PMFermiCOLPEm Resource

From: Hale, Jerry
Sent: Tuesday, April 17, 2012 8:52 AM
To: mkeeganj@comcast.net
Cc: FermiCOL Resource
Subject: Quad Cities Steam Dryer LER
Attachments: LER 02-003-00.pdf

Mr. Keegan,

Attached is the LER for the Quad Cities steam dryer issue discussed during the last Fermi 3 open items call.

Jerry Hale
Project Manager
U.S. Nuclear Regulatory Commission
Office of New Reactors
(301) 415-8148

Hearing Identifier: Fermi_COL_Public
Email Number: 954

Mail Envelope Properties (E3D0DF334F617344BE38EB00C881B1B36DD193C79D)

Subject: Quad Cities Steam Dryer LER
Sent Date: 4/17/2012 8:51:46 AM
Received Date: 4/17/2012 8:52:37 AM
From: Hale, Jerry

Created By: Jerry.Hale@nrc.gov

Recipients:
"FermiCOL Resource" <FermiCOL.Resource@nrc.gov>
Tracking Status: None
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Files	Size	Date & Time
MESSAGE	255	4/17/2012 8:52:37 AM
LER 02-003-00.pdf	358452	

Options
Priority: Standard
Return Notification: No
Reply Requested: Yes
Sensitivity: Normal
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Recipients Received:

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Exelon Nuclear

September 9, 2002

SVP-02-074

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

Quad Cities Nuclear Power Station, Unit 2
Facility Operating License No. DPR-30
NRC Docket No. 50-265

Subject: Licensee Event Report 265/02-003, "Reactor Shutdown due to Failure of Reactor Steam Dryer from Flow-Induced Vibrations as a Result of Extended Power Uprate"

Enclosed is Licensee Event Report (LER) 265/02-003, "Reactor Shutdown due to Failure of Reactor Steam Dryer from Flow-Induced Vibrations as a Result of Extended Power Uprate," for Quad Cities Nuclear Power Station.

This report is submitted voluntarily in accordance with NUREG 1022, Section 2.7, as an event or condition that might be of generic interest or concern.

We are committing to the following actions:

- Evaluations will be performed of other components in the dryer assembly and in the steam flow path to determine any additional vulnerability to steam flow induced vibration failures. Recommendations will be provided for monitoring and/or future modifications to alleviate any identified problem areas.

- The Quad Cities Unit 1 1/4" dryer cover plate will be replaced with a 1/2" plate to remove vulnerability to failure.

Any other actions described in the submittal represent intended or planned actions by Exelon Generation Company (EGC), LLC. They are described for the NRC's information and are not regulatory commitments.

IE22

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

Respectfully,

Timothy J. Tulon
Site Vice President
Quad Cities Nuclear Power Station

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

NRC FORM 366 (7-2001) U.S. NUCLEAR REGULATORY COMMISSION

APPROVED BY OMB NO. 3150-0104 EXPIRES 7-31-2004

Estimated burden per response to comply with this mandatory information 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 Management Branch (T-6 E6), U S Nuclear Regulatory Commission, Washington, DC 20555-0001, or by internet e-mail to bjs1@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 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)

1. FACILITY NAME	2. DOCKET NUMBER	3. PAGE
Quad Cities Nuclear Power Station Unit 2	05000265	1 of 4

4. TITLE: Reactor Shutdown due to Failure of Reactor Steam Dryer from Flow-Induced Vibrations as a Result of Extended Power Uprate

5. EVENT DATE			6. LER NUMBER			7. REPORT DATE			8. OTHER FACILITIES INVOLVED	
MO	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REV NO	MO	DAY	YEAR	FACILITY NAME	DOCKET NUMBER
									N/A	N/A
07	11	02	02	- 003 -	00	09	09	02	FACILITY NAME: N/A	DOCKET NUMBER: N/A

9. OPERATING MODE	1
10. POWER LEVEL	083

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

20 2201(b)	20 2203(a)(3)(ii)	50 73(a)(2)(ii)(B)	50 73(a)(2)(ix)(A)
20 2201(d)	20 2203(a)(4)	50.73(a)(2)(iii)	50 73(a)(2)(x)
20.2203(a)(1)	50 36(c)(1)(i)(A)	50.73(a)(2)(iv)(A)	73 71(a)(4)
20 2203(a)(2)(i)	50 36(c)(1)(ii)(A)	50.73(a)(2)(v)(A)	73 71(a)(5)
20.2203(a)(2)(ii)	50 36(c)(2)	50.73(a)(2)(v)(B)	X OTHER Specify in Abstract below or in NRC Form 366A **Voluntary Report**
20 2203(a)(2)(iii)	50 46(a)(3)(ii)	50.73(a)(2)(v)(C)	
20 2203(a)(2)(iv)	50 73(a)(2)(i)(A)	50 73(a)(2)(v)(D)	
20 2203(a)(2)(v)	50 73(a)(2)(i)(B)	50 73(a)(2)(vii)	
20 2203(a)(2)(vi)	50.73(a)(2)(i)(C)	50 73(a)(2)(viii)(A)	
20 2203(a)(3)(i)	50 73(a)(2)(ii)(A)	50 73(a)(2)(viii)(B)	

12. LICENSEE CONTACT FOR THIS LER

NAME	TELEPHONE NUMBER (Include Area Code)
Wally Beck, Regulatory Assurance Manager	(309) 227-2800

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	AC	DRY	S390	Y					

14. SUPPLEMENTAL REPORT EXPECTED		15. EXPECTED SUBMISSION DATE	MONTH	DAY	YEAR
YES (If yes, complete EXPECTED SUBMISSION DATE)	X NO				

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

On July 11, 2002, at 0241 hours, Unit 2 plant personnel conservatively initiated a shutdown using Technical Specification (TS) Section 3.0.3. The reactor entered the shutdown mode (Mode 3) at 1417 hours. An operability assessment had previously been performed in response to indications of a damaged reactor steam dryer (initial indications started on June 7, 2002). TS 3.0.3 was conservatively entered when those indications changed such that, based on the analysis of the changed indications, reasonable assurance of continued operability of connected safety systems could no longer be supported. Following the unit shutdown, an inspection of the Unit 2 Reactor internals on July 13, 2002, revealed that a Steam Dryer cover plate had failed. Fragments were found in a Main Steam line and a Main Turbine stop valve inlet screen.

The root cause of the steam dryer failure was determined to be a lack of industry experience and knowledge of flow-induced vibration dryer failures. The dryer failed as a result of fatigue caused by flow-induced vibrations created by higher steam flows due to Extended Power Uprate conditions.

The safety significance of this event was minimal. Subsequent reviews determined all of the Unit 2 safety systems would have responded as designed had a design basis event occurred and that the entry into TS 3.0.3 was not a required entry. Therefore, this report is submitted as a voluntary report.

Corrective actions include repair to the Unit 2 steam dryer and further evaluation of resonant frequency issues.

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

Reactor Shutdown due to Failure of Reactor Steam Dryer from Flow-Induced Vibrations as a Result of Extended Power Uprate (EPU)

A. CONDITION PRIOR TO EVENT

Unit: 2 Event Date: July 11, 2002 Event Time: 1417 hours
Reactor Mode: 1 Mode Name: Power Operation Power Level: 083%

Power Operation (1) - Mode switch in the RUN position with average reactor coolant temperature at any temperature.

B. DESCRIPTION OF EVENT

Over a period of approximately 30 days, Quad Cities Unit 2 experienced several anomalous readings related to reactor pressure, reactor level, steam flow, and moisture carryover. When the first anomalous reading occurred on June 7, 2002, an evaluation was made that concluded that the only component that could cause such readings was a degraded Steam Dryer [DRY]. An operability determination was completed that supported continued operation of the unit. A key element of the operability determination was that no loose parts could migrate such that they would affect emergency equipment.

Based on analyses of additional plant data from June 18, 2002, to July 10, 2002, it was determined that there no longer was reasonable assurance that the operability determination supported continued operation with a degraded Steam Dryer because Steam Dryer fragments were potentially migrating from the Reactor [AC] and entering the Main Steam lines [SB]. Since these fragments could potentially impact multiple safety systems, Technical Specification 3.0.3 was conservatively entered and a Unit 2 shutdown was initiated on July 11, 2002.

An inspection of the Unit 2 Reactor internals on July 13, 2002, revealed that a Steam Dryer cover plate had failed, which allowed steam to bypass the dryer. Steam Dryer cover plate fragments were found in a Main Steam line flow venturi [FE] and Main Turbine [TA] stop valve [V] inlet screen. However, based on the magnitude of the actual Steam Dryer failure and the actual migration of its broken parts, it was concluded that all of the Unit 2 safety systems would have responded as designed had a design basis event occurred, and that the entry into TS 3.0.3 was not a required entry.

C. CAUSE OF EVENT

The root cause of the Steam Dryer failure was a lack of industry experience and knowledge of flow-induced vibration dryer failures.

An examination of the cracked Steam Dryer cover plate by metallurgical experts and a study of a scale model at the General Electric San Jose facility resulted in the determination that the cause of the Steam Dryer cover plate failure was high cycle mechanical fatigue caused by flow-induced vibrations. The flow-induced vibration coincided with the natural frequency of the failed 1/4" thick cover plate, creating a resonance condition. The flow-induced vibration frequency was created by pressure pulsations whose magnitude increased with higher steam flows due to the EPU conditions. Unit 2 reached EPU conditions (~117% of pre-EPU Power) for the first time in March 2002. This condition was not identified during the EPU evaluations performed due to the lack of industry experience and knowledge of flow-induced vibration dryer failures.

D. SAFETY ANALYSIS

The safety significance of the Steam Dryer failure was minimal. The changes in sensed and actual Reactor water level and pressure, moisture carry-over, and increased Main Steam flows had no adverse effect on plant operation during all normal and potential accident modes. The accidents and transients described in Updated Final Safety Analysis Report Section 15.0 remained bounding and there were no effects on the Technical Specifications or the TRM due to the actual event. Based on the magnitude of the actual Steam Dryer failure and the actual migration of its broken parts, it can be concluded that all of the Unit 2 safety systems would have responded as designed, had a design basis event occurred. Therefore, although the unit was conservatively shut down using TS 3.0.3, the Unit 2 safety systems were capable of performing their safety functions throughout the event and entry into TS 3.0.3 was not a required entry. This report is submitted as a voluntary report of an event that might be of generic interest or concern.

E. CORRECTIVE ACTIONS

Immediate Actions:

- The damaged 1/4" Unit 2 Steam Dryer outer bank cover plate was replaced with a 1/2" thick plate.
- The undamaged side 1/4" outer bank cover plate on the Unit 2 Steam Dryer was replaced with a 1/2" plate.
- All Steam Dryer foreign material from the Reactor Vessel, Main Steam system, and other interconnected systems was identified and retrieved.
- The Steam Dryer was inspected for additional damage and repair/disposition.
- All collateral damage due to the damaged Steam Dryer was identified and repaired/dispositioned.
- Temporary acoustic monitoring of the Unit 2 Steam Dryer was installed to obtain data to identify the power level (steam flow) at which the frequency of concern significantly increases.

Corrective Actions to be Completed:

- Evaluations will be performed of other components in the dryer assembly and in the steam flow path to determine any additional vulnerability to steam flow induced vibration failures. Recommendations will be provided for monitoring and/or future modifications to alleviate any identified problem areas.
- The Quad Cities Unit 1 1/4" dryer cover plate will be replaced with a 1/2" plate to remove vulnerability to failure.

F. PREVIOUS OCCURRENCES

No previous occurrences of Steam Dryer failure at Quad Cities were identified.

G. COMPONENT FAILURE DATA

The Steam Dryer was manufactured by Stearns-Roger.