UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION I
475 ALLENDALE RD, STE 102
KING OF PRUSSIA, PENNSYLVANIA 19406-1415

August 15, 2023

David P. Rhoades
Senior Vice President
Constellation Energy Generation, LLC
President and Chief Nuclear Officer (CNO)
Constellation Nuclear
4300 Winfield Rd
Warrenville, IL 60555

SUBJECT: PEACH BOTTOM ATOMIC POWER STATION, UNITS 2 AND 3 – COMPREHENSIVE ENGINEERING TEAM INSPECTION REPORT 05000277/2023011 AND 05000278/2023011

Dear David Rhoades:

On July 5, 2023, the U.S. Nuclear Regulatory Commission (NRC) completed an inspection at Peach Bottom Atomic Power Station, Units 2 and 3 and discussed the results with Adam Frain, Director of Operations, and other members of your staff. The results of this inspection are documented in the enclosed report.

Two findings of very low safety significance (Green) are documented in this report. One of these findings involved a violation of NRC requirements and was determined to be Severity Level IV. 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 the 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 Atomic Power Station, Units 2 and 3.

If you disagree with a cross-cutting aspect assignment or a finding not associated with a regulatory requirement 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 Atomic Power Station, Units 2 and 3.

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 Title 10 of the *Code of Federal Regulations* (10 CFR) 2.390, "Public Inspections, Exemptions, Requests for Withholding."

Sincerely,

Melvin K. Gray

Digitally signed by Melvin K. Gray
Date: 2023.08.15 13:22:38 -04'00'

Mel Gray, Chief
Engineering Branch 1
Division of Operating Reactor Safety

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 – COMPREHENSIVE ENGINEERING TEAM INSPECTION REPORT 05000277/2023011 AND 05000278/2023011 DATED AUGUST 15, 2023

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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:	05000277/2023011 and 05000278/2023011
Enterprise Identifier:	I-2023-011-0010
Licensee:	Constellation Energy Generation, LLC
Facility:	Peach Bottom Atomic Power Station, Units 2 and 3
Location:	Delta, PA 17314
Inspection Dates:	April 10, 2023 to July 5, 2023
Inspectors:	F. Arner, Senior Reactor Analyst J. Brand, Reactor Inspector L. Dumont, Senior Reactor Inspector D. Kern, Senior Reactor Inspector N. Mentzer, Reactor Inspector B. Pinson, Senior Reactor Inspector J. Schoppy, Senior Reactor Inspector
Approved By:	Mel Gray, Chief Engineering Branch 1 Division of Operating Reactor Safety

Enclosure

SUMMARY

The U.S. Nuclear Regulatory Commission (NRC) continued monitoring the licensee's performance by conducting a design basis assurance inspection (teams) 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

Failure to Monitor and Test the Condition of Station Blackout Cables			
Cornerstone	Significance	Cross-Cutting Aspect	Report Section
Mitigating Systems	Green FIN 05000277,05000278/2023011-01 Open/Closed	[P.2] - Evaluation	71111.21M
The inspectors identified a self-revealed finding of very low safety significance (Green), because Constellation did not test and monitor the condition of several potentially wetted critical medium voltage (MV) power cables as stipulated by ER-AA-300-150, Cable Condition Monitoring Program, Revision 7. Specifically, ER-AA-300-150, sections 4.3.6 and 4.2.4 specified that critical MV cables installed for extended periods in wetted/submerged environments and normally energized MV cables in conduit that are embedded in concrete be tested to determine the impact of the exposure to the adverse environment. Constellation did not implement the cable condition monitoring on four of six potentially wetted critical MV cables associated with the Station Blackout (SBO) line. Consequently, on April 4, 2023, one of the four MV cables which were not tested failed and caused an electrical fault in the SBO switchyard that made the SBO line unavailable to Peach Bottom Atomic Power Station (PBAPS).			

Failure to Obtain NRC Approval prior to Implementing a Change to the Station Blackout Line Testing			
Cornerstone	Significance/Severity	Cross-Cutting Aspect	Report Section
Mitigating Systems	Green Severity Level IV NCV 05000277,05000278/2023011-02 Open/Closed	None (NPP)	71111.21M
The inspectors identified a Green finding and associated Severity Level IV Non-cited violation (NCV) of 10 CFR 50.59(c)(2)(ii), "Changes, Tests, and Experiments," which states, in part, that a licensee shall obtain a license amendment prior to implementing a proposed change that would result in more than a minimal increase in the likelihood of occurrence of a malfunction of a structure, system, or component (SSC) important to safety previously evaluated in the updated final safety analysis report (UFSAR). Specifically, on February 8, 2018, the licensee deleted a commitment and discontinued periodic load testing of the SBO Conowingo line which, was performed to verify the capability of the line to start and carry approximately 7000kW of load.			

Additional Tracking Items

None.

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 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

71111.21M - Comprehensive Engineering Team Inspection

The inspectors evaluated the following components and listed applicable attributes, permanent modifications, and operating experience:

Structures, Systems, and Components (SSCs) (IP Section 03.01) (8 Samples)

For each component or operator action sample listed below, the team reviewed licensing and design basis documents and a sampling of applicable operator actions, periodic testing results, corrective action program documents, internal and external operating experience, preventive and corrective maintenance work orders, modifications, and aging management programs. Additionally, the team performed walkdowns of the component or procedure and conducted interviews with licensee personnel.

The team used the attributes contained in IP 71111.21M, Appendix A, Component Review Attributes, such as those listed below as guidance. Specifically, the team evaluated these attributes in the course of applying 71111.21M, Appendix B, Component Design Review Considerations and 71111.21M, Appendix C, Component Walkdown Considerations.

(1) Station blackout line from Conowingo Dam and associated operator actions

- Process medium (water, air, electrical signal) will be available and unimpeded during accident/event conditions.
- Energy sources (fuel, air, steam, electricity), including those used for control functions, will be available and adequate during accident/event conditions.
- Component controls will be functional and provide desired control during accident/event conditions.
- Operating procedures (normal, abnormal, or emergency) are consistent with operator actions for accident/event conditions.
- Instrumentation and alarms are available to operators for making necessary decisions.
- Installed configuration will support its design basis function under accident/event conditions.
- Component operation and alignments are consistent with design and licensing basis assumptions.
- Design bases and design assumptions have been appropriately translated into design calculations and procedures.

- Performance capability of selected components have not been degraded through modifications.
- Acceptance criteria for tested parameters are supported by calculations or other engineering documents to ensure that design and licensing bases are met.
- Tests and/or analyses validate component operation under accident/event conditions.
- Potential degradation is monitored or prevented.
- Equipment is adequately protected from environmental hazards.

The team used Appendix B guidance for Instrumentation, Circuit Breakers and Fuses, Cables, Electrical Loads, and As-Built System.

(2) Breaker 152-1701; cross-tie to vital buses via non-segregated bus

- Process medium (water, air, electrical signal) will be available and unimpeded during accident/event conditions.
- Energy sources (fuel, air, steam, electricity), including those used for control functions, will be available and adequate during accident/event conditions.
- Component controls will be functional and provide desired control during accident/event conditions.
- Operating procedures (normal, abnormal, or emergency) are consistent with operator actions for accident/event conditions.
- Instrumentation and alarms are available to operators for making necessary decisions.
- Installed configuration will support its design basis function under accident/event conditions.
- Component operation and alignments are consistent with design and licensing basis assumptions.
- Design bases and design assumptions have been appropriately translated into design calculations and procedures.
- Performance capability of selected components have not been degraded through modifications.
- Acceptance criteria for tested parameters are supported by calculations or other engineering documents to ensure that design and licensing bases are met.
- Tests and/or analyses validate component operation under accident/event conditions.
- Equipment is adequately protected from environmental hazards.
- Component inputs and outputs are suitable for application and will be acceptable under accident/event conditions.

The team used Appendix B guidance for Valves, Pumps, Instrumentation, Circuit Breakers and Fuses, Cables, Electrical Loads, and Motor Control Centers (MCCs).

(3) Unit 3 MOV 10-174; Emergency Service Water / Residual Heat Removal cross-connect

- Energy sources (air, steam, electricity), including those used for control functions, will be available and adequate during accident/event conditions.
- Component controls will be functional and provide desired control during accident/event conditions.

- Operating procedures (normal, abnormal, or emergency) are consistent with operator actions for accident/event conditions.
- Instrumentation and alarms are available to operators for making necessary decisions.
- Installed configuration will support its design basis function under accident/event conditions.
- Component operation and alignments are consistent with design and licensing basis assumptions.
- Design bases and design assumptions have been appropriately translated into design calculations and procedures.
- Performance capability of selected components have not been degraded through modifications.
- Acceptance criteria for tested parameters are supported by calculations or other engineering documents to ensure that design and licensing bases are met.
- Tests and/or analyses validate component operation under accident/event conditions.
- Potential degradation is monitored or prevented.
- Equipment qualification is suitable for the environment expected under all conditions.
- Equipment is adequately protected from environmental hazards. Component inputs and outputs are suitable for application and will be acceptable under accident/event conditions.

The team used Appendix B guidance for Valves, Pumps, Instrumentation, and As-Built System.

(4) Unit 3 AOV-3511; Torus vent valve

- Energy sources (air, steam, electricity), including those used for control functions, will be available and adequate during accident/event conditions.
- Component controls will be functional and provide desired control during accident/event conditions.
- Operating procedures (normal, abnormal, or emergency) are consistent with operator actions for accident/event conditions.
- Instrumentation and alarms are available to operators for making necessary decisions.
- Installed configuration will support its design basis function under accident/event conditions.
- Component operation and alignments are consistent with design and licensing basis assumptions.
- Design bases and design assumptions have been appropriately translated into design calculations and procedures.
- Performance capability of selected components have not been degraded through modifications.
- Acceptance criteria for tested parameters are supported by calculations or other engineering documents to ensure that design and licensing bases are met.
- Tests and/or analyses validate component operation under accident/event conditions.
- Potential degradation is monitored or prevented.

- Equipment qualification is suitable for the environment expected under all conditions.
- Equipment is adequately protected from environmental hazards. Component inputs and outputs are suitable for application and will be acceptable under accident/event conditions.

The team used Appendix B guidance for Valves, Pumps, Instrumentation, and As-Built System.

(5) E13; 4kV vital bus

- Energy sources (electricity), including those used for control functions, will be available and adequate during accident/event conditions.
- Component controls will be functional and provide desired control during accident/event conditions.
- Instrumentation and alarms are available to operators for making necessary decisions.
- Installed configuration will support its design basis function under accident/event conditions.
- Component operation and alignments are consistent with design and licensing basis assumptions.
- Design bases and design assumptions have been appropriately translated into design calculations and procedures.
- Acceptance criteria for tested parameters are supported by calculations or other engineering documents to ensure that design and licensing bases are met.
- Tests and/or analyses validate component operation under accident/event conditions.
- Potential degradation is monitored or prevented.
- Component inputs and outputs are suitable for application and will be acceptable under accident/event conditions.
- Equipment is adequately protected from environmental hazards.

The team used Appendix B guidance for Valves, Pumps, Instrumentation, Electrical Loads, and As-Built System.

(6) E-1; Emergency Diesel Generator

- Process medium (water, air, electrical signal) will be available and unimpeded during accident/event conditions.
- Energy sources (fuel, air, steam, electricity), including those used for control functions, will be available and adequate during accident/event conditions.
- Component controls will be functional and provide desired control during accident/event conditions.
- Operating procedures (normal, abnormal, or emergency) are consistent with operator actions for accident/event conditions.
- Instrumentation and alarms are available to operators for making necessary decisions.
- Heat will be adequately removed from major components.
- Installed configuration will support its design basis function under accident/event conditions.
- Component operation and alignments are consistent with design and licensing basis assumptions.

- Design bases and design assumptions have been appropriately translated into design calculations and procedures.
- Performance capability of selected components have not been degraded through modifications.
- Acceptance criteria for tested parameters are supported by calculations or other engineering documents to ensure that design and licensing bases are met.
- Tests and/or analyses validate component operation under accident/event conditions.
- Potential degradation is monitored or prevented.
- Equipment is adequately protected from environmental hazards.

The team used Appendix B guidance for Valves, Pumps, Instrumentation, Electrical Loads, and As-Built System.

(7) Unit 2 Reactor Core Isolation Cooling System

- Process medium (water, air, electrical signal) will be available and unimpeded during accident/event conditions.
- Energy sources (fuel, air, steam, electricity), including those used for control functions, will be available and adequate during accident/event conditions.
- Operating procedures (normal, abnormal, or emergency) are consistent with operator actions for accident/event conditions.
- Instrumentation and alarms are available to operators for making necessary decisions.
- Heat will be adequately removed from major components.
- Design bases and design assumptions have been appropriately translated into design calculations and procedures.
- Performance capability of selected components have not been degraded through modifications.
- Acceptance criteria for tested parameters are supported by calculations or other engineering documents to ensure that design and licensing bases are met.
- Tests and/or analyses validate component operation under accident/event conditions.
- Potential degradation is monitored or prevented.
- Equipment is adequately protected from environmental hazards.

The team used Appendix B guidance for Valves, Pumps, Instrumentation, Electrical Loads, and As-Built System.

(8) PSD-0293; Rupture Disc

- Energy sources (air, steam, electricity), including those used for control functions, will be available and adequate during accident/event conditions.
- Component controls will be functional and provide desired control during accident/event conditions.
- Operating procedures (normal, abnormal, or emergency) are consistent with operator actions for accident/event conditions.
- Instrumentation and alarms are available to operators for making necessary decisions.
- Installed configuration will support its design basis function under accident/event conditions.

- Component operation and alignments are consistent with design and licensing basis assumptions.
- Design bases and design assumptions have been appropriately translated into design calculations and procedures.
- Performance capability of selected components have not been degraded through modifications.
- Acceptance criteria for tested parameters are supported by calculations or other engineering documents to ensure that design and licensing bases are met.
- Tests and/or analyses validate component operation under accident/event conditions.
- Potential degradation is monitored or prevented.
- Equipment qualification is suitable for the environment expected under all conditions.
- Equipment is adequately protected from environmental hazards. Component inputs and outputs are suitable for application and will be acceptable under accident/event conditions.

The team used Appendix B guidance for Valves, Pumps, Instrumentation, and As-Built System.

Modifications (IP Section 03.02) (5 Samples)

(1) EC 627495, Replacement of MO-2-10-089A/B/C/D for High Pressure Service Water Pressure Reduction, Revision 1
(2) EC 634786, Unit 2 Torus Permanent Drains, Revision 1
(3) EC 632407, RPS Division A Cable Replacement, Revision 1
(4) EC 626985, MPR Anti-rotation device for recirculation valves, Revision 0
(5) EC 634763, ME-0073 Revision to Gain 2D Core Spray Margin, Revision 0

10 CFR 50.59 Evaluations/Screening (IP Section 03.03) (8 Samples)

(1) PB-2020-010-S, High Pressure Coolant Injection/Reactor Core Isolation Cooling Low Pump Suction Pressure Trip Elimination, Revision 1
(2) PB-2020-015-S, Replacement of 2A/B/C/D P042 for HPSW Pressure Reduction, Revision 1
(3) PB-2021-029-S, U2 Torus Permanent Drains, Revision 0
(4) PB-2022-004-S, Upgrade CPU and ASP Modules for APRM/LPRM/RBM, Revision 0
(5) PB-2022-011-S, Addition of Alternate Emergency Service Water flow path, Revision 0
(6) PB-2022-012-S, Shield Plug Alternate Load Path Evaluation, Revision 3
(7) PB-2022-014-S, Removal of Requirement to Perform Main Steam Isolation Valve Partial Closure Testing, Revision 0
(8) PB-2022-018-S, Peach Bottom Unit 2 Cycle 25 Core Reload Design, Revision 0

Operating Experience Samples (IP Section 03.04) (1 Sample)

(1) NRC Information Notice 2005-30: Safe Shutdown Potentially Challenged by Unanalyzed Internal Flooding Event and Inadequate Design

INSPECTION RESULTS

Failure to Monitor and Test the Condition of Station Blackout Cables			
Cornerstone	Significance	Cross-Cutting Aspect	Report Section
Mitigating Systems	Green FIN 05000277,05000278/2023011-01 Open/Closed	[P.2] - Evaluation	71111.21M

The inspectors identified a self-revealed finding of very low safety significance (Green), because Constellation did not test and monitor the condition of several potentially wetted critical medium voltage (MV) power cables as stipulated by ER-AA-300-150, Cable Condition Monitoring Program, Revision 7. Specifically, ER-AA-300-150, sections 4.3.6 and 4.2.4 specified that critical MV cables installed for extended periods in wetted/submerged environments and normally energized MV cables in conduit that are embedded in concrete be tested to determine the impact of the exposure to the adverse environment. Constellation did not implement the cable condition monitoring on four of six potentially wetted critical MV cables associated with the Station Blackout (SBO) line. Consequently, on April 4, 2023, one of the four MV cables which were not tested failed and caused an electrical fault in the SBO switchyard that made the SBO line unavailable to Peach Bottom Atomic Power Station (PBAPS).

Description: A SBO is a complete loss of alternating current (AC) electric power to the essential and nonessential switchgear buses at PBAPS. In 1994, Constellation installed a dedicated power line from the Conowingo hydro power station to PBAPS to serve as an alternate AC power supply to address a postulated SBO event. The dedicated power line consisted of a 48,000-foot submarine cable run from Conowingo station, the SBO switchyard (including SBO electrical bus R010, disconnect links, breakers, and SBO transformer X19), and several shorter MV cables which route power through the SBO switchyard to an onsite 13.2kV electrical bus (2 SUB Bus). The X19 transformer reduced the supplied voltage from 34kV to 13.2kV. The SBO line was designed to supply power to one loop of containment cooling (one residual heat removal pump and one high pressure service water pump) per unit during a postulated SBO event.

At 11:10 p.m., on April 4, 2023, operators declared the SBO line inoperable, due to an electrical fault in the SBO switchyard which caused the SBO transformer feeder breaker (1005) to trip open (IR 4667649). Investigation identified that the normally energized ‘B’ phase electrical cable from breaker 1005 to the X19 SBO transformer had degraded and was the cause of the fault. Post-event cable testing (Tan Delta test) revealed the ‘A’ phase cable was also degraded. Work requests were initiated to replace all three cables (phase A, phase B, and phase C) between breaker 1005 and the X19 transformer. Technical Requirements Manual 3.18, Conowingo line, required the licensee to initiate a condition report to determine causes and corrective actions if the Conowingo line was not restored within 15 days. Engineers initiated IR 4670972 because procurement and installation of replacement cables was going to exceed 15 days.

The inspectors observed this was the third critical MV cable failure at PBAPS in the last 5 years. The previous failures were (1) E1 emergency diesel generator (EDG) cable in 2019 and (2) 1SU bus feeder cable in 2018. In both previous cases the licensee determined the cables had failed due to a phenomenon called water treeing and electrical treeing. These degradation mechanisms can occur when cable insulation is exposed to moisture for extended periods of time. Water trees within the cable insulation may eventually grow to the point where they bridge the outer ground layer to the center high voltage conductor, at which point the stress redistributes across the cable insulation. Water treeing reduces the dielectric

strength of the insulation, eventually weakening the material to the point where it is susceptible to voltage surges that can initiate partial discharging. Partial discharging causes relatively rapid electrical degradation, leading to an electric tree and a faulted cable condition in weeks to months. Electrical tree growth may be accelerated by rapid voltage changes, such as utility switching operations including deenergizing and then reenergizing an electrical distribution bus.

ER-AA-300-150, Cable Condition Monitoring Program, Revision 7, defined potentially wetted cables as including those installed in conduit, embedded in concrete that have a potential to have moisture/water intrusion. The inspectors walked down the SBO switchyard area and noted the failed cable was run in conduit that was embedded in concrete and passed through a below-grade drainage pit that filled with water during periods of rain. ER-AA-300-150 also required that each site shall ensure critical MV cables installed for extended periods in wetted/submerged environments are periodically tested (e.g., every 10 years) to determine the impact of the exposure to the adverse condition. Based on the walkdown, review of ER-AA-300-150, and discussion with station engineers, the inspectors determined the failed cable met the criteria of ER-AA-300-150 that required periodic testing.

Engineers informed the inspectors that the failed cable had not been listed in the site Cable Management Database and therefore had not been identified to be tested prior to its failure. The inspectors reviewed equipment records and determined the failed E1 EDG cables mentioned above also had not been identified in the Cable Management Database and the failed 1SU bus feeder cable had not been identified as a cable which was exposed to wetted conditions. Corrective actions following the previous two cable failures included development of a cable program database for MV cables and creation of a list which identified all MV cables potentially exposed to long term wetted conditions as required by ER-AA-300-150. Engineers informed the inspectors the failed SBO cable had inadvertently been overlooked during these corrective actions and was not included in the cable database.

The licensee's preliminary onsite evaluation determined the most likely cause of the failed SBO line MV cable was water treeing and electrical treeing. Preliminary offsite cable failure analysis also identified a workmanship flaw near the original Raychem splice cable termination. This flaw could have caused partial discharges similar to those caused by water treeing and electrical treeing and could have led to the cable failure. Failure analysis to confirm this diagnosis was in progress at the close of this inspection. Cable condition monitoring required by ER-AA-300-150, such as Tan Delta testing or partial discharge testing, could have detected the insulation degradation prior to cable failure. The inspectors identified three additional potentially wetted MV cables in the SBO switchyard which also had not been periodically tested. These were the cables between (1) disconnect 1001 and the #9 transformer, (2) X19 transformer and breaker 30601, and (3) breaker 30601 and the south 500kV switchyard. Engineers confirmed these cables were not previously tested and should be added to the cable database.

Corrective Actions: The licensee replaced and successfully retested the failed MV cable between breaker 1005 and the X19 transformer. Licensee staff evaluated the SBO switchyard MV cables for current functionality, scheduled periodic cable testing, and assigned actions for further extent-of-condition investigation under IR 4670972.

Corrective Action References: IRs 4667649 and 4670972

Performance Assessment:

Performance Deficiency: The inspectors determined that failure to perform testing and cable condition monitoring on four underground potentially wetted SBO line MV cables as stipulated by self-imposed standard ER-AA-300-150, Cable Condition Monitoring Program, Revision 7 was a performance deficiency that was within the licensee's ability to foresee and correct. Specifically, ER-AA-300-150, sections 4.3.6 and 4.2.4 specified that critical MV cables installed for extended periods in wetted/submerged environments and normally energized MV cables in conduit that are embedded in concrete be tested to determine the impact of the exposure to the adverse condition. Corrective actions to address two previous MV cable failures included development of a list of underground cables exposed to long term submergence (AR 04282775-03) which required testing and condition monitoring. This list should have identified the four SBO line MV cables. Consequently, on April 4, 2023, the SBO line MV cable between breaker 1005 and the X19 transformer failed, causing an electrical fault in the in the SBO switchyard and making the SBO line unavailable to the station.

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 SBO line MV cable between breaker 1005 and the X19 transformer degraded and failed, making the SBO line unavailable to perform its credited design function as an alternate AC power supply during an SBO event.

Significance: The inspectors assessed the significance of the finding using IMC 0609 Appendix A, "The Significance Determination Process (SDP) for Findings At-Power." Using IMC 0609, Appendix A, "Exhibit 2-Mitigating Systems Screening Questions," Section A, "Mitigating SSCs and PRA Functionality," the inspectors determined the finding required a detailed risk evaluation (DRE) because the finding represented a loss of a PRA system as defined in the PRA for greater than 24 hours.

A Region I senior reactor analyst (SRA) completed the DRE and estimated the increase in core damage frequency (CDF) associated with this performance deficiency to be 6.5E-7/yr, or of very low safety significance (Green). The SRA used the Systems Analysis Programs for Hands-On Evaluation (SAPHIRE) Revision 8.2.8, Standardized Plant Analysis Risk (SPAR) Model, version 8.80 for Peach Bottom Unit 2, which includes external events to develop the risk estimate for Units 2 and 3. A key assumption for this evaluation was the exposure time for the degraded condition. The failure of the SBO cable was likely due to partial discharges occurring with progressive deterioration of insulating material leading to electrical breakdown. The assumption was that this was a voltage related degradation mechanism. The analyst noted that without any previous test results such as Tan Delta or partial discharge tests, there was a large amount of uncertainty with how far or how fast the degradation had proceeded within the affected cable section in the past year, including what magnitude of impact transient voltage scenarios would have had on the degraded cable.

Therefore, the SRA used a surrogate event in the assessment to provide a reasonable bounding potential exposure time for the degraded condition. Specifically, a large transient voltage occurred on the subject cable during the de-energization of the SBO line in April of 2022 for unrelated maintenance work. The subject cable was subsequently re-energized with a 34.5kV voltage transient without failure. This was considered a successful functional operation. Assuming degradation would continue to occur over time, a T/2 bounding assessment was applied from that date until the date of the actual failure consistent with the intent of the Risk Assessment of Operating Events Handbook (RASP), Volume I guidance. With repair time added, this resulted in a 210 day exposure time, which would be considered

a best estimate and bounding assumption. This was a surrogate for postulated SBO type scenarios which would result in the de-energization of the line followed by a large voltage transient during re-energization of the degraded cable to support re-powering key required plant equipment.

The SRA used the SPAR model to directly solve risk impacts for various types of postulated events. Because the dominant core damage sequences were associated with events where offsite power would be lost in addition to onsite emergency power, the following model revisions were made to perform a best estimate review of the degraded SBO cable:

- DGR 24H Gate set to TRUE for the corresponding FLEX sequences.
- P1B revised to P1 for Safety Relief Valve fail to re-close in SBO sequences.
- Set ACP-CRB-OO-1005 to TRUE, to model the SBO cable failure and SBO breaker trip.
- Use the Pressurized Water Reactor Owners Group, PWROG-18042-NP, Revision 1, FLEX Equipment Data Collection and Analysis, for generic unreliability estimates for standard FLEX equipment. This has also been audited with comments by the NRC and considered to represent the best estimate Flex reliability by the analyst.
- Turn FLEX credit on by setting FLX-XHE-XE-ELAP to 1E-2.
- IE-LOOPGR, Loss-of-Offsite-Power Grid-related was revised to 1.31E-2 for the Central East region from 5.4E-3 in the SPAR model, based on INL/RPT-22-68809, Analysis of LOOP Events 2021, Table 6.

The internal event risk was dominated by loss-of-offsite-power (LOOP) events with the failure of the Conowingo dam SBO source due to the failed cable, common cause failure of the emergency diesel generators, failure to recover offsite power or the EDGs in 2 hours with convolution and failure of the Flex diesel generator to run. This resulted in an increase in CDF of 4E-7/yr for internal events.

The SRA reviewed Constellation's SBO Line Summary of PRA Results Supporting the Significance Determination dated June 2023. Sensitivity runs using the PWROG FLEX data resulted in a total risk increase (internal and external risk) between 6.5E-7/yr and 8.2E-7/yr for the 210 day exposure time. With respect to fire risk, the Dominant Physical Analysis Units (PAUs) for the condition consisted of the Unit 2 Off Gas Pipe Tunnel and PAU 50-78A, Turbine Building Condensate Demin Piping Tunnel. Dominant core damage sequences were transient fire scenarios affecting cables for all four EDGs, failure of Unit 2 instrument air, consequential LOOP given plant trip, with failure to recover offsite power and failure of the Flex pump to run. The highest fire risk increase relative to the failed SBO cable was determined to be on the order of 2.5E-7/yr. These Unit 2 results bound the Unit 3 impact for delta CDF/yr risk increase for the degraded condition with similar dominant scenarios.

The SRA reviewed portions of the Peach Bottom PRA summary notebook, PB-PRA-013 relative to the analysis of large early release frequency (LERF). This incorporates a level 2 methodology analyzing issues such as magnitude and timing of calculated radionuclide releases through level 2 containment event trees. Constellation's bounding LERF estimate increase was on the order of 3.5E-8/yr. The SRA determined that these results for LERF impact did not change the conclusion of a very low safety significant (Green) issue determined through the review of the CDF/yr increase.

Cross-Cutting Aspect: P.2 - Evaluation: The organization thoroughly evaluates issues to ensure that resolutions address causes and extent of conditions commensurate with their

safety significance. Specifically, the licensee had several wetted MV cable failures, but did not thoroughly evaluate the causes and identify/implement appropriate corrective actions to ensure the SBO line cables remained capable of reliably performing their design function.

Enforcement: Inspectors did not identify a violation of regulatory requirements associated with this finding.

Failure to Obtain NRC Approval prior to Implementing a Change to the Station Blackout Line Testing

Cornerstone	Significance/Severity	Cross-Cutting Aspect	Report Section
Mitigating Systems	Green Severity Level IV NCV 05000277,05000278/2023011-02 Open/Closed	None (NPP)	71111.21M

The inspectors identified a Green finding and associated Severity Level IV Non-cited violation (NCV) of 10 CFR 50.59(c)(2)(ii), "Changes, Tests, and Experiments," which states, in part, that a licensee shall obtain a license amendment prior to implementing a proposed change that would result in more than a minimal increase in the likelihood of occurrence of a malfunction of a structure, system, or component (SSC) important to safety previously evaluated in the updated final safety analysis report (UFSAR). Specifically, on February 8, 2018, the licensee deleted a commitment and discontinued periodic load testing of the SBO Conowingo line which, was performed to verify the capability of the line to start and carry approximately 7000kW of load.

Description: At PBAPS, an alternate AC power source is available in the event of a SBO condition when offsite power sources and EDG power is not available to bring Units 2 and 3 to a safe shutdown condition and maintain that status. A dedicated 34.5kV line provided from the Conowingo dam provides power to PBAPS through a SBO substation, which allows for the powering of safety buses in the event of a SBO condition.

The inspectors reviewed 50.59 screen PB-2018-009-S, "Delete Commitment T04082 Associated with Letter to NRC dated August 6, 1992 / TRM 3.18". The licensee performed the screen on February 8, 2018, to review the impact of deleting commitment T04082, which required PBAPS' dedicated SBO alternate AC source, the Conowingo line, to be tested approximately once every two years to verify its capability to start and carry approximately 7000 kW of load. This periodic testing was discussed in the NRC Supplemental Safety Evaluation Report (ML20116D214) on October 23, 1992, accepting PBAPS' conformance to 10 CFR 50.63, "Station Blackout". The NRC SER noted that the testing met the criteria of NUMARC 87-00 Appendix B, Section B.10, in accordance with Regulatory Guide 1.155 .

In PB-2018-009-S, the licensee concluded that discontinuing the periodic load testing did "not adversely affect the design function or reliability of the Conowingo line, or increase the likelihood of malfunction," and included justification that, in part, FLEX equipment and strategies could be used to conform to 10 CFR 50.63. The inspectors determined that this justification was inadequate because the PBAPS FLEX program does not meet the requirements of 10 CFR 50.63, and no additional testing or monitoring of the SBO line was credited. In addition, licensee staff concluded the Conowingo station blackout line has historically been reliable, noting no failures to provide the required load rating. The inspectors determined that there was no justification in PB-2018-009-S that showed how the Conowingo line would continue to demonstrate the required capacity and reliability as a dedicated alternate AC source to withstand and recover from a SBO condition.

The inspectors determined the deletion of commitment T04082 and discontinued periodic

load testing of the dedicated Conowingo line was an adverse change and required a 50.59 evaluation. Additionally, inspectors determined that absent additional justification that would demonstrate how the Conowingo line would continue to demonstrate the required capacity and reliability, the change would result in more than a minimal increase in the likelihood of occurrence of a malfunction of an SSC important to safety previously evaluated in the UFSAR. As a result, the inspectors determined that the licensee did not obtain NRC approval in accordance with 10 CFR 50.59(c)(2)(ii) prior to implementing the change.

Corrective Actions: The licensee entered this issue into their corrective action program and are evaluating the maintenance strategy for the Conowingo line and the technical justification for the discontinued testing.

Corrective Action References: IR 04673392

Performance Assessment:

Performance Deficiency: The licensee did not obtain NRC approval, in accordance with 10 CFR 50.59(c)(2)(ii), prior to implementing a change to the facility that resulted in more than a minimal increase in the likelihood of occurrence of a malfunction of the Conowingo line. Specifically, the licensee removed commitment T04082, which stated periodic tests would be performed to verify the capability of the Conowingo line to start and carry approximately 7000kW of load. The licensee did not perform a 50.59 evaluation to evaluate the adverse effect of the change and did not provide justification that it was not more than a minimal increase in the likelihood of a malfunction of the Conowingo line.

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 discontinued periodic testing of the Conowingo line without supplemental verification of capability resulted in a more than a minimal increase in the likelihood of occurrence of a malfunction of the Conowingo line.

Significance: The inspectors assessed the significance of the finding using IMC 0609 Appendix A, “The Significance Determination Process (SDP) for Findings At-Power.” Specifically using Exhibit 2 “Mitigating Systems Screening Questions,” Section A, “Mitigating SSCs and PRA Functionality,” the finding screened as having very low safety significance (Green) because the degraded condition did not represent a loss of PRA function.

Cross-Cutting Aspect: Not Present Performance. No cross-cutting aspect was assigned to this finding because the inspectors determined the finding did not reflect present licensee performance.

Enforcement: The Reactor Oversight Process (ROP’s) significance determination process does not specifically consider the regulatory process impact in its assessment of licensee performance. Therefore, it is necessary to address this violation which impedes the NRC’s ability to regulate using traditional enforcement to adequately deter non-compliance.

Severity: The violation resulted in a condition that was determined to have very low safety significance (Green) using the ROP significance determination process. Therefore, the traditional enforcement violation was determined to be a Severity Level IV violation, consistent with the example in paragraph 6.1.d.2 of the NRC Enforcement Policy.
Violation: The inspectors identified a violation of 10 CFR 50.59(c)(2)(ii), “Changes, Tests, and Experiments,” which states, in part, that a licensee shall obtain a license amendment prior to

implementing a proposed change that would result in more than a minimal increase in the likelihood of occurrence of a malfunction of an SSC important to safety previously evaluated in the updated final safety analysis report (UFSAR). Contrary to the above, on February 8, 2018, the licensee deleted a commitment and discontinued periodic load testing of the dedicated SBO Conowingo line which was performed to verify the capability of the line to start and carry approximately 7000kW of load.

Enforcement Action: 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 July 5, 2023, the inspectors presented the design basis assurance inspection (teams) inspection results to Adam Frain, Director of Operations, and other members of the licensee staff.

DOCUMENTS REVIEWED

Inspection Procedure	Type	Designation	Description or Title	Revision or Date
71111.21M	Calculations	18247-M-035	Condensate Storage Tank - Minimum Water Level to Prevent Vortex Formation	Revision 2
		PM-0958	RHR core spray room temperature post LOCA for 95 degF river temperature	Revision 4
		PM-1048	Design Basis for Internal Flood Protection for the HPSW/ESW Pump Structure	Revision 2
		PM-1079	High pressure service water system hydraulic analysis	Revision 4
	Corrective Action Documents	02669300		
		04252679		
		04256257		
		04256520		
		04257567		
		04282775		
		04339435		
		04483828		
		04495400		
		04667649		
	Corrective Action Documents Resulting from Inspection	04668814		
		04668915		
		04668917		
		04668924		
		04669190		
		04669261		
		04669313		
		04669805		
		04670167		
		04670758		
		04671210		
		04671218		
		04671286		
		04671533		

Inspection Procedure	Type	Designation	Description or Title	Revision or Date
		04671559		
		04671686		
		04672508		
		04672821		
		04672834		
		04673201		
		04673392		
		04673437		
		04673451		
		4688999		
	Drawings	6280-M-315	Emergency Service Water and High-Pressure Service Water P&ID	Revision 94
		E-1, Sht 1	Single Line Electrical Drawing	Revision 59
		E-5345	Station Blackout Substation Single Line	Revision 21
	Engineering Evaluations	P-T-13	Peach Bottom Units 2 and 3 Station Blackout Design Basis Document	Revision 8
		PE-0190	Establish Relay Settings for Protective Relays within SBO Switchyard	Revision 1
		PEAM-EPU-124	Peach Bottom Units 2 and 3 Extended Power Uprate Task T0903: Station Blackout	Revision 3
	Miscellaneous		Station Blackout and Station Light and Power Load Services Agreement between PECO Energy Company, Exelon Generation Company, LLC – Exelon Nuclear, and Exelon Generation Company, LLC – Exelon Power	08/12/2015
		MAT PB 627495-2B LOOP	2B HPSW LOOP Modification Acceptance Test	Revision 0
		ML040370628	NRC Letter from Jose Calvo NRR Electrical Branch to Alex Marion of the Nuclear Energy Institute	02/05/2004
		NUREG/CR-3122	Potentially Damaging Failure Modes of High and Medium Voltage Electrical Equipment	
		PB-2018-009-S	50.59 Screen to Delete Commitment T04082 Associated with Letter to NRC Dated August 6, 1992 / TRM 3.18	Revision 0
		PB-2020-031-S	50.59 Screen for EC 627495, Replacement of MO-2-10-089A/B/C/D for HPSW Pressure Reduction	Revision 0

Inspection Procedure	Type	Designation	Description or Title	Revision or Date
		SC-17-03 R1	Hitachi Part 21 Communication, NUMAC PRNM 386SX Computer Module Changes	07/31/2017
	Procedures	AO 33.6-0	ESW pump discharge cross-tie operation	Revision 7
		LS-AA-104	Exelon 50.59 Review Process	Revision 12
		LS-AA-104-1000	50.59 Resource Manual	Revision 14
		OP-AA-102-106	Operator Response Time Program	Revision 8
		OP-PB-102-106	Operator Response Time Program at Peach Bottom	Revision 11
		RT-M-010-174-3	MO-3-174 Outgoing Interlocks Test	02/24/2011
		RT-O-010-415-3	HPSW to RHR Emergency Cross-Tie Valve Functional Test	04/10/2023
		SE-11	Loss of Offsite Power	Revision 17
		SE-11.1	Operating Station Blackout Line during a LOOP Event	Revision 9
		SI3k-54-E33-XXCE	Calibration Check of E33 4kV Undervoltage Relays	Revision 18
		SO 52A.1.A	Diesel Generator Lineup for Automatic Start	Revision 14
		SO 52A.1.B	Diesel Generator Operations	Revision 75
		ST-O-010-306-3	“B” RHR Loop Pump, Valve, Flow and Unit Cooler Functional and Inservice Test	02/12/2023
		ST-O-032-301-3	U3 HPSW Valve and Flow Functional and Inservice Test	03/31/2023
		ST-O-052-701-2	E1 Diesel Generator 24 Hour Endurance Test	04/06/2023
		T-103	Secondary Containment Control	Revision 23
	Work Orders	04315207		
		04931364		
		05181050		
		05302197		