Exelon
Nuclear

Clinton Power Station
8401 Power Road
Clinton, IL 61727-9351

U-604026
July 22, 2011

10 CFR 50.73
SRRS 5A.108

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

Clinton Power Station, Unit 1
Facility Operating License No. NPF-62
NRC Docket No. 50-461

Subject: Licensee Event Report 2011-002-00

Enclosed is Licensee Event Report (LER) No. 2011-002-00: Main Control Room HVAC Fan High Vibrations. This report is being submitted in accordance with the requirements of 10 CFR 50.73.

There are no regulatory commitments contained in this letter.

Should you have any questions concerning this report, please contact A. Khanifar, at (217)-937-3800.

Respectfully,

B. Kell for

William G. Noll
Site Vice President
Clinton Power Station

EET/blf

Enclosure: Licensee Event Report 2011-002-00

cc: Regional Administrator – NRC Region III
NRC Senior Resident Inspector – Clinton Power Station
Office of Nuclear Facility Safety – IEMA Division of Nuclear Safety

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)

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4. TITLE

Main Control Room HVAC Return Fan B High Vibrations

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
									N/A	N/A
05	23	2011	2011	- 002 -	00	07	22	2011	FACILITY NAME: N/A	DOCKET NUMBER: N/A

9. OPERATING MODE

1

10. POWER LEVEL

97.0

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)*
A. Khanifar, Site Engineering Director	(217) 937-3800

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
X	VI	FAN	B517	Y					

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 5/23/11, Operators in the Main Control Room (MCR) noticed a change in noise levels originating from ventilation equipment outside the MCR. Investigation revealed the increased noise was from the MCR (VC) B Return Fan. Vibration readings on the fan assembly were in the alert range, but not in the shutdown range.

Vibration readings were taken over an 8-hour period after the increase in vibration was noted. During that time, vibration levels remained constant. All other MCR Ventilation parameters for the VC B train were normal and unchanged. After this run, VC B train was placed in standby and VC A train was placed in service. An operability evaluation was completed for VC B which concluded VC B was operable.

On 6/7/11, an inspection of the fan was performed. The inspection identified a crack in the fan hub. A new fan was installed and the system was restored to an operable status on 6/10/11.

The fan hub was sent offsite for failure analysis, which concluded that the crack was the result of end-of-life fatigue, caused by low stress, high cycle loading. Analysis concluded that the hub assembly could not support the ability of the fan to perform its specified safety function over the designed mission time of 30 days, and thus the fan was inoperable.

The VC A system was operable during this period; therefore, no loss of safety function occurred during the period of inoperability.

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NARRATIVE

PLANT AND SYSTEM IDENTIFICATION

General Electric – Boiling Water Reactor, 3473 Megawatts Thermal Rated Core Power

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

EVENT IDENTIFICATION

Main Control Room HVAC Return Fan B High Vibrations

A. CONDITION PRIOR TO EVENT

Unit: 1 Event Date: 5/23/11 Event Time: 1200 hours CDT
Mode: 1 Mode Name: Power Operation Reactor Power: 97.0 percent

B. DESCRIPTION OF EVENT

On 5/23/11, at approximately 1200 hours, Operators in the Main Control Room (MCR) noticed an audible noise level originating from ventilation equipment outside the MCR envelope. The initial investigation revealed the elevated noise was emanating from the Main Control Room Ventilation (VC) [VI] B Return Fan [FAN] (0VC04CB). This fan is a vane axial design manufactured by Buffalo Forge (B517). At 1430 hours, initial vibration readings on the fan assembly were obtained and compared to data taken in February 2011. The latest data indicated that the vibration levels were higher than the February readings, specifically; Axial from 0.11 to 0.212 inches per second (in/sec), Vertical from 0.19 to 0.510 in/sec, and Horizontal from 0.21 to 0.557 in/sec. These readings placed the fan vibrations in the alert range (greater than 0.325 in/sec), but not into the shutdown (inoperable) range (0.70 in/sec).

Additional vibration readings were taken on 0VC04CB over approximately an 8 hour period after the step change to determine if the vibration levels were continuing to increase. During that time, vibration levels remained constant. All other MCR ventilation parameters for the VC B train were normal and unchanged.

After obtaining the vibration data during the run, the VC B train was placed in standby in preparation for troubleshooting activities. An operability evaluation was prepared, which supported continued operability of VC B train with the increased vibration readings.

On 6/7/11, during a planned VC B system window to support additional inspections for vibration cause, maintenance personnel performed an inspection of the fan under Work Order 1440503 and identified a crack from the outside of the fan hub to one mounting hole. The crack (approximately four inches long) penetrated the entire thickness of the hub. The crack length and extent were confirmed after fan removal. After this discovery, contingency plans to replace 0VC04CB fan were completed. Following replacement, 0VC04CB was restored to an operable status on 6/10/11.

The fan hub was sent offsite for a formal failure analysis investigation which concluded that the crack was due to end of life fatigue, caused by low stress, high cycle loading. The failure analysis concluded that the fan could have operated for "many hours" before additional fatigue cracks initiated. However, the overall conservative conclusion is that the crack on the hub assembly could not support the ability of the fan to perform its specified safety function for the designed mission time of 30 days, and thus the fan was inoperable.

Based on this, the VC B fan would have been inoperable at point of discovery on 5/23/11 and Technical Specification 3.7.3 and 3.7.4 should have been entered. Technical Specification 3.7.3 Required Action (RA) A.1 would have placed the unit in a 7 day LCO ending on 5/30/11 at which point RA B.1 should have been entered placing the unit on a 12 hour LCO to be in Mode 3. Based on when the VC B fan was repaired and restored to an operable status, on 6/10/11, this constituted a condition prohibited by technical specifications.

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During the time from 5/23/11 to 6/10/11 the VC A system was always operable. Therefore at all times during this event, the MCR was supported by an operable train of VC, and thus no loss of safety function occurred.

C. CAUSE OF EVENT

An equipment apparent cause analysis was conducted under Issue Report (IR) 1225739. The equipment apparent cause determined that the hub crack was the result of end-of-life fatigue, caused by low stress, high cycle loading. 0VC04CB had approximately 115,000 hours of service before the hub crack propagated enough to cause a step change in vibration levels, which stabilized as the crack reached the edge of the hub. The as-found data described a crack from the outside of the fan hub to one fan mounting hole (approximately 4 inches long). The crack penetrated the entire thickness of the hub. The crack length and extent were confirmed after fan removal.

D. SAFETY CONSEQUENCES

This event is reportable under 10 CFR 50.73(a)(2)(i)(B) as an operation or condition which was prohibited by the plant's Technical Specifications due to exceeding Limiting Condition of Operation (LCO) 3.7.3 of Technical Specification (TS) 3.7.3, Control Room Ventilation System, Required Action A.1, to restore an inoperable Control Room Ventilation subsystem to an operable status within 7 days.

As stated previously, the VC B fan hub cracking was identified and confirmed on 6/7/11 and the VC B fan was replaced and restored to an operable status on 6/10/11. Existing analysis is not sufficient to provide the high degree of confidence necessary to support past operability from the time of the increase in vibrations on 5/23/11, until the fan was replaced, or approximately 18 days.

There were no actual safety consequences impacting plant or public safety as a result of this event. The opposite division train was operable during the time of inoperability; therefore there was no loss of safety function.

E. CORRECTIVE ACTIONS

- The VC B return air fan was replaced.
- The VC A return air fan will be replaced in 2012 based on a lower number of operating hours compared to VC B.
- The applicable Performance Centered Maintenance (PCM) templates were reviewed for similar high duty cycle fans (extent of condition) and the replacement strategy was changed from performance monitoring to time directed replacement.

F. PREVIOUS OCCURRENCES

A review of CPS Licensee Event Reports (LERs) for the last three years did not identify any LERs associated with ventilation fan failures; however, one similar previous event was identified.

On 10/26/06, the MCR Supply Fan for VC B, 0VC03CB, failed suddenly and broke apart. A root cause investigation noted that the fan failure was due to cracking of the material in the hub. The failure analysis determined that the cracks propagated by fatigue until a hub section failed in a relatively brittle manner due to mechanical overloading. The difference between this event and the 0VC04CB event on 5/23/11, is the physical difference between the hub diameters, 54 inches for the supply fan compared to 48 inches for the return fan. The supply fan runs closer to the stall region on the fan performance curve and the failure was caused by unbalanced loading on the fan (caused by the design of the system). The supply fan was determined to be too large for the application such that normal system transients put the fan in the stall region. There were multiple cracks found in the supply fan hub, whereas the VC B return fan had one crack that had no further growth possible and no indications of additional fatigue cracks. Finally, the return fan air flow has a straight path to the suction and the VC B supply fan operates above the stall region.

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NARRATIVE

G. COMPONENT FAILURE DATA

Component Description: 48 inch vane-axial fan, 120 horsepower (HP)

Manufacturer	Nomenclature	Model	Mfg. Part Number
Buffalo Forge	N/A	W120 5 ARR No. 4	N/A