ABB COMBUSTION ENGINEERING

NUCLEAR POWER

COMBUSTION ENGINEERING, INC.

U. S. DEPARTMENT OF ENERGY

ADVANCED LIGHT WATER REACTOR
CERTIFICATION PROJECT

SYSTEM 80+™ DESIGN CERTIFICATION

PRA FLOOD PROTECTION

ASSESSMENT

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The System 80+™ Standard Plant includes a number of design features which provide flood protection to safety-related structures, systems, and components. These flood protection measures are designed in accordance with Regulatory Guide 1.102, "Flood Protection for Nuclear Power Plants."

The System 80+™ design emphasizes the elimination and minimization of potential flood sources within safety-related areas as a means of flood protection. For example, station service water and component cooling water heat exchangers are located outside the Nuclear Annex. Water-cooled components within the Nuclear Annex are cooled by Component Cooling Water with the exception of HVAC equipment which is cooled by chilled water systems. These cooling water systems are closed systems with a defined volume of water. Component Cooling Water, Emergency Feedwater, essential Chilled water, etc. are fully separated by division with no open cross connections, thus eliminating the possibility of a single pipe break from flooding one division and the other division being lost due to loss of pressure boundary integrity. Condenser circulating water is also located outside of the Nuclear Annex. These features reduce in-plant cooling water to a limited volume which can be easily accommodated to limit the extent of flooding.

The System 80+™ control complex is protected from flooding in that no water lines are routed above or through the control room or computer room. Water lines routed to HVAC air handling units, etc., around the control room are contained in rooms with curbs which prevent any potential water leakage from entering the control room or computer room.

Protection from external flooding is provided by elevated building entrances. Secondary flooding sources located in the Turbine Building are confined to that building. Entrances from the Turbine Building to the Nuclear Annex are sufficiently elevated to allow operator action to isolate a break in the Condenser Circulating Water System before the water level from the Turbine Building flood reaches the Nuclear Annex entrance.

Lengths of high energy and moderate energy piping have been minimized by equipment location. Equipment is located in quadrants around the spherical containment to minimize the lengths of piping runs. The subsphere provides further close proximity of equipment to reduce piping runs from containment.

Flood barriers have been integrated into the design to provide further flood protection while minimizing the impact on maintenance accessibility. The primary means of flood control in the Nuclear Annex is provided by the structural wall which serves as a barrier between redundant divisions of safe shutdown systems and

components. At the lowest elevation, this structural wall contains no doors or passages, and the limited penetrations through the wall are sealed. This design confines floodwater to one division up to elevation 70+0. Migration of floodwater to the other division would begin only after the water level in the flooded division reaches elevation 70+0. Preliminary determination of major flood volumes such as the Component Cooling Water and Emergency Feedwater Systems show that the volume of water contained in one division of these systems would not rise above elevation 70+0 should a large uncontrollable break occur. Thus, the other division is unaffected.

Each half of the subsphere is compartmentalized to separate redundant safe shutdown components to the extent practical, while maintaining accessibility requirements. The subsphere, which houses the front line safety systems is compartmentalized into quadrants, with two quadrants on either side of the divisional structural wall. Flood barriers provide separation between the quadrants, while maintaining equipment removal capability. Emergency Feedwater pumps are located in separate compartments within the quadrants with each compartment protected by flood barriers. Flood barriers also provide separation between electrical equipment and fluid mechanical systems at the lowest elevation within the Nuclear Annex. Elevated equipment pads prevent equipment from being inundated in the event of flooding.

Flood protection is also integrated into the floor drainage systems. The floor drainage systems are separated by division and Safety Class 3, Seismic Category I valves prevent backflow of water to areas containing safety-related equipment. Each subsphere quadrant contains its own separate sump equipped with redundant Safety Class 3, Seismic Category I sump pumps and associated instrumentation. These pumps are also powered from the diesel generator in the event of loss of offsite power. The Nuclear Annex also has its own divisionally separated floor drainage system, having no common drain lines between divisions. Floors are gently sloped to allow good drainage to the divisional sumps. Floor drains are routed to the lowest elevation to prevent flooding of the upper elevations. The lower elevation in each division has adequate volume to collect water from a break in any system without flooding the other division. In addition, potential discharge of fixed fire suppression systems and fire hoses is considered in the sizing of floor drains to preclude flooding of areas should the fire protection systems be initiated.

The Diesel Generator Building floor drain sump pumps and associated instrumentation are Safety Class 3, Seismic Category I to prevent flooding of the diesel generators. These pumps are also powered from the diesel generators to accommodate a loss of offsite power.

Flood protection is also incorporated into the Component Cooling

Water Heat Exchanger Building and Station Service Water Structure. These structures are divisionally separated by walls such that a flood in one division cannot flood the other division.

In addition to the above design features, the Nuclear Annex and Reactor Building are designed to maintain a dry environment during all floods by incorporating the following safeguards into their construction:

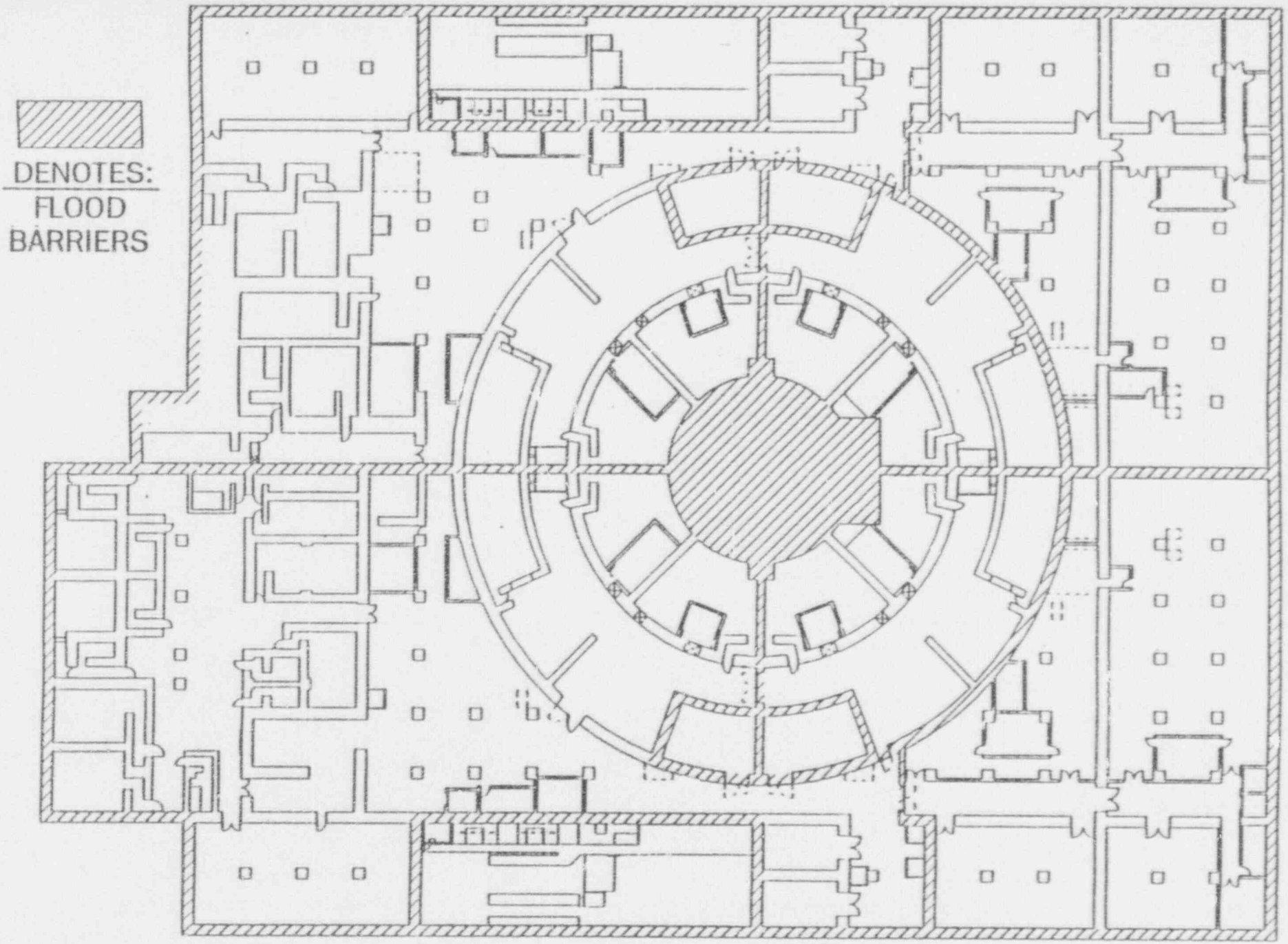
A. No exterior access openings will be lower than 9" above plant grade elevation.

B. The finished yard grade adjacent to the safety-related structures will be maintained at least 9" below the ground floor elevation.

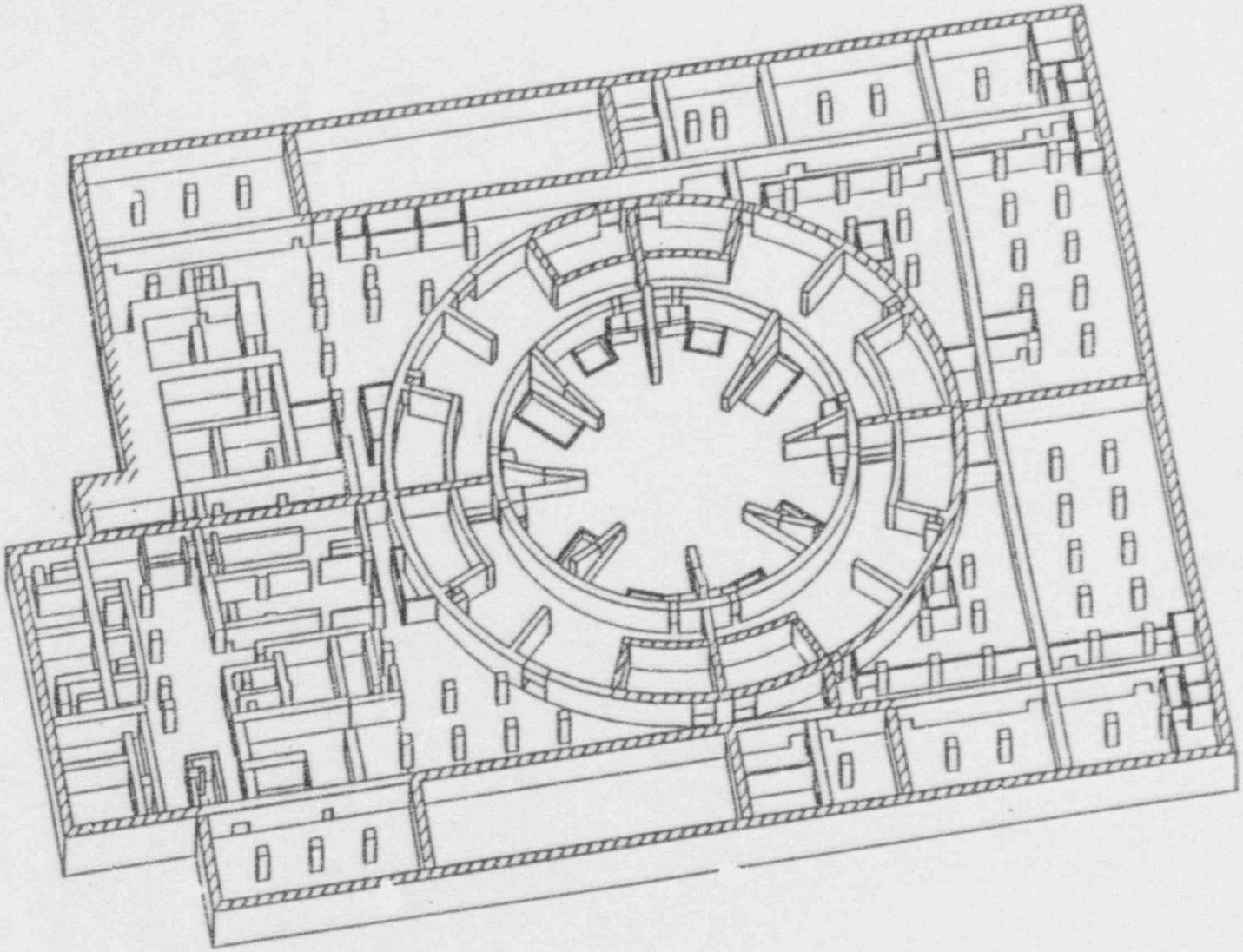
C. Waterstops are used in all horizontal and vertical construction joints in all exterior walls up to flood level elevation.

D. Water seals are provided for all penetrations in exterior walls up to flood level elevation.

E. Waterproofing of walls subject to flooding is provided.



FLOOD BOUNDARIES AND DIVISIONAL WALLS @ EL.50+0



FLOOD BOUNDARIES AND
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DENOTES FLOOD
BARRIERS