

UNITED STATES
NUCLEAR REGULATORY COMMISSION
OFFICE OF NUCLEAR REACTOR REGULATION
OFFICE OF NEW REACTORS
WASHINGTON, DC 20555-0001

February 25, 2014

NRC INFORMATION NOTICE 2014-03: TURBINE-DRIVEN AUXILIARY FEEDWATER
PUMP OVERSPEED TRIP MECHANISM ISSUES

ADDRESSEES

All holders of an operating license or construction permit for a nuclear power reactor issued under Title 10 of the *Code of Federal Regulations* (10 CFR) Part 50, "Domestic Licensing of Production and Utilization Facilities," except those who have permanently ceased operations and have certified that fuel has been permanently removed from the reactor vessel.

All holders of and applicants for a power reactor early site permit, combined license, standard design approval, or manufacturing license under 10 CFR Part 52, "Licenses, Certifications, and Approvals for Nuclear Power Reactors." All applicants for a standard design certification, including such applicants after initial issuance of a design certification rule.

PURPOSE

The U.S. Nuclear Regulatory Commission (NRC) is issuing this information notice (IN) to inform addressees of recent operating experience related to improper adjustments of control mechanisms that led to inoperability of turbine-driven auxiliary feedwater (TDAFW) pumps. Information from these events may apply to turbine-driven pumps in other systems such as reactor core isolation cooling (RCIC) and high-pressure coolant injection (HPCI) systems. It is expected that recipients will review the information for applicability to their facilities and consider actions, as appropriate, to avoid similar problems. However, suggestions contained in this IN are not NRC requirements; therefore, no specific action or written response is required.

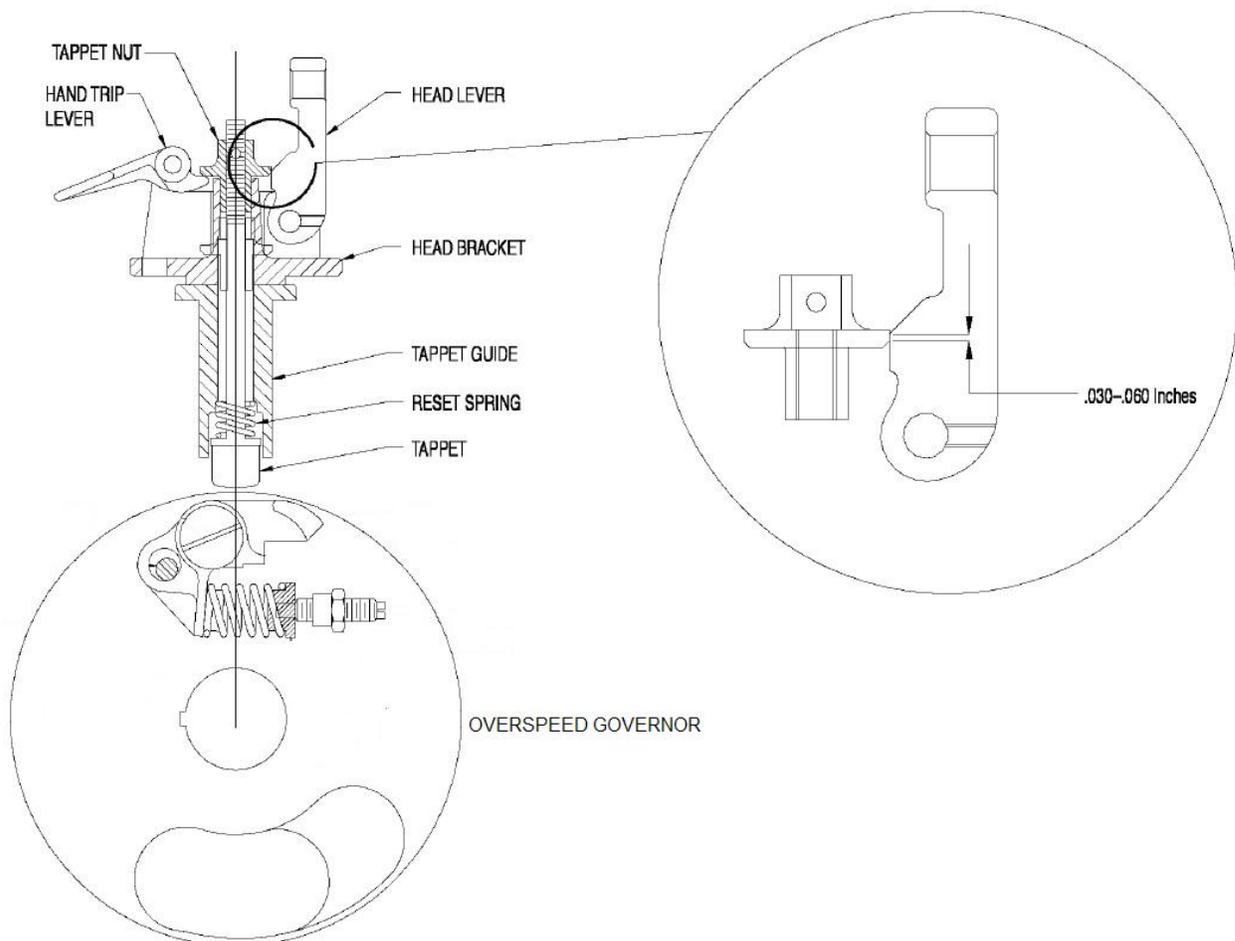
DESCRIPTION OF CIRCUMSTANCES

Wolf Creek Generating Station, Unit 1

On January 13, 2012, during recovery from a loss of offsite power event at Wolf Creek Generating Station, Unit 1, the TDAFW pump overspeed trip mechanism unexpectedly actuated as operators were securing the pump. The licensee, Wolf Creek Nuclear Operating Corporation, determined that the cause of the unexpected actuation was inadequate engagement between the head lever and tappet nut on the overspeed trip mechanism (reference Figure 1 on the next page). The preventive maintenance procedure for adjusting the mechanism had been changed (specifically, removing steps that prescribed direct measurement of the tappet nut engagement), and instead relied on visual inspection. A similar event occurred on November 17, 2009, but corrective actions at the time did not adequately address the issue, making it likely that the conditions leading to the trip were present for an extended period of

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time. As a result of the latest event, the licensee implemented corrective actions that included replacing the trip tappet nut, hand trip lever, and trip linkage spring. In addition, the licensee developed a more precise method of measuring adequate engagement of the head lever to the tappet nut. Additional information is available in NRC Augmented Inspection Team Follow-up Report 05000482/2012009, dated August 6, 2012, and can be found on the NRC's public website in the Agencywide Documents Access and Management System (ADAMS) under Accession Number [ML12227A919](#).



¹Figure 1 Generalized depiction of a turbine overspeed trip mechanism

Palisades Nuclear Plant

On May 10, 2011, during surveillance testing on the TDAFW pump at Palisades Nuclear Plant, the pump tripped as a result of an unexpected actuation of the mechanical overspeed trip mechanism. Entergy Nuclear Operations, Inc. (ENO), the licensee, determined that the cause of the unexpected actuation was inadequate procedures that lead to poor preparation and instruction related to maintenance and testing on the TDAFW pump overspeed trip mechanism.

¹ Copyright © 2002. Electric Power Research Institute, EPRI TR- 1007461. Terry Turbine Maintenance Guide – AFW Application. Reprinted with Permission.

This resulted in failure to perform several vendor recommended maintenance activities on the mechanism. To correct this issue, ENO revised the maintenance and post-maintenance testing procedures to include these maintenance activities and verify the reliability of the overspeed trip mechanism. Additional information is available in NRC Inspection Report 05000255/2012010, dated July 31, 2012, and in Palisades Licensee Event Report 50-255/2011-004-01, dated January 31, 2012. These documents can be found on the NRC's public website in ADAMS under Accession Numbers [ML12213A225](#) and [ML12031A237](#), respectively.

Salem Nuclear Generating Station, Unit 1

On several occasions between April 26 and September 2, 2010, the thirteen TDAFW pump at Salem Nuclear Generating Station, Unit 1, was found tripped. After consulting with the pump vendor, PSEG Nuclear, LLC (the licensee) ultimately determined that the root cause was a rounded head lever surface which resulted in an inadequate contact surface between the tappet nut and head lever. This caused inadequate engagement between the head lever and the tappet nut, making the overspeed trip mechanism overly sensitive. A contributing cause was that a positive rod stop prevented adequate engagement between the head lever and tappet nut. The rod stop mechanism had been installed on the TDAFW pump after initial installation of the pump but was not referenced in any procedure or drawing. PSEG Nuclear, LLC, determined that adjustments were made to the positive rod stop without using an approved procedure. An additional contributing cause identified by the licensee was that the valve's trip solenoid was worn. The licensee implemented corrective actions that included removing the positive rod stop mechanism from the TDAFW pump head lever and a weld build-up repair to the head lever to restore the original design configuration. Additional information is available in NRC Integrated Inspection Report 05000272/2010005 and 05000311/2010005, dated February 8, 2011, and can be found on the NRC's public website ADAMS under Accession Number [ML110390451](#).

North Anna Power Station, Unit 2

Following a reactor trip on December 25, 2007, the Unit 2 TDAFWP at North Anna Power Station, Unit 2, automatically started but immediately tripped due to the actuation of the turbine mechanical overspeed trip mechanism. The cause of the inadvertent trip of the pump was determined to be inadequate engagement of the turbine trip mechanism head lever and tappet nut. Virginia Electric & Power Company, the licensee, reset the turbine trip mechanism and restarted the TDAFWP, which functioned properly for the remainder of the event. The cause of the trip mechanism being inadequately set was that the maintenance procedure did not identify some critical dimensional checks that should be performed when assembling the trip linkage. The licensee's corrective actions were to employ a more accurate method for obtaining critical dimension checks. Additional information is available in NRC Integrated Inspection Report 05000339/2008002 and 05000339/2008002, dated April 30, 2008, and North Anna Licensee Event Report 50-339/2007-004-01, dated May 29, 2008. These can be found on the NRC's public website in ADAMS under Accession Numbers [ML081220395](#) and [ML081620437](#), respectively.

BACKGROUND

Related NRC Generic Communications

[NRC IN 1988-067](#), "PWR Auxiliary Feedwater Pump Turbine Overspeed Trip Failure," dated August 22, 1988. This IN alerted addressees to an event involving the failure of the overspeed trip mechanism as the result of damage to the tappet ball on the overspeed trip device.

[NRC IN 1990-045](#), "Overspeed of Turbine-Driven Auxiliary Feedwater Pumps and Overpressurization of Associated Piping Systems," dated July 6, 1990. This IN alerted addressees to potential problems with failures of the overspeed trip mechanisms of TDAFW pumps that can result in turbine overspeed and overpressurization of the AFW systems.

[NRC IN 1993-051](#), "Repetitive Overspeed Tripping of Turbine-Driven Auxiliary Feedwater Pumps," dated July 9, 1993. This IN alerted addressees to multiple instances of TDAFW pump overspeed trips; the root causes of which were unknown.

DISCUSSION

This IN provides examples of recent operating experience involving inoperability of TDAFW pumps where an invalid overspeed trip occurred without an actual overspeed condition present at the time of the trip. The previous INs referenced above discuss events where actual overspeed of the TDAFW pumps occurred as a result of the failure of the trip mechanisms to actuate. All of these events resulted in the pump being inoperable. It is important to note that improper adjustment of the overspeed trip mechanism can result in an inoperable pump. The pump can become inoperable because of either the failure of the overspeed trip mechanism to actuate when needed, or because of the overspeed trip mechanism actuating without an actual overspeed condition.

The examples in this IN all involved the failure of licensee personnel to establish or follow maintenance procedures as required by the NRC regulations and plant technical specifications. Title 10 of the *Code of Federal Regulations* (10 CFR) Part 50, Appendix B, Criterion V, "Instructions, Procedures, and Drawings," states that nuclear power plants shall have appropriate instructions, procedures, or drawings for activities affecting quality, and that these activities shall be accomplished in accordance with these instructions, procedures, or drawings.

The examples in this IN, as well as the referenced INs, of improper adjustments of control mechanisms that led to inoperability of pumps in nuclear power plants, illustrate the importance of ensuring adequate procedures incorporating vendor guidance are established and followed when setting and maintaining pump overspeed trip mechanisms.

CONTACT

This IN requires no specific action or written response. Please direct any questions about this matter to the technical contact listed below or the appropriate Office of Nuclear Reactor Regulation (NRR) project manager.

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Note: NRC generic communications may be found on the NRC public Web site, <http://www.nrc.gov>, under Electronic Reading Room/Document Collections.

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