XI.M35 ONE-TIME INSPECTION OF ASME CODE CLASS 1 SMALL-BORE PIPING

Program Description

This program augments the requirements in American Society of Mechanical Engineers (ASME) Code, Section XI, 2004 edition[19], and is applicable to small-bore ASME Code Class 1 piping and systems less than 4 inches nominal pipe size (less than NPS 4) and greater than or equal to NPS 1. The program includes pipes, fittings, branch connections, and all full and partial penetration (socket) welds.

According to Table IWB-2500-1, Examination Category B-J, Item No. B9.21 and B9.40 of the current ASME Code, an external surface examination of small-bore Class 1 piping should be included for piping less than NPS 4. Other ASME Code provisions exempt from examination piping NPS 1 and smaller. This program is augmented to include piping from NPS 1 to less than NPS 4. Also, Examination Category B-P requires system leakage of all Class 1 piping. However, the staff believes that for a one-time inspection to detect cracking resulting from thermal and mechanical loading or intergranular stress corrosion of full-penetration welds, the inspection should be a volumetric examination. For a one-time inspection to detect cracking in socket welds, the inspection should be either a volumetric or opportunistic destructive examination. (Opportunistic destructive examination is performed when a weld is removed from service for other considerations, such as plant modifications. A sampling basis is used if more than 1 weld is removed.) These examinations provide additional assurance that either aging of small-bore ASME Code Class 1 piping is not occurring or the aging is insignificant, such that a plant-specific aging management program (AMP) is not warranted.

This program is applicable to systems that have not experienced cracking of ASME Code Class 1 small-bore piping. This program can also be used for systems that experienced cracking but have implemented design changes to effectively mitigate cracking. (Measure of effectiveness includes (1) the one-time inspection sampling is statistically significant;(2) samples will be selected as described in Element 5, Monitoring and Trending below; and (3) no repeated failures over an extended period of time.) For systems that have experienced cracking and operating experience indicates that design changes have not been implemented to effectively mitigate cracking, periodic inspection is proposed, as managed by a plant-specific AMP. Should evidence of cracking be revealed by a one-time inspection, periodic inspection is implemented using a plant-specific AMP.

If small bore piping in a particular plant system has experienced cracking, small bore piping in all plant systems are evaluated to determine whether the cause for the cracking affects other systems (corrective action program).

Evaluation and Technical Basis

1. ***Scope of Program:*** This program is a one-time inspection of a sample of ASME Code Class 1 piping less than NPS 4 and greater than or equal to NPS 1. This program includes measures to verify that degradation is not occurring, thereby either confirming that there is no need to manage age-related degradation or validating the effectiveness of any existing AMP for the period of extended operation. The one-time inspection program for ASME Code Class 1 small-bore piping includes locations that are susceptible to cracking.

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

2. ***Preventive Actions:*** This program is a condition monitoring activity independent of methods to mitigate or prevent degradation.

3. ***Parameters Monitored/Inspected:*** This inspection detects cracking in ASME Code Class 1 small-bore piping.

4. ***Detection of Aging Effects:*** This one-time inspection is designed to provide assurance that aging of ASME Code Class 1 small-bore piping is not occurring, or that the effects of aging are not significant. This inspection does not apply to those plants that have experienced cracking due to stress corrosion, cyclical (including thermal, mechanical, and vibration fatigue) loading, or thermal stratification and thermal turbulence (MRP 146 and MRP 146S). For a one-time inspection to detect cracking in socket welds, the inspection should be either a volumetric or opportunistic destructive examination. (Opportunistic destructive examination is performed when a weld is removed from service for other considerations, such as plant modifications. A sampling basis is used if more than one weld is removed.) For a one-time inspection to detect cracking resulting from thermal and mechanical loading or intergranular stress corrosion of full penetration welds, the inspection should be a volumetric examination. Volumetric examination is performed using demonstrated techniques that are capable of detecting the aging effects in the examination volume of interest. This inspection should be performed at a sufficient number of locations to ensure an adequate sample. This number, or sample size, is based on susceptibility, inspectability, dose considerations, operating experience, and limiting locations of the total population of ASME Code Class 1 small-bore piping locations.

   If an applicant has never experienced a failure in its ASME Code Class 1 piping (a through-wall crack detected in the subject component by evidence of leakage, or through nondestructive or destructive examination) and has extensive operating history (more than 30 years of operation at time of submitting the application), the inspection sample size should be at least 3% of the weld population or a maximum of 10 welds of each weld type for each operating unit. If the applicant has successfully mitigated any failures in its ASME Class 1 piping, the inspection should include 10% of the weld population or a maximum of 25 welds of each weld type (e.g., full penetration or socket weld) for each operating unit using a methodology to select the most susceptible and risk-significant welds. For socket welds, opportunistic destructive examination can be performed in lieu of volumetric examination. Because more information can be obtained from a destructive examination than from nondestructive examination, the applicant may take credit for each weld destructively examined equivalent to having volumetrically examined two welds.

   The one time inspection should be completed within the six year period prior to the period of extended operation.

5. ***Monitoring and Trending:*** This is a one-time inspection to determine whether cracking in ASME Code Class 1 small-bore piping resulting from stress corrosion, cyclical (including thermal, mechanical, and vibration fatigue) loading, or thermal stratification and thermal turbulence (MRP 146 and MRP 146S) is an issue. Evaluation of the inspection results may indicate the need for additional or periodic examinations (i.e., a plant-specific AMP for Class 1 small-bore piping using volumetric inspection methods consistent with ASME Code, Section XI, Subsection IWB).

6. ***Acceptance Criteria:*** If flaws or indications exceed the acceptance criteria of ASME Code, Section XI, Paragraph IWB-3400, they are evaluated in accordance with ASME Code,

Section XI, Paragraph IWB-3131; additional examinations are performed in accordance with ASME Code, Section XI, Paragraph IWB-2430. Evaluation of flaws identified during a volumetric examination of socket welds should be in accordance with IWB-3600.

7. ***Corrective Actions:*** The site corrective action program, quality assurance procedures, site review and approval process, 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 corrective actions, confirmation process, and administrative controls. Should evidence of cracking be revealed by a one-time inspection, periodic inspection is implemented, as managed by a plant-specific AMP.

8. ***Confirmation Process:*** 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.

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*****:** This inspection uses volumetric inspection techniques with demonstrated capability and a proven industry record to detect cracking in piping weld and base material.

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.

EPRI 1011955, *Materials Reliability Program: Management of Thermal Fatigue in Normally Stagnant Non-Isolable Reactor Coolant System Branch Lines (MRP-146*), June 8, 2005.

EPRI 1018330, *Materials Reliability Program: Management of Thermal Fatigue in Normally Stagnant Non-Isolable Reactor Coolant System Branch Lines – Supplemental Guidance (MRP-146S)*, December 31, 2008.

NRC Information Notice 97-46, *Unisolable Crack in High-Pressure Injection Piping*, U.S. Nuclear Regulatory Commission, July 9, 1997.