ENCLOSURE 1

MFN 08-336, Supplement 3

Partial Response to NRC RAI Letter No. 264
Related to ESBWR Design Certification Application

Regulatory Treatment of Non-Safety Systems (RTNSS)

RAI Number 22.5-5 Supplement 2

[1] Original Responses previously submitted under MFN 08-336 and 08-336 Supplement 1 are included without DCD updates to provide historical continuity during review.

NRC RAI 22.5-5

Section 19.A.8.3 addresses design standards associated with RTNSS systems. However, the staff found that, in general, protection for RTNSS systems from potential internal flooding due to seismic events, external flooding due to seismic events, missiles generated during seismic events and high wind, and piping failures in fluid systems outside containment have not been addressed. Please describe how RTNSS systems will be protected as described in Criterion B to address long term (i.e., beyond 72 hours) safety and seismic events:

A. *How RTNSS systems will be protected from flood-related effects associated with both high and moderate-energy fluid piping and component failures inside and outside containment.*
B. *How RTNSS systems will be protected from flood-related effects associated with both natural phenomena and system and component failures.*
C. *How RTNSS systems will be protected against postulated piping failures in fluid systems outside containment.*
D. *How RTNSS systems will be protected against the aforementioned missiles.*

GEH Response

The following Table shows RTNSS Criterion B Systems location and seismic classification based on Table 19A-2 and Table 3.2-1:

System	RTNSS Criterion	Location	Building Category
CB HVAC	B2	Control Building (CB)	Seismic Cat. I
Control Room Area Ventilation	B1	Control Building (CB)	Seismic Cat. I
External Connections	B1	Reactor Building (RB)	Seismic Cat. I
PAM Instruments (DCIS)	B2	Reactor Building (RB) Control Building (CB)	Seismic Cat. I Seismic Cat. I
RB HVAC	B2	Reactor Building (RB)	Seismic Cat. I
Diesel Fire Pump	B1	Fire Pump Enclosure Building (FPE)	Seismic Cat. I
Diesel Generators	B2, C	Electrical Building (EB)	NS
EB HVAC	B2, C	Electrical Building (EB)	NS
PIP Buses	B2, C	Electrical Building (EB)	NS
RCCWS	B2, C	Reactor Building (RB) Turbine Building (TB)	Seismic Cat. I NS
Chilled Water System	B2, C	Reactor Building (RB) Containment Vessel (CV) Control Building (CB) Fuel Building (FB) Turbine Building (TB) Electrical Building (EB)	Seismic Cat. I Seismic Cat. I Seismic Cat. I Seismic Cat. I NS NS
TB HVAC	B2, C	Turbine Building (TB)	NS
PSW	B2, C	Reactor Building (TB) Service Water Building (SF) Outdoors Onsite (OO)	Seismic Cat. I NS NS

Note:
RTNSS components that support the RTNSS functions for the systems in the table above are designed/installed with similar protection from missiles and flooding described in the following table.

The next Table addresses the questions raised by RAI 22.5-5 in columns labeled A, B C and D against the RTNSS Systems located in different buildings.

Only Criterion B1 RTNSS is required to be protected from internal missiles and postulated piping failures in fluid systems outside containment. Criterion B1 addresses those functions (core cooling, decay heat removal and control room habitability) that are designed to Seismic Category II standards so there is reasonable assurance that they can perform their functions following a seismic event. Criterion B2 addresses components that provide additional information for operators to diagnose plant conditions, (post-accident

monitoring) and thus have a less direct effect on the success of key safety functions. Reasonable assurance for long-term functionality of monitoring components is provided by other augmented seismic design criteria.

System Location	**A.** (Internal flooding)	**B.** (External flooding)	**C.** (Internal missiles) (For Criterion B1)	**D.** (Extreme wind and missiles)
Reactor Bldg. (RB) Control Bldg. (CB) Fuel Bldg. (FB) Fire Pump Enclosure Bldg. (FPE) Containment Vessel (CV)	The design/installation of RTNSS equipment includes protection from the effects of internal flooding. The Chilled Water System components inside the CV are environmentally qualified per DCD Tier 2, Rev. 4, Table 3.11-1.	Seismic Category I structures are designed to withstand the flood level and groundwater level specified in DCD Tier 2, Rev. 4, Table 2.0-1 and described in Subsection 3.4.1.2. All exterior access openings are above flood level and exterior penetrations below design flood and groundwater levels are appropriately sealed as described in DCD Tier 2, Rev. 4, Subsection 3.4.1.1. On-site storage tanks are designed and constructed to minimize the risk of catastrophic failure and are located to allow drainage without damage to site facilities in the event of a tank rupture per DCD Tier 2, Rev. 4, Subsection 3.4.1.2.	There are no credible sources of internal missiles per DCD Tier 2, Rev. 4, Section 3.5.	Seismic Category I structures designed for tornado and extreme wind phenomena are described in DCD Tier 2, Rev. 4, Section 3.3 and Section 3.5.1.4.
Electrical Bldg. (EB) Service Water Bldg. (SF) Turbine Bldg. (TB)	The design/installation of RTNSS equipment includes protection from the effects of internal flooding.	All exterior access openings are above flood level and exterior penetrations below design flood and groundwater levels are appropriately sealed; basemat and walls are designed for hydrostatic loading, therefore protected from external flooding.	N/A	The EB and SF are RTNSS Structures designed for Category 5 Hurricane wind and missiles that meet requirement of DCD Tier 2, Rev. 4, Subsection 19A.8.3. The TB structure is designed for tornado wind speed which envelops Category 5 Hurricane speed. The design/ installation of the RTNSS systems in the TB includes protection to comply with the requirement of DCD Tier 2,

				Rev. 4, Subsection 19A.8.3 to withstand winds and missiles generated from Category 5 hurricanes.
PSW System located Outdoors Onsite (OO)	N/A	The design/installation of the RTNSS system includes protection from the effects of flooding.	N/A	The design/installation of the RTNSS system complies with the requirement of DCD Tier 2, Rev. 4, Subsection 19A.8.3 to withstand winds and missiles generated from Category 5 hurricanes.

DCD Tier 2, Subsection 19A.8.4 will be revised and the above information will be added as Tables 19A-3 and 19A-4.

DCD Impact

DCD Tier 2, Section 19A.8.4 will be revised and Tables 19A-3 and 19A-4 will be added as noted in the attached markups

NRC RAI 22.5-5 Supplement 1

GEH's response to RAI 22.5-5 did not provide sufficient details to demonstrate that RTNSS systems have been adequately protected from flood-related effects associated with both natural phenomena and system and component failures.

Specifically, GEH indicated that for RTNSS systems located in Reactor Bldg (RB), Control Bldg (CB), Fuel Bldg (FB), Fire Pump Enclosure Bldg (FPE), Electrical Bldg (EB), Service Water Bldg (SF), and Turbine Bldg (TB), the design/installation of RTNSS equipment included protection from the effects of internal flooding. However, GEH did not provide description/discussion for the design/installation of the RTNSS equipment or discuss how this design/installation will protect RTNSS from the effects of internal flooding.

Similarly, for the plant service water (PSW) system located outdoors onsite (OO), GEH did not describe/discuss how the design/installation of RTNSS equipment will be protected from the effects of external flooding.

Provide detailed description of the design/installation requirements for RTNSS SSCs and discuss how this design/installation will provide the protection for the RTNSS SSCs from the effects of internal flooding and/or external flooding.

GEH Response

RTNSS components are located and installed above the maximum analyzed flood levels in each of the buildings referenced. This requirement is incorporated in the Design Specifications and implemented during the detailed design to ensure protection of the RTNSS components against internal flooding.

The maximum flood level for the ESBWR is 1 ft below the finished grade per DCD Tier 2 Rev. 5 Table 2.0-1. The maximum groundwater level is 2 ft below the finished grade. The PSW system located outdoors is designed with protection from water intrusion if installed below the maximum flood and groundwater levels. This includes designing for hydrostatic loading and provision of cell enclosures. These requirements are incorporated in the Design Specifications and implemented during detailed design.

DCD Impact

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

NRC RAI 22.5-5 Supplement 2

In a request for additional information (RAI 22.5-5), the staff requested GEH to address how RTNSS systems will be protected:

- *from flood-related effects associated with both high and moderate-energy fluid piping and component failures inside and outside containment.*
- *from flood-related effects associated with both natural phenomena and system and component failures.*
- *against postulated piping failures in fluid systems outside containment.*
- *against the aforementioned missiles.*

In the response to RAI 22.5-5, dated April 17, 2008, GEH provided two tables, Table 19A-3, "Structure Housing RTNSS Functions," and Table 19A-4, "Capability of RTNSS Related Structures." In Table 19A-3, GEH identified the RTNSS together with their associated RTNSS criteria, locations (buildings), and building category. In Table 19A-4, GEH identified how the RTNSS in each area (building) are protected from internal flooding, external flooding, internal missiles and extreme wind and missiles. However, GEH did not provide sufficient details about the design of RTNSS with respect to the protection for RTNSS systems from internal and external flooding. Subsequently, in a supplement RAI (RAI 22.5-5 S01), the staff requested GEH to provide detailed description of the design/installation of each RTNSS and discuss how this design/installation will provide the protection for the RTNSS SSCs from the effects of internal flooding and/or external flooding.

In the response to RAI 22.5-5 S01, GEH stated that:

- *RTNSS components are located and installed above the maximum analyzed flood levels in each of the buildings referenced This requirement is incorporated in the Design Specifications and implemented during the detailed design to ensure protection of the RTNSS components against internal flooding.*

- *The maximum flood level for the ESBWR is 1 ft below the finished grade per DCD Tier 2 Rev. 5 Table 2.0-1. The maximum groundwater level is 2 ft below the finished grade. The PSW system located outdoors is designed with protection from water intrusion if installed below the maximum flood and groundwater levels. This includes designing for hydrostatic loading and provision of cell enclosures. These requirements are incorporated in the Design Specifications and implemented during detailed design.*

Also, in DCD Tier 2, Revision 5, Section 14.3.7.3, GEH stated that RTNSS systems shall have Tier 1 inputs that include design descriptions and ITAACs. The staff finds that ESBWR DCD Tier 1, Section 2.0, "Design Descriptions and ITAAC," does not include design descriptions and ITAACs, as stated in DCD Tier 2, Revision 5, Section 14.3.7.3, to ensure that RTNSS systems will be protected against internal flooding, external flooding, internal missiles (inside and outside containment) and extreme wind and missiles.

Therefore, provide ITAACs in DCD Tier 1, Section 2.0, "Design Descriptions and ITAAC," to ensure that RTNSS systems will be protected against:

- *flood-related effects associated with both high and moderate-energy fluid piping and component failures inside and outside containment.*
- *flood-related effects associated with both natural phenomena and system and component failures.*
- *postulated piping failures in fluid systems outside containment.*
- *the internally generated missiles (inside and outside containment).*
- *externally generated missiles*

GEH Response

GEH will add and/or revise the necessary ITAAC for the Reactor Building (RB), Control Building (CB), Fuel Building (FB), Firewater Service Complex (FWSC), Electrical Building (EB) and Service Water Building (SF) to ensure that the RTNSS systems will be protected against *flood-related effects associated with both high and moderate-energy fluid piping and component failures inside and outside containment, flood-related effects associated with both natural phenomena and system and component failures, postulated piping failures in fluid systems outside containment, the internally generated missiles (inside and outside containment) and externally generated missiles.*

GEH has provided the ITAAC for the Turbine building (TB) and the Ancillary Diesel Building (ADB) that include RTNSS protection in the response to RAI 3.8-80 S03 transmitted on Feb. 3, 2009 via MFN 06-407 Supplement 12.

For the RB, CB, FB and FWSC, the analyses performed for tornado wind and missiles also qualify these Seismic Category I structures for hurricane wind and missiles (please see response to RAI 19.1-169 S01 transmitted on Aug. 1, 2008 via MFN-08-199 Supplement 1). Therefore, no ITAAC is required for the RB, CB, FB and FWSC applicable to hurricane wind and missiles for RTNSS protection.

The additional ITAAC in the building sections will provide assurance that the equipment will be protected from the effects of floods, winds and missiles. Internal flooding analysis of the buildings is performed using ANSI/ANS 56.11-1988 guidelines to ensure protection of the RTNSS equipment. The internal flooding analysis includes the flood-related effects associated with both high and moderate-energy fluid piping and component failures and piping failures in fluid systems outside containment. As stated in Table 19A-4 of the Tier 2 DCD there are no credible sources of internal missiles per Section 3.5.

For the TB, ADB, EB and SF, the barrier protection for the RTNSS Systems against hurricane wind and missiles can be the exterior or interior walls, floors or roofs of the buildings that will be qualified for these loads.

DCD Tier 2 Subsection 3.3.1.1 will be revised to clarify the wind load applicable to Seismic Category NS buildings that house RTNSS systems.

DCD Tier 2 Table 19A-4 will be revised to clarify RTNSS system designations and the design of the ADB, EB and SF regarding hurricane missile protection.

DCD Impact

Subsections 2.16.5, 2.16.6 and 2.16.7, Tables 2.16.5-2, 2.16.6-2 and 2.16.7-2 will be revised in DCD Tier 1 Revision 6 as noted in the attached markups.

New Subsections 2.16.12, 2.16.13 and 2.16.14, Tables 2.16.12-1, 2.16.13-1 and 2.16.14-1 will be added in DCD Tier 1 Revision 6 as noted in the attached markups.

Tier 1 Subsections 2.16.8 and 2.16.11 (for the Turbine Building and the Ancillary Diesel Building) are revised in the response to RAI 3.8-80 S03 (transmitted Feb. 3, 2009 via MFN 06-407 Supplement 12)

Subsection 3.3.1.1 and Table 19A-4 will be revised in DCD Tier 2 Revision 6 as noted in the attached markups.

MFN 08-336, Supplement 3
Attachment

DCD Revision 6 Markups

DCD Tier 1

Section 2.16.5 Reactor Building Design Description
Table Table 2.16.5-2 ITAAC For The Reactor Building
Section 2.16.6 Control Building Design Description
Table 2.16.6-2 ITAAC For The Control Building
Section 2.16.7 Fuel Building Design Description
Table 2.16.7-2 ITAAC For The Fuel Building
Section 2.16.12 Fire Water Service Complex Design Description
Table 2.16.12-1 ITAAC For Firewater Service Complex
Section 2.16.13 Electrical Building Design Description
Table 2.16.13-1
ITAAC For Electrical Building
Section 2.16.14 Service Water Building Design Description
Table 2.16.14-1 ITAAC For Service Water Building

DCD Tier 2

Section 3.3.1.1 Design Wind Velocity and Recurrence Interval
Table 19A-4 Capability of RTNSS Related Structures

~~γ.~~• Waterproofing of below flood and groundwater levels external surfaces;

~~δ.~~• Water seals in external walls at pipe penetrations below flood and groundwater levels; and

~~ε.~~• Roofs designed to prevent pooling of large amounts of water in excess of the structural capacity of the roof for design loads.

(7) Protective features used to mitigate or eliminate the consequences of internal flooding are:

~~α.~~• Structural enclosures or barriers;

~~β.~~• Curbs and sills;

~~γ.~~• Leakage detection components; and

~~δ.~~• Drainage systems.

(8) The internal flooding protection features prevent flood water in one division from propagating to other division(s) and ensure equipment necessary for safe shutdown is located above the maximum flood level for that location or is qualified for flood conditions by:

~~α.~~• Divisional walls

~~β.~~• Sills

~~γ.~~• Watertight doors.

(9) The RB is protected against pressurization effects associated with postulated rupture of pipes containing high-energy fluid that occur in subcompartments of the RB.

(10) The Reactor Building minimum passive mixing volume meets design assumptions for the mixing of fission products following a LOCA.

(11) RTNSS equipment in the RB is located above the maximum flood level for that location or is qualified for flood conditions.

Inspections, Tests, Analyses and Acceptance Criteria

Table 2.16.5-2 provides a definition of the inspections, tests and/or analyses, together with associated acceptance criteria for the RB.

Table 2.16.5-2

ITAAC For The Reactor Building

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
9. The RB is protected against pressurization effects associated with postulated rupture of pipes containing high-energy fluid that occur in subcompartments of the RB.	Inspections of the RB subcompartments that rely on overpressure protection devices will be conducted.	Reports document that as-built RB subcompartments which rely on overpressure protection devices are equipped with over pressure protection devices specified in the Design Description 2.16.5.
10. The Reactor Building minimum passive mixing volume meets design assumptions for the mixing of fission products following a LOCA.	Inspections of the as-built dimensions of the areas in the RB credited in the design basis mixing analysis will be performed. The results will be compared to the calculation of the total mixing volume to verify that the results match the assumptions.	A report documents that the as-built RB ensures a passive mixing volume.
11. RTNSS equipment in the RB is located above the maximum flood level for that location or is qualified for flood conditions.	Inspections of the as-built RTNSS equipment in the RB will be conducted.	Inspection report(s) exist and conclude that as-built RTNSS equipment in the RB is located above the maximum flood level for that location or is qualified for flood conditions

2.16.6 Control Building

Design Description

The Control Building (CB) houses the essential electrical, control and instrumentation equipment, the Main Control Room(MCR), and the CB HVAC equipment. The CB is a reinforced concrete box type shear wall structure consisting of walls and slabs and is supported on a foundation mat. The CB structure is a Seismic Category I structure.

The key characteristics of the CB are as follows:

(1) The CB is designed and constructed to accommodate the dynamic, static, and thermal loading conditions associated with the various loads and load combinations, which form the structural design basis. The loads are those associated with:

- Natural phenomena—wind, floods, tornadoes (including tornado missiles), earthquakes, rain and snow.
- Internal events—floods, .
- Normal plant operation—live loads, dead loads and temperature effects.

(2) The functional arrangement of the CB is as described the Design Description of this Subsection 2.16.6 and is as shown in Figures 2.16.6-1 through 2.16.6-5.

(3) The critical CB dimensions used for seismic analyses and the acceptable tolerances are provided in Table 2.16.6-1.

(4) The MCR envelope is separated from the rest of the CB by walls, floors, doors and penetrations, which have three-hour fire ratings.

(5) The lowest elevation in the CB is divided into separate divisional areas for instrumentation and control equipment. CB flooding resulting from component failures in any of the CB divisions does not prevent safe shutdown of the reactor.

For external flooding, protection features are:

~~α.~~ • Exterior access openings sealed in external walls below flood and groundwater levels.

~~β.~~ • Water seals at pipe penetrations installed in external walls below flood and groundwater levels.

~~χ.~~ • Water stops provided in expansion and construction joints below flood and groundwater levels.

For internal flooding, protection features are:

~~α.~~ • Flood water in one division is prevented from propagating to other division(s) by divisional walls, sills and watertight doors.

~~β.~~ • Equipment necessary for safe shutdown is located above the maximum flood level for that location or is qualified for flood conditions.

(6) RTNSS equipment in the CB is located above the maximum flood level for that location or is qualified for flood conditions.

Table 2.16.6-2

ITAAC For The Control Building

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
5. (continued) For internal flooding, protection features are: ~~α.~~• Flood water in one division is prevented from propagating to other division(s) by divisional walls, sills and watertight doors. ~~β.~~• Equipment necessary for safe shutdown is located above the maximum flood level for that location or is qualified for flood conditions.		For internal flooding: ~~α.~~• Flood water in one division is prevented from propagating to other division(s) by divisional walls, sills and watertight doors. ~~β.~~• Equipment necessary for safe shutdown is located above the maximum flood level for that location or is qualified for flood conditions.
6. RTNSS equipment in the CB is located above the maximum flood level for that location or is qualified for flood conditions.	Inspections of the as-built RTNSS equipment in the CB will be conducted.	Inspection report(s) exist and conclude that as-built RTNSS equipment in the CB is located above the maximum flood level for that location or is qualified for flood conditions.

2.16.7 Fuel Building

Design Description

The Fuel Building (FB) contains the spent fuel pool, cask loading area, fuel handling systems and storage areas, lower connection to the inclined fuel transfer system, overhead crane, and other plant systems and equipment. The FB is a Seismic Category I structure except for the penthouse that houses HVAC equipment. The penthouse is a Seismic Category II structure. The FB is a rectangular reinforced concrete box type shear wall structure consisting of walls and slabs and is supported on a foundation mat. The FB is integrated with the RB, sharing a common wall between the RB and FB as well as a large common foundation mat. The building is partially embedded.

There is no safety-related component in the FB that could be affected by internal flooding in this structure. Flooding in the FB could not affect the RB because the connection points in the lower elevation are watertight. To protect the FB against external flooding, penetrations in the external walls below flood level are provided with watertight seals.

The key characteristics of the FB are as follows:

(1) The FB is designed and constructed to accommodate the dynamic, static, and thermal loading conditions associated with the various loads and load combinations, which form the structural design basis. The loads are those associated with:

- Natural phenomena—wind, floods, tornadoes (including tornado missiles), earthquakes, rain and snow;
- Internal events—floods; and
- Normal plant operation—live loads, dead loads and temperature effects.

(2) The functional arrangement of the FB is as described in the Design Description of this Subsection 2.16.7 and is as shown in Figures 2.16.7-1 through 2.16.7-6.

(3) The critical dimensions of the FB used for seismic analyses and the acceptable tolerance are provided in Table 2.16.7-1.

(4) The walls forming the boundaries of the FB and penetrations through these walls have three-hour fire ratings.

(5) The FB external flooding protection features are:

~~(1)~~• Exterior access openings are sealed in external walls below flood and groundwater levels;

~~(2)~~• Water seals at pipe penetrations are installed in external walls below flood and groundwater levels; and

~~(3)~~• Water stops are in expansion and construction joints below flood and groundwater levels.

(6) Internal flooding analysis of the FB is performed using ANSI/ANS 56.11-1988 guidelines to ensure protection of RTNSS equipment.

(7) RTNSS equipment in the FB is located above the maximum flood level for that location or is qualified for flood conditions.

Inspections, Tests, Analyses and Acceptance Criteria

Table 2.16.7-2 provides a definition of the inspections, test and/or analyses, together with associated acceptance criteria for the Fuel Building.

Table 2.16.7-2

ITAAC For The Fuel Building

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
6. Internal flooding analysis of the FB is performed using ANSI/ANS 56.11-1988 guidelines to ensure protection of RTNSS equipment.	Internal flooding analysis of the FB will be performed.	Report(s) exist and conclude that internal flooding analysis of the FB has been performed using ANSI/ANS 56.11-1988 guidelines to ensure protection of RTNSS equipment.
7. RTNSS equipment in the FB is located above the maximum flood level for that location or is qualified for flood condition.	Inspection of the as-built RTNSS equipment in the FB will be conducted.	Inspection report(s) exist and conclude that the as-built RTNSS equipment in the FB is located above the maximum flood level for that location or is qualified for flood condition.

2.16.12 Fire Water Service Complex

Design Description

The Firewater Service Complex (FWSC) consists of two Firewater Storage Tanks (FWS) and a Fire Pump Enclosure (FPE) that share a common basemat. Each FWS is designed with a cylindrical reinforced concrete wall and a dome-shaped reinforced concrete roof. The FWSC is a Seismic Category I structure, non-safety related.

The key characteristics of the FWSC are as follows:

(1) The FWSC is designed and constructed to accommodate the dynamic and static loading conditions associated with the various loads and load combinations that form the structural design basis. The loads are those associated with:

- Natural phenomenon – wind, floods, tornadoes, tornado missiles, earthquakes, rain and snow.
- Normal plant operation – live loads, dead load.

(2) Internal flooding analysis of the FWSC is performed using ANSI/ANS 56.11-1988 guidelines to ensure protection of RTNSS equipment.

(3) RTNSS equipment in the FWSC is located above the maximum flood level for that location or is qualified for flood condition.

(4) The FWSC external flooding features are:

- Water seals at pipe penetrations installed in external walls below flood and groundwater levels.
- Water stops provided in expansion and construction joints below flood and groundwater levels.

(5) The FWSC is constructed in accordance with the design documents with any deviation from the design documents reconciled to demonstrate the as-built FWSC structural integrity.

Inspections, Tests, Analyses and Acceptance Criteria

Table 2.16.12-1 provides a definition of the inspections, tests and/or analyses, together with associated acceptance criteria for the FWSC.

Table 2.16.12-1

ITAAC For Firewater Service Complex

Design Commitment	Inspection, Tests, Analyses	Acceptance Criteria
1. The Firewater Service Complex (FWSC) is designed to accommodate the dynamic and static loading conditions associated with the various loads and load combinations that form the structural design basis. The loads are those associated with: • Natural phenomena—wind, floods, tornadoes, tornado missiles, earthquakes, rain and snow. • Normal plant operation—live loads and dead loads.	Analyses of the FWSC will be conducted	Report(s) exist and conclude that the FWSC design conforms to the structural design basis loads specified in the Design Description of Subsection 2.16.12 associated with: • Natural phenomena - wind, floods, tornadoes, tornado missiles, earthquakes, rain and snow. • Normal plant operation—live loads and dead loads.
2. Internal flooding analysis of the FWSC is performed using ANSI/ANS 56.11-1988 guidelines to ensure protection of RTNSS equipment.	Internal flooding analysis of the FWSC will be performed.	Report(s) exist and conclude that internal flooding analysis of the FWSC has been performed using ANSI/ANS 56.11-1988 guidelines to ensure protection of RTNSS equipment.
3. RTNSS equipment in the FWSC is located above the maximum flood level for that location or is qualified for flood condition.	Inspection of the as-built RTNSS equipment in the FWSC will be conducted.	Inspection report(s) exist and conclude that the as-built RTNSS equipment in the FWSC is located above the maximum flood level for that location or is qualified for flood condition.

Table 2.16.12-1

ITAAC For Firewater Service Complex

Design Commitment	Inspection, Tests, Analyses	Acceptance Criteria
4. The FWSC is protected against external flooding. The following protection features are: • Water seals at pipe penetrations are installed in external walls below flood and groundwater levels. • Water stops are in expansion and construction joints below flood and groundwater levels.	Inspection of the as-built FWSC flood control features will be conducted.	Inspection report(s) exist and conclude that the following as-built FWSC flood protection features exist: • Water seals at pipe penetrations are installed in external walls below flood and groundwater levels. • Water stops are provided in expansion and construction joints below flood and groundwater levels.
5. The FWSC is constructed in accordance with the design documents with any deviations from the design documents reconciled to demonstrate the as-built FWSC structural integrity	Inspection and reconciliation analyses of the as-built FWSC will be performed.	Report(s) exist and conclude that the as-built FWSC is constructed in accordance with the design documents with any deviations reconciled appropriately to demonstrate structural integrity.

2.16.13 Electrical Building

Design Description

The Electrical Building (EB) houses the two non-safety-related standby diesel, associated supporting systems and equipment, and non-safety-related power supplies. The EB also provides space for the Technical Support Center. The EB is seismic category NS.

The key characteristics of the EB are as follows:

(1) The EB is designed and constructed to accommodate the dynamic and static loading conditions associated with the various loads and load combinations that form the structural design basis. The loads are those associated with:

- Natural phenomenon – hurricane wind, floods, earthquakes, rain and snow.
- Normal plant operation – live loads, dead load.

(2) The RTNSS systems in the EB are surrounded by barriers to protect them from hurricane wind and missiles.

(3) Internal flooding analysis of the EB is performed using ANSI/ANS 56.11-1988 guidelines to ensure protection of RTNSS equipment.

(4) RTNSS equipment in the EB is located above the maximum flood level for that location or is qualified for flood condition.

(5) The EB external flooding features are:

- Water seals at pipe penetrations installed in external walls below flood and groundwater levels.
- Water stops provided in expansion and construction joints below flood and groundwater levels.

(6) The EB is constructed in accordance with the design documents, with any deviation from the design documents reconciled to demonstrate the as-built EB structural integrity.

Inspections, Tests, Analyses and Acceptance Criteria

Table 2.16.13-1 provides a definition of the inspections, tests and/or analyses, together with associated acceptance criteria for the EB.

Table 2.16.13-1

ITAAC For Electrical Building

Design Commitment	Inspection, Tests, Analyses	Acceptance Criteria
1. The Electrical Building (EB) is designed to accommodate the dynamic and static loading conditions associated with the various loads and load combinations that form the structural design basis. The loads are those associated with: • Natural phenomena— hurricane wind, floods, earthquakes, rain and snow. • Normal plant operation—live loads and dead loads.	Analyses of the EB will be conducted	Report(s) exist and conclude that the EB design conforms to the structural design basis loads specified in the Design Description of Subsection 2.16.13 associated with: • Natural phenomena— hurricane wind, floods, earthquakes, rain and snow. • Normal plant operation—live loads and dead loads.
2. The RTNSS systems in the EB are surrounded by barriers to protect them from hurricane wind and missiles.	Inspection of the as-built RTNSS equipment in the EB will be conducted.	Report(s) exist and conclude the as-built RTNSS systems in the EB are surrounded by barriers to protect them from hurricane wind and missiles.
3. Internal flooding analysis of the EB is performed using ANSI/ANS 56.11-1988 guidelines to ensure protection of RTNSS equipment.	Internal flooding analysis of the EB will be performed.	Report(s) exist and conclude that internal flooding analysis of the EB has been performed using ANSI/ANS 56.11-1988 guidelines to ensure protection of RTNSS equipment.

Table 2.16.13-1

ITAAC For Electrical Building

Design Commitment	Inspection, Tests, Analyses	Acceptance Criteria
4. RTNSS equipment in the EB is located above the maximum flood level for that location or is qualified for flood condition.	Inspection of the as-built RTNSS equipment in the EB will be conducted.	Inspection report(s) exist and conclude that the as-built RTNSS equipment in the EB is located above the maximum flood level for that location or is qualified for flood condition.
5. The EB is protected against external flooding. The following protection features are: • Water seals at pipe penetrations are installed in external walls below flood and groundwater levels. • Water stops are in expansion and construction joints below flood and groundwater levels.	Inspection of the as-built EB flood control features will be conducted	Inspection report(s) exist and conclude that the following as-built EB flood protection features exist: • Water seals at pipe penetrations are installed in external walls below flood and groundwater levels. • Water stops are provided in expansion and construction joints below flood and groundwater levels.
6. The EB is constructed in accordance with the design documents with any deviations from the design documents reconciled to demonstrate the as-built EB structural integrity	Inspection and reconciliation analyses of the as-built EB will be performed.	Report(s) exist and conclude that the as-built EB is constructed in accordance with the design documents, with any deviations reconciled appropriately to demonstrate structural integrity.

2.16.14 Service Water Building

Design Description

The Service Water Building (SF) houses the non-safety-related vertical pumps and associated valves, strainers, piping and electrical buses. The SF is seismic category NS.

The key characteristics of the SF are as follows:

(1) The SF is designed and constructed to accommodate the dynamic and static loading conditions associated with the various loads and load combinations that form the structural design basis. The loads are those associated with:

- Natural phenomenon – hurricane wind, floods, earthquakes, rain and snow.
- Normal plant operation – live loads, dead load.

(2) The RTNSS systems in the SF are surrounded by barriers to protect them from hurricane wind and missiles.

(3) Internal flooding analysis of the SF is performed using ANSI/ANS 56.11-1988 guidelines to ensure protection of RTNSS equipment.

(4) RTNSS equipment in the SF is located above the maximum flood level for that location or is qualified for flood condition.

(5) Plant Service Water equipment or other equipment designated as RTNSS that is located outdoors is qualified for flood condition and protected from hurricane wind and missiles when buried underground. RTNSS equipment that is not buried directly underground is protected by cell enclosures that provide flooding, wind and missile protection.

(6) The SF external flooding features are:

- Water seals at pipe penetrations installed in external walls below flood and groundwater levels.
- Water stops provided in expansion and construction joints below flood and groundwater levels.

(7) The SF is constructed in accordance with the design documents, with any deviation from the design documents reconciled to demonstrate the as-built SF structural integrity.

Inspections, Tests, Analyses and Acceptance Criteria

Table 2.16.14-1 provides a definition of the inspections, tests and/or analyses, together with associated acceptance criteria for the SF.

Table 2.16.14-1

ITAAC For Service Water Building

Design Commitment	Inspection, Tests, Analyses	Acceptance Criteria
1. The Service Water Building (SF) is designed to accommodate the dynamic and static loading conditions associated with the various loads and load combinations that form the structural design basis. The loads are those associated with: • Natural phenomena— hurricane wind, floods, earthquakes, rain and snow. • Normal plant operation—live loads and dead loads.	Analyses of the SF will be conducted	Report(s) exist and conclude that the SF design conforms to the structural design basis loads specified in the Design Description of Subsection 2.16.14 associated with: • Natural phenomena— hurricane wind, floods, earthquakes, rain and snow. • Normal plant operation—live loads and dead loads.
2. The RTNSS systems in the SF are surrounded by barriers to protect them from hurricane wind and missiles.	Inspection of the as-built RTNSS equipment in the SF will be conducted.	Report(s) exist and conclude the as-built RTNSS systems in the SF are surrounded by barriers to protect them from hurricane wind and missiles.
3. Internal flooding analysis of the SF is performed using ANSI/ANS 56.11-1988 guidelines to ensure protection of RTNSS equipment.	Internal flooding analysis of the SF will be performed.	Report(s) exist and conclude that internal flooding analysis of the SF has been performed using ANSI/ANS 56.11-1988 guidelines to ensure protection of RTNSS equipment.
4. RTNSS equipment in the SF is located above the maximum flood level for that location or is qualified for flood condition.	Inspection of the as-built RTNSS equipment in the SF will be conducted.	Inspection report(s) exist and conclude that the as-built RTNSS equipment in the SF is located above the maximum flood level for that location or is qualified for flood condition.

Table 2.16.14-1

ITAAC For Service Water Building

Design Commitment	Inspection, Tests, Analyses	Acceptance Criteria
5. Plant Service Water equipment or other equipment designated as RTNSS that is located outdoors is qualified for flood condition and protected from hurricane wind and missiles when buried underground. RTNSS equipment that is not buried directly underground is protected by cell enclosures that provide flooding, wind and missile protection.	Inspection of the as-built RTNSS equipment located outdoors will be conducted.	Inspection report(s) exist and conclude that the as-built RTNSS equipment that is located outdoors is qualified for flood condition and protected from hurricane wind and missiles when buried underground. RTNSS equipment that is not buried directly underground is protected by cell enclosures that provide flooding wind and missile protection.
6. The SF is protected against external flooding. The following protection features are: • Water seals at pipe penetrations are installed in external walls below flood and groundwater levels. • Water stops are in expansion and construction joints below flood and groundwater levels.	Inspection of the as-built SF flood control features will be conducted	Inspection report(s) exist and conclude that the following as-built SF flood protection features exist: • Water seals at pipe penetrations are installed in external walls below flood and groundwater levels. • Water stops are provided in expansion and construction joints below flood and groundwater levels.
7. The SF is constructed in accordance with the design documents with any deviations from the design documents reconciled to demonstrate the as-built SF structural integrity	Inspection and reconciliation analyses of the as-built SF will be performed.	Report(s) exist and conclude that the as-built SF is constructed in accordance with the design documents, with any deviations reconciled appropriately to demonstrate structural integrity.

3.3 WIND AND TORNADO LOADINGS

Seismic Category I structures are designed for tornado and extreme wind phenomena. Seismic Category II structures are designed for extreme and tornado wind (excluding tornado missiles).

3.3.1 Wind Loadings

As discussed in Standard Review Plan (SRP) 3.3.1, the design wind velocity and its recurrence interval, the velocity variation with height, and the applicable gust factors are used in defining the input parameters for the structural design criteria appropriate to account for wind loadings. The procedures that are utilized to transform the design wind velocity into an effective pressure applied to structures take into consideration the geometrical configuration and physical characteristics of the structures and the distribution of wind pressure on the structures.

The design of structures that must withstand the effects of the design wind load consider the relevant requirements of General Design Criterion 2 concerning natural phenomena. The wind used in the design includes the most severe wind that has been historically reported for the site and surrounding area with sufficient margin for the limited accuracy, quantity, and period of time in which historical data has been accumulated. Appropriate consideration has been given for the design wind velocity and its recurrence interval, the velocity variation with height, the applicable gust factors, and the bases for determining these site-related parameters. The procedures utilized to transform the wind velocity into an effective pressure applied to structures and parts and portions of structures, are as delineated in Reference 3.3-1.

3.3.1.1 Design Wind Velocity and Recurrence Interval

Seismic Category I and II structures are designed to withstand the design wind velocity listed in Table 2.0-1. The recurrence interval listed in Table 2.0-1 is equivalent to an importance factor of 1.15 based on Category IV building.

Seismic Category NS buildings that house RTNSS equipment are designed to withstand hurricane Category 5 wind velocity at 195 mph, 3-sec. gust, instead of wind speed listed in Table 2.0-1.

3.3.1.2 Determination of Applied Forces

The design wind velocity is converted to velocity pressure in accordance with Reference 3.3-1 with Exposure Category D.

The design wind velocity for use in the ESBWR is listed in Table 2.0-1. Reference 3.3-2 is used to obtain the effective wind pressures for geometric and physical cases that Reference 3.3-1 does not cover.

3.3.1.3 Effect of Failures of Structures or Components Not Designed for Wind Loads

Safety-related systems and components are protected within wind-resistant structures. The remainder of plant structures and components not designed for extreme wind loads are arranged or designed such that their failures do not adversely affect the ability of any Seismic Category I structures, systems, and components to perform their safety-related function(s).

Table 19A-4
Capability of RTNSS Related Structures(1)(2)

System Location	A. (Internal Flooding)	B. (External Flooding)	C. (Internal Missiles)	D. (Extreme Wind and Missiles)
Reactor Bldg. (RB) Control Bldg. (CB) Fuel Bldg. (FB) Fire Pump Enclosure Bldg. (FPE)	The design/installation of RTNSS ~~B~~ equipment includes protection from the effects of internal flooding.	Seismic Category I structures are designed to withstand the flood level and groundwater level specified in Table 2.0-1 and described in Subsection 3.4.1.2. All exterior access openings are above flood level and exterior penetrations below design flood and groundwater levels are appropriately sealed as described in Subsection 3.4.1.1. On-site storage tanks are designed and constructed to minimize the risk of catastrophic failure and are located to allow drainage without damage to site facilities in the event of a tank rupture per Subsection 3.4.1.2.	There are no credible sources of internal missiles per Section 3.5.	Seismic Category I structures designed for tornado and extreme wind phenomena are described inSection 3.3 and Subsection 3.5.1.4.
Ancillary DG Building		The Ancillary DG Building. Is designed to withstand external flooding with the same acceptance criteria as a Seismic Category I Structure.		The Ancillary DG Building is designed for tornado and ~~extreme wind phenomena per Section 3.3~~ Category 5 hurricane wind loads. ~~It is designed to withstand missiles generated from Category 5 hurricanes~~RTNSS systems in the Ancillary Diesel Building are protected from Category 5 hurricane wind and missiles.

Table 19A-4
Capability of RTNSS Related Structures(1)(2)

System Location	A. (Internal Flooding)	B. (External Flooding)	C. (Internal Missiles)	D. (Extreme Wind and Missiles)
Electrical Bldg. (EB) Service Water Bldg. (SF) Turbine Bldg. (TB)	The design/installation of RTNSS ~~C~~ equipment includes protection from the effects of internal flooding.	All exterior access openings are above flood level and exterior penetrations below design flood and groundwater levels are appropriately sealed; basemat and walls are designed for hydrostatic loading, therefore protected from external flooding.	N/A	The EB and SF are RTNSS Structures designed for Category 5 hurricane winds ~~and missiles that meet the requirement of Subsection 19A.8.3~~. RTNSS systems in the EB and SF are protected from Category 5 hurricane wind and missiles. The TB structure is designed for tornado ~~wind speed which envelops~~ and Category 5 hurricane ~~speed~~wind loads. The design/installation of the RTNSS ~~C~~ systems in the TB includes protection to comply with the requirement of Subsection 19A.8.3 to withstand winds and missiles generated from Category 5 hurricanes.
PSW System located Outdoors Onsite (OO)	N/A	The design/installation of the RTNSS ~~C~~ system includes protection from the effects of flooding.	N/A	The design/installation of the RTNSS ~~C~~ system complies with the requirement of Subsection 19A.8.3 to withstand winds and missiles generated from Category 5 hurricanes.

(1) Category 5 hurricane wind speed is 195 mph, 3-sec. gust.

(2) The hurricane missile spectrum is consistent with the tornado missile spectrum identified in Table 2.0-1. The design criteria associated with hurricane missile protection follows Section 3.5 for missiles generated by natural phenomenon. The tornado wind speed is substituted with hurricane wind speed to design the concrete or steel barriers for missile impact.