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

Subject: Biennial 10 CFR 50.59 and Commitment Revision Reports for 2016 and 2017

Enclosed are the 2016-2017 Biennial 10 CFR 50.59 and Commitment Revision Reports as required by 10 CFR 50.59(d)(2) and SECY-00-0045 (NEI 99-04).

There are no new regulatory commitments established by this submittal. If you have any questions or require additional information, please contact Mike Fitzwater, of Regulatory Assurance, at (717) 948-8228.

Respectfully,

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Site Vice President, Three Mile Island Unit 1  
Exelon Generation Co., LLC

Enclosure:  
BIENNIAL 10 CFR 50.59 AND COMMITMENT REVISION REPORTS

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IE47  
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**THREE MILE ISLAND  
UNIT 1  
DOCKET NO. 50-289**

**BIENNIAL 10 CFR 50.59 AND COMMITMENT REVISION REPORTS**

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**EXELON CORPORATION  
THREE MILE ISLAND  
UNIT 1  
DOCKET NO. 50-289**

**BIENNIAL 10 CFR 50.59 REPORT  
JANUARY 1, 2016 THROUGH DECEMBER 31, 2017  
10 CFR 50.59 EVALUATION SUMMARIES**

## Modifications

**Title:** Enable Loss of Phase Relay Automatic Trip Feature

**Year Implemented:** 2017

**Evaluation Number:** TMI-17-E-0001; EC 593110

### Description of Activity:

The proposed activity will enable the automatic trip function of an existing relaying scheme to detect a loss-of-phase condition on the 230kV side of the Unit 1 Station Auxiliary Transformers (SATs) to isolate the SATs and to alarm the condition so that the appropriate operator action can be taken.

The equipment for the loss-of phase system was previously installed under ECR 12-00240 during T1R20 in an alarm-only mode. This activity will evaluate the enabling of the automatic trip feature of the relay which will isolate the affected SAT on a detection of a loss-of-phase condition. Note that the relays will detect an open phase condition in one or in two phases in the zone of protection from the SAT high side back to its respective 230kV bus breaker. Throughout the remaining discussion the use of "open phase" refers to either or both conditions.

The protective relay scheme monitors the current input from existing CTs on the high side of the SATs to detect a loss-of-phase and to provide an alarm when the MINLOAD (Generator Offline) setpoint is reached (as defined in analysis C-1101-700-E420-019). The loss-of-phase relays compare the positive sequence currents, the negative sequence currents and the zero sequence currents at both of the SAT's 230kV side, and on a detected loss-of-phase, these relays will, depending upon transformer loading respond as follows:

- When the primary current in the SAT is above the established relay MINLOAD (Generator Offline) setpoint (as defined in analysis C-1101-700-E420-019), the associated relay will initiate a SAT lockout for an open phase condition via actuation of the existing SAT lockout relays and initiate a Loss of Phase Alarm.
- When the primary current in the SAT is below the established relay MINLOAD (Generator Offline) setpoint (as defined in analysis C-1101-700-E420-019), a Low Load alarm will actuate in the control room and the trips that may be susceptible to spurious actuation will be blocked.

Under Revision 002 to EC 593110, the associated trip contact output test switches are being closed which will enable the loss-of-phase relays to provide the trip function to the SAT lockout relays.

### Reason for Activity:

The activity is being undertaken to address a vulnerability identified during an event that occurred on January 30, 2012 at Byron Station, when the mechanical failure of a porcelain insulator on the

“C” phase of the 345kV feed to SAT 242-1 and SAT 242-2 created a single-phase voltage condition in the switchyard that propagated through the SATs to the buses fed from the SATs, thereby causing a degraded power condition on those buses. The plant transient that followed resulted in a reactor trip, but the 4kV engineered safety features (ESF) buses remained in a degraded condition until operator action isolated the defective (open phase) power supply to the 4kV ESF buses.

The intent of the loss-of-phase detection scheme is to enhance the protection for the Class 1E system from, and to alert the operators to, a potential degraded condition caused by a loss of a single, or two phases that could adversely affect both the Class 1E and the non-Class 1E systems.

In addition, the proposed change is consistent with Industry guidelines provided by NEI in “Industry Initiative on Open Phase Condition”, Project Number: 689, dated March 16, 2015. This guideline identifies that it is important that an open phase in the off-site power circuits not prevent functioning of important to safety SSC’s.

**Effect of Activity:**

This activity will enable previously installed relaying scheme to: (1) detect a loss-of-phase upstream of the SAT and (2) actuate the existing SAT lockout relays to isolate the affected SAT upon detection of a loss-of-phase, when in the relay operating regions as described above. When a SAT is isolated, its associated 4kV ES bus will experience an under-voltage condition. This will start the emergency diesel generator (EDG), load shed the bus, and then load the bus with the required ES loads. When the SAT is isolated, the feed to the associated 6.9kV and 4kV non-ES bus(es) will automatically be transferred from the affected SAT to the unaffected SAT, if it is available. That is, the actuation of the loss-of-phase scheme will produce the same results as the actuation of the existing SAT protection devices.

The loss-of-phase relay scheme does not impact the manual opening or closing of the 230kV bus breakers or of the feed breakers to the 4kV and 6.9kV buses, and will not alter the method of operating the SATs or the 4kV or 6.9kV buses. The manual realignment of power supplies to the 4kV and 6.9kV buses, described in UFSAR Sections 8.2.2.3 and 8.2.2.4, are not affected. Therefore, there is no change in how the SAT, 4kV bus, or 6.9kV bus UFSAR-described design functions are performed or controlled.

The proposed activity, EC 593110 Rev. 2, is based, in part, on an engineering evaluation of the plant design and licensing basis (Operability Evaluation 12-002) which concluded that the Byron event was caused by a failure of a switchyard component and that detection down to the level of this type of failure is beyond the requirements of GDC 17 and was not contemplated as part of the original plant design. Therefore, the function of automatically separating the offsite source during this event was not specifically identified as an automatic action within the original plant design criteria. As such, the proposed activity has been developed as an enhancement to plant safety that addresses a condition that is outside the current design and licensing basis for the plant.

### **Summary of Conclusion for the Activity's 50.59 Review:**

Since the proposed activity is considered an enhancement of the preferred (offsite) power source to protect the Class 1E system from a condition that is outside the current design and licensing basis for the plant, the failure of the loss-of-phase system to perform its intended function of isolating the affected SAT upon detection of a loss-of-phase upstream of a SAT does not adversely affect any UFSAR-described design function.

The proposed activity will enable a previously installed relaying scheme to detect and alarm a loss-of-phase condition on the 230kV side of the Unit 1 SATs so that the degraded offsite source can be removed from the onsite electrical distribution system. The proposed activity does not adversely affect SAT capacity or the existing automatic and manual switching capabilities involving the normal, alternative and/or emergency feeds to the 4kV ES buses, 4kV non-ES buses or the 6.9kV buses. The proposed activity does not adversely affect the existing equipment protection, including protection from overcurrent, under-voltage, or degraded voltage conditions.

If a loss-of-phase is detected as discussed above, the protective relay system will actuate the associated SAT lockout relays to isolate the affected SAT and will alert the operators to the degraded condition of the offsite power source feeding the SAT. These actions will produce the same results as actuation of existing SAT protection devices – that is, isolation of the station electrical distribution system from the problem and re-alignment of the affected buses to alternate AC sources. The procedure changes involved with this activity do not involve a change to a procedure that adversely affects how UFSAR-described SSC design functions are performed or controlled.

However, the installation of equipment whose spurious actuation, due to a relay malfunction, could result in a loss of offsite power to a 4kV ES bus or (if the unaffected SAT feeds to the 6.9kV or 4kV non-ES buses were not available) reactor trip adversely affects the UFSAR (Section 8.1 described design function that: "provisions must be included to minimize the probability of losing electric power from the transmission network", as is required by GDC-17. Therefore, a 50.59 evaluation was performed for 50.59 Screening Question 1.

The 50.59 Evaluation determined that due to the balancing of the positive effects (isolating a degraded power source) and the potential unlikely negative effects (inappropriate isolation of a functioning power source), the proposed activity does not result in more than a minimal increase in the frequency of occurrence of an accident previously evaluated in the UFSAR or result in a more than minimal increase in the frequency of a malfunction of an SSC.

Existing protective features protect the SATs in the event of various electrical system failures. The loss-of-phase protective feature utilizes the SAT lockout in a similar manner to isolate a degraded or faulted offsite power supply from the 4kV and 6.9kV busses. Therefore, this manner of utilizing the SAT lockout is not outside the reference bounds of the design for the SAT nor is it inconsistent with analyses or descriptions in the UFSAR. The proposed activity involves the enabling of an additional feature so that the power supply to a 4kV ES bus will be controlled in the same manner as at present – that is, an unreliable power supply to the 4kV bus will be disconnected. Therefore, the proposed activity does not involve a test or experiment not described in the UFSAR, where an SSC is

utilized or controlled in a manner that is outside the reference bounds of the design for that SSC or is inconsistent with analysis or description in the UFSAR.

The loss-of-phase protection and alarm scheme does not affect the times or functions of the existing required degraded or under-voltage protective relay systems or single auxiliary transformer operation that are described in the Technical Specifications. Existing SAT protection features are not addressed in the Technical Specifications.

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**Title:** MU-P-1C Performance Requirement Revision

**Year Implemented:** 2017

**Evaluation Number:** TMI-17-E-0002; EC 621381

**Description of Activity:**

Revise makeup pump (MU-P-1C) minimum performance requirement in accordance with C-1101-211-E540-091 "TMI-1 IST Acceptance Criteria for HPI Pumps" Rev 1C.

**Reason for Activity:**

OP-TM-211-211 "HPI Test" completed in 1R22 showed MU-P-1C performance was below the acceptance criteria (IR 4055126). The revised acceptance criteria reduces conservative margin.

**Effect of Activity:**

This design change package demonstrates that MU-P-1C performance meets or exceeds all design requirements. There is no impact on plant operations. The revised acceptance criteria are based on the existing ECCs analysis, and HPI performance requirements described in the UFSAR. There is no change to safety analysis.

**Summary of Conclusion for the Activity's 50.59 Review:**

The modified performance requirement for MU-P-1C ensures that the pump can deliver the flow assumed in the safety analysis. Based on the attached evaluation this design change can be completed without prior NRC approval.

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## **Procedure Changes**

There were no 10 CFR 50.59 required procedure changes for this reporting period.

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End of 10 CFR 50.59 Revision Report

**EXELON CORPORATION  
THREE MILE ISLAND  
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**BIENNIAL COMMITMENT REVISION REPORT  
JANUARY 1, 2016 THROUGH DECEMBER 31, 2017**

Letter Source: GL 83-28 ITEM 4.2.2: Trending of reactor trip breaker parameters to forecast

Exelon Tracking No.: 1122355-05/1985T0042

Nature of Commitment: GPUN Committed internally to revise procedures to incorporate data gathering requirements needed for the B&WOG reactor trip breaker reliability program.

**Summary of Justification:**

The original commitment to participate in the B&WOG reliability program was for two years and was for approval for a previous breaker design. TMI has satisfied this commitment and therefore it can be closed. Amendment No. 255 (August 2005) changed the frequency of the RPS surveillance tests from monthly to quarterly. In addition, Amendment No. 274 (January 2011) updated the TMI Technical Specification to remove the surveillance test interval frequencies and place them in the licensee controlled Surveillance Frequency Control Program (SFCP).

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Letter Source: IEB 88-04: Potential safety related pump loss

Exelon Tracking No: 1122355-47/1989T0012

Nature of Commitment: GPUN committed to the NRC:

- 1) The DHR pump minimum recirculation capacity was adequate to ensure that pump operability was not affected by minimum recirculation operation.
- 2) Additional vibration readings were incorporated into the surveillance test procedures.
- 3) The revision by June 1989 of procedures to provide additional guidance that will apply when higher vibration levels are encountered at blade passing frequency while operating or testing the DHR pumps at minimum recirculation flow rate.
- 4) The completion of steps to minimize the time that DHR pumps are operated at minimum flow during testing.
- 5) The notification of the NRC by letter of any additional actions that may be required in the future. Also, to provide the justification for continued operation as requested by IEB 88-04.

**Summary of Justification:**

The 1<sup>st</sup> commitment is unchanged and has been addressed by analysis under RCMT 1122355-34, formerly 1988T0078.

The remaining 4 commitment changes/deletions are addressed individually below:

- 2) Safety Evaluation, SE-945100-196, provided the basis for revising UFSAR section 6.1.2.1.b, which deletes the description concerning minimizing DH pump operation at minimum recirculation conditions and how this operation is minimized. Pump testing has shown that minimum recirculation operation is not a short-term concern. The DH pump can operate continually at flow rates below that which is obtained with the bypass line only. (TR-9640, Rev. 0 Hydraulic Evaluation by Ingersoll Dresser Pump Co. of Decay Heat Pumps IDP Model 8HN194, March 12, 1997, provides the technical basis for this conclusion.) Thus, it was demonstrated that the DH Pumps can operate satisfactorily over its entire range of flow while also having vibration levels at all flows remain satisfactory. Therefore, only vibration readings as required by the IST Program are required to be taken: This is documented in the surveillance test procedures OP-TM-212-201, OP-TM-212-202, OP-TM-212-203, OP-TM-212-204, OP-TM-212-205, OP-TM-212-206, OP-TM-212-213, and OP-TM-202-214.
- 3) Safety Evaluation, SE-945100-196, provided the basis for revising UFSAR section 6.1.2.1.b, which deletes the description concerning minimizing DH pump operation at minimum recirculation conditions and how this operation is minimized. Pump testing has shown that minimum recirculation operation is not a short-term concern. The DH pump can operate continually at flow rates below that which is obtained with the bypass line only. (TR-9640, Rev. 0 Hydraulic Evaluation by Ingersoll Dresser Pump Co. of Decay Heat Pumps IDP Model 8HN194, March 12, 1997, provides the technical basis for this conclusion.) Thus, it was demonstrated that the DH Pumps can operate satisfactorily over its entire range of flow while also having vibration levels at all flows remain satisfactory. Therefore, additional guidance is not needed when operating or testing the DHR Pumps at minimum recirculation flow rate.
- 4) Safety Evaluation, SE-945100-196, provided the basis for revising UFSAR section 6.1.2.1.b, which deletes the description concerning minimizing DH pump operation at minimum recirculation conditions and how this operation is minimized. Pump testing has shown that minimum recirculation operation is not a short-term concern. The DH pump can operate continually at flow rates below that which is obtained with the bypass line only. (TR-9640, Rev. 0 Hydraulic Evaluation by Ingersoll Dresser Pump Co. of Decay Heat Pumps IDP Model 8HN194, March 12, 1997, provides the technical basis for this conclusion.) Thus, it was demonstrated that the DH Pumps can operate satisfactorily over its entire range of flow while also having vibration levels at all flows remain satisfactory. Therefore, procedural steps to minimize the time that DHR Pumps are operated at minimum flow during testing are not applicable.
- 5) The changes described above occurred in 1997, well beyond the two-year time-frame that IEB 88-04 states that our "actions in response to this bulletin should be documented and maintained at the plant site for a minimum of two (2) years." Thus, these changes do not require notification by letter. All changes described above do not impact operability of the DHR Pumps and therefore the intent of IEB 88-04 is not affected by these changes.

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Letter Source: 311-90-2127 TMI Unit 1 Response to Generic Letter 90-03  
(RELAXATION OF STAFF POSITION IN GENERIC LETTER 83-28, ITEM 2.2  
PART 2 "VENDOR INTERFACE FOR SAFETY-RELATED COMPONENTS")

Exelon Tracking No: 1122355-07/1990T0043  
1122355-08/1985T0060  
1122355-56/1985T0062

Nature of Commitment: In response to GL 90-03 Item 2, GPUN described how an adequate vendor interface program for TMI-1 was being maintained which included periodic contact with vendors of key safety related components (beyond those provided by the NSSS supplier).

Summary of Justification:

The policy to periodically contact vendors of safety related equipment to determine if there is new product information relevant to the installed plant equipment will be eliminated. This change will be implemented by a revision of CC-AA-204 (CONTROL OF VENDOR EQUIPMENT MANUALS). The revision of the commitment does not affect 6170-QAP-7207.09 "QA Evaluation of Suppliers".

The vendor "re-contact" program has been implemented for more than 25 years and has not proven to be an effective use of resources. From its inception the program was understood to be one method among many which serve to ensure the reliability of plant equipment. This program was intended to provide a qualitative improvement in reliability by enforcing regular communications with vendors of key safety related components.

Significant resources are required to implement the program. In the last six years, 459 vendors have been contacted to determine if there is new information which would be relevant to the reliability of key TMI safety related components. For each contact the existing vendor guidance is compared to the latest guidance. Of the 459 contacts, evaluation of the differences identified 33 cases where the site vendor guidance document was updated. A large fraction of those changes were non-technical changes.

The communication of those technical changes is not dependent upon the vendor "re-contact" program. If a NQA vendor identifies a design or performance deficiency with NQA component, then the 10CFR21 notification process applies. Improvements in vendor guidance are typically normally available through web based applications.