June 24, 2005

Mr. Christopher M. Crane
President and Chief Nuclear Officer
Exelon Nuclear
Exelon Generation Company, LLC
200 Exelon Way, KSA 3-E
Kennett Square, PA 19348

SUBJECT: PEACH BOTTOM ATOMIC POWER STATION, UNITS 2 AND 3 - ISSUANCE OF AMENDMENT RE: FIRE PROTECTION PROGRAM CHANGES (TAC NOS. MC0987 AND MC0988)

Dear Mr. Crane:

The Commission has issued the enclosed Amendments Nos. 255 and 258 to Renewed Facility Operating License Nos. DPR-44 and DPR-56 for Peach Bottom Atomic Power Station, Units 2 and 3. These amendments approve modifications to the fire protection program in response to your application dated September 26, 2003, as supplemented on December 8, 2004.

The modifications involve converting the existing automatic carbon dioxide fire suppression systems installed in each of the four emergency diesel generator rooms and the cable spreading room to manual actuation.

A copy of the safety evaluation is also enclosed. Notice of Issuance will be included in the Commission's Biweekly *Federal Register* Notice.

Sincerely,

***/RA/***

George F. Wunder, Project Manager, Section 2
Project Directorate I
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Docket Nos. 50-277 and 50-278

Enclosures: 1. Amendment No. 255 to Renewed DPR-44
2. Amendment No. 258 to Renewed DPR-56
3. Safety Evaluation

cc w/encls: See next page

June 24, 2005

Mr. Christopher M. Crane
President and Chief Nuclear Officer
Exelon Nuclear
Exelon Generation Company, LLC
200 Exelon Way, KSA 3-E
Kennett Square, PA 19348

SUBJECT: PEACH BOTTOM ATOMIC POWER STATION, UNITS 2 AND 3 - ISSUANCE OF AMENDMENT RE: FIRE PROTECTION PROGRAM CHANGES (TAC NOS. MC0987 AND MC0988)

Dear Mr. Crane:

The Commission has issued the enclosed Amendments Nos. 255 and 258 to Renewed Facility Operating License Nos. DPR-44 and DPR-56 for Peach Bottom Atomic Power Station, Units 2 and 3. These amendments approve modifications to the fire protection program in response to your application dated September 26, 2003, as supplemented on December 8, 2004.

The modifications involve converting the existing automatic carbon dioxide fire suppression systems installed in each of the four emergency diesel generator rooms and the cable spreading room to manual actuation.

A copy of the safety evaluation is also enclosed. Notice of Issuance will be included in the Commission's Biweekly *Federal Register* Notice.

Sincerely,

***/RA/***

George F. Wunder, Project Manager, Section 2
Project Directorate I
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Docket Nos. 50-277 and 50-278

Enclosures: 1. Amendment No. 255 to Renewed DPR-44
2. Amendment No. 258 to Renewed DPR-56
3. Safety Evaluation

cc w/encls: See next page

DISTRIBUTION:

| | | | | |
|---|---|---|---|---|
| PUBLIC | PDI-2 R/F | DRoberts | GWunder | MO'Brien (3) |
| OGC | ACRS | GHill (4) | TBoyce | NIqbal |
| SWeerakkody | DLPM DPR | MShanbaky, RI | | |

ADAMS ACCESSION NUMBER: ML051050172 *SE input provided, no major changes made.

| OFFICE | PM/PD1-2 | LA/PD1-2 | SPLB/SC | OGC | SC/PD1-2 |
|---|---|---|---|---|---|
| NAME | GWunder | MO'Brien | SWeerakkody* | KKannler | DRoberts |
| DATE | 6/02/05 | 6/02/05 | 02/28/05 | 6/13/05 | 6/23/05 |

OFFICIAL RECORD COPY

Peach Bottom Atomic Power Station, Unit Nos. 2 and 3

cc:

Site Vice President
Peach Bottom Atomic Power Station
Exelon Generation Company, LLC
1848 Lay Road
Delta, PA 17314

Associate General Counsel
Exelon Generation Company, LLC
4300 Winfield Road
Warrenville, IL 60555

Plant Manager
Peach Bottom Atomic Power Station
Exelon Generation Company, LLC
1848 Lay Road
Delta, PA 17314

Regulatory Assurance Manager
Peach Bottom Atomic Power Station
Exelon Generation Company, LLC
1848 Lay Road
Delta, PA 17314

Resident Inspector
U.S. Nuclear Regulatory Commission
Peach Bottom Atomic Power Station
P.O. Box 399
Delta, PA 17314

Regional Administrator, Region I
U.S. Nuclear Regulatory Commission
475 Allendale Road
King of Prussia, PA 19406

Mr. Roland Fletcher
Department of Environment
Radiological Health Program
2400 Broening Highway
Baltimore, MD 21224

Correspondence Control Desk
Exelon Generation Company, LLC
P. O. Box 160
Kennett Square, PA 19348

Rich Janati, Chief
Division of Nuclear Safety
Bureau of Radiation Protection
Department of Environmental Protection
Rachel Carson State Office Building
P.O. Box 8469
Harrisburg, PA 17105-8469

Board of Supervisors
Peach Bottom Township
545 Broad Street Ext.
Delta, PA 17314-9203

Mr. Richard McLean
Power Plant and Environmental
Review Division
Department of Natural Resources
B-3, Tawes State Office Building
Annapolis, MD 21401

Dr. Judith Johnsrud
National Energy Committee
Sierra Club
433 Orlando Avenue
State College, PA 16803

Manager-Financial Control & Co-Owner
Affairs
Public Service Electric and Gas Company
P.O. Box 236
Hancocks Bridge, NJ 08038-0236

Manager Licensing-Peach Bottom
Atomic Power Station
Exelon Generation Company, LLC
200 Exelon Way, KSA -3E
Kennett Square, PA 19348

Peach Bottom Atomic Power Station, Unit Nos. 2 and 3

cc:

Vice President - Licensing and Regulatory
Affairs
Exelon Generation Company, LLC
4300 Winfield Road
Warrenville, IL 60555

Vice President-Operations Mid-Atlantic
Exelon Generation Company, LLC
200 Exelon Way, KSA 3-N
Kennett Square, PA 19348

Senior Vice President, Nuclear Services
Exelon Generation Company, LLC
4300 Winfield Road
Warrenville, IL 60555

Director-Licensing and Regulatory Affairs
Exelon Generation Company, LLC
200 Exelon Way, KSA 3-E
Kennett Square, PA 19348

EXELON GENERATION COMPANY, LLC

PSEG NUCLEAR LLC

DOCKET NO. 50-277

PEACH BOTTOM ATOMIC POWER STATION, UNIT 2

AMENDMENT TO RENEWED FACILITY OPERATING LICENSE

Amendment No. 255
Renewed License No. DPR-44

1. The Nuclear Regulatory Commission (the Commission) has found that:

   A. The application for amendment by Exelon Generation Company, LLC (Exelon Generation Company), and PSEG Nuclear LLC (the licensees), dated September 26, 2003, as supplemented on December 8, 2004, complies with the standards and requirements of the Atomic Energy Act of 1954, as amended (the Act), and the Commission's rules and regulations set forth in 10 CFR Chapter I;

   B. The facility will operate in conformity with the application, the provisions of the Act, and the rules and regulations of the Commission;

   C. There is reasonable assurance (i) that the activities authorized by this amendment can be conducted without endangering the health and safety of the public, and (ii) that such activities will be conducted in compliance with the Commission's regulations;

   D. The issuance of this amendment will not be inimical to the common defense and security or to the health and safety of the public; and

   E. The issuance of this amendment is in accordance with 10 CFR Part 51 of the Commission's regulations and all applicable requirements have been satisfied.

2. Accordingly, the requested changes to the fire protection program, as described in the attached Safety Evaluation dated June 24, 2005, are approved.

3. This license amendment is effective as of its date of issuance and shall be implemented following completion of the fire protection system modifications.

FOR THE NUCLEAR REGULATORY COMMISSION

***/RA/***

Darrell J. Roberts, Chief, Section 2
Project Directorate I
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Date of Issuance: June 24, 2005

EXELON GENERATION COMPANY, LLC

PSEG NUCLEAR LLC

DOCKET NO. 50-278

PEACH BOTTOM ATOMIC POWER STATION, UNIT 3

AMENDMENT TO RENEWED FACILITY OPERATING LICENSE

Amendment No. 258
Renewed License No. DPR-56

1. The Nuclear Regulatory Commission (the Commission) has found that:

   A. The application for amendment by Exelon Generation Company, LLC (Exelon Generation Company), and PSEG Nuclear LLC (the licensees), dated September 26, 2003, as supplemented on December 8, 2004, complies with the standards and requirements of the Atomic Energy Act of 1954, as amended (the Act), and the Commission's rules and regulations set forth in 10 CFR Chapter I;

   B. The facility will operate in conformity with the application, the provisions of the Act, and the rules and regulations of the Commission;

   C. There is reasonable assurance (i) that the activities authorized by this amendment can be conducted without endangering the health and safety of the public, and (ii) that such activities will be conducted in compliance with the Commission's regulations;

   D. The issuance of this amendment will not be inimical to the common defense and security or to the health and safety of the public; and

   E. The issuance of this amendment is in accordance with 10 CFR Part 51 of the Commission's regulations and all applicable requirements have been satisfied.

2. Accordingly, the requested changes to the fire protection program, as described in the attached Safety Evaluation dated June 24, 2005, are approved.

3. This license amendment is effective as of its date of issuance and shall be implemented following completion of the fire protection system modifications.

FOR THE NUCLEAR REGULATORY COMMISSION

***/RA/***

Darrell J. Roberts, Chief, Section 2
Project Directorate I
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Date of Issuance: June 24, 2004

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO AMENDMENT NO. 255 TO RENEWED FACILITY OPERATING

LICENSE NO. DPR-44 AND AMENDMENT NO. 258 TO RENEWED FACILITY OPERATING

LICENSE NO. DPR-56

EXELON GENERATION COMPANY, LLC

PSEG NUCLEAR LLC

PEACH BOTTOM ATOMIC POWER STATION, UNITS 2 AND 3

DOCKET NOS. 50-277 AND 50-278

## 1.0 INTRODUCTION

By application dated September 26, 2003, as supplemented by letter dated December 8, 2004, Exelon Generation Company, LLC (Exelon, the licensee), requested amendments to approve modifications to the fire protection program (FPP) for Peach Bottom Atomic Power Station, Units 2 and 3 (PBAPS 2 and 3). The supplement dated December 8, 2004, provided additional information that clarified the application, did not expand the scope of the application as originally noticed, and did not change the staff's original proposed no significant hazards consideration determination as published in the *Federal Register* on December 9, 2003, (68 FR 68669). The change involves converting the existing automatic carbon dioxide ($CO_2$) fire suppression systems installed in the cable spreading room (CSR) and each of the four emergency diesel generator (EDG) rooms to manual actuation.

## 2.0 BACKGROUND

The CSR $CO_2$ system was originally a manually actuated system. The $CO_2$ fire suppression system in the EDG rooms were originally automatic. The CSR $CO_2$ fire suppression system was modified to an automatically actuated system as a part of the post-Browns Ferry fire protection guidelines contained in the Branch Technical Position, Auxiliary and Power Conversion Systems Branch 9.1-5, Appendix A. The CSR does not have a back-up water spray system, but hose stations are installed directly outside the CSR to provide coverage to the CSR.

Both the EDG and CSR $CO_2$ fire suppression systems were designed and installed in accordance with the National Fire Protection Association (NFPA) 12, "Standard on Carbon Dioxide Extinguishing Systems," 1968 edition (code of record (COR)). The design concentration for the EDG rooms is 50%, which is above the recommended 34% of the COR; the CSR used a design concentration of 50%, which matches the recommended 50% concentration in the COR. The NFPA 12, 1968 edition did not specify a minimum length of time

(soak time) for the above concentration levels; however, during the initial full discharge testing performed in 1971, $CO_2$ concentration levels were recorded with soak time. For the E-1 EDG, 46% concentration was achieved in 5 minutes; E-2 EDG, 50% concentration was achieved in 5 minutes; E-3 EDG, 46% concentration was achieved in 5 minutes; and, the E-4 EDG 50% concentration was achieved in 5 minutes. For the CSR, 58% concentration was achieved in 5 minutes. Both the EDG and CSR $CO_2$ fire suppression systems have adequate quantities of $CO_2$ within their respective tanks to permit a second shot of $CO_2$ following the initial discharge.

In their September 26, 2003, license amendment request (LAR), Exelon indicated that there are personnel safety and plant safety risks associated with the automatic actuation capability of $CO_2$ fire suppression systems installed in the CSR and EDG rooms (i.e., inadvertent discharge of the system). In June 2002, the $CO_2$ fire suppression system installed in the EDG E-2 room was inadvertently discharged while the EDG was running and two people were in the room. The cause of the inadvertent actuation was a small light bulb that dropped onto a printed circuit card resulting in a short circuit. The EDG automatically tripped in accordance with the $CO_2$ system discharge logic. Following this event, each of the $CO_2$ fire suppression systems was blocked at the main isolation valve and the systems were declared inoperable and appropriate compensatory measures were implemented per the PBAPS 2 and 3, "Technical Requirements Manual."

As described in Information Notice 99-05, "Inadvertent Discharge of Carbon Dioxide Fire Protection System and Gas Migration," nuclear power plant (NPP) experience has shown that electrical disabling of the $CO_2$ system can still leave the system vulnerable to inadvertent actuation. In addition to the personnel safety concerns associated with the $CO_2$ fire suppression system, there are also potential equipment failure concerns associated with the $CO_2$ system inadvertent discharge. For example, the extreme temperature drop associated with a $CO_2$ discharge in a non-fire accident condition can result in condensation which could cause short circuits in electrical equipment.

The licensee identified the EDG building automatic $CO_2$ fire suppression system as safety-related due to a potential common mode effect on all EDGs in the event of a seismic event. Eliminating the automatic actuation function of the EDG $CO_2$ fire suppression systems will thereby eliminate a potential common mode effect on the EDGs. Based on the risk-insights gained from the plant probabilistic risk assessment (PRA), reduction in the common mode failure of the EDGs provides significant safety gains. The actions necessary to discharge the $CO_2$ system manually can be accomplished without entry into the affected EDG room. The fire safe shutdown analysis for each of the EDG rooms addressed by the proposed change demonstrates that safe shutdown can be accomplished assuming that no fire suppression is available. In addition, the removal of the automatic discharge capability of the $CO_2$ fire suppression system in each of the EDG rooms significantly reduces the probability that an inadvertent discharge would shut down the EDG in a non-fire accident condition. As part of the conversion of the $CO_2$ fire suppression system from automatic to manual, Exelon committed to include existing 3-hour rated fire barriers around each EDG fuel oil day tank room in the fire barrier surveillance program.

Exelon's request to change the automatic $CO_2$ fire suppression system installed in the CSR to a manually operated system is being made both to enhance personnel safety and to prevent a malfunctioning detector from actuating the system. The threat of the $CO_2$ discharge hinders prompt action by the plant fire brigade, such as the immediate use of a portable fire

extinguisher. A small fire can result in an unnecessary $CO_2$ discharge. At PBAPS 2 and 3, a $CO_2$ discharge invokes procedural requirements to immediately shut down both units. Currently the $CO_2$ fire suppression system is locked out and can be manually initiated at the master control valve at the $CO_2$ storage tanks in the turbine building at Elevation 116', and in the CSR at the valve station at Elevation 150'.

The CSR contains two redundant trains of 1-hour fire rated Thermo-Lag electrical raceway fire barrier (ERFB) to satisfy Appendix R requirements. One section of the ERFB is located on the Unit 2 side and the other is on the Unit 3 side. In the LAR, Exelon states that as part of the conversion of the $CO_2$ fire suppression system from automatic to manual actuation, ERFB for Appendix R cables in the CSR will be upgraded from 1-hour to 3-hour rated barriers.

Exelon's proposed modification to convert the existing $CO_2$ fire suppression system actuation from automatic to manual in each EDG room and the CSR closely conforms with the "normal manual operation" systems described in NFPA 12, 2000 edition. A manual action will be required to open a valve to initiate $CO_2$ flow. This valve is similar to an electro-mechanical pilot control (EMPC) valve. The manual valve and control panel will be installed outside of the room being protected and will be easily accessible. The proposed manual system at PBAPS 2 and 3 will require a mechanical EMPC valve operation in order to initiate a discharge and will, therefore, eliminate the potential for an automatic or manual logic circuit failure to cause an inadvertent system discharge. Since electrically disabling the system can still leave the $CO_2$ system vulnerable to inadvertent actuation, mechanical blocking has been chosen as an integral aspect of the proposed manual system design. The Exelon configuration control process and subsequent periodic testing required by the Technical Requirements Manual will ensure continued reliability of the proposed manual system.

The PBAPS 2 and 3 fire brigade consists of full time dedicated fire-fighting personnel with a minimum of five trained people on site at all times. All fire-brigade personnel are knowledgeable in the PBAPS 2 and 3 safety-related systems. This allows them to understand the effects of fire and fire suppression on safe shutdown capability. At PBAPS 2 and 3, the staffing to fight a fire and shut down the plant is available regardless of whether the $CO_2$ system is in automatic or manual. EDG rooms and CSR areas are both easily accessed by the fire brigade.

## 3.0 REGULATORY EVALUATION

One of the principle objectives of the commercial NPP FPP is to ensure that the risk of fire-induced radiological hazards to the public, environment and plant personnel is minimized. To meet this objective, Title 10 of the *Code of Federal Regulations* (10 CFR), Part 50, Section 50.48, "Fire protection," requires each operating NPP to have the means to limit fire damage to structures, systems, or components (SSCs) important to safety so that the capability to shut down the plant safely is ensured. The objective of safe shutdown of the plant is to assure that at least one means of achieving and maintaining safe shutdown capability is available during and after any postulated fire.

Section CFR 50.48(a) requires that each operating NPP has a fire protection plan which satisfies Criterion 3 of Appendix A to Part 50, General Design Criterion (GDC 3). Specific fire protection features deemed necessary to ensure this capability are delineated in Appendix R to

10 CFR Part 50. For areas of the NPP where fire protection features cannot ensure safe-shutdown capability, Section II.D of Appendix R to 10 CFR Part 50 requires that an alternative shutdown capability be provided. Specific design criteria and performance goals of the alternative shutdown capability are contained in Section III.G.3 and III.L of Appendix R.

GDC 3 to Appendix A to 10 CFR Part 50, "Fire protection," requires that SSCs important to safety be designed and located to minimize the probability and effect of fire and explosions. It further requires that the fire-fighting systems shall be designed to assure that their rupture or inadvertent operation does not significantly impair the capability of these SSCs.

The licensees may make changes to their approved FPP without prior staff approval only if those changes would not adversely affect the ability to achieve and maintain safe shutdown in the event of a fire. This is based on the licensee having the standard fire protection license condition that was published in Generic Letter 86-10, "Implementation of Fire Protection Requirements." All changes to the FPP must ensure that compliance is maintained with the requirements of 10 CFR 50.48(a).

## 4.0 TECHNICAL EVALUATION

The PBAPS 2 and 3 approved FPP is common to both units. A low pressure total flooding automatic $CO_2$ fire suppression system is installed in both the PBAPS 2 and 3 EDG rooms and in the CSR. Full discharge tests for the $CO_2$ fire suppression system in the EDG rooms and the CSR were performed as part of initial fire protection equipment acceptance testing in November/December 1971, in accordance with the COR. At PBAPS 2 and 3, the EDG building is separate from the main plant structure, and the CSR is part of the same fire area as the main control room (MCR). A fire in the CSR, therefore, is considered to impact the MCR. As part of the 10 CFR Part 50, Appendix R compliance, a fire in the CSR (which is common to both units) requires a shutdown from outside the MCR at the alternate shutdown panel. The Unit 2 alternate shutdown panel is located in the Unit 2 motor generator (MG) set room (located on Elevation 123' in the radwaste building). The Unit 3 alternate shutdown panel is located in the Unit 3 MG set room (located on Elevation 135' in the radwaste building).

In order to evaluate the ability of the manually actuated EDG rooms and CSR $CO_2$ fire suppression system to provide an equivalent level of fire protection to that required by Section III.G.3 of Appendix R to 10 CFR Part 50, and approved PBAPS 2 and 3 FPP regulatory requirements, the staff identified areas in which additional information was necessary to complete the evaluation. During two phone calls with Exelon held on April 19 and October 28, 2004, the staff discussed the proposed manually actuated $CO_2$ fire suppression systems and PBAPS 2 and 3 safe shutdown capability in the event of a fire. By letter to the licensee dated November 9, 2004, the NRC staff issued a request for additional information (RAI) concerning specific issues to determine the adequacy of the proposed LAR converting the existing $CO_2$ fire suppression system installed in four EDG rooms and the CSR. In addition, on February 10, 2005, the NRC staff participated in a plant walkdown of the areas of concern at PBAPS 2 and 3. During the site visit, the NRC staff reviewed results of the acceptance tests on the $CO_2$ systems and fire-brigade training and pre-fire fire-fighting strategies for the EDG rooms and the CSR. Exelon responded to the staff's RAI in a letter dated December 8, 2004.

### 4.1 Emergency Diesel Generator Rooms

At PBAPS 2 and 3, the EDG rooms are located in a building approximately 30 feet from the power block. Each room contains a single EDG. The total flooding $CO_2$ fire suppression system is automatically initiated by the heat detectors. In addition, the system can also be manually initiated at the master valve outside of the EDG building at the southeast corner of the $CO_2$ storage tank. The system can be shut down by push-button stations at each EDG. In order to prevent inadvertent operation of the $CO_2$ fire suppression system due to a seismic event, the system control devices are qualified in accordance with the requirements for safety-related components. There have been small fires associated with Fairbanks-Morse EDGs on the exhaust manifolds. These fires are very small and burn themselves out without manual intervention. These fires have not damaged the EDG, have not affected EDG operation, and have not resulted in heat detector actuation.

4.1.1 EDG Rooms Fire Hazard

There are two oil hazards within each EDG room, lube oil and diesel fuel oil (Class B combustibles). The main fuel oil supply is in underground tanks located outside of the EDG building. There are dikes located around the doors that separate each EDG room to prevent oil from flowing between the rooms. The most credible fire scenario in the EDG is either lube oil or diesel fuel oil fire. Operation of the EDG provides an ignition source for fuel. The EDGs are most vulnerable to a fire while they are operating. When the EDGs are operating there is typically an operator in the room; furthermore, when the EDGs are operating, the $CO_2$ fire suppression system is tagged shut and is functioning as a manual system. The operator at the EDG can provide notification of a fire to the MCR, shut down the EDG, and initiate the $CO_2$ system manually.

By plant procedure, an activity within the EDG rooms that has the potential to hinder immediate egress from the rooms requires the $CO_2$ fire suppression system to be tagged out of service. Normal entry into these areas does not require the $CO_2$ fire suppression system to be disabled, and only operations personnel are permitted to touch the disarm switches. During normal operation of the EDGs, the rooms are occupied; there are no egress problems associated with these rooms. Activation of the EDG building $CO_2$ fire suppression system does not cause $CO_2$ exposure to the alternate shutdown panels or the MCR.

4.1.2 EDG Rooms Fire Protection Features

The fire detection system protecting the EDG rooms consists of 16 heat detectors installed at the ceiling. These detectors currently initiate the automatic $CO_2$ fire suppression system. The 16 detectors are located in eight locations in pairings of two adjacent heat detectors. The spacing of the detectors is in accordance with NFPA 72E, "Standard On Automatic Fire Detectors," 1972 edition, COR, and Underwriters Laboratory (UL) guidelines. The heat detectors generate an alarm in the MCR, specifically identifying the affected EDG room.

The alarm response cards instruct the MCR operator to dispatch the fire brigade immediately upon receipt of an EDG fire detection alarm.

Each EDG room is a separate fire area with separation being provided by 4-hour rated concrete walls with 3-hour rated fire doors and penetration seals. The fuel oil day tank is located in a room within each EDG room that is separated from the remainder of the EDG room by a 3-hour rated fire barrier and is also protected by the $CO_2$ system. As a part of the conversion of the $CO_2$ fire suppression system from automatic to manual actuation, the barrier between each fuel oil day tank room and the corresponding EDG room will be added to the fire barrier surveillance program.

Fire-fighting supplies (foam concentrate, foam eductors, and foam nozzles) are available in hose houses located both on the east and west sides of the EDG building. Each hose house is adjacent to a fire hydrant and has sufficient hose to supply multiple 2½-inch supply lines to the affected EDG room door. The EDG room is arranged such that fire-fighting foam can be applied from an exterior door so that entry into the room to apply foam would not be required.

4.1.3 EDG Rooms Fire Response Procedures

Upon detection of a fire in the EDG room, an alarm is annunciated on the fire protection panel located in the MCR. Operators will respond in accordance with the alarm response cards (ARCs). Immediate actions are detailed in station procedures FF-01,"Fire Brigade," and ON-114, "Actual Fire Reported in the Power Block, Diesel Generator Building, Inner Screen or Emergency Cooling Tower Structure." The fire brigade leader (and the closest operator) will report directly to the EDG building. The most likely time for a fire in an EDG room is while an EDG is running. When an EDG is running, an operator will already be at the EDG building to monitor the running EDG. The operator (who is required to be fire-brigade qualified) at the EDG building can investigate the fire alarm, notify the MCR, and manually initiate the $CO_2$ fire suppression system in the affected EDG room.

The pre-fire plan, which is available at the EDG building, provides fire-fighting options available to the fire-brigade leader, including step-by-step instructions for manually discharging the $CO_2$ fire suppression system. Location of fire hydrants, fire hose and fire-fighting foam is also provided in the pre-fire plan.

The licensee provided the response time for assembling the fire brigade at the EDG rooms. Based on drill performance, the fire brigade should be able to respond in full turnout gear to the EDG building in 15 to 30 minutes; however, the fire-brigade leader and closest operator will respond immediately to the EDG building and should arrive 3 to 5 minutes after receiving an alarm.

4.1.4 Adequacy of the Manually Activated EDG Rooms $CO_2$ Fire Suppression System

The preferred design of a $CO_2$ fire suppression system is an automatic smoke detection system with a corresponding automatic initiating $CO_2$ fire suppression system. The earlier the detection of the fire and initiation of the $CO_2$ fire suppression system, the less damage will occur. Rapid detection and actuation of the $CO_2$ fire suppression system will tend to arrest a fire in the early stages and douse any flaming, thus preventing the fire from becoming "fully developed," and allowing for adequate emergency response during the required soak period. In general, the adequacy of a manually actuated $CO_2$ fire suppression system depends on the postulated fire

scenario, its growth potential, and time delay between the start of the fire and initiation of the manually actuated $CO_2$ fire suppression system.

The fire detection system installed at the PBAPS 2 and 3 EDG building is not designed to provide detection while an oil fire is in its incipient stage because it relies on heat sensors rather than on smoke detectors. The use of smoke detectors for a fire detection system in the EDG room is not practical because the smoke produced by the EDG during normal operations would likely result in numerous false alarms. The fire growth rate expected from an oil fire would be characterized as a fast growth rate. A fast growing fire in the EDG room that is detected by a heat detector (rated at 190 °F) will already be of significant size with the operation of the EDG already in jeopardy.

The critical issues with the manual actuation of the $CO_2$ system are whether PBAPS 2 and 3 personnel recognize the severity of the lube oil or diesel fuel oil fire hazard and discharge the system before the fire has had time to become fully developed. A fully developed oil fire will result in severe fire damage to the EDG room. Exelon indicated in its September 26, 2003, submittal, that if a fire event occurs in an EDG room, it is assumed that the fire-affected EDG is unavailable. Power and control cables between the EDG rooms and its Units 2 and 3 4 kV switchgear are routed within the room and terminated at various panels associated with the EDG. Failures of these cables can affect the associated divisionalized Unit 2 and 3 4 kV switchgear; however, as demonstrated by the Appendix R safe-shutdown analysis, these failures do not prevent achieving safe shutdown using the unaffected redundant equipment. The other 3 division EDGs and 4 kV switchgear will remain available since the fire in a single EDG room division does not affect key support systems for the remaining EDGs, because 3-hour fire barriers are provided between each of the EDG rooms

4.1.5 Conclusions Regarding EDG Room System

Based on the above evaluation, the NRC staff concludes that the ability of PBAPS 2 and 3 to achieve and maintain safe-shutdown conditions in accordance with the requirements of Appendix R to 10 CFR 50 is not affected by the conversion of the EDG building $CO_2$ fire suppression system from automatic to manual operation for the following reasons:

- The affected EDG will be unavailable, but the remaining EDGs will remain free of fire damage.

- A fully developed fire in an EDG room will result in the loss of the EDG regardless of automatic or manual initiation of the $CO_2$ fire suppression system, therefore, the delay in the $CO_2$ fire suppression system initiation that may result from a manual actuation versus an automatic actuation is inconsequential in terms of the operation of the EDG.

- The 3-hour rated fire barrier will retain the integrity of the room when subjected to an exposure fire and limit the fire in the EDG room. This provides reasonable assurance that the effects of a fire are limited to a discrete fire area and that three EDGs will remain free of fire damage.

- NFPA 12, 1968 edition recommended the use of a 34% design concentration for the

use on combustible liquid such as oil or kerosene. The $CO_2$ system for EDG rooms was designed to provide a 50% concentration. This additional agent will completely extinguish the fire and maintain an extinguishing concentration for a long period of time, allowing surfaces that become hot during the pre-burn to cool and not reignite oil.

- A recent fire PRA performed by the licensee screened out each EDG room without consideration of a fire detection or suppression system.

The staff, therefore, agrees with the licensee's proposed change of the EDG building $CO_2$ fire suppression system from automatic to manual actuation.

4.2 Cable Spreading Room

At PBAPS 2 and 3, the CSR is common to both units. The CSR is located on Elevation 150' in the turbine building, directly below the MCR and above the 4 kV switchgear rooms. The plant computer room is located in the center of the CSR. The CSR is part of the MCR fire area (Fire Area 25) that includes the MCR (Fire Zone 25-108), the CSR (Fire Zone 25-78H), the computer room (Fire Zone 25-129), and the fan room (Fire Zone 25-108A). The CSR contains two redundant trains of 1-hour fire rated Thermo-Lag ERFB to satisfy Appendix R requirements. The Unit 2 ERFB protects two conduits and, the Unit 3 ERFB also protects two conduits. Cables within these conduits, support the operation of automatic depressurization system (ADS)/safety relief valves (SRVs) for Units 2 and 3 when operated from their respective Unit 2 and Unit 3 alternative shutdown control stations located in the Units 2 and 3 radwaste building. These ERFBs will be upgraded from 1-hour to 3-hour rated thermo-lag ERFBs in conjunction with changing the automatic $CO_2$ fire suppression system to a manually actuated system. The safe-shutdown systems in this area comply with Appendix R, Section III.G.2 and Section III.G.3. The plant can safely shut down in the event of a fire in this area. To date no fires have ever been reported in the CSR.

The CSR is not continuously occupied, but is entered many times each shift by operations, security, and maintenance personnel; therefore, the CSR is considered to be a normally occupied area. Most activities within the CSR are performed at floor level, and egress while at floor level can be accomplished in a timely manner; however, occasionally, work is required in the overhead cable tray area which hampers the ability to exit the CSR. When work is performed in the overhead area, the $CO_2$ system is tagged out of service for personnel safety.

4.2.1 Cable Spreading Room Fire Hazard

The CSR at PBAPS 2 and 3 houses the equipment for both electrical safety and instrument racks of the plants. The CSR also contains a large quantity of electrical cables in conduits and open cable trays above the equipment. The CSR contains low voltage electrical cabinets (120 VAC or 125 VDC). The cabinets are generally sealed at the top, although some cabinets have side ventilation openings. There is no oil-filled equipment present in the room, and transient combustibles are typically temporary computers being used to monitor an instrument cabinet.

The dominant fire hazard identified in the CSR would be an electrical cable jacket and insulation fire. Plastic fueled fires are classified as Class A fires. The exposed cable in the CSR has fire retardant insulation (cross-linked polyethylene (XLPE)) and is limited to instrumentation and control applications. The majority of the exposed electrical cabling has been routed in either conduit or cable trays.

The fire growth rate expected from a cable fire would be characterized as slow-growth fire. The very nature of the fire retardant properties of XLPE thermoset cables would tend to retard the growth of the fire. The length of the incipient stage of fire would be dependent on the ignition energy and surface area of cable exposed to the fire. Ignition sources in the CSR consist of low-voltage cabinets which produce low heat. Based on the NRC-sponsored cable testing (NUREG/CR-3656, "Evaluation of Suppression Methods for Electrical Cable Fires," October 1986), it took between 5 minutes and 10 minutes for an exposure fire to become a fully developed fire in a single cable tray, and approximately 18 minutes to become a fully developed fire in a stack of five cable trays.

The potential for an unmitigated deep-seated fire at PBAPS 2 and 3 CSR is low because of the large size of fire required and spatial separation present between the cabinets and cables trays. As demonstrated in NUREG/CR-3656, a significant amount of cable insulation must be heated to achieve sustained burning for flame spread. The above experimental study showed that a sufficient quantity of cable jacket and insulation must undergo pyrolysis to produce a combustible fuel mixture to cause a fire. Small localized areas of smoldering insulation will not generate sufficient fuel vapor in a large CSR to sustain burning and fire spread. As the cable insulation continues to cool, available ignition temperature drops which decreases the pyrolysis rate, reduces the production of combustible vapor, and decreases the risk of fire reflash. Eventually the fire zone cools, fuel vapor production stops, ignition temperatures are not available and reflash cannot occur if oxygen concentration is increased. Further, the smoke detection would react before a deep-seated fire was able to develop. The fire retardant cables would resist but not eliminate the fire propagation through cables. In the case of smoldering combustion, propagation is very slow. When thermosetting plastics, such as XLPE cable, are heated, a pyrolysis similar to that of wood and wood products occurs. This accounts for its smoldering characteristics. The outer surface of the cable jacket material in the fire zone will char and form a barrier that insulates the subsurface plastic material, holding in heat. This retained heat perpetuates the pyrolysis even if surface flames are extinguished. It would take between 5 minutes and 18 minutes of exposure fire to develop a deep-seated fire in the cables.

The PBAPS 2 and 3 pre-operational testing of the manual $CO_2$ fire suppression system in the CSR demonstrated that an extinguishing concentration of 58% was achieved in 5 minutes. These values meet the NFPA 12, 1968 edition, COR, which is the PBAPS 2 and 3 current licensing basis. This pre-operational discharge testing demonstrated that the manual $CO_2$ fire suppression system is effective in dousing a fully developing cable fire. Re-ignition of the fully developed cable tray fire is prevented with a $CO_2$ concentration of more than 50% and a soak time of 5 minutes as concluded in the testing. The CSR $CO_2$ fire suppression system is capable of achieving and maintaining a 58% concentration and a soak time of 5 minutes. Further, rapid detection of a fire with ionization smoke detectors will tend to arrest a fire in its early stage preventing the fire from getting fully developed and reducing the probability of the fire becoming deep-seated. At PBAPS 2 and 3, the total time between first alarm and the decision to manually actuate the $CO_2$ system would be approximately 6 minutes or less.

4.2.2 Cable Spreading Room Fire Protection Features

The fire detection system protecting the CSR is a cross-zoned ionization smoke detection system. Twenty-five smoke detectors are arranged in two zones to provide a cross-zoned configuration that is used for automatically actuating the $CO_2$ system (i.e., a smoke detector from each zone is required to initiate $CO_2$ discharge). Either detection zone initiates an alarm in the MCR as well as an alarm within the CSR. The second detector initiates the $CO_2$ discharge sequence, which includes shutdown of ventilation fans, closures of ventilation dampers and the start of the discharge delay timer. The CSR fire detection panel is located directly outside the entry doors and uses a mimic display to graphically show the location of alarming detectors. Exelon plans to maintain the existing cross-zoned smoke detection system in the CSR. In the event of a fire in the CSR, the smoke detection system in the room will detect the fire while it is still in an incipient stage and provide an alarm to the MCR, at which time an operator will be dispatched to investigate the alarm. The CSR is located in the central plant location, just below the MCR, which ensures a rapid response by an operator.

The smoke detection zone layout for the CSR is equivalent in effectiveness and safety to that prescribed by NFPA 72E, 1972 Edition. The existing layout of the 25 smoke detectors at the CSR ceiling is consistent with the spacing guidelines of NFPA 72E. The quantity of smoke detectors provided is above the minimum quantity required by the NFPA 72E, 1972 edition.

4.2.3 Cable Spreading Room Fire Response Procedures

Upon detection of a fire in the CSR, the condition is brought to the attention of operators by an alarm on the fire protection panel located in the MCR and addressed by the ARCs. Procedures FF-01 and ON-114 call for dispatch of the fire brigade and describe other actions to be taken in the event of a fire. The fire-brigade leader will respond immediately to the CSR; therefore, there will be no appreciable time delay in verifying the fire. Based on drill experience, the fire-brigade leader will reach the CSR about 3 minutes after the alarm. The fire brigade leader will enter the CSR, identify the source of smoke, provide immediate notification to the MCR, and extinguish the fire using the portable fire extinguishers located within the CSR. If the fire in the CSR is larger than can be extinguished by a portable fire extinguisher, the fire-brigade leader has the option to manually discharge the $CO_2$ system or use a manual hose line to fight the fire before the arrival of the remainder of the fire brigade. Hose stations are located outside of each CSR door. The fire brigade should be able to respond in full turnout gear to the CSR in 10 to 12 minutes.

The CSR pre-fire plan adequately describes step-by-step instructions on how to discharge the $CO_2$ system manually, and the portable extinguishing equipment (hose stations and $CO_2$ fire extinguishers) that is available for fire-fighting in the CSR.

4.2.4 Adequacy of the Manually Activated CSR $CO_2$ Fire Suppression System

A large number of scenarios are possible in case of a fire in the CSR depending on the severity of the fire, smoke level in the room, availability of the $CO_2$ system, and manual actions taken by the fire brigade and the operators. Given the smoke detectors in the room and heightened awareness of the importance of suppressing a fire in the CSR, it is judged that the likelihood that an initially small fire will grow sufficiently in size to damage both power trains is very small. The likelihood of a fire involving a large quantity of combustible material is deemed to be very

small as well. The fire-brigade leader would be dispatched from the MCR and would arrive at the CSR approximately 3 minutes after the alarm to take appropriate action.

One concern is that a manually actuating $CO_2$ fire suppression system introduces the risk that the system may actuate too late and the fire has time to become fully developed and possibly deep-seated. This same risk is not inherent with an automatically actuated $CO_2$ fire suppression system. The time-line to develop a deep-seated fire depends on the size of the fire and fire growth rate. In the event of a fire in the CSR the fire-brigade leader response time could impose an additional 3-minute delay beyond that which would have been achieved with automatic actuation. For this case, however, the initiating fire is expected to be relatively small and contained within a single cabinet or cable tray. Based on the fire protection feature in the CSR and cable construction and effectiveness of the $CO_2$ fire suppression system, it is not expected that damage resulting from this type of fire scenario would be extensive. If the manual $CO_2$ fire suppression system is discharged within 5 minutes of the fire's detection, it is unlikely that a fully developed fire would have time to develop outside of the electrical cabinet. NUREG/CR-3656 fire testing indicates that a second 5-minute cycle was required for the propane burner to establish a self-sustaining fire in the donor tray that contains thermoplastic cables.

In the event of a fire, it is unlikely that the fire would spread far beyond the initiating cabinet due to their enclosed nature. Strict compliance with NFPA 72E would produce a significant increase in the level of fire detection or time of fire detection in the CSR. In the unlikely event that a fire were to initiate and propagate into a fire scenario that was beyond the capability of both the $CO_2$ fire suppression system and the fire brigade to extinguish it, damage would be contained within the 3-hour rated walls, floor, and ceiling which form that CSR fire area. Since the fire brigade would be maintaining a watch of the CSR, the likelihood of a deep-seated fire to flare up and cause additional failures by propagating to the other cable trays is small. The fire brigade would maintain a fire watch for an extended time after the CSR is considered clear of all fires. As described in Section 3.0, the licensee has implemented an approved alternate shutdown strategy that is independent of this fire area. The proposed change, therefore, would not adversely affect the ability to achieve and maintain plant safe shutdown in the event of a fire.

4.2.5 Conclusions Regarding CSR System

Based on the above evaluation, the staff concludes that the ability of PBAPS 2 and 3 to achieve and maintain safe-shutdown conditions, in accordance with the requirements of Appendix R to 10 CFR Part 50, is not affected by the conversion of the CSR $CO_2$ fire suppression system from automatic to manual operation for the following reasons:

- In the event of a postulated fire in the CSR, both units can safely shutdown using the alternate shutdown panel located outside the CSR. The PBAPS 2 and 3 Appendix R alternate shutdown strategy is described in the approved FPP.

- The CSR fully complies with the requirements of Appendix R to 10 CFR Part 50. The compliance will be provided by protecting several control cables to operate SRVs with a 3-hour rated ERFB when converting the $CO_2$ system from automatic to manual actuation. SRVs can be controlled from the ADS alternate control stations located in the switchgear rooms. Operation of these valves is not required to

achieve hot shutdown, but required to achieve cold shutdown from alternate control stations. Currently, these ERFBs are provided with 1-hour rated thermo-lag ERFB to meet Appendix R requirement.

- A fire originating in the low-voltage equipment cabinet or a transient combustible fire exposing cable trays will be slow to develop. Based on the fire detection arrangement in the CSR, detection of this type of fire would likely occur well before the fire had time to develop fully.

- Due to the inherent fire resistance of the cables, a fire of this nature is anticipated to take a long time to extend and take root in cables. It is expected that manual actuation of the $CO_2$ system would occur before the fire had time to develop into a fully developed fire scenario and well before the fire had time to become deep-seated. The manual $CO_2$ fire suppression system would have to be operated within 3 minutes from the time of detection (from initial alarm) to ensure that a deep-seated fire would not develop. A fire suppression system must control and reduce fire growth to minimize damage from a fire. Total flooding of the CSR by manually initiating $CO_2$ fire suppression would accomplish this by rapidly achieving greater than 50% $CO_2$ concentration. This would prevent both a flaming fire and deep-seated combustion.

- From the NRC staff's view of the physical configuration of the CSR, its associated fire hazards and fire protection features, and fire response procedures, a fire which initiated in one of the cabinets or a cable tray would likely be detected in its incipient stage and would not become fully developed.

The staff, therefore, agrees with the licensee's proposed change of the CSR $CO_2$ fire suppression system from automatic to manual actuation.

## 5.0 SUMMARY

On the basis of its review and evaluation of the information provided in the LAR and the licensee's response to the NRC staff questions, the staff concludes that Exelon has provided a thorough description of the proposed change and a clear safety assessment which adequately addresses the issue. The technical reasons that support the licensee's request, personnel safety and plant safety risks following an inadvertent discharge of the $CO_2$ system, are consistent with the operating experience of inadvertent discharge of an automatic $CO_2$ fire suppression system even if the system is electrically disabled. The staff agrees with the licensee's appraisal of the existing conditions and conclusions concerning the potential for an unexpected release of $CO_2$ in the EDG rooms and the CSR.

In the event of a $CO_2$ system failure, the maximum amount of $CO_2$ that can be discharged into the CSR is 24,000 lb. The maximum amount of $CO_2$ that can be discharged into a single EDG room in the event of a system failure is 5,500 lb. Emptying the entire content of the $CO_2$ tank into the room is a hazard that is associated with the $CO_2$ system regardless of the type of actuation. In fact, with automatic actuation, the potential for an inadvertent discharge is greater, thus the potential for a system malfunction is greater. The manual system reduces the potential for an inadvertent discharge, thus reducing the potential for a system failure allowing the entire

contents of the tank to flow into the room. The $CO_2$ fire suppression systems installed in the EDG rooms and the CSR are operable and meet the requirements of NFPA 12, 1968 edition (PBAPS 2 and 3 COR) in that they will achieve the design function of suppression, controlling and extinguishing a fire that may occur.

The NRC staff finds that a combination of all of the above fire protection aspects present in the EDG rooms and the CSR in the second element of the defense-in-depth would be maintained and a fire will not prevent the performance of necessary safe shutdown functions; therefore, the safe shutdown of the plant is assured. Further, there does not appear to be any overriding technical basis that converting the $CO_2$ fire suppression system from automatic to manual actuation compromises a second element of the defense-in-depth in the PBAPS 2 and 3-approved FPP. The staff, therefore, agrees with the licensee's proposed change of the $CO_2$ fire suppression system from automatic actuation to manual actuation. The staff finds the proposed changes to the PBAPS 2 and 3 approved FPP acceptable.

## 6.0 STATE CONSULTATION

In accordance with the Commission's regulations, the Pennsylvania State official was notified of the proposed issuance of the amendments. The State official had no comments.

## 7.0 ENVIRONMENTAL CONSIDERATION

The amendments change a requirement with respect to installation or use of a facility component located within the restricted area as defined in 10 CFR Part 20. The NRC staff has determined that the amendments involve no significant increase in the amounts, and no significant change in the types, of any effluents that may be released offsite, and that there is no significant increase in individual or cumulative occupational radiation exposure. The Commission has previously issued a proposed finding that the amendments involve no significant hazards consideration, and there has been no public comment on such finding (68 FR 68669). Accordingly, the amendments meet the eligibility criteria for categorical exclusion set forth in 10 CFR 51.22(c)(9). Pursuant to 10 CFR 51.22(b) no environmental impact statement or environmental assessment need be prepared in connection with the issuance of the amendments.

## 8.0 CONCLUSION

The Commission has concluded, based on the considerations discussed above, that: (1) there is reasonable assurance that the health and safety of the public will not be endangered by operation in the proposed manner, (2) such activities will be conducted in compliance with the Commission's regulations, and (3) the issuance of the amendments will not be inimical to the common defense and security or to the health and safety of the public.

Principal Contributor: N. Iqbal

Date: June 24, 2005