



**U.S. NUCLEAR REGULATORY COMMISSION**  
**STANDARD REVIEW PLAN**

**12.1 ASSURING THAT OCCUPATIONAL RADIATION EXPOSURES ARE AS LOW AS IS REASONABLY ACHIEVABLE**

**REVIEW RESPONSIBILITIES**

**Primary** - Organization responsible for the review of health physics issues.

**Secondary** - None

**I. AREAS OF REVIEW**

The staff will review the applicant's preliminary safety analysis report (PSAR) for a construction permit (CP) or final safety analysis report (FSAR) for an operating license (OL), design certification (DC), or combined license (COL) as it relates to assuring that occupational radiation exposure (ORE) will be as low as is reasonably achievable (ALARA):

The specific areas of review are as follows:

**1. Policy Considerations**

- A. The applicant's management policy with respect to designing and constructing the plant CP PSAR, DC FSAR or COL FSAR, and the planned organizational structure (OL FSAR and COL FSAR).
- B. The applicable activities carried on by the applicant's management personnel having responsibility for radiation protection (OL FSAR and COL FSAR)

Revision 3 - March 2007

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**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 Regulatory Guide 1.70, "Standard Format and Content of Safety Analysis Reports for Nuclear Power Plants (LWR Edition)." Not all sections of Regulatory Guide 1.70 have a corresponding review plan section. The SRP sections applicable to a combined license application for a new light-water reactor (LWR) are based on Regulatory Guide 1.206, "Combined License Applications for Nuclear Power Plants (LWR Edition)."

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](mailto:NRR_SRP@nrc.gov).

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- C. Information describing the applicant's implementation of policy, organization, training, and design review guidance provided in Regulatory Guides 1.8, 8.8, and 8.10, and information describing any proposed alternatives (CP PSAR and updated in the OL FSAR, DC FSAR, or COL FSAR)
2. Design Considerations
- A. Information describing how the applicant has used experience from past designs and from operating plants to develop improved radiation protection design (CP PSAR and updated in the OL FSAR, DC FSAR, or COL FSAR)
  - B. Information describing the applicant's implementation of the design guidelines of Regulatory Guide 8.8, Section C.2, and other industry-developed design guidance that includes ALARA criteria, and information describing any proposed alternatives (CP PSAR and updated in the OL FSAR, DC FSAR, or COL FSAR)
  - C. Information describing the applicant's consideration of ALARA criteria during the implementation of a certified design or design modifications (CP PSAR and updated in the OL FSAR, or COL FSAR)
3. Operational Considerations
- A. The applicant's methods for planning and accomplishing work, including interfaces between radiation protection, operations, maintenance, planning, and scheduling
  - B. The applicant's use of operating plant experience in planning the operational considerations for plant designs (CP PSAR and updated in the OL FSAR, or COL FSAR)
  - C. Information describing the applicant's implementation of radiation protection programs, and operational guidance of Regulatory Guides 8.8 and 8.10, as well as information describing any proposed alternatives (CP PSAR and updated in the OL FSAR, or COL FSAR)
4. Radiation Protection Considerations. In accordance with the requirements of 10 CFR 20.1101, ALARA procedures, including those covering work scheduling, work planning, and appropriate radiological controls, should be integral with the facility radiation protection program (CP PSAR and updated in the OL FSAR, or COL FSAR).
5. Inspections, Tests, Analyses, and Acceptance Criteria (ITAAC). For design certification (DC) and combined license (COL) reviews, the staff reviews the applicant's proposed ITAAC associated with the structures, systems, and components (SSCs) related to this SRP section in accordance with SRP Section 14.3, "Inspections, Tests, Analyses, and Acceptance Criteria." The staff recognizes that the review of ITAAC cannot be completed until after the rest of this portion of the application has been reviewed against acceptance criteria contained in this SRP section. Furthermore, the staff reviews the ITAAC to ensure that all SSCs in this area of review are identified and addressed as appropriate in accordance with SRP Section 14.3.
6. COL Action Items and Certification Requirements and Restrictions. For a DC application, the review will also address COL action items and requirements and restrictions (e.g., interface requirements and site parameters).

For a COL application referencing a DC, a COL applicant must address COL action items (referred to as COL license information in certain DCs) included in the referenced DC. Additionally, a COL applicant must address requirements and restrictions (e.g., interface requirements and site parameters) included in the referenced DC.

### Review Interfaces

None

## II. ACCEPTANCE CRITERIA

### Requirements

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

1. 10 CFR 19.12, as it relates to keeping workers who receive ORE informed as to the storage, transfer, or use of radioactive materials or radiation in such areas, and instructed as to the risk associated with ORE, precautions and procedures to reduce exposures, and the purpose and function of protective devices employed
2. 10 CFR 20.1101 and the definition of ALARA in 10 CFR 20.1003, as they relate to those measures that ensure that radiation exposures resulting from licensed activities are below specified limits and ALARA
3. 10 CFR 52.47(b)(1), which requires that a DC application contain the proposed inspections, tests, analyses, and acceptance criteria (ITAAC) that are necessary and sufficient to provide reasonable assurance that, if the inspections, tests, and analyses are performed and the acceptance criteria met, a plant that incorporates the design certification is built and will operate in accordance with the design certification, the provisions of the Atomic Energy Act, and the NRC's regulations;
4. 10 CFR 52.80(a), which requires that a COL application contain the proposed inspections, tests, and analyses, including those applicable to emergency planning, that the licensee shall perform, and the acceptance criteria that are necessary and sufficient to provide reasonable assurance that, if the inspections, tests, and analyses are performed and the acceptance criteria met, the facility has been constructed and will operate in conformity with the combined license, the provisions of the Atomic Energy Act, and the NRC's 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 the review described in 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.

1. Policy Considerations. Acceptability will be based on evidence that a policy for ensuring that ORE will be ALARA has been formulated in accordance with the training requirements in 10 CFR 19.12 and the ALARA provisions of 10 CFR 20.1101(b), and that the policy has been described, displayed, and will be implemented in accordance with the provisions of Regulatory Guides 8.8 (Regulatory Position C.1) and 8.10 (Regulatory Position C.1) and NUREG-1736, as it relates to maintaining doses ALARA. A specific individual(s) will be designated and assigned responsibility and authority for implementing ALARA policy. Alternative proposed policies will be evaluated on the basis of a comparison with the above regulatory guides and NUREG-1736.
2. Design Considerations. Acceptability will be based on evidence that the design methods, approach, and interactions are in accordance with the ALARA provisions of 10 CFR 20.1101(b) and Regulatory Guide 8.8 (Regulatory Position C.2) and will include incorporation of measures for reducing the need for time spent in radiation areas; maintenance; measures to improve the accessibility to components requiring periodic maintenance or inservice inspection; measures to reduce the production, distribution, and retention of activated corrosion products throughout the primary system; measures for assuring that ORE during decommissioning will be ALARA; reviews of the design by competent radiation protection personnel; instructions to designers and engineers regarding ALARA design; experience from operating plants and past designs; and continuing facility design reviews. Alternative proposed design policies will be evaluated on the basis of a comparison with the design guidance in Regulatory Guide 8.8 (Regulatory Position C.2).
3. Operational Considerations. Acceptability will be based on evidence that the applicant has a program to develop plans and procedures in accordance with Regulatory Guides 1.33, 1.8, 8.8, and 8.10 that can incorporate the experiences obtained from facility operation into facility and equipment design and operations planning and that will implement specific exposure control techniques.
4. Radiation Protection Considerations. Acceptability will be based on evidence that overall facility operations, as well as the radiation protection program, integrate the procedures necessary to ensure that radiation doses are ALARA, including work scheduling, work planning, design modifications, and radiological considerations.

The following regulatory guides and NUREGs provide information, recommendations, and guidance and in general describe a basis acceptable to the staff for implementing the requirements of 10 CFR 19.12 and 10 CFR 20.1101:

1. Regulatory Guide 1.8, as it relates to a basis acceptable to the staff for complying with the Commission's regulations with regard to the qualifications and training of radiation protection personnel
2. Regulatory Guide 1.33, as it relates to compliance with the Commission's quality assurance regulatory requirements during nuclear power plant operations
3. Regulatory Guide 8.8, as it relates to a basis acceptable to the staff for meeting the requirements of 10 CFR 20.1101(b) by providing radiation protection information pertaining to actions taken during design, construction, operation, and decommissioning to ensure that ORE is kept ALARA

4. Regulatory Guide 8.10, as it relates to a basis acceptable to the staff for meeting the requirements of 10 CFR 20.1101(b) concerning the commitment by the applicant's management and vigilance by the radiation protection manager and the radiation protection staff to maintain ORE ALARA
5. Regulatory Guide 8.27, as it relates to instructing personnel involved in licensed activities regarding their role and responsibilities for making every reasonable effort to maintain radiation exposures ALARA
6. NUREG-1736, as it relates to the requirements for a radiation protection program to maintain doses ALARA

### Technical Rationale

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

1. Compliance with 10 CFR 19.12 requires that workers who receive occupational exposure be kept informed of radioactive materials and radiation; receive instructions with the objective of minimizing exposures to radioactive materials or radiation and health protection problems, and explaining precautions or procedures and protective devices associated with each; receive instructions to observe the applicable Commission regulations; receive instructions to report violations of applicable Commission regulations; receive instructions in response to warnings; and be advised of the availability of radiation exposure reports.

A specific requirement in 10 CFR 19.12 mandates that workers be instructed in precautions or procedures to minimize radiation exposure; therefore, it relates to the principle of keeping occupational doses ALARA and applies to SRP Section 12.1. With full knowledge of the hazards associated with the exposure and handling of radioactive material and the precautions that should be observed, the individual will have sufficient knowledge such that radiation doses associated with his or her work duties will be kept ALARA.

Meeting these requirements will provide reasonable assurance that individuals exposed to, and handling, radioactive materials will perform their work duties in a manner that will keep occupational doses ALARA.

2. Compliance with 10 CFR 20.1101(b) requires that the licensee use, to the extent practicable, procedures and engineering controls based on sound radiation protection principles that result in occupational doses and doses to members of the public that are ALARA.

The regulation in 10 CFR 20.1101(b) is the principal basis for requiring licensees to adopt a policy and establish procedures designed to keep radiation exposures ALARA; therefore, it directly applies to SRP Section 12.1. SRP Section 12.1 describes staff positions related to the design and operation of nuclear plants, including positions to maintain radiation doses in conformance with the ALARA principle. The SRP references Regulatory Guides 8.8 and 8.10, which also cover ALARA principles.

3. Collectively, this SRP subsection and the noted regulatory guides provide the management policy and design and operational considerations that, if followed, will meet the NRC requirements relative to ALARA.

Meeting these requirements will provide reasonable assurance that plant operations will result in occupational doses and doses to members of the public ALARA.

### III. REVIEW PROCEDURES

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

These review procedures are based on the identified SRP acceptance criteria. For deviations from these acceptance criteria, the staff should review the applicant's evaluation of how the proposed alternatives provide an acceptable method of complying with the relevant NRC requirements identified in Subsection II.

1. The reviewer will evaluate the information furnished in the SAR for completeness in accordance with Regulatory Guide 1.70 or RG 1.206 for DCs and COLs. The staff will review the management policy and planned organizational structure to determine how the guidance given in Regulatory Guides 1.8, 8.8, and 8.10 will be implemented, and will consider any alternatives proposed. The review of organizational structure includes a determination of whether the individuals responsible for the radiation protection program are at a sufficiently high level of management to ensure reasonable independence from operating pressures, as well as an evaluation of the implementation of management's commitment for ensuring that ORE will be ALARA and that radiation protection management has direct access to station management in radiation protection matters. Any concerns regarding organizational structure as related to the radiation protection manager will be communicated to the staff reviewers who have the primary review responsibility for this item under SRP Chapter 13.
2. The reviewer will evaluate information in this section in accordance with Regulatory Guide 8.8, Section C.1.b.(3), to determine whether the organizational structure provides a mechanism for the radiation protection manager and the radiation protection organization to interact with design review groups in such a manner that the design of the plant will incorporate methods and techniques for reducing ORE. If the future plant radiation protection manager has not yet been selected, design review should be accomplished in accordance with the guidance of Regulatory Guide 8.8, unless acceptable alternatives are proposed. The reviewer will determine that appropriate personnel with operating plant experience have evaluated the proposed plant design. The reviewer will determine from information furnished whether the applicant has incorporated previously accepted design features and has used operating experience to improve the design of the plant with regard to ensuring that ORE will be ALARA. The reviewer will also evaluate the material in this section against the requirements of 10 CFR 19.12 and 10 CFR 20.1101(b) and the guidelines of Regulatory Guide 8.10.
3. Based on this review, the staff may request additional information or ask the applicant to modify its submission in order to meet the acceptance criteria given in Subsection II of this SRP section.

4. For review of a DC application, the reviewer should follow the above procedures to verify that the design, including requirements and restrictions (e.g., interface requirements and site parameters), set forth in the final safety analysis report (FSAR) meets the acceptance criteria. DCs have referred to the FSAR as the design control document (DCD). The reviewer should also consider the appropriateness of identified COL action items. The reviewer may identify additional COL action items; however, to ensure these COL action items are addressed during a COL application, they should be added to the DC FSAR.

For review of a COL application, the scope of the review is dependent on whether the COL applicant references a DC, an early site permit (ESP) or other NRC approvals (e.g., manufacturing license, site suitability report or topical report).

5. For review of both DC and COL applications, SRP Section 14.3 should be followed for the review of ITAAC. The review of ITAAC cannot be completed until after the completion of this section.

#### 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. The staff concludes that the ALARA policy, design, and operational [or, for COLs, design and implementation] considerations are acceptable. This conclusion is based on the applicant having met the training requirements of 10 CFR 19.12, the ALARA provisions of 10 CFR 20.1101(b), and the guidance in Regulatory Guides 8.8 (Regulatory Position C.2) and 8.10 (Regulatory Position C.1).
2. The applicant has provided a management commitment to ensure that [plant name] will be designed, constructed, and operated in a manner consistent with the above criteria. The [title of person or group (e.g., plant health physicist and staff)] periodically reviews, updates, and modifies as appropriate plant design features and changes, as well as all operating and maintenance features, using exposure data and experience gained from operating nuclear power plants to ensure that occupational exposures will be kept as low as is reasonably achievable in accordance with Regulatory Guide 8.8 guidance.
3. The objective of the plant radiation protection design is to maintain individual doses and total person-Sievert (person-rem) doses to plant workers, including construction workers, and to members of the general public as low as is reasonably achievable, and to maintain individual doses within the limits of 10 CFR Part 20. The staff's review considered all plant sources of direct radiation and airborne radioactive contamination within restricted areas.
4. [Utility/Applicant/Certified Design Vendor] will incorporate the following facility and equipment design considerations at [plant/design name] to satisfy the radiation protection design objectives listed above. [List several design considerations used.] These design considerations conform with the guidelines of Regulatory Guide 8.8 and are acceptable.

5. Operating and maintenance personnel follow specific plans and procedures to ensure that goals related to keeping exposures as low as is reasonably achievable are achieved in the operation of the plant. Engineering controls for the protection of personnel have been optimized. Operations involving high person-Sievert (person-rem) exposures will be carefully preplanned and carried out by personnel who are well trained in radiation protection and using proper equipment. During such maintenance activities, personnel are monitored for exposure to radiation and contamination. Their radiation exposures are reviewed and are used to make changes in future job procedures and techniques. The management staff will review radiation exposure trends periodically to determine major changes in problem areas and to note the worker groups that are accumulating the highest exposures. The staff will use these reports to recommend design modifications or changes in plant procedures. These practices conform with those described in Regulatory Guide 8.8 and 8.10 and are acceptable.

For DC and COL reviews, the findings will also summarize the staff's evaluation of requirements and restrictions (e.g., interface requirements and site parameters) and COL action items relevant to this SRP section.

In addition, to the extent that the review is not discussed in other SER sections, the findings will summarize the staff's evaluation of the ITAAC, including design acceptance criteria, as applicable.

## 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 submitted six months or more after the date of issuance of this SRP section, unless superseded by a later revision.

The referenced regulatory guides and NUREGs contain the implementation schedules for conformance to parts of the method discussed herein.

## VI. REFERENCES

1. 10 CFR Part 19, "Notices, Instructions, and Reports to Workers; Inspections."
2. 10 CFR Part 20, "Standards for Protection Against Radiation."
3. 10 CFR Part 50, "Domestic Licensing of Production and Utilization Facilities."
4. 10 CFR Part 52, "Early Site Permits; Standard Design Certifications; and Combined Licenses for Nuclear Power Plants."
5. Regulatory Guide 1.206, "Combined License Applications for Nuclear Power Plants."
6. NUREG-1736, "Consolidated Guidance: 10 CFR Part 20—Standards for Protection Against Radiation."



7. Regulatory Guide 1.8, "Qualification and Training of Personnel for Nuclear Power Plants."
8. Regulatory Guide 1.33, "Quality Assurance Program Requirements (Operation)."
9. Regulatory Guide 1.70, "Standard Format and Contents of Safety Analysis Reports for Nuclear Power Plants."
10. Regulatory Guide 8.8, "Information Relevant to Assuring that Occupational Radiation Exposures at Nuclear Power Stations Will Be as Low as Is Reasonably Achievable."
11. Regulatory Guide 8.10, "Operating Philosophy for Maintaining Occupational Radiation Exposures as Low as Is Reasonably Achievable."
12. Regulatory Guide 8.27, "Radiation Protection Training for Personnel at Nuclear Power Plants."

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**PAPERWORK REDUCTION ACT STATEMENT**

The information collections contained in the 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.

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