HITACHI

GE Hitachi Nuclear Energy

James C. Kinsey
Vice President, ESBWR Licensing

PO Box 780 M/C A-55
Wilmington, NC 28402-0780
USA

T 910 675 5057
F 910 362 5057
jim.kinsey@ge.com

MFN 08-086, Supplement 4

Docket No. 52-010

March 5, 2008

U.S. Nuclear Regulatory Commission
Document Control Desk
Washington, D.C. 20555-0001

Subject: Response to Portion of NRC Request for Additional Information Letter No. 126 Related to ESBWR Design Certification Application - RAIs 14.3-338, 14.3-339, and 14.3-340

The purpose of this letter is to submit the GE Hitachi Nuclear Energy (GEH) response to the U.S. Nuclear Regulatory Commission (NRC) Request for Additional Information (RAI) sent by NRC letter dated December 20, 2007 (Reference 1). The GEH response to RAIs 14.3-338, 14.3-339, and 14.3-340 is addressed as follows.

Enclosure 1 contains a change list that provides the location and description of each change to DCD Tier 2 Section 14.3 resulting from the subject RAIs. Enclosure 2 contains markups of the DCD Tier 2 Section 14.3 showing the changes resulting from the response to the subject RAIs that will be incorporated in DCD Revision 5.

In addition to the changes to DCD Tier 2 Section 14.3 in response to the subject RAIs, other changes to DCD Tier 2 Section 14.3 are shown in Enclosure 1 (change list) and Enclosure 2 (markups). These other changes are in response to the NEI ITAAC Closure Group interactions with the NRC Staff, and the October 2007 Tier 1 meeting between the NRC and GEH. GEH considers these other changes to be part of the GEH response to RAI 14.3-340, which updates DCD Tier 2 Section 14.3 to be consistent with the current guidance provided in the NRC Regulatory Guide 1.206 and NUREG-0800.

D068
NRO

If you have any questions or require additional information, please contact me.

Sincerely,

R. E. Brown for/

James C. Kinsey
Vice President, ESBWR Licensing

Reference:

1. MFN 07-718, Letter from U.S. Nuclear Regulatory Commission to Robert E. Brown, *Request For Additional Information Letter No. 126 Related To ESBWR Design Certification Application*, December 20, 2007.

Enclosure:

1. Response to Portion of NRC Request for Additional Information Letter No. 126 Related to ESBWR Design Certification Application – RAIs 14.3-338, 14.3-339, and 14.3-340 – CHANGE LIST

2. Response to Portion of NRC Request for Additional Information Letter No. 126 Related to ESBWR Design Certification Application - RAIs 14.3-338, 14.3-339, and 14.3-340 – DCD TIER 2, SECTION 14.3, MARKUPS

cc:	AE Cubbage	USNRC (with enclosure)
	GB Stramback	GEH/San Jose (with enclosure)
	RE Brown	GEH/Wilmington (with enclosure)
	DH Hinds	GEH/Wilmington (with enclosure)
	eDRF	0000-0080-4806

MFN 08-086, Supplement 4

Enclosure 1

Response to Portion of NRC Request for Additional Information Letter No. 126 Related to ESBWR Design Certification Application RAIs 14.3-338, 14.3-339, and 14.3-340

CHANGE LIST

Section 14.3 Changes From Revision 4 to Revision 5

Item	Location	Description of Change
1.	Section 14.3	Made editorial changes in numerous locations to remove excessive spacing, correct punctuation, delete repeated words, correct misspelling, and correct grammar. Spelled out acronyms where appropriate and edited Acronym list where needed.
2.	S14.3, 2nd para, new 3rd para	Added discussion in response to RAI 14.3-340.
3.	S14.3, 4th para, 1st sentence	Replaced "...define..." with "...describe..." for clarification.
4.	S14.3, 5th para, bullets	Changed the list of elements of content for Tier 1 by removing other information that was previously included to discuss in more detail in sections following Introduction section.
5.	S14.3, 6th para	Replaced "...following is a description..." with "...sections below describe..." for improved readability.
6.	S14.3, 6th para	Added discussion in response to RAI 14.3-340.
7.	S14.3.1, new 1st para, and new 3rd through 5th paras	Rewrote section for clarification.
8.	S14.3.1, 6th para	Replaced "...were largely made..." with "...were selected largely..." and added last sentence for clarification.
9.	S14.3.2, 1st para and new 2nd para	After minor editorial changes in the first paragraph, added discussion in new 2nd paragraph in response to RAI 14.3-340.
10.	S14.3.2.1, 2nd para, item (2)	Revised Item and subitems in response to RAI 14.3-340.
11.	S14.3.2.1, 2nd para, item (4)	Revised Item (4) in response to RAI 14.3-340.
12.	S14.3.2.1, 2nd para, item (5)	Revised Item (5) for clarification.

Item	Location	Description of Change
13.	S14.3.2.1, 2nd para, item (6)	Revised Item (6) for clarification.
14.	S14.3.2.1, 2nd para, item (8)	Added discussion to Item (8) for clarification.
15.	S14.3.2.1, 2nd para, item (9)	Added discussion to Item (9) for clarification.
16.	S14.3.2.1, 2nd para, number 11	Revised Item (11)in response to RAI 14.3-340.
17.	S14.3.2.1, 6th para and bullets 1 through 5 and 7 through 11	Revised section for consistency and clarification.
18.	S14.3.2.1, 6th para, 6th bullet	Revised bullet in response to RAI 14.3-338.
19.	S14.3.2.1, 7th para	Modified the 3rd and the 4th sentence in response to RAI 14.3-340.
20.	S14.3.2.2, 3rd para, Item 1	Added new 2nd sentence and modified 3rd sentence for clarification.
21.	S14.3.2.2, 3rd para, Item 2	Rewrote Item (2) for clarification.
22.	S14.3.2.2, 3rd para, Item 5	Removed the last sentence and Items a and b in response to RAI 14.3-339.
23.	S14.3.2.2, Selection Methodology section	Rewrote the Selection Methodology section in response to RAI 14.3-340.
24.	S14.3.3	Additional explanation of non-system based material added. Much of the added information was previously in the Introduction section (14.3).
25.	S14.3.3.1, title	Revised title of this subsection to include components.
26.	S14.3.3.1, 1st para	Changed "nuclear safety related" to "safety-related."

Item	Location	Description of Change
27.	S14.3.3.1, 1st para	Added last three sentences for clarification.
28.	S14.3.3.2, 1st para, 1st sentence	Added the definition of "I&C" for clarificaiton.
29.	S14.3.3.4, 1st para	Added "Tier 2" to the first sentence for clarification.
30.	S14.3.4, New 1st para	Added discussion for clarification.
31.	S14.3.4, 5th para	Deleted "The introductory text of Tier 1, Section 4 addresses these issues by stating the..." for clarification.
32.	S14.3.5, new 1st para	Added new discussion to beginning of section for clarification.
33.	S14.3.7, 1st para, 1st sentence	Updated references in response to RAI 14.3-340.
34.	S14.3.7.2	Removed outdated references and discussion based on outdated guidance. Provided updated references in response to RAI 14.3-340.
35.	14.3.7.3, (1)b	Added "For these nonsafety-related systems... The ITAAC may simply verify that the equipment is provided and "exists" in the plant. According to NRC guidance in NUREG-0800, Section 14.3, the term "exists," when used in the Acceptance Criteria for ITAAC, means that the item is present and meets the design description. Detailed supporting information on what should be present to conclude that an item "exists" and meets the design description is contained in the appropriate sections of the DCD. The approach stated herein also is consistent with the graded approach for Tier 1 content and ITAAC described in the NRC guidance." in response to RAI 14.3-154, MFN 07-647, December 14,2007.
36.	S14.3.7.3, Item 2	Revised Item (2), 1st paragraph, Items g, h, i, n, t, and 2nd paragraph for clarification.
37.	S14.3.7.3, Item (2)s	Revised Item (2)s in response to RAI 14.3-340.
38.	S14.3.8, 4th para	Revised 4th paragraph for clarification.
39.	S14.3.11	Added new References 14.3-1 and 14.3-2 in response to RAI 14.3-340.
40.	T14.3-1	The title of the right-hand column has been modified to include: "**and ITAAC Design Commitment.**"

Item	Location	Description of Change
41.	T14.3-1	"House Boiler System" has been changed to "Hot Water System."

MFN 08-086, Supplement 4

Enclosure 2

Response to Portion of NRC Request for Additional Information Letter No. 126 Related to ESBWR Design Certification Application RAIs 14.3-338, 14.3-339, and 14.3-340

DCD TIER 2, SECTION 14.3, MARKUPS

14.3 INSPECTIONS, TESTS, ANALYSES AND ACCEPTANCE CRITERIA

This section provides the selection criteria and processes used to develop the Tier 1 information and inspections, tests, analyses and acceptance criteria (ITAAC). The Tier 1 information provides the principal design bases and design characteristics that are certified by the 10 CFR Part 52 rulemaking process and included in the formal ESBWR design certification rule.

This top-level design information in Tier 1 is extracted from the more detailed ESBWR design information presented in Tier 2. Limiting the Tier 1 contents to top-level information reflects the tiered approach to design certification endorsed by the Commission (Staff Requirements Memorandum February 15, 1991 regarding SECY-90-377; 10 CFR Part 52 Statement of Considerations 54 Fed. Reg. 15372, 154377, (1989). See also SECY-90-241, 90-377 and SECY-91-178.) This is also consistent with NRC guidance in Regulatory Guide 1.206, "Combined License Applications for Nuclear Power Plants," Section C.II.1, "Inspections, Tests, Analyses, and Acceptance Criteria," which states:

> The type of information and the level of detail included in the ITAAC for each structure and system are based on a graded approach that is commensurate with the safety-significance of the facility's SSCs.

The theme is also noted in NUREG-0800, "Standard Review Plan," Section 14.3, "Inspections, Tests, Analyses, and Acceptance Criteria," which states:

> The types of information and the level of detail in Tier 1 are based on a graded approach commensurate with the safety significance of the structures, systems, and components (SSCs) for the design.

The objective of this section is to ~~define~~ describe the bases and methods that were used to develop Tier 1. This section contains no new technical information regarding the ESBWR design.

Tier 1 consists of the following:

- The Table of Contents, List of Tables, List of Illustrations, and Abbreviations and Acronyms List are included in the preamble material for Tier 1.
- An introduction section (described in Subsection 14.3.1). ~~that defines terms used in Tier 1 as well as listing general provisions, which are applicable to Tier 1 entries. The intent of these entries is to avoid ambiguities and misinterpretations by providing front-end guidance to users of Tier 1.~~
- Design D~~d~~escriptions and ITAAC (described in Subsection 14.3.2). This section includes ~~for~~:
  - Systems that are fully within the scope of the ESBWR design certification, and
  - The in-scope portion of those systems that are only partially within the scope of the ESBWR design certification.

~~The intent of the Tier 1 design descriptions is to delineate the principal design bases and principal design characteristics that are referenced in the design certification rule. The design descriptions are accompanied by the ITAAC required by 10 CFR 52 to be part of the design certification application. The ITAAC define verification activities that are to~~

~~be performed for a facility with the objective of confirming that the plant is built and operates in accordance with the design certification. Successful completion of these certified design ITAAC, together with the site-specific ITAACs for the site-specific portions of the plant, are the basis for the NRC finding under 10 CFR Part 52.103(g).~~

~~□Tier 1 design descriptions and their associated ITAAC for design and construction activities that are applicable to more than one system. Design related processes have been included in Tier 1 for:~~

~~Aspects of the ESBWR design likely to undergo rapid, beneficial technological developments in the lifetime of the design certification. Certifying the design processes associated with these areas of the design rather than specific design details permits future license applicants referencing the ESBWR design certification to take advantage of the best technology available at the time of a site-specific application and facility construction. Example: design of programmable, microprocessor-based instrumentation and control systems.~~

~~Aspects of the design that depend upon characteristics of as procured, as installed systems, structures and components. These characteristics are not available at the time of certification, and therefore, cannot be used to develop and certify design details. Example: design of piping systems that depend upon detailed routing and equipment information.~~

- Non-System Based Material (described in Subsection 14.3.3).
- Interface Material (described in Subsection 14.3.4). ~~requirements as defined within 10 CFR Part 52.47. Interface requirements are those that must be met by the site-specific portions of the complete nuclear power plant that are not within the scope of the certified design. These requirements define characteristics of the site-specific features that must be provided in order for the certified design to comply with certification commitments. Interface requirements are defined for: (a) systems entirely outside the scope of the design certification, and (b) the out-of-scope portions of those systems that are only partially within the scope of the design certification. Site-specific ITAAC design features implement the interface requirements; therefore, Tier 1 does not include ITAAC for interface requirements.~~
- Site ~~p~~Parameters (described in Subsection 14.3.5). ~~used as the basis for ESBWR design presented in Tier 2. These parameters represent a bounding envelope of site conditions for any license application referencing the ESBWR design certification. No ITAAC is necessary for the site parameters entries, because compliance with site parameters are verified as part of issuance of a license for a plant that references the ESBWR design certification.~~

~~□A list of acronyms and legends used in the body of Tier 1. (This material is self-explanatory and is not discussed any further in this section.)~~

The ~~following is a description of~~ sections below describe the criteria and methods by which specific technical entries for Tier 1 were selected. The structure of the description is based on the Tier 1 report structure. The criteria and methods that are discussed in the following sections are guidelines only. For some matters, the contents of Tier 1 may not directly correspond to these guidelines, because special considerations related to the matters may have warranted a

different approach. For such matters, a case-by-case determination was made regarding how or whether the matters should be addressed in Tier 1. These determinations were based upon the principles inherent in 10 CFR Part 52 and its underlying purposes, as well as NRC guidance regarding the content of Tier 1 and ITAAC. Tier 1 does not contain information that the NRC may designate as Tier 2*, which is information in Tier 2 that, if considered to be changed by a combined license applicant or licensee, requires NRC approval prior to the changes. NRC guidance in NUREG-0800, Section 14.3, states that "Tier 2* is generally information that is not appropriate for treatment in Tier 1 because it is subject to change."

14.3.1 Tier 1, Section 1 - Introduction

The introduction section defines terms used in Tier 1, as well as lists general provisions, which are applicable to Tier 1 entries. The intent of these entries is to avoid ambiguities and misinterpretations by providing front-end guidance to users of Tier 1.

This section includes ~~two subsections~~:

1.1 ~~Tier 1 Information Level of Detail~~

~~1.2~~ Definitions and General Provisions

~~**Level of Detail and Scope** — Tier 1, Section 1.1 provides the basis of the level of detail for the technical descriptions in Tier 1, and the general scope of the ESBWR presented for certification.~~

~~**Selection Criteria** — Tier 1, Section 1.2 first defines terms that are used throughout Tier 1 and could (potentially) be subject to various interpretations. Selection of entries was based on a judgment that a particular word/phrase merits definition - with particular emphasis on terms associated with implementation of the ITAAC. Second, Tier 1, Section 1.2 contains a mixture of provisions that were selected on the basis that the provision was necessary to either:~~

- ~~Define technical requirements applicable to multiple systems in Tier 1; or~~
- ~~Provide clarification and guidance for future users of Tier 1.~~

Definitions are included for terms used in Tier 1 that could be subject to various interpretations. The intent is to be consistent with Tier 2 information, and to reflect NRC guidance regarding various terms. Should questions on terminology arise, the definitions would aid in understanding the intent of the information in Tier 1.

General provisions are included for treatment of individual items, implementation of ITAAC (including ITAAC format), discussion of matters related to operations, interpretation of figures, and rated reactor core thermal power.

The legend for figures provided in this section explains the symbols used in the Tier 1. The purpose is solely to aid in understanding the figures. The symbols used are consistent with general industry use.

Selection Methodology — Entries in the Definitions section ~~were largely made~~ were selected largely on the basis of a self-evident need for a term to be defined. These terms were accumulated during the preparation and review of Tier 1. Entries in the General Provisions section also were arrived at as part of Tier 1 development and review process. Each entry has a unique background, but the overall intent is to clearly state the broad guidelines and interpretations that guided Tier 1 preparation for the ESBWR and should be understood by Tier 1

users. Symbols in the legend were selected because they may be subject to interpretation and explanation of the symbols may aid in understanding.

14.3.2 Tier 1, Section 2 - Design Descriptions and ITAACs

This section ~~has~~ contains the design description and ITAAC material for ~~the~~ individual ESBWR systems, and ~~has~~ includes an entry for every system that is either fully or partially within the scope of the ESBWR design certification. Consequently, there is a Tier 1, Section 2 entry for ~~every~~ each ESBWR system identified in Tier 2, Section 1.2. The intent of this comprehensive listing of ESBWR systems is to better define at the Tier 1 level the full scope of the certified design. ~~(~~As discussed further below, the Tier 1 entry for many systems with no safety significance is limited to the system name only and does not include any design description or ITAAC material.~~)~~ The preparation of system design descriptions and the associated ITAAC are discussed separately in the next two subsections.

The intent of the Tier 1 design descriptions is to delineate the principal design bases and principal design characteristics that are referenced in the design certification rule. Consequently, the design descriptions focus on the ITAAC content. The design descriptions are accompanied by the ITAAC required by 10 CFR Part 52 to be part of the design certification application. The ITAAC define verification activities that are to be performed for a facility with the objective of confirming that the plant is built, and can operate, in accordance with the design certification. Successful completion of the certified design ITAAC, together with the site-specific ITAAC for the site-specific portions of the plant, are the basis for the NRC finding under 10 CFR 52.103(g).

14.3.2.1 Design Descriptions

The Tier 1 design descriptions for each ESBWR system address the top-level design features and performance standards that pertain to the safety of the plant and include descriptive text and supporting figures. The intent of Tier 1 design descriptions is to define the ESBWR design characteristics which are referenced in the design certification rule as a result of the certification provisions of 10 CFR Part 52.

Selection Criteria — The following criteria were considered in determining which information warranted inclusion in the certified design descriptions.

(1) The information in the Tier 1 design descriptions is to be selected from the technical information presented in Tier 2 and should not contain information that is not in Tier 2. This reflects the approach that Tier 1 contains top-level design information and is based on the Commission directive in the Statement of Considerations for Part 52 that there "be less detail in a certification than in an application for certification." In this context, the certification is Tier 1 and the application for certification includes Tier 2.

(2) Tier 2 contains a wide spectrum of information on various aspects of the ESBWR design, and not all of this information warrants inclusion in the Tier 1 design descriptions. The Tier 1 design descriptions should only contain information from Tier 2 that is most significant to safety and which focuses on the ITAAC. ~~Tier 2 contains a wide spectrum of information on various aspects of the ESBWR design, and not all of this information warrants inclusion in the Tier 1 design descriptions.~~ This selection criterion reflects the Commission directive in the Statement of Considerations for Part 52 that the certified design should "encompass roughly the same design features that Section 50.59 prohibits

changing without prior NRC approval." This is consistent with NRC guidance in RG 1.206, section C.II.1, and NUREG-0800, Section 14.3, which states the following:

> The design descriptions (DD) address the most safety-significant aspects of each of the systems of the design, and were derived from the detailed design information contained in Tier 2. The applicant should put the top-level design features and performance characteristics that were the most significant to safety in the Tier 1 design descriptions. The level of detail in Tier 1 is governed by a graded approach to the SSCs of the design, based on the safety significance of the functions they perform. The design descriptions include the figures associated with the systems. The design descriptions serve as binding requirements for the lifetime of a facility to assure that the plant does not deviate from the certified design. ... For example, safety-related SSCs should be described in Tier 1 with a relatively greater amount of information. Other SSCs should also be included based on their importance to safety, such as containment isolation aspects of non-safety systems. Some non-safety aspects of SSCs need not be discussed in Tier 1. This graded approach recognizes that although many aspects of the design are important to safety, the level of design detail in Tier 1 and verification of the key design features and performance characteristics should be commensurate with the significance of the safety functions to be performed.

~~However, for clarity and better understanding, additional information if often provided.~~ In determining what Tier 2 information is most significant to safety, several factors were considered, including the following:

a. Whether the feature or function in question is necessary to satisfy ~~the~~ NRC~~'s~~ regulations in Parts 20, 50, 52, 73 and 100.

b. Whether the feature or function in question pertains to a structure, system or component (SSC) ~~which is~~ classified as safety-related.

c. Whether the feature or function in question is specified in ~~the~~ NRC~~'s~~ Standard Review Plan (NUREG-0800)as being necessary to perform a safety-significant function.

d. Whether the feature or function in question represents an important assumption or insight from the probabilistic risk assessment.

e. Whether the feature or function in question is important in preventing or mitigating severe accidents or protection against hazards.

f. Whether the feature or function in question ~~has a~~could have a significant effect on the safety or operation of the nuclear power plant.

g. Whether the feature or function in question is typically the subject of a provision in the Technical Specifications.

The absence or existence of any of one of these factors was not conclusive in determining which information is significant to safety. Instead, these factors, together with the other factors listed in this section, were taken into account in making this determination.

(3) Mostly safety-related features and functions of SSCs are discussed in the Tier 1 design descriptions. Some nonsafety-related SSCs are discussed in the Tier 1 design descriptions

only to the extent that they perform safety-significant functions or have features to prevent a significant adverse effect upon the safety-related functions of other SSCs. This criterion follows from the principle that only features and functions that are safety-significant warrant treatment in Tier 1. Nonsafety features and functions of safety-related SSCs are not generally discussed in the Tier 1 design descriptions.

(4) The Tier 1 design descriptions for SSCs are limited to a discussion of design features and functions, focusing largely on what will be the content for ITAAC. The design bases of SSCs, and explanations of their importance to safety, are provided in Tier 2 and are not included in the Tier 1 design descriptions. The purpose of the Tier 1 design descriptions is to define the certified design and to provide a description that will be used in the ITAAC Design Commitment column. Justification that the design meets regulatory requirements is presented in Tier 2 and that is not the intent of Tier 1 design descriptions. ~~For example, the design descriptions for the emergency core cooling systems (ECCS) state the flow capacity of the systems; the descriptions do not provide information that demonstrates these flow capacities are sufficient to maintain post-accident fuel cladding temperatures within 10 CFR 50.46 acceptance criteria.~~

(5) The Tier 1 design descriptions focus on the physical characteristics of the facility that will be verified through the associated ITAAC. Neither ~~T~~the Tier 1 design descriptions ~~do not~~nor ITAAC contain programmatic requirements related to operating conditions or to operations, maintenance, or other programs because these matters are controlled by other means such as the Technical Specifications. For example, the design descriptions do not describe operator actions needed to control systems.

(6) The design descriptions in Tier 1, Section 2, discuss the configuration and performance characteristics that the SSCs should have after construction is completed. In general, the Tier 1 design descriptions do not discuss the processes that are used for designing and constructing a plant that references the ESBWR design certification. This is acceptable because the safety-function of a SSC is dependent upon its final as-built condition and not the processes used to achieve that condition. ~~There are some e~~Exceptions to this criterion include the information in Section 3 of Tier 1.

~~(6)These are:~~

~~a.The welding, dynamic qualification (including seismic and other design bases dynamic loads), environmental qualification and valve testing requirements addressed in Tier 1, Section 2; and~~

~~b.The various design and qualification processes defined in Section 3. The specific programmatic aspects of the design and construction processes (training, qualification of welders, etc.) are not within the scope of the design certification. Consequently, these issues are not addressed in Tier 1.~~

(7) The Tier 1 design descriptions address fixed design features expected to be in place for the lifetime of the facility. This is acceptable because portable equipment and replaceable items are controlled through operational related programs. Because Tier 1 pertains to the design, it is not appropriate for it to include a discussion of these items.

(8) The Tier 1 design descriptions do not ~~(~~usually~~)~~ discuss component types (e.g., valve and instrument types), component internals, or component manufacturers. This approach is based on the premise that the safety function of a particular design element can be performed by a variety of component types and internals from different manufacturers. Consequently, a Tier 1 entry that defines particular component type/manufacturer would have no safety-related benefit and would unnecessarily restrict the procurement options of future applicants and licensees. Tier 1 does contain exceptions to this general criterion, and these exceptions occur when the type of component is of safety significance. For example, if Tier 1 specifies that the safety valves are of the direct-acting type, then this precludes the use of reverse acting valves controlled by pilot valves as safety valves. Therefore, ITAAC were developed to avoid this type of restriction on equipment types to the degree practical while still addressing enough design detail to specify the appropriate means of verification that the as-built plant conforms with the design. Where appropriate, ITAAC include specific types of components.

(9) The Tier 1 design descriptions do not contain any proprietary information, because of the need to comply with requirements associated with publication of rules. However, Tier 1 does contain information (largely related to figures) that may be withheld from public disclosure on the basis of it being sensitive unclassified nuclear security information (SUNSI).

(10) In order to allow ~~the~~ an applicant or licensee of a plant that references the ESBWR design certification to take advantage of improvements in technology, ~~the~~ Tier 1 design descriptions in general do not prescribe design features that are the subject of rapidly evolving technology. Examples ~~are:~~include design of the main control room and instrumentation and control systems. This issue is discussed further in Subsection 14.3.3.

(11) Tier 1 design descriptions are intended to be self-contained and generally do not make direct reference to Tier 2, industrial standards, regulatory requirements or other documents. (There are some exceptions involving industry standards, such as the ASME Code and the Code of Federal Regulations. Specific versions of code editions are identified in Tier 2 rather than Tier 1. This provides for specific requirements that are acceptable, yet allows the code to be updated via the change process in the design certification rule. However, due to the provisions of 10 CFR 52.63 and the rule certifying the design, updates to codes and standards in 10 CFR 50.55a would not necessarily be requirements for the certified design.) If various ~~these~~ sources contain technical information of sufficient safety significance to warrant Tier 1 treatment, the information has been extracted from the source and included directly in the appropriate system design description. This approach is appropriate because it is unambiguous and it avoids potential questions regarding how much of a referenced document is encompassed in, and becomes part of the Tier 1.

(12) Selection of the technical terminology to be used in Tier 1 was guided by the principle that the terminology should be as consistent as possible with that used in Tier 2 and the body of regulatory requirements and industrial standards applicable to the nuclear industry. This approach is intended to minimize problems in interpreting the intent of Tier 1 commitments.

Selection Methodology — Using the criteria listed above, Tier 1 description material was developed for each system by reviewing Tier 2 material relating to that system. Tier 1 utilizes a

system-by-system report structure that is different than the structure of Tier 2. Consequently, developing the Tier 1 design description entry for any one system was based on review of the multiple Tier 2 chapters having technical information related to that system.

Because the safety significance of the ESBWR systems varies, application of the criteria listed above results in a graded treatment of the systems. This leads to considerable variations in the scope of the design description entries. Table 14.3-1 lists the types of ESBWR systems, and is a summary of the overall consequences of this graded treatment.

For safety-related systems, application of the above criteria resulted in design description entries that include the following information (as applicable) described briefly, focusing the content on ITAAC, and relying on figures where appropriate~~as applicable~~:

- ~~The~~ system~~'s~~ name and scope;
- ~~The~~ system~~'s~~ purpose;
- ~~The~~ system~~'s~~ safety-related modes of operation;
- ~~The~~ system~~'s~~ classification (i.e., safety-related, seismic category, and ASME Code Class);
- ~~The~~ system~~'s~~ location;
- ~~The basic configuration~~functional arrangement of the portions of the system~~'s~~ that are safety-significant, including any components located in that portion of the system (usually shown by means of a figure);
- ~~The~~ type of electrical power provided for the system;
- ~~The~~ electrical independence and physical separation of divisions within the system;
- ~~The~~ system~~'s~~ instruments, controls, and alarms to the extent located in the Main Control Room or Remote Shutdown System;
- ~~V~~valves within the system that have active safety-related functions; and
- ~~A~~any other features or functions ~~that are~~ significant to safety or important for meeting certain NRC regulations, such as 10 CFR Part 20.

The Tier 1 design descriptions for nonsafety-related systems also include the information listed above but only to the extent that the information is relevant to the system and is significant to safety. Because much of this information is not relevant to safety-related systems, the Tier 1 design descriptions for nonsafety-related systems are generally substantially less extensive than the descriptions for safety-related systems. As discussed above, there are many systems for which no design description entries (and therefore no ITAAC) are included in Tier 1 and the entry is limited to the system title and a statement that "No ITAAC are required for this system." This is consistent with NRC guidance in RG 1.206, Section C.II.1.

14.3.2.2 Inspections, Tests, Analyses and Acceptance Criteria (ITAAC)

As needed, a table of ITAAC entries is provided for each system that has design description entries. The intent of these ITAAC is to define activities that are undertaken to verify the as-

built system conforms to the design features and characteristics defined in the design description for that system. ITAAC are provided in tables with the following three-column format.

Design Commitment **Inspections, Tests, Analyses** **Acceptance Criteria**

Each design commitment in the left-hand column of the ITAAC tables has an associated inspections, tests or analyses (ITA) requirement specified in the middle column, and the acceptance criteria for the ITA are defined in the right-hand column.

Selection Criteria: — The following were considered when determining which information warranted inclusion in the Tier 1 ITAAC entries:

(1) The scope and content of the ITAAC correspond to the scope and content of the Tier 1 design descriptions. The design commitment is extracted directly from the design descriptions and differences in text are minimized, unless intentional, but the text is essentially the same in all cases. This approach ensures that there are no ITAAC for aspects of the design not addressed in the design description. This is appropriate because the objective of the ITAAC design certification entries is to verify that the as-built facility has the design features and performance characteristics defined in the Tier 1 design descriptions.

Each system that has a design description, which addresses some design aspect required for plant safety, has an ITAAC table.

(2) ~~One~~An inspection, test, or analysis, or a combination thereof, may verify one or more provisions in the Tier 1 design description, as defined by the ITAAC. ~~In particular, an ITAAC that calls for a system functional test or an inspection of basic configuration may verify a number of provisions in Tier 1 design description. Therefore, there is not necessarily a one-to-one correspondence between the ITAAC and the Tier 1 design descriptions.~~

(3) The inspections, tests, and analyses are to be completed (and the acceptance criteria satisfied) prior to fuel loading. Therefore, the ITAAC do not include any inspections, tests, or analyses that are dependent upon conditions that only exist after fuel load.

(4) Because the Tier 1 design descriptions are limited to fixed design features expected to be in place for the lifetime of the facility, the ITAAC also are limited to a verification of fixtures in the plant.

(5) In general, the ITAAC verify the as-built configuration and performance characteristics of SSCs as identified in the Tier 1 design descriptions. With limited exceptions, (e.g., welding), the ITAAC do not address typical construction processes for the reasons discussed in item (6) of Subsection 14.3.2. 1. ~~As necessary, ITAAC coverage of the exceptions is by:~~

~~a. The general provisions of Tier 1, Section 1.2.2, Items (1) through (4) that are invoked by configuration verification entries in individual system ITAAC tables; and~~

~~b.The ITAAC entries in Tier 1, Section 3~~

Selection Methodology — Using the criteria listed above, ITAAC table entries were developed for each system. This was achieved by evaluating the design features and performance characteristics defined in the Tier 1 design descriptions and preparing an ITAAC table entry for

each design description entry that satisfied the above selection criteria. As a result of this process there is a close correlation ~~(although not necessarily one-for-one for the reasons noted in item (2) above)~~ between the left-hand column ("Design Commitment") of the ITAAC table and the corresponding design description entry.

Having established the design features for which ITAAC are appropriate, the ITAAC table was completed by selecting the method to be used for verification (either a test, an inspection, or an analysis, or a combination of these) and the acceptance criteria against which the as-built features~~/~~ and/or performance are measured. The proposed verification activity is identified in the middle column of the ITAAC table.

The emphasis when selecting an ITAAC verification method was to utilize on-site testing of the as-built facility wherever possible. However, the selection of these items was dependent upon the plant feature to be verified but was guided by the ITA approach presented in Table 14.3-2. Thus, in some cases, a "type test" is specified to mean a manufacturer's test or other tests that are not necessarily intended to be in the final as-installed condition.

Where testing is specified, appropriate conditions for the test will be established in accordance with the Initial Test Program (ITP) described in Tier 1, DCD Tier 2 Section 14.2, and Regulatory Guide 1.68. Conversion or extrapolation of test results from the test conditions to design condition may be necessary to satisfy certain ITAAC. To the extent practical, the ITAAC verification methods will be either tests or inspections, which are objective.[1]

~~The proposed verification activity is identified in the middle column of the ITAAC table. Where appropriate, Tier 2 provides details regarding implementation of the verification activity.~~ Selection of acceptance criteria is dependent upon the specific design characteristic being verified by the ITAAC table entry: in most cases the appropriate acceptance criteria is self-evident and is based upon the Tier 1 design descriptions. For many of the ESBWR ITAAC, the acceptance criterion is a statement that the as-built facility has the design feature or performance characteristic identified in the design description. A central guiding principle for acceptance criteria preparation is the recognition that the criteria should be objective and unambiguous.

The use of objective and unambiguous terms for the acceptance criteria minimizes opportunities for multiple, subjective (and potentially conflicting) interpretations as to whether an acceptance criterion has, or has not, been met. In ~~some~~ most cases, the ITAAC acceptance criteria contain numerical parameters from Tier 2 that are not specifically identified in the Tier 1 design description or the Design Commitment column of the ITAAC table. This is acceptable because the design description defines the important design feature/performance that merits Tier 1 treatment whereas the acceptance criterion defines a measurement standard for determining if the as-built facility is in compliance with the Tier 1 design description commitment. . NRC guidance in NUREG-0800, Section 14.3, states the following regarding acceptance criteria:

[1] Such objective ITAAC which are verified through tests and inspections are generally not subject to adjudication (*see* NRC Letter, J. Lyons (NRC) to R. Simard (NEI), "Resolution of Combined License Topic 5 (COL-5), the 10 CFR 52.103 Hearing Process," Nov. 20, 2003, Encl. at 4: "NEI also states that the Commission may consider, in deciding whether to grant a request for a hearing, whether the contention is exempt from adjudication under the Administrative Procedures Act.' NEI Paper at 27; *see* Administrative Procedure Act (APA) 5 U.S.C. § 554(a)(3). The NRC staff agrees." In amending 10 CFR Part 52 in 2007, the NRC specifically acknowledged in the discussion of the rule change that this provision could be invoked for ITAAC.

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

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

Where appropriate, Tier 2 has identified detailed criteria applicable to the same design feature or function that is the subject of more general acceptance criteria in the ITAAC table.

For numerical acceptance criteria, ranges and/or tolerances are generally included. This is necessary and acceptable because:

- Specification of a single-value acceptance criterion is impractical because minute/trivial deviations would represent noncompliance;
- Tolerances recognize that legitimate site variations can occur in complex construction projects; and
- Minor variations in plant parameters within the tolerance bounds have no effect on plant safety.

The Acceptance Criteria column specifies that a report documents the successful completion of the ITAAC verification. This is generally intended to represent the front material (e.g., a form) that would be included in an ITAAC closure package to summarize completion of the ITAAC. All supporting information would be referenced in such a report and be included in the closure package or the location specified in the report. The "report" may be a simple form that consolidates all of the necessary information related to the verification package for supporting successful completion of the ITAAC.

14.3.3 Tier 1, Section 3 - Non-System Based Material

Tier 1 design descriptions and their associated ITAAC for design and construction activities that are applicable to more than one system are included in this section. Design related processes have been included in Tier 1 for:

Aspects of the ESBWR design likely to undergo rapid, beneficial technological developments in the lifetime of the design certification. Certifying the design processes associated with these areas of the design rather than specific design details permits future license applicants referencing the ESBWR design certification to take advantage of the best technology available at the time of a site-specific application and facility construction. Examples include design of programmable, microprocessor-based instrumentation and control systems.

- Aspects of the design that depend upon characteristics of as procured, as-installed systems, structures and components. These characteristics are not available at the time of certification, and therefore, cannot be used to develop and certify design details. Examples include design of piping systems that depend upon detailed routing and equipment information and equipment qualification.
- Thus, the material in Section 3 may be included because, in selected areas of the design, Tier 2 may not contain sufficient design detail. These ITAAC may represent what is commonly referred to as Design Acceptance Criteria (DAC). For these DAC, the Tier 1 ITAAC, combined with design information and appropriate design methodologies, codes, and standards provided in Tier 2, provide sufficient detail to provide an adequate basis for the NRC to make a final safety determination regarding the design, subject only to satisfactory design implementation and verification of the DAC ITAAC following completion of the DAC ITAAC. DAC also have confirmation ITAAC which ensure that the as-built plant conforms to the design DAC ITAAC.

Entries in this section of Tier 1 have the same structure as the system material discussed in Subsection 14.3.2; i.e., design description text and figures and a table of ITAAC entries. The objective of this Tier 1 material is to address selected design and construction activities, which are applicable to more than one system and cannot conveniently be covered in the system-by-system information presented in Tier 1, Section 2. Where appropriate, Tier 1 specifies that these non-system based ITAAC may be closed on a system-by-system basis for purposes of system turnover. However, the final ITAAC closure package must include verification that all of the systems were completed for that particular ITAAC.

The following summarizes the scope and bases for the Tier 1, Section 3 entries. For each, the design description text defines the applicability of the entry.

14.3.3.1 ~~Piping Design~~Design of Piping Systems and Components

The piping design section of Tier 1 defines the processes by which ESBWR piping is designed and evaluated. The material applies to piping systems that are classified as ~~nuclear~~ safety-related. In general, these piping systems are designated as Seismic Category I and are further classified as ASME Code Class 1, 2 or 3. The section also addresses the consequential effects of pipe rupture such as jet impingement, potential missile generation, pressure/temperature effects, ~~etc.~~ Similarly, ASME components are designed and procured to ASME Codes and Standards that require the design reports. ITAAC are included to ensure that piping systems and ASME components design reports are in order and verify that the ASME Code requirements are met. Each of these is reconciled to ensure that the as-installed piping systems or ASME components are in conformance with the Design Reports.

Certification of plant safety-related piping systems via design processes rather than via certification of specific design features is necessitated and justified by the following:

- Piping design is based on detailed piping arrangement information as well as the geometry and dynamic characteristics of the as-procured equipment that forms part of the piping system. This detailed plant-specific information is unavailable at the time of design certification and cannot therefore be used to develop detailed design information. This precludes certification of specific piping designs.

- An extensive definition of design methodologies is contained in Tier 2, Chapter 3. These methodologies are not considered to be part of Tier 1 but are one of several methods for executing the design process steps defined in the piping design. In addition, sample design calculations have been performed with these methods to provide confidence that they are complete and yield acceptable design information.
- Piping design for nuclear plants is a well-understood process based on straightforward engineering principles. This, together with Tier 2 methodology definition and sample calculations, provides confidence that future design work by individual applicants/licensees results in acceptable designs that properly implement the applicable requirements.

The technical material in the piping design Tier 1 entry was selected using the criteria and methodology as discussed above for Tier 1, Section 2 system entries.

14.3.3.2 Software Development

Development of the associated ESBWR instrumentation and controls (I&C) software applications is dependent upon the detailed, as-procured characteristics of the hardware to be used. An example would be the microprocessors to be used for the programmable digital control features. Consequently, software development cannot be completed at the time of design certification without first selecting the specific implementation hardware. In addition to the technology issue discussed below, this would be incompatible with the principle that certification should not define vendor-specific (i.e., as-procured) design characteristics for components.

All aspects of digital, microprocessor based control technology are expected to undergo significant changes as the technology continues to evolve. These future changes are expected to be beneficial and involve both the software and the hardware. Certification of specific software details at this time would preclude future site-specific applicants from taking advantage of these technology advances.

Development of software for programming of real-time microprocessor based controllers is being continually upgraded by techniques like automated development of system requirements and automated verification activities. These trends, coupled with ongoing industry efforts to establish standards for software development, provide confidence that future execution of this Tier 1 entry results in I&C equipment, which fully comply with ESBWR requirements and all Tier 2 commitments.

The software development process is discussed in detail in Appendix 7C. This material is not considered part of Tier 1; however, it provides one of several acceptable methods for implementing the ITAAC in the Tier 1.

14.3.3.3 Human Factors Engineering

The human factors engineering (HFE) entry defines the processes by which the details of the human-system interface (HSI) is developed, designed and evaluated. The processes defined in this entry require the use of analyses based on human factors principles and apply to the main control room (MCR), including areas which provide the displays, controls and alarms required for normal, abnormal and emergency plant conditions. They also apply to the Remote Shutdown System (RSS), Technical Support Center (TSC), Emergency Operations Facility (EOF), and

Local Control Stations (LCSs) with safety-related functions or as defined by HFE task analysis. For detailed HSI design implementation, the certification of processes (rather than specific design features) is necessitated and justified by the following:

- The technology of equipment associated with HSI implementation is rapidly evolving (and improving) and certification of implementation processes permits future licensees to take advantage of beneficial technological advances available at the time of application. An example is the rapid advances that have taken (and are taking) place in flat panel display technology.
- Detailed implementation of the HSI is dependent upon the details of the as procured, as-installed equipment. For example, different manufacturers use different techniques to monitor equipment performance. Because this equipment is not available at the time of design certification, it is not possible to develop HSI implementation details. This can be only be accomplished by a licensee when specific equipment characteristics are known.
- The fundamental design work for the ESBWR HSI has been completed and is described in Tier 2. This includes commitments to a set of standard design features as well as a minimum inventory of fixed alarms, displays and controls necessary for the operators to implement the emergency operating procedures and to carry out those human actions shown to be important by the plant PRA. This design information, coupled with the comprehensive commitments to HSI implementation processes based on currently accepted HFE practices, provides confidence that the execution of these processes result in acceptable MCR and RSS detail designs that implement the applicable requirements.

Selection of specific technical material for the HFE design descriptions and ITAAC entries in the Tier 1 utilized the same selection criteria and methodology as described above for Tier 1, Section 2 system entries.

14.3.3.4 Radiation Protection

The Tier 2 radiation protection chapter (Chapter 12) defines the design confirming that radiation protection features maintain exposures for both plant personnel and the general public below allowable limits. The material applies to the radiological shielding and ventilation design of buildings within the scope of the ESBWR certified design. ITAAC confirm that the building radiation zones are in accordance with site-specific radiation shielding calculations.

14.3.3.5 Initial Test Program

The Initial Test Program (ITP) defines testing activities that are conducted following completion of construction and construction-related inspections and tests. The ITP extends through to the start of commercial operation of the facility. This program is discussed within Section 14.2 and centers heavily on testing of the safety-related systems.

A summary of the ITP has been included in Tier 1, Section 3.5. This summary includes an overview of the ITP structure together with commitments related to test documentation and administration controls. This information has been included in Tier 1 because of the importance of the ITP in defining comprehensive pre-fuel load and post-fuel load testing for the as-built facility to demonstrate compliance with the design certification. Key pre-fuel load ITP testing for individual systems is defined in the system ITAAC in Tier 1, Sections 2 and 3.

No ITAAC entries have been included in Tier 1 for the ITP. This is acceptable because:

- Many of the ITP activities involve testing with the reactor at various power levels and thus cannot be completed prior to fuel load (Part 52 requires ITAAC to be completed prior to fuel load).
- Testing activities specified as part of the ITAAC in Tier 1, Sections 2 and 3 must be performed prior to fuel load. Because these ITAAC testing activities address the design features and characteristics of key safety significance, additional ITAAC for the ITP as defined in Tier 1, Section 3.5 are not necessary to assure that the as-built plant conforms with the ESBWR certified design.

14.3.3.6 Design Reliability Assurance Program

The Tier 1 scope of the Design Reliability Assurance Program (D-RAP) design description and ITAAC includes risk-significant SSCs, both safety-related and nonsafety-related, that provide defense-in-depth or result in significant improvement in the Probabilistic Risk Assessment (PRA) evaluations. The D-RAP ITAAC will provide reasonable assurance that the design of risk-significant SSCs ~~are~~ is consistent with their risk analysis assumptions.

14.3.3.7 Post-Accident Monitoring Instrumentation

The Tier 1 post accident monitoring instrumentation design description and ITAAC provide information required to monitor variables and systems over their anticipated ranges for post-accident conditions as appropriate to ensure adequate safety. The design description and ITAAC include from what systems the post accident monitoring instrumentation receives information.

14.3.3.8 Environmental Qualification of Mechanical and Electrical Equipment

The environmental qualification design description and ITAAC address safety-related electrical equipment located in harsh environment(s), mechanical equipment located in harsh environment(s), and digital I&C equipment located in mild environment(s), to ensure that safety-related functions can be performed.

14.3.4 Tier 1, Section 4 - Interface Material

Interface requirements are included as defined by 10 CFR 52.47. Interface requirements are those that must be met by the site-specific portions of the complete nuclear power plant that are not within the scope of the certified design. These requirements define characteristics of the site-specific features that must be provided in order for the certified design to comply with certification commitments. Interface requirements are defined for: (a) systems entirely outside the scope of the design certification, and (b) the out-of-scope portions of those systems that are only partially within the scope of the design certification. Site-specific ITAAC design features implement the interface requirements; therefore, Tier 1 does not include ITAAC for interface requirements.

This section of Tier 1 provides interface requirements for those system of a complete power-generating facility that are either totally or partially not within the scope of the ESBWR design as defined in the certification application (Tier 2). Generally structures, systems and components that are part of, or within, the Reactor Building, Fuel Storage Building, Service Building, Control Building, Turbine Building and Radwaste Building are in the ESBWR scope. Those portions of

the plant outside of these buildings are not generally in the DCD scope. This scope split occurs because design of the plant features located outside the main buildings is dependent upon site-specific characteristics that are unknown at the time of certification (e.g., the long-term source of water for the PCCS pools).

The basis for this interface requirements entry in Tier 1 is the discussion in 10 CFR Part 52.47. An applicant for a license that references the ESBWR design certification must provide site-specific systems with design features/characteristics that comply with the interface requirements. For systems that are partially within the scope of the ESBWR, interface requirements are listed in either Tier 1, Section 4 or in a separate sub-part of the Tier 1, Section 2 entry that addresses the in-scope portion of the system. In all cases, the Tier 1 entries for these systems are limited to defining interface requirements. Conceptual designs for the out-of-scope interfacing systems are presented in Tier 2 but are not addressed in Tier 1. This is appropriate because the applicant provides site-specific designs that meet the interface requirement; these site-specific designs may not correspond to the conceptual designs described in Tier 2.

Tier 1 does not define any ITAAC associated with the interface requirements. This is acceptable because the individual site-specific applicants who reference the ESBWR design certification provide ITAAC for the plant SSCs outside the scope of the ESBWR design certification on a site-specific, design-specific basis. (Part of the review process at the time of the license application is to assess compliance of the site-specific designs with the interface requirements.)

Design certification applications should contain justification that the requirements are verifiable through inspection, testing or analysis and that the method to be used for verification be included as part of the ITAAC. ~~The introductory text of Tier 1, Section 4 addresses these issues by stating the i~~Interface requirements are similar in nature to the design commitments in Tier 1, Section 2 for which ITAAC have been developed. This represents justification that a site-specific applicant is able to develop ITAAC to verify compliance with the design features or characteristics that implement the interface requirements. The methods to be used for these verifications are specified in the site-specific ITAAC and are similar to the methods in the Tier 1, Section 2 ITAAC for comparable/similar design characteristics.

Selection Criteria — The selection criteria listed in Tier 2, Subsection 14.3.2.1 were used to guide selection of interface requirements defined in Tier 1, Section 4 (or in the Section 2.0 entries referenced from Tier 1, Section 4). The intent is that the interface requirements in Tier 1 define key, safety-significant design attributes and performance characteristics of the site-specific, out-of-scope portion of the plant which must be provided in order for the certified portions of the ESBWR to comply with the design commitments in Tier 1. It is an objective of this section that it address interfaces between in-scope and out-of-scope portions of the plant that are unique to the ESBWR design; it is not intended that it be a comprehensive listing of all design requirements applicable to the out-of-scope portions of the plant. The latter is provided along with a site-specific Final Safety Analysis Report that includes a discussion of the site-specific design features.

Selection Methodology — The interface requirements included in the Tier 1 were selected from the interface requirements listed in Tier 2 for fully or partially out-of-scope systems, which are not already addressed else where in Tier 1.

14.3.5 Tier 1, Section 5 - Site Parameters

Site Parameters used as the basis for ESBWR design presented in Tier 2 are included in Tier 1. These parameters represent a bounding envelope of site conditions for any license application referencing the ESBWR design certification. No ITAAC are necessary for the site parameter entries, because compliance with site parameters are verified as part of issuance of a license for a plant that references the ESBWR design certification.

This section of Tier 1 defines the site parameters that were used as a basis for the design defined in the ESBWR certification application. These entries respond to the 10 CFR 52.47 requirements that the design certification documentation include site parameter information. The plant must be designed and built using the parameters in Tier 1, Section 5. ~~Furthermore~~That is, it is intended that applicants referencing the ESBWR design certification demonstrate that these parameters for the selected site are within the certification envelope.

Site-specific external threats that relate to the acceptability of the design (and not to the acceptability of the site) are not considered site parameters and are addressed as interface requirements in the appropriate system entry in Tier 1, Section 4. For example, the Technical Support Center (TSC) HVAC System requires that toxic gas monitors be located in the outside air intake if the site is adjacent to toxic gas sources with the potential for releases of significance to plant operating personnel in the TSC.

Section 5 of Tier 1 does not include any ITAAC, and is limited to defining the ESBWR site parameters. This is an appropriate approach because a license applicant prior to issuance of the license must demonstrate compliance of the site with these parameters.

Selection Criteria — Tier 2, Section 2 provides the envelope of site design parameters used for the ESBWR design. The corresponding Tier 1, Section 5 is based on using information from Tier 2 Section 2. Tier 1, Section 5 is limited to tabular entries, and no supporting text material is required.

14.3.6 Tier 1 Generation Summary

A central element of the design certification processes deriving from 10 CFR Part 52 centers on selection and documentation of the technical information to be included in the rule as the ESBWR certified design. The certified design description is a subset of the comprehensive set of design information presented in Tier 2. It includes:

- The key, safety-significant aspects of the overall design described in the certification application (Tier 2);
- The ITAAC that are used to verify the as-built facility conforms with the ESBWR certified design;
- Interface requirements; and
- Site parameters.

The information presented in Tier 1 is prepared using the selection criteria and methodology described herein, and is intended to satisfy the above Part 52 requirements for Rule content. In particular, the ITAAC entries in Tier 1, Sections 2 and 3 confirm that key design performance

characteristics and design features are in place, and that the as-built facility operates in accordance with the design certification.

14.3.7 Evaluation Process For Updating Design Descriptions and ITAAC

The following guidance is based on ~~draft SRPs 14.3 through 14.3.11, Draft Regulatory Guide DG-1145~~NRC guidance in NUREG-0800, Section 14.3, and RG 1.206, Section C.II.1, and 10 CFR 52.97(b)(1), with respect to the ESBWR design. This guidance is to be ~~followed~~ used for determining the content of system design description (DD) and/or ITAAC updates, changes and additions in Section 2 of Tier 1, and may be used for determining site-specific ITAAC.

To ensure the appropriate level of detail for Tier 1 changes, the following Tier 1 content determination process for systems uses a graded approach with sets of Tier 1 DD and ITAAC selection criteria.

14.3.7.1 Generic Guidance

The DCD Tier 2 safety analyses are based largely on system-level safety functions (assumed and analyzed) being performed and the key parameters of each safety-related function (e.g., water injection in "x" seconds with a flow rate of "y" gallons per minute), rather than addressing all aspects of each individual component in a system. Therefore, component-level details that are already covered by a verifiable design characteristic, feature or function (DCFF) of a safety-related function or a system-level detail should be described in Tier 2, if appropriate, and need not be included in the Tier 1 design descriptions (DDs). The ITAAC, however, should be written with objective criteria that can, to the extent practical, be verified through inspection or testing, and should include values that verify that a structure, system or component (SSC) performs as assumed in the safety analyses (as applicable) or as required by NRC regulation.

Tier 1 should address the equipment performance values modeled in the Tier 2 safety analyses and other performance values directly related to ensuring nuclear safety and/or ensuring compliance with NRC regulations.

To ensure the safety of the as-built plant, the ITAAC should confirm the DCFFs assumed and/or modeled in the Tier 2 safety analyses.

10 CFR 52.97(b)(1) states "*The Commission shall identify within the combined license the inspections, tests, and analyses, including those applicable to emergency planning, that the licensee shall perform, and the acceptance criteria that, if met, 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.*" Therefore, Tier 1 should include the DDs and ITAACs needed to ensure that the design related regulations (e.g., the 10 CFR 50, App. A, *General Design Criteria*) will be verified.

It is understood that not all safety-related SSCs are safety/risk-significant, and that all nonsafety-related are not safety/risk-significant. For a passive plant like the ESBWR, the safety-significant nonsafety-related SSCs are determined by applying the Regulatory Treatment of Non-safety Systems (RTNSS) criteria. Plus, there are nonsafety-related functions modeled/assumed in the plant safety analyses with respect to mitigating the effects of anticipated operational occurrences (AOOs) and special events (e.g., station blackout and ATWS). To ensure conservatism, all

safety-related SSCs should be assumed to be safety-significant. Therefore, for completeness, it is assumed that all SSCs that perform safety-related, AOO mitigation, special event mitigation and RTNSS mitigation functions have some degree of safety significance. By exclusion, all other SSC functions are not safety-significant, and ~~are not required to~~ need not be addressed in Tier 1, except to address any design aspects directly required to ensure compliance with a regulation.

14.3.7.2 NRC Guidance ~~From Draft SRPs 14.3 – 14.3.11 and DG-1145~~

Much of the information within ~~draft SRPs 14.3 – 14.3.11 and DG-1145~~ RG 1.206 and NUREG-0800, Section 14.3, addresses active or evolutionary plants, and thus, may not be directly applicable to a passive plant like the ESBWR. However, those portions that apply to both evolutionary and passive plants can be applied to the ESBWR.

~~Draft SRP 14.3, Section I, "AREAS OF REVIEW," second paragraph states "*The overall review approach consists of ensuring that the top-level design information in the DCD Tier 2 is appropriately included in Tier 1. The type of information and the level of detail in Tier 1 is based on a graded approach that is commensurate with the safety significance of the SSCs for the design. The top-level information selected should contain the principal performance characteristics and safety functions of the SSCs. This information must be appropriately verified by ITAAC.*" Plus, Draft SRP 14.3, Appendix A, Section IV, first paragraph states "*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.*" Therefore, a graded approach, based on safety functions, should be used determining the amount of detail in the Tier 1 DD and ITAAC. Therefore, (a) the content of the Tier 1 design information should come from the top-level safety-significant information in Tier 2, (b) the level of detail in Tier 1 should be based on a graded approach with respect to safety, and (c) the ITAAC should be based on the content of the Tier 1 design information (but must include values, if appropriate).~~

~~Draft SRP 14.3, Section III, "General Review Procedures," Item 5 states "*Ensure that the standard ITAAC entries in Appendix D that are related to your review area are appropriately included.*"~~

~~Draft SRP 14.3, Section III, "General Review Procedures," Item 10 states "*Ensure that the ITAAC are consistent with the technical specifications, including their bases and limiting conditions for operation.*" The safety functions and values used in the Tier 2 safety analyses may be reflected in the Technical Specifications (TS) limiting conditions for operation (LCOs).~~

~~Draft SRP 14.3, Appendix A, Section IV, Item B.1 states~~

> ~~"*The design descriptions (DD) address the most safety-significant aspects of each of the systems of the design, and were derived from the detailed design information contained in Tier 2. The level of detail in Tier 1 governed by a graded approach to the SSCs of the design, based on the safety significance of the functions they perform.*"~~
>
> ~~"*For example, Safety-Related SSCs should be described in Tier 1 with a relatively greater amount of information. Other SSCs should also be included based on their importance to safety, such as containment isolation aspects of non-safety systems. Some non-safety aspects of SSCs need not be discussed in Tier 1. This graded approach recognizes that*~~

~~*although many aspects of the design are important to safety, the level of design detail in Tier 1 and verification of the key design features and performance characteristics should be commensurate with the significance of the safety functions to be performed.*"~~

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

~~*"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 need to 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 Tier 2 in sufficient detail for the staff to reach its safety decision."*~~

~~Based on the above, the following provides examples of factors to be considered when determining whether to include a particular design element or feature in an ITAAC.~~

- ~~If a proposed ITAAC line item topic is consistent with a standard ITAAC entry from draft SRP 14.3, Appendix D **and** is applicable to the ESBWR's passive design, then the proposed ITAAC topic should be included in the Tier 1 system DD and ITAAC.~~
- ~~The safety functions and values used in the Tier 2 safety analyses may be reflected in the TS LCOs. Therefore, in those cases, to ensure ITAAC and LCO consistency, the ITAAC (as applicable) should be consistent with the LCOs containing the safety analysis values.~~

  ~~Note: TS trip allowable values are conservatively based (due to the application of setpoint methodology) on the analytical limits used in Tier 2, and thus, are not equal to those values.~~
- ~~A graded approach, based on safety functions and NRC regulations, is used determining the amount of detail in the Tier 1 DD and ITAAC.~~
- ~~Only those design aspects that can be verified prior to fuel load should be included in the ITAAC.~~
- ~~A global commitment to a code (ASME or IEEE) may not be readily verifiable, while specific code requirements can be readily verifiable, and thus, they should be included in the ITAAC. The ITAAC should be written so that the verification of completion will be readily discernable.~~
- ~~In some cases, for designs/technologies that are subject to change, the DD should contain higher level functional commitments, and need not include the lower level details that are described within Tier 2. However, if the safety analysis or a SSC functional description relies on a value for performing the safety analyses or for compliance with NRC regulatory requirements, the ITAAC should include those values/details.~~

~~□The ITAAC for a system should be based on the safety-significant information in the DD or on information that demonstrate how an NRC regulation is met, whether safety-significant or not.~~

~~□If information beyond the top level Tier 1 information is needed to verify an ITAAC, then that information should be within Tier 2. Therefore, if additional information to understand or verify an ITAAC is needed and is not currently within Tier 2, then this information should be added to Tier 2 and in the ITAAC, as appropriate.~~

~~□When fixed (safety-significant) design information is not available during the design certification phase, then the Design Acceptance Criteria (DAC) to be met on a site-specific basis should be provided in Tier 1 and Tier 2.~~

~~□SSCs with no safety significance generally should have no DD or ITAAC entry. However, the system should be listed, and Tier 1 states that there is no ITAAC entry. This ensures that ITAAC were considered and determined to be not required. Exceptions to this approach are SSCs that are relied upon to comply with NRC regulatory requirements, which, in many cases, are deterministic and not necessarily based on safety and risk significance.~~

- ~~Items, which are verifiable prior to fuel load and are consistent with DG-1145, Section C.II.2 or its appendices, are included in the Tier 1 DD and ITAAC. .~~

14.3.7.3 Criteria and Application Process

Each system addressed in Tier 2 shall be addressed in Tier 1 to the appropriate level of detail. The following graded three-level approach is used to determine the general level of detail in each Tier 1 system description.

(1) General Tier 1 Content Determination:

a. Systems with system-level or component-level safety-related, RTNSS, Infrequent Event and/or Special Event (e.g., ATWS, Station Blackout and Safe Shutdown Fire in Tier 2, Chapter 15) mitigation functions or have a DCFF required for meeting a regulation shall have Tier 1 inputs that include DD and ITAAC.

b. For nonsafety-related systems with design functions or features that:

(i) Prevent or mitigate AOOs analyzed in Tier 2;

(ii) Perform fuel protection or cooling (inside or outside the reactor vessel) functions; and/or

(iii) Are included in the plant to actively/automatically control offsite doses below 10 CFR 20 limits.

For these nonsafety-related systems, Tier 1 shall include DDs, but ITAAC are not required. However, some ITAAC are included for functions/values specifically modeled in the AOO safety analyses, specific fuel protection and cooling functional criteria, and/or active/automatic offsite release prevention functions. The ITAAC may simply verify that the equipment is provided and "exists" in the plant. According to NRC guidance in NUREG-0800, Section 14.3, the term "exists," when used in the Acceptance Criteria for ITAAC, means that the item is present and meets the design

description. Detailed supporting information on what should be present to conclude that an item "exists" and meets the design description is contained in the appropriate sections of the DCD. The approach stated herein also is consistent with the graded approach for Tier 1 content and ITAAC described in the NRC guidance.

~~c.~~The Tier 1 content of those systems that do not qualify under Items (1)a or (1)b generally need not include DDs or ITAAC. (These systems generally will be included in Tier 1 only by subject [i.e., title], and include a "no entry" statement.)

(2) DD Content Determination:

For each Item (1)a system, the following DCFFs ~~shall~~ may be included in the Tier 1 DDs and are useful for consideration when determining appropriate ITAAC. However, the main focus of the Tier 1 Design Descriptions is to specifically identify the information needed for the ITAAC Design Commitments. Thus, these DCFFs also relate directly to the ITAAC.~~(The level of detail of each DCFF should be such that it is not expected to change, and DCD Tier 2 should referenced for the additional details needed to verify the ITAAC.)~~

a. Purpose and functions;

b. Classifications (i.e., safety-related, seismic category, and ASME Code Classes);

c. Safety-related functions (i.e., modes of operation) and requirements;

d. Application of 10 CFR 50, Appendix A single failure criterion (e.g., separate trains, loops and divisions) to provide each safety-related function;

e. Features or functions used to mitigate the special events evaluated in the Tier 2 safety analyses;

f. Safety-related electrical trip signals and initiations modeled in the Tier 2 safety analyses;

g. The ~~configuration~~ functional arrangement of a safety-related system's safety-significant components (usually provided by means of a figure or table), generally showing which equipment must be qualified for a harsh environment (i.e., within the primary containment);

h. Use of safety-related ~~(Class 1E)~~ electrical power;

i. ~~Class 1E~~Safety-related electric power independence, capacity, capability, electrical protection and controls;

j. The safety-related instruments and manual controls located in the Main Control Room;

k. Safety-related logic, interlocks, bypasses and system inputs;

l. Safety-related electrical channel integrity and channel independence;

m. Safety to non-safety interfaces and isolation devices (if any);

n. ~~(Deleted)~~Alarms (if any);

o. In a separate Tier 1 subsection, Remote Shutdown System instruments and controls for performing safety-related functions;

p. Equipment initiations and system performance parameters used in the Tier 2 accident analyses (e.g., key containments design parameters, validated by the plant safety analyses);

q. Non-system level safety-related functions in nonsafety-related systems (e.g., containment isolation);

r. Features or functions determined by the Tier 2 RTNSS evaluation;

s. Any additional safety-significant details from ~~draft SRP~~ NUREG-0800, Section 14.3, Appendix D,~~;~~ or Regulatory Guide 1.206, ~~DG-1145,~~ Section C.II.2, or its appendices; and [KTS199]

t. Nonsafety-significant DCFFs, needed to verify the design related NRC regulations.

For each Item (1)b system, the following DCFFs ~~shall~~ may be included in the Tier 1 DDs and are useful for consideration when determining appropriate ITAAC. However, the main focus of the Tier 1 Design Descriptions is to specifically identify the information needed for the ITAAC Design Commitments. Thus, these DCFFs also relate directly to the ITAAC. ~~(The level of detail of each DCFF in the DDs should be such that it is not expected to change.)~~

a. Those that are specifically provided to prevent or mitigate Anticipated Operational Occurrences analyzed in Tier 2, Chapter 15;

~~v.~~b. Those that are specifically provided to perform nonsafety-related fuel protection or cooling (inside or outside the reactor vessel) functions;

~~w.~~c. Those that actively/automatically control offsite doses below 10 CFR 20 limits; and

~~x.~~d. Nonsafety-significant DCFFs, needed to verify the design related NRC regulations or to comply with NRC regulations.

(3) ITAAC Table Line Item Topics Determination:

Starting with the DCFFs determined in Item (2), and reviewing them against the functions and features assumed in the safety analyses, use the following criteria to determine the ITAAC table line item topics for each system. (The level of detail of each ITAAC line item should be such that it is not expected to change, and DCD Tier 2 should be referenced for the additional details needed to verify the ITAAC.)

a. The as-built configuration and/or performance characteristic of the DCFF, which can be confirmed prior to fuel load; **and**

b. Is

i. Assumed or modeled in a safety analysis or required for a RTNSS function; or

ii. Required to meet a design related NRC regulation or to comply with NRC regulation.

Any DCFF, already covered by the verification of ~~higher~~ higher-level ITAAC table line item(s) (e.g., system/function vs. component), should not be included.

Do not combine DCFFs, if it would be easier to confirm them separately, via separate line items, particularly if there are objective criteria for each of these items.

14.3.8 Overall ITAAC Content For Combined License Applications

10 CFR 52.80(a) specifies that the contents of a COL application must include:

(1) The proposed inspections, tests, and analyses that the licensee shall perform, and

(2) The acceptance criteria that provide reasonable assurance that, if the inspections, tests, and analyses are performed and the acceptance criteria met, the facility has been constructed and will operate in conformity with the COL, provisions of the Atomic Energy Act, and U.S. Nuclear Regulatory Commission (NRC) rules and regulations.

This subsection provides the methodology used in developing the ITAAC, in accordance with 10 CFR 52.80(a). The ITAAC are provided in tabular form, consistent with the format shown in RG 1.206 Table C.II.1-1.

The entire set of ITAAC for each facility (COL-ITAAC) consists of the following four parts:

(1) Design Certification ITAAC (DC-ITAAC), i.e., Tier 1 ITAAC;

(2) Emergency Planning ITAAC (EP-ITAAC);

(3) Physical Security Hardware ITAAC (PS-ITAAC); and

(4) Site-specific ITAAC (SS-ITAAC), if any is/are needed.

$$\text{COL-ITAAC} = (\text{DC} + \text{EP} + \text{PS} + \text{SS})\ \text{ITAAC}$$

As listed above, RG 1.206, Section C.II.1, Appendix C~~.II.1 C~~ discusses a generic set PS-ITAAC developed by the Nuclear Energy Institute's Plant Security Task Force (see Reference 14.3-1). The result of this effort is a generic set PS-ITAAC for security design features that can be included in a certified design or on a site-specific basis without change. The design PS-ITAAC are included within Tier 1.

The COL applicant shall provide EP-ITAAC, based on industry guidance (see Subsection 14.3.10).

14.3.9 Site-Specific ITAAC

RG 1.206 Section C.III.7.2 states that the COL applicant is required "to develop ITAAC for the site-specific design portions of the facility (SS-ITAAC) that are not included in the certified design." Therefore, if there are design functions and/or features for ensuring plant safety, which are not addressed in Tier 1, then the Tier 1 ITAAC must be supplemented with SS-ITAAC. If Tier 1 addresses all functions and features that ensure plant safety, then a SS-ITAAC is not required.

Based upon Subsection 14.3.7 and RG 1.206 Sections C.II.1 and C.III.7.2, the extent to which each site-specific system requires ITAAC is dependent upon the safety significance of the functions performed by the system. In particular, a system with a safety-significant function (e.g., safety-related function) should have at least one entry in an ITAAC table for that function. If a site-specific system is described in the FSAR and does not meet an ITAAC selection criterion, just the system title and the statement "No entry for this system" are provided within the ITAAC portion of the COL application (see Subsection 14.3.10). If a site-specific system is not described in the FSAR, then the system is not addressed within the ITAAC.

SS-ITAAC do not address ancillary buildings and structures on the site, such as administrative buildings, parking lots, warehouses, training facilities, etc.

14.3.10 COL Information

14.3-1-A EP-ITAAC

Provide the EP-ITAAC for the facility.

14.3-2-A Site-Specific ITAAC

Provide SS-ITAAC for systems not evaluated in the DCD.

14.3.11 References

14.3-1 USNRC, Regulatory Guide 1.206, "Combined License Applications for Nuclear Power Plants," June 2006.

14.3-2 USNRC, NUREG 0800, "Standard Review Plan."

14.3-3 Nuclear Energy Institute, "New Plant Security Task Force Work Product," August 2007.

Table 14.3-1

Types of Systems and Summary of Their Graded Treatment

System Type	Scope of Design Description and ITAAC Design Commitment
Safety-related systems that contribute to plant performance during design basis events (e.g., emergency core cooling systems).	Major safety-related features and performance characteristics.
Nonsafety-related systems that have safety-related components (e.g., containment isolation valves).	Brief discussion of design features and performance characteristics of the safety-related components.
Nonsafety-related systems used to mitigate AOOs (e.g., turbine bypass).	Brief discussion of design features and performance characteristics affecting the analyzed response(s) to the event(s).
Nonsafety-related systems involved in special events (e.g., station blackout).	Brief discussion of design features and performance characteristics affecting the safety of the plant's response to the event(s).
Nonsafety-related systems potentially affecting safety (e.g. potential missiles from the main turbine).	Brief discussion of design features which prevent or mitigate the potential safety concern.
Nonsafety-related systems, which affect overall plant design (e.g., Drywell Cooling System).	Case-by-case evaluation. A brief discussion of the system if warranted by overall standardization goals.
Nonsafety-related systems with no relationship to safety or any influence on overall plant design (e.g., ~~House Boiler~~ Hot Water System).	No discussion except identification of the system title.
System for which the Tier 1 entry has been included in another system (e.g., the Unit Auxiliary Transformer is addressed in the electrical power distribution system).	No additional discussion except identification of the system title.

Table 14.3-2

Test, Inspection or Analysis Approach & Application Process

ITA Approach	Application
Inspection	To be used when verification can be accomplished by visual observations, physical examinations, review of records based on visual observations or physical examinations that compare the as-built structure, system or component condition to one or more Tier 1 design description commitments.
Test	To be used when verification can be accomplished by the actuation or operation, or establishment of specified conditions, to evaluate the performance or integrity of the as-built structures, system or components. The type of tests identified in the ITAAC tables are not limited to in-situ testing of the completed facility but also include (as appropriate) other activities such as factory testing, special test facility programs, and laboratory testing.
Analysis	To be used when verification can be accomplished by calculation, mathematical computation or engineering or technical evaluations of the as-built structures, systems or components. (In this case, engineering or technical evaluations could include, but are not limited to, comparisons with operating experience or design of similar structures, systems or components.)