U.S. NUCLEAR REGULATORY COMMISSION

STANDARD REVIEW PLAN

14.3 INSPECTIONS, TESTS, ANALYSES, AND ACCEPTANCE CRITERIA

REVIEW RESPONSIBILITIES

Primary - Licensing project manager
Additional review responsibilities are identified in each subsection of this SRP:

14.3.1	Site Parameters - Relocated to SRP Section 2.0
14.3.2	Structural and Systems Engineering - Inspections, Tests, Analyses, and Acceptance Criteria
14.3.3	Piping Systems and Components - Inspections, Tests, Analyses, and Acceptance Criteria
14.3.4	Reactor Systems - Inspections, Tests, Analyses, and Acceptance Criteria
14.3.5	Instrumentation and Controls - Inspections, Tests, Analyses, and Acceptance Criteria
14.3.6	Electrical Systems - Inspections, Tests, Analyses, and Acceptance Criteria
14.3.7	Plant systems - Inspections, Tests, Analyses, and Acceptance Criteria
14.3.8	Radiation Protection - Inspections, Tests, Analyses, and Acceptance Criteria
14.3.9	Human Factors Engineering - Inspections, Tests, Analyses, and Acceptance Criteria
14.3.10	Emergency Planning - Inspections, Tests, Analyses, and Acceptance Criteria
14.3.11	Containment Systems - Inspections, Tests, Analyses, and Acceptance Criteria
14.3.12	Physical Security Hardware - Inspections, Tests, Analyses, and Acceptance Criteria
14.2	Initial Plant Test Program - Design Certification and New License Applicants
17.4	Reliability Assurance Program (RAP)
Appendix A	Information on Prior Design Certification Reviews

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Appendix B   Review Branch Responsibility for the Evolutionary Designs [Deleted]
Appendix C   Detailed Review Guidance
Appendix D   ITAAC Entries - Examples

Secondary -   Organization responsible for the review of probabilistic safety assessment

I. AREAS OF REVIEW

This standard review plan (SRP) section provides guidance to staff responsible for reviewing inspections, tests, analyses, and acceptance criteria (ITAAC) for design certification (DC) and combined license (COL) applications under 10 CFR Part 52.

The overall review approach ensures that the complete facility is verified and that the ITAAC are necessary and sufficient to verify conformance with the applicable regulations (10 CFR 52.97(b)). Previous DC applicants' used the convention design control document (DCD) Tier 2 information for their FSAR and Tier 1 for inclusion within the DC rule. ITAAC was included within Tier 1 information. This SRP section continues with this convention as the anticipated COL applications should be referencing these certified designs. Related information on the previously certified designs reviews is in Appendix A to this SRP and in Appendices A through D to 10 CFR Part 52. For a COL application that does not reference a DC, there would be no Tier 1 or Tier 2 information.

The type of information and the level of detail in Tier 1 are based on a graded approach commensurate with the safety significance of the structures, systems, and components (SSCs) for the design. The top-level information selected should include the principal performance characteristics and safety functions of the SSCs and should be verified appropriately by ITAAC. Design-specific and unique features of the facility should be considered carefully for inclusion in Tier 1. The SRP Section 14.3 subsections provide specific review area guidance.

The general areas of review are as follow:

1. Staff reviews the ITAAC and the supporting information in Section 14.3 of the Tier 2 portion of the DCD submitted by the applicant for a DC. It is necessary to develop the Tier 1 design descriptions before the ITAAC can be prepared for NRC staff review. An explanation of the terminology used in this SRP and how the Tier 1 information, which includes design descriptions and ITAAC, was developed for certification of the evolutionary designs is provided in Appendix A to this SRP.

2. Applicants may submit Tier 1 design descriptions based on the structures and systems of their designs rather than on the format of the DCD Tier 2 and the SRP. This may result in overlapping NRC review responsibilities. Also, some organizations have responsibilities for many systems. For example, consistent treatment of alarms, displays, and controls is the responsibility of one reviewer and functionality of safety-related motor operated valves (MOVs) maybe the responsibility of another; therefore, the review process may be facilitated by task groups of reviewers from several organizations as for the reviews of the evolutionary designs.

3. Staff responsible for the review of the probabilistic risk assessment (PRA) reviews Tier 1 to ensure appropriate treatment of important insights and assumptions from the

probabilistic risk assessment. Reviewers should use the guidance in the SRP Chapter 19 to determine the appropriate top-level design features for inclusion in Tier 1 and provide inputs to the responsible staff. Important integrated plant safety analyses from Tier 2 should be considered, such as analyses of fires, floods, severe accidents, and shutdown risk. Cross-references for PRA in Tier 2 showing where design features from key integrated plant safety analyses were incorporated into the design should be retained in the DCD. Specific cross-references to the appropriate sections of Tier 1 and Tier 2 should also be retained. The PRA for site-specific portions of the design should be evaluated during the COL review.

4. For a DC application, the review of ITAAC includes the applicants justification that compliance with the interface requirements is verifiable through ITAAC and the method to be used for verification.

5. The review covers the overall scope of the ITAAC. For a DC application the ITAAC cover the complete design and the interface requirements. For a COL application, the complete scope includes site-specific ITAAC.

6. For a COL review that references a DC or an ESP with ITAAC[1], this review includes confirmation that ITAAC are applied to the design as approved in the DC or ESP, respectively. In addition, this review is on the site-specific ITAAC information which was not included as part of the DC or ESP.

7. <u>COL Action Items and Certification Requirements and Restrictions</u>. For a DC application, the review should 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 should address COL action items (referred to as COL license information in certain DCs) included in the referenced DC. Additionally, a COL applicant should address requirements and restrictions (e.g., interface requirements and site parameters) included in the referenced DC.

<u>Review Interfaces</u>

Other SRP sections interface with this section as follows:

1. Certain SRP sections are identified as interfaces within SRP Section 14.3 subsections, but this list is not exhaustive. It is expected that the staff reviews ITAAC after the application is reviewed against acceptance criteria contained in the majority of SRP sections. These reviews against acceptance criteria inform the scope and sufficiency of the ITAAC.

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

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[1]An ESP application proposing complete and integrated emergency plans for review and approval should include ITAAC. An ESP application proposing major features of an emergency plan for review and approval may include proposed ITAAC.

II. ACCEPTANCE CRITERIA

Requirements

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

1. 10 CFR 52.17(b)(3), requires that an ESP application proposing complete and integrated emergency plans contain ITAAC and that an ESP application proposing major features of the emergency plans may contain ITAAC.

2. 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 should operate in accordance with the design certification, the provisions of the Atomic Energy Act, and the NRC's regulations;

3. 10 CFR 52.47(a)(26), which requires that a DC application contain justification that compliance with the interface requirements of paragraph (a)(25) of this section is verifiable through inspections, tests, or analyses. The method to be used for verification of interface requirements should be included as part of the proposed ITAAC required by paragraph (b)(1) of this section.

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 should perform, and the acceptance criteria that are necessary and sufficient to provide reasonable assurance that, if the inspections, tests, and analyses should 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. Acceptance on the scope of the ITAAC is based on the complete facility or for a DC application, limited to the SSCs covered by the DC.

2. Acceptance criteria on the sufficiency of the ITAAC for the areas of review are specified in SRP Section 14.3 subsections.

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 paragraph:

1. ITAAC requirements are included in 10 CFR Part 52 licensing processes to provide reasonable assurance that, if the inspections, tests, and analyses are performed and the acceptance criteria met, the facility has been constructed and should operate in conformity with the combined license, the provisions of the Atomic Energy Act, and the NRC's regulations.

III. REVIEW PROCEDURES

The reviewer should 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.

Preparation for the review of ITAAC should include the following:

1. Complete the review of the SSCs against the acceptance criteria in the rest of the SRP sections before completing the review of ITAAC. If the ITAAC review is completed before the significant issues are resolved, the ITAAC review may have to be revised. Also review the latest versions of the safety evaluation report (SER) and Tier 2 for familiarization with the facility design and its nomenclature.

2. Review the applicable regulations, SRP sections, regulatory guides (RGs), unresolved safety issues (USIs), and generic safety issues (GSIs), NRC generic correspondence, industry operating experience, NRC inspection programs, and any additional regulatory guidance from the Commission, as an additional means of determining the safety significance of SSCs. Also review NRC generic communications and operating experience discussed in Tier 2 to achieve familiarity with how insights have been incorporated into the plant design.

3. If applicable, review the DCD for a certified design similar to the design for which certification is sought, specifically the Tier 1 information, for the purpose of using a similar approach, format, and language and for familiarity with the treatment of SSCs, the appropriate level of design detail, and other certification issues.

4. Review the safety analyses for the design, including analyses of design-basis accidents, severe accidents, flooding, overpressure protection, containment, core cooling, fire protection, transients, shutdown risk, anticipated transient without scram, steam generator tube rupture, Three Mile Island (TMI) items, PRAs, regulatory treatment of nonsafety-related systems, or other analyses as specified by the staff. Review cross-references in DCD Tier 2, Section 14.3, showing where key parameters from these analyses are addressed in the Tier 1 information. Review cross-references for PRA and severe accidents in the applicable sections of Tier 2.
5. Review the methodology and criteria for Tier 1 information in DCD Tier 2, Section 14.3.

General Review Procedures:

1. Perform the preparatory steps listed and review the applicant's DCD for consistency and applicability with Appendix A to this SRP section.

2. The subsections to this SRP for the specific review areas and determine the SSCs that are applicable to the specific review.

3. Review the Tier 1 design descriptions to ensure that the key performance characteristics and safety functions of SSCs are appropriately treated at a level of detail commensurate with their safety significance.

4. Review Tier 1 for whether all information is clear and consistent with the Tier 2 information. If any new items are added to ITAAC, then ensure that they are added, including appropriate supporting analyses, to the applicable sections of Tier 2. Figures and diagrams should be reviewed to ensure that they accurately depict the functional arrangement and requirements of the systems. Reviewers should use the detailed review guidance in Appendix C to this SRP section as an aid in treating issues consistently and comprehensively.

5. Ensure that the standard ITAAC entries in Appendix D to this SRP section related to the review area are included appropriately. The reviewer also should review the general provisions for verification of dynamic qualification of equipment, equipment qualification for harsh environments, welding issues, and MOVs.

6. Ensure that definitions, legends, interface requirements, and site parameters that pertain to issues in the review area are treated consistently and appropriately in the DCD.

7. Review the cross-references in DCD Tier 2 Section 14.3 for safety analyses, and cross-references for PRA and severe accident analyses in the applicable sections of DCD Tier 2, that are applicable to your review area and verify that the key parameters and assumptions are addressed in Tier 1.

8. Review the Tier 1 design acceptance criteria (DAC) and make sure of the necessary supporting information is included in DCD Tier 2.

9. Ensure that the ITAAC emphasize testing of the as-built facility and use the definitions for testing in Appendix A. ITAAC may be the same as a pre-operational test for an SSC contained in DCD Tier 2, Section 14.2. In such a case, the pre-operational test can be used to satisfy the ITAAC; however, pre-operational tests are not relied on for testing in lieu of ITAAC. Testing designated in the ITAAC should also be included in the Tier 2 information.

10. Ensure that the ITAAC are compatible with the technical specifications, including their bases and limiting conditions for operation.

11. Ensure that the ITAAC reflect the resolutions of technically relevant USIs/GSIs, TMI items, and operating experience.

12. Ensure that sufficient interfaces with other reviewers, as specified in these SRP sections, are accomplished to address all significant Tier 1 issues completely and comprehensively. Ensure that inputs from secondary reviewers, including those identified in this SRP section, are reflected appropriately in Tier 1.

13. For the review of an ESP application that contains ITAAC, the reviewer should use SRP Section 14.3.10 to perform the review.

14. For the review of a DC application, the staff reviews the applicants justification that compliance with interface requirements is verifiable through ITAAC and the method to be used for the verification. The staff also should identify necessary COL action items.

15. For the review of a COL application referencing a DC or an ESP with ITAAC, the staff confirms that the ITAAC within the DC or early site permit (ESP) are applied to the appropriate portions of the facility design. In addition, the staff should review site-specific ITAAC on portions of the facility outside the scope of the certified design. In general the scope of review is dependent on whether the COL applicant references a DC, an ESP or other NRC-approved material, applications, and/or reports.

16. The licensing project manager reviews the ITAAC to verify that they encompass the complete facility or complete DC.

17. Implementation of the ITAAC program is 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.

For a DC application, each reviewer ensures that sufficient information has been provided and concludes that the Tier 1 information is acceptable; however, safety findings for the standard design are based on Tier 2, not Tier 1, information because Tier 1 information is derived from Tier 2. Consequently, any design information presented in Tier 1 also should be in the appropriate Tier 2 sections. Further, the purpose of ITAAC is to verify that a facility referencing the design certification is built and operates in accordance with the design certification and applicable regulations. The evaluation findings on Tier 1 from each reviewer are provided to the project manager to be combined in FSER Chapter 14.3 to support the following overall conclusion:

1. The staff reviewed the Tier 1 information in the (standard design) DCD in accordance with the guidance in SRP Section 14.3. Based on this review and a review of the selection methodology and criteria for the development of the Tier 1 information in Section 14.3 of the DCD, the staff concludes that the top-level design features and performance characteristics of the SSCs are appropriately described in Tier 1 and the Tier 1 information is acceptable.

2. Further, the Tier 1 design descriptions can be verified adequately by ITAAC. Therefore, the staff concludes that the ITAAC are necessary and sufficient for reasonable assurance that, if the inspections, tests, and analyses are performed and the acceptance criteria met, then a facility referencing the certified design can be constructed and operated in compliance with the design certification and applicable regulations.

For a COL application, the complete facility can be verified by ITAAC and the ITAAC are necessary and sufficient. See 10 CFR 52.97(b)

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 version.

VI. REFERENCES

1. 10 CFR Part 52, "Licenses, Certifications, and Approvals for Nuclear Power Plants." Specific sections noted in the SRP section.

2. NRC Inspection Manual Chapter IMC-2503, "Construction Inspection Program - ITAAC Inspections," issued April 25, 2006.

APPENDIX A

INFORMATION ON PRIOR DESIGN CERTIFICATION REVIEWS

The purpose of this appendix is to describe how previous design certification applications have implemented the requirements of Subpart B of 10 CFR Part 52, so that this information can be used as guidance for review of new design certification applications. The NRC staff developed guidance for implementing inspections, tests, analyses, and acceptance criteria (ITAAC) and other design certification issues as part of its review of the Advanced Boiling-Water Reactor (ABWR) and System 80+ designs (evolutionary designs). Where applicable, the guidance has been updated to reflect Appendix D to Part 52 - Design Certification Rule for the AP1000 Design

I. Background - Design Certification

Design certification is a process whereby standard designs are approved by rulemaking. The resulting design certification rule is added to 10 CFR 52 as an appendix. Each appendix incorporates by reference a design control document (DCD) that contains the design information. An applicant for design certification is required to submit a DCD to the NRC for review and approval. A combined license applicant or licensee who references a certified design should comply with both the rule certifying the design and the DCD. In 10 CFR 52.47(a), the applicant must provide a final safety analysis report, which is equivalent to the DCDs in the appendices to 10 CFR Part 52. The following terms were defined for the evolutionary design reviews:

A. Generic design control document (generic DCD) means the document containing Tier 1 and Tier 2 information and generic technical specifications that is incorporated by reference into the design certification rules. This document is prepared by the applicant for design certification.

B. Plant-specific DCD means the document, maintained by an applicant or licensee who references a design certification rule, consisting of the information in the generic DCD, as modified and supplemented by the plant-specific departures and exemptions made under the change process in the design certification rule.

C. Tier 1- means the portion of the design-related information contained in the generic DCD that is approved and certified by this design certification rule (Tier 1 information). The design descriptions, interface requirements, and site parameters are derived from Tier 2 information. Tier 1 information includes:

   i. Definitions and general provisions;
   ii. Design descriptions;
   iii. Inspections, tests, analyses, and acceptance criteria (ITAAC);
   iv. Significant site parameters; and
   v. Significant interface requirements.

D. Tier 2 means the portion of the design-related information contained in the generic DCD that is approved but not certified by this design certification rule (Tier 2 information). Compliance with Tier 2 is required, but generic changes to and plant-specific departures from Tier 2 are governed by the change process in the design certification rule. Compliance with Tier 2 provides a sufficient, but not the only acceptable, method for complying with Tier 1. Compliance methods differing from Tier 2 should satisfy the change process in the design certification rule. Tier 2 information includes:

i. Information required by 10 CFR 52.47, generic TS, the design-specific PRA, the evaluation of SAMDAs, and conceptual design information;

ii. Information required for a final safety analysis report under 10 CFR 50.34;

iii. Supporting information on the inspections, tests, and analyses that should be performed to demonstrate that the acceptance criteria in the ITAAC have been met; and

iv. (COL) action items (COL information), which identify certain matters that should be addressed in the site-specific portion of the FSAR by an applicant who references a design certification rule. These items constitute information requirements but are not the only acceptable set of information in the FSAR. An applicant may depart from or omit these items, provided that the departure or omission is identified and justified in the FSAR. After issuance of a construction permit or COL, these items are not requirements for the license unless such items are restated in the FSAR.

v. The investment protection short-term availability controls in section 16.3 of the DCD.

E. Tier 2*- means the portion of the Tier 2 information, designated as such in the generic DCD, which is subject to the change process in the design certification rule. This designation expires for some Tier 2* information at fuel load.

The DCDs for the evolutionary designs consisted of an introduction, Tier 2 information, which is mostly the standard safety analysis report (SSAR) for the standard design), and Tier 1 information. The significance of designating design information as either Tier 1 or Tier 2 is that different change processes and criteria apply to each tier, as described in the evolutionary design certification rules. Basically, Tier 1 information is difficult to change after the design certification rule is issued because changes require a finding by the NRC that the change is needed to assure adequate protection of the public health and safety. This results in a very high threshold for change to Tier 1 by either the NRC or others once the rule is issued. Whereas, Tier 2 information can be changed by a combined license (COL) applicant or licensee under a "50.59-like" process, provided the change does not impact Tier 1. The entire change process is set forth in the design certification rules (Appendices A - D to 10 CFR Part 52).
The remainder of this appendix discusses the form and content of the DCD, selected issues unique to design certification reviews, and additional guidance for DCDs. This guidance relies on the requirements for design information to be

included in safety analysis reports (SARs) for facilities, as described in NRC Regulatory Guide (RG) 1.206, and the various sections of this SRP.

II. Introduction to the DCD

The introduction to the DCD should describe the purpose, content overview, and COL applicant or licensee uses of the Tier 1 and Tier 2 portions of the DCD. Although the introduction is part of the DCD, it is neither Tier 1 nor Tier 2 information. Rather, the DCD introduction provides a convenient explanation of the DCD, and is non-binding. All substantive requirements are described in the design certification rule.

III. Tier 2 information

1. General Content of the Tier 2 Information. The Tier 2 portion of the DCD should basically consist of the same information as is required for the design certification applicant's SSAR. However, some portions of the DCD may differ from a SSAR, as discussed below. The information in the design certification application (SSAR) is the basis for the staff's safety evaluation for the design. Conceptually, any information that is required for final design approval, but is not intended to be included in the DCD (e.g., proprietary information), should be submitted as a separate report that is referenced in the appropriate section of the DCD. This information should be minimized because it may need to be resubmitted to the staff as part of a combined license application.

2. Designation of Tier 2* Information in the DCD. Tier 2* information is that information in Tier 2 that, if considered to be changed by a combined license (COL) applicant or licensee, requires NRC approval prior to the change. The areas designated as Tier 2* by the NRC staff are listed in the FSER, and these areas should be similar for the passive designs.

   The staff may determine that selected material in the SSAR, if considered for a change by an applicant or licensee that references the certified design, would require NRC approval prior to implementation of the change. This information is designated as Tier 2* information. Tier 2* is generally information that is not appropriate for treatment in Tier 1 because it is subject to change. Tier 2* is generally considered for areas associated with detailed structural and equipment design; design and analysis methodology for fuel and control rods; and supporting material for the DAC areas of the design. Some designations of Tier 2* material may expire at first full power operation, when the detailed design of the facility and its performance characteristics are known, and tested through the initial test program. The NRC bears the final responsibility for designating which material in the SSAR is Tier 2*. All cases where the staff believes that Tier 2* applies are to be reviewed and approved by the cognizant Division Director. The staff's rationale for the Tier 2* information in each area and the basis for the determination that a change would require prior NRC approval, should be documented in the FSER.

   The DCD should designate clearly (bracketed and italicized) the information that is determined to be Tier 2*. Use of other markers such as asterisks and bold type may also be appropriate. A table should be provided in the DCD listing the areas of the DCD that contain Tier 2* information. A statement should be included with the table stating that prior NRC approval is required to change the information, and the statement may be added to each Tier 2* area in the DCD as appropriate for clarity.

IV. Tier 1 information

A third section of the DCD is the Tier 1 information. This information consists of an introduction to Tier 1, certified design descriptions, figures, and corresponding inspections, tests, analyses, and acceptance criteria (ITAAC) for systems and structures of the design, design material applicable to multiple systems of the design (referred to as design acceptance criteria or DAC), significant interface requirements, and significant site parameters for the design. The information in the Tier 1 portion of the DCD is extracted from the detailed information contained in the application for design certification. While the Tier 1 information must address the complete scope of the design to be certified, the amount of design information is proportional to the safety-significance of the structures and systems of the design.

1. Introduction to Tier 1. This section of Tier 1 includes definitions of terms and a listing of general provisions that are applicable to all Tier 1 entries.

   A. Definitions. This section defines terms used in Tier 1 that could be subject to various interpretations. The intent is to be consistent and as closely aligned as possible with the terminology in the SSAR, in common industry use, industry codes and standards, and NRC regulations, and guidance. Thus, should questions on terminology arise, these references would aid in understanding the intent of the information in Tier 1. Although not all-inclusive, the following definitions that apply to terms used in the Design Descriptions and associated ITAAC are acceptable:

      i. Acceptance Criteria means the performance, physical condition, or analysis result for a structure, system or component that demonstrates the Design Commitment is met.

      ii. Analysis means a calculation, mathematical computation, or engineering or technical evaluation. Engineering or technical evaluations could include, but are not limited to, comparisons with operating experience or design of similar structures, systems or components.

      iii. As-built means the physical properties of the structure, system, or component following the completion of its installation or construction activities at its final location at the plant site.

      iv. Basic Configuration (for a Building) means the arrangement of building features (e.g., floors, ceilings, walls, basemat and doorways) and of the structures, systems, or components within, as specified in the building DD.

      v. Basic Configuration (for a System) means the functional arrangement of structures, systems, and components specified in the Design Description and the verifications for that system specified in the General Provisions.

vi. Design Commitment means that portion of the Design Description that is verified by ITAAC.

vii. Design Description means that portion of the design that is certified.

viii. Division (for electrical systems or equipment) is the designation applied to a given safety-related system or set of components which are physically, electrically, and functionally independent from other redundant sets of components.

ix. Division (for mechanical systems or equipment) is the designation applied to a specific set of safety-related components within a system.

x. Inspect or Inspection mean visual observations, physical examinations, or reviews of records based on visual observation or physical examination that compare the structure, system, or component condition to one or more Design Commitments. Examples include walkdowns, configuration checks, measurements of dimensions, or non-destructive examinations.

xi. Test means the actuation or operation, or establishment of specified conditions, to evaluate the performance or integrity of as-built structures, systems, or components, unless explicitly stated otherwise.

xii. Type Test means a test on one or more sample components of the same type and manufacturer to qualify other components of that same type and manufacturer. A type test is not necessarily a test of the as-built structures, systems or components.

2. General Provisions. This section of Tier 1 provides general provisions that are applicable to the design descriptions, figures, and the ITAAC.

A. Verifications for Basic Configuration for Structures and Systems This section of Tier 1 includes provisions related to the verification of the ITAAC for basic configuration for systems and structures of the design. This ITAAC is contained in the buildings and most of the systems described in Tier 1. The ITAAC includes inspection of the functional arrangement of the system as described in the design description and as shown in the figures. It also includes, and is limited to, verifications of welding, environmental qualification, seismic qualification, and motor operated valves as described in the definitions and general provisions provided in the DCD Tier 1.

B. Treatment of Individual Items A licensee is not prohibited from utilizing an item not described in Tier 1. However, the as-built facility should be consistent with the rule approving the design, including both tiers of information. The change process for the certified design is described in the design certification rule.

The term "operate" as utilized in Tier 1 is intended to refer to the actuation and running of equipment. This is not meant to include the term "operable" in the context of the ongoing reliability and availability of equipment. In developing the

ITAAC, the staff recognized that other programs ensure the continued safe operation of a facility after fuel load. For example, the continued operability of a facility after the ITAAC are satisfied is ensured through the Technical Specifications, Startup and Power Ascension Test Programs, as well as various programs such as the maintenance program, quality assurance program, and the in-service inspection and in-service testing program. Also, the operator ensures the facility is operated as designed, through the use of appropriate plant operating and emergency procedures.

The term "exists," when used in the Acceptance Criteria, means that the item is present and meets the design description. Detailed supporting information on what should be present to conclude that an item "exists" and meets the design description is contained in the appropriate sections of the SSAR.

C. Implementation of ITAAC. The implementation of a construction verification program, including ITAAC and other licensee programs, is the responsibility of the licensee. The successful completion of the ITAAC in the combined license should constitute the basis for the NRC's determination to allow fuel loading for the facility. The licensee should periodically certify to the NRC that the inspections, tests, and analyses have been performed, and that the acceptance criteria have been met. These notifications should document the basis for the successful completion of the ITAAC. A licensee may utilize the efforts of subordinate vendors, contractors, or consultants. However, the licensee referencing the certified design retains responsibility for ensuring that the ITAAC are met. Additionally, the ITAAC can be satisfied using other programs, such as the pre-operational testing portion of the initial test program or the QA program required by 10 CFR Part 50, Appendix B. However, these programs are not a substitute for ITAAC.

In accordance with 10 CFR 52.99, and Appendixes A, B, and C of Part 52, the staff should inspect to ensure that the required inspections, tests, and analyses have been performed and that the prescribed acceptance criteria have been met. At appropriate intervals, the NRC should publish in the *Federal Register,* notices of the successful completion of the inspections, tests, and analyses. The ITAAC may be satisfied at any time prior to fuel load, including prior to issuance of a combined license. However, the primary intent of the ITAAC is to verify that the as-built plant on the final site has been constructed and should perform in accordance with the design certification and applicable regulations. Thus, many ITAAC are anticipated to be met towards the end of facility construction and pre-operational testing.

The key aspects of the design are described in Tier 1. Those aspects of the design that can not be verified until after fuel loading are not included in ITAAC. This is because 10 CFR Part 52 requires that the ITAAC be satisfied prior to fuel loading. For these, the initial test program verifies various aspects of the design after fuel load, but prior to operation. Examples of these requirements are the post-fuel load startup and power ascension test program verification of fuel, control rod, and core characteristics, as well as system and integrated plant operating characteristics. The treatment of these issues should be similar to their treatment at facilities licensed under 10 CFR Part 50, in that verification of the satisfactory completion of these requirements should be a condition of the license.

Once completion of ITAAC and the supporting design information demonstrate that the facility has been properly constructed, it then becomes the function of existing programs such as the technical specifications, the maintenance program, and the in-service inspection and in-service testing program to demonstrate that the facility continues to operate in accordance with the certified design and the license. Additionally, a utility referencing the design is required by 10 CFR Part 50, Appendix B, to have a quality assurance program that ensures that SSCs are appropriately designed, procured, and perform satisfactorily in service. Further, the operator ensures the facility is operated as designed, through the use of appropriate plant operating and emergency procedures.

D. Discussion of Matters Related to Operations Descriptions in Tier 1 may refer to matters of operation, such as normal valve or breaker alignment during normal operational modes. These descriptions are not intended to require operators to take any particular action. The operational matters referred to in Tier 1 are governed by existing programs to ensure the ongoing safe operation of a facility, such as plant operating and emergency procedures.

E. Interpretation of Figures The design descriptions include the figures in Tier 1, where the figures are provided. They are intended to depict the functional arrangement of the significant SSCs of the standard design. An as-built facility referencing the certified design should be consistent with the performance characteristics and functions described in the design descriptions and figures.

F. Rated Reactor Core Thermal Power. The rated reactor core thermal power for the design should be specified.

3. Legend for Figures and Acronyms and Abbreviations A legend supporting Tier 1 figures should be provided. The symbology selected should be consistent and as closely aligned as possible with the symbology in Tier 2, in common industry use, industry codes and standards, and NRC rules, regulations, and guidance. Thus, should questions on interpretation arise, these references would aid in understanding the intent of the information. In addition, the meanings of acronyms and abbreviations should be provided for any of those terms used in Tier 1.

4. System Design Descriptions, Figures, and ITAAC. System design descriptions and ITAAC should be provided for: (a) structures and systems that are fully within the scope of the standard design certification, and (b) the in-scope portions of those systems that are only partially within the scope of the standard design certification. The system design descriptions should be accompanied by the appropriate ITAAC. The selection methodology and criteria for the system design descriptions and ITAAC should be specified in DCD Tier 2 Section 14.3. Entries should be provided in Tier 1 for all systems necessary to define the full scope of the design. Checklists for fluid systems,

electrical systems, and building structures are provided in Appendix C to SRP Section 14.3 to achieve consistency in treatment of issues.

A. Design Descriptions and Figures. The design descriptions (DD) address the most safety-significant aspects of each of the systems of the design, and were derived from the detailed design information contained in Tier 2. The applicant should put the top-level design features and performance characteristics that were the most significant to safety in the Tier 1 design descriptions. The level of detail in Tier 1 is governed by a graded approach to the SSCs of the design, based on the safety significance of the functions they perform. The design descriptions include the figures associated with the systems. The design descriptions serve as binding requirements for the lifetime of a facility to assure that the plant does not deviate from the certified design.

The scope of the certified design is defined by the information in the DCD. Therefore, each branch should ensure that all appropriate systems that are either fully or partially within the scope of the design certification are addressed in Tier 1, at the appropriate level of detail based on the safety significance of the SSCs. For example, safety-related SSCs should be described in Tier 1 with a relatively greater amount of information. Other SSCs should also be included based on their importance to safety, such as containment isolation aspects of non-safety systems. Some non-safety aspects of SSCs need not be discussed in Tier 1. This graded approach recognizes that although many aspects of the design are important to safety, the level of design detail in Tier 1 and verification of the key design features and performance characteristics should be commensurate with the significance of the safety functions to be performed.

The design descriptions include a narrative and simplified schematic figures in Tier 1, where the figures are provided. The narrative should state the system purpose, significant performance characteristics and safety functions, whether it is safety-related or not, system location, key design features, seismic and ASME code classifications, description of system operation, major controls and displays, logic circuits, interlocks, Class 1E power sources and divisions, equipment to be qualified for harsh environments (and other than harsh for certain I&C equipment), and interface requirements, as applicable.

Figures should be provided for most systems, with the amount of information depicted based on the safety significance of the SSCs. Where figures are not required, generally for simple non-safety significant systems, the narrative should be sufficient to describe the system. The figures are intended to depict the functional arrangement of the significant SSCs of the standard design. Particular attention should be paid to the legend for the figures to ensure common understanding of requirements, system boundaries, piping code breaks, electrical configurations, etc.

Numeric performance values and key parameters in safety analyses should be specified in the design descriptions based on their safety significance; however, numbers for all parameters need not be specified unless there is a specific reason to include them (e.g., important to be maintained for the life of the facility).

The use of codes and standards in Tier 1 should be minimized, with exceptions granted on a case-by-case basis. Instead, the applicable requirements from the regulations, codes, or standards should be stated in Tier 1, rather than reference them. This ensures that requirement is clear, and allows flexibility if the reference changes. References to various parts of ASME Section III are possible for verification of issues such as pressure boundaries, and references to ASME Section XI for pre-service inspection requirements. Also, references to 10 CFR Part 20 may be required for use in radiation protection. The specific code edition, volume, version, date, etc., should be specified in Tier 2, rather than Tier 1. This provides for specific requirements that are acceptable, yet allows the code to be updated via the change process in the rule certifying the design. It is important to note that, due to the provisions of 10 CFR 52.63 and the rule certifying the design, changes to the codes and standards in 10 CFR 50.55a would not necessarily be requirements for the certified design.

B. ITAAC. The purpose of the ITAAC is to verify that an as-built facility conforms to the approved plant design and applicable regulations. When coupled in a COL with the ITAAC for site-specific portions of the design, they constitute the verification activities for a facility that should be successfully met prior to fuel load. If the licensee demonstrates that the ITAAC are met and the NRC agrees that they are successfully met, then the licensee will be permitted to load fuel. Once completion of ITAAC and the supporting design information demonstrate that the facility has been properly constructed, it then becomes the function of existing programs such as the technical specifications, the in-service inspection and in-service testing program, the quality assurance program, and the maintenance program, to demonstrate that the facility continues to operate in accordance with the certified design and the license.

The scope of ITAAC at the design certification stage is limited to, and should be consistent with, the systems, structures, and components (SSC) that are in the certified design. The ITAAC for the site-specific design features should be developed at the COL stage. Also, ITAAC are limited to the design features and requirements that must be verified prior to fuel loading. Therefore, items like power ascension testing that are also described in the application should be covered by license conditions in the COL.

Also, the scope of the ITAAC is consistent with the SSCs that are in the design descriptions. In general, each system has one or more ITAAC that verify the information in the design descriptions. The system ITAAC should verify that the key design characteristics and performance requirements of the SSCs are verified. The level of detail specified in the ITAAC should be commensurate with the safety significance of the functions and bases for that SSC.

Standard ITAAC have been developed that verify selected aspects of the standard design. These are provided in Appendix D to this SRP. The standard ITAAC should be used to ensure consistent and comprehensive treatment of these issues in the applicable systems of Tier 1.

A three-column format for ITAAC is acceptable, as discussed below.

Column 1 - Design Commitments This column contains the text for the specific design commitment that is extracted from the design descriptions discussed above. Any differences in text should be minimized, unless intentional. Differences in text are generally intended to better conform the commitments in the design description with the ITAAC format.

Column 2 - Inspections, Tests, and Analyses This column contains the specific method to be used by the licensee to demonstrate that the design commitment in Column 1 has been met. The method is either by inspection, test, or analysis or some combination of these.

Tier 2 contains detailed supporting information for various inspections, tests, and analyses that can, and should be, used to verify the Tier 1 design information and satisfy the acceptance criteria. If questions on interpretation should arise, the material in Tier 2 provides the background material and context for Tier 1 information. Tier 2 contains information reviewed by the staff which is the basis for the staff's safety determination for the design. Therefore, the information in Tier 2 describes an acceptable means, but not the only means, of satisfying an ITAAC.

Inspections are defined in the Introduction, and include visual and physical observations, walkdowns or record reviews. The inspections required for the "Basic Configuration Walkdown" ITAAC invoke the general provisions contained in the Introduction for as-built structures and systems.

Tests are defined in the Introduction, and mean the actuation, operation, or establishment of specified conditions to evaluate the performance or integrity of the as-built SSCs. This includes functional and hydrostatic tests for the systems. The preferred means to satisfy the ITAAC is in-situ testing, where possible, of the as-built facility. The term "as-built" is intended to mean testing in the final as-installed condition at a facility. The term "type tests" is used in this column to mean manufacturer's tests or other tests that are not necessarily intended to be in the final as-installed condition. The results of pre-operational tests can be used to satisfy an ITAAC. However, the pre-operational tests described in DCD Tier 2 Section 14.2 or RG 1.68 are not a substitute for ITAAC. Where testing is specified, appropriate conditions for the test should be established in accordance with the Initial Test Program (ITP) described in Tier 1, DCD Tier 2 Section 14.2, and RG 1.68. Conversion or extrapolation of the test results from the test conditions to the design conditions may be required to satisfy the ITAAC.

Analyses are defined in the Introduction, and may refer to detailed supporting information in the DCD Tier 2, simple calculations, or comparisons with operating experience or design of similar SSCs. The details of the analysis method should be specified in either the ITAAC or Tier 2 (preferred). The ITAAC should not reference Tier 2, but Tier 2 may reference the appropriate ITAAC. For example, detailed analysis methods of seismic and environmental qualification supporting the general provisions in the Tier 1 Introduction are contained in Chapter 3 of Tier 2 and detailed piping design information supporting additional design material applicable to multiple sections of the design are also contained in Chapter 3.

Column 3 - Acceptance Criteria This column contains the specific acceptance criteria for the inspections, tests, or analyses described in Column 2 which, if met, demonstrate that the design commitments in Column 1 have been met.

In general, the acceptance criteria should be objective and unambiguous. In some cases, the acceptance criteria may be more general because the detailed supporting information in Tier 2 does not lend itself to concise verification. For example, the acceptance criteria for the design integrity of piping and structures may be that a report "exists" that concludes the design commitments are met. In these cases, Tier 2 provides the detailed supporting information on multiple interdependent parameters that should be provided in order to demonstrate that a satisfactory report exists.

Numeric performance values for SSCs are specified as ITAAC acceptance criteria when values consistent with the design commitments are possible, or when failure to meet the stated acceptance criterion would clearly indicate a failure to properly implement the design or meet the safety analysis.

5. Tier 2 Supporting Information The DCD Tier 2 should include all information reviewed by the staff which is relied upon in reaching the staff's safety determination. All requirements for the design should be included in the DCD Tier 2. To the extent that design detail or other information reviewed in the course of inspections or audits is necessary for the staff to reach a safety conclusion, that design detail or other information should be in the DCD Tier 2. It is not sufficient for such information to be on the docket, it should be in the DCD Tier 2.

   In some cases, the detailed supporting information necessary to perform the inspections, tests, and analyses, or to demonstrate compliance with the acceptance criteria may not be identified by the standard format for safety analysis reports or the SRP, but is required to be added to Tier 2 to show the intended methods of performance of the ITAAC. Examples of this information includes detailed design, inspection, and construction items such as welding processes, piping stress reports, and building construction reports contained in appendices to DCD Tier 2 Chapter 3 for the evolutionary standard designs. Other examples may include supporting information for design processes and design acceptance criteria (DAC) for selected areas of the design.

6. Section 14.3 of Tier 2 The top-level design information in Tier 1 is extracted from the more detailed design information in Tier 2. Section 14.3 of Tier 2 should provide the

bases, processes and selection criteria used to develop the Tier 1 information. However, the section should contain no technical information not already presented in other sections of Tier 2. Section 14.3 should contain a description of each section of Tier 1 and a discussion of its development. The following items should be addressed:

A. A discussion of the scope of the certified design, the interfaces with the certified design, and the site parameters selected.

B. A discussion of the scope and applicability of any definitions and general provisions.

C. A discussion of the how the Design Descriptions were developed, and how the various inspections, tests, analyses, and acceptance criteria for design commitments were selected.

D. A discussion of the development of any additional design material, including the justification for any design processes and design acceptance criteria (DAC) for selected areas of the design.

E. A discussion of the Tier 1 commitments for the Initial Test Program and Design Reliability Assurance Program.

The design descriptions may utilize a system-based structure which is different than the structure of Tier 2. Consequently, developing the design description entries for any one system should be based on the multiple DCD Tier 2 chapters having technical information related to that system. This approach should be discussed in Section 14.3, describing how the many design aspects of the SSCs in Tier 1 were derived.

The emphasis in DCD Tier 2 Section 14.3 should be on discussing the level of detail in Tier 1. Acceptable approaches for selection of the top-level requirements for Tier 1 may be based on the safety significance of SSCs, their importance in various safety analyses, and their functions for defense-in-depth considerations. At a minimum, the section should include a discussion of how the following items were addressed in the selection of the Tier 1 material:

i. Selection of design information from the various chapters of Tier 2.

ii. Features or functions necessary to satisfy the NRC's regulations in 10 CFR Parts 20, 50, 52, 73, or 100.

iii. Treatment of safety-related SSCs.

iv. Treatment of important features and functions identified in the NRC's SRP.

v. Important insights or assumptions from the probabilistic risk assessment

vi. Treatment of severe accident design features.

vii. Incorporation of operating experience. This includes USIs, GSIs, and TMI items; NRC generic correspondence such as bulletins, circulars, and generic letters; and relevant industry operating experience.

viii. Provisions in the facility technical specifications and their bases.

ix. Provisions in the test descriptions for the pre-operational and power ascension test programs contained in Section 14.2 of Tier 2.

The staff is particularly interested in ensuring that the assumptions and insights from key safety and integrated plant safety analyses in Tier 2, where plant performance is dependent on contributions from multiple systems of the design, are adequately considered in Tier 1. Addressing these assumptions and insights in Tier 1 ensures that the integrity of the fundamental analyses for the design are preserved in an as-built facility referencing the certified design. These analyses include flooding analyses, over-pressure protection, containment analyses, core cooling analyses, fire protection, transient analyses, anticipated transient without scram analyses, steam generator tube rupture analyses (PWRs only), radiological analyses, USIs/GSIs and TMI items, or other key analyses as specified by the staff. Therefore, applicants should provide information, in tabular form, in Section 14.3 that cross references the important design information and parameters of these analyses to their treatment in Tier 1. The cross-references should be sufficiently detailed to allow a COL applicant or licensee to consider whether a proposed design change impacts the treatment of these parameters in Tier 1.

In addition, cross references should also be provided showing how key insights and assumptions from PRA and severe accident analyses are addressed in the design information in the DCD. For these analyses only, the cross references should show where each of the key assumptions and insights has been captured in Tier 1, as well as in the technical specifications (including administrative controls), reliability assurance activities, emergency procedure guidelines, the initial test program, and COL action items. These cross references may be provided along with the detailed PRA and severe accident analyses in the applicable sections of Tier 2. The cross-references should be sufficiently detailed to allow a COL applicant or licensee to consider whether a proposed design change impacts the treatment of these parameters in Tier 1.

7. Additional Certified Design Material. This section of Tier 1 should contain the Design Descriptions and their related ITAAC for design and construction activities that are applicable to more than one system of the design. The following items should be addressed in Tier 1, if applicable to the standard design. Applicants may propose additional items to be treated on a generic basis. The Design Descriptions should describe the scope and applicability of the additional certified design material to the appropriate systems. Alternatively, the additional material may be specified in the Design Descriptions and ITAAC for the SSCs to which they apply.

A. Design Acceptance Criteria (DAC) Additional material may be provided because, in selected areas of the design, applicants may not provide sufficient design detail in the DCD Tier 2. Applicants may not have provided complete design information in these areas because they are either areas of rapidly changing technology where applicants believe it is unwise to prematurely freeze the design, or because the information is dependent on as-built or as-procured information. Areas of rapidly changing technology may include control room and remote shutdown system design (human factors), and digital instrumentation and controls. Areas dependent on as-built or as-procured information may include piping design and radiation shielding. For these areas, applicants should provide the design related processes and associated DAC in Tier 1 that a COL applicant or licensee would follow to complete the design.

The design information and appropriate design methodologies, codes, and standards provided in the DCD Tier 2, together with the design descriptions and DAC, should be sufficiently detailed to provide an adequate basis for the staff to make a final safety determination regarding the design, subject only to satisfactory design implementation and verification of the DAC by the COL applicant or licensee. The DAC are a set of prescribed limits, parameters, procedures, and attributes upon which the NRC relies, in a limited number of technical areas, in making a final safety determination in support of the design certification. The acceptance criteria for the DAC should be objective; that is, they should be inspectable, testable, or subject to analysis using pre-approved methods, and should be verified as a part of the ITAAC performed to demonstrate that the as-built facility conforms to the certified design. Thus, the acceptance criteria for DAC are specified together with the related ITAAC in Tier 1, and both are part of the design certification. The DAC and the ITAAC, when met, ensure that the completed design and as-constructed plant conforms to the design certification. The material in the DCD Tier 2 for each of the DAC areas should include, as appropriate, sample calculations or other supporting information to illustrate methods that are acceptable to the staff for meeting the Tier 1 DAC commitments.

The DAC may be provided in Tier 1 as part of additional certified design material applicable to more than one system. If so, the structure of each area where DAC are used is the same as for the other areas of the design that are verified by ITAAC. The structure consists of three parts: the Tier 1 Design Description, the corresponding DAC, and the Tier 2 supporting information in the DCD Tier 2 for the DAC. The Design Description for each DAC should describe its scope and applicability to the SSCs of the design. Amplifying information on this Tier 1 information should be contained in DCD Tier 2 Section 14.3. Alternatively, applicants may choose to address all design issues appropriately in the SSCs to which they apply, so that no DAC are needed.

For the two areas of rapidly changing technology, control room and remote shutdown system design (human factors), and digital computer-based instrumentation and controls design, the Design Descriptions and DAC delineate the process and requirements that a COL applicant or licensee should implement to develop the design information required in each area. Acceptance criteria are specified in Tier 1 for the development process at various stages of detailed design and subsequent construction and testing. The COL applicant or licensee is required to develop the procedures and test programs necessary to demonstrate that the DAC requirements are met at each stage. Similar to ITAAC, the COL applicant or licensee should certify to the NRC that the design through that phase is in compliance with the certified design. The NRC should review, audit, and inspect the work to confirm that the COL applicant or licensee has adequately implemented the commitments of the DAC at these phases. The process may be referred to as a "phased" DAC because it consists of a set of sequential steps or phases that require successful completion. A COL applicant or licensee is not required to certify that each phase is completed sequentially. However, if the staff determines that a DAC was not successfully met, the design process may be required to be repeated to meet the DAC, possibly requiring a change to the as-built system design.

B. Initial Test Program (ITP) Refer to SRP Section 14.2.

C. Reliability Assurance Program in the design phase Refer to SRP Section 17.4.

8. Interface Requirements This section of Tier 1 specifies interface requirements that should be met by the site-specific portions of a facility that are not within the scope of the certified design. The interface requirements in the DCD define the design attributes and performance characteristics that ensure that the site-specific portion of the design is in conformance with the certified design. The site-specific portions of the design are those portions of the design that are dependent on characteristics of the site, such as the design of the ultimate heat sink.

This section of Tier 1 also identifies the scope of the design to be certified by specifying the systems that are completely or partially out of scope of the certified design. Thus, interface requirements are defined for: (a) systems that are entirely outside the scope of the design, and (b) the out-of-scope portions of those systems that are only partially within the scope of the standard design. In some cases, the scope of the standard design requires that the DCD contain information that was supplied by a utility in the past. However, simply because design information may be traditionally "licensee-supplied" does not mean that it is "out-of-scope" of the standard design.

Although the top-level interface requirements are specified in Tier 1, more detailed interface requirements may be specified in Tier 2 (generally in Chapter 1), but they should be consistent with the Tier 1 information. The evolutionary designs defined the interface between the systems of the design and the site-specific systems to be physically at the walls of the major buildings of the design, such as the turbine building, reactor building, and control building. All SSCs within those buildings were considered within the scope of the design, and the SSCs outside of those buildings were considered out of scope and site-specific. Alternative definitions of interfaces may also be acceptable, such as those based on the locations of transfers of various process flows into and out of the design scope (radioactive or contaminated flows, electrical flows, heat flows, water and air flows, etc.).

9. Site Parameters Site parameters are specified in this section of Tier 1 for establishing the bounding parameters to be used in the selection of a suitable site for a facility referencing the standard design. The design is evaluated in terms of these parameters during the reviews for design certification. Therefore, to ensure that a facility built on the site remains in conformance with the design certification, a suitable site should be demonstrated to be within the bounding parameters and characteristics, and a facility should be constructed at the site in accordance with their use in the approved design.

APPENDIX C

DETAILED REVIEW GUIDANCE

FLUID SYSTEMS REVIEW CHECKLIST

The following provides guidance and rationale of what should be included in the Tier 1 Design Descriptions (DDs), figures, and ITAAC for fluid systems. Examples of acceptable Tier 1 information may be found in the DCDs for the evolutionary designs.

I. Design Descriptions and Figures

A. Design Descriptions

The following information should be included in the various Design Descriptions in a consistent order.

i. System purpose and functions (minimum is safety functions, may include some non-safety functions)

The DD identifies the system's purpose and function. It captures the system components that are involved in accomplishing the direct safety function of the system. Each DD should include wording (preferably in the first paragraph) that identifies whether the system is safety-related or is a non-safety system. Exceptions should be noted if parts of the system are not safety-related or if certain aspects of a non-safety system have a safety significance.

ii. Location of system The building that the system is located (e.g., containment, reactor building, etc.) should be included in the DD.

iii. Key design features of the system The design description should describe the components that make up the system. Key features such as the use of the some of the safety relief valves to perform as the Automatic Depressurization System should be described in the DD. However, details of a components design, such as the internal workings of the MSIVs and SRVs, need not be included in the design description because this could limit the COL applicant or licensee to a particular make and model of a component. If the results of the PRA indicate that a particular component or function of a system is risk significant, that component or function should be described in the DD. Any features such as flow limiters, backflow protection, surge tanks, severe accident features, etc. should be described in the DD as follows:

(1) Flow limiting features for high-energy line breaks (HELBs) outside of containment - The minimum pipe diameter should be confirmed because these features are needed to directly limit/mitigate Design Basis Events such as pipe breaks. Lines less than 1 inch

(e.g., instrument lines) need not included because their small size limits the effects of HELBs outside containment.

(2) Keep Fill systems - These should be included in the design description when needed for the direct safety function to be achieved without the damaging effects of water hammer.

(3) Online Test Features - Some systems/components have special provisions for online test capability which is critical to demonstrate its capability to perform the direct safety function. An example is an ECCS test loop. These online test features should be described in the DD.

(4) Filters - Filters that are required for a safety function (such as Control room HVAC radiation filtering) should be in the design description. The basic configuration ITAAC should check that the filter exists, but need not test the filter performance.

(5) Surge Tank - The capacity of the surge tank should be verified if the tank is needed to perform the direct safety function. For example, in the case of the RCW surge tank a certain volume is required to meet the specific system leakage assumptions.

(6) Severe Accident Features - These features should be described in the design description, and the basic configuration ITAAC should verify that they exist. In general, the capabilities of the features need not be included in the ITAAC. Detailed analyses should be retained in Tier 2.

(7) Hazard (e.g., flood, fire) Protection Features - Special features (switches, valves, dampers) used to provide protection from hazards should be included in the appropriate system design description. Other features such as walls, doors, curbs, etc., should also be covered, but in most cases these should be in an ITAAC for buildings or structures.

(8) Special Cases for Seismic - There may be some nonsafety equipment that requires special treatment because of its importance to safety. An example is the seismic analysis of the BWR main steam piping that provides a fission product leakage path to the main condenser and allows the elimination of the traditional main steam isolation valve control system.

iv. Seismic and ASME code classifications. The safety classification of structures, systems, and components are described in each system's design description. The functional drawings identify the boundaries of the ASME Code classification that are applicable to the safety class. The generic Piping Design ITAAC includes a verification of the design report to ensure that the appropriate code design requirements for the system's safety class have been implemented. Therefore, design pressures and temperatures for fluid systems do not need to be specified in the DD except in special cases such as ISLOCA where the system has to meet additional requirements.

v. System operation. The DD should provide a description of the important performance modes of operation of the system. This should include realignment of the system following an actuation signal (e.g., a safety injection signal for a PWR or a LOCA signal for a BWR).

vi. Alarms, Displays and Controls. The DD for the systems should describe the important system alarms, displays (do not use the term "indications"), and controls available in the control room. Important instrumentation that is required for direct operation or accident mitigation should be shown on the system figure, or described in the DD if there is no figure. Those that are provided for routine system performance monitoring or operator convenience need not be shown or discussed.

The Generic Technical Guidelines (e.g., ERGs, EPGs) in DCD Tier 2 Chapter 18 should have identified the minimum set of controls, displays, and alarms necessary for the main control room (MCR) and remote shutdown panel (RSP), and these should be included in Tier 1. The functioning of the alarms, displays, and controls in the MCR and RSP should be verified in either the system ITAACs or in the MCR/RSP ITAACs. The intent is to test the integrated as-built system; however, separate testing of the actual operation of the system and the alarms/displays/controls circuits using simulated signals may be acceptable where this is not practical. See also the standard ITAAC for control room features and the remote shutdown panel in Appendix C to this SRP section.

vii. Logic. If a system/component has a direct safety function, it typically receives automatic signals to perform some action. This includes start, isolation, etc. The DD captures these aspects related to the direct safety function of the system.

viii. Interlocks. Interlocks needed for direct safety functions should be included in the system DD. Examples include the interlocks to prevent ISLOCA and an interlock that switches the system or component from one mode to a safety function mode. Other interlocks that are more equipment protective in nature, are only included in the DCD Tier 2.

ix. Class 1E electrical power sources/divisions. The DD or figure should identify the electrical power source/division for the equipment included in the system. Independent Class 1E power sources are required for components performing direct safety functions and are needed to meet single failure criterion, GDC 17, etc. Electrical separation should also be addressed in the electrical and I&C systems ITAAC.

x. Equipment to be qualified for harsh environments. Electrical equipment that is used to perform a necessary safety function should be demonstrated to be capable of maintaining functional operability under all service conditions, including LOCA, postulated to occur during its installed life for the time it is required to operate. Documentation relating to equipment qualification issues should be completed for all equipment items important to safety in accordance with the requirements of 10 CFR 50.49. The basic configuration standard ITAAC described in Appendix D to this SRP section verifies this aspect of the design. The scope of environmental qualification to be verified by the ITAAC includes the Class 1E electrical equipment identified in the Design Description (or on the accompanying figures), and connected instrumentation and controls, connected electrical components (such as cabling, wiring, and terminations), and the lubricants necessary to support performance of the safety functions of the Class 1E electrical components. The qualification of I&C equipment for "other than harsh" environments should be addressed in the I&C ITAAC.

xi. Interface requirements. The interface requirements should be identified in the Design Descriptions for out of scope or partially out of scope systems and cross-referenced in a separate section of the certified information. An example for a BWR is the Reactor Service Water System. The methodology for developing ITAAC for the interface requirements should be described in the DCD Tier 2 or certified information. Non-safety systems which cannot impact safety systems do not need Interface Requirements. Specific in-scope design details which preclude a non-safety system from impacting a safety system should be addressed in Tier 1. This is discussed further in Appendix A to this SRP section.

xii. Accessibility for ISI Testing and Inspection. The accessibility does not have to be addressed in Tier 1, but should be addressed in Tier 2. The NRC does not intend to grant reliefs to the ISI requirements after design certification.

xiii. Numeric performance values. Numeric performance values for SSC should be specified as ITAAC acceptance criteria to demonstrate satisfaction of a Design Commitment (DC). The numeric performance values do not have to be specified as DC and in the DD unless there is a specific reason to include them there. Key numbers and physical parameters used in the Chapter 6, 14.3, and 15 safety analyses and significant parameters of the PRA should be included in the DD.

xiv. Normally, all design commitments in the DD Tier 1 should be verified by a specific ITAAC, unless there are specific reasons why this is not necessary. A single ITAAC may verify several design commitments. For example, the basic configuration ITAAC verifies the physical arrangement of the system using the design description and figures, in addition to verifications of other specific issues.

B. Figures

i. In general, figures and/or diagrams are required for all systems. However, a separate figure may not be needed for simple systems, structures, and components (e.g., the condenser). The format for the figures and/or diagrams should be simplified piping diagrams for mechanical systems. Symbols used on the figures should be consistent with the legend provided by the applicant.

ii. All components discussed in the design description should be shown on the figure.

iii. System boundaries with other systems should be clearly delineated in the figures. With few exceptions, system boundaries should occur at a component.

iv. ASME code class boundaries for mechanical equipment and piping are shown on the figure and form the basis for the basic configuration check (system) that is required in each individual system ITAAC. The configuration check includes an inspection of the welding quality for all ASME Code Class 1, 2, and 3 piping systems described in the design description. A hydrotest is also required in each system ITAAC for ASME Code Class 1, 2, and 3 piping systems to verify the pressure integrity of the overall piping system, including the process of fabricating the system, and welding and bolting requirements.

v. As a minimum, the instruments (pressure, temperature, etc.) required to perform Generic Technical Guidelines (e.g., ERGs, EPGs)(as described in the DCD Tier 2 Chapter 18) should be shown on the figures, or described in the DD.

vi. The minimum inventory of alarms, indications, and controls, if established in the main control room or remote shutdown panel ITAAC, do not have to be discussed in individual DD's or shown on figures. Other "essential" alarms (e.g., associated with shutdown cooling system (SCS) high pressure (ISLOCA), SCS performance monitoring indications) not part of the minimum inventory should be shown on the figures.

vii. Identification of all alarms, displays and controls on the remote shutdown panel should be included in the system diagram or alternatively in the remote shutdown panel ITAAC.

viii. Class 1E power sources (i.e., division identification) for electrical equipment can be shown on the figure in lieu of including them in the Design Description.

ix. Figures for safety-related systems should include most of the valves on the DCD Tier 2 P&ID except for items, such as fill, drain, test tees, and maintenance isolation valves. The scope of valves to be included on the figures are those MOVs, POVs, and check valves with a safety related active function, a complete list of which is contained in the IST plan. Valves remotely operable from the Control Room should be shown if their mispositioning could affect system safety function. Other valves are evaluated for exclusion on a case-by-case basis. Figures for non-safety-related systems may have less detail.

x. Fail-safe positions of the pneumatic valves need not be shown on figures or discussed in the DD unless the fail-safe position is relied on to accomplish a direct safety function of the system.

xi. Containment isolation valves (CIVs) should be shown on the figures of the applicable system ITAAC, or discussed in the DD if there is no figure. The demonstration of CIV performance to a Containment Isolation Signal, electrical power assignment to the CIVs and failure response to the CIVs, as applicable, may be included in the system ITAAC or in a separate containment isolation system ITAAC that encompasses all CIVs. Leak rate testing of the CIVs should be addressed in Tier 1, and may be addressed in the containment ITAAC.

xii. Heat loads requiring cooling, e.g., pump motors, heat exchangers, need not show the source of cooling unless the source of cooling has a specific or unique characteristic that would require Tier 1 treatment, e.g., RCP seal water cooling.

C. Style Guidelines for Design Descriptions and Figures

i. New terminology should be avoided, standard terminology should be used (i.e., use terms in common use in the CFR or Reg Guides vice redefining them).

ii. Pressures should include units to indicate if the parameter is absolute, gage, or differential.

iii. "LOCA signal" should be used vice specific input signals such as "High drywell" or "Low water level" because control systems generally processes the specific input signals and generate a LOCA signal that actuates the component.

iv. In general, the term "ASSOCIATED" should be avoided because this term has particular meaning regarding electrical circuits and its use may lead to confusion.

v. Numbers should be expressed in metric units with English units in parentheses.

vi. The design description should be consistent in the use of present or future tense.

vii. "Division" should be used instead of train, loop, or subsystem (unless it is a subsystem).

viii. "Tier 1" and "Tier 2" should not be used in the design description or ITAAC.

ix. Systems should be described as "safety-related" and "nonsafety-related," not "essential" and "nonessential."

x. The correct system name should be used consistently.

II. Inspections, Tests, Analyses and Acceptance Criteria (ITAAC)

Normally, all design commitments in Tier 1 should be verified by a specific ITAAC entry, unless there are specific reasons why this is not necessary.

A. Standard ITAAC Entries. See Appendix D to this SRP section.

B. System Specific ITAAC Entries.

i. Operational/functional Aspects of the System. The design description captures the system components that are involved in accomplishing the direct safety function. Typically, the system ITAAC specify functional tests, or tests and analyses, to verify the direct safety functions for the various system operating modes.

ii. Critical Assumptions from Transient and Accident Analyses. The critical assumptions from transient and accident analyses should be verified by ITAAC. Cross-references should be provided in DCD Tier 2 Section 14.3 showing how the key physical parameters from these Tier 2 analyses are captured in Tier 1. These cross-references are also called "Roadmaps". All critical parameters given in the DCD Tier 2 (mainly in chapters 6 and 15) should be identified in the roadmaps. Reviewers should ensure that the critical input parameters are included, as appropriate, in the applicable system ITAAC. The roadmaps and the specific analyses are discussed further in Appendix A to this SRP section.

iii. PRA and Severe Accident Insights. If the results of the PRA indicate that a particular component or function of a system is risk significant, that component or function should be verified by ITAAC. PRA insights should be identified in the DCD Tier 2 and in the staff's SER. The reviewer should verify in the individual system ITAAC that the PRA insights are included in the corresponding system ITAAC as indicated in the DCD Tier 2. Roadmaps for PRA, including shutdown safety analyses, as well as severe accidents, should be included in the appropriate sections of the DCD Tier 2, with specific references to the system ITAAC where the key parameters from these analyses are verified. This is discussed further in Appendix A to this SRP section.

iv. Online Test Features. Some systems have special provisions for online test capability which is critical to demonstrate its capability to perform the direct safety function. An example is an ECCS test loop. These online test features should be verified by ITAAC.

v. Surge Tanks. The capacity of a surge tank should be verified if the tank is needed to perform the direct safety function. For example, for BWRs, a certain RCW surge tank volume is required to meet the specific system leakage assumptions.

vi. Special Cases for Seismic Qualification. There may be some non-safety equipment that requires special treatment because of its importance to safety. An example is the seismic analysis of the ABWR main steam piping that provides a fission product leakage path to the main condenser and allows the elimination of the traditional main steam isolation valve leakage control system.

vii. Initiation Logic. If a system/component has a direct safety function it typically receives automatic signals to perform some action. This includes start, isolation, etc. The system ITAAC capture these aspects related to the direct safety function. The entire logic and combinations are not tested in the system ITAAC because the overall logic is checked in the I&C ITAAC for the safety system logic.

viii. Interlocks. Interlocks needed for direct safety functions should be included in the system design description and ITAAC. Examples include the interlocks to prevent ISLOCA and an interlock that switches the system or component from one mode to a safety function mode. Other interlocks that are more equipment protective in nature, are only in the DCD Tier 2. All of the interlocks are not tested in the system ITAAC because the overall logic is checked in the I&C ITAACs for the safety system logic.

ix. Automatic Override Signals. Automatic signals that override equipment protective features during a DBE (e.g., thermal overloads for MOVs), need not be included in the ITAAC if there are other acceptable methods for assuring system function during a design basis event.

x. Single Failure. The design description should not state that the system meets single failure criteria (SFC). There should not be an ITAAC to verify that the system meets single failure, rather, the system attributes such as independence and physical separation which relate to the SFC should be in ITAAC.

xi. Flow Control Valves. In general, the flow control capability of control valves does not have to be tested in ITAAC. However, flow control valves should be shown on the figure if they are required to fail-safe or receive a safety actuation signal. The fail-safe position should be noted on the figure, or discussed in the DD if there is no figure.

xii. Pressure Testing of Ventilation Systems. Where ductwork constitutes an extension of the control room boundary for habitability, the ductwork should be pressure tested.

C. Style Guidelines for ITAAC

i. The first column (design commitment (DC)) should be as close in wording to the design description as possible.

ii The middle column of the ITAAC always should contain at least one of the three "Inspection" or "Test" or "Analysis". Sometimes, it should be a combination of the three.

iii. Standard pre-ops tests defined in the DCD Tier 2 and Reg Guide 1.68 are not a substitute for ITAAC, however, the results of pre-op tests can be used to satisfy an ITAAC. DCD Tier 2 and Reg Guide 1.68 tests should be examined and tests elevated to ITAAC as necessary.

iv. If an ITAAC test is not normally done as part of a pre-operational test, the test methodology should be in Tier 1 or added to the DCD Tier 2 Section 14.2. Any supporting design or analysis issues should be put in the appropriate sections of Tier 2. Reference to the ITAAC may be included in Tier 2. Reference should not be made from Tier 1 to Tier 2 because this effectively makes Tier 2 part of Tier 1.

v. Use of the Terms "Test" and "Type Test" in the ITA should be consistent with the Tier 1 Definitions. Alternatively, testing may be classified as "Vendor", "Manufacturer", or "Shop" to make clear what type of test is intended.

vi. If an analysis is required in the ITAAC, then the analysis or at least the outline of the analysis should be prepared and that should be put in the ITAAC or the appropriate section of the DCD Tier 2. The DCD Tier 2 may reference the ITAAC.

vii. ITAAC column 2 should identify the component, division, or system that the inspection, test, and/or analysis verifies.

viii. Refer only to inspections, not "visual" inspections.

ix. Numerical values, where appropriate, should be specified in the third column, acceptance criteria.

x. The ITAAC should be consistent in the use of present or future tense.

xi. "Division" should be used instead of train, loop, or subsystem (unless it is a subsystem).

xii. "Tier 1" and "Tier 2" should not be used in the ITAAC.

xiii. Avoid clarifying phrases in the ITAAC.

xiv. The correct system name should be used consistently.

III. Reviewer Check Lists

The following check lists are provided to assists the reviewer in the review of the fluid systems Design Descriptions, Figures, and ITAAC. As discussed before, the level of detail in any particular Design description, Figure, or ITAAC should be proportional to the safety significance of the SSC being reviewed. Therefore, all items shown on the check lists should not be applicable to all systems being reviewed.

DESIGN DESCRIPTION CHECK LIST

SYSTEM: ____________________________

1. System purpose/functions (minimum is safety functions, may include some non-safety functions) ____
2. Location of system (containment, reactor building, etc.) _____
3. Key design features of the system (such as ADS part of SRVs, flow limiters, backflow protection, surge tanks, severe accident features, etc.) _____
4. Seismic and ASME code classifications ____
5. System operation ____
6. Controls/displays ____
7. Logic ____
8. Interlocks ____
9. Class 1E electrical power sources/divisions ____
10. Equipment to be qualified for harsh environments ____
11. Interface requirements ____

(See Appendix C.I for guidance.)

FIGURES CHECK LIST

SYSTEM: ____________________________

1. All components discussed in the design description. ____

2. Boundaries with interfacing systems should be clearly delineated in the figures/diagrams. ____

3. ASME code class boundaries for mechanical equipment and piping. ____

4. As a minimum, instruments required to perform Generic Technical Guidelines (e.g., ERGs, EPGs)(as described in the DCD Tier 2 Chapter 18). ____

5. Essential alarms that are not included in the minimum inventory of alarms. ____

6. Class 1E power sources (i.e., division identification) for electrical equipment. ____

7. Identification of all alarms, displays, and controls on the remote shutdown panel unless these are covered by the remote shutdown panel ITAAC. ____

8. Pneumatic and motor-operated valves and check valves that perform "active" safety functions, including all POVs/MOVs that are within the scope of GL 89-10. ____

9. Fail-safe position of pneumatic valves that are relied upon to accomplish the direct safety function of the system. ____

(See Appendix C.I for guidance.)

ITAAC CHECK LIST

SYSTEM: ____________________________

1. Basic configuration ____
2. Hydrostatic test for ASME Section III components ____
3. Net positive suction head ____
4. Divisional power supplies ____
5. Physical separation ____
6. Control room configuration ____
7. Remote shutdown system ____
8. Motor operated valves ____
9. Pneumatically operated valves ____
10. Check valves ____
11. Operational and functional aspects of the system ____
12. Critical assumptions from transient and accident analyses ____
13. PRA insights (RAP input) ____
14. Online testing features ____
15. Surge tanks ____
16. Special cases for seismic qualification (e.g., ABWR main steam line piping) ____
17. Initiation logic ____
18. Interlocks ____
19. Flow control valves ____
20. Pressure testing of ventilation systems ____
21. Chapter 14 Testing reviewed ____

(See Appendix C.II for guidance.)

INSTRUMENTATION AND CONTROL SYSTEMS REVIEW CHECKLIST

This section provides additional guidance for evaluating COL applications, Tier 1 Design Descriptions (DDs),figures and ITAAC for instrumentation and control systems. Examples of this information may be found in the DCDs for the certified designs referenced in the applicable appendices to 10 CFR Part 52.

I. Design Descriptions and Figures

The DD should address instrumentation and control (I&C) equipment that is involved in performing safety functions. Essentially, this would include the complete Class 1E I&C systems, and should include the following information:

A. Hardware architecture descriptions:
   - descriptions of all hardware modules
   - cabinet layout and wiring
   - seismic and environmental control requirements
   - power sources

B. Software architecture descriptions:
   - software design specifications
   - code listings
   - build documents
   - installation configuration tables

C. Regulatory guides (RGs) which have specific recommendations. This may be an area where a specific design aspect addressed by an RG is identified as a design commitment. However, all RG recommendations may not need Tier 1 treatment.

D. Safety-significant operating experience problems that have been identified (particularly through generic letters or bulletins, and in some cases information notices).

E. Policy issues raised for the standard designs.

F. New design features (such as communications between various portions of the digital system or other systems). All of the new features may not need Tier 1 treatment.

G. Insights or key assumptions identified through the PRA.

H. GSI resolutions that have resulted in design/operational features.

I. Post-TMI requirements (e.g.,post-accident monitoring).

II. ITAAC Entries (for the above equipment)

The I&C ITAAC should be developed to address the following considerations:

A. Compliance with 10 CFR 50.55a(h), "Criteria for Protection Systems for Nuclear Generating Stations," and IEEE Standard 603-1991 (and the Correction Sheet Dated January 30, 1995)[2]. The following sections correspond to sections in the IEEE Standard.

- Section 4.1 Identification of the design-basis events. The ITAAC should verify the inclusion of the initial conditions and allowable limits of plant conditions for each DBE.

- Section 4.4 Identification of monitored variables. The ITAAC should verify the analytical limit associated with each variable, the ranges (normal, abnormal, and accident conditions), and the rates of change for these variables to be accommodated until proper completion of the protective action is ensured.

- Section 4.5 Minimum criteria for manual initiation and control of protective actions subsequent to initiation. The ITAAC should verify the points in time and the plant conditions during which manual control is allowed, the justification for permitting initiation or subsequent control solely by manual means, the range of environmental conditions imposed upon the operator during normal, abnormal, and accident circumstances throughout which the manual operation is performed, and the variables that should be displayed for the operator to use in taking manual action.

- Section 4.6 Identification of the minimum number and locations of sensors. The ITAAC should include analysis of the minimum number and locations of sensors that the safety systems require for protective purposes.

- Section 4.7 Range of transient and steady-state conditions. The ITAAC should verify the range of transient and steady-state conditions, including both motive and control power and the environment (e.g., voltage, frequency, radiation, temperature, humidity, pressure, and vibration) during normal, abnormal, and accident circumstances throughout which the safety system is required.

- Section 4.8 Identification of conditions having the potential to cause functional degradation of safety system performance. The ITAAC should include analysis of the conditions that have the potential to causing functional degradation of the safety systems (e.g.,

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[2]Refer to RG 1.206, Section C.I.7, Appendix 7B for additional discussion on conformance with IEEE Standard 603.

missiles, pipe breaks, fires, loss of ventilation, spurious operation of fire suppression systems, operator error, failure in non-safety-related systems).

- Section 4.9 Identification of the methods used to assess the reliability of the safety system design. The ITAAC should verify that this analysis was performed correctly and accepted by the NRC.

- Section 5.1 Single-Failure Criterion. The ITAAC should include analysis or demonstration to show that the safety systems can perform all safety functions required for a DBE in the presence of (1) any single detectable failure within the safety systems, concurrent with all identifiable but non-detectable failures; (2) all failures caused by the single failure; and (3) all failures and spurious system actions that cause or are caused by the DBE requiring the safety functions.

- Section 5.2 Completion of Protective Action. The ITAAC should include analysis or demonstration to show that the safety systems are designed so that, once initiated (automatically or manually), the intended sequence of protective actions of the "execute features" should continue until completion, and deliberate operator action is required to return the safety systems to normal.

- Section 5.3 Quality. The ITAAC should verify that all components, modules, and software are of a quality that is consistent with minimum maintenance requirements and low failure rates, and the safety system equipment has been designed, manufactured, inspected, installed, tested, operated, and maintained in accordance with a prescribed quality assurance program

- Section 5.4 Equipment Qualification. The ITAAC should include analysis or demonstration to show that the safety system equipment has been qualified by type test, previous operating experience, or analysis, or any combination of these three methods, to substantiate that it should be capable of meeting, on a continuing basis, the design-basis performance requirements.

- Section 5.5 System Integrity. The ITAAC should include analysis or demonstration to show that the safety systems have been designed to accomplish their safety functions under the full range of applicable conditions enumerated in the design basis.

- Section 5.6 Independence. The ITAAC should include analysis or demonstration to show that there is physical, electrical, and communications independence between redundant portions of a safety system, between safety systems and effects of a DBE, and between safety systems and other systems.

- Section 5.7 Capability for Test and Calibration. The ITAAC should include analysis or demonstration to show that the safety systems have the capability to test and calibrate safety system equipment while retaining the systems' capability to accomplish their safety functions.

- Section 5.8 Information Displays. The ITAAC should verify that (1) the display instrumentation provided for manually controlled actions for which no automatic control is provided are part of the safety systems; (2) the display instrumentation provides accurate, complete, and timely information pertinent to safety system status; and (3) there is an indication of bypasses.

- Section 5.9 Control of Access. The ITAAC should verify that the safety system design permits administrative control of access to safety system equipment.

- Section 5.10 Repair. The ITAAC should verify that the safety systems have been designed to facilitate timely recognition, location, replacement, repair, and adjustment of malfunctioning equipment.

- Section 5.11 Identification. The ITAAC should verify that (1) the safety system equipment is distinctly identified for each redundant portion of a safety system, (2) identification of safety system equipment is distinguishable from any identifying markings placed on equipment for other purposes, and (3) identification of safety system equipment and its divisional assignments does not require frequent use of reference material.

- Section 5.12 Auxiliary Features. The ITAAC should include analysis or demonstration to show that auxiliary supporting features meet all requirements of this standard, and do not degrade the safety systems below an acceptable level.

- Section 5.13 Multi-Unit Stations. The ITAAC should include analysis or demonstration to show that safety systems that are shared between units at multi-unit generating stations can simultaneously perform required safety functions in all units.

- Section 5.14 Human Factors Considerations. The ITAAC should verify that functions that are allocated (in whole or in part) to the human operator(s) and maintainer(s) can be successfully accomplished to meet the safety system design goals.

- Section 5.15 Reliability. The ITAAC should verify that an appropriate analysis of the design has been performed to confirm that established quantitative or qualitative reliability goals have been achieved for systems for which such goals have been defined.

- Sections 6.1 Automatic Control. The ITAAC should verify that all protective actions can be automatically initiated and controlled.

- Sections 6.2 Manual Control. The ITAAC should verify that the control room provides the means to manually initiate and control automatically initiated protective actions at the division level.

- Section 6.3 Interaction Between the Sense and Command Features and Other Systems. The ITAAC should include analysis or demonstration to show that no single credible event (including the event's direct and consequential results) can cause a non-safety system action that results in a condition, which requires protective action and can concurrently prevent that protective action in sense and command feature channels that are designated to provide principal protection against the condition.

- Section 6.4 Derivation of System Inputs. The ITAAC should verify that sense and command feature inputs are derived from signals that are direct measures of the desired variables, as specified in the design basis.

- Section 6.5 Capability for Testing and Calibration. The ITAAC should include analysis or demonstration to show that there are means for checking, with a high degree of confidence, the operational availability of each sense and command feature input sensor that may be required for a safety function during reactor operation.

- Sections 6.6 Operating Bypasses. The ITAAC should include analysis or demonstration to show that whenever the applicable permissive conditions are not met, a safety system should automatically prevent the activation of an operating bypass, or initiate the appropriate safety function(s).

- Sections 6.7 Maintenance Bypass. The ITAAC should include analysis or demonstration to show that the safety system can accomplish its safety function while sense and command features equipment is in a maintenance bypass state.

- Section 6.8 Setpoints. The ITAAC should verify that the allowance for uncertainties between the process analytical limit and the device setpoint has been determined using a documented and approved methodology.

- Section 7.3 Completion of Protective Action for Executive Features. The ITAAC should include analysis or demonstration to show that the safety systems are designed so that once initiated, the protective actions of "execute features" should proceed to completion.

- Section 8 Power Source Requirements. The ITAAC should verify that the power to the safety system is Class 1E.

B. Compliance with General Design Criteria in Appendix A to Part 50

The ITAAC should address each of the following GDCs:

- GDC 1, as it pertains to quality standards for design, fabrication, erection, and testing. The ITAAC should verify that (1) the safety-related I&C systems were designed, fabricated, erected, and tested to the required quality standards; (2) those standards were evaluated to determine their applicability, adequacy, and sufficiency; (3) a quality assurance program was established and implemented; and (4) appropriate records of the design, fabrication, erection, and testing of SSCs are being maintained by (or under the control of) the nuclear power unit licensee throughout the life of the unit.

- GDC 2, as it pertains to protection against natural phenomenon. The ITAAC should verify that (1) the safety-related I&C systems were designed to withstand the effects of natural phenomena such as earthquakes, tornadoes, hurricanes, floods, tsunami, and seiches without loss of capability to perform their safety functions; (2) the most severe natural phenomena were appropriately considered with sufficient margin; and (3) the effects of normal and accident conditions were appropriately combined with the effects of the natural phenomena.

- GDC 4, as it pertains to environmental and dynamic effects. The ITAAC should verify that the safety-related I&C systems were designed to accommodate the effects of, and be compatible with, the environmental conditions associated with normal operation, maintenance, testing, and postulated accidents, including LOCAs.

- GDC 13, as it pertains to instrumentation and control requirements. The ITAAC should verify that the safety-related I&C systems were designed to provide instrumentation to monitor variables and systems over their anticipated ranges for normal operation, anticipated operational occurrences, and accident conditions, as appropriate to ensure adequate safety. This monitoring should include those variables and systems that can affect the fission process, the integrity of the reactor core, the reactor coolant pressure boundary, and the containment and its associated systems. In addition, appropriate controls should be provided to maintain these variables and systems within prescribed operating ranges.

- GDC 19, as it pertains to control room requirements. The ITAAC should verify that (1) actions can be taken in the control room to safely operate the nuclear power unit under normal conditions, and maintain it in a safe condition under accident conditions, including LOCAs, and (2) adequate radiation protection has been provided to permit access to, and occupancy of, the control room under accident conditions, for the duration of the accident, without personnel receiving radiation exposures in excess of the total effective dose equivalent (TEDE) of 0.05 Sv (5 rem) specified in 10 CFR 50.2.

- GDC 20, as it pertains to protection system design requirements. The ITAAC should verify that the protection system was designed to automatically initiate the operation of appropriate systems, including the reactivity control systems, to (1) ensure that specified acceptable fuel design limits are not exceeded as a result of anticipated operational occurrences, (2) sense accident conditions, and (3) initiate the operation of systems and components important to safety.

- GDC 21, as it pertains to protection system reliability and testability. The ITAAC should verify that the safety-related I&C systems were designed for high functional reliability and inservice testability. The ITAAC should also verify that the redundancy and independence designed into the systems should be sufficient to ensure that (1) no single failure results in loss of the protection function, and (2) removing any component or channel from service should not result in loss of the required minimum redundancy unless the acceptable reliability of protection system operation can otherwise be demonstrated. In addition, the ITAAC should verify that the protection system was designed to permit periodic testing of its functioning with the reactor in operation, and this capability includes testing channels independently to identify any failures or losses of redundancy that may have occurred.

- GDC 22, as it pertains to protection system independence. The ITAAC should verify that the safety-related I&C systems were designed so that neither natural phenomena, nor normal operating, maintenance, testing, and postulated accident conditions should affect redundant channels in a manner that results in loss of the protection function. Alternatively, the ITAAC should demonstrate on some other defined basis that (1) the safety-related I&C systems offer acceptable independence of the protection system, and (2) design techniques, such as functional diversity or diversity in component design and principles of operation, were used to prevent loss of the protection function.

- GDC 23, as it pertains to protection system failure modes. The ITAAC should verify that the safety-related I&C systems were designed to fail into a safe state or into a state that is demonstrated to be acceptable if they experience conditions such as disconnection of the system, loss of energy, or postulated adverse environments.

- GDC 24, as it pertains to separating protection systems from control systems. The ITAAC should verify that the safety-related I&C systems were separated from control systems to the extent that failure of any single control system component or channel, or failure or removal from service of any single protection system component or channel that is common to the control and protection systems, leaves intact a system that satisfies all reliability, redundancy, and independence requirements of the protection system. In addition, the ITAAC should verify that interconnection of the protection and control systems was sufficiently limited to ensure that safety is not significantly impaired.

- GDC 25, as it pertains to protection system requirements for reactivity control malfunctions. The ITAAC should verify that the protection system was designed to ensure that specified acceptable fuel design limits are not exceeded for any single malfunction of the reactivity control systems, such as accidental withdrawal of control rods.

- GDC 29, as it pertains to protection against anticipated operational occurrences. The ITAAC should verify that the protection and reactivity control systems were designed to ensure an extremely high probability of accomplishing their safety functions in the event of anticipated operational occurrences.

C. Documentation of a High-Quality Software Design Process

- The ITAAC should address the following planning documentation, with a requirement to demonstrate each of the management, implementation, and resource characteristics shown in BTP 7-14[3]:

  - Software management plan. The ITAAC should (1) verify that the software management plan addresses each of the management, implementation, and resource characteristics shown in BTP 7-14, and (2) specifically evaluate how the quality of the vendor effort should be assessed and found to be acceptable.

  - Software development plan. The ITAAC should verify that the software development plan addresses each of the management, implementation, and resource characteristics shown in BTP 7-14. In addition, the ITAAC should specifically verify that the plan clearly states (1) which tasks are part of each life cycle; (2) what the inputs and outputs of that life cycle should be; and (3) how the review, verification, and validation of those outputs are defined.

  - Software test plan. The ITAAC should verify that the software test plan addresses each of the management, implementation, and resource characteristics shown in BTP 7-14. In addition, the ITAAC should specifically verify (1) which tasks are part of each life cycle; (2) what the inputs and outputs of that life cycle should be; and (3) how the review, verification, and validation of those outputs were determined.

  - Software quality assurance plan. The ITAAC should verify that (1) the software quality assurance plan addresses each of the management, implementation, and resource characteristics shown in BTP 7-14, and (2) following this plan should result in high-quality software that should perform its intended safety function.

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[3]Refer to RG 1.206, Section C.I.7, Appendix 7C for additional discussion on conformance with IEEE Standard 7-4.3.2.

- Integration plan. The ITAAC should verify that the integration plan addresses each of the management, implementation, and resource characteristics shown in BTP 7-14. In addition, if some of the software is dedicated as commercial grade or reuses previously developed software, the ITAAC should specifically verify how that software should be integrated with newly developed software.

- Installation plan. The ITAAC should verify that the installation plan addresses each of the management, implementation, and resource characteristics shown in BTP 7-14.

- Maintenance plan. The ITAAC should verify that the maintenance plan addresses each of the management, implementation, and resource characteristics shown in BTP 7-14. In addition, the ITAAC should specifically verify how software maintenance should be performed after the system has been delivered, installed, and accepted.

- Training plan. The ITAAC should verify that the training plan addresses each of the management, implementation, and resource characteristics shown in BTP 7-14.

- Operations plan. The ITAAC should verify that the operations plan addresses each of the management, implementation, and resource characteristics shown in BTP 7-14. In addition, the ITAAC should specifically evaluate the system's operational security, verifying the existence of means to ensure no unauthorized changes to hardware, software, and system parameters, as well as monitoring to detect penetration (or attempted penetration) of the system.

- Software safety plan. The ITAAC should verify that the software safety plan addresses each of the management, implementation, and resource characteristics shown in BTP 7-14.

- Software verification and validation (V&V) plan. The ITAAC should verify that the software V&V plan addresses each of the management, implementation, and resource characteristics shown in BTP 7-14. In addition, the ITAAC should specifically verify the independence of the V&V organization in management, scheduling, and finance.

- Software configuration management (CM) plan. The ITAAC should verify that the software CM plan addresses each of the management, implementation, and resource characteristics shown in BTP 7-14. In addition, the ITAAC should specifically verify that the following items should be under the control of a software librarian or group who is responsible for archiving the various versions of the software: any software or software information that affects the safety software, such as software requirements, designs, and code; support software used in development; libraries of software components essential to safety; software plans that could affect quality; test software requirements, designs, or code used in testing; test results and analyses used to qualify software; software documentation; databases and software configuration data; pre-developed software items that are safety system software; software change documentation; and tools used in the software project for management, development, or assurance tasks.

The ITAAC should address the following implementation documents, with a requirement to demonstrate each of the management, implementation, and resource characteristics shown in BTP 7-14:

- Safety analyses
- Verification and validation analysis and test reports
- Configuration management reports
- Requirement traceability matrix

The ITAAC should verify that each of the implementation documents should document each of the following life-cycle phases:

- Requirements
- Design
- Implementation
- Integration
- Validation
- Installation
- Operations
- Maintenance

The ITAAC should address the following software life cycle process design output documents, with a requirement to demonstrate each of the characteristics shown in BTP 7-14:

- The ITAAC should verify the system test procedures and results (validation tests, site acceptance tests, pre-operational and startup tests) that provide assurance that the system functions as intended.

- The ITAAC should verify that the design output documents address each of the functional characteristics shown in BTP 7-14. In addition, the ITAAC should specifically verify that the defense-in-depth and diversity design conforms to the guidance of BTP 7-19, "Guidance for Evaluation of Defense-in-Depth and Diversity in Digital Computer-Based Instrumentation and Control Systems."

- The ITAAC should verify that the application conforms with the digital safety system security guidance provided in Revision 2 of Regulatory Guide 1.152, "Criteria for Use of Computers in Safety Systems of Nuclear Power Plants."

- The ITAAC should verify that the software requirements specifications address each of the functional characteristics shown in BTP 7-14, each individual requirement is traceable to a digital system requirement, and there are no added functions or requirements that are not traceable to the system requirements.

- The ITAAC should verify that the hardware and software architecture descriptions address each of the functional characteristics shown in BTP 7-14, and that the hardware and software architecture is clear, understandable, and sufficiently detailed to allow understanding of the operation of the hardware and software.

- The ITAAC should verify that the software design specifications address each of the functional characteristics shown in BTP 7-14.

- The ITAAC should verify that the code listings address each of the functional characteristics shown in BTP 7-14, and have sufficient comments and annotations to clearly show the developer's intent.

- The ITAAC should verify that the build documents address each of the functional characteristics shown in BTP 7-14.

- The ITAAC should verify that the installation configuration tables address each of the functional characteristics shown in BTP 7-14.

- The ITAAC should verify that the operations manuals address each of the functional characteristics shown in BTP 7-14.

- The ITAAC should verify that the maintenance manuals address each of the functional characteristics shown in BTP 7-14.

- The ITAAC should verify that the training manuals address each of the functional characteristics shown in BTP 7-14.

III. <u>Style Guidelines for ITAAC</u>

1. The wording in the first column of the ITAAC [Design Commitment (DC)] should be as close as possible to the DD or the design information in the COL application.

2. The second column of the ITAAC should always contain at least one of the three methods ("Inspection" or "Test" or "Analysis"), and may sometimes contain a combination of the three.

3. Standard pre-operational tests, defined in relevant sections of the COL application and Regulatory Guide 1.68, are not a substitute for ITAAC; however, the results of such tests can be used to satisfy an ITAAC.

4. If an ITAAC test is not normally performed as part of a pre-operational test, the test methodology should be described in the relevant section of the COL application. Appropriate sections of the application may also include any supporting design or analysis issues, as well as references to the ITAAC.

5. Use of the terms “Test” and “Type Test” in the second column should be consistent with the definitions provided in Section C.II.2.1.1 of this regulatory guide. Alternatively, testing may be classified as “Vendor,” “Manufacturer,” or “Shop,” to clarify the intended test type.

6. If the ITAAC requires an analysis, the ITAAC should identify the specific type of analysis and/or its results/outcome. The specific analysis or results/outcome necessary to support the ITAAC may also be discussed in the relevant sections of the COL application, which may reference the ITAAC as required.

7. The second column of the ITAAC should identify the component, division, or system to be verified by the inspection, test, and/or analysis.

8. Refer only to inspections, not “visual” inspections.

9. The third column of the ITAAC (Acceptance Criteria) should specify numerical values.

10. The ITAAC should be consistent in the use of present or future tense.

11. “Division” should be used instead of train, loop, or subsystem (unless it is a subsystem).

12. ITAAC should be written clearly to avoid the use of clarifying phrases.

13. The correct system name should be used consistently.

ELECTRICAL SYSTEMS REVIEW CHECKLIST

This section is intended to provide additional guidance for evaluating Tier 1 system design descriptions (DDs), figures, and ITAAC in the electrical area (for purposes of review responsibility the electrical area also includes the Lighting Systems). The following information should be included in Tier 1 information in a consistent order.

1. Design Descriptions and Figures

Electrical equipment that is involved in performing the direct safety function should be addressed in the Design Description (see Institute of Electrical and Electronics Engineers-308-1980 paragraph 5.2 for a discussion of direct safety function). This would basically include (in Tier 1) the complete Class 1E electric system - including power sources (which include offsite sources even though they are not Class 1E) and distribution equipment. With regard to the electrical equipment that is part of the Class 1E system but is included to improve the reliability of the individual Class 1E divisions (for example equipment protective trips), additional factors need to be considered. For example, if a failure or false actuation of a feature such as a protective device could prevent the safety function, and operating experience has shown problems related to this feature; then treatment in Tier 1 should probably be included. In addition, some fire protection analyses are based on the ability of breakers to clear fire caused faults. With respect to the non-Class 1E portions of the electrical system (powering the balance of plant (BOP) loads), a brief certified design description may be included. The DD for this portion should focus on the aspects, if any, needed to support the Class 1E portion. Therefore, based on the above, the following equipment should be treated in the DD:

A. Overall Class 1E electric distribution system. This would include any high level treatment for cables, breakers, disconnect switches, switchgear, metal enclosed bus, load centers, motor control centers, motor starters, relays, protective devices, distribution transformers, and connections/terminations.

B. Power sources including the following:

- Offsite, including feeds from the main generator (a generator breaker to allow backfeed should be addressed), main power transformers, unit auxiliary transformers (UATs), reserve auxiliary transformers (RATs), etc.

- DC system - batteries/battery chargers

- Emergency diesel generator (EDG), including load sequencing, and EDG support systems. Plant Systems Branch has lead responsibility for EDG support systems. (This may be included for passive designs also due to risk-significance.)

- Class 1E vital AC inverters, regulating transformers, transfer devices

- Alternate AC (AAC) power sources for Station Blackout (SBO)

C. Other Electrical Features including the following:

- Containment electrical penetrations
- Cable Ampacity and derating criteria
- Cable Tray Loading criteria.

D. Lightning protection. General configuration type check.

E. Grounding. Configuration type check.

For both lightning protection and grounding, it is expected that this should be part of a inspection to check that the features exist. No analyses to demonstrate adequacy need be in ITAAC.

F. Lighting - emergency control room, remote shutdown panel NOTE:It may be difficult to rationalize its inclusion based on "accomplishing a direct safety function." The basis has to be more defense-in-depth and operating experience and possibly PRA.

G. GDC 17 and 18 specified requirements. For example, GDC 17 requires that physically independent circuits be provided from the offsite to the Class 1E distribution system. Also GDC 17 requires provisions be included to minimize the probability of losing electric power from any of the remaining supplies as a result of or coincident with, the loss of power generated by the nuclear power unit, the loss of power from the transmission network, or the loss of power from the onsite electric power supplies. Here is a case where some design description and ITAAC or interface requirements are needed for a "non-Class 1E" area, because of its "importance to safety." GDC 18 requires electric power systems important to safety to be designed to permit appropriate periodic inspection and testing.

H. Other specific rules and regulations that are applicable to electric systems. For example, the Station Blackout Rule (10 CFR 50.63) is met by an Alternate AC source or a coping analysis, and the appropriate features should be in Tier 1. These are non-Class 1E aspects, but are "important to safety."

I. Regulatory Guides (RGs) which have specific recommendations (all of the RG recommendations may not need Tier 1 treatment). Here may be an area that Tier 1 treatment captures the design aspect addressed by the RG.

J. Operating experience problems of safety significance that have been identified - particularly through Electrical Distribution System Functional Inspections (EDSFIs), Generic Letters, circulars, Regulatory Issued Summaries, NRC Bulletins and in some cases Information Notices. For example, degraded voltages, breaker coordination, and short circuit protection have been highlighted.

K. Policy issues raised for the standard designs. For the electrical area this includes the AAC source for SBO, second offsite source to non-Class 1E buses, and direct offsite feed to Class 1E buses.

L. New features in the design (all of the new features may not need Tier 1 treatment). For example, on the advanced boiling-water reactor (ABWR) this includes the main generator breaker for back feed purposes; and the potential for harmonics introduced by new reactor internal pumps (RIPs), and main feed water (MFW) pump speed controllers and their potential effects on the Class 1E equipment.

M. PRA identified insights or key assumptions. In the electrical area this typically involves SBO which should already receive treatment in ITAAC because of the SBO rule (see above). As another example, in the case of CE it appears that their "split bus" arrangement is a <u>significant</u> or key assumption in their PRA and therefore in some cases it is important that within a Division a particular pump motor is on a particular bus. CE raised this to its ITAAC based on the PRA. NOTE: In some cases it may be possible to use PRA results to decide that some aspect does <u>not</u> need Tier 1 treatment, i.e. the PRA shows it is of little safety significance.

N. A severe accident feature has been added to the design. If there are such features it may turn out that an electrical support aspect may need an ITAAC.

O. Resolution of Generic Safety Issues (GSIs) have identified solutions that have resulted in design/operational features. For example, the resolution of GI-48/49 (as part of GI-128) identified treatment of "tie breakers." The figure showing the Class 1E distribution system should show this feature if it exists. Then any special features to deal with this feature should be covered.

P. Post TMI requirements - e.g., power to power operated relief valve (PORV) block valve, Pressurizer heaters, etc.

2. <u>ITAAC ENTRIES (for the above equipment)</u>

The standard ITAAC entries for electrical systems in Appendix D to this SRP section should be used to the extent possible. Normally, all design commitments in Tier 1 should be verified by a specific ITAAC entry, unless there are specific reasons why this is not necessary.

A. <u>Basic Configuration ITAAC (See also Appendix D)</u>. General functional arrangement - this is captured in the basic configuration standard ITAAC, but the level of detail is determined by the design description and what is shown on any figure(s).

Qualification of components - qualification of SSCs for seismic and harsh environment is covered by the basic configuration ITAAC. Tier 1 should only deal with electrical equipment in harsh environments. Electrical equipment in a "mild" environment should be treated in Tier 2 only. An exception is made for I&C state-of-the-art digital equipment in "other than harsh" environment, which I&C ITAAC should cover. Since there is some of this type equipment which may be utilized in the electrical distribution systems, the I&C ITAAC should cover this potential. The basis for this exception is that recent I&C equipment in "mild" environments has some operating experience that shows sensitivity particularly to temperature, and new digital equipment may have even more sensitivity.

B. <u>Independence</u>. include separation, interties (if any), identification (e.g., color coding), location, non-Class 1E loads on 1E buses. This may be covered by the divisional power supply and physical separation standard ITAAC in Appendix D to this SRP section.

C. <u>Capacity and Capability</u>. Sizing of sources and distribution equipment,

<u>Loading</u> - analyses to demonstrate that the equipment has adequate capacity to support accomplishment of a safety function. Tier 2 should discuss the analyses. Testing should be included to demonstrate the EDG capacity and capability. These can be based on the Technical Specifications.

(NOTE: Margin - in some cases regulatory guidance specifies the need for margin in capacity to allow for future load growth. If it is only for future load growth, ITAAC does not need to check for the additional margin.)

<u>Voltage</u> - analyses to demonstrate the acceptability of voltage drop and verify its adequacy to support the accomplishment of a direct safety function. Tier 2 would include the discussion of how the voltage analyses should be performed, i.e., reference to industry standards or company practice as appropriate. Testing should show the EDG voltage and frequency response. This is the same as Technical Specifications.

D. <u>Equipment Protective Features</u>. Inclusion should be based on the potential for preventing safety functions and the operating experience.

- Equipment short circuit capability and breaker coordination should be included by specifying ITAAC for analyses. The description of the analyses should be in Tier 2.

- Similarly, diesel generator protective trips (and bypasses if applicable) should be considered. A bypass example might be LOCA signals which bypass EDG trips, however specifying that in the DD and ITAAC would probably lock a design into this approach and there is the alternative approach of providing coincidence for the trips. The information in Tier 1 should be written to allow for options which can then be described in Tier 2.

- If the fire analyses rely on fire caused faults to be cleared, this may need to be treated in the DD and ITAAC. It may be covered by the breaker coordination (see above).

E. <u>Sensing Instrumentation and Logic</u> . e.g., detection of undervoltage and start and sequential loading the EDG. This is a direct safety function in response to design basis event of loss of power. Problems with relay settings should be considered in this requirement.

F. <u>Controls, Displays, and Alarms</u>. Check DCD Tier 2/FSER Chapter 18 on the minimum inventory for emergency operating procedures (EOPs), ERGs, etc.

G. Test Features. Limited to cases were special online test features have been specifically included (maybe for a special new design feature)

H. Connection of Non-1E Loads on 1E Buses. Because of the potential degradation of the Class 1E sources this is part of the independence review.

I. Location of Equipment. Important for some equipment in relation to its environment.

The following information should be included in the building design descriptions (DD) in a consistent order.

I. Building Structures

1. An ITAAC item for each building should verify the structural capability of the building to withstand design basis loads. A structural analysis should be performed to reconcile the as-built data with the structural design basis. The acceptance criteria should be the existence of a structural analysis report which concludes that the as-built building is able to withstand the structural design basis loads.

   The DCD Tier 2 should describe the details of the scope and contents of the structural analysis report and the need for reconciliation of construction deviations and design changes with the building dynamic response and its structural adequacy.

2. Do not use the ASME Code N-stamp as an acceptance criterion. Rather, verify the existence of ASME Code-required design documents (e.g., design specifications or design reports) that are prepared by the COL licensee.

3. The turbine building DD may not need structural drawings (the DCD Tier 2 does not contain turbine building drawings) because it is non-safety related. For the boiling water reactors (ABWR and SBWR) that use the main steam line and condenser as an alternate leakage path for fission products, the DCD Tier 2 should include a description of the need for the turbine building to withstand a UBC Zone 3 level earthquake, and the turbine building should not use a dual-system or a concentric system design.

4. The building DD should specify the embedment depth (from the top of the foundation to the finished grade), and an ITAAC should verify it.

5. Design descriptions for building structures should provide enough dimensions for the COL applicant or licensee to develop dynamic models for the seismic analyses. Examples of these dimensions include overall building dimensions, thickness of walls and floor slabs, thickness of foundation mat, etc.

6. Code boundary primary containment should be defined.

II. Protection Against Hazards

1. Internal flooding - features such as divisional walls, fire doors, watertight doors, and penetrations should be included in the DDs and ITAAC.

2. External flooding - features such as thickness of walls and protection features for penetrations below the flood level should be included in the DD and ITAAC. The waterproof coating of the exterior walls should not be included because the wall thickness is being relied upon to prevent in-leakage. Also, site parameters should be specified in the DCD.

3. <u>Fire barriers</u> - the fire rating of divisional walls, floors, doors, and penetrations should be included in the DD and ITAAC. Fire detection and suppression should be addressed in the fire protection ITAAC.

4. <u>External events (tornados, wind, rain and snow)</u> - these loads should be addressed in the structural analysis described in I.1.

5. <u>Internal events (fires, floods, pipe breaks, and missiles)</u> - these loads should be addressed in the structural analysis described in I.1.

6. For a discussion of site parameters, see SRP Section 14.3.1.

EMERGENCY PLANNING REVIEW CHECKLIST

A generic set of acceptable emergency planning (EP) ITAAC was developed through coordination efforts between the NRC and the Nuclear Energy Institute (NEI). This coordination effort resulted in the development of generic EP-ITAAC that are provided in a table in subsection 14.3.10. The combined license applicant should consider this set of EP-ITAAC in the development of their application-specific EP-ITAAC that is tailored to the specific reactor design and emergency planning program requirements for their proposed plant site. A smaller set of EP-ITAAC is acceptable if the application contains information that fully addresses emergency preparedness requirements associated with any of the generic ITAAC contained in the in subsection 14.3.10 table. The table is not all-inclusive, or exclusive of other ITAAC an applicant may propose. Additional plant-specific EP-ITAAC (i.e., beyond those listed in the table) may be proposed, and they should be examined to determine their acceptability on an applicant-specific basis.

PHYSICAL SECURITY HARDWARE REVIEW CHECKLIST

A generic set of acceptable physical security (PS) hardware ITAAC is provided in a table in subsection 14.3.12. This effort was coordinated between the NRC and the Nuclear Energy Institute (NEI) New Plant Security Task Force. The results of this effort are intended to provide acceptable examples of generic PS-ITAAC for security design features that are included in a certified design and those that are site-specific. The combined license applicant should consider this generic set of PS-ITAAC in the development of their application-specific PS-ITAAC that is tailored to the specific reactor design and security program requirements for their proposed plant site.

APPENDIX D

ITAAC ENTRIES - EXAMPLES

Design Description	Inspections, Tests, Analyses	Acceptance Criteria
	CONFIGURATION ITAAC	
1. The functional arrangement of the ____ __System is as described in the Design Description of this Section ___ and/or as shown on Figure ___. (If a figure is not used, reference the Section number.)	1. Inspections of the as-built system will be performed.	1. The as-built ______ System conforms with the functional arrangement as described in the Design Description of this Section ___ and/or as shown in Figure __ .
	HYDROSTATIC TEST	
2. The ASME Code components of the __ __ System retain their pressure boundary integrity under internal pressures that will be experienced during service.	2. A hydrostatic test will be conducted on those code components of the _____ System required to be hydrostatically tested by the ASME code.(Note 1) (Note 1: Modify to call out pressure test for pneumatic/gas and oil systems, if that is what is proposed; or, pressure test can be used for all entries since the code will determine the testing fluid.)	2. The results of the hydrostatic test of the ASME Code components of the ____ System conform with the requirements in the ASME Code, Section III.(Note 1)

Design Description	Inspections, Tests, Analyses	Acceptance Criteria
	NET POSITIVE SUCTION HEAD	
3a. The _____________ pumps have sufficient NPSH. 3b. The ________ storage tank/pool has sufficient capacity. * These items in the list at right require system-unique modification.	3. Inspections, tests, and analyses will be performed based upon the as-built system. The analysis will consider the effects of: - pressure losses for pump inlet piping and components, *- suction from the suppression pool with water level at the minimum value, *- 50% blockage of pump suction strainers, *- design basis fluid temperature(100°C), *- containment at atmospheric pressure *- vendor test results of required NPSH.	3a. The available NPSH exceeds the NPSH required. 3b. The ________ storage tank/pool capacities exceed the minimum required volumes of __ _ gallons (____ liters).
	DIVISIONAL POWER SUPPLY	
4. Each of the ___ System divisions (or Class 1E loads) is powered from their respective Class 1E Division as shown on Figures ___.	4. Tests will be performed on the ____ System by providing a test signal in only one Class 1E Division at a time.	4. The test signal exists only in the Class 1E Division (or at the equipment powered from the Class 1E division) under test in the ____ System.
	PHYSICAL SEPARATION	
5. Each mechanical division of the ____ System (Divisions A, B, C)* is physically separated from the other divisions. *As appropriate for each system.	5. Inspections of the as-built ____ System will be performed.	5. Each mechanical division of the _____ System is physically separated from other mechanical divisions of the _____ system by structural and/or fire barriers (with the exception of _____).

Design Description	Inspections, Tests, Analyses	Acceptance Criteria
	CONTROL ROOM CONFIGURATION	
6. Control Room alarms, displays, and/or controls* provided for the _____ System are defined in Section ____.	6. Inspections will be performed on the Control Room alarms, displays, and/or controls* for the _____ System. *Delete any category for which no entries are included in the Design Description.	6. Alarms, displays, and/or controls* exist or can be retrieved in the Control Room as defined in Section ____.
	REMOTE SHUTDOWN SYSTEM	
7. Remote Shutdown System (RSS) displays and/or controls provided for the _ ___ System are defined in Section ____.	7. Inspections will be performed on the RSS displays and/or controls for the ____ System.	7. Displays and/or controls exist on the RSS as defined in Section ____.
	MOTOR OPERATED VALVES	
8. Motor-operated valves (MOVs) designated in Section ___ as having an active safety-related function open, close, or both open and also close under differential pressure, fluid flow, and temperature conditions.	8. Tests of installed valves will be performed for opening, closing, or both opening and also closing under system preoperational differential pressure, fluid flow, and temperature conditions.	8. Upon receipt of the actuating signal, each MOV opens, closes, or both opens and also closes, depending upon the valve's safety function.

Design Description	Inspections, Tests, Analyses	Acceptance Criteria
	PNEUMATICALLY OPERATED VALVES	
9. The pneumatically operated _____ valve(s) shown in Figure ______ closes (opens) if either electric power to the valve actuating solenoid is lost, or pneumatic pressure to the valve(s) is lost.	9. Tests will be conducted on the as-built _______ valve(s).	9. The pneumatically operated ______ valve(s) shown in Figure ______ closes (opens) when either electric power to the valve actuating solenoid is lost, or pneumatic pressure to the valve(s) is lost.
	CHECK VALVES	
10. Check valves designated in Section __ as having an active safety-related function open, close, or both open and also close under system pressure, fluid flow, and temperature conditions.	10. Tests of installed valves for opening, closing, or both opening and also closing, will be conducted under system preoperational pressure, fluid flow, and temperature conditions.	10. Based on the direction of the differential pressure across the valve, each CV opens, closes, or both opens and also closes, depending upon the valve's safety functions.
	INDEPENDENCE FOR ELECTRICAL AND I&C SYSTEMS	
11. In the ____ System, independence is provided between Class 1E Divisions, and between Class 1E Divisions and non-Class 1E equipment.	11.1. Tests will be performed on the ___ System by providing a test signal in only one Class 1E Division at a time. 11.2. Inspection of the as-installed Class 1E Divisions in the ____ System will be performed.	11.1. The test signal exists only in the Class 1E Division under test in the ____ System. 11.2. In the ____ System, physical separation or electrical isolation exists between these Class 1E Divisions. Physical separation or electrical isolation exists between Class 1E Divisions and non-Class 1E equipment.