

UNITED STATES
NUCLEAR REGULATORY COMMISSION
OFFICE OF NUCLEAR REACTOR REGULATION
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NRC INFORMATION NOTICE 2005-24: NONCONSERVATISM IN LEAKAGE DETECTION SENSITIVITY

ADDRESSEES

All holders of operating license or construction permits for nuclear power reactors, except those that have permanently ceased operations and have certified that fuel has been permanently removed from the reactor.

PURPOSE

The U.S. Nuclear Regulatory Commission (NRC) is issuing this information notice (IN) to inform addressees that the reactor coolant activity assumptions for containment radiation gas channel monitors may be nonconservative. As a result, the containment gas channel may not be able to detect a 1 gallon-per-minute (1-gpm) leak within 1 hour. It is expected that the recipients will review the information for applicability to their facilities and consider actions, as appropriate, to avoid similar problems. However, suggestions contained in this information notice are not NRC requirements; therefore, no specific action or written response is required.

DESCRIPTION OF CIRCUMSTANCES

Several nuclear power plant licensees have reported problems with the detection capabilities of containment radiation gas channel monitors. The following gives several examples of these reports.

On May 2, 2005, the McGuire nuclear power plant licensee reported that the containment atmosphere radioactivity monitors were not sensitive enough for their intended function of detecting a 1-gpm reactor coolant system (RCS) leak within 1 hour (Licensee Event Report (LER) 50-369/2005-01, ADAMS Accession No. ML051310167). This resulted in a Severity Level IV noncited violation.

The McGuire licensee declared the atmosphere monitors inoperable and performed compensatory actions in accordance with plant technical specifications. The compensating actions were to (1) establish temporary alarm setpoints to provide earlier notification should a significant RCS leak occur, (2) instruct operators on other methods of RCS leak detection, (3) establish sensitivities as low as practical based on actual RCS radioactivity levels, (4) periodically review the sensitivities for revision as needed, (5) provide additional training as needed, and (6) consider submitting a license amendment request to clarify the capabilities of the leak detection instrumentation.

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In February 2005, NRC inspectors at the Catawba nuclear power plant identified a noncited violation of Technical Specification 5.4.1.a, "Written Procedures," because the licensee failed to establish and maintain an adequate procedure for the required containment atmosphere radioactivity monitor surveillance in that the associated alarm function was not set or tested to alarm at a value equivalent to 1 gpm in 1 hour for a realistic current reactor coolant activity level (NRC Integrated Inspection Report 50-413/2005-02 and 50-414/2005-02, ADAMS Accession No. ML051160367).

The Catawba licensee also declared these channels to be inoperable and is performing compensatory actions in accordance with plant technical specifications.

In June 2003, an NRC inspection made a similar finding at Callaway (NRC Inspection Report 50-483/2003-04, ADAMS Accession No. ML032020562) that resulted in a noncited violation. The gas channel monitor was not capable of performing its design basis function of detecting a 1 gpm RCS leak within 1 hour. The calculation for the gas channel monitor response used an RCS source term corresponding to an assumed 0.1 percent failed fuel but, because of improved fuel performance and RCS chemistry control, the plant operated with an RCS source term several orders of magnitude smaller.

The Callaway licensee responded to this situation similarly by (1) declaring the gas channel out of service to prevent its being credited for leakage detection and (2) considering a license amendment request to revise the final safety analysis report and technical specification bases to reflect actual leakage detection capabilities.

DISCUSSION

The NRC requires licensees to use a means of detecting and, to the extent practical, identifying the location of any sources of RCS leakage (Title 10 of the Code of Federal Regulations, Part 50, Appendix A, "General Design Criteria [GDC] for Nuclear Power Plants," Criterion 30, "Quality of Reactor Coolant Pressure Boundary"). The NRC provided guidance on meeting GDC 30 in Regulatory Guide (RG) 1.45, "Reactor Coolant Pressure Boundary Leakage Detection Systems." Some licensees committed to using RG 1.45 as the basis for meeting GDC 30.

RG 1.45 states that an acceptable means would provide for adequate sensitivity and response time of all leakage detection systems to detect a leakage rate of 1 gpm in less than 1 hour. Further, the acceptable means would employ at least three separate detection methods. Two of these methods are monitoring sump level and sump flow and monitoring airborne particulate radioactivity. The third method is either monitoring the condensate flow rate from air coolers or monitoring airborne gaseous radioactivity. The guide also states that a "realistic" primary radioactivity concentration should be assumed when analyzing the sensitivity of leak detection systems.

During original plant licensing, the typical calculation for the technical specification for gas channel monitor response used an RCS source term corresponding to an assumed 0.1 percent failed fuel. Nowadays, because of improvements in fuel performance and RCS chemistry control, the actual RCS source term can be orders of magnitude smaller. Though desirable, a

small source term can result in reduced leakage monitoring capabilities. Using a realistic RCS source term, a 1 gpm RCS leak would likely not be detected by a gas channel monitor for a much greater time than within 1 hour. The 0.1-percent failed fuel assumption introduces a nonconservatism into the technical specifications. Guidance on resolving such a nonconservatism is given in NRC Administrative Letter 98-10, "Dispositioning of Technical Specifications That Are Insufficient to Assure Plant Safety."

The consistency of leakage detection systems with RG 1.45 has been questioned at several nuclear power plants. See NUREG/CR-6861, "Barrier Integrity Research Program," December 2004 (ADAMS Accession No. ML043580207) for a good discussion of detector sensitivities.

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

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