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

SECTION 9.4.3 AUXILIARY AND RADWASTE AREA VENTILATION SYSTEM

REVIEW RESPONSIBILITIES

Primary - Auxiliary Systems Branch (ASB)

Secondary - Instrumentation and Control Systems Branch (ICSB)
Mechanical Engineering Branch (MEB)
Power Systems Branch (PSB)

I. AREAS OF REVIEW

The ASB reviews the auxiliary and radwaste area ventilation system (ARAVS) from air intake to the point of discharge where the system connects to the gaseous cleanup and treatment system or station vents to assure conformance with the requirements of General Design Criteria 2, 4 and 5. The review includes components such as air intakes, ducts, air conditioning units, blowers, isolation dampers, and roof exhaust fans. The review of the ARAVS covers the radwaste areas and controlled access nonradioactive areas and their relationship to safety-related areas in the auxiliary building.

1. The ASB reviews the functional performance requirements and the air treatment equipment for the ARAVS to determine whether the ventilation system or portions of the system have been designed or need to be designed as a safety-related system. Based on this determination, the safety-related part of the system is reviewed with respect to functional performance requirements during normal operation, during adverse environmental occurrences, and during and subsequent to postulated accidents, including the loss of offsite power. The ASB reviews safety-related portions of the system to assure that:

   a. A single active failure cannot result in loss of the system functional performance capability.

   b. Components and piping have sufficient physical separation or shielding to protect essential portions of the system from missiles, pipe whip, and fires.

   c. Failures of non-seismic Category I equipment or components will not result in unfiltered releases of radioactive contaminants.

2. The ASB also reviews safety-related portions of the ARAVS with respect to the following:

a. The capability to direct ventilation air from areas of low radioactivity to areas of progressively higher radioactivity.

b. The capability to detect the need for isolation and to isolate safety-related portions of the system in the event of fires, failures, or malfunctions, and the capability of the isolated system to function under such conditions.

c. To determine that the quality group and seismic design requirements are met for the system.

3. The Effluent Treatment Systems Branch (ETSB) evaluates the ARAVS's functional performance to assure that the system meets acceptable limits for radioactive releases during normal operations under SRP Section 11.3.

4. The Radiological Assessment Branch (RAB) reviews and evaluates the capability of the ARAVS to detect and control leakage of radioactive contamination from the system, as well as radiation protection criteria as described in SRP Section 12.3.

5. The applicant's proposed technical specifications are reviewed for operating license applications as they relate to areas covered in this SRP section.

Secondary reviews are performed by other branches and the results used by the ASB to complete the overall evaluation of the system. The MEB will, upon request, review the seismic qualification of components and confirm that the components, piping, and structures are designed in accordance with applicable codes and standards. The ICSB and PSB will determine the adequacy of the design, installation, inspection, and testing of all electrical components (sensing, control and power) required for proper operation.

## II. ACCEPTANCE CRITERIA

Acceptability of the ARAVS design, as described in the applicant's Safety Analysis Report (SAR), is based on specific general design criteria and regulatory guides. The design of safety-related portions of the ARAVS is acceptable if the integrated design of the system is in accordance with the following criteria:

1. General Design Criterion 2, as related to structures housing the system and the system itself being capable of withstanding the effects of natural phenomena such as earthquakes, tornadoes, hurricanes, and floods.

2. General Design Criterion 4, with respect to structures housing the system and the system itself being capable of withstanding the effects of external missiles and internally generated missiles, pipe whip, and jet impingement forces associated with pipe breaks.

3. General Design Criterion 5, as related to shared systems and components important to safety.

4. Regulatory Guide 1.26, as related to quality group classification of systems and components.

5. Regulatory Guide 1.29, as related to seismic design classification of system components.

6. Regulatory Guide 1.117, as related to the protection of structures, systems and components important to safety from the effects of tornado missiles.

7. Branch Technical Position ASB 9.5-1, as related to capability of the system to remove smoke.

8. Branch Technical Positions ASB 3-1 and MEB 3-1, as related to breaks in high and moderate energy piping systems outside containment.

For those areas of review identified in subsection I of this SRP section as being the responsibility of other branches, the acceptance criteria and their methods of application are contained in the SRP sections corresponding to those branches.

## 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 subsection II. For the review of operating license (OL) applications, the procedures are utilized 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 procedures for OL reviews include 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.

Upon request from the primary reviewer, the secondary review branches will provide input for the areas of review stated in subsection I. The primary reviewer obtains and uses such inputs as required to assure that this review procedure is complete.

As a result of various ARAVS designs proposed by applicants, there will be variations in system requirements. For the purpose of this SRP section, a typical system is assumed which has fully redundant subsystems, each having an identical essential (safety features) portion. For cases where there are variations from this typical arrangement, the reviewer would adjust the review procedures given below. However, the system design would be required to meet the acceptance criteria given in subsection II. The reviewer will select and emphasize material from this SRP section as may be appropriate for a particular case.

1. The SAR is reviewed to verify that the system description and piping and instrumentation diagrams (P&IDs) show the ARAVS equipment used for normal operation, and

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the ambient temperature limits for the areas serviced. The system performance requirements are reviewed to determine that allowable component operational degradation (e.g., loss of function, damper leakage) and the procedures that will be followed to detect and correct these conditions are adequately described. The reviewer, using results from failure modes and effects analyses as appropriate, determines that the safety-related portion of the system is capable of functioning in spite of the failure of any active component.

2. The system P&IDs, layout drawings, and component descriptions and characteristics are then reviewed to determine that:

   a. Essential portions of the ARAVS are correctly identified and are isolable from non-essential portions of the system. The P&IDs are reviewed to verify that they clearly indicate the physical divisions between such portions and indicate design classification changes. System drawings are also reviewed to verify that they show the means for accomplishing isolation and the description is reviewed to identify minimum performance requirements for the isolation dampers. For the typical system, the drawings and description are reviewed to verify that two automatically operated isolation dampers in series separate non-essential portions and components from the essential portions.

   b. Essential portions of the ARAVS, including the isolation dampers separating essential from non-essential portions, are classified seismic Category I and Quality Group C. Component and system descriptions in the SAR that identify mechanical and performance characteristics are reviewed to verify that the above seismic classification has been included, and that the P&IDs indicate any points of change in design classification.

3. The reviewer verifies that the essential portion of the system has been designed so that system function will be maintained as required in the event of adverse environmental phenomena or in the event of certain pipe breaks or loss of offsite power. The reviewer evaluates the system, using engineering judgment and the results of failure modes and effects analyses to determine that:

   a. The failure of non-essential portions of the system or of other systems not designed to seismic Category I standards and located close to essential portions of the system, or of non-seismic Category I structures that house, support, or are close to essential portions of the ARAVS, will not preclude operation of the essential portions of the ARAVS. Reference to SAR sections describing site 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. (CP)

   b. The essential portions of the ARAVS are protected from the effects of floods, hurricanes, tornadoes, and internally and externally generated missiles.

Flood protection and missile protection criteria are discussed and evaluated in detail under the Section 3 series of the SRP. The location and the design of the system, structures, and fan rooms (cubicles) are reviewed to determine that the degree of protection provided is adequate. A statement to the effect that the system is located in a seismic Category I structure that is tornado missile and flood protected, or that components of the system will be located in individual cubicles or rooms that will withstand the effects of both flooding and missiles is acceptable.

c. The essential portions of the system are protected from the effects of high and moderate energy line breaks. Layout drawings are reviewed to assure that no high or moderate energy piping systems are close to essential portions of the ARAVS, 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 procedures for reviewing this information are given in SRP Section 3.6.

d. Components and subsystems, necessary for preventing the release of radioactive contaminants, can function as required in the event of loss of offsite power. The system design will be acceptable if the ARAVS meets minimum system requirements as stated in the SAR assuming a failure of a single active component within the system or in the auxiliary electric power source which supplies the system. The SAR is reviewed to see that for each ARAVS component or subsystem affected by the loss of offsite power, the resulting system flow capacity will not cause the loss of preferred direction of air flow from areas of low potential radioactivity to areas of higher potential radioactivity. Statements in the SAR and the results of failure modes and effects analyses are considered in verifying that the system meets these requirements. This will be an acceptable verification of system functional reliability.

4. The descriptive information, P&IDs, ARAVS drawings, and failure modes and effects analyses in the SAR are reviewed to assure that essential portions of the system can function following design basis accidents assuming a concurrent single active failure. The reviewer evaluates the analyses presented in the SAR to assure functioning of required components, traces the availability of these components on system drawings, and checks that the SAR contains verification that minimum system isolation or filtration requirements are met for each accident situation for the required time spans. For each case the design will be acceptable if minimum system requirements are met.

## IV. EVALUATION FINDINGS

The reviewer determines 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:

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"The auxiliary and radwaste area ventilation system (ARAVS) includes all components and ductwork from air intake to the point of discharge where the system connects to the gaseous cleanup and treatment system or station vents. Based on the review of the applicant's proposed design criteria, design bases, and safety classification for the auxiliary and radwaste area ventilation system and the requirements for system performance to preclude an unacceptable release of contaminants to the environment during normal, abnormal, and accident conditions, the staff concludes that the design of the auxiliary and radwaste area ventilation system and auxiliary supporting systems is in conformance with the Commission's regulations as set forth in General Design Criterion 2, "Design Bases for Protection Against Natural Phenomena," General Design Criterion 4, "Environmental and Missile Design Bases," General Design Criterion 5, "Sharing of Structures, Systems and Components," and meets the guidelines contained in Regulatory Guide 1.26, "Quality Group Classifications and Standards for Water-, Steam-, and Radioactive-Waste-Containing Components of Nuclear Power Plants," Regulatory Guide 1.29, "Seismic Design Classification," Regulatory Guide 1.117, "Tornado Design Classification," Branch Technical Position ASB 9.5-1, "Fire Protection for Nuclear Power Plants," and Branch Technical Positions ASB 3-1 and MEB 3-1 and is, therefore, 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. Regulatory Guide 1.26, "Quality Group Classifications and Standards for Water-, Steam-, and Radioactive-Waste-Containing Components of Nuclear Power Plants."

5. Regulatory Guide 1.29, "Seismic Design Classification."

6. Regulatory Guide 1.117, "Tornado Design Classification."

7. Branch Technical Position ASB 9.5-1, "Fire Protection for Nuclear Power Plants," attached to SRP Section 9.5.1.

8. 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.