UNITED STATES
NUCLEAR REGULATORY COMMISSION
OFFICE OF NUCLEAR REACTOR REGULATION
WASHINGTON, D.C. 20555-0001

February 15, 2000

# NRC REGULATORY ISSUE SUMMARY 2000-02
# CLOSURE OF GENERIC SAFETY ISSUE 23, REACTOR COOLANT PUMP SEAL FAILURE

Addressees

All holders of operating licenses for nuclear power reactors, except those who have permanently ceased operations and have certified that fuel has been permanently removed from the reactor vessel.

Intent

The U.S. Nuclear Regulatory Commission (NRC) is issuing this regulatory issue summary (RIS) to notify nuclear power reactor licensees about the staff's closure of Generic Safety Issue 23 (GSI-23), "Reactor Coolant Pump Seal Failure." This RIS transmits no new requirements, and no action or written response is requested.

Background Information

GSI-23 was identified in 1980 as a result of staff concerns about reactor coolant pump (RCP) seal failure, that is, seal degradation leading to a significant unisolable loss of reactor coolant, at pressurized-water reactor (PWR) facilities. The scope of GSI-23 does not include boiling-water reactors (BWRs) because operating experience and analysis indicate that seal failures in BWRs result in smaller leak rates than seal failures in PWRs. Additionally, seal failures in BWRs may be mitigated by the recirculation loop isolation valves, and the reactor coolant makeup capability of the reactor core isolation cooling system, the high-pressure coolant injection system, and the feedwater system is greater in BWRs than is the capability of comparable makeup systems in PWRs. There are only two isolation condenser BWRs that do not have independently powered emergency makeup systems; however, the particular type of pump seal that is used in both of these BWR plants has been successfully tested under station blackout (SBO) conditions and showed minimal leakage. The NRC considers the risk from BWR recirculation pump seal failure to be low, and, therefore, GSI-23 deals only with PWRs.

The RCP seal failure issue was originally prioritized as a high-priority issue on the basis of the frequency with which RCP seal failures occurred during normal operation from the mid-1970s to the early 1980s. The actual, normal operational RCP seal failure frequency at that time exceeded the small-break loss-of-coolant accident (LOCA) frequency assumed in the WASH-1400 study by an order of magnitude. The normal operational seal failure rate has since been significantly reduced through improvements in design and operation of RCP seals.

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A potential cause of RCP seal failure is the loss of all seal cooling as a result of SBO, a loss of component cooling water (CCW), or a loss of service water (SW). As described in NUREG-0933, "A Prioritization of Generic Safety Issues," the scope of GSI-23 originally included RCP seal failures caused by SBO. The scope of GSI-23 was expanded to include consideration of GSI-65, "Probability of Core-Melt Due to Component Cooling Water System Failures," and GSI-153, "Loss of Essential Service Water in LWRs." These additions expanded the scope to include the loss of all seal cooling from loss of CCW and loss of SW.

By 1994, the staff produced a large body of work leading up to a proposed resolution of GSI-23 and a draft rule on loss of RCP seal cooling. This work addressed the degradation of RCP polymers, the conditions under which polymer seals could experience extrusion, and the effects of loss of cooling conditions on the primary hydraulic seals. Additionally, this work addressed the conditions under which hydraulic seals are likely to become unstable. In SECY-94-225, dated August 26, 1994, a draft rule was proposed for public comment to resolve GSI-23 (Reference 1). In a staff requirements memorandum (SRM) dated March 31, 1995, the Commission disapproved issuance of the draft proposed rule for public comment stating, among other things, that there was a wide range of plant-specific considerations for PWRs, some of which would result in the expending of excessive resources without a commensurate benefit in safety (Reference 2). The SRM further noted that some licensees were planning to address the RCP seal failure concern and to make other associated improvements under their individual plant examination program.

Summary of Issue

Following the Commission's decision, the staff conducted an additional study to determine whether generic, cost-beneficial safety enhancements were appropriate to address GSI-23. The staff has completed its study and has concluded that no additional generic requirements should be proposed and licensees should not be required to revise the current deterministic SBO coping analysis assumptions. Therefore, the staff decided to close GSI-23. The staff has documented the results of its study in a closure memorandum from the Director of the Office of Nuclear Regulatory Research to the Executive Director for Operations, dated November 8, 1999 (Reference 3). The staff's decision to close GSI-23 is based on the following considerations: (1) the Commission's decision not to proceed with rulemaking; (2) the plant-specific nature of LOCA risk induced by RCP seal failure; (3) the voluntary industry initiatives to implement corrective measures related to RCP seal failure, including the use of improved O-ring polymer material in Westinghouse seals; (4) the implementation of 10 CFR 50.63, the SBO rule, which has reduced the likelihood of RCP seal failure induced LOCA in certain plants by the addition of alternate power sources; (5) the implementation of 10 CFR 50.65, the maintenance rule, which has reduced the likelihood of a loss of component cooling water and essential service water systems; and (6) improved RCP seal performance.

On the basis of the closure memorandum of November 8, 1999, the staff has concluded that no further action on the part of licensees is necessary regarding plant-specific SBO coping analyses to address RCP seal failure concerns. However, the staff will continue to pursue plant-specific risk analysis of the loss of CCW/SW systems to assess this contributor to RCP seal failure risk. The bases for the staff's conclusion, the studies performed by the staff, planned future actions, and the development of improved seal failure models are discussed in

detail in the closure memorandum. The closure memorandum also includes additional discussion of background information and includes a summary list of references for the major studies on RCP seal performance.

Backfit Discussion

This RIS requests no action or written response and is, therefore, not a backfit under 10 CFR 50.109. Consequently, the staff did not perform a backfit analysis.

*Federal Register* Notification

A notice of opportunity for public comment was not published in the *Federal Register* because this RIS is informational, and the public was afforded opportunities to comment while the issue was being studied.

If there are any questions about this matter, please contact the person listed below, or the appropriate Office of Nuclear Reactor Regulation project manager for a specific nuclear power plant.

References

1. Memorandum from A. C. Thadani to W. D. Travers, “Closeout of Generic Safety Issue 23, Reactor Coolant Pump Seal Failure,” dated November 8, 1999 (Accession Number ML993370509).

2. SECY-94-225, "Issuance of Proposed Rulemaking Package on GSI-23, Reactor Coolant Pump Seal Failure," dated August 26, 1994 (Accession Number 9504140302).

3. Memorandum from J. C. Hoyle to J. M. Taylor, “SECY-94-225, Issuance of Proposed Rulemaking Package on GSI-23, Reactor Coolant Pump Seal Failure,” dated March 31, 1995 (Accession Number 9504140300).

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| 2000-01 | Changes Concerning Foreign Ownership, Control, or Domination of Nuclear Reactor Licensees | 01/27/2000 | All NRC licensees |
| 1999-06 | Voluntary Submission of Performance Indicator Data | 12/01/1999 | All holders of OLs for nuclear reactors, except for those licensees who have permanently ceased operations and have certified that fuel has been permanently removed from the reactor vessel |
| 1999-05 | Implementing Procedure for Power Reactor NOEDs Processed During the Y2K Transition | 12/01/1999 | All holders of OLs for nuclear power reactors, except for those licensees who have permanently ceased operations and have certified that fuel has been permanently removed from the reactor vessel |
| 1999-04 | Sources of Information Previously Published in the AEOD Annual Report | 11/23/1999 | All NRC licensees |
| 1999-03 | Resolution of Generic Issue 145 Actions to Reduce Common-Cause Failures | 10/13/1999 | All holders of OLs for nuclear power reactors, except for those licensees who have permanently ceased operations and have certified that fuel has been permanently removed from the reactor vessel |

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