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Exelon Nuclear

September 1, 2011

10 CFR 50.73

SVP-11-066

U. S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, D.C. 20555

Quad Cities Nuclear Power Station, Unit 1
Renewed Facility Operating License No. DPR-29
NRC Docket No. 50-254

Subject: Licensee Event Report 254/2011-003-00, Control Room Emergency Ventilation Air Conditioning System Inoperable

Enclosed is Licensee Event Report (LER) 254/2011-003-00, Control Room Emergency Ventilation Air Conditioning System Inoperable, for Quad Cities Nuclear Power Station, Unit 1.

This report is submitted in accordance with 10 CFR 50.73(a)(2)(v)(D), which requires the reporting of any event or condition that could have prevented the fulfillment of the safety function of structures or systems that are needed to mitigate the consequences of an accident.

There are no regulatory commitments contained in this letter.

Should you have any questions concerning this report, please contact Mr. W. J. Beck at (309) 227-2800.

Respectfully,

Tim Hanley For
Site Vice President
Quad Cities Nuclear Power Station

cc: Regional Administrator – NRC Region III
NRC Senior Resident Inspector – Quad Cities Nuclear Power Station

IE22
NRR

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.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.

LICENSEE EVENT REPORT (LER)

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

1. FACILITY NAME	2. DOCKET NUMBER	3. PAGE
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4. TITLE

Control Room Emergency Ventilation Air Conditioning System 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
									Quad Cities Nuclear Power Station Unit 2	05000265
07	06	2011	2011	- 003 -	00	09	06	2011	FACILITY NAME: N/A	DOCKET NUMBER: N/A

9. OPERATING MODE

1

10. POWER LEVEL

100%

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 NUMBER *(Include Area Code)*
Tom Petersen – Regulatory Assurance	(309) 227-2825

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	VI	ACU	C147	Y					

14. SUPPLEMENTAL REPORT EXPECTED

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

15. EXPECTED SUBMISSION DATE

MONTH	DAY	YEAR
N/A	N/A	N/A

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

On July 6, 2011 at 1410 hours, the Unit 1/2 (common) "B" Control Room Emergency Ventilation (CREV) Refrigeration Condensing Unit (RCU) was declared inoperable due to an increase in vibration amplitude caused by a broken chiller compressor connecting rod. Operators performed required actions to safely secure the CREV RCU in accordance with procedures and training, and without complications. This resulted in entering Technical Specification 3.7.5, Condition A (30 day Action). This event affected both the Unit 1 and Unit 2 Control Rooms since they share a common control room and CREV system.

The Train B CREV Air Conditioning (AC) system is a single train safety-related system that is designed to operate in a post-accident condition to maintain design temperature in the Control Room Envelope (CRE), and loss of the CREV AC could impact the plant's ability to mitigate the consequences of an accident.

The CREV RCU chiller compressor connecting rod failure was caused by flooded starts of the compressor. The root cause of the flooded start was an unanticipated failure mode for the design application of the system.

Corrective actions included replacing the failed compressor with a new compressor, and revising the frequency for vibration analysis on the B CREV RCU to monthly. Future corrective actions include installation of an automatic pump-down modification for the B CREV RCU compressor.

The safety significance of this event was minimal. Given the impact on the CREV AC system, this report is submitted in accordance with the requirements of 10 CFR 50.73(a)(2)(v)(D), which requires the reporting of any event or condition that could have prevented the fulfillment of the safety function of structures or systems that are needed to mitigate the consequences of an accident.

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NARRATIVE

PLANT AND SYSTEM IDENTIFICATION

General Electric - Boiling Water Reactor, 2957 Megawatts Thermal Rated Core Power

Energy Industry Identification System (EIIS) codes are identified in the text as [XX].

EVENT IDENTIFICATION

Control Room Emergency Ventilation Air Conditioning System Inoperable

A. CONDITION PRIOR TO EVENT

Unit: 1 Event Date: July 6, 2011 Event Time: 1410 hours
Reactor Mode: 1 Mode Name: Power Operation Power Level: 100%

B. DESCRIPTION OF EVENT

On 7/6/11, Operations was performing the normal monthly surveillance of the Train "B" Control Room Emergency Ventilation (CREV) [VI] system. During the performance of the surveillance the Component Maintenance Organization (CMO) recorded vibration data on the air conditioning (AC) [ACU] portion, Refrigeration [RFU] Condensing Unit [CDU] (RCU), 0-9400-102. Analysis of the data revealed a significant increase in the vibration amplitudes at all measurement locations. After consultation with Quad Cities CMO vibration analysts and an independent review by a vibration analyst from another Exelon Station, the recommendation was made to Operations to secure the chiller [CHU] to prevent further damage due to the increased vibration amplitudes.

On 7/6/11 at 1410 hours, the chiller was declared inoperable. As a result, Technical Specification 3.7.5, Condition A (30 day Action) was entered. ENS Notification (# 47030) was made in accordance with 10CFR50.72 (b)(3)(v)(D) since the CREV system is a single train safety system, and loss of the CREV AC could impact the plant's ability to mitigate the consequences of an accident.

On 7/6/11 at 1540 hours, the chiller was secured. When the CREV RCU crankcase cover plates were removed from the compressor [CMP], a damaged cylinder, failed bearing, and broken connecting rod were discovered.

On 7/12/11 replacement activities on the failed compressor were completed. An uncoupled run was performed on the motor [MO] where vibration data was collected. This vibration data indicated no bearing degradation on either of the motor bearings and therefore the motor did not need replacing.

On 7/12/11 at 2115 hours, the "B" CREV system was declared operable following its 10 hour confidence run.

Prior to the 7/6/11 compressor failure, the B CREV RCU had run successfully since April 2009. In April 2009 the compressor and motor were replaced due to high vibration conditions. After the April 2009 compressor replacement, the failed compressor was disassembled and inspected and was found to contain a broken connecting rod. As a result, the station performed an evaluation that contained several corrective actions and modifications intended to prevent this event from reoccurring.

Since the April 2009 compressor replacement, modifications had been made to the system to improve system performance. Subsequent to the 7/6/11 compressor failure, additional analysis, reviews of available vendor compressor options, and reviews of fleet experience from another Exelon Station determined that installation of an automatic pump-down system would provide additional margin to avoid flooded compressor starts. The automatic pump-down option helps to minimizes buildup of refrigerant during the times when the compressor is sitting idle.

Given the impact on the CREV AC system, this report is submitted in accordance with the requirements of 10 CFR 50.73(a)(2)(v)(D), which requires the reporting of any event or condition that could have prevented the fulfillment of the safety function of structures or systems that are needed to mitigate the consequences of an accident.

C. CAUSE OF EVENT

The increased compressor vibration amplitude was the result of a failed bearing and broken connecting rod caused by flooded starts of the compressor. The root cause of the flooded start was an unanticipated failure mode for the design application of the system.

A contributing cause to this event was that station personnel did not select a corrective action that resulted from a similar event at another Exelon Station. In May 2009, a separate Exelon Station experienced a similar failure mode to a Carrier Model 5H compressor. As a result of that failure, that Exelon Station installed an automatic pump-down modification on their Carrier Model 5H compressor in late 2009; the modification has shown success in reducing failure modes. The opportunity to upgrade the Quad Cities CREV RCU design based on this similar Exelon Station event had, however, occurred one month after the completion of the previous (2009) Quad Cities failure investigation. At that time it was concluded that the Quad Cities plans for compressor improvements were appropriate and that the automatic pump down modification was not essential. Quad Cities Station may have benefitted from implementation of this pertinent Exelon experience and the related modification.

The extent of condition of this event is isolated to the B CREV RCU compressor which is a single train safety-related system that contains one Carrier Model 5H120 reciprocating compressor. There are no other Heating Ventilation and Air Conditioning (HVAC) [AHU] systems or other systems at Quad Cities Station that utilize the same type of compressor or operating conditions. The Train A Control Room HVAC system currently has three Trane reciprocating compressors. These compressors are currently not operating, due to unrelated issues and are being replaced as part of a full system upgrade with screw type compressors in late 2011. Temporary chillers are currently in operation on the Train A Control Room HVAC as part of the upgrade process.

D. SAFETY ANALYSIS

The purpose of the CREV system is to maintain the proper air environment for instrumentation and personnel in the Control Room [NA]. The Train B CREV AC system is a single train safety-related system that is designed to operate in a post-accident condition to maintain design temperature in the Control Room Envelope (CRE). The Train B CREV RCU 0-9400-102 is a Carrier reciprocating compressor; Model 5H120, with a capacity of 90 tons. The backup to the Train B CREV system is the Train A Control Room HVAC system, which is a non-safety-related system. This event is a Maintenance Rule Functional Failure of the Z5795 – Control Room HVAC System.

The increased vibration amplitudes during this event resulted in declaring the "B" CREV and RCU inoperable and subsequently securing the system. Operators performed required actions safely, in accordance with procedures and training, and without complications. This resulted in entering Technical Specification 3.7.5, Condition A (30 day Action). The loss of the CREV AC could impact the plant's ability to mitigate the consequences of an accident.

NARRATIVE

The safety significance of this event was minimal. The CREV system filtration capability was not lost, and control room temperature was maintained during this event. In addition, the non-safety related Train A Control Room HVAC system (currently replaced with temporary chillers), was available and operating throughout this event.

The CREV AC system is not explicitly modeled in the Plant Probabilistic Risk Assessment (PRA). Certain Operator Actions (OAs) are modeled in the PRA, however, the effect of this event on OA human error probabilities (HEPs) would have a negligible quantitative impact on the calculated Core Damage Frequency (CDF) and Large Early Release Frequency (LERF) since loss of CREV AC events are slow progressing events (being reduced temperature control of the Control Room). In the loss of CREV system event, Station procedures direct the opening of doors and use of temporary fans, as necessary. Applicable Operator training is performed on these actions and the equipment is pre-staged as a part of the response to station blackout requirements.

Although opening Control Room doors to support room cooling would introduce the increased potential for radiological or chemical events impacting the Main Control Room, the probability of a loss of CR HVAC event coincident with a radiological or chemical event is small and therefore, would also have a negligible quantitative impact on CDF and LERF.

In conclusion, the degradation of the 0-9400-102 CREV system AC chiller was not risk significant.

E. CORRECTIVE ACTIONS

Immediate:

1. Replaced the failed compressor with a new compressor on July 12, 2011.
2. Revised the frequency for vibration analysis on the B CREV RCU from 6 months to monthly.

Follow-up:

1. Install an automatic pump-down modification for the B CREV RCU compressor. This is the most effective method of keeping liquid refrigerant out of the compressor crankcase during idle periods.
2. Review operating history and other indications for the B CREV RCU compressor. Determine if the compressor should be replaced at the same time the pump-down modification is to be installed.
3. Review operating events associated with Carrier Model 5H condensing unit compressors and disposition the corrective actions.

F. PREVIOUS OCCURRENCES

The station events database, LERs, EPIX, and NPRDS were reviewed for similar events at Quad Cities Nuclear Power Station. This event was a CREV RCU chiller connecting rod failure due to flooded starts of the compressor, which was caused by an unanticipated failure mode for the design application of the system.

- Station Events Database – IR 910666 (04/23/09), Old B CR HVAC RCU Found With Broken Rod (Equipment Apparent Cause Evaluation) - Train B CREV RCU was found with a broken piston connecting rod. This condition was found during a compressor replacement activity (due to vibrations on the compressor had increased and could not be resolved through other maintenance activities). Since this April 2009 compressor replacement, modifications had been made to the system to improve system performance. Subsequent to the 7/6/11 compressor failure, additional analysis, reviews of available vendor compressor options, and reviews of fleet experience from another Exelon Station, determined that installation of an automatic pump-down system would provide additional margin to avoid flooded compressor starts. The automatic pump-down option helps to

minimize buildup of refrigerant during the times when the compressor is sitting idle. This issue and resulting actions are addressed in the Cause of Event and Corrective Actions sections of this LER.

- LER 254-2005-006-00 (01/27/06), Failure of the Control Room Emergency Ventilation Air Conditioning Compressor Due to a Manufacturing Defect in an Electrical Relay – This event was an electrical relay failure caused by a manufacturing deficiency (bound armature retaining pin) specific to this relay. Based on the causes of this event and associated corrective actions, this previous LER although similar in topic area (CREV AC compressor), is not considered a significant station experience that would have directly contributed to preventing this event.

G. COMPONENT FAILURE DATA

The component that failed was the Train B CREV RCU 0-9400-102, which is a Carrier Model 5H120 reciprocating air conditioning compressor with a capacity of 90 tons.

This event has been reported to EPIX as Failure Report No. 1120.