



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

SECTION 9.3.3

EQUIPMENT AND FLOOR DRAINAGE SYSTEM

REVIEW RESPONSIBILITIES

Primary - Auxiliary and Power Conversion Systems Branch (APCSB)

Secondary - Effluent Treatment Systems Branch (ETSB)  
Containment Systems Branch (CSB)  
Radiological Assessment Branch (RAB)I. AREAS OF REVIEW

The equipment and floor drainage system (EFDS) is designed to assure that waste liquids, valve and pump leakoffs, and tank drains are directed to the proper area for processing or disposal. The APCSB reviews the equipment and floor drainage system, including the collection and disposal of liquid effluents outside containment. This includes piping and pumps from equipment or floor drains to the sumps, and any additional equipment that may be necessary to route effluents to the drain tanks and then to the radwaste system.

1. The APCSB reviews the EFDS capability to collect and dispose of all waste liquid effluents so that they will be processed in a controlled and safe manner. APCSB will determine that:
  - a. The system is capable of handling the volume of leakage expected, including the capacities of the sumps, drain tanks, and sump pumps.
  - b. The system is capable of preventing a backflow of water that might result from maximum flood levels to areas of the plant containing safety-related equipment.
  - c. There is no potential for inadvertent transfer of contaminated fluids to a non-contaminated drainage system.
2. The applicant's proposed technical specifications are reviewed at the operating license stage as they relate to areas covered in this review plan.

Secondary reviews will be 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 will provide verification that the radwaste system is capable of collecting, sampling, analyzing, and processing the effluents from the EFDS consistent with the requirements for disposal of radwaste material. The CSB will verify that portions of the drain system

**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. 20546.

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penetrating the containment barrier are designed with acceptable isolation features to maintain containment integrity for all operating conditions including accidents. RAB will verify that the system will meet occupational radiation protection criteria of Regulatory Guide 8.8.

## II. ACCEPTANCE CRITERIA

1. Acceptability of the design of the equipment and floor drainage system, as described in the applicant's safety analysis report (SAR) is based on the system being designed to prevent the flooding of areas housing safety-related equipment and to prevent the inadvertent transfer of contaminated fluids to non-contaminated drainage systems for disposal.
2. There are no general design criteria or regulatory guides that are directly applicable to the safety-related performance requirements for the EFDS. The APCSB uses the following criteria to determine if portions of the EFDS are safety-related:
  - a. If the system is capable of detecting leaks in safety systems that utilize the drainage system sumps, and is the only means for such leakage detection, it is considered safety-related in this regard.
  - b. If the system can cause the inundation of safety-related areas due to drain backflow that may result from blockage or the probable maximum flood, it is considered safety-related in this area.
  - c. If the system is connected so that an inadvertent transfer of contaminated fluids to non-contaminated drainage systems can occur, it is considered safety-related in this area.
3. The general design criteria and regulatory guides utilized in review of those portions of the system where failure or malfunction could result in adverse effects on essential systems or components (i.e., necessary for safe shutdown, accident prevention, or accident mitigation) follow:
  - a. General Design Criterion 2, as related to the capability of withstanding the effects of natural phenomena such as earthquakes, tornadoes, hurricanes, and floods.
  - b. General Design Criterion 4, with respect to the capability of withstanding the effects of external missiles and internally generated missiles, pipe whip and jet impingement forces associated with pipe breaks.
  - c. Regulatory Guide 1.29, as related to the seismic design classification of components.
  - d. Regulatory Guide 8.8 related to maintaining occupational radiation exposure as low as practicable.

- e. Branch Technical Positions APCSB 3-1 and MEB 3-1, as related to breaks in high and moderate energy piping systems outside containment.
4. An additional basis for determining the acceptability of safety-related portions of the EFDS will be the degree of similarity of the design with that for 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 as set forth in the preliminary safety analysis report meet the acceptance criteria given in Section II of this plan. For 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 applications 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.

The reviewer will select and emphasize material from this plan, as may be appropriate for a particular case.

1. The SAR is reviewed to see that the EFDS description section, layout drawings, and piping and instrumentation diagrams (P&IDs) show the EFDS layout and equipment, including pumps and valves necessary for routing effluents, the minimum drain tank capacity system flow requirements, connections to areas containing safety-related equipment or to non-contaminated drain systems, and any use made of the EFDS for leakage detection for safety-related systems. The reviewer determines which portions of the EFDS have safety functions or can adversely affect safety-related systems, using the criteria of Section II.2, above. These "essential" portions of the EFDS are then reviewed on the basis of the criteria of Section II.3, as is described in the paragraphs that follow.
2. The EFDS performance requirements section of the SAR is reviewed to confirm that it describes component allowable operational degradation (e.g., drain blockage, sump pump leakage, or failures) for safety-related portions of the system and describes the procedures that will be followed to detect and correct these conditions if they become excessive. The reviewer determines that essential portions of the system can sustain the loss of any active component and meet minimum system requirements. The system P&IDs, layout drawings, and component descriptions and characteristics are then reviewed for the following points:
  - a. Essential portions of the EFDS are correctly identified and are isolable from the non-essential portions of the system to the extent required by system performance requirements.

- b. Essential portions of the EFDS are classified Quality Group C or higher and seismic Category I. Components and system descriptions in the SAR are reviewed to verify that the seismic and safety classifications have been included, and that the P&IDs indicate any points of change in piping quality group classification.
  3. The reviewer verifies that the system safety functions will be maintained, as required, in the event of adverse environmental phenomena such as earthquakes, tornadoes, hurricanes, and floods, or in the event of certain pipe breaks. The reviewer evaluates the system, using engineering judgment, failure modes and effects analyses, and the results of reviews performed under other review plans, to determine that:
    - a. 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 EFDS, will not preclude operation of the essential portions of the EFDS. Reference to SAR Chapter 2 (which describes site features) and the general arrangement and layout drawings will be necessary. Statements in the SAR to the effect that the above conditions are met are acceptable
    - b. System capability to prevent drain or flood water from backing up in the drainage system into areas housing safety-related equipment has been incorporated. Statements in the SAR that this capability is provided are acceptable.
    - c. Provisions are made in the system to control and direct the flow of radioactive waste fluids to the radwaste area. It will be acceptable if the system P&IDs and design criteria show that the potential for inadvertent transfer of contaminated fluids to noncontaminated drainage system for disposal has been precluded.
    - d. 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 EFDS, 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 the procedures for reviewing this information are given in the corresponding review plans.
  4. The descriptive information, P&IDs, EFDS drawings, and failure modes and effects analyses in the SAR are reviewed to assure that essential portions of the system can function as required following design basis accident, assuming a concurrent failure of a single active component. The reviewer evaluates the analyses presented in the SAR to assure function of required components, traces the availability of these components on system drawings, and checks that the SAR contains verification that minimum system flow 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 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 equipment and floor drainage system includes all piping from equipment or floor drains to the sump, the sump pumps, and the associated pumps and piping network necessary to route effluents to the drain tanks and then to the radwaste system. The scope of review of the equipment and floor drainage system for the \_\_\_\_\_ plant included layout drawings, process flow diagrams, piping and instrumentation diagrams, and descriptive information for the equipment and floor drainage system and the auxiliary 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 equipment and floor drainage system, and the requirements for continuous removal of liquids from areas containing safety-related equipment during normal, abnormal, and accident conditions. (CP)] [The review has determined that the applicant's design of the equipment and floor drainage systems is in conformance with the design criteria and bases. (OL)]

"The basis for acceptance in the staff review has been conformance of the applicant's designs and design criteria for the essential portions of the equipment and floor drainage system and necessary auxiliary supporting systems to the Commission's regulations as set forth in the general design criteria, and to applicable regulatory guides, staff technical positions, and industry standards.

"The staff concludes that the design of the equipment and floor drainage system conforms to all applicable regulations, guides, staff positions, and industry standards, and is 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. Regulatory Guide 1.29, "Seismic Design Classification," Revision 1.
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 8.8, "Information Relevant to Maintaining Occupational Radiation Exposure As Low As Practicable (Nuclear Reactors)."
6. Branch Technical Positions APCSB 3-1, "Protection Against Postulated Piping Failures in Fluid Systems Outside Containment," attached to Standard Review Plan 3.6.1, and MEB 3-1, "Postulated Break and Leakage Locations in Fluid System Piping Outside Containment," attached to Standard Review Plan 3.6.2.

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SRP 9.3.4