March 9, 2007

Mr. Christopher M. Crane
President and Chief Nuclear Officer
Exelon Nuclear
Exelon Generation Company, LLC
4300 Winfield Road
Warrenville, IL 60555

SUBJECT: BYRON STATION, UNIT 2 NRC SUPPLEMENTAL INSPECTION REPORT 05000455/2007007

Dear Mr. Crane:

On February 9, 2007, the U.S. Nuclear Regulatory Commission (NRC) completed a supplemental inspection pursuant to Inspection Procedure 95001 at your Byron Station, Unit 2. The purpose of the inspection was to examine the causes for, and actions taken related to the identification of a White Performance Indicator (PI) with the Heat Removal System (Auxiliary Feedwater) in the Mitigating Systems Cornerstone. This supplemental inspection was conducted to provide assurance that the root causes and contributing causes of the events resulting in the White performance indicator were understood, independently assess the extent of condition, and provide assurance that the corrective actions for risk significant performance issues were sufficient to address the root causes and contributing causes and to prevent recurrence. The enclosed report documents the inspection findings which were discussed on February 9, 2007, with Mr. Dave Hoots and other members of your staff. The NRC was informed of your readiness for the inspection on January 19, 2007.

The inspection examined activities conducted under your license as they relate to safety and compliance with the Commission's rules and regulations and with the conditions of your license. The inspector reviewed selected procedures and records, observed activities, and interviewed personnel.

Based on the results of this inspection, no findings of significance were identified. The inspector determined that, in general, the problem identification, root cause evaluation, and corrective actions were adequate.

In accordance with 10 CFR 2.390 of the NRC's "Rules of Practice," a copy of this letter and its enclosure will be made available electronically for public inspection in the NRC Public Document Room or from the Publicly Available Records (PARS) component of NRC's document system (ADAMS), accessible from the NRC Web site at http://www.nrc.gov/reading-rm/adams.html (the Public Electronic Reading Room).

Sincerely,

/RA/

Richard A. Skokowski, Chief
Branch 3
Division of Reactor Projects

Docket Nos. 50-454; 50-455
License Nos. NPF-37; NPF-66

Enclosure: Inspection Report 05000455/2007007
w/Attachment: Supplemental Information

cc w/encl: Site Vice President - Byron Station
Plant Manager - Byron Station
Regulatory Assurance Manager - Byron Station
Chief Operating Officer
Senior Vice President - Nuclear Services
Vice President - Mid-West Operations Support
Vice President - Licensing and Regulatory Affairs
Director Licensing
Manager Licensing - Braidwood and Byron
Senior Counsel, Nuclear
Document Control Desk - Licensing
Assistant Attorney General
Illinois Emergency Management Agency
State Liaison Officer, State of Illinois
State Liaison Officer, State of Wisconsin
Chairman, Illinois Commerce Commission
B. Quigley, Byron Station

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Manager Licensing - Braidwood and Byron
Senior Counsel, Nuclear
Document Control Desk - Licensing
Assistant Attorney General
Illinois Emergency Management Agency
State Liaison Officer, State of Illinois
State Liaison Officer, State of Wisconsin
Chairman, Illinois Commerce Commission
B. Quigley, Byron Station

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U. S. NUCLEAR REGULATORY COMMISSION

REGION III

Docket Nos:	50-455
License Nos:	NPF-66
Report Nos:	05000455/2007007
Licensee:	Exelon Generation Company, LLC
Facility:	Byron Station, Unit 2
Location:	Byron, IL 61010
Dates:	February 5, 2007, through February 9, 2007
Inspector:	B. L. Bartlett, Senior Resident Inspector
Approved by:	R. Skokowski, Chief Branch 3 Division of Reactor Projects

Enclosure

SUMMARY OF FINDINGS

IR 05000455/2007007; 02/05/2007- 02/09/2007; Byron Station, Unit 2; Supplemental Inspection for a White Performance Indicator in the Mitigating Systems cornerstone.

This report covers a 1-week supplemental inspection performed by a Senior Resident Inspector. No findings of significance were identified. The NRC's program for overseeing the safe operation of commercial nuclear power reactors is described in NUREG-1649, "Reactor Oversight Process," Revision 3, dated July 2000.

A. NRC - Identified and Self-Revealing Findings

Cornerstone: Mitigating Systems

The NRC performed this Supplemental Inspection in accordance with Inspection Procedure 95001, “Inspection For One or Two White Inputs In A Strategic Performance Area,” to examine the causes for and actions taken related to the identification of a White Performance Indicator (PI) with the Heat Removal System (Auxiliary Feedwater) in the Mitigating Systems cornerstone. The inspector determined that the licensee’s evaluation was acceptable. The licensee utilized a structured approach to evaluate each of the three events which contributed to the White PI. The licensee’s corrective actions were appropriate to the causes identified. At the conclusion of the inspection, the corrective actions were either completed or being tracked for completion.

B. Licensee Identified Violations

None.

REPORT DETAILS

01 INSPECTION SCOPE

The purpose of this supplemental inspection was to assess the licensee's evaluation associated with a performance indicator (PI) for Unit 2 that crossed the threshold from Green to White in the Mitigating Systems cornerstone of the Reactor Safety Strategic Performance Area. Specifically, the licensee had three instances where the Unit 2 Train B Auxiliary Feedwater (AF) Pump either failed during operation or was identified in an as-found failed condition. The effect of these three failures caused the Heat Removal System portion of the Mitigating Systems Performance Index (MSPI) to cross the threshold from Green to White during the first quarter (June 2006) that the revised MSPI went into effect.

The inspector reviewed the licensee's actions associated with these three events and conducted interviews with licensee personnel to ensure that the root cause and contributing causes of the events were identified, understood, and appropriate corrective actions were initiated. The three events reviewed were:

1. On March 3, 2005, the 2B AF Pump tripped on overspeed conditions during a routine surveillance.

2. On November 4, 2005, the 2B AF Pump was started for a routine surveillance; when the pump was secured, the control power failed.

3. On January 5, 2006, the 2B AF Pump experienced a loss of control power. This failed condition was identified during a routine control board walkdown by a reactor operator.

02 EVALUATION OF INSPECTION REQUIREMENTS

02.01 Problem Identification

a. *Determine that the evaluation identified who (i.e., licensee, self-revealing, or NRC) and under what conditions the issues were identified.*

The licensee's evaluation of the three events appropriately determined who, and under what conditions the issues were identified. Specifically:

1. The March 3, 2005, event was self-revealed during a routine surveillance test.

2. The November 4, 2005, event was self-revealed when the pump was shut down after a routine surveillance. A reactor operator observed that the control power indicating light was not illuminated.

3. The January 5, 2006, event was identified by the licensee during a routine control board walkdown by a licensed reactor operator. The actual failure time remained unknown.

b. *Determine that the evaluation documents how long the issue existed, and prior opportunities for identification.*

1. The cause of the March 3, 2005, pump overspeed trip was attributed to a faulty signal generator. A preventative maintenance (PM) task, with a periodicity of 6 years, was developed after a failure of a signal generator in 1988. The licensee installed a new signal generator during the scheduled PM work activity in February 2004. This signal generator subsequently failed during the March 2005 event. The pump had been operated numerous times since 2004 without any overspeed trips or related issues. No other causes were identified and no other prior opportunities for identification were noted.

2. The cause of the November 4, 2005, loss of control power to the pump was attributed to the failure of fuse number 6. Specifically, after the pump was successfully tested, the fuse failed upon normal shutdown of the pump and was identified at that time. Evidence supported that the fuse failed due to age-related degradation. No other causes were identified and no prior opportunities for identification were noted.

3. The cause of the January 5, 2006, loss of control power to the pump was traced to an internal short on a relay. Although the licensee could not identify the exact time of the failure, they concluded that the pump was unavailable for approximately 3 hours or less.

   Specifically, on January 5, 2006, at 8:56 a.m. during a required hourly control room board walkdown, the on-watch reactor operator identified that control power had been lost to the pump. Since operators were required to perform a control board walkdown prior to taking the watch and once per hour while on watch, the licensee interviewed several operators to determine when the pump failed in relationship to the performed walkdowns. The licensee concluded that the operators would likely identify that the control power light indication was not illuminated during the required control room board walkdowns. Therefore, the control power was unlikely to have failed earlier than the 6:00 a.m.shift start time.

   The inspector determined that the licensee's assessment of how long the loss of control power condition existed was reasonable, but not overly conservative. Specifically, since no exact time of failure could be determined, the last time positive indication of pump operability would be during the prior pump operations. The last successful operation of the 2B AF pump was on January 3, 2007, which was approximately 45 hours and 47 minutes prior to the identification of the failed control power. The inspector confirmed that this amount of inoperable time was within the technical specification (TS) allowed outage time. Based on this review, the inspector determined that this issue was not risk significant because the total inoperability time would not have exceeded the TS requirement.

Regarding other prior opportunities for identification, the inspector noted that the cause of the loss of control power was traced to an internal short on a relay. The failure could have begun with intermittent spikes in current and thus, could explain the fuse failure in November 2005, since the same fuse failed during this event. However, records showed that the licensee had appropriately checked voltages in the control circuit following the November 2005 event and identified no discrepancies.

c. *Determine that the licensee evaluated the plant specific risk consequences and compliance concerns associated with the issues.*

Regarding risk assessments, a review of the control room logs and other records revealed that upon each of the failures, licensee personnel immediately assessed plant risk as required by their procedure. In addition, where appropriate, necessary equipment was posted as protected.

Regarding compliance issues, the licensee performed several related assessments. Specifically, a review of the failure of the relay was performed against the requirements of 10 CFR Part 21, and a review of TS requirements was made for the control power failure identified by the reactor operator. The inspector reviewed these assessments and no findings were noted.

02.02 Root Cause and Extent of Condition Evaluation

a. *Determine that the problem was evaluated using a systematic method to identify root causes and contributing causes.*

1. As required by the station's corrective action procedure, the licensee performed an Apparent Cause Evaluation (ACE) for the March 3, 2005, trip of the 2B auxiliary feedwater pump.

   The licensee sent the failed signal generator to a utility owned failure analysis center. The failure analysis determined that when force was applied off-center to the rotating shaft, the signal generator's output became noisy. Analysis in the field determined that noise had caused an indicated overspeed condition, but actual pump speed had not been high. There was also some indication that the shaft had experienced some off-center stress. After assessing the information, the licensee concluded that mounting the signal generator slightly off-center resulted in a noisy speed signal and caused the pump to trip on an indicated overspeed condition.

   The inspector determined that the methods used to identify the root and contributing causes were appropriate to the circumstances.

2. As required by the station's corrective action procedure, the licensee performed an ACE for the November 4, 2005, failure of the fuse that resulted in a loss of control power. Evidence supported that the fuse failed due to age-related degradation. No other cause was identified. The subsequent failure in January 2006 demonstrated that the fuse failure was probably caused by an

intermittent failure of a relay, but, at the time of the November 2005 failure, the licensee had taken appropriate steps to identify other causes and did not identify the intermittent failure of the relay. Specifically, records showed that the licensee had checked voltages in the control circuit following the November 2005 event and identified no discrepancies.

The inspector determined that methods used to identify the root and contributing causes were appropriate to the circumstances.

3. As required by the station's corrective action procedure, the licensee performed an ACE for the January 5, 2006, failure of control power.

   The cause of the loss of control power was traced to an internal short on a relay. The failure could have begun with intermittent spikes in current and thus could explain the fuse failure in November 2005, since the same fuse failed during this event. However, records showed that the licensee had checked voltages in the control circuit following the November 2005 event and identified no discrepancies.

   The inspector determined that methods used to identify the root and contributing causes were appropriate to the circumstances.

During a self-assessment prior to this inspection, licensee personnel identified that a full root cause evaluation had not been performed for the White performance indicator. The licensee's self-assessment and subsequent Nuclear Oversight assessment determined that the station's failure to perform a full root cause analysis did not cause any substantial failure to identify and implement corrective actions. The inspector agreed with this conclusion but determined that the failure to perform a full root cause analysis contributed to the failure to schedule or perform an effectiveness review. See Section 02.03.d below.

b. *Determine that the root cause evaluation was conducted to a level of detail commensurate with the significance of the problem.*

   The inspector determined that the root cause evaluation was performed with sufficient detail and analysis to support the conclusions reached. The individual ACEs adequately considered previous internal and external operating experience, organizational response, programmatic weaknesses, procedure, and training adequacy.

c. *Determine that the root cause evaluation included a consideration of prior occurrences of the problem and knowledge of prior operating experience.*

   The inspector determined that the ACEs had appropriately considered prior occurrences of similar problems, especially at the Braidwood Station and other similar equipment at the Byron Station.

d. *Determine that the root cause evaluation included consideration of potential common cause(s) and extent of condition of the problems.*

The inspector's review of the licensee's evaluation concluded that, in general, licensee personnel had adequately evaluated the extent of condition and potential common causes.

02.03 Corrective Actions

a. *Determine that appropriate corrective actions are specified for each root/contributing cause or that there is an evaluation that no actions are necessary.*

The corrective actions were clearly described and were entered into the licensee's corrective action program. The established corrective actions, in general, appropriately addressed the root causes and contributing causes of the events. A licensee-performed self-assessment determined that for the pump's overspeed trip event in March 2005, the apparent cause determination was not specific enough. The precise root cause had not been determined to the degree that a common mode failure could not be ruled out. Issue Report (IR) 576640 was written to document the observation and to recommend instituting periodic testing of the signal generator.

b. *Determine that the corrective actions have been prioritized with considerations of the risk significance and regulatory compliance.*

The inspector reviewed the corrective actions and verified that actions were prioritized and scheduled to be completed in a manner commensurate with the safety significance.

c. *Determine that a schedule has been established for implementing and completing the corrective actions.*

The corrective actions to prevent recurrence and the corrective actions to address the contributing causes were adequately scheduled for implementation. In addition, the inspector verified that the completed actions had been implemented according to assigned due dates, and that pending actions were tracked for resolution and closure. The licensee's self-assessment determined that some corrective actions had not been completed when actions were shown as completed. Specifically, some of the applicable relays did not have their preventive maintenance work activity revised to include an inspection for similar failures. Issue Report 576643 was written to document the incomplete corrective actions and to track the completion of the revisions to the remaining PMs. No violations of NRC requirements were noted.

d. *Determine that quantitative or qualitative measures of success have been developed for determining the effectiveness of the corrective actions to prevent recurrence.*

The inspector determined that the licensee did not schedule the performance of an effectiveness review. Based on the inspector's review, it was noted that the licensee performed an ACE for each of the three events, and each of the ACEs covered all aspects required by the licensee's corrective action procedure. However, effectiveness

reviews were not required for ACEs, but were only required for the root cause analyses. As previously noted, a licensee self-assessment had previously determined that a full root cause analysis had not been performed.

The inspector informed the licensee that an effectiveness review had not been scheduled and the licensee initiated IR 589600. The IR addressed the need to complete the actions that a full root cause analysis would have performed that were not required for ACEs, such as an effectiveness review. This IR initiated those actions as appropriate. No violations of NRC requirements were noted.

03 Meetings

03.01 Exit Meeting Summary

On February 9, 2007, the resident inspector presented the inspection results to Mr. D. Hoots and his staff, who acknowledged the findings. The inspector asked the licensee whether any materials examined during the inspection should be considered proprietary. No proprietary information was identified.

03.02 Regulatory Performance Meeting

In accordance with the requirements of Manual Chapter 0305, "Operating Reactor Assessment Program," dated January 25, 2007, the exit meeting served as the Regulatory Performance Meeting between Mr. Richard Skokowski, Chief, Branch 3, Division of Reactor Projects, NRC Region III, and Mr. D. Hoots and other members of the licensee staff.

ATTACHMENT: SUPPLEMENTAL INFORMATION

SUPPLEMENTAL INFORMATION

KEY POINTS OF CONTACT

Licensee

D. Hoots, Site Vice President
M. Snow, Plant Manager
S. Fruin, Operations
A. Giancatarino, Engineering Director
B. Grundmann, Regulatory Assurance Manager
T. Hulbert, NRC Coordinator
W. Kouba, NOS Manager
J. Langan, Regulatory Assurance
M. Prospero, Operations Manager
J. Harkness, System Engineer
K. Passmore, Plant Engineering Group Lead
J. Feimster, Plant Engineering Group Lead
K. Kovar, Engineering Program's Manager
J. Langan, Regulatory Assurance
H. Kats, System Engineer

Nuclear Regulatory Commission

R. Skokowski, Chief, Branch 3, Division of Reactor Projects

LIST OF ITEMS OPENED, CLOSED, AND DISCUSSED

Opened

None

Closed

None

Discussed

None

LIST OF DOCUMENTS REVIEWED

The following is a list of documents reviewed during the inspection. Inclusion on this list does not imply that the NRC inspector reviewed the documents in their entirety but rather that selected sections or portions of the documents were evaluated as part of the overall inspection effort. Inclusion of a document on this list does not imply NRC acceptance of the document or any part of it, unless this is stated in the body of the inspection report.

Documents Reviewed

IR 308024; 2B AF Pump Trip on Overspeed During ASME Run, March 03, 2005
IR 308203; Found Loose Connection While T-Shooting the 2B Auxiliary Feedwater (AF) Pump O/S, March 03, 2005
IR 308392; 2B AF Pump Tripped Again on Overspeed, March 04, 2005
IR 394647; No Control Power to the 2B AF Pump, November 05, 2005
Functional Failure Cause Determination Evaluation for No Control Power to the 2B AF Pump, January 10, 2006
IR 438938; Loss of Control Power 2B AF Pump, January 05, 2006
IR 439295; 2B AF Relay K18 Potential Contact Rating Issue, January 06, 2005
IR 445289; Unit 2 AF MSPI Indicator Will Go White, January 24, 2006
IR 484529; NOS Identified No Tracking of Added Actions / Documentation Issues, April 28, 2006
IR 552111; MSPI AF Margin Recovery Actions, November 1, 2006
IR 576635; MSPI Check-In: Root Cause Not Performed Per LS-AA-120, January 8, 2007
IR 576640; MSPI Check-In: ACE Determination Not Specific Enough, January 8, 2007
IR 576643; MSPI Check-In: Closure of CA did not Assure Completion, January 8, 2007
IR 583287; WR Needed to Monitor Signal Generator Output, January 25, 2007
IR 583292; WR Needed to Monitor Signal Generator Output, January 25, 2007
EC 358853; Review of the Potter-Brumfield Relay KHS17D11-24 as used in the AF Diesel K18 "Diesel Running Auxiliary Relay," Revision 0
EC 360000; Part 21 Review of AF K18 Relay Base, Revision 0
Failure Analysis of a Synchro-Start, Model MGO, P/N SA-3146, Signal Generator From The 2B AF Diesel Generator at Byron Station Unit 2, April 18, 2005
Failure Analysis (1) Buss NON-3 Fuse, December 21, 2005
Failure Analysis of Potter-Brumfield, KHS-17D11-24V, Relay for Byron Station, February 09, 2006
LS-AA-120; Issue Identification and Screening Process, Revision 6
LS-AA-125; Corrective Action Program (CAP) Procedure, Revision 10
LS-AA-125-1004; Effectiveness Review Manual, Revision 2
Drawing -122, Diagram of Auxiliary Feedwater, Revision AW
NOL-06-07-003, dated January 26, 2007, "Nuclear Oversight Readiness Letter for the NRC Inspection of the Auxiliary Feedwater Mitigating Systems Performance Indicator White Window - NRC Inspection Procedure (IP) 95001"

Corrective Action Documents As A Result of NRC Inspection

IR 588511; Typo in IR Event Date - IR 439295, February 07, 2006 (NRC Identified)
IR 589600; Procedure Non-Compliance with Investigation Class White PI, February 9, 2007 (NRC Identified)

LIST OF ACRONYMS USED

ACE	Apparent Cause Evaluation
ADAMS	Agencywide Documents Access and Management System
AF	Auxiliary Feedwater
CFR	Code of Federal Regulations
DRP	Division of Reactor Projects
IMC	Inspection Manual Chapter
IR	Issue Report
MSPI	Mitigating System Performance Index
NRC	United States Nuclear Regulatory Commission
PARS	Public Availability Records
PI	Performance Indicator
PM	Preventive Maintenance
TS	Technical Specification