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Subject: Response to Portion of NRC Request for Additional Information Letter No. 126 Related to ESBWR Design Certification Application, RAI Numbers 14.3-220, 14.3-221, 14.3-222, 14.3-223, and 14.3-301

The purpose of this letter is to submit the GE Hitachi Nuclear (GEH) response to the U. S. Nuclear Regulatory Commission (NRC) Request for Additional Information (RAI) sent by NRC Letter dated December 20, 2007 (Reference 1).

The GEH response to RAI Numbers 14.3-220, 14.3-221, 14.3-222, 14.3-223, and 14.3-301 is addressed in Enclosure 1. The enclosed changes will be incorporated in the upcoming DCD Revision 5 submittal.

Verified DCD changes associated with this RAI response are identified in the enclosed DCD markups by enclosing the text within a black box. The marked-up pages may contain unverified changes in addition to the verified changes resulting from this RAI response. Other changes shown in the markup(s) may not be fully developed and approved for inclusion in DCD Revision 5.

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

Sincerely,

James C. Kinsey

James C. Kinsey
Vice President, ESBWR Licensing

D068
NRO

Reference:

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

Enclosure:

1. Response to Portion of NRC Request for Additional Information Letter No. 126 Related to ESBWR Design Certification Application RAI Numbers 14.3-220, 14.3-221, 14.3-222, 14.3-223, and 14.3-301

cc:	AE Cubbage	USNRC (with enclosure)
	GB Stramback	GEH/San Jose (with enclosure)
	RE Brown	GEH/Wilmington (with enclosure)
	DH Hinds	GEH/Wilmington (with enclosure)
	eDRF	0000-0080-5100 (RAI 14.3-220, 14.3-221, 14.3-222, 14.3-223) 0000-0083-7297 (RAI 14.3-301)

Enclosure 1

MFN 08-086 Supplement 38

Response to Portion of NRC Request for

Additional Information Letter No. 126

Related to ESBWR Design Certification Application

RAI Numbers 14.3-220, 14.3-221, 14.3-222, 14.3-223, and 14.3-301

Note: Verified DCD changes associated with this RAI response are identified in the enclosed DCD markups by enclosing the text within a black box. The marked-up pages may contain unverified changes in addition to the verified changes resulting from this RAI response. Other changes shown in the markup(s) may not be fully developed and approved for inclusion in DCD Revision 5.

NRC RAI 14.3-220

NRC Summary:

Isolation of RB systems and volumes

NRC Full Text:

DCD Tier 1, Table 2.16.2-1 does not list safety-related dampers for supply inlet, exhaust outlet and smoke purge outlets of the Reactor Building Clean Area HVAC Subsystem (CLAVS). The description states that the CLAVS area is "nonradiologically controlled." The staff needs additional information on how the Reactor Building Contaminated Area HVAC Subsystem (CONAVS) volumes and Reactor Building Refueling and Pool Area HVAC Subsystem (REPAVS) volumes which are isolated by SR dampers are sealed from the CLAVS clean area volume during an accident when the negative pressure differentials between volumes are not maintained. Since there are no safety-related dampers to assure CLAVS isolation post accident, the CLAVS volume may be considered part of the external environment. As such, all releases to the CLAVS by way of the CONAVS or REPAVS volumes must be considered as exfiltration from the RB.

Has the volume used in the design basis analysis for the reactor building been reduced by the volume of the non-radiologically controlled CLAVS volume which is not isolated by safety-related dampers? If the CLAVS area is credited as a radiation control area, please revise the description and add the CLAVS dampers to the list of safety-related components in Tier 1 Table 2.16.2-1.

The CLAVS area is stated as being a non-radiological control area which may mean that no credit is given to these non-safety-related dampers and that the CLAVS area is effectively open to the environment. In the testing of RBVS isolation dampers per Table 2.16.2-2, Item 2, are the CLAVS exhaust and supply dampers which are not listed as safety related in Table 2.16.2-1 tested for isolation?

GEH Response

A. The Reactor Building Ventilation subsystem CLAVS is provided with safety-related dampers for the supply and exhaust building penetrations including smoke purge and battery room exhaust as discussed in response to RAI 9.4-42 (MFN 07-592, dated November 23, 2007). By design, the building potentially contaminated areas (CONAVS and REPAVS) are separated from the clean area (CLAVS) of the Reactor Building. The differential pressure, established during normal operation, between subsystems is not needed to maintain radiological areas from communicating with non-radiological areas during accident conditions. There are no flow paths, door louvers, etc. where air travels between ventilation subsystems (radiological and non-radiological areas). They are separated by the building compartmentalization. On a Loss of Power, all three subsystem's isolation dampers close to isolate the entire reactor building.

B. RAI 6.2-165 will re-confirm the volume used in the design basis accident in its entirety. Safety-related CLAVS isolation dampers have been added to DCD Tier 1, Table 2.16.2-1, per RAI 14.3-52 S01 (MFN 07-032, Supplement 1, dated December 14, 2007). The CLAVS subsystem is not a radiation area; however, this area is isolated during an accident coincident with a loss of power. This serves as an additional building boundary / barrier.

C. The CLAVS subsystem is a non-radiological controlled ventilation system, which is designed to run, creating a slightly positive pressure, unless there is a loss of power event. With a loss of power, the system is designed to isolate the CLAVS area from the outside environment. Safety-related dampers perform this function. The CLAVS subsystem is not effectively open to the environment. The CLAVS Safety-related dampers were added to Table 2.16.2-1 under RAI 14.3-52 S01, and they will be tested per Table 2.16.2-2, Items 2 and 3.

DCD Impact

No DCD changes will be made in response to this RAI.

NRC RAI 14.3-221

NRC Summary:

Post 72 hour operating requirements of RBVS

NRC Full Text:

Regarding the Design Description in Tier 1 Section 2.16.2.1, how does the Reactor Building HVAC System (RBVS) maintain isolation and control of releases post accident as in Item 2 (The RBVS isolation dampers automatically close upon receipt of a high radiation signal or loss of AC power) if it operates to provide post 72-hour cooling as in Item 7 (The RBVS provides post 72-hour cooling for DCIS, CRD and RWCU pump rooms...)?

What parts of the RBVS are operating and does it exhaust from the building?

Does it provide for either cooling or control of hydrogen in safety-related battery rooms?

In testing the RB for leak tightness as per Tier 1 Table 2.16.5-2, Item 4, does the test have to consider the RBVS running in the 72 hour post accident cooling mode? What portions of the RBVS system are classified as RTNSS? Is the CLAVS area of the RB considered as part of the RB for testing?

How is the RTNSS qualification demonstrated and verified? Can the releases be demonstrated to be less than the 50% mass per day leakage rate assumed in the design basis analysis?

What cooling systems (chilled water, component cooling water, etc.) are required to support the RBVS cooling functions? What source of power is supplied to these systems?

Are the supporting cooling systems classified as RTNSS?

Has the 72-hour post accident RBVS operation requirements been evaluated for winter and summer design temperature conditions?

GEH Response

A. The RBVS isolation dampers automatically close upon receipt of a high radiation signal (CONAVS and REPAVS) or loss of AC power (CONAVS, REPAVS and CLAVS). The building is designed to remain isolated post accident until power is restored and a radiological assessment is made prior to restarting the ventilation subsystems (CONAVS, REPAVS and CLAVS). During this isolation period, the room coolers are designed for removing heat from the DCIS, CRD and RWCU pump room areas, provided power has been restored. During the first 72-hours, with no power available, the heat is removed passively by the surrounding structures.

B. The RBVS building isolation and post accident cooling is described in part A of this response. Prior to restarting the CONAVS and REPAVS ventilation subsystems, a radiological assessment of the subsystem atmosphere would be performed. The redundant Reactor Building HVAC Purge Exhaust Filter Units would be available to clean up and discharge the building air, creating a negative pressure in the CONAVS area, when power is available.

   Upon restoration of power, a radiological assessment of the CLAVS area is made prior to restarting this ventilation subsystem, which includes battery room exhaust fans. Once this assessment approves the restart of the CLAVS ventilation subsystem, battery recharge can follow ensuring that battery room exhaust fans are running while charging takes place. The battery room area is served by the CLAVS subsystem of the RBVS. Since batteries do not generate hydrogen while discharging, there is no potential building-up of hydrogen gas in the battery rooms until power restoration at recharging. When power is restored, the CLAVS area ventilation (including battery exhaust fans) will be restarted concurrent with the recharging of the batteries effectively removing any hydrogen generated and heat generated in this area.

C. The RB leak tightness test will be conducted to validate the leakage assumptions of the ESBWR Containment Fission Product Removal Evaluation Model. This analysis does not consider the RBVS in operation, as during the 72 hour post accident cooling mode. Therefore, the RB HVAC systems will not be in operation during RB leak tightness testing. The RB leak tightness test per Table 2.16.5-2, Item 4, will be performed with no RB subsystems CONAVS, CLAVS, and REPAVS running. The room coolers, which have no ventilation contact outside their specific areas, will not be required to be running. The CLAVS subsystem is not considered as part of the RB for testing. The RBVS RTNSS functions are listed in DCD Chapter 19A, Table 19A-2.

D. RBVS RTNSS functions will be tested as per ITAAC Table 2.16.2-2, Item 7. The release will be demonstrated by test to be less than the assumed value in the design basis analysis as stated in Table 2.16.5-2, Item 4.

E. Chilled Water is the cooling system required to support post 72 hr RBVS RTNSS functions. The source of power to the Nuclear Island Chilled Water subsystem (NICWS) is from PIP Plant Investment busses A and B. This power supply is provided with onsite diesel backup.

F. Yes, the room coolers and Chilled Water (as stated above) for the DCIS area cooling are supporting RTNSS functions. These functions are listed in DCD Tier 2, Table 19A-2.

G. The 72 hour post accident RBVS system requirements have been evaluated for winter and summer design temperature operation.

DCD Impact

No DCD changes will be made in response to this RAI.

NRC RAI 14.3-222

NRC Summary:

Post accident migration of contamination to clean areas

NRC Full Text:

In the Design Description in Tier 1 Section 2.16.2.1, in Items (5) and (6) both the CONAVS and REPAVS maintain negative pressures when operation with respect to adjoining clean areas. During an accident both of these systems are isolated. What prevents the contamination in the CONAVS and REPAVS areas from migrating to the clean areas of the building and ultimately escape the building to the environment?

If there are barriers that would prevent this, are these barriers tested and controlled by surveillance? Please provide an ITAAC to confirm these barriers, if applicable.

GEH Response

The design of the RB is such that there is no communication between the potentially contaminated CONAVS and REPAVS subsystems and the CLAVS subsystem. This is because there are internal walls and barriers with no openings or communication between the clean and contaminated areas. These areas are tested for leak tightness during the building pressure test.

The Reactor Building is periodically tested as stated in DCD Sections 6.2.3 – Reactor Building Functional Design and committed to in Chapter 16, Technical Specification, SR 3.6.3.1.4. The initial plant RB leak tightness test is performed per Table 2.16.5-2, Item 4. This testing will ensure that RB leakage rate, including internal barriers, under the conditions expected to exist during a LOCA is within accident analysis limits. This testing ensures the communication between RB contaminated areas and outside areas remains below the established Technical Specification limits. No additional ITAAC is needed.

DCD Impact

No DCD changes will be made in response to this RAI.

NRC RAI 14.3-223

NRC Summary:

Post accident hydrogen control in Battery Rooms

NRC Full Text:

Tier 1 Table 2.16.2-2 Item 4 does not provide for verification that the hydrogen concentration levels in the battery rooms can be maintained less than 2% by volume for post accident conditions when the RBVS is shut down (and temperatures could be very high) or when only the RTNSS portions of the RBVS are operational post 72 hours after accident. Please provide an addition to the ITAAC that verifies design features to control hydrogen levels under all conditions of operation or provide a justification as to why hydrogen levels do not need to be controlled post accident..

GEH Response

Since batteries do not generate hydrogen while discharging, there is no potential hydrogen gas build-up in the battery rooms during the 72 hours after an accident. Only after power restoration, when recharging the batteries is performed, is there a potential for hydrogen gas buildup in the battery areas. Note that these batteries, VRLA-type (Valve Regulated Lead Acid), are designed to produce very little hydrogen when recharging under normal conditions. Upon restoration of power, a radiological assessment of the CLAVS area is made prior to restarting the ventilation subsystem, which includes battery room exhaust fans. Once this assessment approves the restart of the CLAVS ventilation subsystem, battery recharge can follow ensuring that battery room exhaust fans are running while charging takes place. ITAAC Table 2.16.2-2, Item 4, verifies "The RBVS maintains the hydrogen concentration levels in the battery rooms below 2% by volume". The battery room exhaust discharges to the Reactor Building / Fuel Building vent stack, which has monitoring.

DCD Impact

No DCD changes will be made in response to this RAI.

NRC RAI 14.3-301

NRC Summary:

Structural and/or fire barriers

NRC Full Text:

In ITAAC Table 2.1.2-3, ITAAC #7, the staff requests that the applicant not use "and/or" in the acceptance criteria because it is vague. It should be one or the other term. Please review all ITAAC in the DCD and eliminate the use of "and/or."

In addition, the staff requests that the term "physical separation" be defined. The usage of "physical separation" for this ITAAC implies that criteria for divisional separation to comply with single failure criterion are synonymous with separation criteria for fire hazards analysis.

Also, the staff requests that the applicant revise the DC to clarify whether the design commitment is to comply with single failure criterion or separation criteria for fire hazards analysis.

GEH Response

GEH has evaluated the use of *and/or* throughout the Tier 1 DCD material. Specific examples using *structural and/or fire barriers* are addressed in the response to this RAI while the other examples of usage of *and/or* in other Tier 1 sections is addressed by the GEH response to RAI 14.3-303 (MFN 08-086 Supplement 27, dated April 11, 2008).

In addition, this RAI response supersedes the responses to RAI 5.2-29 (MFN-06-178, dated June 16, 2006) for Table 2.1.2-3, ITAAC Item 7, for the Nuclear Boiler System and RAI 6.3-25 (MFN 06-241 Supplement 2, dated April 12, 2007) for Table 2.4.2-3, ITAAC Item16, for the Gravity-Driven Cooling System.

A review of DCD Tier 1 Rev 4 identified the use of "physical separation between trains by structural and/or fire barriers" in the following ITAAC tables:

Table 2.1.2-3 ITAAC for the Nuclear Boiler System
Table 2.2.4-6 ITAAC for the Standby Liquid Control System
Table 2.4.1-3 ITAAC for the Isolation Condenser System
Table 2.4.2-3 ITAAC for the Gravity-Driven Cooling System
Table 2.15.4-2 ITAAC for the Passive Containment Cooling System

These ITAAC are focused on providing physical separation to comply with single failure criterion. Separation criteria for Fire Hazard Analysis (FHA) is addressed in ITAAC

Table 2.16.3.1-1, Item 1 which requires 3-hour rated fire barriers between redundant divisions or trains of safety-related systems to prevent damage that could adversely affect a safe shutdown function from a single fire.

IEEE Standard 384-74 provides the separation criteria for Class 1E systems and components and states that acceptable separation is achieved by safety class structures, distance, or barriers, or any combination thereof. Similar requirements are also necessary to ensure single failure criterion is met for mechanical systems.

Physical separation is provided for safety-related system to assure a single failure will not prevent safe shutdown of the plant. Safety-related structures provide 'positive' separation; and are used to provide separation when feasible. Sometimes safety-related structures are not feasible and design features such as spatial separation or whip restraints versus structures are used to achieve physical separation. The requirements are dependent on the specific hazard. For example, for some low energy systems, analysis may determine spatial separation is acceptable. A whip restraint or jet/missile shield would provide protection from mechanical damage, but would not provide protection from an environmental hazard. The methods used to protect redundant safety-related systems from results of single failures or events are utilization of safety-related structures, spatial separation, or other design features.

DCD Tier 2 Revision 4, Section 3.6.1.3, states, in part:

Protection Methods by Separation

> The plant arrangement provides physical separation to the extent practicable to maintain the independence of redundant safety-related systems (including their auxiliaries) in order to prevent the loss of safety function caused by any single postulated event. Redundant trains (e.g., A and B trains) and divisions are located in separate compartments to the extent possible. Physical separation between redundant safety-related systems with their related auxiliary supporting features, therefore, is the basic protective measure incorporated in the design to protect against the dynamic effects of postulated pipe failures.
>
> Because of the complexities of several divisions being adjacent to high-energy lines in the drywell, specific break locations are determined in accordance with Section 3.6.2.1 for possible spatial separation. Care is taken to avoid concentrating safety-related equipment in the break exclusion zone allowed according to Section 3.6.2.1. If spatial separation requirements (distance and/or arrangement to prevent damage) cannot be met based on the postulation of specific breaks, then barriers, enclosures, shields, or restraints are provided . . .

ITAAC Table 3.1-1, ITAAC For The Generic Piping Design, assures design features are adequate to ensure design features protect mechanical systems from postulated failures as addressed in the excerpt above. ITAAC Item 6 was modified per GEH response to RAI 14.3-131 S01 (MFN 07-266 Supplement 1, dated November 29, 2007). Table 3.1-1 commits to identify "the features that protect against dynamic effects of pipe failures, such as whip restraints, equipment shields, drainage systems, and physical separation of piping, equipment, and instrumentation are installed as defined in the design analyses". ITAAC Item 3 assures protection or qualification against the dynamic and environmental effects associated with analysis of postulated failures. For these five (5) systems with ITAACs requiring physical separation, a pipe break is the most credible failure, which could adversely affect the other train. Therefore the ITAAC in Table 3.1-1 verify that a single failure of a mechanical train of NBS, SLC, ICS, GDCS, or PCCS will not adversely affect the other train of these systems. The Table 3.1-1 ITAAC are more inclusive and will assure safe shutdown will not be prevented due to failure of a mechanical train, when structural barriers are not provided.

Since performance of ITAAC Item 6 in Table 3.1-1 fulfills the requirement of the five (5) ITAAC addressed by this RAI, these five (5) ITAAC are being deleted.

DCD Impact

Design Commitment (7) and associated ITAAC Item 7 in Table 2.1.2-3 are deleted from Section 2.1.2 for NBS.

Design Commitment (17) and associated ITAAC Item17 in Table 2.2.4-6 are deleted from Section 2.1.2 for SLC.

Table 2.4.1-3 ITAAC Item 7 is deleted from Section 2.4.1 for ICS.

Design Commitment (16) and associated ITAAC Item 16 in Table 2.4.2-3 are deleted from Section 2.4.2 for GDCS.

Design Commitment (6) and associated ITAAC Item 6 in Table 2.15.4-2 are deleted from Section 2.15.4 for PCCS.

(7) ~~Each mechanical train of safety-related NBS equipment located in the Reactor Building outside the drywell is physically separated from the other trains~~Deleted.

(8) ~~Instrumentation and Control~~Isolation Capability

a. The MSIVs close upon command

b. The FWIVs close upon command

~~a.~~c. NBS minimum inventory of alarms, displays, and status indications in the main control room are addressed in section 3.3~~Control Room alarms, displays, and/or controls provided for the NBS are defined in Table 2.1.2-2.~~

~~b.The MSIVs close upon any of the following conditions:~~

~~-Main Condenser Vacuum Low (Run mode)~~

~~-Turbine Area Ambient Temperature High~~

~~-MSL Tunnel Ambient Temperature High~~

~~-MSL Flow Rate High~~

~~-Turbine Inlet Pressure Low~~

~~-Reactor Water Level Low~~

(9) ~~Repositional~~ Repositionable valves (not including the DPVs ~~(squib-activiated valves)~~ or safety/relief valves) with operators designated in Table 2.1.2-2 as having an active safety-related function open, close, or both open and also close under ~~design~~ differential pressure, fluid flow, and temperature conditions.

(10) ~~The pneumatically operated valve(s) shown in Figure 2.1.2-2 closes (opens) if either electric power to the valve actuating solenoid is lost, or pneumatic pressure to the valve(s) is lost.~~Deleted

(11) Check valves designated in Table 2.1.2-1 as having an active safety-related function open, close, or both open and also close under ~~design~~ system pressure, fluid flow, and temperature conditions.

(12) The throat diameter of each MSL flow restrictor is sized for design choke flow requirements.

(13) Each MSL flow restrictor has taps for two instrument connections to be used for monitoring the flow through ~~each~~ its associated MSL.

(14) The combined steamline volume from the RPV to the main steam turbine stop valves and steam bypass valves is sufficient to meet the assumptions for AOOs and infrequent events.

(15) The MSIVs are capable of fast closing under design differential pressure, fluid flow and temperature conditions.

(16) When all four inboard or outboard MSIVs are stroked from a full-open to full-closed position by their actuators~~closed by normal means~~, the combined leakage through the MSIVs for all four MSLs will be less than or equal to the design bases assumption value.

Table 2.1.2-3

ITAAC For The Nuclear Boiler System

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
b) Each ~~of the~~Seismic Category I lines~~s~~, identified in Table 2.1.2-1, ~~for which functional capability is required~~ is designed to withstand combined normal and seismic design basis loads without a loss of its safety-related function~~al capability~~(s).	Inspection will be performed for the existence of a report verifying that the as-built piping meets the requirements for functional capability.	Report(s) document that a report exists and concludes that each of the as-built Seismic Category I lines, identified in Table 2.1.2-1, is designed to withstand combined normal and seismic design basis loads without a loss of its safety-related function(s)~~for which functional capability is required meets the requirements for functional capability~~.
6a). Each of the NBS ~~System~~ safety-related ~~divisions~~equipment identified in Table 2.1.2-2 is powered from its respective safety-related divisional power supply. . b) Separation is provided between NBS ~~System~~ safety-related divisions, and between safety-related divisions and nonsafety-relate~~d~~ cable.	See Tier 1, Section 2.2.15 and Table 2.2.15-2, Items 21a & 21b.~~See Tier 1, Subsections 2.13.1, 2.13.3, or 2.13.5, as appropriate.~~ See Tier 1, Subsection 2.2.15 and Table 2.2.15-2, Items 3a & 3b.~~See Tier 1, Subsection 2.2.15.~~	See Tier 1, Section 2.2.15 and Table 2.2.15-2, Items 21a & 21b.~~See Tier 1, Subsection 2.13.1, 2.13.3, or 2.13.5, as appropriate.~~ See Tier 1, Subsection 2.2.15 and Table 2.2.15-2, Items 3a & 3b.~~See Tier 1, Subsection 2.2.15.~~
7. ~~Each mechanical train of safety-related NBS equipment located in the Reactor Building outside the drywell is physically separated from the other trains.~~(Deleted)	~~Inspections of the as-built NBS equipment trains will be performed.~~(Deleted)	~~Report(s) document that each mechanical train of NBS equipment located in the Reactor Building outside the drywell is physically separated from the other trains by structural and/or fire barriers.~~(Deleted)

b. Pressure boundary welds in piping identified in Table 2.2.4-4 as ASME Code Section III meet ASME Code Section III requirements.

(12) Pressure boundary integrity

a. The components identified in Table 2.2.4-4 as ASME Code Section III retain their pressure boundary integrity at ~~under internal pressures that will be experienced during service~~their design pressure.

b. The piping identified in Table 2.2.4-4 as ASME Code Section III retains its pressure boundary integrity at its design pressure.

(13) The Seismic Category I equipment identified in Tables 2.2.4-4 and 2.2.4-5 can withstand seismic design basis loads without loss of safety function.

(14) Each of the components identified in Table 2.2.4-4 for which functional capability is required is designed to withstand combined normal and seismic design basis loads without a loss of its functional capability.

(15) Each of the SLC System divisions (or safety-related loads/components) identified in Tables 2.2.4-4 and 2.2.4-5 is powered from its respective safety-related division.

(16) In the SLC System, independence is provided between safety-related divisions, and between safety-related divisions and nonsafety-related equipment.

(17) ~~Each mechanical train of the SLC System is physically separated from the other trains outside of the Containment.~~(Deleted)

(18) Re-positionable (not squib) valves designated in Table 2.2.4-4 as having an active safety-related function open, close, or both open and close under differential pressure, fluid flow, and temperature conditions.

(19) The pneumatically operated valve(s) designated in Table 2.2.4-4 fail in the mode listed if either electric power to the valve actuating solenoid is lost, or pneumatic pressure to the valve(s) is lost.

(20) Check valves designated in Table 2.2.4-4 as having a safety-related function open, close, or both open and close under system pressure, fluid flow, and temperature conditions.

(21) The SLC System injection squib valve will open as designed.

(22) The equivalent natural boron concentration at cold shutdown conditions for the total solution injection volume is based on the liquid inventory in the RPV at the main steam line nozzle elevation plus the liquid inventory in the reactor shutdown cooling piping and equipment of the RWCU/SDC system.

(23) SLC software is developed in accordance with the software development program described in Section 3.2.

Inspections, Tests, Analyses and Acceptance Criteria

Table 2.2.4-6 defines the inspections, tests, and/or analyses, together with associated acceptance criteria for the SLC system.

Table 2.2.4-6

ITAAC For The Standby Liquid Control System

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
17. ~~Each mechanical train of the SLC System is physically separated from the other trains outside of the Containment.~~(Deleted)	~~Inspections of the as-built SLC System will be performed.~~(Deleted)	~~Report(s) document that each mechanical train of the SLC System is physically separated from other mechanical trains of the system by structural and/or fire barriers outside of the Containment.~~(Deleted)
18. Re-positionable (not squib) valves designated in Table 2.2.4-4 as having an active safety-related function open, close, or both open and close under differential pressure, fluid flow, and temperature conditions.	Tests of installed valves will be performed for opening, closing, or both opening and closing under system preoperational differential pressure, fluid flow, and temperature conditions.	Report(s) document that, upon receipt of the actuating signal, each valve opens, closes, or both opens and closes, depending upon the valve'’s safety function.
19. The pneumatically operated valve(s) designated in Table 2.2.4-4 fail in the mode listed if either electric power to the valve actuating solenoid is lost, or pneumatic pressure to the valve(s) is lost.	Tests will be conducted on the as-built valve(s).	Report(s) document that the pneumatically operated valve(s) identified in Table 2.2.4–4 fail in the listed mode when either electric power to the valve actuating solenoid is lost, or pneumatic pressure to the valve(s) is lost.
20. Check valves designated in Table 2.2.4-4 as having a safety-related function open, close, or both open and close under system pressure, fluid flow, and temperature conditions	Tests of installed valves for opening, closing, or both opening and closing, will be conducted under system preoperational pressure, fluid flow, and temperature conditions.	Report(s) document that, based on the direction of the differential pressure across the valve, each CV opens, closes, or both opens and closes, depending upon the valve'’s safety functions.
21. The SLC System injection squib valve will open as designed.	A vendor type test will be performed on a squib valve to open as designed.	Records of vendor type test will conclude SLC injection squib valves used in the injection and equalization will open as designed.

Table 2.4.1-3

ITAAC For The Isolation Condenser System

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
6a. Each of the IC System divisions (or safety-related loads/components) identified in Table 2.4.1-2 is powered from its respective safety-related division.	Testing will be performed on the IC System by providing a [simulated] test signal in only one safety-related division at a time.	Report(s) document that a [simulated] test signal exists in the safety-related division (or at the equipment identified in Table 2.4.1-2 powered from the safety-related division) under test in the IC System.
b. In the IC System, independence is provided between safety-related divisions, and between safety-related divisions and non-safety related equipment.	i) Tests will be performed on the IC System by providing a test signal in only one safety-related division at a time. ii) Inspection of the as-installed safety-related divisions in the IC System will be performed.	Report(s) document that: i) The test signal exists only in the safety-related Division under test in the System. ii) In the IC System, physical separation or electrical isolation exists between these safety-related divisions. Physical separation or electrical isolation exists between safety-related divisions and non-safety related equipment.
7. ~~Each mechanical train of the IC System is physically separated from the other trains.~~ ~~Physical separation is not required in the Primary Containment.~~Deleted	~~Inspections of the as-built IC System will be performed.~~Deleted~~.~~	~~Report(s) document that each mechanical train of the IC System is physically separated from other mechanical trains of the system by structural and/or fire barriers.~~ .Deleted

(9) The GDCS squib valve used in the injection and equalization open as designed.

(10) a. Check valves designated in Figure 2.4.2-1 as having an active safety-related function open, close, or both open and also close under system pressure, fluid flow, and temperature conditions.

~~(10)~~b. The GDCS injection line check valves meet the criterion for maximum fully open flow coefficient in the reverse flow direction.

(11) Control Room indications and controls are provided for the GDCS.

(12) GDCS squib valves maintain RPV backflow leak tightness and maintain reactor coolant pressure boundary integrity during normal plant operation.

(13) Each GDCS injection line includes a nozzle flow limiter to limit break size. [N498]

(14) Each GDCS equalizing line includes a nozzle flow limiter to limit break size. [N499]

(15) Each of the GDCS divisions is powered from their respective safety-related power divisions.

(16) ~~Each mechanical division of the GDCS outside the drywell is physically separated from the other divisions with the exception of divisions B and C connected to pool B/C as shown in Figure 2.4.2-1.~~Deleted

(17) The GDCS pools A, B/C, and D are sized to hold a minimum drainable water volume.

(18) The GDCS pools A, B/C, and D are of sized for holding a specified minimum water level.

(19) The minimum elevation change between minimum water level of GDCS pools and the centerline of GDCS injection line nozzles is sufficient to provide gravity-driven flow.

(20) The minimum drainable volume from the suppression pool to the RPV is sufficient to meet long-term post-LOCA core cooling requirements.

(21) The long-term GDCS minimum equalizing driving head is based on RPV Level 0.5.

(22) The GDCS Deluge squib valves open as designed.

(23) GDCS software is developed in accordance with the software development program described in Section 3.2.

Refer to Subsection 2.2.15 for "Instrumentation and Controls Compliance with IEEE Standard 603."

Inspections, Tests, Analyses and Acceptance Criteria

Table 2.4.2-3 provides a definition of the inspections, test and/or analyses, together with associated acceptance criteria for the Gravity-Driven Cooling System.

Table 2.4.2-3

ITAAC For The Gravity-Driven Cooling System

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
16. ~~Each mechanical division of the GDCS is physically separated from the other divisions with the exception of divisions B and C connected to pool B/C as shown in Figure 2.4.2-~~Delete	~~Inspections of the as-built GDCS will be performed.~~Delete	~~Inspection confirms each mechanical division of the GDCS is physically separated from other mechanical divisions of the GDCS by structural and /or fire barriers with the exception of divisions B and C connected to pool B/C as shown in Figure 2.4.2-1.~~Delete
17. The GDCS pools A, B/C, and D are sized to hold a minimum drainable water volume.	An analysis of combined minimum drainable volume for GDCS pools A, B/C, and D will be performed.	Analysis confirms the combined minimum drainable water volume for GDCS pools A, B/C, and D is 1636 m^3 (57775 ft^3).
18. The GDCS pools A, B/C, and D are of sized for holding a specified minimum water level.	An analysis of minimum water level in GDCS pools A, B/C, and D will be performed.	Analysis confirms the minimum water level in GDCS pools A, B/C, and D is 6.5 m (21.33 ft).
19. The minimum elevation change between minimum water level of GDCS pools and the centerline of GDCS injection line nozzles is sufficient to provide gravity-driven flow.	An analysis of minimum elevation change between minimum water level of GDCS pools and the centerline of GDCS injection line nozzles will be performed.	Analysis confirms the minimum elevation change between minimum water level of GDCS pools and the centerline of GDCS injection line nozzles is 13.5 m (44.3 ft).
20. The minimum drainable volume from the suppression pool to the RPV is sufficient to meet long-term post-LOCA core cooling requirements.	An analysis of minimum drainable volume from the suppression pool to the RPV will be performed.	Analysis confirms the minimum drainable volume from the suppression pool to the RPV is 799 m^3 (28,216 ft^3).

(5) a. The seismic Category I equipment identified in Table 2.15.4-1 can withstand seismic design basis loads without loss of safety function.

b. Each of the lines identified in Table 2.15.4-1 for which functional capability is required is designed to withstand combined normal and seismic design basis loads without a loss of its functional capability.

(6) ~~Each mechanical train of the PCCS (A, B, C, D, E & F)* is physically separated from the other trains. *As indicated on Figure 2.15.4-1. Physical separation is not required in the Primary Containment~~Deleted~~.~~

(7) The PCCS together with the pressure suppression containment system will limit containment pressure to less than its design pressure for 72 hours after a LOCA.

(8) The equipment qualification of PCCS components is addressed in Tier 1 Section 3.8.

(9) In order to ensure the PCCS can maintain the drywell to wetwell differential pressure to a limit less than the value that causes pressure relief through the horizontal vents, the vent line discharge point is submerged at an elevation below low water level but above the uppermost horizontal vent.

(10) The PCCS will be designed to limit the fraction of containment leakage through the condensers to an acceptable value.

(11) The PCCS vent fans flow rate is sufficient to meet beyond 72 hours containment cooling requirements.

(12) The PCCS vent fans can be remotely operated from the MCR.

Inspections, Tests, Analyses and Acceptance Criteria

Table 2.15.4-2 provides a definition of the inspections, tests and/or analyses, together with associated acceptance criteria for the Passive Containment Cooling System.

Table 2.15.4-2

ITAAC For The Passive Containment Cooling System

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
b. Each of the lines identified in Table 2.15.4-1 for which functional capability is required is designed to withstand combined normal and seismic design basis loads without a loss of its functional capability.	Inspection will be performed for the existence of a report verifying that the as-built piping meets the requirements for functional capability.	Report(s) document that a report exists and concludes that each of the as-built lines identified in Table 2.15.4-1 for which functional capability is required meets the requirements for functional capability.
6. ~~Each mechanical train of the PCCS (A, B, C, D, E & F)* is physically separated from the other trains.~~ ~~*As indicated on Figure 2.15.4-1~~. ~~Physical separation is not required in the Primary Containment.~~Deleted	~~Inspections of the as-built PCCS will be performed.~~Deleted	~~Report(s) document that the each mechanical train of the PCCS is physically separated from other mechanical trains of the system by structural and/or fire barriers (with the exception of portions in Primary Containment).~~ Deleted
7. The PCCS together with the pressure suppression containment system will limit containment pressure to less than its design pressure for 72 hours after a LOCA.	Using prototype test data and as-built PCC unit information, an analysis will be performed to establish the heat removal capability of the PCC unit.~~An analysis will be performed using similar or more conservative performance characteristics than those of a test unit of established performance capability.~~	Test(s) and analysis(es) reports exist and ~~document~~conclude that analyzed containment pressure for 72 hours after a LOCA is less than containment design pressure, and that the PCC unit heat removal capacity is no less than 11 MWt given the following conditions: • Pure saturated steam in the tubes at 308 kPa (44.7 psi) absolute and 134°C (273°F) • IC/PCC pool water temperature is at atmospheric pressure and 102°C (216°F).~~Analyzed containment~~