U.S. NUCLEAR REGULATORY COMMISSION

STANDARD REVIEW PLAN

OFFICE OF NUCLEAR REACTOR REGULATION

3.5.1.1 INTERNALLY GENERATED MISSILES (OUTSIDE CONTAINMENT)

REVIEW RESPONSIBILITIES

Primary - Auxiliary Systems Branch (ASB)

Secondary - None

I. AREAS OF REVIEW

The ASB reviews all structures, systems, and components (SSC) provided to support the reactor facility that require protection from internally generated missiles (outside containment) to assure conformance with the requirements of General Design Criterion 4. The review concerns missiles that could result from in-plant component overspeed failures and high-pressure system ruptures.

The ASB 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 and the SSC whose failure could result in a significant release of radioactivity. All SSC will be reviewed to assure adequate protection from internally generated missiles if the SSC are necessary to perform functions required for attaining and maintaining a safe shutdown condition or if the SSC are necessary to mitigate the consequences of an accident.

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).

If safety-related systems or components are located in areas containing nonsafety-related SSC, then the nonsafety-related SSC are reviewed with respect to internal

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 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.

missile effects if the failure could preclude the intended safety function of the safety-related SSC.

In addition, the ASB will coordinate with the Structural Engineering Branch (SEB) review that interfaces with the review of this area as follows:

> The SEB determines 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 (SRP Section 3.5.3). The results are used by the ASB to complete the overall evaluation of protection against internally generated missiles. For the area of review identified above, the acceptance criteria and their methods of application are contained in the SRP section.

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.

The design of structures, systems, and components is acceptable if the integrated design affords missile protection in accordance with General Design Criterion 4, with respect to protecting structures, systems, and components important to safety against the effects of internally generated missiles that may result from equipment failures, in order to maintain their essential safety functions. Acceptance is based on the design meeting the guidelines of Regulatory Guide 1.115, as related to the identification and protection of SSC important to safety from the effects of turbine missiles, and the NRC staff verification that the applicant's essential SSC will be protected from internally generated missiles (outside containment) by location in individual missile-proof structures or by special localized protective shields or barriers.

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 subsection II of this SRP section. 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 SRP section as may be appropriate in a particular case.

The reviews of the effects of internally generated missiles on structures are performed by SEB as part of its primary responsibility for SRP Section 3.5.3. The objective in the review of the reactor facility, structures, systems and components, with regard to protection requirements for internally generated missiles, is to identify the SSC that 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 ASB evaluates

the SSC with regard to their function in achieving and maintaining a safe reactor shutdown condition 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 and arrangement of the SSC and the methods used vary from plant to plant depending upon the individual design. The review identifies variations in plant designs that must be evaluated on an individual case basis. SSC that perform a safety function, or which 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 are reviewed to identify potential sources of missiles and to determine the SSC that require protection in order 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 SSC that require protection from internally generated missiles and the adequacy of the protection provided. Components within one train of a system containing redundant trains need not be protected from missiles originating from the same train.

The reviewer determines that nonsafety-related SSC are protected from internally generated missiles if their failure by a missile impact could prevent a required safety function of the SSC.

IV. EVALUATION FINDINGS

The reviewer verifies that sufficient information has been provided to satisfy the requirements of this SRP section 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. Based on the review of the applicant's design bases and criteria for essential structures, systems, and components necessary to maintain a safe plant shutdown, the staff concludes that the structures, systems, and components to be protected from internally generated missiles (outside containment) meet the requirements of General Design Criterion 4. This conclusion is based on our determination that the applicant has met the requirement of GDC 4 with respect to protection of safety-related SSC from internal missiles outside containment as the applicant:
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> 1. Has met regulatory positions C.1 and C.3 of Regulatory Guide 1.115 "Protection Against Low Trajectory Turbine Missiles" as related to the identification and protection of SSC important to safety from the effects of turbine missiles;
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> 2. Has used methods for identification of potential sources of internal missiles and for demonstrating the adequacy of the protection provided which have been reviewed by the staff in this or in previous applications and found acceptable;

3. Has shown that essential SSC functions will be protected from internally generated missiles (outside containment) by locating the systems or components in individual missile-proof structures or providing special localized protective shields or barriers.

V. IMPLEMENTATION

The following is intended to provide guidance to applicants and licensees regarding the NRC staff's plans for using this SRP section.

Except in those cases in which the applicant proposes an acceptable alternative method for complying with specified portions of the Commission's regulations, the method described herein will be used by the staff in its evaluation of conformance with Commission regulations.

Implementation schedules for conformance to parts of the method discussed herein are contained in the referenced regulatory guide.

VI. REFERENCES

1. 10 CFR Part 50, Appendix A, General Design Criterion 4, "Environmental and Missile Design Bases."

2. Regulatory Guide 1.115, "Protection Against Low-Trajectory Turbine Missiles."