



**UNITED STATES
NUCLEAR REGULATORY COMMISSION**

REGION III
2443 WARRENVILLE RD. SUITE 210
LISLE, ILLINOIS 60532-4352

November 27, 2017

EA-17-098

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 - FINAL SIGNIFICANCE DETERMINATION OF A
WHITE FINDING WITH ASSESSMENT FOLLOWUP AND NOTICE OF
VIOLATION; NRC INSPECTION REPORT NO. 05000461/2017010**

Dear Mr. Hanson:

This letter provides you the final significance determination of the preliminary White finding discussed in U.S. Nuclear Regulatory Commission (NRC) Inspection Report No. 05000461/2017009 dated August 14, 2017. A copy of the inspection report can be found in the NRC's Public Document Room or from the NRC's Agencywide Documents Access and Management System (ADAMS), accessible from the NRC's website at <http://www.nrc.gov/reading-rm/adams.html> under accession number ML17226A321. The finding involved the failure to evaluate the change in the actual drop out voltages for replacement relays associated with the Division 1 Emergency Diesel Generator (EDG) room ventilation fan, which was a component subject to the requirements of Title 10 of the *Code of Federal Regulations* (CFR) Part 50, Appendix B. The change in drop out voltages prevented the fan from operating during an undervoltage condition, resulting in the Division 1 EDG being unable to perform its intended safety function and becoming inoperable for a time longer than its technical specification allowed outage time.

In letter dated September 18, 2017, the Exelon Generation Company (EGC) provided a response to the NRC's preliminary determination regarding the finding. This letter is available in ADAMS under ML17263A124. In the response, EGC indicated that it recognized that a performance deficiency occurred, and did not dispute the apparent violation or the assigned cross-cutting aspect. The response also indicated that after reviewing new information, which was attached to the response letter, EGC had reassessed the safety significance and believed the finding was of very low safety significance (Green). The NRC's response is provided in Enclosure 2.

After considering the information developed during the inspection and the additional information you provided in your letter dated September 18, 2017, the NRC has concluded that the finding is appropriately characterized as White, a finding of low to moderate safety significance.

You have 30 calendar days from the date of this letter to appeal the determination of significance for the identified White finding. Such appeals will be considered to have merit only if they meet the criteria given in the NRC Inspection Manual Chapter (IMC) 0609, Attachment 2. An appeal must be sent in writing to the Regional Administrator, Region III, 2443 Warrenville Road, Suite 210, Lisle, IL 60532.

The NRC has also determined that the failure to verify the suitability of the replacement relays for the Division 1 EDG room ventilation fan was a violation of 10 CFR 50, Appendix B, Criterion III, "Design Control" as cited in the enclosed Notice of Violation (Notice) (Enclosure 1). As a result of the design control violation, it was determined that from May 18, 2016, to March 11, 2017, when the unsuitable relay was installed the associated EDG was inoperable, a period greater than the technical specification allowed outage time of 14 days. The circumstances surrounding the violation were described in detail in Inspection Report No. 05000461/2017009. In accordance with the NRC Enforcement Policy, the Notice is considered escalated enforcement action because it is associated with a White finding. The NRC determined that this finding affected the cross-cutting area of human performance in the aspect of challenge the unknown, where individuals stop when faced with uncertain conditions.

The NRC has concluded that the information regarding the reason for the violation, the corrective actions taken and planned to correct the violation and prevent recurrence, and the date when full compliance will be achieved is already adequately addressed on the docket in Inspection Report No. 05000461/2017009. Therefore, you are not required to respond to this letter unless the description therein does not accurately reflect your corrective actions or your position.

As a result of our review of Clinton's performance, including this White finding, we have assessed the Clinton Power Station to be in the Regulatory Response column of the NRC's Action Matrix, effective the third quarter of 2017. Therefore, we plan to conduct a supplemental inspection using Inspection Procedure 95001, "Inspection for One or Two White Inputs in a Strategic Performance Area," when your staff has notified us of your readiness for this inspection. This inspection procedure is conducted to provide assurance that the root cause and contributing cause of risk significant performance issues are understood, the extent of condition and the extent of cause are identified, and the corrective actions are sufficient to prevent recurrence.

In accordance with 10 CFR 2.390 of the NRC's "Rules of Practice," a copy of this letter, its enclosures, and your response, if you choose to provide one, will be made available electronically for public inspection in the NRC Public Document Room or from the NRC's document system (ADAMS), accessible from the NRC Web site at <http://www.nrc.gov/reading-rm/adams.html>. To the extent possible, your response should not include any personal privacy, proprietary, or safeguards information so that it can be made available to the Public without redaction.

Sincerely,

/RA/

Cynthia D. Pederson
Regional Administrator

Docket No. 050-00461
License No. NPF-62

Enclosures:

1. Notice of Violation
2. NRC's response

cc: Distribution via LISTSERV®

Letter to Bryan Hanson from Cynthia Pederson dated November 27, 2017

SUBJECT: CLINTON POWER STATION - FINAL SIGNIFICANCE DETERMINATION OF A WHITE FINDING WITH ASSESSMENT FOLLOWUP AND NOTICE OF VIOLATION; NRC INSPECTION REPORT 05000461/2017010

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NOTICE OF VIOLATION

Exelon Generation Company, LLC
Clinton Power Station

Docket No. 050-00461
License No. NPF-62
EA-17-098

During a Nuclear Regulatory Commission (NRC) inspection conducted March 7 through August 3, 2017, a violation of NRC requirements was identified. In accordance with the NRC Enforcement Policy, the violation is listed below:

Title 10 *Code of Federal Regulations* (CFR) Part 50, Appendix B, Criterion III, "Design Control," requires, in part, that measures be established for the selection and review for suitability of application of materials, parts, equipment, and processes that are essential to the safety-related functions of the structures, systems and components.

Technical Specification (TS) 3.8.1 "AC Sources—Operating" requires, in part, that three diesel generators be operable in Modes 1,2, and 3. Condition B.4 states, in part, that the required inoperable diesel generator be restored to operable status within 14 days. Required Action F.1 states the reactor be in Mode 3 within 12 hours if the completion time specified in B.4 is not met.

Contrary to the above, in December 2007, the licensee failed to review for suitability of application replacement relays essential to the safety-related functions of the Division 1 Emergency Diesel Generator (EDG) Room Ventilation Fan. Specifically, the licensee failed to evaluate the change in the actual drop out voltages for replacement relays associated with the Division 1 EDG Room Ventilation Fan resulting in the safety-related fan becoming inoperable during undervoltage conditions. Consequently, from May 18, 2016, to March 11, 2017, when the unsuitable relay was installed and subsequently replaced, the Division 1 EDG was inoperable, a period greater than the technical specification allowed outage time of 14 days. Additionally, because the licensee was not aware of the diesel generator's inoperability during the unit's operation cycle, the required action in TS 3.8.1.F.1 was not followed.

This violation is associated with a White Significance Determination Process finding.

The NRC has concluded that information regarding the reason for the violation, the corrective actions taken and planned to correct the violation and prevent recurrence, and the date when full compliance will be achieved is already adequately addressed on the docket in Inspection Report No. 05000461/2017009. However, you are required to submit a written statement or explanation pursuant to 10 CFR 2.201 if the description therein does not accurately reflect your corrective actions or your position. In that case, or if you choose to respond, clearly mark your response as a "Reply to a Notice of Violation, EA-17-098" and send it to the U.S. Nuclear Regulatory Commission, ATTN: Document Control Desk, Washington, DC 20555-0001 with a copy to the Regional Administrator, Region III, 2443 Warrenville Road, Suite 210, Lisle, IL 60532, and a copy to the NRC Resident Inspector at the facility that is the subject of this Notice of Violation, within 30 days of the date of the letter transmitting this Notice.

If you contest this enforcement action, you should also provide a copy of your response, with the basis for your denial, to the Director, Office of Enforcement, United States Nuclear Regulatory Commission, Washington, DC 20555-0001.

If you choose to respond, your response will be made available electronically for public inspection in the NRC Public Document Room or from the NRC's document system (ADAMS), accessible from the NRC Web site at <http://www.nrc.gov/reading-rm/adams.html>. Therefore, to the extent possible, the response should not include any personal privacy, proprietary, or safeguards information so that it can be made available to the Public without redaction.

In accordance with 10 CFR 19.11, you may be required to post this Notice within two working days of receipt.

Dated this 27th day of November 2017.

NRC RESPONSE TO INFORMATION
PROVIDED BY EXELON GENERATION COMPANY
IN LETTER DATED SEPTEMBER 18, 2017

In letter dated September 18, 2017, the Exelon Generation Company (licensee) provided a response to the NRC's preliminary significance determination regarding the finding. In the response, the licensee indicated that it recognized a performance deficiency occurred, and did not dispute the apparent violation or the assigned cross-cutting aspect. The response also indicated that after reviewing new information, which was attached to the response letter, the licensee had reassessed the safety significance and believed the finding was of very low safety significance (Green). Furthermore, the licensee stated that (1) the new information refined the prediction of temperatures within the Division 1 Emergency Diesel Generator (EDG) room; (2) the refined analysis resulted in reduced room temperatures and along with increased equipment survivability limits results in an increased survivability margin for the limiting critical devices for the "LOCA/LOOP – Doors Closed" case from ≥ 11 degrees F to ≥ 37 degrees F; and (3) as a result, there is reasonable assurance that sufficient margin exists between the environmental temperatures and equipment survivability limits for the critical components associated with the EDG function for the PRA mission time.

The licensee concluded that the finding should be characterized as Green using NRC Inspection Manual Chapter 0609 Appendix A, Exhibit 2. The licensee also provided additional risk insights that room temperatures above 175 degrees F were not reached in the "ILLOCA/LOOP Doors Closed" scenario until almost 20 hours into the event providing additional time to restore functionality to the ventilation fan or to open doors and provide alternate cooling. The following describes the licensee's evaluation as discussed in their letter as well as the NRC response.

The licensee initially performed an analysis, EC 619834, and later refined that analysis under EC 620632, which was submitted to the NRC to evaluate the Clinton Division 1 Diesel Generator room heat-up due to loss of Division 1 EDG room ventilation fan. NRC inspectors conducted a review of these analyses to assess the reasonableness of area temperatures generated by GOTHIC computer modeling and the reasonableness of component survivability predictions based on testing and qualifications.

The licensee developed the GOTHIC computer model of the Division 1 EDG room in order to generate best-estimate area heat rate and area temperature profiles. The licensee benchmarked the model against data collected during a loaded run performed on April 27, 2017. Inspectors determined the licensee reasonably modeled the EDG room and reasonably developed room temperatures used under the critical components survivability assessment. The NRC agreed that the new information refined the prediction of temperatures within the EDG room, resulting in reduced room temperatures from the initial evaluation.

The NRC's review of the temperature profiles focused on the scenario the licensee described as "LOCA/LOOP Doors Closed." The NRC also reviewed the "LOOP Doors Closed" scenario but concluded that this single deterministic scenario could not be used to establish revised probabilistic risk assessment (PRA) success criteria for EDG operation with no room cooling because it did not capture the full spectrum of realistic LOOP event scenarios and EDG loading that could occur in response to LOOP initiating events modeled in PRA. The NRC determined that temperature estimates using the

EDG loading as represented by the “LOCA/LOOP Doors Closed” scenario was a better representation of the temperature profile that would need to be considered to re-evaluate EDG room cooling success criteria for PRA. The NRC used this scenario to evaluate the component survivability for PRA function.

In order to assess component survivability, the licensee conducted testing or performed evaluations. The NRC reviewed the test results and concluded that they demonstrated the potential for equipment to operate beyond the operating limits identified during design. Although the licensee provided test data, we judged that the test sample size, most frequently one test per component for those that were tested, did not represent a statistically significant sample or represent a substantive basis to reliably establish equipment survivability limits.

With respect to component evaluations, we relied on component information/details contained within the previously discussed EC’s and IP-Q-396a, “Operability Evaluation of Equipment at Elevated Temperature in Diesel Generating Room,” which is part of the current licensing basis. The IP-Q-396a previously evaluated the qualification of the components for operation at elevated temperatures (room temperature excursions to 140 degrees F for 12 hours). The licensee’s analysis identified 21 components as critical; components necessary to support the function of the EDG.

Based on these reviews, we determined the licensee’s evaluation did not provide a reasonable basis to conclude the EDG would function for the PRA mission time of 24 hours without the fan and without any operator action to open EDG room doors to provide room cooling. This conclusion is consistent with our preliminary significance determination. Although the estimated temperatures in the room were lower in the revised licensee evaluation, they were still well beyond the qualified temperatures of the critical components as described in the current licensing basis evaluations. In our judgment, the significant departure (i.e., greater than 10%) from qualified temperatures was not justified by the limited testing and did not provide reasonable assurance that margin existed between the room temperature and equipment survivability limits.

The licensee also provided some additional risk insights regarding additional time available for operator action to mitigate the impact of the ventilation fan failure. We concluded that these insights would not impact our conclusions on the reliability of operator recovery action to open doors documented in the preliminary detailed risk evaluation for the finding. Without pre-existing procedures and training for restoring functionality to the fan, further risk reduction credit was not justified. The licensee proposed that fan functionality could be restored by identifying the chattering relay, reviewing drawings, removing control power fuses, and manually closing the fan breaker. However, we note that when the actual condition was discovered on March 7, 2017, it took 2 days for licensee staff to evaluate the problem and restore the fan to an operable status. Once the problem was fully understood, the licensee determined that the relay had been cycling since February 24, 2017. The actual operating experience and the lack of procedures and training to cope with this specific failure do not support crediting operator recovery of the fan during an event.

With respect to the action to recover cooling by opening doors, the NRC treated the action as skill-of-the craft action where a specific procedure was not necessary and the lack of a procedure was not considered an influencing performance shaping factor. Regarding additional time to open doors, we concluded that time was also not a

significant influencing performance shaping factor and that additional time would not impact the human error probability previously estimated and credited in the preliminary significance determination evaluation. The NRC's preliminary and final significance determination evaluation estimated a success rate of approximately 98% for operators to respond to the fan failure and open doors which represents a very reliable action.

Although we did not agree with the licensee's conclusion on the significance of the finding, our review determined that the EDG could operate beyond qualified component temperatures before room temperatures became excessively high, impacting the EDG function. The NRC modified the preliminary significance determination based on the review of your additional analyses and consideration of the potential to run longer, but not complete the 24 hour PRA mission.

In the preliminary significance determination, the NRC assumed the EDG could run for two hours without room cooling. Based on the new information provided, the NRC further evaluated the preliminary significance determination by considering that the EDG could run for up to 20 hours without room cooling or operator action to open room doors. The temperature rise in the room significantly increases when fire dampers close at 165 degrees F. In the license evaluation, this occurred at 20 hours into the event. The NRC viewed the timing as subject to uncertainty, but considered that overall, the evaluation showed that the EDG could successfully operate for longer than two hours.

The estimated change in internal event core damage frequency for the 10 month exposure time considering the EDG could run for up to 20 hours was $1.1E-6/yr.$, which is slightly lower than the preliminary estimate of $2.5E-6/yr.$ This estimate represents an internal event risk contribution only. The external event contribution was not quantified but would add to the internal event risk. Consistent with the preliminary evaluation, the NRC determined that the additional risk contribution from external events would not cause the overall significance result to be higher than the result obtained from the internal event risk estimate. The dominant risk contributors remain the same as in the preliminary significance determination.

Due to the uncertainty in evaluating the ability of the EDG to function outside of its design temperature rating, the NRC also performed a sensitivity evaluation by increasing the failure to run probability of the EDG, using an assumption that significantly higher room temperatures than what the equipment is designed for would result in decreased EDG reliability. The result showed that with modest increases in the failure to run probability (e.g., a factor of 2) for a 24 hour mission time, the result remained White.

The NRC qualitatively considered the sensitivity of our conclusion to our assumption that LOOP PRA initiating events required room cooling either from the ventilation fan or operator action. If the EDG could perform its mission for some LOOP event sequences, but not all, the risk could potentially be lower. However, the NRC could not conclude based on the available information that it would be below the $1E-6/yr.$ delta core damage frequency threshold.

Our best estimate internal event risk calculation combined with insights regarding external event risk and the sensitivity evaluations performed were collectively used to arrive at the risk-informed decision that this finding is of low to moderate safety significance (White).