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MFN 08-086 Supplement 12

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U.S. Nuclear Regulatory Commission
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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 14.3-228, 14.3-231, 14.3-232, 14.3-234, 14.3-381, and 14.3-382

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 14.3-228, 14.3-231, 14.3-232, 14.3-234, 14.3-381, and 14.3-382 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 14.3-228, 14.3-231, 14.3-232, 14.3-234, 14.3-381, and 14.3-382

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	0000-0080-3555 Rev. 1

ENCLOSURE 1

MFN 08-086 Supplement 12

Response to Portion of NRC Request for

Additional Information Letter No. 126

Related to ESBWR Design Certification Application

RAI Numbers
14.3-228, 14.3-231, 14.3-232, 14.3-234, 14.3-381, and 14.3-382

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 14.3-228

Item 3 of DCD Tier 1, Revision 4, Section 2.15.3 states that the "Containment Internal Structures identified in Table 2.15.3-1 conform to Seismic Category I requirements and can withstand seismic design basis loads and suppression pool hydrodynamic loads without loss of structural integrity and safety function."

1. *Please add also the design basis loss-of-coolant-accident generated loads because the containment internal structures should be designed to stand such loads.*

2. *Also, please add the same information to the acceptance criteria for item 3(i) of DCD Tier 1, Table 2.15.3-2.*

GEH Response

GEH agrees to revise DCD Tier 1, Section 2.15.3 (Item 3), and Table 2.15.3-2 (Item 3), as requested by NRC.

DCD Impact

DCD Tier 1, Section 2.15.3 (Item 3), and Table 2.15.3-2 (Item 3), will be revised as noted in the attached markup.

NRC RAI 14.3-231

The following components are important for containment analyses, and therefore, needs to be listed in DCD Tier 1, Table 2.15.3-1:

(a) Vacuum breakers
(b) Safety relief valve discharge quenchers

GEH Response

GEH agrees the DCD Tier 1 material should be revised. However, the Vacuum Breakers and the Safety Relief Valve Discharge Quenchers are components that do not meet the definition of Containment Internal Structures, thus, should not be included in Table 2.15.3-1, "Containment Internal Structures Locations".

The Description of Containment functions including the Vacuum Breakers that are listed in Section 2.15.3 will be removed and relocated to Section 2.15.1, Containment System. The Safety Relief Valve Discharge Quenchers are shown in Table 2.1.2-1, "Nuclear Boiler System Mechanical Equipment". DCD Tier 1 Sections 2.15.1, 2.15.3, Tables 2.15.1-2, and 2.15.3-2, and Figure 2.15.3-1 will be revised in response to this RAI.

DCD Impact

DCD Tier 1 Sections 2.15.1, 2.15.3, Tables 2.15.1-2, and 2.15.3-2, and Figure 2.15.3-1, will be revised as noted in the attached markups.

NRC RAI 14.3-232

Please add an ITAAC to DCD Tier 1, Table 2.15.3-2 to verify that the reactor vessel shield wall is able to withstand the design differential pressure between the reactor vessel annulus and the drywell.

GEH Response

The differential pressure between the Reactor Vessel Annulus and the Drywell is addressed by the Annulus Pressurization (AP) loads. Table 2.15.3-2, ITAAC Item 3, will be revised to add the AP loads to verify the structural integrity of Containment Internal Structures identified in Table 2.15.3-1 that includes the Reactor Shield Wall.

DCD Impact

DCD Tier 1, Table 2.15.3-2 (Item 3), will be revised as noted in the attached markup.

NRC RAI 14.3-234

Please provide the following information in DCD Tier 1, Figure 2.15.3-1, to verify aspects of the containment analyses:

(a) Vacuum breaker area in legend Item 11
(b) Total number of vertical vents in legend Item 12
(c) Relative elevation of spillover holes in legend Item 14.

GEH Response

The following information will be incorporated in DCD Tier 1, Revision 4, Figure 2.15.1-1 "Containment System" as requested by the NRC. Figure 2.15.3-1 "Containment Internal Structures" will be updated to reflect only Containment Internal structures and will no longer include these components.

(a) Vacuum breaker area:	0.2 m^2 each	(ref: DCD Tier 2, Rev. 4, S6.2.1.1.4)
	0.6 m^2	(6.46 ft^2) total
(b) Total number of vertical vents:	12	(ref: DCD Tier 2, Rev. 4, Table 6.2-3)
(c) Relative elev. of spillover holes:	12370 mm	(ref: DCD Tier 2, Rev. 4, Fig. 3G.1-57)

DCD Impact

DCD Tier 1, Figures 2.15.3-1, and 2.15.1-1, will be revised as noted in the attached markups.

NRC RAI 14.3-381

For ITAAC Table 2.15.3-2 Item 2, the staff requests that the applicant provide reference to the Containment Internal Structures identified in Table 2.15.3-1. The applicant should consider "inspection and analyses will be performed" in the ITA and should delete the phrase "as documented in the design reports". In addition, the AC should be clarified to state that inspection reports and analyses document that the as-built components of the containment internal structures comply with ANSI/AISC N690 requirements.

GEH Response

GEH agrees to revise DCD Tier 1 Table 2.15.3-2 (Item 2) as requested by NRC.

DCD Impact

DCD Tier 1, Section 2.15.3 Design Description, and Table 2.15.3-2 will be revised as noted in the attached markup.

NRC RAI 14.3-382

For ITAAC Table 2.15.3-2 Item 3i, the staff requests that the applicant provide reference to the Containment Internal Structures identified in Table 2.15.3-1 in the ITA and AC. In addition, the applicant should revise the ITA to identify that "analyses will be performed on the containment internal structures identified in Table 2.15.3-1 to ensure they meet seismic Category I requirements and can withstand seismic design basis loads and suppression pool hydrodynamic loads without loss of structural integrity and safety function."

GEH Response

GEH agrees to revise DCD Tier 1, Table 2.15.3-2 (Item 3), as requested by NRC.

DCD Impact

DCD Tier 1, Table 2.15.3-2 (Item 3), will be revised as noted in the attached markup.

2.15 CONTAINMENT, COOLING AND ENVIRONMENTAL CONTROL SYSTEMS

2.15.1 Containment System

Design Description

The Containment System confines the potential release of radioactive material in the event of a design basis accident. The Containment System is comprised of a reinforced concrete containment vessel (RCCV), penetrations and drywell head.

The Containment System is as shown in Figure 2.15.1-1. The RCCV is located in the Reactor Building.

(1) The functional arrangement of the Containment System is described in the Design Description of this Section 2.15.1 and as shown in Figure 2.15.1-1.

(2) Components and piping identified in Table 2.15.1-1 as ASME Code Section III are designed and constructed in accordance with ASME Code Section III requirements.[KJN642]

a. The RCCV and its liners are designed to meet the requirements in Article CC-3000 of ASME Code, Section III, Division 2.

b. The steel components of the RCCV are designed to meet the requirements in Article NE-3000 of ASME Code, Section III, Division 1.

(3) Pressure Boundary Welds

a. Pressure boundary welds in components ~~and piping~~ identified in Table 2.15.1-1 as ASME Code Section III meet ASME Code Section III requirements.

b. Pressure boundary welds in piping identified in Table 2.15.1-1 as ASME Code Section III meet ASME Code Section III requirements.

(4) The components and piping identified in Table 2.15.1-1 as ASME Code Section III retain their pressure boundary integrity at their design pressure.[KJN645]

(5) The seismic Category I equipment identified in Table 2.15.1-1 can withstand seismic design basis load without loss of structural integrity and safety function.[KJN646]

(6) The equipment qualification of Containment Systems components is addressed in DCD Tier 1 Section 3.8.

a. The safety-related components identified in Table 2.15.1-1 are powered from their respective safety-related division.[KJN647]

b. Separate electrical penetrations are provided for circuits of each safety-related division and for nonsafety-related circuits.

c. The circuits of each electrical penetration are of the same voltage class.[KJN648]

(7) The containment system provides a barrier against the release of fission products to the atmosphere.

(8) The containment system pressure boundary retains its integrity when subject to a design pressure of 310 kPa gauge (45 psig).

(9) The containment system provides the safety-related function of containment isolation for containment boundary integrity.

(10) Containment electrical penetration assemblies, whose maximum available fault current (including failure of upstream devices) is greater than the continuous rating of the penetration, are protected against currents that are greater than the continuous ratings.

(11) The minimum set of displays, alarms and controls, based on the emergency procedure guidelines and important operator actions, is available in the main control room

(12) The amount of chlorine bearing cable insulation exposed to the containment atmosphere is limited.

(13) The DW and WW volumes are adequately sized to accommodate the calculated maximum DW temperature and absolute pressure that are postulated to occur as a result of a design basis accident

(14) The water volume of the wetwell suppression pool is adequately sized to condense the steam that is forced into the wetwell from the drywell due to a postulated pipe break.

(15) Each vacuum breaker isolation valve automatically closes if the vacuum breaker does not fully close when required.

(16) Each vacuum breaker has proximity sensors to detect open/close position. This indication is available in the main control room.

(17) The containment penetration isolation design for each fluid piping system requiring isolation meets the single-failure criterion to ensure completion of penetration isolation.

(18) Drywell to wetwell bypass leakage is less than the assumed value used in the containment capability design basis containment response analysis.

(19) Total drywell to wetwell vacuum breaker bypass pathway leakage is less than the assumed value used in the containment capability design basis containment response analysis.

Inspections, Tests, Analyses and Acceptance Criteria

Table 2.15.1-2 provides a definition of the inspections, tests, and/or analyses, together with associated acceptance criteria for the Containment System.

Table 2.15.1-2

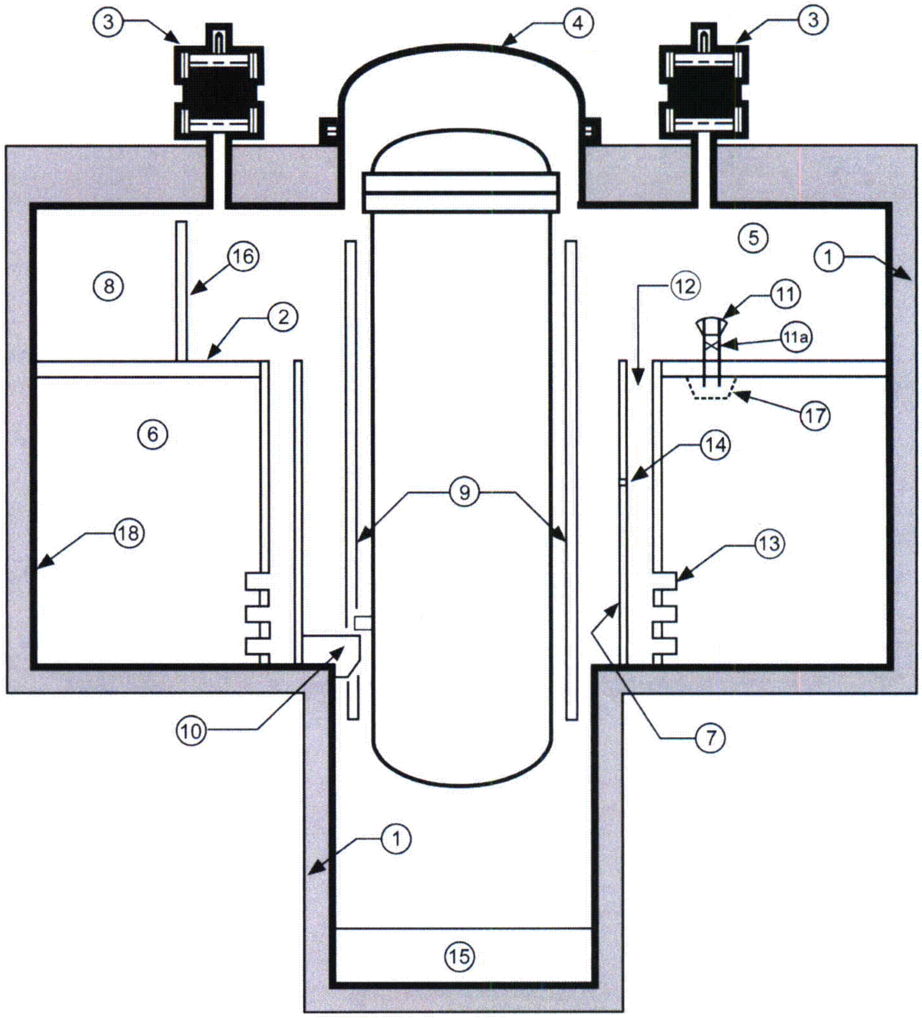
ITAAC For The Containment System

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
11. The minimum set of displays, alarms and controls, based on the emergency procedure guidelines and important operation actions, is available in the main control room.	Inspection of the as-built main control room will verify that the minimum set of displays, alarms and controls for the Containment System is available.	Inspection report(s) document that the minimum set of displays, alarms and controls for the Containment System, as defined by the emergency operating procedures and important operator actions exist in the as-built main control room.
12. The amount of chlorine bearing cable insulation exposed to the containment atmosphere is limited.	Analyses and inspection will be used to confirm the final exposed chlorine bearing cable insulation mass.	A report documents that the amount of chlorine bearing cable insulation exposed to the containment atmosphere (i.e. not within an enclosed cable tray, pipe, conduit, or metal cable jacketing) is ≤ 3400 kg.
13. The DW and WW volumes are adequately sized to accommodate the calculated maximum DW temperature and absolute pressure that are postulated to occur as a result of a design basis accident.	Using as-built dimensions, the DW and WW volumes will be calculated.	A report documents that the calculated as-built DW and WW volumes are greater than or equal to the design basis values.
14. The water volume of the wetwell suppression pool is adequately sized to condense the steam that is forced into the wetwell from the drywell due to a postulated design basis event.	Using as-built dimensions of the wetwell and a minimum measured suppression pool depth of 5.4 meters (213 inches), the volume of the suppression pool will be calculated.	A report demonstrates that the calculated suppression pool water volume is equal to or greater than the water volume assumed in the containment performance safety analysis.

Table 2.15.1-2

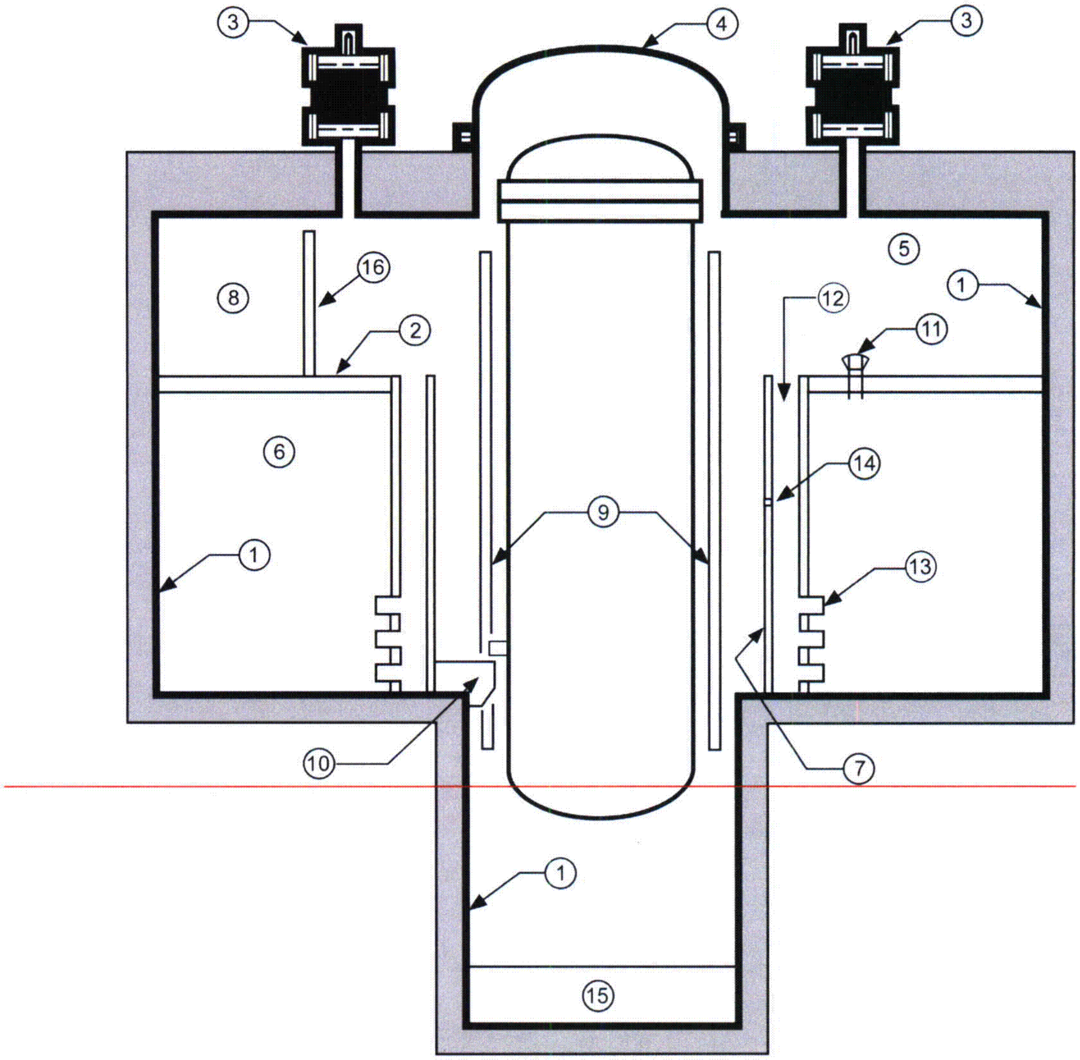
ITAAC For The Containment System

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
15. Each vacuum breaker isolation valve automatically closes if the vacuum breaker does not fully close when required.	A test will be performed by providing a simulated or real not-fully closed vacuum breaker signal originating from the closed position proximity sensor and temperature senors to close the associated vacuum breaker isolation valve.	A report demonstrates that each as-built vacuum breaker isolation valve automatically closes when a simulated or real not-fully closed signal is provided from the closed position proximity sensor of its associated vacuum breaker.
16a. Each vacuum breaker has proximity sensors to detect open/close position. This indication is available in the main control room.	Testing will be performed with each as-built vacuum breaker to demonstrate that the proximity sensors indicate open and closed position.	Test report(s) demonstrate that each as-built vacuum breaker proximity sensor indicates an open position with the vacuum breaker fully open and indicates a closed position when the vacuum breaker is in the fully closed position.The open and closed position indications of the as-built vacuum breakers are available in the main control room.
16b. Each vacuum breaker has temperature sensors to detect bypass leakage. This indication is available in the main control room.	A vendor type test will be performed on a vacuum breaker to detect bypass leakage.	Records of vendor type test concludes vacuum breakers temperature sensors detect bypass leakage.
17. The containment penetration isolation design for each fluid piping system requiring isolation meets the single-failure criterion to ensure completion of penetration isolation.	Single-failure analysis is performed on the isolation design of each penetration class or penetration, as applicable.	A study of all applicable primary containment fluid system penetrations demonstrates that, for each penetration or penetration class isolation design, the single-failure criterion is satisfied.



LEGEND

1. Reinforced Concrete Containment Vessel (RCCV)
2. Diaphram Floor Slab
3. (6) Passive Containment Cooling System (PCCS)
4. Drywell Head
5. Drywell
6. Wetwell
7. Vent Wall
8. (3) GDCS Pools
9. Reactor Shield Wall
10. (8) RPV Support Brackets
11. (3) Vacuum Breakers, ≥ 0.6m^2 (6.46 ft^2) Total
11a. (3) Vacuum Breakers, ≥ 0.6m^2 (6.46 ft^2) Total
12. (12) Vertical Vents, ≥ 13.6m^2 (146 ft^2) Total
13. (36) Horizontal Vents, ≥ 0.7m (2.30 ft) I.D.
14. (12) Spillover Holes, 200mm (8 inch) Nominal Diameter, Elevation 12370 mm
15. BiMAC
16. GDCS Pool Wall (Typical)
17. Protective Shield/Debris Screen
18. Suppression Pool Stainless Steel Liner



LEGEND
1. Containment Vessel (RCCV)
2. Diaphram Floor Slab
3. Passive Containment Cooling System (PCCS), Total 6
4. Drywell Head
5. Drywell
6. Wetwell
7. Vent Wall
8. GDCS Pools, Total 3
9. Reactor Shield Wall
10. RPV Support Bracket (Typical 8)
11. Vacuum Breaker, Total 3
12. Vertical Vents, $\geq 13.6m^2$ ($146\ ft^2$) Total
13. Horizontal Vent, $\geq$ 0.7m (2.30 ft) I.D., 36 Total
14. Spillover Hole, 200mm (8 inch) Nominal Diameter, 12 Total
15. BiMAC
16. GDCS Pool Wall (Typical)

Figure 2.15.1-1. Containment System

2.15.3 Containment Internal Structures

Design Description

The functions of the containment internal structures include (1) support of the reactor vessel radiation shielding, (2) support of piping and equipment, and (3) formation of the pressure suppression boundary. The containment internal structures consist of the diaphragm floor slab (DF) that separates the Drywell (DW) and the Wetwell (WW), vent wall, Gravity-Driven Cooling System (GDCS) pool walls, reactor shield wall, and the Reactor Pressure Vessel (RPV) support bracket.

The Containment Internal Structures are as shown in Figure 2.15.3-1 and the component locations of the Containment System are as shown in Table 2.15.3-1.

(1) The functional arrangement of the Containment Internal Structures is described in the Design Description of this Section 2.15.3.

(2) Containment Internal Structures identified in Table 2.15.3-1 are designed and constructed in accordance with ANSI/AISC N690 requirements.

(3) The Containment Internal Structures identified in Table 2.15.3-1 conform to Seismic Category I requirements and ~~and~~ can withstand seismic design basis loads, ~~and~~ suppression pool hydrodynamic loads, design basis loss of coolant accident generated loads and annulus pressurization loads without loss of structural integrity and safety function.

(4) (Deleted)~~The DW and WW volumes are adequately sized to accommodate the calculated maximum DW temperature and absolute pressure that are postulated to occur as a result of a design basis accident.~~

(5) The diaphragm floor and vent wall structures that separate the DW and WW retain their integrity when subject to ~~pressure at or above design pressure~~design differential pressure.

(6) (Deleted)~~The water volume of the WW suppression pool is adequately sized to condense the steam that is forced into the WW from the DW due to a postulated pipe break.~~

(7) (Deleted)~~Each vacuum breaker isolation valve automatically closes if the vacuum breaker does not fully close when required.~~

(8) (Deleted)~~Each vacuum breaker has proximity sensors to detect open/close position. This indication is available in the main control room.~~

Inspections, Tests, Analyses and Acceptance Criteria

Table 2.15.3-2 provides a definition of the inspections, tests, and/or analyses, together with associated acceptance criteria for the Containment Internal Structures.

Table 2.15.3-2

ITAAC For The Containment Internal Structure

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
1. The basic configuration of the Containment Internal Structures is as described in Subsection 2.15.3.	Inspections of the as-built system will be conducted.	Inspection reports document that the as-built Containment Internal Structures conforms with the description in Subsection 2.15.3.
2. The Containment Internal Structures identified in Table 2.15.3-1 are designed and constructed in accordance with ANSI/AISC N690 requirements.	Inspections and analyses will be conducted performed forof the as-built components of the Containment Internal Structures identified in Table 2.15.3-1.as documented in the design reports.	Inspection reports(s) and analyses document that the design reports exist, and the as-built components of the Containment Internal Structures identified in Table 2.15.3-1 are constructed in accordance comply with ANSI/AISC N690 requirements.
3. The Containment Internal Structures identified in Table 2.15.3-1 conform to Seismic Category I requirements and can withstand seismic design basis loads, and suppression pool hydrodynamic loads, design basis loss of coolant accident generated loads and annulus pressurization loads without loss of structural integrity and safety function.	i) Analyses of Seismic Category I requirements will be performed.Analyses will be performed on the Containment Internal Structures identified in Table 2.15.3-1 to ensure they meet Seismic Category I requirements and can withstand seismic design basis loads, suppression pool hydrodynamic loads, design basis loss of coolant accident generated loads and annulus pressurization loads without loss of structural integrity and safety function.	i) Analysis report(s) exists documents and inspections demonstrates that the as-built Containment Internal Structures identified in Table 2.15.3-1 can withstand seismic design basis dynamic loads, and suppression pool hydrodynamic loads, design basis loss of coolant accident generated loads and annulus pressurization loads without loss of structural integrity and safety function

Table 2.15.3-2

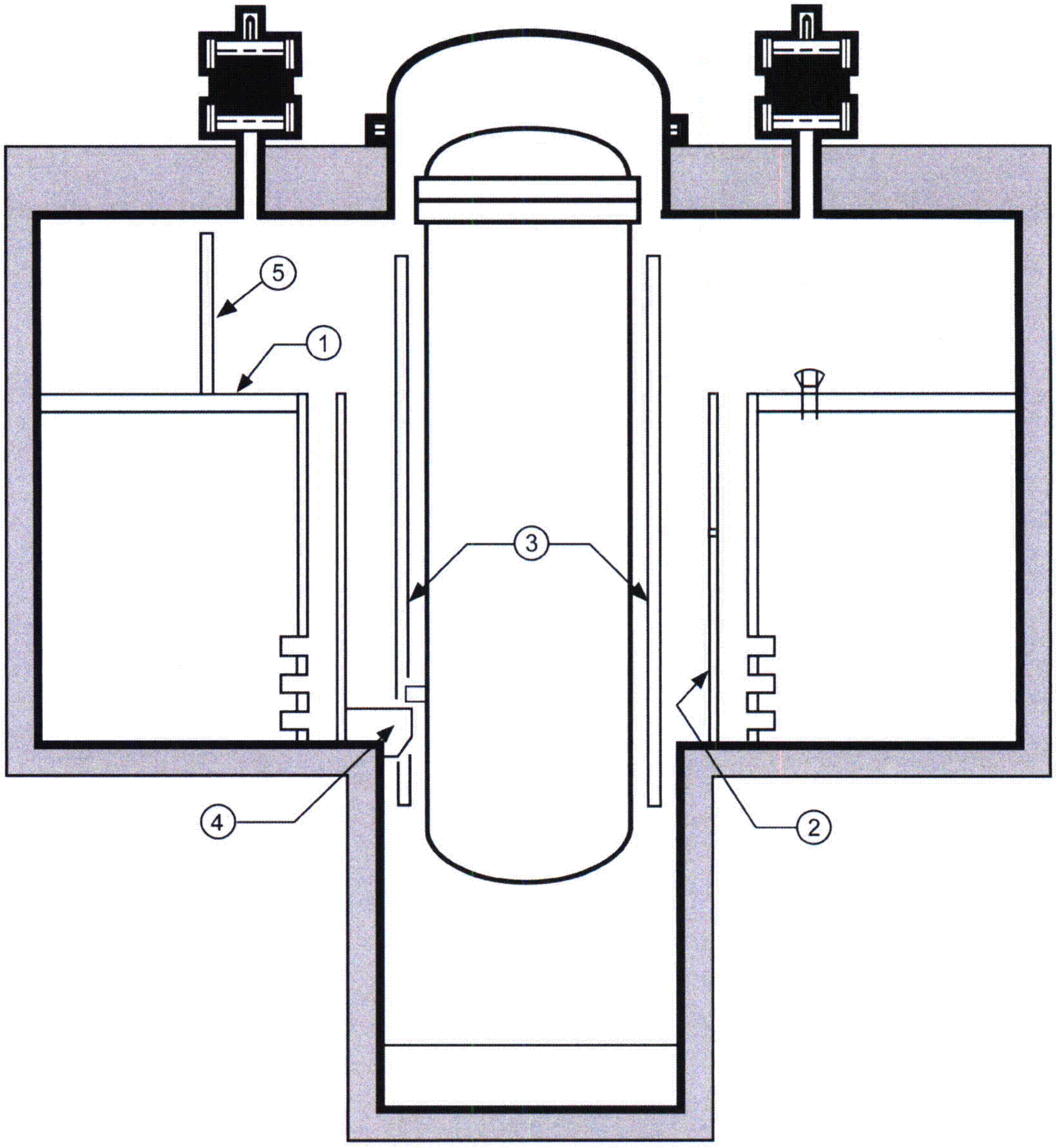
ITAAC For The Containment Internal Structure

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
	ii) Inspections of the as-built Containment Internal Structures identified in Table 2.15.3-1 will be performed to verify that they are housed in a seismic Category I structure.	ii) A report documents that the as-built Containment Internal Structures identified in Table 2.15.3-1 are housed in a seismic Category I structure..
4. (Deleted)~~The DW and WW volumes are adequately sized to accommodate the calculated maximum DW temperature and absolute pressure that are postulated to occur as a result of a design basis accident.~~	(Deleted)~~Using as-built dimensions, the DW and WW volumes will be calculated.~~	(Deleted)~~A report documents that the calculated as-built DW and WW volumes are greater than or equal to the design basis values.~~
5. The diaphragm floor and vent wall structures that separate the DW and WW retain their integrity when subject to ~~pressure at or above design pressure~~design differential pressure.	Part of the containment Structural Integrity Test specified in Tier 1 Table 2.15.1-2 ITAAC # 8 will test the diaphragm floor and vent wall structure with a test pressure equal to ~~{~~1.~~15~~0~~}~~ times the design differential pressure conducted with the DW pressure greater than WW pressure.	A report of the SIT results demonstrates compliance with ASME Code requirements for the applied test pressure for the containment structures.
6. (Deleted)~~The water volume of the WW suppression pool is adequately sized to condense the steam that is forced into the WW from the DW due to a postulated design basis event.~~	(Deleted)~~Using as-built dimensions of the WW and a minimum measured suppression pool depth of 5.4 meters (213 inches), the volume of the suppression pool will be calculated.~~	(Deleted)~~A report demonstrates that the calculated suppression pool water volume is equal to or greater than the water volume assumed in the containment performance safety analysis.~~

Table 2.15.3-2

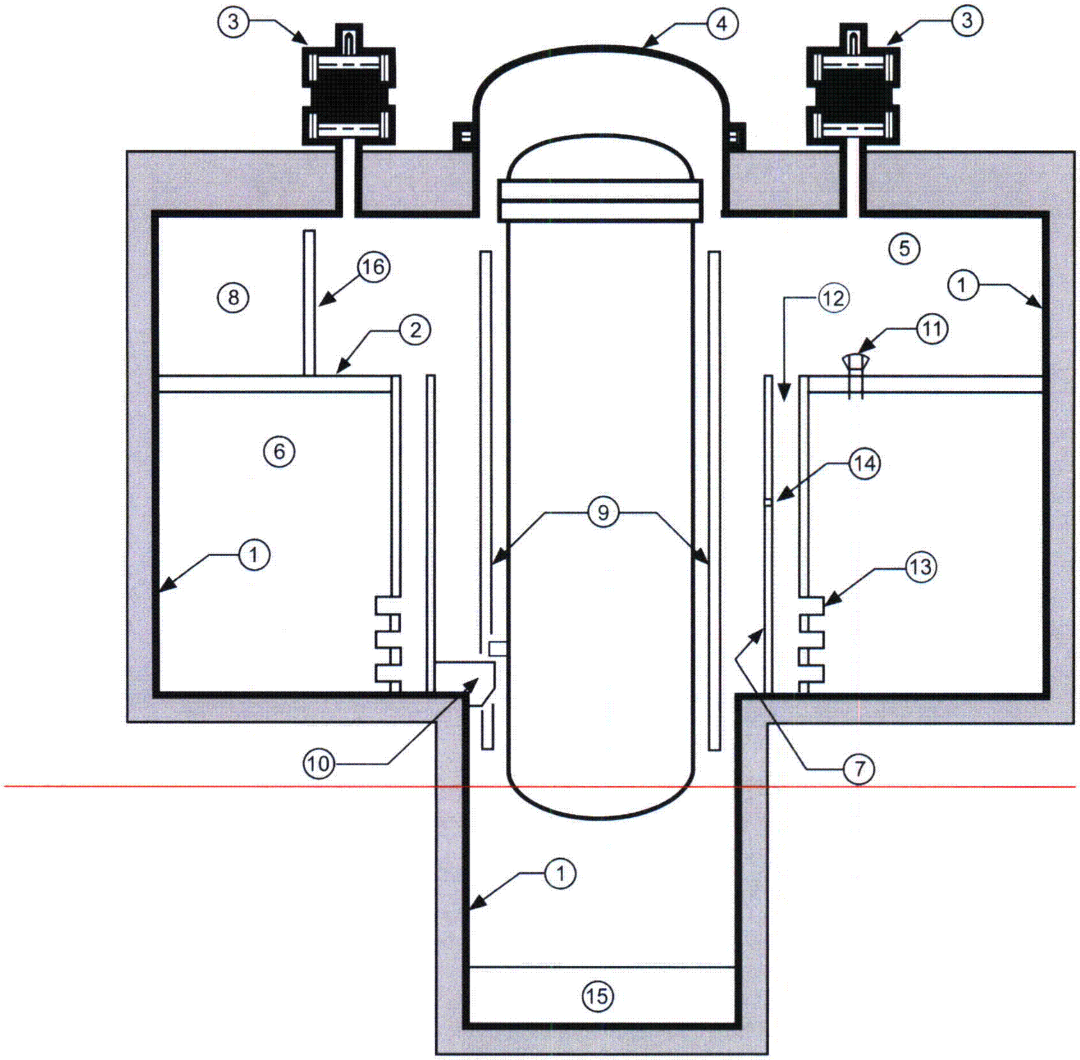
ITAAC For The Containment Internal Structure

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
7. (Deleted)~~Each vacuum breaker isolation valve automatically closes if the vacuum breaker does not fully close when required.~~	(Deleted)~~A test will be performed by providing a simulated or real not-fully closed vacuum breaker signal originating from the closed position proximity sensor to close the associated vacuum breaker isolation valve.~~	(Deleted)~~A report demonstrates that each as-built vacuum breaker isolation valve automatically closes when a simulated or real not-fully closed signal is provided from the closed position proximity sensor of its associated vacuum breaker.~~
8. (Deleted)~~Each vacuum breaker has proximity sensors to detect open/close position. This indication is available in the main control room.~~	(Deleted)~~Testing will be performed with each as-built vacuum breaker to demonstrate that the proximity sensors indicate open and closed position.~~	(Deleted)~~Test report(s) demonstrate that each as-built vacuum breaker proximity sensor indicates an open position with the vacuum breaker fully open and indicates a closed position when the vacuum breaker is in the fully closed position.~~



LEGEND

1. Diaphram Floor Slab
2. Vent Wall
3. Reactor Shield Wall
4. RPV Support Bracket (Typical 8)
5. GDCS Pool Wall (Typical)



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9. Reactor Shield Wall
10. RPV Support Bracket (Typical 8)
11. Vacuum Breaker, Total 3
12. Vertical Vents, $\geq 13.6 m^2$ (146 ft^2) Total
13. Horizontal Vent, $\geq$ 0.7m (2.30 ft) I.D., 36 Total
14. Spillover Hole, 200mm (8 inch) Nominal Diameter, 12 Total
15. BiMAC
16. GDCS Pool Wall (Typical)

Figure 2.15.3-1. Containment Internal Structures