

July 16, 2009

MEMORANDUM TO: R. W. Borchardt
Executive Director for Operations

FROM: Eric J. Leeds, Director **/RA/ by John A. Grobe for**
Office of Nuclear Reactor Regulation

SUBJECT: COMPLETION OF ACTIONS FOR GENERIC SAFETY ISSUE
163, "MULTIPLE STEAM GENERATOR TUBE LEAKAGE"
(STEAM GENERATOR ACTION PLAN ITEM 3.11)

The Office of Nuclear Reactor Regulation has completed its technical assessment of Generic Safety Issue (GSI) 163, "Multiple Steam Generator Tube Leakage." This assessment resulted in the enclosed technical report, which will be made publicly available. The U. S. Nuclear Regulatory Commission (NRC) opened GSI 163 to address an NRC staff member's concern given in a differing professional opinion (DPO) dated December 23, 1991, and March 27, 1992 (ADAMS accession numbers 9212290195 and ML003709116, respectively), relating to the potential for a main steamline break (MSLB) accident to cause significant primary-to-secondary leakage that could damage the core. The DPO was prompted by widespread outer-diameter stress-corrosion cracking at the steam generator (SG) tube support plates at the Trojan Nuclear Power Plant, which the DPO author claimed could not be reliably detected, and by the staff's approval of alternate repair criteria, which would allow many tubes known to contain such cracks to remain in service. By memorandum from B. Sheron to L. Reyes dated July 5, 2007 (ADAMS accession number ML071630094), GSI 163 was closed in the Generic Issues Program and was transferred to NRR for regulatory office implementation.

In accordance with NRC Management Directive 6.4, "Generic Issues Program," the staff screened the issue and classified it as GSI 163 on June 16, 1992 (ADAMS accession number 9212040356). The principal assertion addressed by GSI 163 was the potential for multiple SG tube leaks during an MSLB that cannot be isolated outside containment to lead to core damage that could result from the loss of all primary system coolant and safety injection fluid in the refueling water storage tank. The technical work conducted to address this issue supports its closure with no changes to existing regulations or guidance beyond new technical specification (TS) requirements that all U. S. pressurized-water reactor (PWR) licensees voluntarily adopted.

The NRC opened GSI 163 in response to the DPO concerns as described above. However, it considers resolution of GSI 163 separate from resolution of the DPO. The DPO concerns were reviewed by an ad hoc subcommittee of the Advisory Committee for Reactor Safeguards (ACRS) that served as the DPO review panel. ACRS endorsed the subcommittee's conclusions and recommendations and transmitted them to the NRC Executive Director for Operations on February 1, 2001 (ADAMS accession numbers ML010780125 and ML010750315).

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In a memorandum to the DPO author dated March 5, 2001 (ADAMS accession number ML010660353), the NRC Executive Director for Operations stated that the concerns raised in the DPO were concluded to be dispositioned and the DPO to be closed based on the following three points:

- (1) the ACRS ad hoc subcommittee's finding that the alternative repair criteria and condition monitoring program can adequately protect public health and safety;
- (2) the ACRS ad hoc subcommittee's conclusion that no immediate regulatory actions were necessary; and
- (3) the NRC staff's development of an SG action plan (SGAP) (ADAMS accession numbers ML011300073 and ML091000401) to address the conclusions and recommendations in the ACRS ad hoc subcommittee's report.

To address the GSI concern, the staff evaluated the adequacy and effectiveness of regulatory requirements relating to the management of SG tube integrity to ensure that all tubes will exhibit acceptable structural margins against burst or rupture under normal operating conditions and under design-basis accidents (DBAs), including an MSLB, and that leakage from one or multiple tubes under DBAs will be limited to very small amounts, consistent with the applicable regulations for offsite and control room dose. As part of this effort, the staff considered the conclusions and recommendations of the ACRS ad hoc subcommittee and the staff's followup actions taken in response to these findings under the SGAP.

As of September 30, 2007, new performance-based TS requirements were in place at all U. S. PWRs. These requirements are the culmination of years of work between the NRC staff and the industry to develop a generic template for new TS requirements incorporating a programmatic, performance-based approach for ensuring SG tube integrity (*Federal Register*, Volume 70, May 6, 2005, page 24126). Each PWR licensee adopted the new TS requirements voluntarily, consistent with the generic template, and not as the result of an NRC backfit. These requirements are intended to ensure that all tubes exhibit adequate structural margins against burst or rupture for the spectrum of normal operating and DBA conditions, consistent with the original design basis. These requirements are also intended to ensure that total leakage from tubes at a plant will not exceed values assumed in licensing-basis accident analyses even if no tubes actually rupture under these conditions. In addition, licensees are required to periodically demonstrate that these structural margin and accident leakage criteria are satisfied for all tubes or, if not met, to report the occurrence in accordance with Title 10 of the *Code of Federal Regulations* (10 CFR) 50.72, "Immediate Notification Requirements for Operating Nuclear Power Reactors," and 10 CFR 50.73, "Licensee Event Report System."

Although these are new TS requirements, U.S. PWR licensees have used the basic elements of the required performance-based approach since 2000 as part of the industry's initiative under Nuclear Energy Institute (NEI) 97-06, "Steam Generator Program Guidelines," dated December 1997. NEI 97-06 itself was an evolutionary development because tube inspection technologies, inspection practices, and tube integrity management practices had been undergoing significant improvement since the mid-1970s. These improvements have contributed significantly to improved SG tube integrity performance during this period. Improved water chemistry practices and the increasing number of PWRs with SGs of improved design and more stress-corrosion crack resistant tubing have also contributed to this trend. Since

adoption of the NEI 97-06 performance-based strategy in licensee SG programs and the corresponding availability of more complete information concerning instances of failure to satisfy SG tube integrity performance criteria, actual incidences of failure to meet these criteria have been infrequent. This experience provides strong evidence that the potential for one or more tube ruptures, or leakage from multiple tubes totaling tube rupture proportions, under normal operating conditions or DBAs is well within that assumed in NRC risk studies to date. Although there are some ongoing related issues associated with design basis accident definition at plants with once through steam generators (seven units total), these issues involve confirming compliance with existing requirements and do not impact the staff's recommendation to consider GSI 163 as complete.

In accordance with Management Directive 6.4, the GSI closeout process includes an endorsement by ACRS. The staff met with ACRS on May 7, 2009, to discuss the staff's technical basis for the resolution of GSI 163. In a letter dated May 20, 2009, to NRC Chairman Gregory B. Jaczko (ADAMS accession number ML091320055), ACRS concluded that GSI 163 can be closed as proposed by the staff.

Based on the above, the staff concludes that current TS requirements relating to SG tube integrity provide reasonable assurance that all tubes will exhibit acceptable structural margins against burst or rupture under normal operating conditions and DBAs, including MSLB, and that leakage from one or multiple tubes under DBAs will be limited to very small amounts, consistent with the applicable regulations for offsite and control room dose. Thus, the staff concludes that the GSI 163 principal assertion and related concerns in the DPO are not substantiated, that no changes to existing regulations or guidance are needed, and that actions for the GSI are completed. Similarly, the staff concludes that SGAP item 3.11, relating to the closure of GSI 163, is closed.

Enclosure:

As stated

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