## 14.3 Tier 1 Selection Criteria and Processes

This section of Tier 2 provides the selection criteria and processes used to develop the Tier 1 information. 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 ABWR design certification rule.

This top-level design information in Tier 1 is extracted directly from the more detailed ABWR design information presented in Tier 2 (which is part of the certification application). 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.)

The objective of this section is to define the bases and methods that were used to develop Tier 1. Tier 2 Tables 14.3-1 through 14.3-10 provide a historical summary of the results of the review used to identify design information that was included in the Tier 1 design descriptions for the ABWR systems, as discussed in Subsection 14.3.2.1. As such, this historical information is not updated. This section contains no new technical information regarding the ABWR design.

Tier 1 consists of the following:

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

(2) Design descriptions for: a) systems that are fully within the scope of the ABWR design certification, and b) the in-scope portion of those systems that are only partially within the scope of the ABWR 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 inspections, tests, analyses and acceptance criteria (ITAAC) required by 10 CFR 52.47(a) (1) (vi) 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 will operate in accordance with the design certification. Successful completion of these certified design ITAAC, together with the combined license (COL) applicant's ITAAC for the site-specific portions of the plant, will be the basis for the NRC finding under 10 CFR Part 52.103(g).

(3) 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:

(a) Aspects of the ABWR 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 ABWR design certification to take advantage of the best technology available at the time of COL application and facility construction. Example: design of programmable, microprocessor-based instrumentation and control systems.

(b) Aspects of the design which are dependant 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 which are dependent upon detailed routing and equipment information.

(4) Interface requirements as defined by 10 CFR Part 52.47(a) (1) (vii). Interface requirements are those requirements which 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 which 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. The COL applicant will provide ITAAC for the site-specific design features that implement the interface requirements; therefore, Tier 1 does not include ITAAC for interface requirements.

(5) Site parameters used as the basis for ABWR design presented in Tier 2. These parameters represent a bounding envelope of site conditions for any license application referencing the ABWR design certification. No ITAAC are necessary for the site parameters entries because compliance with site parameters will be verified as part of issuance of a license for a plant that references the ABWR design certification.

(6) Appendices listing 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 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 Part 52 and its underlying purposes.

## 14.3.1 Tier 1 Section: 1.0 Introduction

This section includes two subsections:

1.1 Definitions

1.2 General Provisions

**Selection Criteria —** Tier 1, Section 1.1 is used to define terms which are used throughout Tier 1 and could (potentially) be subject to various interpretations. Selection of entries was based on a simple judgement that a particular word/phrase merits definition - with particular emphasis on terms associated with implementation of the ITAAC. Tier 1, Section 1.2 contains a mixture of provisions that were selected on the basis that the provision was necessary to either a) define technical requirements applicable to multiple systems in Tier 1 or to b) to provide clarification and guidance for future users of Tier 1.

**Selection Methodology** — Entries in the Definition section were largely made 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 ABWR and should be understood by Tier 1 users.

**Example Entries** — Typical terms defined in Tier 1, Section 1.1 are “as-built,” “Division,” “Type Test.” Issues requiring Tier 1, Section 1.2 treatment include guidance on interpretation of figures provided in the body of Tier 1 and defining the scope of what is included if a system configuration check is specified in an ITAAC entry.

## 14.3.2 Tier 1 Section: 2.0 Certified Design Material for ABWR Systems

This section of Tier 1 has the design description and ITAAC material for the individual ABWR Systems and has an entry for every system that is either fully or partially within the scope of the ABWR design certification. Consequently, there is a Tier 1, Section 2.0 entry for every ABWR system identified in Tier 2, Section 1.2. The intent of this comprehensive listing of ABWR systems is to define at the Tier 1 level the full scope of the certified design. (As discussed 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.)

Since preparation of system design descriptions and the associated ITAAC are sequential, separate processes, they are discussed separately in the next two subsections.

#### 14.3.2.1 Design Descriptions

The Tier 1 design descriptions for each ABWR system address the top-level design features and performance standards which 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 ABWR 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 (54 Fed. Reg. 15372,15377 (1989)) 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) The Tier 1 design descriptions contain only information from Tier 2 that is most significant to safety. Tier 2 contains a wide spectrum of information on various aspects of the ABWR design, and not all of this information warrants inclusion in the Tier 1 design descriptions. This selection criterion reflect the Commission directive in the Statement of Considerations for Part 52 (Fed. Reg. 15372, 15377 (1989)) that the certified design should “encompass roughly the same design features that Section 50.59 prohibits changing without prior NRC approval.” 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 safety-related structure, system, or component.

(c) Whether the feature or function in question is specified in the NRC’s Standard Review Plan 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.

(f) Whether the feature or function in question has had a significant impact on the safety or operation of existing nuclear power plants.

(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) In general, only the safety-related features and functions of structures, systems and components are discussed in the Tier 1 design descriptions. Structures, systems, and components that are not classified as safety-related 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 impact upon the safety-related functions of other structures, systems, or components. This criterion follows from the principle that only features and functions that are safety-significant warrant treatment in Tier 1. Non-safety features and functions of safety-related structures, systems, and components are not generally discussed in the Tier 1 design descriptions.

(4) In general, the Tier 1 design descriptions for structures, systems, and components are limited to a discussion of design features and functions. The design bases of structures, systems, and components, 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. Justification that the design meets regulatory requirements is presented in Tier 2. For example, the design descriptions for the emergency core cooling systems 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 clad temperatures within 10 CFR 50 Appendix K limits.

(5) The Tier 1 design descriptions focus on the physical characteristics of the facility. The Tier 1 design descriptions do not 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 2.0 discuss the configuration and performance characteristics that the structures, systems, and components should have after construction is completed. In general, the Tier 1 design descriptions do not discuss the processes that will be used for designing and constructing a plant that references the ABWR design certification. This is acceptable because the safety-

function of a structure, system, or component is dependent upon its final as-built condition and not the processes used to achieve that condition. There are some exceptions to this criterion. 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 1.2 and

(b) the various design and qualification processes defined in Tier 1, Section 3.

In addition, the programmatic aspects of the design and construction processes (training, qualification of welders, etc.) are part of the licensee's programs and are subject to commitments made at the time of COL issuance. Consequently, these issues are not addressed in Tier 1.

(7) In general, 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. Since Tier 1 pertains to the design, it is not appropriate for it to include a discussion of these items. One exception to this general approach pertains to nuclear fuel, fuel channels, and control rods. These components are discussed in the Tier 1 design descriptions due to their importance to safety and the desire to control their overall design throughout the lifetime of a plant that references the certified ABWR design.

(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 benefits 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, Tier 1, Section 2.1.2 specifies that the ABWR safety-relief valves shall be of the direct-acting type with pneumatic operators. This precludes the use of reverse acting valves controlled by pilot valves.

(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.

(10) In order to allow the applicant or licensee of a plant that references the ABWR 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: design of the main control room and instrumentation and control systems. This issue is discussed further in Tier 2, Section 14.3.3.

(11) Tier 1 design descriptions are intended to be self-contained and does not make direct reference to Tier 2, industrial standards, regulatory requirements or other documents. (There are some exceptions involving the ASME Code and the Code of Federal Regulations.) If 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 which 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. For example, preparing a system design description could involve reviewing the following chapters.

| Tier 2 Chapter | Potentially Relevant Material |
|---|---|
| 1 | Official system/structure name. |
| | Design features to address Three Mile Island (TMI) items. |
| | Design features to address station blackout considerations. |
| 3 | System and component classification information. |
| | Structural design. |

| Tier 2 Chapter | Potentially Relevant Material |
|---|---|
| 4,5,6,9,10,11 | Design features and configuration of mechanical/hydraulic/ pneumatic systems. |
| 6 | System characteristics assumed for design basis loss-of-coolant accidents. |
| 7 | System control features and logic. |
| 8 | System power supply configuration. |
| 12 | System features related to radiation protection. |
| 15 | System characteristics assumed as part of the plant transient event analysis - including anticipated transients without scram. |
| 16 | System and component features necessary to support plant compliance with Technical Specifications. |
| 19 | Important design features identified by the plant probabilistic risk analysis (PRA). |
| | System and component design features associated with resolution of Unresolved Safety Issues (USI) and Generic Safety Issues (GSI). |
| | Important design features associated with mitigation of severe (beyond design basis) accidents. |

This listing is not necessarily complete. It is provided as an example of potential Tier 2 sources of important system/component design information that should be included in Tier 1 design descriptions for the ABWR systems. Of particular importance was the need to review those sections of Tier 2 which document plant safety evaluations for which acceptable plant performance is dependent upon contributions from multiple ABWR systems. Specifically, detailed reviews were conducted of the following in chapters of Tier 2 ; the flooding analyses in Chapter 3, the analysis of overpressure protection in Chapter 5, containment analyses in Chapter 6, the core cooling analyses in Chapters 6 and 15, the analysis of fire protection in Chapter 9, the safety analysis of transients and the anticipated transients without scram in Chapter 15, the radiological analyses in Chapter 15, resolution of generic safety issues and Three Mile Island issues in Chapters 1 and 19, and the PRA and severe accident analyses in Chapter 19. These reviews were a key factor in identifying the important, safety-related system design information warranting discussion in the design descriptions. Tier 2 Tables 14.3.-1 through 14.3-10 summarize the information identified by these reviews. Tier 2 Tables 19.8-1 through 19.8-7 summarize the important design features identified by the PRA and severe accident analyses.

**Example Entries —** Because the safety significance of the ABWR systems varies considerably, 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. The following lists the types of ABWR systems and is a summary of the overall consequences of this graded treatment:

| System Type | Scope of Design Description |
|---|---|
| Safety-related systems that contribute to plant performance during design basis accidents (e.g., emergency core cooling systems). | Major safety-related features and performance characteristics. |
| Non-safety-related systems involved in beyond-design-basis events (e.g., combustion turbine generator contribution to station blackout). | Brief discussion of design features and performance characteristics affecting the safety of the plant's response to the event(s). |
| Non-safety-related systems potentially impacting safety (e.g. potential missiles from the main turbine). | Brief discussion of design features which prevent or mitigate the potential safety concern. |
| Non-safety-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. |

| System Type | Scope of Design Description |
|---|---|
| Non-safety-related systems with no relationship to safety or any influence on overall plant design (e.g., House Boiler 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. |

For safety-related systems, application of the above criteria resulted in design description entries which include the following information, 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 of the system's safety-significant components (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 important instruments, controls, and alarms to the extent located in the Main Control Room or Remote Shutdown System; identification of which of the important Class 1E electrical equipment within the system is qualified for a harsh environment; motor-operated valves within the system that have an active safety-related function; and any other features of functions that are significant to safety.

The Tier 1 design descriptions for non-safety-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. Since much of this information is not relevant to non-safety-related systems, the Tier 1 design descriptions for non-safety-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.

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

A table of ITAAC entries is provided for each system which has design description entries. The intent of these ITAAC is to define activities that will be undertaken to verify the as-built system conforms with 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. 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. 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.

With only a few special-case exceptions (nuclear fuel, fuel channels and control rods), each ABWR system with any design description text has an ITAAC table with one or more entries. This reflects the assessment that (in general) any design feature meriting a Tier 1 description also merits an ITAAC entry to verify that the feature has been included in the as-built facility.

(2) One inspection, test, or analysis may verify one or more provisions in the Tier 1 design description. In particular, an ITAAC which 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. For example, there are no ITAAC for nuclear fuel, fuel channels and control rods because they are frequently changed by a licensee. (In the specific case of nuclear fuel, fuel channels and control rods, ITAAC also are not possible for these components because they are not installed in the plant until after authorization is given for fuel load.)

(5) In general, the ITAAC verify the as-built configuration and performance characteristics of structures, systems and components 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 Tier 2, Section 14.3.2.1. As necessary, ITAAC coverage of the exceptions is by:

(a) The provisions of Tier 1, Section 1.2, Items (1) through (4) that are invoked by configuration verification entries in individual system ITAAC tables.

(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 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 (ITA)) and the acceptance criteria (AC) against which the as-built feature/performance will be measured. The emphasis when selecting an ITAAC verification method was to utilize in-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 following:

| 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. |

| ITA approach | Application |
|---|---|
| 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.) |

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. For example, Tier 2, Appendix 6D defines how results from High Pressure Core Flooder (HPCF) tests (which are also discussed in Tier 1, Section 2.4.2) will be converted from the test conditions to the design basis conditions for the HPCF System. This information is not referenced in Tier 1 and is not part of Tier 1; it is considered as providing only one of potentially several acceptable methods for completing the ITA.

Selection of acceptance criteria (AC) is dependent upon the specific design characteristic being verified by the ITAAC table entry: in most cases the appropriate AC is self-evident and is based upon the Tier 1 design descriptions. For many of the ABWR ITAAC, the AC 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 AC preparation is the recognition that the criteria should be objective and unambiguous. The use of objective and unambiguous terms for the AC will minimize opportunities for multiple, subjective (and potentially conflicting) interpretations as to whether an AC has, or has not, been met. In some 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. 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 example, Tier 2 Appendix 18E provides detailed guidance on human factors which is also the subject of the AC in Tier 1, Section3.1. This Tier 2 material is not considered part of Tier 1but does provide one of potentially several methods for satisfying the ITAAC.

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

(a) Specification of a single-value AC is impractical since minute/trivial deviations would represent noncompliance.

(b) Tolerances recognize that legitimate site variations can occur in complex construction projects.

(c) Minor variations in plant parameters within the tolerance bounds have no impact on plant safety.

**Examples Entries** — Tier 2, Table 14.3-11 is a partial listing of the entries in the ITAAC table for the Standby Liquid Control System; this table is representative of ITAAC for other ABWR systems.

## 14.3.3 Tier 1 Section: 3.0 Additional Design Material

Entries in this section of Tier 1 have the same structure as the system material discussed in Section 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 2.0. There are five entries in Tier 1, Section 3.0, and the following summarizes the scope and bases for these entries. For each, the design description text defines the applicability of the entry.

### 14.3.3.1 Human Factors Engineering

The human factors engineering (HFE) entry defines the processes by which the details of the human-system interface (HSI) will be 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).

For MCR and RSS detailed HSI design implementation, the certification of processes (rather than specific design features) is necessitated and justified by the following:

(1) 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.

(2) 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. Since 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.

(3) The fundamental design work for the ABWR 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 detailed HSI implementation processes based on currently accepted HFE practices, provides confidence that the execution of these processes will result in acceptable MCR and RSS detail designs that properly implement all of 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 2.0 system entries.

#### 14.3.3.2 Radiation Protection

The radiation protection section of Tier 1 defines the processes by which it will be confirmed that the as-built facility has radiation protection features that 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 ABWR certified design.

Certification of plant radiation protection features via process definition rather than via certification of specific design features is necessitated and justified by the following:

(1) Actual radiological source terms are dependent upon the characteristics of the as-built, as-installed equipment. For example, such parameters as equipment sizes, geometry, and valve stem leakage rates influence source terms. Consequently, final radiological evaluation cannot be completed prior to availability of this as-built data and therefore cannot be used to finalize radiological protection design features at the time of design certification.

(2) Radiological studies using representative/ reasonable assumptions have been completed and reported in Tier 2, Chapter 12. These preliminary studies show the ABWR radiological protection features are such that acceptance criteria related to occupational and general public exposure are met. This provides high confidence that the processes defined in the radiological Tier 1 entry can be successfully executed

within the envelope of the ABWR certified design. This confidence is based in part on the recognition that technology associated with radiation sources and protection is well understood and is unlikely to experience any major changes during the lifetime of the design certification.

Selection of entries in Tier 1 utilized the same selection criteria and methodology as discussed above for Tier 1, Section 2.0 system entries.

#### 14.3.3.3 Piping Design

The piping design section of Tier 1 defines the processes by which ABWR piping will be 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.

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:

(1) 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.

(2) 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.

(3) 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 will result 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 2.0 system entries.

### 14.3.3.4 Instrumentation and Control

This Tier 1 section has multiple entries addressing the following issues associated with plant instrumentation and control (I&C):

(a) System design description and ITAAC for the Safety System Logic and Control (SSLC) System.

(b) I&C Development and Qualification Processes.

(c) Design descriptions and ITAAC for ABWR design features that provide diverse backup as protection against common-mode failure in the SSLC.

Items a and c address design features of the various ABWR systems and were developed using the selection criteria and methodology described in Tier 2, Sections 14.3.2.1 and 14.3.2.2.

#### 14.3.3.4.1 I&C Development and Qualification Processes

This section of Tier 1 defines the hardware and software development processes to be used in the design, testing and installation of I&C equipment. This includes:

(1) Software and hardware development processes and plans 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 (EMI) on the ABWR I&C equipment.

(3) A program to establish setpoints for safety-related instrument channels.

(4) A program to qualify safety-related I&C equipment for in-service environmental conditions.

Certification of these aspects of the ABWR design via processes/programs rather that via certification of specific design feature is necessitated and justified by the following:

(1) Software Development

(a) Development of specific software is dependent upon the detailed, as-procured characteristics of the hardware to be used-- especially the microprocessors to be used for the programmable digital control features. Consequently, software development cannot be completed at the time of design certification without 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.

(b) 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 COL applicants from taking advantage of these technology advances.

(c) Development of software for programming of real-time microprocessor based controllers is a well understood process which is being continual upgraded by application of such techniques as automated development of 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 will result in I&C equipment fully in compliance with ABWR requirements and all Tier 2 commitments.

(d) The software development process is discussed in detail in Appendix 7B. 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.

(2) EMI, Setpoints and Equipment Qualification

Activities associated with these aspects of I&C hardware are dependent upon the characteristics of the as-built, as-installed equipment and cannot therefore be completed as part of the design certification. For example:

(a) Confirmation that I&C hardware has acceptable protection against the effects of EMI is dependent upon the details of the design and the EMI field in which it is located. The latter depends upon the detailed plant design and arrangement and is therefore not available at the time of certification.

(b) Setpoint methodology requires consideration of such factors as instrument accuracy, calibration accuracy, and drift, as well as the signal transmission characteristics of the as-installed data handling equipment -- all characteristics of the as-procured hardware and thus not available at the time of certification.

(c) Equipment qualification is based on the environmental conditions that will be experienced in service (pressure, temperature, radiation, etc.). These conditions are dependent upon the as-built design of the plant. Furthermore, qualification processes must reflect the as-procured hardware design; e.g., the materials of construction, the location of non-metallic components vis-a-vis radioactive sources, etc. None of this information is available at the time of design certification.

Because of these considerations, it is appropriate that the Tier 1 entries for these I&C hardware-related subjects be in the forms of commitments to plans and processes.

### 14.3.3.5 Initial Test Program

The ABWR Initial Test Program (ITP) defines testing activities that will be 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 extensively discussed in Tier 2, Chapter 14 and centers heavily on testing of the ABWR 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- 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:

(a) 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).

(b) Testing activities specified as part of the ITAAC in Tier 1, Sections 2 and 3 must be performed prior to fuel load. Since these ITAAC testing activities address the design features and characteristics of key safety significance, additional ITAAC for the ITP as defined inTier 1, Section 3.5. are not necessary to assure that the as-built plant conforms with the ABWR certified design.

## 14.3.4 Tier 1 Section: 4.0 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 ABWR design as defined in the certification application (Tier 2). For the ABWR, these systems are listed in Tier 2, Section 1.1.2. Generally structures, systems and components that are part of, or within, the Reactor Building, Service Building, Control Building, Turbine Building and Radwaste Building are in the ABWR scope. Those portions of the plant outside of these buildings are not generally in the ABWR scope. This scope split occurs because design of the plant features located outside the main buildings is dependent upon site-specific characteristics which are unknown at the time of certification (e.g., the source of plant cooling water, the characteristics of the electrical grid to which the plant is connected, etc.). The basis for this interface requirements entry in Tier 1 is the discussion in 10 CFR Part 52.47(a) (1) (vii). An applicant for a license that references the ABWR design certification must provide site-specific systems with design features/characteristics that comply with the interface requirements.

An entry is provided in Section 4.0 of Tier 1 for each of the systems listed in Section 1.2; for systems that have no interface requirements of sufficient safety-significance to warrant Tier 1 treatment, the entry is limited to the system title only. For systems that are partially within the scope of the ABWR, interface requirements are listed in either Tier 1, Section 4.0 or in a separate sub-part of the Tier 1, Section 2.0 entry which 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 required by 10 CFR Part 52.47(a)(1)(ix); these designs are presented in Tier 2 but are not addressed in Tier 1. This is appropriate because the applicant will provide 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 ITAAC for the plant structures, systems, and components outside the scope of the ABWR design certification will be provided on a site-specific, design-specific basis by the individual COL applicants who reference the ABWR design certification. (Part of the review process at the time of the license application will be to assess compliance of the site-specific designs with the interface requirements.)

10 CFR Part 52.47(a)(1)(viii) specifies that design certification applications contains 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 4.0 addresses these issues by stating the interface requirements are similar in nature to the design commitments in Tier 1, Section 2.0 for which ITAAC have been developed. This represents justification that a COL applicant will be 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 will be specified in the COL ITAAC and will be similar to the methods in the Tier 1, Section 2.0 ITAAC for comparable/similar design characteristics.

**Selection Criteria** — The selection criteria listed in Tier 2, Section 14.3.2.1 were used to guide selection of interface requirements defined in Tier 1, Section 4.0 (or in the Section 2.0 entries referenced from Tier 1, Section 4.0). 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 ABWR 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 ABWR 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 will be provided for NRC review when the COL applicant submits a site-specific safety analysis report that will include 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. For example: Tier 2, Section 8.2.3 defines interface requirements for the Offsite Power Systems. These sections and similar interface requirement sections for other systems were reviewed, and Tier 1, Section 4.0 entries selected using the criteria discussed above.

**Example Entry** — Table 14.3-12 shows the UHS interface requirements inTier 1, Section 4 and is representative of entries for other systems.

## 14.3.5 Tier 1 Section: 5.0 Site Parameters

This section of Tier 1 defines the site parameters which were used as a basis for the design defined in the ABWR certification application. These entries respond to the 10 CFR 52.47(a)(1)(iii) requirement that the design certification documentation include site parameter information. The plant must be designed and built using the parameters in Tier 1, Section 5.0. Furthermore, it is intended that applicants referencing the ABWR 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 5.0 of Tier 1 does not include any ITAAC and is limited to defining the ABWR site parameters. This is an appropriate approach because compliance of the site with these parameters must be demonstrated by a license applicant prior to issuance of the license.

**Selection Criteria** — Tier 2, Section 2.0, Table 2.0-1 provides the envelope of site design parameters used for the ABWR design. The corresponding Tier 1, Section 5.0 is based on using Tier 2 Table 2.0-1 in its entirely except as modified to meet the Tier 1 content criteria discussed in this Tier 2 section (i.e., 14.3). For example, references in the Tier 2 table to specific Regulatory Guides have been deleted from the Tier 1 table because of the guideline that Tier 1 does not contain direct references to codes and standards. Tier 1, Section 5 is limited to a tabular entry; no supporting text material is required.

## 14.3.6 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 ABWR certified design. The certified design description is a subset of the comprehensive set of design information presented in Tier 2. It includes:

(a) the key, important safety-significant aspects of the overall design described in the certification application (Tier 2),

(b) the inspections, tests, analyses and acceptance criteria (ITAAC) that will be used to verify the as-built facility conforms with the ABWR certified design, and

(c) interface requirements and site parameters.

The information presented in Tier 1 has been prepared using the selection criteria and methodology described in this Tier 2 section 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 will confirm that key design performance characteristics and design features are in place and that the as-built facility will operate in accordance with the design certification.

## Table 14.3-1 Core Cooling Analysis

| Tier 2 Entry | Parameter | Tier 2 Value |
|---|---|---|
| 6.3.3.5 | Following a LOCA the RHR System is Automatically Directed to the LPFL Mode | ---- |
| 6.3.3.7.4 | The Safety Related Systems Will Operate as Designed with the Loss of All Offsite AC Power | ---- |
| Table 6.3-1 | Low Pressure Flooder System | |
| | Vessel Pressure at which Flow May Commence (MPaD -- vessel to drywell) | 1.55 |
| | Min. Rated Flow ($m^3$/h per pump) | 954 |
| | At vessel Pressure (MPaD -- vessel to drywell) | 0.275 |
| | Initiating Signals | |
| | Low Water Level | ---- |
| | or | |
| | High Drywell Pressure | ---- |
| | Maximum Allowable Time Delay from Low Pressure Permissive Signal to Injection Valve Fully Open (s) | 36.0 |
| Table 6.3-1 | Reactor Core Isolation Cooling System | |
| | Vessel Pressure at which Flow May Commence (MPaD-- vessel to the air space of the compartment containing the water source for the pump suction) | 8.12 |
| | Min. Rated Flow ($m^3$/h) | 182 |
| | At Vessel Pressures (MPaD-- vessel to the air space of the to compartment containing the water source for the pump suction) | 8.12 to 1.03 |
| | Initiating Signals | |
| | Low Water Level | ---- |
| | or | |
| | High Drywell Pressure | ---- |
| | Maximum Allowable Time Delay from Initiating Signal to Rated Flow Available and Injection Valve Fully Open (s) | 29.0 |
| Table 6.3-1 | High Pressure Core Flooder System | |
| | Vessel Pressure at which Flow May Commence (MPaD -- vessel to the air space of the compartment containing the water source for the pump suction) | 8.12 |
| | Minimum Rated Flows ($m^3$/h per subsystem) | 182 to 727 |

## Table 14.3-1 Core Cooling Analysis (Continued)

| Tier 2 Entry | Parameter | Tier 2 Value |
|---|---|---|
| | At Vessel Pressures (MPaD -- vessel to the air space of the compartment containing the water source for the pump suction) | 8.12 to 0.686 |
| | Initiating Signals | |
| | Low Water Level | ---- |
| | or | |
| | High Drywell Pressure | ---- |
| | Maximum Allowable Time Delay from Initiating Signal to Rated Flow Available and Injection Valve Fully Open and Power Available at the Emergency Busses (s). | 16.0 |
| | Maximum Emergency Diesel Generator Startup Time (s) | 20.0 |
| Table 6.3-1 | Automatic Depressurization System | |
| | Total Number of Relief Valves with ADS Function | 8 |
| | Min. Flow Capacity (kg/h x $10^6$) | 2.903 |
| | At Vessel Pressure (MPaG) | 7.76 |
| | Initiating Signals | |
| | Low Water Level | --- |
| | and | |
| | High Drywell Pressure | ---- |
| | or | |
| | High Drywell Pressure Bypass Timer Timed Out | ---- |
| | Time Delay (s) | 480 |
| | Delay Time from All Initiating Signals Completed to the Time Valves are Open (s) | 29.0 |
| Table 6.3-3 | The RHR Subsystems are Divisionally Separated | ---- |
| | The HPCF Subsystems are Divisionally Separated | ---- |
| | RCIC Operation Does not Required AC Power | ---- |
| | A Single Failure Will not Prevent the Operation of More Than One ADS Valve | ---- |
| Table 6.3-4 | LOCA Break Sizes | |
| | Steamline ($cm^2$) | 985 |
| | Feedwater Line ($cm^2$) | 839 |
| | RHR Shutdown Cooling Suction Line ($cm^2$) | 792 |
| | RHR Injection Line ($cm^2$) | 205 |

## Table 14.3-1 Core Cooling Analysis (Continued)

| Tier 2 Entry | Parameter | Tier 2 Value |
|---|---|---|
| | High Pressure Core Flooder ($cm^2$) | 92 |
| | Bottom head Drain Line ($cm^2$) | 20.3 |
| Table 15.6-4 | MSIV Closure Initiated by High Steam Flow | ---- |
| | Scram Initiated by MSIV Closure | ---- |
| Table 15.6-15 | Scram Initiated by Low Water Level 3 | ---- |

## Table 14.3-2 Containment Pressure/Temperature Response

| Tier 2 Entry | Parameter | Tier 2 Value |
|---|---|---|
| 6.2.1.1.3.3.1.1 | Minimum MSIV Closing Time (s) | 3.0 |
| | High Pressure Core Flooder System | |
| | Minimum Rated Flows ($m^3$/h per subsystem) | 182 to 727 |
| | At Vessel Pressures (MPaD -- vessel to the air space of the compartment containing the water source for the pump suction) | 8.12 to 0.686 |
| | Low Pressure Flooder System | |
| | Vessel Pressure at which Flow May Commence (MPaD -- vessel to drywell) | 1.55 |
| | Min. Rated Flow ($m^3$/h per pump) | 954 |
| | At Vessel Pressure (MPaD -- vessel to drywell) | 0.275 |
| | Reactor Core Isolation Cooling System | |
| | Min. Rated Flow ($m^3$/h) | 182 |
| | At Vessel Pressures (MPaD -- vessel to the air space of the compartment containing the water source for the pump suction) | 8.12 to 1.03 |
| 6.2.1.1.3.3.2 | Maximum MSIV Closing Time (s) | 5.0 |
| | Total Surface of Drywell Connecting Vents ($m^2$) | 11.3 |
| | Vacuum Breakers | |
| | Quantity | 8 |
| | Total Flow Area ($m^2$) | 1.53 |
| Table 6.2-2 | Drywell | |
| | Leak Rate (%/Day) | 0.5 |
| | Wetwell | |
| | Leak Rate (%/Day) | 0.5 |
| | Min. Suppression Pool Water Volume ($m^3$) | 3580 |
| | Vent System | |
| | Number of Vents | 30 |
| | Nominal Vent Diameter (m) | 0.7 |
| | Total Horizontal Vent Area ($m^2$) | 11.6 |
| Table 6.2.2-a | Containment Spray | |
| | Number of RHR Subsystems (Pump Plus Heat Exchanger) | 2 |

## Table 14.3-2 Containment Pressure/Temperature Response (Continued)

| Tier 2 Entry | Parameter | Tier 2 Value |
|---|---|---|
| | Wetwell Spray Flow Rate per RHR Subsystem (kg/h x $10^5$) | 1.14 |
| | Containment Cooling System | |
| | Number of RHR Subsystems (Pump Plus Heat Exchanger) | 3 |
| | Pump Capacity ($m^3$/h per pump) | 954 |
| | Overall Heat Transfer Coefficient (kJ/S•°C) | 370.5 |
| Table 6.3-4 | LOCA Break Sizes | |
| | Steamline ($cm^2$) | 985 |
| | Feedwater Line ($cm^2$) | 839 |
| | RHR Shutdown Cooling Suction Line ($cm^2$) | 792 |
| | RHR Injection Line ($cm^2$) | 205 |
| | High Pressure Core Flooder ($cm^2$) | 92 |
| | Bottom head Drain Line ($cm^2$) | 20.3 |

## Table 14.3-3 Transient Analysis

| Tier 2 Entry | Parameter | Tier 2 Value |
|---|---|---|
| Table 15.0-1 | Reactor Internal Recirculation Pumps | |
| | Number of Pumps | 10 |
| | Pump Trip Inertia (kg•m$^2$) | |
| | Trip Mitigation (maximum) | 26.5 |
| | Accident (minimum) | 17.5 |
| | Relief Valve (Relief Function) | |
| | Capacity (% NBR Steam Flow at 7.89 MPaG) | 91.3 |
| | Number of Valves | 18 |
| | Opening Time (s)<br>(valve stroke time only. Does not include 0.1 s delay to energize solenoid) | 0.15 |
| | High Flux Trip Scram | ---- |
| | APRM Simulated Thermal Power Trip Scram | ---- |
| | Total Steamline Volume (m$^3$) | 113.2 |
| Table 15.0-6 | FMCRD Scram Times | |
| | 10% Rod Insertion (s) | 0.46 |
| | 40% Rod Insertion (s) | 1.208 |
| | 60% Rod Insertion (s) | 1.727 |
| | 100% Rod Insertion (s) | 3.719 |
| 15.1.1.2.2 | High Simulated Thermal Power Trip Scram | ---- |
| Table 15.1-5 | High Water Level 8 Initiates | |
| | Feedwater Pump Trip | ---- |
| Table 15.1-5 | Turbine Stop Valve Position Switches Initiate | |
| | Reactor Scram | ---- |
| | Trip of 4 RIPs | ---- |
| Table 15.1-7 | Low Water Level 2 Initiates | |
| | Trip of 6 RIPs | ---- |
| | RCIC System | ---- |
| | Maximum Startup Time ((s) -- includes 1.0 s for instrument delay) | 30 |
| | MSIV Closure on Low Turbine Inlet Pressure | ---- |
| 15.1.3.3.1 | MSIV Closure Time (s -- maximum isolation valve closing time plus 0.5 s for instrument delay) | 5.0 |

## Table 14.3-3 Transient Analysis (Continued)

| Tier 2 Entry | Parameter | Tier 2 Value |
|---|---|---|
| Table 15.1-9 | SRNM High Neutron Flux Scram | |
| 15.2.1.3.1 | TCV Full Stroke Servo Closure(s) | 2.5 |
| Table 15.2-1a | Low Water Level 3 Initiates Trip of 4 RIPs | ---- |
| Table 15.2-2 | High Dome Pressure Initiates Trip of 4 RIPs | ---- |
| Table 15.2-3 | T/G Load Rejection Initiates | |
| | Turbine Control Valve Fast Closure | ---- |
| | Turbine Bypass System Operation on High Pressure | ---- |
| | Fast Control Valve Closure Initiates | |
| | Scram | ---- |
| | Trip of 4 RIPs | ---- |
| 15.2.2.3.1 | TCV Full Stroke Fast Closure (s -- from normal operating position) | 0.08 |
| Table 15.2-6 | Turbine Trip Initiates | |
| | Turbine Control Valve Fast Closure | ---- |
| | Turbine Bypass System Operation on High Pressure | ----- |
| 15.2.3.3.1 | Turbine Stop Valve Full Stroke Closure (s) | 0.10 |
| Table 15.2-9 | MSIV Position Switches Initiate | |
| | Scram | ---- |
| 15.2.4.3.1 | Minimum MSIV Closure Time (s) | 3.0 |
| Table 15.2-14 | Low Condenser Vacuum Initiates | |
| | MSIV Closure | ---- |
| 15.2.6.1.1.2 | RIP M/G Set | |
| | Number of RIPs | 6 |
| | Length of Time Hold Original Speed (s) | 1.0 |
| | RIP Coastdown | |
| | Rate (% per s) | 10 |
| | Length of Time (s) | 2.0 |
| | Time of RIP Trip (s) | 3.0 |
| Table 15.2-17 | Low Water Level 3 Initiates Reactor Scram | ---- |
| 15.2.7.2.21 | Meets Single-failure Criterion | ---- |
| 15.2.9 | RHR System has 3 Independent Divisions | ---- |
| 15.3.1.1.1 | No More Than 3 RIPs on One Electrical Power Bus | ---- |
| 15.3.1.2.2.2 | Rapid Core Flow Coastdown Initiates Reactor Scram | ---- |

## Table 14.3-3 Transient Analysis (Continued)

| Tier 2 Entry | Parameter | Tier 2 Value |
|---|---|---|
| | Mode Switch in the **Refuel** Position | |
| 15.4.1.1.2.2 | Refueling Platform Cannot be Moved Over the Core If a Control Rod is Withdrawn and Fuel is on the Hoist | ---- |
| 15.4.1.1.2.3 | Only One or Two Control Rods Associated with the Same HCU Can Be Withdrawn | ---- |
| 15.4.1.2.1 | On Short Flux Period SRNMs Generate | |
| | Reactor Scram | ---- |
| 15.4.1.2.3.2 | FMCRD Withdrawal Speed (mm/s) | 30 |
| 15.4.2.1 | At Power the ATLM of the RCIS Prevents Rod Withdrawal Based on MCPR and APLHGR Limits | ---- |
| 15.4.4.1.1 | Overcurrent Protection Logic on the Electrical Bus Which Supplies the Power to the RIPs | ---- |
| 15.4.9.1 | FMCRD Designed to Prevent Rod Ejection | ---- |
| 15.4.10.1 | FMCRD Designed to Prevent Separation of Control Blade and Drive | ---- |

## Table 14.3-4 Radiological Analysis

| Tier 2 Entry | Parameter | Tier 2 Value |
|---|---|---|
| Table 15.6-5 | Maximum MSIV Closure Time (s) (Assumes 0.5 s for instrument delay.) | 5.0 |
| Table 15.6-8 | Primary Containment Leakage Rate (% per day) | 0.5 |
| | MSIV Total Leakage Rate for All Lines (L/M) @ Standard Conditions | 66.1 |
| | SGTS | |
| | Filter Efficiency Assumed for LOCA (%) | 97 |
| | Drawdown Time (min) | 20 |
| | Control Room | |
| | Recirculation Rates | |
| | Min. Charcoal Efficiency (%) | 95 |
| Table 15.7-8 | SGTS Filter Efficiency Assumed for Fuel Handling Accident (%) | 99 |

## Table 14.3-5 Overpressure Protection

| Tier 2 Entry | Parameter | Tier 2 Value |
|---|---|---|
| 5.2.2.1.4 | Direct Scram Signal Generated By: | |
| | Position Switches on | |
| | MSIVs | ---- |
| | Turbine Stop Valves | ---- |
| | Pressure Switches on | |
| | TCV Hydraulic Actuation System Dump Valve | ---- |
| Table 5.2-2 | Scram Signal on | |
| | High Flux | ---- |
| | Recirculation Pump Trip on | |
| | High Vessel Pressure | ---- |
| Table 5.2-3 | Safety/Relief Valve | |
| | Spring Set Pressure | |
| | 2 SRVs MPaG | 7.92 |
| | Capacity per valve (kg/h) (103% Spring Set Pressure) | 395000 |
| | 4 SRVs (MPaG) | 7.99 |
| | Capacity per valve (kg/h) (103% Spring Set Pressure) | 399000 |
| | 4 SRVs (MPaG) | 8.06 |
| | Capacity per valve (kg/h) (103% Spring Set Pressure) | 402000 |
| | 4 SRVs (MPaG) | 8.13 |
| | Capacity per valve (kg/h) (103% Spring Set Pressure) | 406000 |
| | 4 SRVs (MPaG) | 8.20 |
| | Capacity per valve (kg/h) (103% Spring Set Pressure) | 409000 |
| | No. of Valves | 18 |
| Figure 5.2-1 | SRV Safety Function Opening Time (s) | 0.3 |

## Table 14.3-6 Flooding Protection

| Tier 2 Entry | Parameter | Tier 2 Value |
|---|---|---|
| | Reactor and Control Building Flood Protection (from External Sources) | |
| Table 3.4-1 | All Penetrations Below Grade Watertight | ---- |
| | Pipe Penetrations Below Design Flood Level Will Be Sealed Against Hydrostatic Head Inside Tunnel or Connecting Building | |
| | Watertight Doors installed on All Access Ways Below Design Flood Level | |
| 3.4.1.1.1 | Min. Wall Thicknesses Below Design Flood Level (m) | 0.61 |
| | Piping Tunnels Below Grade do not Penetrate Exterior Walls | ---- |
| | Reactor Building Flood Protection (from Internal Sources) | |
| 3.4.1.1.2 | All Piping, Vessels and Head Exchangers with Flooding Potential are Seismically Analyzed | |
| | Standby Liquid Control System | ---- |
| | Residual Heat Removal System | ---- |
| | High Pressure Core Flooder System | ---- |
| | Reactor Core Isolation Cooling System | ---- |
| | Reactor Building Cooling Water System | ---- |
| | HVAC Emergency Cooling Water Sys. | ---- |
| | Reactor Service Water System | ---- |
| | Fire Protection System | ---- |
| | Oil Storage and Transfer System | ---- |
| | Main Steamlines (Inside Reactor Bldg) | ---- |
| | Feedwater lines (Inside Reactor Bldg) | ---- |
| | Water Sensitive Safety-Related Equipment Raised Off the Floor (mm) | |
| | All Rooms With a Potential for Flooding Are Supplied With Floor Drains | ---- |
| | MSIVs Automatically Close on High Temperature in Main Steamline Tunnel | ---- |
| 3.4.1.1.2.1.1 | Evaluation of Floor 100 (B3F) | |

## Table 14.3-6 Flooding Protection (Continued)

| Tier 2 Entry | Parameter | Tier 2 Value |
|---|---|---|
| | Watertight Doors on Compartments Containing ECCS Equipment | ---- |
| | Watertight Doors have Open/Close Status Indicator Lights and Alarms in MCR | ---- |
| 3.4.1.1.2.1.2 | Evaluation of Floor 200 (B2F) | |
| | RHR Pressure Lines Inside Pipe Chases | ---- |
| | Minimum Floor Spread Area ($m^2$) | 300 |
| 3.4.1.1.2.1.3 | Evaluation of Floor 300 (B1F) | |
| | (No Additional Requirements) | |
| 3.4.1.1.2.1.4 | Evaluation of Floor 400 (1F) | |
| | RHR, HPCF and RCIC Lines in Pipe Chases | ---- |
| | Foam Sprinkler System in Diesel Generator Areas | ---- |
| 3.4.1.1.2.1.5 | Evaluation of Floor 500 (2F) | |
| | Divisional DG Equipment Areas are Separated and Mechanically Isolated from Each Other | ---- |
| | FPC Pools<br>Seismic Category I | ---- |
| | Steamline Tunnel Area Isolated by Sealed Doors and Firewalls | ---- |
| 3.4.1.1.2.1.6 | Evaluation of Floor 600 (3F) | |
| | Foam Sprinkler System in (Fuel Storage) Day Tank Areas | ---- |
| 3.4.1.1.2.1.7 | Evaluation of Floor 700 (M4F) | |
| | (No Additional Requirements) | |
| 3.4.1.1.2.1.8 | Evaluation of Floor 800 (4F) | |
| | Each RCW Surge Tank A,B & C and Its Associated Piping Is in a Separate Compartment | ---- |
| 3.4.1.1.2.2 | Control Building Flood Protection (from Internal Sources) | |
| | No Openings into the Control Building from the Steam Tunnel | ---- |
| | Steam Tunnel Sealed At the Reactor Building End | ---- |
| | All Rooms with a Potential for Flooding Are Supplied With Floor Drains | ---- |
| | High Water Level Sensors in RCW/RSW Heat Exchanger Room | |
| | Powered by Class 1E Power Supply | ---- |
| | Automatically Close RSW Isolation Valves and Stop Pumps | ---- |

## Table 14.3-6 Flooding Protection (Continued)

| Tier 2 Entry | Parameter | Tier 2 Value |
|---|---|---|
| | Water Tight Doors on RCW/RSW Heat Exchanger Rooms | ---- |
| | Redundant Mechanical Functions are Physically Separated | ---- |
| | Water Sensitive Safety-Related Equipment Raised Off the Floor (mm) | 200 |
| 3.4.1.1.2.3 | Radwaste Building Flood Protection (from Internal Sources) | |
| | Seismic Category I Substructure | ---- |
| 3.4.1.1.2.4 | Service Building Flood Protection (from Internal Sources) | |
| | Watertight Doors on Access Corridors | ---- |
| | Turbine Building Flood Protection (from Internal Sources) | |
| | Normally Closed Alarmed Door in Passage From Service Building | ---- |
| | High Water Level in Condenser Pit Automatically Shuts Down Circulating Water System | ---- |

## Table 14.3-7 Fire Protection

| Tier 2 Entry | Parameter | Tier 2 Value |
|---|---|---|
| 9A.2.4 | Electrical Cable Fire-stops Have Fire Rating Equal to Rating of Barrier They Penetrate | ---- |
| | Control, Power or Instrument Cables of Systems Having Similar Safety Related or Shutdown Functions are Located in Separate Fire-resistive Enclosures. | ---- |
| | A Minimum of Two Fire Suppression Means is Available to Each Fire Area | ---- |
| 9A.4.1.1.1 | Drywell Inerted During Plant Operation | ---- |
| | Drywell Has Primary Containment Supply/Exhaust System | ---- |
| 9A.4.1.1.2 | Wetwell Inerted During Plant Operation | ---- |
| | Wetwell Has Spray System | ---- |
| Appendix 9A | Systems Having Similar Safety Related or Shutdown Functions are Located in Separate Fire-resistive Enclosures. | ---- |
| Appendix 9A | A Means of Fire Detection, Alarming and Suppression is Provided and Accessible. | ---- |
| | Fire Stops Are Provided for Cable Tray and Piping Penetrations Through Rated Fire Barriers | ---- |
| | Alternate Means of Access and Egress are Provided by a Separate Stair Tower, Elevator or Corridor | ---- |

## Table 14.3-8 ATWS Analysis

| Tier 2 Entry | Parameter | Tier 2 Value |
|---|---|---|
| | **Nominal Initial Operating Conditions** | |
| Table 15E-2 | Minimum Suppression Pool Volume ($m^3$) | 3580 |
| | **Equipment Performance Characteristics** | |
| 15.8.2 | Minimum SLCS Capacity(L/min) | 378 |
| Table 15E-3 | Minimum Closure Time of MSIV (s) | 3.0 |
| | Relief Valve | |
| | Capacity (%NBR Steam Flow at 7.89 MPaG) | 91.3 |
| | Number of Valves | 18 |
| | Opening Time (s)<br>(Valve stroke time only. Does not include 0.1s delay to energize solenoid.) | 0.15 |
| Table 15E-3 | Reactor Core Isolation Cooling System | |
| | Min. Rated Flow (kg/h) | 50.4 |
| | At Vessel Pressures (MPaD -- vessel to the air space of the compartment containing the water source for the pump suction) | 8.12 to 1.03 |
| | Initiates on Low Water Level | ---- |
| | Maximum Allowable Time Delay from Initiating Signal to Rated Flow Available and Injection Valve Fully Open (s) | 29.0 |
| | High Pressure Core Flooder System | |
| | Number of Subsystems | 2 |
| | Minimum Rated Flows (kg/s per subsystem) | 50.4 to 201.6 |
| | At Vessel Pressures (MPaD -- vessel to the air space of the compartment containing the water source for the pump suction) | 8.12 to 0.69 |
| | Initiates on Low Water Level | ---- |
| | Injection Terminated on High Water Level | ---- |
| | Maximum Allowable Time Delay from Initiating Signal to Rated Flow Available and Injection Valve Fully Open (Does not include diesel start time and Loading sequence --s) | 20.0 |
| | Nominal Recirculation Pump System Inertia (kg•$m^2$) | 21.5 |
| | Maximum Electro-Hydraulic Control Rod Insertion Time (s) | 135 |
| | Total Minimum RHR Pool Cooling Capacity For 3 Subsystems (MJ/s•°C) | 1.11 |

## Table 14.3-8 ATWS Analysis (Continued)

| Tier 2 Entry | Parameter | Tier 2 Value |
|---|---|---|
| | MSIV Closure Initiated on Low Water Level | ---- |
| | MSIV Closure Initiated on Low Main Steamline Inlet Pressure to Turbine | ---- |
| | **ATWS Logic and Setpoints** | |
| 15E.4 | ARI and FMCRD Run-in Initiated on | |
| | High Dome Pressure | ---- |
| | or | |
| | Low Water Level 2 | ---- |
| | SLCS Initiated on an ATWS Trip Signal | ---- |
| | ATWS Trip Signals for SLCS Initiation | |
| | High Dome Pressure | ---- |
| | and | |
| | SRNM ATWS permissive | ---- |
| | Analytical Time Delay (minutes) | 3 |
| | or | |
| | Low Water Level 2 | ---- |
| | and | |
| | SRNM ATWS permissive | ---- |
| | Analytical Time Delay (minutes) | 3 |
| | or | |
| | Manual ARI/FMCRD Run-in Signals | ---- |
| | and | |
| | SRNM ATWS permissive | ---- |
| | Analytical Time Delay (minutes) | 3 |
| | RPT (RIPs not Connected to M/G Set) Initiated on | |
| | High Dome Pressure | ---- |
| | **ATWS Logic and Setpoints** | |
| 15E.4 | RPT (RIPs Connected to M/G Set) Initiated on | |
| | Low Water Level 2 | ---- |
| | Recirculation Runback Initiated on | |
| | Any Scram Signal | ---- |
| | or | |

## Table 14.3-8 ATWS Analysis (Continued)

| Tier 2 Entry | Parameter | Tier 2 Value |
|---|---|---|
| | Any ARI/FMCRD Run-in Signal | ---- |
| | Feedwater Runback Initiated on an ATWS Trip Signal | ---- |
| | ATWS Trip Signals for Feedwater Runback | |
| | High Dome Pressure | ---- |
| | and | |
| | SRNM ATWS permissive | ---- |
| | Analytical Time Delay (minutes) | 2 |
| | ADS Inhibit | ---- |
| | Automatic Initiation of ADS is Inhibited Unless | |
| | Low Reactor Water Level 1.5 | ---- |
| | and | |
| | APRM ATWS permissive | ---- |

## Table 14.3-9 Generic Safety Issues

| Tier 2 Entry | Parameter | Tier 2 Value |
|---|---|---|
| 19B.2-2 | A-1: Water Hammer | |
| | Steam Supply System Designed to Accommodate Steam Hammer | ---- |
| | MSL Designed for Dynamic Loadings Due to Fast Closing of the Turbine Stop Valves | ---- |
| | RCIC System | |
| | MUWC to Keep System Filled | ---- |
| | HPCF System | |
| | MUWC to Keep System Filled | ---- |
| | RHR System | |
| | Jockey Pump to Keep System Filled | ---- |
| 19B.2-3 | A-7: MARK I Long-Term Program | |
| | Vacuum Breakers | |
| | Swing Check Type Valves | ---- |
| | Open Passively on Negative Differential Pressure | ---- |
| | Require No External Power to Actuate | ---- |
| | Installed Horizontally Through Pedestal Wall | ---- |
| 19B.2-4 | A-8: MARK II Containment Pool Dynamic Loads Long-Term Program | |
| | (Refer to response to 19B.2-3) | |
| 19B.2-5 | A-9: ATWS | |
| | Alternate Rod Insertion Feature Diverse and Independent From RPS | ---- |
| | Electric Insertion of FMCRD Feature Diverse and Independent From RPS | ---- |
| | Recirculation Pump Trip on ATWS Signal | ---- |
| | Automatic Initiation of SLC on ATWS Signal | ---- |
| 19B.2-8 | A-24: Qualification of Class 1E Safety Related Equipment | |
| | All Class 1E Electrical Equipment is Environmentally, Dynamically and Seismically Qualified | ---- |
| 19B.2.-9 | A-25: Non-Safety Loads on Class 1E Power Sources | |
| | Non-Class 1E Loads not Connected to Class 1E Loads Except FMCRD Loads | ---- |
| | Class 1E Load Breakers in Division I Between Class 1E Power and Non-Class 1E FMCRD Loads | ---- |

## Table 14.3-9 Generic Safety Issues (Continued)

| Tier 2 Entry | Parameter | Tier 2 Value |
|---|---|---|
| 19B.2-10 | A-31: Residual Heat Removal (RHR) Shutdown Requirements | |
| | RHR System Composed of 3 Electrically And Mechanically Independent Divisions | ---- |
| | Shutdown Cooling Can Be Manually Initiated from the Control Room | ---- |
| | RHR System Can Be powered from Both Offsite and Standby Emergency Electrical Power | ---- |
| 19B.2-11 | A-35: Adequacy of Offsite Power Systems | |
| | Equipment Qualified for Operation with Voltage up to 10% Less than Normal | ---- |
| 19B.2.12 | A-36: Control of Heavy Loads Near Spent Fuel | |
| | Equipment Handling Components Meet Single Failure Criteria | ---- |
| | Redundant Safety Interlocks and Limit Switches Prevent Heavy Loads Over Spent Fuel | ---- |
| 19B.2.13 | A-39: Determination of Safety Relief Valve Pool Dynamic Loads and Temperature Limits | |
| | Each S/RV Discharge Pipe Fitted with an X-Quencher | ---- |
| 19B.2-16 | A-44: Station Blackout | |
| | Sources of Electrical Power | |
| | No. of Standby Turbine Generators | 1 |
| | No. of Emergency Diesel Generators | 3 |
| 19B.2-17 | A-47: Safety Implications of Control Systems | |
| | Feedwater Controller | |
| | Trip Feedpumps on High Water Level | ---- |
| | Fault Tolerant Through Redundant Micro-processors and Self Diagnostics | ---- |
| 19B.2-18 | A-48: Hydrogen Control Measures and Effects of Hydrogen Burns on Safety Equipment | |
| | Containment Inerted During Normal Operation | ---- |
| | Permanently Installed Hydrogen Recombiners | ---- |
| 19B.2-20 | B-17: Criteria for Safety-Related Operator Actions | |
| | RHR Heat Exchanger in LPCI Injection Loop | ---- |
| 19B.2-22 | B-55: Improved Reliability of Target Rock Safety/Relief Valves | |
| | ABWR Uses a Direct Acting S/RV Design | ---- |

## Table 14.3-9 Generic Safety Issues (Continued)

| Tier 2 Entry | Parameter | Tier 2 Value |
|---|---|---|
| 19B.2-23 | B-56: Diesel Reliability | |
| | Independent Diesel Generators | 3 |
| | Combustion Turbine Generator | 1 |
| 19B.2-24 | B-61: Allowable ECCS Equipment Outage Periods | |
| | ECCS Capable of Being Tested During Plant Operation | |
| | RCIC | ---- |
| | HPCF | ---- |
| | RHR | ---- |
| 19B.2-25 | B-63: Isolation of Low Pressure Systems Connected to the Reactor Coolant Pressure Boundary | |
| | Boundary Valves Designed, Fabricated and Tested According to ASME B&PV Code, Section III | |
| | RHR System | ---- |
| | HPCF System | ---- |
| | RCIC System | ---- |
| | CRD System | ---- |
| | SLC System | ---- |
| | CUW System | ---- |
| | Nuclear Boiler System | ---- |
| | Reactor Recirculation System | ---- |
| 19B.2-26 | B-66: Control Room Infiltration Measurements | |
| | Normal AC Filtration Units | |
| | Number of Divisions | 2 |
| | Mechanically and Electrically Separate | ---- |
| | Number of Outdoor Air Intake | 2 |
| | Automatic Switch-over to Emergency Units on High Radiation in Air Intake | ---- |
| | Emergency Filtration Units | |
| | Number of Units | 2 |
| | Mechanically and Electrically Separate | ---- |
| | Provisions to Detection | |
| | Smoke | ---- |
| | Airborne Radioactive Material | ---- |

## Table 14.3-9 Generic Safety Issues (Continued)

| Tier 2 Entry | Parameter | Tier 2 Value |
|---|---|---|
| | Provisions to Remove Smoke and Airborne Radioactive Material | ---- |
| 19B.2-27 | C-1: Assurance of Continuous Long Term Capability of Hermetic Seals on Instrumentation and Electrical Equipment | |
| | Safety-related Electrical Equipment is Environmentally Qualified in Accordance with NRC Guidance Including NUREG-0588 | ---- |
| 19B.2-28 | C-10: Effective Operation of Containment Sprays in a LOCA | |
| | SGTS | |
| | Redundant | ---- |
| | Filters Gaseous Effluent from Primary and Secondary Containment | ---- |
| | No. of RHR Subsystems Which Provide Containment Spray | 2 |
| | Sprays Manually Initiated by Operator | ---- |
| | Sprays Automatically Terminated When LPFL Injection Valve Open | ---- |
| | High Drywell Pressure Interlock On Drywell Spray Operation | ---- |
| 19B.2-30 | 15: Radiation Effects on Reactor Vessel Supports | |
| | Vessel Support Skirt Located Below Core Beltline | ---- |
| | Wide Water Flow Region Between Shroud and Vessel Wall | ---- |
| 19B.2-32 | 25: Automatic Air Header Dump on BWR Scram System | |
| | Scram Initiated by Low Pressure in the Common Header Supplying the Charging Water to the Scram Accumulators | ---- |
| 19B.2-33 | 40: Safety Concerns Associated with Pipe Breaks in the BWR Scram System | |
| | Ball-check Valve in the FMCRD Flange Housing at Connection of the Insert Line with the Drive Scram Port | ---- |
| 19B.2-35 | 51: Proposed Requirements for Improving the Reliability of Open Cycle Service Water Systems | |
| | A Closed Cooling Water System Will Be Utilized which Transfers Heat Loads Via Heat Exchanger to Service Water System | ---- |
| | The Safety-Related Portions of the RCW and RSW Will Operate as Designed | |
| | Assuming Loss of All Offsite Power | ---- |
| | Assuming Any Single Failure | ---- |

## Table 14.3-9 Generic Safety Issues (Continued)

| Tier 2 Entry | Parameter | Tier 2 Value |
|---|---|---|
| 19B.2-36 | 057: Effects of Fire Protection Systems Actuation on Safety-Related Equipment | |
| | A Means of Fire Detection is Provided | ---- |
| | All Rooms in the Reactor and Control Buildings with a Potential for Flooding Are Supplied With Floor Drains | ---- |
| | Safety-Related Equipment Raised Off the Floor | ---- |
| | Safety-Related Divisions | |
| | Number | 3 |
| | Mechanically and Electrically Independent | ---- |
| 19B.2-37 | 67.3.3: Improved Accident Monitoring | |
| | Plant Post Accident Monitoring Variables | |
| | Neutron Flux | ---- |
| | Control Rod Position | ---- |
| | Boron Concentration | ---- |
| | Reactor Coolant System Pressure | ---- |
| | Drywell Pressure | ---- |
| | Drywell Sump Level | ---- |
| | Coolant Level in Reactor | ---- |
| | Suppression Pool Water Level | ---- |
| | Containment Area Radiation | ---- |
| | Primary Containment Pressure | ---- |
| | Primary Containment Isolation Valve Position | ---- |
| | Coolant Gama | ---- |
| | Coolant Radiation | ---- |
| | RHR Flow | ---- |
| | HPCF Flow | ---- |
| | RHR Heat Exchanger Outlet Temp | ---- |
| | RCIC Flow | ---- |
| | SLC Pressure | ---- |
| | SLCS Storage Tank Level | ---- |
| | SRV Position | ---- |
| | Feedwater Flow | ---- |
| | Standby Energy Status | ---- |

## Table 14.3-9 Generic Safety Issues (Continued)

| Tier 2 Entry | Parameter | Tier 2 Value |
|---|---|---|
| | Suppression Pool Water Temp | ---- |
| | Drywell Air Temperature | ---- |
| | Drywell/Containment Hydrogen Concentration | ---- |
| | Drywell/Containment Oxygen Concentration | ---- |
| | Primary Containment Air Temp | ---- |
| | Secondary Containment Airspace (effluent) Radiation Noble Gas | ---- |
| | Containment Effluent Radioactivity - Noble Gas | ---- |
| | Condensate Storage Tank Level | ---- |
| | Cooling Water Temperature to ESF System Components | ---- |
| | Cooling Water Flow to ESF System Components | ---- |
| | Emergency Ventilation Damper Position | ---- |
| | Service Area Radiation Exposure Rate | ---- |
| | Purge Flows - Noble Gases and Vent Flow Rate | ---- |
| | Identified Release points - Particulates and Halogens | ---- |
| | Airborne Radio Halogens and Particulates | ---- |
| 19B.2-38 | 75: Generic Implications of ATWS Events at Salem Nuclear Plant | |
| | Separate Scram Groups | 4 |
| | Solid State Load Drivers Per Scram Group | 8 |
| | Contactors for Manual Scram Per Scram Group | 2 |
| 19B.2-40 | 83: Control Room Habitability | |
| | Control Room HVAC Filtration System | ---- |
| | Control Room Designed to Withstand Effects of Natural Phenomena | ---- |
| | Fire Alarm System Provided | ---- |
| | Fire Hoses and Portable Fire Extinquishers Available | ---- |
| 19B.2-42 | 87: Failure of HPCI Steam Line Without Isolation | |
| | Opening and/or Closing of Installed MOVs Used for Isolation of CUW and RCIC Will be Conducted Under Preoperational Differential Pressure, Fluid Flow and Temperature Conditions | ---- |
| | Flow Restrictor in CUW Main Suction Line | ---- |

## Table 14.3-9 Generic Safety Issues (Continued)

| Tier 2 Entry | Parameter | Tier 2 Value |
|---|---|---|
| | Bottom Head Drainline Tees into CUW Suction Line at an Elevation Above TAF | ---- |
| 19B.2-44 | 103: Design For Probable Maximum Precipitation | |
| | Design Maximum Rainfall Rate (cm/h) | 49.3 |
| | Design Maximum Short Term Rate (cm/5 min) | 15.7 |
| 19B.2-45 | 105: Interfacing System LOCA at BWRs | |
| | Design Pressure of Some Low Pressure Components Upgraded to 2.82 MPaG | |
| | RHR System | ---- |
| | HPCF System | ---- |
| | RCIC System | ---- |
| | CRD System | ---- |
| | SLC System | ---- |
| | CUW System | ---- |
| 19B.2-48 | 118: Tendon Anchorage Failure | |
| | Primary Containment Structure is of a Reinforced Concrete Design | ---- |
| 19B.2-49 | 120: On-Line Testability of Protection Systems | |
| | Manual and Automatic Testability of RPS, LDIS and ECCS Initiation Logic During Reactor Operation | ---- |
| 19B.2-50 | 121: Hydrogen Control for Large, Dry PWR Containment | |
| | (Not Applicable to BWRs and Pressure Suppression Containment) | |
| | Containment Inerted During Normal Operation | ---- |
| 19B.2-52 | 128: Electrical Power Reliability | |
| | Four Separate and Independent Class 1E dc Divisions | |
| | No Power Supplied to Non-Class 1E Loads | |
| 19B.2-53 | 142: Leakage Through Electrical Isolators in Instrument Circuits | |
| | Fiber Optic Isolation Devices Used for Electrical Isolation of Logic Level and Analog Signals | ---- |
| 19B.2-54 | 143: Availability of Chilled Water Systems and Room Cooling | |
| | Safety-Related HECW System Provides Chilled Water to Main Control Room Air Conditioning, DG zone Coolers and Control Building Essential Electrical Equipment | ---- |

## Table 14.3-9 Generic Safety Issues (Continued)

| Tier 2 Entry | Parameter | | Tier 2 Value |
|---|---|---|---|
| | | Essential Equipment HVAC System Provides Controlled Temperature Environment for Safety-Related Equipment Under Accident Conditions | ---- |
| 19B.2-57 | 153: Loss of Essential Service Water in Light-Water Reactors | | |
| | | RSW Divisions | |
| | | Total Number | 3 |
| | | Physically and Electrically Separate | ---- |
| | | RCW Heat Exchangers per Division | 3 |
| 19B.2.59 | A-17: Systems Interaction in Nuclear Power Plants | | |
| | | Redundant Safety-Related Equipment and Systems Divisionally Separated | ---- |
| | | Redundant Electrical Power Systems Divisionally Separated | ---- |
| | | Divisions Designed Against Intra-Divisional Flooding | ---- |
| 19B.2.60 | A-29: Nuclear power Plant Design for the Reduction of Vulnerability to Industrial Sabotage | | |
| | | Redundant Safety-Related Equipment and Systems Divisionally Separated | ---- |
| | | Redundant Electrical Power Systems Divisionally Separated | ---- |
| | | Controlled Access to Safety-Related Areas | ---- |
| 19B.2.61.1 | C-8 | Main Steam Line Leakage Control System | |
| | | Main Steamlines and All Branch Lines are Designed to Withstand SSE | ---- |
| | | Non-Safety Main Steam and Bypass Lines at the Turbine Designed to Maintain Structural Integrity Following SSE | ---- |
| | | Condenser Anchorage Designed to Survive SSE | ---- |
| 19B.2.62 | 029: Bolting Degradation or Failure in Nuclear Power Plants | | |
| | | RCPB Component Fabricated, Tested and Installed in Accordance with ASME Code, Sections III and XI | ---- |
| 19B.2.63 | 82: Beyond Design Basis Accidents in Spent Fuel Pools | | |
| | | Spent Fuel Pool | |
| | | Seismic Category 1 | ---- |
| | | Low Water Level Alarm | ---- |
| | | Over-Flow Weirs to Skimmer | ---- |
| | | Check Valve in Discharge Line | ---- |

## Table 14.3-10 TMI Issues

| Tier 2 Entry | Parameter | Tier 2 Value |
|---|---|---|
| 19A.2.17 | I.D.3 Safety System Status Monitoring | |
| | Automatic Indication of Bypassed and Inoperable Status of Safety Systems | ---- |
| 19B.2.65 | I.D.5(2) Plant Status and Post-Accident Monitoring | |
| | Post-Accident Information Available to the Operator is in Compliance with RG 1.97 | ---- |
| 19B.2.66 | I.D.5(3) On-Line Reactor Surveillance System | |
| | ABWR Design Incorporates a Reactor Vessel Loose Parts Monitoring System | ---- |
| 1A.2.5 | II.B.1 Reactor Coolant System Vents | |
| | Steam-Driven RCIC | 1 |
| | Power-Operated Relief Valves | |
| | Number | 18 |
| | Dual Position Indication | |
| | Position Sensors | ---- |
| | SRV Discharge Temperature Elements | ---- |
| | Remotely Operable from the Control Room | ---- |
| 1A.2.6 | II.B.2 Plant Shielding to Provide Access to Vital Areas and Protect Safety Equipment for Post-Accident Operation | |
| | Vital Areas as per NUREG-0737 Accessible Post-LOCA | |
| | Continuous Occupancy | ---- |
| | Non-Continuous Occupancy | ---- |
| 1A.2.7 | II.B.3 Post-Accident Sampling | |
| | Able to Obtain Samples Under Accident Conditions | ---- |
| 19A.2.21 | II.B.8 Rulemaking Proceeding on Degraded Core Accidents | |
| | Inerted Primary Containment | ---- |
| | Permanently-Installed Recombiners | ---- |
| 1A.2.9 | II.D.1 Testing Requirements | |
| | SRVs Qualified for Steam Discharge | ---- |
| | Redundant Logic to Respond to High Water Level Conditions | ---- |
| | RHR Shutdown Cooling Systems | |
| | Number | 3 |
| | Separate Vessel Penetration and Suction Lines | ---- |

## Table 14.3-10 TMI Issues (Continued)

| Tier 2 Entry | Parameter | Tier 2 Value |
|---|---|---|
| 1A.2.10 | II.D.3 Relief and Safety Valve Position Indication | |
| | Dual Position Indication | |
| | Position Sensors | ---- |
| | SRV Discharge Temperature Elements | ---- |
| 1A.2.13 | II.E.4.1 Dedicated Penetrations | |
| | Recombiners in Secondary Containment | |
| | Number | 2 |
| | Permanently Installed | ---- |
| 1A.2.14 | II.E.4.2 Isolation Dependability | |
| | Diverse Containment Isolation Signals | ---- |
| | Non-Essential Systems | |
| | Automatically Isolated On Containment Isolation Signal | ---- |
| | Redundant Isolation Valves | ---- |
| | Resetting Isolation Signal Does Not Automatically Reopen Isolation Valves | ---- |
| | Containment Purge and Vent Valves | |
| | Close on Isolation Signals | ---- |
| | Fail Closed | ---- |
| | Close on High Radiation | ---- |
| 19A.2.27 | II.E.4.4 Purging | |
| | Drywell Has Primary Containment Supply/Exhaust System | ---- |
| 1A.2.15 | II.F.1 Additional Accident Monitoring Instrumentation | |
| | Plant Post Accident Monitoring Variables | |
| | Neutron Flux | ---- |
| | Control Rod Position | ---- |
| | Boron Concentration | ---- |
| | Reactor Coolant System Pressure | ---- |
| | Drywell Pressure | ---- |
| | Drywell Sump Level | ---- |
| | Coolant Level in Reactor | ---- |
| | Suppression Pool Water Level | ---- |
| | Containment Area Radiation | ---- |

## Table 14.3-10 TMI Issues (Continued)

| Tier 2 Entry | Parameter | Tier 2 Value |
|---|---|---|
| | Primary Containment Pressure | ---- |
| | Primary Containment Isolation Valve Position | ---- |
| | Coolant Gama | ---- |
| | Coolant Radiation | ---- |
| | RHR Flow | ---- |
| | HPCF Flow | ---- |
| | RHR Heat Exchanger Outlet Temp | ---- |
| | RCIC Flow | ---- |
| | SLC Pressure | ---- |
| | SLCS Storage Tank Level | ---- |
| | SRV Position | ---- |
| | Feedwater Flow | ---- |
| | Standby Energy Status | ---- |
| | Suppression Pool Water Temp | ---- |
| | Drywell Air Temperature | ---- |
| | Drywell/Containment Hydrogen Concentration | ---- |
| | Drywell/Containment Oxygen Concentration | ---- |
| | Primary Containment Air Temp | ---- |
| | Secondary Containment Airspace (effluent) Radiation Noble Gas | ---- |
| | Containment Effluent Radioactivity - Noble Gas | ---- |
| | Condensate Storage Tank Level | ---- |
| | Cooling Water Temperature to ESF System Components | ---- |
| | Cooling Water Flow to ESF System Components | ---- |
| | Service Area Radiation Exposure Rate | ---- |
| | Purge Flows - Noble Gases and Vent Flow Rate | ---- |
| | Identified Release points - Particulates and Halogens | ---- |
| | Airborne Radio Halogens and Particulates | ---- |
| 1A.2.16 | II.F.2 Identification of and Recovery from Conditions Leading to Inadequate Core Cooling | |
| | Reactor Wide Range Water Level | |
| | Number of Divisions | 4 |
| | Number of Sensors per Division | 2 |

## Table 14.3-10 TMI Issues (Continued)

| Tier 2 Entry | Parameter | Tier 2 Value |
|---|---|---|
| | Number of Sets of Sensing Lines per Division | 1 |
| | Trip Logic per Set of Sensors | 2 / 4 |
| | Number of Sets of Sensors | 2 |
| 1A.2.17 | II.F.3 Instrumentation for Monitoring Accident Conditions | ---- |
| 1A.2.18 | II.K.1(5) Safety-Related Valve Position Description | ---- |
| 1A.2.20 | Describe Automatic and Manual Actions for Proper Functioning of Auxiliary Heat Removal Systems when FW System not Operable | |
| | Reactor Scram on Low Water Level | ---- |
| | RCIC System | |
| | Initiates on Low Water Level | ---- |
| | Terminates Injection on High Water Level | ---- |
| | Restarts on Low Water Level | ---- |
| | RPV Pressure Controlled by | |
| | Main Turbine Bypass Valves | ---- |
| | Safety Relief Valves | ---- |
| | Discharge to Suppression Pool | ---- |
| | RHR Systems has Manual Pool Cooling Mode | ---- |
| | HPCF Systems | |
| | Initiates on Low Water Level | ---- |
| | ADS | |
| | Initiates on Low Water Level | ---- |
| | RHR - LPFL Mode | |
| | Initiates on Low Water Level | ---- |
| 1A.2.21 | II.K1(23) Describe Uses and Types of RV Level Indication for Automatic and Manual Initiation of Safety Systems | |
| | Shutdown Water-Level Measurement | |
| | Range | |
| | Top of RPV | ---- |
| | Bottom of Dryer Skirt | ---- |
| | Narrow Water-Level Measurement | |
| | Range | |
| | Above Main Steam Outlet Nozzle | ---- |
| | Bottom of Dryer Skirt | ---- |

## Table 14.3-10 TMI Issues (Continued)

| Tier 2 Entry | Parameter | Tier 2 Value |
|---|---|---|
| | Low Water Level 3 Automatic Initiation | |
| | Reactor Scram | ---- |
| | RHR Shutdown Cooling Isolation | ---- |
| | Containment Isolation | ---- |
| | Wide Water-Level Measurement | |
| | Range | |
| | Above Main Steam Outlet Nozzle | ---- |
| | Top of Active Fuel | ---- |
| | Low Water Level 2 Automatic Initiation | |
| | RCIC | ---- |
| | CUW Isolation | ---- |
| | Low Water Level 1.5 Automatic Initiation | |
| | HPCF | ---- |
| | MSIV Closure | ---- |
| | Drywell Cooling System Isolation | ---- |
| | Low Water Level 1 Automatic Initiation | |
| | ADS | ---- |
| | RHR-LPFL | ---- |
| | Fuel-Zone Water-Level Measurement Range | |
| | Above Main Steam Outlet Nozzle | ---- |
| | Above RIP Deck | ---- |
| 1A.2.22 | II.K.3(13) Separation of HPCS and RCIC System Initiation Levels | |
| | RCIC System | |
| | Initiates on Low Water Level | ---- |
| | Terminates Injection on High Water Level | ---- |
| | Restarts on Low Water Level | ---- |
| | HPCF System | |
| | Initiates on Low Water Level | ---- |
| | Terminates Injection on High Water Level | ---- |
| | Restarts on Low Water Level | ---- |
| 1A.2.23 | II.K.3(15) Modify Break Detection Logic to Prevent Spurious Isolation of HPCI and RCIC Systems | |

## Table 14.3-10 TMI Issues (Continued)

| Tier 2 Entry | Parameter | Tier 2 Value |
|---|---|---|
| | RCIC has a Bypass Start System | ---- |
| 1A.2.24 | II.K.3(16) Reduction of Challenges and Failures of Safety Relief Valves - Feasibility Study and System Modification | |
| | Elimination of Pilot Operated Relief Valves | ---- |
| | Redundant Solid State Logic | ---- |
| | Pressure Relief Mode Operation is Direct Opening Against Spring Force | ---- |
| 1A.2.26 | II.K.3(18) Modification of ADS Logic-Feasibility Study and Modification for Increased Diversity of Some Event Sequences | |
| | High Drywell Pressure Bypass Timer (minutes) | 8 |
| | Initiates on Low Water Level | ---- |
| 1A.2.28 | II.K.3(22) Automatic Switchover of RCIC System Suction - Verify Procedures and Modify Design | |
| | RCIC Automatically Switches Pump Suction Source From CSP to Suppression Pool | ---- |
| | Switchover Signals | |
| | Low CSP Water Level | ---- |
| | or | |
| | High Suppression Pool Level | ---- |
| 1A.2.29 | II.K.3(24) Confirm Adequacy of Space Cooling Study for HPCI and RCIC Systems | |
| | Individual Room Safety Grade Cooling Units | |
| | RCIC | ---- |
| | HPCF | ---- |
| | Separate Essential Electrical Power Supples | |
| | RCIC | ---- |
| | HPCF | ---- |
| 1A.2.30 | II.K.3(25) Effect of Loss of AC Power on Pump Seals | |
| | RCW and RSW Pumps Automatically Loaded to D / Gs Following LOPP | ---- |
| 19B.2.71 | II.K.3(27) Provide Common Reference Level for Vessel Instrumentation | |
| | For ABWR the Common Reference for the Reactor Vessel Water Level is at the Top of the Active Fuel | ---- |

## Table 14.3-10 TMI Issues (Continued)

| Tier 2 Entry | Parameter | Tier 2 Value |
|---|---|---|
| 1A.2.31 | II.K.3(28) Study and Verify Qualification of Accumulators on ADS Valves | |
| | Accumulator Sized to Provide One ADS Actuation with Drywell at Design Pressure | ---- |
| | Seismic Category I Pneumatic Piping within Primary Containment | ---- |
| 1A.2.33.3 | II.K.3(46) Response to List of Concerns from ACRS Consultant | |
| | High Pressure Injection ECCS | |
| | RCIC | 1 |
| | HPCF | 2 |
| | Automatic Depressurization on Low Vessel Water Level | ---- |
| | ECCS Injection Directly into Vessel | |
| | HPCF | 2 |
| | RHR-LPFL | 2 |
| | ECCS Injection Into Feedwater Lines | |
| | RCIC | 1 |
| | RHR-LPFL | 1 |
| | ECCS Injection Lines Maintained Filled with Water | |
| | RCIC | ---- |
| | HPCF | ---- |
| | RHR-LPFL | ---- |
| | High Pressure ECCS Designed to Take Suction from Suppression Pool | |
| | RCIC | ---- |
| | HPCF | ---- |
| | High Pressure ECCS have a Designed Test Mode which Takes Suction from and Discharges to the Suppression Pool | |
| | RCIC | ---- |
| | HPCF | ---- |
| | High Pressure ECCS have a Designed Low Flow Bypass Mode which Discharges to the Suppression Pool | |
| | RCIC | ---- |
| | HPCF | ---- |

## Table 14.3-10 TMI Issues (Continued)

| Tier 2 Entry | Parameter | Tier 2 Value |
|---|---|---|
| | RCIC and HPCF Do not Share Any Common Suction Piping with RHR | |
| | RCIC | ---- |
| | HPCF | ---- |
| | ECCS Have Minimum Flow Protection for All Operating Modes | |
| | RCIC | ---- |
| | HPCF | ---- |
| | RHR | ---- |
| | Number of RCW Divisions | 3 |
| | Individual ECCS Pumps Can be Isolated Without Affecting Other ECCS Pumps | |
| | RCIC | ---- |
| | HPCF | ---- |
| | RHR | ---- |
| | ABWR has Water Level Measurement Directly on the Vessel | ---- |
| | Containment Sprays are Manually Initiated | ---- |
| | Essential Equipment Inside the Containment is Qualified for Harsh Environment | ---- |
| | ADS Automatically Depressurizes the Vessel on Low Water Level | ---- |
| | ABWR has Manual Vessel Depressurization Capability | ---- |
| 1A.2.34 | III.D.1.1(1) Review Information Submitted by Licensee Pertaining to Reducing Leakage from Operating Systems | |
| | Inboard and Outboard Isolation Valves on All Lines Which Penetrate Primary Containment | ---- |
| | ABWR has a Leak Detection and Isolation System | ---- |
| | MSIV Closure on: | |
| | High Temperature in Steam Tunnel | ---- |
| | High Temperature in Turbine Building | ---- |
| | High Radiation in HVAC Air Exhaust Results In: | |
| | Closure of HVAC Air Ducts to Reactor Building | ---- |
| | Closure of Containment Purge and Vent Lines | ---- |
| | Activation of Standby Gas Treatment System | ---- |

## Table 14.3-10 TMI Issues (Continued)

| Tier 2 Entry | Parameter | Tier 2 Value |
|---|---|---|
| 1A.2.36 | III.D.3.4 Control Room Habitability | |
| | HVAC System | |
| | Redundant Safety Grade Systems with Outdoor Air Intakes | ---- |
| | Able to Maintain 3.2 mm WG Positive Pressure in Habitable Control Room | ---- |
| | Radiation and Smoke Sensors in Intake Lines to Isolate Outdoor Air Intake | ---- |
| | Habitable Control Room Shielding | |
| | Min. Thickness of Concrete Between Habitable Control Room Area and Steam Lines (meters) | 1.6 |
| | Control Room Constructed Below Grade Level | ---- |

## Table 14.3-11 Example of Tier 1 ITAAC Entry: Standby Liquid Control (SLC) System

| | Inspections, Tests, Analyses and Acceptance Criteria | |
|---|---|---|
| **Design Commitment** | **Inspections, Tests, Analysis** | **Acceptance Criteria** |
| 1. The Basic configuration of the SLC System is shown in Figure 2.2.4. | 1. Inspections of the as-built system will be conducted. | 1. The as-built SLC System conforms with the basic configuration shown in Figure 2.2.4. |
| 2. The ASME Code components of the SLC 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 SLC System that are required to be hydrostatically tested by the ASME Code. | 2. The results of the hydrostatic test of the ASME Code components of the SLC System conform with the requirements in the ASME Code, Section III. |
| 3. | 3. | 3. |
| a. A test tank and associated piping and valves permit testing of the SLC System during plant operation. The tank is supplied with demineralized water, which is pumped in either a closed loop or is injected into the reactor. | a. Tests will be conducted on each division of the as-built SLC System using installed controls, power supplies and other auxiliaries. The following tests will be conducted:<br>(1) Demineralized water will be pumped against a pressure greater than or equal to 8.72 MPaA in a closed loop on the test tank.<br>(2) Demineralized water will be injected from the test tank into the reactor. | a.<br>(1) Demineralized water is pumped with a flow rate greater than or equal to 189 L/min in the closed loop.<br>(2) Demineralized water is injected from the test tanks into the reactor. |
| b. The SLC System delivers at least 378 l/min of solution with both pumps operating when the reactor pressure is less than or equal to 8.72 MPaA. | b. Tests will be conducted on the as-built SLC System using installed controls, power supplies and other auxiliaries. Demineralized water will be injected from the storage tank into the reactor with both pumps running against a discharge pressure of greater than of equal to 8.72 MPaA. | b. The SLC System injects greater than or equal to 378 L/min into the reactor with both pumps running against a discharge pressure of greater than or equal to 8.72 MPaA. |

## Table 14.3-12 Interface Requirements for the Ultimate Heat Sink

| | |
|---|---|
| 1. | Provide cooling water to the RSW System for normal plant operation and to permit safe shutdown and cooldown of the plant and maintain the plant in a safe shutdown condition for design basis events. |
| 2. | Makeup water for the UHS shall not be required for at least 30 days following a design basis accident. |
| 3. | Any active safety-related systems, structures, or components within the UHS shall have three divisions powered by their respective Class 1E divisions. Each division shall be physically separated and electrically independent of the other divisions. |
| 4. | UHS System Divisions A and B components shall have control interfaces with the Remote Shutdown System (RSS) as required to support UHS operation during RSS design basis conditions. |
| 5. | Be classified as Seismic Category I. |