



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

SECTION 10.4.1

MAIN CONDENSERS

REVIEW RESPONSIBILITIES

Primary - Auxiliary and Power Conversion Systems Branch (APCSB)

Secondary - Effluent Treatment Systems Branch (ETSB)

I. AREAS OF REVIEW

The main condenser (MC) system is designed to condense and deaerate the exhaust steam from the main turbine and provide a heat sink for the turbine bypass system.

1. The APCSB reviews the performance requirements of the main condenser for both direct and indirect cycle plants during all operating conditions. Emphasis will be placed on the review of direct cycle facilities with regard to the prevention of loss of vacuum, galvanic corrosion, and hydrogen buildup.
2. The APCSB reviews the design of the MC system with respect to the following:
 - a. The means to detect and control system leakage, to detect radioactive leakage into or out of the system, and to preclude accidental releases of radioactive materials to the environment in amounts in excess of established limits.
 - b. Instrumentation and control features that determine and verify that the MC is operating in a correct mode.
 - c. The means provided to deal with flooding from a complete failure of the MC and to preclude damage to safety-related equipment from the flooding.
 - d. The capability of the MC to withstand the blowdown effects of steam from the turbine bypass system.

Secondary reviews are performed by other branches and the results used by the APCSB to complete the overall evaluation of the system. The secondary reviews are as follows: the ETSB evaluates the inventory of radioactive contaminants in the MC during power operation and during shutdown.

 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. 20556.

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II. ACCEPTANCE CRITERIA

There are no general design criteria or regulatory guides that directly apply to the main condenser. Acceptability of the design of the main condenser system, as described in the applicant's safety analysis report (SAR), is based on the system being designed such that failures do not cause unacceptable flooding of areas housing safety-related equipment, or result in excessive releases of radioactivity to the environment. An additional basis for determining the acceptability of the MC system will be the degree of similarity of the design with that of previously reviewed plants with satisfactory operating experience.

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 meet the acceptance criteria given in Section II of this plan. 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. The reviewer will select and emphasize material from this review plan, as may be appropriate for a particular case.

1. The SAR is reviewed to determine that the system description delineates the main condenser system capabilities including the minimum system heat transfer and system flow requirements for normal plant and turbine bypass operation. Measures provided to prevent loss of vacuum, galvanic corrosion of MC tubes and components, and hydrogen buildup in the MC are reviewed, with particular emphasis on these measures in direct cycle (boiling water reactor) plants. System performance requirements are reviewed to determine that they satisfactorily limit possible system degradation conditions (e.g., leakage, partial loss of vacuum) and describe the procedures that are followed to detect and correct these conditions. The SAR is also reviewed to determine that any allowed MC system degraded operation does not have an adverse effect on the reactor primary system.
2. The reviewer evaluates the MC system design to verify that:
 - a. Means have been provided for detecting and controlling condenser leakage.
 - b. Measures have been provided to detect radioactive leakage into and out of the MC system and to preclude unacceptable accidental releases of radioactivity to the environment from the system.
 - c. The system is provided with instrumentation and control features that determine and verify that the MC is operating in a correct mode.
3. The reviewer uses engineering judgment and the results of failure modes and effects analyses to determine that:

- a. The failure of a main condenser and the resulting flooding will not preclude operation of any essential systems. Reference to sections of the SAR describing plant features and the general arrangement and layout drawings will be necessary, as well as the SAR tabulation of seismic design classifications for structures and systems. Statements in the SAR that verify that the above conditions are met are acceptable.
- b. The system, in conjunction with the main steam system, has provisions to detect loss of condenser vacuum and to effect isolation of the steam source. For direct cycle plants, it will be acceptable if the detection system in the MC can actuate the main steam isolation valves to limit the quantity of steam lost out of the condenser.
- c. Design provisions have been incorporated into the MC that will preclude component or tube failures from turbine bypass system steam blowdown.

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 main condenser system includes all components and equipment from the turbine exhaust to the connections and interfaces with the main condensate and other systems. The scope of review of the main condenser system for the _____ plant included layout drawings, piping and instrumentation diagrams, and descriptive information for the main condenser system and 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 main condenser system and the requirements to preclude safety-related equipment malfunctions or failures due to rupture of the main condensers. (CP)] [The review has determined that the design of the main condenser system and supporting systems is in conformance with the proposed design criteria and design bases. (OL)]

"The basis for acceptance in the staff review has been conformance of the applicant's design criteria and design bases for the main condenser system and supporting systems to applicable staff technical positions and industry standards.

"The staff concludes that the design of the main condenser system conforms to all applicable staff positions and industry standards, and is acceptable."

V. REFERENCES

None.

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