

Designated Original

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U. S. Nuclear Regulatory Commission
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**SUSQUEHANNA STEAM ELECTRIC STATION
LICENSEE EVENT REPORT 50-387/2006-004-00
LICENSE NO. NPF-14
PLA-6095**

Docket No. 50-387

Attached is Licensee Event Report (LER) 50-387/2006-004-00. An invalid actuation of the Reactor Protection System (RPS) occurred during a planned transfer of RPS power supplies. Reactor Core Isolation Cooling (RCIC), High Pressure Coolant Injection (HPCI), and Primary Containment Isolation actuations also occurred in response to the scram. The actuation of RPS, RCIC, HPCI, and Primary Containment Isolation Systems were determined to be reportable under 10 CFR 50.73(a)(2)(iv)(A) as an unplanned actuation of systems that mitigate the consequences of significant events. This event resulted in no actual adverse consequences to the health and safety of the public.

PPL is conducting a formal root cause investigation into why a recently implemented design change failed to recognize the impact of a power supply transfer on the RPS logic. A supplement to this report will be submitted to provide the root cause and any additional corrective actions to prevent recurrence.

No commitments are associated with this LER.

Robert Saccone
Vice President – Nuclear Operations

Attachment

- cc: Mr. A. J. Blamey, Sr. Resident Inspector
Mr. S. J. Collins, Regional Administrator, Region I
Mr. R. R. Janati, DEP/BRP
Mr. R. Osborne, Allegheny Electric

*Rec'd DCD
1/19/07
JE22*

Estimated burden per response to comply with this mandatory collection request: 50 hours. Reported lessons learned are incorporated into the licensing process and fed back to industry. Send comments regarding burden estimate to the Records and FOIA/Privacy Service Branch (T-5 F52), U.S.Nuclear Regulatory Commission, Washington, DC 20555-0001, or by Internet e-mail to infocollects@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.

LICENSEE EVENT REPORT (LER)

(See reverse for required number of digits/characters for each block)

1. FACILITY NAME	Susquehanna Steam Electric Station Unit 1	2. DOCKET NUMBER	05000387	3. PAGE	1 OF 4
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4. TITLE Reactor Scram during transfer of RPS power supplies

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
6	15	2006	2006	004	00	8	10	2006	FACILITY NAME	DOCKET NUMBER

9. OPERATING MODE 1	11. THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check all that apply)
10. POWER LEVEL 100%	
	<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)(B) <input type="checkbox"/> 20.2203(a)(1) <input type="checkbox"/> 20.2203(a)(4) <input type="checkbox"/> 50.73(a)(2)(ii)(B) <input type="checkbox"/> 50.73(a)(2)(ix)(A) <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)(x) <input type="checkbox"/> 20.2203(a)(2)(ii) <input type="checkbox"/> 50.36(c)(1)(ii)(A) <input checked="" 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	TELEPHONE NUMBER (Include Area Code)
Dayne R. Brophy, Senior Engineer – Nuclear Regulatory Affairs	(570) 542-3365

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

14. SUPPLEMENTAL REPORT EXPECTED	15. EXPECTED SUBMISSION DATE						
<input checked="" type="checkbox"/> YES (If yes, complete 15. EXPECTED SUBMISSION DATE) <input type="checkbox"/> NO	<table border="1"> <tr> <th>MONTH</th> <th>DAY</th> <th>YEAR</th> </tr> <tr> <td>9</td> <td>29</td> <td>2006</td> </tr> </table>	MONTH	DAY	YEAR	9	29	2006
MONTH	DAY	YEAR					
9	29	2006					

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

On 6/15/2006 with Unit 1 in Mode 1 at 100% power, the Control Room completed preparations to transfer Division B of the Reactor Protection System (RPS) from its normal power supply to its alternate source. The transfer momentarily de-energizes that division of RPS and results in a half-scrum. During the 2006 Refuel Outage, a new Power Range Neutron Monitoring System (PRNMS) was installed. Because of differences in the original monitoring system logic and PRNMS logic, the transfer resulted in a full scram. The event was determined to be reportable under 10 CFR 50.72; reference ENS Notification EN #42642.

Following the automatic scram, the Unit 1 reactor water level decreased to ~-36". Reactor Core Isolation Cooling (RCIC) initiated and was within the instrumentation tolerance for the Level 2 setpoint of -38" to initiate High Pressure Coolant Injection (HPCI). Once reactor water level recovered, the normal feedwater system was utilized to maintain the normal operating level (+35"). Level 3 (+13") and Level 2 (-38") Primary Containment Isolation signals were received and all safety systems functioned as expected. The actuation of RPS, RCIC & HPCI systems and Primary Containment isolations are unplanned actuations of systems that are designed to mitigate the consequences of significant events and are reportable per 10 CFR 50.73(a)(2)(iv)(A).

This event resulted in no actual adverse consequences to the health and safety of the public.

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17. NARRATIVE (If more space is required, use additional copies of NRC Form 366A)

PLANT CONDITIONS AT TIME OF EVENT

Unit 1, Mode 1, 100%
Unit 2, Mode 1, 100%

BACKGROUND

The Reactor Protection System (RPS; EIIS Code: JC) contains two divisions, each with a normal and alternate power supply. A transfer of the RPS division power supply causes a momentary loss of power to the logic, resulting in a half scram. In addition, the RPS power supply also provides power to relays associated with the Mode switch position logic. A momentary loss of RPS power for a division results in indication that the Mode switch is no longer in RUN. With the reactor operating at greater than 14%, this also generates a half-scram signal based on the original APRM scram logic.

During the Spring 2006 Refueling Outage, a new Power Range Neutron Monitoring System (PRNMS; EIIS Code: I) was installed that provides input to the Average Power Range Monitors (APRM; EIIS Code: I). The modification included a change in the APRM logic from a divisionalized one-out-of-two taken twice logic to a two-out-of-four voter logic input to RPS.

EVENT DESCRIPTION

On 6/15/2006, Susquehanna Unit 1 was in Mode 1, operating at 100% power. Operations personnel had completed preparations in accordance with Procedure OP-158-001 to transfer Division B of RPS from its normal power supply to its alternate power supply to perform scheduled maintenance. These preparations involve initiating systems and aligning components to prevent spurious actuations caused by the momentary loss of power during the transfer. This was also the first time a RPS power supply had been transferred since the Spring 2006 Refuel Outage when PRNMS was installed.

At 0300 hours on 6/15/06, Operators transferred Division B RPS power supplies. The momentary loss of power to Division B RPS de-energized relays associated with the 'Mode Switch In Run' logic; this logic inputs to APRM12 and APRM14. With the reactor power at greater than 14% both APRMs tripped when they received a 'Mode Switch Not In Run' signal. With two-out-of-four APRMs tripped, it resulted in a full RPS actuation/automatic scram.

All control rods (EIIS Code: AA) fully inserted. Reactor water level dropped to approximately -36". Both Reactor Core Isolation Cooling (RCIC; EIIS Code: BN) and High Pressure Coolant Injection (HPCI; EIIS Code: BJ) initiated and injected as designed. Note, it was later confirmed that -36" was within the instrumentation tolerance for the Level 2 setpoint of -38" to be received. The resulting over-feed condition resulted in a level 8 (+54") trip of the steam driven pumps, RCIC, HPCI, and Feedwater (EIIS Code: SJ). Feedwater Pump 'A' was restored from the level 8 trip and provided normal water level control.

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The scram and subsequent decrease in reactor water level resulted in receiving the level 3 (+13") and level 2 (-38") containment isolation and system actuation signals (EISS Code: JM). Plant response was as anticipated, with some systems and components in other than their normal alignments as part of the procedural requirements for the power supply transfer under OP-158-001. This did not complicate Control Room operator response.

The Reactor Recirculation Pumps (EISS Code: AD) tripped as designed on the receipt of a level 2 signal. The B Recirculation Pump was subsequently restarted to prevent thermal stratification of the reactor vessel coolant.

Due to exhaust steam from RCIC and HPCI, Suppression Pool temperatures exceeded 90 degrees requiring entry into Emergency Operating Procedures. The 'A' Loop of Residual Heat Removal (RHR; EISS Code: BO) was placed in Suppression Pool Cooling to restore pool temperature below 90 degrees.

A post scram review of PRMNS confirmed that the system functioned properly and the scram was not a result of a component malfunction or human error.

This event resulted in no actual adverse consequences to the health and safety of the public.

CAUSE OF THE EVENT

During the development of the PRMNS modification, the failure mode of the Mode switch logic input was not recognized. In addition, post modification testing did not identify this latent design deficiency. Further development of actual root causes are in progress with input from the organizations, contractors, and vendors involved in the modification. This LER will be supplemented when the final evaluation is completed.

ANALYSIS / SAFETY SIGNIFICANCE

Actual Consequences

The invalid signal caused the trip of two APRMs resulting in a reactor scram. All control rods inserted and safety systems functioned as expected. The health and safety of the public was not affected.

Potential Consequences

A scram is an Initiating Event in the Susquehanna Probabilistic Risk Assessment (PRA). A scram with subsequent equipment failures and/or human errors can lead to core damage. The Susquehanna PRA identifies that a scram signal with an additional failure to scram (ATWS) is a significant contributor to the total core damage frequency. This accident sequence in the PRA assumes that the Main Turbine/Main Generator has tripped concurrent with the scram signal. In the event described in this LER, the main turbine did not trip until the main generator tripped on primary anti-motoring. The anti-motoring trip occurs because the steam flow from the reactor decreased rapidly after the control rods fully inserted. If an ATWS occurred during this event, the main turbine/

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main generator would not have tripped, and the reactor core would continue to have adequate core cooling via Feedwater. The main turbine would have continued to operate, and the main condenser would have remained as the heat sink until Operations shut down the reactor per Emergency Operating Procedures. The PRA identifies some accident sequences that initiate with a successful scram; however, these accident sequences are an insignificant contributor to the total core damage frequency. Thus, the potential of this event to cause core damage and, hence, impact the health and safety of the public was not significant.

CORRECTIVE ACTIONS

Completed Actions

- 1) PPL performed an extent of condition review of the PRNMS modification to verify that no similar design deficiencies existed that could result in unplanned actuations during a RPS power interruption.
- 2) An additional modification was performed to re-configure the mode switch relay contacts to remove the full scram vulnerability. This included additional post-modification testing to insure proper response.
- 3) Procedural changes were made to reduce the potential of a full RPS actuation.

Planned Actions

- 1) Complete a Root Cause Analysis to evaluate the PPL Design Process. Determine the root cause(s) and implement the needed corrective measures to prevent recurrence.
- 2) Review and make the appropriate changes in the design of the Unit 2 PRMNS modification scheduled to be implemented during the Spring 2007 Refuel Outage.

ADDITIONAL INFORMATION

None

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ReplyRequested: No
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Junk Mail Handling Evaluation Results

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