



U.S. NUCLEAR REGULATORY COMMISSION

STANDARD REVIEW PLAN

14.3.9 HUMAN FACTORS ENGINEERING - INSPECTIONS, TESTS, ANALYSES, AND ACCEPTANCE CRITERIA

REVIEW RESPONSIBILITIES

Primary - Organization responsible for the review of human factors engineering.

Secondary - None

I. AREAS OF REVIEW

This SRP section addresses Tier 1 information including inspections, tests, analyses, and acceptance criteria (ITAAC) related to the human factors aspects of the nuclear power plant design. ITAAC information may be submitted in the final safety analysis report (FSAR) of a combined license (COL) application or as Tier 1 information of the design control document (DCD) for a design certification (DC) application.

The specific areas of review are:

1. Tier 1 information and the ITAAC for the human factors engineering (HFE) program proposed by a DC or COL application submitted by the applicant. For the purposes of this review, Tier 1 information should be high level commitments to human factors principles and program elements described in SRP Chapter 18. Since Tier 1 information will be included in rulemaking this should only be information that is unlikely

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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.

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to change. This review is coordinated with the review of the applicant's HFE program as described in SRP Chapter 18. It is recognized that the review of ITAAC is performed after review of the application against acceptance criteria contained in Chapter 18 of the SRP.

2. The scope of the applicant's HFE program, as it pertains to human-system interfaces, which includes the main control room, the remote shutdown facility, the local control stations, the technical support center, and the emergency operations facility.
3. Review to ensure a minimum inventory of displays, alarms, and controls is included in Tier 1.
4. For a DC application:
 - A. The staff reviews the proposed 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 Atomic Energy Act, and the NRC regulations.
 - B. The staff reviews the justification that compliance with the interface requirements is verifiable through ITAAC. The staff also reviews the method that is to be used for verification of the interface requirements.
5. For a COL application:
 - A. The staff reviews the proposed ITAAC 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 Atomic Energy Act, and the NRC regulations.
 - B. If the application references a standard design certification, the staff verifies that the ITAAC contained in the certified design apply to those portions of the facility design that are approved in the design certification.
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.

The following HFE program elements are not reviewed under Section 14.3.9 of the SRP:

Staffing and Qualifications - reviewed under SRP Sections 13.1 and 13.2 during COL application.

Procedure Development - reviewed under SRP Section 13.5 during COL application.

Training Program Development - reviewed under SRP Section 13.2 as an operational program.

Human Performance Monitoring - not required for design certifications; reviewed under Section 14.3.9 of the SRP as a COL Action Item only.

Review Interfaces

Other SRP sections interface with this section as follows:

1. SRP Section 14.3 provides general guidance on review interfaces. The reviewer performs related reviews and coordination activities, as requested by other branches, for issues in Tier 1 related to human factors engineering.
2. Acceptability of ITAAC information for Instrumentation and Controls is reviewed under SRP Section 14.3.5. Descriptions of human-system interfaces components and characteristics addressed by the Sections 14.3.9 and 14.3.5 reviews should be consistent. As appropriate, the review results of one section should be considered in the review activities for the other section.
3. Acceptability of ITAAC information for Plant systems including HVAC design, containment isolation, and selected aspects of the containment design is reviewed under SRP Section 14.3.7.
4. Acceptability of ITAAC information for emergency preparedness is reviewed under SRP Section 14.3.10.
5. Acceptability of the corporate-level management and technical support organizations is reviewed under SRP Section 13.1.1, "Management and Technical Support Organization."
6. Acceptability of specific staffing requirements is reviewed under SRP Section 13.1.2 - 13.1.3, "Operating Organization."
7. Acceptability of specific criteria for reviewing training programs for reactor operators in Section 13.2.1 and non-licensed plant staff in Section 13.2.2 is reviewed under SRP Section 13.2, "Training."
8. Acceptability of specific criteria for the content of administrative procedures under Section 13.5.1 and operating and maintenance procedures under Section 13.5.2 is reviewed under SRP Section 13.5, "Plant Procedures."
9. Acceptability of anticipated operational occurrences and postulated accidents is reviewed under SRP Section 15, "Transient and Accident Analyses." Information from analyses conducted to address the criteria of Section 15 should be incorporated as input to the HFE design process.

10. Acceptability of HFE programs of applicants by verifying that HFE practices and guidelines are incorporated into the plant's design is reviewed under SRP Section 18, "Human Factors Engineering."
11. Acceptability of probabilistic risk assessments for site-specific safety risks is reviewed under SRP Section 19.2, "Review of Risk Information Used to Support Permanent Plant-Specific Changes to the Licensing Basis: General Guidance."

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 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;
2. 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. SRP Chapter 18 provides guidance for the NRC staff to use in determining whether an applicant has proposed an acceptable HFE design. The applicant's HFE program will be evaluated in accordance with the review criteria of SRP Chapter 18 and NUREG-0711, "Human Factors Engineering Program Review Model." As indicated in Chapter 18, the HFE program technical information for the DC or COL review may be based on a design and implementation process plan. Therefore, the DC or COL ITAAC may be based on a design and implementation process plan. For example, acceptance criteria for the task analysis program element may be stated as "a report exists and

concludes that function-based task analyses were conducted in conformance with the task analysis implementation plan and include the following functions . . .”

2. If an implementation plan, rather than a completed HFE element, was accepted as part of the design certification process, then ITAAC should address the completion of the HFE program element.
3. If an implementation plan was not reviewed and approved as part of the design certification, then the ITAAC should address both the development of the plan as well as item 2 above.
4. The reviewer will verify that HFE-related ITAAC information is provided based on accepted HFE principles and program elements as discussed in SRP Chapter 18 and incorporated into the plant's design.
5. HFE-related ITAAC should primarily address verification of products (e.g., the control room, the human-system interfaces, etc.) or results reports from implementing the HFE program element implementation plan.
6. Minimum Inventory of Displays, Alarms and Controls:

Tier 1 includes a minimum inventory of displays, controls, and alarms that are necessary to carry out the vendor's emergency procedure guidelines (i.e., Owners' Groups Generic Technical Guidelines) and critical actions identified from the applicant's PRA and task analysis of operator actions. The reviewers evaluation of the minimum inventory will encompass a multi-disciplinary effort consisting of human factors, I&C, PRA, and plant, reactor, and electrical system engineering. The minimum inventory list has been implemented through the rule-making process for four certified designs (10 CFR Part 52 Appendixes A, B, C, and D). The criteria used to determine acceptability of the inventory includes assuring that: (1) the scope of these items in the Generic Technical Guidelines and PRA effort are adequately considered, (2) the task analysis is detailed and comprehensive, (3) RG 1.97, Revision 3, Category 1 variables or RG 1.97, Revision 4, Type A, B, and C variables for accident monitoring are included, and (4) important system displays and controls described in Tier 1 system design descriptions necessary for transient mitigation are included.

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. Application of 10 CFR 52.47(b)(1), as it relates to ITAAC (for DC) provides reasonable assurance that the SSCs in this area of review will operate in accordance with the design certification, the provisions of the Atomic Energy Act, and the NRC's regulations;
2. Application of 10 CFR 52.80(a), as it relates to ITAAC (for COL) provides reasonable assurance the SSCs in this area of review have been constructed and will be operated in conformity with the combined license, the provisions of the Atomic Energy Act, and the NRC's regulations.

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. Follow the general procedures for review of Tier 1 contained in the Review Procedures section of SRP Section 14.3. Ensure that the DCD is consistent with Appendix A to SRP Section 14.3.
2. Ensure that all Tier 1 information is consistent with Tier 2 information. ITAAC such as the final design verification ITAAC should be reviewed to ensure that the ITAAC accurately describes an inspection to verify that an as-built plant is built and operates in conformance to the certified HFE program and the standard design certification. Reviewers should use the Review Checklists in Appendix C to SRP Section 14.3 as an aid in establishing consistent and comprehensive treatment of issues.
3. Ensure that ITAAC clearly delineates HFE program elements equivalent to those in NUREG-0711 and evaluate whether the ITAAC establish appropriate acceptance criteria. The reviewer should verify that each HFE program element has an implementation plan and a results summary report as described in SRP Chapter 18, either in the DC, the FSAR or the ITAAC. The ITAAC should ensure that the acceptance criteria reflect accepted HFE principles and program elements outlined in NUREG-0711.
4. Ensure that guidance, as necessary, is provided to other technical review organizations such that the minimum inventory of alarms, displays and controls in Tier 1 is treated in a consistent manner among technical review organizations.
5. Ensure that the process for developing the minimum inventory of alarms, displays, and controls contained in Tier 1 includes ITAAC that have been developed with acceptable selection criteria.
6. For each system of the standard plant design that has alarms, controls or displays, ensure that the Standard ITAAC Entries in Appendix D to SRP Section 14.3 (e.g., Control Room Configuration and Remote Shutdown System) are included in the individual System ITAAC.
7. Confirm that the ITAAC define acceptable methods and acceptance criteria to confirm that each commitment is met for HFE program activities from the design and implementation process plan.
8. 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).

9. Implementation of ITAAC will be inspected in accordance with NRC Inspection Manual Chapter IMC-2503, "Construction Inspection Program - ITAAC Inspections."

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.

The reviewer verifies that sufficient information has been provided to satisfy the requirements of SRP Section 14.3 and this SRP section, and concludes that the ITAAC is acceptable. A finding similar to that in the Evaluation Findings section of SRP Section 14.3 should be provided in a separate section of the SER.

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

VI. REFERENCES

1. 10 CFR Part 52.47 "Contents of Applications."
2. 10 CFR Part 52.80 "Contents of Applications."
3. NUREG-1503, "Final Safety Evaluation Report Related to the Certification of the Advanced Boiling Water Reactor," Volumes 1 and 2, July 1994.

4. NUREG-1462, "Final Safety Evaluation Report Related to the Certification of the System 80+ Design," Volumes 1 and 2, August 1994.
5. SECY-92-196, "Development of Design Acceptance Criteria (DAC) for the Advanced Boiling Water Reactor (ABWR)," dated May 28, 1992.
6. NUREG-0711, Rev. 2 "Human Factors Engineering Program Review Model, February, 2004."
7. SECY-93-087, "Policy, Technical, and Licensing Issues Pertaining to Evolutionary and Advanced Light-Water Reactor (ALWR) Designs," April 2, 1993.
8. Staff Requirements Memorandum on SECY-93-087, "Policy, Technical, and Licensing Issues Pertaining to Evolutionary and Advanced Light-Water Reactor (ALWR) Designs," July 15, 1993.
9. NRC Inspection Manual Chapter IMC -2503, "Construction Inspection Program - ITAAC Inspections," issued April 26, 2006.
10. Regulatory Guide 1.97, Rev. 4, "Criteria for Accident Monitoring Instrumentation for Nuclear Power Plants," June 2006.

PAPERWORK REDUCTION ACT STATEMENT

The information collections contained in 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 14.3.9

Description of Changes

This SRP section affirms the technical accuracy and adequacy of the guidance previously provided in (Draft) Revision 0, dated June 1996 of this SRP. See ADAMS accession number ML052070669.

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 0, dated [Month] 2007:

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

I. AREAS OF REVIEW

Expanded discussion to include specific areas of review within Human Factors Engineering and indicated that the review is coordinated with the applicant's HFE program as described in SRP Chapter 18. Noted which HFE program elements are not reviewed under this SRP section.

II. ACCEPTANCE CRITERIA

Revised discussion of regulatory requirements to acknowledge that the requirements for ITAAC stem from 10 CFR 52.

Revised acceptance criteria to clarify that an applicant's HFE program may be based on a design and implementation process plan.

Added acceptance criteria that ITAAC be established consistent with SRP Chapter 18.

Updated technical rationale to parallel revised SRP acceptance criteria.

III. REVIEW PROCEDURES

Provide guidance to reviewers for evaluating ITAAC related to HFE program elements equivalent to those in NUREG-0711.

Provide guidance that ITAAC defines acceptable methods and acceptance criteria for confirming each commitment is met for HFE program activities from the design and implementation plan.

IV. EVALUATION FINDINGS

Revised for consistency with NRC update guidance.

V. IMPLEMENTATION

Revised for consistency with NRC update guidance.

VI. REFERENCES

Added references cited in new text.