



Exelon Generation®

Three Mile Island Unit 1  
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June 24, 2014  
TMI-14-095

10 CFR 50.73

U.S. Nuclear Regulatory Commission  
Attn: Document Control Desk  
Washington, D.C. 20555-0001

THREE MILE ISLAND NUCLEAR STATION, UNIT 1 (TMI-1)  
RENEWED FACILITY OPERATING LICENSE NO. DPR-50  
DOCKET NO. 50-289

SUBJECT: LICENSEE EVENT REPORT (LER) NO. 2014-001-00  
"Unfused DC Motor Control Circuits"

This report is submitted in accordance with 10 CFR 50.73(a)(2)(ii)(B). For additional information regarding this LER contact Mike Fitzwater, Sr. Regulatory Engineer, TMI Unit 1 Regulatory Assurance at (717) 948-8228.

There are no regulatory commitments contained in this LER.


Sincerely,

Mark Newcomer  
Plant Manager, Three Mile Island Unit 1  
Exelon Generation Co., LLC

MN/mdf

cc: TMI Senior Resident Inspector  
Administrator, Region I  
TMI-1 Senior Project Manager

JE22  
NRC

<b>NRC FORM 366</b> (01-2014)	<b>U.S. NUCLEAR REGULATORY COMMISSION</b>	<b>APPROVED BY OMB: NO. 3150-0104</b>	<b>EXPIRES: 01/31/2017</b>
		Estimated burden per response to comply with this mandatory collection request: 80 hours. Reported lessons learned are incorporated into the licensing process and fed back to industry. Send comments regarding burden estimate to the FOIA, Privacy and Information Collections Branch (T-5 F53), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by internet e-mail to Infocollects.Resource@nrc.gov, and to the Desk Officer, Office of Information and Regulatory Affairs, NEOB-10202, (3150-0104), Office of Management and Budget, Washington, DC 20503. If a means used to impose an information collection does not display a currently valid OMB control number, the NRC may not conduct or sponsor, and a person is not required to respond to, the information collection.	
<b>LICENSEE EVENT REPORT (LER)</b> (See Page 2 for required number of digits/characters for each block)			

<b>1. FACILITY NAME</b> Three Mile Island, Unit 1	<b>2. DOCKET NUMBER</b> 05000289	<b>3. PAGE</b> 1 OF 4
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**4. TITLE**  
 Unfused DC Motor Control Circuits

5. EVENT DATE			6. LER NUMBER			7. REPORT DATE			8. OTHER FACILITIES INVOLVED	
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REV NO.	MONTH	DAY	YEAR	FACILITY NAME	DOCKET NUMBER
04	25	2014	2014	001	00	06	24	14		05000
									FACILITY NAME	DOCKET NUMBER
										05000

<b>9. OPERATING MODE</b>	<b>11. THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check all that apply)</b>			
N	<input type="checkbox"/> 20.2201(b)	<input type="checkbox"/> 20.2203(a)(3)(i)	<input type="checkbox"/> 50.73(a)(2)(i)(C)	<input type="checkbox"/> 50.73(a)(2)(vii)
	<input type="checkbox"/> 20.2201(d)	<input type="checkbox"/> 20.2203(a)(3)(ii)	<input type="checkbox"/> 50.73(a)(2)(ii)(A)	<input type="checkbox"/> 50.73(a)(2)(viii)(A)
	<input type="checkbox"/> 20.2203(a)(1)	<input type="checkbox"/> 20.2203(a)(4)	<input checked="" type="checkbox"/> 50.73(a)(2)(ii)(B)	<input type="checkbox"/> 50.73(a)(2)(viii)(B)
	<input type="checkbox"/> 20.2203(a)(2)(i)	<input type="checkbox"/> 50.36(c)(1)(i)(A)	<input type="checkbox"/> 50.73(a)(2)(iii)	<input type="checkbox"/> 50.73(a)(2)(ix)(A)
100	<input type="checkbox"/> 20.2203(a)(2)(ii)	<input type="checkbox"/> 50.36(c)(1)(ii)(A)	<input type="checkbox"/> 50.73(a)(2)(iv)(A)	<input type="checkbox"/> 50.73(a)(2)(x)
	<input type="checkbox"/> 20.2203(a)(2)(iii)	<input type="checkbox"/> 50.36(c)(2)	<input type="checkbox"/> 50.73(a)(2)(v)(A)	<input type="checkbox"/> 73.71(a)(4)
	<input type="checkbox"/> 20.2203(a)(2)(iv)	<input type="checkbox"/> 50.46(a)(3)(ii)	<input type="checkbox"/> 50.73(a)(2)(v)(B)	<input type="checkbox"/> 73.71(a)(5)
	<input type="checkbox"/> 20.2203(a)(2)(v)	<input type="checkbox"/> 50.73(a)(2)(i)(A)	<input type="checkbox"/> 50.73(a)(2)(v)(C)	<input type="checkbox"/> OTHER
	<input type="checkbox"/> 20.2203(a)(2)(vi)	<input type="checkbox"/> 50.73(a)(2)(i)(B)	<input type="checkbox"/> 50.73(a)(2)(v)(D)	Specify in Abstract below or in NRC Form 366A

**12. LICENSEE CONTACT FOR THIS LER**

FACILITY NAME Michael Fitzwater, TMI Unit 1 Senior Regulatory Engineer	TELEPHONE NUMBER (Include Area Code) (717) 948-8228
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**13. COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT**

CAUSE	SYSTEM	COMPONENT	MANU-FACTURER	REPORTABLE TO EPIX	CAUSE	SYSTEM	COMPONENT	MANU-FACTURER	REPORTABLE TO EPIX

<b>14. SUPPLEMENTAL REPORT EXPECTED</b>	<b>15. EXPECTED SUBMISSION DATE</b>	
<input type="checkbox"/> YES (If yes, complete 15. EXPECTED SUBMISSION DATE) <input checked="" type="checkbox"/> NO		MONTH    DAY    YEAR

**ABSTRACT** (Limit to 1400 spaces, i.e., approximately 15 single-spaced typewritten lines)

On 04/25/14 while Three Mile Island Unit 1 (TMI-1) was operating at 100% power, a concern was identified by Engineering as a result of their review of an industry operating event (ENS 49490). It was identified that unprotected DC control circuits for non safety-related DC motors routed from the turbine building to other separate fire areas could potentially overheat from a postulated fire in the Cable Spreading Room/Relay Room which could affect control cables routed in the same cable trays and potentially affect equipment credited to achieve and maintain fire safe shutdown. The condition was initially reported in ENS 50059 and again in ENS 50108 as a result of the extent of condition review. The apparent cause of the event is failure to identify that full-voltage 250VDC control circuit fuses should have been installed. Corrective actions were completed to install fuses in the identified and affected control circuits.

The submittal of this LER constitutes reporting to the NRC in accordance with 10 CFR 50.73(a)(2)(ii)(B).



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Estimated burden per response to comply with this mandatory collection request: 80 hours. Reported lessons learned are incorporated into the licensing process and fed back to industry. Send comments regarding burden estimate to the FOIA, Privacy and Information Collections Branch (T-5 F53), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by internet e-mail to Infocollects.Resource@nrc.gov, and to the Desk Officer, Office of Information and Regulatory Affairs, NEOB-10202, (3150-0104), Office of Management and Budget, Washington, DC 20503. If a means used to impose an information collection does not display a currently valid OMB control number, the NRC may not conduct or sponsor, and a person is not required to respond to, the information collection.

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**NARRATIVE**

**A. EVENT DESCRIPTION**

Plant Conditions before the event:

Babcock & Wilcox – Pressurized Water Reactor – 2568 MWth Core Power  
 Date/Time: April 25, 2014  
 Power Level: 100%  
 Mode: Full Power Operations

Event:

On April 25, 2014, during an operating experience review of an event at South Texas Project, TMI-1 Design Engineering identified that a 250VDC full-voltage control circuit for the LO-P-6, Main Turbine Emergency Bearing Oil Pump (EBOP) motor was unfused. This was significant because the EBOP control circuit is routed in the same tray with fire safe shutdown control circuits. A postulated fire in the cable spreading room could cause failure of the EBOP control circuit, which in turn could cause failure of the control circuit for both instrument air compressors, which are part of the credited fire safe shutdown path for a fire in the cable spreading room. This was entered into the corrective action program, determined to be an unanalyzed condition, fire watches were established, and an Emergency Notification System (ENS) report was made to the NRC (ENS 50059 notification date of 04/25/14).

As part of extent of condition review, three other 250VDC full-voltage control circuits were also identified (GN-P-2, Generator Emergency Seal Oil Pump Motor; LO-P-9A, "A" Main Feedwater Pump Turbine Emergency Oil Pump Motor; LO-P-9B, "B" Main Feedwater Pump Turbine Emergency Oil Pump Motor) that could cause a loss of the credited fire safe shutdown path by also affecting both instrument air compressors. Another ENS report was made to the NRC (ENS 50108 notification date of 05/12/14).

**B. CAUSE OF EVENT**

The apparent cause of the event was that since original design and, subsequent reviews since then, Exelon failed to identify full-voltage 250VDC control circuit fuses that should have been installed in specific control circuits.

In the 1960s, General Electric (GE) designed the TMI-1 Main Turbine Emergency Bearing Oil Pump control circuit without fuses as their standard practice. In addition, TMI-1 was designed in the late 1960's prior to cable separation requirements and has fire safe shutdown circuits routed with non-fire safe shutdown circuits in the same cable tray. In 1980, in response to a significant fire at Browns Ferry Nuclear Plant, the NRC issued 10 CFR 50 Appendix R. The TMI-1 response to Appendix R was produced by TMI-1 Architect / Engineering firm Gilbert / Commonwealth (G/C) in the mid-1980's. In 1987, G/C failed to identify that certain 250VDC full-voltage control circuit fuses should have been installed. In 1996, General Public Utilities Nuclear Corporation (GPUN), TMI-1 operating company from 1982 to 1999, during review of safe shutdown analysis (SSA) open items, missed an opportunity to identify that the DC motor control circuit fuses should have been installed.

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Two contributing causes were identified in addition to the apparent cause. The design specification used was too lenient to provide adequate safety because it allowed non-safe shutdown control circuits to be routed together with safe shutdown control circuits. This made circuits required for fire safe shutdown vulnerable to mal-operation of non-safe shutdown circuits. This was one of the reasons the NRC issued Appendix R. This fact coupled with the owner oversight of the contractor performed work, failed to identify the need for full-voltage 250VDC control circuit fuses that should have been installed. The owner at the time did not have an owner's acceptance policy with the necessary rigor to review the externally generated report that could have identified the deficiencies.

**C. ANALYSIS / SAFETY SIGNIFICANCE**

This condition would not have adversely affected the ability to safely shutdown the plant and maintain it in a safe shutdown condition.

The relay room, which is the main area of concern for a potential fire, is protected by carbon dioxide suppression system as well as fire detection; additionally it has robust fire barriers. Therefore, considering the capability of fire detection, the fire suppression/barrier systems and fire brigade training and response, the potential relay room fire would be quickly detected and extinguished.

The other areas of concern, the Control Room, 1D 4KV switchgear and 1E 4KV switchgear all have fire detection and robust fire barriers.

The potential for a relay room fire that requires remote shutdown of the plant coupled with the loss of the normal instrument air compressors due to a secondary fire is considered unlikely. If remote shutdown were required coupled with a loss of instrument air there is defense in depth provided by the 2 hour back-up instrument air system. Additionally, there are proceduralized actions to cope with the loss of instrument air. The operators are trained and there are procedures to manually control Emergency Feedwater flow via valves EF-V-30 A-D and steam generator pressure via manual control of the Atmospheric dump valves MS-V-4A/B.

There were no actual consequences from this condition. Given a low probability of occurrence for a potential event, there is reasonable assurance that the health and safety of the public would have been maintained.

**D. CORRECTIVE ACTIONS**

Fuses were installed in the four identified 250VDC full-voltage control circuits.

**E. PREVIOUS OCCURENCES**

A review of INPO/WANO Operating Experience was conducted using the following search keywords: "unfused" and "250 VDC". This search turned up several plants that reported an Appendix R unanalyzed condition related to lack of DC circuit fuses in ammeter circuits in the last quarter of 2013 and the first quarter of 2014. Exelon IR 1595043, documented OPEX evaluation of unprotected direct current ammeters result in analyzed condition in which TMI responded that the ammeter circuit condition

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was not applicable to TMI-1. IR 1581135 documents OPEX evaluations addressing the Appendix R unanalyzed condition related to lack of fuses on DC motor control circuits identified at South Texas Project (STP). Review found newer plants, such as Byron and Braidwood had unfused DC circuits, but their non-safe shutdown circuits are routed in separate raceway and therefore do not have the issue. No new insights were found related to causal factors. Quad Cities is the only plant found in this OPEX review that had identified the issue in the late 1990s and addressed the extent of condition. Quad Cities did not identify the issue during original Appendix R implementation; they identified it in the late 1990's before TMI was part of Exelon fleet, as part of a large reconstitution effort. Quad Cities provided useful information on the corrective actions related to sizing of fuses to resolve the issue.

Previous Events	Previous Events Reviewed
Quad Cities 1990's IR 1581135-11	Quad Cities addressed this issue as part of safe shutdown analysis reconstitution.
South Texas Project 10/31/2013 IR 1581135	Same issue as TMI. Permanent fix yet to be determined.
Calvert Cliffs 03/10/2014 CR-2014-002667	Same issue as TMI. Permanent fix yet to be determined.
Ginna 03/13/2014 CR-2014-001346	Similar issue as TMI, except DC motor operated valve control circuits were unfused and safe shutdown adversely affected. Ginna is fixing the issue by adding fuses.
Nine Mile Point 2 05/08/2014 CR-2014-004630	Similar issue as TMI, except DC motor operated valve control circuits were unfused and safe shutdown adversely affected. NMP-2 is fixing the issue by adding fuses.

\* Energy Industry Identification System (EIIIS), System Identification (SI) and Component Function Identification (CFI) Codes are included in brackets, [SI/CFI] where applicable, as required by 10 CFR 50.73 (b)(2)(ii)(F).