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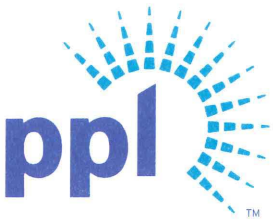

AUG 24 2012

U. S. Nuclear Regulatory Commission
Attn: Document Control Desk
Mail Stop OP1-17
Washington, DC 20555-0001

**SUSQUEHANNA STEAM ELECTRIC STATION**
**LICENSEE EVENT REPORT 50-387/2012-008-00**
**LICENSE NO. NPF-14**
**PLA-6907** **Docket No 50-387**

Attached is Licensee Event Report (LER) 50-387/2012-008-00. The event involved loss of one of two offsite power sources, resulted in automatic actuation of containment isolation valves in more than one system, and is being reported in accordance with 10 CFR 50.73(a)(2)(iv)(A).

There were no actual consequences to the health and safety of the public as a result of this event.

No regulatory commitments are associated with this LER.

J. M. Helsel
WHBishop for J. M. Helsel

Attachment: LER 50-387/2012-008-00

Copy: NRC Region I
Mr. P. W. Finney, NRC Sr. Resident Inspector
Ms. C. J. Sanders, NRC Project Manager
Mr. L. J. Winker, DEP/BRP

NRC FORM 366 (10-2010) U.S. NUCLEAR REGULATORY COMMISSION

APPROVED BY OMB: NO. 3150-0104 EXPIRES:10/31/2013

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 Section (T-5 F53), U. S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by internet e-mail to infocollects.resources@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)

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4. TITLE **LOSS OF ONE OF TWO OFFSITE POWER SOURCES**

| 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 |
| | | | | | | | | | Susquehanna Steam Electric Station Unit 2 | 05000388 |
| 06 | 28 | 2012 | 2012 | - 008 | - 00 | 08 | 24 | 2012 | FACILITY NAME | DOCKET NUMBER 05000 |

**9. OPERATING MODE**

4

**10. POWER LEVEL**

000%

**11. THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §:** *(Check all that apply)*

- ☐ 20.2201(b)
- ☐ 20.2201(d)
- ☐ 20.2203(a)(1)
- ☐ 20.2203(a)(2)(i)
- ☐ 20.2203(a)(2)(ii)
- ☐ 20.2203(a)(2)(iii)
- ☐ 20.2203(a)(2)(iv)
- ☐ 20.2203(a)(2)(v)
- ☐ 20.2203(a)(2)(vi)
- ☐ 20.2203(a)(3)(i)
- ☐ 20.2203(a)(3)(ii)
- ☐ 20.2203(a)(4)
- ☐ 50.36(c)(1)(i)(A)
- ☐ 50.36(c)(1)(ii)(A)
- ☐ 50.36(c)(2)
- ☐ 50.46(a)(3)(ii)
- ☐ 50.73(a)(2)(i)(A)
- ☐ 50.73(a)(2)(i)(B)
- ☐ 50.73(a)(2)(i)(C)
- ☐ 50.73(a)(2)(ii)(A)
- ☐ 50.73(a)(2)(ii)(B)
- ☐ 50.73(a)(2)(iii)
- ☒ 50.73(a)(2)(iv)(A)
- ☐ 50.73(a)(2)(v)(A)
- ☐ 50.73(a)(2)(v)(B)
- ☐ 50.73(a)(2)(v)(C)
- ☐ 50.73(a)(2)(v)(D)
- ☐ 50.73(a)(2)(vii)
- ☐ 50.73(a)(2)(viii)(A)
- ☐ 50.73(a)(2)(viii)(B)
- ☐ 50.73(a)(2)(ix)(A)
- ☐ 50.73(a)(2)(x)
- ☐ 73.71(a)(4)
- ☐ 73.71(a)(5)
- ☐ OTHER

Specify in Abstract below or in NRC Form 366A

**12. LICENSEE CONTACT FOR THIS LER**

| FACILITY NAME | TELEPHONE NUMER *(Include Area Code)* |
|---|---|
| C. E. Manges, Jr., Senior Engineer - Nuclear Regulatory Affairs | (570) 542-3089 |

**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 | EA | IS | W120 | Yes | | | | | |

**14. SUPPLEMENTAL REPORT EXPECTED**

☐ YES *(If yes, complete 15. EXPECTED SUBMISSION DATE)* ☒ NO

**15. EXPECTED SUBMISSION DATE**

| MONTH | DAY | YEAR |
|---|---|---|
| | | |

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


On June 28, 2012, at 1353, Susquehanna Steam Electric Station experienced a loss of power from one of two offsite power sources when Startup Transformer 20 (T-20) shutdown automatically. All Engineered Safeguards System (ESS) electrical busses fed by T-20 automatically transferred to the other offsite power source, Startup Transformer 10 (T-10). Additionally, Startup Bus 20, which is normally fed from T-20, automatically transferred to T-10. Multiple system containment isolation valves on both Units 1 and 2 closed as a result of the electrical transient. Operators were able to reset and restore each system. On Unit 1, Residual Heat Removal (RHR) shutdown cooling ceased operation during the transient. Shutdown cooling was restored within one hour by control room operators in accordance with off-normal procedures. Unit 2 remained at 100% power throughout the event. At the time of the event, Unit 1 was in Mode 4, Cold Shutdown and Unit 2 was operating in Mode 1 at approximately 100% power.

This event was an unplanned actuation of systems that mitigate the consequences of significant events and was reported as an 8 hour report in EN 48055 in accordance with 10 CFR 50.72(b)(3)(iv)(A). The event is also reportable as an LER in accordance with 10 CFR 50.73(a)(2)(iv)(A).

The direct cause of the event was an open ammeter switch contact causing a phase current imbalance that was detected by the protective relaying and initiated transformer lockout. The root causes of the event included: 1) foreign material from the manufacturing process that prevented the ammeter switch contact from closing and 2) design of the protective relay scheme that included a shared metering function.

Key corrective actions that are planned include: 1) an interim compensatory action to ensure that switches within the extent of condition are not operated, 2) completing an engineering evaluation to select the best approach to correcting the condition, and 3) implementing the approach selected based on the engineering evaluation.

There were no adverse consequences to the health and safety of the public as a result of this event. This event is being reported under 10 CFR 50.73(a)(2)(iv)(A) as an unplanned actuation of systems that mitigate the consequences of significant events.

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NARRATIVE

EVENT DESCRIPTION

On June 28, 2012 at 1353, an unbalanced phase current was detected and actuated protective relaying and de-energized Start-up Transformer 20 (T-20) [EIIS Code: EA]. The immediate consequence from this event was loss of one of the two offsite power sources for both Units. All Engineered Safeguards System (ESS) electrical busses fed by T-20 automatically transferred to the other offsite power source, Startup Transformer 10 (T-10) [EIIS Code: EA]. Additionally, Startup Bus 20, which is normally fed from T-20, automatically transferred to T-10. Multiple system containment isolation valves [EIIS Code: JM] on both Units 1 and 2 closed as a result of the electrical transient. Operators were able to reset and restore each system. On Unit 1, Residual Heat Removal (RHR) shutdown cooling [EIIS Code: BO] ceased operation during the transient. Shutdown cooling was restored in less than one hour by control room operators in accordance with off-normal procedures. Unit 2 remained at 100% power throughout the event. At the time of the event, Unit 1 was in Mode 4, Cold Shutdown and Unit 2 was operating in Mode 1 at approximately 100% power.

Compensatory actions in response to an industry event at the Byron Station were being performed immediately prior to the event. This included recording phase currents at the 13.8kV Switchgear (0A104) using Ammeter Switch AS-0A10401 [EIIS Code: EA]. As reported by an operator, shortly after moving the ammeter switch from the 'B' position to the 'A' position T-20 tripped. Initial investigation identified an unexpected open contact on the ammeter switch while in the 'A' position.

This event was an unplanned actuation of systems that mitigate the consequences of significant events and was reported as an 8 hour report in EN 48055 in accordance with 10 CFR 50.72(b)(3)(iv)(A). The event is also reportable as an LER in accordance with 10 CFR 50.73(a)(2)(iv)(A).

Background Information

The lock out condition that led to the loss of T-20 was determined to be caused by the malfunction of a Westinghouse Type W2 ammeter switch AS-0A10401 (Style Number 3669A05G01 rated for 600V, 20A continuous operation). The switch malfunction was specifically found to be an 'A' phase contact failing to close. The ammeter switch's function is to "switch" from phase-to-phase, by manipulating the control knob, to allow an ammeter to read the current flow through the selected phase. The metering devices and the ground differential protective relay device for the switch were found to utilize the same current transformer circuit.

Investigation by an independent lab concluded that the cause of the open contact was a result of surface contamination which was visually similar to the insulating material of the switch under magnification. Discussion with switch manufacturer indicated that trimming of the insulating material during manufacturing occasionally produces glass polyester fibers and dust.

Failure Analysis of the Ammeter Switch

An independent lab was contracted to perform a failure analysis on the Westinghouse W2 ammeter switch that malfunctioned on June 28, 2012. The failure analysis included 1) visual examination, 2) electrical & functional checks, and 3) disassembly and analysis of the ammeter switch. The failure analysis concluded the following:

- The switch was in good physical condition with no evidence of any exterior thermal, electrical, or mechanical damage. The switch was sealed and not susceptible to foreign material intrusion after manufacture.
- The open circuit condition witnessed at Susquehanna was reproduced at the lab. Electrical testing revealed that 'A' phase contact E7-F7 was responsible for the open circuit. Contact resistance measurement revealed that the contact was not completely open, but rather had a large resistance.
- No mechanical deficiencies were noted during the disassembly process.
- All stationary contacts had some minor black surface contamination, but no pitting was found. The E7 contact had some white surface contamination adhered to both stationary and rotor portions of the contacts. A comparison of the white surface contamination and a particle of the switch frame material (glass polyester insulation) was made under magnification and determined to be visually similar.

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NARRATIVE

## CAUSE OF THE EVENT

The direct cause of the event was an open ammeter switch contact causing a phase current imbalance that was detected by the protective relaying and initiated transformer lockout.

The root causes of the event were as follows:

- Foreign material from the manufacturing process that prevented the ammeter switch contact from closing
- Design of protective relay scheme included shared metering function

## ANALYSIS/SAFETY SIGNIFICANCE

Actual Consequences:

The immediate consequence from the switch failure was loss of one of the two offsite power sources for both Units. At the time of the event, Unit 1 was in Mode 4, Cold Shutdown and Unit 2 was operating in Mode 1 at approximately 100% power. A review of the plant response to the event concluded that all automatic load shedding, bus transfers, and equipment response occurred as expected.

A consequence of the event was the loss of normal RHR shutdown cooling on Unit 1. Unit 1 was operating in Mode 4 at the time of the event with shutdown cooling provided by the 1B RHR pump and 1B RHR loop heat exchanger. Loss of T-20 resulted in undervoltage load shedding on 4kv ESS bus 1B that included trip of the operating 1B RHR pump. Review of data showed shutdown cooling was restored using the 1D RHR pump on June 28, 2012 at 14:26. As a result of the 32 minute loss of decay heat removal, 1B heat exchanger inlet temperature increased from 105.7 degrees F to 111.2 degrees F, a change of 5.5 degrees F. The shutdown risk assessment report for June 28, 2012 identified the Unit 1 time to 200 degrees F was 2.5 hours. The increase in coolant temperature did not challenge fuel cladding integrity as the resulting temperatures were within normal operating range for Mode 4.

As a result of the loss of T-20, the Security electrical system experienced an electrical transient. At the time of the event, battery charger 0D584 was out of service for maintenance and inverter 0D585 was on bypass and was not a buffer to the electrical transient caused by the loss of T-20. As a result, a number of security components such as card readers were affected by the transient.

Potential Consequences:

T-20 is one of two sources of offsite power supply to Susquehanna Units 1 and 2. Loss of T-20 increases the frequency for a loss of offsite power initiating event. The PRA model baseline risk analysis identifies that a Loss of Offsite Power is the dominant initiating event for the station. For a unit operating in Modes 1, 2, or 3, the potential consequence of T-20 unavailability is an increase in core damage frequency and large early release frequency in the event of a Loss of Offsite power.

The increase in risk with T-20 unavailable was evaluated using the EOOS risk monitor software (no random maintenance model) and conservatively assumed the 72 hour LCO 3.8.1 completion time. The increase in risk to Unit 2, which was operating in Mode 1, was determined to be less than the NRC IMC 609 Appendix K Green/White Threshold of less than 1E-06 ICDP and less than 1E-07 ILERP.

Unit 1 was operating in Mode 4, Cold Shutdown, at the time of the event. Evaluation of the five key shutdown safety functions by the OCC risk analyst using the EOOS risk monitor identified a change in risk level from Green to Yellow in the overall plant risk and in the Electrical Systems key safety function. The change in risk level reflected the reduction in defense in depth of available AC power supply sources for mitigating equipment.

# LICENSEE EVENT REPORT (LER)
# CONTINUATION SHEET

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**NARRATIVE**

## CORRECTIVE ACTIONS

Key corrective actions include:

1. As an interim compensatory measure, controls will be put in place to ensure that switches identified as being within the extent of condition are not operated.
2. An engineering evaluation will be completed to select the best approach to correcting the condition. The evaluation will determine if testing and/or a preventive maintenance activity could resolve the problem, if a replacement switch is available that is not prone to the same failure, and select a design change to ensure that an ammeter switch failure does not actuate the protective relay function.
3. The approach selected based on the engineering evaluation will be implemented.

## PREVIOUS SIMILAR EVENTS

None