



UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION III
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July 11, 2018

Mr. Bryan C. Hanson
Senior VP, Exelon Generation Company, LLC
President and CNO, Exelon Nuclear
4300 Winfield Road
Warrenville, IL 60555

SUBJECT: CLINTON POWER STATION—NRC 95001 SUPPLEMENTAL INSPECTION
REPORT 05000461/2018040 AND ASSESSMENT FOLLOW-UP LETTER

Dear Mr. Hanson,

On June 15, 2018, the NRC completed a supplemental inspection at Clinton Power Station using Inspection Procedure 95001, "Supplemental Inspection Response to Action Matrix Column 2 Inputs." The NRC performed this inspection to review the station's actions in response to a White Finding/Violation in the Mitigating Systems Cornerstone, which was documented and finalized in NRC Inspection Report 05000461/2017009 and after being notified of your readiness for this inspection via letter dated March 9, 2018. The NRC inspectors discussed the results of this inspection and the implementation of corrective actions with Mr. T. Stoner and other members of your staff. The results of this inspection are documented in the enclosed report.

This supplemental inspection was conducted to provide assurance that the root causes and contributing causes of the events resulting in the White Finding/Violation were understood, the extent of condition and extent of cause of any performance issues were identified, and the corrective actions for any performance issues were sufficient to address the root causes and contributing causes to prevent recurrence.

The NRC determined your staff's evaluation identified the primary root cause of the White Finding to be vulnerabilities in the original design of the Emergency Diesel Generator Ventilation Fan logic. The extent of condition was determined to potentially affect other Safety-Related load shedding and sequencing circuits. The corrective actions to prevent recurrence were determined to be modifications to the plant in order to remove the design vulnerability.

The NRC determined completed or planned corrective actions were sufficient to address the performance issue that led to the White Finding/Violation. Therefore, the performance issue will not be considered as an Action Matrix input after the end of the second quarter of 2018 in which the supplemental inspection exit meeting was conducted. After reviewing Clinton's performance in addressing the White Finding/Violation which was the subject of this Inspection Procedure 95001, "Supplemental Inspection Response to Action Matrix Column 2 Inputs," the NRC concluded your actions met the objectives of the inspection procedure. Therefore, in accordance with the guidance in Inspection Manual Chapter (IMC) 0305, "Operating Reactor Assessment Program," the White Finding/Violation will only be considered in assessing plant

performance for a total of four quarters. As a result, the NRC determined the performance at Clinton to be in the Regulatory Response Column of the ROP Action Matrix as of July 1, 2018. The unit remains in the Regulatory Response Column based on another White Finding/Violation associated with the Division 3 shutdown service water (SX) pump.

This letter, its enclosure, and your response (if any) will be made available for public inspection and copying at <http://www.nrc.gov/reading-rm/adams.html> and at the NRC Public Document Room in accordance with 10 CFR 2.390, "Public Inspections, Exemptions, Requests for Withholding."

Sincerely,

/RA/

Karla Stoedter, Branch Chief
Branch 1
Division of Reactor Projects

Docket No. 50-461
License No. NPF-62

Enclosure:
Inspection Report 05000461/2018040

cc: Distribution via LISTSERV®

Letter to Bryan C. Hanson from Karla Stoedter dated July 11, 2018

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U.S. NUCLEAR REGULATORY COMMISSION

REGION III

Docket Numbers: 50-461

License Numbers: NPF-62

Report Numbers: 05000461/2018040

Enterprise Identifier: I-2018-040-0004

Licensee: Exelon Generation Company, LLC

Facility: Clinton Power Station

Location: Clinton, IL

Dates: June 4 through June 15, 2018

Inspector: J. Hanna, Senior Reactor Analyst

Approved by: K. Stoedter, Chief
Branch 1
Division of Reactor Projects

SUMMARY

The U.S. Nuclear Regulatory Commission (NRC) continued monitoring the licensee's performance by conducting a supplemental inspection at Clinton Power Station in accordance with the Reactor Oversight Process. The Reactor Oversight Process is the NRC's program for overseeing the safe operation of commercial nuclear power reactors. Refer to <https://www.nrc.gov/reactors/operating/oversight.html> for more information. Any NRC identified and self-revealed findings, violations, and additional items are summarized in the table below. There were no licensee-identified non-cited violations documented in this report.

List of Findings and Violations

No findings or violations were identified.

Additional Tracking Items

None

INSPECTION SCOPES

Inspections were conducted using the appropriate portions of the inspection procedures (IPs) in effect at the beginning of the inspection unless otherwise noted. Currently approved IPs with their attached revision histories are located on the public website at <http://www.nrc.gov/reading-rm/doc-collections/insp-manual/inspection-procedure/index.html>. Samples were declared complete when the IP requirements most appropriate to the inspection activity were met consistent with Inspection Manual Chapter (IMC) 2515, "Light-Water Reactor Inspection Program - Operations Phase." The inspectors reviewed selected procedures and records, observed activities, and interviewed personnel to assess licensee performance and compliance with Commission rules and regulations, license conditions, site procedures, and standards.

OTHER ACTIVITIES—TEMPORARY INSTRUCTIONS, INFREQUENT AND ABNORMAL

95001—Supplemental Inspection Response to Action Matrix Column 2 Inputs

In preparation for the inspection, the licensee performed a root cause analysis (RCA) to address the White Violation. This RCA was reviewed during the inspection to address the objectives of the inspection procedure. The inspectors determined that the licensee's RCA was conducted to a level of detail commensurate with the significance of the problem and reached reasonable conclusions. The inspectors also concluded that the licensee identified reasonable and appropriate corrective actions and that the corrective actions appeared to be prioritized commensurate with the safety significance of the issue.

The inspectors reviewed the licensee's root causes, contributing causes, extent of condition, and extent of cause determinations developed in response to a White Violation of Title 10 *Code of Federal Regulations* (CFR) 50, Appendix B, Criterion III, "Design Control" and an associated Technical Specification (TS) violation of TS 3.8.1, "AC Sources—Operating." The inspectors assessed whether the licensee's corrective actions to address the root and contributing causes were sufficient to prevent recurrence. The highlights of the performance review and NRC's assessment are documented below.

The inspector attempted to review the commonalities between this White Violation and the White Violation associated with the Division 3 shutdown service water (SX) pump see NRC Inspection Report 05000461/2017011 for details. However the licensee had not completed the RCA to evaluate the relationship between both conditions at the time of the inspection, therefore it could not be reviewed. This inspection attribute will be performed in the forthcoming IP 95001 inspection when the licensee informs the agency of their readiness.

(1) Problem Identification

- a) The self-revealing condition was discovered on March 7, 2017, when an equipment operator who was performing rounds heard a clicking noise coming from Unit Substation 1A. Upon investigation, the licensee determined the noise was coming from relay 427X2–41A (commonly called the X2 relay). Relay 427X2–41A is an Agastat time delay relay that provides a signal to reset the load shed and resequencing circuit for the Division 1 EDG room vent fan. Further troubleshooting determined that the relay was cycling every ten seconds. With the relay cycling, the room vent fan could not start automatically nor be started locally. On March 9, 2017, the licensee declared the Division 1 EDG inoperable since the vent fan was required to support EDG operation.
- b) The vulnerable condition (an undesired interaction between the X2 and X3 relays in the EDG cooling fan start circuitry) existed since January 2008 when the licensee implemented a design change to replace X3 relays in the plant. Previously these relays were Gould J13 relays and were being replaced with GE CR120BD relays due to obsolescence. In addition to the X3 relay replacement described above, the licensee also replaced the X2 relay in December 2011 and on May 16, 2016. The prior opportunities for identification were when the item equivalency evaluations were done for the relay replacement in the 2008 timeframe, and then subsequently in 2011 and 2016 when the X2 relays were again replaced.
- c) The interaction between the X2 and X3 relays would have caused the cooling fan for the EDG to fail to start and ultimately would result in a fail-to-run of the engine. As described in NRC Inspection Report 05000461/2017009, the internal events change in core damage frequency (CDF) estimate was approximately $2.5E-6$ /yr, which represents a finding of low to moderate safety significance (White). The dominant core damage sequence was a loss of offsite power event, failure of the Division 1, 2, and 3 diesel generators, and the failure to recover power before battery depletion. Two violations (Title 10 of the CFR, Part 50, Appendix B, Criterion III, “Design Control,” and Technical Specification (TS) 3.8.1, “AC Sources-Operating,” Condition B.4) were identified.

(2) Root Cause, Extent-of-Condition, and Extent-of-Cause Evaluation

- a) The licensee performed the root cause assessment using a systematic methodology to identify the root and contributing causes. The techniques used were Event and Causal Factor analysis blended with a “Why staircase” and the Support/Refute analysis to complement each other.

- b) The RCA was conducted to a level of detail commensurate with the safety/risk significance of the problem. For example, the RCA explored how the original design of the EDG cooling fan circuitry, which was vulnerable to a relay coordination issue interacted with a lack of understanding of the design basis by the procurement staff.
- c) The licensee's RCA team reviewed Clinton's specific operating history and industry operating experience in order to identify prior opportunities to identify the problem. No items were identified. The RCA team concluded that there were significant differences between prior occurrences and industry operating experience such that they should not be considered precursors.
- d) The RCA concluded that the extent of condition included other safety-related circuits that performed load shedding and sequencing and which rely on parallel sequencing logic to perform the control function. The extent of cause was determined to be "other safety related relay logic circuits that rely on executing parallel sequencing logic to perform the control function." The inspectors were concerned that the extent of cause did not review the programmatic aspects of the problem and challenged the licensee regarding this apparent deficiency. The licensee was able to provide documentation showing that programmatic aspects, e.g., training, safety culture, etc. were reviewed.
- e) The RCA appropriately considered all potential safety culture components (as described in NUREG-2165, "Safety Culture Common Language"), for the root cause, extent of condition, and extent of cause.
- f) At the time of this inspection, Clinton Power Station had a second White Finding/Violation for a performance deficiency on the Division 3 SX pump. However, the licensee had not completed the RCA to understand the relationship between the EDG failure and the Division 3 SX failure, therefore it could not be inspected. This inspection aspect will be addressed during a subsequent IP 95001 inspection when the licensee informs the NRC of their readiness.

(3) Corrective Actions

- a) The corrective actions to prevent recurrence (CATPR) taken for the root cause were to perform Engineering Changes and Work Orders that altered the wiring for both the Division 1 and Division 2 EDGs. These actions were completed at the time of the inspection. The planned (i.e., future) corrective actions to prevent recurrence of the root cause were to perform similar alterations of the 0AP05E and 0AP06E (Control Room Ventilation) circuitry. These actions were scheduled to be completed on September 14, 2018. The corrective actions for the contributing cause were to: 1) create Procurement Engineering Standards (PES) that address critical characteristics for relay logic, and 2) identify the critical characteristics to be included in the PES.
- b) The inspectors determined all corrective actions were adequately prioritized. All corrective actions and corrective actions to prevent recurrence were completed at the time of the inspection, with the exception of those described in 3.b above.

- c) As described in 3.b above, the licensee’s scheduled completion date for the modifications to the Control Room Ventilation System (which was the corrective action to prevent recurrence of the root cause) is September 14, 2018.
 - d) For the effectiveness review of the CATPR, the licensee verified the design change worked satisfactorily through the performance of the Post Maintenance Test of Work Orders 4609243–15 and 4622524 on the EDG ventilation modifications. For effectiveness review of the corrective actions on the contributing cause, the licensee planned to perform a Post Maintenance Test after the Control Room Ventilation System modifications were completed.
 - e) The licensee’s corrective actions (both taken and planned) adequately addressed the Notice of Violations of Title 10 *Code of Federal Regulations* Part 50, Appendix B, Criterion III, “Design Control” and an associated Technical Specification (TS) violation of TS 3.8.1, “AC Sources–Operating.”
- (4) Evaluation of IMC 0305 Criteria for Treatment of Old Design Issues: The licensee did not request credit for self-identification of an old design issue; therefore, the risk-significant issue was not evaluated against the IMC 0305 criteria for treatment of an old design issue.

INSPECTION RESULTS

95001—Supplemental Inspection Response to Action Matrix Column 2 Inputs

Observation	IP 95001
<p>Assessment of licensee’s evaluation and corrective actions: The root cause assessment accurately described who identified the issue and under what conditions the issue was identified, how long the issue existed and the prior opportunities for identification. The root cause used a systematic methodology to identify the root and contributing causes and was conducted to a level of detail commensurate with the significance of the problem. The root cause evaluation included a consideration of prior occurrences of the problem and did a thorough review of prior operating experience that might have represented opportunities to identify earlier. The root cause evaluation addressed the extent of condition and the extent of cause of the problem. The root cause, extent of condition, and extent of cause evaluations appropriately considered the safety culture traits in NUREG–2165, “Safety Culture Common Language,” referenced in IMC 0310, “Aspects Within Cross-Cutting Areas.” The appropriate corrective actions were specified for each of the root and contributing causes and have been effectively prioritized with consideration of significance and regulatory compliance. The corrective actions taken to address and preclude repetition of significant performance issues were prompt and effective. The Notice of Violation (NOV) related to the supplemental inspection was adequately addressed.</p> <p>The inspectors determined that completed or planned corrective actions were sufficient to address the performance issue that led to the White Violation.</p>	

No findings or violations were identified.

EXIT MEETINGS AND DEBRIEFS

The inspectors confirmed that proprietary information was controlled to protect from public disclosure. No proprietary information was documented in this report.

- On June 15, 2018, the inspector presented the Supplemental Procedure 95001 inspection results to Mr. T. Stoner, Site Vice President, and other members of the licensee staff.
- During the exit meeting, the NRC discussed the performance of Clinton in accordance with IMC 0305, Section 10.01.a. The meeting was attended by the Division of Reactor Projects Branch Chief for Clinton and Site Vice President and other senior licensee staff. The NRC and licensee discussed the issues related to the White Violation which resulted in Clinton moving to the Regulatory Response Column of the Action Matrix. This discussion included the causes, corrective actions, extent of condition and extent of cause, and other planned licensee actions for the issues identified as a result of the White input. The criteria required for returning to the Licensee Response Column of the Action Matrix was discussed.

DOCUMENTS REVIEWED

95001—Supplemental Inspection Response to Action Matrix Column 2 Inputs

- AR 1234567; Example Document for Document Reviewed Section; Revision 1
- AR 04112376, "Self-Assessment 4098228 Identifies Deficiencies in RCR-39827"
- AR 02628567, "Part 21 NLI Supplied Masterpact Replacement Circuit Breaker"
- Exelon Root Cause Assessment "1AP11E427X2-41A Making Loud Clicking Sound," Revisions 2 & 3
- Exelon Procedure PI-AA-125, "Corrective Action Program Procedure," Revision 6
- Exelon Procedure PI-AA-125-1001, "Root Cause Analysis Manual," Revision 3
- Exelon Procedure PI-AA-125-1004, "Effectiveness Review Manual," Revision 3
- Exelon Procedure PI-AA-126, "Self-Assessment and Benchmark Program," Revision 2
- Exelon Procedure SM-AA-300, "Procurement Engineering Support Activities," Revisions 1 & 6
- Exelon Nuclear Engineering Standard, "Relay Procurement and Acceptance," Revision 0
- Item Equivalency Evaluation 57906 for the GE CR120BD04341 Relay, dated March 9, 2004
- Item Equivalency Evaluation 68980 dated June 17, 2010
- Item Equivalency Evaluation 68979 dated June 17, 2010
- Item Equivalency Evaluation 81745 dated October 9, 2013
- Item Equivalency Evaluation 81066 dated August 15, 2013
- Item Equivalency Evaluation 67090 dated November 20, 2009
- Item Equivalency Evaluation 66303 dated September 12, 2009
- Item Equivalency Evaluation 57906 dated September 12, 2009
- Item Equivalency Evaluation 34648 dated September 25, 2006
- Item Equivalency Evaluation 72868 dated July 22, 2011
- Item Equivalency Evaluation 77777 dated October 21, 2012
- Item Equivalency Evaluation 78840 dated February 2, 2013
- Item Equivalency Evaluation 81662 dated October 3, 2013
- Item Equivalency Evaluation 82519 dated December 15, 2013
- Item Equivalency Evaluation 89916 dated September 4, 2015
- Self-Assessment, "Readiness Assessment – Supplemental Inspection for Emergency Diesel Generator Room Ventilation Fan Start Failure," dated February 28, 2018
- Clinton Power Station PowerPoint Presentation titled "Using Critical Parameters," and associated sign-in sheets for trainees