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RS-14-027

February 3, 2014

10 CFR 50.54(f)

U. S. Nuclear Regulatory Commission ATTN: Document Control Desk Washington, DC 20555-0001

> Braidwood Station, Units 1 and 2 Facility Operating License Nos. NPF-72 and NPF-77 NRC Docket Nos. STN 50-456 and STN 50-457

> Byron Station, Units 1 and 2 Facility Operating License Nos. NPF-37 and NPF-66 NRC Docket Nos. STN 50-454 and STN 50-455

Clinton Power Station, Unit 1 Facility Operating License No. NPF-62 NRC Docket No. 50-461

Dresden Nuclear Power Station, Units 2 and 3 Renewed Facility Operating License Nos. DPR-19 and DPR-25 NRC Docket Nos. 50-237 and 50-249

LaSalle County Station, Units 1 and 2 Facility Operating License Nos. NPF-11 and NPF-18 NRC Docket Nos. 50-373 and 50-374

Limerick Generating Station, Units 1 and 2 Facility Operating License Nos. NPF-39 and NPF-85 NRC Docket Nos. 50-352 and 50-353

Oyster Creek Nuclear Generating Station Renewed Facility Operating License No. DPR-16 NRC Docket No. 50-219

Peach Bottom Atomic Power Station, Units 2 and 3 Renewed Facility Operating License Nos. DPR-44 and DPR-56 NRC Docket Nos. 50-277 and 50-278

Quad Cities Nuclear Power Station, Units 1 and 2 Renewed Facility Operating License Nos. DPR-29 and DPR-30 NRC Docket Nos. 50-254 and 50-265

Three Mile Island Nuclear Station, Unit 1 Renewed Facility Operating License No. DPR-50 NRC Docket No. 50-289 U. S. Nuclear Regulatory Commission February 3, 2014 Page 2

Subject: Exelon Generation Company, LLC Additional Information Regarding Response to Bulletin 2012-01, "Design Vulnerability in Electric Power System"

References:

- 1. NRC Bulletin 2012-01, "Design Vulnerability in Electric Power System," dated July 27, 2012
- Letter from K. R. Jury (EGC) to NRC, "Exelon Generation Company, LLC 90-Day Response to NRC Bulletin 2012-01, 'Design Vulnerability in Electric Power System," dated October 25, 2012
- Letter from M. G. Evans (NRC) to M. J. Pacilio (EGC), "Request for Additional Information Regarding Response to Bulletin 2012-01, 'Design Vulnerability in Electric Power System," dated December 20, 2013

On July 27, 2012, Reference 1, NRC Bulletin 2012-01, "Design Vulnerability in Electric Power System," was issued to all holders of operating licenses and combined licenses for nuclear power reactors, except those who have permanently ceased operation and have certified that fuel has been removed from the reactor vessel. The Bulletin requested that all addresses submit a written response within 90 days in accordance with 10 CFR 50.54, "Conditions of licenses," paragraph (f). The Bulletin requested information to determine compliance with 10 CFR 50.55a(h)(2), "Protection systems," 10 CFR 50.55a(h)(3), "Safety systems," and Appendix A to 10 CFR Part 50, GDC 17, "Electric power systems," or equivalent principal design criteria as specified in licensee's Updated Final Safety Analysis Report.

Exelon Generation Company, LLC (EGC) responded to the Bulletin in Reference 2. In Reference 3, the NRC requested additional information from licensees to verify that they have completed interim corrective actions and compensatory measures in response to the design vulnerability described in Reference 1, and to determine the status of each licensee's long-term corrective actions.

Attachments 1 through 10 to this letter provide EGC's response to the Reference 3 request for each EGC nuclear operating station.

There are no regulatory commitments contained in this letter. Should you have any questions concerning this letter, please contact Mr. Mitchel Mathews at (630) 657-2819.

I declare under penalty of perjury that the foregoing is true and correct. Executed on the 3rd day of February 2014.

Respectfully,

pmt

David M. Gullott Manager – Licensing Exelon Generation Company, LLC

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Attachments:

- 1. Braidwood Station, Units 1 and 2, Additional Information Regarding Response to Bulletin 2012-01, "Design Vulnerability in Electric Power System"
- 2. Byron Station, Units 1 and 2, Additional Information Regarding Response to Bulletin 2012-01, "Design Vulnerability in Electric Power System"
- 3. Clinton Power Station, Unit 1, Additional Information Regarding Response to Bulletin 2012-01, "Design Vulnerability in Electric Power System"
- 4. Dresden Nuclear Power Station, Units 2 and 3, Additional Information Regarding Response to Bulletin 2012-01, "Design Vulnerability in Electric Power System"
- 5. LaSalle County Station, Units 1 and 2, Additional Information Regarding Response to Bulletin 2012-01, "Design Vulnerability in Electric Power System"
- 6. Limerick Generating Station, Units 1 and 2, Additional Information Regarding Response to Bulletin 2012-01, "Design Vulnerability in Electric Power System"
- 7. Oyster Creek Nuclear Generating Station, Unit 1, Additional Information Regarding Response to Bulletin 2012-01, "Design Vulnerability in Electric Power System"
- 8. Peach Bottom Atomic Power Station, Units 2 and 3, Additional Information Regarding Response to Bulletin 2012-01, "Design Vulnerability in Electric Power System"
- 9. Quad Cities Nuclear Power Station, Units 1 and 2, Additional Information Regarding Response to Bulletin 2012-01, "Design Vulnerability in Electric Power System"
- 10. Three Mile Island Nuclear Station, Unit 1, Additional Information Regarding Response to Bulletin 2012-01, "Design Vulnerability in Electric Power System"

Braidwood Station, Units 1 and 2, Additional Information Regarding Response to Bulletin 2012-01, "Design Vulnerability in Electric Power System"

ATTACHMENT 1 Braidwood Station, Units 1 and 2, Additional Information Regarding Response to Bulletin 2012-01, "Design Vulnerability in Electric Power System"

NRC Request:

In order for the NRC staff to complete its review of responses to the bulletin, the following additional information is requested:

NRC Request No. 1. Provide a summary of all interim corrective actions that have been taken since the January 30, 2012, event at Byron Station, Unit 2, to ensure that plant operators can promptly diagnose and respond to open phase conditions on the offsite power circuits for Class-1E vital buses until permanent corrective actions are completed.

Response to NRC Request No. 1 for Braidwood Station:

Braidwood Station has implemented several interim compensatory measures to minimize the impact should the open phase event occur. An operability evaluation was approved to ensure appropriate actions were developed in response to an assumed open phase condition (OPC). Actions included:

- Modification of the system auxiliary transformer (SAT) 4 kV undervoltage alarm from a twoout-of-two to a one-out-of-two configuration to enhance annunciatiation for a loss of single phase event
- Alignment of plant voltmeters to ensure all phases are monitored
- Implementation of a designated operator to isolate the safety buses from the grid in a timely fashion
- Completion of required reading packages for operators to enhance operator awareness
- Enhancement of alarm / annunciator response procedures
- Creation of operator aids and placards to enhance operator response
- Installation of new protective relays in an alarm only mode to detect an open phase event

These compensatory actions now provide effective controls to promptly diagnose and mitigate an OPC.

NRC Request No. 2. Provide a status and schedule for completion of plant design changes and modifications to resolve issues with an open phase of electric power.

Response to NRC Request No. 2 for Braidwood Station:

Exelon Generation Company, LLC (EGC) has developed an algorithm that preliminary analysis demonstrates is effective in detecting OPCs for wye-wye connected transformers like those in service at Braidwood Station. This algorithm will be utilized via digital relaying to detect and isolate OPCs. Braidwood Station has installed relays in alarm-only mode on Units 1 and 2. The isolation capabilities of the relays will be activated following an analysis of data gathered during the current monitoring period.

EGC used Electromagnetic Transient Program – Restructured Version (EMTP-RV) to complete the design analyses. This choice was made due to the relatively short time delays necessary to coordinate with plant protection devices and transmission system protection.

Byron Station, Units 1 and 2, Additional Information Regarding Response to Bulletin 2012-01, "Design Vulnerability in Electric Power System"

ATTACHMENT 2 Byron Station, Units 1 and 2, Additional Information Regarding Response to Bulletin 2012-01, "Design Vulnerability in Electric Power System"

NRC Request:

In order for the NRC staff to complete its review of responses to the bulletin, the following additional information is requested:

NRC Request No. 1. Provide a summary of all interim corrective actions that have been taken since the January 30, 2012, event at Byron Station, Unit 2, to ensure that plant operators can promptly diagnose and respond to open phase conditions on the offsite power circuits for Class-1E vital buses until permanent corrective actions are completed.

Response to NRC Request No. 1 for Byron Station:

Byron Station has implemented several interim compensatory measures to minimize the impact should the open phase event occur. An operability evaluation was approved to ensure appropriate actions were developed in response to an assumed open phase condition (OPC). Actions included:

- Modification of the system auxiliary transformer (SAT) 4 kV undervoltage alarm from a twoout-of-two to a one-out-of-two configuration to enhance annunciatiation for a loss of single phase event
- Alignment of plant voltmeters to ensure all phases are monitored
- Implementation of a designated operator to isolate the safety buses from the grid in a timely fashion
- Completion of required reading packages for operators to enhance operator awareness
- Enhancement of alarm / annunciator response procedures
- Creation of operator aids and placards to enhance operator response
- Installation of new protective relays in an alarm only mode to detect an open phase event

These compensatory actions now provide effective controls to promptly diagnose and mitigate an OPC.

NRC Request No. 2. Provide a status and schedule for completion of plant design changes and modifications to resolve issues with an open phase of electric power.

Response to NRC Request No. 2 for Byron Station:

Exelon Generation Company, LLC (EGC) has developed an algorithm that preliminary analysis demonstrates is effective in detecting OPCs for wye-wye connected transformers like those in service at Byron Station. This algorithm will be utilized via digital relaying to detect and isolate OPCs. Byron Station has installed relays in alarm-only mode on Units 1 and 2. The isolation capabilities of the relays will be activated following an analysis of data gathered during the current monitoring period.

EGC used Electromagnetic Transient Program – Restructured Version (EMTP-RV) to complete the design analyses. This choice was made due to the relatively short time delays necessary to coordinate with plant protection devices and transmission system protection.

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Clinton Power Station, Unit 1, Additional Information Regarding Response to Bulletin 2012-01, "Design Vulnerability in Electric Power System"

ATTACHMENT 3 Clinton Power Station, Unit 1 Additional Information Regarding Response to Bulletin 2012-01, "Design Vulnerability in Electric Power System"

NRC Request:

In order for the NRC staff to complete its review of responses to the bulletin, the following additional information is requested:

NRC Request No. 1. Provide a summary of all interim corrective actions that have been taken since the January 30, 2012, event at Byron Station, Unit 2, to ensure that plant operators can promptly diagnose and respond to open phase conditions on the offsite power circuits for Class-1E vital buses until permanent corrective actions are completed.

Response to NRC Request No. 1 for Clinton Power Station (CPS):

Lessons learned from the events at Byron Station were reviewed and various interim corrective actions were evaluated for safety and efficiency at CPS. Based on the plant's offsite power configuration, electrical design details, and lessons learned, the following actions were taken to ensure plant operators can promptly diagnose and respond to open phase conditions (OPCs):

- Prepared required reading packages for all Licensed Operators.
- Aligned plant voltmeters to ensure all phases are monitored.
- Created Operator aids and placards.
- Enhanced alarm and annunciator response procedures.
- Implemented a designated operator to isolate the safety buses from the grid in a timely fashion.
- Aligned normal configuration of engineered safety features Bus 1A1 on one offsite source with Bus 1B1 on the other offsite source.
- Aligned non-safety loads to the unit auxiliary transformer to enhance protection for balance of plant loads.
- Implemented quarterly visual inspections of the switchyard insulators using binoculars and high resolution photography.

NRC Request No. 2. Provide a status and schedule for completion of plant design changes and modifications to resolve issues with an open phase of electric power.

Response to NRC Request No. 2 for CPS:

Exelon Generation Company, LLC (EGC) has developed algorithms that preliminary analysis demonstrates will be effective in detecting OPCs for wye-wye and wye-delta-wye connected transformers like those in service at CPS. Current plans are to utilize these algorithms at CPS via digital relaying to detect and isolate OPCs. CPS is currently in the conceptual design phase of the modification process that is planning to utilize this relaying for the credited offsite sources.

EGC is using Electromagnetic Transient Program – Restructured Version (EMTP-RV) to perform plant and transmission system analyses. This choice was made due to the relatively short time delays necessary to coordinate with plant protection devices and transmission system protection.

Dresden Nuclear Power Station, Units 2 and 3, Additional Information Regarding Response to Bulletin 2012-01, "Design Vulnerability in Electric Power System"

ATTACHMENT 4 Dresden Nuclear Power Station, Units 2 and 3 Additional Information Regarding Response to Bulletin 2012-01, "Design Vulnerability in Electric Power System"

NRC Request:

In order for the NRC staff to complete its review of responses to the bulletin, the following additional information is requested:

NRC Request No. 1. Provide a summary of all interim corrective actions that have been taken since the January 30, 2012, event at Byron Station, Unit 2, to ensure that plant operators can promptly diagnose and respond to open phase conditions on the offsite power circuits for Class-1E vital buses until permanent corrective actions are completed.

Response to NRC Request No. 1 for Dresden Nuclear Power Station (DNPS):

DNPS has implemented several interim compensatory measures to minimize the impact should the open phase event occur. An operability evaluation was approved to ensure appropriate actions were developed in response to an assumed open phase condition (OPC). Actions included:

- Modification of plant ESS 4kV bus voltage alarms from two-out-of-two configuration to enhance annunciation of a single phase event
- Alignment of plant voltmeters to ensure all phases are monitored
- Completion of required reading packages for operators
- Enhancement of alarm and Annunciator response procedures
- Completion of switchyard walk downs to verify that no Ohio Brass insulators are installed.
- Performance of periodic walk-downs and pre-defined surveillances of the switchyard to identify open phase vulnerabilities.
- Performance of daily rounds of the transformer yard including general and detailed inspections of the transformers to ensure parameters are within limits.
- Performance of bi-annual infrared inspections of switchyard equipment.
- Performance of quarterly pre-defined infrared inspections of offsite power transformer equipment.
- Completion of operator training that included enhanced objectives that ensure operators can diagnose and respond to an open phase condition.

These compensatory actions now provide effective controls to promptly diagnose and mitigate a loss of singe-phase event.

ATTACHMENT 4 Dresden Nuclear Power Station, Units 2 and 3 Additional Information Regarding Response to Bulletin 2012-01, "Design Vulnerability in Electric Power System"

NRC Request No. 2. Provide a status and schedule for completion of plant design changes and modifications to resolve issues with an open phase of electric power.

Response to NRC Request No. 2 for DNPS:

Exelon Generation Company, LLC (EGC) has developed an algorithm that current analysis demonstrates is effective in detecting open phase conditions (OPCs) for wye-wye connected transformers like those in service at DNPS. An open phase detection relay is installed in the alarm only mode at DNPS, Unit 3.

Open phase detection relays were installed at DNPS, Unit 2 during refueling outage D2R23 in November 2013 but relay programming and settings were not available; therefore, the alarm mode could not be activated. EGC is using Electromagnetic Transient Program – Restructured Version (EMTP-RV) to complete the analyses. This choice was made due to the relatively short time delays necessary to coordinate with plant protection devices and transmission system protection. The relay installation will allow online relay programming upon completion of the design analyses and alarm activation which is currently scheduled for May 2014. The open phase detection relay trip functions will be enabled at DNPS, Units 2 and 3 following a comprehensive review and analysis of data collected during the monitoring period.

LaSalle County Station, Units 1 and 2, Additional Information Regarding Response to Bulletin 2012-01, "Design Vulnerability in Electric Power System"

ATTACHMENT 5 LaSalle County Station, Units 1 and 2, Additional Information Regarding Response to Bulletin 2012-01, "Design Vulnerability in Electric Power System"

NRC Request:

In order for the NRC staff to complete its review of responses to the bulletin, the following additional information is requested:

NRC Request No. 1. Provide a summary of all interim corrective actions that have been taken since the January 30, 2012, event at Byron Station, Unit 2, to ensure that plant operators can promptly diagnose and respond to open phase conditions on the offsite power circuits for Class-1E vital buses until permanent corrective actions are completed.

Response to NRC Request No. 1 for LaSalle County Station (LSCS):

LSCS has implemented several interim compensatory measures to minimize the impact should the open phase event occur. An operability evaluation was approved to ensure appropriate actions were developed in response to an assumed open phase condition (OPC). Actions included:

- Modifications of plant voltage alarms in the Main Control Room to alert the operators for the event.
- Issuance of a standing order to provide operator actions, and bus voltage to monitor with the preferred selection of C-A phases of the engineered safety features (ESF) buses.
- Completion of required reading packages for operators.
- Installation of flags on main control panel to support operator actions for the event.
- Assignment of a designated operator to monitor 4kV ESF bus voltage and open Station Auxiliary Transformers (SAT) feed breakers for the event.
- Enhancement of alarm and annunciator response procedures for verification of the voltages on all three phases of the ESF buses.
- Revision to procedures to provide clear operator directions for the response to an OPC event.

These compensatory actions now provide effective controls to promptly diagnose and mitigate a loss of singe-phase event.

ATTACHMENT 5 LaSalle County Station, Units 1 and 2, Additional Information Regarding Response to Bulletin 2012-01, "Design Vulnerability in Electric Power System"

NRC Request No. 2. Provide a status and schedule for completion of plant design changes and modifications to resolve issues with an open phase of electric power.

Response to NRC Request No. 2 for LSCS:

Exelon Generation Company, LLC (EGC) has developed an algorithm that current analysis demonstrates that is effective in detecting OPCs in wye-wye connected transformers like those in service at LSCS. These algorithms will be utilized via digital relaying to detect and isolate OPCs. For LSCS, Unit 2, the OPC detection relay is installed in the alarm only mode and for Unit 1, a design change is in progress for installation of OPC detection. The relay trip function will be enabled on both LSCS units based on analysis of data collected during a monitoring period.

EGC is using Electromagnetic Transient Program – Restructured Version (EMTP-RV) to complete the analyses. This choice was made due to the relatively short time delays necessary to coordinate with plant protection devices and transmission system protection.

Limerick Generating Station, Units 1 and 2, Additional Information Regarding Response to Bulletin 2012-01, "Design Vulnerability in Electric Power System"

ATTACHMENT 6 Limerick Generating Station, Units 1 and 2, Additional Information Regarding Response to Bulletin 2012-01, "Design Vulnerability in Electric Power System"

NRC Request:

In order for the NRC staff to complete its review of responses to the bulletin, the following additional information is requested:

NRC Request No. 1. Provide a summary of all interim corrective actions that have been taken since the January 30, 2012, event at Byron Station, Unit 2, to ensure that plant operators can promptly diagnose and respond to open phase conditions on the offsite power circuits for Class-1E vital buses until permanent corrective actions are completed.

Response to NRC Request No. 1 for Limerick Generating Station (LGS):

Interim compensatory measures to minimize the impact should the open phase event occur at LGS have been implemented. An operability evaluation was approved to ensure appropriate actions were developed in response to an Open Phase Condition (OPC). These Actions include:

- Completion of required reading packages for station operators to enhance operator awareness.
- Completion of operator training on Single Phase Detection.
- Enhancement of alarm / annunciator response procedures.
- Issuance of Procedure SE-17, "Loss of Single Phase from Offsite Source". This
 procedure provides instructions to recognize and mitigate the impact of the loss of a
 single phase from one of the offsite electrical sources.
- Addition of a Main Control Room alarm to annunciate for a phase unbalance condition upstream of the 10 Station Auxiliary Bus.

NRC Request No. 2. Provide a status and schedule for completion of plant design changes and modifications to resolve issues with an open phase of electric power.

Response to NRC Request No. 2 for LGS:

Exelon Generation Company, LLC (EGC) is developing, in cooperation with Schweitzer Engineering Laboratories and Dominion, algorithms that will be effective in detecting the OPC in connected transformers. The LGS design is in the conceptual phase with plans to install a modification that utilizes this relaying on the 10 Station Auxiliary Transformer, 20 Regulating Transformer, and the 101 and 201 Safeguard Transformers.

EGC is using Electromagnetic Transients Program – Restructured Version (EMTP-RV) to complete the analyses. This choice was made due to the relatively short time delays necessary to coordinate with plant protection devices and transmission system protection.

Oyster Creek Nuclear Generating Station, Unit 1, Additional Information Regarding Response to Bulletin 2012-01, "Design Vulnerability in Electric Power System"

ATTACHMENT 7 Oyster Creek Nuclear Generating Station Additional Information Regarding Response to Bulletin 2012-01, "Design Vulnerability in Electric Power System"

NRC Request:

In order for the NRC staff to complete its review of responses to the bulletin, the following additional information is requested:

NRC Request No. 1. Provide a summary of all interim corrective actions that have been taken since the January 30, 2012, event at Byron Station, Unit 2, to ensure that plant operators can promptly diagnose and respond to open phase conditions on the offsite power circuits for Class-1E vital buses until permanent corrective actions are completed.

Response to NRC Request No. 1 for Oyster Creek Nuclear Generating Station (OCNGS):

OCNGS has implemented several interim compensatory measures to minimize the impact should the open phase event occur. An operability evaluation was approved to ensure appropriate actions were developed in response to an assumed open phase condition (OPC). Actions included:

- Licensed operators were provided training on this issue.
- In accordance with OCNGS Procedure 681.4.005, "Substation Tour Sheet," the tap
 positions for all three phases of the voltage regulators for the startup transformers are
 recorded. The tap positions of the voltage regulators for each transformer must be within
 two steps of each other. If a single phase was open on either of the two startup transformer
 supply lines, the tap position for the open phase would be different (i.e., by more than two
 steps) than the other two phases. If the tap positions are out of position by more than two
 steps, the acceptance criteria of OCNGS Procedure 681.4.005 is not met and an
 engineering assessment of the condition is performed. The substation tour is normally
 performed on a daily basis if conditions permit. However, when an engineered safety
 feature (ESF) system is out of service, the TAP positions of the voltage regulators for each
 transformer are verified every eight hours in accordance with OCNGS Procedure 681.4.004,
 "Technical Specification Log Sheet."
- Alarm response procedures for "BUS 1C VOLTS LO" and "BUS 1D VOLTS LO" have been
 revised to provide guidance to operators for detection and action to separate the ESF buses
 from the offsite power source, should a loss of a single phase occur.

NRC Request No. 2. Provide a status and schedule for completion of plant design changes and modifications to resolve issues with an open phase of electric power.

Response to NRC Request No. 2 for OCNGS:

The design of the OCNGS auxiliary power system and the General Design Criterion (GDC) 17, "Electric power systems," power sources are robust in that the sources are physically independent and completely redundant. As a result, even though the OPC may not be detected and could impact one division of ESF function, all ESF and important-to-safety functions are preserved in the other division. Based on the physical independence of the two GDC 17 sources, the compensatory actions, the small potential for inadvertent actuation of the OPC protection scheme, and the short time the OPC protection scheme would be in operation (i.e., OCNGS will be shut down in the year 2019), there are no plans to implement any OPC protection scheme at OCNGS.

Peach Bottom Atomic Power Station, Units 2 and 3, Additional Information Regarding Response to Bulletin 2012-01, "Design Vulnerability in Electric Power System"

ATTACHMENT 8 Peach Bottom Atomic Power Station, Units 2 and 3, Additional Information Regarding Response to Bulletin 2012-01, "Design Vulnerability in Electric Power System"

NRC Request:

In order for the NRC staff to complete its review of responses to the bulletin, the following additional information is requested:

NRC Request No. 1. Provide a summary of all interim corrective actions that have been taken since the January 30, 2012, event at Byron Station, Unit 2, to ensure that plant operators can promptly diagnose and respond to open phase conditions on the offsite power circuits for Class-1E vital buses until permanent corrective actions are completed.

Response to NRC Request No. 1 for Peach Bottom Atomic Power Station (PBAPS): Interim compensatory measures to minimize the impact should the open phase event occur at PBAPS have been implemented. An operability evaluation was approved to ensure appropriate actions were developed in response to an assumed open phase condition (OPC). Actions included:

- Revision of Operations Procedure SO 53.7.S, "Response to a 13 kV Startup Bus Computer Alarm or Observed Voltage Outside its Range on Panel 00C024," to provide instructions for detecting and responding to an OPC on a startup source since PBAPS's startup sources feed the station Class-1E vital buses.
- Completion of a required reading package describing the Byron Station event by all station licensed and non-licensed operators.
- o Creation of an assignment to develop a modification to address the OPC issue.

NRC Request No. 2. Provide a status and schedule for completion of plant design changes and modifications to resolve issues with an open phase of electric power.

Response to NRC Request No. 2 for PBAPS:

Exelon Generation Company, LLC (EGC) is developing, in cooperation with Schweitzer Engineering Laboratories and Dominion, detection algorithms that will be effective in detecting OPCs for wye-delta and delta-wye connected transformers like those in service at PBAPS. Current plans are to utilize these algorithms at PBAPS via digital relaying to detect and isolate OPCs. PBAPS is currently in the conceptual design phase of the modification process that is planning to utilize this relaying on the startup source transformers and emergency auxiliary transformers.

EGC is using Electromagnetic Transient Program – Restructured Version (EMTP-RV) to complete the analyses. This choice was made due to the relatively short time delays necessary to coordinate with plant protection devices and transmission system protection.

Quad Cities Nuclear Power Station, Units 1 and 2, Additional Information Regarding Response to Bulletin 2012-01, "Design Vulnerability in Electric Power System"

ATTACHMENT 9 Quad Cities Nuclear PowerStation, Units 1 and 2, Additional Information Regarding Response to Bulletin 2012-01, "Design Vulnerability in Electric Power System"

NRC Request:

In order for the NRC staff to complete its review of responses to the bulletin, the following additional information is requested:

NRC Request No. 1. Provide a summary of all interim corrective actions that have been taken since the January 30, 2012, event at Byron Station, Unit 2, to ensure that plant operators can promptly diagnose and respond to open phase conditions on the offsite power circuits for Class-1E vital buses until permanent corrective actions are completed.

Response to NRC Request No. 1 for Quad Cities Nuclear Power Station (QCNPS):

QCNPS has implemented several interim compensatory measures to minimize the impact should the open phase event occur. An operability evaluation was approved to ensure appropriate actions were developed in response to an assumed open phase condition (OPC). Actions included:

- Modification of the Class 1E 4 kV undervoltage alarm from a two-out-of-two to a one-out-oftwo configuration to enhance annunciatiation for a loss of single phase event.
- Alignment of plant voltmeters to ensure all phases are monitored.
- Completion of required reading packages for operators to enhance operator awareness.
- Enhancement of alarm/annunciator response procedures.
- Periodic walkdowns are on-going of the switchyard.
- Transformer rounds are performed daily to ensure parameters are within expected limits.

NRC Request No. 2. Provide a status and schedule for completion of plant design changes and modifications to resolve issues with an open phase of electric power.

Response to NRC Request No. 2 for QCNPS:

Exelon Generation Company, LLC (EGC) has developed an algorithm that current analysis demonstrates is effective in detecting the OPC in wye-wye connected transformers like those in service at QCNPS. These algorithms will be utilized via digital relaying to detect and isolate OPCs. QCNPS has installed one relay in alarm-only mode on the Unit 1 Reserve Auxiliary Transformer (RAT), and has plans in-place to install a relay on the Unit 2 RAT. The isolation capabilities of the relays will be activated following the analysis of data gathered during a monitoring period.

EGC is using Electromagnetic Transient Program – Restructured Version (EMTP-RV) to complete the analyses. This choice was made due to the relatively short time delays necessary to coordinate with plant protection devices and transmission system protection.

Three Mile Island Nuclear Station, Unit 1, Additional Information Regarding Response to Bulletin 2012-01, "Design Vulnerability in Electric Power System"

ATTACHMENT 10 Three Mile Island Nuclear Station, Unit 1, Additional Information Regarding Response to Bulletin 2012-01, "Design Vulnerability in Electric Power System"

NRC Request:

In order for the NRC staff to complete its review of responses to the bulletin, the following additional information is requested:

NRC Request No. 1. Provide a summary of all interim corrective actions that have been taken since the January 30, 2012, event at Byron Station, Unit 2, to ensure that plant operators can promptly diagnose and respond to open phase conditions on the offsite power circuits for Class-1E vital buses until permanent corrective actions are completed.

Response to NRC Request No. 1 for Three Mile Island Station (TMI):

TMI has implemented several interim compensatory measures to minimize the impact should the open phase event occur. An Operability Evaluation was approved to ensure appropriate actions were developed in response to an assumed open phase condition (OPC). These measures include:

- Revised alarm response procedure (4kV ES Bus Trouble) to check for loss of phase on the Auxiliary Transformer input ammeters, and, if confirmed, open the feeder breaker for the associated Engineered Safeguards (ES) 4160V AC Switchgear and align to the associated Emergency Diesel Generator (EDG). The affected ES bus will be aligned to the associated EDG, and ensure all the equipment have reliable power to perform their safety related actions.
- Briefed Operators on the procedure change.
- Completed classroom and simulator training on OPC response.
- Created assignments to track the actions recommended by the Nuclear Energy Institute (NEI) OPC Initiative.

Since all the indications and actions are in the Main Control Room, this allows the operators to quickly recognize and respond to this event.

ATTACHMENT 10 Three Mile Island Nuclear Station, Unit 1, Additional Information Regarding Response to Bulletin 2012-01, "Design Vulnerability in Electric Power System"

NRC Request No. 2. Provide a status and schedule for completion of plant design changes and modifications to resolve issues with an open phase of electric power.

Response to NRC Request No. 2 for TMI:

Exelon Generation Company, LLC (EGC) has developed an algorithm that current analysis demonstrates is effective in detecting the OPC in wye-wye connected transformers like those in service at TMI. Relays that utilize this algorithm are installed in the alarm only mode at TMI, Unit 1.

Modifications to install overhead and associated Plant Process Computer Alarms have been installed to notify operators of the OPC, and alarm response procedures have been revised to provide actions for operators for response to the OPC if the associated Overhead or PPC alarm is received.

Analyses to support plant response to an OPC with an accident signal present are in progress for TMI, Unit 1. EGC is using Electromagnetic Transient Program – Restructured Version (EMTP-RV) to complete the analyses. This choice was made due to the relatively short time delays necessary to coordinate with plant protection devices and transmission system protection. Current plans are to enable the relay trip function at TMI, Unit 1 following analysis of the data collected during the monitoring period.

Training Curriculum was revised and training has been provided to ensure operators can diagnose and respond to an OPC.

EGC intends to complete necessary actions as scheduled in the NEI OPC Initiative.