U.S. NUCLEAR REGULATORY COMMISSION

STANDARD REVIEW PLAN

10.4.2 MAIN CONDENSER EVACUATION SYSTEM

REVIEW RESPONSIBILITIES

Primary - Organization responsible for the review of the main condenser evacuation system associated with the balance of the plant.

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.

3. Inspection, Test, Analysis, and Acceptance Criteria (ITAAC). For design certification (DC) and combined license (COL) reviews, the applicant's proposed information on the ITAAC associated with the systems, structures, and components (SSCs) related to this SRP section is reviewed in accordance with SRP Section 14.3, "Inspections, Tests, Analyses, and Acceptance Criteria - Design Certification." The staff recognizes that the review of ITAAC is performed after review of the rest of this portion of the application against acceptance criteria contained in this SRP section. Furthermore, the ITAAC are reviewed to assure 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. COL action items may be identified in the NRC staff's final safety evaluation report (FSER) for each certified design to identify information that COL applicants must address in the application. Additionally, DCs contain requirements and restrictions (e.g., interface requirements) that COL applicants must address in the application. For COL applications referencing a DC, the review performed under this SRP section includes information provided in response to COL action items and certification requirements and restrictions pertaining to this SRP section, as identified in the FSER for the referenced certified design.

Review Interfaces

The listed 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(a)(1)(vi), as it relates to ITAAC (for design certification) sufficient to assure that the SSCs in this area of review will operate in accordance with the certification.

3. 10 CFR 52.97(b)(1), as it relates to ITAAC (for combined licenses) sufficient to assure that the SSCs in this area of review have been constructed and will be operated in conformity with the license and the Commission'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 review described in Subsection I of 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 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 requirements and/or SRP 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 and emphasize material from the procedures described below, as may be appropriate for a particular case.

For each area of review specified in subsection I of this SRP section, the review procedure is identified below. These review procedures are based on the identified SRP acceptance criteria. For deviations from these specific acceptance criteria, the staff should review the applicant's evaluation of how the proposed alternatives to the SRP criteria 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.

3. For reviews of DC and COL applications under 10 CFR Part 52, the reviewer should follow the above procedures to verify that the design set forth in the safety analysis report, and if applicable, site interface requirements meet the acceptance criteria. For DC applications, the reviewer should identify necessary COL action items. With respect to COL applications, the scope of the review is dependent on whether the COL applicant references a DC, an ESP or other NRC-approved material, applications, and/or reports.

   After this review, SRP Section 14.3 should be followed for the review of Tier I information for the design, including the postulated site parameters, interface criteria, and ITAAC.

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 (to the extent that the review is not discussed in other SER sections) the staff's evaluation of the ITAAC, including design acceptance criteria, as applicable, and interface requirements and combined license action items relevant to this SRP section.

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 docketed six months or more after the date of issuance of this SRP section, unless superceded 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."

SRP Section 10.4.2
Description of Changes

This SRP section affirms the technical accuracy and adequacy of the guidance previously provided in (Draft) Revision 3, dated June 1996 of this SRP. See ADAMS accession number ML052070590.

In addition this SRP section was administratively updated in accordance with NRR Office Instruction, LIC-200, Revision 1, "Standard Review Plan (SRP) Process." The revision also adds standard paragraphs to extend application of the updated SRP section to prospective submittals by applicants pursuant to 10 CFR Part 52.

The technical changes are incorporated in Revision 3, dated [Month] 2007 with the following exceptions, as applicable:

1. Removed specific branch responsibilities.

2. General editorial and formatting changes.

3. Converted the document to the current format, Exhibit 2 of LIC-200.

Review Responsibilities - Reflects changes in review branches resulting from reorganization and branch consolidation. Change is reflected throughout the SRP.

REVIEW RESPONSIBILITIES - Reflects changes in review branches resulting from reorganization and branch consolidation. Change is reflected throughout the SRP.

I. AREAS OF REVIEW

1. Introductory paragraph re-written for consistency and clarity.

2. Specific Review #3, moved information about radiological effluents and explosive gas monitoring to review interfaces.

3. Interface #1, added interface with seismic SRP Section 3.2.2.

II. ACCEPTANCE CRITERIA

1. Removed GDC 64 reference because it was redundant and is covered in interface #3, SRP section 11.5.

2. Removed Regulatory Guide 1.26 reference because it is redundant and is covered in interface #1, SRP section 3.2.2.

3. Removed references to Regulatory Guide 1.33 and 1.123 because they are covered in SRP Chapter 17, Interface #4.

4. Removed references to "Standards for Steam Surface Condensers" because these standards do not pertain to SSC's important to safety, they are performance guidelines.

5. Removed Regulatory Guide 1.26 reference because it is redundant and is covered in interface #1, SRP section 3.2.2.

6. Moved explosive gas guidance to technical rationale for consistency.

The following changes were made to the “technical rationale” subsection:

7. Removed references about monitoring for radioactivity because it does not belong in GDC 60.

8. Removed all references to GDC 64 Because it is covered under interface #3, SRP Section 11.5.

9. Removed reference to reg guide 1.26 because this is covered under interface #1, SRP Sections 3.2.1 and 3.2.2.

10. Added Appendix I reference to ALARA to be more clear in guidance.

III. REVIEW PROCEDURES

1. Removed reference to reg guide 1.26 because this is covered under interface #1, SRP Section 3.2.2.

2. Removed references to Regulatory Guide 1.33 and 1.123 because they are covered in SRP Chapter 17, Interface #4.

IV. EVALUATION FINDINGS

V. IMPLEMENTATION

VI. REFERENCES

1. Added 10 CFR Part 50, Appendix I.

2. Added 10 CFR Part 52.

3. Removed GDC 64.

4. Removed “Standards for Steam Surface Condensers”.

5. Removed Regulatory Guide 1.26.