December 21, 1995

MEMORANDUM TO: Those on Attached List

FROM: Theodore R. Quay, Director
Standardization Project Directorate
Division of Reactor Program Management

Original signed by

SUBJECT: REVIEW OF THE STANDARD REVIEW PLAN FOR ITAAC

Attachment 1 to this memorandum contains a draft standard review plan (SRP) for the Tier 1 Certified Design Material (CDM) and Inspections, Tests, Analyses, and Acceptance Criteria (ITAAC) for design certification reviews under 10 CFR Part 52. This SRP is in response to the Commission's guidance in the SRM related to SECY-90-377, "Requirements for Design Certification Under 10 CFR Part 52," and is being developed as part of the SRP Update Program. Please provide your comments on the attachment by January 24, 1996.

The SRP will be used in the reviews of the CDM/ITAAC for the passive designs. It documents the lessons learned in the ITAAC reviews for the GE ABWR and the ABB-CE System 80+ evolutionary designs. It was derived primarily from the final safety evaluation reports for these designs and the draft ITAAC review guidance used during the reviews. Attachment 2 contains industry comments on the draft review checklists in SRP Appendix D that should be considered as part of your review of the SRP. Comments and recommendations from those people who were involved in the evolutionary ITAAC reviews are strongly desired, especially ITAAC team leaders.

The TAC number for the review of the SRP is M91844, "ABWR-ITAAC SRP/REG GUIDE DEVELOPMENT." Specific questions on the SRP should be directed to Tom Boyce at 415-1130 or THB on E-mail.

Attachments:
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NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

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Attachments:
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x 24-1, pt. 52 Design Certification

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U.S. NUCLEAR REGULATORY COMMISSION

# STANDARD REVIEW PLAN

OFFICE OF NUCLEAR REACTOR REGULATION

## 14.3 CERTIFIED DESIGN MATERIAL AND ITAAC REVIEW GUIDANCE

REVIEW RESPONSIBILITIES

Primary - See the review responsibilities for the subsections to this SRP section listed below.

Secondary - PSGB, SPSB, SCSB (See discussion of responsibilities below).

This SRP section provides general guidance that is applicable to all branches for review of certified design material (CDM) for standard designs under 10 CFR Part 52, including inspections, tests, analyses, and acceptance criteria (ITAAC). The SRP subsections listed below contain branch-specific guidance for standard design certification reviews under Part 52.

| | | |
|---|---|---|
| 14.3.1 | Site Parameters | ECGB |
| 14.3.2 | Structural and Systems Engineering | ECGB |
| 14.3.3 | Piping Systems and Components | ECGB |
| 14.3.4 | Reactor Systems | SRXB |
| 14.3.5 | Instrumentation and Controls | HICB |
| 14.3.6 | Electrical Systems | EELB |
| 14.3.7 | Plant systems | SPLB |
| 14.3.8 | Radiation Protection and Emergency Preparedness | PERB |
| 14.3.9 | Human Factors | HHFB |
| 14.3.10 | Initial Test Program and D-RAP | HQMB |

Appendix A Review Branch Assignments
Appendix B Format of a Design Control Document (DCD)
Appendix C Format of the CDM/ITAAC
Appendix D Review Checklists
Appendix E Standard ITAAC Entries
Appendix F Selected Review Issues
Appendix G Design Acceptance Criteria (DAC)
Appendix H Scope of the Design and Interface Requirements

## I. AREAS OF REVIEW

Each branch reviews the CDM and the supporting information in Section 14.3 of the standard safety analysis report (SSAR) submitted by the applicant. The CDM information includes ITAAC for the structures, systems, and components of the design; information applicable to multiple systems; site parameters; and interface criteria for the design. Definitions, legends, and general provisions in the CDM are also reviewed.

### Review Interfaces

All information in the CDM is reviewed by one or more branches as shown in Appendix A. The primary review branches are responsible for the safety evaluation in the functional areas shown above, and the secondary review branches supply input to the primary review branches. Additional secondary review branches are listed in the subsections to this SRP section.

Applicants may provide CDM that is based on the systems of the design rather than on the review branch-oriented format of the SSAR and SRP, thereby creating overlapping NRC review responsibilities. For example, the reactor core isolation cooling system is reviewed primarily by the Reactor Systems branch, and that branch receives technical input and comments from the Instrumentation and Controls branch.

Also, some branches have review responsibilities across many systems. For example, consistent treatment of alarms, displays, and controls is the responsibility of the Human Factors Branch, and functionality of safety-significant motor operated valves (MOVs) is the responsibility of the Structural and Geosciences Branch. The review process may be facilitated using task groups comprised of reviewers from several branches, as was done for the reviews of evolutionary standard designs.

### Secondary Review Branch Responsibilities

PSGB: Reviews the CDM to ensure appropriate treatment of security issues. Reviewers should use the guidance in SRP Chapter 13 related to security issues to determine the appropriate top-level design features for treatment in the CDM, and provide inputs to the responsible review branches. Programmatic and site-specific aspects of security are considered as part of a combined license application.

SPSB: Reviews the CDM to ensure appropriate treatment of important insights and assumptions from the probabilistic risk assessment (PRA). Reviewers should use the guidance in the SRP sections related to PRA issues to determine the appropriate top-level design features for treatment in the CDM, and provide inputs to the responsible review branches. Important integrated plant safety analyses from the SSAR should be considered, such as fires and flooding, as well as shutdown risk and severe accident analyses. Applicants should document in the SSAR how important insights from the PRA analyses where incorporated in the standard design, including the CDM, technical specifications, initial test program, reliability assurance activities, emergency procedure guidelines, and COL Action Items. Guidance for documentation of the PRA review in the DCD is contained in Appendix B to this SRP. PRA analyses regarding site-specific aspects of the design are considered as part of a combined license application.

SCSB: Reviews the CDM to ensure appropriate treatment of severe accident design features and containment design features. Reviewers should use the guidance in the SRP sections related to severe accident issues to determine the appropriate top-level design features for treatment in the CDM, and provide inputs to the responsible review branches. Applicants should document in the SSAR how important insights from the severe accident analyses where incorporated in the standard design, including the CDM.

INTRODUCTION - Standard Design Certifications

The requirements for design certification applicants to submit material are contained in 10 CFR 52.47, and the requirements for combined license applicants are contained in Subpart C to Part 52.

Following review and final design approval (FDA) by the NRC staff, standardized reactor designs are certified in rules issued as appendices to 10 CFR Part 52. Each appendix incorporates by reference a DCD that contains the design certification information for the respective design. An applicant for design certification is required to submit a DCD to the staff for review and approval. A combined license applicant or licensee referencing a standard design must comply with both the rule certifying the design and the DCD. The DCD includes the Tier 1 information that is certified by the rule and the Tier 2 information that is approved by the rule. Guidance on the format and content of the DCD is contained in Appendix B of this SRP section.

The Tier 1 portion of the DCD is referred to as the CDM, and is derived from the Tier 2 information. The CDM consists of an introduction; definitions, legends, and general provisions; design descriptions and ITAAC; interface requirements; and site parameters for the design. The purpose of the ITAAC is to verify that a facility that references the design certification has been built and will operate in accordance with the design certification and applicable regulations. Guidance on the format and content of the CDM/ITAAC is contained in Appendix C of this SRP section.

The Tier 2 information generally consists of the SSAR for the design, with deletion of selected information such as proprietary information for the purposes of rule preparation. Section 14.3 of the SSAR provides the bases and methods that were used to develop the information for the CDM.

The DCD will be effective for the life of a facility that references a standard design certification. 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 describe in the rule certifying the standard design. Generally, Tier 2 information can be changed by a combined license applicant or licensee via a "50.59-like" process, provided the change does not impact the CDM (Tier 1). However, the CDM is difficult to change after the design certification rule is issued because changes then require a finding by the NRC that the change is needed to assure adequate protection of the public health and safety. The net effect is to provide a very high threshold for change to the CDM by either the NRC or others once the rule is issued.

## II. ACCEPTANCE CRITERIA

In general, acceptability of the CDM is based on meeting the relevant requirements of the following regulations. Additional acceptance criteria are provided in the "Acceptance Criteria" subsections of the SRP sections listed in the introductory section above.

1. 10 CFR Part 52, §52.47(a)(1)(iii) and (vi-viii) as they relate to the contents of design certification applications. The information includes site parameters, interface criteria, and the ITAAC which are necessary and sufficient to provide reasonable assurance that a plant which references a certified design is built and will operate in accordance with the design certification.

2. 10 CFR Part 52, §52.97(b) as it relates to the identification of ITAAC within a combined license. An applicant or licensee must identify and perform those ITAAC, including those applicable to emergency planning, that are necessary and sufficient to provide reasonable assurance that the facility has been constructed and will be operated in conformity with the license, the provisions of the Atomic Energy Act, and the Commission's rules and regulations.

The evolutionary standard designs established the precedent for the information in the DCD and the CDM, including the ITAAC. The staff received Commission guidance on several key issues associated with the design certification reviews in the staff requirements memorandum (SRM) dated February 15, 1991, relating to SECY-90-377, "Requirements for Design Certification Under 10 CFR Part 52." These issues included the development of regulatory guidance, the role of ITAAC, the level of design detail needed for design certification, issue finality, the two-tiered approach to the design certification rule structure, and flexibility in the design change process. In general, the level of design detail in the CDM and the verification of the key design features and performance characteristics should be commensurate with the safety significance of the functions to be performed. The information in this SRP section is consistent with the guidance in that SRM and 10 CFR Part 52.

Technical Rationale: The technical rationale for application of the above acceptance criteria to the CDM, including the ITAAC, is discussed in the following paragraphs.

1. Compliance with 10 CFR Part 52, §52.47(a)(1)(iii) and (vi-viii) requires applicants for design certification to include proposed site parameters, interface criteria, and inspections, tests, analyses and acceptance criteria for the design. The design is reviewed and approved by the staff during design certification, and prior to application for construction and operation of a facility. However, upon completion of construction, an as-built facility must be verified to be in accordance with the approved design and applicable regulations. Therefore, application of 10 CFR 52.47 to the CDM ensures that the applicant for design certification submits information necessary and sufficient to provide reasonable assurance that a facility which references a certified design is built and will operate in accordance with the design certification.

2. Compliance with 10 CFR Part 52, §52.97(b) requires applicants for a combined license to include site-specific information and proposed ITAAC for the design, construction and operation of a complete facility. The information required is reviewed and approved by the staff prior to the issuance of a combined license and the start of facility construction. However, upon completion of construction, an as-built facility must be verified to be in accordance with the approved design and applicable regulations. Therefore, application of §52.97(b) to the information in a combined license application ensures that the applicant for a combined license submits ITAAC, including those applicable to emergency planning, that are necessary and sufficient to provide reasonable assurance that the facility has been constructed and will be operated in conformity with the license, the provisions of the Atomic Energy Act, and the Commission's rules and regulations.

## III. REVIEW PROCEDURES

Preparation: Preparation for the review of the applicant's CDM should include the following:

1. Review of the applicable chapters or sections of the SSAR, for the purpose of familiarization with the facility design in the appropriate review discipline and the nomenclature that is applied to structures, systems and components (SSCs) within the facility.

2. Review of the SRP sections applicable to the area of review, applicable rules and regulations, general design criteria (GDC), 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, for the purpose of determining the safety significance of SSCs in the CDM.

3. Review of the CDM in the DCDs for other standard designs certifications, for familiarity with treatment of SSCs, various issues, and the appropriate level of detail in the CDM. Also, a review of 10 CFR Part 52 and its Appendixes, for the purpose of familiarization with the licensing process for early site permits, standard design certifications, and combined licenses.

4. Review of the initial test program in Chapter 14.2 of the SSAR for the purpose of familiarization with the applicant's preoperational and power ascension test programs, since many of the tests and SSC's tested in the pre-operational test program can be used to satisfy an ITAAC.

5. Review of the facility technical specifications (TS) in Chapter 16 of the SSAR for familiarity with the TS bases and limiting conditions of operations for the SSCs of the facility.

6. Review of key safety analyses in the applicable sections of the SSAR, including Chapters 6 and 15. These analyses may include flooding analyses, overpressure protection, containment analyses, core cooling analyses, fire protection, transient analyses, ATWS, steam generator tube rupture, radiological analyses, Unresolved Safety Issues and Generic Safety Issues (USIs/GSIs) and TMI items, PRA, severe accident

analyses, or other analyses as specified by the staff. Review of Section 14.3 of the SSAR of cross references showing where key parameters from these analyses are addressed in the CDM.

7. Review of PRA, shutdown risk, and severe accident analyses in the SSAR for familiarity with the risk significance of SSCs. Review of cross references in the applicable SSAR sections of key insights and assumptions from these analyses to the CDM.

8. Review of USI/GSIs and TMI items, NRC generic communications, and operating experience discussed in the SSAR that are applicable to the design, for the purpose of familiarity with how these issues were resolved on a design-specific basis and their safety significance.

9. Review SSAR Section 14.3 describing the development of the CDM, and review Appendixes B and C of this SRP Section describing the format of the DCD and CDM/ITAAC.

General Review Guidance

1. *Evaluation Report* - The reviewer should provide an evaluation of the CDM in a separate section of the safety evaluation report (SER) for his review area. However, safety determinations for the design should be based on the information in the SSAR, and should not be based on the CDM. This is because the information in the CDM, including the ITAAC, is derived from the detailed information contained in the SSAR. Consequently, any design information presented in the CDM should also be contained in the appropriate sections of the SSAR. Further, the purpose of the ITAAC is to verify that a facility that references the design certification has been built and will operate in accordance with the design certification and the applicable regulations.

2. *Overall Review Approach* - The review consists of ensuring that the top-level information in the SSAR is appropriately treated in the CDM. The type of information and the level of detail in the CDM should be based on a graded approach commensurate with its safety significance for the design. The top-level information selected should contain the principal performance characteristics and safety functions of the SSCs of the facility. This information should be appropriately verified by the ITAAC. Also, design-specific and unique features of the facility should be carefully considered for treatment in the CDM.

3. *Finality of the Review* - Reviewers should keep in mind that although the reactor designers propose the DCD, CDM, and ITAAC during design certification reviews, it is the combined license applicant or licensee who must perform the ITAAC and live with the DCD for the lifetime of a facility. The CDM, including the ITAAC, is difficult to change after the design certification rule is issued because changes then require a finding by the NRC that the change is needed to assure adequate protection of the public health and safety, a very high threshold for change by either the NRC or others. Also, reviewers must realize that the information within the scope of the standard design is considered "resolved" or "final", meaning that it is not subject to further NRC staff approval as part of a combined license application or as part of ITAAC verification. Furthermore, the staff must be able to inspect a

facility to ensure that the ITAAC are performed adequately and that the acceptance criteria have been met. Therefore, both the applicant and the review branches need to ensure that the DCD, in both tiers of information, reflects the requirements for the design accurately and precisely. This avoids unintended confusion and unnecessary changes to the CDM during combined license applications, ITAAC verification, and during the lifetime of a facility. Reviewers are responsible for ensuring that the information in the SSAR, including any amendments, is accurate and consistent with the information in the CDM. Significant coordination with the project manager and other branches should be anticipated.

4. *Implementation of 10 CFR Part 52 Issues* - Reviewers should recognize that they are responsible for implementing many issues treated uniquely for reviews of standard designs under 10 CFR Part 52. Guidance for these issues is provided in the appendices to this SRP section. These issues include the format of the DCD, CDM/ITAAC, and SSAR, the treatment of proprietary and safeguards information, PRA and severe accident information, conceptual design information, Combined License Action Items, severe accident design alternatives, secondary references, technical specifications, design acceptance criteria (DAC), scope of the design and interface requirements, site parameters, requests for additional information (RAIs), USIs/GSIs, and TMI items.

5. *Use of Review Guidance* - The staff developed various items for use in the reviews of the CDM, and incorporated lessons learned from multiple interactions with reactor designers, industry groups, senior NRC managers, OGC and the Commission during the course of the evolutionary standard design reviews into this SRP section. Review checklists for various CDM systems of a design are contained in Appendix D to this SRP section. The applicability of the issues identified in the checklist to the systems is based on the safety significance of the specific SSCs. Standard ITAAC entries that may be used to verify selected issues in the appropriate systems of the design are contained in Appendix E. Examples of these standard ITAAC entries are those for the basic configuration of systems, verification of control room and remote shutdown features, and electrical independence.

6. *Level of Detail in the CDM* - The applicant for design certification should provide the methodology and selection criteria for information in the CDM in SSAR Section 14.3. SSAR Section 14.3 is discussed in more detail in Appendix C to this SRP section, regarding the format of the CDM/ITAAC. Essentially, the applicant should put the top-level design features and performance standards that were most significant to safety in the CDM. Thus, the level of detail in the CDM should be governed by a graded approach to the SSCs of the design, based on the safety significance of the functions they perform.

   The scope of the certified standard design is defined by the information in the DCD, and in particular the CDM. Therefore, each branch should ensure that all appropriate systems that are either fully or partially within the scope of the standard design certification are addressed in the CDM, at the appropriate level of detail based on the safety significance of the SSCs. For example, safety-related SSCs should be in described in the CDM with a significant amount of information. Other

SSCs should also be included based on their importance to safety. Non-safety aspects of SSCs need not be discussed in the CDM. This graded approach recognizes that although many aspects of the design are important to safety, the level of design detail in the CDM and verification of the key design features and performance characteristics should be commensurate with the significance of the safety functions to be performed.

In some cases, the scope of the standard design requires that additional material be included in the CDM and SSAR beyond that required from reactor designers for facilities licensed under 10 CFR Part 50. In particular, supporting information for the ITAAC; certain aspects of power generation and support equipment; and aspects of facility structures, equipment and programs should be included in the SSAR. Examples of this information include the detailed analysis or testing methodology required to demonstrate that the acceptance criteria for various ITAAC have been met, amplifying information for diesel generators, form and content of welding records, requirements for piping design stress and as-built reconciliation reports, and details of building design and construction reports.

7. *Determination of Safety Significance* - Multiple sources of information should be utilized to determine the safety significance of SSCs in the CDM. Sources of NRC information includes the SRP, applicable rules and regulations, general design criteria (GDC), regulatory guides (Rgs), unresolved safety issues (USIs) and generic safety issues (GSIs) in NUREG-0933, NRC generic correspondence, industry operating experience, NRC inspection programs, and any additional regulatory guidance from the Commission. Sources of information in the design certification application include whether or not the information pertains to safety-related SSCs, the importance in the technical specifications, treatment in the initial test program, integrated plant safety analyses, insights from probabilistic risk assessment (PRA), and severe accident analyses.

8. *Applicable Regulations* - The staff may seek guidance from the Commission for selected issues applicable to a standard design, including staff positions that deviate from or are not embodied in current regulations. The resolutions and requirements that result from such issues should be addressed where appropriate in the CDM, based on the safety significance of the issue. Examples of these issues are contained in the Commission guidance related to SECY-90-016, "Evolutionary Light Water Reactor Design Certification Issues and Their Relationship to Current Regulatory Requirements," as modified by the Commission's guidance related to SECY-93-087, "Policy, Technical, and Licensing Issues Pertaining to Evolutionary and Advanced Light-Water Reactor Designs," dated April 2, 1993. The Commission's staff requirements memorandum (SRM) related to this SECY is dated July 21, 1993. Also, SECY-95-132, "Policy and Technical Issues Associated With the Regulatory Treatment of Non-Safety Systems (RTNSS) in Passive Plant Designs (SECY-94-084)", dated May 22, 1995. The staff should clearly state in its SER where this Commission guidance was used as the basis for its safety determinations, and the applicable regulation that the design must meet. These applicable regulations are included as "applicable regulations" in the design certification rule for the design.

9. *Design Acceptance Criteria (DAC)* - For some areas of the design, design and engineering information may not be provided by applicants at a level of detail customarily reviewed by the staff in making a final safety determination. These areas could include areas of rapidly changing technology, such as control room and remote shutdown system design (human factors), and advanced instrumentation and controls; or they could be areas that are dependent on as-built or as-procured information, such as piping design and radiation shielding, ventilation, and airborne monitoring design. For these areas, applicants should provide the design processes and related design acceptance criteria (DAC) that will be used to complete the design. The DAC are discussed in more detail in Appendix G to this SRP section.

10. *Tier 2* Information* - 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 requires a significant amount of information to describe and 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, must be documented in the SER. The designation of Tier 2* information in the SSAR is discussed in more detail in Appendix B to this SRP section.

11. *Cross-references for Safety Analyses* - Applicants may utilize a system-based structure for the CDM which is different than the structure of the SSAR. Consequently, developing the CDM for any one system must be based on a review of the multiple SSAR chapters having technical information related to that system. Applicants should ensure that key safety and integrated plant safety analyses parameters in the SSAR are adequately considered in the CDM and DCD, and provide cross-references documenting this to the staff. These analyses include flooding analyses, overpressure protection, containment analyses, core cooling analyses, fire protection, transient analyses, anticipated transient without scram (ATWS), steam generator tube rupture, radiological analyses, USI/GSIs and TMI items, PRA, severe accident analyses, or other analyses as specified by the staff. A COL applicant or licensee proposing to change design information in the SSAR that pertained to these analyses via the "50.59-like" change process should use these cross-references when considering whether the proposed change impacts the treatment of these parameters in the CDM. This is discussed further in Appendix B to this SRP section, regarding the format of the DCD.

12. *Relationship of the CDM/ITAAC to Other Facility Programs* - The DCD is referenced in a combined license. The Tier 1 portion of the DCD is

termed the CDM, and includes the ITAAC. The Design Descriptions in the CDM serve as commitments for the lifetime of a facility. The Design Descriptions remain in effect to assure that the plant does not deviate from the certified design throughout the plant life. The ITAAC must be demonstrated to have been successfully performed prior to fuel loading, but are not intended to be demonstrated subsequently. A COL applicant or licensee may change the information in the SSAR in accordance with the "50.59-like" change process described in the rule certifying the design, provided that the change does not impact the information in the CDM.

Prior to fuel load, the licensee is required to perform the required inspections, tests, and analyses for the design, and certify to the NRC that the acceptance criteria have been met. The NRC inspects to verify successful performance of the ITAAC. In some cases, ITAAC can be satisfied using the results of various facility programs, such as the pre-operational test program or the quality assurance program required by 10 CFR 50, Appendix B. However, these programs are not a substitute for requiring an ITAAC in the CDM.

Although the key aspects of the design are described in the CDM, not all can be verified by the ITAAC 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 will be similar to their treatment at facilities licensed under 10 CFR Part 50, in that verification of the satisfactory completion of these requirements will be a condition of the license.

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 will 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 testing.

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.

13. *Regulations, Codes and Standards* - The use of codes and standards in the CDM 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 the CDM, 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 the SSAR, rather than Tier 1. This provides for specific requirements that are acceptable, yet allows the code to be updated via the "50.59-like" process, provided the change does not impact the CDM or create an unreviewed safety question. It is important to note that, due to the provisions of 10 CFR 52.63, changes to the codes and standards in 10 CFR 50.55a would not affect the certified design.

The above considerations provide an overall framework for the development of the CDM and the staff's review. However, because of the difficulty in specifying the exact information necessary to verify the key performance and safety aspects of an as-built nuclear power facility, considerable engineering judgement is inherent in the approval of the final material for the CDM.

General Review Procedures

1. Perform the preparatory steps listed above, and become familiar with the general review guidance.

2. Use the list of review branch responsibilities in Appendix A to this SRP section to determine the SSCs to be reviewed for the standard design.

3. Review the CDM for the evolutionary design most similar to the current design, for the purpose of using similar approach, format and language.

4. Use the subsections to this SRP section for the CDM in the review area.

5. Review the CDM/ITAAC to ensure that the key performance characteristics and safety functions of SSCs of the standard design are appropriately treated in the CDM systems, at a level of detail commensurate with their safety significance.

6. The CDM is reviewed to ensure that all information is clearly delineated and consistent with the SSAR information. Figures and diagrams should be reviewed to ensure that they accurately depict the functional arrangement and requirements of the systems. Reviewers should use the review checklists in Appendix D of this SRP section as an aid in establishing consistent and comprehensive treatment of issues.

7. The reviewer should ensure that the standard ITAAC entries in Appendix E of this SRP section that are related to his review area are included in the approoriate systems of the standard design. The reviewer should review the general provision for verification of dynamic qualification of equipment (ECGB), equipment qualification for harsh environments (SPLB), welding issues (ECGB), and MOVs (ECGB), if applicable.

8. Reviewers should ensure that design features from the resolutions of applicable regulations and Commission guidance are adequately addressed in the CDM, based on safety significance. Ensure that the bases and applicable regulations for these items are documented clearly in the SER.

9. Reviewers should ensure that any Tier 2* information is clearly designated in the SSAR, and consider expiration of these items at first full power, if appropriate. The rationale for designating the information as Tier 2* information, and the bases for the staff's decision that the information requires prior NRC approval to change should be specified in the SER (See also discussion in Appendix B to this SRP section, regarding format of the DCD).

10. Reviewers should ensure that definitions, legends, interface requirements, and site parameters that pertain to issues in their review areas are treated consistently and appropriately in the CDM.

11. Review the cross-references for safety analyses in SSAR 14.3 applicable to the review area, and verify that the key parameters and assumptions are addressed in the CDM.

12. Review the DAC for the design, if applicable. Ensure all supporting information is present in the SSAR.

13. Ensure that the ITAAC are consistent with the pre-operational test program in Chapter 14.2. Ensure that any new items for ITAAC are added to the SSAR, if appropriate. Ensure that any items requiring post-fuel load verification are identified in the power ascension test program in the SSAR. Ensure that the ITAAC themselves, and the language in the ITAAC emphasize testing of the as-built design.

14. Ensure the CDM and ITAAC are consistent with the technical specifications, including the bases. Ensure the CDM and ITAAC are reflect the resolutions of technically relevant USIs/GSIs, TMI items, and operating experience.

15. The reviewer should ensure that appropriate guidance is provided to other branches such that issues in the CDM pertaining to his review area are treated in a consistent and comprehensive manner among branches.

16. Reviewers should ensure that sufficient interfaces with other branches, as specified in these SRP sections, is accomplished to ensure all issues are completely and comprehensively addressed in the CDM, where appropriate.

17. Reviewers should ensure that inputs from secondary review branches is appropriately reflected in the CDM. This includes PSGB (security issues), SPSB (PRA, shutdown risk, plant safety analyses), and SCSB (containment and severe accident analyses), in addition to the secondary review branches identified in the subsections to this SRP section.

18. Provide an evaluation of the CDM/ITAAC and DAC with the review area, but in a separate section of the SER. Provide a separate conclusion on the CDM/ITAAC and the DAC.

CDM/ITAAC Section-by-Section Review Procedures

The following is a general procedure for a section-by-section review of the CDM/ITAAC for systems of the standard design. The format of the CDM/ITAAC, including the introduction, interface requirements, and site parameters are discussed further in Appendix C to this SRP section. Review checklists for various CDM systems are contained in Appendix D.

The design information in the CDM Design Descriptions should be derived from the information in the SSAR. The ITAAC should verify the information in the design descriptions, and therefore, the as-built facility. Each branch reviews the CDM as discussed in the following items.

A. DESIGN DESCRIPTIONS

The Design Descriptions (DD) include a narrative and simplified schematic figures in the CDM, 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 interface requirements, as applicable. A checklist for the review of Design Descriptions is contained in Appendix D of this SRP section.

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. A checklist for the review of figures is contained in Appendix D of this SRP section.

An as-built facility referencing the certified design must be consistent with the performance characteristics and functions described in the design descriptions and figures. Any changes to the detailed information in the SSAR must be in accordance with the "50.59-like" change process in the design certification rule for the design, which allows the COL applicant or licensee to make design changes, provided the changes do not impact the information in the CDM. The detail in the SSAR would thus be similar to an NRC Regulatory Guide in that the SSAR would describe an acceptable, but not the only acceptable method, of meeting the DD functional requirements and/or broad commitments. However, in order to make changes to Tier 2 (SSAR) a licensee must use the 50.59-like process to determine if the change impacts the DD or ITAAC or creates an unreviewed safety question. Whether or not the NRC identifies Tier 2* information which would require prior NRC approval, the COL applicant or licensee is responsible to identify and review all changes and determine that each change before implementation does not constitute an unreviewed safety question.

The staff should ensure that significant features of the design certification application contained in the SSAR upon which the staff is relying to reach its safety conclusion are captured in the DD. The specific features or commitments which are to be included in the DD are a matter of staff judgment. Two important factors should be balanced in reaching a decision to incorporate information into the DD: (1) the safety significance of the design feature or commitment to the staff's safety decision, and (2) an evaluation of whether it is likely or not that the design feature or commitment will need to be changed in the future. If the staff concludes that it is likely that the details of a particular design feature or commitment will change then it is appropriate to limit the amount of detail in the DD. For example, if current technology is changing and the staff concludes it is inappropriate to specify a particular technology by rulemaking; then the level of detail in the DD should be limited to functional requirements and/or broad commitments. Additional detail as to how the functional requirements and/or broad commitments will be met must be specified in sufficient detail in the SSAR for the staff to reach its safety decision.

B. INSPECTIONS, TESTS, ANALYSES AND ACCEPTANCE CRITERIA (ITAAC)

The purpose of ITAAC is to verify that the as-built facility conforms with the approved design and applicable regulations. If the licensee demonstrates that ITAAC are met, then the licensee will be permitted to load fuel. Therefore, ITAAC must be necessary and sufficient to provide the NRC with reasonable assurance that the facility should be authorized to load fuel. The Design Descriptions should be based upon this requirement for ITAAC. As a result, the ITAAC must verify the significant design features, from the Design Descriptions, and the applicable requirements that are necessary and sufficient to authorize fuel loading and subsequent operation.

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

Finally, the level of detail in any particular ITAAC should be proportional to the safety significance of the systems, structures, and components (SSC) covered by that ITAAC. The certified Design Descriptions for an SSC should contain the significant functions and bases for that SSC. Further guidance on selecting the design information that should be extracted from the application for design certification and included in the Design Description and ITAAC is described below. A checklist for the review of ITAAC is contained in Appendix D to this SRP section.

A three column format for ITAAC is acceptable. The following guidance should be followed in reviewing proposed ITAAC:

Column 1 - Design Commitment

The specific text for the design commitment described in Column 1 is to be extracted from the DD discussed above. Any differences in text should be minimized and be intentional. Design commitments which are to be verified prior to fuel load are to be identified under Column 1. Design commitments which cannot be verified until after fuel load are to be included in the Initial Test Program (ITP) description (SSAR Chapter 14) or COL license conditions. The ITAAC, ITP, and COL license condition description must include sufficient inspection, testing, and/or analysis commitments to verify that the facility will operate in accordance with the approved design and applicable regulations.

Column 2 - Inspections, Tests and Analyses

The specific method to be used by the licensee to demonstrate that the design commitment in Column 1 has been met, is to be described in Column 2. The method is either an inspection, test, or analysis or some combination of inspection, test and analysis. If the method of demonstration includes an analysis, the details of the analysis method must be described in either Column 2 or in the SSAR. The preferred location for analysis methods is in the SSAR. The SSAR should include a reference to the particular ITAAC analysis which is being described in detail. Standard pre-operational tests defined in the SSAR and Regulatory Guide 1.68 are not a substitute for ITAAC, however, the results of pre-operational tests can be used to satisfy an ITAAC.

Column 3 - Acceptance Criteria

The specific acceptance criteria for the methods described in Column 2 which, if met, demonstrate that the design commitment in Column 1 has been met, is to be described in Column 3. When a choice between putting detail in Column 1 and Column 3 exists, the preference should be to put the detail in Column 3. This ensures that the acceptance criteria is detailed and thereby removes ambiguity regarding acceptable implementation of the commitment. 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 (e.g., important to be maintained for the life of the facility).

In the case of ITAAC for the Control Room Design and for Digital Instrumentation and Control Design, the ITAAC for each phase of the design development process should be separately identified with entries in Column 1, 2 and 3. Failure to satisfy the Column 3 acceptance criteria for a particular phase will require repeating that phase of the design development process until the Column 3 criteria is met for that ITAAC and all subsequent phased ITAAC (or rulemaking is pursued to amend the acceptance criteria).

C. STANDARD SAFETY ANALYSIS REPORT

The SSAR must include all information reviewed by the staff which is relied upon in reaching the staff's safety determination. 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 must be submitted as an amendment to the SSAR. It is not sufficient for such information to be on the docket, it must be in the SSAR.

## IV. EVALUATION FINDINGS

Each review branch verifies that sufficient information has been provided to satisfy the requirements of this Standard Review Plan section, and concludes that the CDM is acceptable, as discussed in the Evaluation Findings of the SRP subsections to this SRP section. The findings of all review branches may be combined to support the following type of overall conclusive statement to be included in the staff's safety evaluation report:

"Based on the staff's review of the material in the (standard design) CDM, and a review of the selection methodology and criteria for the development of the CDM contained in SSAR Section 14.3, the staff concludes that the top-level design features and performance characteristics of the SSCs important to safety are appropriately described in the CDM, and the CDM is acceptable.

"Further, these top-level commitments can be adequately verified by the ITAAC provided by (the applicant). Therefore, in the appropriate parts of Section 14.3 of this report, the staff concludes that the CDM are necessary and sufficient to provide reasonable assurance that, if the inspections, tests, and analyses are performed, and the acceptance criteria met, a facility referencing the certified design will be constructed and will operate in conformity with the design certification and applicable regulations.

"The staff also concludes in the appropriate parts of Section 14.3 of this report that the interface requirements and site parameters in the CDM meet the requirements for design certification applications in 10 CFR 52.47, and are acceptable."

## V. IMPLEMENTATION

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

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

## VI. REFERENCES


1. 10 CFR Part 52, §52.47 "Contents of Applications."

2. 10 CFR Part 52, §52.97 "Issuance of Combined Licenses."

3. NRC Commission Policy Statement on Severe Reactor Accidents Regarding Future Designs and Existing Plants, 50 FR 32138,

4. NRC Commission Policy Statement, "Nuclear Power Plant Standardization," 52 FR 34884, September 15, 1987.

5. SECY-90-016, "Evolutionary Light Water Reactor Certification Issues and Their Relationship to Current Regulatory Requirements," dated January 12, 1990. The Commission's guidance on this SECY was provided in an SRM dated June 26, 1990.

6. SECY-90-241, "Level of Detail Required for Design Certification Under Part 52," July 11, 1990. The Commission's guidance on this SECY was provided in an SRM dated August 22, 1990.

7. SECY-90-377, "Requirements for Design Certification Under 10 CFR Part 52," November 8, 1990. The Commission's guidance on this SECY was provided in an SRM dated February 15, 1991.

8. SECY-91-178, "Inspections, Tests, Analyses, and Acceptance Criteria (ITAAC) for Design Certifications and Combined Licenses," June 12, 1991. The Commission's guidance on this SECY was provided in an SRM dated September 24, 1991.

9. SECY-91-210, "Inspections, Tests, Analyses, and Acceptance Criteria (ITAAC) Requirements for Design Review and Issuance of a Final Design Approval (FDA)," July 16, 1991. The Commission's guidance on this SECY was provided in an SRM dated October 18, 1991.

10. SECY-92-053, "Use of Design Acceptance Criteria During 10 CFR Part 52 Design Certification Reviews," February 19, 1992.

11. SECY-92-134, "NRC Construction Inspection Program for Evolutionary and Advanced Reactors Under 10 CFR Part 52," April 15, 1992.

12. SECY-92-196, "Development of Design Acceptance Criteria (DAC) for the Advanced Boiling Water Reactor (ABWR)," May 28, 1992.

13. SECY-92-214, "Development of Inspections, Tests, Analyses, and Acceptance Criteria (ITAAC) for Design Certifications," June 11, 1992.

14. SECY-92-287, "Form and Content for a Design Certification Rule," August 18, 1992. The Commission's guidance on this SECY was provided in an SRM dated June 23, 1993.

15. SECY-92-287A, "Form and Content for a Design Certification Rule," dated March 26, 1993. The Commission's guidance on this SECY was provided in an SRM dated June 23, 1993.

16. SECY-92-299, "Development of Design Acceptance Criteria (DAC) for the Advanced Boiling Water Reactor (ABWR) in the Areas of Instrumentation and Controls (I&C) and Control Room Design," August 27, 1992.

17. SECY-92-327, "Review of Inspections, Tests, Analyses, and Acceptance Criteria (ITAAC) for the General Electric (GE) Advanced Boiling Water Reactor (ABWR)," September 22, 1992.

18. SECY-92-436, "Status of the Revised Construction Inspection Program", December 31, 1992.

19. SECY-93-087, "Policy, Technical, and Licensing Issues Pertaining to Evolutionary and Advanced Light-Water Reactor Designs, " April 2, 1993. The Commission's guidance on this paper was provided in an SRM dated July 21, 1993.

20. Advance Notice of Proposed Rulemaking, "Rulemakings to Grant Standard Design Certification for Evolutionary Light Water Reactor Designs," 58 FR 58664, November 3, 1993.

21. NUREG-1503, "Final Safety Evaluation Report Related to the Certification of the Advanced Boiling Water Reactor", Volumes 1 and 2, July 1994.

22. NUREG-1462, "Final Safety Evaluation Report Related to the Certification of the System 80+ Design," Volumes 1 and 2, August 1994.

23. SECY-94-294, "Construction Inspection and ITAAC Verification", December 5, 1994.

24. Notice of Proposed Rules, "Standard Design Certification for the U.S. Advanced Boiling Water Reactor Design," 60 FR 17902, April 7, 1995, and "Standard Design Certification for the System 80+ Design," 60 FR 17924, April 7, 1995.

25. SECY-95-090, "Emergency Planning Under 10 CFR Part 52", April 11, 1995.

26. SECY-95-132, "Policy and Technical Issues Associated With the Regulatory Treatment of Non-Safety Systems (RTNSS) in Passive Plant Designs (SECY-94-084)", May 22, 1995.

27. Notice of Final Rules, "Standard Design Certification for the U.S. Advanced Boiling Water Reactor Design," DATE TBD, and "Standard Design Certification for the System 80+ Design," DATE TBD.

## 14.3.1 SITE PARAMETERS

### I. REVIEW RESPONSIBILITIES

Primary - ECGB

Secondary - PERB

### I. AREAS OF REVIEW

ECGB reviews the site parameters in the certified design material (CDM), Chapter 2 of the standard safety analysis report (SSAR), and the supporting information in SSAR Section 14.3 submitted by the applicant.

During reviews of early site permit applications under Subpart A to 10 CFR Part 52, or reviews of combined license applications under Subpart C to 10 CFR Part 52, ECGB reviews the information submitted to demonstrate compliance with the site parameters for the standard design, and other site parameters not within the scope of the standard design.

Review Interfaces

SRP Section 14.3 provides general guidance on review interfaces. ECGB performs related reviews and coordination activities, as requested by other branches, for issues in the CDM regarding site parameters.

ECGB also performs the following reviews under the SRP sections indicated:

1. ECGB determines the acceptability of CDM information for structural engineering items in SRP Section 14.3.2.

2. ECGB determines the acceptability of CDM information for piping design, including piping DAC if applicable, in SRP Section 14.3.3.

Secondary Review Branch Responsibilities

1. The Emergency Preparedness and Radiation Protection Branch (PERB) determines the acceptability of the CDM information regarding atmospheric dispersion (X/Qs) for exclusion area boundaries and low population zones (LPZs) in SRP Section 14.3.8.

### II. ACCEPTANCE CRITERIA

Acceptability is based on meeting the relevant requirements of the following regulations:

1. 10 CFR 52.47(a)(1)(iii), as they relate to the contents of design certification applications. The applicant must provide postulated site parameters for the design, and an analysis and evaluation of the design in terms of such parameters.

2. 10 CFR 52.79, as they pertain to the technical contents of combined license applications.

Technical Rationale

The technical rationale for application of the above acceptance criteria to the CDM, including the ITAAC, is discussed in the following paragraphs.

1. 10 CFR 52.47(a)(1)(iii), as they relate to the contents of design certification applications. Part 52 provides for design certification reviews separate from site suitability reviews. However, for the staff to make its safety determinations for a standard design, assumptions must be made about certain parameters for potential sites. Therefore, design certification applicants must provide postulated site parameters for the design, and an analysis and evaluation of the design in terms of such parameters.

2. 10 CFR 52.79, as they pertain to the technical contents of combined license applications. Characteristics of a potential site must be known for the NRC to determine the acceptability of a nuclear power facility on that site.

The following should be addressed to demonstrate that the standard design meets the above criteria.

The site parameters used in the design must be specified in both the CDM and Chapter 2 of the SSAR. The site parameters specified in the CDM are the top-level bounding site parameters used for in the selection of a suitable site for a facility referencing the certified design. Because they were used in bounding evaluations of the certified design, they define the requirements for the design that must be met by a site. This ensures that a facility built on the site remains in conformance with the design certification. Appropriate values for site parameters should be selected that make the design suitable for many sites. The site parameters specified in the SSAR Chapter 2 should be consistent with those in the CDM.

The analysis and evaluation of the design may be contained in the various sections of the SSAR. For example, the safe shutdown earthquake parameter is discussed in structural and piping analyses in Chapter 3, atmospheric dispersion parameters are discussed in radiological analyses in Chapter 9, and elevation parameters are discussed in the flooding analyses in Chapter 9. Supporting information for the ITAAC may also utilize these site parameters, as discussed in SRP Sections 14.3.2 and 14.3.3. The staff's evaluations of the site parameters and the design in the appropriate sections of SSAR should be utilized to determine the appropriate top-level site parameters for the CDM, and their acceptability.

Site parameters should be specified for the following parameters:

Maximum ground water level
Maximum flood level
Precipitation (rain and snowfall)
Ambient Design Temperature
Extreme Wind
Tornado (maximum speed, pressure drop, missile spectra)
Soil Properties (minimum bearing capacity, minimum shear wave velocity, liquefaction potential)

Seismology (SSE response spectra, using figures)
Meterological Dispersion (Values at EAB and LPZ at appropriate time intervals for short and long term)

The site parameters should include a requirement that liquefaction not occur underneath structures, systems, and components resulting from the site-specific SSE. In addition, although the design for the sites should be based on the 0.3g RG 1.60 spectra, the evaluation of the sites for liquefaction potential should use the site-specific SSE with acceptance criteria demonstrating adequate margin for no liquefaction.

Site parameters for external missile spectra should be specified in the CDM. Alternatively, the design basis for missiles may be specified in the SSAR, provided that external missiles are adequately addressed in the design for buildings and structures, and verified by appropriate ITAAC.

An applicant for a combined license must demonstrate that the site parameters in the design certification rule are met at a given site as part of an application and issuance of a combined license under Subpart C of 10 CFR Part 52. If the site cannot meet these site parameters, an exemption must be requested in accordance with the change process in the rule certifying the design.

Also, consideration of hazards and parameters that were not previously considered as part of the design certification is done as part of a combined license application on a site-specific basis. Examples may include proximity to air traffic patterns, toxic hazards, and transportation.

## III. REVIEW PROCEDURES

1. Reviewers should follow the general procedures for review of the CDM contained in SRP Section 14.3. This includes knowledge of the DCD and the CDM/ITAAC as discussed in the appendices to SRP Section 14.3.

2. The site parameters in the CDM and SSAR Chapter 2 are reviewed to ensure that the appropriate site parameters are specified, and their values are appropriate for many potential sites. The CDM is reviewed to ensure that all information is consistent with the SSAR information.

3. The appropriate analyses for evaluation of the site parameters in the SSAR are reviewed for adequacy, and to ensure that the top-level site parameters are specified in the CDM.

4. Reviewers should ensure that the inputs from PERB regarding atmospheric dispersion site parameters are appropriately treated in the CDM and SSAR Chapter 2.

## IV. EVALUATION FINDINGS

The reviewer verifies that sufficient information has been provided to satisfy the requirements of this Standard Review Plan section, and concludes that the CDM is acceptable. For design certification reviews, the findings should support the following type of overall conclusive statement to be included in the staff's safety evaluation report:

"(The applicant) provided site parameters postulated for the certified design in the CDM and in the appropriate sections of the SSAR. The appropriate sections of the SSAR information also provided an acceptable analysis and evaluation of the design in terms of these parameters, and the staff found the design acceptable in the related sections of this report."

"Further, based on the staff's review of the site parameters in the (standard design) CDM, and a review of the selection methodology and criteria for the development of the CDM contained in SSAR Section 14.3, the staff concludes that (the applicant) provided the top-level site parameters in the CDM. Therefore, the staff also concludes that the site parameter information in the CDM meets the requirements for design certification applications in 10 CFR 52.47(a)(1)(iii), and is acceptable."

For combined license reviews, the findings should support the following type of overall conclusive statement to be included in the staff's safety evaluation report:

"(The applicant) provided sufficient information to demonstrate that the site parameters for the certified standard design in the DCD have been met by the proposed site, and that the analyses of the design in terms of the site parameters remain valid. Therefore, the site is acceptable for the standard design."

## V. IMPLEMENTATION

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

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

## VI. REFERENCES

1. NUREG-1503, "Final Safety Evaluation Report Related to the Certification of the Advanced Boiling Water Reactor", Volumes 1 and 2, July 1994.

2. NUREG-1462, "Final Safety Evaluation Report Related to the Certification of the System 80+ Design," Volumes 1 and 2, August 1994.

## 14.3.2 STRUCTURAL AND SYSTEMS ENGINEERING

### I. REVIEW RESPONSIBILITIES

Primary - ECGB

Secondary - SPLB, PERB

### I. AREAS OF REVIEW

ECGB reviews the certified design material (CDM) and Section 14.3 of the standard safety analysis report (SSAR) submitted by the applicant. The information includes inspections, tests, analyses, and acceptance criteria (ITAAC), interface requirements, site parameters, and information applicable to multiple systems of the design. Definitions, legends, and general provisions in the CDM are also reviewed.

ECGB has primary review responsibility for CDM building structures, chemical engineering systems, site parameters, piping design, reactor pressure vessel (RPV) systems, and legends for figures. If the CDM information is based on the systems of the design, assignment of review responsibilities is consistent with those contained in Appendix A to this SRP section. ECGB reviews the CDM information for issues regarding structural, mechanical, materials, and chemical engineering. In addition, ECGB reviews the CDM for treatment of MOVs, check valves, and pumps; seismic and safety classification of SSCs; materials and chemical engineering, and for other structural aspects of systems.

Review Interfaces

SRP Section 14.3 provides general guidance on review interfaces. ECGB performs related reviews and coordination activities, as requested by other branches, for issues in the CDM as discussed above.

ECGB also performs the following reviews under the SRP sections indicated:

1. ECGB determines that the CDM information is adequate for site parameters for the design in SRP Section 14.3.1.

2. ECGB determines that the CDM information is adequate for piping design, including piping DAC if applicable, in SRP Section 14.3.3.

In addition, ECGB will coordinate other branches' evaluations that interface with the overall review of the systems as follows:

1. The Electrical Engineering Branch (EELB) determines the acceptability of the CDM information regarding the separation requirements and locations of major electrical components and systems in SRP Section 14.3.6.

2. The Reactor Systems Branch (SRXB) determines the acceptability of the CDM information regarding the arrangement of reactor and core cooling systems, including design considerations for preventing intersystem loss-of-coolant accidents in SRP Section 14.3.4.

For those areas of review identified above as being part of the primary review responsibility of other branches, the acceptance criteria necessary for the review and their methods of application are contained in the referenced SRP section of the corresponding primary branches.

Secondary Review Branch Responsibilities

1. The Plant Systems Branch (SPLB) determines the acceptability of the CDM information regarding the arrangement of major plant SSCs, the design features of SSCs and ability of structures to withstand fires and flooding, and the design of building HVAC systems, in SRP Section 14.3.7.

2. The Emergency Preparedness and Radiation Protection Branch (PERB) determines acceptability of the CDM information regarding the radiation protection aspects of the structures in SRP Section 14.3.8.

## II. ACCEPTANCE CRITERIA

Acceptability is based on meeting the relevant requirements of the regulations discussed below:

1. 10 CFR Part 52, §52.47(a)(1)(iii) and (vi-viii) as they relate to the contents of design certification applications. The information includes site parameters, interface criteria, and the ITAAC which are necessary and sufficient to provide reasonable assurance that a plant which references a certified design is built and will operate in accordance with the design certification.

2. 10 CFR Part 52, §52.97(b) as it relates to the identification of ITAAC within a combined license. An applicant or licensee must identify and perform those ITAAC, including those applicable to emergency planning, that are necessary and sufficient to provide reasonable assurance that the facility has been constructed and will be operated in conformity with the license, the provisions of the Atomic Energy Act, and the Commission's rules and regulations.

The reviewer should primarily utilize the NRC rules and regulations to review the top level commitments in the CDM. Other sources include RGs, SRP guidelines, and PRA insights from the standard design safety and severe accident analyses and operating experience. The reviewer should also use the review checklists in the Appendix D of this SRP section as an aid for establishing consistency and completeness. If applicable, the staff also adhere to policy discussions by the Commission. Examples of these are contained in the SRM related to SECY-90-016, "Evolutionary Light Water Reactor Certification Issues and Their Relationship to Current Regulatory Requirements," as modified by the Commission guidance in the SRM related to SECY-93-087, "Policy, Technical, and Licensing Issues Pertaining to Evolutionary and Advanced Light-Water Reactor Designs." The SRM related to SECY-93-087 is dated July 21, 1993.

The reviewer should examine the design descriptions, figures, ITAAC, and the SSAR for consistency. The CDM should be for all the systems to ensure consistency with the seismic and safety classification described in Chapter 3 of the SSAR. The seismic classification of the system as described in the design description and the ASME Code Class boundaries of the system as depicted on the figures should be consistent with SSAR Chapter 3.

The reviewer should ensure that the ITAAC are consistent with the preoperational tests specified in Chapter 14.2 of the SSAR. Further, the ITAAC should be reviewed to ensure that those tests have been appropriately included in SSAR Chapter 14.2, and whether the appropriate preoperational tests have been adequately incorporated into ITAAC. The CDM should be reviewed for tests in Chapter 14.2 of the SSAR or in the ITAAC that would require an analysis to convert preoperational test conditions to accident conditions, to ensure that the methodology for performing the analysis was specified adequately. In addition, all systems ITAAC should be reviewed to ensure that selected issues are adequately and consistently treated in the CDM through the use of the standard ITAAC entries for basic configuration, hydrostatic tests, physical separation, pneumatically operated valves, MOVs, and check valves.

The reviewer should use the following general approach in reviewing the design descriptions, figures, and ITAAC and for establishing what information should reside in each tier. The certified design (design description) should contain top level design, fabrication, testing, and performance requirements for SSCs important to safety. ITAAC should be established, in part, to verify that these top-level (Tier 1) design, fabrication, testing and performance requirements are met when the standard plant design is built.

Although the establishment of what specific information is to be included in the design description is essentially a matter of judgement, the reviewer should use the review checklists provided in Appendix D to this SRP section as an aid for establishing consistency and comprehensiveness in his review of the systems. These areas provide some guidance in certain areas regarding what information should be in which tier as well as whether an inspection, test or analysis is required to be performed. Examples of these areas include component welding, equipment seismic and dynamic qualification, pumps, valves, and piping systems. The basis for selecting these areas includes its importance to safety as well as past experience with construction and operating problems.

Design descriptions and ITAAC should be developed and grouped by systems and building structures. These Tier 1 requirements for systems and building structures are typically verified by inspections, tests, and analyses specified in the system ITAAC. For example, system-specific performance tests are typically conducted to demonstrate that the system can perform its intended function. For building structures, the structural capability is typically verified by performing an analysis to reconcile the as-built data with the structural design bases for each safety-related building.

For components, the verification of design, fabrication, testing, and performance requirements should be partially addressed in conjunction with the specific system ITAAC. For example, a test should typically be performed to verify the ability of a motor-operated valve to close under design-basis fluid conditions. However, performance tests may not be practical for verifying certain component design requirements such as its seismic design or safety classification. Therefore, ITAAC may be developed to verify certain areas where performance tests are not practical. These areas include seismic design qualification and fabrication (i.e., welding) of components. An acceptable means of accomplishing verifying the seismic design qualification and fabrication of components is to establish ITAAC on a generic basis, in the general provision for verifying the basic configurations of systems, rather than on an individual component basis.

The Tier 1 treatment of the design qualification and fabrication of components should be reviewed to ensure that these issues are verified by ITAAC. An acceptable means of accomplishing this is specified below:

(1) Fabrication of Components

A basic configuration check (system) 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. A hydrotest should also be required in each system ITAAC for ASME Code Class 1, 2, and 3 piping systems to verify that, in the process of fabricating the overall piping system, the welding and bolting requirements for ensuring the pressure integrity have been met. The methods to be used by the COL applicant or licensee to verify the acceptability of the welds should be discussed in the SSAR in the sections applicable to the specific component or structure.

(2) Design Qualification of Components

(a) Safety Classification - The safety classification of SSCs should be described in each system's design description. The functional drawings should identify the boundaries of the ASME Code classification that are applicable to the safety class. The piping DAC should include a verification of the design report to ensure that the appropriate code design requirements for the system's safety class have been implemented.

(b) Mechanical and Electrical Equipment (including I&C) - A basic configuration check (system) is required in each individual system ITAAC. The configuration check includes an inspection of the as-built equipment (including anchorages) and a review of the qualification records to verify that the equipment in its as-built condition is seismically qualified. The material in SSAR Chapter 3 that provides detailed supporting information for the CDM regarding the methods to be used by the COL applicant or licensee for the dynamic qualification of equipment should be considered for designation as Tier 2* information. Tier 2* information is information that, if considered for a change by an applicant or licensee that references the certified standard design, would require NRC approval prior to implementation of the change. Tier 2* material is discussed further in SRP Section 14.3. The format of Tier 2* information in the SSAR is discussed further in Appendix B to this SRP section.

(c) Valves - The verification of the design qualification of valves is performed in conjunction with the basic configuration check for mechanical equipment as discussed above. Specifically, for MOVs, a special inspection is required as a part of the basic configuration check to verify the records of vendor tests that demonstrate the ability of MOVs to function under design conditions. In addition, in-situ tests should be required for MOVs and check valves in each system ITAAC. These tests may be performed during the initial test program. The material in SSAR Chapter 3 should provide detailed supporting information for the CDM regarding the methods to be used by the COL applicant or licensee for the design, qualification, and testing of MOVs to demonstrate their design basis capability. This material should be considered for designation as Tier 2* information. Tier 2* information is information that, if considered for a change by an applicant or licensee that references the certified standard design, would require NRC approval prior to implementation of the change. Tier 2* material is discussed further in SRP Section 14.3. The format of Tier 2* information in the SSAR is discussed further in Appendix B to this SRP section.

(d) Piping - The verification of the overall piping design including the effects of high-energy line breaks and the application of leak-before-break (as applicable) may be performed in conjunction with the piping DAC, if applicable. The as-built piping system is required to be reconciled with the design commitments. The material in SSAR Section Chapter 3 should provide detailed supporting information for the CDM regarding the analysis methods and design criteria to be used by the COL applicant or licensee to complete the piping design. This material should be considered for designation as Tier 2* information. Tier 2* information is information that, if considered for a change by an applicant or licensee that references the certified standard design, would require NRC approval prior to implementation of the change. Tier 2* material is discussed further in SRP Section 14.3. The format of Tier 2* information in the SSAR is discussed further in Appendix B to this SRP section.

<u>Review of the Standard Design Structural Design Integrity</u>

The scope of structural design covers the major structural systems in the standard design plant, including the RPV, ASME Code Class 1, 2, and 3 piping systems, and major building structures (primary containment, reactor building, control building, turbine building, service building, and radwaste building). For PWRs, this includes the reactor vessel (RV), ASME Code Class 1, 2, and 3 piping systems, and major building structures (primary containment, nuclear island structures, turbine building, component cooling water (CCW) heat exchanger structures, diesel fuel storage structures (DFSSs), and radwaste building). The RPV, piping systems, and primary containment (For PWRS, RV, piping systems, and primary containment) are included because they provide the defense-in-depth principle for nuclear plants. The major building structures house those systems and components that are important to safety.

In establishing the top level requirements for structural design, the staff used the General Design Criteria (GDC) of 10 CFR Part 50, Appendix A, as its basis. The primary general design criteria pertaining to the major structural system design are GDC 1, "Quality Standards and Records," GDC 2, "Design Bases for the Protection Against Natural Phenomena," GDC 4, "Environmental and

Dynamic Effects Design Basis," GDC 14, "Reactor Coolant Pressure Boundary," GDC 16, "Containment Design," and GDC 50, "Containment Design Basis."

GDC 1 requires, in part, the need for structures, systems and components important to safety to be designed, fabricated, erected, and tested to quality standards commensurate with the importance of the safety functions to be performed.

GDC 2 requires, in part, the need to design structures, systems, and components important to safety to withstand the effects of natural phenomena such as earthquakes, tornados, hurricanes, and floods without loss of capability to perform their safety functions, including the appropriate combinations of the effects of normal and accident conditions with the effects of the natural phenomena.

GDC 4 requires, in part, the need to protect structures, systems, and components important to safety from dynamic effects including the effects of missiles, pipe whipping, and discharging fluids that may result from equipment failures and from events and conditions outside the nuclear power unit.

GDC 14 requires, in part, the need for the reactor coolant pressure boundary to be designed, fabricated, erected, and tested so as to have an extremely low probability of abnormal leakage, of rapidly propagating failure, and of gross rupture.

GDC 16 requires, in part, the need for the reactor containment to provide an essentially leak-tight barrier against uncontrolled release of radioactivity to the environment.

GDC 50 requires, in part, the need for the reactor containment structure including access openings and penetrations to be designed so that the containment structure and its internal compartments can accommodate, without exceeding the design leakage rate and with sufficient margin, the calculated pressure and temperature conditions resulting from any loss-of-coolant accident.

Using the above GDC as its basis, the following top-level attributes should be verified by ITAAC:

(1) pressure boundary integrity (GDC 14, 16 and 50)
(2) normal loads (GDC 2)
(3) seismic loads (GDC 2)
(4) suppression pool hydrodynamic loads (GDC 4)
(5) flood, wind, and tornado (GDC 2)
(6) rain and snow (GDC 2)
(7) pipe rupture (GDC 4)
(8) codes and standards (GDC 1)

In addition, to ensure that the final as-built plant conforms to the certified design, applicants should provide ITAAC to reconcile the as-built plant with the structural design basis. A summary of the top-level structural design requirements for the major structural systems that are verified by the structures and systems in the CDM and the piping design information in the CDM.

Pressure Boundary Integrity

To ensure that the applicable requirements of GDC 14, 16, and 50 have been adequately addressed, ITAAC should be established to verify the pressure boundary integrity of the RPV, piping, and primary containment (For PWRs, RV, piping, and primary containment) for the standard design. GDC 16 and 50 apply to the primary containment and GDC 14 applies to the RPV (RV for PWRs) and the reactor coolant pressure boundary piping systems. The pressure integrity for these major structural systems are needed to ensure the defense-in-depth principle.

For the RPV and piping, hydrostatic tests performed in conjunction with the ASME Boiler and Pressure Vessel Code, Section III, should be required by ITAAC. For the primary containment, a structural integrity test should be required by ITAAC to be performed on the pressure boundary components of the primary containment in accordance with the ASME Boiler and Pressure Vessel Code, Section III. Because the requirements of GDC 14, 16, and 50 do not apply to the reactor, control, turbine, service, and radwaste buildings (nuclear island structures, turbine building, CCW heat exchanger structures, DFSSs, and radwaste building for PWRs), ITAAC are not required to verify the pressure integrity for these other buildings.

Normal Loads

To ensure that the applicable requirements of GDC 2 have been adequately addressed, ITAAC should be established to verify that the normal and accident loads have been appropriately combined with the effects of natural phenomena.

For piping systems, ITAAC should require an analysis to reconcile the as-built piping design with the design-basis loads (which include the appropriate combination of normal and accident loads). For the RPV, the fabrication may be performed primarily in the vendor's shop where adherence to design drawings is tightly controlled. Therefore, ITAAC for the as-built reconciliation of normal loads with accident loads for the RPV are inappropriate. Instead, ITAAC should verify that the ASME Code-required reports exist to document that the RPV has been designed, fabricated, inspected, and tested to Code requirements to ensure adequate safety margin.

Similarly, for safety-related buildings, ITAAC should require an analysis for reconciling the as-built plant with the structural design basis loads (which include the combination of normal and accident loads with the effects of natural phenomena). The analysis results should be documented in a structural analysis report, the scope and contents of which must be described in the SSAR. The staff may determine that the design of certain structures does not require verification by ITAAC, based on their safety significance. In particular, these ITAAC should apply only to safety-related structures and are not applicable to the service and turbine buildings (radwaste and turbine building for PWRs).

Seismic Loads

To ensure that the applicable requirements of GDC 2 have been adequately addressed, ITAAC are established to verify that the safety-related systems and structures have been designed to seismic loadings. Component qualification for seismic loads should be addressed by ITAAC for verifying the basic configuration of systems.

As discussed above for normal loads on piping systems and the RPV, ITAAC should require an analysis to reconcile the as-built piping design with the design basis loads (which include seismic loads). For the RPV, ITAAC for the as-built reconciliation of seismic loads for the RPV are deemed to be inappropriate as previously discussed. Instead, ITAAC verify that the ASME Code-required reports exist for the RPV ensuring that the RPV has been designed, fabricated, inspected, and tested to ASME Code requirements.

For safety-related buildings, ITAAC require an analysis for reconciling the as-built plant with the structural design-basis loads (which include seismic loads). The analysis results are to be documented in a structural analysis report, as discussed above. These ITAAC apply only to safety-related structures and are not applicable to the service and turbine buildings (radwaste and turbine building for PWRs). However, because the leakage path for fission products includes components within the turbine building, the turbine building is required to withstand the effects of a safe-shutdown earthquake. Therefore, ITAAC should be established to verify that, under seismic loads, the collapse of the turbine building will not impair the safety-related functions of any structures or equipment located adjacent to or within the turbine building.

For non-seismic Category I SSCs, the need for ITAAC to verify that their failure will not impair the ability of near-by safety-related SSCs to perform their safety-related functions should be assessed based on the specific design. If the design detail and as-built and as-procured information for many non-safety-related systems (e.g., field-run piping and balance-of-plant systems) is not provided by the applicant for design certification and the spatial relationship between such systems and seismic Category I SSCs cannot be established until after the as-built design information is available, the non-seismic to seismic (II/I) interaction cannot be evaluated until the plant has been constructed. Accordingly, the design criteria for ensuring acceptable II/I interactions and a commitment for the COL applicant to describe the process for completion of the design of balance-of-plant and non-safety related systems to minimize II/I interactions and proposed procedures for an inspection of the as-built plant for II/I interactions should be specified as a COL action item in the SSAR.

Suppression Pool Hydrodynamic Loads (BWRs only)

To ensure that the applicable requirements of GDC 4 have been adequately addressed, ITAAC should be established to verify that the safety-related systems and structures have been designed to suppression pool hydrodynamic loadings, which include safety relief valve discharge and loss-of-coolant accident (LOCA) loadings. Component qualification for suppression pool hydrodynamic loads may be addressed by ITAAC established for verifying the basic configuration of systems.

As discussed above for seismic loads on piping systems and the RPV, ITAAC should require an analysis to reconcile the as-built piping design with the design- basis loads (which include suppression pool hydrodynamic loads). For the RPV, ITAAC should verify that the ASME Code-required reports exist to ensure that the RPV has been designed, fabricated, inspected, and tested to ASME Code requirements.

For the reactor building and primary containment including the internal structures, ITAAC should require an analysis for reconciling the building as-built configuration with the structural design basis loads (which include suppression pool hydrodynamic loads). The as-built analysis results should be documented in a structural analysis report as discussed above. The effects of suppression pool hydrodynamic loads do not extend beyond the reactor building, and, thus, ITAAC are not required to verify these loadings for the other standard design building structures.

ITAAC also should require the verification of the horizontal vent system, water volume, and the safety-relief valve discharge line quencher arrangement to ensure adequacy of the suppression pool hydrodynamic loads used for design.

Flood, Wind, Tornado, Rain, and Snow

To ensure that the applicable requirements of GDC 2 have been adequately addressed, ITAAC should be established to verify that the safety-related systems and structures have been designed to withstand the effects of natural phenomena other than those associated with seismic loadings. The effects include those associated with flood, wind, tornado, rain, and snow.

These loadings do not apply to the RPV, the ASME Code Class 1, 2, and 3 piping systems and components, nor the primary containment because they are all housed within the safety-related buildings. For safety-related buildings, ITAAC should require an analysis for reconciling the as-built plant with the structural design basis loads (which include the flood, wind, tornado, rain, and snow loads). Based on their safety significance, these ITAAC need apply only to safety-related structures and need not be applicable to the service and turbine buildings (radwaste and turbine building for PWRs).

For flooding, site parameters are specified that require the maximum flood level and ground water level be below the finished plant grade level. ITAACs also require inspections to verify that divisional flood barriers and water-tight doors exist, and penetrations (except for water-tight doors) in the divisional walls are sealed up to the internal and external flood levels. In addition, for safety-related buildings, flood barriers are established up to the finished plant grade level to protect against water seepage, and flood doors and flood barrier penetrations are provided with flood protection features.

ITAAC should also require inspections to verify that water-tight doors exist, penetrations (except for water-tight doors) in the divisional walls are at least 2.5 m above the floor, and safety-related electrical, instrumentation, and control equipment are located at least 20 cm above the floor surface. In addition, for safety-related buildings, ITAAC should require that external walls below flood level are equal to or greater than 0.6 m to protect against water seepage, and penetrations in the external walls below flood level are provided with flood protection features.

Pipe Break

To ensure that the applicable requirements of GDC 4 have been adequately addressed, ITAAC should be established to verify that the safety-related SSCs have been designed to the dynamic effects of pipe breaks. Component qualification for the dynamic effects of pipe breaks should be addressed by ITAAC established for verifying the basic configuration of systems.

For the RPV, ITAAC that verify the basic configuration of the RPV system require an inspection of the critical locations that establish the bounding loads in the LOCA analyses for the RPV to ensure that the as-built areas not exceed the postulated break areas assumed in the LOCA analyses.

In addition, ITAAC should be established to verify by inspections of as-built, high-energy pipe break mitigation features and of the pipe break analysis report that safety-related SSCs be protected against the dynamic and environmental effects associated with postulated high-energy pipe breaks. ITAAC to verify pipe break loads are not required for the turbine, service, and radwaste buildings (turbine and radwaste buildings for PWRs) either because they are not safety-related structures or there are no high-energy lines located within the structure.

Codes and Standards

To ensure that the applicable requirements of GDC 1 have been adequately addressed, ITAAC should be established to verify that appropriate codes and standards are used in the design and construction of safety-related systems and components. In general, the staff considers those codes and standards endorsed by the regulations under 10 CFR 50.55a in determining which codes and standards were appropriate for Tier 1 verification. The ASME Boiler and Pressure Vessel Code, Section III for Code Class 1, 2, and 3 systems and components is established as the code for the design and construction of standard design piping systems and the RPV. For safety-related building designs, the staff should base its safety findings on audits of standard design calculations which relied on specific codes and standards. These codes and standards are contained in the appropriate sections of SSAR Chapter 3. Inspections will be conducted as a part of ITAAC to verify that ASME Code-required documents exist that demonstrate that the RPV, piping systems and containment pressure boundaries have been designed and constructed to their appropriate Code requirements. For other ASME Code components and equipment, the verification of Code compliance will be performed in conjunction with the quality assurance programs and by the authorized inspection agency as required by the ASME Boiler and Pressure Vessel Code. This SSAR material should be considered for designation as Tier 2* information. Tier 2* information is information that, if considered for a change by an applicant or licensee that references the certified standard design, would require NRC approval prior to implementation of the change. Tier 2* material is discussed further in SRP Section 14.3.

As-built Reconciliation

To ensure that the final as-built plant structures are built in accordance with the certified design as required by 10 CFR Part 52, structural analyses should be performed which reconcile the as-built configuration of the plant structures with the structural design bases of the certified design. The structural analyses should be documented in structural analysis reports. Structural analysis reports should be verified in conjunction with ITAAC for the primary containment and the reactor, control, radwaste, and turbine buildings (nuclear island structures, radwaste building, CCW heat exchangers, DFSSs, and turbine building for PWRs). The detailed supporting information on what is required for an acceptable analysis report should be contained in SSAR Chapter 3.

Similarly for piping systems, an as-built analysis should be performed using the as-designed and as-built information. ITAAC should verify the existence of acceptable final as-built piping stress reports that conclude the as-built piping systems are adequately designed.

For the RPV, the key dimensions of the RPV system should be verified in conjunction with the basic configuration check of the system. The key dimensions of the RPV system and the acceptable variations of the key dimensions should be provided in the certified design description. Alternatively, acceptable variations and the bases for them should be provided in the SSAR.

For component qualification, tests, analyses, or a combination of tests and analyses should be performed for seismic Category I mechanical and electrical equipment (including connected instrumentation and controls) to demonstrate that the as-built equipment and associated anchorages are qualified to withstand design basis dynamic loads without loss of safety function. These test and analyses should be performed as a part of ITAAC to verify the basic configuration of the system in which the equipment is located.

Technical Rationale

The technical rationale for application of the above acceptance criteria to the CDM, including the ITAAC, is discussed in the following paragraphs.

1. Compliance with 10 CFR Part 52, §52.47(a)(1)(iii) and (vi-viii) requires applicants for design certification to include proposed site parameters, interface criteria, and inspections, tests, analyses and acceptance criteria for the design. The design is reviewed and approved by the staff during design certification, and prior to application for construction and operation of a facility. However, upon completion of construction, an as-built facility must be verified to be in accordance with the approved design and applicable regulations. Therefore, application of 10 CFR 52.47 to the CDM ensures that the applicant for design certification submits information necessary and sufficient to provide reasonable assurance that a facility which references a certified design is built and will operate in accordance with the design certification.

2. Compliance with 10 CFR Part 52, §52.97(b) requires applicants for a combined license to include site-specific information and proposed ITAAC for the design, construction and operation of a complete facility. The information required is reviewed and approved by the staff prior to the issuance of a combined license and the start of facility construction. However, upon completion of construction, an as-built facility must be

verified to be in accordance with the approved design and applicable regulations. Therefore, application of §52.97(b) to the information in a combined license application ensures that the applicant for a combined license submits ITAAC, including those applicable to emergency planning, that are necessary and sufficient to provide reasonable assurance that the facility has been constructed and will be operated in conformity with the license, the provisions of the Atomic Energy Act, and the Commission's rules and regulations.

## III. REVIEW PROCEDURES

Reviewers should follow the general procedures for review of the CDM contained in SRP Section 14.3. This includes knowledge of the DCD and the CDM/ITAAC as discussed in the appendices to SRP Section 14.3. Review responsibilities are contained in Appendix A to this SRP section.

1. The CDM/ITAAC are reviewed to ensure that the CDM systems are clearly delineated, including the key performance characteristics and safety functions of SSCs based on their safety significance. Reviewers should apply the acceptance criteria in this SRP Section to the review of the CDM information.

2. The CDM is reviewed to ensure that all information is consistent with the SSAR information, including the initial test program discussed in SSAR Chapter 14.2. Figures and diagrams should be reviewed to ensure that they accurately depict the functional arrangement and requirements of the systems. Reviewers should use the Review Checklists in Appendix D for review of systems as an aid in establishing consistent and comprehensive treatment of issues.

3. The design descriptions, figures, ITAAC, and the SSAR for all the systems should be reviewed to ensure consistency with the seismic and safety classification described in Section 3.2 of the SSAR. The reviewer should ensure that the seismic classification of the system as described in the design description and the ASME Code Class boundaries of the system as depicted on the figures is consistent with SSAR Section 3.2.

4. The reviewer should ensure that appropriate guidance is provided to other branches such that structural engineering issues in the CDM are treated in a consistent manner among branches.

5. The reviewer should ensure that the standard ITAAC entries related to structural engineering items are included in the appropriate systems of the standard design. The reviewer should review the basic configuration ITAAC in the general provisions for appropriate verification of seismic and dynamic qualification of equipment, welding issues, and MOVs. The reviewer should ensure consistent application and treatment of the standard ITAAC entries in Appendix E to this SRP section for basic configuration ITAAC, hydrostatic tests, physical separation, motor operated valves, pneumatically operated valves, and check valves for the appropriate systems in the CDM.

6. Reviewers should ensure that design features from the resolutions of

applicable regulations and Commission guidance are adequately addressed in the CDM, based on safety significance. Ensure that the bases for these items are documented clearly in the SER. Ensure that the specific Tier 2* information is clearly designated in the SSAR, and consider expiration of these items at first full power, if appropriate. The staff's basis for designating the information as Tier 2* and the rationale for its decision that it requires prior NRC approval to change should be specified in the SER (See also the discussion in Appendix B to this SRP section, regarding format of the DCD).

7. Reviewers should ensure that definitions, legends, interface requirements, and site parameters that pertain to structural engineering issues are treated consistently and appropriately in the CDM.

8. Reviewers should ensure that inputs from the secondary review branches (PERB and SPLB) as discussed in the "Areas of Review" section above are reflected in the CDM information.

9. Reviewers should ensure that the review of the CDM is coordinated with the ECGB review of site parameters in SRP Section 14.3.1 and piping design in SRP Section 14.3.3.

10. Reviewers should ensure that review interfaces with EELB and SRXB are coordinated as discussed in the "Areas of Review" section above.

## IV. EVALUATION FINDINGS

The reviewer verifies that sufficient information has been provided to satisfy the requirements of this Standard Review Plan section, and concludes that the CDM is acceptable. The findings should support the following type of conclusive statement to be included in the staff's safety evaluation report:

> "The staff performed a multidisciplinary review of the SSCs of the (standard design), in accordance with 10 CFR Part 52 and SRP Section 14.3.2. This review included information contained in various CDM and SSAR submittals to the staff, as discussed previously in this section of the safety evaluation report.
>
> "Based on the staff's review of the material in the (standard design) CDM, and a review of the selection methodology and criteria for the development of the CDM contained in SSAR Section 14.3, the staff concludes that the top-level design features and performance characteristics of the structures important to safety are appropriately described in the CDM, and the CDM is acceptable.
>
> "Further, these top-level commitments can be adequately verified by the ITAAC provided by (the applicant). Therefore, the staff concludes that the CDM are necessary and sufficient to provide reasonable assurance that, if the inspections, tests, and analyses are performed, and the acceptance criteria met, a facility referencing the certified design will be constructed and will operate in conformity with the design certification and applicable regulations.

## V. IMPLEMENTATION

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

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

## VI. REFERENCES


1. NUREG-1503, "Final Safety Evaluation Report Related to the Certification of the Advanced Boiling Water Reactor", Volumes 1 and 2, July 1994.

2. NUREG-1462, "Final Safety Evaluation Report Related to the Certification of the System 80+ Design," Volumes 1 and 2, August 1994.

## 14.3.3 PIPING SYSTEMS AND COMPONENTS

### I. REVIEW RESPONSIBILITIES

Primary - ECGB

Secondary - NA

### I. AREAS OF REVIEW

ECGB reviews the certified design material (CDM) and Section 14.3 of the standard safety analysis report (SSAR) submitted by the applicant. The information includes inspections, tests, analyses, and acceptance criteria (ITAAC), interface requirements, site parameters, and information applicable to multiple systems of the design. Definitions, legends, and general provisions in the CDM are also reviewed.

ECGB has primary review responsibility for CDM building structures, chemical engineering systems, site parameters, piping design, reactor pressure vessel (RPV) systems, and legends for figures. If the CDM information is based on the systems of the design, assignment of review responsibilities is consistent with those contained in Appendix A to this SRP section. ECGB reviews the CDM information for issues regarding structural, mechanical, materials, and chemical engineering. In addition, ECGB reviews the CDM for treatment of MOVs, check valves, and pumps; seismic and safety classification of SSCs; materials and chemical engineering, and for other structural aspects of systems.

#### Review Interfaces

SRP Section 14.3 provides general guidance on review interfaces. ECGB performs related reviews and coordination activities, as requested by other branches, for issues in the CDM as discussed above.

ECGB also performs the following reviews under the SRP sections indicated:

1. ECGB determines that the CDM information is adequate for site parameters for the design in SRP Section 14.3.1.

2. ECGB determines that the CDM information is adequate for structural aspects of the SSCs of the design in SRP Section 14.3.2.

In addition, ECGB will coordinate other branches' evaluations that interface with the overall review of the systems as follows:

1. The Reactor Systems Branch (SRXB) determines the acceptability of the CDM information regarding the arrangement of reactor and core cooling SSCs in SRP Section 14.3.4.

2. The Plant Systems Branch (SPLB) determines the acceptability of the CDM information regarding the ability of SSCs to withstand the environmental effects of high-energy line breaks in SRP Section 14.3.7.

For those areas of review identified above as being part of the primary review responsibility of other branches, the acceptance criteria necessary for the review and their methods of application are contained in the referenced SRP section of the corresponding primary branches.

## II. ACCEPTANCE CRITERIA

Acceptability is based on meeting the relevant requirements of the regulations discussed below:

1. 10 CFR Part 52, §52.47(a)(1)(iii) and (vi-viii) as they relate to the contents of design certification applications. The information includes site parameters, interface criteria, and the ITAAC which are necessary and sufficient to provide reasonable assurance that a plant which references a certified design is built and will operate in accordance with the design certification.

2. 10 CFR Part 52, §52.97(b) as it relates to the identification of ITAAC within a combined license. An applicant or licensee must identify and perform those ITAAC, including those applicable to emergency planning, that are necessary and sufficient to provide reasonable assurance that the facility has been constructed and will be operated in conformity with the license, the provisions of the Atomic Energy Act, and the Commission's rules and regulations.

The piping design aspects of the standard design should be provided in SSAR Chapter 3, "Structures, Components, Equipment, and Systems." If applicants for design certification submit design processes and design acceptance criteria (DAC) in lieu of a final piping design, the evaluation of the piping DAC should be provided in a separate section of the staff's final safety evaluation report.

Design certification applicants may not provide the complete design information in this design area before design certification because the piping design is dependent upon as-built and as-procured information. Instead, they may provide the processes and acceptance criteria by which the details of the design in this area would be developed, designed, and evaluated. The DAC are discussed further in Appendix G to this SRP section. The format of the CDM, including the DAC, are discussed further in Appendix C to this SRP section. The basis for using DAC for all areas of the design, and the development of design processes and acceptance criteria, should be discussed in SSAR Section 14.3.

Design descriptions and the associated DAC should be specified in the CDM. The scope of the standard design to which the CDM information applies should be stated in the design description. It should address its application to piping systems classified as both nuclear safety-related and non-nuclear safety systems. The implementation of the process and the design is the responsibility of the COL applicant or licensee.

The reviewer should use the SRP guidelines to evaluate the piping design information in the standard design CDM and SSAR and perform a detailed audit of the piping design criteria, including sample calculations. The staff should evaluate the adequacy of the structural integrity and functional capability of safety-related piping systems. The review is not limited to the

American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code Class 1, 2, and 3 piping and supports, but includes buried piping, instrumentation lines, the interaction of non-seismic Category I piping with seismic Category I piping, and any safety-related piping designed to industry standards other than the ASME Code. The staff's evaluation should include the analysis methods, design procedures, acceptance criteria, and related ITAAC (and DAC, if applicable) that are to be used for the completion and verification of the standard design piping design. The staff's evaluation should include both CDM and SSAR information regarding the applicable codes and standards, analysis methods to be used for completing the piping design, modeling techniques, pipe stress analyses criteria, pipe support design criteria, high-energy line break criteria, and leak-before-break (LBB) approach applicable to the standard design.

The piping design information in the CDM should provide the design process to develop the piping for the nuclear safety-related (seismic Category I) systems of the standard design. Piping systems that must remain functional during and following an SSE should be designated as seismic Category I and further classified as ASME Code Class 1, 2, or 3. The piping systems and their components should be designed and constructed in accordance with the ASME Code requirements identified in the individual systems of the standard design. The CDM should ensure that the piping systems will be designed to perform their safety-related functions under all postulated combinations of normal operating conditions, system operating transients, postulated pipe breaks, and seismic events. The material in the CDM should also address the consequential effects of pipe ruptures such as jet impingement, potential missile generation, and pressure and temperature effects.

An acceptable approach to the CDM information for piping design is to specify three distinct ITAAC that ensure the design process for piping systems occurs as described in the design description. The first ITAAC specified in the CDM should require that an ASME Code certified stress report exists to ensure that the ASME Code Class 1, 2, or 3 piping systems are designed to retain their pressure integrity and functional capability under internal design and operating pressures and design basis loads. The specific contents and requirements of the certified stress report are contained in the ASME Code. The particular certified stress report to be used to satisfy the ITAAC should be specified in the SSAR. An acceptable version of an ASME Code certified stress report is the design document required by ASME Code, Section III, Subarticle NCA-3550. A certified piping stress report provides assurance that requirements of the ASME Code, Section III for design, fabrication, installation, examination, and testing have been met and that the design complies with the design specifications.

The second ITAAC should require that a pipe break analysis report exists that documents that SSCs that are required to be functional during and following an SSE have adequate high-energy pipe break mitigation features, or alternatively, that a leak-before-break report exists for those sections of piping systems qualified for leak-before-break design. The design description should discuss the criteria used to postulate pipe breaks, the analytical methods used to perform pipe breaks, and the method to confirm the adequacy of the results of the pipe break analyses. The design description should be verified in a Pipe Break Analysis Report that provides assurance that the high-energy line break analyses have been completed and meet the following certified design commitments. For postulated pipe breaks, the Pipe Break Analysis Report shall confirm that: (1) piping stresses in the containment penetration area shall be within their allowable stress limits, (2) pipe whip restraints and jet shield designs shall be capable of mitigating pipe break loads, (3) loads on safety-related SSCs shall be within their design load limits, and (4) SSCs are protected or are qualified to withstand the environmental effects of postulated failures. The Pipe Break Analysis Report shall conclude that, for each postulated piping failure, the reactor can be shut down safely and maintained in a safe, cold shutdown condition without offsite power. Detailed information that supports this ITAAC should be contained in SSAR Chapter 3.

The third ITAAC should require that an as-built piping stress report exists that documents the results of an as-built reconciliation analysis confirming that the final piping system has been built in accordance with the ASME Code certified stress report. The report provides an overall verification that the as-constructed piping system is consistent with the certified design commitments. Although similar to the first ITAAC, this verification also provides assurance that modification of any document used for construction from the corresponding document used for design analysis has been reconciled with the certified stress report discussed above. This documentation may become part of the certified stress report.

Selected material in SSAR Chapter 3 should provide design information and defines design processes that are acceptable for use in meeting the piping DAC in the CDM. However, the SSAR information may be changed by a COL applicant or licensee referencing the certified design in accordance with a "50.59-like" process specified in the design certification rule. The staff's evaluation of the standard design for piping systems is based on the design processes and acceptance criteria material in the DAC and the SSAR. Consequently, the staff should consider designating selected aspects of these piping design processes as Tier 2* information. Tier 2* information is information that, if considered for a change by a COL applicant or licensee, requires NRC approval prior to implementation of the change. Tier 2* information is information that, if considered for a change by an applicant or licensee that references the certified standard design, would require NRC approval prior to implementation of the change. Consideration should also be given to allowing the designation of Tier 2* to expire at the first full power when the detailed design is complete and performance characteristics of the facility are known. The NRC bears the final responsiblity for designating which material in the SSAR is Tier 2*. The basis for the use of Tier 2* should be discussed in the staff's safety evaluation report. Tier 2* material is discussed further in SRP Section 14.3. The format of Tier 2* information in the SSAR is discussed further in Appendix B to this SRP section.

Technical Rationale

The technical rationale for application of the above acceptance criteria to the CDM, including the ITAAC, is discussed in the following paragraphs.

1. Compliance with 10 CFR Part 52, §52.47(a)(1)(iii) and (vi-viii) requires applicants for design certification to include proposed site parameters, interface criteria, and inspections, tests, analyses and acceptance criteria for the design. The design is reviewed and approved by the

staff during design certification, and prior to application for construction and operation of a facility. However, upon completion of construction, an as-built facility must be verified to be in accordance with the approved design and applicable regulations. Therefore, application of 10 CFR 52.47 to the CDM ensures that the applicant for design certification submits information necessary and sufficient to provide reasonable assurance that a facility which references a certified design is built and will operate in accordance with the design certification.

2. Compliance with 10 CFR Part 52, §52.97(b) requires applicants for a combined license to include site-specific information and proposed ITAAC for the design, construction and operation of a complete facility. The information required is reviewed and approved by the staff prior to the issuance of a combined license and the start of facility construction. However, upon completion of construction, an as-built facility must be verified to be in accordance with the approved design and applicable regulations. Therefore, application of §52.97(b) to the information in a combined license application ensures that the applicant for a combined license submits ITAAC, including those applicable to emergency planning, that are necessary and sufficient to provide reasonable assurance that the facility has been constructed and will be operated in conformity with the license, the provisions of the Atomic Energy Act, and the Commission's rules and regulations.

## III. REVIEW PROCEDURES

Reviewers should follow the general procedures for review of the CDM contained in SRP Section 14.3. This includes knowledge of the DCD and the CDM/ITAAC as discussed in the appendices to SRP Section 14.3. Review responsibilities are contained in Appendix A to this SRP section.

1. The SSAR is reviewed to gain an understanding of the piping design proposed by the applicant for the standard design.

2. The CDM/ITAAC are reviewed to ensure that the CDM clearly delineates the important aspects of piping design, specifies its applicability to the standard design, and establishes appropriate acceptance criteria. Reviewers should apply the acceptance criteria in this SRP Section to the review of the CDM information. The CDM is reviewed to ensure that all information is consistent with the SSAR information.

3. The reviewer should ensure that appropriate guidance is provided to other branches such that piping design issues in the CDM are treated in a consistent manner among branches.

4. Reviewers should ensure that design features from the resolutions of applicable regulations and Commission guidance are adequately addressed in the CDM, based on safety significance. Ensure that the bases for these items are documented clearly in the SER. Ensure that the specific Tier 2* information is clearly designated in the SSAR, and consider expiration of these items at first full power, if appropriate. The staff's basis for designating the information as Tier 2* and the rationale for the staff's decision that it requires prior NRC approval

to change should be specified in the SER (See also the discussion in Appendix B to this SRP section, regarding format of the DCD).

5. Reviewers should interface with the Plant Systems Branch to ensure the acceptability of the CDM information regarding the ability of SSCs to withstand the environmental effects of high-energy line breaks, and interface with the Reactor Systems Branch to ensure the acceptability of the CDM information regarding location and arrangements of piping and major components for reactor and core cooling systems.

6. Reviewers should ensure that the site parameters in the CDM, particularly the SSE, and the CDM/ITAAC information in the CDM for the systems and structures of the design, are consistent with the information in the CDM regarding piping design.

## IV. EVALUATION FINDINGS

Each review branch verifies that sufficient information has been provided to satisfy the requirements of this Standard Review Plan section, and concludes that the CDM is acceptable, as discussed in the Evaluation Findings of the SRP subsections to this SRP section. The findings of all review branches may be combined to support the following type of overall conclusive statement to be included in the staff's safety evaluation report:

"The staff performed a multidisciplinary review, utilizing several task groups, of the SSCs of the (standard design), in accordance with 10 CFR Part 52 and SRP Section 14.3.3. This review included information contained in various CDM and SSAR submittals to the staff, as discussed previously in this section of the safety evaluation report.

"Based on the staff's review of the material in the (standard design) CDM, and a review of the selection methodology and criteria for the development of the CDM contained in SSAR Section 14.3, the staff concludes that the top-level design features and performance characteristics of the piping design aspects of the SSCs important to safety are appropriately described in the CDM, and the CDM is acceptable.

"Further, these top-level commitments can be adequately verified by the ITAAC (and/or DAC) provided by (the applicant). Therefore, in the appropriate parts of Section 14.3 of this report, the staff concludes that the CDM are necessary and sufficient to provide reasonable assurance that, if the inspections, tests, and analyses are performed, and the acceptance criteria met, a facility referencing the certified design will be constructed and will operate in conformity with the design certification and applicable regulations.

## V. IMPLEMENTATION

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

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

VI. <u>REFERENCES</u>


1. NUREG-1503, "Final Safety Evaluation Report Related to the Certification of the Advanced Boiling Water Reactor", Volumes 1 and 2, July 1994.

2. NUREG-1462, "Final Safety Evaluation Report Related to the Certification of the System 80+ Design," Volumes 1 and 2, August 1994.

3. SECY-92-196, "Development of Design Acceptance Criteria (DAC) for the Advanced Boiling Water Reactor (ABWR)," dated May 28, 1992.

14.3.4 REACTOR SYSTEMS

I. REVIEW RESPONSIBILITIES

Primary - SRXB

Secondary - SCSB, SPSB

I. AREAS OF REVIEW

SRXB reviews the certified design material (CDM) and Section 14.3 of the standard safety analysis report (SSAR) submitted by the applicant. The information includes inspections, tests, analyses, and acceptance criteria (ITAAC), interface requirements, site parameters, and information applicable to multiple systems of the design. Definitions, legends, and general provisions in the CDM are also reviewed.

SRXB has primary review responsibility for the reactor systems and core cooling systems in the CDM. If the CDM information is based on the systems of the design, assignment of review responsibilities is consistent with those contained in Appendix A to this SRP section. SRXB has secondary review responsibilities for those systems that could affect the operation of the reactor and core cooling systems. In addition, SRXB has responsibility for the review of selected definitions, interface requirements of the standard design with the site, and site parameters for the design, that pertain to reactor systems issues.

The Containment Systems and Severe Accident Branch (SCSB) is responsible for providing inputs to SRXB regarding the design features and functions of SSCs that should be addressed in the CDM information based on severe accident analyses. The Probabilistic Risk Assessment Branch (SPSB) is responsible for providing inputs to SRXB regarding the risk significant design features and functions of SSCs that should be addressed in the CDM information based on probabilistic risk analysis and shutdown risk evaluations.

Review Interfaces

SRP Section 14.3 provides general guidance on review interfaces. SRXB performs related reviews and coordination activities, as requested by other branches, for issues in the CDM related to reactor systems.

In addition, SRXB will coordinate other branches' evaluations that interface with the overall review of the systems as follows:

1. The Electrical Engineering Branch (EELB) determines the acceptability of the CDM information regarding electrical SSCs in SRP Section 14.3.6.

2. The Civil Engineering and Geosciences Branch (ECGB) determines the acceptability of the CDM information regarding the ability of SSCs to withstand various natural phenomena in SRP Sections 14.3.1 and 14.3.2, and regarding piping design in SRP Section 14.3.3.

3. The Instrumentation and Controls Branch (HICB) determines the acceptability of the CDM information regarding the I&C aspects of the

standard design in SRP Section 14.3.5.

For those areas of review identified above as being part of the primary review responsibility of other branches, the acceptance criteria necessary for the review and their methods of application are contained in the referenced SRP section of the corresponding primary branches.

## II. ACCEPTANCE CRITERIA

Acceptability is based on meeting the relevant requirements of the following regulations:

1. 10 CFR Part 52, §52.47(a)(1)(iii) and (vi-viii) as they relate to the contents of design certification applications. The information includes site parameters, interface criteria, and the ITAAC which are necessary and sufficient to provide reasonable assurance that a plant which references a certified design is built and will operate in accordance with the design certification.

2. 10 CFR Part 52, §52.97(b) as it relates to the identification of ITAAC within a combined license. An applicant or licensee must identify and perform those ITAAC, including those applicable to emergency planning, that are necessary and sufficient to provide reasonable assurance that the facility has been constructed and will be operated in conformity with the license, the provisions of the Atomic Energy Act, and the Commission's rules and regulations.

The reviewer should primarily utilize the SRP sections related to reactor and core cooling systems in its review of the CDM to determine the safety significance of SSCs for the design of reactor and core cooling systems. Other sources include applicable rules and regulations, GDCs, RGs, USIs and GSIs, NRC generic correspondence, PRA, insights from the standard design's safety and severe accident analyses, and operating experience. The CDM should be reviewed for consistency with the initial test program described in SSAR Chapter 14.2. The reviewer should also use the review checklists provided in Appendix D to this SRP section as an aid for establishing consistency and comprehensiveness in his review of the systems. If applicable, the reviewer should utilize regulatory guidance from the Commission for selected policy and technical issues related to particular design. Examples of these are contained in SECY-93-087, "Policy, Technical, and Licensing Issues Pertaining to Evolutionary and Advanced Light-Water Reactor Designs." The SRM related to this is dated July 21, 1993.

The CDM should be reviewed for treatment of design information proportional to the safety significance of the SSC for that system. Many items may be judged to be important to safety, and thus should be included in the CDM. The following issues are identified to ensure comprehensive and consistent treatment in the CDM based on the safety significance of the system being reviewed:

(1) System purpose and functions
(2) Location of system
(3) Key design features of the system
(4) Seismic and ASME code classifications

(5) System operation in various modes
(6) Controls, alarms, and displays
(7) Logic
(8) Interlocks
(9) Class 1E electrical power sources and divisions
(10) Equipment to be qualified for harsh environments
(11) Interface requirements
(12) Numeric performance values
(13) Accuracy and quality of figures

Additionally, standard ITAAC entries should be utilized to verify selected issues, where appropriate. The reviewer should ensure consistent application and treatment of all of the standard ITAAC entries, since most apply to the treatment of issues for reactor systems. Also, the reviewer should utilize the review checklist for fluid systems in Appendix D. In general, many of the reactor and core cooling systems are classified as safety-related, and therefore many of the characteristics and features of these systems are judged to have safety significance. This is reflected in a relatively higher level of detail in the CDM for these systems than other systems of the standard design.

The CDM should be reviewed to verify that plant safety analyses, such as for core cooling, transients, overpressure protection, steam generator tube rupture, and anticipated transient without scram (ATWS), are adequately addressed. Applicants should provide tables in SSAR Section 14.3 to show how the important input parameters used in the transient and accident analyses for the design are verified by the ITAAC.

SRXB should also receive inputs from PRA, including shutdown risk, and severe accident analyses to ensure important insights and design features from these analyses are incorporated into the CDM. For the severe accident analyses in particular, the basis for the staff's review for the evolutionary standard designs was the Commission guidance related to SECYs 90-016 and 93-087, later included in the design certification rules for these designs. For both PRA and severe accident analyses, although large uncertainties and unknowns may be associated with the event phenomena, design features important for severe accident prevention and mitigation resulting from these analyses should be selected for treatment in the CDM. The supporting information regarding the detailed design and analyses should remain in the SSAR. For many of the design features, it may be impractical to test their functionality because of the absence of simulated severe accident conditions. An example might be the ability of the reactor cavity to absorb the heat and radiation effects of a molten core. Consequently, the existence of the feature on a figure, subject to a basic configuration walkdown, may be considered sufficient CDM treatment.

The specific fuel, control rod, and core designs presented in the SSAR will constitute an approved design that may be used for the COL first cycle core loading, without further NRC staff review. If any other core design is requested for the first cycle, the COL applicant or licensee will be required to submit for staff review that specific fuel, control rod, and core design analyses as described in SSAR Chapters 6 and 15. Much of the detailed supporting information in the SSAR for the nuclear fuel, fuel channel, and control rod CDM, if considered for a change by a COL applicant or licensee that references the certified standard design, would require prior NRC approval. Therefore, for the evolutionary designs, the staff concluded that this information should be designated as Tier 2* information. However, the staff allowed some of the Tier 2* designation to expire after first full power operation of the facility, when the detailed design was complete and the core performance characteristics were known from the startup and power ascension test programs. The NRC bears the final responsibility for designating which material in the SSAR is Tier 2*.

No ITAAC are required for the CDM information in the fuel, control rod, and core design areas because of the requirement for prior NRC approval of any proposed changes to the approved design. Post fuel load testing programs (e.g., startup testing and power ascension testing) verify that the actual core performs in accordance with the analyzed core design.

Specific issues that should be examined for treatment in Tier 1 include net positive suction head for key pumps (standard ITAAC entry specified in the applicable systems), and intersystem LOCA (the design pressure of the piping of the systems that interface with the reactor coolant pressure boundary should be specified in the design descriptions or figures of the applicable systems, using code designations and safety classes).

Technical Rationale

The technical rationale for application of the above acceptance criteria to the CDM, including the ITAAC, is discussed in the following paragraphs.

1. Compliance with 10 CFR Part 52, §52.47(a)(1)(iii) and (vi-viii) requires applicants for design certification to include proposed site parameters, interface criteria, and inspections, tests, analyses and acceptance criteria for the design. The design is reviewed and approved by the staff during design certification, and prior to application for construction and operation of a facility. However, upon completion of construction, an as-built facility must be verified to be in accordance with the approved design and applicable regulations. Therefore, application of 10 CFR 52.47 to the CDM ensures that the applicant for design certification submits information necessary and sufficient to provide reasonable assurance that a facility which references a certified design is built and will operate in accordance with the design certification.

2. Compliance with 10 CFR Part 52, §52.97(b) requires applicants for a combined license to include site-specific information and proposed ITAAC for the design, construction and operation of a complete facility. The information required is reviewed and approved by the staff prior to the issuance of a combined license and the start of facility construction. However, upon completion of construction, an as-built facility must be verified to be in accordance with the approved design and applicable regulations. Therefore, application of §52.97(b) to the information in a combined license application ensures that the applicant for a combined license submits ITAAC, including those applicable to emergency planning, that are necessary and sufficient to provide reasonable assurance that the facility has been constructed and will be operated in conformity with the license, the provisions of the Atomic Energy Act, and the Commission's rules and regulations.

## III. REVIEW PROCEDURES

Reviewers should follow the general procedures for review of the CDM contained in SRP Section 14.3. This includes knowledge of the DCD and the CDM/ITAAC as discussed in the appendices to SRP Section 14.3. Review responsibilities are contained in Appendix A to this SRP section.

1. The CDM/ITAAC are reviewed to ensure that the systems are clearly delineated, including the key performance characteristics and safety functions of SSCs based on their safety significance. Reviewers should apply the acceptance criteria in this SRP Section to the review of the CDM information.

2. The CDM is reviewed to ensure that all information is consistent with the SSAR information. Figures and diagrams should be reviewed to ensure that they accurately depict the functional arrangement and requirements of the systems. Reviewers should use the Review Checklist in Appendix D-1 for review of fluid systems as an aid in establishing consistent and comprehensive treatment of issues.

3. The reviewer should ensure that appropriate guidance is provided to other branches such that reactor and core cooling systems issues in the CDM are treated in a consistent manner among branches.

4. The reviewer should ensure that inputs from SPSB regarding PRA, including shutdown risk, and SCSB regarding severe accident analyses are appropriately treated in the CDM.

5. The CDM is reviewed to ensure that standard ITAAC entries are included where appropriate in the systems of the standard design. The reviewer should ensure consistent application and treatment of the standard ITAAC, and in particular for the basic configuration ITAAC and the net positive suction head ITAAC.

6. The CDM is reviewed to ensure that design features from the resolutions of applicable regulations and Commission guidance are adequately addressed in the CDM, based on safety significance. Ensure that the bases for these items are documented clearly in the SER. Ensure that the specific Tier 2* information is clearly designated in the SSAR, and consider expiration of these items at first full power, if appropriate. The staff's basis for designating the information as Tier 2* and the rationale for its decision that it requires prior NRC approval to change should be specified in the SER (See also the discussion in Appendix B to this SRP section, regarding format of the DCD).

7. The CDM definitions, legends, interface requirements, and site parameters are reviewed to ensure that reactor systems issues are treated consistently and appropriately.

## IV. EVALUATION FINDINGS

Each review branch verifies that sufficient information has been provided to satisfy the requirements of this Standard Review Plan section, and concludes that the CDM is acceptable, as discussed in the Evaluation Findings of the SRP subsections to this SRP section. The findings of all review branches may be combined to support the following type of overall conclusive statement to be included in the staff's safety evaluation report:

"The staff performed a multidisciplinary review of the SSCs of the (standard design), in accordance with 10 CFR Part 52 and SRP Section 14.3.4. This review included information contained in CDM and SSAR submittals to the staff, as discussed previously in this section of the safety evaluation report."

"Based on the staff's review of the material in the (standard design) CDM, and a review of the selection methodology and criteria for the development of the CDM contained in SSAR Section 14.3, the staff concludes that the top-level design features and performance characteristics of the reactor and core cooling SSCs important to safety are appropriately described in the CDM, and the CDM is acceptable.

"Further, these top-level commitments can be adequately verified by the ITAAC provided by (the applicant). Therefore, in the appropriate parts of Section 14.3 of this report, the staff concludes that the CDM are necessary and sufficient to provide reasonable assurance that, if the inspections, tests, and analyses are performed, and the acceptance criteria met, a facility referencing the certified design will be constructed and will operate in conformity with the design certification and applicable regulations.

"The staff also concludes that the interface requirements (and site parameters, if applicable) in the CDM meet the requirements for design certification applications in 10 CFR 52.47, and are acceptable."

## V. IMPLEMENTATION

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

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

## VI. REFERENCES

1. NUREG-1503, "Final Safety Evaluation Report Related to the Certification of the Advanced Boiling Water Reactor", Volumes 1 and 2, July 1994.

2. NUREG-1462, "Final Safety Evaluation Report Related to the Certification of the System 80+ Design," Volumes 1 and 2, August 1994.

## 14.3.5 INSTRUMENTATION AND CONTROLS

REVIEW RESPONSIBILITIES

Primary - HICB

Secondary - None

### I. AREAS OF REVIEW

The information to be reviewed is the certified design material (CDM) and the inspections, tests, analyses, and acceptance criteria (ITAAC) for software development in digital computer systems proposed by the applicant. This review should be coordinated with the review of the applicant's software development process, as described in BTP ICSB-aa. The reviewer's primary responsibilities include a review of the CDM for I&C systems involving core protection and control, other miscellaneous instrumentation and controls (I&C) systems, any additional material in the CDM for software development in digital computer systems, and selected interface requirements related to I&C issues. HICB has secondary review responsibilities for ESF systems, reactivity control systems, and other systems using I&C equipment.

Review Interfaces

SRP Section 14.3 provides general guidance on review interfaces. HICB performs related reviews and coordination activities, as requested by other branches, for issues in the CDM related to I&C systems.

In addition, HICB will coordinate other branches' evaluations that interface with the overall review of the systems as follows:

1. The Reactor Systems Branch (SRXB) determines the acceptability of the CDM information regarding reactor and core cooling systems design features that prevent and mitigate design basis accidents in SRP Section 14.3.4.

2. The Electrical Engineering Branch (EELB) determines the acceptability of the CDM information regarding electrical issues in SRP Section 14.3.6.

For those areas of review identified above as being part of the primary review responsibility of other branches, the acceptance criteria necessary for the review and their methods of application are contained in the referenced SRP section of the corresponding primary branches.

### II. ACCEPTANCE CRITERIA

Acceptability is based on meeting the relevant requirements of the following regulations:

1. 10 CFR Part 52, §52.47(a)(1)(iii) and (vi-viii) as they relate to the contents of design certification applications. The information includes site parameters, interface criteria, and the ITAAC which are necessary and sufficient to provide reasonable assurance that a plant which references a certified design is built and will operate in accordance

with the design certification.

2. 10 CFR Part 52, §52.97(b) as it relates to the identification of ITAAC within a combined license. An applicant or licensee must identify and perform those ITAAC, including those applicable to emergency planning, that are necessary and sufficient to provide reasonable assurance that the facility has been constructed and will be operated in conformity with the license, the provisions of the Atomic Energy Act, and the Commission's rules and regulations.

3. For I&C systems, acceptability is based on meeting the relevant requirements of the following regulations:

   10 CFR 50.55a(h), "Criteria for Protection Systems for Nuclear Generating Stations," and IEEE Standard 279-1971, as it pertains to safety-related protection systems requirements.

   GDC 1, as it pertains to quality standards and records requirements

   GDC 2, as it pertains to protection against natural phenomenon

   GDC 4, as it pertains to environmental and dynamic effects

   GDC 13, as it pertains to instrumentation and control requirements

   GDC 19, as it pertains to control room requirements

   GDC 20, as it pertains to protection system design requirements

   GDC 21, as it pertains to protection system reliability and testability requirements

   GDC 22, as it pertains to protection system independence requirements

   GDC 23, as it pertains to protection system failure modes requirements

   GDC 25, as it pertains to protection system requirements for reactivity control malfunctions

   GDC 29, as it pertains to protection against anticipated operational occurrences requirements

To meet the above regulations, the appropriate CDM and ITAAC entries should address the following design issues:

(1) General functional requirements for the system

(2) Single failure criterion

(3) Quality of components and modules (hardware and software)

(4) Equipment qualification

(5) Channel integrity and channel independence

(6) Classification of equipment

(7) Isolation devices

(8) Single random failure

(9) System inputs

(10) Capability for sensor checks, tests and calibration

(11) Channel bypasses, operating bypasses, indication of bypasses, and access to means for bypassing

(12) Completion of protective action once initiated

(13) Manual initiation

(14) Information read-out

(15) Identification

The CDM should be reviewed for adequacy of both safety-related and non-safety-related systems of the design. The I&C design described in the SSAR and CDM may be to the level of control functional blocks. The block concept is useful for developing the system control interface diagrams that are needed for depicting the configuration of the I&C system architecture. For safety-related systems, the above criteria and in the Chapter 7 SRP sections should be assessed. For those systems reviewed that are not safety-related systems, appropriate criteria from the SRP applicable to those systems may be used.

Standard ITAAC entries for several attributes of the I&C system are listed in Appendix E to this SRP section. HICB is responsible for consistent use of the standard ITAAC in the CDM for electrical isolation and physical separation (independence) as it pertains to I&C issues. Guidance regarding its use should be provided to other branches as appropriate.

4. For the microprocessor and digital control technology aspects of the I&C system design, the design information should address the following:

For the microprocessor and digital control technology aspects of the I&C system design, applicants may not provide complete design information in the SSAR. This is because the technology in this area is rapidly evolving and it is, therefore, important that the certified design description and ITAAC not "lock in" a design which could be obsolete at the time of construction.

If this is the case, the process to complete the design, with appropriate acceptance criteria, should be specified in the CDM, with detailed supporting information in SSAR Chapter 7 and SSAR Section 14.3 (see format of the CDM/ITAAC in Appendix C and discussion of design processes and design acceptance criteria (DAC) in Appendix G to this SRP section). The issues discussed in that material should include the design of the safety system and plant protection system controls, development and qualification processes for I&C hardware and software, and design features that provide I&C system diversity as protection against common mode failures and address defense-in-depth considerations. These issues and their relationships to other systems of the design should be described in the CDM. Figures may be used for this at a block diagram level.

The description of the logic and control should address automatic decision-making and trip logic functions, and manual initiation functions associated with the safety actions of the safety-related systems. Safety-related trip logic and monitoring of plant protection system resides in logic and control system equipment. Logic and control equipment comprises microprocessor-based, software-controlled signal processors that perform signal conditioning, setpoint comparison, trip logic, system initiation and reset, self-test, calibration, and bypass functions. The signal processors associated with a particular safety-related system are an integral part of that system and do not belong to logic and control system.

The CDM should address the development and qualification processes for I&C equipment. The discussion should include (1) design processes and acceptance criteria to be used for safety-related systems using programmable microprocessor-based control equipment, (2) a program to assess and mitigate the effects of electromagnetic interference on I&C equipment, (3) a program to establish setpoints for safety-related instrument channels, and (4) a program to qualify safety-related I&C equipment for in-service environmental conditions.

The CDM should address the hardware and software development process to be used in the design, testing, and installation of I&C equipment. The CDM includes the description of the design process to be followed for hardware and software development, design commitments, the inspections, tests, and analysis to be performed to verify that the design is consistent with the commitments, and the appropriate acceptance criteria against which the design will be judged. This ITAAC describes attributes of the process to be used to develop the software as well as attributes of the final software product. The ITAAC for software and hardware verifies the applicant's proposed design stages within the overall design process. The various stages are described in more detail in the SSAR. An example of various design stages is given below.

(1) Planning
(2) Design definition
(3) Software design
(4) Software coding
(5) Integration
(6) Validation
(7) Change control

The CDM and SSAR contain criteria which describe the method to develop plans and procedures that will guide the design process throughout the lifecycle stages. The ITAAC provides the acceptance criteria for verifying the design through the stages while the SSAR adds the set of guidelines and standards that will provide more detailed criteria for the development of the design. The CDM should be written to incorporate the most important and general aspects (top-level requirements) from the standards. The set of standards and criteria in the SSAR encompass the guidance for generating the plans that will be used in the computer software and hardware design process for the computer design throughout the lifecycle.

The certified design description and design development process continue for the lifetime of the plant. Any safety-related software that is changed or added after plant startup is required to either be developed using the certified design development process described in the computer CDM, or the licensee must submit a design process (together with the design bases) description that will producc software of the same or higher quality than the original certified design process, consistent with the CDM. The licensee will be required to use the approved software change procedure (SCP) based upon the certified design development process for the operation stage of the lifecycle.

A. Diversity and Defense-In-Depth

The CDM should address the concern that software design faults or other initiating events common to redundant, multidivisional logic channels of I&C protection systems could disable significant portion of the plant's safety functions at the moment when these functions are needed to mitigate an accident, and addresses the diverse backup features that are provided for the primary automatic logic. Diversity is provided in the form of hard-wired backup for reactor trip, diverse display of important process parameters, defense-in-depth arrangement of equipment, and other equipment diversity.

B. Electromagnetic Interference (EMC)

The CDM should address the process to ensure that I&C equipment is able to function properly when subjected to an electromagnetic environment. An EMC compliance plan to confirm the level of immunity to electrical noise should be included in the design, installation, and testing of I&C equipment. The plan should be structured on the basis that EMC of I&C equipment is verified by factory testing and site testing of both individual components and interconnected systems to meet electromagnetic compatibility requirements.

C. Setpoint Methodology

The CDM should address the process to ensure that setpoints for initiation of safety-related functions are determined, documented, installed, and maintained. The process (the instrument setpoint methodology) may establish a program for specifying requirements for documenting the bases for selection of trip setpoints, accounting for instrument inaccuracies, response testing, and replacement of instrumentation.

D. Equipment Qualification of I&C Components

The CDM should address the process to ensure that qualification of safety-related I&C equipment is able to complete its safety-related function under the environmental conditions that exist up to and including the time the equipment has finished performing that function. An equipment qualification program may be established that ensures qualification specifications consider conditions that exist during normal, abnormal, and design-basis accident events in terms of their cumulative effect on equipment performance for the period up to the end of equipment life.

5. Software Development: In general, the CDM should discuss the following elements of software development.

   A software QA (SQA) plan describes the software-specific activities that are to be performed and controlled in addition to the approved QA plan (in accordance with 10 CFR Part 50, Appendix B, "Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants") for the total ABWR design. The SQA plan establishes the criteria under which the other software development plans will be generated. The software management plan (SMP) establishes the organization and authority structure for the design, the procedures to be used, and the interrelationships between major activities. The software configuration management plan (CMP) provides the means to identify software products, control and implement changes, and record and report change implementation status. The software development plan (SDP) describes a development process, tools documentation, and products developed according to the software lifecycle. The verification and validation plan (V&VP) describes the method to ensure that the requirements of each phase or stage of the design process (lifecycle) are fully and accurately implemented into the next phase. Each software module should be verified by an organization that is independent of the organization that developed the software module. The software safety plan (SSP) describes the safety and hazards analyses that will be performed. The software operation and maintenance plan (SOMP) includes the procedures required to ensure that the software will be operated correctly and that the quality of the software is maintained. These plans may be combined into a software management plan, a configuration management plan, and a verification and validation plan.

   The ITAAC activities completed by the COL applicant will be inspected by the NRC to verify conformance with the requirements at several stages during the digital control system design process or stage of the lifecycle. The documents which demonstrate satisfactory implementation of the ITAAC will be available for inspection during the NRC audit at the completion of each of the above stages. The stages or phases should be shown in the CDM. The NRC audit and the COL applicant conformance review points are shown in Chapter 7 of the staff's safety evaluation report. These should correspond with the phases described by applicants in the CDM. The actual stages, including the conformance review and audit points, will be determined for each of the software products to be developed when design implementation is scheduled to begin.

   At each stage the design development must be verified by the COL applicant to be in accordance with the certified design process and the detailed design developed (through that stage) to be in conformance with the certified design. Upon completion of ITAAC activities for each stage, the COL applicant will certify to the NRC that the stage has been completed and the design and construction completed up through that stage is in compliance with the certified design. Although not required, the COL applicant should satisfactorily complete ITAAC activities at each stage prior to proceeding to the next stage of the design development process. Failure to successfully complete the ITAAC at a stage, as determined by the conformance review or the NRC audit, may require repeating an earlier stage ITAAC or changing the system design. The NRC staff will identify any open issues which require resolution for each stage of the ITAAC. Significant open issues which are not resolved could result in the NRC staff concluding that the ITAAC had not been satisfactorily completed.

The ITAAC should contain the following information:

- The specific design commitments to be verified by the ITAAC,
- The inspections, tests, and/or analyses to be performed, and
- The corresponding acceptance criteria which demonstrates that the design commitment has been met.

An example of one page of an ITAAC is provided in Figure 1 in this SRP section. The format of the CDM/ITAAC is discussed further in Appendix C to this SRP section.

As a part of the submission for a design certification under Subpart B or a combined license under Subpart C of Part 52, the applicant must submit a proposed life cycle and all of the plans which are required in the first phase of that life cycle. The BTP on Software Process, BTP ICSB-aa, and the BTP on Level of Detail, BTP ICSB-cc, describe the HICB branch position on reviewing these planning documents. Since the planning commitments for the software development process are reviewed as part of the application, the software ITAAC needs to cover only those phases titled Requirements through Installation. See Figure 2.

The software ITAAC should contain the commitments for each phase of the defined software development life cycle extracted from the planning documents, a method for verifying that each design commitment is met through inspection, test, or analysis, and an acceptance criterion for meeting the commitment. A set of acceptable commitments for each phase of the software life cycle is outlined in the BTP on Software Process, BTP ICSB-aa, which also contains an acceptable method of verification and acceptable acceptance criteria for each of the commitments.

The commitments in the ITAAC should reflect in detail the elements, activities, and documentation required of the various phases of the life cycle as shown in Figure 1 and as detailed in the BTP on Software Process, BTP ICSB-aa. Inspection should be the method for verifying the commitment and the acceptance criteria for each commitment should closely parallel the attributes listed in BTP ICSB-aa. The acceptance criteria specified should be adequate to demonstrate that the software development activities committed to for each phase have been completed, and that these activities have produced the software attributes described in the BTP on Software Qualities, BTP ICSB-bb.

The software development process outlined in this SRP section is a "rolling wave" process in that as each phase is completed, more detail is added to the subsequent phases. For example, in the planning phase, a V&V plan is developed which commits the organization to a comprehensive software testing program. Then, during the design phase of the life cycle, detailed inspection and test plans are developed, including procedures and acceptance criteria. The detailed plans and procedures describe Tier 2 or Tier 2* validation attributes that represent commitments to be met. The inspections, tests, and the acceptance procedures which go with them should be adequate to assure that, if the tests are performed and the acceptance criteria are met, the system will perform according to its design (§52.47(a)(1)(vi) and §52.79(c)). The BTP on Software Qualities, BTP ICSB-bb, describes software characteristics that should be demonstrated by the ITAAC or supporting tier 2 validation activities.

Tier 2* Information

The material in SSAR Chapter 7 provides design information and defines design processes that are acceptable for use in meeting the acceptance criteria in the CDM. However, the SSAR information may be changed by a COL applicant or licensee referencing the certified design in accordance with a "50.59-like" process. The staff bases its safety determinations on the design processes specified in the SSAR. Therefore, for the evolutionary designs, the staff designated selected information in SSAR Chapter 7 that, if considered for a change, requires NRC approval prior to implementation. This information is known as Tier 2* information (see Appendix C regarding format of the DCD for instructions on designating information in the SSAR as Tier 2*). Similar information should be considered on a design-specific basis for all standard designs. However, the staff allowed some of the Tier 2* designation to expire after first full power operation of the facility, when the detailed design was complete and the facility performance characteristics were known from the initial test program. The NRC bears the final responsibility for designating which material in the SSAR is Tier 2*.

Technical Rationale

The technical rationale for application of the above acceptance criteria to the CDM, including the ITAAC, is discussed in the following paragraphs.

1. Compliance with 10 CFR Part 52, §52.47(a)(1)(iii) and (vi-viii) requires applicants for design certification to include proposed site parameters, interface criteria, and inspections, tests, analyses and acceptance criteria for the design. The design is reviewed and approved by the staff during design certification, and prior to application for construction and operation of a facility. However, upon completion of construction, an as-built facility must be verified to be in accordance with the approved design and applicable regulations. Therefore, application of 10 CFR 52.47 to the CDM ensures that the applicant for design certification submits information necessary and sufficient to provide reasonable assurance that a facility which references a certified design is built and will operate in accordance with the design

certification.

2. Compliance with 10 CFR Part 52, §52.97(b) requires applicants for a combined license to include site-specific information and proposed ITAAC for the design, construction and operation of a complete facility. The information required is reviewed and approved by the staff prior to the issuance of a combined license and the start of facility construction. However, upon completion of construction, an as-built facility must be verified to be in accordance with the approved design and applicable regulations. Therefore, application of §52.97(b) to the information in a combined license application ensures that the applicant for a combined license submits ITAAC, including those applicable to emergency planning, that are necessary and sufficient to provide reasonable assurance that the facility has been constructed and will be operated in conformity with the license, the provisions of the Atomic Energy Act, and the Commission's rules and regulations.

## III. REVIEW PROCEDURES

Reviewers should follow the general procedures for review of the CDM contained in SRP Section 14.3. This includes knowledge of the DCD and the CDM/ITAAC as discussed in the appendices to SRP Section 14.3. Review responsibilities are contained in Appendix A to this SRP section.

1. Review Chapter 7 of the SSAR for familiarity with the design for hardware and software development in digital computer based instrumentation and controls systems.

2. The CDM/ITAAC are reviewed to ensure that the I&C systems are clearly delineated, including the key performance characteristics and safety functions of SSCs based on their safety significance. Reviewers should apply the acceptance criteria in this SRP Section to the review of the CDM information.

3. The CDM is reviewed to ensure that all information is consistent with the SSAR information. Figures and diagrams should be reviewed to ensure that they accurately depict the functional arrangement and requirements of the systems. Reviewers should use the review checklists in Appendix D for review of systems as an aid in establishing consistent and comprehensive treatment of issues.

4. The reviewer should ensure that appropriate guidance is provided to other branches such that I&C issues in the CDM are treated in a consistent manner among branches.

5. The reviewer should ensure that the standard ITAAC entries related to I&C items are included in the appropriate systems of the standard design. The reviewer should review the general provision for verification of equipment qualification. The reviewer should ensure consistent application and treatment of the standard ITAAC entries for basic configuration ITAAC and independence for electrical and I&C systems in the appropriate systems in the CDM.

6. Reviewers should ensure that design features from the resolutions of

applicable regulations and Commission guidance are adequately addressed in the CDM, based on safety significance. Ensure that the bases for these items are documented clearly in the SER.

7. Reviewers should ensure that definitions, legends, interface requirements, and site parameters that pertain to I&C issues are treated consistently and appropriately in the CDM.

8. Confirm the ITAAC covers all software development activities from the completion of process planning through the completion of system installation. Confirm the ITAAC includes each commitment made in the software development planning documents. Confirm the ITAAC defines acceptable methods and acceptance criteria for confirming each commitment is met.

9. Confirm via a sequence of audits that the ITAAC is appropriately implemented and that it demonstrates the software process is developing quality software as described in BTP ICSB-bb. NUREG/CR-Task 9 provides detailed information that may be used in auditing the performance of software ITAAC.

VI. <u>REFERENCES</u>

1. 10 CFR Part 50, "Code of Federal Regulations - Energy - Domestic licensing of production and utilization facilities."

2. 10 CFR Part 52, "Code of Federal Regulations - Energy - Early site permits; standard design certifications; and combined licenses for nuclear power plants."

3. SECY-91-178, "Inspections, Tests, Analyses, and Acceptance Criteria (ITAAC) for Design Certifications and Combined Licenses."

4. SECY-91-210, "Inspections, Tests, Analyses, and Acceptance Criteria (ITAAC) Requirements for Design Review and Issuance of a Final Design Approval (FDA)."

5. SECY-92-053, "Use of Design Acceptance Criteria During 10 CFR Part 52 Design Certification Reviews."

6. NUREG/CR-6101, "Software Reliability and Safety in Nuclear Reactor Protection Systems."

7. NUREG/CR-Task9, "Assessing Safety-Critical Software in Nuclear Power Plants."

8. NUREG-1503, "Final Safety Evaluation Report Related to the Certification of the Advanced Boiling Water Reactor", Volumes 1 and 2, July 1994.

9. NUREG-1462, "Final Safety Evaluation Report Related to the Certification of the System 80+ Design," Volumes 1 and 2, August 1994.

The following IEEE standards are referenced in NUREG/CR-6101 and are included here for completeness.

8. IEEE Std 730.1-1989, "Software Quality Assurance Plans."

9. IEEE Std 828-1984, "Software Configuration Management Plans."

10. IEEE Std 830-1985, "Software Requirements Specifications."

11. IEEE Std 1012-1986, "Software Verification and Validation Plans."

12. IEEE Std 1058.1-1987, "Standard for Software Project Management Plans."

13. IEEE Std P-1228, "Standard for Software Safety Plans."

14. IEEE Std 7-4.3.2-1993, "Standard Criteria for Digital Computers in Safety Systems of Nuclear Power Generating Stations."

## IV. EVALUATION FINDINGS

The reviewer verifies that sufficient information has been provided to satisfy the requirements of this Standard Review Plan section, and concludes that the CDM is acceptable. The findings should support the following type of overall conclusive statement to be included in the staff's safety evaluation report:

> "Based on the staff's review of the material in the (standard design) CDM, and a review of the selection methodology and criteria for the development of the CDM contained in SSAR Section 14.3, the staff concludes that the top-level design features and performance characteristics of the instrumentation and controls aspects of SSCs important to safety are appropriately described in the CDM, and the CDM is acceptable.
>
> "Further, these top-level commitments can be adequately verified by the ITAAC provided by (the applicant). Therefore, the staff concludes that the CDM are necessary and sufficient to provide reasonable assurance that, if the inspections, tests, and analyses are performed, and the acceptance criteria met, a facility referencing the certified design will be constructed and will operate in conformity with the design certification and applicable regulations.

If the applicant has provided DAC for various aspects of the standard design, then the reviewer should provide a separate evaluation similar to the above for that material.

## V. IMPLEMENTATION

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

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

| Inspections, Tests, Analyses and Acceptance Criteria | | |
|---|---|---|
| Design Commitment | Inspections, Tests, or Analyses | Acceptance Criteria |
| *Hardware/Software Development* | | |

| | | |
|---|---|---|
| 7. A quality assurance program encompassing software is employed as a controlled process for software development, hardware integration, and final product and system testing. | 7. The program for quality assurance that encompasses software shall be reviewed. | 7. A quality assurance program is in place that defines controlled processes for software development, hardware integration, and final product and system testing. As a minimum, the program requires a Software Management Plan, Configuration Management Plan and Verification and Validation Plan as described in the following items. |
| 8. A Software Management Plan (SMP) shall be instituted which establishes that software for embedded control hardware shall be developed, designed, evaluated, and documented per a design development process that addresses, for safety-related software, software safety issues at each defined life-cycle phase of the software development.<br><br>The SMP shall state that the output of each defined life-cycle phase shall be documents that define the current state of that design phase and the design input for the next design phase. | 8. The Software Management Plan shall be reviewed. | 8. The Software Management Plan shall define:<br><br>a. The organization and responsibilities for development of the software design; the procedures to be used in the software development; the interrelationships between software design activities; and the methods for conducting software safety analyses.<br><br>b. That the software safety analyses to be conducted for safety-related software applications shall:<br><br>(1) Identify software requirements having safety-related implications.<br><br>(2) Document the identified safety-critical software requirements in the software requirements specification for the design. |

Figure 1. Example Instrumentation and Control ITAAC (excerpt)

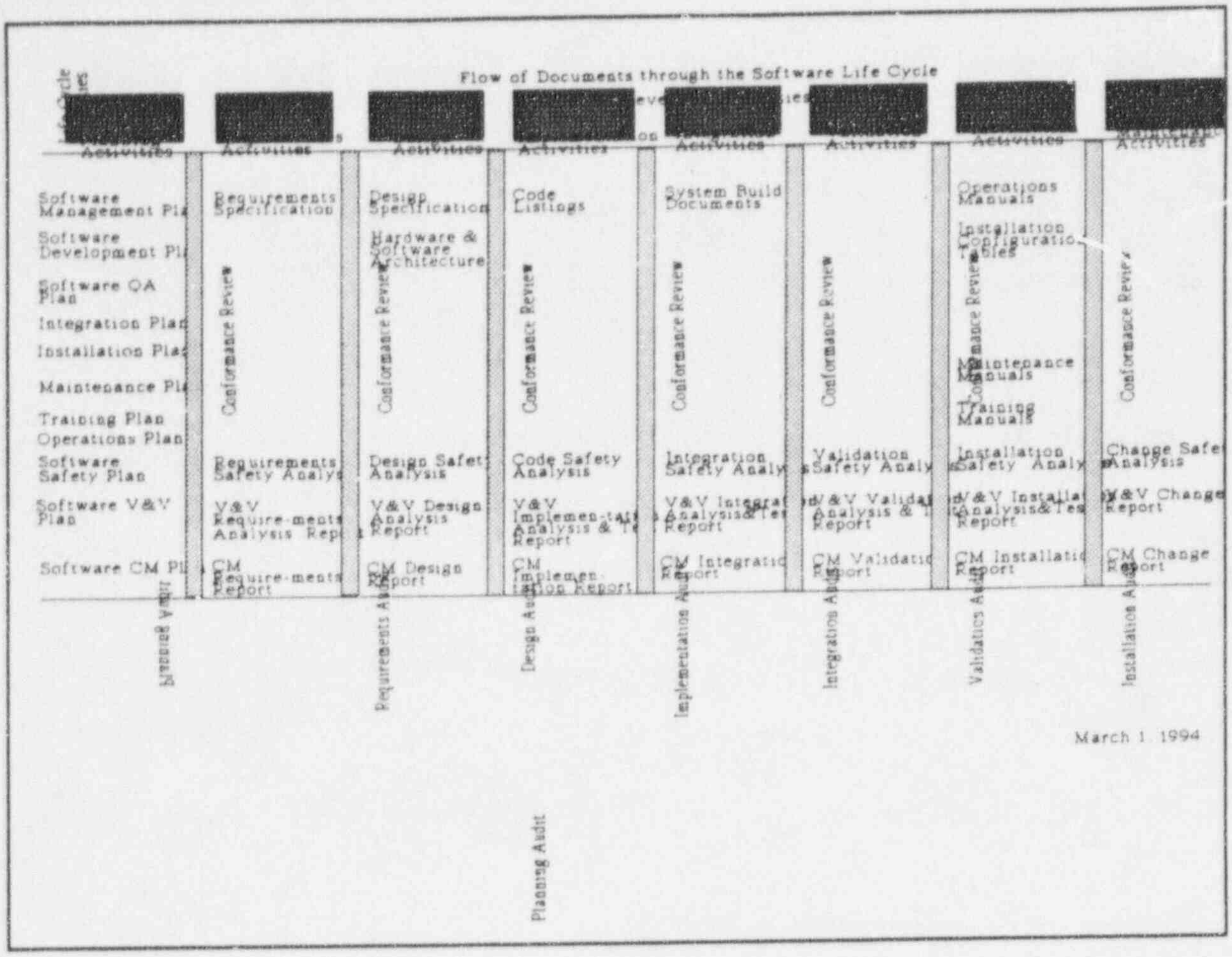

Figure 2. Flow of Documents through the Software Life Cycle

## 14.3.6 ELECTRICAL SYSTEMS

### I. REVIEW RESPONSIBILITIES

Primary - EELB

Secondary - None

### I. AREAS OF REVIEW

EELB reviews the certified design material (CDM) and Section 14.3 of the standard safety analysis report (SSAR) submitted by the applicant. The information includes inspections, tests, analyses, and acceptance criteria (ITAAC), interface requirements, site parameters, and information applicable to multiple systems of the design. Definitions, legends, and general provisions in the CDM are also reviewed.

EELB has primary review responsibility for the station electrical systems in the CDM. If the CDM information is based on the systems of the design, assignment of review responsibilities is consistent with those contained in Appendix A to this SRP section. The scope of the electrical review includes the entire Class 1E portion of the electrical system as well as a major portion of the non-Class 1E electrical system. It also includes portions of the plant lighting system. In addition, EELB has responsibility for the review of selected definitions, interface requirements of the standard design with the site, and site parameters for the design, that pertain to electrical issues.

#### Review Interfaces

SRP Section 14.3 provides general guidance on review interfaces. EELB performs related reviews and coordination activities, as requested by other branches, for CDM systems using Class 1E power.

In addition, EELB coordinates other branches' evaluations that interface with the overall review of the systems as follows:

1. The Plant Systems Branch (SPLB) determines the acceptability of the CDM information regarding qualification of equipment to withstand harsh environments in SRP Section 14.3.7.

2. The Civil Engineering and Geosciences Branch (ECGB) determines the acceptability of the CDM information regarding qualification of equipment for seismic environments in SRP Section 14.3.2.

For those areas of review identified above as being part of the primary review responsibility of other branches, the acceptance criteria necessary for the review and their methods of application are contained in the referenced SRP section of the corresponding primary branches.

### II. ACCEPTANCE CRITERIA

Acceptability is based on meeting the relevant requirements of the following regulations:

1. 10 CFR Part 52, §52.47(a)(1)(iii) and (vi-viii) as they relate to the contents of design certification applications. The information includes site parameters, interface criteria, and the ITAAC which are necessary and sufficient to provide reasonable assurance that a plant which references a certified design is built and will operate in accordance with the design certification.

2. 10 CFR Part 52, §52.97(b) as it relates to the identification of ITAAC within a combined license. An applicant or licensee must identify and perform those ITAAC, including those applicable to emergency planning, that are necessary and sufficient to provide reasonable assurance that the facility has been constructed and will be operated in conformity with the license, the provisions of the Atomic Energy Act, and the Commission's rules and regulations.

In establishing the top level requirements for the electrical design, the reviewer should use the Code of Federal Regulations including the GDC of Appendix A and Parts 50.49, "Environmental Qualification," and 50.63, "Station Blackout," as his main bases. In addition, IEEE nuclear standards should be used, as appropriate, to further establish top level requirements. These are discussed below. The reviewer should use the review checklists provided in Appendix D to this SRP section as an aid for establishing consistency and comprehensiveness in his review of the systems. Also, the reviewer should consider significant lessons learned from operating experience problems and insights gained from the PRA for the standard design.

3. GDC 17, in part, requires that an onsite and an offsite electric power system be provided to permit functioning of structures, systems and components important to safety. It further requires that the onsite electric power system have independence and redundancy and the electric power supplied by the offsite system be supplied by two physically independent circuits.

4. 10 CFR 50.49 requires that certain electrical equipment be qualified for accident (referred to as harsh) environments.

5. 10 CFR 50.63 requires that a nuclear power plant be able to withstand and recover from a station blackout event.

6. IEEE 308 "IEEE Standard Criteria for Class 1E power Systems for Nuclear Power Generating Stations," in conjunction with other related IEEE standards, establish specific design criteria for nuclear power plant electrical systems and equipment.

The staff's review of the standard plant is conducted to ensure, in part, that the CDM contains top level design, fabrication, testing, and performance requirements for SSCs important to safety. Design descriptions and ITAAC should be established to verify that these top level requirements (or design commitments) are met when the plant is built.

<u>Class 1E Electrical Systems</u>

The standard design Class 1E electrical systems may include: (1) the Class 1E electrical power distribution system, (2) the emergency diesel generators,

(3) the Class 1E direct current power supply, and (4) the Class 1E vital ac and Class 1E instrument and control power supplies. Using the above regulations, IEEE standards, operating experience, and PRA as its bases, the applicant should establish top-level design commitments for the Class 1E electrical systems of the standard design to be included in the design descriptions and verified by ITAAC. The top-level design commitments for the Class 1E electrical systems include design aspects related to:

1. Equipment qualification for seismic and harsh environment

   To ensure that the seismic design requirements of GDC 2 and the environmental qualification requirements of 10 CFR 50.49 have been adequately addressed, a "basis configuration" standard ITAAC may be established for applicable systems to verify these design aspects of electrical equipment important to safety.

   The design description should identify that Class 1E equipment is seismic Category 1 and equipment located in a harsh environment is qualified. The basic configuration standard ITAAC may be used to verify these areas.

2. Redundancy and independence

   To ensure that the Class 1E electric systems meet the single failure requirements of GDC 17 (and other GDC), ITAAC may be established to verify the redundancy and independence of the Class 1E portion of the electrical design.

   For the electrical systems, ITAAC should verify the Class 1E divisional assignments and independence of electric power by both inspections and tests. The independence may be established by both electrical isolation and physical separation. Identification of the Class 1E divisional equipment should be included to aid in demonstrating the separation. (The detailed requirements are specified in the SSAR. For example, separation distances and identification are outlined in the SSAR.) These attributes should be verified all the way to the electrically powered loads by a combination of the electrical system ITAAC and the ITAAC of the individual fluid, I&C, and HVAC systems which also cover the electrical independence and divisional power supply requirements.

3. Capacity and capability

   To ensure that the electrical systems have the capacity and capability to supply the safety-related electrical loads, ITAAC may be established to verify the adequate sizing of the electrical system equipment and its ability to respond (e.g., automatically in the times needed to support the accident analyses) to postulated events. This includes the Class 1E portion and the non-Class 1E portion to the extent that it is involved in supporting the Class 1E system.

   ITAAC should be included to analyze the as-built electrical system and installed equipment (diesel generators, transformers, switchgear, batteries, etc.) to verify its ability to power the loads. In addition, the ITAAC should also include tests to demonstrate the operation of the equipment.

To ensure that the Class 1E portions of the electrical power system have the capability to respond to postulated events including LOCA, loss of normal preferred power, and degraded voltage conditions, ITAAC should be established to verify the initiation of the Class 1E equipment necessary to mitigate the event.

ITAAC should be included to analyze the as-built electrical power system for its response to a LOCA, loss of voltage, combinations of LOCA and loss of voltage, and degraded voltage. In addition, tests should be included to demonstrate the actuation of the electrical equipment in response to postulated events.

4. Electrical protection features

To ensure that the electrical power system is protected against potential electrical faults, ITAAC should be established to verify the adequacy of the electrical circuit protection included in the design. Operating experience and NRC Electrical Distribution System Functional Inspections (EDSFIs) have indicated some problems with the short circuit rating of some electrical equipment and breaker and protective device coordination.

ITAAC should be included to analyze the as-built electrical system equipment for its ability to withstand and clear electrical faults. ITAAC should also be included to analyze the protection feature coordination to verify its ability to limit the loss of equipment due to postulated faults.

5. Displays/controls/alarms

To help ensure that the electrical power system is available when required, ITAAC should be included to verify the existence of monitoring and controls for the electrical equipment. The minimum set of displays, alarms, and controls is based on the emergency procedure guidelines. In some cases, additional displays, alarms, and controls may be specified based on special considerations in the design and/or operating experience.

ITAAC should be included to inspect for the ability to retrieve the information (displays and alarms), and to control the electrical power system in the main control room and/or at locations provided for remote shutdown.

Other Electrical Equipment Important to Safety

In addition to the Class 1E systems addressed above, other aspects of the electrical design that are deemed to be important to safety and the top-level design commitments are included in the CDM.

1. Offsite Power

To ensure that the requirements of GDC 17 for the adequacy and independence of the preferred offsite power sources within the standard design scope were met, ITAAC should verify the capacity and capability of the offsite sources to feed the Class 1E divisions, and the independence of those sources.

ITAAC should be included to inspect the direct connection of the offsite sources to the Class 1E divisions and to inspect for the independence/separation of the offsite sources. Lightning protection and grounding features are inspected as part of the basic configuration ITAAC.

In addition, the design description includes "interface" requirements for the portions of the offsite power outside of the standard design scope; however, no ITAAC are included for the interfaces. The interfaces define the requirements that the offsite portion of the design (that is out-of-scope) must meet to support and not degrade the in-scope design.

2. Containment Electrical Penetrations

To ensure the containment electrical penetrations (both those containing Class 1E circuits and those containing Non Class 1E circuits) do not fail due to electrical faults and potentially breach the containment, ITAAC should verify that all electrical containment penetrations are protected against postulated currents greater than their continuous current rating.

3. Combustion Turbine Generator

To ensure the availability of the combustion turbine generator (CTG) as an alternate AC source for station blackout events, the ITAAC should verify, through inspection and testing, the CTG's and its auxiliaries inclusion in the design and its independence from other AC sources. In addition, the standard design's PRA should be used for an indication of the importance of the CTG from a risk perspective.

4. Lighting

To ensure that portions of the plant lighting remain available during power failures, ITAAC should be developed to verify the continuity of power sources for the lighting systems.

<u>Electrical Power For Non-Safety Plant Systems</u>

To ensure that electrical power is provided to support the non-safety plant systems, Design Descriptions cover portions of the non-Class 1E electrical systems. A basic configuration ITAAC may be utilized to verify the functional arrangement and the Tier 1 design commitments for these areas.

<u>Technical Rationale</u>:

The technical rationale for application of the above acceptance criteria to the CDM, including the ITAAC, is discussed in the following paragraphs.

1. Compliance with 10 CFR Part 52, §52.47(a)(1)(iii) and (vi-viii) requires applicants for design certification to include proposed site parameters, interface criteria, and inspections, tests, analyses and acceptance criteria for the design. The design is reviewed and approved by the staff during design certification, and prior to application for construction and operation of a facility. However, upon completion of construction, an as-built facility must be verified to be in accordance with the approved design and applicable regulations. Therefore, application of 10 CFR 52.47 to the CDM ensures that the applicant for design certification submits information necessary and sufficient to provide reasonable assurance that a facility which references a certified design is built and will operate in accordance with the design certification.

2. Compliance with 10 CFR Part 52, §52.97(b) requires applicants for a combined license to include site-specific information and proposed ITAAC for the design, construction and operation of a complete facility. The information required is reviewed and approved by the staff prior to the issuance of a combined license and the start of facility construction. However, upon completion of construction, an as-built facility must be verified to be in accordance with the approved design and applicable regulations. Therefore, application of §52.97(b) to the information in a combined license application ensures that the applicant for a combined license submits ITAAC, including those applicable to emergency planning, that are necessary and sufficient to provide reasonable assurance that the facility has been constructed and will be operated in conformity with the license, the provisions of the Atomic Energy Act, and the Commission's rules and regulations.

3. Compliance with GDC 17, in part, requires that an onsite and an offsite electric power system be provided to permit functioning of structures, systems and components important to safety. It further requires that the onsite electric power system have independence and redundancy and the electric power supplied by the offsite system be supplied by two physically independent circuits. This provides a reasonable assurance that the facility will function reliably in the event of a fault in an area of the electrical design.

4. Compliance with 10 CFR 50.49 requires that certain electrical equipment be qualified for accident (referred to as harsh) environments. This provides a reasonable assurance that the equipment needed in the event of an accident will perform its intended function.

5. Compliance with 10 CFR 50.63 requires that a nuclear power plant be able to withstand and recover from a station blackout event. This ensures that the plant can withstand and recover from this event safely.

6. Compliance with IEEE 308 "IEEE Standard Criteria for Class 1E power Systems for Nuclear Power Generating Stations," in conjunction with other related IEEE standards, establish specific design criteria for nuclear power plant electrical systems and

equipment. This provides a reasonable assurance that the electrical systems will perform their intended function in the anticipated operational environment.

## III. REVIEW PROCEDURES

Reviewers should follow the general procedures for review of the CDM contained in SRP Section 14.3. This includes knowledge of the DCD and the CDM/ITAAC as discussed in the appendices to SRP Section 14.3. Review responsibilities are contained in Appendix A to this SRP section.

1. The CDM/ITAAC are reviewed to ensure that the electrical systems are clearly delineated, including the key performance characteristics and safety functions of SSCs based on their safety significance. Reviewers should apply the acceptance criteria in this SRP Section to the review of the CDM information.

2. The CDM is reviewed to ensure that all information is consistent with the SSAR information. Figures and diagrams should be reviewed to ensure that they accurately depict the functional arrangement and requirements of the systems. Reviewers should use the Review Checklist in Appendix D-2 for review of electrical systems as an aid in establishing consistent and comprehensive treatment of issues.

3. The reviewer should ensure that appropriate guidance is provided to other branches such that electrical issues in the CDM are treated in a consistent manner among branches.

4. The reviewer should ensure that the standard ITAAC entries related to electrical systems are included in the appropriate electrical systems. The reviewer should coordinate the SPLB review of the general provision for verification of equipment qualification. The reviewer should interface with the ECGB review of the general provision for verification of seismic qualification of electrical components in the basic configuration ITAAC. The reviewer should ensure consistent application and treatment of the standard ITAAC entries for divisional power supply, physical separation, and independence for electrical and I&C systems in the CDM.

5. Reviewers should ensure that design features from the resolutions of applicable regulations and Commission guidance are adequately addressed in the CDM, based on safety significance. Ensure that the bases for these items are documented clearly in the SER.

6. Reviewers should ensure that definitions, legends, interface requirements, and site parameters that pertain to electrical issues are treated consistently and appropriately in the CDM.

## IV. EVALUATION FINDINGS

The reviewer verifies that sufficient information has been provided to satisfy the requirements of SRP Section 14.3 and this SRP Subsection, and concludes that the CDM is acceptable. When the review is complete, a finding of the following type should be provided for the staff's safety evaluation report:

"The staff performed a multidisciplinary review of the SSCs of the (standard design), in accordance with 10 CFR Part 52 and SRP Section 14.3.6. This review included information contained in various CDM and SSAR submittals to the staff, as discussed previously in this section of the safety evaluation report.

"Based on the staff's review of the material in the (standard design) CDM, and a review of the selection methodology and criteria for the development of the CDM contained in SSAR Section 14.3, the staff concludes that the top-level design features and performance characteristics of the electrical SSCs important to safety are appropriately described in the CDM, and the CDM is acceptable.

"Further, these top-level commitments can be adequately verified by the ITAAC provided by (the applicant). Therefore, the staff concludes that the CDM is necessary and sufficient to provide reasonable assurance that, if the inspections, tests, and analyses are performed, and the acceptance criteria met, a facility referencing the certified design will be constructed and will operate in conformity with the design certification and applicable regulations.

"The staff also concludes that the interface requirements (and site parameters, if applicable) in the CDM meet the requirements for design certification applications in 10 CFR 52.47, and are acceptable."

## V. IMPLEMENTATION

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

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

## VI. REFERENCES

1. NUREG-1503, "Final Safety Evaluation Report Related to the Certification of the Advanced Boiling Water Reactor", Volumes 1 and 2, July 1994.

2. NUREG-1462, "Final Safety Evaluation Report Related to the Certification of the System 80+ Design," Volumes 1 and 2, August 1994.

## 14.3.7 PLANT SYSTEMS

### I. REVIEW RESPONSIBILITIES

Primary - SPLB

Secondary - NA

### I. AREAS OF REVIEW

SPLB reviews the certified design material (CDM) and Section 14.3 of the standard safety analysis report (SSAR) submitted by the applicant. The information includes inspections, tests, analyses, and acceptance criteria (ITAAC), interface requirements, site parameters, and information applicable to multiple systems of the design. Definitions, legends, and general provisions in the CDM are also reviewed.

SPLB has primary review responsibility for most of the fluid systems in the CDM that are not part of the core reactor systems. If the CDM information is based on the systems of the design, assignment of review responsibilities is consistent with those contained in Appendix A to this SRP section. The scope of the plant systems review includes new and spent fuel handling systems, power generation systems, air systems, cooling water systems, radioactive waste systems and heating, ventilation and air conditioning systems. The group reviews issues which affect multiple SSCs such as equipment qualification and protection from fires, floods and tornado missiles, and has secondary review responsibilities for most of the fluid systems and the structures of the design. In addition, SPLB has responsibility for the review of selected definitions, interface requirements of the standard design with the site, and site parameters for the design, that pertain to plant systems issues.

#### Review Interfaces

SRP Section 14.3 provides general guidance on review interfaces. SPLB performs related reviews and coordination activities, as requested by other branches, for issues in the CDM related to plant systems.

In addition, SPLB will coordinate other branches' evaluations that interface with the overall review of the systems as follows:

1. The Electrical Engineering Branch (EELB) determines the acceptability of the CDM information regarding electrical SSCs in SRP Section 14.3.6.

2. The Civil Engineering and Geosciences Branch (ECGB) determines the acceptability of the CDM information regarding the ability of SSCs to withstand various natural phenomena in SRP Sections 14.3.1 and 14.3.2, and regarding piping design in SRP Section 14.3.3.

For those areas of review identified above as being part of the primary review responsibility of other branches, the acceptance criteria necessary for the review and their methods of application are contained in the referenced SRP section of the corresponding primary branches.

## II. ACCEPTANCE CRITERIA

Acceptability is based on meeting the relevant requirements of the following regulations:

1. 10 CFR Part 52, §52.47(a)(1)(iii) and (vi-viii) as they relate to the contents of design certification applications. The information includes site parameters, interface criteria, and the ITAAC which are necessary and sufficient to provide reasonable assurance that a plant which references a certified design is built and will operate in accordance with the design certification.

2. 10 CFR Part 52, §52.97(b) as it relates to the identification of ITAAC within a combined license. An applicant or licensee must identify and perform those ITAAC, including those applicable to emergency planning, that are necessary and sufficient to provide reasonable assurance that the facility has been constructed and will be operated in conformity with the license, the provisions of the Atomic Energy Act, and the Commission's rules and regulations.

3. 10 CFR 50.49 as it relates to environmental qualification of electrical equipment important to safety for nuclear power plants. Applicants must ensure that safety-related, some nonsafety-related, and some post-accident monitoring equipment can perform their intended functions in various anticipated environments.

The reviewer should utilize the SRP in its review of the CDM to determine the safety significance of SSCs. Other sources include applicable rules and regulations, GDCs, RGs, USIs and GSIs, NRC generic correspondence, PRA, insights from the standard design's safety and severe accident analyses, and operating experience. The CDM should be reviewed for consistency with the initial test program described in SSAR Chapter 14.2. The reviewer should also use the review checklists provided in Appendix D to this SRP section as an aid for establishing consistency and comprehensiveness in his review of the systems. If applicable, the reviewer should utilize regulatory guidance from the Commission for selected policy and technical issues related to particular design. Examples of these are contained in SECY-93-087, "Policy, Technical, and Licensing Issues Pertaining to Evolutionary and Advanced Light-Water Reactor Designs." The SRM related to this is dated July 21, 1993.

The CDM should be reviewed for treatment of design information proportional to the safety significance of the SSC for that system. Many items may be judged to be important to safety, and thus should be included in the CDM. The following issues are identified to ensure comprehensive and consistent treatment in the CDM based on the safety significance of the system being reviewed:

(1) System purpose and functions
(2) Location of system
(3) Key design features of the system
(4) Seismic and ASME code classifications
(5) System operation in various modes
(6) Controls, alarms, and displays
(7) Logic

(8) Interlocks
(9) Class 1E electrical power sources and divisions
(10) Equipment to be qualified for harsh environments
(11) Interface requirements
(12) Numeric performance values
(13) Accuracy and quality of figures

Additionally, standard ITAAC entries should be utilized to verify selected issues, where appropriate. The reviewer should ensure consistent application and treatment of the standard ITAAC entries for basic configuration ITAAC, net positive suction head, and physical separation for appropriate systems in the CDM. In particular, the general provision for environmental qualification aspects of SSCs invoked by the basic configuration ITAAC should be reviewed to ensure appropriate treatment in the CDM.

Environmental qualification (EQ) of safe-shutdown equipment may be verified as part of the basic configuration ITAAC for safety-related systems. EQ treatment in the ITAAC would then be discussed in the General Provisions section of the CDM. Verification may include type tests or a combination of type tests and analyses of Class 1E electrical equipment identified in the Design Description or accompanying figures to show that the equipment can withstand the conditions associated with a design basis accident without loss of safety function for the time that the function is needed.

Integrated plant safety analyses such as fires, floods and missile protection should be reviewed to ensure that they are adequately addressed in the CDM. The insights from these analyses that are addressed in the CDM should be contained in SSAR Section 14.3. The issues of floods, fires, missiles, pipe failures, and environmental protection may be verified by the ITAAC on a system-specific basis, rather than generically. Divisional separation (both physical and electrical) is an acceptable means of ensuring protection of safety-related equipment from these events. Verification of divisional separation may be performed as part of both individual system ITAACs and building ITAACs. Physical and electrical separation may be verified in each safety-related system ITAAC and divisional barriers may be verified in the reactor and control building ITAACs.

The design features in the CDM should be selected to ensure that the integrity of the analyses are preserved in an as-built facility. For example, 3-hour fire boundaries and divisional separation may be shown in the building figures. Also, flooding features such as structure elevations should be specified in the site parameters, flood doors may be shown on the building figures, and elevations are shown on the buildings to verify that the approximate physical location of components and relative elevations of buildings minimize the effects of flooding. As-built reconciliation reports for fires and floods to ensure consistency with the SSAR analyses should be required by the appropriate system ITAAC (e.g., fire protection system) and selected building ITAAC, respectively.

Other specific issues that should be addressed include heat removal capabilities for design-basis accidents and tornado and missile protection. Heat removal capabilities may be verified through heat removal requirements for core cooling system heat exchangers and interface requirements for site-specific systems. Tornado and missile protection may be provided by inlet and outlet dampers in ventilation systems, and through the structural design of buildings.

The reviewer should receive inputs on the treatment of issues identified above from other branches such as the structural, electrical and I&C branches. In addition, the secondary review branches specified in SRP Section 14.3 should provide inputs on selected issues. These issues include key insights and assumptions from PRA and severe accident analyses, as well as inputs for issues such as treatment of alarms, displays and controls, and functionality of MOVs. Cross-references from the SSAR to the CDM for key insights and assumptions from PRA and severe accidents should be provided by applicants in the SSAR together with these analyses.

The issue of containment isolation may be addressed by a combination of the system ITAACs or in a single system ITAAC. The containment isolation valves should be specified in the CDM, and are most clearly shown on the system figures. The verification of the design qualification of the motor operated containment isolation valves may be verified by the basic configuration check in the system ITAAC as discussed in the general provisions. In addition, in-situ tests should be required for containment isolation MOV and check valves in each system ITAAC. The ITAAC should verify that the containment isolation valves close on receipt of an isolation signal. Actual closure of the containment isolation valves may be checked using the manual isolation switches in the main control room (MCR). The ITAAC should verify that a containment isolation signal is generated for each of the process variables that will cause a containment isolation; the intent is to preclude multiple cycling of the containment isolation valves during the testing.

The CDM should address and verify at least the minimum inventory of alarms, controls, and indications as derived from the Emergency Procedure Guidelines, the requirements of RG 1.97, and probabilistic risk assessment insights. These may be specified in the MCR and the Remote Shutdown System (RSS) ITAAC, or addressed in the appropriate ITAAC, and verified to exist. Other controls, indications and alarms should be identified in the system ITAAC based on their safety significance. Locations for these should be shown on system figures if important to system design and function. The ability of these controls, indications, and alarms to function should be checked during operation of the system for the functional tests required by the system ITAAC. Because the intent of the ITAAC is to verify the final as-built condition of the plant, the operation of the system during the completion of the functional tests required in the system ITAAC should be conducted from the MCR. Therefore, the verification that the system can be operated from the MCR need not be a separate ITAAC. Also, because the operation of the equipment from the control room demonstrates the control function, continuity checks between the RSS and the equipment demonstrates that the control signal will be received by the component and provides adequate assurance that the equipment can be operated by the RSS. The results of the pre-operational test program may be utilized to demonstrate the ability to operate plant equipment by the RSS.

Technical Rationale

The technical rationale for application of the above acceptance criteria to the CDM, including the ITAAC, is discussed in the following paragraphs.

1. Compliance with 10 CFR Part 52, §52.47(a)(1)(iii) and (vi-viii) requires applicants for design certification to include proposed site parameters, interface criteria, and inspections, tests, analyses and acceptance criteria for the design. The design is reviewed and approved by the staff during design certification, and prior to application for construction and operation of a facility. However, upon completion of construction, an as-built facility must be verified to be in accordance with the approved design and applicable regulations. Therefore, application of 10 CFR 52.47 to the CDM ensures that the applicant for design certification submits information necessary and sufficient to provide reasonable assurance that a facility which references a certified design is built and will operate in accordance with the design certification.

2. Compliance with 10 CFR Part 52, §52.97(b) requires applicants for a combined license to include site-specific information and proposed ITAAC for the design, construction and operation of a complete facility. The information required is reviewed and approved by the staff prior to the issuance of a combined license and the start of facility construction. However, upon completion of construction, an as-built facility must be verified to be in accordance with the approved design and applicable regulations. Therefore, application of §52.97(b) to the information in a combined license application ensures that the applicant for a combined license submits ITAAC, including those applicable to emergency planning, that are necessary and sufficient to provide reasonable assurance that the facility has been constructed and will be operated in conformity with the license, the provisions of the Atomic Energy Act, and the Commission's rules and regulations.

3. Compliance with 10 CFR 50.49 requires that certain electrical equipment be qualified for accident (referred to as harsh) environments. This provides a reasonable assurance that various equipment will perform its intended function in anticipated environments.

## III. REVIEW PROCEDURES

Reviewers should follow the general procedures for review of the CDM contained in SRP Section 14.3. This includes knowledge of the DCD and the CDM/ITAAC as discussed in the appendices to SRP Section 14.3. Review responsibilities are contained in Appendix A to this SRP section.

1. The CDM/ITAAC are reviewed to ensure that the plant systems are clearly delineated, including the key performance characteristics and safety functions of SSCs based on their safety significance. Reviewers should apply the acceptance criteria in this SRP Section to the review of the CDM information.

2. The CDM is reviewed to ensure that all information is consistent with the SSAR information. Figures and diagrams should be reviewed to ensure that they accurately depict the functional arrangement and requirements of the systems. Reviewers should use the Review Checklist in Appendix D-1 for review of fluid systems as an aid in establishing consistent and comprehensive treatment of issues.

3. The reviewer should ensure that appropriate guidance is provided to other branches such that plant systems issues in the CDM are treated in a consistent manner among branches.

4. The reviewer should ensure that the standard ITAAC entries related to plant systems items are included in the appropriate systems of the standard design. The reviewer should review the general provision for verification of equipment qualification. The reviewer should ensure consistent application and treatment of the standard ITAAC entries for basic configuration ITAAC, net positive suction head, and physical separation for appropriate systems in the CDM.

5. Reviewers should ensure that design features from the resolutions of applicable regulations and Commission guidance are adequately addressed in the CDM, based on safety significance. Ensure that the bases for these items are documented clearly in the SER.

6. Reviewers should ensure that definitions, legends, interface requirements, and site parameters that pertain to plant systems issues are treated consistently and appropriately in the CDM.

## IV. EVALUATION FINDINGS

The reviewer verifies that sufficient information has been provided to satisfy the requirements of SRP Section 14.3 and this SRP section, and concludes that the CDM is acceptable. When the review is complete, a finding of the following should be provided for the staff's safety evaluation report:

> "The staff performed a multidisciplinary review of the SSCs of the (standard design), in accordance with 10 CFR Part 52 and SRP Section 14.3.7. This review included information contained in various CDM and SSAR submittals to the staff, as discussed previously in this section of the safety evaluation report.
>
> "Based on the staff's review of the material in the (standard design) CDM, and a review of the selection methodology and criteria for the development of the CDM contained in SSAR Section 14.3, the staff concludes that the top-level design features and performance characteristics of the plant systems SSCs important to safety are appropriately described in the CDM, and the CDM is acceptable.
>
> "Further, these top-level commitments can be adequately verified by the ITAAC provided by (the applicant). Therefore, the staff concludes that the CDM is necessary and sufficient to provide reasonable assurance that, if the inspections, tests, and analyses are performed, and the acceptance criteria met, a facility referencing the certified design will be constructed and will operate in conformity with the design certification and applicable regulations.
>
> "The staff also concludes that the interface requirements (and site parameters, if applicable) in the CDM meet the requirements for design certification applications in 10 CFR 52.47, and are acceptable."

## 14.3.8 RADIATION PROTECTION AND EMERGENCY PREPAREDNESS

### I. REVIEW RESPONSIBILITIES

Primary - PERB

Secondary - NA

### I. AREAS OF REVIEW

Each branch reviews the certified design material (CDM) and Section 14.3 of the standard safety analysis report (SSAR) submitted by the applicant. The information includes inspections, tests, analyses, and acceptance criteria (ITAAC), interface criteria, site parameters, and information applicable to multiple systems of the design. Definitions, legends, and general provisions in the CDM are also reviewed.

PERB has primary review responsibility for the CDM information pertaining to the radiation protection and emergency preparedness aspects of the design. If the CDM information is based on the systems of the design, assignment of review responsibilities is consistent with those contained in Appendix A to this SRP section. Examples of the systems within the scope of the review include radiation monitoring systems, containment atmospheric monitoring systems, and emergency response facilities in the CDM. PERB has primary review responsibility for any additional material regarding design processes for radiation protection and their related design acceptance criteria. PERB also has primary review responsibilities for selected site parameters involving atmospheric dispersion (X/Qs) for exclusion area boundaries (EABs) and low population zones (LPZs). The reviewer has secondary review responsibility for all other CDM and ITAACs which address the plant radiation protection design or systems relied upon in the design-basis accidents (DBAs) dose assessment. These ITAACs include buildings, ventilation and filtration systems, primary containment, drywell bypass, and the post-accident sampling system.

Review Interfaces

SRP Section 14.3 provides general guidance on review interfaces. PERB performs related reviews and coordination activities, as requested by other branches, for issues in the CDM related to plant systems.

In addition, PERB will coordinate other branches' evaluations that interface with the overall review of the systems as follows:

1. The Plant Systems Branch (SPLB) determines the acceptability of the CDM information regarding HVAC design, containment isolation, and selected aspects of the containment design in SRP Section 14.3.6.

2. The Civil Engineering and Geosciences Branch (ECGB) determines the acceptability of the CDM information regarding the ability of SSCs to withstand various natural phenomena in SRP Sections 14.3.1 and 14.3.2, and regarding piping design in SRP Section 14.3.3.

3. The Reactor Systems Branch (SRXB) determines the acceptability of the

CDM information regarding design features to prevent and mitigate design basis accidents, such as design features based on timing and mass release, in SRP Section 14.3.4.

4. The Containment Systems and Severe Accident Branch (SCSB) determines the acceptability of the CDM information regarding containment systems design, in the applicable sections of the SRP pertaining to the SSAR.

For those areas of review identified above as being part of the primary review responsibility of other branches, the acceptance criteria necessary for the review and their methods of application are contained in the referenced SRP section of the corresponding primary branches.

## II. ACCEPTANCE CRITERIA

Acceptability is based on meeting the relevant requirements of the following regulations:

1. 10 CFR Part 52, §52.47(a)(1)(iii) and (vi-viii) as they relate to the contents of design certification applications. The information includes site parameters, interface criteria, and the ITAAC which are necessary and sufficient to provide reasonable assurance that a plant which references a certified design is built and will operate in accordance with the design certification.

2. 10 CFR Part 52, §52.97(b) as it relates to the identification of ITAAC within a combined license. An applicant or licensee must identify and perform those ITAAC, including those applicable to emergency planning, that are necessary and sufficient to provide reasonable assurance that the facility has been constructed and will be operated in conformity with the license, the provisions of the Atomic Energy Act, and the Commission's rules and regulations.

To meet the above regulations, the appropriate CDM, ITAAC and site parameters should address the following design issues:

The reviewer should primarily utilize the SRP in its review of the CDM to determine the safety significance of SSCs. Other sources include applicable rules and regulations, GDCs, RGs, USIs and GSIs, NRC generic correspondence, and operating experience. The reviewer should utilize the review checklists in Appendix D as an aid for comprehensiveness and consistency in its review of the systems.

The reviewer should ensure that the CDM for the area radiation monitoring systems provides information on radiation dose rates in the plant during normal operation and accidents and provides alarms to warn plant personnel of changes in those dose rates. The CDM for the containment atmospheric monitoring system should provide information on radiation dose rates and gas concentrations during accidents and provide alarms to warn plant personnel of high levels of these parameters. The CDM for emergency response facilities should ensure that adequate facilities are provided for the technical support center (TSC) and operational support center (OSC) including space, data retrieval and communications equipment, and a ventilation system to provide radiation protection.

Design Processes and Design Acceptance Criteria (DAC)

An applicant for design certification may not provide sufficient detail in selected aspects of the design, including sufficient information to stipulate the source terms needed to verify the design of the shielding, ventilation, and airborne radioactivity monitoring systems. The applicant may choose to provide design processes and design acceptance criteria (DAC) for this material, as discussed in Appendix H to this SRP section. The rationale for determining which areas of the design should utilize design processes and acceptance criteria should be documented by the applicant in SSAR Section 14.3. Essentially, the applicant should extract the most important design processes and acceptance criteria from Chapter 12 of the SSAR and put them into the CDM. This may be done in a separate section of the CDM, or provided in the applicable systems of the CDM, as discussed in Appendix C to this SRP section. A COL applicant or licensee must meet these criteria in the design of the plant, and the staff can audit the facility's design documentation to ensure that the criteria are met. The following discussion is specific to the review of design processes and acceptance criteria in this area:

Applicants may not provide the complete design information in this design area before design certification because the radiation shielding design and the calculated concentrations of airborne radioactive material were dependent upon as-built and as-procured information of plant systems and components. Therefore, applicants may not be able to describe the standard design's radiation source terms (i.e., the quantity and concentration of radioactive materials contained in, or leaking from plant systems) in sufficient detail to allow the staff to verify the adequacy of the shielding design, ventilation system designs, or the design and placement of the airborne radioactivity monitors. Instead, applicants may provide the processes and acceptance criteria by which the details of the design in this area would be developed, designed, and evaluated. This scope of the material in the CDM should be stated in the design description. Examples of its application could be to the radiological shielding and ventilation design of the reactor building, turbine building, control building, service building, and radwaste building. The implementation of the process and the design is the responsibility of the COL applicant or licensee.

The acceptance criteria in the DAC may be taken from the acceptance criteria in the applicable sections of Chapter 12 of the SRP. The analysis methods and source term assumptions specified in the DAC should be consistent with approved methods and assumptions listed in the SRP. The SRP is the basis for the staff's safety review of the standard design. Therefore, demonstrating that the final design meets these DAC with the methods and assumptions specified in Tier 1 ensures that the as-built design meets the applicable acceptance criteria of the SRP and the associated regulations and staff technical positions.

The DAC in the Tier 1 information should address the verification of the plant radiation shielding design and the plant airborne concentrations of radioactive materials (e.g., the ventilation system and airborne monitoring system designs). The DAC should require the COL applicant to calculate radiation levels and airborne radioactivity levels within the plant rooms and areas to verify the adequacy of these design features during plant construction (concurrently with the verification of the ITAAC). The plant rooms and areas to which the DAC apply may be given in figures in the CDM. Detailed supporting information for the DAC should be contained in appropriate sections of SSAR Chapter 12.

The criteria in the CDM should ensure that the radiation shielding design (either that provided for by the plant structures, or design permanent or temporary shielding) is adequate to ensure that the maximum radiation levels in plant areas are commensurate with the area's access requirements so radiation exposures to plant personnel can be maintained as low as reasonably achievable (ALARA) during normal plant operations and maintenance. The CDM should ensure that adequate shielding is provided for those areas of the plant that may require occupancy to permit an operator to aid in the mitigation of or the recovery from an accident. The CDM should ensure that the contribution to the radiation dose from gamma shine (particularly from the turbine building) to a member of the public (off site) will be a small fraction of the EPA dose limit in 40 CFR Part 190.

The criteria in the CDM should ensure that the plant provides adequate containment and ventilation flow rates to control the concentrations of airborne radioactivity to levels commensurate with the access requirements of areas in the plant. The CDM should ensure that once the concentrations of airborne radioactivity are determined, the required airborne monitors are provided in the appropriate locations in the plant.

Radiological Dose Consequences

The reviewer should review the ITAAC for which PERB has secondary review responsibility, focusing on verifying design features and assumptions upon which the radiological dose consequence assessment of design basis accidents (DBAs). The following discussion provides examples of some of the important design features and assumptions that should be addressed in the CDM. The maximum MSIV closure time and maximum MSIV leakage rates may be verified by the ITAAC for the nuclear boiler system (BWR's only). The maximum primary containment leakage rate may be verified by the ITAAC for the primary containment system. The minimum radioiodine removal efficiency of the charcoal adsorbers in the standby gas treatment system (SGTS) filter trains and the maximum time for the SGTS to draw a specified negative pressure in the secondary containment may be verified by the ITAAC for the SGTS. The minimum radioiodine removal efficiency of the charcoal adsorbers in the control room and TSC ventilation system filter trains may be verified by the ITAAC for the HVAC systems. Capability of the main steam system to maintain structural integrity in an safe-shutdown earthquake (SSE) may be verified by the ITAAC for the turbine main steam system. Capability of the off-gas system to withstand an internal hydrogen explosion may be verified by the ITAAC for the off-gas system. The applicant should provide a radiological analysis table in SSAR Section 14.3 that should be used to ensure that the most important, though not necessarily all, of the key parameters in the accident dose analyses are addressed in the CDM.

Site Parameters

PERB is responsible for ensuring that the meteorological dispersion values assumed in various accident analyses are identified as bounding parameters for a site in the CDM section for site parameters. These parameters should be specified for the EAB and LPZ at appropriate time intervals for the standard design. The reviewer should ensure that the site parameters in Chapter 2 of the SSAR are consistent with the CDM. The parameters are used to evaluate the suitability of a site for the design, and must be demonstrated as part of an early site permit or as part of an application for a combined license.

Emergency Planning

This portion of the review should be accomplished as part of a combined license application or application for an early site permit. The Energy Policy Act of 1992 amended the Atomic Energy Act to require that the applicant for a combined license submit ITAAC for emergency planning, and this requirement was incorporated into §52.97(b). The staff provided its preliminary views on acceptable ITAAC to the Commission in SECY-95-090, "Emergency Planning Under 10 CFR Part 52," April 11, 1995. The staff developed significant portions of this ITAAC using the information in NUREG-0654, Supplements 1 and 2.

Technical Rationale:

The technical rationale for application of the above acceptance criteria to the CDM, including the ITAAC, is discussed in the following paragraphs.

1. Compliance with 10 CFR Part 52, §52.47(a)(1)(iii) and (vi-viii) requires applicants for design certification to include proposed site parameters, interface criteria, and inspections, tests, analyses and acceptance criteria for the design. The design is reviewed and approved by the staff during design certification, and prior to application for construction and operation of a facility. However, upon completion of construction, an as-built facility must be verified to be in accordance with the approved design and applicable regulations. Therefore, application of 10 CFR 52.47 to the CDM ensures that the applicant for design certification submits information necessary and sufficient to provide reasonable assurance that a facility which references a certified design is built and will operate in accordance with the design certification.

2. Compliance with 10 CFR Part 52, §52.97(b) requires applicants for a combined license to include site-specific information and proposed ITAAC for the design, construction and operation of a complete facility. The information required is reviewed and approved by the staff prior to the issuance of a combined license and the start of facility construction. However, upon completion of construction, an as-built facility must be verified to be in accordance with the approved design and applicable regulations. Therefore, application of §52.97(b) to the information in a combined license application ensures that the applicant for a combined license submits ITAAC, including those applicable to emergency planning, that are necessary and sufficient to provide reasonable assurance that the facility has been constructed and will be operated in conformity with the license, the provisions of the Atomic Energy Act, and the Commission's rules and regulations.

## III. REVIEW PROCEDURES

Reviewers should follow the general procedures for review of the CDM contained in SRP Section 14.3. This includes knowledge of the DCD and the CDM/ITAAC as discussed in the appendices to SRP Section 14.3. Review responsibilities are contained in Appendix A to this SRP section.

1. The CDM/ITAAC are reviewed to ensure that the radiation protection systems are clearly delineated, including the key performance characteristics and safety functions of SSCs based on their safety significance. Reviewers should apply the acceptance criteria in this SRP Section to the review of the CDM information.

2. The CDM is reviewed to ensure that all information is consistent with the SSAR information. Figures and diagrams should be reviewed to ensure that they accurately depict the functional arrangement and requirements of the systems. Reviewers should use the review checklists in Appendix D for review of CDM systems as an aid in establishing consistent and comprehensive treatment of issues.

3. The reviewer should ensure that appropriate guidance is provided to other branches such that radiation protection issues in the CDM are treated in a consistent manner among branches.

4. Reviewers should ensure that design features from the resolutions of applicable regulations and Commission guidance are adequately addressed in the CDM, based on safety significance. Ensure that the bases for these items are documented clearly in the SER.

5. Reviewers should ensure that site parameters for radiological dispersal (X/Q) are specified in the CDM, with appropriate time intervals, and are the bounding parameters from plant accident analyses. Ensure that site parameter values in Chapter 2 of the SSAR are consistent with the CDM.

## IV. EVALUATION FINDINGS

Each review branch verifies that sufficient information has been provided to satisfy the requirements of this Standard Review Plan section, and concludes that the CDM is acceptable. The findings should support the following type of overall conclusive statement to be included in the staff's safety evaluation report:

> "Based on the staff's review of the material in the (standard design) CDM, and a review of the selection methodology and criteria for the development of the CDM contained in SSAR Section 14.3, the staff concludes that the top-level design features and performance characteristics of the radiation protection aspects of SSCs important to safety are appropriately described in the CDM, and the CDM is acceptable.
>
> "Further, these top-level commitments can be adequately verified by the ITAAC provided by (the applicant). Therefore, the staff concludes that the CDM are necessary and sufficient to provide reasonable assurance that, if the inspections, tests, and analyses are performed, and the acceptance criteria met, a facility referencing the certified design will be constructed and will

operate in conformity with the design certification and applicable regulations.

"The staff also concludes that the site parameters (and interface requirements, if applicable) in the CDM meet the requirements for design certification applications in 10 CFR 52.47, and are acceptable."

If the applicant has provided DAC for the radiation protection aspects of the standard design, then the reviewer should provide a separate evaluation similar to the above for that material.

## V. IMPLEMENTATION

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

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

## VI. REFERENCES

1. NUREG-1503, "Final Safety Evaluation Report Related to the Certification of the Advanced Boiling Water Reactor", Volumes 1 and 2, July 1994.

2. NUREG-1462, "Final Safety Evaluation Report Related to the Certification of the System 80+ Design," Volumes 1 and 2, August 1994.

3. NUREG-0654, "                    ," Supplements 1 and 2.

4. SECY-95-090, "Emergency Planning Under 10 CFR Part 52," April 11, 1995.

## 14.3.9 HUMAN FACTORS ENGINEERING

### I. <u>REVIEW RESPONSIBILITIES</u>

Primary - HHFB

Secondary - NA

### I. <u>AREAS OF REVIEW</u>

HHFB reviews the certified design material (CDM) and Section 14.3 of the standard safety analysis report (SSAR) submitted by the applicant. The information includes inspections, tests, analyses, and acceptance criteria (ITAAC), interface requirements, site parameters, and information applicable to multiple systems of the design. Definitions, legends, and general provisions in the CDM are also reviewed.

The reviewer has primary review responsibility for the main control room panels, remote shutdown panel, and local control panels described in the CDM. The reviewer also has primary review responsibility for additional material applicable to multiple systems of the standard design in the CDM pertaining to human factors engineering, if such material is provided by the applicant. The reviewer is responsible for providing input to other review branches regarding the minimum inventory of alarms, controls, and indications appropriate for the main control room and the remote shutdown station.

<u>Review Interfaces</u>

SRP Section 14.3 provides general guidance on review interfaces. HHFB performs related reviews and coordination activities, as requested by other branches, for issues in the CDM related to human factors engineering.

In addition, SPLB will coordinate other branches' evaluations that interface with the overall review of the control room and remote shutdown room, as follows:

1. The Electrical Engineering Branch (EELB) determines the acceptability of the CDM information regarding electrical SSCs in SRP Section 14.3.6.

2. The Civil Engineering and Geosciences Branch (ECGB) determines the acceptability of the CDM information regarding the ability of SSCs to withstand various natural phenomena in SRP Sections 14.3.1 and 14.3.2.

3. The Instrumentation and Controls Branch (HICB) determines the acceptability of the CDM information regarding the I&C aspects of the standard design in SRP Section 14.3.5.

4. The Plant Systems Branch (SPLB) determines the acceptability of the CDM information regarding the HVAC design in SRP Section 14.3.7.

For those areas of review identified above as being part of the primary review responsibility of other branches, the acceptance criteria necessary for the review and their methods of application are contained in the referenced SRP section of the corresponding primary branches.

## II. ACCEPTANCE CRITERIA

Acceptability is based on meeting the relevant requirements of the following regulations:

1. 10 CFR Part 52, §52.47(a)(1)(iii) and (vi-viii) as they relate to the contents of design certification applications. The information includes site parameters, interface criteria, and the ITAAC which are necessary and sufficient to provide reasonable assurance that a plant which references a certified design is built and will operate in accordance with the design certification.

2. 10 CFR Part 52, §52.97(b) as it relates to the identification of ITAAC within a combined license. An applicant or licensee must identify and perform those ITAAC, including those applicable to emergency planning, that are necessary and sufficient to provide reasonable assurance that the facility has been constructed and will be operated in conformity with the license, the provisions of the Atomic Energy Act, and the Commission's rules and regulations.

See also the acceptance criteria in SRP Chapter 18 regarding the requirements for an effective human factors engineering design. The acceptance criteria can be met by meeting the requirements of the following:

The reviewer should determine the top-level design features and requirements appropriate for treatment in the CDM based on several sources. The basis for the review in this area is a human factors engineering (HFE) program review model (PRM) developed by the staff. The staff's certification review in the control room design area is based on a design and implementation process plan. The reviewer should also utilize the SRP section applicable to human factors review. Other sources should include applicable rules and regulations, Rgs, USIs and GSIs, and operating experience.

The staff developed the HFE PRM to serve as a technical basis for the review of the design process and design acceptance criteria (DAC) for certification of the standard plant control room and remote shutdown station design. The HFE PRM is (1) based upon currently accepted HFE practices, (2) well-defined, and (3) validated through experience with the development of complex, high-reliability systems in other industrial and military applications. The review model identifies the important HFE elements in a system development, design, and evaluation process that are necessary and sufficient requisites to successful integration of human factors in complex systems. The review model also identifies aspects of each HFE element that are key to a safety review, and describes acceptance criteria by which the HFE elements can be evaluated. The HFE PRM has eight program elements, each of which contain both general and more specific acceptance criteria.

Design Processes and Design Acceptance Criteria (DAC)

10 CFR Part 52 requires applicants for design certification to meet the TMI requirements in 10 CFR 50.34(f)(2)(iii) for providing a control room design that reflects state-of-the-art human factors principles. Applicants may not develop a final control room and remote shutdown station design before design certification because this is an area of rapidly changing technology.

Instead, applicants may provide the processes and acceptance criteria in the CDM and the detailed supporting information in SSAR Chapter 18 by which the details of the design in this area would be developed, designed, and evaluated. In lieu of having a completed control room design for review, the reviewer must base his safety determination on an acceptable process for the design of the control room. In addition, applicants must submit a description of a minimum inventory of displays, controls, and alarms necessary to accomplish the emergency procedure guidelines (EPGs) and critical operator actions identified through PRA analysis.

If provided by the applicant, the processes and design acceptance criteria in the CDM regarding human factors engineering should apply to the human factors design of the control room and the remote shutdown systems of the standard design. The detailed supporting information for the human factors aspects of the main control room and remote shutdown station design should be provided in SSAR Chapter 18, "Human Factors". The implementation of the processes in the final design is the responsibility of the COL applicant or licensee. Design processes and acceptance criteria are discussed further in Appendix H to this SRP section.
The CDM should describe the process to develop the Human-Systems Interaction (HSI) design information for the control room and Remote Shutdown Station (RSS) based on human factors systems analyses and human factors principles. A design effort should be directed by a multi-disciplinary HFE design team comprised of personnel with expertise in HFE and other technical areas relevant to the HSI design, evaluation and operations. The HSI design team shall develop a program plan to establish methods for implementing the HSI design through a process of human factors system analyses as discussed in the CDM, and based on the HSI design implementation process in the PRM. The details of implementation of each stage of the development process should be described in the CDM, together with the related acceptance criteria. Detailed supporting information should be contained primarily in SSAR Chapter 18.

The material in SSAR Chapter 18 provides design information and defines design processes that are acceptable for use in meeting the acceptance criteria in the CDM. However, the SSAR information may be changed by a COL applicant or licensee referencing the certified design in accordance with a "50.59-like" process. The staff bases its safety determinations on the design processes specified in the SSAR. Therefore, for the evolutionary designs, the staff designated selected information in SSAR Chapter 18 that, if considered for a change, requires NRC approval prior to implementation. This information is known as Tier 2* information (see Appendix C regarding format of the DCD for instructions on designating information in the SSAR as Tier 2*). Similar information should be considered on a design-specific basis for all standard designs. However, the staff allowed some of the Tier 2* designation to expire after first full power operation of the facility, when the detailed design was complete and the facility performance characteristics were known from the startup and power ascension test programs. The NRC bears the final responsibility for designating which material in the SSAR is Tier 2*.

<u>Minimum Inventory of Displays, Alarms and Controls</u>

The minimum inventory of displays, controls, and alarms should be developed through a task analysis of the operator actions necessary to carry out the EPGs and PRA critical actions. The staff's evaluation of the resulting minimum inventory encompasses a multi-disciplinary effort consisting of human factors, I&C, PRA, and plant, reactor, and electrical system engineering. The criteria used to determine acceptability of the inventory includes assuring that: (1) the scope of these items in the EPGs and PRA effort are adequately considered, (2) the task analysis is detailed and comprehensive, (3) RG 1.97, category I variables for accident monitoring are included, and (4) important system displays and controls described in the Tier 1 system design descriptions necessary for transient mitigation are included.

The minimum inventory list for the control room and the controls and indicators required on systems to remotely shutdown the reactor should be included in the CDM. The items required for operation of the remote shutdown system may be designated on the figures for the individual systems, or listed in the remote shutdown system in the CDM. Detailed supporting information is contained in Chapter 7 of the SSAR. The individual systems that contained the sensors for the displays, controls, and alarms should be reviewed to ensure that standard ITAAC entries were used to verify their function. The design processes and acceptance criteria specified in the CDM for I&C equipment, particularly the verification and validation aspects of the I&C design, will verify proper operation of the I&C aspects of the equipment. Similarly, the design processes and acceptance criteria for HFE contained in the CDM, particularly the verification and validation aspects of the HFE design, will verify proper design and operation of the equipment for human factors aspects.

The ability of these controls, indications, and alarms to function should be checked during operation of the system for the functional tests required by the system ITAAC. Because the intent of the ITAAC is to verify the final as-built condition of the plant, the operation of the system during the completion of the functional tests required in the system ITAAC should be conducted from the MCR. Therefore, the verification that the system can be operated from the MCR need not be a separate ITAAC. Also, because the operation of the equipment from the control room demonstrates the control function, continuity checks between the RSS and the equipment demonstrates that the control signal will be received by the component and provides adequate assurance that the equipment can be operated by the RSS. The results of the pre-operational test program may be utilized to demonstrate the ability to operate plant equipment by the RSS.

Technical Rationale

The technical rationale for application of the above acceptance criteria to the CDM, including the ITAAC, is discussed in the following paragraphs.

1. Compliance with 10 CFR Part 52, §52.47(a)(1)(iii) and (vi-viii) requires applicants for design certification to include proposed site parameters, interface criteria, and inspections, tests, analyses and acceptance criteria for the design. The design is reviewed and approved by the staff during design certification, and prior to application for construction and operation of a facility. However, upon completion of construction, an as-built facility must be verified to be in accordance with the approved design and applicable regulations. Therefore, application of 10 CFR 52.47 to the CDM ensures that the applicant for design certification submits information necessary and sufficient to provide reasonable assurance that a facility which references a

certified design is built and will operate in accordance with the design certification.

2. Compliance with 10 CFR Part 52, §52.97(b) requires applicants for a combined license to include site-specific information and proposed ITAAC for the design, construction and operation of a complete facility. The information required is reviewed and approved by the staff prior to the issuance of a combined license and the start of facility construction. However, upon completion of construction, an as-built facility must be verified to be in accordance with the approved design and applicable regulations. Therefore, application of §52.97(b) to the information in a combined license application ensures that the applicant for a combined license submits ITAAC, including those applicable to emergency planning, that are necessary and sufficient to provide reasonable assurance that the facility has been constructed and will be operated in conformity with the license, the provisions of the Atomic Energy Act, and the Commission's rules and regulations.

## III. REVIEW PROCEDURES

Reviewers should follow the general procedures for review of the CDM contained in SRP Section 14.3. This includes knowledge of the DCD and the CDM/ITAAC as discussed in the appendices to SRP Section 14.3. Review responsibilities are discussed above in this SRP section.

1. The CDM/ITAAC are reviewed to ensure that the human factors requirements for systems are clearly delineated, including the key performance characteristics and safety functions of SSCs based on their safety significance. Reviewers should apply the acceptance criteria in this SRP Section to the review of the CDM information.

2. The CDM is reviewed to ensure that all information is consistent with the SSAR information. Figures and diagrams should be reviewed to ensure that they accurately depict the functional arrangement and requirements of the systems.

3. The reviewer should ensure that appropriate guidance is provided to other branches such that the minimum inventory of alarms, displays and controls in the CDM is treated in a consistent manner among branches.

4. The reviewer should ensure that the standard ITAAC entries (see Appendix E to this SRP section) for control room configuration and the remote shutdown station are included where appropriate in the systems of the standard design.

5. The CDM is reviewed to ensure that design features from the resolutions of applicable regulations and Commission guidance are adequately addressed in the CDM, based on safety significance. Ensure that the bases for these items are documented clearly in the SER. Ensure that the specific Tier 2* information is clearly designated in the SSAR, and consider expiration of these items at first full power, if appropriate. The staff's basis for designating the information as Tier 2* and the rationale for its decision that it requires prior NRC approval to change should be specified in the SER (see also the discussion in Appendix B to

this SRP section, regarding format of the DCD).

## IV. EVALUATION FINDINGS

The reviewer verifies that sufficient information has been provided to satisfy the requirements of this Standard Review Plan section, and concludes that the CDM is acceptable. The findings should support the following type of conclusive statement to be included in the staff's safety evaluation report:

"Based on the staff's review of the material in the (standard design) CDM, and a review of the selection methodology and criteria for the development of the CDM contained in SSAR Section 14.3, the staff concludes that the top-level design features and performance characteristics of the human factors aspects of SSCs important to safety are appropriately described in the CDM, and the CDM is acceptable.

"Further, these top-level commitments can be adequately verified by the ITAAC provided by (the applicant). Therefore, the staff concludes that the CDM are necessary and sufficient to provide reasonable assurance that, if the inspections, tests, and analyses are performed, and the acceptance criteria met, a facility referencing the certified design will be constructed and will operate in conformity with the design certification and applicable regulations.

If the applicant has provided additional material applicable to multiple systems of the design, typically the human factors engineering design processes and their related acceptance criteria, otherwise known as design acceptance criteria (DAC), then the reviewer should provide a separate evaluation similar to the above for that material.

## V. IMPLEMENTATION

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

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

## VI. REFERENCES


1. NUREG-1503, "Final Safety Evaluation Report Related to the Certification of the Advanced Boiling Water Reactor", Volumes 1 and 2, July 1994.

2. NUREG-1462, "Final Safety Evaluation Report Related to the Certification of the System 80+ Design," Volumes 1 and 2, August 1994.

3. Human Factors Program Review Model ????????????

14.3.10 INITIAL TEST PROGRAM AND D-RAP

I. REVIEW RESPONSIBILITIES

Primary - HQMB

Secondary - NA

I. AREAS OF REVIEW

HQMB reviews the certified design material (CDM) and Section 14.3 of the standard safety analysis report (SSAR) submitted by the applicant. The information includes inspections, tests, analyses, and acceptance criteria (ITAAC), interface requirements, site parameters, and information applicable to multiple systems of the design. Definitions, legends, and general provisions in the CDM are also reviewed.

HQMB has primary review responsibility for the CDM information related to the Initial Test Program (ITP) and the Design-Reliability Assurance Program (D-RAP).

Review Interfaces

SRP Section 14.3 provides general guidance on review interfaces. HQMB performs related reviews and coordination activities, as requested by other branches, for issues in the CDM related to testing issues and the reliability assurance program.

For testing issues, the reviewer is responsible for providing clear guidance to other branches regarding the utilization of the pre-operational test descriptions in SSAR Chapter 14.2 for development of the system ITAAC. The CDM is reviewed by the branch that is responsible for reviewing the design of that particular system. HQMB is responsible for ensuring that all initial plant tests are reviewed and will provide the coordination and supplementary review necessary to accomplish this review.

The reviewer is also responsible for ensuring that safety significant design requirements identified by other branches that cannot be verified by ITAAC because they can only be performed after fuel loading, are verified in the startup and power ascension test programs in SSAR Section 14.2. In addition, the reviewer is responsible for ensuring that new testing requirements developed in the context of the CDM review is adequately treated in the SSAR, particularly SSAR Section 14.2.

For D-RAP issues, the reviewer is responsible for coordinating the reviews of the Probabilistic Risk Assessment Branch (SPSB), so that risk-significant SSCs are identified in the DCD, and are treated appropriately in the CDM. The acceptance criteria necessary for the review and their methods of application are contained in the applicable SRP sections related to the PRA review in the SSAR.

II. ACCEPTANCE CRITERIA

Acceptability is based on meeting the relevant requirements of the following regulations:

1. 10 CFR Part 52, §52.47(a)(1)(iii) and (vi-viii) as they relate to the contents of design certification applications. The information includes site parameters, interface criteria, and the ITAAC which are necessary and sufficient to provide reasonable assurance that a plant which references a certified design is built and will operate in accordance with the design certification.

2. 10 CFR Part 52, §52.97(b) as it relates to the identification of ITAAC within a combined license. An applicant or licensee must identify and perform those ITAAC, including those applicable to emergency planning, that are necessary and sufficient to provide reasonable assurance that the facility has been constructed and will be operated in conformity with the license, the provisions of the Atomic Energy Act, and the Commission's rules and regulations.

Initial Test Program - The above acceptance criteria can be met for the ITP by the following:

A high level commitment in the CDM to an ITP and a description of the program and major program documents (i.e., a site-specific startup administrative manual, test specifications, and test procedures). The SSAR Chapter 14.2 should contain a complete description of the ITP.

The reviewer should review the CDM to ensure it contains a high level commitment to an ITP as described in the acceptance criteria above and in Appendix C to this SRP section, regarding format of the CDM/ITAAC. The staff should also review the CDM for consistency with the guidelines contained in the SRP Section 14.2 and RG 1.68, "Initial Test Program for Water-Cooled Nuclear Power Plants." RG 1.68 describes the general scope and depth of testing that is acceptable to the staff for conduct of pre-operational and startup testing as part of the ITP. Additional testing requirements and commitments may be required on a design specific basis, particularly for new or unusual aspects of standard designs.

The reviewer is responsible for ensuring that the ITAAC emphasizes testing of the as-built design where possible. The pre-operational test descriptions in SSAR Chapter 14.2 should be utilized in the development of the system ITAAC. Matrices of how pre-operational and power ascension tests apply to the ITAAC may be utilized. The ITP may be used to satisfy an ITAAC, however, the ITP is not a substitute for the ITAAC. Special attention should be focused on use of terms like as-built, tests, type tests, component tests, etc., in the CDM systems and the CDM definitions section (see definitions in Appendix G to this SRP section).

The use of integrated plant testing across multiple systems is not necessary for ITAAC if all components are tested by the individual system ITAAC. However, a COL licensee may use the results of integrated plant testing to satisfy multiple ITAAC. Examples of this might be the automatic start of diesel generators in response to an ESF actuation signal, re-energizing the vital AC busses, and subsequent auto-sequence loading of the diesels with ESF components.

Where required to support the ITAAC, the reviewer should ensure that the SSAR contains a description of the analysis methods to reconcile in-situ test conditions to the design basis for a SSC. This supporting information may be in either SSAR Section 14.2 or the appropriate SSAR sections pertaining to the SSC.

The reviewer is responsible for ensuring that certain items that cannot be verified in ITAAC prior to fuel load are adequately treated in the power ascension test program. Examples of post-fuel load testing might include the testing of main steam isolation valves at high flow/temp/pressure conditions, testing involving 100% load rejection by a turbine, and fuel and control rod performance verification.

The key facets of the ITP are described in the Tier 1 CDM to ensure that subsequent changes in the conduct of the ITP cannot be initiated unilaterally by the COL applicant. The ITP is described in Tier 1 because of the essential role of a test program in the verification that SSCs have been constructed and will perform satisfactorily in service. The Tier 1 description requires that the ITP be performed under suitably controlled conditions and processes. The development of test procedures, conduct of the tests, and safe execution of the test program, are important considerations in ensuring that as-built facility is in accordance with the design certification and applicable regulations. Thus, the staff will have the confidence that the ITP will be implemented effectively, so that the appropriate testing methodologies, and associated programmatic controls for testing plant systems will be ensured.

A corresponding ITAAC for this design description is not required for several reasons:

(1) The Tier 1 certified design material consists of a high level commitment to an ITP, and a description of the program and major program documents that constitute an acceptable ITP (i.e., a site-specific startup administrative manual, test specifications, and test procedures). The specific testing necessary to verify design features and performance aspects of the design is delineated in the system-specific ITAAC.

(2) The ITP covers a broader spectrum of time than the ITAAC. While ITP pre-operational testing shall be completed prior to fuel load, the ITP startup and power ascension testing will be conducted after fuel load. As the ITP involves testing post-fuel load, it is not appropriate to define associated ITAAC entries as Part 52 specifies that the ITAAC will be completed prior to fuel load.

Design Reliability Assurance Program - The above acceptance criteria can be met for the D-RAP by the following:

The CDM should contain a high level commitment to a D-RAP for use in the detailed design and equipment specification of risk-significant SSCs prior to fuel load, and as described in Appendix C to this SRP section. An ITAAC should be provided to verify the commitments in the CDM. The SSAR Section 17.4 contains a more detailed description of the D-RAP. The D-RAP is described in Tier 1 because of the essential role of a reliability assurance program in assuring that the final as-built facility performs satisfactorily in service. The following items were found to be acceptable for the verified to be in accordance with the approved design and applicable regulations. Therefore, application of §52.97(b) to the information in a combined license application ensures that the applicant for a combined license submits ITAAC, including those applicable to emergency planning, that are necessary and sufficient to provide reasonable assurance that the facility has been constructed and will be operated in conformity with the license, the provisions of the Atomic Energy Act, and the Commission's rules and regulations.

III. REVIEW PROCEDURES

Reviewers should follow the general procedures for review of the CDM contained in SRP Section 14.3.

1. The CDM is reviewed to ensure that all information is consistent with the SSAR information regarding ITP and D-RAP descriptions.

2. Reviewers should apply the acceptance criteria in this SRP Section to the review of the CDM information for ITP and D-RAP.

3. The reviewer should ensure that appropriate guidance is provided to other branches such that testing issues in the CDM are treated in a consistent manner among branches. See review interface section above. Matrices of how pre-operational and power ascension tests applied to the ITAAC may be utilized. Special attention should be focused on use of terms like as-built, tests, type tests, component tests, etc., in the CDM systems and the CDM definitions section (see definitions in Appendix G to this SRP section).

IV. EVALUATION FINDINGS

The reviewer verifies that sufficient information has been provided to satisfy the requirements of this Standard Review Plan section, and concludes that the CDM is acceptable. The findings should support the following type of conclusive statement to be included in the staff's safety evaluation report:

"Based on the staff's review of the material in the (standard design) CDM, and a review of the selection methodology and criteria for the development of the CDM contained in SSAR Section 14.3, the staff concludes that the ITP (or D-RAP) is appropriately described in the CDM, and the CDM is acceptable.

V. IMPLEMENTATION

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

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

VI. REFERENCES

1. NUREG-1503, "Final Safety Evaluation Report Related to the Certification of the Advanced Boiling Water Reactor", Volumes 1 and 2, July 1994.

2. NUREG-1462, "Final Safety Evaluation Report Related to the Certification of the System 80+ Design," Volumes 1 and 2, August 1994.

3. SECY-95-132, "Policy and Technical Issues Associated With the Regulatory Treatment of Non-Safety Systems (RTNSS) in Passive Plant Designs (SECY-94-084)," May 22, 1995.

# APPENDIX A

## BRANCH REVIEW RESPONSIBILITIES

This appendix contains the primary and secondary review branch assignments used for the GE Nuclear Energy Advanced Boiling Water Reactor (GE ABWR) and the Asea Brown Boveri-Combustion Engineering (ABB-CE) System 80+ evolutionary standard designs.

# GE NUCLEAR ENERGY ABWR

# TIER 1 CDM/ITAAC

# TASK GROUP ASSIGNMENTS

## STRUCTURAL CDM/ITAAC PRIMARY REVIEW RESPONSIBILITIES

| CDM/ITAAC Section Number | CDM/ITAAC System Title | Secondary Review Branches |
|---|---|---|
| 2.1.1 | Reactor Pressure Vessel System | SRXB |
| 2.6.1 | Reactor Water Cleanup System | SPLB |
| 2.10.4 | Condensate Purification System | SPLB |
| 2.11.1 | Makeup Water (Purified) System | SPLB |
| 2.11.20 | Sampling System | SPLB/PERB |
| 2.14.1 | Primary Containment System | SPLB/SCSB/PERB |
| 2.15.10 | Reactor Building | PERB/SPLB/PSGB |
| 2.15.11 | Turbine Building | PERB/SPLB |
| 2.15.12 | Control Building | SPLB/PERB/PSGB |
| 2.15.13 | Radwaste Building | SPLB/PERB |
| 2.15.14 | Service Building | SPLB/PERB/PERB |
| 3.3 | Piping DAC | |
| 5.0 | Site Parameters | PERB/SPLB/Projects |
| Appendix A | Legend for Figures | EELB/SPLB |
| TOTAL NUMBER OF SYSTEMS: 14 | | |

## PLANT SYSTEMS CDM/ITAAC PRIMARY REVIEW RESPONSIBILITIES

| CDM/ITAAC Section Number | CDM/ITAAC System Title | Secondary Review Branches |
|---|---|---|
| 2.3.1 | Process Radiation Monitoring System | PERB/HICB |
| 2.4.3 | Leak Detection & Isolation System | HICB |
| 2.5.5 | Refueling Equipment | SRXB |
| 2.5.6 | Fuel Storage Facility | ECGB/SRXB |
| 2.6.2 | Fuel Pool Cooling & Cleanup System | ECGB |
| 2.6.3 | Suppression Pool Cleanup System | ECGB |
| 2.9.1 | Radwaste System | PERB |
| 2.9.2 | Radioactive Drain Transfer System | PERB |
| 2.10.1 | Turbine Main Steam System | ECGB/PERB |
| 2.10.2 | Condensate Feedwater & Condensate Air Extraction System | ECGB |
| 2.10.7 | Main Turbine | ECGB |
| 2.10.9 | Turbine Gland Steam System | |
| 2.10.13 | Turbine Bypass | |
| 2.10.16 | Generator | |
| 2.10.21 | Main Condenser | ECGB |
| 2.10.22 | Off-Gas System | PERB |
| 2.10.23 | Circulating Water System | |
| 2.11.2 | Makeup Water (Condensate) System | |
| 2.11.3 | Reactor Building Cooling System | |
| 2.11.4 | Turbine Building Cooling Water System | |
| 2.11.5 | HVAC Normal Cooling Water System | |
| 2.11.6 | HVAC Emergency Cooling Water System | |
| 2.11.8 | Ultimate Heat Sink | ECGB |

| | | |
|---|---|---|
| 2.11.9 | Reactor Service Water System | ECGB |
| 2.11.10 | Turbine Service Water System | |
| ?.11.11 | Station Service Air System | ECGB |
| 2.11.12 | Instrument Air System | ECGB |
| 2.11.13 | High Pressure Nitrogen Gas Supply System | ECGB |
| 2.14.4 | Standby Gas Treatment System | PERB |
| 2.14.6 | Atmospheric Control System | |
| 2.14.7 | Drywell Cooling System | |
| 2.14.8 | Flammability Control | ECGB/HICB |
| 2.15.3 | Cranes & Hoists | ECGB |
| 2.15.5a | Control Building HVAC Systems | ECGB |
| 2.15.5b | Controi Room Habitability CDM/ITAAC HVAC System | ECGB/PERB |
| 2.15.5c | Reactor Building HVAC System | ECGB/PERB |
| 2.15.6 | Fire Protection System | HICB |
| 2.16.2 | Oil Storage & Transfer System | ECGB |
| 4.1 | Ultimate Heat Sink | ECGB/ Projects |
| 4.3 | Potable & Sanitary Water System | |
| 4.4 | Turbine Service Water System | Projects |
| 4.5 | Reactor Service Water Interface | Projects |
| 4.6 | Makeup Water Preparation System | Projects |
| TOTAL NUMBER OF SYSTEMS: 43 | | |

## REACTOR SYSTEMS CDM/ITAAC PRIMARY REVIEW RESPONSIBILITIES

| CDM/ITAAC Section Number | CDM/ITAAC System Title | Secondary Review Branches |
|---|---|---|
| 2.1.2 | Nuclear Boiler System | ECGB/SPLB |
| 2.1.3 | Reactor Recirculation System | ECGB |
| 2.2.2 | Control Rod Drive System | ECGB |
| 2.2.4 | Standby Liquid Control System | HICB |
| 2.4.1 | Residual Heat Removal System | ECGB/HICB |
| 2.4.2 | High Pressure Core Flooder System | ECGB/HICB |
| 2.4.4 | Reactor Core Isolation Cooling System | ECGB/HICB |
| 2.8.1 | Nuclear Fuel | |
| 2.8.2 | Fuel Channel | |
| 2.8.3 | Control Blade | |
| 2.8.4 | Loose Parts Monitoring | ECGB/HICB |
| TOTAL NUMBER OF SYSTEMS: 11 | | |

## ELECTRICAL SYSTEMS CDM/ITAAC PRIMARY REVIEW RESPONSIBILITIES

| CDM/ITAAC Section Number | CDM/ITAAC System Title | Secondary Review Branches |
|---|---|---|
| 2.12.1 | Electrical Power Distribution System | |
| 2.12.10 | Electrical Wiring Penetrations | ECGB |
| 2.12.11 | Combustion Turbine Generator | SPLB |
| 2.12.12 | DC Power Supply | |
| 2.12.13 | Emergency Diesel Generator System | SPLB |
| 2.12.14 | Vital AC Power Supply & AC Instrument & Control Power Supply Systems | HICB |
| 2.12.15 | Instrument & Control Power Supply | HICB |
| 2.12.17 | Lighting & Service | HHFB |
| 4.2 | Offsite Power Interface | Projects |
| TOTAL NUMBER OF SYSTEMS: 9 | | |

## HUMAN FACTORS CDM/ITAAC PRIMARY REVIEW RESPONSIBILITIES

| CDM/ITAAC Section Number | CDM/ITAAC System Title | Secondary Review Branches |
|---|---|---|
| 2.2.6 | Remote Shutdown System | HICB/SRXB/SPSB |
| 2.7.1 | Main Control Room Panel | HICB/EELB/ECGB/SPSB |
| 2.7.3 | Local Control Panels | HICB/EELB/ECGB/SPSB |
| 3.1 | Human Factors Engineering (DAC) | |
| TOTAL NUMBER OF SYSTEMS: 4 | | |

## RADIATION PROTECTION CDM/ITAAC PRIMARY REVIEW RESPONSIBILITIES

| CDM/ITAAC Section Number | CDM/ITAAC System Title | Secondary Review Branches |
|---|---|---|
| 2.3.2 | CDM/ITAAC Radiation Monitoring System | |
| 2.3.3 | Containment Atmospheric Monitoring System | |
| 3.7 | Radiation Protection DAC | |
| TOTAL NUMBER OF SYSTEMS: 3 | | |

## INSTRUMENTATION AND CONTROL SYSTEMS
## CDM/ITAAC PRIMARY REVIEW RESPONSIBILITIES

| CDM/ITAAC Section Number | CDM/ITAAC System Title | Secondary Review Branches |
|---|---|---|
| 2.2.1 | Rod Control & Information System | SRXB |
| 2.2.3 | Feedwater Control System | SRXB |
| 2.2.5 | Neutron Monitoring | SRXB |
| 2.2.7 | Reactor Protection System | SRXB |
| 2.2.8 | Recirculation Flow Control System | SRXB |
| 2.2.9 | Automatic Power Regulatory System | SRXB |
| 2.2.10 | Steam Bypass & Pressure Control | SRXB/SPLB |
| 2.2.11 | Process Computer System | |
| 2.7.5 | Multiplexing System | |
| 2.12.16 | Communication System | EELB |
| 2.14.9 | Suppression Pool Temperature Monitoring System | |
| 3.4 | A. Safety System Logic & Control (DAC)<br>B. I&C Development & Qualification Processes (DAC) | |
| 4.7 | Communication System | Projects |
| TOTAL NUMBER OF SYSTEMS: 13 | | |

## PROJECTS CDM/ITAAC PRIMARY REVIEW RESPONSIBILITIES

| CDM/ITAAC Section Number | CDM/ITAAC System Title | Secondary Review Branches |
|---|---|---|
| 1.1 | Definitions | All |
| 1.2 | General Provisions | ECGB/SPLB |
| 2.16.3 | Site Security | Note:PSGB has lead |
| --- | Reliability Assurance Program | Note:HQMB has lead; SPSB secondary |
| --- | Initial Test Program | Note:HQMB has lead |
| --- | Cross-references of key analyses SSAR->CDM (Roadmaps) | SPSB/SCSB/SPLB/SRXB All |
| Appendix B | Acronyms & Abbreviations | |
| Appendix C | Metric Conversion Table | |
| TOTAL NUMBER OF SYSTEMS: 8 | | |

**ABB-CE SYSTEM 80+**

**TIER 1 CDM/ITAAC**

**TASK GROUP ASSIGNMENTS**

## STRUCTURAL CDM/ITAAC PRIMARY REVIEW RESPONSIBILITIES

| CDM/ITAAC Section Number | CDM/ITAAC System Title | Secondary Review Branches |
|---|---|---|
| 1.3 | Site Parameters | PERB/SPLB/Projects |
| 1.4 | Figure Legend | EELB/SPLB |
| 2.1.1 | Nuclear Island Structures | SCSB/PERB/SPLB/PERB |
| 2.1.2 | Turbine Building | SPLB/SPSB |
| 2.1.3 | Component Cooling Water Heat Exchanger Structure | |
| 2.1.4 | Diesel Fuel Storage Structure | SPLB |
| 2.1.5 | Radioactive Waste Building | PERB |
| 2.1.6 | Reactor Vessel Internals | SRXB |
| 2.1.7 | In-core Instrument Guide Tubes | SRXB |
| 2.2.4 | Control Element Drive Mechanism | SRXB |
| 2.3.3 | Component Supports | |
| 2.7.7 | Demineralized Water Makeup Systems | SPLB |
| 2.7.16 | Chemical & Volume Control System | SRXB/SPLB |
| 2.8.7 | Steam Generator Blowdown System | SRXB |
| 3.1 | Piping Design (DAC) | |
| TOTAL NUMBER OF SYSTEMS: 15 | | |

## PLANT SYSTEMS CDM/ITAAC PRIMARY REVIEW RESPONSIBILITIES

| CDM/ITAAC Section Number | CDM/ITAAC System Title | Secondary Review Branches |
|---|---|---|
| 2.4.2 | Annulus Ventilation System | |
| 2.4.3 | Combustible Gas Control in Containment | |
| 2.4.5 | Containment Isolation | ECGB |
| 2.4.6 | Containment Spray | |
| 2.7.1 | New Fuel Storage Racks | SRXB/ECGB |
| 2.7.2 | Spent Fuel Storage Racks | SRXB/ECGB |
| 2.7.3 | Pool Cooling and Purification System | SRXB |
| 2.7.4 | Fuel Handling System | ECGB |
| 2.7.5 | Station Service Water System | |
| 2.7.6 | Component Cooling Water System | SRXB |
| 2.7.8 | Condensate Storage System | |
| 2.7.9 | Process Sampling System | SRXB |
| 2.7.10 | Instrument Air System | |
| 2.7.11 | Turbine Building Cooling Water System | |
| 2.7.12 | Essential Chilled Water System | |
| 2.7.13 | Normal Chilled Water System | |
| 2.7.14 | Turbine Building Service Water System | |
| 2.7.15 | Equipment & Floor Drainage System | |
| 2.7.17 | Control Building Ventilation System | PERB |
| 2.7.18 | Fuel Building Ventilation System | PERB |
| 2.7.19 | Diesel Building Ventilation System | |
| 2.7.20 | Subsphere Building Ventilation System | |
| 2.7.21 | Containment Purge Ventilation System | SCSB/PERB |

| | | |
|---|---|---|
| 2.7.22 | Containment Cooling & Ventilation System | |
| 2.7.23 | Nuclear Annex Ventilation System | |
| 2.7.24 | Fire Protection System | |
| 2.7.27 | Compressed Gas Systems | |
| 2.7.28 | Potable & Sanitary Water System | |
| 2.7.29 | Radwaste Building Ventilation System | PERB |
| 2.8.1 | Turbine Generator | EELB/ECGB |
| 2.8.2 | Main Steam Supply System | |
| 2.8.3 | Main Condenser | |
| 2.8.4 | Main Condenser Evacuation System | |
| 2.8.5 | Turbine Bypass System | |
| 2.8.6 | Condensate and Feedwater System | |
| 2.8.8 | Emergency Feedwater System | HICB |
| 2.8.9 | Condenser Circulating Water System | |
| TOTAL NUMBER OF SYSTEMS: 37 | | |

## REACTOR SYSTEMS CDM/ITAAC PRIMARY REVIEW RESPONSIBILITIES

| CDM/ITAAC Section Number | CDM/ITAAC System Title | Secondary Review Branches |
|---|---|---|
| 2.2.1 | Nuclear Design | |
| 2.2.2 | Fuel Systems | |
| 2.2.3 | Thermal and Hydraulic Design | |
| 2.3.1 | Reactor Coolant System | ECGB |
| 2.3.2 | Shutdown Cooling System | ECGB/SPLB |
| 2.4.1 | Safety Depressurization System | SPLB/HICB |
| 2.4.4 | Safety Injection System | HICB |
| TOTAL NUMBER OF SYSTEMS: 7 | | |

## ELECTRICAL SYSTEMS CDM/ITAAC PRIMARY REVIEW RESPONSIBILITIES

| CDM/ITAAC Section Number | CDM/ITAAC System Title | Secondary Review Branches |
|---|---|---|
| 2.6.1 | Electrical Power Distribution System | |
| 2.6.2 | Onsite Standby AC Power Sources | |
| 2.7.26 | Lighting System | HHFB |
| TOTAL NUMBER OF SYSTEMS: 3 | | |

## HUMAN FACTORS CDM/ITAAC PRIMARY REVIEW RESPONSIBILITIES

| CDM/ITAAC Section Number | CDM/ITAAC System Title | Secondary Review Branches |
|---|---|---|
| 2.10 | Technical Support Center | PERB |
| 2.12.1 | Main Control Room | |
| 2.12.2 | Remote Shutdown Room | HICB/SRXB |
| 2.12.3 | Control Panels | HICB |
| TOTAL NUMBER OF SYSTEMS: 4 | | |

## RADIATION PROTECTION CDM/ITAAC PRIMARY REVIEW RESPONSIBILITIES

| CDM/ITAAC Section Number | CDM/ITAAC System Title | Secondary Review Branches |
|---|---|---|
| 2.9.1 | Condensate & Feedwater System | SPLB |
| 2.9.2 | Gaseous Waste Management System | SPLB |
| 2.9.3 | Solid Waste Management System | SPLB |
| 2.9.4 | Process & Effluent Radiological Monitoring & Sampling System | SPLB |
| 3.2 | Radiation Protection (DAC) | ECGB |
| TOTAL NUMBER OF SYSTEMS: 5 | | |

## INSTRUMENTATION AND CONTROLS SYSTEMS CDM/ITAAC PRIMARY REVIEW RESPONSIBILITIES

| CDM/ITAAC Section Number | CDM/ITAAC System Title | Secondary Review Branches |
|---|---|---|
| 2.5.1 | Plant Protection System | |
| 2.5.2 | Engineered Safety Features- Component Control System | |
| 2.5.3 | Safety Related Display Instrumentation | |
| 2.5.4 | Protection System Interfaces to Non-Safety Systems | |
| 2.7.25 | Communication System | |
| TOTAL NUMBER OF SYSTEMS: 5 | | |

## PROJECTS CDM/ITAAC PRIMARY REVIEW RESPONSIBILITIES

| CDM/ITAAC Section Number | CDM/ITAAC System Title | Secondary Review Branches |
|---|---|---|
| 1.0 | Introduction | |
| 1.1 | Definitions | |
| 1.2 | General Provisions | EELB/SPLB |
| 1.4 | Abbreviations | |
| 2.11 | Initial Test Program | HQMB |
| --- | Reliability Assurance Program | HQMB |
| TOTAL NUMBER OF SYSTEMS: 6 | | |

## APPENDIX B

## GUIDANCE ON THE PREPARATION OF A DESIGN CONTROL DOCUMENT (DCD)

The purpose of this appendix is to provide guidance on preparation of a DCD for standard reactor plant designs. The appendix discusses the format for the DCD, discusses selected issues unique to design certification reviews under 10 CFR Part 52, and provides additional guidance for standard safety analysis reports (SSARs) for the designs. The guidance relies on the requirements for design information to be included in safety analysis reports (SARs) for facilities licensed under 10 CFR Part 50, as described in NRC Regulatory Guide (RG) 1.70 and the various sections of this SRP. The format for certified design material (CDM) is discussed in Appendix C to this SRP section.

The DCD is the master document that contains the Tier 1 and 2 information referenced in the design certification rule. The DCD will be incorporated by reference in the design certification rules for the designs. All applicants for a combined license (COL) that reference the design certification rule must conform with the information in the DCD.

The DCD may be submitted to the staff at any time prior to design certification rulemaking. The DCD could then be the single document used for staff review for final design approval (FDA) and subsequent design certification, thereby superseding the need for separate SSAR and CDM documents. Alternatively, applicants may use the SSAR and CDM for FDA, then submit a separate DCD, based on reformatting these documents, for design certification rulemaking. The staff believes that early preparation of the DCD is essential to facilitating reviews for design certification, and to conserving both applicant and staff resources. The preparation of the DCD is primarily administrative in nature.

In general, the applicant's SSAR should be designated as the Tier 2 portion of the DCD, and the CDM should be designated as the Tier 1 portion. The Tier 2 portion of the DCD should retain as much of the information in the design certification applicant's SSAR as possible. However, some portions of the SSAR may be removed from the DCD as discussed below. The information in the application will be 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 would not be considered resolved in the design certification rulemaking within the meaning of 10 CFR 52.63, and would need to be resubmitted to the staff as part of a combined license application.

Based on the experience gained from the evolutionary standard design reviews, many issues associated with the preparation of the DCD were resolved as discussed below.

1. Format of the DCD

   The following discussion is based on the assumption that the design certification applicant desires a two-tiered format for its design certification rule. Therefore, the DCD should have three sections: an introduction, the SSAR (Tier 2), and the CDM (Tier 1). 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 design certification rule.

Introduction: The introduction should describe the purpose, content overview, and COL applicant or licensee uses of the Tier 1 and Tier 2 portions of the DCD, with particular emphasis on the issues discussed in this guidance letter. 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 or procedural requirements described in the DCD introduction will be set forth in the design certification rule.

Tier 2: Another section of the DCD should contain the Tier 2 information. Tier 2 is the portion of the design-related information contained in the DCD that is **approved** by the design certification rule, but is not certified. In general, this is the information previously contained in the SSAR, and submitted in accordance with the requirements of 10 CFR 52.47. Tier 2 also includes supporting information on the inspections, tests, and analyses that will be performed to demonstrate that the acceptance criteria in the ITAAC have been met. Compliance with the more detailed Tier 2 information provides a sufficient method, but not the only acceptable method, for complying with the more general design requirements included in Tier 1. If an applicant or licensee used methods other than those described in Tier 2, then the alternative method must be evaluated using the change process in the design certification rule. The alternative methods would be open to staff review and could be a possible issue for a hearing.

Tier 1: A third section of the DCD should be the Tier 1 information. The Tier 1 portion of the design-related information contained in the DCD is **certified** by the design certification rule. This information consists of an introduction to Tier 1, the certified design descriptions 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, 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. Additional design material and related ITAAC are also provided in Tier 1 for selected design and construction activities that are applicable to multiple systems of the design. This additional design material is generally the information that is dependent on as-built, as-procured, or evolving technology, and the detailed design information for these areas must be completed by a COL applicant or licensee. Supporting information for the Tier 1 information should be provided along with related design information in the Tier 2 section of the DCD. In addition, a description of the methodology and criteria for how the Tier 1 information was developed should be provided in Section 14.3 of the DCD. The Tier 1 design descriptions serve as design commitments for the lifetime of a facility referencing the design certification, and the ITAAC verify that the as-built facility conforms with the approved design and applicable NRC regulatory requirements. The detailed format of the Tier 1 Certified Design Material (CDM) is contained in an Appendix to SRP Section 14.3. The requirements for the content of the CDM is contained in SRP Section 14.3.

If the Tier 1 information uses a system-based structure, then it will be different from the analysis-based structure of the Tier 2 material. The staff is particularly interested in ensuring that the assumptions and insights from key safety and integrated plant safety analyses in the Tier 2 material, where plant performance is dependent on information from multiple chapters of the Tier 2 material, are adequately captured in the Tier 1 material. These analyses include flooding, overpressure protection, containment analyses, core cooling analyses, fire protection, transient analyses, radiological analyses, anticipated transients without scram, steam generator tube rupture, USI/GSI's and TMI items, or other analyses specified by the staff. Cross-references for these analyses should be submitted along with the Tier 1 material and included in Section 14.3 of the Tier 2 portion of the DCD.

In addition, cross-references for where assumptions and insights from the probabilistic risk assessment and severe accident analyses are addressed in the DCD should be included along with these analyses in the related portion of the Tier 2 material. For these analyses only, the cross-references should show where each of the key assumptions and insights has been captured in the design in the Tier 1 design information, as well as in the technical specifications (including administrative controls), reliability assurance activities, emergency procedure guidelines, initial test program, and COL action items.

The Tier 1 information must include the most significant of the interface requirements for the standard design which were submitted in response to 10 CFR 52.47(a)(1)(vii). The Tier 1 information must also include the most significant of the site parameters that were submitted in response to 10 CFR 52.47(a)(1)(iii).

2. Treatment of Proprietary and Safeguards Information

Because of the requirement of the Office of the Federal Register that all information incorporated in the design certification rule be publicly available, proprietary and safeguards information that is withheld from public disclosure cannot be included in the DCD. Since this information is not included in the DCD, it will not have issue preclusion in a construction permit or COL proceeding. However, this information is part of the NRC staff's bases for its safety findings for the design, and the NRC considers this information to be a requirement for facilities that reference the design certification rule. Therefore, the proprietary and withheld safeguards information, or its equivalent, must be resubmitted as part of a COL application.

The maximum use of publically available information in the application is strongly recommended to facilitate resolution of issues for future COL applicants and licensees. For example, upon close examination by the evolutionary plant designers, significant portions of proprietary information were able to be reclassified as non-proprietary. Also, for one design, the SSAR and DCD were prepared using non-safeguards-sensitive (publically available) information.

After determining what material cannot be included in the DCD, and to ensure that it is clear what is required as part of a COL application, the applicant should clearly indicate in the DCD any deletions of proprietary or safeguards information for purposes of DCD preparation. The DCD should also indicate the appropriate location of the proprietary or safeguards information residing in separate, external documents.

3. Deletion of Probabilistic Risk Assessment (PRA) Information

For the evolutionary design reviews, industry requested deletion of certain design probabilistic risk assessment (PRA) information from the DCD because of questions on the regulatory significance of that information. The PRA was used in the design review to determine the risk significance of key structures, systems, and components. The NRC concluded that the detailed methodology and quantitative portions of the design PRA did not need to be included in the DCD but the assumptions, insights, and discussions of PRA analyses must be retained in the DCD.

If the detailed portions of the PRA are intended to be removed from the DCD, the objective should be to retain sufficient structure and detail that COL applicants or licensees may fill in detailed design information using the design certification PRA as a baseline. Essentially, only selected quantitative portions should be removed rather than a converse approach where only a minimal amount of information would be retained in the DCD. Additional guidance is listed in the following paragraphs.

a. The details of the PRA are necessary for the staff to evaluate the risk significance of structures, systems, and components of the design during its review. However, to facilitate the removal of the detailed quantitative portion of the PRA at the completion of the design review, the staff proposes that separate sections in the DCD or external reports should be developed for the quantitative analyses that support the qualitative discussion of the PRA.

b. Detailed discussions of PRA data analysis may be removed, but PRA insights, assumptions, results, sensitivity study results, and importance rankings should be retained. Any sections of information that were deleted should be indicated in the DCD, and should be contained in a separate, external report. Deterministic severe accident and shutdown risk analyses should remain in the DCD, although these may be edited to remove detailed PRA data.

c. The PRA analyses that demonstrate why various design features for structures, systems or components are important should be retained in the DCD. A list of risk-significant structures, systems, and components should be provided in the DCD. These analyses should be retained either in one DCD location or the appropriate sections of the DCD discussing the systems of the design. Also, cross references to other documents should be retained in the DCD if they support the information retained in the DCD.

d. As discussed in paragraph 1 above, cross-references for probabilistic and severe accident analyses in the SSAR showing where design features from key integrated plant safety analyses were incorporated into the design should be retained in the DCD in the same form as in the SSAR. Specific cross-references to the appropriate sections of the SSAR and CDM should be retained.

e. Information that is currently in the SSAR but does not involve PRA should be retained in the DCD. This includes items such as 10 CFR 50.34(f) items and unresolved and generic safety issues (USIs/GSIs).

4. 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 were listed in the final safety evaluation reports (FSERs) for the evolutionary designs (NUREG-1503 and NUREG-1462), and these areas should be similar for the passive designs. The areas designated as Tier 2* were generally those associated with detailed structural and equipment design; design and analysis methodology for fuel and control rods; and supporting material for the Instrumentation & Controls, Control Room, and Piping design acceptance criteria (DAC). The requirement for prior NRC approval for many of these Tier 2* areas may expire at the first full power operation of a facility.

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.

5. Conceptual Design Information

Conceptual design information is information that an applicant for design certification is required to submit for site-specific portions of the design by 10 CFR 52.47(a)(1)(ix). An applicant for a construction permit or COL that references the DCR must also describe those portions of the plant design which are site-specific, and demonstrate compliance with the interface requirements, as required by 10 CFR 52.79(b). The COL applicant does not need to conform with the conceptual design information in the DCD. The conceptual design information, which describes examples of site-specific design features, is required to facilitate the design certification review, is non-binding, and it is neither Tier 1 nor 2.

Conceptual design information should be retained in the DCD. The information should be clearly designated as conceptual design information in the appropriate sections of the DCD. The introduction to the DCD should identify the location of the conceptual design information, and explain that this information is included in the DCD for informational purposes only. The introduction should also state that the site-specific design information must be submitted for review as part of a COL application.

6. Treatment of Combined License (COL) Action Items in the DCD

COL action items are outside the scope of the design certification but must be addressed by an applicant or licensee that references the design certification, as required by 10 CFR 52.77 and 52.79. In general, COL action items deal with programmatic or site-specific issues associated with the design.

COL action items should be specified in the Tier 2 portion of the DCD in self-contained subsections, along with the general areas of the design to which they apply. The DCD Introduction should identify the location of the COL action items in the DCD. A table should be provided in the DCD listing the design areas that contain COL action items. An appropriate discussion on the status of these items may be included.

7. Treatment of Severe Accident Design Alternatives

A design certification applicant must submit an evaluation of design alternatives for severe accidents, as required by 10 CFR 50.34(f)(1)(i). This evaluation may be retained in the DCD, or submitted in a separate report that is referenced in the appropriate section of the DCD. In addition, design certification applicants are also required to submit a separate evaluation of severe accident mitigation design alternatives (SAMDAs) to address, in part, the environmental requirements in 10 CFR Part 51 as they pertain to the design certification rulemaking. The treatment of SAMDAs in design certification rulemakings is discussed in more detail in SECY-91-229, "Severe Accident Mitigation Design Alternatives for Certified Standard Designs." The evaluation of SAMDAs need not be referenced or incorporated in the DCD.

8. Treatment of Secondary References in the DCD

Secondary references are references in the DCD to external documents outside the DCD. They typically include industry codes, standards, and topical reports, as well as NRC regulations, regulatory guides, NUREGs, and generic correspondence. These also include references to proprietary information and references to information deleted from the SSAR for purposes of DCD preparation. The DCD itself is considered a primary reference of the rule certifying the design. The following guidance is designed to ensure that the requirements of the DCD and secondary references are clear for the benefit of reactor designers, the NRC, the public, and COL applicants. The staff recognizes that additional discussion with industry on implementation of this guidance may be required.

In general, the DCD should incorporate the applicable requirements of the secondary references rather than reference the external documents containing the requirements. However, if requirements are contained in an external document, the DCD should clearly identify the specific requirements contained in the external document, or the portions of the document that constitute the requirements. Also, references to external documents <u>must</u> be specific as to the applicable version, edition or date.

References that are cited for informational purposes should be retained in the DCD. In addition, internal cross-references to other parts of the DCD need not be modified, even if the cross-reference is to an external document. In either case, the DCD should be clear whether the reference is intended to be a requirement or is intended for informational purposes only.

9. Miscellaneous Format Issues

   a. Section numbering should be the same in the DCD as currently in the CDM and the SSAR.

   b. Guidelines for preparation of emergency procedures are required to be in the DCD as Tier 2 information.

   c. Technical Specifications are required to be in the DCD as Tier 2 information.

   d. Documentation of requests for additional information (RAIs) should be included in the DCD as a separate section if the information in the RAIs is not otherwise described in the appropriate Tier 1 or Tier 2 portions of the DCD.

   e. Any currently copyrighted material in the SSAR will need to be the subject of further discussion between the staff and the applicant.

   f. The numbers in the DCD should be expressed in the International System of Units (SI), accompanied by the equivalent English units in parentheses. This is in accordance with the NRC's metrication policy (57 <u>Federal Register</u> 46202, October 7, 1992), and the Metric Conversion Act of 1975, as amended.

10. Unresolved Safety Issues/Generic Safety Issues (USI/GSIs)

Section 52.47(a)(iv) requires applicants for design certification to submit proposed technical resolutions for medium- and high-priority USI/GSIs identified in NUREG-0933 that are technically relevant to the design. Section 52.47(a)(ii) requires applicants for design certification to demonstrate compliance with any technically relevant portions of the Three Mile Island (TMI) requirements set forth in 10 CFR 50.34(f).

Applicants for design certification should provide a listing in the SSAR of the issues applicable to the standard design. The listing should indicate where the technical resolutions have been incorporated into the design documentation in the SSAR. Rationale should be provided for those issues that the applicant determines to be not applicable. Appendix B of NUREG-0933 may be used as a guide in determining applicable issues, but should not be considered an all-inclusive list for all standard designs.

Applicants may demonstrate the incorporation of operating experience in the design by addressing the technically relevant NRC generic communications, including circulars, bulletins, and generic letters. A summary listing of these documents is contained in NUREG form, and i- also available electronically for searches. Additional review of operating experience may be required in selected areas of the design.

These items should be retained in the DCD.

## APPENDIX C

## FORMAT OF THE CDM/ITAAC

The Certified Design Material (CDM) is the Tier 1 portion of the DCD. The following format for the CDM is acceptable to meet the requirements of 10 CFR 52.47. Alternative formats may also be acceptable. The requirements for the content of the CDM are discussed in more detail in SRP section 14.3. The CDM consists of an introductory section, design descriptions and corresponding inspections, tests, analyses, and acceptance criteria (ITAAC) for the SSC's of the design, design material applicable to multiple SSC's, interface requirements, and site parameters for the standard design.

A. <u>Introduction</u>

This section of the CDM should provide definitions of terms used in the CDM, and a listing of general provisions that are applicable to all CDM entries.

1. Definitions

This section provides terms used in the CDM that could be subject to various interpretations. The intent of the terms used in the CDM was 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 rules, regulations, and guidance. Thus, should questions on terminology arise, these references would aid in understanding the intent of the information in the CDM. Although not all-inclusive, the following definitions that apply to terms used in the Design Descriptions and associated ITAAC are acceptable:

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

**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.

**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.

**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 Design Description.

**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 Section 1.2.

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

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

**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.

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

**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.

**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.

**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 the CDM 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 the CDM 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 many of the systems described in the CDM. The verification consists of an inspection of the system functional arrangement in its final as-built condition at the plant site, and includes the elements of the design descriptions and the system figures in the CDM. This functional arrangement inspection verifies, using as-built system drawings, design documentation, and in-situ plant walkdowns, that the as-built facility is in conformance with the certified design and applicable regulations.

Several other aspects of the design were considered to have significance to the performance of safety functions of SSCs of a facility. The basis for selecting these aspects included its importance to safety as well as its past experience with construction and operating problems. Thus, specific inspections for these aspects are part of the basic configuration ITAAC for systems and structures. The other inspections to be conducted to satisfy this ITAAC include, and are limited to, verification of the following:

(1) Verifications of the quality of pressure boundary welds for ASME

Code Class 1, 2, and 3 components and systems described in the design descriptions and figures. Detailed supporting information for verification of welding requirements in accordance with ASME Code requirements is contained in SSAR Chapter 3.

(2) Verifications of the dynamic qualification (e.g., seismic, LOCA, and safety relief valve discharge loads) of seismic Category I mechanical and electrical equipment (including connected instrumentation and controls) described in the design descriptions and figures. Detailed supporting information for dynamic qualification requirements, including qualification records, is contained in SSAR Chapter 3.

(3) Verifications of the environmental qualification of Class 1E electrical equipment described in the design descriptions and figures. Detailed supporting information for environmental qualification requirements is contained in SSAR Chapter 3.

(4) Verifications of the design qualification of motor-operated valves (MOVs) described in the design descriptions and figures. Detailed supporting information for design qualification of MOVs is contained in SSAR Chapter 3.

**b) Treatment of Individual Items**

A licensee is not prohibited from utilizing an item not described in the CDM. However, the as-built facility must be consistent with the rule approving the design, including both tiers of information. The change processes for the certified design are described in the design certification rule for the standard design.

The term "operate" as utilized in the CDM 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 must 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**

A three column format is used for the ITAAC. The design commitments in the first column are derived from the design information in the design descriptions. The inspections, tests, and analyses in the middle column provide the intended means of verifying the design commitment. The acceptance criteria in the third column provide the criteria used to determine whether the design commitment is met.

The licensee is required by 10 CFR Part 52 to perform the required inspections, tests, and analyses for the design, and certify to the NRC that the acceptance criteria have been met. 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 ITP required by the CDM, or the QA program required by 10 CFR Part 50, Appendix B.

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 will perform in accordance with the design certification and applicable regulations.

**d) Discussion of Matters Related to Operations**

Descriptions in the CDM 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 the CDM 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 the CDM, 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 must be consistent with the performance characteristics and functions described in the design descriptions and figures. Any changes to the detailed information in the SSAR must be in accordance with the "50.59-like" change process in the design certification rule for the standard design, which allows the COL applicant or licensee to make design changes, provided the changes do not impact the information in the CDM.

**f) Rated Reactor Core Thermal Power**

The rated reactor core thermal power for the standard design should be specified.

3. Legend for Figures and Acronyms and Abbreviations

A legend supporting CDM figures should be provided in the CDM. The symbology selected should be consistent and as closely aligned as possible with the symobology in the SSAR, 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 the CDM.

The meanings of acronyms and abbreviations should be provided in the CDM for any of these terms used in the CDM.

B. System Design Descriptions 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 SSAR Section 14.3.

General provisions that apply to these structures and systems are contained in the CDM Introduction. Additional CDM material for design issues that apply to many of these structures and systems may be provided in a separate section of the CDM. Interface requirements for the in-scope portions of the systems are provided in the system design descriptions. The interface requirements for the out-of-scope portions of the systems of the design may be contained in a separate section of the CDM. Entries should be provided in the CDM for all systems necessary to define the full scope of the design.

1. Design Descriptions

The design descriptions address the most safety-significant aspects of each of the systems of the design, and were derived from the detailed design information contained in the SSAR. The design descriptions include the figures associated with the systems.

The design descriptions will serve as commitments for the lifetime of a facility. 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. Nevertheless, the Tier 1 design descriptions will remain in effect throughout the plant life to assure that the plant does not deviate from the certified design. In general, a COL applicant or licensee may change the information in the SSAR in accordance with the "50.59-like" change process described in the rule certifying the design, provided that the change does not impact the information in the design descriptions.

Numeric performance values for 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).

2. 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 must be successfully met prior to fuel load. If the licensee demonstrates that the ITAAC are met and the staff agrees that they are successfully met, then the licensee will be permitted to load fuel.

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. This is not true in all cases. Reasons for not requiring an ITAAC verification for a Tier 1 design commitment may include: (1) the information is only included for context, (2) fulfillment of other ITAAC are sufficient to show verification of the design commitment, (3) a single ITAAC can verify more than one design commitment, or (4) verification of the item can only occur after fuel loading. For the last item, the power ascension testing program described in SSAR Chapter 14 should ensure that all important design features and commitments that could not be verified prior to fuel load were addressed where appropriate.

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. As required by 10 CFR 52.47, the ITAAC must be necessary and sufficient to provide the NRC with reasonable assurance that the facility is built and will operate in accordance with the design certification and applicable regulations.

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

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 inspections, tests, or analyses.

The SSAR contains detailed supporting information for the CDM about 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 the SSAR provides the background material and context for the CDM. The SSAR contains information reviewed by the staff which is the basis for the staff's safety determination for the design. Therefore, the information in the SSAR provides an acceptable means of satisfying an ITAAC.

Inspections are defined in the CDM 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 CDM Introduction for as-built structures and systems.

Tests are defined in the CDM 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 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 SSAR 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 the CDM, SSAR Section 14.2 and RG 1.68. Conversion of the test results from the test conditions to the design conditions may be required to satisfy the ITAAC.

The preferred means to satisfy the ITAAC is in-situ testing, where possible, of the as-built facility. Also, in some cases, the results and documentation from facility programs such as the quality assurance program or the ITP may be used to satisfy an ITAAC.

Analyses are defined in the CDM Introduction, and may refer to detailed supporting information in the SSAR, simple calculations, or comparisons with operating experience or design of similar SSCs. For example, detailed analysis methods of seismic and environmental qualification supporting the general provisions in the CDM Introduction are contained in SSAR Chapter 3, and detailed piping design information supporting additional design material applicable to multiple sections of the design, are also contained in SSAR Chapter 3.

Column 3 - <u>Acceptance Criteria</u>

This column contains the specific acceptance criteria for the inspections, tests, or analyses described in Column 2 which, if met, demonstrate that the design commitment in Column 1 has 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 the SSAR 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, the SSAR provides the detailed supporting information on multiple interdependent parameters that must 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.

3. SSAR Section 14.3

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

Section 14.3 should contain a description of each section of the CDM, and a discussion of its development. The following items should be addressed.

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

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

3. 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.

4. 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.

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

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

The emphasis in Section 14.3 should be on discussing the level of detail in the CDM. Acceptable approaches for selection of the top-level requirements for the CDM 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.

1. Selection of design information from the various chapters of the SSAR.

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

3. Treatment of safety-related SSCs.

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

5. Important insights or assumptions from the probabilistic risk assessment (PRA).

6. Treatment of severe accident design features.

7. 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.

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

9. Provisions in the test descriptions for the pre-operational and power ascension test programs contained in Section 14.2 of the SSAR.

The staff is particularly interested in ensuring that the assumptions and insights from key safety and integrated plant safety analyses in the SSAR, where plant performance is dependent on contributions from multiple systems of the design, are adequately considered in the CDM. Addressing these assumptions and insights in the CDM 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, overpressure 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 SSAR Section 14.3 that cross references the important design information and parameters of these analyses to their treatment in the CDM.

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 the CDM, 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 the SSAR.

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 the CDM. The change process, including the "50.59-like" change process for Tier 2 design information, is specified in the design certification rule for the standard design.

4. Tier 2 Supporting Information

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 in 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 SSAR 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.

5. ITAAC Implementation

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 facility on the final site has been constructed and will operate according to the design certification and applicable regulations.

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 will constitute the basis for the NRC's determination to allow fuel loading for the facility.

The licensee will 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. In accordance with 10 CFR 52.99, the staff will assure that the required inspections, tests, and analyses have been performed and that the prescribed acceptance criteria have been met. At appropriate intervals, the NRC will publish in the Federal Register, notices of the successful completion of the inspections, tests, and analyses.

C. Additional Certified Design Material

This section of the CDM 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 the CDM, 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.

1. Design Acceptance Criteria (DAC) - Additional material may be provided because, in selected areas of the design, applicants did not provide sufficient design detail in the SSAR. 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. For these areas, applicants should provide the design related processes and associated DAC in the CDM that a COL applicant or licensee would follow to complete the design. Supporting information, with appropriate codes and standards, should be contained in the related sections of the SSAR. The DAC are discussed in greater detail in Appendix G to this SRP section.

2. Initial Test Program (ITP) - The CDM should contain a high level commitment to an ITP and a description of the program and major program documents (i.e., a site-specific startup administrative manual, test specifications, and test procedures). The SSAR Chapter 14.2 contains a complete detailed description of the ITP. The ITP is described in Tier 1 because of the essential role of a test program in the verification that SSCs have been constructed and will perform satisfactorily in service. The top-level ITP commitments in the CDM ensure that suitable controls are imposed over the pre-operational and start-up testing programs, which provide reasonable assurance that the facility can be operated without undue risk to the public. For example, the Tier 1 description requires that the ITP be performed under suitably controlled conditions and processes. Further, the development of test procedures, conduct of the tests, and safe execution of the test program, are important considerations in ensuring that as-built facility is in accordance with the design certification and applicable regulations. A corresponding ITAAC for this design description may not be required for several reasons:

   (1) The Tier 1 certified design material consists of a high level commitment to an ITP, and a description of the program and major program documents that constitute an acceptable ITP (i.e., a site-specific startup administrative manual, test specifications, and test procedures). The specific testing necessary to verify design features and performance aspects of the design is delineated in the system-specific ITAAC.

   (2) The ITP covers a broader spectrum of time than the ITAAC. While ITP pre-operational testing shall be completed prior to fuel load, the ITP startup and power ascension testing will be conducted after fuel load. As the ITP involves testing post-fuel load, it is not appropriate to define associated ITAAC entries as Part 52 specifies that the ITAAC will be completed prior to fuel load.

3. Design Reliability Assurance Program (D-RAP) - The CDM should contain a

high level commitment to a D-RAP for use in the detailed design and equipment specification of risk-significant SSCs prior to fuel load. The Design Description in the CDM should describe the scope, purpose, objectives, and essential elements of the D-RAP. It should provide a commitment for a process to evaluate and prioritize SSCs, and list the SSCs based on their risk-significance. It should include a commitment that the process used to determine dominant failure modes considered industry experience, analytical models, and applicable requirements. Also, for those SSCs designated as risk-significant, the key assumptions and risk insights should consider operations, maintenance, and monitoring activities. An ITAAC should be provided to verify the commitments in the CDM. The SSAR Section 17.4 should contain a more detailed description of the D-RAP. The D-RAP is described in Tier 1 because of the essential role of a reliability assurance program in assuring that the final as-built facility performs satisfactorily in service.

D. Interface Requirements

This section of the CDM specifies interface requirements that must be met by the site-specific portions of a facility that are not within the scope of the certified design. They 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 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.

See Appendix H of this SRP section for further discussion of the scope of the standard design, interface requirements, conceptual design information, and COL Action Items.

The requirements for interfaces for a design are contained in 10 CFR 52.47(a)(1)(vii-ix). An applicant for design certification is required to provide:

(1) the interface requirements to be met by those portions of the plant for which the application does not seek certification.

The interface requirements may be located in this section of the CDM, or located with the Design Descriptions and ITAAC for applicable SSCs and cross referenced to this section of the CDM. Cross referencing is typically used for systems that are partially out of scope of the standard design.

(2) justification that compliance with the interface requirements is verifiable through inspection, testing, or analysis, and the method to be used for verification of interface requirements.

This justification should be provided in the CDM. An acceptable justification is a statement in the CDM that the development of ITAAC for the interface requirements will be similar in nature to the development of ITAAC for SSCs within the scope of the standard design. Thus, compliance with the interfaces is verifiable through ITAAC. The development process for the Design Descriptions and ITAAC should be described in SSAR Section 14.3.

(3) a representative conceptual design for those portions of the plant for which the application does not seek certification.

Representative conceptual designs should be provided by design certification applicants in the appropriate sections of the SSAR so that the staff can perform its review of the standard design. This information should be clearly identified as conceptual design information for the site-specific, out-of-scope portion of the design.

An applicant for a combined license must provide appropriate information regarding the site-specific portion of the design and ITAAC to demonstrate compliance with the interface requirements. The review of this information is accomplished in the review of an application for a combined license under Subpart C of 10 CFR Part 52.

E. Site Parameters

Site parameters are specified in this section of the CDM 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 must be demonstrated to be within the bounding parameters and characteristics, and a facility must be constructed at the site in accordance with their use in the approved design. The demonstration that the site parameters are met at a given site is accomplished in conjunction with an application and issuance of a combined license under Subpart C of 10 CFR Part 52.

The requirements for site parameters for a design are contained in 10 CFR 52.47(a)(1)(iii). An applicant for design certification is required to provide the site parameters used in the design, and an analysis and evaluation of the design in terms of these parameters. The top-level site parameters should be specified in the CDM. Detailed site parameters should be specified in Chapter 2 of the SSAR, and the analysis and evaluation of the design should be contained in the applicable sections of the SSAR.

OTHER FORMAT ISSUES:

1. Treatment of proprietary and safeguards information.

See the discussion of this topic in the appendix of SRP Section 14.3 regarding guidance on the preparation of a DCD.

2.

Style Guide items

- Manufacturer or component types not specified,
- Codes and standards
- Exceptions to every rule on a case-by-case basis
- Extract of regulations rather than reference (see intro section)

## APPENDIX D-1

## FLUID SYSTEMS REVIEW CHECKLIST

### I. DESIGN DESCRIPTIONS AND FIGURES

The following provides guidance and rationale of what should be included in the certified design material (CDM) for fluid system Design Descriptions (DD) and ITAAC. Examples of acceptable Design Descriptions and Figures may be found in the DCDs for the evolutionary designs.

#### A. DESIGN DESCRIPTIONS

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

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

   The design description (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.

2. Location of system

   The building that the system is located (e.g., containment, reactor building, etc.) shall be included in the design description.

3. 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, should not be included in the design description because this could limit the COL applicant 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 will 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:

   Flow limiting features for high-energy line breaks (HELBs) outside of containment - The minimum pipe diameter will 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) are not included because their small size limits the effects of HELBs outside containment.

Keep Fill systems - These will be included in the design description when needed for the direct safety function to be achieved without damaging water hammer.

On-line Test Features - Some systems/components have special provisions for on line test capability which is critical to demonstrate its capability to perform the direct safety function. An example is an ECCS test loop. These on-line test features will be described in the DD.

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

Surge Tank - The capacity of the surge tank will 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.

Severe Accident Features - These features will be described in the design description and the configuration ITAAC will verify that they exist. The capabilities of the features will not be included in the ITAAC.

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

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 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.

4. 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 design description except in special cases such as ISLOCA where the system has to meet additional requirements.

5. System operation

The DD should provide a description of the various modes of operation of the system. This should include realignment of the system following a LOCA (or other) signal.

6. Controls, Displays and Alarms

The design description will describe the system controls, displays (do not use the term "indications"), and alarms available in the control room. Important instrumentation will be shown on the system figure. The EPGs and Chapter 18 have identified the minimum set of controls, displays, and alarms necessary to perform safety functions. They will be used as guidance for establishing the needs for main control room controls, displays and alarms to be included in Tier 1.

7. 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.

8. Interlocks

Interlocks needed for direct safety functions will be included in the system design description. 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 SSAR.

9. 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 will also be addressed in the electrical and I&C systems ITAAC.

10. Equipment to be qualified for harsh environments

Electrical equipment that is used to perform a necessary safety function must 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 will be completed for all equipment items important to safety in accordance with the requirements of 10 CFR 50.49. 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 "mild" environments will be addressed in the I&C ITAAC.

11. Interface requirements

    The interface requirements will be identified in the Design Descriptions for applicable systems and cross-referenced in a separate section of the certified information. An example is the Reactor Service Water System. The methodology for developing ITAAC for the interface requirements will be described in the SSAR or certified information. Non-safety systems which cannot impact safety systems do not need Interface Requirements. Specific in-scope design details which preclude the non-safety system from impacting a safety system must be addressed in Tier 1.

12. Accessibility for ISI Testing and Inspection

    The accessibility does not have to be addressed in Tier 1. However, NRC will not grant reliefs to the ISI requirements after Design Certification.

13. 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.

14. Normally, all design commitments in Tier 1 must be verified by a specific ITAAC, unless there are specific reasons why this is not necessary. Some acceptable reasons include: (a) the information is only included for context, (b) fulfillment of other ITAAC are sufficient to show verification of the design commitment; (c) a single ITAAC can verify more than one design commitment.

B. FIGURES

1. 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 will be simplified piping diagrams for mechanical systems. Symbols used on the figures should be consistent with the legend provided by the applicant.

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

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

4. 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 that, in the process of fabricating the overall piping system, the welding and bolting requirements for ensuring the pressure integrity have been met.

5. As a minimum, instruments required to perform emergency operation procedures (as described in the SSAR, Chapter 18) are shown on the figure.

6. The minimum inventory of alarms as established in the MCR or RSP ITAAC do not have to be shown on DD Figures. Other essential alarms, e.g., associated with SCS high pressure (ISLOCA), SCS performance monitoring indications, not part of the minimum inventory should be shown on the DD figures.

7. 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.

8. Identification of all indication and control on the remote shutdown panel will be included in the system diagram or alternatively in the remote shutdown panel ITAAC.

9. Figures for safety-related systems should include valves on SSAR 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 must be shown if their mispositioning could affect system safety function. Other valves are evaluated for exclusion on a case-by-case basis.

10. Fail-safe positions of the pneumatic valves will not be shown unless the fail-safe position is relied on to accomplish the direct safety function of the system.

11. CIVs are to be shown on the figure of the applicable system ITAAC. 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 will be addressed in the containment ITAAC. This approach should be explained in the General Provisions section or in an alternate section of the Tier 1 document.

12. 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

The following general guidelines should be used during the review of design descriptions and figures:

1. 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).

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

3. "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.

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

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

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

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

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

9. Systems should be described as "safety-related" and "nonsafety-

related," not "essential" and "nonessential."

10. The correct system name should be used consistently.

## II. INSPECTIONS, TESTS, ANALYSES AND ACCEPTANCE CRITERIA (ITAAC)

The following guidance and rationale of what should be included in the certified design material was developed during the review of fluid system Design Descriptions and ITAAC, and provides the staff's positions regarding ITAAC. Each of the standard ITAAC entries are discussed in the order they are presented in Appendix G. Additional guidance refers to example ITAAC presented in Appendix H. As additional experience is gained, this guidance may be updated and revised.

Normally, all design commitments in Tier 1 must be verified by a specific ITAAC entry, unless there are specific reasons why this is not necessary. Some acceptable reasons include: (a) the information is only included for context, (b) fulfillment of other ITAAC are sufficient to show verification of the design commitment; (c) a single ITAAC entry can verify more than one design commitment.

### A. STANDARD ITAAC ENTRIES

#### 1. BASIC CONFIGURATION

This ITAAC entry includes inspection of the functional arrangement of the system components as shown in the figures and includes inspections, tests and analyses of welding, environmental qualification, seismic qualification, and MOVs as described in the definitions and general provisions provided in Appendix A, and as discussed below:

FUNCTIONAL ARRANGEMENT

The system will be inspected to determine that the functional arrangement of the components is as discussed in the Design Description and shown in the figures. Unless specified explicitly, the figures are not indicative of the scale, location, dimensions, shape, or spatial relationships of as-built SSC. In particular, the as-built attributes of SSC may vary from the attributes depicted on the figures, provided that those safety functions discussed in the Design Description pertaining to the figure are not adversely affected.

Some features and components of the systems are only addressed by the configuration ITAAC as discussed below:

Keep-Fill Systems - These will be included in the design description when needed for the direct safety function to be achieved without damaging water hammer and verified by the configuration ITAAC. However, a separate functional test will not be performed because the keep-fill system will be tested as part of the overall system functional tests.

Filters - Filters that are required for a safety function (such as Control Room HVAC radiation filtering) should be in the design description. The configuration ITAAC will check that the filter is exists, but will not test the filter performance because changes in technology and performance requirements could occur that would modify the specific performance criteria necessary for the filter. Additionally, filter performance is verified by Tech Spec surveillance.

Severe Accident Features - These features will be described in the design description and the configuration ITAAC will verify that they exist. The capabilities of the features will not be included in the ITAAC because these features do not lend themselves to in-situ verification.

## WELDING

General Design Criterion 14 of 10 CFR Part 50, Appendix A requires that the reactor coolant pressure boundary be designed, fabricated, erected, and tested so as to have an extremely low probability of abnormal leakage. In addition, General Design Criterion 30 requires that components which are part of the reactor coolant pressure boundary be designed, fabricated, erected, and tested to the highest quality standards practical.

The integrity of the pressure boundary in the plant will be ensured, in part, through a verification of the welding quality. An inspection is required to be performed to verify the quality of welding for ASME Code Class 1, 2, and 3 pressure-retaining components using appropriate non-destructive examination (NDE) methods. Verification of welding quality is performed as a part of ITAAC for the basic configuration check of each specific system.

The scope of welding to be verified by the ITAAC includes ASME Code Class 1, 2, and 3 pressure-boundary welds. The ASME Code class welds are included in Tier 1 because the ASME Boiler and Pressure Vessel Code, Section III is referenced in 10 CFR 50.55a. Nuclear power plant components classified as Quality Groups A, B, and C are required by 10 CFR 50.55a to meet the requirements for ASME Code Classes 1, 2, and 3, respectively. In each system description, the functional drawing identifies the boundaries of the ASME Code classification. The integrity of the pressure boundary is required to be maintained because it is directly involved in preventing or mitigating an accident or event under the defense-in-depth principle. ASME Code Class 1, 2, and 3 structural welds (e.g., pipe support welds) are not included within the Tier 1 scope because they were deemed to be indirectly involved in preventing or mitigating an accident or event (e.g., Pipe supports provide protection of the piping; but, it is the piping itself that is needed for accident mitigation). Thus, ASME Code Class 1, 2, and 3 structural welds are included in the Tier 2 scope.

## ENVIRONMENTAL QUALIFICATION

Electrical equipment that is used to perform a necessary safety function must 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 will be completed for all equipment items important to safety in accordance with the requirements of 10 CFR 50.49. This documentation will be in the form of the equipment qualification list and the device specific qualification files, and will include the specified environmental conditions, qualification methods (e.g., tests, or tests and analyses), and documentation of qualification results. The installed condition of electrical equipment important to safety will be compatible with conditions for which it was qualified. 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 ITAAC will verify that the Class 1E electrical equipment identified in the Design Description (or on accompanying figures) is qualified for its application and meets its specified performance requirements when it is subjected to the conditions predicted to be present when it must perform its safety function up to the end of its qualified life. The qualification of I&C equipment for "mild" environments will be addressed in the I&C ITAAC.

## EQUIPMENT SEISMIC QUALIFICATION

General Design Criterion 2 of 10 CFR Part 50, Appendix A requires that structures, systems, and components important to safety be designed to withstand the effects of natural phenomena including earthquakes. In addition, General Design Criterion 4 requires that structures, systems, and components be appropriately designed against dynamic effects.

To verify the ability of mechanical and electrical equipment to perform their safety functions during and following a safe shutdown earthquake, an inspection is required to be performed to verify that the as-built equipment is qualified to withstand seismic and dynamic loadings. The equipment qualification for seismic and dynamic effects is performed in conjunction with an ITAAC for the basic configuration check of each specific system.

The scope of equipment qualification to be verified by the ITAAC includes those seismic Category I mechanical and electrical equipment (including associated instrumentation and controls) that are depicted on the functional drawings in the design description. Although other seismic Category I equipment might exist within the system and might not be depicted on the functional drawing, they are still required to be seismically qualified but are not required to be included in the ITAAC verification scope. The reason is that the design description and the functional drawings define that portion of the standard design, that is approved by certification and is necessary to perform the system's safety function. Thus, only the seismic Category I equipment that is included in the certified design is required to be verified by the ITAAC. The verification of these other seismic Category I equipment is considered a part of the 10 CFR Part 50, Appendix B quality assurance program.

MOTOR-OPERATED VALVES

General Design Criterion (GDC) 1 requires that structures, systems, and components important to safety be designed, fabricated, erected, and tested to quality standards commensurate with the importance of the safety functions to be performed. GDC 1 further requires that a quality assurance program be established and implemented in order to provide adequate assurance that these structures, systems, and components will satisfactorily perform their safety functions. Criterion III, "Design Control," of Appendix B to 10 CFR 50 requires that measures be established to assure that the design bases for those structures, systems, and components are correctly translated into specifications, drawings, procedures, and instructions. Criterion XI, "Test Control," requires that a test program be established to assure that testing required to demonstrate that structures, systems, and components will perform satisfactorily in service is identified and performed.

The ability of motor-operated valves (MOV) to perform their safety functions will be ensured, in part, through verification of the MOV qualification program. The ITAAC for the basic configuration check requires verification that:

> The results of test of active safety related MOVs identified in the figures or design descriptions demonstrate that the MOVs are qualified to perform their safety functions under certified design differential pressure, system pressure, fluid temperature, ambient temperature, minimum voltage, and minimum and/or maximum stroke-time.

The MOV qualification program relies on testing of each size, type, and model. The testing and acceptance criteria for qualification are described in the SSAR.

Numerous problems with MOVs in operating plants have been identified over the past several years through operational experience, licensee programs in response to NRC Generic Letter 89-10, and NRC staff inspections. Therefore, in addition to the configuration ITAAC, tests of installed MOVs are required in each system ITAAC.

The scope of MOVs to be verified by these ITAAC entries includes those MOVs that are depicted on the functional drawings in the Design Descriptions. These MOVs will include all MOVs with a safety related active function, a complete list of which is contained in the IST plan.

2. HYDROSTATIC TEST

General Design Criterion 14 of 10 CFR Part 50, Appendix A requires that the reactor coolant pressure boundary be designed, fabricated, erected, and tested so as to have an extremely low probability of abnormal leakage. In addition, General Design Criterion 30 requires that components which are part of the reactor coolant pressure boundary be designed, fabricated, erected, and tested to the highest quality standards practical.

The pressure boundary integrity will be ensured, in part, through a test verifying the leak-tightness of the ASME Code piping systems. A hydrostatic test is specified as a part of the ITAAC for each individual piping system.
The scope of the hydrostatic test for the ITAAC includes ASME Code Class 1, 2, and 3 piping systems. The ASME Code class piping systems have been selected for Tier 1 treatment because the ASME Boiler and Pressure Vessel Code, Section III is referenced in 10 CFR 50.55a. Nuclear power plant components classified as Quality Groups A, B, and C are required by 10 CFR 50.55a to meet the requirements for ASME Code Classes 1, 2, and 3, respectively. The ASME Code, Section III requires that a hydrostatic test be performed. In each system description, the functional drawing identifies the boundaries of the ASME Code classification. The integrity of the pressure boundary is required to be maintained because it is directly involved in preventing or mitigating an accident or event under the defense-in-depth principle.

3. NET POSITIVE SUCTION HEAD (NPSH)

The system ITAAC will verify that pumps with direct safety functions (typically ECCS and SLCS pumps) have the required NPSH to accomplish their safety function by a combination of test and analysis. The analysis method for determining NPSH will typically be provided in the SSAR.

4. DIVISIONAL POWER SUPPLY

Electrical independence (separation) will be verified in the system ITAAC. 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 will also be addressed in the electrical and I&C systems ITAAC.

5. PHYSICAL SEPARATION

Physical separation (for hazards) will be verified in the ITAAC. The hazards postulated are Design Basis Events and, therefore, the design features that protect the equipment need to be verified by the ITAAC to demonstrate independence (and single failure). System features (switches, valves, dampers) used to provide protection from hazards will be included in the appropriate system design description and ITAAC. Structural features such as walls, doors, curbs, etc., will also be covered, but in most cases these will be in a building ITAAC.

## 6. CONTROL ROOM FEATURES

Controls and displays (we are not using the term "indications" in ITAAC) - The design description will describe the system displays and controls available in the control room. Important instrumentation will be shown on the system figure. The EPGs and Chapter 18 of the SSAR identify the minimum set of controls and displays necessary to perform safety functions. They will be used as guidance for establishing the needs for main control room displays and controls to be included in Tier 1. The system ITAAC will only verify that these features exists since their performance will be addressed in the HFE and I&C ITAAC.

Alarms - If an alarm is identified in the SSAR inventory of alarms based upon the EPGs and PRA, then it need not be specifically called out in the system ITAAC. These alarms will be addressed in the HFE and I&C ITAAC. Any additional alarms determined to be necessary should be included in the system ITAAC.

## 7. REMOTE SHUTDOWN PANEL

Controls, displays, and alarms available on the remote shutdown panel can be identified and verified as part of the remote shutdown panel ITAAC, or identified in the system ITAAC and verified as part of the remote shutdown panel ITAAC.

The EPGs and Chapter 18 of the SSAR identify the minimum set of controls and displays necessary to perform safety functions. They will be used as guidance for establishing the needs for remote shutdown panel displays and controls to be included in Tier 1.

If the controls, displays, and alarms are identified in the system ITAAC, the design description will describe the system displays and controls available on the remote shutdown panel. Important instrumentation will be shown on the system figure. The system ITAAC will only verify that these features exists since their performance will be addressed in the HFE and I&C ITAAC.

## 8. MOTOR OPERATED VALVES

In addition to the MOV qualification testing (Generic Letter 89-10) required in the Basic Configuration ITAAC, MOVs with active safety functions are tested in the system ITAAC to check the capability of the as-installed MOV to operate under differential pressure. In some cases closing/opening times are specified. This addresses problems that have occurred due to installation errors. The SSAR will contain a complete list of safety-related MOVs which have an active function.

These tests are required to be performed under pre-operational differential pressure, fluid flow, and temperature conditions to assure that the valves open and/or close within time limits as specified. The SSAR in Section 3.9.6 further defines that these tests will be conducted under maximum achievable pre-operational conditions and describes the analysis of these tests results that will be conducted to demonstrate that the valve will function under design conditions. Any change to the commitment to conduct these tests under maximum achievable conditions and to analyze these results to assure MOV function under design conditions would involve an unreviewed safety question and, therefore, would require NRC review and approval prior to implementation. Any requested change to these commitments shall either be specifically described in the COL application or submitted for license amendment after COL issuance.

9. PNEUMATICALLY OPERATED VALVES

In cases where the fail-safe position of pneumatic valves is relied on to accomplish the direct safety function of the system, the system ITAAC will verify the fail-safe position.

10. CHECK VALVES

Numerous installation problems with check valves in operating plants have been identified through operating experience and NRC staff's inspections. Therefore, in addition to the acceptance criteria for design and qualifications described in the SSAR, tests of installed (active) safety-related check valves are required in each system ITAAC. These tests will be conducted under system preoperational pressure, fluid flow, and temperature conditions to assure that the valves open and/or close as expected based on the direction of the differential pressure across the valves.

Note: Since the industry has not experienced significant operational problems with other types of valves, or with pumps in general, the proper operation of these components will be tested as part of the functional tests of the system under the system ITAAC.

B. SYSTEM SPECIFIC ITAAC ENTRIES (see Appendix H for examples)

1. 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.

2. CRITICAL ASSUMPTIONS FROM TRANSIENT AND ACCIDENT ANALYSES

The critical assumptions from transient and accident analyses will be verified by ITAAC. "Roadmaps" will be used to identify the critical input parameters assumed in the transient and accident analyses. All critical input parameters given in the SSAR (mainly in chapters 6 and 15) will be identified in the "roadmap" with the respective system ITAAC number. The reviewer will verify in the individual system ITAAC that the critical input parameters are included in the corresponding system ITAAC as indicated in the "roadmap".

3. PRA INSIGHTS

If the results of the PRA indicate that a particular component or function of a system is risk significant, that component or function will be verified by ITAAC. PRA insights will be identified in the staff's SER. The reviewer will verify in the individual system ITAAC that the PRA insights are included in the corresponding system ITAAC as indicated in the SSAR.

4. ON-LINE TEST FEATURES

Some systems have special provisions for on-line test capability which is critical to demonstrate its capability to perform the direct safety function. An example is an ECCS test loop. These on-line test features will be verified by ITAAC.

5. SURGE TANKS

The capacity of a surge tank will 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.

6. 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.

7. 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.

8. INTERLOCKS

Interlocks needed for direct safety functions will 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 SSAR. 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.

9. AUTOMATIC OVERRIDE SIGNALS

Automatic signals that override equipment protective features during a DBE (e.g., thermal overloads for MOVs), may not be included in the ITAAC because there are other acceptable methods for assuring system function during a DBE.

10. SINGLE FAILURE

The design description will not state that the system meets single failure criteria (SFC). There will 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 will be in ITAAC.

11. FLOW CONTROL VALVES

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.

12. 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

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

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

3. Standard pre-ops tests defined in the SSAR 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. SSAR and Reg Guide 1.68 tests should be examined and tests elevated to ITAAC as necessary.

4. If an ITAAC test is not normally done as part of a pre-operational test, the test methodology should be in Tier 1 or the SSAR with reference to the ITAAC.

5. Use of the Terms "Test" and "Type Test" in the ITA should be consistent with the Definitions. Testing which would be classified as "Vendor", "Manufacturer", "Shop" could be specified as such to make clear what type of test is intended. An alternate approach would be to define "shop" test.

6. If an analysis is required in the ITAAC, then the analysis or at least the outline of the analysis will be prepared and that will be put in the ITAAC or the SSAR with reference to the ITAAC it supports.

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

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

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

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

13. Avoid clarifying phrases in the ITAAC.

14. 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 will 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 B.I for guidance.)

## FIGURES CHECK LIST

**SYSTEM:** ____________________

1. All components discussed in the design description. ______

2. System boundaries with other 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 emergency operation procedures (as described in the SSAR, 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 indication and control 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 B.I for guidance.)

# ITAAC CHECK LIST

SYSTEM: ______________________________

1. Basic configuration ________
2. Hydrostatic test ________
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. On-line 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 B.II for guidance.)

# APPENDIX D-2

## ELECTRICAL SYSTEMS REVIEW CHECKLIST

The following guidance and rationale of what should be included in the certified design material was developed during the review of electric system Design Descriptions (DD) and ITAAC, and provides the staff's positions regarding the content of the DD and ITAAC. The information should be included in the design description in a consistent order. As additional experience is gained, this guidance may be updated and revised. Examples of Design Descriptions and Figures are provided in Appendix H.

This section is intended to provide additional guidance for evaluating the DD and ITAAC, in the Electrical area (for purposes of review responsibility the Electrical area also includes the Lighting Systems).

A. DESIGN DESCRIPTION

Electrical equipment that is involved in performing the direct safety function should be addressed in the Design Description (see IEEE-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, <u>and</u> 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 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:

1. Overall Class 1E electric distribution system - this would include any high level treatment for cables, buses, breakers, disconnect switches, switchgear, motor control centers, distribution transformers, and connections/terminations

2. Power sources including:

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

- DC system - battery/battery chargers
- Emergency diesel generator (EDG support systems need to be covered also - Plant Systems Branch has lead responsibility)
- Vital AC inverters, regulating transformers, transfer devices
- Alternate ac power sources for SBO

3. Other Electrical Features including:
   - Containment electrical penetrations
   - 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.
4. Lightning protection - general configuration type check.
5. Grounding - configuration type check. For both lightning protection and grounding, it is expected that this will be part of a inspection to check that the features exist. No analyses to demonstrate adequacy will be in ITAAC.
6. Lighting

The Design Description should also cover the following:

1. 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. Here is a case where some design description and ITAAC are needed for a "non-Class 1E" area, because of its "importance to safety."
2. Other specific Rules, Regulations that are applicable to electric systems. For example - the Station Blackout Rule is to be met by an Alternate AC source and, therefore, that feature should be in Tier 1. This is another non-1E aspect, but "important to safety."
3. Regulatory Guides which have specific recommendations (all the RG guidance may not need Tier 1 treatment). Here may be an area that the Tier 1 treatment captures the design aspect addressed by the RG but the acceptance allows alternate approaches which are then discussed in the SAR.
4. Operating Experience problems of safety significance that have been identified - particularly through EDSFIs, Generic Letter, Bulletins and in some cases Information Notices. For example, degraded voltages

have been highlighted. In addition, breaker coordination and short circuit protection have been also highlighted.

5. Policy issues raised for the ALWRs. 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.

6. New features in the design. In the electrical area on the ABWR this includes the main generator breaker for back feed purposes; and the potential for harmonics introduced by new RIPs, MFW pump controllers and its potential effects on the Class 1E equipment.

7. PRA identified insights or key assumptions. In the electrical area this typically involves SBO which should already receive treatment in ITAAC because of the 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 has raise 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.

8. The ACRS/Greybeard Committee issues. For examples see the ACRS letters and Greybeard comments. NOTE: The staff has gone on record as not necessarily agreeing with all their comments.

9. 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.

10. Resolution of a Generic Safety Issue (GSIs) has identified a solution which has resulted in design/operational features. For example, in the electrical area 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.

11. Post TMI requirements - e.g., power to PORV block valve, Pressurizer heaters, etc.

B. ITAAC ENTRIES (for the above equipment)

The following guidance and rationale of what should be included in the certified design material was developed during the review of electric system Design Descriptions and ITAAC, and provides the staff's positions regarding ITAAC. The standard ITAAC entries for electrical systems are discussed in Appendix G. Additional guidance refers to example ITAAC presented in Appendix H. As additional experience is gained, this guidance may be updated and revised.

Normally, all design commitments in Tier 1 must be verified by a specific ITAAC entry, unless there are specific reasons why this is not necessary. Some acceptable reasons include: (a) the information is only included for context, (b) fulfillment of other ITAAC are sufficient to show verification of the design commitment; (c) a single ITAAC entry can verify more than one design commitment.

1. BASIC CONFIGURATION (see Appendix G)

   General functional arrangement - this can be captured in the "Basic configuration" ITAAC but the level of detail is determined by the design description and what is shown on any figure(s).

   Qualification - seismic and harsh environment will be covered by the "basic configuration" ITAAC (see definitions in Appendix A). Tier 1 will only deal with electrical equipment in harsh environments. Electrical equipment in a "mild" environment will be treated in the SSAR only. An exception is made for I&C state-of-the-art digital equipment in "mild" environment which the I&C ITAAC will cover mild environment. Since there is some of this type equipment which may be utilized in the Electrical Distribution Systems, the I&C ITAAC will be expanded to cover this potential. The basis for this exception is that newer I&C equipment in mild environments has some operating experience that shows sensitivity particularly to temperature, and in addition the new digital equipment may have even more sensitivity.

2. INDEPENDENCE - include separation, inter-ties (if any), identification (e.g., color coding), location, non-Class 1E loads on 1E buses (see Appendix G).

3. CAPACITY AND CAPABILITY - sizing of sources and distribution equipment,

   Loading - analyses to demonstrate the capacities of the equipment because this is important to accomplishing the safety function. The SSAR should discuss the analyses. Testing should be included to demonstrate the EDG capacity and capability. This is the same as the Tech Spec tests.

   (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.)

   Voltage - analyses to demonstrate voltage drop(because this is important to accomplishing the direct safety function). Tier 2 would include the discussion of how the voltage analyses will 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 Tech Spec tests.

4. EQUIPMENT PROTECTIVE FEATURES - 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 would be in the SSAR.

   - 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 the SSAR.

   - 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).

5. SENSING INSTRUMENTATION AND LOGIC - e.g., detection of undervoltage and start and 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.

8. INDICATIONS, ALARMS - check chapter 18 on the EOPs

9. TEST FEATURES - limited to cases were special on-line test features have been specifically included (maybe for a special new design feature)

10. 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.

11. LOCATION OF EQUIPMENT - important for some equipment in relation to its environment.

# APPENDIX D-3

## BUILDING STRUCTURES REVIEW CHECKLIST

The following guidance and rationale of what should be included in the certified design material was developed during the review of building structures Design Descriptions (DD) and ITAAC, and provides the staff's positions regarding the content of the DD and ITAAC. The information should be included in the design description in a consistent order. As additional experience is gained, this guidance may be updated and revised. Examples of Design Descriptions and Figures are provided in Appendix H.

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 SSAR 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 design description does not need structural drawings (the SSAR 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 SSAR should include a description of the need for the T/B to withstand a UBC Zone 3 level earthquake, and the T/B should not use a dual-system or a concentric system design.

4. The building design descriptions should specify the embedment depth (from the top of the foundation to the finished grade). An ITAAC should verify the embedment depth.

## II. PROTECTION AGAINST HAZARDS

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

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

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

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

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

## III. SITE PARAMETERS

1. The site parameters should include a requirement that liquefaction not occur underneath structures, systems, and components resulting from the site-specific SSE.

2. Although the design for the sites should be based on the 0.3g RG 1.60 spectra, the evaluation of the sites for liquefaction potential should use the site-specific SSE with acceptance criteria demonstrating adequate margin for no liquefaction.

# APPENDIX D-4

## PIPING SYSTEMS REVIEW CHECKLIST

The following guidance and rationale of what should be included in the certified design material was developed during the review of piping systems Design Descriptions (DD) and ITAAC, and provides the staff's positions regarding the content of the DD and ITAAC. The information should be included in the design description in a consistent order. As additional experience is gained, this guidance may be updated and revised. Examples of Design Descriptions and Figures are provided in Appendix H.

### I. PIPING DESIGN

General Design Criterion 2 of 10 CFR Part 50, Appendix A requires that structures, systems, and components important to safety be designed to withstand the effects of natural phenomena including earthquakes. In addition, General Design Criterion 4 requires that structures, systems, and components be appropriately designed against dynamic effects including pipe whipping. However, dynamic effects associated with postulated pipe ruptures may be excluded from the design basis when analyses reviewed and approved by the Commission demonstrate that the probability of fluid system piping rupture is extremely low under conditions consistent with the design basis for the piping.

To verify the ability of piping systems to perform their safety functions during and following a safe shutdown earthquake, an inspection is required to verify that the as-built piping systems are designed to retain their pressure integrity and functional capability under design basis loadings. In addition, an inspection is required to verify that safety-related structures, systems, and components are protected against the dynamic effects associated with postulated high-energy pipe breaks. The ITAAC for verifying the piping design requirements are performed under the generic Piping Design.

The scope of the piping to be verified by the generic Piping ITAAC includes all ASME Code Class 1, 2, and 3 piping systems and high-energy piping systems. The ASME Code Class piping systems are included in Tier 1 because the ASME Boiler and Pressure Vessel Code, Section III is referenced in 10 CFR 50.55a. Nuclear power plant components classified as Quality Groups A, B, and C are required by 10 CFR 50.55a to meet the requirements for ASME Code Classes 1, 2, and 3, respectively. In each system description, the functional drawing identifies the boundaries of the ASME Code classification for the piping systems. The piping pressure boundary and structural integrity are required to be maintained because they are directly involved in preventing or mitigating an accident or event under the defense-in-depth principle.

The ITAAC in the generic Piping Design provides a certified design commitment that the as-built piping system be designed to meet ASME Code, Section III requirements. The certified design commitment also requires that safety-related structures, systems, and components be protected against the dynamic effects associated with postulated high-energy pipe breaks. An inspection of ASME Code-required documents will be conducted to confirm the existence of an ASME Code-certified stress report and a pipe break analysis report.

The inspection will involve a walkdown of the as-built piping and supports and a review of the ASME Code certified stress report to ensure that the as-built piping system has been reconciled with the piping design requirements. The existence of a Code-certified stress report (also referred to as a design report) provides confidence that all the design and service loadings as stated in the design specification have been evaluated, and that the acceptance criteria of the ASME Code, Section III have been considered. The methodology and specific attributes to be inspected are described in the SSAR.

The inspection will also involve a review of the as-built, high-energy pipe break mitigation features (e.g., pipe whip restraints and jet impingement shields) to ensure that the installed features are consistent with the pipe break analysis report. The methodology and specific attributes to be inspected are described in the SSAR. Alternatively, if an NRC-approved leak-before-break report exists, then the dynamic effects from those postulated high-energy pipe breaks could be excluded.

II. PIPING DESIGN QUALIFICATION AND FABRICATION

The verification of design, fabrication, testing, and performance requirements are partially addressed in conjunction with the specific system ITAAC. However, performance tests are not practical for verifying certain component design requirements such as its seismic design or safety classification. Therefore, ITAAC have been developed to verify certain areas where performance tests are not practical. These areas include seismic design qualification and fabrication of components (i.e., welding). The ITAAC for seismic design qualification and fabrication are established on a generic basis rather than on an individual component basis.

The verification of the design qualification and fabrication of components are captured in the ITAAC as discussed below:

<u>Design Qualification</u>

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. The verification of the overall piping design including the effects of high-energy line breaks is performed in conjunction with the generic piping design ITAAC. The as-built piping system is required to be reconciled with the design commitments.

Fabrication

A basic configuration check (system) 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. A hydrotest is also required in each system ITAAC for ASME Code Class 1, 2, and 3 piping systems to verify that, in the process of fabricating the overall piping system, the welding and bolting requirements for ensuring the pressure integrity have been met.

A detailed description of the ITAAC for component design qualification and fabrication and the bases for determining which material is Tier 1 or Tier 2 are discussed in the following sections.

1. WELDING

General Design Criterion 14 of 10 CFR Part 50, Appendix A requires that the reactor coolant pressure boundary be designed, fabricated, erected, and tested so as to have an extremely low probability of abnormal leakage. In addition, General Design Criterion 30 requires that components which are part of the reactor coolant pressure boundary be designed, fabricated, erected, and tested to the highest quality standards practical.

The integrity of the pressure boundary in the plant will be ensured, in part, through a verification of the welding quality. An inspection is required to be performed to verify the quality of welding for ASME Code Class 1, 2, and 3 pressure-retaining components using appropriate non-destructive examination (NDE) methods. Verification of welding quality is performed as a part of ITAAC for the basic configuration check of each specific system.

The scope of welding to be verified by the ITAAC includes ASME Code Class 1, 2, and 3 pressure-boundary welds. The ASME Code class welds are included in Tier 1 because the ASME Boiler and Pressure Vessel Code, Section III is referenced in 10 CFR 50.55a. Nuclear power plant components classified as Quality Groups A, B, and C are required by 10 CFR 50.55a to meet the requirements for ASME Code Classes 1, 2, and 3, respectively. In each system description, the functional drawing identifies the boundaries of the ASME Code classification. The integrity of the pressure boundary is required to be maintained because it is directly involved in preventing or mitigating an accident or event under the defense-in-depth principle. ASME Code Class 1, 2, and 3 structural welds (e.g., pipe support welds) are not included within the Tier 1 scope because they were deemed to be indirectly involved in preventing or mitigating an accident or event (e.g., Pipe supports provide protection of the piping; but, it is the piping itself that is needed for accident mitigation). Thus, ASME Code Class 1, 2, and 3 structural welds are included in the Tier 2 scope.

The ITAAC for the basic configuration check requires:

> Inspections, including non-destructive examination of the as-built, pressure-boundary welds for ASME Code Class 1, 2, and 3 components identified in the design description to demonstrate that the requirements of the ASME Code, Section III for assuring the quality of pressure-boundary welds are met.

The inspection of the ASME Code Class 1, 2, and 3 welding activities may involve a review of NDE records or the actual performance of the appropriate NDE method described in the SSAR.

The acceptance criteria for the welds are the ASME Code, Section III weld examination requirements. The specific weld examination requirements for a particular ASME Code Class 1, 2, and 3 component and weld type are considered Tier 2 and are tabulated in the SSAR. The specific weld examination requirements are considered Tier 2 because they could change depending on future revisions to the ASME Code, Section III requirements.

Other welding activities (non-ASME Code) includes:

(1) pressure-boundary welds other than ASME Code, Section III welds,
(2) structural and building steel welds,
(3) electrical cable tray and conduit support welds,
(4) heating, ventilation, and air-conditioning support welds, and
(5) refueling cavity and spent fuel pool liner welds.

These other types of welding are included in the Tier 2 scope. The SSAR describes the applicable codes and standards for the other types of welding and the weld acceptance criteria. Similar to the ASME Code Class 1,2, and 3 structural welds, the function of these other welds is needed for protection of safety-related systems, structures, and components but are not directly involved (or are redundant) in preventing an accident or event. Accordingly, these other types of welding were deemed inappropriate for Tier 1 scope.

2. HYDROTEST

General Design Criterion 14 of 10 CFR Part 50, Appendix A requires that the reactor coolant pressure boundary be designed, fabricated, erected, and tested so as to have an extremely low probability of abnormal leakage. In addition, General Design Criterion 30 requires that components which are part of the reactor coolant pressure boundary be designed, fabricated, erected, and tested to the highest quality standards practical.

The pressure boundary integrity will be ensured, in part, through a test verifying the leak-tightness of the ASME Code piping systems. A hydrostatic test is specified as a part of the ITAAC for each individual piping system.

The scope of the hydrostatic test for the ITAAC includes ASME Code Class 1, 2, and 3 piping systems. The ASME Code class piping systems have been selected for Tier 1 treatment because the ASME Boiler and Pressure Vessel Code, Section III is referenced in 10 CFR 50.55a. Nuclear power plant components classified as Quality Groups A, B, and C are required by 10 CFR 50.55a to meet the requirements for ASME Code Classes 1, 2, and 3, respectively. The ASME Code, Section III requires that a hydrostatic test be performed. In each system description, the functional drawing identifies the boundaries of the ASME Code classification. The integrity of the pressure boundary is required to be maintained because it is directly involved in preventing or mitigating an accident or event under the defense-in-depth principle.

The ITAAC for each piping system contains a certified design commitment that the ASME Code components of the system retain their pressure boundary integrity under internal pressures that will be experienced during service. A hydrostatic test is required to be conducted on those ASME Code components of the system that are required to be hydrostatically tested by the ASME Code. The acceptance criteria for the hydrostatic test will meet the ASME Code, Section III requirements.

3. SAFETY CLASSIFICATION

General Design Criterion 1 of 10 CFR Part 50, Appendix A requires that structures, systems, and components important to safety be designed, fabricated, erected, and tested to quality standards commensurate with the importance of the safety functions to be performed.

To verify the acceptability of the use of quality standards, an inspection is required to confirm the availability of code-required design documentation. The documentation review is performed as a part of the generic Piping Design ITAAC. The design description for each system contains the ASME Code classification for the various portions of the system.

The ASME Boiler and Pressure Vessel Code class requirements are verified because the ASME Code, Section III is referenced in 10 CFR 50.55a. Nuclear power plant components classified as Quality Groups A, B, and C are required by 10 CFR 50.55a to meet the requirements for ASME Code Class 1, 2, and 3, respectively. The ASME Code classes allow a choice of rules that provide assurance of structural integrity and quality commensurate with the relative importance assigned to the individual items of the nuclear power plant. The functional drawings in each individual system design description identifies the ASME Code class boundaries. The use of other codes and standards (e.g., AISC Steel Construction Manual for building structural steel) are considered within the Tier 2 scope, and the SSAR contains descriptions of the applicable codes and standards for these other safety-related structures, systems, and components that are not designed to the ASME Boiler and Pressure Vessel Code, Section III.

The ITAAC in the generic Piping Design provides a certified design commitment that the piping system is designed to meet its ASME Code Class requirements. An inspection of ASME Code-required documents will be conducted to confirm the existence of an ASME Code certified stress report.

The inspection may involve a review of the as-built documentation and of the ASME Code certified stress report. The existence of a Code-certified stress report (also referred to as a design report) provides confidence that the overall ASME Code design process was followed for that particular system, and thus, the applicable requirements of the various ASME Code classes have been met.

# APPENDIX E

## STANDARD ITAAC ENTRIES

| Design Description | Inspections, Tests, Analyses | Acceptance Criteria | Rationale |
|---|---|---|---|
| | **CONFIGURATION ITAAC** | | |
| 1. The basic configuration of the _______ System is as shown on Figure ____. (If a figure is not used, reference the Section number.) | 1. Inspections of the as-built system will be conducted. | 1. The as-built _______ System conforms with the basic configuration shown in Figure __. | II.A.1 App. B |
| | **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)<br><br>(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) | II.A.2 App. B |

| Design Description | Inspection, Tests, Analysis | Acceptance Criteria | Rationale |
|---|---|---|---|
| | **NET POSITIVE SUCTION HEAD** | | |
| 3. The ________________ pumps have sufficient NPSH.<br><br>* 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:<br><br>- pressure losses for pump inlet piping and components,<br>*- suction from the suppression pool with water level at the minimum value,<br>*- 50% blockage of pump suction strainers,<br>*- design basis fluid temperature(100°C),<br>*- containment at atmospheric pressure<br>*- vendor test results of required NPSH. | 3. The available NPSH exceeds the NPSH required. | II.A.3<br>App. B |
| | **DIVISIONAL POWE˜. SUPPLY** | | |
| 4. Class 1E loads of the ______ System are powered from Class 1E Divisions, as described in Section _____. | 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 under test in the _____ System. | II.A.4<br>App. B |
| | **PHYSICAL SEPARATION** | | |
| 5. Each mech unical division of the ______ System (Divisions A, B, C)* is physically separated.<br><br>*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 the other mechanical divisions of the ______ system by structural and/or fire barriers (with the exception of _______). | II.A.5<br>App. B |

| Design Description | Inspection, Tests, Analysis | Acceptance Criteria | Rationale |
|---|---|---|---|
| | **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.<br><br>*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 _____. | II.A.6<br>App. B |
| | **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 _____. | II.A.7<br>App. B |
| | **MOTOR OPERATED VALVES** | | |
| 8. Motor-operated valves (MOV) designated in Section ____ as having an active safety-related function open and/or close under differential pressure and fluid flow and temperature conditions. | 8. Opening and/or closing tests of installed valves will be conducted under preoperational differential pressure, fluid flow, and temperature conditions.<br><br>*Table entries for key valves only; i.e., one or two most important valves in a system. | 8. Each MOV opens and/or closes. The following valves open and/or close in the following time limits upon receipt of the actuating signal:<br><br>Valve* — Time (sec)<br>___ — ____ open / ____ close<br>___ — ____ open / ____ close | II.A.8<br>App. B |

| Design Description | Inspection, Tests, Analysis | Acceptance Criteria | Rationale |
|---|---|---|---|
| | **PNEUMATICALLY OPERATED VALVES** | | |
| 9. The pneumatically operated ________ valve(s) in the ________ System closes (opens) when either electric power to the valve actuating solenoid is lost or the pneumatic pressure to the valve(s) is lost. | 9. Tests will be performed on _______ valve(s). | 9. ______ valve(s) closes. | II.A.9 App. B |
| | **CHECK VALVES** | | |
| 10. Check valves designated in Section as having an active safety-related function will open and/or close under system pressure and fluid flow conditions. | 10. Opening and/or closing tests of installed valves will be conducted under system preoperational pressure, fluid flow, and temperature conditions. | 10. Each check valve opens and/or closes. | II.A.10 App. B |
| | **INDEPENDENCE FOR ELECTRICAL AND I&C SYSTEMS** | | |
| 11. Independence is provided between Class 1E Divisions, and between Class 1E Divisions and non-Class 1E equipment, in the _____ System. | 11.1. Tests will be performed in the _____ System by providing a test signal in only one Class 1E Division at a time. | 11.1. The test signal exists only in the Class 1E Division under test in the _____ System. | B.2 App. C |
| | 11.2. Inspection of the as-installed Class 1E Divisions in the _____ System will be performed. | 11.2. Physical separation exists between Class 1E Divisions in the _____ System. Physical separation exists between Class 1E Divisions and non Class 1E equipment in the _____ System. | |

# APPENDIX F

## SELECTED REVIEW ISSUES

This appendix is reserved for issues not conveniently covered in other areas of this SRP. It is currently under development.

1. Combined License Issues

2. ITAAC Verification

3. Construction Inspection Program

# APPENDIX G

## DESIGN ACCEPTANCE CRITERIA

Applicability: ECGB, PERB, HHFB, HICB

Design and engineering information for some areas of the design may not be provided by applicants at a level of detail customarily reviewed by the staff in making a final safety determination. Evolutionary design certification applicants provided less detailed information in these areas for two general reasons. The applicants believed they were either areas of rapidly changing technology and it would have been detrimental to freeze the details of the design many years before an actual plant was ready to be constructed, or because the applicants believed they were areas for which they did not have sufficient as-built or as-procured information to complete the final design. Areas of rapidly changing technology included control room and remote shutdown system design (human factors), and advanced instrumentation and controls. Areas dependent on as-built or as-procured information included piping design and radiation shielding, ventilation, and airborne monitoring design. The staff provided its views on the DAC to the Commission in SECY-92-053, "Use of Design Acceptance Criteria During 10 CFR Part 52 Design Certification Reviews," dated February 19, 1992.

The design information and appropriate design methodologies, codes, and standards provided in the SSAR, 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 must 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 the CDM, 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 SSAR 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 the CDM 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 SSAR 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 CDM information should be contained in SSAR Section 14.3. Alternatively, applicants may choose to address all design issues appropriately in the structures, systems and components (SSCs) to which they apply.

The applicable review branches should provide a separate safety evaluation and finding for the DAC; however, this evaluation may be a section of its safety evaluation for the overall design. The staff should base its safety findings for the areas where DAC are used on the Tier 2 information specified in the SSAR, including applicable design methodologies, codes and standards, contingent on verification that the design has been properly implemented according to the Tier 1 Design Descriptions and the corresponding DAC.

For the two areas of rapidly changing technology, control room and remote shutdown system design (human factors), and advanced instrumentation and controls design, the Design Descriptions and DAC delineate the process and requirements that a COL applicant or licensee must implement to develop the design information required in each area. Acceptance criteria are specified in the CDM 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 will certify to the NRC that the design through that stage is in compliance with the certified design. The NRC will review and inspect the work to confirm that the COL applicant or licensee has adequately implemented the commitments of the DAC at these stages. The process may be referred to as a "phased" DAC because it consists of a set of sequential steps or stages 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.

## APPENDIX H

## SCOPE OF THE DESIGN AND INTERFACE REQUIREMENTS

The requirements for applicants for design certification to specify interface requirements for a standard design are contained in 10 CFR 52.47(a)(1)(vii-ix). These requirements are discussed further below. Essentially, interface requirements must be specified between the standard design and the site-specific portion of the design. Examples of the design information that is site-specific are the ultimate heat sink and portions of the switchyard. The scope of the certified design is determined by the design information specified in both tiers of the DCD. Applicants for design certification must provide any required design information for the in-scope portion of the standard design, and conceptual design information in the SSAR for the site-specific portions of the design.

An applicant for a combined license need not conform with the conceptual design information in the DCD. The conceptual design information, which decribes examples of site-specific features, is required to facilitate the design certification review, is non-binding, and it is neither Tier 1 nor 2.

Because it is difficult to define all the detailed design aspects of the plant that are within the scope of the design, it is generally easier to refer to the portions of the standard design that are out of scope. The out of scope information includes all information required of combined license applicants that is not within the scope of the design, including site-specific information and licensee programs such as fitness-for-duty, security, and operator training and licensing programs.

In some cases, the scope of the standard design requires that the DCD contain information that in the past has been supplied by a utility. Therefore, simply because design information may be traditionally "licensee-supplied" information does not mean that it is "out of scope" design information. However, COL Action Items may be specified in the SSAR for certain information that is out-of-scope of the standard design, generally for programmatic or site-specific items. The COL Action Items listed in the SSAR are not meant to be an all-inclusive list of the items required by a COL applicant. An applicant for a combined licensee should address these items in its application.

The CDM specifies the top-level interface requirements that must be met by the site-specific portions of a facility that are not within the scope of the certified design. More detailed interface requirements may be specified in the SSAR (generally in Chapter 1), but they must be consistent with the CDM information. They 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 CDM 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.

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. This approach was acceptable. However, alternative definitions of interfaces may be acceptable, such as those based on the locations of transfers of various process flows into and out of the design scope (radiological flows, electrical flows, heat flows, water flows, air flows, etc.).

Section 10 CFR 52.47(a)(1)(vii-ix) requires an applicant for design certification to provide:

(1) the interface requirements to be met by those portions of the plant for which the application does not seek certification.

The interface requirements may be located in a separate section of the CDM, or they may be located with the Design Descriptions and ITAAC for applicable SSCs and cross referenced to that section of the CDM. Cross referencing is typically used for systems that are partially out of scope of the standard design. The staff evaluates these interface requirements as part of its review of the applicable systems in the CDM.

(2) justification that compliance with the interface requirements is verifiable through inspection, testing, or analysis, and the method to be used for verification of interface requirements.

This justification should be provided in the CDM. An acceptable justification is a statement in the CDM that the development of ITAAC for the interface requirements will be similar in nature to the development of ITAAC for SSCs within the scope of the standard design. Thus, compliance with the interfaces is verifiable through ITAAC. The development process for the Design Descriptions and ITAAC should be described in SSAR Section 14.3.

(3) a representative conceptual design for those portions of the plant for which the application does not seek certification.

Representative conceptual designs should be provided by design certification applicants in the appropriate sections of the SSAR so that the staff can perform its review of the standard design. This information should be clearly identified as conceptual design information for the site-specific, out-of-scope portion of the design.

An applicant for a combined license must provide appropriate information regarding the site-specific portion of the design and ITAAC to demonstrate compliance with the interface requirements. The review of this information is accomplished in the review of an application for a combined license under Subpart C of 10 CFR Part 52.