



U.S. NUCLEAR REGULATORY COMMISSION

**STANDARD REVIEW PLAN**  
OFFICE OF NUCLEAR REACTOR REGULATION

9.2.3 DEMINERALIZED WATER MAKEUP SYSTEM

REVIEW RESPONSIBILITIES

Primary - Auxiliary Systems Branch (ASB)

Secondary - None

I. AREAS OF REVIEW

The ASB reviews the demineralized water makeup system (DWMS) from the supply connection of the service or municipal water source to the points of discharge. The capability to provide an adequate supply of treated water of reactor coolant purity to other systems as makeup, and to provide other plant demineralized water requirements is reviewed. The design of the DWMS is generally not safety related; the review is primarily directed toward assuring that a failure or malfunction of the system could not adversely affect essential systems requirements in accordance with General Design Criteria (GDC) 2 and 5.

1. The ASB review of the DWMS system includes the following considerations:
  - a. Capability of the system to effectively store, handle, and dispense all chemicals utilized in the demineralizing and regeneration process.
  - b. Capability of the DWMS to operate within the environment to which it is exposed.
  - c. Provisions for the regeneration wastes to be directed to a suitable point in the radwaste system or other specified areas for subsequent processing prior to discharge to the environment and instrumentation and isolation capabilities provided, including the ability to detect corrosive solutions and the valving necessary to isolate the system.
2. The ASB reviews the system function relative to other safety-related systems to determine whether portions of the system are safety related and to determine whether a seismic Category I makeup source is required.

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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.

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3. The DWMS is also reviewed to assure that a malfunction or failure of a component will not have an adverse effect on any safety-related system or components.
4. ASB also performs the following reviews under the SRP sections indicated:
  - a. Review of flood protection is performed under SRP Section 3.4.1,
  - b. Review of the protection against internally generated missiles is performed under SRP Section 3.5.1.1,
  - c. Review of the structures, systems, and components to be protected against externally generated missiles is performed under SRP Section 3.5.2, and
  - d. Review of high- and moderate-energy pipe breaks is performed under SRP Section 3.6.1.

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

The Structural Engineering Branch (SEB) determines the acceptability of the design analyses, procedures, and criteria used to establish the ability of seismic Category I structures housing the system and supporting systems to withstand the effects of natural phenomena such as the safe shutdown earthquake (SSE), the probable maximum flood (PMF), and tornado missiles as part of its primary review responsibility for SRP Sections 3.3.1, 3.3.2, 3.5.3, 3.7.1 through 3.7.4, 3.8.4, and 3.8.5. The Mechanical Engineering Branch (MEB) determines that the components, piping, and structures are designed in accordance with applicable codes and standards as part of its primary review responsibility for SRP Sections 3.9.1 through 3.9.3. The MEB, also, determines the acceptability of the seismic and quality group classifications for system components as part of its primary review responsibility for SRP Sections 3.2.1 and 3.2.2. The MEB also reviews the adequacy of the inservice testing program of pumps and valves as part of its primary review responsibility for SRP Section 3.9.6. The Materials Engineering Branch (MTEB) verifies that inservice inspection requirements are met for system components as part of its primary review responsibility for SRP Section 6.6, and, upon request, verifies the compatibility of the materials of construction with service conditions. The Instrument and Control Systems Branch (ICSB) and the Power Systems Branch (PSB) determine the adequacy of the design, installation, inspection, and testing of all essential electrical components (sensing, control, and power) required for proper operation as part of their primary review responsibility for SRP Sections 7.1 and 8.1, respectively. The Effluent Treatment Systems Branch (ETSB) verifies that the limits for radioactivity concentrations are met as part of its primary review responsibility for SRP Section 11.5.

The Chemical Engineering Branch (CMEB) verifies the capability of the DWMS to chemically process raw water to provide reactor coolant purity water for makeup to the reactor coolant system and associated systems and to provide demineralized water to other systems as required as part of its primary review responsibility for SRP Sections 5.4.8, 9.3.4 and 5.4.2.1 (BTP-MTEB 5-3). The reviews for

Fire Protection, Technical Specifications, and Quality Assurance are coordinated and performed by the Chemical Engineering Branch, Licensing Guidance Branch, and Quality Assurance Branch as part of their primary review responsibility for SRP Sections 9.5.1, 16.0, and 17.0, respectively.

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 design of the DWMS, as described in the applicant's safety analysis report (SAR), is based on design criteria or regulatory guides that apply directly to the safety-related functional performance requirements for the DWMS. The ASB assures that the system is capable of providing the required supply of reactor coolant purity water to all systems.

Several general design criteria and regulatory guides are used to evaluate the system design for those cases when a failure or malfunction of the DWMS could adversely effect essential systems or components (i.e., those necessary for safe shutdown or accident prevention or mitigation). These are as follows:

1. General Design Criterion 2, "Design Bases for Protection Against Natural Phenomena," as related to the safety-related portions of the system being capable of withstanding the effects of earthquakes. Acceptance is based on meeting the guidance of Regulatory Guide 1.29, Position C-1, if any portion of the system is deemed to be safety related, and Position C-2 for nonsafety-related functions.
2. General Design Criterion 5 "Sharing of Structures, Systems, and Components, in regard to the effect of sharing in multiple-unit facilities.

## **III. REVIEW PROCEDURES**

The procedures set forth below are used during the construction permit (CP) application 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 applications, the review procedures and acceptance criteria are utilized 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 selects and emphasizes material from this SRP section, as may be appropriate for a particular case. A determination will be made as to whether the DWMS or portions thereof are safety related, including whether a seismic Category I makeup source is required for safe shutdown or for accident conditions. In confirming this design aspect, an analysis is made in which it is assumed that any DWMS pipe fails or component malfunctions or fails in such a manner as to cause maximum damage to other equipment located nearby. The

system will be considered nonsafety related if its failure does not affect the ability of the reactor facility to achieve and maintain safe shutdown conditions.

1. The ASB evaluates the system design information and drawings and, utilizing engineering judgment, operational experience, and performance characteristics of similar, previously approved systems, to verify that:
  - a. The system is capable of fulfilling the requirements of the facility for makeup water on a day-to-day basis.
  - b. The component redundancy necessary for the system to perform its design function is provided.
  - c. The potential for leakage and accidental spills has been minimized.
  - d. Instrumentation (e.g., a conductivity monitor) has been provided together with the capability to isolate the system should planned operating conditions be exceeded.
  - e. Piping has been provided as necessary to direct solutions and regenerative wastes to the radwaste system or other specified areas for processing and disposal.
2. The ASB also verifies, with input from the CMEB as requested, the following:
  - a. Precautions are taken or incorporated into the system design to properly store, handle, and dispense corrosive and toxic chemicals effectively and safely so that safety-related systems would not be adversely affected in the event of a leak or spill.
  - b. The components utilized are compatible with the associated chemicals.

The review for seismic design is performed by SEB and the review for seismic and quality group classification is performed by MEB as indicated in subsection I of this SRP section.

The ASB reviews the interface between seismic and nonseismic portions of the system and the isolation capabilities to assure that a failure of the nonseismic portion would not affect the seismic Category I portion and will not prevent safe plant shutdown.

#### IV. EVALUATION FINDINGS

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

The demineralized water makeup system includes all components and piping associated with the system from the service or municipal water source to the points of discharge to other systems or to a discharge canal. The review has determined the adequacy of the applicant's proposed design criteria and design bases for the demineralized water makeup system, regarding safety-related requirements (if any) for an adequate supply of reactor coolant purity water during all conditions of plant operation.

Portions of the DMW system that are necessary for safe shutdown or necessary to mitigate the consequences of an accident are classified seismic Category I and Quality Group C.

The staff concludes that the design of the demineralized water makeup system is acceptable and meets the requirements of General Design Criteria 2 and 5. This conclusion is based on the following:

1. The applicant has met the requirements of General Design Criterion 2 with respect to safety-related portions of the system being capable of withstanding the effects of earthquakes. Acceptance is based on meeting the guidance of Regulatory Guide 1.29, Position C-1, if any operation is deemed safety related, and Position C-2, for nonsafety-related portions. Portions of the system are deemed safety related if a failure or malfunction could result in adverse effects on essential systems or components (i.e., necessary for safe shutdown, accident prevention or accident mitigation).
2. The applicant has met the requirements of General Design Criterion 5 with respect to sharing of structures, systems, and components by demonstrating that such sharing does not affect the safe shutdown of either unit in the event of an active or passive failure.

#### 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.

Implementation schedules for conformance to parts of the method discussed herein are contained in the referenced regulatory guide.

#### VI. REFERENCES

1. 10 CFR Part 50, Appendix A, General Design Criterion 2, "Design Bases for Protection Against Natural Phenomena."
2. 10 CFR Part 50, Appendix A, General Design Criterion 5, "Sharing of Structures, Systems, and Components."
3. Regulatory Guide 1.29, "Seismic Design Classification."