19.8 Important Features Identified by the ABWR PRA

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

STP DEP T1 5.0-1 (Table 19.8-5)

~~STP DEP 9.2-5~~

STP DEP 19R-1 (Table 19.8-5)

19.8.5 Important Features from Flooding Analyses

19.8.5.1 Summary of Analysis Results

The following site-specific supplement discusses internal flooding from the Reactor Service Water pump house.

The ABWR flooding analysis evaluated all potential flood sources and through the use of simplified event trees determined the CDF for each building of interest. The ~~three~~ four *buildings determined to have the potential for flooding to affect safety-related equipment are the Turbine, Control, and Reactor Buildings,* and the Reactor Service Water (RSW) pump house*. The other buildings do not contain safety-related equipment and are not connected to buildings that do. Tunnels from each of these buildings which are routed to the radwaste building are sealed to prevent interbuilding flooding. Therefore, the interbuilding flooding probability through these tunnels was evaluated to be several orders of magnitude lower than direct flooding due to pipe breaks in each building and was not included in the event trees. The adequacy of the tunnel seals should be confirmed by the COL applicant. The CDF for events initiated by flooding in the Turbine Building is extremely small for a low power cycle heat sink (PCHS) and very small for a high PCHS. The CDF for events initiated by flooding in the Control Building is very small,* the CDF for events initiated by flooding in the RSW pump house is very small*, and the CDF for events initiated by flooding in the Reactor Building is extremely small. The estimated CDF for events initiated by flooding from all internal flood sources is very small for a low PCHS and for a high PCHS.*

19.8.5.3 Features Selected

~~STP DEP 9.2-5~~

~~*The anti-siphon capability applies to both the RSW supply and return lines from/to the ultimate heat sink.*~~

The following site-specific supplement discusses internal flooding from the Reactor Service Water pump house.

Water Level Sensors in the RCW/RSW rooms

Water level sensors are installed in the turbine building condenser pit, ~~and~~the RCW rooms in the control building, and ~~in~~the RSW pump rooms*. These sensors are used to detect flooding in the rooms and send signals to trip pumps and close isolation valves*

in the affected systems. The sensors are arranged in a two-out-of-four logic. The control building and the RSW pump house ~~*has*~~have *two sets of sensors (lower and upper) which measure the water level using diverse means to eliminate the potential for common cause failures. The sensors also send signals to the control room to alert the operator to a potential flooding condition so that appropriate manual actions can be taken to isolate the flooding source.*

STP DEP 19R-1

~~*Anti-siphon Capability*~~

~~*The reactor service water (RSW) system contains anti-siphon capability (e.g.,vacuum breakers, air break) to stop flooding in the event of a break in a RSW line in the reactor component cooling water (RCW) rooms in the control building. The antisiphon capability will terminate RSW flow if the RSW pumps are tripped but the isolation valves in the affected division fail to close. The anti-siphon capability applies to both the RSW supply and return lines from/to the ultimate heat sink.*~~

STP DEP 19R-1

Ultimate Heat Sink

The ultimate heat sink will be designed such that water cannot gravity drain to the control building. ~~*in excess of the allowed 4000 meters of RSW pipe from the isolation valves in the pump house (2000 meters each for supply and return).*~~

~~***RSW System***~~

~~*A maximum of 4000 meters of RSW piping is allowed between the RSW isolation valves at the pump house and the control building (2000 meters each for supply and return).*~~

The following site-specific supplement discusses internal flooding from the Reactor Service Water pump house.

Floods Originating in Turbine, Control, ~~***and***~~ **or *Reactor Buildings*, or the RSW Pump House**

The screening analysis indicated that the flooding analysis only needed to address internal flooding from sources in the Turbine, Control, and Reactor Buildings, and the RSW Pump House. *Other buildings do not contain equipment that can be used to achieve safe shutdown and flooding in those buildings cannot propagate to buildings which contain safe shutdown equipment. Although flooding originating in the Turbine Building could propagate through the Service Building and potentially enter the Control or Reactor Buildings if watertight doors fail or are left open, the analysis does not consider flooding to originate in the Service Building. The analysis addresses the potential for propagating of flooding through the Service Building.*

STP DEP T1 5.0-1

Operator Check Watertight Doors are Dogged

The flooding analysis assumes that all watertight doors except the normally-open main control room access door, *are closed and dogged to prevent floods from propagating from one area to another* or from outside to the inside. *The watertight doors are alarmed to alert security personnel that a watertight door is open but, with the exception of the watertight doors in the RSW pump house, will not alarm to indicate that a door is not dogged. To guard against a door being left undogged, operators should check the doors every shift to assure that they are closed and dogged. The watertight doors in the RSW pump house are alarmed if open or if left undogged.* All plant entrance doors located below the maximum flood level are provided with watertight doors or other watertight barriers. The equipment access entrances to the emergency diesel generator rooms are provided with watertight blocks that are only removed for necessary maintenance.

~~**Building Entrance Elevation**~~

~~Entrance to all plant buildings is located at an elevation at least one foot above the flood elevation expected from the probable maximum precipitation. With the plant entrances located at that elevation, many external flood sources can be screened from consideration since water cannot enter plant buildings.~~

View of the Main Cooling Reservoir

Plant buildings are located such that security personnel will have a clear and unobstructed view of the main cooling reservoir. Having such a view allows for prompt notification of the main control room so that the normally-open watertight door to the main control room can be closed before failure of the main cooling reservoir could be expected to threaten the plant. The area between the plant and the main cooling reservoir is lighted so that clear views are provided at night.

Operator Actions to Ensure Integrity Against External Floods

In addition to having unobstructed views of the main cooling reservoir, security personnel will be trained to alert the main control room immediately to any indication of main cooling reservoir failure. On such notification, personnel in the main control room will ensure that the access door is closed immediately. Also, all external doors located below the maximum flood level will be closed and verified on notification of any upstream dam failures. The emergency procedures for Severe External Flooding ensure that watertight barriers are in place and external opening sandbagged prior to the arrival on site of high water levels from external flooding (COM 19.9-3).

Table 19.8-5 Important Features from Flooding Analyses

Feature	Basis
~~Anti-siphon capability in RSW systems (2.11.9 Interface Requirement~~ Redundant motor-operated isolation valves which receive an automatic closure signal from the RCW/RSW heat exchanger room level switches.	~~Anti-siphon capability will prevent a control building flood from continuing to siphon water after the pumps have been stopped. Failure of this capability could increase the chances of some floods leading to core damage.~~ Redundant motor-operated isolation valves will prevent a control building flood from continuing to drain after the pumps have been stopped. Failure of this capability could increase the chances of some floods leading to core damage.
Buildings other than the Turbine, Control, and Reactor Building, and the RSW pump house, do not contain equipment that can be used to achieve safe shutdown and flooding in those buildings cannot propagate to buildings which contain safe shutdown equipment (Multiple ITAAC entries define ABWR design).	The screening analysis indicated that the flooding analysis only needed to address internal flooding from sources in the Turbine, Control, and Reactor Buildings, and the RSW pump house. If this is not the case, the basic flooding analysis could be invalidated.
~~A maximum of 4000 meters or RSW piping is allowed between RSW isolation valves at the pump house and the Control Building (2000 meters each for supply and return).~~	~~Following isolation of an RSW pipe break, draining of the water in the RSW piping into the Control Building will only affect equipment in one RCW division.~~
~~Entrance to plant buildings is located at an elevation at least one foot above the flood level expected from a probable maximum precipitation event.~~	~~Prevents most external flooding events from entering plant buildings.~~
All external entrances to safety-related buildings located below the maximum flood level are provided with watertight doors or barriers.	Assuming that an external flooding event has occurred, ensures that no water enters safety-related buildings, thereby allowing safe shutdown of the plant.
Clear and unobstructed view of the main cooling reservoir is provided from plant buildings.	Allows prompt notification of the main control room of any potential failure of the main cooling reservoir.
Water level sensors in RSW pump rooms and logic in the control building to alert operator and trip RSW pump, and close suction and discharge motor-operated isolation valves in affected RSW division.	Assuming a flood has occurred, the water level sensors and logic, along with motoroperated isolation valve closure, are the only automatic features that can identify and terminate flooding in the RSW pump rooms.