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

December 21, 2011

NRC INFORMATION NOTICE 2011-22: INSTRUMENTATION AND CONTROL MODULE HARDWARE, CONFIGURATION, AND PROCEDURE ISSUES

ADDRESSEES

All holders of an operating license or construction permit for a nuclear power reactor 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.

PURPOSE

The U.S. Nuclear Regulatory Commission (NRC) is issuing this information notice (IN) to inform addressees of recent instrumentation and control (I&C) module issues involving component failures, degraded connections, incorrect configurations and settings, and inadequate plant operational procedures. The NRC expects that recipients will review the information for applicability to their facilities and consider actions, as appropriate, to avoid similar problems. Suggestions contained in this IN are not NRC requirements; therefore, no specific action or written response is required.

DESCRIPTION OF CIRCUMSTANCES

Recent licensee event reports (LERs) contain examples of I&C module issues. The causes of these I&C module issues can be separated into the following categories:

- incorrect process controller tuning and setting
- degraded connections for I&C modules
- I&C power supply failures
- plant maintenance procedures

Examples of LERs in each category are described below.

Incorrect Process Controller Tuning and Setting

Millstone Power Station, Unit 3

On May 17, 2010, an automatic reactor trip occurred from 17 percent power due to low steam generator (S/G) water level. Inadequate design of the system that controls S/G levels at low power caused the event. Because of the slow response of the level control system, excessive oscillations in S/G levels began while in automatic control. As operators attempted to smooth

the oscillations while in manual control, the shrink effect from the introduction of cooler feedwater caused the S/G water level to decrease to its reactor trip setpoint. Additional information appears in LER 05000423/2010-002-00 on the NRC's public Web site in the Agencywide Documents Access and Management System (ADAMS) under Accession No. ML103340497.

Indian Point Nuclear Generating, Unit 2

On September 3, 2010, an automatic reactor trip occurred from 41 percent power during a scheduled plant shutdown. A turbine trip initiated by high S/G water level caused the reactor trip. The high S/G level occurred following an S/G level transient that began when operators removed one main feedwater pump from service by manually reducing the pump speed at an unnecessarily rapid rate, thus securing discharge flow in only 60 seconds. The operating main feedwater pump, which was in automatic control, increased in speed; however, the initial response was slow because of a mispositioned gain adjustment on the pump speed controller. Operators attempted to stabilize the S/G water level by placing main feedwater water-regulating valves in manual operation, but they could not successfully avoid the high S/G water level. (See LER 05000247/2010-007-00 (ADAMS Accession No. ML103130040).)

Wolf Creek Generating Station

On October 17, 2010, an automatic reactor trip occurred from 15 percent power when control room operators were unable to maintain S/G levels at low reactor power as the facility increased reactor power during plant startup. As reactor power and feedwater flow increased, the temperature mitigating effect of feedwater pre-heating was eventually overcome by higher feedwater flow rates, resulting in lower feedwater temperatures (and the attendant effects on S/G level of shrink and swell). Additionally, at these higher feedwater flow rates, the main feedwater bypass valves are not in their optimum throttling range (i.e., more valve actuator movement is necessary to change the flow). As a result, the desired S/G level could not be maintained with the S/G level control in automatic. S/G level oscillations required operators to attempt to control feedwater in manual to regain control of S/G level. Divergent S/G level oscillations produced a high S/G level that challenged the experience and ability of operators trying to manually control the feedwater system, and produced a turbine trip and main feedwater isolation, leading to a decrease in S/G levels and resulting in an automatic reactor trip on low S/G level. (See LER 05000482/2010-012-00 (ADAMS Accession No. ML103570047).)

H.B. Robinson Steam Electric Plant, Unit 2

On March 28, 2010, following a reactor trip and safety injection initiated by an electrical fault, when volume control tank level (the normal source of borated water to the charging pumps) reached a predefined point, the charging pump suction failed to automatically realign to the refueling water storage tank because of the improper configuration of a level comparator. The operating crew was unaware of this condition for approximately 49 minutes. Review of plant indications revealed that the charging system was no longer delivering flow to the reactor coolant system or reactor coolant pump seals after approximately 37 minutes. The licensee determined that when it upgraded the volume control tank level comparator in 2008, the installation instructions specified an incorrect configuration

for the internal jumpers of the level comparator. In addition, the post-maintenance testing did not identify the incorrect configuration. (See LER 05000261/2010-002-00 (ADAMS Accession No. ML101530502).)

Degraded Connections

Turkey Point Nuclear Generating, Unit 4

On September 21, 2010, an automatic reactor trip occurred from 100 percent power while the licensee was performing its quarterly surveillance of the reactor protection system for channel II of the high pressurizer pressure protection loop. A reactor trip was caused by a spurious trip signal from channel I of the high pressurizer pressure protection loop coincident with channel II tripped as part of the surveillance procedure. Excessive separation in the electrical bifurcated pins of the connectors of the instrument comparator module caused the spurious trip signal from channel I. (See LER 05000251/2010-006-00 (ADAMS Accession No. ML103330189).)

Instrumentation and Control Power Supply Failure

H.B. Robinson Steam Electric Plant, Unit 2

On November 6, 2009, while the plant was operating at 100 percent power, the feed regulating valve to S/G "A" unexpectedly closed, and operators manually tripped the reactor because of the decreasing S/G level. The licensee determined that a vendor design error resulted in a premature part failure in the power supply for the associated feed regulating valve control loop. (See LER 05000261/2009-003-00 (ADAMS Accession No. ML100110218).)

Plant Maintenance Procedures

Indian Point Nuclear Generating, Unit 3

On May 28, 2009, in response to vibration alarms for main feedwater pump "B," control room operators reduced reactor power from 100 percent to approximately 65 percent and removed the pump from service. Main feedwater pump "A" unexpectedly could not supply sufficient feedwater flow to all four S/Gs (particularly to S/G "B") because the pump could not reach full speed due to excessive play in the governor linkages. Operators reduced power to 61 percent so that the available feedwater flow was sufficient to restore S/G levels. Although all four main feedwater regulating valves had opened fully to restore S/G levels, the feedwater regulating valve "B" unexpectedly remained fully open after S/G "B" reached the programmed level. The S/G "B" water level reached the high-level trip setpoint, thus initiating a turbine trip that resulted in an automatic reactor trip. The licensee determined that the main feedwater pump "A" governor problem was the result of poor oversight of the vendor maintenance work order that was performed without completing governor valve stroke readings that would have revealed the excessive play in the linkages. The licensee determined that the S/G "B" level controller problem was caused by an incorrect controller setting (i.e., the reset time was too short) because of inadequate programmatic control of controller settings. (See LER 05000286/2009-004-00 (ADAMS Accession No. ML092330119).)

DISCUSSION

I&C modules monitor and/or control plant parameters within a range as specified in plant technical specifications. Properly functioning I&C modules provide accurate automatic control of plant processes, which reduces the burden on operators and allows them to focus on overall plant safety. On the other hand, I&C module failures can cause plant transients, such as turbine trips or reactor trips, and can complicate transient recovery. The examples in this IN illustrate the importance of (1) understanding the function of lead/lag modules and knowing how to test the timing function individually and within the process loop, (2) understanding the design settings for each module and performing relevant tests to attain the correct process loop response for all operating conditions, and (3) using the proper methods to test newly installed I&C modules, including bench and rack testing.

CONTACT

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

/RA/

Timothy J. McGinty, Director
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Note: NRC generic communications may be found on the NRC public Web site, http://www.nrc.gov, under NRC Library.

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