3.12 Tunnels

3.12.1 Main Steam Tunnel

3.12.1.1 Design Basis

The main steam line tunnel is a low leakage reinforced concrete structure. The structure is designed to withstand the forces of a high energy line break.

The floor and the tunnel walls that could be subjected to standing water will be designed to be watertight to the hydrostatic head of standing water plus any additional pressures that the water head may be subjected to. The portion of the tunnel over the Control Building will be subjected to very small amounts of standing water. Water released to the tunnel will flow to either the Turbine Building or the Reactor Building. Water in the Reactor Building portion of the tunnel will accumulate in the recessed portion to a height approximately equal to the bottom of the tunnel over the control building. The water in this space can be drained to the Reactor Building sumps by opening two normally closed manual drain valves located inside secondary containment.

The junction of the tunnel at each building require structural gaps to permit relative displacements of the tunnel due to seismic and thermal movement. The junctions will also be required to include features to provide shielding from the radiation sources in the tunnel. The structural gaps between the tunnel sections will be sealed to provide a confined environment during normal operation. In addition, the seals will be designed to prevent a main steam line or feedwater line break from effecting the plants ability to be brought to a safe shutdown.

3.12.1.2 Description

The Main Steam Tunnel space consists of portions of the Reactor Building, Control Building, and Turbine Building. The tunnel is basically a horizontal rectangular chase that is closed at the Reactor Building end and open at the Turbine Building. The tunnel houses the four main steam lines, the outboard Main Steam Isolation Valves (MSIVs), the two feedwater lines, outboard feedwater isolation valves, other piping, instrumentation, electrical cabling, and other associated equipment.

3.12.1.3 Safety Evaluation

The main steam tunnel is designed to withstand the effects of high energy line breaks and to vent the resulting pressure buildup to atmosphere via blow out panels in the Turbine Building.

3.12.2 Safety-Related Tunnels

3.12.2.1 Design Basis

(1) The tunnels will be designed to applicable safety requirements involving site seismic, flood, fire, and environmental conditions in order to maintain the safety function of

the safety-related divisional equipment contained inside. Specific seismic requirements are included in Subsection 3.7.3.12.

(2) The tunnels will be routed independently or provide separate compartments or internal substructures to assure necessary divisional separation requirements between the three (3) divisions.

(3) The tunnels will be designed to withstand the combined effects of hydrostatic head from site flooding and the dynamic effects resulting from internal piping system breaks. Provisions for relieving pressure resulting from pipe breaks will be provided as necessary including the use of external manways.

(4) The tunnels will be designed to ensure that the integrity of the piping penetrations at the interfacing buildings are maintained under design conditions.

(5) The tunnels will be designed to allow periodic inspection of the piping, cables, and piping penetrations.

(6) The tunnels will contain leak detection equipment and provisions for water removal.

(7) Entrances to the tunnels shall be provided with appropriate means to prevent unauthorized access.

(8) Tunnels used for routing fuel oil lines will be constructed in a manner that prevents fuel oil from accumulating next to safety-related structures by sloping them downward away from the building.

3.12.2.2 Description

The purpose of the safety-related tunnels is to provide protected and divisionalized pathways for piping, power cable, and instrumentation and control cable. The safety-related tunnels will be used to route piping and cabling from the Reactor and Control Buildings, to the Emergency Diesel Generator fuel oil storage tanks and the Reactor Service Water pump house.

3.12.2.3 Safety Evaluation

Divisional separation is to be maintained within the tunnel structures. A safety-related division will always be available after considering any combination of a single divisional piping break and a single active component failure.

Pipe break flooding in one division will not degrade the operation of the other two divisions. Ground water intrusion will be prevented.

Penetrations into safety-related structures will be designed to withstand pipe breaks and their effects including hydrostatic forces resulting from pipe tunnel flooding.

Flooding of the tunnels due to site flood conditions will be precluded by protecting the entrances of the tunnel from water entry.

3.12.3 Miscellaneous Tunnels

3.12.3.1 Design Basis

The equipment contained in these tunnels is non-safety related and therefore the tunnel will be non-safety related (e.g. radwaste tunnel). The design of these tunnels includes consideration of requirements for water tightness, accessibility, leak detection, and water removal. The design requirements of the tunnel must ensure that tunnel failure will not effect the ability of the plant to be shutdown. The tunnel structures shall be designed so that in the unlikely event of structural failure of a tunnel will not result in unacceptable damage to penetration seals at the interface with safety-related structures. The design must also include consideration for the potential of communicating the effects of pipe breaks from one building to another.

Penetrations at the interface with the safety-related structures will be designed to withstand the combined effects of hydrostatic head from site flooding and the dynamic effects resulting from internal piping system breaks. Provisions for relieving pressure resulting from pipe breaks will be provided as necessary. These tunnels will contain leak detection equipment and provisions for water removal.

3.12.3.2 Safety Evaluation

The use of non-safety related tunnels will not negatively impact the ability of the plant to be shutdown safely. Inter-building flooding via the non-safety-related tunnels will be precluded by penetration seals at each building/tunnel interface. Flooding of the tunnel from external sources (site flood) shall be prevented.

3.12.3.3 Description

The use of tunnels to route piping, cabling and other services from one structure to another will be determined by site characteristics and other design considerations. The ABWR presently includes a radwaste tunnel for routing radwaste piping and other services to and from the Radwaste, Control, Reactor, and Turbine Buildings.