3.4 Water Level (Flood) Design

The information in this section of the reference ABWR DCD, including all subsections and tables and figures, is incorporated by reference with the following supplements and departures.

STP DEP T1 5.0-1 (Table 3.4-1)

STD DEP T1 2.3-1

STD DEP T1 2.15-1

STP DEP 1.2-2

STD DEP 3.8-1

3.4.1.1.1 Flood Protection from External Sources

STP DEP T1 5.0-1

Waterproofing of foundations and walls of Seismic Category I structures below ~~grade~~ flood level *~~arise~~ is accomplished principally by the use of water stops at expansion and construction joints. In addition to water stops, waterproofing of the plant structures and penetrations that house safety-related systems and components is provided up to 8 cm above the ~~plant ground~~* flood *level to protect the external surfaces from exposure to water.*

3.4.1.1.2 Compartment Flooding from Postulated Component Failures

STDP DEP T1 2.3-1

The MSL tunnel area is instrumented with ~~radiation and~~ air temperature monitors that are used to automatically isolate the MSIVs upon detection of high abnormal limits.

3.4.1.1.2.3 Evaluation of Radwaste Building Flooding Events

STD DEP T1 2.15-1

STD DEP 3.8-1

The Radwaste Building is a reinforced concrete structure consisting of a ~~Seismic Category I~~ substructure ~~13.5~~ 13.7*m below grade at the basemat top and a super-structure ~~15.7~~* 13.7*m above grade. This building does not contain safety-related equipment and is not contiguous with other plant structures except through the radwaste piping and tunnel. In case of a flood, the building substructure serves as a large sump which can collect and hold any leakage within the building. Also, the medium and large radwaste tanks are housed in sealed compartments which are designed to contain any spillage or leakage from tanks that may rupture. The piping that transfer the liquid waste from the other buildings to the Radwaste Building traverse through a tunnel. ~~which runs near (but does not penetrate) the Radwaste Building.~~* The top of the radwaste tunnel is at grade (Figure 1.2-23e). *~~at an elevation of 1,500mm, 3m~~*

~~above the basemat slab 1,036cm (Table 3.4-1).~~ Seals are provided for all penetrations from the tunnel to prevent building to building flooding.

The structural design of this building is such that no internal flooding is expected or will occur under the worst case conditions from ~~those tanks that are isolated by the Seismic Category I compartments~~medium and large radwaste tanks.

3.4.1.1.2.5 Evaluation of Turbine Building Flood Events

STP DEP 1.2-2

Circulating Water System and Turbine Building Water System (TSW) are the only systems large enough to fill the ~~condenser pit~~Turbine Building; therefore, only these two systems can flood into adjacent buildings.

A failure ~~in either~~ of ~~these systems~~Circulating Water System will result in the total flooding of the Turbine Building ~~up to~~ below grade. Another failure in TSW system will result in the total flooding of Turbine Building still within the TSW System equipment room. These are accomplished by leak detectors in a condenser pit and TSW System equipment room, and automatic means to shutdown those systems. Water is prevented from crossing to other buildings by two means in the case of the leak detection failure. The first is a normally closed alarmed door in the connecting passage between the Turbine Building and Service Building. The second is that the radwaste tunnel will be sealed at both ends to prevent water from either entering the tunnel or leaving the tunnel. A large hydrostatic head is prevented by a large non-water-tight truck door at grade to provide a release point for any flooding water.

Because of the large size of the circulating water system and the TSW system, ~~a~~ leaks will fill the condenser pit and the TSW System equipment room quickly. Monitors were added in the condenser pit and the TSW System equipment room of the Turbine Building to provide leak detection and an automatic means to shutdown the Circulating Water System and TSW System in the event of flooding in the Turbine Building (Subsections 10.4.5.2.3 and 10.4.5.6).

3.4.2 Analytical and Test Procedures

STP DEP T1 5.0-1

Since the design flood elevation is ~~30.5 cm below~~ ~~414.5~~442.0 cm above the finished plant grade, ~~there is no dynamic force due to flood. The~~ the lateral hydrostatic and hydrodynamic pressure on the structures due to the design flood water level, as well as ground and soil pressures, are calculated.

3.4.3 COL License Information

3.4.3.1 Flood Elevation

The following site specific supplement addresses COL License Information Item 3.5.

The site specific flood elevation is defined as ~~414.5~~442.0 cm above grade. The design basis flood is described in ~~For the cause and specific flooding scenarios considered see~~ Subsection 2.4S.2.

As described in Table 3.4-1 note 3 and 5, all penetrations and doors that penetrate the exterior walls of Seismic Category I Buildings that are located below the design basis flood level are watertight. Therefore all safety-related equipment in these buildings are protected from postulated external floods and satisfy the requirements of GDC 2.

3.4.3.2 Ground Water Elevation

The following site specific supplement addresses COL License Information Item 3.6.

The site specific ground water elevation is defined in Subsection 2.4S.12. The ground water elevation is lower than 61.0cm below grade.

3.4.3.3 Flood Protection Requirements for Other Structures

The following site specific supplement addresses COL License Information Item 3.7.

The Ultimate Heat Sink and Reactor Service Water Piping Tunnel have the same flood protection features as other Seismic Category I structures within the scope of the certified design. These design features are addressed in Subsection 3.4.1.1. As described in that Subsection, they are protected from postulated flooding and satisfy the requirements of GDC 2 and the guidance of RG 1.102.

The Ultimate Heat Sink and Reactor Service Water Piping Tunnel are divisionally separated in accordance with Section 3.13 and 3.12. Penetrations that are located below design flood level are watertight thereby preventing an internal flood event from propagating from one division to another.

3.4.3.4 Penetration Seals

The following site specific supplement addresses COL License Information Item in Subsection 3.4.1.1.1.

Penetrations located between Seismic Category I building and non-Seismic Category I building or to the outside below site- specific flood elevation are similar to a primary containment penetration. They consist of a steel sleeve embedded in the wall with a closure plate that acts as a seal and as a pipe anchor. The sleeve, closure plate and pipe are welded together to form a highly reliable seal.

Table 3.4-1 Structures, Penetrations, and Access Openings Designed for Flood Protection

Structure	Reactor Building	Service Building	Control Building	Radwaste Building	Turbine Building	Ultimate Heat Sink
Design Flood Level ~~(mm)~~	~~11,695~~ ~~14,508~~14,783 mm (~~47.6~~48.5 ft)	~~11,695~~ 10058 mm (33 ft)	~~11,695~~ ~~14,508~~14,783 mm (~~47.6~~48.5 ft)	~~11,695~~ 10058 mm (33 ft)	~~11,695~~ 10058 mm (33 ft)	~~14,508~~ 14,783 mm (~~47.6~~48.5 ft)
Design Ground Water Level ~~(mm)~~	~~11,390~~ 9,753mm (32 ft)	~~11,390~~ 9,753 mm (32 ft)	~~11,390~~ 9,753 mm (32 ft)	~~11,390~~ 9,753 mm (32 ft)	~~11,390~~ 9,753 mm (32 ft)	8,534 mm (28.0 ft)
Reference Plant Grade ~~(mm)~~	~~12,000~~ 10,363 mm (34ft)	~~12,000~~ 10,363 mm (34ft)	~~12,000~~ 10,363 mm (34ft)	~~12,000~~ -10,363 mm (34ft)	~~12,000~~ -10,363 mm (34ft)	10,363 mm (34 ft)
Base Slab ~~(mm)~~	~~8,200~~ –9,837 mm (-32.27 ft)	~~2,150 & 3,500~~ -3,787 mm & 1,863 mm (-12.42 ft & -6.11 ft)	~~8,200~~ –9,837 mm (-32.27 ft)	~~1,500~~ -3,137 mm (-10.29 ft)	~~5,300~~ 3,663 mm (12.02 ft)	~~1,830 mm & -305 mm~~4,267 mm (~~6 ft & -1ft~~14 ft)
Actual Plant Grade ~~(mm)~~	~~12,000~~ 10,363 mm (34 ft)	~~12,000~~ 10,363 mm (34 ft)	~~12,000~~ 10,363 mm (34 ft)	~~12,000~~ 10,363 mm (34 ft)	~~12,000~~ 10,363 mm (34 ft)	~~14,935 mm (49 ft~~10,363 mm (34 ft))
~~*Building Height (mm)*~~	~~49,700~~	~~22,200~~	~~22,200~~	~~28,000~~	~~54,300~~	
Penetrations Below Design Flood Level (Notes 1 through 4)	Refer to Table 6.2-9	None	RCW, RSW and miscellaneous lines, and electrical penetrations	None, except radwaste piping	Radwaste piping	**RSW piping and electric cables**

Table 3.4-1 Structures, Penetrations, and Access Openings Designed for Flood Protection

Structure	Reactor Building	Service Building	Control Building	Radwaste Building	Turbine Building	Ultimate Heat Sink
Access Openings Below Design Flood Level (Note 5 and 6)	Access way**s to outside and** from S/B **and C/B (Ref. 1.2-4 through 1.2-8)** ~~*@ 4,800 mm*~~	Access way**s** from R/B, **C/B and T/B. (Fig. 1.2-17 through 1.2-20)** ~~*@ 3,500 mm, (Fig. 1.2-18)*~~ ~~*Area access ways from C/B @ 2,150 mm, 3,500 mm, and 7,900 mm (Fig. 1.2-19)*~~ ~~*Area access way from T/B @ 3,500 mm (Fig. 1.2-24)*~~	~~*Hx area access from S/B @ 2,150 mm, (Fig. 1.2-15)*~~ ~~*Area access from S/B @ 3,500 (See Fig. 1.2-18*~~ ~~*Area access way from S/B @ 7,900 mm, (See Fig. 1.2-15)*~~ **Access ways to outside, S/B, R/B, and RW/B (See Fig 1.2-17 through 1.2-20)**	None	Access ways from S/B ~~*@ 5,300 mm,*~~ **(Fig 1.2-18)**	**None**

Notes:

1 *Watertight penetrations will be provided for all Reactor and Control Turbine and Radwaste Buildings penetrations that are below grade design flood level.*

2 *The safety-related and non-safety-related tunnels prevent the lines running through them from being exposed to outside ground flooding.*

3 *Penetrations below design flood level will be sealed against any hydrostatic head resulting from the design basis flood, or from a moderate energy pipe failure in the tunnel or inside a connecting building.*

4 *Waterproof sealant applied to the building exterior walls below flood level will also be extended a minimum of 150 mm along the penetration surfaces.*

5 *Watertight doors (bulkhead type) are provided at all Reactor and Control Building access ways that are below* ~~*grade*~~ <u>design flood level</u>.

6 <u>The figure shown best depicts the indicated access.</u>

7 <u>Per FEMA's Flood Maps, STP 3&4 is not located in flood prone region, therefore per ASCE 7 Chapter 5 Non-Safety-Related buildings do not need to be designed for flood.</u>