



**UNITED STATES
NUCLEAR REGULATORY COMMISSION**

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

February 9, 2022

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

SUBJECT: LIMERICK GENERATING STATION, UNITS 1 AND 2 – INTEGRATED
INSPECTION REPORT 05000352/2021004 AND 05000353/2021004

Dear Mr. Rhoades:

On December 31, 2021, the U.S. Nuclear Regulatory Commission (NRC) completed an inspection at Limerick Generating Station, Units 1 and 2. On January 28, 2022, the NRC inspectors discussed the results of this inspection with Mr. Frank Sturniolo, Site Vice President, 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. Both of these findings involved violations of NRC requirements. We are treating these violations as non-cited violations (NCVs) consistent with Section 2.3.2 of the Enforcement Policy.

If you contest the violations or the significance or severity of the violations 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 Limerick Generating Station, Units 1 and 2.

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 Limerick Generating Station, Units 1 and 2.

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* 2.390, "Public Inspections, Exemptions, Requests for Withholding."

Sincerely,

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

Docket Nos. 05000352 and 05000353
License Nos. NPF-39 and NPF-85

Enclosure:
As stated

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SUBJECT: LIMERICK GENERATING STATION, UNITS 1 AND 2 – INTEGRATED
INSPECTION REPORT 05000352/2021004 AND 05000353/2021004 DATED
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U.S. NUCLEAR REGULATORY COMMISSION
Inspection Report

Docket Numbers: 05000352 and 05000353

License Numbers: NPF-39 and NPF-85

Report Numbers: 05000352/2021004 and 05000353/2021004

Enterprise Identifier: I-2021-004-0022

Licensee: Constellation Energy Generation, LLC

Facility: Limerick Generating Station, Units 1 and 2

Location: Sanatoga, PA 19464

Inspection Dates: October 1, 2021 to December 31, 2021

Inspectors: A. Ziedonis, Senior Resident Inspector
L. Grimes, Resident Inspector
S. Haney, Senior Project Engineer
E. Garcia, Reactor Engineer
H. Anagnostopoulos, Senior Health Physicist
M. Henrion, Health Physicist
T. Fish, Senior Operations Engineer
M. Patel, Senior Reactor Inspector

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

Enclosure

SUMMARY

The U.S. Nuclear Regulatory Commission (NRC) continued monitoring the licensee's performance by conducting an integrated inspection at Limerick Generating Station, Units 1 and 2, 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 Perform a Functionality Assessment to Adequately Maintain the Fire Protection Program			
Cornerstone	Significance	Cross-Cutting Aspect	Report Section
Mitigating Systems	Green NCV 05000352,05000353/2021004-01 Open/Closed	[H.13] - Consistent Process	71152
The inspectors identified a Green finding and associated non-cited violation (NCV) of License Condition 2.C.(3), Fire Protection, when Constellation did not adequately maintain all provisions of the approved fire protection program (FPP) with the 'A' residual heat removal (RHR) shutdown cooling (SDC) suction valve stuck and disabled in the closed position for approximately six months. Specifically, Constellation did not assess the credited FPP function of the Unit 1 'A' RHR SDC suction valve, in accordance with station procedures, which resulted in Constellation not adequately maintaining the capability to achieve cold shutdown for certain fire scenarios until the valve was repaired.			

TS 6.8 NCV: Failure to Follow Preventive Maintenance Program Procedure Results in HPCI Inoperability and Unavailability			
Cornerstone	Significance	Cross-Cutting Aspect	Report Section
Mitigating Systems	Green NCV 05000352,05000353/2021004-02 Open/Closed	[H.6] - Design Margins	71152
The inspectors identified a Green finding and associated NCV of Technical Specification (TS) 6.8, "Procedures and Programs," when Constellation did not follow procedure ER-AA-200, "Preventive Maintenance Program," Revision 2, during the performance of Unit 1 high pressure coolant injection (HPCI) emergency shutdown (ESD) switch equipment classification. As a result, the switch failed due to age-related internal mechanical degradation, which rendered the HPCI system inoperable and unavailable.			

Additional Tracking Items

Type	Issue Number	Title	Report Section	Status
LER	05000352/2021001-00	LER 2021-001-00 for Limerick Generating Station, Unit 1, HPCI Inoperable Due to Remote Shutdown Panel Switch Failure	71153	Closed

PLANT STATUS

Unit 1 began the inspection period at rated thermal power. On October 30, 2021, the unit was down-powered to approximately 80 percent thermal power to perform a control rod pattern adjustment. The unit was returned to full power on October 31, 2021. On November 20, 2021, the unit was down-powered to approximately 80 percent thermal power to perform a control rod pattern adjustment. The unit was returned to full power on November 21, 2021, and remained at or near rated thermal power for the remainder of the inspection period.

Unit 2 operated at or near rated thermal power for the entire 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 activities described in IMC 2515, Appendix D, "Plant Status," conducted routine reviews using IP 71152, "Problem Identification and Resolution," observed risk significant activities, and completed on-site portions of IPs. 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.

On February 1, 2022, the operating license for Limerick Generating Station held by Exelon Generation Company, LLC was transferred to Constellation Energy Generation, LLC (Constellation) as documented in the associated license amendments (ML22021B660). While some or all of the inspection documented in this report was performed while the license was held by Exelon Generation Company, LLC, this report will refer to the licensee as Constellation throughout.

REACTOR SAFETY

71111.01 - Adverse Weather Protection

Seasonal Extreme Weather Sample (IP Section 03.01) (1 Sample)

- (1) The inspectors evaluated readiness for seasonal extreme weather conditions prior to the onset of seasonal cold temperatures on November 1, 2021

71111.04 - 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 common control room emergency fresh air supply system alignment during planned 'A' train damper maintenance on October 6, 2021

- (2) Unit 1 'A' RHR train on November 22, 2021
- (3) Unit 2 'B' RHR train on November 24, 2021

Complete Walkdown Sample (IP Section 03.02) (1 Sample)

- (1) The inspectors evaluated system configurations during a complete walkdown of the Unit common RHR service water system during the week of December 13, 2021

71111.05 - Fire Protection

Fire Area Walkdown and Inspection Sample (IP Section 03.01) (5 Samples)

The inspectors evaluated the implementation of the FPP by conducting a walkdown and performing a review to verify program compliance, equipment functionality, material condition, and operational readiness of the following fire areas:

- (1) Fire Area 25, Unit common auxiliary equipment room on November 3, 2021
- (2) Fire Area 79, Unit 1 D11 emergency diesel generator room on November 4, 2021
- (3) Fire Area 14, Unit 1 D14 emergency 4KV switchgear room on November 17, 2021
- (4) Fire Area 66, Unit 2 safeguard system isolation valve room on November 17, 2021
- (5) Fire Areas 122 and 123, Unit common spray pond pump house on December 15, 2021

71111.06 - Flood Protection Measures

Inspection Activities - Internal Flooding (IP Section 03.01) (1 Sample)

The inspectors evaluated internal flooding mitigation protections in the:

- (1) Unit 1 reactor building reactor water cleanup holding pump compartments on October 25, 2021

71111.11A - Licensed Operator Requalification Program and Licensed Operator Performance

Requalification Examination Results (IP Section 03.03) (1 Sample)

- (1) The inspectors reviewed and evaluated the licensed operator examination failure rates for the requalification annual operating exams and biennial written exams administered October through November 2021.

71111.11B - Licensed Operator Requalification Program and Licensed Operator Performance

Licensed Operator Requalification Program (IP Section 03.04) (1 Sample)

- (1) Biennial Requalification Written Examinations

The inspectors evaluated the quality of the licensed operator biennial requalification written examinations administered October through November 2021.

Annual Requalification Operating Tests

The inspectors evaluated the adequacy of the facility licensee's annual requalification operating test.

Administration of an Annual Requalification Operating Test

The inspectors evaluated the effectiveness of the facility licensee in administering requalification operating tests required by 10 CFR 55.59(a)(2) and that the facility licensee is effectively evaluating their licensed operators for mastery of training objectives.

Requalification Examination Security

The inspectors evaluated the ability of the facility licensee to safeguard examination material, such that the examination is not compromised.

Remedial Training and Re-examinations

The inspectors evaluated the effectiveness of remedial training conducted by the licensee, and reviewed the adequacy of re-examinations for licensed operators who did not pass a required requalification examination.

Operator License Conditions

The inspectors evaluated the licensee's program for ensuring that licensed operators meet the conditions of their licenses.

Control Room Simulator

The inspectors evaluated the adequacy of the facility licensee's control room simulator in modeling the actual plant, and for meeting the requirements contained in 10 CFR 55.46.

Problem Identification and Resolution

The inspectors evaluated the licensee's ability to identify and resolve problems associated with licensed operator performance.

71111.11Q - Licensed Operator Requalification 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 Unit 1 planned power reduction for control rod testing and a rod pattern adjustment on December 4 and 5, 2021

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

- (1) The inspectors observed and evaluated licensed operator annual requalification exam scenarios in the simulator on November 10, 2021

71111.12 - Maintenance Effectiveness

Maintenance Effectiveness (IP Section 03.01) (3 Samples)

The inspectors evaluated the effectiveness of maintenance to ensure the following structures, systems, and components remain capable of performing their intended function:

- (1) Unit common HPCI system emergency shutdown switch on December 6 and 7, 2021
- (2) Unit common emergency diesel generator D22 planned maintenance during the weeks of December 6 and December 13, 2021
- (3) Unit 1 rod drive control system on December 15 and December 16, 2021

71111.13 - Maintenance Risk Assessments and Emergent Work Control

Risk Assessment and Management Sample (IP Section 03.01) (4 Samples)

The inspectors evaluated the accuracy and completeness of risk assessments for the following planned and emergent work activities to ensure configuration changes and appropriate work controls were addressed:

- (1) Unit 2 station risk during emergency diesel generator system outage window during the week of October 11, 2021
- (2) Unit 1 emergent work in response to inoperability of the position indication associated with control rod 10-51 on October 15, 2021
- (3) Unit 1 emergent work in response to main generator rectifier leak and generator field ground alarm on October 27, 2021
- (4) Unit common elevated risk during planned maintenance associated with one of two offsite electrical sources on November 15, 2021

71111.15 - Operability Determinations and Functionality Assessments

Operability Determination or Functionality Assessment (IP Section 03.01) (5 Samples)

The inspectors evaluated the licensee's justifications and actions associated with the following operability determinations and functionality assessments:

- (1) Unit 2 reactor core isolation cooling system following the identification of outboard steam supply valve leakage on October 15, 2021
- (2) Unit common FLEX pumps 'A' and 'B' functionality following unfavorable oil samples on November 9, 2021
- (3) Unit 2 thermal limits reduced margin on November 16, 2021
- (4) Unit 2 'A' reactor protection system inverter sync fail alarm on November 23, 2021
- (5) Unit 1 control rods following channel distortion testing on December 4, 2021

71111.18 - Plant Modifications

Temporary Modifications and/or Permanent Modifications (IP Section 03.01 and/or 03.02) (2 Samples)

The inspectors evaluated the following temporary or permanent modifications:

- (1) Unit common spray pond make-up line temporary plugging during pipe replacement on November 19, 2021
- (2) Unit common remote shutdown panel reactor core isolation cooling system speed indication instrument circuit modification on December 2, 2021

71111.19 - Post-Maintenance Testing

Post-Maintenance Test Sample (IP Section 03.01) (5 Samples)

The inspectors evaluated the following post-maintenance test activities to verify system operability and functionality:

- (1) Unit 2 'A' scram discharge volume inboard vent and drain valve stroke timing following solenoid replacement on October 4, 2021
- (2) Unit common manhole 106-west de-watering pump following replacement on November 10, 2021
- (3) Unit 2 reactor core isolation cooling system outboard isolation valve following planned maintenance on November 17, 2021
- (4) Unit 1 remote shutdown panel reactor core isolation cooling speed indication following troubleshooting and repairs on December 3, 2021
- (5) Unit 2 remote shutdown panel hand switch associated with 'A' RHR heat exchanger tube side inlet valve following hand switch repairs on December 6, 2021

71111.22 - Surveillance Testing

The inspectors evaluated the following surveillance tests:

Surveillance Tests (other) (IP Section 03.01) (2 Samples)

- (1) ST-6-092-316-1, Unit 1 D12 emergency diesel generator fast start operability test run on October 12, 2021
- (2) ST-6-092-112-2, Unit 2 D22 emergency diesel generator 24-hour endurance test on November 9, 2021

Inservice Testing (IP Section 03.01) (1 Sample)

- (1) ST-6-055-230-2, Unit 2 HPCI pump, valve and flow test on November 8, 2021

71114.06 - Drill Evaluation

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

- (1) The inspectors evaluated the conduct of a routine emergency planning drill on October 7, 2021

RADIATION SAFETY

71124.02 - Occupational ALARA Planning and Controls

Radiological Work Planning (IP Section 03.01) (4 Samples)

The inspectors evaluated the licensee's radiological work planning for the following activities:

- (1) 1R18 Suppression Pool Diving Combined ALARA Plan/Micro-ALARA Plan 20-017 on January 15, 2020 through February 17, 2020
- (2) 2R16 Suppression Pool Diving Combined ALARA Plan/ Micro-ALARA Plan 21-017 on March 23, 2021 through April 8, 2021
- (3) 1R18 Drywell NI/Drytube/LPRM/TIP Tubing/Support Steel Combined ALARA Plan/Micro-ALARA Plan 2020-001 on April 14, 2020 through May 12, 2020
- (4) Unit 2 Condenser Bay Steam Leak Repairs 20-097 Combined ALARA Plan/Micro-ALARA Plan on December 2, 2020

Verification of Dose Estimates and Exposure Tracking Systems (IP Section 03.02) (5 Samples)

The inspectors evaluated dose estimates and exposure tracking for the following activities:

- (1) 1R18 Suppression Pool Diving Combined ALARA Plan/ Micro-ALARA Plan 20-017 on January 15, 2020 through February 17, 2020
- (2) Unit 2 Condenser Bay Steam Leak Repairs 20-097 ALARA Post-job Review on March 1, 2021
- (3) 1R18 Drywell NI/Drytube/LPRM/TIP Tubing/Support Steel 2020-001 ALARA Post-Job Review on April 14, 2020 through May 12, 2020
- (4) 2R16 Suppression Pool Diving Plan 21-017 ALARA Post-Job Review on May 13, 2021 through June 2, 2021
2R16 Suppression Pool Diving ALARA Work-in Progress Review (80 - 90 percent WIP) on May 10, 2021
- (5) 2R16 Unit 2 Drywell Nuclear Instrumentation ALARA PLAN 2021-061 Post-Job Review on May 18, 2021 through June 8, 2021

Implementation of ALARA and Radiological Work Controls (IP Section 03.03) (2 Samples)

The inspectors reviewed as low as reasonably achievable practices and radiological work controls for the following activities:

- (1) Unit 1 '1C' main condenser inspection and repair (ALARA plan 20-035) during 1R18
- (2) Initial entry into the Unit 2 condenser hotwell during 2R16

Radiation Worker Performance (IP Section 03.04) (1 Sample)

- (1) The inspectors evaluated radiation worker and radiation protection technician performance during work activities.

71124.06 - Radioactive Gaseous and Liquid Effluent Treatment

Walkdowns and Observations (IP Section 03.01) (5 Samples)

The inspectors evaluated the following radioactive effluent systems during walkdowns:

- (1) Common Radwaste Liquid Effluent Radiation Monitor
- (2) Unit 1 'A' South Stack Radiation Monitor
- (3) Common Hot Maintenance Shop Radiation Monitor
- (4) Common 'A' North Stack Radiation Monitor
- (5) Common North Stack Wide Range Accident Monitor

Sampling and Analysis (IP Section 03.02) (5 Samples)

Inspectors evaluated the following effluent samples, sampling processes and compensatory samples:

- (1) Unit 1 'A' South Stack Tritium Sample
- (2) Unit 2 'A' South Stack Tritium Sample
- (3) Hold Pond Tritium Sample
- (4) Unit 2 'B' South Stack Noble Gas Sample
- (5) Common North Stack Noble Gas Sample

Dose Calculations (IP Section 03.03) (3 Samples)

The inspectors evaluated the following dose calculations:

- (1) Gaseous Discharge Permit G-20210615-149-C for the Common North Stack
- (2) Gaseous Discharge Permit G-20210418-190-C for the Unit 2 South Stack
- (3) Liquid Discharge Permit L-20210501-117-B for the Equipment Drain Sample Tank 'A'

Abnormal Discharges (IP Section 03.04) (3 Samples)

The inspectors evaluated the following abnormal discharges:

- (1) Abnormal Liquid Discharge Permit L-20210323-043-B for Hold Pond
- (2) Abnormal Liquid Discharge Permit L-20210408-076-B for Hold Pond
- (3) Abnormal Liquid Discharge Permit L-20210907-135-B for Underground Normal Waste Holdup Tank

OTHER ACTIVITIES – BASELINE

71151 - Performance Indicator Verification

The inspectors verified licensee performance indicators submittals listed below:

MS10: Cooling Water Support Systems (IP Section 02.09) (2 Samples)

- (1) Unit 1 for the period of October 1, 2020 through September 30, 2021
- (2) Unit 2 for the period of October 1, 2020 through September 30, 2021

BI01: Reactor Coolant System (RCS) Specific Activity Sample (IP Section 02.10) (2 Samples)

- (1) Unit 1 for the period of October 1, 2020 through September 30, 2021
- (2) Unit 2 for the period of October 1, 2020 through September 30, 2021

BI02: RCS Leak Rate Sample (IP Section 02.11) (2 Samples)

- (1) Unit 1 for the period of October 1, 2020 through September 30, 2021
- (2) Unit 2 for the period of October 1, 2020 through September 30, 2021

OR01: Occupational Exposure Control Effectiveness Sample (IP Section 02.15) (1 Sample)

- (1) Unit 1 for the period of December 2020 through November 2021
Unit 2 for the period of December 2020 through November 2021

PR01: Radiological Effluent Technical Specifications/Offsite Dose Calculation Manual
Radiological Effluent Occurrences (RETS/ODCM) Radiological Effluent Occurrences Sample
(IP Section 02.16) (1 Sample)

- (1) Unit 1 for the period of December 2020 through November 2021
Unit 2 for the period of December 2020 through November 2021

71152 - Problem Identification and Resolution (PI&R)

Semiannual Trend Review (IP Section 02.02) (1 Sample)

- (1) The inspectors reviewed the licensee's corrective action program for potential adverse trends that might be indicative of a more significant safety issue

Annual Follow-up of Selected Issues (IP Section 02.03) (2 Samples)

The inspectors reviewed the licensee's implementation of its corrective action program related to the following issues:

- (1) Identification, evaluation, and corrective action in response to 'A' RHR SDC suction motor operated valve trip on thermal overload (issue report (IR) 4443727)
- (2) Identification, evaluation, and corrective action in response to Unit 1 HPCI system surveillance test failure and subsequent event notification 55484 (IR 4448242)

71153 – Follow-up of Events and Notices of Enforcement Discretion

Event Report (IP Section 03.02) (1 Sample)

The inspectors evaluated the following licensee event reports (LERs):

- (1) LER 2021-001-00, Unit 1 HPCI Inoperable Due to Remote Shutdown Panel Switch Failure (ADAMS Accession No. ML21326A008). The inspection conclusions associated with this LER are documented in this report under the Inspection Results associated with section 71152. This LER is closed.

INSPECTION RESULTS

Failure to Perform a Functionality Assessment to Adequately Maintain the Fire Protection Program			
Cornerstone	Significance	Cross-Cutting Aspect	Report Section
Mitigating Systems	Green NCV 05000352,05000353/2021004-01 Open/Closed	[H.13] - Consistent Process	71152
<p>The inspectors identified a Green finding and associated NCV of License Condition 2.C.(3), Fire Protection, when Constellation did not adequately maintain all provisions of the approved FPP with the 'A' residual heat removal (RHR) shutdown cooling (SDC) suction valve stuck and disabled in the closed position for approximately six months. Specifically, Constellation did not assess the credited FPP function of the Unit 1 'A' RHR SDC suction valve, in accordance with station procedures, which resulted in Constellation not adequately maintaining the capability to achieve cold shutdown for certain fire scenarios until the valve was repaired.</p>			
<p><u>Description:</u> On December 30, 2020, the Unit 1 RHR SDC suction motor operated valve (MOV) HV-051-1F006A (1F006A) tripped on thermal overload (TOL) protection while attempting an open stroke from the closed position during the performance of post-maintenance testing following preventive maintenance (PM) activities on the valve's associated motor control unit (MCU). During the open stroke attempt, the equipment operator noted an unusual noise local at the valve, and the electrical maintenance technician measured locked rotor current of 26.5 amps at the MCU breaker. Operators subsequently opened the breaker to de-energized the valve in the closed position, documented the condition in IR 4392945, and declared the valve inoperable for the SDC mode of operation per plant TS limiting conditions for operation 3.4.9.1, 3.4.9.2, 3.9.11.1, and 3.9.11.2, which are only applicable in operating conditions 3, 4 and 5. On December 31, 2020, Constellation added IR 4392945 to the station's priority work list to plan troubleshooting the cause of the 1F006A TOL trip.</p> <p>On June 28, 2021, after previous troubleshooting efforts to unseat and open the valve had been unsuccessful, maintenance technicians took local electrical control at the MOV motor, and determined the electrical leads had been reversed such that the valve was stroking opposite of the attempted direction. In response, Constellation performed a motor replacement, verified the as-left electrical leads were correctly landed, inspected the MOV actuator, and performed satisfactory diagnostic testing of the MOV.</p> <p>The inspectors performed a review of Constellation's overall identification, evaluation, and corrective actions in response to the TOL trip of the 1F006A on December 30, 2020. The inspectors reviewed IR 4392945, assignment 3, and noted an action was assigned to perform a temporary procedure change to incorporate alternate SDC for certain fire actions, but never completed prior to the performance of 1F006A repairs on June 28, 2021. The inspectors reviewed the operability screening in IR 4392945, and identified that no functionality assessment was performed against any FPP requirements associated with the 1F006A valve. The inspectors subsequently reviewed Constellation procedure OP-AA-115, "Operability</p>			

Determinations,” Revision 23, and noted that step 1.4 required a functionality assessment of deficient conditions involving non-TS structures, systems, and components that perform necessary functions described in the current licensing basis, including the Updated Final Safety Analysis Report (UFSAR) and FPP. Additionally, step 2.11 stated that operations can request a formal functionality evaluation in accordance with CC-AA-301-101, “Engineering Technical Evaluations.” The inspectors also reviewed procedure CC-AA-211-1001, “Fire Protection Engineering Evaluations,” and noted that it was used to evaluate FPP conditions, configurations, and deviations, and further noted that it stated fire protection engineering evaluations should be documented in accordance with the engineering technical evaluation process.

The inspectors reviewed UFSAR section 9A.5, “Analysis of Capability to Achieve Safe Shutdown,” and noted that shutdown method “R” credits only the ‘A’ RHR loop to achieve and maintain cold shutdown, whereas the other shutdown methods credit any SDC loop or use of a pre-established alternate shutdown mode to achieve and maintain safe shutdown. The inspectors reviewed sections 9A5.3.22 and 9A5.3.24 of the UFSAR safe shutdown analysis; Specification N-294, “Post-Fire Safe Shutdown Requirements,” Revision 4, Attachment H; and 1FSSG-3044E, “Fire Area 044E Fire Guide,” Revision 1; and noted that fire areas 22 (Unit 1 cable spreading room), 24 (main control room), and 44E (reactor enclosure safeguard access area - east) were three fire areas in Unit 1 that credited only the ‘A’ loop of RHR to achieve cold shutdown. The inspectors further noted that USFAR section 9A.3.2.1, item 25, describes that Limerick conforms to 10 CFR Appendix R item number L.1, which requires the shutdown capability for each fire area be able to achieve and maintain cold shutdown within 72 hours. Overall, the inspectors determined that Constellation did not perform a functionality assessment to evaluate the capability to achieve and maintain cold shutdown following discovery that the 1F006A valve was non-functional for its SDC function. Additionally, the inspectors determined that with the valve stuck in its closed seat and the cause not understood, the ability to perform troubleshooting and corrective maintenance to manually open the valve and achieve cold shutdown conditions within 72 hours could not reasonably be credited without an associated fire protection engineering technical evaluation.

Corrective Actions: Constellation repaired ‘A’ RHR SDC MOV 1F006A on June 28, 2021, therefore restoring compliance with FPP License Condition 2.C.(3). Additionally, Constellation captured the failure to perform a functionality assessment against the FPP under IR 4471255.

Corrective Action References: IRs 4471255, 4443727, 4443735, 4392945, 4432134

Performance Assessment:

Performance Deficiency: The inspectors determined that not performing a FPP functionality assessment in response to the failed closed ‘A’ RHR SDC suction valve constituted a failure to adequately maintain all provisions of the approved FPP, as required by License Condition 2.C.(3). The inspectors determined that not adequately maintaining all provisions of the approved FPP was a performance deficiency because it was reasonably within Constellation’s ability to foresee and correct, and should have been prevented.

Screening: The inspectors determined the performance deficiency was more than minor because it was associated with the Protection Against External Factors 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, with the ‘A’ RHR SDC suction valve stuck in the

failed closed position, the credited method to achieve cold shutdown was not adequately maintained for approximately six months until the valve was repaired.

Significance: The inspectors assessed the significance of the finding using Appendix F, “Fire Protection and Post - Fire Safe Shutdown SDP.” The inspectors determined this finding was of very low safety significance (Green) in accordance with step 1.4.7-C, because the finding did not adversely affect the ability to reach and maintain hot shutdown/hot standby or safe stable conditions using the credited safe shutdown success path. Specifically, the finding impacted the ability to reach and maintain cold shutdown conditions for two specific fire areas in the safe shutdown analysis.

Cross-Cutting Aspect: H.13 - Consistent Process: Individuals use a consistent, systematic approach to make decisions. Risk insights are incorporated as appropriate. Specifically, operators did not apply a consistent level of rigor when assessing a degraded condition such that they only considered its impact on the TS function and did not perform a FPP functionality assessment.

Enforcement:

Violation: Limerick Generating Station, Unit 1, License Condition 2.C.(3), Fire Protection, requires Constellation to maintain in effect all provisions of the approved FPP as described in the UFSAR. UFSAR section 9A.5.2.2, shutdown method “R,” credits the use of the ‘A’ loop of RHR SDC mode to achieve and maintain cold shutdown conditions in the event of certain fires described in UFSAR safe shutdown analysis. Constellation procedure OP-AA-108-115, “Operability Determinations,” Revision 23, step 1.4, requires a functionality assessment of non-TS equipment that performs a necessary function described in the current licensing basis, which includes the FPP.

Contrary to the above, from December 30, 2020, until June 28, 2021, Constellation did not adequately maintain all provisions of the approved FPP when a functionality assessment was not performed with the ‘A’ RHR SDC suction valve stuck in the failed closed position. Consequently, Constellation did not ensure the credited method to achieve and maintain cold shutdown, for certain fire areas in the UFSAR safe shutdown analysis, could be performed within 72 hours, as described in UFSAR section 9A.3.2.1, item 25.

Enforcement Action: This violation is being treated as a non-cited violation, consistent with Section 2.3.2 of the Enforcement Policy.

TS 6.8 NCV: Failure to Follow Preventive Maintenance Program Procedure Results in HPCI Inoperability and Unavailability

Cornerstone	Significance	Cross-Cutting Aspect	Report Section
Mitigating Systems	Green NCV 05000352,05000353/2021004-02 Open/Closed	[H.6] - Design Margins	71152

The inspectors identified a Green finding and associated NCV of TS 6.8, “Procedures and Programs,” when Constellation did not follow procedure ER-AA-200, “Preventive Maintenance Program,” Revision 2, during the performance of Unit 1 HPCI emergency shutdown (ESD) switch equipment classification. As a result, the switch failed due to age-related internal mechanical degradation, which rendered the HPCI system inoperable and unavailable.

Description: On September 23, 2021, during the performance of a quarterly in-service test of the Unit 1 HPCI system, the HPCI system was not capable of sustaining discharge pressure and flow parameters required by TS, as oscillations were observed in pump discharge pressure, pump flow, and turbine speed. HPCI was secured, declared inoperable and unavailable, and the issue was reported under event notification number 55484. Constellation performed troubleshooting and identified high resistance contacts on the normally energized ESD switch, which is wired in series with the flow controller output signal to the ramp generator signal converter. Constellation replaced the ESD switch, performed a successful in-service test of the HPCI pump, and restored HPCI to OPERABLE on September 27, 2021. The ESD switch was installed in the early 1990's in response to LER 89-002-001, to provide remote shutdown panel manual switch capability to de-energize HPCI control power for a specific fire scenario that required main control room evacuation. Constellation noted that earlier on September 23, 2021, prior to performance of the PV&F test, the ESD switch had been cycled off and back on as part of a separate logic system functional test, which was completed satisfactorily and the HPCI system was restored to OPERABLE. Acceptance criteria for the ESD switch manipulation test step consisted solely of verifying the condition of a control power status light in the main control room. However, the switch consists of multiple contacts and the as-left high resistance was across a different switch contact than the one verified by indicating light. This high resistance resulted in a reduction in the flow controller demand signal received by the ramp generator signal converter module, and accounted for the unstable speed control in both automatic and manual modes (unstable voltage signal) thereby resulting in the inability of the pump to maintain rated flow and discharge pressure.

Constellation performed a work group evaluation (WGE) under IR 4448242-11, which included a failure analysis of the ESD switch, and determined the cause of the high contact resistance was attributed to an internal switch failure. The HPCI ESD switch was a rotary-style key switch assembly that consisted of 5 wafer-style deck layers assembled in compression. The failure analysis determined that with the switch mounted in a steady state condition, the internal parts were not able to sufficiently flex to significantly affect performance. However, switch manipulations were determined to result in flexing of the internal switch deck layers, thereby increasing the contact resistances. Constellation determined the components within the multi-layered switch decks were flexing and separating, likely due to age-related degradation of the epoxy, which was resulting in high resistance measurements at certain contact points. The inspectors reviewed the failure analysis, which identified the failure mode to be age-related mechanical degradation that resulted in high internal contact resistance, most notably in deck number 3, which included the contacts associated with the flow controller demand signal output.

The inspectors reviewed the component classification of the HPCI ESD switch, to determine the PM program requirements, and noted that the switch was classified as non-critical, with a low duty cycle in a mild environment. Based on this classification, there was no time-directed replacement of the switch. The inspectors reviewed Constellation program procedures regarding equipment classification to understand how PM schedules were determined. ER-AA-200, "Preventive Maintenance Program," Revision 2, step 4.1.3 requires equipment classifications to be performed in accordance with ER-AA-200-1001, "Equipment Classification." ER-AA-200-1001, Revision 2, Attachment 1, step 1.4, requires a component to be classified as critical if its failure results in the failure of a maintenance rule high safety significant (HSS) function. The inspectors reviewed the maintenance rule function of HPCI and noted that the high pressure safety injection function was classified as an HSS function. In addition, ER-AA-200-1001, Attachment 4, Component Classification Guidance and

Examples, example #4, states that certain passive components covered by testing requirements may be classified as run to maintenance. However, the inspectors determined that Constellation did not perform any periodic testing to demonstrate that the ESD switch contacts maintained the HPCI system safety function following cycling of the switch to test the capability to turn system control power off and on. The inspectors reviewed the performance centered maintenance template for switches, and noted that critical switches with a low duty cycle in a mild environment were specified to have a replacement frequency of 20 years. The inspectors further noted that Constellation's failure analysis described the switch as 32 years old. Ultimately, the inspectors determined that Constellation did not appropriately classify the component as critical, or develop an appropriate test method to classify the switch as run to maintenance, and as such did not establish or evaluate appropriate PM per station procedures.

Corrective Actions: Constellation captured the inadequate equipment classification in IR 4474120, replaced the failed switch on Unit 1, performed a corrective action program evaluation under IR 4448242-11 to understand the equipment failure mechanism and evaluate the issue for additional assigned actions, and wrote IR 4449379 to address the extent of condition of the failed switch.

Corrective Action References: IRs 4474120, 4448242 and 4449379

Performance Assessment:

Performance Deficiency: The inspectors determined that not properly pre-planning and performing preventive maintenance in accordance with station procedures was reasonably within Constellation's ability to foresee and correct, should have been prevented, and was therefore determined to be a performance deficiency.

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 performance deficiency resulted in the failure of a switch that rendered the HPCI system inoperable and unavailable.

Significance: The inspectors assessed the significance of the finding using Appendix A, "The Significance Determination Process (SDP) for Findings At-Power." The inspectors utilized IMC 0609, Appendix A, Exhibit 2, "Mitigating System Screening Questions," to determine this finding was of very low safety significance (Green) because it did not represent the loss of the probabilistic risk assessment function of a single train TS system (HPCI) for greater than its TS allowed outage time. Specifically, it was determined that the switch failed when it was manipulated during logic system functional testing on September 23, 2021, which only amounted to approximately 4 days of system unavailability prior to its repair on September 27, 2021.

Cross-Cutting Aspect: H.6 - Design Margins: The organization operates and maintains equipment within design margins. Margins are carefully guarded and changed only through a systematic and rigorous process. Special attention is placed on maintaining fission product barriers, defense-in-depth, and safety-related equipment. Specifically, Constellation did not maintain the HPCI ESD switch within the allowable classification margins of the preventive maintenance program, which resulted in age-related mechanical switch failure.

Enforcement:

Violation: Limerick Generating Station, Unit 1, TS 6.8, "Procedures and Programs," Section 6.8.1a, requires written procedures shall be established, implemented, and maintained covering the activities in Regulatory Guide 1.33, "Quality Assurance Program Requirements," Revision 2. Regulatory Guide 1.33, Section 9.b, "Procedures for Performing Maintenance," requires PM schedules should be developed to specify inspection or replacement of parts that have a specific lifetime. Constellation procedure "ER-AA-200," "Preventive Maintenance Program," Revision 2, step 4.1.1, requires component classification be performed in accordance with ER-AA-200-1001, "Equipment Classification."

Contrary to the above, since February 10, 2017, Constellation failed to implement station procedures covering preventive maintenance activities of the HPCI ESD switch. Specifically, the HPCI ESD switch was not properly classified in accordance with ER-AA-200-1001, and therefore did not have an adequate PM schedule that included appropriate testing or replacement. Consequently, on September 23, 2021, the HPCI switch failed due to age-related internal mechanical degradation, which rendered HPCI inoperable and unavailable.

Enforcement Action: This violation is being treated as a non-cited violation, consistent with Section 2.3.2 of the Enforcement Policy.

Observation: Missed Evaluation Opportunities

71152

On June 28, 2021, Constellation performed troubleshooting in response to the Unit 1 'A' RHR SDC suction MOV trip on TOL during the performance of open stroke post-maintenance testing following the performance of PM activities at the valve's associated MCU (see above NCV 2022001-01). Constellation identified reversed electrical leads at the valve motor, and documented this condition in IR 4432134. Inspectors noted that Constellation did not assign any actions to evaluate the cause of the reversed electrical leads. On August 31, 2021, after several rounds of inspector questioning, Constellation wrote IR 4443727 to pursue a WGE regarding the cause of the reversed electrical leads, and IR 4443735 to capture the untimeliness associated with the overall evaluation and corrective action.

On November 15, 2021, Constellation management review committee approved WGE 4443727-05 associated with the failed post-maintenance testing on the 'A' RHR SDC suction valve. Constellation determined the cause of the failed post-maintenance testing was attributed to a legacy condition of reversed electrical leads at the valve motor. With respect to the MCU PM activities, Constellation determined the leads at the MCU TOL were most likely in a reversed orientation prior to performance of the PM activities, since the as-left electrical configurations at the MCU (following completion of the MCU PM activities) were verified to be satisfactory during initial troubleshooting. The WGE assigned actions to both operations and electrical maintenance to enhance procedure guidance for performing as-found MCU wiring configuration checks, revised MCU post-maintenance testing work order activities to place associated MOVs in an intermediate position and bump for rotation prior to fully stroking the valves, incorporated the legacy wiring discrepancies into equipment operator training, and performed an extent of condition review of other MOVs with an associated recovery plan.

EXIT MEETINGS AND DEBRIEFS

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

- On November 19, 2021, the inspectors presented the Radioactive Gaseous and Liquid Effluent Treatment inspection results to Mr. Michael Gillin, Plant Manager, and other members of the licensee staff.
- On January 28, 2022, the inspectors presented the integrated inspection results to Mr. Frank Sturniolo, Site Vice President, and other members of the licensee staff.

DOCUMENTS REVIEWED

Inspection Procedure	Type	Designation	Description or Title	Revision or Date
71111.04	Corrective Action Documents	4450985	LGS TS Table 3.3.7.1-1, Action 70 Improvement Opportunity	10/05/2021
		4451066	Control Room low differential pressure	10/06/2021
		4451403	HU event with Clearance and Tagging	10/07/2021
		4451418	MCR hard negative during testing of HD-078-027A	10/07/2021
71111.06	Corrective Action Documents	4451062	Safety: Blue Drains Clogged on 313'	10/06/2021
		4460858	Clogged floor drain in U1 Rx 283' elevation	11/14/2021
71111.12	Corrective Action Documents	4426890	2R16 RDCS Trend	06/02/2021
		4439520	Aggregate IR for U1 RDCS INOPS/CCP	08/08/2021
		4442069	U1 RDCS System Health	08/23/2021
		4448242	U1 HPCI UNSAT response during ST-6-055-230-1	09/23/2021
		4455530	Trend IR: Ops knowledge and response to RDCS INOP conditions	10/25/2021
		4474120	NRC ID - HPCI ESD Switch Incorrect RCM Classification	01/27/2022
71111.13	Corrective Action Documents	4452857	U/1 Control Rod 10-51 INOP at position 48	10/14/2021
		4452861	U/1 random RBM Upscale/Inop and Rod Block	10/14/2021
		4452864	Single rod position fault turns all PPC rod position magenta	10/14/2021
		4460218	AVR Gen Field EFR Communications Fault Time Delay Change	11/11/2021
71111.15	Corrective Action Documents	4454506	Proactive Inspection of E/S X-M1-21015 (U2)	09/03/2021
		4454508	Proactive Inspection of E/S X-M1-21011 (U2)	09/03/2021
		4458042	LGS U2 MFLPD Trending Higher than Designed	11/02/2021
		4459540	00-P975 Seal Oil Looks Milky	11/09/2021
		4459541	00-P976 Seal Oil Looks Milky	11/09/2021
		4461816	U2 Multiple LPRMs signal dropout during 3DM case	11/18/2021
		4462346	2A RPS Inverter Sync Fail	11/21/2021
		4466594	Tech Eval for MR90 for ECCS Trip Unit Inverters	12/14/2021
71111.18	Corrective Action Documents	4444417	Degraded HBC-537-E001 piping	09/02/2021
		4460332	Hole found in pipe in spray pond	11/12/2021
71111.19	Corrective Action Documents	4450334	Unit 2 SDV inboard valves exceeded max allowable stroke time	10/02/2021
		4450513	Copper union leaking air during PMT on the SV-047-2F009	10/04/2021

Inspection Procedure	Type	Designation	Description or Title	Revision or Date
		4464842	HSS-051-2F014 was binding when operated	12/06/2021
		4465538	LAR - Extend the RSP AOT Time to 30 Days	12/09/2021
71124.02	Miscellaneous		2021 Limerick Generation Station Li2R16 Radiation Protection Outage Report	
			704 Suppression Pool Emergent Work Activities	Revision 00
			ALARA Briefing/Attendance Form ALARA Plan #21-0017	
			701 Outage Suppression Pool Diving	Revision 01
			703 Outage Suppression Pool Work Activities	Revision 00
			2020 Limerick Generation Station Li1R18 Radiation Protection Outage Report	