2.1.5 Essential Service Water Building

Design Description

1.0 System Description

Each of the four Essential Service Water Buildings (ESWB) is an independent, safety related, Seismic Category I, reinforced concrete structure. Each ESWB houses an Essential Service Water Cooling Tower structure (ESWCT) and an Essential Service Water Pump Building (ESWPB). The ESWCT houses two cooling towers and a water storage basin. The ESWPB houses pumps and electrical equipment. A total of four ESWBs are located in pairs on each side of the Nuclear Island (NI) complex. The pairs of buildings are separated to protect them from being simultaneously affected by external events such as aircraft hazards and explosion pressure waves. As shown on Figure 2.1.5-1, one pair is located adjacent to the Turbine Building and the other pair is located adjacent to the Fuel Building (FB).

Each ESWB is embedded 21 ft below grade and is approximately 164 ft by 108 ft wide by 118 ft high (i.e., from the bottom of the basemat to the top of the building at elevation 96 ft 0 in.). The ESWBs are Seismic Category I structures, which are capable of performing their safety function during and following a safe shutdown earthquake (SSE). The buildings are designed for external hazards including rain and snow, flooding, wind loads, extreme winds loads, missile impact loads, SSE loads, and site proximity hazards. The buildings are also designed for structure and component dead loads, live loads, pipe reactions, and thermal effects.

The function of the ESWBs is to house equipment and cooling water associated with the Essential Service Water System.

2.0 Arrangement

2.1 The basic configuration of the ESWBs is as shown on Figure 2.1.5-1—U.S. EPR Building Layout Showing ESWB Locations.

3.0 Mechanical Design Features

3.1 Separation is provided between the two pairs of ESWBs and the NI common basemat structures as shown on Figure 2.1.5-1 to preclude interaction between the ESWBs and NI common basemat structures.

3.2 The ESWBs have extreme wind-generated missile protection shields provided for the safety-related fans and pumps as shown on Figure 2.1.5-2—Essential Service Water Building Plan Elevation +14 ft., Figure 2.1.5-3—Essential Service Water Building Plan Elevation +63 ft., Figure 2.1.5-4—ESWB Elevation Section A-A, and Figure 2.1.5-5—ESWB Elevation Section B-B.

3.3 The ESWBs site grade level is located within +/- 3 inches of the building +0 ft elevation.

3.4 Internal hazard protection barriers separate each ESWB from the other ESWBs so that the impact of internal hazards, including fire, flood, high-energy line break and missile impact, is contained within the ESWB of hazard origination.

3.5 The ESWB structures are Seismic Category I and will withstand design basis loads, as specified below, without loss of structural integrity and safety-related functions.

- Normal plant operation (e.g., dead loads, live loads, lateral earth pressure loads, hydrostatic loads, hydrodynamic loads, and temperature loads).
- Internal events (e.g., internal flood loads, accident pressure loads, accident thermal loads, accident pipe reaction, and pipe break loads—including reaction loads, jet impingement loads, cubicle pressurization loads, and missile impact loads).
- External events (e.g., wind, extreme winds, rain, snow, flood, extreme winds-generated missiles, and earthquake).

3.6 ESWB structural walls or floors having exterior penetrations located below grade elevation are protected against external flooding by watertight seals.

3.7 The ESWB structures have key dimensions and tolerances specified in Tables 2.1.5-1—Key Dimensions of Essential Service Water Building Structure and 2.1.5-2—Key Dimensions of Essential Service Water Building Foundation Footprint.

Inspections, Tests, Analyses, and Acceptance Criteria

Table 2.1.5-3 lists ESWB ITAAC.

Table 2.1.5-1—Key Dimensions of Essential Service Water Building Structure

Label	Wall of Section Descriptions	Region	Floor Elevation or Elevation Range	Key Dimensions (1)
F5	Foundation Basemat.	Refer to Figure 2.1.5-4 and Figure 2.1.5-5.	Nominal elevation -16 ft.	6 ft – 0 in.
W12	Shear Wall at Column Line 4 Below Elevation +63 ft.	Refer to Figure 2.1.5-4.	From nominal elevations -16 ft to +63 ft.	3 ft – 0 in.
W13	Shear Wall at Column Line 4 Above Elevation +63 ft.	Refer to Figure 2.1.5-4.	From nominal elevations +63 ft to +96 ft.	2 ft – 0 in.
S11	Fan Deck Slab.	Refer to Figure 2.1.5-3.	Nominal elevation +63 ft.	2 ft – 6 in.

1. Concrete forming and placement tolerances for construction shall conform to the requirements of ACI 349 and ACI 117.

Table 2.1.5-2—Key Dimensions of Essential Service Water Building Foundation Footprint

Label	Section Descriptions	Region	Key Dimension	Tolerance (inches)
D14	Distance from North to South edge of ESWB foundation base slab.	Refer to Figure 2.1.5-1.	164 ft (2)	+/- 12 in.
D15	Distance from East to West edge of ESWB foundation base slab.	Refer to Figure 2.1.5-1.	107 ft – 11 ¼ in. (2)	+/- 12 in.
D16	Distance from +0 ft elevation to ESWB roof elevation.	Refer to Figure 2.1.5-4.	96 ft	+/- 12 in.(1)
D17	Distance from +0 ft elevation to top of ESWB foundation base slab.	Refer to Figure 2.1.5-4.	18 ft	

1. Tolerance specified is for the total dimension from top of foundation to top of roof elevation. The key dimensions individually are permitted to utilize up to the total tolerance specified provided the combined total tolerance for the two key dimensions does not exceed the tolerance specified.

2. Key dimension does not include basemat extensions.

Table 2.1.5-3—Essential Service Water Building ITAAC
Sheet 1 of 3

Commitment Wording		Inspections, Tests, Analyses	Acceptance Criteria
2.1	The basic configuration of the ESWBs is as shown on Figure 2.1.5-1.	An inspection of the basic configuration of the as-built ESWBs will be performed.	The basic configuration of the ESWBs is as shown on Figure 2.1.5-1.
3.1	Separation is provided between the two pairs of ESWBs and the NI common basemat structures as shown on Figure 2.1.5-1 to preclude interaction between the ESWBs and NI common basemat structures.	An inspection will be performed to verify the as-built physical separation distance between the ESWBs and the NI common basemat structures.	The two pairs of ESWBs are separated from the NI common basemat structures as shown on Figure 2.1.5-1. A separation distance of at least 20 ft exists between the two pairs of ESWBs and NI common basemat structures.
3.2	The ESWBs have extreme wind-generated missile protection shields provided for the safety-related fans and pumps as shown on Figure 2.1.5-2, Figure 2.1.5-3, Figure 2.1.5-4, and Figure 2.1.5-5.	An inspection and analysis will be performed to verify the as-built ESWB extreme wind-generated missile protection shields provided for the safety-related fans and pumps will withstand design basis extreme wind loads without loss of structural integrity or safety-related functions.	A report concludes that the ESWB extreme wind-generated missile protection shields provided for the safety-related fans and pumps as shown on Figure 2.1.5-2, Figure 2.1.5-3, Figure 2.1.5-4, and Figure 2.1.5-5 will withstand the design basis extreme wind loads without loss of structural integrity or safety-related functions.
3.3	The ESWBs site grade level is located within +/- 3 inches of the building +0 ft elevation.	An inspection will be performed to verify the as-built ESWBs site grade level at building +0 ft elevation.	The ESWB site grade level is located within +/- 3 inches of the building +0 ft elevation.

Table 2.1.5-3—Essential Service Water Building ITAAC
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Commitment Wording		Inspections, Tests, Analyses	Acceptance Criteria
3.4	Internal hazard protection barriers separate each ESWB from the other ESWBs so that the impact of internal hazards, including fire, flood, high-energy line break, and missile impact is contained within the ESWB of hazard origination.	a. An analysis will be performed to determine the internal hazard protection barriers separate each ESWB from the other ESWBs so that the impact of internal hazards, including fire, flood, high-energy line break, and missile impact is contained within the ESWB of hazard origination.	a. A report defines the internal hazard protection barriers separate each ESWB from the other ESWBs so that the impact of internal hazards, including fire, flood, high-energy line break, and missile impact is contained within the ESWB of hazard origination.
		b. An inspection will be performed to verify the as-built internal hazard protection barriers that separate each ESWB from the other ESWBs.	b. Internal hazard protection barriers that separate each ESWB from the other ESWBs is shown on Figure 2.1.5-6.

Table 2.1.5-3—Essential Service Water Building ITAAC
Sheet 3 of 3

Commitment Wording		Inspections, Tests, Analyses	Acceptance Criteria
3.5	The ESWB structures are Seismic Category I and will withstand design basis loads, as specified below, without loss of structural integrity and safety-related functions: ● Normal plant operation (e.g., dead loads, live loads, lateral earth pressure loads, hydrostatic loads, hydrodynamic loads, and temperature loads). ● Internal events (e.g., internal flood loads, accident pressure loads, accident thermal loads, accident pipe reaction, and pipe break loads – including reaction loads, jet impingement loads, cubicle pressurization loads, and missile impact loads). ● External events (e.g., wind, extreme winds, rain, snow, flood, extreme winds-generated missiles, and earthquake).	An inspection and analysis of the as-built ESWB structures for the design basis loads will be performed.	A report concludes that the ESWB structures will withstand the design basis loads as specified below without loss of structural integrity or safety-related functions: ● Normal plant operation (e.g., dead loads, live loads, lateral earth pressure loads, hydrostatic loads, hydrodynamic loads, and temperature loads). ● Internal events (e.g., internal flood loads, accident pressure loads, accident thermal loads, accident pipe reaction, and pipe break loads – including reaction loads, jet impingement loads, cubicle pressurization loads, and missile impact loads). ● External events (e.g., wind, extreme winds, rain, snow, flood, extreme winds-generated missiles, and earthquake).
3.6	ESWB structural walls or floors having exterior penetrations located below grade elevation are protected against external flooding by watertight seals.	An inspection will be performed to verify as-built ESWB structural walls or floors having exterior penetrations located below grade elevation are protected against external flooding by watertight seals.	Watertight seals exist for exterior penetrations of ESWB structural walls and floors located below grade elevation.
3.7	The ESWB structures have key dimensions and tolerances specified in Tables 2.1.5-1 and 2.1.5-2.	An inspection will be performed to verify key dimensions and tolerances of the as-built ESWB structures.	The ESWB structures conform to the key dimensions and tolerances specified in Tables 2.1.5-1 and 2.1.5-2.

Next File