2.15.10 Reactor Building

Design Description

The Reactor Building (R/B) is a structure which houses and provides protection and support for the reactor primary systems, the primary containment and much of the plant safety-related equipment. Figures 2.15.10a through 2.15.10o show the basic configuration and scope of the R/B*.

The R/B is constructed of reinforced concrete and structural steel with a steel frame and reinforced concrete roof. The R/B encloses the primary containment. The R/B slabs and fuel pool girders are integrated with the reinforced concrete containment vessel (RCCV). The R/B slabs are supported by columns, shear walls and beams to carry vertical loads to the basemat and transfer horizontal loads through the RCCV and R/B shear walls to the basemat and R/B foundation. The R/B, together with the RCCV and the reactor pedestal, are supported by a common basemat. Inside the RCCV, the basemat is considered part of the Primary Containment System (PCS); outside the RCCV, the basemat is part of the R/B. The top of the R/B basemat is located 20.2m ±0.3m below the finished grade elevation.

The R/B is divided into three separate divisional areas for mechanical and electrical equipment and four divisional areas for instrumentation racks. Inter-divisional boundaries have the following features:

(1) Inter-divisional walls, floors, doors and penetrations, and penetrations in the external R/B walls to connecting tunnels, which have three-hour fire rating.

(2) Watertight doors in the basement to prevent flooding in one division from propagating to other divisions.

(3) Divisional walls in the basement are 0.6 meters thick or greater.

Watertight doors on Emergency Core Cooling System rooms have open/close sensors with status indication and alarms in the main control room.

The R/B flooding that results from component failures in any of the R/B divisions does not prevent safe shutdown of the reactor. The basement floor is the collection location point for floods. The building configuration at this elevation is such that even for a flooding event involving release of either the suppression pool or the condensate storage tank (CST) water into the R/B, no more than one division of safety-related equipment is affected. Except for the basement area, safety-related electrical, instrumentation and control equipment is located at least 20 cm above the floor surface.

* The overall building dimensions provided in Figures 2.15.10a through 2.15.10o are provided for information only and are not intended to be part of the certified ABWR information.

The R/B is protected against external flood. The following design features are provided:

(1) External walls below flood level are equal to or greater than 0.6 meters thick to prevent ground water seepage.

(2) Penetrations in the external walls below flood level are provided with flood protection features.

(3) A tunnel connects the Radwaste Building, Turbine Building, Control Building and Reactor Building for the liquid radwaste system piping. The penetrations from the tunnel to the Reactor Building are watertight.

The R/B is protected against the pressurization effects associated with postulated rupture of pipes containing high-energy fluid that occur in subcompartments of the R/B.

There are three divisionally separated tunnels for routing Oil Storage and Transfer (OST) System piping and cable from the fuel oil storage tanks to the R/B. These tunnels are configured so that any fuel oil leakage does not accumulate at the R/B boundary. Tunnel flooding due to site flood conditions is precluded by protecting the entrances against water entry.

The R/B and oil transfer tunnels are classified as Seismic Category I. They are designed and constructed to accommodate the dynamic and static loading conditions associated with the various loads and load combinations which form the structural design basis. The loads are (as applicable)those associated with:

(1) Natural phenomena—wind, floods, tornados (including tornado missiles), earthquakes, rain and snow.

(2) Internal events—floods, pipe breaks and missiles.

(3) Normal plant operation—live loads, dead loads, temperature effects and building vibration loads.

Systems, structures, and components located in the R/B and classified as safety-related are protected against inter-divisional flooding that results from postulated failures in Seismic Category I or non-nuclear safety (NNS) components located in the R/B or from external flooding events. Each postulated flooding event is documented in a Flood Analysis Report which concludes the reactor can be shutdown safely and maintained in a safe, cold shutdown condition without offsite power.

Specific areas of the R/B are protected against the effects associated with postulated impact of an aircraft per 10 CFR 50.150.

Inspections, Tests, Analyses and Acceptance Criteria

Table 2.15.10 provides a definition of the inspections, tests, and/or analyses, together with associated acceptance criteria, which will be undertaken for the R/B.