



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

10.4.5 CIRCULATING WATER SYSTEM

REVIEW RESPONSIBILITIES

Primary - Auxiliary Systems Branch (ASB)

Secondary - None

I. AREAS OF REVIEW

The circulating water system (CWS) provides a continuous supply of cooling water to the main condenser to remove the heat rejected by the turbine cycle and auxiliary systems.

1. The ASB reviews the performance of the CWS with respect to its functional requirements and the effects of adverse environmental occurrences, abnormal operational transients, or accident conditions such as loss of offsite power.
2. The ASB reviews the CWS and its interfaces with other systems to determine that a malfunction, failure of a component, or failure of a circulating water pipe including the failure of an expansion joint do not have unacceptable adverse effects on the functional performance capabilities of safety-related systems located in the immediate area.
3. ASB further reviews the design of the circulating water system with respect to the following:
 - a. The capability to prevent or detect and control flooding of safety-related areas so that the intended safety function of a safety system or component will not be precluded due to circulating water system leakage.
 - b. Provisions to annunciate abnormal and unsafe operating conditions.
4. ASB also performs the review of high- and moderate-energy pipe breaks under SRP Section 3.6.1.

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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.

5. Upon request, the Chemical Engineering Branch (CMEB) will review the compatibility of the methods proposed for control of water chemistry and of long-term corrosion and organic fouling with system components and piping materials, and will assure that agents used for the control of water chemistry, corrosion, and organic fouling should be compatible with the materials of the system.

In addition, the ASB will coordinate other branch evaluations that interface with the overall review of the CWS as follows:

As part of its primary review responsibilities, the Instrumentation and Control Systems Branch (ICSB) in SRP Sections 7.1 and 7.6, and the Power Systems Branch (PSB) in SRP Sections 8.3.1 and 8.3.2 review instrumentation and controls and electrical power systems as they may relate to operations that could affect safety-related systems or components.

For those areas of review identified above as being the responsibility of other branches, the acceptance criteria and their methods of application are contained in the SRP sections identified as the primary review responsibility of those branches.

II. ACCEPTANCE CRITERIA

Acceptability of the circulating water system, as described in the applicant's safety analysis report (SAR), is based on meeting the requirements of General Design Criteria 4 as it relates to design provisions provided to accommodate the effects of discharging water that may result from a failure of a component or piping in the CWS. Compliance with GDC 4 is based on meeting the following:

1. Means should be provided to prevent or detect and control flooding of safety-related areas so that the intended safety function of a system or component will not be precluded due to leakage from the CWS.
2. Malfunction or a failure of a component or piping of the CWS including an expansion joint should not have unacceptable adverse effects on the functional performance capabilities of safety-related systems or components.

III. REVIEW PROCEDURES

The procedures below are used during the construction permit (CP) review to determine that the design criteria and bases and the preliminary design as set forth in the preliminary safety analysis report meet the acceptance criteria given in subsection II. For the review of operating license (OL) applications, the procedures are used to verify that the initial design criteria and bases have been appropriately implemented in the final design as set forth in the final safety analysis report.

Upon request from the primary reviewer, the coordinating review branches will provide input for the areas of review stated in subsection I. The primary reviewer obtains and uses such input as required to assure that this review procedure is complete.

The reviewer will select and emphasize material from this SRP section as may be appropriate for a particular case.

1. Although the circulating water system is not safety related, a failure of this system, or any of its components, may affect a safety-related component or system. Since large quantities of water flow through the CWS, a leak or break in a component or pipe or expansion joint failure could cause severe and unacceptable flooding of adjacent areas. The reviewer verifies that the design includes provisions to minimize hydraulic transients and their effect upon the functional capability and the integrity of system components.

In evaluating the effects of the failure of an expansion joint, ASB assumes that the butterfly valve(s) are not available to isolate CWS flow out of the failed expansion joint unless the valve(s) have been designed to safety-grade requirements. The ASB reviews the descriptions and drawings in the SAR and determines that provisions are incorporated in the design to prevent unacceptable flooding of areas containing safety-related equipment or to mitigate the consequences of flooding.

2. The ASB reviews the CWS to verify that the capability to detect leaks and secure the system quickly and effectively exists.
3. Based on the information contained in the SAR, the reviewer verifies that the applicant's proposed methods for control of water chemistry and of long-term corrosion and organic fouling, and the chemical agents used for these purposes are compatible with the system materials.

IV. EVALUATION FINDINGS

The reviewer verifies that sufficient information has been provided and his review supports conclusions of the following type, to be included in the staff's safety evaluation report:

The circulating water system includes all components and equipment necessary to provide the main condenser with a continuous supply of cooling water. The system is designed to nonnuclear safety, Quality Group D requirements since it is not necessary for safe shutdown, accident prevention or accident mitigation. Based on the review of the applicant's proposed design criteria and bases for the circulating water system, the staff concludes that the design of the circulating water system is acceptable and meets the requirements of General Design Criterion 4. This conclusion is based on the following:

The applicant has met the requirements of General Design Criterion 4 with respect to the effects of discharging water that may result from a failure of a component or piping in the CWS. Acceptance is based on provisions of the design that prevent flooding of safety-related areas so that the intended safety function of a system or component will not be precluded due to leakage from the CWS; or provisions of the design that detect and control flooding of safety-related areas so that the intended safety function of a system or component will not be precluded due to leakage from the CWS; or provisions of the design such that malfunction of a component or piping of the CWS including an expansion joint will not have unacceptable

adverse effects on the functional performance capabilities of safety-related systems or components.

V. IMPLEMENTATION

The following is intended to provide guidance to applicants and licensees regarding the NRC staff's plans for using this SRP section.

Except in those cases in which the applicant proposes an acceptable alternative method for complying with specified portions of the Commission's regulations, the method described herein will be used by the staff in its evaluation of conformance with Commission regulations.

VI. REFERENCES

10 CFR Part 50, General Design Criterion 4, "Environmental and Missile Design Bases."