



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

May 1, 2017

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

**SUBJECT: OYSTER CREEK NUCLEAR GENERATING STATION - TRIENNIAL FIRE  
PROTECTION INSPECTION REPORT 05000219/2017007**

Dear Mr. Hanson:

On April 7, 2017, the U.S. Nuclear Regulatory Commission (NRC) completed a triennial fire protection inspection at Oyster Creek Nuclear Generating Station. The enclosed inspection report documents the inspection results, which were discussed on April 7, 2017, with Mr. Garey Stathes, Site Vice President, and other members of your staff.

The inspection examined activities conducted under your license as they related 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.

The NRC inspectors did not identify any finding or violation of more than minor significance.

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 No. 50-219  
License No. DPR-16

Enclosure:  
Inspection Report 05000219/2017007  
w/Attachment: Supplemental Information

SUBJECT: OYSTER CREEK NUCLEAR GENERATING STATION TRIENNIAL FIRE  
 PROTECTION INSPECTION REPORT 05000219/2017007 DATED MAY 1, 2017

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**U.S. NUCLEAR REGULATORY COMMISSION**

**REGION I**

Docket No.: 50-210

License No.: DPR-16

Report No.: 05000219/2017007

Licensee: Exelon Generation Company, LLC

Facility: Oyster Creek Nuclear Generating Station

Location: Forked River, New Jersey

Dates: March 20 – April 7, 2017

Inspectors: E. DiPaolo, Senior Reactor Inspector (Team Leader)  
K. Young, Senior Reactor Inspector  
F. Arner, Senior Reactor Analyst  
S. Anderson, Reactor Inspector  
J. Ayala, Reactor Inspector

Observers: C. Hobbs, Reactor Inspector  
V. Gubbi, Nuclear Engineer, New Jersey,  
Department of Environmental Protection, Bureau of Nuclear Engineering

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

**SUMMARY**

IR 05000219/2017007; 03/20/2017 - 04/07/2017; Oyster Creek Nuclear Generating Station; Triennial Fire Protection Inspection.

The report covered a two-week onsite triennial fire protection team inspection by specialist inspectors. The U.S. Nuclear Regulatory Commission's (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.

## REPORT DETAILS

### Background

This report presents the results of a triennial fire protection inspection conducted in accordance with NRC Inspection Procedure (IP) 71111.05T, "Fire Protection." The objective of the inspection was to assess whether Exelon Generation Company, LLC (Exelon) had implemented an adequate fire protection program and that post-fire safe shutdown capabilities have been established and are being properly maintained at the Oyster Creek Nuclear Generating Station (Oyster Creek). The following fire areas (FAs) and/or fire zones (FZs) were selected for detailed review based on risk insights from the Oyster Creek Individual Plant Examination of External Events (IPEEE) and the Oyster Creek Fire Probabilistic Risk Assessment:

- OB-FZ-8A/B Motor-Generator Set Room and Mechanical Equipment Room
- OB-FZ-4 Cable Spreading Room
- RB-FZ-1D Reactor Building 51' Elevation
- TB-FA-3A 4160V Emergency Switchgear 1C Vault

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

The inspection team evaluated Exelon's fire protection program (FPP) against applicable requirements which included Operating License Condition, NRC Safety Evaluation Reports (SERs), 10 CFR 50.48, and 10 CFR 50, Appendix R. The team also reviewed related documents that included the Updated Final Safety Analysis Report (UFSAR), Section 9.5.1, fire protection plan, fire hazards analysis (FHA), and post-fire safe shutdown analyses.

The team evaluated aspects of two mitigating strategies for responding to large fires and explosions, as required by Operating License Condition 2.C.(8) and 10 Code of Federal Regulations (CFR) 50.54(hh)(2). 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.

### 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, safe shutdown analyses, and supporting drawings and documentation to verify that post-fire safe shutdown capabilities were properly protected. The team ensured that applicable separation requirements of Section III.G of 10 CFR Part 50, Appendix R, and the licensee's design and licensing bases were maintained for the credited safe shutdown equipment and their supporting power, control, and instrumentation cables. This review included an assessment of the adequacy of the selected systems for reactivity control, reactor coolant makeup, reactor 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 and radiant energy heat barriers to design and licensing basis requirements, industry standards, and the Oyster Creek 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 to verify whether the material and configuration was appropriate for the required fire rating and conformed to the engineering design.

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

The team reviewed initial discharge testing, design specifications, vendor requirements, and routine functional testing for the carbon dioxide (CO<sub>2</sub>) suppression systems for the 4160V Emergency Switchgear 1C Vault. The team walked down accessible portions of the CO<sub>2</sub> 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 fire fighting strategies and CO<sub>2</sub> 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 diesel driven fire pumps, interviewed system and program engineers, and reviewed selected issue reports (IRs) 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 the testing was adequately conducted, the acceptance criteria were met, and any 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 firefighting. In addition, the team reviewed Exelon's fire brigade equipment inventory and inspection procedure and recent inspection and inventory results to verify adequate equipment was available, and 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 walkdowns to verify that redundant trains of systems required for hot shutdown, which are located in the same fire area, are not subject to damage from fire suppression activities or from the rupture or inadvertent operation of fire suppression systems.

Specifically, the team verified that:

- A fire in one of the selected fire areas would not indirectly, through production of smoke, heat or hot gases, cause activation of suppression systems that could potentially damage all redundant safe shutdown trains;
- A fire in one of the selected fire areas (or the inadvertent actuation or rupture of a fire suppression system) would not indirectly cause damage to all redundant trains (e.g. sprinkler caused flooding of other than the locally affected train); and,
- Adequate drainage is provided in areas protected by water suppression systems

b. Findings

No findings were identified.

.05 Post-Fire Safe Shutdown Capability – Normal and Alternative

a. Inspection Scope

The team reviewed the safe shutdown analysis, operating procedures, piping and instrumentation drawings (P&IDs), electrical drawings, the UFSAR and other supporting documents for the selected fire areas to verify that the licensee had properly identified the systems and components necessary to achieve and maintain safe shutdown conditions. The team assessed the adequacy of the selected systems and components for reactivity control, reactor coolant makeup, reactor heat removal, process monitoring, and support system functions. This review included verification that alternative post-fire shutdown could be performed both with and without the availability of offsite power. Plant walkdowns were also performed to verify that the plant configuration was consistent with that described in the safe shutdown and fire hazards analyses. The team verified that the systems and components credited for use during shutdown would remain free from fire damage.

The team verified that the training program for licensed and non-licensed operators included alternative shutdown capability. The team also verified that personnel required for safe shutdown using the normal or alternative shutdown systems and procedures are trained and available onsite 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 to ensure the implementation and human factors adequacy of the procedures. The team also verified that the operators could be reasonably expected to perform specific actions within the time required to maintain plant parameters within specified limits.



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

- ABN-30, Control Room Evacuation, Revision 29;
- FSP-OB8A, Fire Support Procedure for Recirculation Motor-Generator Set Room, Revision 6;
- FSP-OB8B, Fire Support Procedure for Mechanical Equipment Room, Revision 4;
- FSP-RB1D, Fire Protection Procedure for Reactor Building 51' Elevation, Revision 7; and,
- FSP-TB3A, Fire Support Procedure for Turbine Building, 4160 Switchgear Room 1C, Revision 4

The team reviewed manual actions to ensure that they had been properly reviewed and approved and that 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 capability and instrumentation and control functions to ensure the tests are adequate to ensure the functionality of the alternative shutdown capability.

b. Findings

No findings were identified.

.06 Circuit Analysis

a. Inspection Scope

The team verified that the licensee performed a post-fire safe shutdown analysis for the selected fire areas and the analysis appropriately identified the structures, systems, and components important to achieving and maintaining safe shutdown. Additionally, the team verified that the licensee's analysis ensured that necessary electrical circuits were properly protected and that circuits that could adversely impact safe shutdown due to hot shorts or shorts to ground were identified, evaluated, and dispositioned to ensure spurious actuations would not prevent safe shutdown.

The team's review considered fire and cable attributes, cable routing, potential undesirable consequences and common power supply/bus concerns. Specific items included the credibility of the fire threat, cable insulation attributes, cable failure modes, and actuations resulting in flow diversion or loss of coolant events.

The team also reviewed cable raceway drawings and/or cable routing databases for a sample of components required for post-fire safe shutdown to verify that 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 verify that the licensee had taken appropriate actions in accordance with the design and licensing basis and NRC Regulatory Guide 1.189, Revision 2.

Circuit analysis was performed for the following components:

- LI-211-994, Isolation Condenser 'B' Shell Water Level
- V-17-2, Shutdown Cooling Pump 'B' Inlet Suction Valve
- V-17-56, Shutdown Cooling Loop 'B' Discharge Isolation Valve
- V-20-21, Core Spray Parallel Isolation Valve
- V-20-33, Core Spray Pump Suction Valve
- 1B2M, Main Breaker, 460V Unit Substation (USS) 1B2 Unit 041B
- 1B2P, Breaker, 460V Feeder to USS 1B2
- 1-1, Reactor Building Closed Cooling Water Pump

The team reviewed a sample of circuit breaker coordination studies to ensure equipment needed to conduct post-fire safe shutdown activities would not be impacted due to a lack of coordination that could result in a common power supply or common bus concern.

The team verified that the transfer of control from the control room to the alternative shutdown location(s) would not be 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 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 also inspected the designated emergency storage lockers to verify the availability of portable radios for the fire brigade and for plant operators. The team also verified that communications equipment such as repeaters and transmitters would not be affected by a fire.

b. Findings

No findings were identified.

.08 Emergency Lighting

a. Inspection Scope

The team walked down the emergency lights in the selected fire areas to independently evaluate the placement and coverage areas of the lights. The team assessed whether the lights provided adequate illumination on local equipment and instrumentation required for post-fire safe shutdown, to ensure local operations could be reliably performed under expected post-fire conditions. In addition, emergency light placement was also evaluated to determine adequate illumination of local area access and egress pathways.

The team interviewed system engineers and technical staff to evaluate the adequacy and the performance of the Emergency Lighting Units (ELUs). The team also verified that 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 verify that the emergency lighting was being 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, equipment, and materials to accomplish repairs of components required for cold shutdown which might be damaged by the fire to ensure cold shutdown could be achieved within the time frames specified in their design and licensing bases. In addition, the team verified that the repair equipment, components, 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 that 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 also verified that the short term compensatory measures compensated for the degraded function or feature until appropriate corrective action could be taken and that the licensee was effective in returning the equipment to service in a reasonable period of time.

The team reviewed selected compensatory measures in the form of operator manual actions for 10 CFR 50 Appendix R, Section III.G.2 designated areas to evaluate whether those actions could be reasonably accomplished. Specific attributes reviewed included availability of diagnostic instrumentation, expected environmental conditions, minimum staffing, communications, equipment availability, training, procedures, and verification and validation.

b. Findings

No findings were identified.

.11 Fire Protection Program Changes

a. Inspection Scope

The team reviewed recent changes to the approved fire protection program to verify that the changes did not constitute 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 the licensee'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 also reviewed. The team performed plant walkdowns to verify that transient combustibles and ignition sources were being implemented 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.(8), and 10 CFR 50.54(hh)(2). The team reviewed the following mitigation strategies:

- EDMG-SPX6, Reactor Pressure Vessel Injection via Feedwater system using the portable pump
- EDMG-SPX10, Containment Injection using the portable pump

The team's review included: a detailed assessment of the procedural guidance; a discussion with operations staff 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 [OA]**4OA2 Identification and Resolution of Problems.01 Corrective Actions for Fire Protection Deficienciesa. Inspection Scope

The team verified that the licensee was identifying fire protection and post-fire safe shutdown issues at an appropriate threshold and entering them into the corrective action program. The team also reviewed a sample of selected issues to verify that the licensee had taken or planned appropriate corrective actions.

b. Findings

No findings were identified.

4OA6 Meetings, Including ExitExit Meeting Summary

The team presented their preliminary inspection results to Garey Stathes, Site Vice President, and other members of the site staff at an exit meeting on April 7, 2017. No proprietary information was included in this inspection report.

**ATTACHMENT: SUPPLEMENTAL INFORMATION**

**SUPPLEMENTAL INFORMATION**

**KEY POINTS OF CONTACT**

Licensee Personnel

G. Stathes, Site Vice President  
M. Gillin, Plant Manager  
R. Dutes, Licensing  
J. Jimenez, Senior Regulatory Assurance Specialist  
C. McNamer, Senior Rector Operator  
N. Onuorah, Fire Protection Engineer  
T. Prosser, Fire Marshall  
M. Rossi, Licensed Operator Training Instructor  
S. Schwartz, System Manager  
E. Siebenaller, Electrical Maintenance  
M. Taylor, Exelon Corporate Fire Protection  
T. Trettel, Fire Protection System Engineer  
J. Weissinger, Director, Operations  
W. Wasfy, Fire Protection Safe Shutdown Engineer

State of New Jersey

R. Pinney, Supervisor, New Jersey Department of Environmental Protection, Bureau of Nuclear Engineering  
V. Gubbi, Nuclear Engineer, New Jersey Department of Environmental Protection, Bureau of Nuclear Engineering

NRC

G. Dentel, Chief, Engineering Branch 2, Division of Reactor Safety  
F. Arner, Senior Reactor Analyst, Division of Reactor Safety  
A. Patel, Senior Resident Inspector, Oyster Creek Nuclear Generating Station L. Andrews, Resident Inspector, Oyster Creek Nuclear Generating Station  
A. Turilin, Resident Inspector (Acting), Oyster Creek Nuclear Generating Station

**LIST OF ITEMS OPENED, CLOSED, AND DISCUSSED**

Opened

None.

Opened and Closed

None.

Closed

None.

## LIST OF ITEMS OPENED, CLOSED, AND DISCUSSED

### Fire Protection Licensing and Design Basis Documents

Specification SP-1302-06-013, Fire Protection Specification for Post-Fire Safe Shutdown Program Requirements at Oyster Creek Nuclear Generating Station, Revision 6, dated 3/24/16

Updated Final Safety Analysis Report, Chapter 9.5.1, Fire Protection Program, Revision 18, dated 10/13

Document No. 990-1746, Oyster Creek Nuclear Generating Station Fire Hazards Analysis Report, Revision 18

Summary of Appendix A (to Branch Technical Position APSCB 9.5-1, dated 9/29/76), Revision 14

Exelon Letter, Request for Exemption from 10 CFR 50, Appendix R, Section III.G., "Fire Protection of Safe Shutdown Capability" (Phase 1), dated 3/3/09

U.S. NRC Exemption 10 CFR 50, Appendix R, Section III.G Requirements, dated 3/30/11 (ML110700471)

Exelon Letter, Request for Exemption from 10 CFR 50, Appendix R, Section III.G, "Fire Protection of Safe Shutdown Capability" (Phase 2), dated 3/4/09

Exelon Letter, Response to Request for Additional Information Request for Exemption from 10 CFR 50, Appendix R, Section III.G, "Fire Protection of Safe Shutdown Capability, dated 4/2/10

U.S. NRC Exemption 10 CFR 50, Appendix R, Section III.G Requirements, dated 3/30/11 (ML1108260626)

Oyster Creek Nuclear Generating Station Safety Evaluation Report (SER), Fire Protection 3/3/78

Oyster Creek Nuclear Generating Station SER, Fire Protection Supplement No. 2, 11/13/79

Oyster Creek Nuclear Generating Station SER, Fire Protection Supplement No. 3, 8/25/80

U.S. NRC Exemption from Requirements of Appendix R to 10 CFR Part 50, Section III.G.2 and the Post-Fire Safe Shutdown Capability, dated 3/24/86

U.S. NRC Exemption from Certain Technical Requirements Contained in Section III.G if Appendix R to 10 CFR Part 50, dated 6/25/90

### Calculations, Analysis, and Engineering Evaluations

C-1302-732-5350-005, Oyster Creek Nuclear Generating Station-Solid State Trip Device Settings for 480V Unit Substation Circuit Breakers, Revision 8

C-1302-735-5350-008, OC-Battery Bus Coordination, Revision 4

C-1302-911-E120-037, Fire Area / Zone TB-FA-3A-Fire Safe Shutdown Analysis, Revision 0

C-1302-911-E120-005, Fire Area / Zone RB-FZ-1D & 1G-Fire Safe Shutdown Analysis, Revision 0

C-1302-911-E120-001, Fire Area/Zone OB-FA-5-Fire Safe Shutdown Analysis, Revision 0

C-1302-911-E120-029, Fire Area/Zone OB-FZ-8AB-Fire Safe Shutdown Analysis, Revision 0

TDR 350, Selection of Controls and Instrumentation for Remote Shutdown System, Revision 4

TDR 612, Reactor Water Inventory Study for Appendix R Evaluation, Revision 0

TDR N. 630, OC Interrupting Device Coordination Study, Revision 1

TDR 864, Water Impingement from Water Fire Suppression Systems at Oyster Creek, Revision 0

Combustible Load Report, Fire Zone OB-FZ-8AB, dated 3/22/17

EC-EVAL 339805, Fire Door Acceptance Criteria

FPE-OC-000814-005, Fire Door Evaluation, Revision 0

Oyster Creek Individual Plant Evaluation, Section 4, Fire Analysis, dated 11/22/1995

OC-PRA-21.06, Oyster Creek Nuclear Generating Station, Fire Probabilistic Risk Assessment Summary and Quantification Notebook, Revision 0

6231-PGD-2685, Startup, Operation and Shutdown of Godwin Portable Pump, Revision 3  
 C-1302-811-E310-043, OCGS Fire Protection Hydraulic Model Margin Analysis, Revision 1  
 C-1302-810-5360-003, Diesel Fire Pump Run Time, Revision 0  
 BM TE-01, Technical Evaluation of Mecatiss MPF-60 Fire Barriers, dated 8/5/98  
 C312254, Thermo-Lag Raceway Cable Upgrade Mods, dated 6/20/00  
 C312256, Thermo-Lag Raceway Cable Upgrade Mods, dated 4/27/00  
 C312266, Thermo-Lag Raceway Cable Upgrade Mods, dated 6/6/00  
 4160 CO2 Test System, dated 4/14/80  
 ETR-P1787-001, Appendix R Evaluation of Electrical Protective Device Coordination, Revision 0  
 01575737-05, DC Ammeter Evaluation, Revision 1  
 1059021-2, Multiple Spurious Operation Scenarios 5k and 10b Evaluation, Revision 1

#### Drawings and Wiring Diagrams

BR 3000, Electrical Power System Key One Line Diagram, Revision 14  
 BR 3001, Sht. 1, Plant Elect. Generation Main One Line Diagram, Aux., Startup & Main XFMR, SBO XFMR and Main Generator, Rev 17  
 BR 3001, Sht. 2, Emergency Power System, Emergency Diesel Generators, Revision 4  
 BR 3001A, 4160V System, 4160V SWGR Bus 1A, Revision 11  
 BR 3001B, 4160V System, 4160V SWGR Bus 1B & Dilution Plant, Revision 17  
 BR 3001C, 4160V System, 4160V SWGR Bus 1C & 1D, Revision 1  
 BR 3002, Sht. 1, 480V System, 460V Unit Substation 1A3 & 1B3, Revision 10  
 BR 3002, Sht. 2, 480V System, 460V Unit Substation 1A2 & 1B2, Revision 13  
 BR 3004, Sht. 1, Reactor Building 460V MCC, 1A21 & 1A21A, Revision 22  
 BR 3004, Sht. 3, Reactor Building 460V MCC 1B21 and 1B21A, Revision 22  
 BR 3005, Misc. Building 460V MCC, 1B2A & 1B32, Revision 9  
 BR 3013, AC Vital Power System, Vital MCC 1AB2, 1A2 & 1B2, Revision 19  
 BR 3028, 125V DC Distr. Center A & B, MCC DC-1, Revision 22  
 DJP 3E-787-18-1001, Radio Communications Sys. Electrical Connection Diagram, Channels 1, 3, and 5 Repeaters, Revision 1  
 DJP FBS RB-FZ-1D-01, Fire Barriers Mecatiss, Revision 0  
 DJP FBS RB-FZ-1D-02, Fire Barriers Mecatiss, Revision 0  
 DJP FBS RB-FZ-1D-03, Fire Barriers Mecatiss, Revision 1  
 E1107, Remote Shutdown Panel Transfer Scheme, Revision 4  
 E1137, Local Shutdown Panel LSP-1A2 Transfer Scheme, Revision 4  
 E1138, Local Shutdown Panel LSP-1A2 Transfer Scheme, Revision 3  
 E1311, Appendix "R" Raceway 480V SWGR RMS Enlarged Plan, Revision 6  
 GE103D4627, AKD-5 Powermaster Switchgear, Revision 20  
 GE116B8328, Sht. 13, Reactor Bldg. Closed Cooling Water Pump 1-1, P-5-001, Revision 20  
 GE148F912, Process Instrumentation, Emergency Condenser Level-Pressure, Revision 25  
 GE157B6350, Sht. 148, Containment Spray Sys. MCC 1B21B Unit B04, CNTMT Spray Valve V-21-0005, Revision 4  
 GE157B6350, Sht. 158A, Core Spray Sys. MCC 1A21 Unit C02 Core Spray Pump Suction Valve V-20-0003, Revision 2  
 GE157B6350, Sht. 158B, Core Spray Sys. MCC 1A21A Unit C03 Core Spray Pump Suction Valve V-20-0033, Revision 2  
 GE157B6350, Sht. 159A, Core Spray Sys. MCC 1B21A Unit C02 Core Spray Pump Suction Valve V-20-0004, Revision 2  
 GE157B6350, Sht. 159B, Core Spray Sys. MCC 1B21A Unit D03 Core Spray Pump Suction Valve V-20-0032, Revision 2  
 GE157B6350, Sht. 165, Containment Spray System, MCC 1B21B Unit B02, CNTMT Spray Pump Suction Valve V-21-0001, Revision 13



GE157B6350, Sht. 165, Containment Spray System, MCC 1B21B Unit B03, CNTMT  
Spray Pump Suction Valve V-21-0003, Revision 14  
GE157B6350, Sht. 209, Core Spray System MCC 1A21 Unit C02 Core Spray Parallel  
ISOL-V-20-0021, Revision 21  
GE157B6350, Sht. 210, Core Spray System MCC 1A21 Unit C02 Core Spray Parallel  
ISOL V-20-0041, Revision 20  
GE157B6397, Sht. 5, RX Shutdown Cooling Valve V-17-0056, Revision 6  
GE157B6397, Sht. 11, RX Shutdown Cooling Valve, V-17-0002, Revision 10  
GE223R0173, 4160V System, 4160V SWGR 1D Unit D5-460V USS 1B2, Revision 9  
SK13432.42-APPR, Tray Identification Appendix "R" Report 1<sup>st</sup> & 2<sup>nd</sup> FLR Office Building,  
Revision 3  
148F912, Process Instrumentation, Revision 9  
3104, Turbine Building Conduit & Tray Plan, Basement, Revision 22  
3105, Turbine Building Conduit & Tray Plan, Basement, Revision 18  
3106, Turbine Building Conduit & Tray Plan, Basement, Revision 13  
3113, Turbine Building Conduit & Tray – Sections & Details, Revision 6  
3159, Turbine Building Conduit & Tray Plan, 1<sup>st</sup> Floor, Revision 25  
7023-56767, Remote Shutdown Panel Wiring & Connection Diagram, Revision 14

#### Engineering Change Requests (ECR)

ECR OC 11-00368, Core Spray System Valves MSO Modification, Revision 5  
ECR OC 11-00370, Containment Spray System MSO Modifications, Revision 3  
ECR OC 12-00298, MSOPS-MSO Shutdown Cooling Modification, Revision 0  
ECR OC 14-00417, DC Ammeter Fuse Modification, Revision 2

#### Piping and Instrumentation Diagrams

BR 2013, Instrument (Control) Air System, Revision 89  
BR 2010, Control and Cable Spreading Rooms HVAC, Revision 32  
BR 2004, Sht. 2, Condensate Transfer System, Flow Diagram, Revision 102  
BR 2005, Emergency Service Water System, Revision 88  
GE148F262, Emergency Condenser, Rev 55  
GE148F711, Shutdown Cooling System, Revision 45  
GE148F740, Containment Spray System, Revision 44  
885D781, Core Spray System, Revision 76

#### Large Fires and Explosions Mitigation Strategies Documents

EDMG-SPX6, Reactor Pressure Vessel Injection via Feedwater System Using the  
Portable Pump, Revision 4  
EDMG-SPX10, Containment Injection Using the Portable Pump, Revision 4

#### Fire Protection Evaluations of Modifications and Design Changes

ECR 01-00682, Evaluate Penetration Seal 128 & 129, dated 9/19/01  
ECR 01-01152, Perform Evaluation of Penetration Seal 199, dated 12/13/01  
ECR 15-00357, Installation of N2 Bottle for RB 75' Chemistry Sample Sink, dated 9/28/15  
ECR 16-00046, Simplex Fire Panel Modification, dated 1/25/16  
ECR 16-00152, Penetration Seal Evaluation for Fukushima Flex Modification, dated 4/26/16  
ECR 01-01153, Perform Evaluation of Penetration Seals 625 and 626, dated 12/13/01  
ECR 01-01154, Perform Evaluation of Penetration Seals 675 and 676, dated 12/13/01  
ECR 11-00153, Revise Quality Classification of Fire Dampers DM-559-16/17, dated 4/21/11

Operating Experience (OPEX) Evaluations

- OPEX Review of NRC Information Notice (IN) 2013-09, Compressed Flammable Gas Cylinders and Associated Hazards
- OPEX Review of NRC IN 2013-06, Corrosion in Fire Protection Piping Due to Air and Water Interaction
- OPEX Evaluation, NRC IN 2014-10, Potential Circuit Failure-Induced Secondary Fires or Equipment Damage (IR 2386737)
- OPEX Evaluation, NRC IN 2015-02, Anti-Freeze Agents in Fire Water Sprinkler Systems (IR 2451647)
- OPEX Evaluation, NRC IN 2014-15, Inadequate Controls of Respiratory Protection Accessibility, Training, and Maintenance (IR 2421301)
- OPEX Evaluation, NRC IN 2013-02, Issues Potentially Affecting Nuclear Facility Fire Safety (IR 1492237)

Quality Assurance Audits and Self Assessments

- Oyster Creek Triennial Fire Protection Inspection Preparatory Self-Assessment (IR 2615640), dated 11/18/16
- NOSA-OYS-16-06, Fire Protection Audit Report (IR 2699561), dated 11/9/16

System Health Reports

- Oyster Creek Fire Protection/Fire Safe Shutdown Program, 2nd Quarter 2016
- Oyster Creek Fire Protection/Fire Safe Shutdown Program, 3rd Quarter 2016
- Electrical System Health Reports Summary, 3/17/17

Procedures

- ABN-29, Plant Fires, Revision 31
- ABN-30, Control Room Evacuation, Revision 29
- CC-AA-211, Fire Protection Program, Revision 8
- FSP-OB8A, Support Procedure OB8A, Fire Support Procedure for Recirculation MG Set Room, Revision 6
- FSP-OB8B, Support Procedure OB8B, Fire Support Procedure for Mechanical Equipment Room, Revision 4
- FSP-RB1D, Support Procedure RB1D, Fire Support Procedure for Reactor Building 51' Elevation, Revision 7
- FSP-TB3A, Support Procedure TB3A, Fire Support Procedure for Turbine Building, 4160V Switchgear Room 1C, Revision 4
- OP-AA-201-008, Pre-Fire Plan Manual, Revision 3
- OP-OC-201-008, Oyster Creek Pre-Fire Plans, Revision 23
- OP-OC-201-008-1004, Pre-Fire Plan RB-FZ-1D, Reactor Building (51' Elevation), Revision 2
- OP-OC-201-008-1014, Pre-Fire Plan OB-FZ-8A, 8B, MG Set Room/Mechanical Equipment Room, Revision 0
- OP-OC-201-008-1020, Pre-Fire Plan OB-FZ-4, Cable Spreading Room, Revision 1
- OP-OC-201-008-1025, Pre-Fire Plan TB-FA-3A, TB-FA-3B, 4160V "C" and "D" Vaults, Revision 1
- OP-AA-102-106, Operator Response Time Program, Revision 4
- OP-OC-102-106, Operator Response Time Program at Oyster Creek, Revision 1
- Procedure 101.2, Oyster Creek Site Fire Protection Program, Revision 73
- Procedure 101.2-3, Oyster Creek Site Fire Protection Program, Technical Requirements, Revision 73
- SA-AA-122, Handling and Storage of Compressed Gas Cylinder/Portable Tanks and Cryogenic Container/Dewars, Revision 13

Procedure 305, Shutdown Cooling System Operation, Revision 123  
Procedure 307, Isolation Condenser System, Revision 126  
Procedure 331, Office Building Heating, Ventilation, and Air Condition System, Revision 72  
Procedure 333, Plant Fire Protection System, Revision 124  
Procedure 338, 480 Volt Electrical System, Revision 60  
Procedure 346, Operation of the Remote and Local Shutdown Panels, Revision 23  
2400-APR-3228.02, Appendix R Temporary Torus Temperature Indication, Revision 10  
2400-APR-3531.01, Appendix R Temporary Power for and ESW Pump and Repair of ESW Pump 1-4 Control Cable 63-326, Revision 10  
2400-APR-3730.01, Appendix R De-Termination of 1A2/1B2 Bus Tie Cables and Repair of Breaker 1B2M Control Cable 22-370, Revision 10  
2400-APR-3900.01, Appendix R Repair Kit Annual Inspection, Revision 21  
CC-AA-211, Fire Protection Program, Revision 8  
101.2, Oyster Creek Site Fire Protection Program, Revision 73  
2400-SME-3915.01, Motor Control Center Preventive Maintenance, Revision 21  
2400-SME-3915.03, 4160 Volt Breaker Preventive Maintenance, Revision 13  
2400-SME-3915.05, Low Voltage Power Circuit Breaker Corrective/Preventive Maintenance, Revision 9  
2400-SME-3915.08, Low Voltage Power Circuit Breaker Maintenance for AK50, AKS50, AK75, AKR75 and AK100 Breakers, Revision 24  
2400-SME-3915.15, Low Voltage Power Circuit Breakers Corrective/Preventive Maintenance for AKF-1B-10 Breakers, Revision 5  
MA-AA-725-112, Preventive Maintenance Inspection of GE 480V Types AK-50/75, AKS-50, & AKR-75/100 Circuit Breakers and Cubicles, Revision 13  
MA-AA-725-119, Preventive Maintenance on General Electric Type AKF-25 Circuit Breakers, Revision 6  
CC-AA-206, Fuse Control, Revision 11  
MA-AB-725-118, Preventative Maintenance on General Electric Type AKF-2D Circuit Breakers, Revision 9  
CC-AA-211, Fire Protection Program, Revision 8  
645.6.017, Fire Barrier Penetration Surveillance RB-FZ-1D, Revision 29

#### Operator Safe Shutdown Training

N-OC-2621, ILTQG, Initial License Training Qualification Guide, dated 6/12/14  
N-OC-2621, Course Code 828.0.0064, Alternate Shutdown Facility, dated 1/30/15  
N-OC-2621, Course Code TQOC1051006, Equipment Operator Qualification Guide, dated 8/6/15  
Oyster Creek Job Performance Measures List, dated 3/24/17

#### Fire Fighting Strategies (i.e., Pre-Fire Plans)

OP-OC-201-008-1004, Oyster Creek Generation Station Pre-Fire Plan, (Fire Area/Zone RB-FZ-1D), Revision 2  
OP-OC-201-008-1014, Oyster Creek Generating Station Pre-Fire Plan, (Fire Area/Zone OB-FZ-8A/B), Revision 0  
OP-OC-201-008-1020, Oyster Creek Generation Station Pre-Fire Plan, (Fire Area/Zone OB-FZ-4), Revision 1-3A, TB-FA-3B), Revision 1

#### Fire Brigade Training

FBP01, Introduction/Orientation Fire Brigade Program, Revision 7  
FBP07, Hose Streams/Appliances/Tools, Revision 7

Fire Brigade Drills and Critiques

OP-AA-201-003, Fire Drill in A-B Battery Room, Performed 12/16/15  
 OP-AA-201-003, Fire Drill in Lower Cable Spreading Room, Performed 11/19/15  
 OP-AA-201-003, Fire Drill in Main Office Building, Performed 2/3/17  
 OP-AA-201-003, Fire Drill in Main Control Room, Performed 2/7/17  
 OP-AA-201-003, Fire Drill in 'A' 480V Room, Performed 1/18/17  
 OP-AA-201-003, Fire Drill in South Access Road, Performed 11/20/16

Transient Combustible, Hot Work, and Ignition Source Permits and Evaluations

182, Fire Area TB-FZ-11A, dated 11/22/16  
 183, Fire Area TB-FZ-11F, dated 12/05/16  
 191, Fire Area TB-FZ-11E, dated 1/7/17  
 192, Fire Area OB-FZ-8C, dated 1/9/17  
 194, Fire Area TB-FZ-11D, dated 1/12/17  
 04591790-04, Hot Work Permit for TB 0', Condenser Bay, dated 2/17/17

Completed Tests and Surveillances

609.3.008, Isolation Condenser "B" Shell Water Level Instrument Calibration, Performed 1/3/17  
 R2257697, Flow Test of B.5.B Pump Located in Warehouse, dated 3/31/16  
 645.2.027, Fire Pump Diesel Monthly Battery Surveillance, Performed 2/6/17  
 645.2.027, Fire Pump Diesel Monthly Battery Surveillance, Performed 11/07/16  
 645.2.002, Fire Pump Diesel Weekly Battery Surveillance, Performed 3/13/17  
 645.2.002, Fire Pump Diesel Weekly Battery Surveillance, Performed 3/21/17  
 645.4.012, Fire Pump Functional Test, Performed 9/1/15  
 645.4.012, Fire Pump Functional Test, Performed 12/3/15  
 645.4.012, Fire Pump Functional Test, Performed 12/2/16  
 645.4.001, Fire Pump #1 Operability Test, Performed 2/6/17  
 645.4.001, Fire Pump #1 Operability Test, Performed 3/6/17  
 645.6.010, Fire Suppression Deluge Valve Functional Test, Performed 1/29/15  
 645.6.010, Fire Suppression Deluge Valve Functional Test, Performed 3/25/15  
 645.6.010, Fire Suppression Deluge Valve Functional Test, Performed 2/17/16  
 645.6.010, Fire Suppression Deluge Valve Functional Test, Performed 2/12/16  
 645.6.011, Deluge and Sprinkler System Inspection, Performed 2/6/15  
 645.6.011, Deluge and Sprinkler System Inspection, Performed 4/25/16  
 645.6.015, Low Pressure CO2 System Valve Position Verification, Performed 12/9/16  
 645.6.015, Low Pressure CO2 System Valve Position Verification, Performed 1/15/17  
 645.6.016, Fire Suppression Low Pressure CO2 System Functional Test, Performed 8/5/15  
 645.6.016, Fire Suppression Low Pressure CO2 System Functional Test, Performed 11/08/16  
 645.6.023, Fire Suppression Water System Underground Flow Test, Performed 4/14/10  
 645.6.023, Fire Suppression Water System Underground Flow Test, Performed 8/30/13  
 645.6.007, Fire Protection System Flush, Performed 4/28/15  
 645.6.007, Fire Protection System Flush, Performed 7/21/16  
 645.6.017, Fire Barrier Penetration Surveillance, Performed 10/26/15  
 645.6.017, Fire Barrier Penetration Surveillance, Performed 4/9/14  
 645.6.017, Fire Barrier Penetration Surveillance, Performed 5/16/14  
 645.6.017, Fire Barrier Penetration Surveillance, Performed 5/20/16  
 645.6.017, Fire Barrier Penetration Surveillance, Performed 9/23/16  
 645.6.017, Fire Barrier Penetration Surveillance, Performed 09/25/16  
 645.6.026, Fire Damper Inspection, Performed 3/22/13  
 645.6.026, Fire Damper Inspection, Performed 10/13/13  
 645.6.026, Fire Damper Inspection, Performed 8/4/15  
 645.6.026, Fire Damper Inspection, Performed 12/22/15

- 645.6.028, Thermo-Lag and Mecatiss Envelope System Fire Barriers, Performed 12/2/14
- 645.6.028, Thermo-Lag and Mecatiss Envelope System Fire Barriers, Performed 9/8/16
- 645.6.031, Fire Detection System Alarm Circuitry Test for Reactor Building 51' & 95' Elevation, Performed 3/28/15
- 645.6.031, Fire Detection System Alarm Circuitry Test for Reactor Building 51' & 95' Elevation, Performed 6/24/16
- 645.6.032, Fire Detection System Alarm Circuitry Test for Turbine Building & 4160V Switchgear Room, Performed 11/13/15
- 645.6.032, Fire Detection System Alarm Circuitry Test for Turbine Building & 4160V Switchgear Room, Performed 1/25/17
- 645.6.034, Fire Detection System Alarm Circuitry Test for 480V Switchgear Rooms, A/B Battery Rooms, & MG Set Room, Performed 6/2/15
- 645.6.034, Fire Detection System Alarm Circuitry Test for 480V Switchgear Rooms, A/B Battery Rooms, & MG Set Room, Performed 8/18/16
- 645.6.133, Fire Detection System Alarm Circuitry Test for Lower Cable Spreading Rooms, Performed 10/1/15
- 645.6.133, Fire Detection System Alarm Circuitry Test for Lower Cable Spreading Rooms, Performed 11/22/16
- 658.4.002, Fire Brigade and Safe Shutdown Radio Test, Performed 2/11/17
- 680.4.002, Local Shutdown Panel LSP-1AB2, Functional Test, Performed 10/4/16
- 680.4.003, Local Shutdown Panel LSP-1B3 Functional Test, Performed 9/20/14 and 11/2/16
- 680.4.004, Local Shutdown Panel LSP-1A2 Functional Test, Performed 9/27/16
- 680.4.006, Remote Shutdown Panel Functional Test-TRAIN B, Performed 10/1/14 and 5/31/16
- 680.4.009, Remote Shutdown Panel Functional Test for Control Power Transfer and Isolation Condenser Valves, Performed 9/22/15
- 680.4.010, Local Shutdown Panel LSP-1B32 Function Test, Performed, 3/12/15

Issue Reports (IR) [ADD \* when IR was written as a result of the NRC inspection]

3987792*	1645668	2531688	2736153
3988174*	1645125	2539417	2739218
3987846*	1646085	2547023	2740398
3988174*	1650161	2548558	2741514
3988681*	1654568	2552592	2742628
3988703*	1656576	2560901	2741247
3989007*	1660733	2561495	2741778
3993735*	1669686	2561498	2742642
3993934*	1674403	2561627	2742651
3995200*	1675957	2566343	3963054
524521	1685155	2589492	3967259
1054105	1691093	2589424	3981920
1275720	1698036	2589893	
1521603	1698110	2591244	
1638171	2384036	2597474	
1638631	2386737	2599026	
1638726	2387644	2611939	
1639317	2394239	2633423	
1638726	2407781	2638713	
1639330	2417768	2645005	
1639352	2427835	2647080	
1642061	2447594	2647735	
1645106	2448012	2669309	
1645125	2459147	2676669	
1645241	246127	2704528	
1645441	2469435	2705488	
1645668	2478373	2712574	
1645693	2528690	2722103	
1646051	2531077	2730051	

Work Orders

R2250555	R2247175	R0806268	R2060977
R2266919	R2061329	R2132486	R2132589
R2250551	R2171730	R2277834	R2256175
R2271311	M2386540	1304961	1304962
4587706	4594884	4594884	4596692
4602219	4387611	4187700	4588244
C2034336			

Vendor Manuals

VM-OC-5937, Solfrunt Gauges Installation and Overhaul Instruction Manual, Revision 1  
VM-OC-2785, Big Beam Emergency Lighting Equipment, Revision 2

Industry Standards

NFPA 12, Standard on Carbon Dioxide Extinguishing Systems, 1985 Edition  
EPRI-TR-106826 Battery Performance Monitoring by Internal Ohmic Measurements -  
Emergency Lighting Unit Batteries, 12/96  
EPRI-TR-100249 Emergency Battery Lighting Unit Maintenance and Application Guide, 6/97

Miscellaneous Documents

Regulatory Guide 1.189, Fire Protection for Nuclear Power Plants, Revision 2, 10/09

**LIST OF ACRONYMS**

CFR	<i>Code of Federal Regulations</i>
CO2	Carbon Dioxide
ELU	Emergency Lighting Unit
Exelon	Exelon Generation Company, LLC
FA	Fire Area
FHA	Fire Hazards Analysis
FPP	Fire Protection Program
FZ	Fire Zone
IN	Information Notice
IPEEE	Individual Plant Examination of External Events
IR	Issue Report
NFPA	National Fire Protection Association
NRC	U.S. Nuclear Regulatory commission
OPEX	Operating Experience
Oyster Creek	Oyster Creek Nuclear Generating Station
P&ID	Piping and Instrumentation Drawing
SER	NRC Safety Evaluation Report
USS	Unit Substation
UFSAR	Updated Final Safety Analysis Report