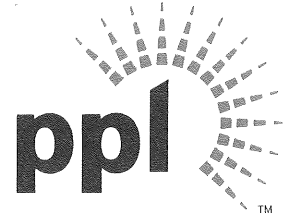


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MAY 23 2012

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

**SUSQUEHANNA STEAM ELECTRIC STATION
LICENSEE EVENT REPORT 50-387/2012-001-00
LICENSE NO. NPF-14
PLA-6857**

Docket No 50-387

Attached is Licensee Event Report (LER) 50-387/2012-001-00. The event involved both control structure chillers being inoperable at the same time resulting in a condition that could have prevented the fulfillment of a safety function and is being reported in accordance with 10 CFR 50.73(a)(2)(v). The condition is also reportable in accordance with 10 CFR 50.73(a)(2)(i)(B) as a condition prohibited by Technical Specifications.

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.

A handwritten signature in black ink, appearing to read "Jeffrey M. Helsel", is written over a large, faint circular watermark or stamp.

J. M. Helsel

Attachment: LER 50-387/2012-001-00

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

NRC FORM 366 (10-2010)	U.S. NUCLEAR REGULATORY COMMISSION <h2 style="margin: 0;">LICENSEE EVENT REPORT (LER)</h2> <p style="margin: 0;">(See reverse for required number of digits/characters for each block)</p>	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.
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1. FACILITY NAME Susquehanna Steam Electric Station Unit 1	2. DOCKET NUMBER 05000387	3. PAGE 1 OF 4
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4. TITLE
Both Control Structure Chillers Inoperable

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
02	16	2012	2012	- 001	- 00	05	23	2012	Susquehanna Steam Electric Station Unit 2	05000388
									FACILITY NAME	DOCKET NUMBER
										05000

9. OPERATING MODE 1	11. THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: <i>(Check all that apply)</i>			
10. POWER LEVEL 99%	<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 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)
	<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 checked="" type="checkbox"/> 50.73(a)(2)(i)(B)	<input checked="" 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 C. E. Manges, Jr., Senior Engineer - Nuclear Regulatory Affairs	TELEPHONE NUMER <i>(Include Area Code)</i> (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
E	KM	CON	C150	Yes					

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

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

On February 22, 2012 at approximately 1500, a linkage connector on the "B" Control Structure (CS) chiller that connects the compressor guide vanes to the guide vane motor was found broken. As a result, Operations declared "B" CS chiller inoperable and entered the appropriate Technical Specifications. On March 27, follow-up investigation into the guide vane failure determined that "B" CS chiller failed while the "A" CS chiller was out-of-service for maintenance. Consequently, both CS chillers were inoperable simultaneously.

The direct cause of the connector failure was cyclic fatigue. The apparent cause was cyclic fatigue failure initiated / accelerated by corrosion of the ball-joint connector.

The broken ball-joint connectors on the "B" CS chiller were replaced. Other key corrective actions that will be completed include: replacing the mechanical ball-joint connectors on the guide vane linkage on other applicable chillers, including replacement of the ball-joint connectors on the chiller guide vane linkage as a preventive maintenance activity for the "B" CS chiller and other applicable chillers, and completing a root cause analysis on chiller reliability.

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)(v) as a condition that could have prevented the fulfillment of a safety function and 10 CFR 50.73(a)(2)(i)(B) as a condition prohibited by Technical Specifications.

LICENSEE EVENT REPORT (LER) CONTINUATION SHEET

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Susquehanna Steam Electric Station Unit 1	05000387	YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	2 OF 4
		2012	- 001	- 00	

NARRATIVEEVENT DESCRIPTION

On February 22, 2012 at approximately 1500, a linkage connector on the "B" Control Structure (CS) chiller [EIS Code: KM] that connects the compressor guide vanes to the guide vane motor was found broken. The guide vanes operate as a variable inlet valve to the chiller compressor regulating compressor load. The broken linkage connector prevented proper load control of the "B" CS chiller. Operations declared "B" CS chiller inoperable and entered the appropriate Technical Specifications.

On March 27, follow-up investigation into the guide vane failure determined that the "B" CS chiller failed while the "A" CS chiller was out-of-service for maintenance. Consequently, both CS chillers were inoperable simultaneously resulting in a condition that could have prevented the fulfillment of a safety function and a required report in accordance with 10 CFR 50.73(a)(2)(v). The condition also resulted in a condition prohibited by Technical Specifications and is reportable in accordance with 10 CFR 50.73(a)(2)(i)(B).

Sequence of Events:

The following is a summary of the sequence of events related to the reportable condition:

- The "A" CS chiller was out-of-service from February 9, 2012 to February 18, 2012 to repair a refrigerant leak.
- At 1225 on February 18, 2012, Operations placed the "A" CS chiller in operation and placed "B" CS chiller in Standby.
- At 1555 on February 18, 2012, Operations declared the "A" chiller operable.
- At approximately 1500 on February 22, 2012, electricians were performing refrigerant leak checks at "B" CS chiller when they found the control linkage between the guide vane motor and guide vanes broken. The electricians promptly notified their supervision and Operations.
- At 1545 on February 22, 2012, Operations declared the "B" CS chiller inoperable and entered the appropriate Technical Specifications.
- At 0222 on February 23, 2012, electricians replaced both connectors on the guide vane linkage of the "B" CS chiller.
- At 0448 on February 23, 2012, Operations placed the "B" CS chiller in operation in accordance with the applicable procedure and chiller operation was satisfactory.
- At 0902 on February 23, 2012, Operations declared the "B" CS chiller operable and exited the applicable Technical Specifications.
- On March 27, 2012, Engineering reviewed the current traces of the "B" CS chiller and concluded that the guide vane linkage failed at approximately 1500 on February 16, 2012. Based on this conclusion, it was determined that both CS chillers were simultaneously inoperable for approximately 49 hours (from approximately 1500 on February 16, 2012 to 1555 on February 18, 2012 when the "A" CS chiller was returned to service and declared operable).

Background Information

The chiller guide vane assembly consists of a mechanical linkage between the guide vane motor and guide vanes. A connecting rod joins the rotary arm of the guide vane motor to the rotary arm of the chiller guide vanes. This connecting rod is secured to each rotary arm with a ball-joint connector. The ball-joint connector on the guide vanes of the "B" CS chiller failed during this event.

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NARRATIVEFailure Analysis

The failed ball-joint connector (guide vane end) was removed and sent to the Hazleton Chemistry Lab for material analysis. The opposite un-failed ball-joint connector (guide vane motor end) was also sent to the Lab. The Materials Lab Report noted the following:

- The connector failure was due to cyclic fatigue. No pre-existing defect was found that acted as an initiator for the fatigue cracking.
- Corrosion deposits observed on the bolt indicate the ball-and-socket is not as free to move, binding up, and transferring higher than desired loads to the narrow neck region of the bolt.
- The fatigue failure is not fabrication related.
- The unbroken connector also showed a small crack in the same area as the broken connector. The unbroken connector was also in the process of failing by fatigue.
- It is likely that other ball-joint connectors are experiencing the same failure mechanism.

Two observations were made regarding the ball-joint connectors on the "B" CS chiller relative to this event:

- The broken ball-joint connector was painted with light green paint typical of Carrier chillers. Hence, it is very likely the ball-joint connectors on the "B" CS chiller were never replaced and part of the original equipment.

With regard to the corrosion deposits observed on the ball-and-socket portion of the connector, the corrosion limited the free movement of the connector causing mechanical binding of the guide vane linkage. In turn, the binding of the guide vane linkage transferred higher than desired loads and stresses to the narrow neck region of the bolt initiating / accelerating the fatigue failure.

A chiller preventive maintenance (PM) review was performed and determined the ball-joint connectors are not currently replaced on any PM frequency. Hence, one of the primary causes of the failure was simply due to the age of the connector. The failed connector on the "B" CS chiller had been in-service for over 30 years contributing to the buildup of corrosion and subsequent fatigue failure over this service period.

CAUSE OF THE EVENT

The direct cause of the ball-joint connector failure was cyclic fatigue.

The apparent cause of the failure was determined to be cyclic fatigue initiated /accelerated by corrosion of the ball-joint connector.

ANALYSIS/SAFETY SIGNIFICANCEActual Consequences:

The chiller guide vanes regulate chiller load. As chiller load increases/decreases, the guide vanes open/close to maintain the chilled water outlet temperature at a setpoint. With the guide vane linkage broken, the "B" CS chiller would be unable to regulate itself to changing load conditions. The "B" CS chiller operated for approximately 2 days with its guide vane linkage broken until the "A" CS chiller was placed in-service on February 18, 2012. During this two day period, the "B" CS chiller operated at constant load. Due to minimal changes in chiller demand, the cooling load provided by the "B" CS chiller was sufficient to maintain CS room temperatures within normal operating bands.

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NARRATIVEPotential Consequences:

During the period the guide vane linkage was broken, the "B" CS chiller was able to provide some minimal cooling load; however, the chiller would not be able to respond to changing load conditions. Consequently, the chiller was not capable of operating at design conditions considering the following changes in chiller load conditions:

- ESW operation (higher condenser temperature than SW)
- CREOASS operation (additional heat load)
- LOCA conditions (additional heat load)

CORRECTIVE ACTIONS

The following are the key corrective actions associated with this issue:

1. The broken ball-joint connectors on the "B" CS chiller were replaced.
2. The mechanical ball-joint connectors on the guide vane linkage will be replaced on other applicable chillers.
3. Replacement of the ball-joint connectors on the chiller guide vane linkage will be included as a preventive maintenance activity for the "B" CS chiller and other applicable chillers.
4. A root cause analysis on chiller reliability is in progress.

PREVIOUS SIMILAR EVENTS

None