

## **2.4 Hydrologic Engineering**

The U.S. EPR is designed for a groundwater elevation up to 3.3 feet below the finished grade elevation and an exterior flood level of one foot below the finished grade elevation. For factored load combinations, the lateral soil load is based on saturated soil associated with flooding and groundwater. The finished yard grade is nominally zero feet elevation, with slopes provided for drainage to preclude water from entering the buildings. No safety-related dewatering systems are provided in the U.S. EPR. Flood protection features are described in Section 3.4.

The U.S. EPR is designed for a maximum rainfall rate of 19.4 inches per hour. A rain, snow, and ice load of 100 pounds per square foot has been used, which includes the weight of the 100-year return period snow pack and the weight of the 48-hour probable maximum winter precipitation.

The hydrologic information in Section 2.4 is site specific and will be provided by the Combined License (COL) applicant that references the U.S. EPR design certification.

Sites are acceptable that are within the envelope of the groundwater and flood water maximum elevations described for the U.S. EPR standard plant design.

### **2.4.1 Hydrologic Description**

A COL applicant that references the U.S. EPR design certification will provide a site-specific description of the hydrologic characteristics of the plant site.

### **2.4.2 Floods**

A COL applicant that references the U.S. EPR design certification will identify site-specific information related to flood history, flood design considerations, and effects of local intense precipitation.

### **2.4.3 Probable Maximum Flood (PMF) on Streams and Rivers**

A COL applicant that references the U.S. EPR design certification will provide site-specific information to describe the probable maximum flood of streams and rivers and the effect of flooding on the design.

### **2.4.4 Potential Dam Failures, Seismically Induced**

A COL applicant that references the U.S. EPR design certification will verify that the site-specific potential hazards to safety-related facilities due to the seismically-induced failure of upstream and downstream water control structures are within the hydro-geologic design basis.

### **2.4.5 Probable Maximum Surge and Seiche Flooding**

A COL applicant that references the U.S. EPR design certification will provide site-specific information on the probable maximum surge and seiche flooding and determine the extent to which safety-related plant systems require protection. The

applicant will also verify that the site-parameter envelope is within the design maximum flood level, including consideration of wind effects.

#### **2.4.6 Probable Maximum Tsunami Flooding**

A COL applicant that references the U.S. EPR design will provide site-specific information and determine the extent to which safety-related facilities require protection from tsunami effects.

#### **2.4.7 Ice Effects**

A COL applicant that references the U.S. EPR design certification will provide site-specific information regarding ice effects and design criteria for protecting safety-related facilities from ice-produced effects and forces with respect to adjacent water bodies.

The ultimate heat sink (UHS) and mechanical draft cooling towers are described in Section 9.2.5. The water temperature in each of the four UHS cooling tower basins is monitored and in the event that basin water temperature drops to 40°F, an alarm alerts the operator to place the associated train in operation to prevent the formation of ice in the basin. Under extended low load/low ambient temperature conditions, it may be necessary to have all four essential service water (ESW) trains operating. Chemicals may also be added to the ESW system to lower the point at which cooling water freezes. The UHS cooling tower fans are also capable of operation in reverse direction for short periods to minimize ice buildup at the air inlets.

Makeup water to the UHS cooling tower basin is site-specific. A COL applicant that references the U.S. EPR design certification will evaluate the potential for freezing temperatures that may affect the performance of the ultimate heat sink makeup, including the potential for frazil and anchor ice, maximum ice thickness, and maximum cumulative degree-days below freezing.

#### **2.4.8 Cooling Water Canals and Reservoirs**

For the U.S. EPR, the ultimate heat sink (UHS) is provided by mechanical draft cooling towers as described in Section 9.2.5. Makeup water to the UHS cooling tower basin is site-specific. A COL applicant that references the U.S. EPR design certification will provide site-specific information and describe the design basis for cooling water canals and reservoirs used for makeup to the UHS cooling tower basins.

#### **2.4.9 Channel Diversions**

A COL applicant that references the U.S. EPR design certification will provide site-specific information and demonstrate that in the event of upstream diversion or rerouting of the source of cooling water, alternate water supplies will be available to safety-related equipment.

**2.4.10 Flooding Protection Requirements**

A COL applicant that references the U.S. EPR design certification will use site-specific information to compare the location and elevations of safety-related facilities, and of structures and components required for protection of safety-related facilities, with the estimated static and dynamic effects of the design basis flood conditions. Additional flood protection measures are provided in Section 3.4.

**2.4.11 Low Water Considerations**

A COL applicant that references the U.S. EPR design certification will identify natural events that may reduce or limit the available cooling water supply, and will verify that an adequate water supply exists for operation or shutdown of the plant in normal operation, anticipated operational occurrences, and in low water conditions.

**2.4.12 Groundwater**

A COL applicant that references the U.S. EPR design certification will provide site-specific information to identify local and regional groundwater reservoirs, subsurface pathways, onsite use, monitoring or safeguard measures, and to establish the effects of groundwater on plant structures.

**2.4.13 Pathways of Liquid Effluents in Ground and Surface Waters**

A COL applicant that references the U.S. EPR design certification will provide site-specific information on the ability of the groundwater and surface water environment to delay, disperse, dilute, or concentrate accidental radioactive liquid effluent releases, regarding the effects that such releases might have on existing and known future uses of groundwater and surface water resources.

**2.4.14 Technical Specification and Emergency Operation Requirements**

A COL applicant that references the U.S. EPR design certification will describe any emergency measures required to implement flood protection in safety-related facilities and to verify there is an adequate water supply for shutdown purposes.