



U.S. NUCLEAR REGULATORY COMMISSION
STANDARD REVIEW PLAN
OFFICE OF NUCLEAR REACTOR REGULATION

5.2.4 REACTOR COOLANT PRESSURE BOUNDARY INSERVICE INSPECTION AND TESTING

REVIEW RESPONSIBILITIES

Primary - Materials Engineering Branch (MTEB)

Secondary - None

I. AREAS OF REVIEW

General Design Criterion 32, "Inspection of Reactor Coolant Pressure Boundary," requires, in part, that components which are part of the reactor coolant pressure boundary (RCPB) shall be designed to permit periodic inspection and testing of important areas and features to assess their structural and leaktight integrity. Inservice inspection programs are based on the general requirements of 10 CFR Part 50, Section 50.55a, as detailed in Section XI of the ASME Code, "Rules for Inservice Inspection of Nuclear Power Plant Components." Inservice inspection includes a pre-service baseline inspection prior to initial plant startup. The following areas relating to the inservice inspection program for NRC Quality Group A components of the RCPB are reviewed. These components are also ASME Boiler and Pressure Vessel Code (hereinafter "the Code"), Section III, Code Class 1 components.

1. System Boundary Subject to Inspection

The inservice inspection (ISI) program for those portions of the reactor coolant pressure boundary consisting of Code Class 1 components is reviewed. The inservice inspection requirements for steam generator tube inspection, ASME Code Class 2 and 3 components, and high energy fluid system piping between containment isolation valves are reviewed by MTEB as part of its primary review responsibility for Standard Review Plan Sections 5.4.2.2 and 6.6.

2. Accessibility

The descriptive information that pertains to the general and specific provisions for access to components covered by the Code, Section XI, is reviewed. In addition, the remote access equipment needed to perform inspections in a radiation field or areas not readily accessible to inspection personnel is reviewed.

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USNRC STANDARD REVIEW PLAN

Standard review plans are prepared for the guidance of the Office of Nuclear Reactor Regulation staff responsible for the review of applications to construct and operate nuclear power plants. These documents are made available to the public as part of the Commission's policy to inform the nuclear industry and the general public of regulatory procedures and policies. Standard review plans are not substitutes for regulatory guides or the Commission's regulations and compliance with them is not required. The standard review plan sections are keyed to the Standard Format and Content of Safety Analysis Reports for Nuclear Power Plants. Not all sections of the Standard Format have a corresponding review plan.

Published standard review plans will be revised periodically, as appropriate, to accommodate comments and to reflect new information and experience.

Comments and suggestions for improvement will be considered and should be sent to the U.S. Nuclear Regulatory Commission, Office of Nuclear Reactor Regulation, Washington, D.C. 20555.

3. Examination Categories and Methods

The descriptive information that pertains to Section XI, Article IWB-2000 is reviewed.

4. Inspection Intervals

The schedules of examinations and inspections in the applicant's or licensee's safety analysis report (SAR) and plant Technical Specifications are reviewed. In addition, those inspections which are performed during the inspection interval, such as during refueling outages, are reviewed.

5. Evaluation of Examination Results

- a. The proposed evaluation methods for any indications of structural defects detected during ISI examinations are reviewed.
- b. The repair procedures proposed for components that reveal unacceptable structural defects during ISI examinations are reviewed.

6. System Leakage and Hydrostatic Pressure Tests

The descriptive information on leak tests and hydrostatic pressure tests of Code Class 1 components is reviewed.

7. Code Exemptions

The ASME Section XI Code exemptions as permitted by IWB-1220 are reviewed.

8. Relief Requests

Requests for relief from the Code Section XI examination requirements which are found to be impractical due to the limitations of design, geometry, or materials of construction of components are evaluated in accordance with §50.55a, 10 CFR Part 50.

9. Additional Areas of Review

The reactor vessel material surveillance program is reviewed by MTEB as part of its primary review responsibility for Standard Review Plan Section 5.3.3, "Reactor Vessel Integrity."

11. ACCEPTANCE CRITERIA

The requirements for periodic inspection and testing of the RCPB required by General Design Criterion 32 are specified in 10 CFR Part 50, §50.55a, "Codes and Standards" and detailed in Section XI of the ASME Code. Compliance with the preservice and inservice examinations of 10 CFR Part 50, §50.55a, as detailed in Section XI of the Code, constitutes an acceptable basis for satisfying in part the requirements of General Design Criterion 32. Specific acceptance criteria for meeting the ISI requirements of General Design Criterion 32 and 10 CFR Part 50, §50.55a for the areas of review described in subsection I of this SRP section are as follows:

1. System Boundary Subject to Inspection

The applicant's or licensee's definition of the RCPB is acceptable if it is in agreement with the following criteria: for pressurized-water-reactor (PWR) and boiling-water-reactor (BWR) nuclear power systems, the inspection requirements of 10 CFR Part 50, §50.55a as detailed in Section XI of the Code must be met for all Class 1 pressure-containing components (and their supports). The system boundary includes all pressure vessels, piping, pumps, and valves which are part of the reactor coolant system, or connected to the reactor coolant system, up to and including:

- a. The outermost containment isolation valve in system piping that penetrates the primary reactor containment.
- b. The second of two valves normally closed during normal reactor operation in system piping that does not penetrate primary reactor containment.
- c. The reactor coolant system safety and relief valves.

2. Accessibility

The design and arrangement of system components are acceptable if adequate clearance is provided in accordance with IWA-1500, "Accessibility," of the Code.

3. Examination Categories and Methods

The examination categories and methods specified in the SAR are acceptable if in agreement with the criteria in IWB-2000 of Section XI of the Code. Every area subject to examination should fall within one or more of the examination categories in IWB-2000 and must be examined at least to the extent specified. The methods of examination for the components and parts of the pressure-retaining boundaries are also listed in the requirements of IWB-2000 of Section XI of the Code.

The applicant's or licensee's examination techniques and procedures used for PSI or ISI of the system are acceptable if in agreement with the following criteria:

- a. The methods, techniques, and procedures for visual, surface, or volumetric examination are in accordance with IWA-2000 of Section XI of the Code.
- b. Alternative examination methods, combination of methods, or newly developed techniques to those given above in a. are acceptable provided that the results are equivalent or superior. The acceptance standards for these alternate methods are given in Section XI, IWB-3000, "Acceptance Standards for Flaw Indications."

4. Inspection Intervals

The required examinations and pressure tests must be completed during each ten-year interval of service, hereinafter designated as the inspection

interval. In addition, the scheduling of the program must comply with the provisions of IWA-2000, concerning inspection intervals of Section XI of the Code.

5. Evaluation of Examination Results

- a. The standards for examination evaluation in the program for flaw evaluation are acceptable if in agreement with the requirements of Section XI, IWB-3000, "Standards for Examination Evaluations."
- b. The proposed program regarding repairs of unacceptable indications or replacement of components containing unacceptable indications is acceptable if in agreement with the requirements of Section XI, IWB-4000, "Repair Procedures." The criteria that establish the need for repair or replacement are described in Section XI, IWB-3000.

6. System Leakage and Hydrostatic Pressure Tests

The pressure-retaining Code Class 1 component leakage and hydrostatic pressure test program is acceptable if the program agrees with the requirements of Section XI, IWB-5000, "System Leakage and Hydrostatic Pressure Tests," and the Technical Specification requirements for operating limitations during heatup, cooldown, and system hydrostatic pressure testing. In some cases, these limitations may be more severe than those in IWB-5000.

7. Code Exemptions

Exemptions from Code examinations are permitted if the criteria in IWB-1220 are met. The applicant's or licensee's program must list the exemptions taken in accordance with the code.

8. Relief Requests

Relief requests for Code examinations which are found to be impractical due to the limitations of design, geometry, or materials of construction of components are reviewed. The staff may grant relief and may impose such alternative requirements as it determines is authorized by law and will not endanger life or property or the common defense and security and is otherwise in the public interest giving due consideration to the burden upon the applicant or licensee that could result if the requirements were imposed on the facility.

III. REVIEW PROCEDURES

The reviewer will select and emphasize material from the procedures described below, as may be appropriate for a particular case.

1. System Boundary Subject to Inspection

The information furnished in the SAR is reviewed for agreement with subsection II.1 of this SRP section and to verify that any differences between the applicant's or licensee's definition of the RCPB and subsection II.1 are identified and justified, e.g., "Pressurizer: not applicable, as plant is a BWR." or, "no longitudinal welds in beltline region as vessel is constructed of forged rings."

2. Accessibility

The descriptive information concerning accessibility furnished in the SAR is reviewed for compliance with subsection II.2 of this SRP section. The reviewer verifies that the clearances supplied for general access to the system components listed in IWB-2000 of Section XI are adequate.

The reviewer verifies that adequate provisions are made for remote inspection of those components affected by radiation fields after plant startup. These components include the beltline welds and reactor vessel nozzle interior surfaces. The reviewer verifies that remote inspection devices proposed for periodic inservice inspections will be used for the preservice baseline inspection program to demonstrate feasibility.

3. Examination Categories and Methods

The reviewer verifies that the examination techniques described by the applicant or licensee are the same as those in subsection II.3 of this SRP section. If alternative examination methods are proposed, they are reviewed to verify that the results are equivalent or superior to those in IWB-2200 of Section XI, and that the acceptance standards of IWB-3000 of Section XI are met.

4. Inspection Intervals

The Technical Specification program for inservice inspection is reviewed to establish that the inspection schedule for every area and component in the program is in agreement with subsection II.4 of this SRP section.

5. Evaluation of Examination Results

The criteria statements provided by the applicant or licensee are reviewed for agreement with subsection II.5 of this SRP section as follows:

- a. The reviewer verifies that the applicant's or licensee's criteria incorporate IWB-3000 of Section XI regarding standards for examination evaluation.
- b. The reviewer verifies that the applicant's or licensee's criteria incorporate IWB-4000 of Section XI regarding repair procedures.

6. System Leakage and Hydrostatic Pressure Test

The reviewer determines that the Technical Specification on hydrostatic pressure testing for system leakage of the RCPB adheres to subsection II.6 of this SRP section. The Technical Specification on operating limitations during heatup, cooldown, and system hydrostatic pressure testing must be referenced.

7. Exemptions

The reviewer verifies that the exemptions from Code examinations are in accordance with the criteria in IWB-1220.

8. Relief Requests

The reviewer determines if an applicant or licensee has demonstrated that a code requirement is impractical due to the limitations of design, geometry, or materials of construction.

IV. EVALUATION FINDINGS

The reviewer verifies that adequate information is provided in accordance with the requirements of this SRP section, and that his evaluation supports conclusions of the following type, to be included in the staff's safety evaluation report:

To ensure that no deleterious defects develop during service, selected welds and weld heat-affected zones will be inspected prior to plant startup and periodically throughout the life of the plant. The applicant (licensee) has stated that his inservice inspection (ISI) program will comply (complies) with the rules published in 10 CFR Part 50, Section 50.55a. The design of the reactor coolant system incorporates provisions for access for inservice inspection in accordance with Section XI of the ASME Boiler and Pressure Vessel Code, () Edition, including Addenda through the () Addenda. Suitable equipment will be (has been) developed and installed to facilitate the remote inspection of these areas of the reactor coolant pressure boundary that are not readily accessible to inspection personnel. The ISI program will consist of a preservice inspection plan and an inservice inspection plan. The conduct of periodic inspections and leakage and hydrostatic testing of pressure-retaining components of the reactor coolant pressure boundary in accordance with the requirements of Section XI of the ASME Code provides reasonable assurance that evidence of structural degradation or loss of leaktight-integrity occurring during service will be detected in time to permit corrective action before the safety function of a component is compromised. Compliance with the inservice inspections required by this Code constitutes an acceptable basis for satisfying in part the requirements of General Design Criterion 32.

The staff concludes that the inservice program is acceptable and meets the inspection and testing requirements of General Design Criterion 32 and 10 CFR Part 50, Section 50.55a. This conclusion is based on the applicant's or licensee's meeting the requirements of the ASME Boiler and Pressure Vessel Code, Section XI, as reviewed by the staff and determined to be appropriate for this application.

V. IMPLEMENTATION

The following is intended to provide guidance to applicants and licensees regarding the NRC staff's plan for using this SRP section. Except in those cases in which the applicant or licensee proposes an acceptable alternative method for complying with the specified portions of the Commission's regulations, the methods described herein will be used by the staff in its evaluation of conformance with Commission regulations. Implementation schedules are defined in Section 50.55a of 10 CFR Part 50.

VI. REFERENCES

1. 10 CFR Part 50, Appendix A, General Design Criterion 32, "Inspection of Reactor Coolant Pressure Boundary."
2. ASME Boiler and Pressure Vessel Code, Section III, "Nuclear Power Plant Components," and Section XI, "Rules for Inservice Inspection of Nuclear Power Plant Components," Division 1, "Rules for Inspection and Testing of Components of Light-Water Cooled Plants," American Society of Mechanical Engineers.