U.S. NUCLEAR REGULATORY COMMISSION

STANDARD REVIEW PLAN

OFFICE OF NUCLEAR REACTOR REGULATION

10.4.6 CONDENSATF CLEANUP SYSTEM

REVIEW RESPONSIBILITIES

Primary - Chemical Engineering Branch (CMEB)

Secondary - None

I. AREAS OF REVIEW

The condensate cleanup system (CCS) removes dissolved and suspended impurities due to corrosion from condenser or steam generator leaks that could be introduced into the CCS by carryover from the main steam system. The CCS is not required for safe shutdown or mitigation of postulated accidents, but is important in maintaining the primary coolant quality in direct cycle plants or the secondary coolant quality in indirect cycle plants.

The CMEB reviews the CCS from the supply point downstream of the condensate pumps to the discharge point upstream of the feedwater heaters, and also to the interfaces with the effluent treatment systems.

1. The CMEB assures that the CCS is reviewed to verify that the system provides feedwater to the reactor for direct cycle plants or to steam generators for indirect cycle plants that meets water purity requirements. Condensers are reviewed to determine that proper design measures are taken to assure that the chloride concentration and other contaminant concentrations are limited to allowable values until the condensate and feedwater systems can be isolated in the event of condenser tube leaks.

2. A review is performed by CMEB to determine that the quality of the water supplied to the reactor for direct cycle plants (SRP Section 5.4.8), and to the steam generators for indirect cycle plants (BTP MTEB 5-3), meets water purity requirements. CMEB reviews are performed to verify the compatibility of the materials of construction with the service conditions.

CMEB will coordinate the evaluations of other branches that interface with the overall review of the condensate cleanup system as follows:

The Auxiliary Systems Branch (ASB) reviews the system to determine that the design satisfies the recommendations of Branch Technical Position ASB 3-1 with respect to breaks and cracks in high- and moderate-energy system piping as part of its primary review responsibility for SRP Section 3.6.1. The Effluent Treatment Systems Branch (ETSB) determines the effect of the CCS on fission and corrosion product concentrations and the effect of the quantity of spent resin and regenerant solution on radwaste system requirements as part of its primary review responsibility for SRP Sections 11.2, 11.3 and 11.4. The shielding design for the condensate demineralizer system is reviewed by the Radiological Assessment Branch as part of its primary review responsibility for SRP Section 12.2. The review for technical specifications is coordinated and performed by the Licensing Guidance Branch as part of its primary review responsibility for SRP Section 16.0.

For those areas of review identified above as being reviewed as part of the primary review responsibility of other branches, the acceptance criteria necessary for the review and their methods of application are contained in the referenced SRP section of the corresponding primary branch.

II. ACCEPTANCE CRITERIA

CMEB acceptance criteria for the CCS is based on meeting the relevant requirements of General Design Criterion 14 as it relates to the water chemistry control being capable of preventing adverse chemistry conditions that could degrade the primary coolant boundary integrity. Specific criteria necessary to meet requirements of GDC 14 are as follows:

1. For direct cycle (BWR) plants, the design of the CCS should conform to the recommendations of Regulatory Guide 1.56, as related to the design of condensate demineralizer systems to maintain the proper water purity specified for the reactor.

2. For indirect cycle (PWR) plants, the secondary water chemistry program should conform with SRP Section 5.4.2.1, Branch Technical Position MTEB 5-3.

III. REVIEW PROCEDURES

The review 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 (PSAR) meet the acceptance criteria given in subsection II of this SRP section. 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 (FSAR).

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

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

1. CMEB evaluates the system design information and drawings and, utilizing engineering judgment, operational experience, and performance characteristics of similar, previously approved systems, verifies that:

   a. The system meets the requirements for condensate cleanup capacity, provides effluent of the required purity, and contains adequate instrumentation to monitor the effectiveness of the system. For BWRs refer to Regulatory Guide 1.56 and for PWRs refer to BTP MTEB 5-3.

   b. The system is connected to radioactive waste disposal systems to allow disposal of spent resin or regenerant solutions when required.

2. ASB reviews the effects of CCS high-and moderate-energy piping failures under SRP Section 3.6.1 to assure that other safety-related systems are not rendered inoperable.

3. ETSB determines the capability to treat and process spent resin and resin regenerant solutions in liquid and solid waste management systems under SRP Sections 11.2, 11.3, and 11.4.

4. RAB determines the adequacy of the shielding design of the condensate demineralizers under SRP Section 12.2.

IV. EVALUATION FINDINGS

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

The condensate cleanup system includes all components and equipment necessary for the removal of dissolved and suspended impurities which may be present in the condensate. Based on the staff's review of the applicant's proposed design criteria and design bases for the condensate cleanup system and the requirements for operation of the system, the staff concludes that the design of the condensate cleanup system and supporting systems is acceptable and meets the primary boundary integrity requirements of General Design Criterion 14. This conclusion is based on the applicant having met the requirements of GDC 14 as it relates to maintaining acceptable chemistry control for BWR reactor coolant and for PWR secondary coolant during normal operation and anticipated operational occurrences by reducing corrosion of BWR reactor system components and of PWR steam generator tubes and materials, thereby reducing the likelihood and magnitude of reactor piping failures and of primary-to-secondary coolant leakage. This requirement has been met by the applicant's design of the CCS meeting the regulatory positions of Regulatory Guide 1.56 for BWRs and meeting the Branch Technical Position MTEB 5-3 for PWRs.

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 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

1. 10 CFR Part 50, Appendix A, General Design Criterion 14, "Reactor Coolant Pressure Boundary."

2. Regulatory Guide 1.56, "Maintenance of Water Purity in Boiling Water Reactors."

3. Branch Technical Positions ASB 3-1, "Protection Against Postulated Piping Failures in Fluid Systems Outside Containment," attached to SRP Section 3.6.1, and MEB 3-1, "Postulated Break and Leakage Locations in Fluid System Piping Outside Containment," attached to SRP Section 3.6.2.

4. Branch Technical Position MTEB 5-3, "Monitoring of Secondary Side Water Chemistry in PWR Steam Generators," attached to SRP Section 5.4.2.1.