

XI.M4 BWR VESSEL ID ATTACHMENT WELDS

Program Description

The program includes inspection and flaw evaluation in accordance with the guidelines of a staff-approved boiling water reactor vessel and internals project (BWRVIP-48-A) to provide reasonable assurance of the long-term integrity and safe operation of boiling water reactor (BWR) vessel inside diameter (ID) attachment welds.

The guidelines of BWRVIP-48-A include inspection recommendations and evaluation methodologies for the attachment welds between the vessel wall and vessel ID brackets that attach safety-related components to the vessel (e.g., jet pump riser braces and core spray piping brackets). In some cases, the attachment is a simple weld; in others, it includes a weld build-up pad on the vessel. The BWRVIP-48-A guidelines include information on the geometry of the vessel ID attachments; evaluate susceptible locations and safety consequence of failure; provide recommendations regarding the method, extent, and frequency of inspection; and discuss acceptable methods for evaluating the structural integrity significance of flaws detected during these examinations.

Evaluation and Technical Basis

1. **Scope of Program:** The program is focused on managing the effects of cracking due to stress corrosion cracking (SCC), including intergranular stress corrosion cracking (IGSCC). The program is an augmented inservice inspection program that uses the inspection and flaw evaluation criteria in BWRVIP-48-A to detect cracking and monitor the effects of cracking on the intended function of the components. The program provides for repair and/or replacement, as needed, to maintain the ability to perform the intended function. The program is applicable to structural welds for BWR reactor vessel internal integral attachments.
2. **Preventive Actions:** The BWR Vessel ID Attachment Welds Program is a condition monitoring program and has no preventive actions. Maintaining high water purity reduces susceptibility to SCC or IGSCC. Reactor coolant water chemistry is monitored and maintained in accordance with the Water Chemistry Program. The program description, evaluation, and technical basis of water chemistry are presented in GALL AMP XI.M2, "Water Chemistry."
3. **Parameters Monitored/Inspected:** The program monitors for cracks induced by SCC and IGSCC on the intended function of BWR vessel ID attachment welds. The program looks for surface discontinuities that may indicate the presence of a crack in the component in accordance with the guidelines of approved BWRVIP-48-A and the requirements of the American Society of Mechanical Engineers (ASME) Code, Section XI, Table IWB 2500-1 (2004 edition³).
4. **Detection of Aging Effects:** The extent and schedule of the inspection and test techniques prescribed by BWRVIP-48-A guidelines are designed to maintain structural integrity and ensure that aging effects are discovered and repaired before the loss of intended function. Inspection can reveal cracking. Vessel ID attachment welds are inspected in accordance with the requirements of ASME Section XI, Subsection IWB, Examination Category B-N-2.

³ Refer to the GALL Report, Chapter I, for applicability of other editions of the ASME Code, Section XI.

The ASME Code, Section XI inspection specifies visual VT-1 examination to detect discontinuities and imperfections on the surfaces of components and visual VT-3 examination to determine the general mechanical and structural condition of the component supports. The inspection and evaluation guidelines of BWRVIP-48-A recommend more stringent inspections for certain attachments. The guidelines recommend enhanced visual VT-1 examination of all safety-related attachments and those non-safety-related attachments identified as being susceptible to IGSCC. Visual VT-1 examination is capable of achieving 1/32-inch resolution; the enhanced visual VT-1 examination method is capable of achieving a 1/2 mil (0.0005 inch) wire resolution. The nondestructive examination (NDE) techniques appropriate for inspection of BWR vessel internals, including the uncertainties inherent in delivering and executing NDE techniques in a BWR, are included in BWRVIP-03.

5. **Monitoring and Trending:** Inspections scheduled in accordance with ASME Code, Section XI, IWB-2400 and approved BWRVIP-48-A guidelines provide timely detection of cracks. If flaws are detected, the scope of examination is expanded. Any indication detected is evaluated in accordance with ASME Code, Section XI or the staff-approved BWRVIP-48-A guidelines. Applicable and approved BWRVIP-14-A, BWRVIP-59-A, and BWRVIP-60-A documents provide guidelines for evaluation of crack growth in stainless steels, nickel alloys, and low-alloy steels, respectively.
6. **Acceptance Criteria:** Acceptance criteria are given in BWRVIP-48-A and ASME Code, Section XI.
7. **Corrective Actions:** Repair and replacement procedures are equivalent to those requirements in ASME Code, Section XI. Corrective action is performed in accordance with ASME Code, Section XI, IWA-4000. As discussed in the Appendix for GALL, the staff finds that licensee implementation of the corrective action guidelines in BWRVIP-48-A provides an acceptable level of quality in accordance with 10 CFR Part 50, Appendix B 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 that licensee implementation of the guidelines in BWRVIP-48-A provides an acceptable level of quality in accordance with the 10 CFR Part 50, Appendix B 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 due to SCC, including IGSCC, has occurred in BWR components. The program guidelines are based on an evaluation of available information, including BWR inspection data and information on the elements that cause IGSCC, to determine which attachment welds may be susceptible to cracking. Implementation of this program provides reasonable assurance that cracking will be adequately managed and that the intended functions of the vessel ID attachments will be maintained consistent with the current licensing basis for the period of extended operation.

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.
- 10 CFR 50.55a, *Codes and Standards*, 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.
- BWRVIP-03 (EPRI 105696 R1, March 30, 1999), *BWR Vessel and Internals Project, Reactor Pressure Vessel and Internals Examination Guidelines*, Final Safety Evaluation Report by the Office of Nuclear Reactor Regulation for BWRVIP-03, July 15, 1999.
- BWRVIP-14-A (EPRI 1016569), *Evaluation of Crack Growth in BWR Stainless Steel RPV Internals*, September 2008.
- BWRVIP-48-A (EPRI 1009948), *BWR Vessel and Internals Project, Vessel ID Attachment Weld Inspection and Flaw Evaluation Guidelines*, November 2004.
- BWRVIP-59-A (EPRI 1014874), *Evaluation of Crack Growth in BWR Nickel-Base Austenitic Alloys in RPV Internals*, May 2007.
- BWRVIP-60-A (EPRI 1008871), *BWR Vessel and Internals Project, Evaluation of Crack Growth in BWR Low Alloy Steel RPV Internals*, June 2003.
- BWRVIP-62 (EPRI 108705), *BWR Vessel and Internals Project, Technical Basis for Inspection Relief for BWR Internal Components with Hydrogen Injection*, March 7, 2000.
- BWRVIP-190 (EPRI 1016579), *BWR Vessel and Internals Project: BWR Water Chemistry Guidelines—2008 Revision*, October 2008.