



U.S. NUCLEAR REGULATORY COMMISSION

STANDARD REVIEW PLAN

10.4.2 MAIN CONDENSER EVACUATION SYSTEM

REVIEW RESPONSIBILITIES

Primary - Organization responsible for the review of power conversion systems.

Secondary - None

I. AREAS OF REVIEW

The main condenser evacuation system (MCES) is designed to establish and maintain condenser vacuum and to transfer radioactive gases to the gaseous waste processing system or ventilation exhaust systems. Review of the MCES is focused on the system features incorporated to monitor and control releases of radioactive materials in effluents. This includes the startup system which initially establishes main condenser vacuum and the normal system which maintains condenser vacuum once it has been established.

Specific areas of review are as follows:

1. The design, design objectives, capacity, method of operation, and factors that influence gaseous radioactive material handling, e.g., system interfaces and potential bypass routes. The review includes the system piping and instrumentation diagrams (P&IDs).
2. If the potential for explosive mixtures exists, design features to preclude the possibility of an explosion which could cause a release of radioactive material to the environment.

Revision 3 - March 2007

USNRC STANDARD REVIEW PLAN

This Standard Review Plan, NUREG-0800, has been prepared to establish criteria that the U.S. Nuclear Regulatory Commission staff responsible for the review of applications to construct and operate nuclear power plants intends to use in evaluating whether an applicant/licensee meets the NRC's regulations. The Standard Review Plan is not a substitute for the NRC's regulations, and compliance with it is not required. However, an applicant is required to identify differences between the design features, analytical techniques, and procedural measures proposed for its facility and the SRP acceptance criteria and evaluate how the proposed alternatives to the SRP acceptance criteria provide an acceptable method of complying with the NRC regulations.

The standard review plan sections are numbered in accordance with corresponding sections in Regulatory Guide 1.70, "Standard Format and Content of Safety Analysis Reports for Nuclear Power Plants (LWR Edition)." Not all sections of Regulatory Guide 1.70 have a corresponding review plan section. The SRP sections applicable to a combined license application for a new light-water reactor (LWR) are based on Regulatory Guide 1.206, "Combined License Applications for Nuclear Power Plants (LWR Edition)."

These documents are made available to the public as part of the NRC's policy to inform the nuclear industry and the general public of regulatory procedures and policies. Individual sections of NUREG-0800 will be revised periodically, as appropriate, to accommodate comments and to reflect new information and experience. Comments may be submitted electronically by email to NRR_SRP@nrc.gov.

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3. Inspections, Tests, Analyses, and Acceptance Criteria (ITAAC). For design certification (DC) and combined license (COL) reviews, the staff reviews the applicant's proposed ITAAC associated with the structures, systems, and components (SSCs) related to this SRP section in accordance with SRP Section 14.3, "Inspections, Tests, Analyses, and Acceptance Criteria." The staff recognizes that the review of ITAAC cannot be completed until after the rest of this portion of the application has been reviewed against acceptance criteria contained in this SRP section. Furthermore, the staff reviews the ITAAC to ensure that all SSCs in this area of review are identified and addressed as appropriate in accordance with SRP Section 14.3.
4. COL Action Items and Certification Requirements and Restrictions. For a DC application, the review will also address COL action items and requirements and restrictions (e.g., interface requirements and site parameters).

For a COL application referencing a DC, a COL applicant must address COL action items (referred to as COL license information in certain DCs) included in the referenced DC. Additionally, a COL applicant must address requirements and restrictions (e.g., interface requirements and site parameters) included in the referenced DC.

Review Interfaces

Other SRP sections interface with this section as follows:

1. Review of the acceptability of the seismic and quality group classifications is performed under SRP Sections 3.2.1 and 3.2.2.
2. Provisions incorporated to detect explosive gas mixtures and manage gaseous effluents collected from the MCES are reviewed under SRP Section 11.3.
3. Review of the radiological monitoring instrumentation in place to monitor gaseous effluents in the MCES is performed under SRP Section 11.5.
4. Review of the systems quality assurance programs is performed under SRP Chapter 17.

The specific acceptance criteria and review procedures are contained in the referenced SRP sections.

II. ACCEPTANCE CRITERIA

Acceptance criteria are based on meeting the relevant requirements of the following Commission regulations:

1. General Design Criterion 60 as it relates to the MCES design for the control of releases of radioactive materials to the environment.
2. 10 CFR 52.47(b)(1), which requires that a DC application contain the proposed inspections, tests, analyses, and acceptance criteria (ITAAC) that are necessary and sufficient to provide reasonable assurance that, if the inspections, tests, and analyses are performed and the acceptance criteria met, a plant that incorporates the design certification is built and will operate in accordance with the design certification, the provisions of the Atomic Energy Act, and the NRC's regulations;

3. 10 CFR 52.80(a), which requires that a COL application contain the proposed inspections, tests, and analyses, including those applicable to emergency planning, that the licensee shall perform, and the acceptance criteria that are necessary and sufficient to provide reasonable assurance that, if the inspections, tests, and analyses are performed and the acceptance criteria met, the facility has been constructed and will operate in conformity with the combined license, the provisions of the Atomic Energy Act, and the NRC's regulations.

SRP Acceptance Criteria

Specific SRP acceptance criteria acceptable to meet the relevant requirements of the NRC's regulations identified above are as follows for the review described in this SRP section. The SRP is not a substitute for the NRC's regulations, and compliance with it is not required. However, an applicant is required to identify differences between the design features, analytical techniques, and procedural measures proposed for its facility and the SRP acceptance criteria and evaluate how the proposed alternatives to the SRP acceptance criteria provide acceptable methods of compliance with the NRC regulations.

1. The requirements of General Design Criteria 60 (GDC 60) are met when the MCES design includes provisions to prevent excessive releases of radioactivity to the environment which may result from a failure of a structure, system or component in the MC. Acceptance is based on meeting the following:
 - A. If there is a potential for explosive mixtures to exist, the MCES is designed to withstand the effects of an explosion and instrumentation is provided to detect and annunciate the buildup of potentially explosive mixtures, dual instrumentation is provided to detect, annunciate, and effect control measures to prevent the buildup of potentially explosive mixtures, as outlined in SRP Section 11.3, subsection II, "Acceptance Criteria," SRP Acceptance Criteria, Item 6.

Such a potential does not exist on systems designed to maintain the steam content above 58% by volume in hydrogen-air mixtures or nitrogen content above 92% by volume in hydrogen-oxygen mixtures in all MCES components. The design pressure and normal operational absolute pressure should be provided for MCES components containing potentially explosive mixtures.

Technical Rationale

The technical rationale for application of these acceptance criteria to the areas of review addressed by this SRP section is discussed in the following paragraphs:

1. Compliance with GDC 60 requires that provisions be included in the nuclear power unit design to control suitably the release of radioactive materials in gaseous and liquid effluents during normal operation, including anticipated operational occurrences.

GDC 60 is applicable to the design of the MCES because radioactive materials in both gaseous and liquid form are routinely processed in this system in BWRs during normal operation. In PWRs, radioactive materials are processed in this system only if there is a primary-to-secondary steam generator tube leak. Design features are incorporated into the system to ensure that these radioactive materials are controlled and routed appropriately.

2. Meeting these requirements provides assurance that the release of radioactive materials in gaseous and liquid effluents from the MCES during normal operation, including anticipated operational occurrences, is kept as low as is reasonably achievable, in accordance with 10 CFR Part 50 Appendix I.

III. REVIEW PROCEDURES

The reviewer will select material from the procedures described below, as may be appropriate for a particular case.

These review procedures are based on the identified SRP acceptance criteria. For deviations from these acceptance criteria, the staff should review the applicant's evaluation of how the proposed alternatives provide an acceptable method of complying with the relevant NRC requirements identified in Subsection II.

1. In the review of the MCES, the SAR and P&IDs are reviewed to determine the flow paths of gases through the system, including all bypasses, and the points of release of gaseous wastes to the environment or other systems. This information is used in SRP Section 11.3 to calculate the quantity of radioactive material released annually in gaseous effluents during normal operations, including anticipated operational occurrences. Review of the system verifies that water from the mechanical vacuum pumps and condensate from the steam jet air ejectors are classified as radioactive liquids and treated accordingly.
2. If there is a potential that explosive mixtures may exist, The determination is made whether the applicant has designed the MCES to withstand the effects of such an explosion and has provided instrumentation to detect and annunciate or has provided dual instrumentation on redundant MCES trains to detect, annunciate, and effect control measures to prevent the buildup of potentially explosive mixtures. The review will also determine if the applicant's design includes adequate provisions to stop continuous leakage-paths after an explosion.

For review of a DC application, the reviewer should follow the above procedures to verify that the design, including requirements and restrictions (e.g., interface requirements and site parameters), set forth in the final safety analysis report (FSAR) meets the acceptance criteria. DCs have referred to the FSAR as the design control document (DCD). The reviewer should also consider the appropriateness of identified COL action items. The reviewer may identify additional COL action items; however, to ensure these COL action items are addressed during a COL application, they should be added to the DC FSAR.

For review of a COL application, the scope of the review is dependent on whether the COL applicant references a DC, an early site permit (ESP) or other NRC approvals (e.g., manufacturing license, site suitability report or topical report).

For review of both DC and COL applications, SRP Section 14.3 should be followed for the review of ITAAC. The review of ITAAC cannot be completed until after the completion of this section.

IV. EVALUATION FINDINGS

The reviewer verifies that the applicant has provided sufficient information and that the review and calculations (if applicable) support conclusions of the following type to be included in the staff's safety evaluation report. The reviewer also states the bases for those conclusions.

The main condenser evacuation system (MCES) includes equipment and instruments to establish and maintain condenser vacuum and to prevent an uncontrolled release of radioactive material to the environment. The staff has reviewed the applicant's system descriptions, piping and instrumentation diagrams, and design criteria for the components of the MCES.

The staff concludes that the MCES design is acceptable in that the applicant has met the requirements of General Design Criteria 60 with respect to the design features in place to control releases of radioactive materials to the environment.

For DC and COL reviews, the findings will also summarize the staff's evaluation of requirements and restrictions (e.g., interface requirements and site parameters) and COL action items relevant to this SRP section.

In addition, to the extent that the review is not discussed in other SER sections, the findings will summarize the staff's evaluation of the ITAAC, including design acceptance criteria, as applicable.

V. IMPLEMENTATION

The staff will use this SRP section in performing safety evaluations of DC applications and license applications submitted by applicants pursuant to 10 CFR Part 50 or 10 CFR Part 52. Except when the applicant proposes an acceptable alternative method for complying with specified portions of the Commission's regulations, the staff will use the method described herein to evaluate conformance with Commission regulations.

The provisions of this SRP section apply to reviews of applications submitted six months or more after the date of issuance of this SRP section, unless superseded by a later revision.

VI. REFERENCES

1. 10 CFR Part 50, Appendix A, General Design Criterion 60, "Control of Releases of Radioactive Materials to the Environment."
2. 10 CFR Part 50, Appendix I, "Numerical Guides For Design Objectives and Limiting Conditions For Operation to Meet the Criterion "As Low as is Reasonably Achievable" For Radioactive Material in Light Water Cooled Nuclear Power Reactor Effluents."
3. 10 CFR Part 52 "Early Site Permit; Standard Design Certifications; And Combined Licenses For Nuclear Power Plants."

PAPERWORK REDUCTION ACT STATEMENT

The information collections contained in the Standard Review Plan are covered by the requirements of 10 CFR Part 50 and 10 CFR Part 52, and were approved by the Office of Management and Budget, approval number 3150-0011 and 3150-0151.

PUBLIC PROTECTION NOTIFICATION

The NRC may not conduct or sponsor, and a person is not required to respond to, a request for information or an information collection requirement unless the requesting document displays a currently valid OMB control number.