occurred after the generator came up to proper voltage and frequency after a nominal 30 seconds and was therefore considered to be a failure to start. The RASP guidance states the exposure time should be the time between the last successful functional operation and the failure discovery date, including repair time, when the inception of the failure is unknown. The SRA noted through interviews with plant personnel and a review of data, that there was no known indication of any abnormal conditions during the last successful monthly surveillance run of the E-1 EDG. Therefore, there was no data indicating that there would have been imminent failure of the machine once it had reached operating steady state voltage and load conditions. However, after that shutdown and thermal cooldown of the associated cables, the next monthly E-1 start and voltage flash resulted in the failure to start condition. Therefore, the SRA determined that a best estimate of exposure time was from the last successful start and run of the EDG until the subsequent failure, including repair time. This period was a nominal 31 days.

A Region I SRA performed a detailed risk evaluation using the Peach Bottom Unit 2 and Unit 3 Standardized Plant Analysis Risk (SPAR) models, with the Unit 2 model being used as a surrogate for external events for Unit 3. The SRA used a modified Unit 2 SPAR model, version 8.50 and Systems Analysis Programs for Hands-On Integrated Reliability Evaluations version 8.20. This model was revised to include FLEX modifications, which the station had developed in response to Order 12-049, "Order to Modify Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events," because this affects how the operators respond to an extended loss of alternating current power. The SPAR model determined the total (internal and external events) contribution to the increase in core damage frequency (CDF) to be $3.5E-7$ /yr for Unit 2. This was determined to bound the impact to Unit 3. The SRA performed a site visit to review and compare Exelon's fire model outputs to the SPAR model to determine a best estimate of the external risk contribution for the failure of the E-1 EDG. The SRA noted that the latest Exelon fire model had a slightly higher estimate for external risk in the range of an increase in CDF of $6E-7$ /yr for Unit 2 and $3E-7$ /yr for Unit 3. The SRA noted this included sensitivity analysis considerations for increased FLEX equipment failure rates and FLEX operator failure rates above the licensee's baseline model.

The SRA used the SPAR model to determine the internal events increase in CDF/yr. The dominant sequences consisted of a grid related loss-of-offsite-power (LOOP), common cause failure of all the EDGs, with the failure to establish the Conowingo tie line setup (station blackout source), failure to recover offsite power and EDGs, and failure of the reactor core isolation cooling pump to run. The internal events increase in CDF/yr for the E-1 fail to start was determined to be $7E-8$ /yr for the 31-day exposure. The SRA determined the final best estimate total risk increase in CDF using the SPAR model for internal events and Exelon's fire risk model output for external events to be $7E-7$ /yr for Unit 2 and $4E-7$ /yr for Unit 3 or of very low safety significance (Green). The risk was dominated by the postulated fire events

and was noted to be slightly higher for Unit 2 because of the differences in power sources for the divisional batteries and subsequent effect of the E-1 EDG failure having a greater impact on Unit 2.

Exelon's risk evaluation revealed that fire events dominated the risk increase of the E-1 failure, similar to what the SPAR model revealed. The dominant risk contributor for Unit 2 was a fire within the E-42 4kV switchgear room. This included electrical high energy arc fault (HEAF) fires involving the 20A18 switchgear and the 00C026DX E-4 diesel generator alternate control panel fires. The highest contributing core damage sequences included the fire scenario initiating event within this room, failure of high-pressure injection long term, and for some initiating events, the normally aligned offsite power feeder breaker spuriously opening resulting in a LOOP to the E-12 4kV switchgear. Other sequences include losing power because the 00A19 (4kV bus duct feeding the safety busses from offsite power) could be damaged by the HEAF or the breaker upstream of 00A19 opens due to damage to its associated differential relay cabling and failure of the opposite offsite power breaker to close due to cable damage. Therefore, because of the nature of the postulated fire, even though offsite power is being delivered to the station and in various cases the 00A19 and 00A20 bus ducts are still delivering 4kV power to other 4kV switchgears, these events are not considered total LOOP events. However, the above scenarios result in failure of the DC power supply to the safety relief valves resulting in the failure to depressurize, with failure of the high-pressure systems and resultant core damage.

The Unit 2 SPAR model was consistent in reflecting the HEAF within the E-42 switchgear room to be a dominant contributor to the conditional increase in CDF due to the E-1 failure. This sequence consisted of the HEAF event, with failure to align alternate power to battery charger 2AD03, and failure of the E-3 EDG to run resulting in the loss of high-pressure injection with failure to depressurize with no ability to cross tie AC power.

For Unit 3, Exelon's fire model determined that a fire within the Unit 3 E-43 4kV switchgear room was a dominant contributor to the conditional increase in CDF/yr. A HEAF results in the loss of offsite power feed to the safety busses with the E-3 EDG in assumed maintenance (loss of all EDG's) and a failure to align FLEX equipment as one of the dominant sequences.

Exelon performed detailed model runs for the effect on the increase on large early release frequency (LERF). The SRA noted that fires dominated the conditional increase in risk with Unit 2 resulting in a CDF increase of 2E-8/yr and Unit 3 a slightly lower 1E-8/yr for the 31-day exposure time. The SRA reviewed a few of the top core damage sequences and considered them to be reasonable. This was a Level 2 methodology analyzing issues such as magnitude and timing of calculated radionuclide releases through level 2 containment event trees. This resulted in a LERF multiplier for both units relative to the CDF sequences of a nominal 5E-2. Therefore the LERF results were consistent with the CDF determinations of a very low safety significance issue (Green).

Cross-Cutting Aspect: P.3 - Resolution: The organization takes effective corrective actions to address issues in a timely manner commensurate with their safety significance. Specifically, Exelon had documented their cable monitoring program deficiency in the CAP multiple times and did not effectively correct the issue.

Enforcement:

Violation: 10 CFR Part 50, Appendix B, Criterion XVI, "Corrective Action," requires that measures be established to assure that conditions adverse to quality are promptly identified

and corrected. Peach Bottom Units 2 and 3 TS 3.8.1 requires all four EDGs to be operable in Mode 1 and, if any one EDG is determined to be inoperable, it shall be returned to an operable status within 14 days or the unit shall be shut down and in Mode 3 within 12 hours.

Contrary to the above, from May 2013 to May 29, 2019, Exelon did not perform cable testing on the EDG output cables as required by their cable monitoring program, and as a result they did not identify degraded output cables associated with the E-1 diesel, which represented a condition adverse to quality. Furthermore, the failure to perform cable testing was repetitively documented in their CAP and adequate corrective actions were not established prior to the E-1 failure. Therefore, Exelon did not identify and correct the condition adverse to quality associated with the cables that led to the E-1 EDG failure on May 29, 2019. Consequently, the E-1 EDG was rendered inoperable prior to May 29, 2019, for a period longer than its TS allowed outage time, and the unit had not been shut down and placed in Mode 3.

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

Observation: Cable Monitoring Program PI&R Sample

71152

The NRC inspectors reviewed corrective actions associated with deficiencies in the implementation of Exelon procedure ER-AA-300-150, "Cable Condition Monitoring Program." The cable monitoring program was established to monitor the health of power cables at Peach Bottom through cable testing.

In December 2018, Peach Bottom experienced an unexpected failure of the 1 start-up (SU) bus power cable, and Exelon entered the condition into the CAP under IR 4241082. Exelon performed a cause evaluation and determined that the 1 SU power cables had incorrectly been excluded from testing under the cable monitoring program. Exelon replaced the 1 SU power cables and added the applicable cables to the cable monitoring testing program.

In May 2019, Peach Bottom experienced an unexpected failure of the E-1 EDG output power cable, which rendered the E-1 diesel inoperable. Exelon entered this condition into the CAP under IR 4252679. Exelon performed immediate corrective actions to modify the E-1 EDG and abandon the faulted cable to support returning it back to operable. Exelon determined that an adverse trend existed in the cable monitoring program performance due to the two unexpected cable failures and numerous adverse performance IRs written against the program from site, NOS, and external organizations. Exelon entered the issues into the CAP under IR 4256520 and performed a root cause evaluation. The root cause determined that the E-1 EDG power cables were not tested because predefined work activities were not established through the work management process. The contributing cause identified that engineering cable program owners and their managers did not effectively use the CAP to identify and resolve gaps in the cable monitoring program prior to the E1 EDG power cable failure. Exelon established extensive corrective actions to include replacement of all EDG output power cables, establishing predefined maintenance tasks for cable testing, CAP action closure quality training, and performance of a comprehensive review of all engineering programs.

The inspectors reviewed the root cause evaluation and determined that it adequately identified the root and contributing causes of the E-1 EDG power cable failure and the degraded performance of the cable monitoring program. The inspectors noted that the cable monitoring program experienced a number of program owner turnovers and contained an inadequate level of documentation in the program notebook to support sufficient ownership

and oversight of the program. Furthermore, numerous IRs indicated that potential programmatic weaknesses had not been addressed. These IRs were inadequately addressed or inadvertently closed in the CAP and no substantial corrective actions had been completed. The inspectors identified an NCV regarding Exelon's failure to perform adequate corrective actions associated with the cable monitoring program which directly resulted in the unexpected E-1 EDG power cable failure. The NCV is documented under section 71152 of this report. The inspectors review concluded that the proposed corrective actions regarding program ownership and CAP action closure quality were adequate to address the root and contributing causes. Furthermore, the inspectors determined that the station took appropriate conservative actions to replace all of the EDG power cables.

EXIT MEETINGS AND DEBRIEFS

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

- On October 4, 2019, the inspectors presented the integrated inspection results to Mr. Matthew Herr, Plant Manager, and other members of the licensee staff.
- On September 26, 2019, the inspectors presented the 10 CFR 50.59 inspection results to Mr. Pat Navin, Site Vice President, and other members of the licensee staff.

DOCUMENTS REVIEWED

Inspection Procedure	Type	Designation	Description or Title	Revision or Date
71111.01	Miscellaneous		PBAPS Summer Performance Monitoring Update	July 17, 2019
	Procedures	OP-AA-108-107-1001	Station Response to Grid Capacity Conditions	Revision 7
71111.04Q	Corrective Action Documents	4264530		
	Drawings	6280-M-330	Emergency Cooling System	Revision 38
		6280-M-362, Sheet 1	CS Cooling System	Revision 64
Procedures	ST-O-014-301-3	CS Loop A Pump, Valve, Flow, and Cooler Functional and Inservice Test	Revision 34	
71111.05Q	Fire Plans	PF-132	Diesel Generator Building, General Area - Elevation 127'-0"	Revision 9
		PF-13D	Unit 3 Reactor Building, 3 'A' and 3 'C' CS Room, Elevation 91'-6"	Revision 3
		PF-3	Unit 2 Reactor Building, 2 'B' and 2 'D' RHR Pump and Heat Exchanger Room, Elevation 91'-6"/116'-0"	Revision 6
		PF-59	Unit 2 Reactor Building, HPCI Room, Elevation 88'-0"	Revision 7
71111.06	Corrective Action Documents	2705919		
	Miscellaneous		PBAPS UFSAR Appendix J	Revision 21
	Procedures	RT-O-010-415-3	HPSW to RHR Emergency Cross-Tie Valve Functional Test	Revision 5
		ST-O-032-501-3	HPSW Valves Remote Position Indication Verification	Revision 6
T-231-3	HPSW Injection Into the Torus	Revision 10		
71111.12	Corrective Action Documents	4273687		
	Procedures	ER-AA-450	Structures Monitoring	Revision 7
ER-PB-450-1006		Peach Bottom Structures Monitoring Instructions	Revision 6	
71111.13	Corrective Action Documents	4264554		
71111.15	Corrective Action Documents	1415409 (E02), 4249845, 4271243,		

Inspection Procedure	Type	Designation	Description or Title	Revision or Date
		4272385, 4272625		
	Drawings	6280-M-319, Sheet 2	Makeup Demineralizer Water	Revision 53
	Procedures	AO 52E.3.A	Diesel Generator Jacket Coolant System Fill During a LOOP	Revision 0
		SO 52A.8.C	Diesel Generator Running Inspection	Revision 43
71111.17T	Corrective Action Documents	1462769		
		2401565		
		2633582		
		4011762		
	Corrective Action Documents Resulting from Inspection	4282184		
	Procedures	GP-20	Temporarily Defeating ECCS Auto Initiation Signal during Outages	Revision 15 and 16
		M-004-200	Reactor Pressure Vessel Disassembly	Revision 39
SE-1		Plant Shutdown from the Remote Shutdown Panel	Revision 23	
71111.18	Engineering Changes	IP-ENG-001 FORM 2, EC 628399	Spare E-1 Diesel Failed Cables	Revision 0
		IP-ENG-001 FORM 2, EC 628400	E-1 to E-4 EDGs Cables Replacement	Revision 12
	Procedures	ER-AA-300-150	Cable Condition Monitoring Program	Revision 5
		MA-AA-716-012	Attachment 1, 480V/4160v/6900V & 13.2 KV Switchgear Breakers Test Matrix	Revision 24
	Work Orders	4926277		
		4926277-12		
	71111.19	Corrective Action Documents	4264289	
4266600				
4269448				
4269804				
Miscellaneous			EDG Cable Replacement Project(s)	July 2019

Inspection Procedure	Type	Designation	Description or Title	Revision or Date
	Procedures	VBS-0757A	ECT Fan A Vibration	
		LS-2920B	'B' CS Room Flooding Level	
		MA-AA-716-012	Post-Maintenance Testing	Revision 22
		S12R-63A-356-XXCE	Electronic Calibration/Functional Check of the ESW Radiation Monitor RIS-0-17-356	Revision 0
		ST-O-052-211-2	E-1 Diesel Generator Slow Start Full Load and IST Test	Revision 27
	Work Orders	4921655		
		4926277-43		
71111.22	Corrective Action Documents	4282390		
	Procedures	SI2I-54-E42-XXFQ	Functional Test of E-42 4KV Undervoltage Relays	Revision 2
71152	Corrective Action Documents	0656157, 1511027, 3963696, 3969726, 4120194, 4203289, 4204454, 4240533, 4249035, 4241082, 4241090, 4247715, 4248920, 4251551, 4252679, 4252875, 4253195, 4255204, 4252216, 4256520, 4257453, 4257456,		

Inspection Procedure	Type	Designation	Description or Title	Revision or Date
		4257458,		
	Procedures	ER-AA-300-150	Cable Condition Monitoring Program	Revision 5
		MA-PB-743-002	Tan Delta Cable Testing	Revision 4
		PI-AA-126-1001-F-01	Self-Assessment	Revision 2