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

June 19, 2009

NRC INFORMATION NOTICE 2009-09: IMPROPER FLOW CONTROLLER SETTINGS RENDERS INJECTION SYSTEMS INOPERABLE AND SURVEILLANCE DID NOT IDENTIFY

ADDRESSEES

All holders of operating licenses for boiling-water nuclear power reactors, except those who have permanently ceased operations and who 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 alert addressees that improper flow controller settings in the high-pressure core spray (HPCS) system, high-pressure coolant injection (HPCI) system, and/or reactor core isolation cooling (RCIC) system injection systems at several boiling-water reactors resulted in system flow oscillations that rendered the systems inoperable. Testing failed to identify the inoperable systems because the system alignment during the surveillance differed from the system alignment when the systems are called upon to perform their safety functions. The NRC expects that recipients will review the information for applicability to their facilities and will 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

Perry Nuclear Power Plant, Unit 1

As discussed in NRC IN 2008-13, "Main Feedwater System Issues and Related 2007 Reactor Trip Data," on November 28, 2007, an unplanned automatic reactor trip occurred at Perry Nuclear Power Plant, Unit 1, that stemmed from a failure of the digital feedwater control system. As the reactor vessel water level decreased, the RCIC pump automatically started but tripped after 11 seconds on low RCIC pump suction pressure because the RCIC flow controller was tuned incorrectly in 2006. At the time of the RCIC pump trip, RCIC was aligned to take suction from the suppression pool instead of the normal path from the condensate storage tank (CST) because of an inoperable CST level indicator. While using HPCS to maintain the water level in the reactor vessel, the operating crew attempted to recover RCIC by first realigning the RCIC pump suction from the suppression pool to the CST. With the RCIC flow controller in automatic, operators started and ran the RCIC pump and then attempted to feed water into the reactor. At that point, the operator noted large injection flow oscillations and RCIC again tripped on low suction pressure. Operators successfully recovered RCIC by starting the RCIC pump with the flow controller in manual, and supplied water to the reactor vessel without large flow oscillations

or RCIC tripping. It was later determined that the RCIC flow controller gain, reset and rate settings had been altered from the settings used to successfully inject to the reactor vessel during plant startup testing. These changes resulted in an overly responsive flow control loop.

Limerick Generating Station, Unit 2

On April 24, 2007, the Limerick Generating Station, Unit 2, was at 100-percent power when the redundant reactivity control system inadvertently initiated a reduction in total feedwater flow to the reactor vessel. Subsequently, the rapid decrease of the water level in the reactor vessel caused an automatic scram. As the water level of the reactor vessel continued to decrease during the event, the HPCI and RCIC systems automatically started at -38 inches, as designed. Following initiation, the HPCI and RCIC systems experienced abnormal system flow oscillations from no-flow to full-flow (5,600 gallons per minute for the HPCI system and 600 gallons per minute for the RCIC system) for 3.4 seconds and 1.2 seconds, respectively. Additionally, the common suction source for both systems unexpectedly swapped from the CST to the suppression pool due to pressure oscillations in the common suction piping. Approximately 2 minutes following the scram, the operators placed both HPCI and RCIC flow controllers into manual control and continued to restore reactor water level. Both systems responded to manual control as expected, and the flow oscillations ceased. The licensee subsequently determined it had incorrectly adjusted the flow controller gain and reset settings to the values outside the expected range by a factor of 10. Additional information is available in Limerick Licensee Event Report 50-353/2007-003, dated June 22, 2007 (which can be found on the NRC's public Web site in the Agencywide Documents Access and Management System (ADAMS) under Accession No. ML071730270).

Root Cause

In each of the above examples, one of the causes of the flow oscillations was improper flow controller tuning of the HPCS, HPCI, and RCIC systems. Licensee test programs and surveillance procedures did not identify this deficiency. Surveillance testing of HPCS, HPCI, and RCIC pumps is performed while at power with the systems drawing water from the CST and discharging through a full-flow test return line back to the CST, also known as a CST-to-CST alignment. However, when these systems are called upon to perform their safety function, these systems draw water from the CST and inject into the reactor vessel. Industry operating experience has demonstrated that HPCS, HPCI and RCIC system response is slower when operating in a CST-to-CST alignment compared to actual injection operation. Therefore, these systems need to be tuned and maintained appropriately to account for the difference in response during actual vessel injection. General Electric/Hitachi Report 0000-0079-1103, Revision 1, delineates that RCIC operability of the flow control loop can be assured by maintaining RCIC flow controller tuning settings used during successful reactor pressure vessel injections.

DISCUSSION

The HPCS, HPCI, and RCIC systems are required to be operable as specified in plant technical specifications. As illustrated above, failure to establish adequate procedures to properly tune system flow controllers as required by Title 10 of the Code of Federal Regulations (10 CFR) Part 50, Appendix B, Criterion V, "Instructions, Procedures, and Drawings" can result in these

systems being rendered inoperable. In addition, surveillance testing did not reveal that systems were inoperable and could not perform their safety function to inject water to the reactor vessel, which is contrary to 10 CFR Part 50, Appendix B, Criterion XI, "Test Control."

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 (NRR) project manager.

/RA by TQuay for/

Timothy J. McGinty, Director
Division of Policy and Rulemaking
Office of Nuclear Reactor Regulation

Technical Contact: Pong Chung, NRR
301-415-2473
E-mail: Pong.Chung@nrc.gov

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

systems being rendered inoperable. In addition, surveillance testing did not reveal that systems were inoperable and could not perform their safety function to inject to the reactor vessel, which is contrary to 10 CFR Part 50, Appendix B, Criterion XI, "Test Control."

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.

/RA by TQuay for/

Timothy J. McGinty, Director
Division of Policy and Rulemaking
Office of Nuclear Reactor Regulation

Technical Contact: Pong Chung, NRR
301-415-2473
E-mail: Pong.Chung@nrc.gov

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

ADAMS Accession Number: ML091050027 TAC No.: ME0622

OFFICE	EICB:DE	TECH EDITOR	BC:EICB:DE	D:DE	PGCB:DPR	PGCB:DPR
NAME	PChung	KAzariah-Kribbs	WKemper	PHiland	DBeaulieu	CHawes
DATE	5/12/09	4/15/09 email	5/26/09	5/28/09	6/3/09	6/3/09
OFFICE	BC:PGCB:DPR	D:DPR				
NAME	MMurphy	TMcGinty				
DATE	6/16/09	6/19/09				

OFFICIAL RECORD COPY