



**UNITED STATES
NUCLEAR REGULATORY COMMISSION**

REGION III
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December 2, 2015

EA-15-001
EA-15-115

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

SUBJECT: DRESDEN NUCLEAR POWER STATION, UNITS 2 AND 3 –
NRC SUPPLEMENTAL INSPECTION REPORT 05000237/2015011;
05000249/2015011 AND ASSESSMENT FOLLOW-UP LETTER

Dear Mr. Hanson:

On March 26, and September 16, 2015, the U.S. Nuclear Regulatory Commission (NRC) provided you with letters of final significance determinations for two preliminary White findings discussed previously in inspection reports 05000237/2014005; 05000249/2014005 and 05000237/2015002; 05000249/2015002, dated January 29, 2015, and July 1, 2015, for Unit 3 and Unit 2, respectively. These reports are available in the NRC's Agencywide Documents Access and Management System (ADAMS) at Accession Numbers ML15085A273 and ML15260A508. ADAMS is accessible from the NRC Web site at <http://www.nrc.gov/reading-rm/adams.html>. The findings involved the failure of electromatic relief valves (ERVs) on both Units 2 and 3 to perform their intended safety functions. As a result, the NRC assigned the two White findings Action Matrix inputs for the Mitigating Systems cornerstone in the fourth quarter of 2014 for Unit 3, and the second quarter of 2015 for Unit 2.

In response to these Action Matrix inputs, the NRC informed you that a supplemental inspection under Inspection Procedure 95001, "Supplemental Inspection for One or Two White Inputs in a Strategic Performance Area," would be required.

On August 25, 2015, you informed the NRC that Dresden Units 2 and 3 were ready for the supplemental inspection.

On October 19, 2015, the NRC completed the supplemental inspection and discussed the results of this inspection and the implementation of your corrective actions with Mr. G. Morrow, Operations Director, and other members of your staff. This exit meeting also served as a Regulatory Performance Meeting. The inspector documented the results of this inspection in the enclosed inspection report.

The NRC performed this supplemental inspection to determine whether: (1) the root and contributing causes for the significant issues were understood; (2) the extent of condition and extent of cause for the identified issues were understood; and (3) your completed or planned corrective actions were sufficient to address and prevent repetition of the root and contributing causes.

B. Hanson

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The NRC determined that your staff's evaluation identified the primary root cause of the issues to be the inadequate design of the ERV actuators. An additional root cause, specific only to the Unit 2 failure, was identified as the lack of adequate maintenance procedures for the ERV actuator sub-components. The Root Cause Evaluation report also identified a contributing cause of a "lack of adherence to the technical conscience principles."

The NRC determined that the programs and processes at Dresden Nuclear Power Station generally met the Commission's rules and regulations. The NRC has determined that completed or planned corrective actions are sufficient to address the performance that led to the White findings. Since a safety-significant finding is considered an Action Matrix input for the entire duration of: (1) the quarter that includes the finding's start date; and (2) the next three quarters, Unit 2 will remain in the Regulatory Response Column of the Action Matrix until the end of the first quarter of 2016. Because Unit 3's White finding was held open beyond four quarters, in accordance with Inspection Manual Chapter 0305, Unit 3 will change Action Matrix columns to the Licensee Response Column upon issuance of this inspection report and assessment follow-up letter. However, Unit 3's White finding will continue to be considered an Action Matrix input in conjunction with any future greater-than-green inputs for the remainder of the fourth quarter of 2015.

Based on the results of this inspection, the NRC inspector did not identify any findings or violations.

In accordance with Title 10 of the *Code of Federal Regulations* (10 CFR) 2.390, "Public Inspections, Exemptions, Requests for Withholding," of the NRC's "Rules of Practice," a copy of this letter, its enclosure, and your response (if any) will be available electronically for public inspection in the NRC's Public Document Room or from the Publicly Available Records (PARS) component of the NRC's 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 John Rutkowski Acting for/

Jamnes Cameron, Chief
Branch 4
Division of Reactor Projects

Docket Nos. 50-237; 50-249
License Nos. DPR-19; DPR-25

Enclosure:
IR 05000237/2015011; 05000249/2015011
w/Attachment: Supplemental Information

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U.S. NUCLEAR REGULATORY COMMISSION

REGION III

Docket Nos: 50-237; 50-249
License Nos: DPR-19; DPR-25

Report No: 05000237/2015011; 05000249/2015011

Licensee: Exelon Generation Company, LLC

Facility: Dresden Nuclear Power Station, Units 2 and 3

Location: Morris, IL

Dates: October 13 through October 19, 2015

Inspector: R. Ruiz, Senior Resident Inspector—LaSalle

Approved by: J. Cameron, Chief
Branch 4
Division of Reactor Projects

Enclosure

SUMMARY

Inspection Report (IR) 05000237/2015011, 05000249/2015011; 10/13/2015 – 10/19/2015; Dresden Nuclear Power Station, Units 2 & 3; Supplemental Inspection - Inspection Procedure (IP) 95001.

A senior resident inspector performed this inspection. No findings were identified during this inspection. The U.S. Nuclear Regulatory Commission's (NRC's) program for overseeing the safe operation of commercial nuclear power reactors is described in NUREG-1649, "Reactor Oversight Process."

Cornerstone: Mitigating Systems

The NRC staff performed this supplemental inspection in accordance with IP 95001, "Inspection for One or Two White Inputs in a Strategic Performance Area," to assess the licensee's evaluation associated with the failures of electromatic relief valves (ERVs) to perform their intended safety functions, as discovered in November 2014 for Unit 3 and February 2015 for Unit 2. During this supplemental inspection, the inspector determined that the licensee performed a comprehensive evaluation of the self-revealed failures which were described in NRC IR 05000237; 05000249/2014005 and IR 05000237; 05000249/2015002. The licensee identified the primary root cause for each of the failures to be the inadequate design of the ERV actuators. An additional root cause, specific only to the Unit 2 failure, was identified as the lack of adequate maintenance procedures for the ERV actuator sub-components. The Root Cause Evaluation report also identified a contributing cause of a "lack of adherence to the technical conscience principles."

Given the licensee's acceptable performance in addressing the deficiencies which led to the two ERV failures and resultant White findings, Unit 2 will remain in the Regulatory Response Column of the Action Matrix until the end of the first quarter of 2016 and Unit 3 will change Action Matrix columns back to the Licensee Response Column upon issuance of this inspection report and assessment follow-up letter; however, Unit 3's White finding will continue to be considered an Action Matrix input in conjunction with any future greater-than-green inputs for the remainder of the fourth quarter of 2015.

REPORT DETAILS

4. OTHER ACTIVITIES

4OA4 Supplemental Inspection (95001)

.1 Inspection Scope

This inspection was conducted in accordance with Inspection Procedure (IP) 95001, "Inspection for One or Two White Inputs in a Strategic Performance Area," to assess the licensee's evaluation of one White inspection finding in the Mitigating Systems Cornerstone for each Unit. The inspection objectives were to provide assurance that:

- the root causes and contributing causes of risk-significant performance issues were understood;
- the extent of condition and extent of cause of risk-significant issues were identified; and
- licensee's corrective actions to risk-significant performance issues were or will be sufficient to address the root causes and contributing causes, and to prevent recurrence.

Dresden Nuclear Power Station, Unit 3 and Unit 2, entered the Regulatory Response column of U.S. Nuclear Regulatory Commission's (NRC's) Action Matrix in the fourth quarter of 2014, and the second quarter of 2015, respectively, as a result of two inspection findings of low to moderate safety significance (White). The findings were associated with the inability of the 3E and 2C electromatic relief valves (ERVs) to perform their specified safety functions, as discovered during as-found surveillance testing. The equipment failures occurred as a result of design deficiencies on the ERV actuator components, which made them susceptible to vibration/misalignment-induced failure modes. The self-revealed findings were described in NRC Inspection Report (IR) 05000237; 05000249/2014005, dated January 29, 2015, for Unit 3, and IR 05000237; 05000249/2015002, dated July 1, 2015, for Unit 2, and were considered as Mitigating Systems Cornerstone findings. The NRC staff characterized these issues as having low to moderate safety significance and finalized these characterizations in NRC IRs 05000249/2015008 and 05000237/2015010, dated March 26, and September 16, 2015, for Units 3 and 2, respectively.

By letter dated August 25, 2015, the licensee notified the NRC that it had completed the evaluation of the circumstances surrounding the performance deficiencies and was ready for the NRC to assess their evaluation and subsequent corrective actions. The licensee's preparation for the inspection consisted of primarily the development of a root cause report under Action Request (AR) 2445040, "Dresden Electromatic Relief Valve Actuator Failures." The licensee also conducted a focused self-assessment under AR 2521704, "Inspection for ERV White Finding," to review the adequacy of the developed root cause report. The inspector reviewed the root cause report; the associated apparent cause report; the focused self-assessment report; and other documents related to the root cause-identified issues.

The inspector reviewed corrective actions that were taken or planned to address the identified causes. The inspector also held discussions with licensee personnel to ensure that the root and contributing causes and the contribution of safety culture components were understood and corrective actions taken or planned were appropriate to address the causes and preclude repetition. Documents reviewed are listed in the Attachment to this report.

.2 Evaluation of the Inspection Requirements

02.01 Problem Identification

- a. Determine whether the evaluation identified by whom (i.e., licensee, self-revealing, or NRC), and under what conditions the issue was identified.

The inspector determined that the root cause evaluation (RCE) adequately identified by whom and under what conditions the issues was identified. The RCE concluded that the findings were self-revealing. The 3E ERV failed to open during the D3R23 performance of procedure DOS 0250-07, "Electromatic Relief Valve Testing with the Reactor Depressurized." The 2C ERV failed to open during the extent of condition testing from the 3E ERV failure while also performing procedure DOS 0250-07. The licensee performed the extent of condition testing during forced outage D2F56 on Unit 2.

- b. Determine whether the evaluation documented how long the issue existed, and whether there were any prior opportunities for identification.

The inspector determined that the evaluation properly documented how long the issues existed. For the Unit 3E ERV failure, the exact time and date of failure is unknown, but the failure occurred during the operating cycle between November 2012 and November 6, 2014. The RCE documented the failure of the organization to replace the valve actuators during previous refueling outage D3R22 as a missed opportunity to prevent the event.

For the Unit 2C ERV failure, the exact time and date of failure was similarly unknown, but occurred during the operating cycle that began on November 2013 and ended during the forced outage on February 7, 2015. Additionally, the licensee documented a missed opportunity to have identified the 2C ERV failure sooner if they had tested the valve during the previous Unit 2 forced outage (D2F55) that began on January 13, 2015, approximately 3 weeks prior to D2F56.

The RCE further documented that the underlying component design deficiency associated with the "floating plunger" design existed since the time of original vendor design, procurement, and installation at the station. The RCE also highlighted historical occurrences within the Corrective Action Program (CAP) that showed similar wear and degradation patterns, which the licensee considered to be prior opportunities to have identified the design deficiency, even though those historical occurrences did not result in safety-function failures.

- c. Determine whether the licensee's RCE documented the plant-specific risk consequences and compliance concerns associated with the issue.

The RCE included a discussion of nuclear, radiological and environmental safety significance and stated that the licensee's risk assessment showed that the 3E ERV

failure resulted in a Delta core damage frequency (CDF) of 2.85E-6 and a Delta large early release frequency (LERF) value of 7.7E-7, while the 2C ERV failure resulted in a Delta CDF of 2.69E-6 and a Delta LERF of 1.2E-6. The RCE also documented the compliance aspects of the performance issues as they resulted in two violations of Title 10 of the *Code of Federal Regulations* (10 CFR) 50, Appendix B, Criterion III, Design Control. The inspector concluded that the licensee's RCE documented the risk consequences and compliance concerns associated with the issues.

d. Findings

No findings were identified.

02.02 Root Cause, Extent of Condition, and Extent of Cause Evaluation

- a. Determine whether the licensee's RCE applied systematic methods in evaluating the issue in order to identify root causes and contributing causes.

The inspector determined that the RCEs adequately applied systematic methods in evaluating the issues to identify root causes and contributing causes. The licensee assigned a multi-disciplined team to utilize various analysis tools to determine the root and contributing causes for the failures of the ERVs. Those tools included:

- Why Staircase analyses;
- Cause and Effect analyses;
- Event and Causal Factor Chart;
- Programmatic and Organizational Contributors;
- Safety Culture Components; and
- Troubleshooting Support/Refute Matrix.

The inspector determined that the licensee used adequate methods to evaluate the root and contributing causes of the events.

- b. Determine whether the licensee's root cause evaluation was conducted to a level of detail commensurate with the significance of the problem.

The inspector determined that the RCE was conducted to a level of detail commensurate with the significance of the events. In the RCE, the licensee identified the primary root cause for each of the failures to be the inadequate design of the ERV actuators. An additional root cause, specific only to the Unit 2 failure, was identified as the lack of adequate maintenance procedures for the ERV actuator sub-components. The RCE also identified a contributing cause of a "lack of adherence to the technical conscience principles."

The inspector noted a minor discrepancy regarding the licensee's characterization of the design-related root cause as it pertained to both units' ERV failures. The licensee had originally concluded that the design-related root cause was only applicable to the 3E ERV failure, and not the 2C ERV failure. The original design of the ERV actuators made them susceptible to vibration-induced wear and degradation as evidenced in the 3E ERV failure, and the "floating plunger" design made them susceptible to the

misalignment-induced wear and degradation, compounded by the vibrational environment, as evidenced in the 2C ERV failure. The inspector determined that this minor discrepancy in the licensee's documented conclusion had no appreciable impact on the overall outcome of the corrective actions associated with the events. This issue was discussed with licensee staff and AR 2571355 was generated to resolve the concern and revise the RCE to more accurately reflect that the design-related root cause also applied to Unit 2.

- c. Determine whether the licensee's RCE included consideration of prior occurrences of the problem and knowledge of prior operating experience.

In its RCE, the licensee included an evaluation of internal and external Operating Experience (OE). Prior occurrences of ERV failures and the actions taken from these failures were analyzed within the context of the subject failures. For the Unit 3 ERV failure, the licensee identified one specific similar prior failure on Unit 3 at Dresden in 2012. This internal OE was used extensively by the licensee in the development of its RCE. The Unit 2 failure was discovered only through the licensee's review of extent of condition following the prior Unit 3 failure. The RCE also reviewed OE at other reactor sites and documented whether the specific item had elements applicable to Dresden and how those elements, if applicable, were or are addressed. Based on the licensee's evaluation, the inspector determined that the licensee's RCE included a consideration of prior occurrences of the problem and knowledge of prior OE.

- d. Determine that the root cause evaluation addressed the extent of condition and the extent of cause of the problem.

Regarding the licensee's extent of condition review, the inspector concluded that the licensee considered and addressed the appropriate structures, systems, and components. At Dresden, there are a total of eight ERV actuators installed; four per unit. After the 3E ERV failure, all Unit 3 ERV actuators were immediately upgraded, and the Unit 2 ERVs were tested in a subsequent forced outage where the 2C ERV was discovered to have failed. All Unit 2 ERV actuators were then replaced with the upgraded design. The extent of condition was not applicable to the Target Rock safety relief valves because they are mechanical relief valves without actuators, and therefore were excluded from the extent of condition. The licensee also looked across their fleet to the stations that have ERVs and did not find any additional applicability.

Regarding the licensee's extent of cause reviews for the two root causes and one contributing cause, the inspector concluded that the licensee's review was of sufficient depth and breadth, through a combination of the actions planned and taken as developed through the RCE and AR 2571355.

Regarding the "design deficiency" root cause, the licensee determined that the cause was applicable to both Units' ERV actuators and additional actions are planned to evaluate for any further design deficiencies that may exist in vibration sensitive structures, systems, or components in the plant (e.g., Main Steam components in the drywell, and snubbers, etc.).

Regarding the "inadequate procedures" root cause, the licensee determined in the RCE that the maintenance procedure issues were only applicable to the ERVs and generated actions to evaluate the new maintenance procedure for similar deficiencies. Through discussions with the inspector, the licensee elected to broaden the scope of the extent of

cause review to evaluate, station-wide, for other similarly deficient procedures that may exist due to similar circumstances. Specifically, the station chose to evaluate procedures for safety-related applications (i.e., activities affecting quality) for any occurrence where deficiencies were previously noted by station personnel but closed to no action/no procedure revision, or which remain unresolved for an unacceptable amount of time, which could all be indicative of a currently existing deficient procedure. The licensee captured these actions in AR 2571355.

Regarding the "lack of adherence to technical conscience principles" contributing cause, the licensee determined that the extent of cause has the potential to apply to every department within Exelon. As such, the licensee has imbedded processes and procedures into its Management Model to identify and address lack of adherence to standards, and has created a number of training actions to address the issue.

Overall, the inspector concluded that the licensee adequately addressed the extent of condition and extent of cause of the issues.

e. Findings

No findings were identified.

02.03 Corrective Actions

- a. Determine that appropriate corrective actions are specified for each root and contributing cause or that the licensee has an adequate evaluation for why no corrective actions are necessary.

To prevent recurrence, all Unit 3 and Unit 2 ERV actuators were replaced with an upgraded, hardened design to eliminate the vibration-related design deficiency associated with the original floating plunger design, under Work Orders (WOs) 1661343 and 1661347, respectively.

Regarding the Unit 2-specific procedural root cause, Corrective Action to Prevent Recurrence 2445040-23 entailed a procedure revision to MA-DR-EM-4-00200. The revision provided specific guidance on how to align all components during re-assembly, provided specific component replacement guidance based on wear measured, and provided specific procedural guidance on how to characterize the wear observed on the ERV actuator sub-components.

Regarding the contributing cause of "lack of adherence to technical conscience principles," the licensee has implemented continuing training to site leadership and the accredited engineering support population on the Technical Conscience Principles.

- b. Determine whether the licensee prioritized the corrective actions with consideration of the risk significance and regulatory compliance.

The inspector determined that the licensee adequately prioritized the corrective actions with consideration for the risk significance and regulatory compliance. The licensee's prompt corrective actions to replace and upgrade all eight of the station's ERV actuators immediately upon discovery of the respective Unit's failed ERV, was timely. Although the licensee did not pursue the extent of condition testing of the Unit 2 ERVs at their earliest opportunity, this gap was evaluated and discussed by the licensee in the RCE

and will be addressed through the corrective actions associated with the "technical conscience" contributing cause.

The corrective actions associated with the procedure revisions were already complete at the time of this inspection and were considered timely. The actions to initiate the new training modules to address the "lack of adherence to technical conscience principles" were also completed by the time of this inspection and were considered timely.

Overall, the inspector concluded that the corrective actions had been prioritized with consideration of the risk significance and regulatory compliance.

- c. Determine whether the licensee established a schedule for implementing and completing the corrective actions.

The inspector determined that the licensee adequately established a schedule for implementing and completing the corrective actions. There are no remaining major corrective actions pending as of the date of this inspection.

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

As documented in the RCE, the licensee established measures for determining the effectiveness of the corrective actions. These measures included the following:

- Validate that no similar ERV failures occur with the modified design installed after one full cycle of operation;
- Ensure the procedure revision to MA-DR-EM-4-00200 has been implemented and provides specific guidance on how to align all components during re-assembly, provide specific component replacement guidance based on wear measured, and provide specific procedural guidance on how to characterize the wear observed on the ERV actuator sub-components actions associated with updating vendor manuals and adjusting equipment as needed; and
- No procedural deficiencies are identified during D2R24. If component deficiencies are identified in the CAP, validate the condition was captured in the WO per the procedural guidance. No procedure revisions are required during D2R24, excluding editorial revisions.

The licensee entered these corrective action items into their CAP to ensure that these effectiveness review actions will be performed. The inspector determined that quantitative and qualitative measures of success had been developed for determining the effectiveness of the corrective actions to preclude repetition.

- e. IP 95001 requires that the inspection staff determine that the licensee's planned or taken corrective actions adequately address a Notice of Violation (NOV) that was the basis for the supplemental inspection, if applicable.

The NRC issued two NOVs to the licensee on March 26, and September 16, 2015, for violations of 10 CFR 50, Appendix B, Criterion III, Design Control. The licensee provided the NRC a written response to the NOVs by letter dated August 25, 2015, in which the licensee notified the NRC that it had completed its evaluation of the circumstances surrounding the performance deficiencies and were ready for the

NRC to assess their evaluation and subsequent corrective actions. During this inspection, the inspector confirmed that the licensee's RCE and planned and taken corrective actions addressed the NOV. The licensee restored full compliance for Unit 3 during the November 2014 refueling outage D3R23, and for Unit 2 during the February 2015 forced outage D2F56 by replacing all eight of the ERV actuators with a more robust, hardened, vibration-tolerant design upgrade.

f. Findings

No findings were identified.

40A6 Exit Meeting

.1 Exit Meeting Summary

On October 19, 2015, the inspector presented the inspection results to with Mr. G. Morrow, Operations Director, and other members of the Dresden staff. The inspector asked the licensee if any of the material examined during the inspection should be considered proprietary. The licensee did not identify any proprietary information.

.2 Regulatory Performance Meeting

During the October 19, 2015, exit meeting, the NRC discussed with the licensee its performance at Dresden in accordance with Inspection Manual Chapter 0305, Section 10.01.a. The meeting was attended by the Region III Division of Reactor Projects, Projects Branch 4, Branch Chief; NRC resident inspector; the Dresden Operations Director; and other senior licensee staff. During this meeting, the NRC and licensee discussed the issues related to the White findings that resulted in Dresden Units 2 and 3 being placed in the Regulatory Response Column of the Action Matrix. This discussion included the causes, corrective actions, extent of condition and extent of cause for the issues identified as a result of the individual scram events.

ATTACHMENT: SUPPLEMENTAL INFORMATION

SUPPLEMENTAL INFORMATION

KEY POINTS OF CONTACT

Licensee

S. Marik, Site Vice President
J. Washko, Plant Manager
L. Antos, Security Manager
B. Franzen, Regulatory Assurance Manager
G. Graff, Nuclear Oversight Manager
F. Gogliotti, Engineering Director
B. Kapellas, Maintenance Director
G. Morrow, Operations Director
P. O'Brien, Corrective Action Program Manager
M. Overstreet, Radiation Protection Manager
A. Pullam, Training Director
J. Quinn, Work Control Director
R. Schmidt, Chemistry Manager
D. Walker, Regulatory Assurance – NRC Coordinator

LIST OF ITEMS OPENED, CLOSED AND DISCUSSED

Opened

None

Closed

05000249/2014005-02	VIO	Failure to Ensure Continued Operability of Unit 3 Electromatic Relief Valve 3-0203-3E Following Implementation of Extended Power Uprate Plant Conditions
05000237/2015002-04	VIO	Failure to Ensure Continued Operability of Unit 2 Electromatic Relief Valve 2-0203-3C (2C) Following Implementation of Extended Power Uprate Plant Conditions

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.

- ACIT 2451103–02/03; Extent of Cause, MSL Vibration Monitoring Needs; undated
- Amend. 211 to DPR–25; NRC Amendment: Dresden Nuclear Power Station, Units 2 and 3 and Quad Cities Nuclear Power Station, Units 1 and 2 – Issuance of Amendments for Main Steam Line Relief Valves and Associated Relief Requests (TAC Nos. MC 1792, MC1793, MC1794 and MC1795)
- AT 203507–02; Closure Notes: Comparison of Full Thermal Vibration Data for Dresden Unit 3 to Previously Evaluated Data; March 10, 2005
- Curtiss-Wright Scientech; TRENDS Assistance Report: Summary of Violations/Findings Associated with Automatic Depressurization System (ADS) issues from 1985 – 1999; January 23, 2015
- DIS 0250-05; Automatic Depressurization System Auto-Actuation Test; October 17, 2011
- DOS 0250–07; Electromatic Relief Valve Testing with Reactor Depressurized; Revs. 4 and 5
- DRE239LN001; Initial Operator Training Handbook, Main Steam; Rev. 11
- EACE 2407705; Apparent Cause Investigation: 3E ERV Failed to Actuate During D3R23; November 6, 2014
- EC 394702; Design Considerations Summary (DCS) Main Steam ERV Actuator Upgrade; Rev. 00
- FASA IR 2521704; Focused Area Self-Assessment: Readiness Assessment—Supplemental Inspection for ERV White Finding; July 24, 2015
- GE Hitachi Nuclear Energy Letter to NRC; Closure of Part 21 60-Day Interim report Notification: Potential Failure of Electromatic Relief Valve Cutout Switch; September 10, 2015
- IR 1135133; EACE: Snubber Failures during D3R21
- IR 1138685; Discrepancies Noted during 3D ERV Surv.
- IR 1441078; Apparent Cause Report (Equipment), Unit 3 3E Actuator Failure during Testing; November 16, 2012
- IR 1466641; 3E ERV EACE Review; January 24, 2013
- IR 158553; Dresden Unit 2; Electromatic Relief Valves (4) Pressure Switches Found Outside of TS Tolerance Due to Setpoint Drift; March 9, 1996
- IR 164699; Nine Mile Point Unit 1; Failure of Plant Protection System Pressure Bistable/Switch that Supports Main Steam Safety/Relief Valve 01-102E; April 2, 1997
- IR 164907; Dresden Unit 3; Failure of Main Steam Safety/Relief Valve; April 11, 1997
- IR 172801; Nine Mile Point Unit 1; Failure of Plant Protection System Pressure Bistable/Switch that Supports Main Steam Safety/Relief Valve 01-102F; May 2, 1998
- IR 180024; Nine Mile Point Unit 1; Failure of Main/Reheat Steam System Circuit Breaker; May 14, 1999
- IR 180041; Nine Mile Point Unit 1; Failure of Clutch in Main/Reheat Steam System Time Delay-Solid State Relay that Supports Main Steam Safety/Relief Valve PSV-01-102A; May 15, 1999

- IR 182756; Dresden Unit 2; Failure of Main Steam Safety/Relief Valve 2-203-3E; October 19, 1999
- IR 187323; Oyster Creek Unit 1; Plant Operation Outside of the TS due to a Failed Acoustic Monitor; July 17, 2000
- IR 188678; Nine Mile Point Unit 1; Manual Reactor Scram Due to Failure of ESF Actuation System Check Valve that Supports Main Steam Safety / relief Valve PSV-01-102A; October 2, 2000
- IR 189474; 3E ERV was Found to be Hanging Up on the Upper Spring Bracket
- IR 192631; Quad Cities Unit 1; Electro-matic Relief Valve
- IR 198508; Valve Pressure Switches Found Actuating Above TS Allowable Values; June 4, 2002
- IR 204104; LER 03-001 – Technical Specification Cooldown Rate Exceeded During Required Cooldown for a Failed Solenoid Actuated Pressure Relief Valve; April 22, 2003
- IR 207401; Quad Cities Unit 1; OE17530 – Main Steam Electromatic Relief Valve Inoperable Due to Pilot Line Shear Caused Increased Vibrations and Resulted in Damage to Solenoid Actuator; November 15, 2003
- IR 207428; Quad Cities unit 1; Failure of Solenoid, Seat, Pilot Assembly, Pilot Disc and Pilot Valve in Main Steam Safety / ADS Valve 1-0203-3B; November 17, 2003
- IR 210141; Nine Mile Point Unit 1; OE18391; ERV Failure Leads to a Reactor Scram; May 2, 2004
- IR 219149; Quad Cities Unit 2; Electromatic Relief Valve Solenoid Actuator Failures (SER 2-06); December 21, 2005
- IR 223850; Damaged Electromatic Relief Valve Actuator; November 14, 2006
- IR 2407705; ERV Failed to Actuate During DOS 0205–07
- IR 2445040 NRC Report 2014-005 Preliminary White Finding for ERV; Generate a Procedure Revision to: MA-DR-EM-4-00200; Dresser Electromatic Solenoid Actuator Rebuild Instructions; Rev. 0
- IR 2514064; Dresden; GEH Part 21 60 Day Interim Report; June 12, 2015
- IR 2571922; NRC Observations during 95001 Inspection for Failed ERVs; October 19, 2015
- IR 301962; Electromatic Relief Valve Actuator Failure During Testing Due to Mechanical Binding Caused by Vibration Induced Wear and A Loose Bolt; November 16, 2012
- IR 314149; Electromatic Relief Valve Actuator Failed to Actuate during Refueling Outage Testing
- IR 441077; QC U1 3D ERV Actuator Shows Tilt Pivot Plate Bolt Wear
- IR 442475; Quad Cities ERV Turnbuckles Found With Cracked Tack Welds
- IR 443753; Dresden Applicability of QC ERV Operating Lever Issues
- IR 443756; Dresden Applicability of QC Failed MS Snubber
- IR 445749; Applicability of Quad Cities ERV Discharge Piping Issues
- IR 446702; Aggregate Evaluation Needed for ERV As-Found Conditions
- IR 700431; Trending IR for 2–0203–03D ERV Pilot Solenoid
- ISI–112; Inservice Inspection Class 1 Main Steam Piping; Rev. F
- MA-DR-EM-4-00200; Dresser Electromatic Solenoid Actuator Rebuild Instructions; Revs. 0, 2
- O107187; Failure of Main Steam Safety / Relief Valve 2–0203–3C
- OE – Equipment Failure; Failure of As-Found Testing of Electromatic Relief Valve Actuator; October 23, 2014
- OE 103220; Failure of Main/Reheat Steam System Pressure Bistable/Switch
- OE 103548; Quad Cities, Forced Norm Rx Shutdown Due to Failure of Main Steam Safety / Relief Valve 2-0203–3E
- OE 105453; Failure of Main Steam Safety / ADS Valve 1–0203–3B

- OE 114427; Quad Cities, Manual Reactor Scram Due to Failure of Main Steam Safety / ADS Valve
- OE 115323; Quad Cities; Failure of Main Steam Safety / ADS Valve
- OE 118293; Failure of Main/Reheat Steam System Pressure Instrument Controller
- OE 119424; Quad Cities; Forced Normal Rx Shutdown Due to Failure of Main Steam Safety / ADS Valve
- OE 119425; Quad Cities; Manual Reactor Scram Due to Failure of Feedwater System Bellows Sensor/Transmitter
- OE 134622; Quad Cities, Forced Normal Rx Shutdown Due to Failure of Main Steam Safety / ADS Valve 2-0203–3E
- OE 134631; Quad Cities, Unit Two Manual Reactor Scram Due to 3E Electromatic Relief Valve Failure to Close Following Testing
- OE 135677; Nine Mile Point, Unit 1, Forced Normal Rx Shutdown Due to Failure of Main Steam Safety / ADS Valve
- OE 137690; Quad Cities, Failure of Main Steam Safety / ADS Valve
- OE 141973; Failure of Main Steam Safety / ADS Disch. Pipe Vac Brkr Valve 2–0220–81E
- OE 15-001; Operability Evaluation: 2(3)-0203-3B, C, D & E Electromatic Relief Valves (ERVs); Rev. 0
- OE 165840; Electromatic Relief Valve (ERV) Pressure Switches Outside Technical Specification and Analytical Values; October 31, 2003
- OE 23855; Main Steam Electromatic Relief Valve Failure to Stroke; December 21, 2006
- OE 96657; Nine Mile Point, Unit 1, Failure of Plant Protection System Pressure Bistable/Switch; September 16, 1991
- OE 97519; Nine Mile Point, Unit 1, Forced Norm Rx Shutdown Due to Failure of Main Steam Safety / Relief Valve 10–102B; February 19, 1992
- PI-AA–125–1001; Root Cause Analysis Manual; Rev. 1
- RCR 2445040; Root Cause Investigation: Dresden Electromatic Relief Valve Actuator Failures; January 29, 2015
- Risk Management Team Memo: Evaluation of Oyster Creek 2014 EMRV As-Found Failures for Common Cause; November 14, 2014
- RS–04–005; Exelon Letter to NRC: Request for Amendment to Technical Specifications Surveillance Requirements for the Main Steam Line Relief Valves and Associated Relief Requests; January 15, 2014
- Search of OLE, Dresden Corrective Action Program; October 14, 2015
- Smith Email Discussion of Missed Opportunities as of March 2011; October 14, 2015
- Smith, Griffith, Aguiar Email Discussion of EC 380962, “Replace the Low Pressure Turbine Rotors and Inner Casings;” February 2015
- Trends Assistance Report: Summary of Violations/Findings Associated with Electromatic Relief Valves (ERVs) from 1985–1999; Curtiss-Wright Scientech; January 23, 2015
- Trends Assistance Report: Summary of Violations/Findings Associated with Automatic Depressurization System (ADS) since January 2000; Curtiss-Wright Scientech; January 22, 2015
- WO 1783686–01; Details Inspections Needed from 3E ERV Failure to Actuate; November 9, 2014
- WO 189474–01; Valve Testing and Maintenance on ERV during D3M10

LIST OF ACRONYMS USED

ADAMS	Agencywide Document Access and Management System
AR	Action Request
CAP	Corrective Action Program
CDF	Core Damage Frequency
CFR	<i>Code of Federal Regulations</i>
ERV	Electromatic Relief Valve
IP	Inspection Procedure
IR	Inspection Report
LERF	Large Early Release Frequency
NOV	Notice of Violation
NRC	U.S. Nuclear Regulatory Commission
OE	Operating Experience
PARS	Publicly Available Records System
RCE	Root Cause Evaluation
WO	Work Order

B. Hanson

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The NRC determined that your staff's evaluation identified the primary root cause of the issues to be the inadequate design of the ERV actuators. An additional root cause, specific only to the Unit 2 failure, was identified as the lack of adequate maintenance procedures for the ERV actuator sub-components. The Root Cause Evaluation report also identified a contributing cause of a "lack of adherence to the technical conscience principles."

The NRC determined that the programs and processes at Dresden Nuclear Power Station generally met the Commission's rules and regulations. The NRC has determined that completed or planned corrective actions are sufficient to address the performance that led to the White findings. Since a safety-significant finding is considered an Action Matrix input for the entire duration of: (1) the quarter that includes the finding's start date; and (2) the next three quarters, Unit 2 will remain in the Regulatory Response Column of the Action Matrix until the end of the first quarter of 2016. Because Unit 3's White finding was held open beyond four quarters, in accordance with Inspection Manual Chapter 0305, Unit 3 will change Action Matrix columns to the Licensee Response Column upon issuance of this inspection report and assessment follow-up letter. However, Unit 3's White finding will continue to be considered an Action Matrix input in conjunction with any future greater-than-green inputs for the remainder of the fourth quarter of 2015.

Based on the results of this inspection, the NRC inspector did not identify any findings or violations.

In accordance with Title 10 of the *Code of Federal Regulations* (10 CFR) 2.390, "Public Inspections, Exemptions, Requests for Withholding," of the NRC's "Rules of Practice," a copy of this letter, its enclosure, and your response (if any) will be available electronically for public inspection in the NRC's Public Document Room or from the Publicly Available Records (PARS) component of the NRC's 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 John Rutkowski Acting for/

Jamnes Cameron, Chief
Branch 4
Division of Reactor Projects

Docket Nos. 50-237; 50-249
License Nos. DPR-19; DPR-25

Enclosure:
IR 05000237/2015011; 05000249/2015011
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Letter to Mr. Bryan C. Hanson from Mr. Jamnes Cameron dated December 2, 2015

SUBJECT: DRESDEN NUCLEAR POWER STATION, UNITS 2 AND 3 –
NRC SUPPLEMENTAL INSPECTION REPORT 05000237/2015011;
05000249/2015011 AND ASSESSMENT FOLLOW-UP LETTER

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