

XI.M5 BWR FEEDWATER NOZZLE

Program Description

This program includes enhanced inservice inspection (ISI) in accordance with (a) the requirements of the American Society of Mechanical Engineers (ASME) Code, Section XI, Subsection IWB, Table IWB 2500-1 (2004 edition⁴); (b) the recommendation of General Electric (GE) NE-523-A71-0594, Rev. 1, *Alternate BWR Feedwater Nozzle Inspection Requirements*; and (c) NUREG-0619 recommendations for system modifications to mitigate cracking. The program specifies periodic ultrasonic inspection of critical regions of the boiling water reactor (BWR) feedwater nozzle.

Systems modifications to mitigate cracking may have been made, such as removal of stainless steel cladding and installation of improved spargers. Mitigation also is accomplished by changes to plant-operating procedures, such as improved feedwater control to decrease the magnitude and frequency of temperature fluctuations. These modifications are design and operating changes and were instituted for many BWRs during their initial 40-year operating period.

Evaluation and Technical Basis

1. **Scope of Program:** The program includes enhanced ISI to monitor the effects of cracking due to cyclic loading and its impact on the intended function of BWR feedwater nozzles.
2. **Preventive Actions:** This program is a condition monitoring program and has no preventive actions.
3. **Parameters Monitored/Inspected:** The aging management program (AMP) monitors for cracking due to cyclic loading and its impact on the intended function of the BWR feedwater nozzle by detection and sizing of cracks by ISI in accordance with ASME Code, Section XI, Subsection IWB; the recommendation of GE NE-523-A71-0594, Rev. 1; and NUREG-0619 recommendations.
4. **Detection of Aging Effects:** The extent and schedule of the inspection prescribed by the program are designed to ensure that aging effects are discovered and repaired before the loss of intended function of the component. Inspection can reveal cracking.

GE NE-523-A71-0594, Rev. 1 specifies ultrasonic testing (UT) of specific regions of the blend radius and bore. The UT examination techniques and personnel qualifications are in accordance with the guidelines of GE NE-523-A71-0594, Rev. 1. Based on the inspection method and techniques and plant-specific fracture mechanics assessments, the inspection schedule is in accordance with Table 6-1 of GE NE-523-A71-0594, Rev. 1. Leakage monitoring may be used to modify the inspection interval.

5. **Monitoring and Trending:** Inspections scheduled in accordance with GE NE-523-A71-0594, Rev. 1 provide timely detection of cracks.
6. **Acceptance Criteria:** Any cracking is evaluated in accordance with ASME Code, Section XI, IWB-3100 by comparing inspection results with the acceptance standards of ASME Code, Section XI, IWB-3400 and IWB-3500.

⁴ Refer to the GALL Report, Chapter I, for applicability of other editions of the ASME Code, Section XI.

7. **Corrective Actions:** Repair and replacement are in conformance with ASME Code, Section XI, Subsection IWA-4000. As discussed in the Appendix for GALL, the staff finds the requirements of 10 CFR Part 50, Appendix B acceptable to address the corrective actions.
8. **Confirmation Process:** Site quality assurance procedures, review and approval processes, and administrative controls are implemented in accordance with the requirements of 10 CFR Part 50, Appendix B. As discussed in the Appendix for GALL, the staff finds the requirements of 10 CFR Part 50, Appendix B acceptable to address the confirmation process and administrative controls.
9. **Administrative Controls:** As discussed in the Appendix for GALL, the staff finds the requirements of 10 CFR Part 50, Appendix B acceptable to address the administrative controls.
10. **Operating Experience:** Cracking has occurred in several BWR plants (NUREG-0619, U.S. Nuclear Regulatory Commission [NRC] Generic Letter 81-11). This AMP has been implemented for nearly 30 years and has been found to be effective in managing the effects of cracking on the intended function of feedwater nozzles.

References

- 10 CFR Part 50, Appendix B, *Quality Assurance Criteria for Nuclear Power Plants*, Office of the Federal Register, National Archives and Records Administration, 2009.
- ASME Section XI, *Rules for Inservice Inspection of Nuclear Power Plant Components*, The ASME Boiler and Pressure Vessel Code, 2004 edition as approved in 10 CFR 50.55a, The American Society of Mechanical Engineers, New York, NY.
- GE-NE-523-A71-0594, Rev. 1, *Alternate BWR Feedwater Nozzle Inspection Requirements*, BWR Owner's Group, August 1999.
- NRC Generic Letter 81-11, *BWR Feedwater Nozzle and Control Rod Drive Return Line Nozzle Cracking (NUREG-0619)*, U.S. Nuclear Regulatory Commission, February 29, 1981.
- NUREG-0619, *BWR Feedwater Nozzle and Control Rod Drive Return Line Nozzle Cracking*, U.S. Nuclear Regulatory Commission, November 1980.