

Dominion Nuclear Connecticut, Inc.  
5000 Dominion Boulevard, Glen Allen, VA 23060  
Web Address: www.dom.com



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U. S. Nuclear Regulatory Commission  
Attention: Document Control Desk  
Washington, DC 20555-0001

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**DOMINION NUCLEAR CONNECTICUT, INC.**  
**MILLSTONE POWER STATION**  
**REPLY TO A NOTICE OF VIOLATION; EA-16-090**

Pursuant to the provisions of 10 CFR 2.201, Dominion Nuclear Connecticut, Inc. (DNC) herein provides a reply to NRC letter EA-16-090 dated May 4, 2016 regarding Dominion's corrective actions for multiple failures of the Millstone Power Station Unit 3 (MPS3) turbine driven auxiliary feedwater control system.

Enclosure 1 provides DNC's response to the violation of NRC requirements specified in Notice of Violation EA-16-090. This enclosure provides: (1) the reason for the violation; (2) the corrective steps to prevent recurrence that have been taken and the results achieved; (3) the corrective steps that will be taken to prevent recurrence; and (4) the date when full compliance will be achieved.

If you have any questions or require additional information, please contact Mr. Thomas Cleary at (860) 444-4377.

Sincerely,

Daniel G. Stoddard  
Senior Vice President Nuclear Operations

Enclosures:

1. Reply to a Notice of Violation; EA-16-090
2. List of NRC Commitments for Notice of Violation; EA-16-090

IED1  
NRR

cc: U.S. Nuclear Regulatory Commission  
Regional Administrator  
Region I  
2100 Renaissance Blvd, Suite 100  
King of Prussia, PA 19406-2713

R. V. Guzman  
NRC Senior Project Manager  
U. S. Nuclear Regulatory Commission, Mail Stop 08-C2  
One White Flint North  
11555 Rockville Pike  
Rockville, MD 20852-2738

NRC Senior Resident Inspector  
Millstone Power Station

**ENCLOSURE 1**

**REPLY TO A NOTICE OF VIOLATION**  
**EA-16-090**

**MILLSTONE POWER STATION UNITS 2 and 3**  
**DOMINION NUCLEAR CONNECTICUT, INC.**

## **NOTICE OF VIOLATION**

*“During an NRC inspection conducted between January 1 and March 31, 2016, a violation of the NRC’s requirements was identified. In accordance with the NRC Enforcement Policy, the violation is listed below:*

*10 CFR 50, Appendix B, Criterion XVI, “Corrective Action,” requires, in part, that measures shall be established to assure that conditions adverse to quality are promptly identified and corrected. In the case of significant conditions adverse to quality, the measures shall assure that the cause of the condition is determined and corrective action taken to preclude repetition.*

*Contrary to the above, since November 4, 2013, Dominion Nuclear Connecticut, Inc. (Dominion) has not established measures to assure that the cause of a significant condition adverse to quality has been determined and corrective actions taken to preclude repetition. Specifically, Dominion’s corrective actions for multiple failures of the Unit 3 turbine driven auxiliary feedwater (TDAFW) control system have not fully considered all potential failure modes, leading to continued unreliable operation due to linkage and control system problems. This resulted in an overspeed trip of the Unit 3 TDAFW system in February 2016.*

*This violation is associated with a Green Significance Determination Process finding.”*

## **RESPONSE TO THE NOTICE OF VIOLATION**

### **1. Reason For Violation**

Dominion Nuclear Connecticut (DNC) does not contest this violation. DNC acknowledges the NRC characterization of the February 22, 2016 TDAFW overspeed trip documented in Inspection Report 05000336/05000425/2016001, that Dominion’s corrective actions for multiple failures of the Millstone Power Station Unit 3 (MPS3) TDAFW control system had not fully considered all potential failure modes leading to unreliable operation due to linkage and control system problems.

DNC had initiated a root cause evaluation (RCE) following the February 2016 overspeed trip, but it was not yet complete at the end of the NRC inspection period. Since the completion of the first quarter NRC inspection period, DNC has completed the RCE.

The reason for this violation is that previous cause evaluations were focused on the specific event and thus the associated analysis of potential failure modes was correspondingly limited and failed to recognize the aggregate impact of changes in the operating conditions, margins, and the method of starting the TDAFW pump. This RCE evaluated, not only the cause of the February 22, 2016 overspeed trip, but also provided a comprehensive evaluation of performance issues for the TDAFW linkage and control system from 1986 to present.

The RCE determined the direct cause of the February 22, 2016 overspeed trip was excessive friction in the control linkage due to a seized spherical bearing. The bearing seized from corrosion that was influenced by an adverse environment from the associated control valve packing leakage and lack of lubrication. An oversized stuffing box allowed movement and bypass of the carbon rings and spacers that accelerated packing wear and resulted in steam/water impingement on the spherical bearing and linkage. The steam/water impingement created a corrosive environment in the non-lubricated spherical bearing, eventually resulting in its seizure.

The historical review of performance since 1986 was documented in the RCE using Change Analysis and a Comparative Timeline. The review included an assessment of the impact of changes on the overall operation of the TDAFW pump, system conditions associated with its operation, and an evaluation of linkage force development (linkage force evaluation performed by an external vendor). This holistic review and analysis of failure modes allowed the RCE team to identify adverse contributors to margin not previously identified and actions that would improve the performance margin of the TDAFW pump while maintaining its performance requirements.

## **2. Corrective Steps To Prevent Recurrence That Have Been Taken And The Results Achieved**

DNC has completed a root cause evaluation that included a broader, comprehensive assessment of potential failure modes of the TDAFW control system, which identified that previous cause evaluations failed to recognize the aggregate impact of historical changes associated with TDAFW operation.

Significant improvements in operation of the TDAFW pump have been achieved as a result of design reviews, enhanced troubleshooting methods, improved maintenance practices, and revised operating procedures. Improvements have been realized in turbine supply steam quality, linkage maintenance, bearing lubrication, valve packing maintenance, and starting and operating margin.

As a result of previous cause evaluations, enhanced troubleshooting guidance was developed, including a specific procedure for TDAFW pump troubleshooting. Use of the improved troubleshooting guidance, along with monitoring equipment, allowed station personnel to identify the cause of the bearing failure and eliminate consideration of other failure modes for the February 22, 2016 overspeed trip.

The direct cause of the TDAFW overspeed trip on February 22, 2016 has been addressed:

- The seized spherical bearing was replaced. The bearing was previously treated as a non-lubricated bearing based on TDAFW pump vendor guidance. However, after the February 22, 2016 overspeed trip, the subcomponent vendor for the bearing was contacted and it was determined the bearing should be lubricated. Lubricating the spherical bearing and the linkage bearing joints in the control linkage reduced overall force resistance and improved resistance to corrosion. Testing after the bearing replacement and lubrication showed improvement in the operation of the TDAFW pump steam control valve linkage.
- A new preventive maintenance task was created and implemented to inspect and lubricate the linkage bearing joints and cam follower spherical bearing. The preventive maintenance task frequency is set to recur every refueling outage.
- To address the steam/water impingement, the governor control valve packing and spacers were replaced. The preventive maintenance frequency for replacing the control valve packing and spacers was revised from every other refueling outage to every refueling outage.

The recently completed RCE included a Comparative Timeline and Change Analysis that identified opportunities to increase margin to the overspeed trip:

- Historically, turbine supply steam included a high moisture content that resulted in challenges to achieving TDAFW startup time requirements. With condensation in the steam supply lines affecting startup time, DNC had changed the governor control valve rack setting to a more open position. Although this addressed the startup time, it also resulted in less stem force being available, reducing margin to a TDAFW pump overspeed trip. DNC implemented a design change in the fall of 2014 to replace steam traps with flow orifices to ensure proper steam quality.

Elimination of the steam quality issue allowed greater flexibility in the operation of the governor control valve rack setting. Through review of the previous linkage force evaluations, it was identified that changing the starting position from 10 (typical) to between 5 and 6 would increase the margin of available closure force by up to a factor of 2, thereby facilitating the operation necessary for the governor to take control of the TDAFW pump.

- After the overspeed trip on February 22, 2016, the governor control valve rack setting was adjusted from a setting of greater than 5 (typically set to 10) to a setting between 5 and 6 to increase the available stem force as part of the RCE corrective actions. Subsequent start of the TDAFW pump in May 2016, as part of startup from a refueling outage, indicated improved force margin to

accommodate minor increases in friction within the linkage/control system. The updated governor control valve rack setting has been incorporated into operation and surveillance procedures.

Additionally a design change was implemented to reduce the TDAFW pump operating speed from 4500 rpm to 4400 rpm to improve margin to the discharge relief valve setting and the overspeed trip setting. Subsequent runs of the TDAFW pump indicated improved performance and margin to the relief valve setting.

Actions taken assure operability and reliability, and have resulted in improved operation of the TDAFW pump as indicated by follow-up testing and a successful on-demand run during a reactor trip on May 15, 2016. The TDAFW pump is monitored to ensure the condition of the TDAFW pump does not degrade.

### **3. Corrective Steps That Will Be Taken To Prevent Recurrence**

Although the RCE included an assessment of potential failure modes of the TDAFW control system, Dominion will commission an independent third-party to perform a Failure Modes and Effects Analysis (FMEA) of the TDAFW control system. The results of the FMEA will be reviewed to ensure the failure modes have been adequately addressed. Any deficiencies will be entered in the corrective action program. This will be completed by October 31, 2016.

While the actions taken have improved performance and assure continued operability and reliability, DNC acknowledges that improving design and operating margin is appropriate. Therefore, DNC will perform a comprehensive evaluation of additional methods to improve the design and operating margins within the TDAFW pump linkage and control system. This evaluation will consider additional changes to the governor rack starting position, vendor recommendations for linkage improvements, benchmarking other utilities with reliable operation for performance improvements, and possible changes to the governor control system. DNC will notify the NRC of the results of the comprehensive review and any planned actions. This review and follow-up notification will be completed by September 30, 2016.

As a reliability enhancement, DNC will implement a design change to improve the control valve bonnet oversized stuffing box to address the condition that contributed to the February 22, 2016 TDAFW pump overspeed trip. This will be completed during the next MPS3 refueling outage (Fall 2017).

In addition, DNC is processing a change to Dominion fleet procedures PI-AA-300, Cause Evaluation, Attachment 4 and PI-AA-300-3001, Root Cause Evaluation. The procedures will require review of the complete operating and maintenance history of equipment for aggregate impact of changes in operating conditions or methods of

operation for recurring equipment issues. These procedure changes will be completed by August 1, 2016.

**4. Date When Full Compliance Will Be Achieved**

The TDAFW pump is presently fully operable and in compliance with its Technical Specifications. Completion of the above specified TDAFW pump reliability activities that address full compliance with the provisions of Appendix B, Criterion XVI, to “assure that the cause of the condition is determined and corrective action taken to preclude repetition,” will be achieved by November 30, 2017.

**ENCLOSURE 2**

**LIST OF NRC COMMITMENTS FOR**  
**NOTICE OF VIOLATION**  
**EA-16-090**

**MILLSTONE POWER STATION UNITS 2 and 3**  
**DOMINION NUCLEAR CONNECTICUT, INC.**

**List of NRC Commitments for Notice of Violation**

The following table identifies those actions committed to by Dominion Nuclear Connecticut, Inc. (DNC) for Millstone Power Station Units 2 (MPS2) and 3 (MPS3) in response to Notice of Violation EA 16-090. Any other statements in this response are provided for information and are not considered commitments.

<b>Commitment</b>	<b>Due Date</b>
DNC is processing a change to Dominion fleet procedures PI-AA-300 Cause Evaluation Attachment 4 and PI-AA-300-3001 Root Cause Evaluation. The procedures will require review of the complete operating and maintenance history of equipment for aggregate impact of changes in operating conditions or methods of operation for recurring equipment issues.	08/01/2016
Dominion will commission an independent third-party Failure Modes and Effects Analysis.	10/31/2016
DNC will perform a comprehensive evaluation of additional methods to improve design and operating margins within the TDAFW pump linkage and control system. DNC will notify the NRC of the results of the comprehensive review and any planned actions.	09/30/2016
DNC will implement a design change to improve the control valve bonnet oversized stuffing box to address the condition that contributed to the February 22, 2016 TDAFW pump overspeed trip.	11/30/2017