



U.S. NUCLEAR REGULATORY COMMISSION

STANDARD REVIEW PLAN

3.5.1.5 SITE PROXIMITY MISSILES (EXCEPT AIRCRAFT)

REVIEW RESPONSIBILITIES

Primary - Organization responsible for the review of manmade site hazards

Secondary - Organization responsible for the review of mechanical effects of missiles on structures, systems, and components

I. AREAS OF REVIEW

The staff reviews the nature and extent of offsite activities identified in SRP Section 2.2.1-2.2.2 to determine whether any missiles resulting from such activities, other than aircraft (SRP Section 3.5.1.6 reviews aircraft hazards), have the potential to adversely affect structures, systems, and components (SSCs) important to safety. The applicant may provide information pertaining to construction permit (CP), operating license (OL), standard design certification (SDC), early site permit (ESP), or combined license (COL) applications. In the event that an offsite activity has the potential for missile production (e.g., explosion) and is found to be a design-basis event according to SRP Section 2.2.3, the staff responsible for evaluating missile effects on SSCs will review the plant design to determine whether the plant is adequately protected against the effects of postulated missiles.

Rev. 2 - [Month] 2007

USNRC STANDARD REVIEW PLAN

This Standard Review Plan, NUREG-0800, has been prepared to establish criteria that the U.S. Nuclear Regulatory Commission staff responsible for the review of applications to construct and operate nuclear power plants intends to use in evaluating whether an applicant/licensee meets the NRC's regulations. The Standard Review Plan is not a substitute for the NRC's regulations, and compliance with it is not required. However, an applicant is required to identify differences between the design features, analytical techniques, and procedural measures proposed for its facility and the SRP acceptance criteria and evaluate how the proposed alternatives to the SRP acceptance criteria provide an acceptable method of complying with the NRC regulations.

The standard review plan sections are numbered in accordance with corresponding sections in the Regulatory Guide 1.70, "Standard Format and Content of Safety Analysis Reports for Nuclear Power Plants (LWR Edition)." Not all sections of the standard format have a corresponding review plan section. The SRP sections applicable to a combined license application for a new light-water reactor (LWR) will be based on Regulatory Guide 1.206, "Combined License Applications for Nuclear Power Plants (LWR Edition)," until the SRP itself is updated.

These documents are made available to the public as part of the NRC's policy to inform the nuclear industry and the general public of regulatory procedures and policies. Individual sections of NUREG-0800 will be revised periodically, as appropriate, to accommodate comments and to reflect new information and experience. Comments may be submitted electronically by email to NRR_SRP@nrc.gov.

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The specific areas of review are as follows:

1. Inspection, Test, Analysis, and Acceptance Criteria (ITAAC). For design certification (DC) and combined license (COL) reviews, the applicant's proposed information on the ITAAC associated with the systems, structures, and components (SSCs) related to this SRP section is reviewed in accordance with SRP Section 14.3, "Inspections, Tests, Analyses, and Acceptance Criteria - Design Certification." The staff recognizes that the review of ITAAC is performed after review of the rest of this portion of the application against acceptance criteria contained in this SRP section. Furthermore, the ITAAC are reviewed to assure that all SSCs in this area of review are identified and addressed as appropriate in accordance with SRP Section 14.3.
2. COL Action Items and Certification Requirements and Restrictions. COL action items may be identified in the NRC staff's final safety evaluation report (FSER) for each certified design to identify information that COL applicants must address in the application. Additionally, DCs contain requirements and restrictions (e.g., interface requirements) that COL applicants must address in the application. For COL applications referencing a DC, the review performed under this SRP section includes information provided in response to COL action items and certification requirements and restrictions pertaining to this SRP section, as identified in the FSER for the referenced certified design.

Review Interfaces

The organizations with functional responsibilities for mechanical effects of missiles on safety related SSCs will review, as appropriate, the specified aspects of site proximity missiles.

The listed SRP sections interface with this section as follows:

1. The SSCs that should be protected against site proximity missiles are identified and reviewed in accordance with SRP Section 3.5.2.
2. Missile effects on plant structures resulting from site proximity missiles are reviewed in accordance with SRP Section 3.5.3.
3. Site proximity missiles are identified and characterized in accordance with SRP Sections 2.2.1-2.2.2 and Section 2.2.3.

The specific acceptance criteria and review procedures are contained in the referenced SRP sections.

II. ACCEPTANCE CRITERIA

Requirements

Acceptance criteria are based on meeting the relevant requirements of the following Commission regulations:

1. 10 CFR Part 100, 10 CFR 100.10, 10 CFR 100.20, 10 CFR 100.21, and 10 CFR Part 52, as they relate to the factors to be considered in the evaluation of sites, which indicate that reactors should reflect through their design, construction, and operation an

extremely low probability for accidents that could result in the release of significant quantities of radioactive fission products. In addition, 10 CFR 100.10 and 10 CFR 100.20 indicate that the site location, in conjunction with other considerations, should ensure a low risk of public exposure. To meet this requirement, the probability that site proximity missiles will impact the plant and cause radiological consequences greater than the 10 CFR Part 100 exposure guidelines must be less than an order of magnitude of 10^{-7} per year (see SRP Section 2.2.3). If the review indicates that the above criterion is not met, then the acceptance criterion described in item 2 below applies.

2. Appendix A to 10 CFR Part 50, General Design Criterion (GDC) 4, requires that SSCs important to safety be appropriately protected against the effects of missiles that may result from events and conditions outside the nuclear power unit. The plant will meet the relevant requirements of GDC 4 and will be considered appropriately protected against site proximity missiles' design if the SSCs important to safety are capable of withstanding the effects of the postulated missiles without loss of safe-shutdown capability and without causing a release of radioactivity in excess of the 10 CFR Part 100 dose guidelines.

The safety-related SSCs to be considered with respect to the above acceptance criteria include those recommended and described in the appendix to Regulatory Guide (RG) 1.117. Other safety-related SSCs that may not be included in RG 1.117 will be considered on a case-by-case basis in accordance with the acceptance criteria of the SRP sections.

3. For early site permit (ESP) applications, the acceptance criteria are based on meeting the relevant requirements of 10 CFR 52.17, 10 CFR 100.20, and 10 CFR 100.21, as they relate to the factors to be considered in the evaluation of sites. These requirements stipulate that individual and societal risk of potential plant accidents must be low.
4. 10 CFR 52.47(a)(1), as it relates to ITAAC (for DC) sufficient to assure that the SSCs in this area of review will operate in accordance with the certification.
5. 10 CFR 52.80(a), as it relates to ITAAC (for COL) sufficient to assure that the SSCs in this area of review have been constructed and will be operated in conformity with the license, the provisions of the Atomic Energy Act and the Commission's rules and regulations

SRP Acceptance Criteria

Specific SRP acceptance criteria acceptable to meet the relevant requirements of the NRC's regulations identified above are as follows for review described in Subsection I of this SRP section. The SRP is not a substitute for the NRC's regulations, and compliance with it is not required. However, an applicant is required to identify differences between the design features, analytical techniques, and procedural measures proposed for its facility and the SRP acceptance criteria and evaluate how the proposed alternatives to the SRP acceptance criteria provide acceptable methods of compliance with the NRC regulations.

Technical Rationale

The technical rationale for application of these requirements and/or SRP acceptance criteria to the areas of review addressed by this SRP section is discussed in the following paragraphs:

1. 10 CFR Part 100, 10 CFR 100.10, and 10 CFR 100.20 establish site requirements in conjunction with other design features to ensure a low risk of public exposure. The NRC has established a probability of less than an order of magnitude of 10^{-7} per year as a staff objective for meeting the requirements of 10 CFR Part 100. In terms of missiles generated by explosions, RG 1.91 indicates that it is the judgment of the NRC staff that, if the exposure rate can be shown to be less than about 10^{-7} per year, the risk of damage from explosions is sufficiently low. Regardless of the source of site proximity missiles, missile hazards that have the potential to cause onsite accidents leading to the release of significant quantities of radioactive fission products, thus posing an undue risk of public exposure, should have a sufficiently low probability of occurrence. Meeting the probability objective for site proximity missiles and the 10 CFR Part 100 exposure guidelines provides a high level of assurance that individuals will not be exposed to excessive radiation doses.
2. Because of the low probabilities of the events under consideration, data are often not available to permit accurate calculation of probabilities. Accordingly, the expected rate of occurrence of potential exposures in excess of the 10 CFR Part 100 guidelines of an order of magnitude of 10^{-6} per year is acceptable if, when combined with reasonable qualitative arguments, the realistic probability can be shown to be lower (see SRP Section 2.2.3).
3. GDC 4 requires that SSCs important to safety be appropriately protected against dynamic effects, including the effects of missiles that may result from events and conditions outside the nuclear plant. Offsite activities that are determined to be a design-basis event, such as an explosion, could have the potential for missile generation. The initiation of externally generated missiles is a dynamic event and the effects of those missiles on SSCs important to safety must be evaluated. Protecting those SSC that are important to safety from the effects of externally generated missiles prevents failure of those systems required for safe-shutdown capabilities and prevents the release of radioactivity which might cause doses in excess of the 10 CFR Part 100 guidelines.

III. REVIEW PROCEDURES

The reviewer will select and emphasize material from the procedures described below, as may be appropriate for a particular case.

For each area of review specified in Subsection I of this SRP section, the review procedure is identified below. These review procedures are based on the identified SRP acceptance criteria. For deviations from these specific acceptance criteria, the staff should review the applicant's evaluation of how the proposed alternatives to the SRP criteria provide an acceptable method of complying with the relevant NRC requirements identified in Subsection II.

1. The identification and description of events that could possibly generate missiles is evaluated based on a review of the safety analysis report (SAR) in accordance with SRP Sections 2.2.1-2.2.2 and 2.2.3.

2. The SSCs identified in accordance with SRP Section 3.5.2 are reviewed with respect to missile vulnerability. Using experience gained from past reviews of similar SSCs on missile interactions and the evaluation of the applicant's information, a determination is made of those portions of the plant that clearly have the potential for unacceptable missile damage. If all SSCs appear to be adequately protected against the effects of the postulated missiles, then the review is terminated and the evaluation findings are written in terms of design-basis considerations (see Subsection II.2 of this SRP section).
3. The total probability of the missiles striking a vulnerable critical area of the plant is estimated. The total probability per year (P_T) may be estimated using the following expression:

$$P_T = P_E \times P_{MR} \times P_{SC} \times P_p \times N$$

where:

P_E = probability per year of design-basis event obtained from the review performed under SRP Section 2.2.3

P_{MR} = probability of missiles reaching the plant

P_{SC} = probability of missiles striking a vulnerable critical area of the plant

P_p = probability of missiles exceeding the energies required to penetrate to vital areas (e.g., based on wall thickness provided for tornado missiles) or producing secondary missiles that could damage vital equipment

N = number of missiles generated by the design-basis event

P_p may be assumed to be equal to 1 as a first step in the analysis. If P_T thus calculated is greater than an order of magnitude of 10^{-7} per year, then site proximity missile impact effects should be estimated, on request, by the organizational unit responsible for reviewing specific SSC. The request should be accompanied by a specified missile description, including missile size, shape, weight, energy, material properties, and trajectory.

4. For reviews of DC and COL applications under 10 CFR Part 52, the reviewer should follow the above procedures to verify that the design set forth in the safety analysis report, and if applicable, site interface requirements meet the acceptance criteria. For DC applications, the reviewer should identify necessary COL action items. With respect to COL applications, the scope of the review is dependent on whether the COL applicant references a DC, an ESP or other NRC-approved material, applications, and/or reports.

After this review, SRP Section 14.3 should be followed for the review of Tier I information for the design, including the postulated site parameters, interface criteria, and ITAAC.

IV. EVALUATION FINDINGS

The reviewer verifies that the applicant has provided sufficient information and that the review and calculations (if applicable) support conclusions of the following type to be included in the staff's safety evaluation report. The reviewer also states the bases for those conclusions.

1. For ESP reviews, a conclusion of the following type may be prepared for the staff's safety evaluation report:

The staff concludes that the site location is acceptable and meets the requirements of 10 CFR 100.20. This conclusion is based on the information provided by the applicant and reviewed by the staff which demonstrates that the probability of site proximity missiles impacting safety-related SSCs is acceptably low (within the criteria given in SRP Section 2.2.3) and, hence, the site location has been determined to present a low risk of public exposure from the hazard of site proximity missiles.

2. For CP and OL reviews, a conclusion of one of the following types may be prepared for the staff's safety evaluation report:

- A. The staff concludes that the protection for SSCs important to safety is acceptable and meets the requirements of GDC 4. This conclusion is based on the information provided by the applicant and reviewed by the staff which identified potential missiles that could adversely affect safety-related SSCs requiring protection from externally generated missiles and which demonstrates that these SSCs have adequate barriers protecting them from the effects of missiles such that radiation exposures in excess of those given in 10 CFR Part 100 will not be exceeded.

- B. Information provided by the applicant and reviewed by the staff has led to the identification of potential missiles that could adversely affect safety-related SSCs important to safety which warrant detailed evaluation of their protection against such externally generated missiles. However, some of these SSCs have adequate barriers protecting them from the effects of such missiles in accordance with the requirements of GDC 4 such that radiation exposures in excess of the limits given in 10 CFR Part 100 will not be exceeded. The remaining safety-related SSCs, although vulnerable to the potential effects of identified missiles, have a sufficiently low probability (within the criteria given in SRP Section 2.2.3) of unacceptable damage (on the basis of considerations such as low strike probability or adequate separation and redundancy) such that the risk of public exposure is low and the design meets the requirements of 10 CFR 100.20.

For DC and COL reviews, the findings will also summarize (to the extent that the review is not discussed in other SER sections) the staff's evaluation of the ITAAC, including design acceptance criteria, as applicable, and interface requirements and combined license action items relevant to this SRP section.

V. IMPLEMENTATION

The staff will use this SRP section in performing safety evaluations of DC applications and license applications submitted by applicants pursuant to 10 CFR Part 50 or 10 CFR Part 52. Except when the applicant proposes an acceptable alternative method for complying with specified portions of the Commission's regulations, the staff will use the method described herein to evaluate conformance with Commission regulations.

The provisions of this SRP section apply to reviews of applications docketed six months or more after the date of issuance of this SRP section, unless superceded by a later revision.

VI. REFERENCES

1. 10 CFR Part 100, "Reactor Site Criteria," Subpart A, "Evaluation Factors for Stationary Power Reactor Site Applications Before January 10, 1997 and for Testing Reactors," Section 100.10, "Factors To Be Considered When Evaluating Sites."
2. 10 CFR Part 100, "Reactor Site Criteria," Subpart B, "Evaluation Factors for Stationary Power Reactor Site Applications on or After January 10, 1997," Section 100.20, "Factors To Be Considered When Evaluating Sites."
3. 10 CFR Part 52, "Early Site Permits; Standard Design Certifications; and Combined Licenses for Nuclear Power Plants," Subpart A, "Early Site Permits," Section 52.17, "Contents of Applications."
4. 10 CFR Part 100, "Reactor Site Criteria," Subpart B, "Evaluation Factors for Stationary Power Reactor Site Applications on or After January 10, 1997," Section 100.21, "Non-Seismic Siting Criteria."
5. 10 CFR Part 50.34(a)(1)(ii) "Contents of Application, Technical Information."
6. Regulatory Guide 1.117, "Tornado Design Classification," Rev.1, April 1978.
7. Regulatory Guide 1.91, "Evaluations of Explosions Postulated To Occur on Transportation Routes Near Nuclear Power Plants," February, 1978.

PAPERWORK REDUCTION ACT STATEMENT

The information collections contained in the draft Standard Review Plan are covered by the requirements of 10 CFR Part 50 and 10 CFR Part 52, and were approved by the Office of Management and Budget, approval number 3150-0011 and 3150-0151.

PUBLIC PROTECTION NOTIFICATION

The NRC may not conduct or sponsor, and a person is not required to respond to, a request for information or an information collection requirement unless the requesting document displays a currently valid OMB control number.

SRP Section 3.5.1.5 Description of Changes

This SRP section affirms the technical accuracy and adequacy of the guidance previously provided in (Draft) Revision 2, dated April 1996 of this SRP (see ADAMS accession number ML052070377), with the following exceptions, as applicable. This section clarifies the probabilistic screening acceptance criteria and revises the text to include consistent use of the term “order of magnitude.”

In addition this SRP section was administratively updated in accordance with NRR Office Instruction, LIC-200, Revision 1, “Standard Review Plan (SRP) Process.” The revision also adds standard paragraphs to extend application of the updated SRP section to prospective submittals by applicants pursuant to 10 CFR Part 52.

The technical changes are incorporated in Revision 2, [Month] dated 2007:

Review Responsibilities - Reflects changes in review branches resulting from reorganization and branch consolidation. Change is reflected throughout the SRP.

Established that the primary reviewer is the organization responsible for the review of manmade site hazards.

Established that the secondary reviewer is the organization responsible for the review of mechanical effects of missiles on SSCs.

I. AREAS OF REVIEW

1. Added a review area for ITAAC
2. Added a subsection detailing review interfaces with other SRP sections
3. Added a review interface with new SRP Section 3.5.3
4. Added a review interface with SRP Section 14.3 for SDC review under Subpart B of 10 CFR Part 52

II. ACCEPTANCE CRITERIA

1. Added 10 CFR Part 52, 10 CFR 100.20, and 10 CFR 100.21 requirements for ESP applications
2. Added reference to Regulatory Guide 1.117
3. Added 10 CFR Part 52, 10 CFR 100.20, and 10 CFR 100.21 requirements that relate to factors to be considered in the evaluation of sites
4. Added 10 CFR 52.47(a)(1)(vi) as it relates to the requirements for ITAAC for DC reviews
5. Added Technical Rationale subsection, including technical rationales for 10 CFR 100, 10 CFR 100.10, 10 CFR 100.20, and GDC 4

III. REVIEW PROCEDURES

Added standard paragraph to address application of Review Procedures in DC reviews (implementation of 10 CFR Part 52)

IV. EVALUATION FINDINGS

Added a new paragraph to the end of the evaluation findings to address DC reviews. The paragraph addresses DC-specific items including ITAAC, design acceptance criteria, site interface requirements, and COL action items relevant to the SRP section (implementation of changes related to 10 CFR Part 52).

V. IMPLEMENTATION

Added standard sentence to indicate application of the SRP Section 3.5.1.5 to reviews of applications filed under 10 CFR Part 50 and 10 CFR Part 52

VI. REFERENCES

1. Removed reference to Regulatory Guide 1.76
2. Added reference to 10 CFR Part 100, "Reactor Site Criteria," Subpart A, "Evaluation Factors for Stationary Power Reactor Site Applications Before January 10, 1997 and for Testing Reactors," Section 100.10, "Factors To Be Considered When Evaluating Sites"
3. Added reference to 10 CFR Part 100, "Reactor Site Criteria," Subpart B, "Evaluation Factors for Stationary Power Reactor Site Applications on or After January 10, 1997," Section 100.20, "Factors To Be Considered When Evaluating Sites"
4. Added reference to 10 CFR Part 100, "Reactor Site Criteria," Subpart B, "Evaluation Factors for Stationary Power Reactor Site Applications on or After January 10, 1997," Section 100.21, "Non-Seismic Siting Criteria"
5. Added reference to 10 CFR Part 52, "Early Site Permits; Standard Design Certifications; and Combined Licenses for Nuclear Power Plants," Subpart A, "Early Site Permits," Section 52.17, "Contents of Applications"
6. Added reference to 10 CFR Part 50.34(a)(1)(ii) "Contents of Application, Technical Information."
7. Added reference to Regulatory Guide 1.117, "Tornado Design Classification," Rev.1, April 1978.