

Multiple Core Cooling Systems of Columbia Generating Station

A nuclear power plant has many overlapping safety features to provide multiple barriers to the release of radiation or contamination. The most important of these features is the emergency core cooling system.

The emergency core cooling system ensures that a back-up water supply will prevent the reactor core from overheating if the normal water supply is lost or reduced. This system is automatically activated when sensors indicate a low water level in the reactor vessel.

The emergency core cooling system is made up of the following sub-systems:

High-Pressure Core Spray

The purpose of this sub-system is to replace water lost in a loss-of-coolant accident while the reactor is at pressure. It also prevents fuel damage by spraying cooling water onto the fuel assemblies if the water level in the reactor drops low enough to uncover part of the fuel. The high-pressure core spray has a large enough volume to supply total emergency cooling requirements and is completely independent of other plant systems, with its own diesel generator, batteries, valves and piping.

Low-Pressure Core Spray

This sub-system prevents fuel-cladding damage if the core is uncovered by a loss-of-coolant accident. It sprays water onto the reactor core after reactor pressure is reduced or if other systems cannot adequately cover the fuel.

Residual Heat Removal System

The three independent RHR loops can provide makeup water at relatively low reactor coolant system pressure.

This system cools suppression pool water, reduces reactor water temperature and provides decay heat removal. The low-pressure coolant injection is a sub-system of the residual heat removal system. It works in conjunction

with other emergency core cooling system components to restore and maintain the desired water level in the reactor vessel after a loss-of-coolant accident. Decay heat is the energy released by atoms in the core after the chain reaction has been stopped.

Reactor Core Isolation Cooling

The RCIC system supplies makeup water to the reactor vessel when the reactor is in hot shutdown condition (coolant above 200F and at pressure).

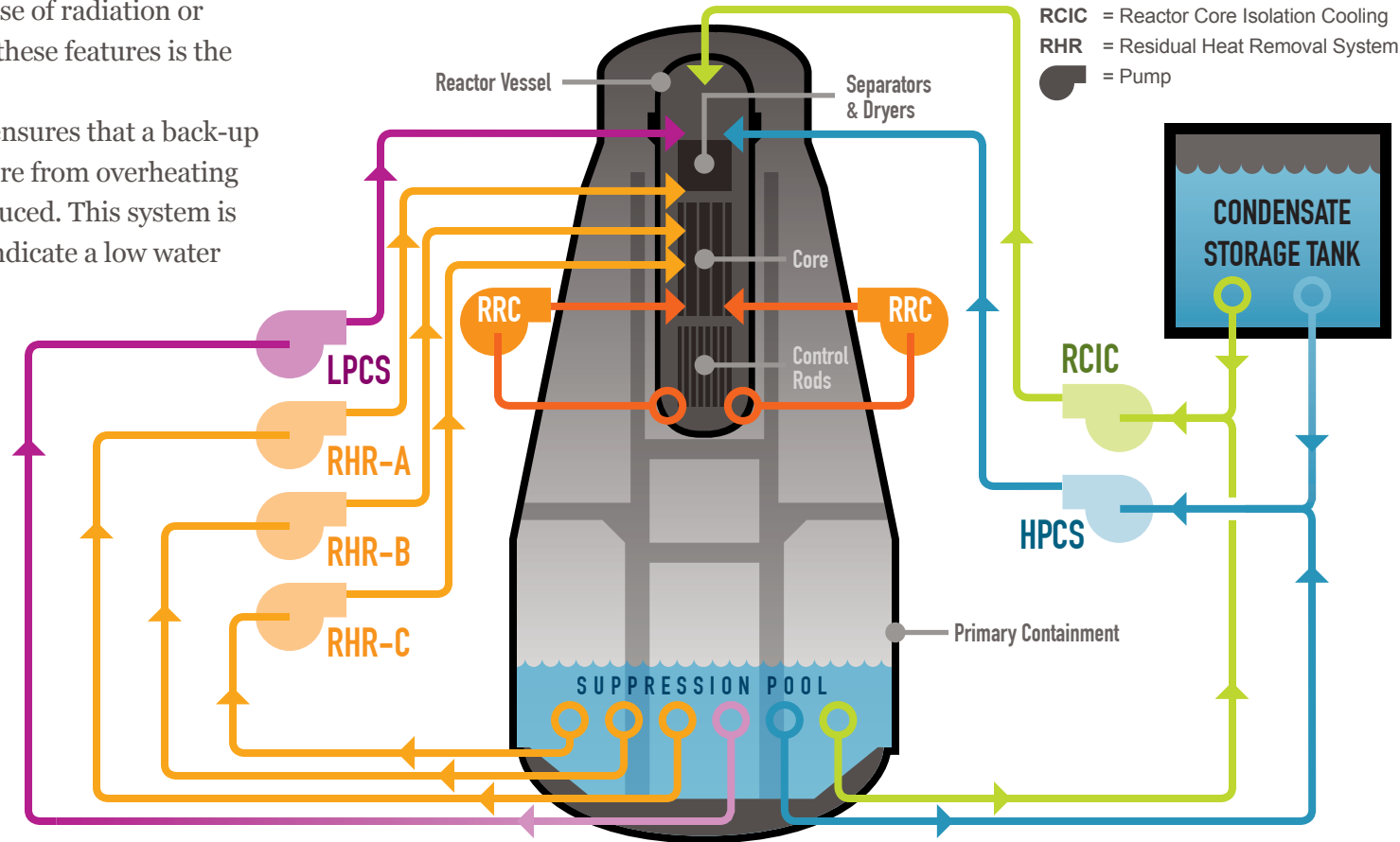
Reactor Recirculation

The RRC system provides forced circulation of reactor coolant, at variable core flows. Using forced circulation allows the reactor to operate at higher powers than would be possible with natural circulation alone. Using variable core flow allows reactor power to be controlled more evenly and smoothly than with control rod movement.

Automatic Depressurization System

This system reduces reactor vessel pressure to enable the flow from the low-pressure core

HPCS = High-Pressure Core Spray
 LPCS = Low-Pressure Core Spray
 RCIC = Reactor Core Isolation Cooling
 RHR = Residual Heat Removal System
 = Pump



spray and low-pressure coolant injection system to enter the vessel and cool the fuel core. This sub-system uses seven safety relief valves to blow down high-pressure steam from the reactor vessel to the suppression pool. The suppression pool is a tank of water in the bottom of the reactor containment. It holds approximately 130,000 cubic feet of water.