July 18, 2002

Mr. John L. Skolds
President and CNO
Exelon Nuclear
Exelon Generation Company, LLC
4300 Winfield Road
5th Floor
Warrenville, IL 60555

SUBJECT: LIMERICK GENERATING STATION - NRC INSPECTION REPORT 50-353/02-009

Dear Mr. Skolds:

On June 20, 2002, the U.S. Nuclear Regulatory Commission (NRC) completed a supplemental inspection at the Limerick Generating Station, Unit 2. The enclosed report documents the inspection results, which were discussed with Mr. Levis and other members of your staff during an exit meeting on June 26, 2002.

The inspection was an examination of your staff's activities in response to a finding of low to moderate safety significance (White) as documented in NRC Inspection Report 50-353/01-001. The White finding concerned the failure to have adequate measures in place to identify that the 2N Safety/Relief Valve (SRV) was degraded and vulnerable to not re-closing after lifting. The inspection was conducted in accordance with NRC Inspection Procedure 95001, "Inspection for One of Two White Inputs in a Strategic Performance Area."

The NRC determined that your staff's evaluation was adequate to identify the underlying causes of this performance issue. The NRC further determined that the extent of condition review was sufficiently broad, and that the completed and planned corrective actions addressed the causes identified in the evaluation. Based on your staff's acceptable actions in addressing the 2N SRV degraded condition, the White finding associated with this issue will only be considered in assessing plant performance for a total of four quarters in accordance with the guidance in Inspection Manual Chapter 0305, "Operating Reactor Assessment Program."

In accordance with 10 CFR 2.790 of the NRC's "Rules of Practice," a copy of this letter and its enclosure will be available electronically for public inspection in the NRC Public Document Room or from the Publicly Available Records (PARS) component of the NRC's document system (ADAMS). ADAMS is accessible from the NRC Web site at http://www.nrc.gov/reading-rm/adams.html (The Public Electronic Reading Room).

Sincerely,

/RA/

David C. Lew, Chief
Performance Evaluation Branch
Division of Reactor Safety

Docket Nos: 50-353
License Nos: NPF-85

Enclosure: Inspection Report 50-353/02-009

cc w/encl:
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President and CNO, Exelon Nuclear
Senior Vice President - Nuclear Services
Vice President - Mid-Atlantic Operations Support
Chairman, Nuclear Safety Review Board
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REGION I

Docket Nos.:	50-353
License Nos.:	NPF-85
Report Numbers:	50-353/02-009
Licensee:	Exelon Generation Company, LLC
Facility:	Limerick Generating Station, Unit 2
Location:	Evergreen and Sanatoga Roads Sanatoga, PA 19464
Dates:	June 17 - June 20, 2002
Inspector:	M. Ferdas, Reactor Inspector
Approved By:	David C. Lew, Chief Performance Evaluation Branch Division of Reactor Safety

SUMMARY OF FINDINGS

IR 05000353/02-009, Limerick Generating Station, Unit 2, on 06/17- 06/20/2002, supplemental inspection.

The inspection was conducted by a regional reactor inspector. The inspection identified no findings of significance. The NRC's program for overseeing the safe operations of commercial nuclear power reactors is described in NUREG-1649, "Reactor Oversight Process," Revision 3, dated July 2000.

Cornerstone: Barrier Integrity

The U.S. Nuclear Regulatory Commission (NRC) performed this supplemental inspection to assess Exelon's evaluation associated with not having adequate measures in place to identify that the 2N Safety/Relief Valve (SRV) was in a degraded condition in which it was vulnerable to a failure to re-close after lifting. This performance issue was previously characterized as having low to moderate risk significance (White) in NRC Inspection Report 50-353/01-11. During this supplemental inspection, performed in accordance with Inspection Procedure 95001, the inspector determined that Exelon performed a comprehensive evaluation. Exelon's evaluation identified the root causes of the event as being misalignment of the pilot disk during manufacturing and normal vibration amplified by loose discharge flange joints on the 2N SRV. Exelon also identified several contributing causes in the areas of equipment availability and human performance that led to the failure to shutdown the plant prior to the inadvertent lift of the 2N SRV. The completed and planned corrective actions addressed the root and contributing causes identified in the evaluation.

Given Exelon's acceptable performance in addressing the 2N SRV degraded, the White finding associated with this issue will only be considered in assessing plant performance for a total of four quarters in accordance with the guidance in IMC 0305, "Operating Reactor Assessment Program." Implementation of Exelon's corrective actions are subject to future NRC inspection.

Report Details

01 INSPECTION SCOPE

The supplemental inspection was completed in accordance with NRC Inspection Procedure 95001 to assess Exelon Generation Company, LLC (Exelon) evaluations of a performance issue identified as having low to moderate safety significance (White). This performance issue was associated with not having adequate measures in place to identify that the 2N Safety/Relief Valve (SRV) was in a degraded condition in which it was vulnerable to a failure to re-close after lifting. In February 2001, during a planned shutdown to repair the 2N SRV, it inadvertently opened and could not be initially re-closed. The plant was manually scrammed per operating procedures and the SRV was replaced.

This event was self revealing and was the subject of a Licensee Event Report (LER) 2-01-001, dated April 20, 2001. Subsequent to the event, the NRC completed two baseline resident inspections, and documented the results in NRC Inspection Reports 50-353/01-03 and 01-11. The performance issue was characterized as "White" in NRC Inspection Report 50-353/01-11 and is related to the barrier integrity cornerstone in the reactor safety strategic performance area. A Notice of Violation (NOV) was issued to Exelon in NRC letter dated January 11, 2002. In a phone conversation on December 20, 2001, with a member of the NRC Region I staff; Exelon declined the opportunity to discuss this issue in a regulatory conference or to provide additional information in a written response.

The supplemental inspection scope included a review of Exelon's root cause evaluation which are documented in Performance Enhancement Program (PEP) I0012314 and Condition Report (CR) 0060832. The inspector reviewed Exelon's evaluations specific to the performance issue and pertinent procedures, calculations, and corrective action (CA) documents. The inspector also discussed the issue with the Exelon staff, in order to assess Exelon's response to the performance issue.

02 EVALUATION OF INSPECTION REQUIREMENTS

02.01 Problem Identification

a. Determination of who (i.e., licensee, self-revealing, or NRC) identified the issue and under what conditions.

The event was self-revealing. On February 23, 2001, during a planned shutdown to repair the 2N SRV, the SRV inadvertently opened and could not be initially re-closed. Subsequently, the NRC identified that Exelon failed to have adequate measures in place to identify that the 2N SRV was in a degraded condition and was vulnerable to a failure to re-close after lifting.

b. Determination of how long the condition existed, and prior opportunities for identification.

Exelon determined that the 2N SRV would potentially not be able to meet its intended function after December 31, 2000. In a letter dated January 11, 2002, the NRC concluded in its final significance determination that the 2N SRV would potentially not be able to meet its intended function after December 5, 2000.

c. Determination of the plant-specific risk consequences (as applicable) and compliance concerns associated with the issue.

Exelon's evaluation assigned a change in core damage frequency of 9.3 E-7 to this condition. The NRC determined that operating with a degraded 2N SRV from December 5, 2000 to February 23, 2001 increased the core damage frequency (CDF) to greater than 1 E-6. The CDF determined by the NRC is based on the time that the 2N SRV was vulnerable to fail to re-close. As stated above, Exelon did not contest the violation.

02.02 Root Cause and Extent of Condition Evaluation

a. Evaluation of methods used to identify root causes and contributing causes.

To evaluate this issue, Exelon used a combination of structured root cause analysis techniques including events and causal factor analysis, failures modes and effect analysis, and barrier analysis. In addition, Exelon conducted interviews with individuals involved with the event, including the SRV vendor, and consultants. Exelon also performed a visual examination of the SRV and laboratory studies including metallurgical analysis and induced leakage testing. The inspector determined that the licensee followed its procedural guidance for performing a level 2A root cause analysis.

b. Level of detail of the root cause evaluation.

Exelon performed a detailed evaluation to determine the cause of the event and conducted multiple induced leakage tests to further develop and/or support the current SRV leakage shut down criteria. Exelon's evaluation identified that the probable root causes of the 2N SRV leakage was misalignment of the pilot disk during manufacturing and normal vibration amplified by loose discharge flange joints on the 2N SRV. Exelon identified several contributing causes in the areas of equipment availability and human performance that led to the failure to shutdown the plant prior to the inadvertent lift of the 2N SRV. These contribution causes were: (1) the preferred means to identify first stage pilot leakage for the SRVs, which was the installed pressure transducer, was inoperable; (2) operability reviews were not rigorously performed and documented in order to bound all failure modes; and (3) Exelon engineering and management teams failed to challenge the uncertainties with the established SRV leakage shutdown criteria.

c. Consideration of prior occurrences of the problem and knowledge of prior operating experience.

Exelon's evaluation included a review of previous events and industry experience. Exelon identified that a previous event occurred at Unit 1 on September 11, 1995, when the 1M SRV inadvertently opened with the unit at 100 percent power due to prolonged pilot valve seat leakage. The inspector reviewed PEP I0004442 which documents the event and discussed it with Exelon personnel. Exelon took corrective actions to this event including modifying the SRVs from a 2-stage to a 3-stage design and initiated other corrective actions. Exelon's root cause analysis team for the February 2001 event concluded that this was a repeat event. Exelon's investigation of other industry experience did not identify another event that involved a SRV lift at power due to a pilot

valve leak.

d. Consideration of potential common causes and extent of condition of the problem.

The licensee's evaluation considered the potential for common cause and extent of condition associated with the performance issues associated with the "White" finding.

02.03 Corrective Actions

a. Appropriateness of corrective actions.

Following the 2N SRV inadvertent opening event, Exelon replaced the 2N SRV, performed a root cause analysis, and revised their SRV leakage shut down criteria contained in the monitoring plan RT-6-04-490-2, "Suppression Pool Gross Input Leak Rate Determination," to a more conservative value. Exelon completed additional induced leakage testing to further develop and support their shutdown criteria for pilot valve leakage. Exelon was developing an administrative guideline to describe the generation and implementation of a monitoring plan to be used to monitor system and component performance. Exelon also communicated this event to its management team and incorporated this event as a "Management Lessons Learned." The completed and planned corrective actions address the root and contributing causes identified in the root cause analysis.

b. Prioritization of corrective actions

The corrective actions identified in the root cause analysis have been appropriately prioritized. Exelon took immediate corrective actions at the time of the event, including replacing the 2N SRV and revising the SRV Leakage Determination Monitoring Process by providing added margin and improved direction on actions associated with pilot valve leakage. Exelon has taken additional corrective actions since the event including laboratory testing of the 2N SRV and several other SRVs, communicating lessons learned from this event to its management team, and enhancing procedures.

c. Establishment of schedule for implementing and completing the corrective actions.

Exelon identified a number of deficiencies associated with their performance and initiated corrective actions to address them. The corrective actions have been scheduled and are being tracked through Exelon's condition reporting process. The inspector noted that one CA associated with Action Request (AR) 0060832-17, development of an administrative process/guideline for developing a monitoring plan, had been deferred by five months. The monitoring plan will help to establish a consistent methodology in the generation and implementation of a monitoring plan. The CA will enhance the barriers that failed to prevent the 2N SRV event and help ensure that similar plant events do not occur. Exelon personnel are currently developing this guidance, and it is being tracked under CR 0060832.

d. Establishment of quantitative or qualitative measures of success for determining the effectiveness of the corrective actions to prevent recurrence.

Exelon scheduled an effectiveness review during their next refueling outage. Measures for determining the effectiveness of corrective actions have not yet been established, however, this CA is being tracked under CR 0060832.

03 MANAGEMENT MEETINGS

Exit Meeting Summary

The results of the inspection were discussed at a meeting with Mr. Levis and other members of Exelon management on June 26, 2002. The exit meeting also served as the regulatory performance meeting per the NRC Reactor Oversight Process.

The licensee did not indicate that any of the information presented at the exit meeting was proprietary.

Persons Contacted

Licensee:
B. Levis, Vice President*
B. Braun, Plant Manager*
A. Winter, Corporate CAPCO*
J. Stone, Director Work Management*
E. Callan, Director Maintenance*
C. Mudrick, Director Engineering*
J. Tucker, Sr. Manager System Engineering
G. Budock, Engineering Services Engineer
G. Kelly, Manager Programs
G. Weiss, Programs Engineer
T. Ryan, System Engineer
J. Mitman, Component Engineer
S. Bobyock, ECCS Manager
R. Hardening, Engineer Regulatory Assurance*

NRC:
D. Lew, Branch Chief Performance Evaluation*
A. Burritt, Sr. Resident Inspector*
J. Yerokun, Sr. Reactor Inspector*

*Attended Exit Meeting

Documents Reviewed

Procedures

LR-C-10, Rev.11	PECO Nuclear Performance Enhancement Program (PEP)
LR-CG-10,Rev.5	Exelon Nuclear Performance Enhancement Program (PEP)
LR-CG-10-1,Rev.2	PECO Energy “Root Cause” Flow Chart and User’s Information Manual
LS-AA-125, Rev.2	Corrective Action Program (CAP) Procedure
LS-AA-125-1001, Rev.1	Root Cause Analysis Manual
LS-AA-125-1004, Rev.1	Effectiveness Review Manual
LS-AA-125-1005, Rev.2	Coding and Trending Manual
LS-AA-125-1006, Rev.1	CAP Process Expectations Manual
RT-6-041-490-2, Rev. 10	Suppression Pool Gross Input Leak Rate Determination

Performance Enhancement Reports (PEP)

I0012314	2N SRV Inadvertently Lifted and Remained Open During Shutdown
I0012312	Bolts Found Missing on Outlet Flange of SRVs
I0004442	Unit 1 Manual Scram Due To Inadvertent Opening of “M” SRV

Condition Report (CR)

00060832	2N SRV Inadvertently Lifted and Remained Open During Shutdown

Licensee Event Report (LER)

01-001-00	Manual Scram Following MSRV Failing Open Due to Erosion and Oxidation of the First Stage Valve Disc Seating Area.

Plant Operations Review Committee (PORC) Meeting Minutes

01-011	PORC Review of Unit 2 Startup Restraints following 2N SRV Failure and Repair, dated 2/25/01
01-012	PORC Review of 2N SRV Tailpipe Flange Missing Studs Corrective Actions for Plant Restart, dated 2/25/01
01-015	SRV Monitoring Plan criteria review following additional test data availability, dated 3/2/01
01-018	SRV Leakage Monitoring Plan Review, dated 3/9/01
01-029	LER 2-01-001 2N MSRV Inadvertent Actuation and Manual Scram, Unit 2, dated 4/20/01
01-030	LER 2-01-001 2N MSRV Inadvertent Actuation and Manual Scram, PORC 01-029 comments incorporated, Unit 2, dated 4/23/01
01-035	RT-6-041-490-2 Rev.8, SRV Leak Monitoring Plan, Unit 2, dated 5/25/01
01-038	PEP I0012312 2N SRV Flange Bolts Missing, dated 6/20/01
01-040	I0012314 2N SRV Scram, dated 7/11/01
01-047	RT-6-041-490-2, Rev. 8 - SRV Leakage Monitoring Plan Review, dated 8/31/01.

Miscellaneous

Exelon Power Labs Report	Dimensional Evaluation of 2N SRV Pilot State Bellows/Body Assembly Limerick Generating Station, dated March 7, 2002
Exelon Power Labs Report	Evaluation of Valve Disc from 2N MSRV at LGS; A/R A1306169, Eval #25, dated April 5, 2001
Exelon Power Labs Report	Evaluation of 2M SRV Pilot Stage Valve Disc; (Ref. A/R A1306169, Eval. #25), dated April 17, 2001
Exelon Power Labs Report	Combined Dimensional, Temperature and Pressure Testing on the 2N SRV Pilot Stage Bellows at BWXT Services, Phase II, Limerick Station, dated May 3, 2002
Exelon Power Labs Report	Evaluation of Pilot Stage Disk and Seat Components From limerick 2N and 2M SRV's; A/R A1306169, Eval #25, dated May 10, 2001
BWXT Services, Inc. Report	Analysis of a Failed Valve Disc From the Limerick Generating Station, dated April 2001
BWXT Services, Inc. Report	Analysis of 2M and 2N Safety Relief Valve Components From Limerick Generating Station, dated May 2001
Wyle Laboratory Report	Testing of the 2N & 2M SRV (2/27/01 - 3/07/01)
Wyle Laboratory Report	Additional SRV Induced Leakage Testing (July 17 - 19,

	2001)
Wyle Laboratory Report	SRV High Flow Testing (August 31, 2001)
Target Rock Report TRP 6904	Root Cause Evaluation for Limerick Generating Station 2N Main Steam Safety Relief Valve Pilot Leakage
Limerick 2N Safety Relief Valve Self	Actuation Event Independent Review Team Final Report, dated March 28, 2001
Technical Manual - Safety/Relief Valve Model 9867F	

Acronyms

AR	Action Request
CA	Corrective Actions
CR	Condition Report
EA	Enforcement Action
IR	Inspection Report
LER	Licensee Event Report
LLC	Limited Liability Company
NRC	Nuclear Regulatory Commission
PEP	Performance Enhancement Program
SRV	Safety/Relief Valve