UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION I
2100 RENAISSANCE BLVD., Suite 100
KING OF PRUSSIA, PA 19406-2713

December 18, 2017

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

SUBJECT: LIMERICK GENERATING STATION – DESIGN BASES ASSURANCE (ENVIRONMENTAL QUALIFICATION PROGRAM) INSPECTION REPORT 05000352/2017007 AND 05000353/2017007

Dear Mr. Hanson:

On November 9, 2017, the U.S. Nuclear Regulatory Commission (NRC) completed an inspection at Limerick Generating Station (Limerick), Units 1 and 2. On November 20, 2017, the NRC's inspection team discussed the results of this inspection with Mr. Jason Murphy, Engineering Director, and other members of your staff. The results of this inspection are documented in the enclosed report.

The NRC inspection team documented one finding of very low safety significance (Green) in this report. This finding involved a violation of NRC requirements. The NRC is treating this violation as a non-cited violation, consistent with Section 2.3.2.a of the Enforcement Policy.

If you contest the violation or the significance of the non-cited violation, you should provide a response within 30 days of the date of this inspection report, with the basis of 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's Resident Inspector at Limerick. In addition, 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's Resident Inspector at Limerick.

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's Public Document Room in accordance with 10 CFR 2.390, "Public Inspections, Exemptions, Requests for Withholding."

Sincerely,

/RA/

Glenn T. Dentel, Chief
Engineering Branch 2
Division of Reactor Safety

Docket Nos. 50-352 and 50-353
License Nos. NPF-39 and NPF-85

Enclosure:
Inspection Report 05000352/2017007
and 05000353/2017007 w/Attachment:
Supplementary Information

cc w/encl: Distribution via ListServ

SUBJECT: LIMERICK GENERATING STATION – DESIGN BASES ASSURANCE (ENVIRONMENTAL QUALIFICATION PROGRAM) INSPECTION REPORT 05000352/2017007 AND 05000353/2017007 DATED DECEMBER 18, 2017

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U.S. NUCLEAR REGULATORY COMMISSION
REGION I

Docket Nos.	50-352 and 50-353
License Nos.	NPF-39 and NPF-85
Report Nos.	05000352/2017007 and 05000353/2017007
Licensee:	Exelon Generation Company, LLC
Facility:	Limerick Generating Station, Units 1 and 2
Location:	Sanatoga, PA
Dates:	October 23, 2017 through November 9, 2017
Inspectors:	C. Bickett, Senior Reactor Inspector, Division of Reactor Safety (DRS), Team Leader J. Ayala, Reactor Inspector, DRS K. Mangan, Senior Reactor Inspector, DRS
Approved By:	Glenn T. Dentel, Chief Engineering Branch 2 Division of Reactor Safety

SUMMARY

IR 05000352/2017007 and 05000353/2017007; 10/23/2017 – 11/09/2017; Limerick Generating Station; Design Bases Assurance Inspection (Programs).

This report covers the Design Bases Assurance Inspection – Programs, conducted by a team of three U.S. Nuclear Regulatory Commission (NRC) inspectors. The inspection team identified one non-cited violation, which was of very low safety significance (Green). The significance of most inspection findings is indicated by their color (i.e., greater than Green, or Green, White, Yellow, Red) and determined using Inspection Manual Chapter (IMC) 0609, "Significance Determination Process," dated April 29, 2015. Cross-cutting aspects are determined using IMC 0310, "Aspects Within the Cross-Cutting Areas," dated December 4, 2014. All violations of NRC requirements are dispositioned in accordance with the NRC's Enforcement Policy, dated November 1, 2016. The NRC's program for overseeing the safe operation of commercial nuclear power reactors is described in NUREG-1649, "Reactor Oversight Process," Revision 6.

Cornerstone: Barrier Integrity

- Green. The inspection team identified a Green non-cited violation of Title 10 of the *Code of Federal Regulations* (10 CFR) 50, Appendix B, Criterion III, "Design Control," because Exelon's design control measures did not provide for verifying or checking the adequacy of design of the inboard high pressure coolant injection (HPCI) steam supply primary containment isolation valve from environmental effects. Specifically, as part of extending component life for license renewal, Exelon changed the normal service temperature of the valve limit switches from 145°F to 135°F without sufficient technical justification. Exelon documented this issue in their corrective action program as issue report 4076939, and changed the qualified life of the limit switches back to 41 years. Exelon also plans to evaluate the impacts of process fluid temperature on the qualified life of the limit switches.

  The inspection team determined that the performance deficiency was more than minor because it was associated with the design control attribute of the Barrier Integrity Cornerstone and adversely affected the cornerstone objective of ensuring that physical design barriers (containment) protect the public from radionuclide releases caused by accidents or events. Specifically, using incorrect service temperatures resulted in inappropriately extending qualified service life of the HPCI inboard containment isolation valve limit switches. The inspection team evaluated this finding in accordance with IMC 0609, Appendix A, "The Significance Determination Process for Findings at Power," Exhibit 3, "Barrier Integrity Screening Questions." The inspection team determined the finding was of very low safety significance (Green) because it was a design deficiency confirmed not to result in an actual open pathway in the physical integrity of reactor containment and did not involve an actual reduction in function of hydrogen igniters in the reactor containment. The finding had a cross-cutting aspect in the area of Human Performance, Design Margins, because Exelon did not evaluate issues to ensure that margins are carefully guarded and changed only through a systematic and rigorous process. Specifically, Exelon changed the service temperature for the Limitorque motor operated valves inside containment in 2014 that extended the qualified service life of the most limiting component beyond 60 years. [H.6] (Section 1R21.2.b)

REPORT DETAILS

1. REACTOR SAFETY

Cornerstones: Initiating Events, Mitigating Systems, and Barrier Integrity

1R21 Design Bases Assurance Inspection (Programs) (71111.21N – 8 samples)

.1 Inspection Sample Selection Process

The inspection team assessed the implementation of Exelon's environmental qualification program, established to meet the requirements of 10 CFR 50.49, "Environmental Qualification of Electrical Equipment Important to Safety for Nuclear Power Plants." The inspection team performed this inspection as outlined in NRC Inspection Procedure 71111.21N, Attachment 1, and "Environmental Qualification under 10 CFR 50.49 Programs, Processes, and Procedures." The inspection team reviewed safety-related equipment relied upon to remain functional during and following design basis events, non-safety-related components whose failure could prevent safety-related equipment from performing design functions, and certain post-accident monitoring equipment. The inspection team then determined which component's environment would be adversely affected by postulated post-accident environmental conditions (temperature, pressure, radiation level, or flood level) and reviewed information contained in Limerick's Probabilistic Risk Assessment and the NRC's Standardized Plant Analysis Risk model for Limerick to determine risk significant components that were also required to meet environmental qualification requirements. Additionally, the inspection team interviewed plant staff, reviewed design records, and discussed the environmental qualification program with the resident inspectors to assist in the selection of components. Finally, the inspection team ensured that different types of components were selected, including pump motors, motor-operated valves, solenoid valves, limit switches, and flow/level transmitters that were located both inside and outside of primary containment. Based on these reviews, the inspection team selected eight environmentally-qualified components and associated subcomponents (e.g., seals, cables, connectors, and lubricants) for inspection.

.2 Results of Detailed Reviews

a. Inspection Scope

The inspection team assessed Exelon's implementation of the environmental qualification program required by 10 CFR 50.49. The inspection team reviewed environmental qualification program-related procedures, component binders, test records, equipment maintenance and operating history, maintenance and operating procedures, vendor documents, design documents, previously identified deficiencies, and design calculations. The inspection team also interviewed plant staff knowledgeable of the design, maintenance, and operation of the selected components. The review and associated interviews were performed to evaluate whether Exelon's staff properly maintained the equipment qualifications for electrical equipment important to safety through plant life (repair, replacement, modification, and plant life extension); established and maintained required environmental qualification documentation records; and implemented an effective corrective action program to identify and correct environmental qualification-related deficiencies and evaluate environmental qualification-related industry operating experience.

The inspection team also performed walkdowns (where accessible) of selected components to verify whether equipment was installed as described in Limerick's environmental qualification binders, the environmental conditions were consistent with those assumed in the evaluations, equipment surrounding environmentally qualified component could fail in a manner that would prevent the component's safety function from being performed, and whether the components were installed in their tested configuration. The inspection team reviewed the following components and associated subcomponents:

Unit 1

- Reactor Area Safeguard 480V Motor Control Center (D114-R-G) [Breaker, current limiter, starter and relay, power cables, cable insulation, and terminal block]

- Air Operator for Safety Relief Valve 'H' (PSV-041-1F013H) [Solenoid, splice, and cable]

- 1A Drywell Unit Cooler (1A1V212 and 1A2V212) [Motor, cable, and fuse]

- Steam Leak Detection Main Steam Tunnel Temperature Element (TE-041-1N010A) [Temperature element, cable, and conduit seal]

- Operator for Main Steam Isolation Valve 'A' (HV-041-1F028A-OP) [Solenoid valve and limit switches]

Unit 2

- HPCI Steam Supply Inboard Primary Containment Isolation Valve (HV-055-2F002) [Limit and torque switches, actuator, lubricant, terminal block, and contact block]

- Drywell Pressure Instrument (PT-0422N094A) [Resistors, O-rings, and wire insulation]

- Suppression Pool Level (LT-055-2N062B) [Level Transmitter]

In addition to the inspection of the selected components, the inspection team performed general plant walkdowns to determine whether components located in areas susceptible to a high energy line break were properly evaluated for operation in a harsh environment. The inspection team also reviewed procurement records and inspected a sample of replacement parts stored in the warehouse to verify environmentally qualified parts approved for installation in the plant were properly identified and controlled; and that storage time and environmental conditions did not adversely affect the components' qualified life or service life. Finally, the inspection team reviewed a sample of components that had been removed from the environmental qualification program to determine if Exelon had correctly determined that the components no longer were required to meet 10 CFR 50.49. Documents reviewed for this inspection are listed in the Attachment.

b. Findings

Introduction. The inspection team identified a Green non-cited violation of 10 CFR 50, Appendix B, Criterion III, "Design Control," because Exelon's design control measures did not provide for verifying or checking the adequacy of design of the inboard HPCI steam supply primary containment isolation valve from environmental effects.

Specifically, as part of extending component life for license renewal, Exelon changed the normal service temperature of the valve limit switches from 145°F to 135°F without sufficient technical justification.

Description. The HPCI system steam supply line contains two Limitorque motor operated valves. These valves are safety-related and function to close after a steam line break to provide containment isolation. Additionally, the limit switches for these valves provide valve position indication for post-accident monitoring. HV-055-2F002 is the "inboard" motor operated valve and is located inside the drywell. HV-055-2F003 is the "outboard" motor operated valve and is located in the reactor building.

Service temperature is a factor in thermal aging and life qualification of components. Exelon established a service temperature of 145°F in order to calculate qualified service life for Limitorque motor operated valves inside the drywell. Based on this service temperature, the limit switches for valve HV-055-2F002 were originally qualified to a service life of 41 years. In 2014, Exelon extended the service life of the limit switches to greater than 60 years by reducing the service temperature in the qualified life calculation to 135°F, which is the average normal ambient drywell temperature. Exelon's basis for this change was that Limitorque valve operators were not subject to temperature rise due to effects of hot process fluids (steam) inside the piping system, and therefore, thermal life was evaluated at normal ambient temperature of the associated room. The environmental qualification binders also stated that valve operators were mounted a sufficient distance from the process pipe such that no temperature rise from the process fluid was applicable. The inspection team noted that the equipment qualification binders did not provide any additional information or calculations to support these conclusions.

In order to verify these conclusions, the inspection team reviewed a sample of environmental qualification binders for other valves located on steam lines in the drywell and noted that Exelon used temperatures above drywell ambient temperature for determination of qualified life of subcomponents for the main steam isolation valves and the safety relief valves. Additionally, since inboard valve HV-055-2F002 was not accessible during the inspection, the inspection team completed a walkdown of the HPCI outboard steam supply valve (HV-055-2F003). The inspection team took temperature readings of valve components and the surrounding area and identified that the limit switch compartment was approximately 10 – 15°F higher than ambient room temperature. Exelon had used normal ambient room temperature (90°F) to calculate the service life of the outboard valve.

The inspection team also noted that Exelon procedure CC-MA-203-1001, "Environmental Qualification Engineering," Revision 6, states to identify any heat rise due to process fluid temperature and its reference source. Exelon design basis document L-T-08, "Electrical Equipment Environmental Qualification Program," Revision 7, states that conditions existing at the outside surface of equipment are not necessarily the conditions experienced by all internal parts of the equipment and that it is possible, and sometimes necessary, to calculate and analyze the conditions experienced within equipment.

This document also notes that temperature of individual subcomponents inside a piece of environmentally qualified equipment may not be the same as the external ambient temperature, and in calculating internal temperature, considerations must include any internally generated heat, heat from process fluids, and thermal resistance of interposed parts. Document L-T-08 also states that equipment that is in direct contact with pipes carrying process fluids can be subjected to local temperatures that are higher than the area temperatures.

Based on the results of the walkdown, as well as the review of environmental qualification documentation, the inspection team concluded that, absent an adequate technical basis for the change to 135°F, a qualified life of greater than 60 years for the motor operated valve limit switches was not conservative. Exelon documented this issue in their corrective action program as issue report 4076939, and changed the qualified life of the limit switches back to 41 years. Exelon also plans to evaluate the impacts of process fluid temperature on the qualified life of the limit switches. This issue did not impact the operability of the inboard HPCI valve since the limit switches are still within their original 41-year qualified life. In the case of the outboard HPCI valve, though Exelon had used normal ambient room temperature to calculate the service life, the inspectors noted that including the temperature rise in the qualified life calculation would still produce a qualified life of greater than 60 years.

Analysis. The inspection team determined that the failure to verify the adequacy of the design of the HPCI inboard containment isolation valve was contrary to 10 CFR 50, Appendix B, Criterion III, and a performance deficiency that was within Exelon's ability to foresee and correct. Exelon did not document the technical basis for using a less conservative service temperature to determine the qualified life of the HPCI inboard containment isolation valve limit switches. The inspection team determined that the performance deficiency was more than minor because it was associated with the design control attribute of the Barrier Integrity Cornerstone and adversely affected the cornerstone objective of ensuring that physical design barriers (containment) protect the public from radionuclide releases caused by accidents or events. Specifically, using incorrect service temperatures provided erroneous environmental qualification of Class 1E components, which extended the qualified service life of the HPCI inboard containment isolation valve limit switches. The inspection team evaluated this finding in accordance with IMC 0609, Appendix A, "The Significance Determination Process for Findings at Power," Exhibit 3, "Barrier Integrity Screening Questions." The inspection team determined the finding was of very low safety significance (Green) because it was a design deficiency confirmed not to result in an actual open pathway in the physical integrity of reactor containment and did not involve an actual reduction in function of hydrogen igniters in the reactor containment.

The finding had a cross-cutting aspect in the area of Human Performance, Design Margins, because Exelon did not evaluate issues to ensure that margins are carefully guarded and changed only through a systematic and rigorous process. Specifically, Exelon changed the service temperature for the Limitorque motor operated valves inside containment in 2014 that extended the qualified service life of the most limiting component beyond 60 years. [H.6]

Enforcement. 10 CFR 50, Appendix B, Criterion III, "Design Control," requires, in part, that design control measures provide for verifying or checking the adequacy of design, such as by the performance of design reviews, by the use of alternate or simplified calculation methods, or by the performance of a suitable testing program. Contrary to the above, in 2014, Exelon's design control measures did not provide for verifying or checking the adequacy of design of the HPCI inboard containment isolation valve. Specifically, Exelon did not verify or check the adequacy of the service temperature used in calculating qualified service life for the HPCI inboard containment isolation valve limit switches. In response to this issue, Exelon changed the qualified life of the limit switches back to 41 years and plans to evaluate the impacts of process fluid temperature on the qualified life of the limit switches.

Because this violation is of very low safety significance (Green) and Exelon entered the issue into their corrective action program as issue report 4076939, this violation is being treated as a non-cited violation, consistent with Section 2.3.2a of the Enforcement Policy. **(NCV 05000352/2017007-01, 05000353/2017007-01, Failure to Document Technical Basis for Service Temperature Changes for Limitorque Motor Operated Valve Limit Switches)**

4. OTHER ACTIVITIES

4OA2 Identification and Resolution of Problems (71152)

a. Inspection Scope

The inspection team reviewed a sample of problems that Exelon had previously identified and entered into the corrective action program. The inspection team reviewed a sample of these issues to verify an appropriate threshold for identifying issues and to evaluate the effectiveness of corrective actions. Additionally, the inspection team evaluated whether deficiencies identified during the inspection were properly documented and evaluated in the corrective action program.

b. Findings

No findings were identified.

4OA6 Meetings, including Exit

On November 20, 2017, the inspection team presented the inspection results to Mr. Jason Murphy, Engineering Director, and other members of the Exelon staff. The inspection team verified that no proprietary information was retained or documented in this report.

ATTACHMENT: SUPPLEMENTARY INFORMATION

SUPPLEMENTARY INFORMATION

KEY POINTS OF CONTACT

Exelon Personnel
J. Murphy, Engineering Director
P. Bennett, Warehouse
J. Berg, System Engineer
G. Budock, Regulatory Assurance Engineer
M. Lui, Environmental Qualification Engineer
N. Roy, Environmental Qualification Engineer
R. Wehrman, Engineering Manager

LIST OF ITEMS OPENED, CLOSED, DISCUSSED, AND UPDATED

Opened/Closed

05000352/2017007-01 05000353/2017007-01	NCV	Failure to Document Technical Basis for Service Temperature Changes for Limitorque Motor Operated Valve Limit Switches (Section 1R21.2.b)

LIST OF DOCUMENTS REVIEWED

Calculations
03Q0403, EQ/Similarity Analysis of Crompton Corp. MOV Long Life (MOVLL) Grease – NLGI Grades 0 and 1 for Use at All Exelon Nuclear Stations, Revision 0
LE-0060, Arrhenius Calculation to Extend Qualified Life of EP O-Ring for Gould Model PD 3018-100-38-12-25 Level Transmitter, Revision 0
LE-0117, Analysis of Calculation LM-280, Radiation Streaming through the Bioshield Wall and Streaming through the Bioshield Penetrations, Revision 0

Drawings
8031-M-42, Sheet 3, P&ID Nuclear Boiler Vessel Instrumentation Unit 2, Revision 21
8031-M-57, Containment Atmospheric Control (Unit 1 and Common), Revision 47
8031-M-57, Containment Atmospheric Control (Unit 1), Revision 47
8031-M-57, Sheets 3 and 6, Containment Atmospheric Control, Revisions 38 and 39
93-14182, Weld Ends Pressure Seal Carbon Steel Y-Globe Valve with SMB-4-150 Limitorque Operator, Revision H
A-305, Sheet 1, Architectural; Air / Steam / Fire & Water Boundaries Floor Plan El. 177'-0" Unit 1, Revision 2
A-306, Sheet 1, Architectural; Air / Steam / Fire & Water Boundaries Floor Plan El. 201'-0" Unit 1, Revision 20
A-307, Sheet 1, Architectural; Air / Steam / Fire & Water Boundaries Floor Plan El. 217'-0" Unit 1, Revision 32
A-308, Sheet 1, Architectural; Air / Steam / Fire & Water Boundaries Floor Plan El. 253'-0" Unit 1, Revision 17
A-309, Sheet 1, Architectural; Air / Steam / Fire & Water Boundaries Floor Plan El. 283'-0" and 269'-0" Unit 1, Revision 20

A-310, Sheet 1, Architectural; Air / Steam / Fire & Water Boundaries Floor Plan El. 313'-0", 302' and 332' Unit 1, Revision 17
A7122-094, Sheet 1, AVCO Solenoid 125VDC
DBA-206-1, Sheet 1, Plans & Sections High Pressure Coolant Injection Reactor Building – Unit 2, Revision 12
DBA-206-1, Sheet 2, Plans & Sections High Pressure Coolant Injection Reactor Building – Unit 2, Revision 12
E-100, Steam Leak Detection System 1 & 2 Units, Revision 17
E-476, Drywell Area Unit Coolers 1 & 2 Units, Revision 23
M-0041, Sheets 1, 2 and 3, P&ID Nuclear Boiler, Revisions 47, 64 and 56
M-0055, Sheet 2, P&ID High Pressure Coolant Injection Unit 2, Revision 57
M-0077, Sheet 1, Drywell HVAC, Revision 12
M-1-B21-1060-E-001, Auto Depressurization System, Revision 35
M-1-B21-1060-E-004, Auto Depressurization System, Revision 14

Equipment Qualification Binders

EQ-LGS-001, Joy Manufacturing Electric Motors with Class H, Type RH Insulation, Revision 0
EQ-LGS-013, Conax Electrical Conductor Seal Assembly, Revision 0
EQ-LGS-014, Patel Engineers Conduit Seals, Revision 0
EQ-LGS-018, Target Rock Model 9867F SRV and Operator Assembly, Revision 0
EQ-LGS-023, AVCO Air Manifold Pilot AC and DC Solenoids, Revision 0
EQ-LGS-025A, Cutler Hammer 480 Volt Motor Control Center Components, Revision 0
EQ-LGS-025B, Cutler Hammer 480 Volt Motor Control Center, Champlain EXAR 400 Insulated Cable, Revision 0
EQ-LGS-025C, Cutler Hammer 480 Volt Motor Control Center Components, Revision 0
EQ-LGS-040, Rosemount Pressure Transmitters, Model 1153 Series B, Revision 0
EQ-LGS-045, Gould Level Transmitters Model PD30118, Revision 0
EQ-LGS-057, PYCO Temperature Elements, Revision 0
EQ-LGS-062A, Rockbestos Firewall III (Chemically Cross-Linked) Cable for Power, Control, Instrumentation, Switchboard Wire, Thermocouple Extension, and Specialty Cable Applications, Revision 0
EQ-LGS-062B, Rockbestos Firewall III (Irradiation Cross-Linked) Cable for Power, Control, Instrumentation, Switchboard Wire, Thermocouple Extension, and Specialty Cable Applications, Revision 0
EQ-LGS-079A, Namco Limit Switches for the Main Steam Isolation Valves, Model EA740-50100, Revision 0

Vendor Test Reports

16436-82N, Report of Test for Nuclear Qualification Testing of Temperature Measurement Devices per IEEE STD. 323-1974 and IEEE STD. 344-1975
17514-1, Nuclear Environmental Qualification Test Program on a MSIV Pneumatic Control Manifold, Revision A, dated 3/14/1985
5074, Target Rock Corporation, Qualification Test Report – Three Way Valve, Solenoid Operated, dated 1/9/1990
528-1132, Nuclear Environmental Qualification of Twenty-Six (26) 480-Volt AC Motor Control Centers for the Limerick Generating Station Units 1 and 2 TSC Number 8031-Q-3, Revision B
600376A, Nuclear Power Station Qualification Type Test Report Limitorque Valve Actuators for BWR Service, date 5/13/1976
Arrhenius Material Files for Various Cutler Hammer MCC Components, Revision 17.0.c
B0058, Limitorque Valve Actuator Qualification for Nuclear Power Station Service, dated 1/11/1980

B0212, Nuclear Power Station Qualification Type Test Report Limitorque Valve Actuator with Type LR Rotor for Westinghouse PWR, dated 4/10/1985
DRF A00-01818 Book #3, Environmental Qualification Report for Gould, Inc. PD3018 Level Transmitter, dated 8/13/1983
E00758, Reliance Electric Company Summary Report Nuclear Power Motor Systems Type Test Support Analysis – Random Wound Motors NUC-9, dated 7/1/1978
EGS-TR-841215-04, Test Report for Nuclear Environmental Qualification/Submergence Testing of Patel/EGS Conduit Seals, dated 9/28/1992
EGS-TR-903200-01, Test Procedure for Nuclear Environmental Qualification of Electrical Connectors, Conduit Seals, Penetration Splice and Victoreen Raychem Seal for Carolina Power and Light, Revision C
EOO562, Qualification Type Test Report Limitorque Valve Actuators for BWR Service, dated, 5/13/1976
IPS-409, Qualification Report for Conductor Modules for Arkansas Nuclear One, dated 3/8/1979
IPS-409.1, Addendum to Design Qualification Report IPS-409 for Electric Conductor Seal Assemlies, dated 2/25/1982
IPS-713, Electrical Conductor Seal Assembly Qualification Report Package for Bechtel Power Corporation, dated 4/30/1981
IPS-725-RA, Installation Manual for Electrical Conductor Seal Assemblies with Long Body for Pipe Thread Equipment Interface, dated 6/26/1981
Namco QTR 180, Generic Qualification of EA740-Series Limit Switches for Use in Nuclear Power Plant Class 1E Applications in Compliance with IEEE Standards 323-1974, 382-1972, AND 344-1975, Revision 1
NEDC-30684 Volume 1, Project Unique Qualification Report for the Philadelphia Electric Company Limerick Generating Station Units 1 and 2 Differential Pressure Transmitter
NEDC-31822P, Limerick Generating Station Units 1 & 2 Environmental Qualification Report, MSIV Limit Switch, dated 7/31/1990
OEOP-006, Qualification Type Test Report Limitorque Valve Actuators for PWR Service, dated 12/9/1975
PECO Power Labs Document 1999 0344, Environmental Qualification of Snap-Lock Limit Switches Manufactured by Namco Controls, Inc., dated 12/16/1999
PEI-TR-841203-12-RA, Final Test Report on Patel Conduit Seals Manufactured by Patel Engineers for Use in Nuclear Power Plants, Revision A
QR-5804, Report of Qualification Tests for Rockbestos Firewall III Chemically Cross-Linked Polyethylene Construction for Class 1E Service in Nuclear Generating Stations, Revision 3
QR-7804, Report of Tests to Establish Insulation Resistance vs. Temerature Characteristics for Firewall III Irradiation Cross-Linked Polyethylene Constructions for Class 1E Service in Nuclear Generating Stations, dated 1/27/1988
Rosemount Procedure 1802, Qualification and Type Test Procedure for Pressure Transmitters Rosemount Models 1153AB, 1153DB, 1153GB, and 1153HB, Revision A
Supplemental Report to NUC-9, dated July 1 1978, Reliance Electric Company Summary Report – Nuclear Power Motor Systems Type Test Support Analysis – Random Wound Motors, Revision 2
Wyle Laboratories Report 40433-TGA, Thermogravimetric Analysis of Four Nonmetallic Materials, dated 3/7/1989
Wyle Laboratories Report 46680TGA-98, Thermogravimetric Analysis Report on Samples of RX865 and RX865M Phenolic Parts to Establish an Activation Energy and Perform a Chemical Analysis of the Materials, dated 3/24/1998
X-604, Qualification Testing of Joy Axivane Fan and Reliance Electric Motor for Class I Service for Nuclear Containment Per IEEE 334-1974, dated 4/6/1977

Procedures
CC-AA-203, Environmental Qualification Program, Revision 12
CC-MA-203-1001, Environmental Qualification Engineering, Revision 6
PES-S-002, Shelf Life, Revision 8
SM-AA-102, Warehouse Operations, Revision 23

Functional, Surveillance, and Modification Acceptance Testing
ST-2-042-413-2, ECCS and NSSSS-Drywell Pressure – High; Division 1, Channel A (Core Spray, LPCI, ADS, RCIC and D/G) Calibration/Functional Test (PT-42-2N094A, PIS-42-2N594A), dated 2/3/2016
ST-2-055-403-2, ECCS – Suppression Pool Water Level – High: Division 2 (HPCI) Calibration/Functional Test (LT-55-2N062B, LIS-55-2N662B), Revision 17, dated 3/21/2017

Institute of Electrical and Electronic Engineers (IEEE) Standards
IEEE 323-1971, General Guide for Qualifying Class I Electric Equipment for Nuclear Power Generating Stations
IEEE 323-1974, IEEE Standard for Qualifying Class IE Equipment for Nuclear Power Generating Stations
IEEE 334-1971, IEEE Trial-Use Guide for Type Tests of Continuous-Duty Class I Motors Installed Inside the Containment of Nuclear Power Generating Stations
IEEE 334-1974, IEEE Standard for Type Tests of Continuous Duty Class IE Motors for Nuclear Power Generating Stations

Miscellaneous
A1933463, Technical Evaluation for MSSI Hydrogen/Oxygen Analyzer Sample Station, Revision 0
AVCO, 6910-0** Coils with Tin Magnet Wire Leads and Varnish Applications Analysis Form, Fit, and Function, dated 11/22/1999
AVCO, Changing Potting 6910-0** Coils from Farboset PX4718 to Ppestic Epoxy Compound Analysis Form, Fit, and Function, dated 1/20/2005
BLP-49888, Report M-003 Summary of Flooding Prevention Requirements, Revision 4
ECR 04-00183, H2/O2 Analyzers Tech Spec Removal, Revision 0
ECR 13-00517, Downgrade H_2O_2 Analyzer from EQ to Non-EQ, Revision 0
ECR LG 06-00349, ECR Needed to Revise Spec M-171
EPRI NP-6408, Guidelines for Establishing, Maintaining, and Extending the Shelf Life Capability of Limited Life Items (NCIG-13), May 1992
Limerick Generating Station Environmental Qualification Master List
Limerick Generating Station Updated Final Safety Analysis Report, Revision 14
Limerick Generating Station, Unit 1 Amendment to Facility Operation License No. 173
Limitorque Technical Update 01-01, Material Color Change, dated 3/5/2001
Limitorque Technical Update 02-01, Nebula EP Grease Replacement, dated 11/13/2002
List of Commercial Grade Dedication Evaluations
L-T-08, Electrical Equipment Environmental Qualification Program Design Basis Document, Revision 7
M-171, Specification for Environmental Service Conditions Limerick Generating Station Units 1 and 2, Revision 17
M-171, Specification for Environmental Service Conditions Limerick Generating Station Units 1 and 2, Revision 16

Maintenance Strategy: LIM-01-025-I-ET-E-TE-041-1N010A, dated 2/9/2017
Maintenance Strategy: LIM-01-041-P-ET-VOA-PSV-041-F013H-OP, dated 2/9/2017
Maintenance Strategy: LIM-01-077-E-ET-MTR-1A1V212-DR, dated 2/10/2017
Maintenance Strategy: LIM-01-093-E-ET-PNL-D114-R-G, dated 10/9/2017
Maintenance Strategy: LIM-02-093-E-ET-FU-20-B224-18/1C, dated 10/9/2017
Maintenance Strategy: LIM-01-041-P-ET-VOA-HV-041-1F028A-OP, dated 2/10/2017
NRC IN 2006-26, Failure of Magnesium Rotors in Motor-Operated Valve Actuators, 11/20/2006
NRC Information Notice (IN) 86-02, Failure of Valve Operator Motor During Environmental Qualification Testing, 1/6/1986
NUREG-0588, Interim Staff Position on Environmental Qualification of Safety-Related Equipment, Revision 1
Outboard MSIV Room, Ambient Temperature Logs, September 2016-2017
PCM Template, Motor Operated Valves, dated 7/23/2010
PCM Template, Pressure Sensor and Transmitter, dated 8/14/2015
Preventive Maintenance Template: Pressure Sensor and Transmitter, Revision 2
Purchase Order 90 077885, Target Rock Division of Curtiss-Wright Flow Control Group from Limerick Generating Station, Revision 2
Regulatory Guide 1.40, Qualification Tests of Continuous-Duty Motors Installed inside the Containment of Water-Cooled Nuclear Power Plants, dated 3/16/1973
Regulatory Guide 1.89, Environmental Qualification of Certain Electric Equipment Important to Safety for Nuclear Power Plants, Revision 1
SM-AA-102, Attachment 2, Housekeeping Surveillance and Inspection, completed January – October 2017
Technical Specifications, Limerick Generating Station

Issue Reports (*Written as a result of this inspection)

601910	3967381	4063841	4072760*
602133	3970144	4069184*	4076939*
602343	3981000	4072756*	4076942*
1416805			

Vendor Manuals

B-3645, Reliance Electric Installation, Operation and Core of Duty Master Nuclear Service Class IE Integral Horsepower Induction Motors, dated 10/1977

Work Orders

0431048	2657481	C0242311	R1025177
2320160	4253419	C0242386	R1062257

LIST OF ACRONYMS

CFR	*Code of Federal Regulations*
DRS	Division of Reactor Safety
HPCI	high pressure coolant injection
IMC	inspection manual chapter
NRC	Nuclear Regulatory Commission