



**UNITED STATES  
NUCLEAR REGULATORY COMMISSION**

REGION III  
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January 25, 2019

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

**SUBJECT: QUAD CITIES NUCLEAR POWER STATION, UNITS 1 AND 2—NRC  
INTEGRATED INSPECTION REPORT 05000254/2018004 AND  
05000265/2018004**

Dear Mr. Hanson:

On December 31, 2018, the U.S. Nuclear Regulatory Commission (NRC) completed an integrated inspection at your Quad Cities Nuclear Power Station, Units 1 and 2. On January 3, 2019, the NRC inspectors discussed the results of this inspection with Mr. Ken Ohr and other members of your staff. The results of this inspection are documented in the enclosed report.

Based on the results of this inspection, the NRC has identified one issue that was evaluated under the risk significance determination process as having very low safety significance (Green). The NRC has also determined that one Violation was associated with this issue. Because the licensee initiated condition reports to address this issue, this Violation is being treated as a Non-Cited Violation (NCV), consistent with Section 2.3.2 of the Enforcement Policy. This NCV is described in the subject inspection report.

If you contest the Violation or significance of the NCV, 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 III; the Director, Office of Enforcement; and the NRC Resident Inspector at the Quad Cities Nuclear Power Station.

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 III; and the NRC Resident Inspector at the Quad Cities Nuclear Power Station.

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

Sincerely,

**/RA/**

Kenneth Riemer, Chief  
Branch 1  
Division of Reactor Projects

Docket Nos. 50-254; 50-265  
License Nos. DPR-29; DPR-30

Enclosure:  
IR 05000254/2018004; 05000265/2018004

cc: Distribution via ListServ®

Letter to Bryan Hanson from Kenneth Riemer dated January 25, 2019

SUBJECT: QUAD CITIES NUCLEAR POWER STATION, UNITS 1 AND 2—NRC  
INTEGRATED INSPECTION REPORT 05000254/2018004 AND  
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U.S. NUCLEAR REGULATORY COMMISSION

REGION III

Docket Nos: 50-254; 50-265

License Nos: DPR-29, DPR-30

Report No: 05000254/2018004; 05000265/2018004

Enterprise Identifier: I-2018-004-0025

Licensee: Exelon Generation Company, LLC

Facility: Quad Cities Nuclear Power Station, Units 1 and 2

Location: Cordova, IL

Dates: October 1 through December 31, 2018

Inspectors: R. Murray, Senior Resident Inspector  
K. Carrington, Resident Inspector  
J. Cassidy, Senior Health Physicist  
A. Dunlop, Senior Reactor Engineer  
M. Garza, Emergency Preparedness Inspector  
M. Jones, Reactor Engineer  
C. Zoia, Senior Operations Engineer  
C. Mathews, IEMA Resident Inspector

Approved by: K. Riemer, Chief  
Branch 1  
Division of Reactor Projects

Enclosure

## SUMMARY

The U.S. Nuclear Regulatory Commission (NRC) continued monitoring licensee's performance by conducting an integrated quarterly inspection at Quad Cities Nuclear 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. Findings and violations being considered in the NRC's assessment are summarized in the table below.

### List of Findings and Violations

Failure to Follow Procedure Causes Turbine Load Reject and SCRAM			
Cornerstone	Significance	Cross-Cutting Aspect	Report Section
Initiating Events	Green NCV 05000254/2018004-01 Closed	[H.11] – Challenge the Unknown	71152 – Problem Identification and Resolution
<p><u>Introduction:</u> A self-revealed Green finding and associated Non-Cited Violation (NCV) of Technical Specification (TS) 5.4.1 was identified when the licensee failed to follow Procedure QCOP 6400-35, "Performing Transmission Switching Orders." Specifically, following the closure of 345 kV circuit breaker 4-6, which is NOT a unit output breaker (therefore, the requirement to perform step F.3.j was not met), the licensee performed step F.3.j, which shorted across auxiliary contacts for circuit breaker 7-8, energized the turbine-generator load reject relay, and caused a turbine trip and reactor SCRAM.</p>			

### Additional Tracking Items

Type	Issue Number	Title	Report Section	Status
LER	05000254/2018-003-00	Two Reactor Protection System Channels Impacted by Single Main Stop Valve Limit Switch Failure	IP 71153 – Follow-Up of Events and Notices of Enforcement Discretion	Closed
LER	05000254/2018-003-01	Two Reactor Protection System Channels Impacted by Single Main Stop Valve Limit Switch Failure	IP 71153 – Follow-Up of Events and Notices of Enforcement Discretion	Closed

## TABLE OF CONTENTS

PLANT STATUS .....	4
INSPECTION SCOPES .....	4
REACTOR SAFETY .....	4
RADIATION SAFETY .....	7
OTHER ACTIVITIES – BASELINE .....	8
OTHER ACTIVITIES—TEMPORARY INSTRUCTIONS, INFREQUENT AND ABNORMAL ..	9
INSPECTION RESULTS .....	9
EXIT MEETINGS AND DEBRIEFS .....	13
DOCUMENTS REVIEWED.....	13

## **PLANT STATUS**

### **Unit 1**

The unit began the operating period at full rated thermal power. On November 17, 2018, operators reduced power on the unit to approximately 78 percent for a planned power reduction for turbine testing and a control rod pattern adjustment. On December 8, 2018, operators reduced power on the unit to approximately 70 percent for a planned power reduction for turbine testing, control rod pattern adjustment, and to troubleshoot and repair the 1B feedwater regulating valve. The unit was returned to full power on December 9, 2018, where it was operated at or near for the remainder of the inspection period, with the exception of other short term power reductions as requested by the transmission system operator.

### **Unit 2**

The unit began the operating period at full rated thermal power. On October 20, 2018, operators reduced power to approximately 72 percent for a planned power reduction for turbine testing, control rod pattern adjustment, and troubleshooting of the 2A feedwater regulating valve. The unit was returned to full power on October 14, 2018, where it operated for the remainder of the inspection period.

## **INSPECTION SCOPES**

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

## **REACTOR SAFETY**

### 71111.04—Equipment Alignment

#### Partial Walkdown (2 Samples)

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

- (1) Unit 1, Division I, 4160 volt (V) bus 13–1 and 480 Vac Motor Control Center No. 18 electrical distribution systems following restoration on October 25, 2018; and
- (2) Unit 1 reactor core isolation cooling (RCIC) system during Unit 1 high pressure coolant injection (HPCI) system work window on November 15, 2018.

#### Complete Walkdown (1 Sample)

The inspectors evaluated system configurations during a complete walkdown of the 'A' and 'B' control room emergency ventilation system and air conditioning/refrigeration system on October 22, 2018.

#### 71111.05AQ—Fire Protection Annual/Quarterly

##### Quarterly Inspection (4 Samples)

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

- (1) Fire Zone 1.1.1.1, Unit 1 Torus Basement Area, Elevation 554', on November 15, 2018;
- (2) Fire Zone 1.1.2.3, Unit 2 Reactor Building, Elevation 623'-0", Mezzanine Level, on November 29, 2018;
- (3) Fire Zone 9.2, Unit 2 Turbine Building, Elevation 595'-0", Diesel Generator, on December 21, 2018; and
- (4) Fire Zone 8.2.7.E, Unit 2 Turbine Building, Elevation 615'-6", North Mezzanine Floor, on December 21, 2018.

##### Annual Inspection (1 Sample)

The inspectors evaluated fire brigade performance on November 20, 2018.

#### 71111.07—Heat Sink Performance

##### Heat Sink (Triennial) (2 Samples)

The inspectors evaluated exchanger/sink performance on the following components:

- (1) Unit 2 emergency diesel generator (EDG) cooling water heat exchangers (2-6661-A(B)), Section 02.02b; and
- (2) Heat sink, Section 02.02d, specifically Sections 02.02d.2 and 02.02d.4, were completed.

#### 71111.11—Licensed Operator Requalification Program and Licensed Operator Performance

##### Operator Requalification (1 Sample)

The inspectors observed and evaluated a portion of a licensed operator annual requalification operating exam in the simulator on November 6, 2018.

##### Operator Performance (1 Sample)

The inspectors observed and evaluated Unit 2 restoration of 1A feedwater regulating valve (FRV) hydraulic controller programmable logic controller (PLC) on October 5, 2018; Unit 2 FRV troubleshooting on October 10, 2018; and Unit 1 downpower for a rod sequence exchange on November 17, 2018.



### Operator Exams (1 Sample)

The inspectors reviewed and evaluated requalification examination results on December 18, 2018.

### 71111.12—Maintenance Effectiveness

#### Routine Maintenance Effectiveness (3 Samples)

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

- (1) Title 10 CFR 50.65(a)(3) Periodic Evaluation May 1, 2016, through May 1, 2018;
- (2) Units 1 and 2 turbine building closed cooling water systems; and
- (3) Units 1 and 2 feed and condensate systems.

### 71111.13—Maintenance Risk Assessments and Emergent Work Control (4 Samples)

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

- (1) Emergent work associated with Unit 2A FRV lockup and emergent repair of gasket leak from 'B' control room heating, ventilation, and air conditioning (HVAC) refrigeration condenser unit, during the week of October 8, 2018;
- (2) Unit 2 planned downpower for turbine testing, emergent replacement of Unit 2B reactor feed pump seal cooling line and troubleshooting of Unit 2A FRV on October 20, 2018;
- (3) Unit 1 Loss of 4 kilovolt (kV) bus 13–1 during 2nd level undervoltage test (emergent issue) [1/2 EDG unavailable and online risk change to yellow] on October 24, 2018; and
- (4) Unit 1 HPCI 2 motor speed changer relay (1–2330–123) emergent replacement on November 15, 2018, and Unit 1 online risk change to yellow; Unit 1B FRV lockup on November 16, 2018, and Unit 1 planned downpower for rod sequence exchange on November 17, 2018.

### 71111.15—Operability Determinations and Functionality Assessments (3 Samples)

The inspectors evaluated the following operability determinations and functionality assessments:

- (1) Issue Report (IR) 4182550: OOT [Out of Tolerance], [Level Transmitter] LT 1–1641–5A [Wide Range Torus Level Instrument Out of Tolerance] and IR 4180674: OOT, 1–1464–A, Trend Code B4 [1A Core Spray Flow Transmitter];
- (2) IR 4192493: Unit 1 HPCI Relay in an Unexpected State; and
- (3) IR 4204885: Unit 1A 125 volts direct current (Vdc) Battery Charger Failure.

### 71111.19—Post Maintenance Testing (4 Samples)

The inspectors evaluated the following post maintenance tests:

- (1) Testing of the control room HVAC system following emergent replacement of failed gasket on control room HVAC refrigeration unit condenser end bell, and 'A' temperature expansion valve replacement on October 11, 2018;

- (2) Testing of Unit ½ emergency diesel output breaker relay following maintenance (fuse replacement on switchboard) on November 30, 2018;
- (3) WO 4601554–01: Mechanical Maintenance Unit 1 Station Blackout (SBO) 22-Year Inspection on November 2, 2018; and
- (4) Safe shutdown makeup pump flow rate test following oil replacement and quarterly maintenance on December 4, 2018.

#### 71111.22—Surveillance Testing

The inspectors evaluated the following surveillance tests:

##### Routine (3 Samples)

- (1) QCOS 0202–23: Reactor Recirculation Pump Run Out Limits Determination and Setting, on October 4, 2018;
- (2) QCOS 6500–09: Unit 1 Second Level Undervoltage Test, on October 26, 2018; and
- (3) WO 46363050–1: EM Perform Offline Baker Testing [Unit] 1B RHR Pump, on October 22, 2018.

#### 71114.04—Emergency Action Level and Emergency Plan Changes (1 Sample)

The inspectors completed the evaluation of submitted Emergency Action Level and Emergency Plan changes on October 30, 2018. This evaluation does not constitute NRC approval.

### **RADIATION SAFETY**

#### 71124.02—Occupational As Low As Reasonably Achievable Planning and Controls

##### Radiological Work Planning (1 Sample)

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

- (1) Radiation Work Permit QC–01–17–00541; DW I/B MSIV [drywell inboard main steam isolation valve] Over Haul;
- (2) Radiation Work Permit QC–02–18–00541; DW I/B MSIV [drywell inboard main steam isolation valve] Over Haul; and
- (3) Radiation Work Permit QC–02–18–00510; DW [drywell] Main Steam Safety Relief Valve Activities.

##### Verification of Dose Estimates and Exposure Tracking Systems (1 Sample)

The inspectors evaluated dose estimates and exposure tracking.

##### Implementation of As Low As Reasonably Achievable and Radiological Work Controls (1 Sample)

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

- (1) Radiation Work Permit QC-01-17-00541; DW I/B MSIV [drywell inboard main steam isolation valve] Over Haul;
- (2) Radiation Work Permit QC-02-18-00541; DW I/B MSIV [drywell inboard main steam isolation valve] Over Haul; and
- (3) Radiation Work Permit QC-02-18-00510; DW [drywell] Main Steam Safety Relief Valve.

## **OTHER ACTIVITIES – BASELINE**

### 71151—Performance Indicator Verification (12 Samples)

The inspectors verified licensee performance indicators submittals listed below:

- (1) MS07: High Pressure Injection Systems—2 Samples (October 1, 2017 – September 30, 2018);
- (2) MS08: Heat Removal Systems—2 Samples (October 1, 2017 – September 30, 2018);
- (3) MS09: Residual Heat Removal Systems—2 Samples (October 1, 2017 – September 30, 2018);
- (4) MS10: Cooling Water Support Systems—2 Samples (October 1, 2017 – September 30, 2018);
- (5) BI01: RCS Specific Activity—2 Samples (October 2017 – September 2018);
- (6) OR01: Occupational Exposure Control Effectiveness Activity—1 Sample (April 2017 – September 2018); and
- (7) PR01: Radiological Effluent Technical Specifications/Offsite Dose Calculation Manual (RETS/ODCM) Radiological Effluent Occurrences—1 Sample (July 2017 – September 2018).

### 71152—Problem Identification and Resolution

#### Semiannual Trend Review (1 Sample)

The inspectors reviewed the licensee's corrective action program between July 1, 2018 and December 31, 2018, for trends that might be indicative of a more significant safety issue.

#### Annual Follow-Up of Selected Issues (2 Samples)

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

- (1) Root Cause Report 4160631: Unit 1 Resin Intrusion Event; and
- (2) Root Cause Report 4177502: Unit 1 Reactor SCRAM from 100 percent Reactor Power.

### 71153—Follow-Up of Events and Notices of Enforcement Discretion

#### Events (2 Samples)

- (1) The inspectors evaluated the loss of the Unit 1, Division I, 4160 Volt bus 13-1, and the licensee's response on October 24, 2018.
- (2) The inspectors evaluated the licensee's retraction of Event Notification (EN) 53657, "Control Room Emergency Ventilation AC System Inoperable," which was originally reported on October 10, 2018. The licensee retracted the EN on November 15, 2018.

### Licensee Event Reports (1 Sample)

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

- (1) Licensee Event Report (LER) 05000254/2018–003–00 and LER 05000254/2018–003–01 (Revisions 0 and 1), Two Reactor Protection System Channels Impacted by Single Main Stop Valve Limit Switch Failure. These LERs are closed because the inspectors determined that there was no performance deficiency.

## **OTHER ACTIVITIES—TEMPORARY INSTRUCTIONS, INFREQUENT AND ABNORMAL**

### **INSPECTION RESULTS**

#### 71152—Problem Identification and Resolution

Observation	71152 – Semi Annual Trend Review
The inspectors reviewed a trend of multiple FRV lock-ups which occurred on both units over several months beginning in September 2018. The licensee documented a trend for FRV failures in IR 4201822. The inspectors reviewed the licensee’s response and subsequent corrective actions for the FRV lock-ups. The licensee was waiting on causal analysis from an off-site vendor at the end of the inspection period. The inspectors did not identify any concerns with the licensee’s response to the FRV lock-ups or the completed corrective actions, which appeared to correct the conditions. The inspectors recommended the next biennial Problem Identification and Resolution inspection review the offsite vendor evaluation for potential extent of condition corrective actions, which may be applicable. The vendor evaluation was being tracked under IR 4177044, assignments 3 and 4.	

Observation	71152 – Annual Sample Review
Root Cause Report 4160631: Unit 1 Resin Intrusion Event	
The inspectors reviewed the licensee’s root cause report for a Reactor Water Cleanup (RWCU) resin intrusion event that occurred on July 31, 2018, during system restoration, following an unplanned isolation of the system. Several issues contributed to this event. The licensee’s root cause was determined to be a latent design vulnerability in the system, which allowed resin material to come off of the RWCU filter demineralizers and migrate into the reactor coolant system. This design vulnerability had been identified by the system designer and vendor (General Electric) in 1976, and was described in GE SIL 159 that same year. Quad Cities had not completed the recommended design changes to the system in the late 1970s based on certain assumptions and procedural changes they had made, in lieu of system modifications. Additional causes identified were system valve leaks and potential degraded RWCU hold pumps, which start on low flow conditions and are designed to maintain resin on the demineralizers. The inspectors did not identify any more than minor performance deficiencies. Considering the time that had lapsed since the GE SIL (42 years), the procedural changes made at the time of the SIL, and the successful system operation, the inspectors determined the cause of this event was not foreseeable. Additionally, the resin intrusion event had caused chemistry parameters to exceed thresholds and caused the station to enter their Technical Requirements Manual limiting conditions for operation; however, the unit was able to maintain normal operations while the RWCU system was placed	

into service and allowed to clean the resin from the reactor coolant system. The inspectors' assessment of the licensee's evaluation of this event was that the corrective actions appeared to address the causes. The inspectors recommended the next biennial Problem Identification and Resolution inspection review that all corrective actions items have been completed from this root cause, because all of the corrective actions were not complete at the end of the inspection period. Additionally, the inspectors recommend that IRs 4165617 and 4164858, which are discussed in the root cause, are reviewed to verify additional contributing causes to this event were investigated. These IRs were related to potential contributing causes of a failure or delay in the RWCU hold pump start sequence, which could not be investigated while the unit was online. Issue Reports 4165617 and 4164858 were still open at the end of the inspection period.

#### Failure to Follow Procedure Causes Turbine Load Reject and SCRAM

Cornerstone	Significance	Cross-Cutting Aspect	Report Section
Initiating Events	Green NCV 05000254/2018004-01 Closed	[H.11] – Challenge the Unknown	IP 71152 – Problem Identification and Resolution

A self-revealed Green finding and associated NCV of TS Section 5.4.1 was identified when the licensee failed to follow procedure QCOP 6400-35, "Performing Transmission Switching Orders." Specifically, following the closure of 345 kV circuit breaker 4-6, which is NOT a unit output breaker (therefore, the requirement to perform step F.3.j. was not met), the licensee performed step F.3.j, which shorted across auxiliary contacts for circuit breaker 7-8, energized the turbine-generator load reject relay, and caused a turbine trip and reactor SCRAM.

#### Description:

On September 26, 2018, at 1908, Quad Cities received an automatic reactor SCRAM from 100 percent power. The SCRAM was a result of a turbine-generator load reject when electricians, who were performing contact checks as a part of a 345 kV breaker switching procedure, shorted across auxiliary contacts for one of the two unit output breakers. The electricians were erroneously directed to perform the auxiliary contact checks by the unit supervisor, who had misunderstood and incorrectly interpreted a step in procedure, QCOP 6400-35, "Performing Transmission Switching Orders."

Procedure QCOP 6400-35 was the implementing procedure for operating 345 kV equipment in the switchyard, usually conducted when there are "switching orders" from the transmission operator. On September 26, 2018, following the completion of maintenance on an off-site power line, Line 0401, the licensee received switching orders, allowing the licensee to restore Line 0401 as a source of power from the electrical grid to the "ring bus." After opening the two ring bus isolation breakers (breaker 4-6 and 6-7) and returning Line 0401 by closing the line disconnect switches, the licensee was ready to reclose the isolation breakers to restore the ring bus. The first breaker the licensee was going to close was breaker 4-6, which is not a unit output breaker. Breaker 6-7, which was also open, is a unit output breaker. Breaker 7-8, also a unit output breaker, was already closed (Unit 1 was online and supplying power to the grid through breaker 7-8.).

Following the closure of breaker 4–6 in accordance with step F.3.f, the licensee continued in step F.3. Step F.3.j stated, “**IF** a Unit output breaker was closed **AND** the Unit is online, **THEN** **check** proper load reject contact status for both output breakers...” Because breaker 4–6 was not an output breaker, this step should have been considered “not applicable.” The unit supervisor misunderstood the meaning of this step and directed electrical maintenance personnel to perform step F.3.j(2), which states, “**if** CKT BKR 6–7 **OR** CKT BKR 7–8 was closed, **THEN** (a) **Verify open** contact 8A–3 to 8A–4 for CKT BKR 7–8, and (b) **Verify open** contact 9A–1 to 9A–2 for CKT BKR 6–7.” Once again, this step was not to be performed because neither breaker 6–7, nor breaker 7–8, had just been closed. Additionally, because breaker 6–7 was open, its auxiliary contacts were expected to be closed and could not have been verified open. As stated previously, breaker 7–8 was closed, and its auxiliary contacts for the load reject circuit would be expected to be open.

When the electricians performed a continuity verification across the auxiliary contacts for breaker 7–8, it effectively created a jumper across the contacts, providing a path for current. With the contacts for breaker 6–7 already closed (because the breaker was open), the circuit logic for the load reject was completed and the automatic SCRAM on Unit 1 occurred.

Corrective Actions: The licensee revised their procedures associated with performing contact checks on unit output breakers to include explicit guidance and direction to only conduct the contact checks when both unit output breakers are closed. The licensee also identified risk perception issues associated with the operation of switchyard breakers. Corrective actions for this issue also included standing orders and guidance for authorizing activities and performing risk challenges.

Corrective Action Reference: IR 4177502, Unit 1 Reactor SCRAM from 100 Percent Reactor Power.

#### Performance Assessment:

Performance Deficiency: The licensee performed continuity checks across the load-reject contacts for breaker 7–8 when they did not meet the conditions for performing the checks per the operating procedure, QCOP 6400–35, “Performing Transmission Switching Orders.”

Screening: The inspectors determined the performance deficiency was more than minor because it adversely affected the Human Performance attribute of the Initiating Events Cornerstone objective to limit the likelihood of events that upset plant stability and challenge critical safety functions during shutdown as well as power operations. Specifically, a human performance error led to the licensee performing a step in the procedure without the conditions being met and caused a turbine-generator load reject and reactor SCRAM.

Significance: The inspectors assessed the significance of the finding using SDP Appendix A, “The Significance Determination Process for Findings at Power.” The inspectors used Exhibit 1, “Initiating Events Screening Questions,” and determined the finding screened as Green because although the finding caused a reactor SCRAM, it did not cause the loss of mitigation equipment relied upon to transition the plant from the onset of the SCRAM to a stable shutdown condition.

Cross-Cutting Aspect: The inspectors determined that the cross-cutting aspect that best corresponds to the apparent cause of the finding was in the Challenge the Unknown aspect in the area of Human Performance, which states that individuals stop when faced with uncertain conditions, and that risks are evaluated and managed before proceeding [H.11]. Specifically,

the licensee's root cause determined that, "Inadequate enforcement of Technical Human Performance and pre-job briefing standards allowed a lapse in the operating crew's ability to identify error precursors and adequately challenge all participants understanding of the intended purpose and expected results of step F.3.j in QCOP 6400-35."

Enforcement:

Violation: Technical Specification Section 5.4.1 states, in part, that "written procedures shall be established, implemented, and maintained covering the applicable procedures recommended in Regulatory Guide 1.33, Revision 2, Appendix A, February 1978."

NRC Regulatory Guide 1.33, Appendix A, Section 4 addresses "Procedures for Startup, Operation, and Shutdown of Safety-Related BWR Systems," and Section 4.w(1), addresses "Offsite Electrical Systems (access circuits)."

The licensee established QCOP 6400-35, Revision 15, "Performing Transmission Switching Orders," as the implementing procedure for operating 345 kV switchyard equipment; the offsite electrical system.

Procedure QCOP 6400-35, Step F.3 directs the steps necessary to close a 345 kV circuit breaker. Step F.3.j states:

**IF** a Unit output breaker was closed **AND** the Unit is online, **THEN** check proper load reject contact status for both output breakers...

(2) **If** CKT BKR 6-7 **OR** CKT BKR 7-8 was closed, **THEN**

(a) **Verify open** contact 8A-3 to 8A-4 for CKT BKR 7-8

(b) **Verify open** contact 9A-1 to 9A-2 for CKT BKR 6-7

Contrary to the above, on September 26, 2018, operators failed to follow Step F.3.j. Specifically, following the closure of 345 kV circuit breaker 4-6, which is NOT a Unit output breaker (therefore, the requirement to perform step F.3.j was not met), the licensee performed step F.3.j, which shorted across auxiliary contacts for circuit breaker 7-8, energized the turbine-generator load reject relay, and caused a turbine trip and reactor SCRAM.

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

71153—Follow-Up of Events and Notices of Enforcement Discretion

Observation	71153 – Follow-Up of Events and Notices of Enforcement Discretion
<p>LER 05000254/2018-003-00 and LER 05000254/2018-003-01 (Revisions 0 and 1), "Two Reactor Protection System Channels Impacted by Single Main Stop Valve Limit Switch Failure"</p> <p>This event was reported for an event where a single cause or condition caused two independent channels to become inoperable in a single system designed to mitigate the consequences of an accident. During surveillance testing on June 9, 2018, the Unit 1 main</p>	

turbine main stop valve number 1 (MSV 1) failed to provide the appropriate reactor protection system (RPS) relay actuations. The MSV 1 limit switch failed to actuate relays in both 'A' and 'B' trains of RPS. Operations entered the limiting condition for operation (LCO) under TS 3.3.1.1, Condition B, for an inoperable channel in both trip systems.

The licensee replaced the limit switch on MSV 1, and the RPS was tested satisfactorily on June 10, 2018. Follow-up inspections of the failed switch showed occasional binding attributed to insufficient or dried lubricant and a hardened O-ring on the operating shaft. Additional causal evaluation by the manufacturer confirmed inadequate lubrication during assembly by the manufacturer.

The inspectors did not identify a performance deficiency because the cause of the event was not within the licensee's ability to foresee and correct. After this event, the vendor had issued a Part 21 related to this issue, which the licensee documented in IR 4181862. The vendor had not completed their evaluation at the end of the inspection period and corrective actions associated with IR 4181862 remained open, pending vendor resolution and guidance. The inspectors recommended the next biennial Problem Identification and Resolution inspection review the corrective actions items associated with IR 4181862.

## **EXIT MEETINGS AND DEBRIEFS**

The inspectors confirmed that proprietary information was controlled to protect from public disclosure. No proprietary information was documented in this report.

- On January 3, 2019, the inspector presented the quarterly integrated inspection results to Mr. K. Ohr, Site Vice President, and other members of the licensee staff.
- On November 9, 2018, the inspector presented the ultimate heat sink triennial inspection results to Mr. B. Wake, Operations Director, and other members of the licensee staff.
- On November 2, 2018, the inspector presented the emergency preparedness inspection results to Ms. Sherrie Grant, Emergency Preparedness Manager, and other members of the licensee staff.
- On December 13, 2018, the inspector presented the radiation protection program inspection results to K. Ohr, Site Vice President, and other members of the licensee staff.
- On December 18, 2018, the inspector discussed the completed 2018 Licensed Operator Requalification Program annual operating test inspection results with Mr. M. Kaufman, Operations Training Manager.

## **DOCUMENTS REVIEWED**

### 71111.04—Equipment Alignment

- DCP 990025; Installation, Operation and Maintenance Instructions for Refrigeration Condensing Units Control Room HVAC Upgrade; 03/5/1984
- Drawing R107D-1321710-E, Sheet 1; Equipment Arrangement, Control Room Refrigeration Condensing Unit
- Drawing R107D-1321710-F, Sheet 2; Equipment Arrangement, Control Room Refrigeration Condensing Unit
- QCOS 5750-02; Control Room Emergency Filtration System Test; Revision 62
- Operations Logs
- QOM 0-5750-01; Control Room HVAC Valve Checklist; Revision 14



- QCOS 5750–04; Quarterly Testing of Control Room HVAC System Valves and Dampers; Revision 38
- QOM 1–1300–02; Unit 1 RCIC Valve Checklist (RCIC Room); Revision 10

#### 71111.05AQ—Fire Protection Annual/Quarterly

- ER–QC–600–1069; Quad Cities Units 1 & 2, Site List of High Risk Fire Areas
- Quad Cities Generating Station Pre-fire Plan; FZ 1.1.1.1 – Unit 1 RB 554’-0” Elev., Torus Area and Top of Torus Area; October 2013
- Quad Cities Generating Station Pre-fire Plan; FZ 1.1.2.3 – Unit 2 RB 623’-0” Elev., Mezzanine Level; October 2013
- Fire Drill Scenario NO: 18 4<sup>th</sup> Qtr #2; Title: Bus 11 902 Panel RFP 1C
- Quad Cities Generating Station Pre-Fire Plan; Fire Zone 9.2; July 2009
- Quad Cities Generating Station Pre-Fire Plan; Fire Zone 8.2.7.E; April 2014

#### 71111.07—Heat Sink Performance

- IR 4106583; Ladder Degradation for Diver Access into the Bay; 02/21/2018
- IR 4106588; Concrete Scaling on the South Wall in the 1B Circ. Bay; 02/21/2018
- IR 4107055; 1A Circ. Bay Diver Inspection Ladder; 02/22/2018
- IR 4127881; Excessive Silt on Inlet of 2A CW Bay; 04/17/2018
- IR 4148330; U2 EDG Trip During QCOS 6600–42; 06/19/2018
- IR 4156181; U2 EDG Elevated Temps During Monthly Load Test; 07/16/2018
- IR 4193363; 2018 UHS Triennial Inspection Observations; 11/09/2018
- IR 4193363; 2018 UHS Triennial Inspection Observations; 11/09/2018
- IR 4193449; 2018 UHS Inspection - Recommended Revision to EC 625010; 11/09/2018
- CALC 8001699–EVAL–1; Analysis and Performance of Weigmann & Rose Heat Exchanger; Revision 0
- CY–AA–120–4110–F–09; Quad Cities Raw Water Treatment and Control; Revision 3
- EC 333328; For the Diesel Generator: Provide a Tube Plugging Limit, Tube Plugging Criteria (%Thru-Wall), and Retubing Methodology; 10/05/2018
- EC 382155; Unit 2 Emergency Diesel Generator Heat Exchanger Replacement; 05/29/2012
- EC 387980; Tube Fouling Limit for Wiegmann and Rose Diesel Generator Heat Exchanger; Revision 0
- EC 625010; EDG Projected Engine Outlet Water Temperature at Maximum Load; 08/28/2018
- ECAPE 4148330; U2 EDG Trip During QCOS 6600–42; 08/22/2018
- Engine System Letter from J.B. Abernathy to Steve Laughlin; 09/05/2018
- ER–AA–340–1002; Service Water Heat Exchanger Inspection Guide; Revision 7
- QCAN 901(2)–3 D–6; RHR Service Water Pump Trip; Revision 5
- QCMPM 4400–11; RHR Service Water Intake Bay Inspection; Revision 12
- QCMPM 4400–12; Circulating Water Intake Bay Inspection; Revision 19
- QCOA 0010–14; Lock and Dam #14 Failure; Revision 12
- QCOA 1000–02; Loss of Shutdown Cooling; Revision 20
- QCOP 1000–04; RHR Service Water System Operation; Revision 22
- QCOP 4100–02; Portable Diesel Pump Operation; Revision 14
- QCOP 6600–14; Emergency Diesel Generator Cooling Water Pump Manual Operation; Revision 18
- QCOS 1000–04; RHR Service Water Pump Operability Test; Revision 62
- QCOS 5750–09; ECCS Room and DGCWP Cubicle Cooler Monthly Surveillance; Revision 37

- QCOS 6600–42; Unit 2 Emergency Diesel Generator Load Test; Revision 52
- QDC–3900–M–0591; Quad Cities Water Volume of the Ultimate Heat Sink After Loss of Normal Heat Sink; Revision 001
- QDC–3900–M–0692; UHS Temperature Effect on Shutdown Capability; Revision 000C
- WO 1588584; MM Open/Inspect Diesel Generator Exchanger; 10/22/2013
- WO 1916397; Open and Inspect Diesel Generator HX; 08/31/2018
- WO 1916398; Open and Inspect Diesel Generator HX; 08/31/2018
- WO 1960779; (LR) DG Endurance Margin/Full Load Reject/Hot Restart; 04/14/2018
- WO 4592099; RHR Service Water Bay Inspection—Both Screens; 08/15/2017
- WO 4592519; Unit 2 Circulating Water Intake Bay Inspections; 05/09/2018
- WO 4633004; Unit 1 Circulating Water Intake Bay Inspections; 02/23/2018
- WO 4642354; Intake Soundings Inside and Outside of Forebay; 11/04/2017
- WO 4678621; RHR Service Water Bay Inspection—Both Screens; 02/23/2018
- WO 4713472; Intake Soundings Inside and Outside of Forebay; 08/14/2018
- WO 4738092; DG Cooling Water Pump Group B Flow (IST); 04/16/2018
- WO 4754541; RHR Service Water Bay Inspection—Both Screens; 08/31/2018
- WO 4795885; DG Cooling Water Pump Group B Flow (IST); 07/15/2018
- WO 4832140; (LR) Diesel Generator Load Test (IST); 10/16/2018

#### 71111.12—Maintenance Effectiveness

- 10 CFR 50.65(a)(3) Periodic Evaluation; Assessment Period: 05/01/2016–05/01/2018; 07/20/2018
- Engage Health Report – Turbine Building Closed Cooling Water System
- ECAP 4042313; Unit 1D Condensate Pump Outboard Seal Leaks Air Into System
- Maintenance Rule Database for Feed and Condensate Systems

#### 71111.13—Maintenance Risk Assessments and Emergent Work Control

- Drawing 4E–1528, Sheet Number 1; Schematic Control Diagram High Pressure Coolant Injection System Valves and Turbine Auxiliaries; Revision AW
- Drawing 4E–1528, Sheet Number 2; Schematic Control Diagram HPCI System Valves and Turbine Auxiliaries; Revision AL
- Diagram 4E–1527, Sheet Number 1; Schematic Diagram High Pressure Coolant Injection System Sensors and Auxiliary Relays; Revision V
- Diagram 4E–1527, Sheet Number 2; Schematic Control Diagram HPCI System Sensors and Auxiliary Relays; Revision K
- Diagram 4E–1527, Sheet Number 3; Schematic Diagram High Pressure Coolant Injection System Sensors and Auxiliary Relays; Revision Q
- Diagram 4E–1527A; Schematic Diagram HPCI System Valves & Turb Aux Feeds; Revision H
- Diagram 4E–1533; Schematic Diagram HPCI Turbine Motor Gear Unit Speed Exchanger and Auxiliary Valves; Revision AP
- WO 4851156–01; Troubleshooting Work Order for HPCI MGU Speed Changer Relay
- QCEM 0700–13; Calibration and Maintenance of GE HGA Relays; Revision 19

#### 71111.15—Operability Determinations and Functionality Assessments

- Diagram 4E–1527, Sheet Number 2; Schematic Control Diagram HPCI System Sensors and Auxiliary Relays; Revision K

- Diagram 4E-1527, Sheet Number 3; Schematic Diagram High Pressure Coolant Injection System Sensors and Auxiliary Relays; Revision Q
- Diagram 4E-1527A; Schematic Diagram HPCI System Valves & Turb Aux Feeds; Revision H
- Diagram 4E-1533; Schematic Diagram HPCI Turbine Motor Gear Unit Speed Exchanger and Auxiliary Valves; Revision AP
- IR 4192493; U1 HPCI Relay in Unexpected State; 11/07/2018
- WO 4604978-01; Core Spray Discharge Flow Loop Transmitter Calibration; 10/05/2018
- QCIS 1600-11; Wide Range Torus Water Level Indication (0 to 30 Feet) Calibration; Revision 11

#### 71111.19—Post Maintenance Testing

- QCOP 6620-09; SBO DG 1(2) Normal Mode Startup; Revision 17
- QCOS 6620-01; SBO DG 1(2) Quarterly Load Test; Revision 51
- WO 4814780; (LR) SBO DG Load Test; 11/02/2018
- IR 4062547; CREV AC Temperature Indication Abnormal; 10/31/2017
- IR 4062552; B Train CREV Superheat Value High; 10/13/2017
- QCOS 5750-02; Control Room Emergency Filtration System Test; Revision 62
- QCOS 5750-04; Quarterly Testing of Control Room HVAC System Valves and Dampers; Revision 38
- WO 1778057-01; Moderate Corrosion on Bonnet Flange for 1-5799-386; 10/05/2018
- WO 1918839-03; Inspect/Evaluate/Adjust Temp Exp Valves; 10/04/2018
- WO 1958101-01; Perform Flowsan; 10/08/2018
- WO 1958102-01; Perform Flowsan 0-5741-319B; 10/08/2018
- WO 4629701-01; (LR) Inspect/Clean Y-Strainer in RHRSW to 'B' CR HVAC; 10/02/2018
- WO 4697777; B CR HVAC Bundled PMT Review; 10/12/2017
- QCOS 2900-01; Safe Shutdown Makeup Pump Flow Rate Test; Revision 38
- Drawing 4E-2330; Synchronizing Diagram; Revision Z
- Drawing 4E-2345, Sheet 1; Schematic Diagram 4160V Bus 23-1 Standby Diesel Half Feed Breakers; Revision BE
- WO 4859931-01; ½ EDG Output Breaker Failed to Close to 23-1; 11/30/2018

#### 71111.22—Surveillance Testing

- QCOS 0202-23; Reactor Recirculation Pump Run Out Limits Determination and Setting; Revision 7
- MA-AA-7223-330; Electrical Testing of AC Motors Using Baker Instrument Advance Winding Analyzer
- QCOS 6500-09; Functional Test of Unit 1 Second Level Undervoltage; Temp Change #3490

#### 71114.04—Emergency Action Level and Emergency Plan Changes

- EP-AA-1006, Addendum 3; Emergency Action Levels for Quad Cities Station; Revisions 3, 4, and 5
- EP-AA-1006; Exelon Nuclear Radiological Emergency Plan Annex for Quad Cities Station; Revisions 38, 39, and 40
- Evaluation No. 17-47; 50.54(q) Program Evaluation/Assessment Review; 06/30/2017
- Evaluation No. 17-82; 50.54(q) Program Evaluation/Assessment Review; 07/03/2017
- Evaluation No. 17-103; 50.54(q) Program Evaluation/Assessment Review; 11/08/2017
- Evaluation No. 18-11; 50.54(q) Program Evaluation/Assessment Review; 02/27/2018

#### 71124.02—Occupational As Low As Reasonably Achievable Planning and Controls

- RP-AA-401; Operational ALARA Planning and Controls; Revision 24
- RP-AA-401-1002; Radiological Risk Management; Revision 11
- RP-AA-400-1001; Establishing Collective Radiation Exposure Annual Business Plan Goals; Revision 5
- RP-AA-400; ALARA Program; Revision 15
- Radiation Protection Q1R24 Refueling Outage Report; 07/13/2017
- Radiation Protection Q2R24 Refueling Outage Report; 09/19/2018
- Radiation Work Permit and Associated ALARA File; RWP QC-01-17-00541; DW I/B MSIV Over Haul (Q1R24); Revision 00
- Radiation Work Permit and Associated ALARA File; RWP QC-02-18-00541; DW I/B MSIV Over Haul; Revision 00
- Radiation Work Permit and Associated ALARA File; RWP QC-02-18-00510; DW Main Steam Safety Relief Valve Activities; Revision 01
- IR 04118622; Increased Dose Rates in Steam Affected Areas Q2R24; 03/24/2018
- IR 04200656; U2 Insoluble Cobalt 60 Elevated and Erratic Since Q2R24; 12/06/2018

#### 71151—Performance Indicator Verification

- MSPI Derivation Report for MSPI Cooling Water System Unavailability Index (UAI); September 2018
- MSPI Derivation Report for MSPI Cooling Water System Unreliability Index (URI); September 2018
- MSPI Derivation Report for MSPI Residual Heat Removal System Unreliability (UAI); September 2018
- MSPI Derivation Report for MSPI Residual Heat Removal System Unreliability (URI); September 2018
- Aggregate MSPI Margin Summary Excel Spreadsheet for Q3 2017
- NEI 99-02, Performance Indicator Guidelines; Revision 7
- System Engineer Unavailability Spreadsheets for Units 1 and 2 RHR and RHRSW Systems
- Operations Logs from October 2017 to October 2018
- LS-AA-2001; Collecting and Reporting of NRC Performance Indicator Data; Revision 15
- SP-AA-3000; Exelon Nuclear Performance Monitoring and Management Implementing Guide; Revision 1
- CY-QC-120-720; Plant Effluent Dose Calculations; Revision 7
- SP-AA-3000 Attachment A; Site Performance Indicator Validation Sheet and Supporting Data; Various Dates
- LS-AA-2090; Monthly Data Elements for NRC Reactor Coolant System Specific Activity and Supporting Data; Various Dates
- LS-AA-2150; Monthly Data Elements for RETS/ODCM Radiological Effluent Occurrences and Supporting Data; Various Dates

#### 71152—Problem Identification and Resolution

- IR 4157059; U2B FRV Position Indication Mismatch on 902-5 Panel; 07/19/2018
- IR 4168366; Unable to Start Unit 2 SBO DG for Surveillance; 08/29/2018
- IR 4160631; Unit 1 Resin Intrusion Event; 10/23/2018
- IR 4177044; Received 902-5 G-7 2A Feedwater Actuator Trouble; 09/26/2018
- IR 4177502; Unit 1 Reactor Scram from 100% Reactor Power; 11/13/2018
- IR 4178364; 1B Feed Reg Valve Lock Up; 09/29/2018

- IR 4179340; EO ID U2 FRV Oil Reservoir Shows Elevated Particle Count; 10/02/2018
- IR 4179621; 1A Feedwater Regulating Valve (FRV) Lockup; 10/02/2018
- IR 4179960; Insufficient Procedural Guidance to Credit QCOS 6600–10; 10/03/2018
- IR 4180657; Received 902–5 G7 for 2A FRV Lockup; 10/05/2018
- IR 4180723; Received 902–5 G7 for 2A FRV Locking Up; 10/05/2018
- IR 4181602; U2 FRV Trending Oil Sample Results. Follow Up IR #4179340; 10/09/2018
- IR 4185850; Relay Failed to Actuate During QCOS 0250–11 2–0590–102B; 10/20/2018
- IR 4187756; Recommended Reassessment of MSIV Design Vulnerability; 10/25/2018
- IR 4184420; 2B SJAЕ Rad Monitor Reading Approaching 90% of Hi Alarm; 10/17/2018
- IR 4200527; RCR 4177502–05 to Be Updated; 12/05/2018
- IR 4200775; QC Notified of Potential Change of Deficiency to NAMCO Switch; 12/06/2018
- IR 4201822; Review of QDC FRV Lockups Trend; 12/10/2018
- IR 4201839; Contingency WO for 2B FRV; 12/10/2018
- IR 4201847; Modify an Existing Contingency WO for the 1A FRV; 12/10/2018
- IR 4202036; 1B FRV Inconsistent Lockups Prior to the Repairs; 12/11/2018
- IR 4204885; 1A 125 Vdc Battery Charger Failure; 12/20/2018
- QCOP 6400–35; Performing Transmission Switching Orders; Revision 15
- QCOP 6400–35; Performing Transmission Switching Orders; Revision 16
- B 3.8 Electrical Power Systems; B 3.8.4 DC Sources-Operating; Revision 0
- B 3.8 Electrical Power Systems; B 3.8.7 Distribution Systems-Operating; Revision 52

#### 71153—Follow-Up of Events and Notices of Enforcement Discretion

- QOA 6500–05; 4 kV Bus 13–1(23–1) Failure; Revision 16
- QOA 6700–04; 480 V Bus 18(28) Failure; Revision 31
- IR 4145668; U1 MSIV did not Initiate 10% Close RPS Signal; 06/09/2018
- IR 4163086; Unit 1 MSV RPS Limit Switch Issue CAP Product Initiation; 08/09/2018
- IR 4188658; 4.0 Critique for the Loss of Busses 13–1 and 18 on 10/24/18; 10/28/2018
- IR 4187243; Trip of Bus 13–1 During Performance of QCOS 6500–09; 10/24/2018
- IR 4187314; U1A RPS MG Set Failed to Flash; 10/24/2018
- IR 4181901; 'B' CR HVAC Condenser Service Water Leak; 10/09/2018
- DRAFT—ENS Retraction—Control Room Emergency Ventilation AC System Inoperable