



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

SECTION 3.5.1.1 INTERNAL GENERATED MISSILES (OUTSIDE CONTAINMENT)

REVIEW RESPONSIBILITIES

Primary - Auxiliary And Power Conversion Systems Branch (APCSB)

Secondary - Structural Engineering Branch (SEB)

I. AREAS OF REVIEW

The APCSB review of the structures, systems and components (SSC) to be protected from internally generated missiles (outside containment) includes all other balance of plant SSC on the site that have been provided to support the reactor facility. The review includes missile sources and internally generated missiles associated with component overspeed failures and missiles that could originate from high-pressure system ruptures.

The APCSB reviews the functional operations and performance requirements for all structures, systems, and components outside containment and identifies the SSC that are necessary for the safe shutdown of the reactor facility in the event of a postulated accident or other circumstances that might result in internally generated missiles. Safety-related SSC will be reviewed with respect to their capability to perform functions required for attaining and maintaining a safe shutdown condition during such accident conditions.

The review of internally generated missile protection includes the following: structures, systems or portion of systems, and components that require protection from internally generated missiles are identified; pressurized components and systems are reviewed to determine their potential for generating missiles; such as valve bonnets and hardware retaining bolts, relief valve parts, and instrument wells; high speed rotating machinery are reviewed to determine their potential for generating missiles from component overspeed or failure, such as failure of the pump itself (resulting from seizure), pump or component parts, and rotating segments (e.g., impellers and fan blades).

The Structural Engineering Branch determine the acceptability of the analysis and criteria used for the design of structures or barriers that protect essential systems and components from internally generated missiles (Standard Review Plan 3.5.3). Their results are used by the APCSB to complete the overall evaluation of protection against internally generated missiles.

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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. 20555.

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## II. ACCEPTANCE CRITERIA

Acceptability of the design information on protection of essential systems and components from internally generated missiles presented in the applicant's safety analysis report (SAR) is based on meeting specific general design criteria and regulatory guides. An additional basis for determining acceptability is the degree of similarity of the design to previously approved plants.

The design of structures, systems, and components is acceptable if the integrated design affords missile protection in accordance with the following criteria: General Design Criterion 4, "Environmental and Missile Design Basis" as it relates to structures housing essential systems and to the systems being capable of withstanding the effects of internally generated missiles; Regulatory Guide No. 1.13, "Fuel Storage Facility Design Basis," as it relates to the design of essential spent fuel pool systems to withstand the effects of internally generated missiles and to provisions to prevent missiles from contacting spent fuel assemblies; and Regulatory Guide No. 127, "Ultimate Heat Sink," as it relates to the design of heat sinks and connecting piping to withstand the effects of internally generated missiles.

A statement in the SAR that essential structures, systems, and components will be protected by locating the systems or components in individual missile-proof structures, physically separating redundant systems or components of the system, or providing special localized protective shields or barriers, is acceptable for the construction permit stage for providing protection from internally generated missiles (outside containment).

## III. REVIEW PROCEDURES

The review procedures set forth below are used during the construction permit (CP) application review to determine that the design criteria and bases and the preliminary design in applicant's preliminary safety analysis report meet the acceptance criteria given in Section II of this review plan. For the review of the operating license (OL) application, the review procedures and acceptance criteria 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 selects and emphasizes areas within the scope of this plan as may be appropriate in a particular case.

The first objective in the review of the reactor facilities, structures, systems and components, with regard to protection requirements for internally generated missiles, is to determine whether they are needed to perform a safety function. Some structures and systems are designed as safety-related in their entirety, others have portions that are safety-related, and others are classified as not needed for safety. In order to determine their safety category, the APCS evaluates the SSC with regard to their function in achieving safe reactor shutdown conditions or in preventing accidents or mitigating the consequences of such accidents. The single failure criterion is used in the analysis. The safety functions to be performed by the SSC in the various plant designs are essentially the same. However, the location of the SSC and the methods used vary from plant to plant depending upon the individual design. This review identifies variations in the various designs that must be evaluated on an individual

case basis. Structures, systems, or components that perform a safety function, or by virtue of their failure could have an adverse effect on a safety function shall be protected from the effects of internally generated missiles.

The information provided in the SAR pertaining to SSC design bases and criteria, system descriptions and safety evaluations, piping and instrumentation diagrams, station layout drawings, and systems and component characteristic and classification tables are reviewed to identify potential sources of missiles and to determine that protective measures are provided to maintain their safety-related functions. The reviewer may use failure mode and effect analyses and the results of reviews by other branches in evaluating specific SSC and the origin of possible missiles, in identifying the structures, systems, and components that require protection from internally generated missiles and the adequacy of the protection provided.

Additional guidance can be found in the branch technical positions attached to Standard Review Plans 3.6.1 and 3.6.2 with regard to high and moderate energy breaks in piping systems outside containment.

#### IV. EVALUATION FINDINGS

The reviewer verifies that sufficient information has been provided to satisfy the requirements of this plan and that his evaluation is complete and adequate to support conclusions of the following type, to be included in the staff's safety evaluation report:

"The review of possible effects of internally generated missiles (outside containment) included structures, systems, and components whose failure could prevent safe shutdown of the plant or result in significant uncontrolled release of radioactivity. The scope of review in this area for the ABC nuclear power plant included layout drawings, piping and instrumentation diagrams, and descriptive information for systems and components essential to the safe operation and shutdown of the plant. [The review has included the applicant's proposed design criteria and bases for essential structures, systems, and components, the adequacy of those criteria and bases, and the equipment necessary to maintain the capability for a safe plant shutdown in the event of an internally generated missile (outside containment). (CP)]. [The review has included the applicant's analysis of the manner in which the design of essential structures, systems, and components conforms to the previously approved design criteria and bases and demonstrates the ability to perform a safe plant shutdown after any internally generated missile accident (outside containment). (OL)].

"The staff concludes that the facility design with regard to protection from internally generated missiles (outside containment) conforms to the Commission's Regulations and to applicable Regulatory Guides, staff technical positions, and industry standards, and is acceptable."

#### V. REFERENCES

1. 10 CFR Part 50, Appendix A, General Design Criterion 4, "Environmental and Missile Design Bases."
2. Branch Technical Position APCS 3-1, "Protection Against Postulated Piping Failures in Fluid Systems Outside of Containment," attached to SRP 3.6.1.

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3. Branch Technical Position MEB 3-1, "Postulated Break and Leakage Locations in Fluid System Piping Outside Containment," attached to SRP 3.6.2.
4. Branch Technical Position SEB 3-1, "Postulated Break and Leakage Locations in Fluid System Piping Outside Containment," attached to SRP 3.6.2.

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SRP 3.5.1.2