

UNITED STATES NUCLEAR REGULATORY COMMISSION WASHINGTON, D. C. 20555

ENCLOSURE

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATING TO USE OF SUBSEQUENT EDITIONS AND ADDENDA TO

THE BOILER AND PRESSURE VESSEL CODE,

SECTION XI, "RULES FOR INSERVICE INSPECTION OF

NUCLEAR POWER PLANT COMPONENTS - DIVISION 1"

TENNESSEE VALLEY AUTHORITY

BROWNS FERRY PLANT, UNITS 1, 2, AND 3

DOCKET NOS. 50-259, 50-260, AND 50-296

1.0 INTRODUCTION

Section 50.55a, "Codes and Standards," of 10 CFR Part 50 requires, in part, that safety-related components meet the requirements of Section XI of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code (hereafter "Code"). In order to meet the requirements of this regulation, the Tennessee Valley Authority (TVA) has submitted to the NRC its first ten year interval Inservice System Pressure Test (SPT) program. TVA's SPT program is prepared to meet the requirements of the 1974 Edition, Summer 1975 Addenda of Section XI of the Code.

Regulation 10 CFR 50.55a(g)(4) requires that Class 1, 2, and 3 components meet the requirements of the applicable edition and addenda of the Code as defined by the regulations. There are exceptions, one of which is for design requirements that become effective subsequently. However, the requirements of the applicable Code are to be met to the extent practical, within the limits of design, deometry, and materials of construction of the components. Regulation 10 CFR 50.55a(g)(4)(iv) permits the use of portions of subsequent editions and addenda to the Code for system pressure tests requirements subject to the limitations of 10 CFR 50.55a(b) and subject to Commission approval.

.2.0 DISCUSSION

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EXCEPTIONS

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In lieu of the requirements of the code of record, TVA proposed to use the requirements in the following areas to be in accordance with the later 1980 Edition, Winter 1981 Addenda of Section XI of the Code.

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1. Test Pressurization Boundaries

CODE REQUIREMENTS

The 1974 Edition, Summer 1975 Addenda did not specifically address this subject. However, the Code states in IWA-5210 the following:

IWA-5210 Test Description - The pressure-retaining components shall be visually examined while the system is under the hydrostatic test pressure and temperature. The test pressure and temperature shall be maintained for at least four hours prior to the performance of the examinations.

ALTERNATIVE CODE REQUIREMENTS

IWA-5220 Test Pressurization Boundaries¹

IWA-5224 System Hydrostatic Test Boundary

- a. The boundary subject to test pressurization during a system hydrostatic test [IWA-5211(d)] shall be defined by the system boundary (or each portion of the boundary) within which the components have the same minimum required classification and are designed to the same primary pressure rating as governed by the system function and the internal fluid operating conditions, respectively.
- b. Systems which share safety functions for different modes of plant operation, and within which the component classifications differ, shall be subject to separate system pressure tests of each portion of the system boundary having the same minimum required component classifications.
- c. Systems designed to operate at different pressures under several modes of plant operation or post-accident conditions shall be subject to a system pressure test within the test boundary defined by the operating mode with the higher pressure.
- d. Where the respective system primary pressure rating on the suction and discharge side of system pumps differ, the system test boundary shall be divided into two separate boundaries (such as suction side and discharge side test boundaries). In the case of positive displacement pumps, the boundary interface shall be the first shutoff valve on the discharge side of the pump.

For Class 2 and 3 systems, the hydrostatic test pressure shall be determined by the component within the test boundary with the lowest design pressure.

¹ The boundary limits are generally defined by the location of the safety class interface valves within the system.

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During system leakage tests, IWA-5211(a), on Class 1 components the test boundary shall be defined as "the reactor coolant system boundary with all valves in the normal position which is required for normal reactor operation startup." The VT-2 examination shall, however, extend to and include the second closed valve at the boundary extremity, as stated in footnote 1, examination category B-P, Table IWB-2500-1 of the 1980 Edition, Winter 1981 Addenda of ASME Section XI.

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STAFF EVALUATION

The defining of test pressurization boundaries is an aid that will help eliminate ambiguities and reduce confusion regarding test requirements.

However, TVA does not adequately describe how the hydrostatic test pressure satisifies code requirements in its statement, "For Class 2 and 3 systems, the hydrostatic test pressure shall be determined by the component within the test boundary with the lowest design pressure". This statement could result in either a higher or lower hydrostatic test pressure for a given system than that required by the Code. This statement is not in the Code of record, nor is it in the Code that is to be used for modifying and updating the current requirements. This statement potentially conflicts with TVA's proposed alternative Code requirements of the 1980 Edition, Winter 1981 Addenda Subparagraph IWA-5224(a). If the relief is requested from the hydrostatic test pressures required by the Code, then such relief shall be submitted to the NRC staff pursuant to 10 CFR 50.55a(g)(5)(iii), and each use of the relief addressed.

2. Hydrostatic Test Condition Holding Time (IWA-5213)

CODE REQUIREMENTS

IWA-5210 Test Description

The pressure retaining components shall be visually examined while the system is under the hydrostatic test pressure and temperature. The test pressure and temperature shall be maintained for at least four hours prior to the performance of the examinations.

ALTERNATIVE CODE REQUIREMENTS

IWA-5213 Test Condition Holding Time

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The holding time after pressurization to test conditions, before the visual examinations commence, shall be as follows:

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d. system hydrostatic tests - 4 hr holding time required after attaining the test pressure and temperature conditions for insulated systems, and 10 min for non-insulated systems or components;

e.

STAFF EVALUATION

Allowing for the reduction of hydrostatic test pressure and temperature holding time for pressure systems or components without insulation coverage will not affect the inspection results and accordingly, will provide an acceptable level of quality and safety.

3. Code Class 2 or Equivalent Test Temperature (IWC-5230)

CODE REQUIREMENTS

IWA-5230 Temperature

The system leakage test and system hydrostatic pressure test shall be conducted at a test temperature that will satisfy the following requirements:

- a. The test temperature for the initial preservice system pressure test shall satisfy the requirements specified in Section III.
- b. The test temperature of IWA-5320(a) shall be modified for inservice system leakage tests and system hydrostatic pressure tests (1) as necessary during the service lifetime of the nuclear power system, following the results obtained from each set of tests of the material specimens withdrawn from the reactor vessel in accordance with the reactor material surveillance program, and (2) as required to meet the fracture toughness criteria applicable to ferritic materials of system components as specified by the enforcement authorities having jurisdiction at the plant site.
- c. The examinations may be performed after the system pressure has been reduced to a level coincident with a temperature of 200°F.

ALTERNATIVE CODE REQUIREMENTS

IWC-5230 Temperature ~~

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a. The system test temperature during a system hydrostatic test in systems containing ferritic steel components shall meet the requirements specified by fracture prevention criteria.

The reactor material surveillance program is specified in 10 CFR 50, Appendix H, "Materials Surveillance Program".

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- b. In systems containing ferritic steel components for which fracture toughness requirements were neither specified nor required in the construction of the components, the system test temperature shall be determined by the Owner.
- c. No limit on system test temperature is required for systems comprised of components constructed entirely of austenitic steel materials.

STAFF EVALUATION

The alternative code requirements address the pressure testing of (1) ferritic steel containing systems for which fracture toughness requirements were not specified or required and (2), austenitic steel materials. These materials, which are present in BFN-2, were not addressed in the Code of record. The proposed alternative code requirements also address ferritic steel containing systems with fracture toughness criteria in the same manner as the present requirements.

 System Hydrostatic Pressure Test of Code Class 2 or Equivalent exempt and nonexempt components

CODE REQUIREMENTS

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IWC-2500 Examination Requirements

IWC-2510 Exempt and Nonexempt Components

Components shall be examined in accordance with IWA-5000 and IWC-5000.

IWC-2520 Nonexempt Components

Components Shall be examined in accordance with the requirements specified in Table IWC-2520.

IWA-5000 System Pressure Test

Frequency of testing is not addressed in this article, it is addressed in IWC-2412.

IWC-2412 Pressure Test and Visual Examination

- a. The examinations and tests required by IWC-2510 for the components inspected in accordance with the provisions of IWC-1220 shall be distributed as follows:
 - Between 25 and 33 1/3% of the required examinations shall be completed by the expiration of one-third of each inspection interval.
 - (2) Between 50 and 66 2/3% of the required examinations shall be completed by the expiration of two-thirds of each inspection interval.

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- (3) The remaining required examinations shall be completed by the end of each inspection interval.
- b. The examinations and tests required by IWC-2510 for all other components shall be performed at least once toward the end of each inspection interval.

ALTERNATIVE CODE REQUIREMENTS

The system pressure tests shall be conducted at the frequency specified for system hydrostatic tests, i.e., once each inspection interval specified in C7.20, C7.40, C7.60 and C7.80 in Table IWC-2500-1, Table 4.1.4-1.

STAFF EVALUATION

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The code of record does not require system pressure tests and only addresses hydrostatic pressure tests. This proposed alternative wording requires one hydrostatic test towards the end of each inspection interval as is presently required.

5. Hydrostatic Pressure Including Static Head (IWA-5265) - The 1974 Edition, Summer 1975 Addenda did not address the increase in hydrostatic pressure due to static head.

CODE REQUIREMENTS

IWC-5220 Pressure

- a. The system hydrostatic test pressure shall be at least 1.25 times the system design pressure (P_D) and conducted at a test temperature not less than 100°F except as may be required to meet the test temperature requirements of IWA-5230.
- b. The test pressure may be reduced in accordance with the following table when system hydrostatic testing is required to be conducted at temperatures above 100°F in order to meet the fracture toughness criteria applicable to ferritic materials of which the system components are constructed.

Test Temperature

Test Pressure

-100°F 200°F 300°F 400°F 500°F		1.25P 1.20PD 1.15PD 1.10PD 1.05PD
500°F		1.05PD

- c. For components that are not required to function during reactor operation, the system test pressure shall not be less than 100% of the pressure_developed during the conduct of a periodic system inservice test. In the case of storage tanks, the nominal hydrostatic pressure developed with the tank filled to its design capacity shall be acceptable as the system test pressure.
- 'd. Open-ended portions of a nonclosed system (e.g., suction line from a storage tank, or discharge line of a containment spray header) extending to the first shutoff valve may be exempted from the test requirements of IWC-2510.

ALTERNATIVE CODE REQUIREMENTS

IWA-5265 Location

- a. When testing an isolated component, the pressure measuring instrument or sensor shall be connected close to the component.
- b. When testing a group of components or a multi-component system, the pressure measuring instrument or sensor shall be connected to any point within the pressure boundary of the components or system such that the imposed pressure on any component, including static head, will not exceed 106% of the specified test pressure for the system.

STAFF EVALUATION

The alternative code requirements address the increase in pressure due to static head which was not addressed in the original code of record. The additional requirements will provide an acceptable level of quality and safety.

3.0 CONCLUSIONS

Based on the staff review of the licensee's modifications to its system pressure test program for Browns Ferry, Units 1, 2, and 3, the staff concludes that the modifications are acceptable with one exception. The exception concerns the statement, "For Class 2 and 3 systems, the hydrostatic test pressure shall be determined by the component within the test boundary with the lowest design pressure". This proposed requirement is not in the present Code of record nor is it in the Code which TVA cites as being used to update and modify the requirements for Browns Ferry Units 1, 2, and 3 and constitutes an open item to this safety evaluation. Accordingly, as this proposed requirement is not in either of the ASME Boiler and Pressure Vessel Code Editions/Addenda pertinent to Browns Ferry, and because it may be in conflict with the 1980 Edition, Summer 1981 Addenda, Section XI, IWA-5224(a), a relief request with justification is required for each instance where code requirements are not satisfied as specified in 10 CFR 50.55a(g)(5)(iii). Use of freeze plugs,

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³ System inservice tests include pressurization of systems to conduct functional tests (i.e., valves and pumps), or a system pressure test.



alternative approaches and the impracticality of performing the hydro-static tests in accordance with the Code should be addressed.

The staff has determined that (1) the use of those portions of the 1980 Edition, Winter 1981 Addenda proposed for modifying and updating the Browns Ferry Units 1, 2, and 3 meet the requirements of 10 CFR 50.55a(b), and (2) for the portions of the 1980 Edition, Winter 1981 Addenda used, the related requirements of the respective editions and addenda have been met. Accordingly, under 10 CFR 50.55(a)(g)(4)(iv), the staff approves the use of those portions of the code as discussed above.

Principal Contributor: D. E. Smith

Dated: August 3, 1989

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