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January 13, 2010

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

Attention: Mr. Jeffrey A. Ciocco,

Docket No. 52-021
MHI Ref: UAP-HF-10005

Subject: **Amended MHI's Responses to US-APWR DCD RAI No. 488-3745 Revision 0**

References: 1) "MHI's Responses to US-APWR DCD RAI No. 488-3754, MHI Ref.: UAP-HF-09579", dated December 25, 2009.
2) "Request for Additional Information No. 488-3745 Revision 0, SRP Section: 14.03.11 – Containment System and Severe Accidents - Inspections, Tests, Analyses, and Acceptance Criteria" dated November 23, 2009.

With this letter, Mitsubishi Heavy Industries, Ltd. ("MHI") transmits to the U.S. Nuclear Regulatory Commission ("NRC") a document entitled "Amended MHI's Responses to Request for Additional Information No. 488-3745 Revision 0."

The amended response is submitted to correct the typographical error in the RAI number (488-3754 versus 488-3745) only. No other changes have been made.

MHI requests to replace the previous letters (Reference 1) with this amended response letter.

Enclosed are the responses to Questions 14.03.11-40 through 14.03.11-42 that are contained within Reference 2.

Please contact Dr. C. Keith Paulson, Senior Technical Manager, Mitsubishi Nuclear Energy Systems, Inc. if the NRC has questions concerning any aspect of the submittals. His contact information is below.

Sincerely,

Y. Ogata

Yoshiki Ogata,
General Manager- APWR Promoting Department
Mitsubishi Heavy Industries, LTD.

Enclosure:

1. Responses to Request for Additional Information No. 488-3745 Revision 0

CC: J. A. Ciocco
C. K. Paulson

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Enclosure 1

UAP-HF-10005
Docket No. 52-021

Responses to Request for Additional Information No. 488-3745
Revision 0

January 2010

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

01/13/2010

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

RAI NO.:	**NO. 488-3745 REVISION 0**
SRP SECTION:	**14.03.11- CONTAINMENT SYSTEM AND SEVERE ACCIDENTS - Inspections, Tests, Analyses, and Acceptance Criteria**
APPLICATION SECTION:	**14.3.4.11**
DATE OF RAI ISSUE:	**11/23/2009**

QUESTION NO.: 14.03.11-40

RAI 14.3.4.11-28:

The staff requested, in RAI 51-916, Question 14.3.11-2 (14.3.4.11-2) and RAI 222-1933, Question 14.3.11-19 (14.3.4.11-19) that the applicant provide additional information on how critical assumptions from transient and accident analyses are verified by ITAAC.

The Staff asked the applicant to provide, the cross references from containment safety analyses that are used to define specific ITAAC. The staff asked the applicant to discuss how the cross references have been used in developing the ITAAC, and for each ITAAC item identified, a discussion on how the ITAAC acceptance criteria will provide verification of the critical assumption from containment safety analyses.

In a letter dated September 18, 2008, Mitsubishi responded to RAI 51-916, Question 14.3.11-2 (14.3.4.11-2) that DCD Tier 2 Table 14.3-1 addresses the cross-reference with Tier 1 and Tier 2, and also includes key parameters (specifications) in the containment transient and accident analyses. This table especially focuses on the numerical performance parameters of the safety function, flood protection, fire protection, severe accident function and so on per SRP 14.3.

These key parameters are directly incorporated in the corresponding design description of the referenced Tier 1 section, and are verified in the ITAAC.

MHI stated that they will expand Table 14.3-1 and directly extract the design commitments from Section 6.2.1 of Tier 2 regarding the containment transient and accident analyses. The comparison with the assumptions in the containment transient and accident analyses will be resolved with the enhancement of Table 14.3-1.

In a letter dated April 23, 2009, Mitsubishi responded to RAI 222-1933, Question 14.3.11-19 (14.3.4.11-19) with revised DCD Tier 2 Table 14.3-1 which identifies which particular analysis (DBA, Severe Accident, Flooding, etc) was used to create each assumption. In addition, several assumptions were added.

The staff has reviewed the response and has identified that the following needs to be addressed by the applicant:

Although the proposed change to Tier 2 Table 14.3.-1 now clearly indicates which particular analysis is used to create each assumption, the NRC staff has noted that how ITAAC are defined to address them are not clearly delineated.

In Table 14.3-1 a, b, c, d, e, f, a Tier 1 reference is given which provides Tier 1 Section and/or Table reference. It does not provide the specific ITAAC item #(s) that verifies the design feature/assumption. Without the specific reference, it is difficult to discern the adequacy of the ITAAC defined.

Provide a reference to the ITAAC item addressing the key design feature/assumption in Table 14.3-1.

Follow-up RAI based on 8/6/2009 Conference call.

ANSWER:

DCD Table 14.3-1 a, b, c, d, e, and f will be revised to identify the specific ITAAC in Tier 1. For some cases, such as ITAAC pertaining to ASME Code Section III, several DCD Tier 1 sections and multiple ITAAC are applicable to a key design feature. In these cases, the design feature may not include a specific ITAAC but identify the sections, tables and/or figures which verify the design feature(s).

Other design features in DCD Table 14.3-1 for which ITAAC are not referenced are as follows:

Environmental qualification of equipment important to safety is another generic design feature with multiple ITAAC entries, for which Table 14.3-1b (Sheet 2 of 2) does not list all applicable ITAAC.

Site parameters, such as atmospheric dispersion factors, for which ITAAC are not applicable, based on NUREG-0800 Section 14.3 guidance. (Tables 14.3-1b (Sheet 1 of 2) and 14.3-1f (Sheet 1 of 2))

Parameters addressed by Technical Specification (TS) requirements for which ITAAC do not directly apply, such as:

- Rated reactor core thermal power defined in TS 1.1 in Table 14.3-1a (Sheet 1 of 10)
- Refueling water storage pit (RWSP) normal operating temperature limits periodically verified during plant operation in accordance with TS Surveillance Requirement (SR) 3.5.4.1) in Table 14.3-1a (Sheet 4 of 10).
- Maximum containment air temperature during normal plant operations, periodically verified in accordance with SR 3.6.5.1. The related design feature in Table 14.3-1a (Sheet 10 of 10) is revised to refer to Tier 1 Subsection 2.7.5.3.1.2, "Containment Fan Cooler System" instead of Table 2.7.5.3-1, "Containment Ventilation System Inspections, Tests, Analyses, and Acceptance Criteria."

Technical Specifications ensure the continued operability of the facility after ITAAC closure; therefore ITAAC are not applied to such parameters.

ASME Code-related ITAAC in Table 14.3-1a (Sheet 1 of 10) apply to each of the US-APWR systems that include piping or components designed, fabricated, installed and tested in accordance with Section III of the ASME Code. These ITAAC are described in DCD Tier 2 Subsection 14.3.4.3 (pp. 14.3-13 and 14.3-14). Examples of the ITAAC for ASME Code Section III components are provided in Table 14.3-2. Multiple ITAAC are provided for each system to address the various aspects of ASME Code compliance for piping and components. Specific references to the numerous individual ITAAC for the ASME Code Section III piping systems and components are therefore not included in DCD Table 14.3-1.

Certain details of design features are described in Tier 1 and identified in Tier 2 Table 14.3-1 but do not have ITAAC that explicitly address the level of detail in the Tier 1 description. Examples of design features in this category include the following:

- "The liner plate is not designed or analyzed as a strength structural element. The minimum concrete design compressive strength (f'c) for the PCCV is 6000 psi. The minimum concrete design compressive strength (f'c) for the basemat is 4000 psi.
  The ultimate capacity for the PCCV is estimated based on cumulative yield strength of steel materials such as rebars, tendons, and liner plate." (Table 14.3-1a, Sheet 1 of 10)

  MHI considers that the features quoted above represent design details that are verified as part of implementing the construction phase quality assurance program and do not warrant specific ITAAC. ITAAC acceptance criteria established for verifying PCCV design and construction provide adequate assurance of its structural capability, specifically:

  - "The result of the structural integrity test (SIT) of the as-built PCCV exists and verifies that the PCCV maintains its structural integrity at a test pressure of 115% of the design pressure of 68 psig in accordance with the requirements of ASME Code, Section III." (ITAAC Item 3 in Table 2.2-4, page 2.2-28).
  - "ASME design report exists for the as-built PCCV, and concludes the PCCV is designed based on the structural design-basis loads." (ITAAC Item 5 in Table 2.2-4, page 2.2-28).

While revising Table 14.3-1 for consistency with DCD Tier 1, revision 2, MHI identified the following additional changes, included in Attachment 1-1:

- The design feature for the minimum inventory of human-system interfaces (HSIs) in Table 14.3-1a (sheet 7 of 10), refers to Tier 1 Table 2.5.4-2, "Information Systems Important to Safety Inspections, Tests, Analyses, and Acceptance Criteria." The HSI is more thoroughly addressed in human factors engineering (HFE) program. Therefore Table 14.3.1-a is revised to refer to ITAAC Items 7f, 7g and 7h in Table 2.9-1, "Human Factors Engineering Inspections, Tests, Analyses, and Acceptance Criteria.

- Similar to the above item, the design feature for the fixed position continuously visible HSI in Table 14.3-1a (sheet 7 of 10) is revised to replace the reference to Table 2.5.4-2 with a reference to ITAAC Item 7f in Table 2.9-1.

- Table 14.3-1a contains duplicate entries on Sheet 7 of 10 and Sheet 8 of 10 for a design feature pertaining to the Class 1 E gas turbine generators and their ability to accept load within 100 seconds of receiving a start signal. Attachment 1-1 includes an editorial correction to delete one of the duplicate items.

- Table 14.3-1a (Sheet 8 of 10) includes a design feature for condensate and feedwater system (CFS) valves to close within 5 seconds of receiving an actuation signal. The reference to Tier 1 Table 2.11.2-2, "Containment Isolation System Inspections, Tests, Analyses and Acceptance Criteria," is replaced with a reference to CFS ITAAC Item 8.b in Table 2.7.1.9-5, which specifically verifies the ability of the valves to close within 5 seconds of receiving an actuation signal.

- The design feature of the capability to open the EFWS cross connect flow paths (Table 14.3-1a, Sheet 9 of 10) is not a safety-related function and is described as a severe accident preventive measure in DCD Subsection 19.2.2.6 (page 19.2-2). Therefore this feature is moved to Table 14.3-1d (Sheet 5 of 8).

- Reactor building (R/B) design features for flood protection in Table 14.3-1b, Sheet 1 of 2, are revised for clarity and consistency with DCD Tier 2, Subsection 3.4.1.5.2 (pp. 3.4-10 to 3.4-17). Similar changes are provided for Tier 1, Subsection 2.2.2.2. The R/B is divided into two areas (east and west), separated by concrete walls and water-tight doors for flood protection. Each of the four divisions of safety-related equipment in the radiological controlled area (RCA) of the R/B is in a separate quadrant around the PCCV.

- Table 14.3-1b (Sheet 1 of 2) includes a design feature for internal flooding at elevation -26 ft, 4 in. in the non-radiological controlled area (NRCA) of the R/B. The design feature of the water tightness of EFW pump rooms is eliminated from the table to be consistent with the changes of eliminating water-tightness of EFW pump rooms in Tier 2 Subsection 3.4.1.5.2.1 of DCD revision 2. Similar change is also provided in Tier 1 Subsection 2.2.2.2.

- In MHI's response to RAI 459-3331, Question 03.06.02-39 (UAP-HF-09542) dated on December 1st, 2009, Tier 1 Table 2.3-2 is revised to expand ITAAC Item 4 for verification of as-designed moderate energy and high energy piping systems. Also ITAAC Item 5 is added to verify the as-built high energy break mitigation features as the reconciliation analysis. ITAAC Items 4 and 5 in Table 2.3-2 are included as cross-references for the pipe break-related design feature in Table 14.3-1b, Sheet 2 of 2.

- Table 14.3-1b, Sheet 2 of 2, includes a design feature that relay chatter does not occur or does not affect safety functions during a seismic event. The reference to Tier 1 Subsection 2.5.6, "Data Communications Systems" for this feature is replaced with a reference to Tier 1 Table 2.5.1-6, ITAAC Item 5, which applies to seismic qualification of protection and safety monitoring system (PSMS) and field equipment for the reactor trip (RT) and engineered safety features (ESF) systems. For this design feature, a general reference to seismic qualification ITAAC is also provided. DCD Tier 2 Subsection 3.10.2, which includes a description of the process for determining susceptibility of equipment to generic failure modes such as contact chatter, and qualifying such equipment, is added to the Tier 2 references.

- Table 14.3-1f, Sheet 1 of 2, is revised to provide editorial changes to the list of postulated accidents that are analyzed for radiological consequences using main control room (MCR) and technical support center (TSC) χ/Q values.

Impact on DCD

Table 14.3-1 will be revised as shown in Attachment 1-1.
Tier 1 Subsection 2.2.2.2 will be revised as shown in Attachment 1-2.

Impact on COLA

There is no impact on the COLA.

Impact on PRA

There is no impact on the PRA.

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

01/13/2010

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

RAI NO.:	**NO. 488-3745 REVISION 0**
SRP SECTION:	**14.03.11- CONTAINMENT SYSTEM AND SEVERE ACCIDENTS - Inspections, Tests, Analyses, and Acceptance Criteria**
APPLICATION SECTION:	**14.3.4.11**
DATE OF RAI ISSUE:	**11/23/2009**

QUESTION NO.: 14.03.11-41

RAI 14.3.4.11-29:

The staff requested, in RAI 51-916, Question 14.3.11-3 (14.3.4.11-3), that the applicant provide cross-references or roadmaps from severe accident analyses that are used to define specific ITAAC addressing severe accident prevention and mitigation features. Also, for each ITAAC item identified, the staff requested a discussion on how the ITAAC acceptance criteria provide verification of the critical assumptions/requirements in severe accident analyses.

In a letter dated September 18, 2008, Mitsubishi responded to RAI 51-916, Question 14.3.11-3 (14.3.4.11-3) that:

MHI will revise the title of Table 14.3-1 to "Tier I and Tier 2 Cross-References". Also, the title of the middle column will be changed to "Key Design Features/PRA Insights/Severe Accident Mitigation Features". For example, the key design features of diverse actuation systems has been addressed in Table 14.3-1 (Sheet 3 of 6) of Tier 2 and Subsection 2.5.3.1 of Tier 1 as an ATWS feature specified in Subsection 19.2.2.1. And, two independent alternative ac power sources have been also addressed in Table 14.3-1 (Sheet 3 of 6) of Tier 2 and Subsection 2.6.5.1 of Tier 1 as a station blackout feature specified in Subsection 19.2.2.3. These design features are verified in the individual ITAAC in the corresponding Tier 1 sections and tables.

In the RAI response, the applicant provided a comparison table of the US-APWR design features for mitigating severe accidents, with the location of Tier 1 information and Tier 2 information.

The applicant pointed out that some of the severe accident mitigation features are not specified in Table 14.3-1, but the existence of these features is verified in the ITAAC as mostly inspections of the functional arrangement and/or design description.

Thus, the verification of the existence of design features for severe accident prevention and mitigation is accomplished in the simple ITAAC as the inspection of the functional arrangement and/or design description in general, but some of the specific design features are verified in a separate ITAAC per the specific requirement of RG 1.206 and SRP 14.3.

The applicant indicated that as part of its RAI response process, MHI found that some of the design features were not specified in Table 14.3-1 and the existence of the SSCs used as the severe accident prevention and mitigation features were not clearly described in Tier 1. The applicant stated that MHI will add these unspecified design features in each design description in Tier 1 and provide the corresponding cross-reference in Table 14.3-1 of Tier 2, respectively.

The staff has reviewed the response and has identified that the following needs to be addressed by the applicant:

1) Table 14.3-1 provided in the Tier 2 DCD and the modification planned in response to RAI 51-916, Question 14.3.11-3 (14.3.4.11-3) does not provide a roadmap or show how key insights and assumptions from PRA and severe accident analyses are addressed in the design information in the DCD. Table 14.3-1 lists (or will list) the key design features/PRA insights/severe accident mitigation features along with references to the applicable sections in Tier 1 and Tier 2 DCD. The table or the accompanying discussion should also identify the specific design feature(s) that should be verified for each of the item and the ITAAC defined to address them.

Essentially, the steps or the analyses conducted to develop Table 14.3-1 should be included in accompanying discussion or should be apparent from the information provided in the table. Some of the discussions provided in response to RAI 51-916, Question 14.3.11-3 (14.3.4.11-3) presents the analysis being conducted and such analyses, as completed to address all relevant issues, should be included in Section 14.3.4.11.

In a letter dated April 23, 2009, Mitsubishi responded to RAI 222-1933, Question 14.3.11-20 (14.3.4.11-20) with revised DCD Tier 2 Table 14.3-1 which identifies which particular analysis (DBA, Severe Accident, Flooding, etc) was used to create each assumption. In addition, several assumptions were added.

The NRC staff has reviewed the response and has identified that the following need to be addressed by the applicant.

Although the proposed change to Tier 2 Table 14.3.-1 now clearly indicates which particular analysis is used to create each assumption, the NRC staff has noted that how the critical assumptions from transient and accident analyses are identified are not clearly delineated.

MHI does not provide a roadmap of how the key design features are delineated and accordingly, it is not clear that all the key design features have been identified. A roadmap should (a) identify the key design features and assumptions delineated in an analysis, (b) include in Table 14.3-1 and relate to the key design feature and assumptions in the analysis (c) cross-reference the ITAAC defined to address the design feature and/or the assumption. A review of the roadmap will assure that all the key design features and assumptions are included for development of ITAAC and that for each, ITAAC are developed or it is judged that ITAAC are not necessary.

One key design feature related to Section 2.11 and 14.3.11 identified in the PRA and Severe Accident Analysis was not included in Table 14.3-1.

- hydrogen igniter power supply is provided from two non-Class 1E buses with alternate AC generation.

Please provide a roadmap as discussed above, that directly addresses all the key design features and assumptions for which ITAAC should be developed. Justify if any of the key design features and assumptions is not addressed in the ITAAC.

Follow-up RAI based on 8/6/2009 Conference call.

ANSWER:

"Roadmaps," as used in NUREG-0800 Standard Review Plan (SRP) Section 14.3 (e.g., SRP Section 14.3 Appendix C, §§ II.B.ii and II.B.iii, p. 14.3-30) consist of the cross references between Tier 1 and Tier 2 information that show how the key physical parameters from the Tier 2 analyses are captured in Tier 1. For the US-APWR, these roadmaps consist of DCD Revision 2 Tables 14.3-1a through 14.3-1f (also referenced as "Table 14.3-1").

Tier 1 information is developed per the NRC-endorsed principle (e.g., as stated in SRP Section 14.3 and NRC Regulatory Guide 1.206 Subsection C.II.1.1) that Tier 1 design descriptions include top-level design features and performance characteristics that are the most significant to safety. The level of detail in Tier 1 is governed by a graded approach to the SSCs of the design, based on the safety significance of the functions they perform.

The system design descriptions should be accompanied by the appropriate ITAAC. The graded approach to selection of top-level design features and parameters applies to ITAAC development as part of the overall development of Tier 1. US-APWR ITAAC are developed by using an approach similar to developing the Tier 1 design descriptions as described in DCD Subsection 14.3.3.2 (pp. 14.3-6-14.3-8). The following considerations discussed in Subsection 14.3.4 (p. 14.3-12) are applied when determining if ITAAC are needed:

- ITAAC address the most safety-significant aspects of each of the systems of the design, describing the top-level design features and performance characteristics most significant to safety;
- Numeric performance values are included for in the ITAAC acceptance criteria for selected performance characteristics consistent with safety analysis assumptions;
- ITAAC level of detail is governed by a graded approach related to the SSCs of the design, based on the safety significance of the functions they perform;
- Non safety related aspects of SSCs may not be subject to ITAAC.

ITAAC for non-safety related SSCs may be limited to inspections to verify conformance to their functional arrangement as described in Tier 1. Non safety related SSCs that are risk-significant, or that prevent or mitigate severe accidents, are verified to exist via specific ITAAC or the functional arrangement ITAAC.

To determine the key design features listed in Table 14.3-1, MHI conducted engineering reviews of the applicable DCD chapters (e.g., Chapters 2 through 10, 15 and 16), to identify key design features used in deterministic safety analyses on case by case basis per Subsection 14.3.3.5 (pp. 14.3-9-14.3-10).

A risk-based approach was also applied to support the deterministic approach, using DCD Chapter 19 to identify features determined to be important by PRA and evaluations of severe accident scenarios. Particular emphasis is placed on DCD Table 19.1-119, which summarizes the key insights and design features with risk-significance. DCD Table 17.4-1 lists risk-significant SSCs as identified in the design phase of the Design – Reliability Assurance Program (D-RAP). Table 17.4-1 was used to cross-check design features for risk-significance, and is also referenced in Table 14.3-1d (Sheet 7 of 7) because D-RAP provides reasonable assurance that the US-APWR is designed, constructed, and operated consistent with risk insights and assumptions for the SSCs.

Table 14.3-1 was updated in DCD Revision 2 to reflect the combination of the deterministic and risk based approaches. Many design features are important to both the deterministic and risk-based analyses. In order to present the roadmaps in a concise manner, such features are presented in the table that addresses its role in the more deterministic analysis (Table 14.3-1a for design basis accidents, Table 14.3-1b for internal and external hazard analysis, and so on), with cross-references to information in DCD Chapter 19 that describe their importance to PRA, severe accident prevention or severe accident mitigation. Design features that are included in the road map principally due to their risk-significance or role in severe accidents, are listed in Table 14.3-1d, "PRA and Severe Accident Analysis Key Design Features." This approach is summarized in DCD Subsection 14.3.3.5 (pp. 14.3-9 and 14.3-10).

During the roadmap development, the following features were generally omitted from the key design features:

Programmatic and operational aspects such as operations and maintenance activities
These aspects include control of valve position, equipment operating status and so on. They are administratively controlled by procedures and programs and are not addressed in Tier 1.

Specific characteristics not considered in each DBA analysis such as hardware information
This information depends on the detailed design of specific equipment and is beyond the level-of-detail threshold of Tier 1 selection criteria. Examples in this category include specific materials of construction for specific equipment, or the detailed environmental parameters specified for equipment design such as radiation dose to equipment during its qualified life.

Less significant features of non-safety related SSCs
The roadmaps and Tier 1 address non-safety related features with a focus on certain design features that are significant to hazard analysis, fire protection, ATWS, severe accident prevention or mitigation, and contribution to risk.

The Tier 1 selection criteria and roadmap development have been addressed in the general discussion of Tier 1 and ITAAC development via revision to Subsection 14.3.3.5 on page 14.3-10 and Subsection 14.3.4 on page 14.3-12 in DCD Revision 2. This RAI question identifies DCD Subsection 14.3.4.11 as requiring revision to include some of the discussion provided in response to RAI 51-916, Question 14.3.11-3 (14.3.4.11-3), MHI ref.: UAP-HF-08183 dated September 18, 2008, regarding reviews to ensure that severe accident prevention and mitigation features are adequately addressed. Subsection 14.3.4.11 specifically addresses ITAAC for containment systems. Severe accident prevention and mitigation design features apply to containment as well as other SSCs, and MHI therefore considers that such features are more appropriately discussed in that Subsections 14.3.3.5 and 14.3.4.

In DCD Revision 2, the hydrogen igniter power supply which is provided by two non-Class 1E buses and alternate AC generation has been added to DCD revision 2, Table 14.3-1d (sheet 7 of 7) and to Tier 1 Table 2.11.4-1, as ITAAC Item 6.

Additional design features were added to DCD Table 14.3-1, consistent with the addition of key PRA insights and assumptions to DCD Table 19.1-119. Identification of ITAAC for these features is addressed in response to Question # 14.03.11-40 of this RAI.

Impact on DCD

There is no impact on the DCD.

Impact on COLA

There is no impact on the COLA.

Impact on PRA

There is no impact on the PRA.

01/13/2010

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

RAI NO.:	**NO. 488-3745 REVISION 0**
SRP SECTION:	**14.03.11- CONTAINMENT SYSTEM AND SEVERE ACCIDENTS - Inspections, Tests, Analyses, and Acceptance Criteria**
APPLICATION SECTION:	**14.3.4.11**
DATE OF RAI ISSUE:	**11/23/2009**

QUESTION NO.: 14.03.11-42

RAI 14.3.4.11-30:

The staff requested, in RAI 51-916, Question 14.3.11-8 (14.3.4.11-8), and RAI 222-1933, Question 14.3.11-24 that the applicant provide ITAAC required to verify the minimum inventory of alarms, displays and controls associated with the containment instrumentation shown on Figure 2.11.2-1, that are not listed in Table 2.11.2-1, and to amend Table 2.11.2-1 as required. The staff also requested that for systems with containment isolation functions (e.g., CVCS, SGBDS, PSS), the applicant provide ITAAC to verify the display of position indication of the containment isolation valves in the MCR, to include the displays of the CIV positions in the respective system tables.

The staff requested the applicant provide ITAAC required to verify the minimum inventory of alarms, displays and controls are provided for the CHS system, as described in the design description paragraph 2.11.4.1.

In a letter dated September 18, 2008, Mitsubishi responded to RAI 51-916, Question 14.3.11-8 (14.3.4.11-8) that:

- Tier 1 of the DCD Revision 2 document will be revised to add the instruments (PT-2390 and 2391') in Table 2.11.2-1

-ITAAC to verify the display of position indication of the containment isolation valves in the MCR will be added in the respective system tables.

-Containment isolation valves in CVCS will be added in Tier 1 Table 2.4.6-4.

-SGBDS and PSS tables of equipment, alarm, displays, and control functions for containment isolation valves will be added and containment isolation valves will be listed in these tables. ITAAC for containment isolation function will be added in Table 2.7.1.10-3 (SGBDS).

1) In a letter dated April 23, 2009, Mitsubishi responded to RAI 222-1933, Question 14.3.11-24 (14.3.4.11-24) that The CHS design description will be revised to add the hydrogen concentration alarm function, but did not commit to add the verification of the existence of such alarm in table 2.11.4-1.

The staff believes that ITAAC to verify the alarm function of the CHS system is appropriate. MHI has stated in RAI responses in section 6.2.5, that an alarm function will be required for the hydrogen monitor. (see response to RAI 6.2.5-4) Therefore a discreet ITAAC to verify the existence of the alarm function for this system would be consistent with the Containment Isolation

System ITAAC selection criteria specified in Tier 2 chapter 14.3.4.11, and would verify the location and functional arrangement description that MHI has proposed in response to RAI 222-1933, Question 14.3.11-24 (14.3.4.11-24).

Provide ITAAC required to verify existence of CHS alarm function.

2) In a letter dated April 23, 2009, Mitsubishi responded to RAI 222-1933, Question 14.3.11-24 (14.3.4.11-24) that Tier 1 table 2.11.2-1 will be revised to consolidate all valves with containment isolation function to make them subject to CIS ITAAC in Tier 1 table 2.11.2-2. MHI also indicated that DCD Tier 1 will be revised as needed to ensure each of the CIVs in the revised table 2.11.2-1 is included in it's appropriate table of alarms, displays and controls.

The NRC Staff has reviewed the response and has determined that a detailed review of all revised ITAAC tables will be conducted upon receipt of DCD revision 2 in order to ensure that all containment isolation valves and their required functions and capabilities are correctly verified via ITAAC.

Follow-up RAI based on 8/6/2009 Conference call.

ANSWER:

ITAAC #4 on page 2.11-48 has been added to ITAAC Table 2.11.4-1 in DCD Tier 1 revision 2 to verify the existence of the CHS alarms and displays in the MCR. The ITAAC is consistent with other alarms and displays ITAAC in Tier 1.

The instruments (PT-2390 and PT-2391) have been added to Table 2.11.2-1 (Sheet 4 of 10). However, the review identified discrepancies with the instruments tag numbers (i.e., PT-2390 and PT-2391). The tag numbers of the instruments in Table 2.11.2-1 will be revised to be consistent with Tier 1 Figure 2.11.2-1 and Tier 2 Chapter 6. The correct tag numbers are PT-371 and PT-372.

Table 2.11.2-2 has been revised to consolidate the CIVs. The table references other system equipment tables for equipment design information.

CVCS containment isolation valve CVS-VLV-202 has been added to Tier 1 Table 2.4.6-2 (Sheet 4 of 6).

CCW containment isolation valves NCS-VLV-403 A, B have been added to Tier 1 Table 2.7.3.3-2 (Sheet 3 of 7).

The following CVCS valves and alarms, displays and controls information for the valves have been added to DCD Tier 1 Table 2.4.6-4:

- Letdown Containment Isolation Valves (CVS-AOV-005,006)
- CVCS Charging Line Containment Isolation Valve (CVS-MOV-152)
- RCP Seal Injection Line Containment Isolation (CVS-MOV-178 A, B, C, D)
- RCP Seal Return Line Containment Isolation Valves (CVS-MOV-203,204)
- Volume Control Tank Outlet Valves (CVS-LCV-031 B, C)
- Charging Pump Alternate Makeup Valves (CVS-LCV-031 D,E,F,G)
- CVCS Charging Line Isolation Valve (CVS-MOV-151)
- Auxiliary Pressurizer Spray Line Isolation Valve (CVS-AOV-155)
- CVCS Charging Line Isolation Valve (CVS-AOV-159)
- Air Operated Valves (CVS-AOV-192 A, B, C, D)
- Air Operated Valves (CVS-AOV-196 A, B, C, D)

- Primary Makeup Water Supply Isolation (CVS-FCV-128, 129)
- Excess Letdown Isolation Valve (CVS-AOV-221, 222)
- CVCS Letdown Line Isolation Valve (CVS-LCV-361)
- CVCS Letdown Line Isolation Valve (CVS-LCV-362)

Table 2.7.1.10-3 has been added to DCD Tier 1 revision 2 to identify the SGBDS alarms displays and controls located in the MCR and RSC. ITAAC items 10, 11 and 13.a in Table 2.7.1.10-4 have been added to verify the existence of the alarms, displays and controls in the MCR and the RSC for the SGBDS equipment in Table 2.7.6.7-4.

Table 2.7.6.7-4 has been added to DCD Tier 1 revision 2 to identify the PSS alarms, displays and controls located in the MCR. ITAAC items 12 and 13 in Table 2.7.6.7-5 have been added to verify the existence of the alarms and displays in the MCR and the RSC for the PSS equipment in Table 2.7.6.7-4.

Impact on DCD

Table 2.11.2-1 (Sheet 4 of 10) will be revised as shown in Attachment 2 to correct the discrepancy with the instrument tag numbers.

Impact on COLA

There is no impact on the COLA.

Impact on PRA

There is no impact on the PRA.

Table 14.3-1a Design Basis Accident Analysis Key Design Features

(Sheet 1 of 10)

Tier 1 Ref.[(1)]	Key Design Features	Tier 2 Location[(2)]
1.2	US-APWR rated reactor core thermal power is 4451 MWt.	1.1.4 Table 4.4-1 Table 6.2.1-4 Table 15.0-2 Table 15.6.5-1 Ch. 16, TS 1.1
Table 2.2-4 ITAAC #7 Table 2.3-2 ITAAC #1.a Each ASME ITAAC in 2.4.1, 2.4.2, 2.4.4, 2.4.5, 2.4.6	RCPB components are designed and fabricated in accordance with 10 CFR 50.55a which requires compliance with the requirements for Class 1 components in the American Society of Mechanical Engineers (ASME) Code.	5.2 6.3 9.3.4
2.2.1.2 Table 2.2-4 ITAAC #3, #5 Table 2.11.1-1 Table 2.11.1-2 ITAAC #1, #2	The PCCV is a prestressed concrete structure designed to endure the peak pressure and temperature for LOCA, and steamline and feedline break conditions.	3.8.1.3 Table 3.8.1-1 6.2.1.1 Table 6.2.1-2
Table 2.2-1 Table 2.2-4 ITAAC #3, #5 2.11.1.1 Table 2.11.1-2 ITAAC #1, #2	The PCCV is designed and constructed in accordance with ASME Code, Section III, and the PCCV is classified as seismic Category I structure.	3.8.1.2 6.2.7
2.2.1.2 ~~Table 2.2-4~~	The liner plate is not designed or analyzed as a strength structural element. The minimum concrete design compressive strength (f'c) for the PCCV is 6000 psi. The minimum concrete design compressive strength (f'c) for the basemat is 4000 psi. The ultimate capacity for the PCCV is estimated based on cumulative yield strength of steel materials such as rebars, tendons, and liner plate.	3.8.1.1.1 Table 6.2.1-2 19.2.4.1

NOTES: (1) Source: Tier 1 section or table. (2) Tier 2 location or table where addressed.

Table 14.3-1a Design Basis Accident Analysis Key Design Features

(Sheet 2 of 10)

Tier 1 Ref.(1)	Key Design Features	Tier 2 Location(2)
Figure 2.11.1-1 Table 2.11.1-2 ITAAC #3	The inner height of the containment is approximately 226.5 ft and the inside diameter of the containment cylinder measures approximately 149 ft. The containment dome is 3 ft.-8 in. or 4 ft.-4 in. thick, while the containment wall thickness is 4 ft.-4 in. The inner surface of containment includes a 0.25 in. welded steel plate liner anchored to the concrete.	6.2.1.1.2
2.2.1.2 Table 2.2-4 ITAAC #3, #5 Table 2.11.1-1 Table 2.11.1-2 ITAAC #1, #2, #3	The containment design pressure is 68 psig. The PCCV is designed for an external pressure of 3.9 psig based on conservative analysis of inadvertent CSS operation. The containment design temperature is 300°F. Free volume of containment is 2,800,000 ft^3.	Table 3.8.1-1 6.2.1.5.3 Table 6.2.1-2 Table 6.5-5 15.4.8.4 15.6.5
2.4.1 Table 2.4.1-2 ITAAC #4.b	Ferritic reactor coolant pressure boundary materials meet 10CFR50 Appendix G fracture toughness criteria and requirements for testing.	5.2.3.3 5.3.1
2.4.2.1 Table 2.4.2-5 ITAAC #10.a	The pressurizer safety valves provide overpressure protection in accordance with the ASME Code Section III. This overpressure protection is provided for the followingbounding events • Loss of external electrical load. • Loss of normal feedwater flow. • Reactor coolant pump shaft break. • Uncontrolled rod cluster control assembly bank withdrawal from a subcritical or low-power startup condition. • Spectrum of rod ejection accidents. The sum of the capacities of the pressurizer safety valves exceeds 1.728×10^6 lb/hr (432,000 lb/hr per valve).	5.2.2.1 Table 5.2.2-1
Table 2.4.2-5 ITAAC #10.a	Pressurizer safety valves set pressure; ≥ 2435 psig and ≤ 2485 psig	Table 5.2.2-1
Table 2.4.2-5 ITAAC #10.d	The reactor coolant flow rate per loop with 10% steam generator tube plugging is at least 112,000 gallons per minute.	Table 5.1-3

NOTES: (1) Source: Tier 1 section or table. (2) Tier 2 location or table where addressed.

Table 14.3-1a Design Basis Accident Analysis Key Design Features

(Sheet 3 of 10)

Tier 1 Ref.[1]	Key Design Features	Tier 2 Location[2]
Table 2.4.2-5 ITAAC #10.c	RCPs have a rotating inertia to provide coastdown flow.	5.4.1 15.3.1.1 15.6.5.2
2.4.4.1 Table 2.4.4-5 ITAAC #7.b	The four independent ECC/CS suction strainers are designed to maintain adequate NPSH and minimize downstream effects to support ECC/CS functions, maintaining the reactor core in a long-term coolable geometry and supporting decay heat removal following a design basis accident.	6.2.2.2 Table 6.2.2-2 Table 19.1-119
2.4.4.1 Table 2.4.4-5 ITAAC #1.a	The RWSP and ECC/CS suction strainers are located at the lower elevation in containment. The coolant and associated debris from a pipe or component rupture (LOCA), and the containment spray drain into the RWSP through transfer pipes.	6.2.2.2.5 Table 19.1-119
2.4.4.1 Table 2.4.4-5 ITAAC #7.b	Insulation and coatings inside containment are consistent with the design basis evaluations of ECC/CS suction strainer performance.	6.1.2 6.1.3 6.2.2.3 Table 19.1-119
2.4.4.1 Table 2.4.4-2 Table 2.4.4-5 ITAAC #1.a, #1.b, #6.b, #6.c, #10.b	The high head safety injection system consists of four independent and dedicated SI pump trains. The SI pump trains are automatically initiated by an ECCS actuation signal, and supply borated water from the RWSP to the reactor vessel via direct vessel injection line.	6.3.2.1 Table 19.1-119
Table 2.4.4-5 ITAAC #7.b	Each safety injection pump has a pump differential head of no less than 3937 ft and no more 4527 ft at the minimum flow, and injects no less than 1259 gpm and no more than 1462 gpm of RWSP water into the reactor vessel at atmospheric pressure.	Table 6.2.1-5 6.3 Figure 6.3-4 Figure 6.3-15 Figure 6.3-16
2.4.4.1 Table 2.4.4-5 ITAAC #7.b	Four (4) ECCS accumulators store borated water under pressure and automatically inject it into the RCS if the reactor coolant pressure decreases below the accumulator pressure. The volume of each accumulator is at least 3,180 ft^3, considering the total water volume and adding the volume of gas space and dead water volume.	Table 6.2.1-4 Table 6.2.1-5 6.3.2.2.2 Table 6.3-5

NOTES: (1) Source: Tier 1 section or table. (2) Tier 2 location or table where addressed.

Table 14.3-1a Design Basis Accident Analysis Key Design Features

(Sheet 4 of 10)

Tier 1 Ref.(1)	Key Design Features	Tier 2 Location(2)
Table 2.4.4-5 ITAAC #7.b Table 2.4.4-6	The water volume injected from each accumulator into reactor vessel is ≥2126 ft^3. The water volume injected from each accumulator into reactor vessel during large flow is ≥1326.8 ft^3. The calculated resistance coefficient of the accumulator system (based on a cross-section area of 0.6827 ft^2) meets the requirements shown in Tier 1 Table 2.4.4-6. The accumulators provide the integrated function of low head injection in the event of a LOCA.	6.3 Table 6.3-5 Table 19.1-119
2.4.4.1 Table 2.4.4-5 ITAAC #7.b	The RWSP is the source of borated water for emergency core cooing and containment spray systems. The volume of the RWSP is at least 81,230 ft^3 taking into account ineffective pit volume and containment cavities and pits where water may be trapped and not drain to the RWSP.	6.2.2.2.5 Table 6.2.1-3 Table 6.2.1-4 Figure 6.2.2-7 6.3 Table 6.3-5
2.4.5.1	The RHRS limits the in-containment RWSP water temperature to not greater than 120° F during normal operation.	5.4.7.1 Table 6.2.1-4 Ch. 16 TS 3.5.4
2.4.5.1 Table 2.4.5-5 ITAAC #8.a	RHRS provides long term core cooling.	5.4.7.1 Table 19.1-119
2.4.5.1 Table 2.4.5-5 ITAAC #1.a, #6.b, #6.c 2.11.3.1 Table 2.11.3-5 ITAAC #1.a, #6.b, #6.c	The CSS/RHRS consists of four independent subsystems, each of which receives electrical power from one of four safety buses. Each subsystem includes one CS/RHR pump and one CS/RHR heat exchanger, which have functions in both the CS system and the RHRS.	6.2.2 5.4.7.2.1 Table 19.1-119

NOTES: (1) Source: Tier 1 section or table. (2) Tier 2 location or table where addressed.

Table 14.3-1a Design Basis Accident Analysis Key Design Features

(Sheet 5 of 10)

Tier 1 Ref.(1)	Key Design Features	Tier 2 Location(2)
2.4.5.1 Table 2.4.5-5 ITAAC #1.a, #8.a 2.11.3.1 Table 2.11.3-5 ITAAC #1.a, #7.b	CSS/RHR provide long term containment and core cooling capability.	6.2.2 6.2.5 Table 19.1-119
Table 2.4.5-5 ITAAC #8.e	The CS/RHR relief valves open at a pressure not greater than the set pressure required to provide low temperature overpressure protection for the RCS, as determined by the LTOP system.	5.4.7.1
Table 2.4.5-5 ITAAC #8.a	Each CS/RHR pump is sized to deliver 3,000 gpm at a discharge head of 410 ft, and provides at least 2645 gpm to the RCS when the RCS is at atmospheric pressure.	5.4.7 Table 5.4.7-2 Figure 5.4.7-4 6.2.2 Table 6.2.1.5
Table 2.4.5-5 ITAAC #8.a	The product of the overall heat transfer coefficient and the effective heat transfer area, UA, of each as-built CS/RHR heat exchanger is greater than or equal to 1.852×10^{6} Btu/hr-°F.	5.4.7 Table 5.4.7-2 6.2.2 Table 6.2.1-5
2.4.6.1 Table 2.4.6-5 ITAAC #1, #8.a	The CVCS charging pumps are arranged in parallel with common suction and discharge headers. Each pump provides full capability for normal makeup. One charging pump is capable of maintaining normal RCS inventory with small system leak if the leakage rate is less than that from a break of a pipe 3/8 inch in inside diameter.	9.3.4.2 Table 19.1-119
2.4.6.1 Table 2.4.6-5 ITAAC #1, #8.a, #8.c	The CVCS charging pumps can take suction from the VCT, the reactor makeup control system, the refueling water storage auxiliary tank and the spent fuel pit. Normally, one charging pump is operating and takes suction from the VCT, supplies charging flow to the RCS and seal water to the reactor coolant pumps.	9.3.4.2 Table 19.1-119

NOTES: (1) Source: Tier 1 section or table. (2) Tier 2 location or table where addressed.

Table 14.3-1a Design Basis Accident Analysis Key Design Features

(Sheet 6 of 10)

Tier 1 Ref.(1)	Key Design Features	Tier 2 Location(2)
Table 2.4.6-5 ITAAC #8.a	Each CVCS charging pump provides a flow rate of greater than or equal to 160 gpm.	9.3.4 Table 9.3.4-2
2.5.1.1 Table 2.5.1-6 ITAAC #14.a	The PSMS initiates automatic reactor trips and ESF actuations, when the plant process signals reach a predetermined limit. (Table 2.5.1-2 and 2.5.1-3)	7.2 7.3 Table 7.2-3 Table 7.3-4
2.5.1.1 Table 2.5.1-6 ITAAC #1	Reactor trip signal is provided by the reactor protection system (RPS), which consists of four redundant and independent trains. Four redundant measurements using sensors from the four separate trains are made for each variable used for reactor trip.	7.2.1 Table 19.1-119
2.5.1 Table 2.5.1-6 ITAAC #2	There are four redundant engineered safety function (ESF) trains.	7.3.1.8 Table 19.1-119
2.5.1 Table 2.5.1-6 ITAAC #29	ESF systems are automatically initiated from signals that originate in the RPS. Manual actuation of ESF systems is carried out through a diverse signal path that bypasses the RPS.	7.3.1.9 Table 19.1-119
2.5.1 Table 2.5.1-6 ITAAC #17.b	A single channel or division of the PSMS can be bypassed to allow on-line testing, maintenance or repair without impeding the safety function.	7.2.1 Table 19.1-119
2.5.4.1 Table 2.5.4-2 ITAAC #1, #2, #4	The PSMS and PCMS provide plant operators with information systems important to safety for: (1) assessing plant conditions and safety system performance, and making decisions related to plant responses to AOOs; and (2) preplanned manual operator actions related to accident mitigation.	7.5

NOTES: (1) Source: Tier 1 section or table. (2) Tier 2 location or table where addressed.

Table 14.3-1a Design Basis Accident Analysis Key Design Features

(Sheet 7 of 10)

Tier 1 Ref.[1]	Key Design Features	Tier 2 Location[2]
2.5.4 Table 2.5.4-2 ITAAC #1, #3, #4	For the monitoring of the post-accident inadequate core cooling, degree of subcooling, RV water level and core exit temperature will be measured.	4.4.6.4 7.5 7.5.1.1.3
~~Table 2.5.4-2~~2.9 Table 2.9-1 ITAAC #7.f, #7.g, #7.h	The minimum inventory of HSIs are • Fixed position continuously visible HSI • Class 1E HSI for control of all safety-related components and monitoring of all safety-related plant instrumentation is provided on the safety VDUs, located on the MCR operator console and the remote shutdown console (Section 7.1). • Minimum inventory for degraded HSI conditions	7.1 18.7.3.2 Table 18.7-1
~~Table 2.5.4-2~~2.9 Table 2.9-1 ITAAC #7.f	The fixed position continuously visible HSI are provided by: The fixed area of the LDP provides indications and alarms which include : • Bypassed and inoperable status indication (BISI) parameters • Type A and B post monitoring (PAM) variables (Section 7.5, Table 7.5-3) • Safety parameter displays including status of critical safety functions and performance of credited safety systems and preferred non safety systems • Prompting alarms for credited manual operator actions and risk important HAs identified in the HRA PAM displays for Type A and B variables on the safety VDUs (Subsection 7.5.1.1) Conventional switches on the MCR operator console for system level actuation of safety functions such as reactor trip, engineering safety features actuation system (ESFAS) actuation, etc. (Tables 7.2-6 and 7.3-5)	Table 7.1-1 Table 7.2-6 Table 7.3-5 7.5 Table 7.5-3 18.7.3.2

~~2.6.1~~ ~~2.6.4.1~~ ~~Table 2.6.4-1~~	~~Each of the four divisions of the Class 1E power distribution systems is provided by a Class 1E gas turbine generator (GTG) to supply power to its dedicated safety bus as a counter measure against loss of offsite power. When loss of offsite power occurs, GTGs automatically start and would accept load in less than or equal to 100 seconds after receiving the start signal.~~	~~8.1.3.1~~ ~~8.3.1.1.3~~ ~~Table 19.1-119~~

NOTES: (1) Source: Tier 1 section or table. (2) Tier 2 location or table where addressed.

Table 14.3-1a Design Basis Accident Analysis Key Design Features

(Sheet 8 of 10)

Tier 1 Ref.(1)	Key Design Features	Tier 2 Location(2)
2.6.4.1 Table 2.6.4-1 ITAAC #13	The Class 1E emergency power sources (EPSs) are capable to provide power at set voltage and frequency to the Class 1E 6.9kV buses within 100 seconds from the start signal.	8.3.1.1.3 Table 19.1-119
2.6.4.1 Table 2.6.4-1 ITAAC #1, #2, #13, #15.a	Each of the four divisions of the Class 1E power distribution systems is provided by a Class 1E gas turbine generator (GTG) to supply power to its dedicated safety bus as a counter measure against loss of offsite power. When loss of offsite power occurs, GTGs automatically start and would accept load in less than or equal to 100 seconds after receiving the start signal.	8.1.3.1 8.3.1.1.3
2.7.1.2.1 Table 2.7.1.2-5 ITAAC #13.a	Six main steam safety valves (MSSVs) are provided per main steam line. MSSVs with sufficient rated capacity are provided to prevent the steam pressure from exceeding 110 percent of the MSS design pressure. The sum of the rated capacities of the MSSVs exceeds 21,210,000 (lb/hr) for all 24 valves.	10.3.2.3.2
Table 2.7.1.2-~~4~~5 ITAAC #13.b	The flow restrictor within the SG main steam line discharge nozzle does not exceed 1.4 sq. ft.	15.1.5.2
2.7.1.2.1 Table 2.7.1.2-~~4~~5 ITAAC #14	The valves close within the following times after receipt of an actuation signal. The main steam isolation valves (MSIVs) close within 5 seconds to limit uncontrolled steam release from one SG in the event of steam line break. The main steam bypass isolation valves close within 5 seconds.	6.2.1.4.1 10.3.2.3.4
2.7.1.2 Table 2.7.1.2-5 ITAAC #1.a	MSIVs are installed in each of the main steam lines to (1) limit uncontrolled steam release from one steam generator in the event of a steam line break, and to (2) isolate the faulted SG in the event of SGTR.	6.2.1 10.3 Table 19.1-119
2.7.1.9.1 Table 2.7.1.9-5 ITAAC #8.b ~~Table 2.11.2-2~~	The main feedwater isolation valves (MFIVs), MFRVs, MFBRVs, SGWFCVs close within 5 seconds after receipt of an actuation signal, to limit the mass and energy release to containment consistent with the containment analysis.	6.2.1.4.1 10.4.7.2.2

NOTES: (1) Source: Tier 1 section or table. (2) Tier 2 location or table where addressed.

Table 14.3-1a Design Basis Accident Analysis Key Design Features

(Sheet 9 of 10)

Tier 1 Ref.(1)	Key Design Features	Tier 2 Location(2)
2.7.1.11 Table 2.7.1.11-5 ITAAC #1.a	EFWS consists of two motor-driven pumps and two steam turbine-driven pumps with two emergency feedwater pits.	10.4.9.2 Table 19.1-119
2.7.1.11.1 Table 2.7.1.11-5	Each EFW pump discharge line connects with a cross-tie line using normally closed motor-operated isolation valves to provide separation of four trains. Operation to open the EFW cross-tie valve when an EFW pump is not available is an important feature to reduce core damage frequency.	10.4.9.2 19.1.4.1 19.2.2
2.7.1.11 Table 2.7.1.11-5 ITAAC #8.b	Upon detection of a water level increase of the SG, the EFW isolation valves and EFW control valves are automatically closed.	10.4.9.2 Table 19.1-119
2.7.1.11 Table 2.7.1.11-5 ITAAC #8.b	The motor-operated EFW isolation valves and EFW control valves are provided in each EFW pump discharge line to close automatically to terminate the flow to the affected (faulted) SG.	10.4.9.2 Table 19.1-119
2.7.1.11 Table 2.7.1.11-5 ITAAC #1.a	The common suction line from each EFW pit is connected by a tie line with two normally closed manual valves. When the two EFW pumps taking suction from the same pit are not available (OLM of one EFW pump and the single failure of other EFW pump), the tie line connections to EFW pits need to be established.	10.4.9.2 Table 19.1-119
Table 2.7.1.11-5 ITAAC #12	Two of the EFW pumps deliver at least 705 gpm to the any of two SGs against a SG pressure up to the set pressure of the first stage of main steam safety valve plus 3 percent.	10.4.9.2.1 Table 10.4.9-2
Table 2.7.1.11-5 ITAAC #13	The usable volume of each EFW pit is greater than or equal to 204,850 gallons.	10.4.9.3
2.7.3.1 Table 2.7.3.1-5 ITAAC #1.a	The ESWS is arranged into four independent trains (A, B, C, and D). Each train consists of one ESWP, two 100% strainers in the pump discharge line, one 100% strainer upstream of the CCW HX, one CCW HX, one essential chiller unit, and associated piping, valves, instrumentation and controls.	9.2.1.2.1 Table 19.1-119
2.7.3.3 Table 2.7.3.3-5 ITAAC #1.a	The CCWS consists of two independent subsystems. One subsystem consists of trains A & B, and the other subsystem consists of trains C & D, for a total of four trains.	9.2.2.2 Table 19.1-119

NOTES: (1) Source: Tier 1 section or table. (2) Tier 2 location or table where addressed.

Table 14.3-1a Design Basis Accident Analysis Key Design Features (Sheet 10 of 10)

Tier 1 Ref.(1)	Key Design Features	Tier 2 Location(2)
2.7.3.3 Table 2.7.3.3-5 ITAAC #7	The CCWS is designed to withstand leakage in one train without loss of the system's safety function.	9.2.2.1.1 Table 19.1-119
2.7.3.3 Table 2.7.3.3-5 ITAAC #8.b	Two motor operated valves are located at the CCW outlet of the RCP thermal barrier Hx and close automatically upon a high flow rate signal at the outlet of this line in the event of in-leakage from the RCS through the thermal barrier Hx, and prevents this in-leakage from further contaminating the CCWS.	9.2.2.2.1.5 Table 19.1-119
2.7.5.3.1.2~~Table 2.7.5.3-1~~	The containment fan cooler system is designed to maintain containment air temperature below 120°F during the normal operation of the plant. 120°F is used as the maximum containment temperature initial condition in the safety analyses.	6.2.1.1.3.5 Table 6.2.1-4 6.3.2.1 Ch. 16 TS 3.6.5
2.7.6.2.1 Table 2.7.6.2-1 ITAAC #2	To preclude unanticipated drainage, the spent fuel pit is not connected to the equipment drain system. A weir and gate provide physical isolation of the refueling canal from each of the pits. All the gates are located above the top elevation of the fuel seated in the SFP racks: they are normally closed and only opened as required.	9.1.2.2.2
Figure 2.11.2-1 Table 2.11.2-1 Table 2.11.2-2 ITAAC #1	Containment penetration isolation features are configured as in Table 6.2.4-3 and figure 6.2.4-1.	6.2.4 Table 6.2.4-1 Table 6.2.4-3 Figure 6.2.4-1 6.2.6
2.11.3.1 Table 2.11.3-5 ITAAC #1.a, #7.b	The CSS is designed to remove containment heat, and remove fission products following an accident.	6.2.2 6.5.2 15.6.5 19.1.3.1 19.1.3.2 Table 19.1-119 19.2.3.3.3
Table 2.11.3-5 ITAAC #7.b	Two CS/RHR pumps deliver no less than 5290 gpm of RWSP water into the containment.	6.2.1 Table 6.2.1-5

NOTES: (1) Source: Tier 1 section or table. (2) Tier 2 location or table where addressed.

Table 14.3-1b Internal and External Hazards Analysis Key Design Features

(Sheet 1 of 2)

Tier 1 Ref.(1)	Key Design Features	Tier 2 Location(2)
Table 2.1-1	Key Site Parameters (Meteorology, Hydrologic Engineering, Geology, Seismology, and Geotechnical Engineering)	Table 2.0-1
2.2 Table 2.2-1 Table 2.2-4 ITAAC #23	Failure of buildings that are not seismic Category I (i.e., turbine building, auxiliary building and access building) does not impact SSCs designed to be seismic Category I.	3.2.1 Table 19.1-119
2.2.2.1 Table 2.2-4 ITAAC #13	The external walls of Seismic I and II structures that are below flood level are adequate thickness to protect against water seepage.	3.4.1.2
Table 2.2-4 ITAAC #16	Penetrations in the external walls below flood level are provided with flood protection features.	3.4.1.2
2.2.2.1 Table 2.2-4 ITAAC #14	Construction joints in the exterior walls and base mats are provided with water stops to prevent seepage of ground water.	3.4.1.2
2.2.2.2 Table 2.2-4 ITAAC #9, #10, #11, #15	Elevation -26 ft, 4 in. in radiological controlled area (RCA) of the R/B is divided into twofour areas, by concrete walls and water-tight door. A water-tight door is provided in each Spray/RHR pump room and SIS pump room. And also water tight doors are provided in doorways between A/B and R/B.	3.4.1.5.2.1
2.2.2.2 Table 2.2-4 ITAAC #9, #10, #11, #15	Elevation -26 ft, 4 in. in the non-radiological controlled area (NRCA) of the R/B is divided into two areas by concrete walls and water-tight door installed in the corridor. ~~The two trains of four emergency feedwater pump rooms are isolated by concrete walls and water-tight door.~~ Water-tight doors are provided in doorways at ground level between T/B and R/B.	3.4.1.5.2.2
2.2.2.2 Table 2.2-4 ITAAC #9, #10, #11, #15	Divisional walls and water tight doors provide train separation and flood barriers to prevent flood water from spreading to adjacent divisions.	3.4.1.5.2.1
Table 2.2-4 ITAAC #1, #9, #10 2.7.6.8 Table 2.7.6.8-1 ITAAC #1	R/B is divided to two divisions (e.g. east side and west side) and thus flood propagation to all four trains is prevented.	3.4.1.5.2 19.1.5.3 Table 19.1-1 Table 19.1-119

NOTES: (1) Source: Tier 1 section or table. (2) Tier 2 location or table where addressed.

Table 14.3-1b Internal and External Hazards Analysis Key Design Features

(Sheet 2 of 2)

Tier 1 Ref.(1)	Key Design Features	Tier 2 Location(2)
2.2.2 Table 2.2-4 ITAAC #9, #10, #11, #15, #16	Areas between the reactor building and the turbine building are physically separated by flood prevention equipment.	3.4.1.5 19.1.5.3 Table 19.1-119
2.3.1 Table 2.3-2 ITAAC #4, #5	Pipe breaks (circumferential and longitudinal) are evaluated for the entire range of effects, including dynamic effects (i.e., pipe whip, jet impingement, jet thrust forces, internal forces due to system decompression, sub-compartment pressurization), environmental conditions, spray wetting, and flooding. When LBB criteria are successfully applied, evaluation of dynamic effects is not required.	3.6 6.2.1.2
Table 2.1-1 2.2.1 Table 2.2-4 ITAAC #5, #6, #212.3.1 Table 2.3-2 Table 2.5.1-6 ITAAC #8 Table 2.5.6-1 ITAAC #4	SSCs needed to achieve and maintain safe shutdown are protected or analyzed to mitigate the impacts of internal and external missile hazards	3.5
Each EQ ITAAC in aApplicable Tier 1 System Sections	Structures, systems, and components important to safety are designed to accommodate the effects of and to be compatible with the environmental conditions associated with normal operation, maintenance, testing, and postulated accidents, including loss-of-coolant accidents.	3.11
2.5.1 Table 2.5.1-6 ITAAC #5 Other seismic qualification ITAAC in applicable Tier 1 System Sections 2.5.6	Relay chatter does not occur or does not affect safety functions during and after seismic event.	3.10.2 Table 19.1-51 Table 19.1-119

2.7.6.8 Table 2.7.6.8-1 ITAAC #1	Flood will not propagate to other areas due to the drain systems.	3.4.1.5.2 19.1.5.3 Table 19.1-119

NOTES: (1) Source: Tier 1 section or table. (2) Tier 2 location or table where addressed.

Table 14.3-1c Fire Protection Key Design Features

Tier 1 Ref.(1)	Key Design Features	Tier 2 Location(2)
2.2.2.3 Table 2.2-4 ITAAC #17	Redundant safe shutdown components and associated electrical divisions outside the containment and the control room complex are separated by 3-hour rated fire barriers to preserve the capability to safely shutdown the plant following a fire. The 3-hour rated fire barriers are placed as required by the fire hazard analysis and support prevention of severe accidents due to loss of multiple trains by fire.	9.5.1.2.1 Table 19.1-119
2.2.2.3 Table 2.2-4 ITAAC #18	All penetrations and openings through the fire barriers are protected with 3-hour rated components (i.e. fire doors in door openings, fire dampers in ventilation duct openings, and penetration seals).	9.5.1.2.1 Table 19.1-119
2.7.6.9.1 Table 2.7.6.9-2 ITAAC #4.b	The seismic standpipe system can be supplied from a safety-related water source which capacity is at least 18,000 gallons.	9.5.1.2.4
2.7.6.9.1 Table 2.7.6.9-2 ITAAC #3, #5	Two 100% capacity fire water pumps are provided: one pump is diesel-driven and one pump is electric motor-driven. Each pump provides sufficient water for the largest sprinkler system plus manual hose streams to support fire suppression activities for two hours or longer, but not less than 300,000 gallons. Redundant water supply capability is provided.	9.5.1.1
2.5.2.1 Table 2.5.2-3 ITAAC #2.a	Independent means to achieve safe shutdown of the reactor is provided if a fire in the MCR resulted in operator evacuation.	7.4.1.5
2.7.6.9.1 Table 2.7.6.9-2 ITAAC #1, #2	Means are provided to detect and locate fires and are indicated to control room operators	9.5.1.2.6

NOTES: (1) Source: Tier 1 section or table. (2) Tier 2 location or table where addressed.

Table 14.3-1d PRA and Severe Accident Analysis Key Design Features

(Sheet 1 of ~~7~~8)

Tier 1 Ref.[1]	Key Design Features	Tier 2 Location[2]
2.2.3.3 Table 2.2-4 ITAAC #24	SSCs that require evaluation in the seismic fragilities task of a seismic margin analysis have sufficient seismic margin.	19.1.5.1.1 Table 19.1-51 Table 19.1-119
2.4.1 Table 2.4.1-2 ITAAC #3	No penetrations through the RV are located below the top of the reactor core. This minimizes the potential for a loss of coolant accident by leakage from the reactor vessel, allowing the reactor core to be uncovered.	5.3.3.1 Table 19.1-119
2.4.2.1 Table 2.4.2-2 Figure 2.4.2-2 Table 2.4.2-5 ITAAC #2, #11.a	The reactor vessel head vent valves; the safety depressurization valve (SDV) and depressurization valves (DV) could be used for high point vents to support prevention of beyond design basis events and severe accident mitigation.	5.4.12 Table 5.4.12-3 19.1.3.1 19.1.3.2 19.2.3.3 Table 19.1-1 Table 19.1-119
2.4.2 Table 2.4.2-5 ITAAC #2, #11.a	Safety depressurization valves (SDVs) are provided at top head of the pressurizer in order to cool the reactor core by feed and bleed operation when loss of heat removal from steam generator occurs.	5.4.12.2 Table 19.1-119
2.4.2 Table 2.4.2-5 ITAAC #2, #11.a 2.4.4 Table 2.4.4-5 ITAAC #1.a, #10.a	In the event of delay in establishing RHR cooling after safety injection, the SDV and SI pump ensure long term heat removal.	Table 19.1-119
2.4.2 Table 2.4.2-5 ITAAC #2, #11.a	RCS depressurization system dedicated for severe accident is provided to prevent high pressure melt ejection.	5.4.12.2 Table 19.1-119
2.4.4 Table 2.4.4-5 ITAAC #1.a, #10.a	In the event of loss of heat removal by the RHRS and SGs, a SI pump can be manually started to maintain RCS water level.	Table 19.1-119

2.4.4 Table 2.4.4-5 ITAAC #1.a, #8 ~~2.11.2~~ ~~2.11.3~~	RWSP suction isolation valves can be closed to prevent leakage of RWSP water from SI, CS/RHR or RWS.	Table 19.1-119

NOTES: (1) Source: Tier 1 section or table. (2) Tier 2 location or table where addressed.

Table 14.3-1d PRA and Severe Accident Analysis Key Design Features

(Sheet 2 of 78)

Tier 1 Ref.[1]	Key Design Features	Tier 2 Location[2]
2.4.5 Table 2.4.5-5 ITAAC #9, #11	In the case of failure of running RHRS, with RHR flow rate – low the valves on the standby RHR suction line and discharge line can be opened and the standby RHR pump started in order to maintain RHR operation.	Table 19.1-119
2.4.5.1 Table 2.4.5-5 ITAAC #1.a	Alternate core cooling/injection utilizing CSS/RHRS is available in case all safety injection fails.	Table 19.1-1 Table 19.1-119 19.2.2
2.4.5.1 Table 2.4.5-5 ITAAC #11 2.7.1.2 Table 2.7.1.2-5 ITAAC #8.a 2.7.1.11 Table 2.7.1.11-5 ITAAC #18	In high RCS pressure sequences, a fast depressurization of the RCS by using the EFW pumps to remove heat through the SGs and by manually opening the MSRVs allows alternate core cooling injection using the CS/RHR pumps.	Table 19.1-119
2.4.5.1 Table 2.4.5-5 ITAAC #1.a	CSS/RHRS provides water to flood the reactor cavity.	Table 19.1-119
2.4.5.1 Table 2.4.5-5 ITAAC #2	Upgraded piping design pressure for the residual heat removal system (RHRS) results in a negligible frequency of occurrence of an inter-system LOCA.	19.1.3.4 Table 19.1-1 Table 19.1-119
2.4.5.1 Table 2.4.5-5 ITAAC #1.a, #2, 7.a	Two motor operated valves in series on the RHR suction line with power lockout capability during normal power operation minimize the probability of RCS pressure entering the RHR system. Even if both these valves are opened during normal power operation, the RHR system is designed to discharge the RCS inventory to the in-containment RWSP. The RHRS is designed to prevent an interfacing system LOCA by having a design rating of 900 lb.	5.4.7.1 Table 19.1-119
2.4.5 Table 2.4.5-5 ITAAC #9	RHR suction isolation valves can be manually closed to isolate a LOCA in the RHR line.	Table 19.1-119

NOTES: (1) Source: Tier 1 section or table. (2) Tier 2 location or table where addressed.

Table 14.3-1d PRA and Severe Accident Analysis Key Design Features

(Sheet 3 of ~~7~~8)

Tier 1 Ref.(1)	Key Design Features	Tier 2 Location(2)
2.4.5 Table 2.4.5-5 ITAAC #1.a	One normally closed air-operated valve is installed in each of two low-pressure letdown lines that are connected to two of four RHR trains.	Table 19.1-119
2.4.5.1 Table 2.4.5-5 ITAAC #1.a	To prevent loss of RCS inventory during mid-loop operation and support severe accident prevention, the low-pressure letdown line isolation valves are automatically closed and the CVCS is isolated from the RHRS, after receiving a RCS loop low-level signal.	5.4.7.2 19.1.3.4 Table 19.1-1 Table 19.1-119 19.2.2.2
2.4.6 Table 2.4.6-5 ITAAC #1.a 2.7.6.3 Table 2.7.6.3-5 ITAAC #1	CVCS charging pumps can provide decay heat removal in the event of loss of RHR and SG cooling. The RWSP can provide makeup~~meakeup~~ to the RWSAT for charging pump suction.	Table 19.1-119
2.5.1 Table 2.5.1-3 Table 2.5.1-6 ITAAC #4 2.5.4 Table 2.5.4-2 ITAAC #2	Containment isolation and heat removal can be manually actuated in the event of failure of the containment isolation signal.	Table 19.1-119
2.5.1 Table 2.5.1-3 Table 2.5.1-6 ITAAC #4 2.5.4 Table 2.5.4-2 ITAAC #2	ESF actuation can be performed manually in the event of failure of automatic ESF actuation.	Table 19.1-119

NOTES: (1) Source: Tier 1 section or table. (2) Tier 2 location or table where addressed.

Table 14.3-1d PRA and Severe Accident Analysis Key Design Features

(Sheet 4 of 8)

Tier 1 Ref.(1)	Key Design Features	Tier 2 Location(2)
2.6.1 Table 2.6.1-3 ITAAC #1 2.6.5 Table 2.6.5-1 ITAAC #1	Non-Class 1E 6.9kV permanent buses P1 and P2 are also connected to the non-Class 1E A-AAC GTG and B-AAC GTG, respectively. The loads which are not safety-related but require operation during LOOP are connected to these buses.	8.3.1.1.1 Table 19.1-119
2.6.1 Table 2.6.1-3 ITAAC #24	Non-segregated busducts/cable buses to safety buses in the T/B electrical room are segregated into two groups by qualified fire barriers.	8.3.1.1.8 9.5.1 19.1.5.2 Table 19.1-1 Table 19.1-119
2.6.4 Table 2.6.4-1 ITAAC #3, #11, #32	The GTG does not need a cooling water system. Cooling of GTG is achieved by air ventilation system GTG combustion air intake and exhaust system for each of the four GTGs supply combustion air of reliable quality to the gas turbine and exhausts combustion products from the gas turbine to the atmosphere. The air intake also provides ventilation/cooling air to the GTG assembly.	9.5.5 9.5.8 Table 19.1-119
2.6.5.1 Table 2.6.5-1 ITAAC #1	Common cause failure between class 1E GTG and non-class 1E GTG supply is minimized by design characteristics. The AAC power sources are of different size, have different starting system from the EPS.	8.4.1.3 Table 19.1-119
2.6.5.1 Table 2.6.5-1 ITAAC #6	In the event of SBO, power to one Class 1E 6.9kV bus can be restored manually from the AAC GTG. Power to the shutdown buses can be restored from the AAC sources within 60 minutes.	8.3.1.1.2.4 8.4.1.2 8.4.1.3 Table 19.1-119
2.6.5.1 Table 2.6.5-1 ITAAC #1	Alternate ac power supported by two non-Class 1E GTGs is incorporated as a countermeasure against SBO. Alternate ac power sources can supply power to two of the four safety buses in case class 1E GTGs fail during loss of offsite power. AAC power sources are non-Class 1E and non-seismic. AAC power sources supply power to loads required to bring and maintain the plant in a safe shutdown condition for a station blackout (SBO) condition.	8.4.1.3 19.1.3.1 19.1.3.4 19.1.4.1 Table 19.1-1 19.2.2

NOTES: (1) Source: Tier 1 section or table. (2) Tier 2 location or table where addressed.

Table 14.3-1d PRA and Severe Accident Analysis Key Design Features

(Sheet 45 of 78)

Tier 1 Ref.[1]	Key Design Features	Tier 2 Location[2]
2.6.5.1 Table 2.6.5-1 ITAAC #1, #5	AAC power sources use different rating GTGs than the Class 1E EPSs, with diverse starting system, independent and separate auxiliary and support systems to minimize common cause failure.	8.4.1.3 Table 19.1-119
2.7.1.2 Table 2.7.1.2-5 ITAAC #8.a 2.7.1.11 Table 2.7.1.11-5 ITAAC #8.a, #18	Main steam depressurization valves (MSDVs) on intact SG(s) can be opened and EFW flow established to promote heat removal and RCS depressurization.	Table 19.1-119
2.7.1.11.1 Table 2.7.1.11-5 ITAAC #1.a	Each EFW pump discharge line connects with a cross-tie line using normally closed motor-operated isolation valves to provide separation of four trains. Operation to open the EFW cross-tie valve when an EFW pump is not available is an important feature to reduce core damage frequency.	10.4.9.2 19.1.4.1 19.2.2
2.7.3.1 Table 2.7.3.1-5 ITAAC #10.a	In the case of failure of running ESWS, with ESW flow rate – low, the standby ESW pump can be started in order to maintain ESWS operation.	Table 19.1-119
2.7.3.1 Table 2.7.3.1-5 ITAAC #1.a	In the case of ESW pump discharge blockage, flow can be switched from the blocked strainer to the standby strainer.	Table 19.1-119
2.7.3.3 Table 2.7.3.3-5 ITAAC #8.a	CCW header tie line isolation valves may be manually closed to achieve header separation in the event of failure of automatic valve closure.	Table 19.1-119
2.7.3.3 Table 2.7.3.3-5 ITAAC #10.a	In the case of failure of running CCWS, with CCW flow rate – low, the standby CCW pump can be started in order to maintain CCWS operation.	Table 19.1-119

NOTES: (1) Source: Tier 1 section or table. (2) Tier 2 location or table where addressed.

Table 14.3-1d PRA and Severe Accident Analysis Key Design Features

(Sheet ~~5~~6 of ~~7~~8)

Tier 1 Ref.[(1)]	Key Design Features	Tier 2 Location[(2)]
2.7.3.3 Table 2.7.3.3-5 ITAAC #1.a	If loss of seal injection should occur, CCW continues to provide flow to the thermal barrier heat exchanger; which cools the reactor coolant. The pump is able to maintain safe operating temperatures and operate safely long enough for safe shutdown of the pump.	5.4.1.1.3 Table 19.1-119
2.7.3.3 Table 2.7.3.3-5 ITAAC #1.a Table 2.7.3.6-3 ITAAC #1	Alternate containment cooling via natural CV circulation can be established by pressurizing CCWS with nitrogen, disconnecting nonessential heat loads and connecting to the containment fan cooler units.	Table 19.1-119
2.7.3.6.1 Table 2.7.3.6-3~~1~~ ITAAC #3	Non-essential chilled water system provides alternate component cooling water to charging pumps in order to maintain RCP seal water injection.	Table 19.1-1 Table 19.1-119
2.7.3.6 Table 2.7.3.6-3 ITAAC #1 2.7.5.3.1.2 Table 2.7.5.3-1	Alternate containment cooling using the containment fan cooler system is provided to prevent containment over pressure even in case of containment spray system failure. The fan cooling units are cooled by the component cooling water system. The containment fan cooler system enhances condensation of surrounding steam by natural convection and thus enhances continuous depressurization of the containment.	9.4.6.2 19.1.3.1 Table 19.1-1 19.1.3.2 Table 19.1-119 19.2.3.3.8
2.7.6.3 Table 2.7.6.3-5 ITAAC #1	As a countermeasure for loss of RHR, RCS makeup by gravity injection from spent fuel pit is available when the RCS in atmospheric pressure.	19.1.6.1 Table 19.1-1 Table 19.1-119
2.7.6.9.1 Table 2.7.6.9-~~1~~2 ITAAC #6.a	The fire protection water supply system (FSS) is available as an alternative component cooling water source for severe accident prevention, including support of CVCS for RCP seal water injection.	9.5.1.2.2 19.1.3.2 19.1.5.3.2 19.2.3.3.3 Table 19.1-119

NOTES: (1) Source: Tier 1 section or table. (2) Tier 2 location or table where addressed.

Table 14.3-1d PRA and Severe Accident Analysis Key Design Features

(Sheet ~~6~~7 of ~~7~~8)

Tier 1 Ref.[1]	Key Design Features	Tier 2 Location[2]
~~2.7.6.9.1~~ Table 2.7.6.9-~~1~~2 ITAAC #6.b	The FSS is available to the containment spray system and water injection to the reactor cavity for severe accident mitigation.	9.5.1.2.2 19.1.3.2 19.2.3.3.3 Table 19.1-119
Table 2.11.1-2 ITAAC #4	A set of drain lines is provided from the steam generator compartments to the reactor cavity to flood the reactor cavity with containment spray water during severe accidents.	19.1.3.2 Table 19.1-119
2.11.1.1 Table 2.11.1-2 ITAAC #5	The core debris trap enhances capturing of ejected molten core in the reactor cavity to support severe accident mitigation. The consequences of a postulated high pressure melt ejection accident, including direct containment heating, are mitigated by the debris trap in the reactor cavity as well as no direct pathway to the upper compartment for the impingement of debris on the containment shell.	19.1.3.2 Table 19.1-1 Table 19.1-119 19.2.3.3.4
2.11.1.1 Table 2.11.1-2 ITAAC #6	The geometry of the reactor cavity is designed to assure adequate core debris coolability. Sufficient reactor cavity floor area and appropriate reactor cavity depth are provided to enhance spreading debris bed for better coolability to support severe accident mitigation.	19.1.3.2 Table 19.1-119 19.2.3.3.3
2.11.1.1 Table 2.11.1-2 ITAAC #7	There is a liner-plate-covering concrete as the floor surface of the reactor cavity, which supports severe accident mitigation by protecting against short-term attack by relocated core debris.	Table 19.1-119 19.2.3.3.3
2.11.2.1 Table 2.11.2-2 ITAAC #14	Main containment penetrations are isolated automatically even when SBO occurs and alternative ac generators are not available.	8.3.1.1.5 Table 8.3.1-10 Table 19.1-1 Table 19.1-119

NOTES: (1) Source: Tier 1 section or table. (2) Tier 2 location or table where addressed.

Table 14.3-1d PRA and Severe Accident Analysis Key Design Features

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Tier 1 Ref.[(1)]	Key Design Features	Tier 2 Location[(2)]
2.11.4.1 Table 2.11.4-1 ITAAC #1, #2, #3, #4, #5, #6	The CHS includes 1. a single hydrogen monitor located outside of containment that measures hydrogen concentration in containment air extracted from the containment. 2. 20 igniters installed inside the containment, designed to burn hydrogen continuously to maintain hydrogen concentration below the low limit of global burn (approximately 10% hydrogen in air), thereby preventing further hydrogen accumulation that could become a threat to containment integrity. 3. The igniters start upon receipt of an ECCS actuation signal and are powered by two non-class 1E buses with non-class 1E GTGs.	6.2.5 Figure 6.2.5-1 19.1.3.2 19.2.3 Table 19.1-119
2.13 Table 2.13-1 ITAAC #1	US-APWR design reliability assurance program provides reasonable assurance that: 1) the US-APWR is designed, constructed, and operated in a manner that is consistent with the assumptions and risk insights for the SSCs, 2) the SSCs do not degrade to an unacceptable level during plant operations, 3) the frequency of transients that challenge SSCs is minimized, and 4) the SSCs function reliably when challenged.	17.4 Table 17.4-1

NOTES: (1) Source: Tier 1 section or table. (2) Tier 2 location or table where addressed.

Table 14.3-1e ATWS Key Design Features

Tier 1 Ref.(1)	Key Design Features	Tier 2 Location(2)
2.5.3.1 Table 2.5.3-4 ITAAC #3, #4	The DAS is a non-safety system that is diverse from the MELTAC platform of the PSMS and PCMS, and is diverse from the hardware used in the reactor trip function of the RT system. The DAS equipment is used for the ATWS mitigation and a countermeasure to common cause failure (CCF) that disables all functions of PSMS and PCMS.	7.8 Table 19.1-119
2.5.3.1 Table 2.5.3-4 ITAAC #1.c	The DAS is electrically and physically isolated from the PSMS	7.8.2.3

NOTES: (1) Source: Tier 1 section or table. (2) Tier 2 location or table where addressed.

Table 14.3-1f Radiological Analysis Key Design Features

(Sheet 1 of 2)

Tier 1 Ref.(1)	Key Design Features	Tier 2 Location(2)
Table 2.1-1.	The χ/Q values used in determining the radiological consequences of postulated accidents (other than the MCR and the TSC).	Table 2.0-1 Table 15.0-13 Table 15A-17
Table 2.1-1	The MCR and the TSC χ/Q values used in determining the radiological consequences of postulated accidents as follows: - Steam system piping failure analysis - RCP rotor seizure analysis - Rod ejection accident analysis - Failure of small lines carrying primary coolant outside containment ~~and SGTR~~ analysis - SGTR analysis - LOCA analysis - Fuel handling accident analysis	Table 2.0-1 Table 2.3.4-1 thru 2.3.4-7 Table 15A-18 Table 15A-19 Table 15A-20 Table 15A-21 Table 15A-22 Table 15A-23 Table 15A-24
2.2.1.1 Table 2.2-4 ITAAC #4.a, #4.b Table 2.11.1-1	Containment leak rate, 0-24 hr following LOCA, is 0.15 %/d.	6.2.1 Table 6.2.1-2 15.4.8.5 Table 15.4.8-3 15.6.5.5 Table 15.6.5-4
2.4.4.1 Table 2.4.4-5 ITAAC #7.c	The sodium tetraborate decahydrate (NaTB) baskets, which provide containment pH control during a LOCA, have a total calculated weight of NaTB of 44,100 pounds.	6.3.2.2.5 Table 6.3-5
2.7.5.1.1 Table 2.7.5.1-3 ITAAC #4.b	Performance values of the MCR HVAC system used in the safety analysis are: Unfiltered CRE inleakage: 120 cfm Filtered air intake flow : 1200 cfm Filtered air recirculation flow : 2400 cfm Filter efficiency Elemental iodine : 95% Filter efficiency Organic iodine : 95% Filter efficiency Particulates : 99%	6.4.2.3 Table 15.6.5-5

NOTES: (1) Source: Tier 1 section or table. (2) Tier 2 location or table where addressed.

Table 14.3-1f Radiological Analysis Key Design Features

(Sheet 2 of 2)

Tier 1 Ref.(1)	Key Design Features	Tier 2 Location(2)
2.7.5.2.1.1 Table 2.7.5.2-3 ITAAC #4.a	Penetration and Safeguard Component Areas negative pressure arrival time : 240 sec Filter efficiencies for particulates: 99%	6.5.1 Table 15.6.5-4
Table 2.11.2-2 ITAAC #8.vi	The low volume containment purge isolation valves response time is within 15 seconds of accident initiation.	Table 6.2.4-3 15.6.5.5.1.1 Table 15.6.5-4 Chapter 16 Bases 3.6.3
Table 2.2-2 Table 2.2-4 ITAAC #1 Table 2.8-1 ITAAC #1.a Table 2.8-2	Shielding walls and floors for safety-related structures are provided to maintain the maximum radiation levels to meet the radiation zone.	3.8.3 Table 12.3-1 12.3.2.2
Table 2.8-1 ITAAC #1.b Table 2.8-2	Shielding walls and floors for the Auxiliary Building are provided to maintain the maximum radiation levels to meet the radiation zone.	Table 12.3-1 12.3.2.2
2.2.1.1 Table 2.2-2 Table 2.2-4 ITAAC #1, #3, #4, #5 2.11.1.1 Table 2.11.1-1 Table 2.11.1-2 ITAAC #1, #2, #3	The PCCV facility is comprised of the containment vessel and the annulus enclosing the containment penetration area, and provides an efficient leak-tight barrier and environmental radiation protection under all postulated conditions, including LOCA.	3.8 6.2.1 Table 6.2.1-2

NOTES: (1) Source: Tier 1 section or table. (2) Tier 2 location or table where addressed.

2.2.2 Protection Against Hazards

2.2.2.1 External Flooding

Protection against external flooding is provided to preserve the safe shutdown capability. The main components protected against external flooding are listed in Table 2.2-3. The external walls that are below flood level are adequate thickness to protect against water seepage, and penetrations in the external walls below flood level are provided with flood protection features. Construction joints in the exterior walls and base mats are provided with water stops to prevent seepage of ground water. Additional protection is provided using a waterproofing system applied to below-grade surfaces.

2.2.2.2 Internal Flooding

Protection against internal flooding is provided to preserve the safe shutdown capability. The main components protected against internal flooding are listed in Table 2.2-3.

Elevation -26 ft, 4 in. in radiological controlled area (RCA) of the R/B is divided into two~~four~~ areas, by concrete walls and water-tight doors. A water-tight door is provided in each CS/RHR pump room and SIS pump room. And also water-tight doors are provided in doorways between A/B and R/B.

Elevation -26 ft, 4 in. in the non-radiological controlled area (NRCA) of the R/B is divided into two areas by concrete walls and water-tight doors installed in the corridor. ~~The two trains of four emergency feedwater pump rooms are isolated by concrete walls and water-tight doors.~~ Water-tight doors are provided in doorways at ground level between the T/B and the R/B.

2.2.2.3 Fire Barriers

Redundant safe shutdown components and associated electrical divisions outside the containment and the control room complex are separated by 3-hour rated fire barriers to preserve the capability to safely shut down the plant following a fire. The main components protected against fires are listed in Table 2.2-3. The 3-hour rated fire barriers are placed as required by the fire hazard analysis (FHA). All penetrations and openings through the fire barriers are protected with 3-hour rated components (i.e. fire doors in door openings, fire dampers in ventilation duct openings, and penetration seals).

2.2.2.4 Site Parameters

Section 2.1 contains specific site parameter requirements necessary to meet the engineering and design needs for construction and operation of the US-APWR standard plant. Site bounding parameters, and subsequent engineering design, are chosen to allow construction of the US-APWR within 75% to 80% of the landmass of the conterminous U.S. and includes all possible sites under current consideration. The design of the US-APWR standard plant and the site parameters are robust to meet most conditions expected to be encountered in all possible sites.

Table 2.11.2-1 Containment Isolation System Equipment Characteristics (Sheet 4 of 10)

System Name	Tag No.	ASME Code Section III Class	Seismic Category I	Remotely Operated Valve	Class 1E/ Qual. For Harsh Envir.	Safety-Related Display	PSMS Control	Active Safety Function	Loss of Motive Power Position
CVVS	VCS-AOV-307	2	Yes	Yes	Yes/No	Yes	Containment Purge Isolation	Transfer Closed	Closed
CVVS	VCS-AOV-305	2	Yes	Yes	Yes/Yes	Yes	Containment Purge Isolation	Transfer Closed	Closed
CVVS	VCS-AOV-304	2	Yes	Yes	Yes/No	Yes	Containment Purge Isolation	Transfer Closed	Closed
CVVS	VCS-AOV-356	2	Yes	Yes	Yes/Yes	Yes	Containment Purge Isolation	Transfer Closed	Closed
CVVS	VCS-AOV-357	2	Yes	Yes	Yes/No	Yes	Containment Purge Isolation	Transfer Closed	Closed
CVVS	VCS-AOV-355	2	Yes	Yes	Yes/Yes	Yes	Containment Purge Isolation	Transfer Closed	Closed
CVVS	VCS-AOV-354	2	Yes	Yes	Yes/No	Yes	Containment Purge Isolation	Transfer Closed	Closed
CVVS~~CWS~~	VCS-PT-371~~2390~~,372~~2391~~	-	Yes	-	No/No	No	-	-	-
VWS	VWS-MOV-407	2	Yes	Yes	Yes/No	Yes	Containment Isolation Phase A	Transfer Closed	As Is