



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

SECTION 3.5.1.2

INTERNALLY GENERATED MISSILES (INSIDE CONTAINMENT)

REVIEW RESPONSIBILITIES

Primary - Reactor Systems Branch (RSB)

Secondary - Structural Engineering Branch (SEB)
Containment Systems Branch (CSB)
Mechanical Engineering Branch (MEB)I. AREAS OF REVIEW

The RSB review of the structures, systems, and components (SSC) to be protected from internally generated missiles (inside containment) includes all SSC within the containment and the containment itself. The review includes internally generated missiles associated with component overspeed failures and missiles that could originate from high energy fluid system failures.

The RSB with the assistance of the CSB reviews the functional operations and performance requirements for structures, systems, and components inside containment and identifies which of the operations are necessary for the safe shutdown of the reactor facility in the event of an accident or other circumstances that might result in an internally generated missile, or for the mitigation of the effects of loss-of-coolant or other accidents. Safety-related SSC are 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:

1. Structures, systems or portion of systems, and components are identified as requiring protection from internally generated missiles.
2. Pressurized components and systems are reviewed to determine the potential for generating missiles such as valve bonnets and hardware, retaining bolts, relief valves parts, and instrument wells.
3. High speed rotating machinery is reviewed to determine the 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., flywheels, impellers and fan blades).

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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The SEB determines the acceptability of the analytical procedures and criteria used for structures or barriers that protect the containment structure and liner, essential systems, and safety-related components from internally generated missiles (Standard Review Plan 3.5.3). Their results are used by the RSB and CSB to complete the overall evaluation of protection against internally generated missiles. The RSB identifies those systems which are designed to withstand the effects of postulated high energy piping failures in accordance with the criteria stated in Regulatory Guide 1.46 (Ref. 4). These systems provide substantial protection from potential missiles and are reviewed by MEB for missile consequences only in those situations for which the protection provided for piping failures is not considered completely adequate by RSB or CSB.

II. ACCEPTANCE CRITERIA

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

1. General Design Criterion 4, as it relates to structures housing essential systems and to the systems being capable of withstanding the effects of internally generated missiles.
2. ASME Code Section III, as it relates to the design of steel or concrete containment, whichever is appropriate.

A statement in the SAR that essential structures, systems, and components will be afforded protection 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 an acceptable design basis at the construction permit stage for providing protection from internally generated missiles (inside containment).

III. REVIEW PROCEDURES

The review 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 review plan. For the review of operating license (OL) applications, 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 the equipment is 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 the safety category of the SSC, the RSB and CSB evaluate the SSC with regard to their function in achieving safe reactor shutdown conditions or in preventing accidents or mitigating the consequences of accidents. The location of the SSC and the protection provided varies from plant to plant depending upon the individual design. The reviewer identifies variations in the design 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 should 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 system and component characteristic and classification tables is reviewed to identify potential sources of missiles and to determine any protective measures afforded the system or component if safety functions can be affected. The reviewer may use failure mode and effect analyses and the results of other parts of the facility review in evaluating specific SSC and the origin of possible missiles, and in determining which structures, systems, and components require protection from internally generated missiles and whether the degree of protection provided is adequate.

IV. EVALUATION FINDINGS

The reviewer verifies that sufficient information has been provided and that his evaluation supports conclusions of the following type, to be included in the staff's safety evaluation report:

"The review of possible effects of internally generated missiles (inside 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 _____ plant included layout drawings, piping and instrumentation diagrams, and descriptive information for structures, 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 (inside 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 (inside containment)(OL).]

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

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V. REFERENCES

1. 10 CFR Part 50, Appendix A, General Design Criterion 4, "Environmental and Missile Design Bases."
2. Regulatory Guide 1.13, "Fuel Storage Facility Design Basis."
3. Regulatory Guide 1.27, "Ultimate Heat Sink."
4. Regulatory Guide 1.46, "Protection Against Pipe Whip Inside Containment."
5. ASME Boiler and Pressure Vessel Code, Section III, Division 1, Subsection NE, "Class MC Components," and Division 2 (ACI-359), "Standard Code for Concrete Reactor Vessels and Containments," American Society of Mechanical Engineers.

SRP 3.5.1.3