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

December 20, 2016

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

SUBJECT: LIMERICK GENERATING STATION – TRIENNIAL FIRE PROTECTION INSPECTION REPORT 05000352/2016007 AND 05000353/2016007

Dear Mr. Hanson:

On November 18, 2016, the U.S. Nuclear Regulatory Commission (NRC) completed a triennial fire protection inspection at your Limerick Generating Station, Units 1 and 2. The enclosed inspection report documents the inspection results, which were discussed on November 18, 2016, with Mr. David Lewis, Plant Manager, and other members of your staff.

The inspection examined activities conducted under your license as they relate to safety and compliance with the Commission's rules and regulations, and with the conditions of your license. The inspectors reviewed selected procedures and records, observed activities, and interviewed station personnel. The inspectors also reviewed mitigation strategies for addressing large fires and explosions.

Based on the results of this inspection, no findings were identified.

In accordance with Title 10 of the *Code of Federal Regulations* (10 CFR) 2.390 of the NRC's "Rules of Practice," a copy of this letter, its enclosure, and your response (if any) will be available electronically for public inspection in the NRC's Public Document Room or from the Publicly Available Records System (PARS) component of the NRC's document system, Agencywide Documents Access and Management System (ADAMS).

ADAMS is accessible from the NRC's Website at http://www.nrc.gov/reading-rm/adams.html (the Public Electronic Reading Room).

Sincerely,

/RA/

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

Docket No: 50-352 and 50-353
License No: NPF-39 and NPF-85

Enclosures:
Inspection Report Nos. 05000352/2016007
and 05000353/2016007 w/Attachment:
Supplemental Information

cc w/ encl: Distribution via ListServ

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U. S. NUCLEAR REGULATORY COMMISSION

REGION I

Docket No:	50-352 and 50-353
License No:	NPF-39 and NPF-85
Report No:	05000352/2016007 and 05000353/2016007
Licensee:	Exelon Generation Company, LLC
Facility:	Limerick Generating Station, Units 1 and 2
Location:	Sanatoga, PA
Dates:	October 31 to November 18, 2016
Inspectors:	J. Richmond, Senior Reactor Inspector (Team Leader) W. Cook, Senior Reactor Analyst K. Young, Senior Reactor Inspector S. Anderson, Reactor Inspector J. Ayala, Reactor Inspector
Observers:	L. Cole, Audit Manager, NRC Office of the Inspector General J. Cheung, Auditor, NRC Office of the Inspector General
Approved by:	Glenn T. Dentel, Chief Engineering Branch 2 Division of Reactor Safety

SUMMARY

IR 05000352/2016007 and 05000353/2016007; 10/31/2016 - 11/18/2016; Limerick Generating Station, Units 1 and 2 (LGS); Triennial Fire Protection Team Inspection.

This report covered a two week on-site triennial fire protection team inspection by specialist inspectors. The NRC's program for overseeing the safe operation of commercial nuclear power reactors is described in NUREG-1649, "Reactor Oversight Process," Revision 6, dated July 2016.

No Findings were identified.

Background

This report presents the results of a triennial fire protection inspection conducted in accordance with U.S. Nuclear Regulatory Commission (NRC) Inspection Procedure (IP) 71111.05T, "Fire Protection (Triennial)." The objective of the inspection was to assess whether Exelon Generation Company, LLC (Exelon) had implemented an adequate fire protection program (FPP) and whether post-fire safe shutdown capabilities had been established and were properly maintained at Limerick Generating Station (LGS). The following fire areas (FA) and associated fire zones (FZ) were selected for detailed review based on prior inspection results, risk insights from the LGS Individual Plant Examination of External Events (IPEEE), and the LGS Fire Probabilistic Risk Assessment:

Fire Area / Fire Zone

- FA 20 Unit 1 Inverter Room, Elevation (Elev.) 254 foot
- FA 26 Remote Shutdown Panel Room Elev. 289 foot
- FZ 44E Unit 1 Reactor Building East, Safeguard System Access Area, Elev. 217 foot

Inspection of these fire areas/zones fulfilled the inspection procedure requirement to inspect a minimum of three samples.

The inspection team evaluated Exelon's FPP against applicable requirements which included plant Technical Specifications, Operating License Condition 2.C.(3), NRC Safety Evaluation Reports (SER), Title 10 of the *Code of Federal Regulations* (10 CFR) 50.48, and Branch Technical Position Chemical Engineering Branch (CMEB) 9.5-1. The team also reviewed related documents that included the Updated Final Safety Analysis Report (UFSAR), Section 9.5.1, "Fire Protection Program," UFSAR, Appendix 9A, "Fire Protection Evaluation Report," which included the fire hazards analysis (FHA), and LGS post-fire safe shutdown analyses.

The team evaluated aspects of three mitigating strategies for responding to large fires and explosions, which are required by Operating License Condition 2.C.(21) for Unit 1, Operating License Condition 2.C.(9) for Unit 2, and 10 CFR 50.54(hh)(2). The team also reviewed related documents that included Nuclear Energy Institute 06-12, "B.5.b Phases 2 and 3 Submittal Guidance," Revision 2 (ML070090060). Inspection of these strategies fulfills the inspection procedure requirement to inspect a minimum of one sample.

Specific documents reviewed by the team are listed in the attachment to this report.

REPORT DETAILS

1. REACTOR SAFETY

Cornerstones: Initiating Events, Mitigating Systems, and Barrier Integrity

1R05 Fire Protection (IP 71111.05T)

.01 Protection of Safe Shutdown Capabilities

a. Inspection Scope

The team reviewed the FHA, post-fire safe shutdown analyses, and supporting drawings and documents to determine whether the safe shutdown capabilities were properly protected from fire damage. The team evaluated equipment and cable separation to determine whether the applicable separation requirements of the LGS design and licensing bases were maintained for the credited safe shutdown equipment and their supporting power, control, and instrumentation cables. The team's review included an assessment of the adequacy of the selected systems for reactor pressure control, reactivity control, reactor coolant makeup, decay heat removal, process monitoring, and associated support system functions.

b. Findings

No findings were identified.

.02 Passive Fire Protection

a. Inspection Scope

The team walked down accessible portions of the selected fire areas to evaluate whether the material conditions of the fire area boundaries were adequate for the fire hazards in the area. The team compared the fire area boundaries, including walls, ceilings, floors, fire doors, fire dampers, penetration seals, electrical raceway and conduit fire barriers, and redundant equipment fire barriers to design and licensing basis requirements, industry standards, and Exelon's FPP, as approved by the NRC, to identify any potential degradation or non-conformances.

The team reviewed selected engineering evaluations, installation and repair work orders, and qualification records for a sample of penetration seals to determine whether the fill material was properly installed and whether the as-left configuration satisfied design requirements for the intended fire rating. The team also reviewed similar records for selected fire protection wraps (including the encapsulation system for 125 Volts Direct Current (VDC) Distribution Panel 1BD102, located in FA 20) to determine whether the material and configuration was appropriate for the required fire rating and conformed to the engineering design requirements.

The team also reviewed recent inspection records for fire dampers, penetration seals, and fire barriers, to verify whether the inspection was adequately conducted, the acceptance criteria were met, and any potential performance degradation was identified.

b. Findings

No findings were identified.

.03 Active Fire Protection

a. Inspection Scope

The team evaluated manual and automatic fire suppression and detection systems in the selected fire areas to determine whether they were installed, tested, maintained, and operated in accordance with NRC requirements, National Fire Protection Association (NFPA) codes of record, and Exelon's FPP, as approved by the NRC. The team also assessed whether the suppression systems' capabilities were adequate to control and/or extinguish fires associated with the hazards in the selected areas.

The team reviewed the as-built capability of the fire water supply system to verify whether the design and licensing basis, and NFPA code of record requirements were satisfied, and to assess whether those capabilities were adequate for the hazards involved. The team reviewed the fire water system hydraulic analyses to assess the adequacy of a single fire water pump to supply the largest single hydraulic load on the fire water system plus concurrent fire hose usage. The team evaluated the fire pump performance tests to assess the adequacy of the test acceptance criteria for pump minimum discharge pressure at the required flow rate, to verify whether the criteria was adequate to ensure that the design basis and hydraulic analysis requirements were satisfied. The team also evaluated the underground fire loop flow tests to determine whether the tests adequately demonstrated that the flow distribution circuits were able to meet design basis requirements. In addition, the team reviewed recent pump and loop flow test results to verify whether the testing was adequately conducted, the acceptance criteria were met, and any potential performance degradation was identified.

The team reviewed design specifications, vendor requirements, and routine functional testing for the Halon suppression system for the remote shutdown panel room (FA 26). The team walked down accessible portions of the Halon system, including storage tanks and supply systems, to independently assess the material condition, operational lineup, and availability of the systems. The team also reviewed and walked down the associated firefighting strategies and Halon system operating procedures.

The team walked down accessible portions of the detection and water suppression systems in the selected areas and major portions of the fire water supply system, including motor and diesel driven fire pumps, interviewed system and program engineers, and reviewed selected condition reports to independently assess the material condition of the systems and components. In addition, the team reviewed recent test results for the fire detection and suppression systems for the selected fire areas to verify whether the testing was adequately conducted, the acceptance criteria were met, and any potential performance degradation was identified.

The team assessed the fire brigade capabilities by reviewing training, qualification, and drill critique records. The team also reviewed Exelon's fire-fighting strategies (i.e., pre-fire plans) and smoke removal plans for the selected fire areas to determine if appropriate information was provided to fire brigade members and plant operators to identify safe shutdown equipment and instrumentation, and to facilitate suppression of a fire that could impact post-fire safe shutdown capability. The team independently inspected the fire brigade equipment, including personnel protective gear (e.g., turnout gear) and smoke removal equipment, to determine operational readiness for fire-fighting. In addition, the team reviewed Exelon's fire brigade equipment inventory and inspection procedures and recent inspection and inventory results to verify whether adequate equipment was available, and whether any potential material deficiencies were identified.

b. Findings

No findings were identified.

.04 Protection from Damage from Fire Suppression Activities

a. Inspection Scope

The team performed document reviews and plant walk downs to determine whether redundant trains of systems required for hot shutdown, located in the same or adjacent fire areas, would be subject to damage from fire suppression activities or from the rupture or inadvertent operation of fire suppression systems. Specifically, the team evaluated whether:

- A fire in one of the selected fire areas would not indirectly, through production of smoke, heat or hot gases, cause unintended activation of suppression systems in adjacent fire areas that could potentially damage redundant safe shutdown trains; and

- A fire suppression system rupture, inadvertent actuation, or actuation due to a fire, in one of the selected fire areas, would not directly damage all redundant trains (e.g., sprinkler caused flooding of other than the locally affected train); and

- Adequate drainage was provided in areas protected by water suppression systems.

b. Findings

No findings were identified.

.05 Alternative Shutdown Capability

a. Inspection Scope

The team reviewed the safe shutdown analysis, operating procedures, piping and instrumentation drawings, electrical drawings, the UFSAR, and other supporting documents for the selected fire areas to determine whether Exelon had properly identified the systems and components necessary to achieve and maintain post-fire safe shutdown conditions. The team evaluated selected systems and components credited by the safe shutdown analysis for reactor pressure control, reactivity control, reactor coolant makeup, decay heat removal, process monitoring, and support system functions to assess the adequacy of Exelon's alternative shutdown methodology. The team also assessed whether alternative post-fire shutdown could be performed both with and without the availability of off-site power. The team walked down selected plant configurations to verify whether they were consistent with the assumptions and descriptions in the safe shutdown and the FHA. In addition, the team evaluated whether the systems and components credited for use during post-fire safe shutdown would remain free from fire damage.

The team reviewed the training program for licensed and non-licensed operators to verify whether it included alternative shutdown capability. The team also verified whether personnel, required for post-fire safe shutdown, using either the normal or alternative shutdown methods, were trained and available on-site at all times, exclusive of those assigned as fire brigade members.

The team reviewed the adequacy of procedures utilized for post-fire shutdown and performed an independent walk through of procedure steps (i.e., a procedure tabletop) to assess the adequacy of implementation and human factors within the procedures. The team also evaluated the time required to perform specific actions to verify whether operators could reasonably be expected to perform those actions within sufficient time to maintain plant parameters within specified limits.

Specific procedures reviewed for normal and alternative post-fire shutdown included:

- SE-1, Remote Shutdown, Revision 73
- 1FSSG-3020, Unit 1 FA 20 Fire Guide, Revision 16
- 1FSSG-3024, Unit 1 FA 24 Fire Guide, Revision 8
- 2FSSG-3024, Unit 2 FA 24 Fire Guide, Revision 7
- 1FSSG-3026, Unit 1 FA 26 Fire Guide, Revision 7
- 2FSSG-3026, Unit 2 FA 26 Fire Guide, Revision 6
- 1FSSG-3044E, Unit 1 FZ 44E Fire Guide, Revision 1
- 2FSSG-3044E, Unit 2 FZ 44E Fire Guide, Revision 1

The team reviewed selected operator manual actions to verify whether they had been properly reviewed and approved and whether the actions could be implemented in accordance with plant procedures in the time necessary to support the safe shutdown method for each fire area. The team also reviewed the periodic testing of the alternative shutdown transfer and isolation capability, and instrumentation and control functions, to evaluate whether the tests were adequate to ensure the functionality of the alternative shutdown capability.

b. Findings

No findings were identified.

.06 Circuit Analysis

a. Inspection Scope

The team reviewed Exelon's post-fire safe shutdown analysis for the selected fire areas to determine whether the analysis identified both required and associated electrical circuits and cables for the systems and components necessary to achieve and maintain safe shutdown. The team reviewed electrical schematics and cable routing data for power, control, and instrumentation associated with selected components. Specifically, the team evaluated the selected circuits and cables to determine whether they were (a) adequately protected from potential fire damage, or (b) analyzed to show that fire-induced faults (e.g., hot shorts, open circuits, and shorts to ground) would not prevent safe shutdown, or (c) analyzed to show that potential damage could be mitigated with approved operator manual actions, in order to determine whether fire-induced faults could adversely impact safe shutdown capabilities. The team's evaluations considered credible fire scenarios, cable insulation attributes, cable failure modes, cable routing, and common power supply or electrical bus configurations.

In addition, the team reviewed cable raceway drawings and cable routing databases for a sample of components required for post-fire safe shutdown to determine whether those cables were routed as described in the safe shutdown analysis. The team also reviewed equipment important to safe shutdown, but not part of the success path, to assess whether Exelon's safe shutdown methodologies were appropriate, conformed to design and licensing basis requirements, and appropriately considered the guidance in NRC Regulatory Guide 1.189, "Fire Protection for Nuclear Power Plants," revision 2.

Cable failure modes were reviewed for the following components:

- 0AP506, "A" Residual Heat Removal Service Water (RHRSW) Pump
- F151-1R005, Residual Heat Removal (RHR) Flow Indicator
- HV49-1F029, Reactor Core Isolation Cooling (RCIC) Pump Suction Valve from Suppression Chamber
- HV49-1F012, RCIC Pump Discharge Valve
- P142-2R011, Reactor Pressure Indicator

The team reviewed a sample of circuit breaker and fuse over-current protection coordination studies to determine whether equipment needed for post-fire safe shutdown activities could be adversely affected due to a lack of coordination that could result in a common power supply or common electrical bus concern. The team also evaluated whether coordination studies appropriately considered multiple faults due to fire. In addition, the team reviewed a sample of circuit breaker maintenance records, for components required for safe shutdown, to determine whether the breakers were properly maintained.

The team assessed the transfer of control from the main control room to the alternative shutdown location to determine whether it would be adversely affected by fire-induced circuit faults (e.g., by the provision of separate fuses and power supplies for alternative shutdown control circuits).

b. Findings

No findings were identified.

.07 Communications

a. Inspection Scope

The team reviewed safe shutdown procedures, the safe shutdown analysis, and associated documents to verify whether an adequate method of communications would be available to plant operators following a fire. During this review, the team considered the effects of ambient noise levels, clarity of reception, reliability, and coverage patterns. The team inspected selected emergency storage lockers to independently verify whether portable communication equipment was available for the fire brigade and plant operators. In addition, the team evaluated whether radio or phone repeaters, transmitters, and power supplies would be reasonably unaffected by a fire.

b. Findings

No findings were identified.

.08 Emergency Lighting

a. Inspection Scope

The team observed the placement and coverage area of eight-hour emergency lights throughout the selected fire areas to evaluate their adequacy for illuminating access and egress pathways and any equipment requiring local operation or instrumentation monitoring for post-fire safe shutdown. The team also verified whether the battery power supplies were rated for at least an eight-hour capacity. Preventive maintenance procedures, the vendor manual, completed surveillance tests, and battery replacement practices were also reviewed to evaluate whether the emergency lighting had been maintained consistent with the manufacturer's recommendations and in a manner that would ensure reliable operation.

b. Findings

No findings were identified.

.09 Cold Shutdown Repairs

a. Inspection Scope

The team reviewed Exelon's dedicated repair procedures, for components which might be damaged by fire and were required to achieve post-fire cold shutdown. The team evaluated selected cold shutdown repairs to determine whether they could be achieved within the time frames assumed in the design and licensing bases. In addition, the team verified whether the necessary repair equipment, tools, and materials (e.g., pre-cut cables with prepared attachment lugs) were available and accessible on site.

b. Findings

No findings were identified.

.10 Compensatory Measures

a. Inspection Scope

The team verified whether compensatory measures were in place for out-of-service, degraded or inoperable fire protection and post-fire safe shutdown equipment, systems, or features (e.g., detection and suppression systems and equipment, passive fire barriers, or pumps, valves, or electrical devices providing safe shutdown functions or capabilities). The team evaluated whether the short term compensatory measures adequately compensated for the degraded function or feature until appropriate corrective action could be taken and whether Exelon was effective in returning the equipment to service in a reasonable period of time.

b. Findings

No findings were identified.

.11 Review and Documentation of FPP Changes

a. Inspection Scope

The team reviewed recent changes to the approved fire protection program to assess whether those changes had an adverse effect on the ability to safely shutdown.

b. Findings

No findings were identified.

.12 Control of Transient Combustibles and Ignition Sources

a. Inspection Scope

The team reviewed Exelon's procedures and programs for the control of ignition sources and transient combustibles to assess their effectiveness in preventing fires and in controlling combustible loading within limits established in the FHA. A sample of hot work and transient combustible control permits were reviewed to assess the adequacy of Exelon's fire protection program administrative controls. The team performed plant walk downs to independently verify whether transient combustibles and ignition sources were being properly controlled in accordance with the administrative controls.

b. Findings

No findings were identified.

.13 Large Fires and Explosions Mitigation Strategies

a. Inspection Scope

The team reviewed selected mitigation strategies intended to maintain or restore core decay heat removal and spent fuel pool cooling capabilities under the circumstances associated with the loss of large areas of the plant due to explosions or large fires. The team assessed whether Exelon continued to meet the requirements of License Condition 2.C.(21) for Unit 1, License Condition 2.C.(9) for Unit 2, and 10 CFR 50.54(hh)(2). The team reviewed the following mitigation strategies:

- T-312, Unit 1, Safety Relief Valve Operation using Alternate Source of DC Power from Portable Cart
- T-342, Unit 2, Portable Pump Injection into Containment
- T-304, Unit 1, Portable Pump Injection into the Reactor Vessel

The team's review included: a detailed assessment of the procedural guidance; a tabletop discussion with a non-licensed operator (i.e., postulated highest ranking Operations Department staff member to survive an event or hostile action) to discuss initial response actions; walk down of selected mitigation strategies with plant staff to assess the feasibility of the strategies and familiarity of the staff with plant equipment and implementing procedures; maintenance and surveillance testing of selected strategy equipment; and an inventory check of selected mitigation equipment to verify whether equipment storage and availability was appropriate.

b. Findings

No findings were identified.

4. OTHER ACTIVITIES

4OA2 Identification and Resolution of Problems (IP 71152)

a. Inspection Scope

The team reviewed a sample of condition reports (CR) associated with the fire protection program, post-fire safe shutdown issues, and mitigation strategy issues to determine whether Exelon was appropriately identifying, characterizing, and correcting problems associated with these areas and whether the planned or completed corrective actions were appropriate. The CRs reviewed are listed in the attachment.

b. Findings

No findings were identified.

4OA6 Meetings, including Exit

The team presented the inspection results to Mr. David Lewis, Plant Manager, and other members of Exelon's staff on November 18, 2016. The team verified that this report does not contain proprietary information.

SUPPLEMENTAL INFORMATION

KEY POINTS OF CONTACT

Licensee Personnel

J. Brittian, Fire Protection Program Engineer
G. Budock, Regulatory Assurance
F. Burzynski, Site Fire Marshall
N. Kanoss, Radio System Engineer
A. McDonald, Fire Brigade Member
J. Mittura, Safe Shutdown Electrical Engineer
C. Pragman, Corporate Fire Protection Engineer
T. Ryan, Manager Engineering Programs
J. Thoryk, Fire Protection System Engineer

NRC Personnel

S. Rutenkroger, Senior Resident Inspector, Limerick
M. Fannon, Resident Inspector, Limerick

LIST OF ITEMS OPENED, CLOSED, AND DISCUSSED

Opened

None.

Opened and Closed

None.

Closed

None.

LIST OF DOCUMENTS REVIEWED

Fire Protection Licensing and Design Basis Documents
Facility Operating License, Unit 1, dated 3/15/16
Facility Operating License, Unit 2, dated 1/28/16
NUREG-0991, Limerick NRC SER, dated 8/83
NUREG-0991, Limerick NRC SER, Supplement No. 2, dated 10/84
NUREG-0991, Limerick NRC SER, Supplement No. 4, dated 5/85
Technical Requirements Manual, Unit 1, Revision 49
Technical Requirements Manual, Unit 2, Revision 48
UFSAR, Section 9.5, Revision 16
UFSAR Appendix 9A, Fire Protection Evaluation Report, Revision 18

Calculations, Analysis, and Engineering Evaluations

1281518-08, Review of NRC Event Notification System Report 47374 - Deficiency Identified in Transition to Performance Based Standard for Fire Protection, dated 11/21/11
1510494-A04, Fire System Underground Main Flow Test Improvements & Acceptance Criteria Revisions, dated 9/26/13
1521603, OPEX Review of Information Notice 2013-09, Compressed Flammable Gas Cylinders and Associated Hazards, Revision 0
1538473, 86-10 Document TRM 3.0.7 Alternate Compensatory Measure for Fire Detection System Supervisory Circuit Degraded Current Condition, dated 9/26/13
1581135-07, Review of NRC Event Notification System Report 49490 - South Texas Hot Short, dated 2/14/14
1595043-07, OPXR Event Report 13-54, Unprotected Direct Current Ammeters Result in Unanalyzed Condition, dated 2/13/14
1607962, 86-10 Document TRM 3.0.7 Alternate Compensatory Measure for Introduction of Combustible Materials into Fire Area 75, dated 1/24/14
2382707, 86-10 Limerick U1 Turbine Building 217' Bus Duct Sprinkler Obstruction/Lack of Coverage Evaluation, dated 12/16/15
2489030, 86-10 Fire Rated Penetration Seal Functionality at Boot Seal, dated 5/14/15
2680133-A03, New Acceptance Criteria for ST-6-022-250-0, dated 10/19/16
307-E-VC000006, MAAP Analysis to Support Multiple Spurious Operations, Revision 0
8031-NPB-14, Secondary Flooding Analysis, Revision 5
A0373086, NRC Information Notice 92-18 Evaluation, dated 3/24/93
A1361986, Emergency Lighting Unit (ELU) Maintenance Strategy & Installation, Revision 0
A1483451, Create New ELU Battery Replacement PM, Revision 0
A1817021, 114-18985 Battery Currently Not Available from Sentry, Revision 0
A-E90-VC-00001, Containment Over-pressurization Evaluation, Revision 0
C-787-VC-00001, Fire Area 20 DC Panel 1BD102 Enclosure Qualification Report, Revision 1
DBD L-S-39, RCIC System Design Basis Document, Revision 13
ECR 11-00303, 86-10 Evaluation of Darmatt KKM-1 Materials for a Fire Rated Enclosure Installed around Panel 1BD102 in FA-20, Revision 2
ECR 11-00303, Installation of Electrical Raceway Fire Barrier in FA 20 (U1 Inverter Room) for DC Panel 1BD102, dated 11/10/12
LEAF-0086, Walkdown Paths for FSSD manual Actions/Repairs, Revision 2
LF-0016-019, Fire Area 020 Fire Safe Shutdown Analysis, Revision 2
LF-0016-024, Fire Area 024 Fire Safe Shutdown Analysis, dated 11/30/06
LF-0016-026, Fire Area 026 Fire Safe Shutdown Analysis, Revision 3
LF-0016-044E, Fire Zone 044E Fire Safe Shutdown Analysis, Revision 2
LF-008, Fire Water System Hydraulic Demand, Revision 0
LG-PRA-021.11, Fire Probabilistic Risk Assessment, Revision 0
LS-0285, Enclosure around Panel 1BD102 in FA-20, Revision 2
L-S-51, Fire Protection System Design Basis Document, Revision 7
L-T-10, Fire Safe Shutdown Design Basis Document, Revision 11
NE-117, IPEEE for Fire Events, dated 5/7/92
NE-294, Post-Fire Safe Shutdown Program Requirements, Revision 3 and 4
R1357926-A05, Diesel Driven Fire Pump Starting Method Evaluation, dated 9/2/16
Safe and Alternate Shutdown Component Information Sheet, Component ID 0AP506
Safe and Alternate Shutdown Component Information Sheet, Component ID F151-1R005
Safe and Alternate Shutdown Component Information Sheet, Component ID HV49-1F029
Safe and Alternate Shutdown Component Information Sheet, Component ID HV49-1F012
Safe and Alternate Shutdown Component Information Sheet, Component ID P142-2R011
T04727, Fire Protection Aging Management Program, dated 10/27/16

Drawings and Wiring Diagrams

A-306, Fire & Water Boundaries Elev. 201 foot, Revision 20
A-307, Fire & Water Boundaries Elev. 217 foot, Revision 32
A-308, Fire & Water Boundaries Elev. 253 foot, Revision 17
A-309, Fire & Water Boundaries Elev. 283 foot, Revision 20
C-11, Yardwork Fire Water System, Revision 52
E-1, Sht. 1, Single Line Diagram Station, Revision 30
E-10024, Shts. 1-6, Block Diagram, Radio & Distributed Antenna System, Revision 23
E-102, Sht. 2, Schematic Block Diagram RHR System 1 & 2 Units, Revision 27
E-105, Sht. 2, Schematic Block Diagram RCIC System 1 & 2 Units, Revision 8
E-115, Sht. 4, Schematic Block Diagram PGCC SITS Cables 1 & 2 Units & Common, Revision 21
E-115, Sht. 6, Schematic Block Diagram PGCC SITS Cables 1 & 2 Units, Revision 21
E-33, Sht. 1, Single Line Meter & Relay Diagram 125/250 VDC System Unit 1, Revision 45
E-33, Sht. 2, Single Line Meter & Relay Diagram 125/250 VDC System Unit 1, Revision 47
E-33, Sht. 3, Single Line Meter & Relay Diagram 125/250 VDC System Unit 1, Revision 28
E-34, Sht. 1, Single Line Meter & Relay Diagram 125/250 VDC System Unit 2, Revision 38
E-34, Sht. 2, Single Line Diagram Instrumentation AC System Unit 2, Revision 40
E-34, Sht. 3, Single Line Diagram 125/250 VDC System 2 Unit, Revision 33
E-361, Sht. 1, Schematic Diagram RHRSW Pumps Common, Revision 8
E-361, Sht. 2, Schematic Diagram RHRSW Pumps Common, Revision 31
E-372, Sht. 2, RHR Heat Exchanger Tube Side Outlet MOVs – 1 & 2 Units, Revision 25 and 26
E-51-1040-E-042, Sht.1, HV-049-1F012 Schematic, Revision 0
E-51-1040-E-046, Sht. 1, HV-049-1F029 Schematic, Revision 0
FSC-198-1652-4, Penetration Seal Design (763-E003) Detail 27, Revision
FSC-198-19-3, Penetration thru Fire Wall Less Than Prescribed Thickness, Detail 23, Revision 4L
FSC-198-22-8, Cable Tray thru Fire Barrier, Detail 27, Revision 6
FSC-198-3480-5, Penetration Seal Design (441-E007) Detail 23, 27, Revision 4
FSC-198-3481-3, Penetration Seal Design (441-E008) Detail 23, Revision 2
FSC-282-33-2, Pipe Conduit thru Gypsum Board Wall Fire Seal Design (441-Z282), Revision 1
H23-P004-E-001, Sht. 1, Connection Diagram Reactor Level & Pressure Local Panel A, Revision 11
M-1047, Heating, Ventilation, and Air Conditioning (HVAC) Auxiliary Equipment Room, Revision 27
M-113, Sht. 157A, HVAC Damper Data Sheets, Fire Dampers and Doors, Revision 1
M-113, Sht. 182, HVAC Damper Data Sheets, Fire Dampers and Doors, Revision 5
M-113, Sht. 8, HVAC Dampers, Class I Seismic, Revision 7
M-1-C61-1050-E-001, Elementary Diagram Remote Shutdown System, Revision 65
M-1-C61-1050-E-003, Elementary Diagram Remote Shutdown, Revision 51
M-1-C61-1050-E-005, Elementary Diagram Remote Shutdown Panel Unit 1, Revision 19
M-1-C61-1050-E-014, Elementary Diagram Remote Shutdown System, Revision 15
M-1-C61-P001-E-032, Connection Diagram Remote Shutdown VB Unit 1, Revision 21
M-1-C61-P001-E-034, Connection Diagram Remote Shutdown VB Unit 1, Revision 3
M-1-C61-P001-E-047, Connection Diagram Remote Shutdown VB, Revision 26
M-1-E51-1040-001, Sht. 1, Elementary Diagram Rector Core Isolation, Revision 61
M-1-E51-1040-008, Sht. 1, Elementary Diagram Rector Core Isolation, Revision 25
M-1-E51-1040-012, Sht. 1, Elementary Diagram Rector Core Isolation, Revision 27
M-1-E51-1040-E-004, Sht. 1, Elementary Diagram Rector Core Isolation, Revision 30
M-500, Plumbing & Drainage, Symbols, Abbreviations and General Notes, Revision 16
M-555, Plumbing & Drainage, Control Room Area-Area 8 Floor Plan, Revision 4
M-88, Loop Diagram Remote Shutdown System RHR Flow Indication, Revision 0

PSA-441, Control Room Area Floor Plan and Wall, Revision 14

Piping and Instrumentation Diagrams
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M-78, Sht. 1, Control Enclosure HVAC (Common), Revision 34
M-78, Sht. 2, Control Enclosure HVAC (Common), Revision 45
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Large Fires and Explosions Mitigation Strategies Documents
OP-AA-201-010-1001, B.5.b Mitigating Strategies Equipment Expectations, Revision 3
T-304, Unit 1, Portable Pump Injection into the Reactor, Revision 1
T-312, Unit 1, SRV Operation Using Alternate Source of DC Power from Portable Cart, Revision 0
T-342, Unit 2, Portable Pump Injection into Containment, Revision 0
TSG-4.1, LGS Operational Contingency Guidelines, Revision 17
TSG-4.2, Extreme Damage Mitigation Guideline for Loss of a Large Area of the Plant, Revision 4

Quality Assurance Audits and Self Assessments
2624166, Limerick Fire Protection Inspection Preparatory Self-Assessment, dated 8/5/16
NOSA-LIM-14-10, Fire Protection Audit Report, dated 9/18/14
NOSA-LIM-16-06, Fire Protection Audit Report, dated 9/23/16

System Health Reports
Fire Protection Common Unit, 1st & 2nd Quarters 2016
Fire Protection, Unit 1, 1st & 2nd Quarters 2016
Fire Protection, Unit 2, 1st & 2nd Quarters 2016

Procedures
ARC-MCR-006 H6L, Spray Pond Pump Structure, Revision 3
CC-AA-209, Fire Protection Program Configuration Change Review, Revision 5
CC-AA-211, Fire Protection Program, Revision 7
CC-AA-211-1001, Fire Protection Engineering Evaluations, Revision 1
IC-11-02043, Preventive Maintenance of Fire System Deluge Valves, Revision 12
M-093-004, 480 VAC Motor Control Center Breaker Assembly and Cubicle Terminal Maintenance, Revision 12

M-C-700-309, Installation of Silicone Cartridge Dispensing for Penetration Seals, Revision 12
OP-AA-201-001, Fire Marshal Tours, Revision 6
OP-AA-201-003, Fire Drill Performance, Revision 15
OP-AA-201-004, Fire Prevention for Hot Work, Revision 12
OP-AA-201-005, Fire Brigade Qualification, Revision 9
OP-AA-201-008, Pre-Fire Plan Manual, Revision 3
OP-AA-201-009, Control of Transient Combustible Material, Revision 17
OP-AA-201-011-1001, Fire Marshal Certification Process, Revision 3
OP-AA-201-012-1001, Operations On-Line Fire Risk Management, Revision 1
OP-LG-102-106, Operator Response Time Program, Revision 5
OP-MA-201-007, Fire Protection System Impairment Control, Revision 6
RT-6-000-591-0, Inspection of Controlled Material Storage Cabinets, Revision 17
RT-6-000-900-0, Inspection of Safe Shutdown Equipment, Revision 30
RT-6-022-911-0, Inspection of Fire Brigade Lockers, Revision 16
S22.8.H, Inoperable Fire Protection Equipment Actions, Revision 34
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S88.1.A, Remote Shutdown Panel Controls, Revision 21
ST-2-022-602-1, Smoke Detection Channel Functional Test, Zones 20 & 22, Revision 21
ST-2-022-604-0, Heat & Smoke Detection Functional Test, Zone 26, Revision 18
ST-2-022-609-1, Smoke Detection Functional Test, Zone 44, Revision 19
ST-2-022-643-1, Heat Detection Functional Test, Zone 44, Revision 12
ST-2-088-321-1, Remote Shutdown System Division 1 RHR Operability Test, Revision 20
ST-2-088-410-2, Remote Shutdown System, Reactor Water Level Calibration (LT-042-2N010, LI-042-2R010), Revision 6
ST-4-022-921-0, Fire Damper Inspection/Function Test, Revision 6
SY-LG-101-124, Duties and Responsibilities of Security Control Centers and Security Supervision, Revision 6
SY-LG-1016, Watch Standing Practices, Revision 7
TPC-16-0291-0, ST-6-022-250-0 Temporary Change, dated 10/28/16
WC-AA-111, Surveillance Program Requirements, Revision 5

Operations Procedures
1FSSG-3020, Fire Area 020 Fire Guide, Revision 16
1FSSG-3024, Fire Area 024 Fire Guide, Revision 8
1FSSG-3026, Fire Area 026 Fire Guide, Revision 7
1FSSG-3044E, Fire Area 044E Fire Guide, Revision 12
2FSSG-3024, Fire Area 024 Fire Guide, Revision 7
2FSSG-3026, Fire Area 026 Fire Guide, Revision 6
2FSSG-3044E, Fire Area 044E Fire Guide, Revision 1
E-1, Common, Loss of All AC Power (Station Blackout), Revision 48
SE-1, Remote Shutdown, Revision 73
SE-1-1, Protected Depressurization Control, Revision 16
SE-1-2, Protected Power Source, Revision 14
SE-1-3, Protected Ventilation Source, Revision 17
SE-23, Security Threat, Revision 26
SE-6, Alternate Remote Shutdown, Revision 30
SE-8, Fire Hard Card, Revision 1
SE-8, Fire, Revision 54

Operator Safe Shutdown Training
LLOR 1302D, B.5.b and SE-23 Implementation, Revision 0
LLOR 1502H, T-300, FLEX, SAFER, ED Checklist, Revision 1
LOJPM1801, Fire Safe Shutdown Action, Manual Local Start of *A-G501, dated 11/15/16
LOJPM1803, Fire Safe Shutdown Action, Align RHR for LPCI Operation, dated 11/15/16
LOJPM2268, Alignment of Long Term Pneumatics for MSRV Operation, dated 10/27/14
TQ-AA-223-F070, Licensed Operator Requalification, B.5.b & SE-23 Implementation, Revision 1

Fire Fighting Strategies (i.e., Pre-Fire Plans)
F-A-304 (Fire Area 44), Unit 1 Safeguard System Access Area, Room 304, Revision 13
F-A-452 (Fire Area 20), Common, U/1 Static Inverter Room, Revision 9
F-A-540 (Fire Area 26), Common, Remote Shutdown Room 540, Revision 11
F-S-001 (Fire Area 122), Spray Pond Pump Structure Western Half, Revision 13
F-S-002 (Fire Area 123), Spray Pond Pump Structure Eastern Half, Revision 11

Fire Brigade Training
2Q14, Quarterly, Fire Brigade Training, dated 4/28/14
3Q13, Quarterly, Fire Brigade Training, dated 8/14/13
4Q16, Quarterly Fire Brigade Training, dated 10/17/16
FBP01, Emergency Response (ER) Training Fire Brigade Introduction/Orientation, Revision 7
FBP04, ER Training Fire Brigade Program, Fire Behavior & Essentials, Revision 11
FBP07, ER Training Fire Brigade Program, Hose Streams, Appliances, Tools, Revision 7
FBP11, ER Training Training Fire Brigade Program, Tactics & Strategy, Revision 9
Fire Brigade Qualification Records, dated 11/2/16

Fire Brigade Announced Drills and Critiques
R1343430, "D" Crew Announced Backshift, Drill Scenario F-GML-001, Radiation Protection Kitchen Area, 2nd Quarter 2016
R1344320, "B" Crew Announced Backshift, Drill Scenario GML Building, Electrical Mezzanine, 2nd Quarter 2016
R1346799, "C" Crew Announced Dayshift, Drill Scenario F-T-335, Common TB 23-Line and Generator Equipment, Fire Area 113, 2nd Quarter 2016

Fire Brigade Unannounced Drills and Critiques
Fire Drill Log, 1st Quarter 2014 through 2nd Quarter 2016
R1331492, "C" Crew Day Shift, Drill Scenario F-A-336, Fire Area 2, 4th Quarter 2015
R1343940, "A" Crew Day Shift, Drill Scenario F-T-543, Fire Area 114, 2nd Quarter 2016
R1353584, "E" Crew Backshift, Drill Scenario F-T-335, Fire Area 113, 3rd Quarter 2016

Transient Combustible Permits and Evaluations
226, Refueling Floor (Reactor Building), dated 9/13/16
228, Refueling Floor (Reactor Building), dated 9/16/16
229, Refueling Floor (Reactor Building), dated 9/16/16
234, Refueling Floor (Reactor Building), dated 10/3/16
235, Refueling Floor (Reactor Building), dated 10/4/16

Hot Work and Ignition Source Permits
C0240008, Valve 010-2502, dated 8/30/16
C0260717, U/2 RCIC Pump Room, dated 3/10/16
M2025286, Replace Valve PCV-021-017, dated 9/1/16
M2029280, Repair Steam Leak 096-0597, dated 6/29/16
M2034106, Repair Leaking Pipe, system-096, dated 3/9/16

Completed Tests and Surveillances

OP-AA-102-106, Operator Response Time Validation Sheet, performed 11/18/13
OP-AA-102-106, Operator Response Time Validation Sheet, performed 12/2/14
OP-AA-102-106, Operator Response Time Validation Sheet, performed 1/15/14
OP-AA-102-106, Operator Response Time Validation Sheet, performed 1/16/15
OP-AA-102-106, Operator Response Time Validation Sheet, performed 1/9/15
OP-AA-102-106, Operator Response Time Validation Sheet, performed 3/18/15
OP-AA-102-106, Operator Response Time Validation Sheet, performed 4/9/15
OP-AA-102-106, Operator Response Time Validation Sheet, performed 4/7/15
OP-AA-102-106, Operator Response Time Validation Sheet, performed 4/8/15
OP-AA-102-106, Operator Response Time Validation Sheet, performed 5/18/15
OP-AA-102-106, Operator Response Time Validation Sheet, performed 6/8/15
OP-AA-102-106, Operator Response Time Validation Sheet, performed 6/15/15
RT-6-000-900-0, Inspection of Safe Shutdown Equipment, performed 7/29/16
RT-6-000-913-0, Inspection of B.5.b Security Order Equipment, performed 7/28/16
RT-6-022-911-0, Inspection of Fire Brigade Lockers, performed 7/23/16
RT-6-108-300-0, Fire Safe Shutdown ELU Operability Verification, performed 9/17/16
RT-6-108-300-1, Fire Safe Shutdown ELU Operability Verification, performed 8/6/16
RT-6-108-300-2, Fire Safe Shutdown ELU Operability Verification, performed 7/23/16
ST-2-088-320-0, Remote Shutdown System Emergency Service Water and RHRSW Operability Test, performed 7/25/14
ST-2-088-320-1, Remote Shutdown System RCIC Operability Test, performed 11/3/15
ST-4-022-920-2, Fire Rated Assembly Inspection, performed 5/4/15
ST-4-022-921-0, Fire Damper Inspection/Functional Test R05, performed 4/21/14 and 6/21/16
ST-4-022-921-1, Fire Damper Inspection/Functional Test R06, performed 4/21/14 and 4/28/16
ST-4-022-922-0, Fire Penetration Visual Inspection, performed 5/30/06, 9/22/12, 12/11/12
ST-6-022-250-0, Underground Fire Main Flow Test, performed 11/4/16

Condition Reports (* denotes NRC identified during this inspection)

01275720	02698247	02736687*	A0373086
01511333	02717801	02736687*	A1934391
01511763	02729935*	02736807*	A1943249
01515025	02729959*	02741243	A2043304
01516231	02729978*	02741426*	A2062067
02695702	02729982*	02741426*	A2062071
02696977	02734588	02741793	
02697889	02736143*	03944053*	

Work Orders

C0244576	R1252111	R1292263	R1309108
C0251757	R1252894	R1293542	R1319466
R1167559	R1254997	R1295056	R1339965
R1231311	R1255978	R1295253	R1340145
R1232295	R1259587	R1298308	R1355547
R1240549	R1270336	R1298887	R1355566
R1242365	R1271028	R1301128	R1356615
R1243605	R1271968	R1307879	R1357926
R1246941	R1282982	R1307942	R1359084
R1249775	R1282985	R1308354	R1362658

Vendor Manuals
4576K16-001, Type 766 Signal Resistor Units, Revision 1

Miscellaneous Documents
748-13, Conduit and Seismic Gap Penetration Fire Barrier Testing, dated 2/79
748-134, Fire Testing Utilizing BISCO SF-20 and SE Foam, Revision 2
748-14, Metal Clad Fire Wall Penetration Barrier Fire Test Report, Revision 4
ECR-07-00300, FSSD Control Room Transducer Upgrade / SWGR Meter Isolation, Revision 0
eSOMS Logs, dated 10/31/16
Limerick Radio Coverage Report, dated 9/23/09
Fire Impairment Log, dated 10/14/16
NRC Information Notice 2013-06, Corrosion in Fire Protection Piping due to Air and Water Interaction, dated 3/25/13
Operator Shift Rosters (15 Examples), dated 11/1/16
Position for Information Notice 92-18 Remote Transfer Capabilities Hot Short Vulnerability, dated 11/13/92

LIST OF ACRONYMS

ADAMS	Agencywide Documents Access and Management System
CFR	Code of Federal Regulations
CMEB	Chemical Engineering Branch
CR	Condition Report
ELU	Emergency Lighting Unit
Exelon	Exelon Generation Company, LLC
FA	Fire Area
FHA	Fire Hazards Analysis
FPP	Fire Protection Program
FZ	Fire Zone
HVAC	Heating, Ventilation, and Air Conditioning
IP	[NRC] Inspection Procedure
IPEEE	Individual Plant Examination of External Events
IR	[NRC] Inspection Report
LGS	Limerick Generating Station
NFPA	National Fire Protection Association
NRC	Nuclear Regulatory Commission
PARS	Publicly Available Records System
RCIC	Reactor Core Isolation Cooling
RHR	Residual Heat Removal
RHRSW	Residual Heat Removal Service Water
SER	Safety Evaluation Report
UFSAR	Updated Final Safety Analysis Report
VDC	Volts Direct Current