



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

SECTION 9.2.6

CONDENSATE STORAGE FACILITIES

REVIEW RESPONSIBILITIES

Primary - Auxiliary and Power Conversion Systems Branch (APCSB)

Secondary - Reactor Systems Branch (RSB)
 Effluent Treatment Systems Branch (ETSB)
 Materials Engineering Branch (MTEB)
 Electrical, Instrumentation and Control Systems Branch (EICSB)
 Structural Engineering Branch (SEB)
 Mechanical Engineering Branch (MEB)
 Radiological Assessment Branch (RAB)

I. AREAS OF REVIEW

The condensate storage facility (CSF) is provided to serve as a receiver for excess water generated by other systems such as the main condenser hotwell, the liquid radwaste low activity reprocessed condensate, and the makeup water treatment system, and also to serve as the water supply or makeup source for various auxiliary systems. The APCSB review covers the CSF from the condensate storage tank up to the connections to or interfaces with other systems or components.

1. The APCSB reviews the capability of the CSF to supply water to various auxiliary systems and to receive return water from other systems.
2. The APCSB reviews the CSF to verify that:
 - a. Failures of CSF components connected to the emergency core cooling system (ECCS) or other safety-related systems do not adversely affect the safety function of the ECCS or other safety-related systems.
 - b. Component redundancy necessary to assure CSF safety functions is provided.
 - c. System components meet design code requirements consistent with the component quality group and seismic design classifications.
 - d. Provisions for mitigating the environmental effects of system leakage or storage tank failure are provided.

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 Revision 2 of 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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- e. Provisions for safe handling of storage tank overflow, the associated instrumentation necessary to detect high or low water level, and isolation means are provided.
3. The applicant's proposed technical specifications are reviewed for operating license applications, as they relate to areas covered in this review plan.

Secondary reviews are performed by other branches and the results used by the APCS to complete the overall evaluation of the CSF. The secondary reviews are as follows. The RSB will identify essential portions of the facilities that are required to function during normal operations and accident conditions, determine that the seismic and quality group classifications for the system components are acceptable, and assist in establishing the basis for minimum condensate storage capacity. The ETSB will verify that the limits for radioactivity concentrations are not exceeded. The SEB will determine 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. The MEB will review the seismic qualification of components and confirm that components, piping, and structures are designed in accordance with applicable codes and standards. The MTEB will verify that inservice inspection requirements are met for system components and, upon request, will verify the compatibility of the materials of construction with service conditions. The EICSB will verify the adequacy of the design, installation, inspection, and testing of all electrical systems (sensing, control, and power) required for proper operation. RAB reviews the facility to assure that radiation levels are as low as possible (ALAP).

II. ACCEPTANCE CRITERIA

Acceptability of the design of the condensate storage facility, as described in the applicant's safety analysis report (SAR), is based on specific general design criteria and regulatory guides. An additional basis for determining the acceptability of the condensate storage facility will be the degree of similarity of the design with that for previously reviewed plants with satisfactory operating experience.

1. For reactor systems where the condensate storage facility is an ultimate means of water supply for safe shutdown or accident mitigation the CSF is acceptable if the integrated facility design is in accordance with the following criteria:
 - a. General Design Criterion 44, to assure:
 - (1) Redundancy of components so that under normal and accident conditions the safety function can be performed assuming a single active component failure coincident with the loss of offsite power.
 - (2) The capability to isolate components, subsystems, or piping if required so that the system safety function will not be compromised.

- (3) The capability to provide sufficient makeup water to safety related cooling systems.
 - b. General Design Criterion 45, as related to design provisions made to permit inservice inspection of safety-related components and equipment.
 - c. General Design Criterion 46, as related to design provisions made to permit operational functional testing of safety-related systems and components to assure structural integrity, system leak tightness, operability and performance of active components, and capability of the integrated system to function as intended during normal, shutdown, and accident conditions.
 - d. General Design Criterion 2, as related to structures housing the facility and the facility itself being capable of withstanding the effects of natural phenomena, external missiles and internally generated missiles, pipe whip, and jet impingement forces associated with pipe breaks.
 - e. General Design Criterion 5, as related to the capability of shared systems and components to perform required safety functions.
 - f. Regulatory Guide 1.26, as related to the quality group classifications of components and systems.
 - g. Regulatory Guide 1.29, as related to the seismic design classification of system components.
 - h. Branch Technical Positions APCSB 3-1 and MEB 3-1, as related to breaks in high and moderate energy piping systems outside containment.
2. For reactor systems where the condensate storage facility is not an ultimate means of water supply for safe shutdown or accident mitigation, the design of the CSF is acceptable if the integrated facility design is in accordance with the following criteria:
 - a. Regulatory Guide 1.29, as related to the seismic design classification of facility components.
 - b. The concentration of activity in the condensate storage tank is not in excess of the unrestricted levels for liquids given in 10 CFR Part 20, or the tank is provided with a seismic Category I retention basin to preclude the release of the stored liquids to the site in the event of tank failure.

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 Section II of this plan. For operating license (OL) reviews, 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.

The review of OL applications includes a determination that the content and intent of the technical specifications prepared by the applicant are in agreement with the requirements for system testing, minimum performance, and surveillance developed as a result of the staff's review.

The condensate storage facility (CSF) may be designed either as a safety-related facility or as a non-safety-related facility, depending on the plant. The safety function performed by the facility is to ensure an adequate supply of water to the auxiliary feedwater system in the event that it is required for the safe shutdown of the reactor. Normal plant system functions performed by the CSF, such as makeup to the condenser hotwells and other auxiliary systems of the plant are reviewed to verify that failure will not have an adverse effect on the safety-related functions of the facility.

The review procedures given below are for a typical CSF system of the safety-related type. For cases where there are variations from this typical arrangement, the reviewer will adjust the review procedures given below. However, the system design will be required to meet the acceptance criteria given in Section II.

1. The safety analysis report is reviewed to determine that the facility description section and piping and instrumentation diagrams (PID's) delineate the CSF equipment that is used for normal operations, abnormal operations, and accident conditions as follows:
 - a. The facility functional requirements and the minimum flow requirements for supplying water to the auxiliary feedwater system and other safety-related systems are described.
 - b. Component allowable operational degradation (e.g., pump leakage) and the procedures that will be followed to detect and correct these conditions when they become excessive are described. The reviewer, using failure modes and effects analyses, comparisons with previously approved facilities, or independent calculations determines that the facility is capable of sustaining the loss of any active component and meeting minimum flow requirements to the safety-related systems.
2. The facility PID's, layout drawings, and component descriptions and characteristics are reviewed to determine the following:
 - a. Essential portions of the CSF are correctly identified and are isolable from the non-essential portions of the system. The PID's are reviewed to verify that they clearly indicate the physical division between each portion. System drawings are also reviewed to see that they show the means for accomplishing isolation and the facility description is reviewed to identify minimum performance requirements for the isolation valves.

- b. Essential portions of the CSF, including the isolation valves separating seismic Category I portions from the non-seismic portions are, at a minimum, classified Quality Group C or higher and seismic Category I.
 - c. Design provisions have been made that permit appropriate inservice inspection and functional testing of system components important to safety. It will be acceptable if the SAR delineates a testing and inspection program and if the system drawings show the necessary test recirculation loops around pumps or isolation valves that would be required by this program.
3. The reviewer verifies that the system has been designed so that facility functions are maintained, as required, in the event of adverse natural phenomena such as tornadoes, hurricanes, and floods, and a loss of offsite power. The reviewer evaluates the facility, using engineering judgment and the results of failure modes and effects analyses to determine the following:
- a. The failure of portions of the facility or of other systems not designed to seismic Category I standards and located close to essential portions of the facility, or non-seismic Category I structures that house, support, or are close to essential portions of the CSF, do not preclude essential functions. Reference to SAR Chapter 2, describing site features, and the general arrangement and layout drawings, as well as to the SAR tabulation of seismic design classifications for structures and facilities will be necessary. Statements in the SAR to the effect that the above conditions are met are acceptable. (CP)
 - b. The essential portions of the CSF are protected from the effects of floods, hurricanes, tornadoes, and internally or externally generated missiles. Flood protection and missile protection criteria are discussed and evaluated in detail under the standard review plans for Chapter 3 of the SAR. The location and design of the facility and structures are reviewed to determine that the degree of protection provided is adequate. A statement to the effect that the facility is located in a seismic Category I structure that is tornado missile and flood protected, or that components of the facility will be located in individual structures that will withstand the effects of both flooding and missiles is acceptable.
 - c. The CSF provides sufficient net positive suction head (NPSH) at safety-related pump suction locations considering low condensate storage tank water levels. The SAR should indicate the minimum water level of the condensate storage tank and the elevation of the pump impellers. An independent calculation verifying the applicant's conclusion regarding pump NPSH may be necessary.

- d. The condensate storage tank is equipped with instrumentation to monitor the water level in the tank and alarm when the water level reaches the low level setpoint which indicates the minimum reserve condensate storage for safety-related system supply.
 - e. The condensate storage tank overflow piping is connected to the radwaste system.
 - f. The essential portions of the facility are protected from the effects of high and moderate energy line breaks or cracks. Layout drawings are reviewed to assure that no high or moderate energy piping systems are close to essential portions of the CSF, or that protection from the effects of failure will be provided. The means of providing such protection will be given in Section 3.6 of the SAR, and the procedures for reviewing this information are given in the corresponding review plans.
 - g. Functions of the essential components and subsystems of the CSF (i.e., those necessary for plant safe shutdown) will not be precluded by a loss of offsite power. The CSF design will be acceptable in this regard if minimum system requirements are met with onsite power.
4. The descriptive information, PID's, system drawings, and failure modes and effects analyses in the SAR are reviewed to assure that essential portions of the CSF will function as needed following design basis accidents, assuming a concurrent single active component failure. The reviewer evaluates the information presented in the SAR on the ability to function of required components, traces the availability of these components on system drawings, and checks that the SAR contains verification that system flow requirements are met for each accident situation for the required time spans. For each case, the design will be acceptable if minimum system flow requirements are met.

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 condensate storage facility (CSF) includes all components and piping associated with the facility to the points of connection or interfaces with other systems. The scope of review of the CSF for the _____ plant included layout drawings, process flow diagrams, piping and instrumentation diagrams, and descriptive information for the facility and auxiliary supporting systems that are essential to its operation. [The review has determined the adequacy of the applicant's proposed design criteria and bases for the condensate storage facility and the requirements for sufficient water supply to safety-related systems during normal, abnormal, and accident conditions (CP).] [The review has determined that the design of the condensate storage facility and auxiliary supporting systems is in conformance with the design criteria and bases (OL).]

"The basis for acceptance in the staff review has been conformance of the applicant's designs, design criteria, and design bases for the condensate storage facility and supporting systems to the Commission's regulations as set forth in the general design criteria, and to applicable regulatory guides, staff technical positions, and industry standards.

"The staff concludes that the design of the condensate storage facility conforms to all applicable regulations, guides, staff positions, and industry standards, and is acceptable."

V. 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 4, "Environmental and Missile Design Bases."
3. 10 CFR Part 50, Appendix A, General Design Criterion 5, "Sharing of Structures, Systems, and Components."
4. 10 CFR Part 50, Appendix A, General Criteria 44, "Cooling Water."
5. 10 CFR Part 50, Appendix A, General Design Criterion 45, "Inspection of Cooling Water System."
6. 10 CFR Part 50, Appendix A, General Design Criterion 46, "Testing of Cooling Water System."
7. Regulatory Guide 1.26, "Quality Group Classifications and Standards for Water-, Steam-, and Radioactive-Waste-Containing Components of Nuclear Power Plants," Revision 1.
8. Regulatory Guide 1.29, "Seismic Design Classification," Revision 1.
9. Branch Technical Positions APCS 3-1, "Protection Against Postulated Piping Failures in Fluid Systems Outside Containment," attached to Standard Review Plan 3.6.1, and MEB 3-1, "Postulated Break and Leakage Locations in Fluid System Piping Outside Containment," attached to Standard Review Plan 3.6.2.

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