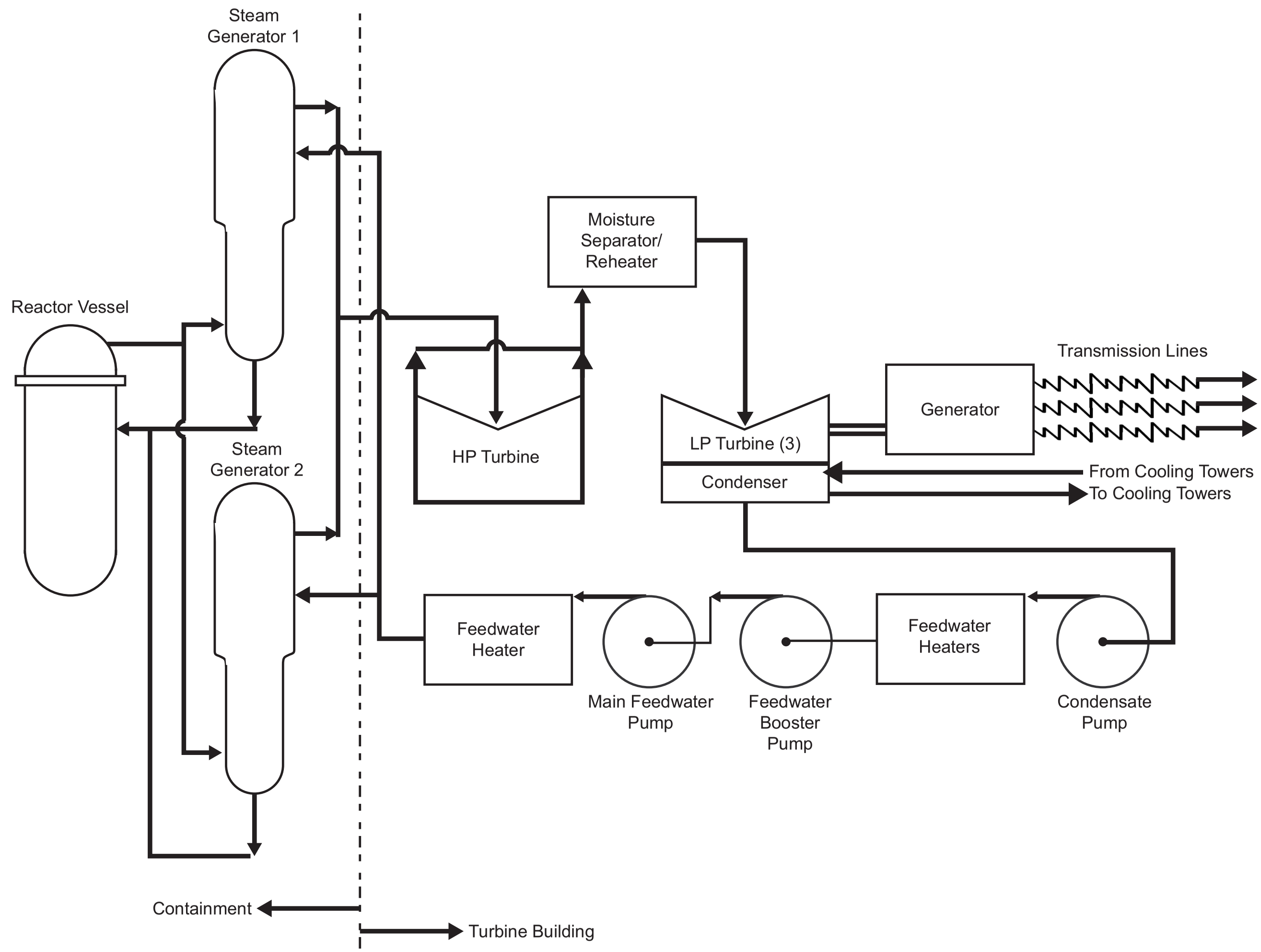

Figure 3.2-1 Simplified Flow Diagram of Reactor Power Conversion System

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3.3 Plant Water Use

The plant water consumption and water treatment for the proposed AP1000 units were determined from the *AP1000 Design Control Document* **(Westinghouse 2005)**, site characteristics, and engineering evaluations. The VEGP site has two sources of water available for plant water supply: surface water from the Savannah River and groundwater from the Cretaceous and Tertiary aquifers. Treated effluents from both sources will be returned to the Savannah River.

3.3.1 Water Consumption

The new AP1000 units require water for both plant cooling and operational uses. The Savannah River provides make-up water for the circulating water system (CWS) to replace the water lost to evaporation, drift, and blowdown. On-site wells provide groundwater make-up for the service water system (SWS). The wells also provide water for other plant systems, including the fire protection system, the plant demineralized water supply system, and the potable water system. Surface water consumptive use for the two AP1000 units' normal operation is 27,924 gpm, with a maximum of 28,904 gpm. Groundwater consumptive use is 752 gpm on average, with a maximum of 3,140 gpm. During normal operation, approximately 305 gpm of groundwater is returned as surface water to the Savannah River. Table 3.3-1 identifies the normal and maximum water demand and effluent streams for the AP1000 units, and Figure 3.3-1 provides a water balance diagram to illustrate the normal operational flows.

The CWS and SWS cooling towers lose water from evaporation and drift. Evaporation and drift from the CWS cooling towers is estimated at 27,924 gpm during normal operations. Evaporation and drift for the SWS cooling tower is estimated at 403 gpm. These values are based on site characteristics and AP1000 design parameters for the cooling systems as identified in Tables 3.4-1 and 3.4-2.

Table 3.3-1 provides the water release estimates for wastewater and blowdown discharged to the Savannah River. The water balances illustrated in Figure 3.3-1 include estimates for all wastewater flows from the site, including radiological effluent releases, sanitary waste, miscellaneous drains, and demineralizer discharges. The normal values listed are the expected limiting values for normal plant operation with two new units in operation. The maximum values are those expected for upset or abnormal conditions with two new units in operation.

Wastewater from the AP1000 units will be managed in the wastewater retention basin and discharged along with cooling tower blowdown to the blowdown sump. The final plant discharge stream will consist of the blowdown sump discharge stream and a small radwaste discharge stream. The final effluent discharge stream will be routed to the Savannah River downstream of the existing units' discharge. Stormwater discharges will be managed through the existing stormwater collection system and retention pond prior to discharge to the Savannah River.

The start-up pond identified in Figures 3.3-1 will be used during the initial plant start-up phase to collect system flushes. Wastewater will be treated, as required, before discharge to the blowdown sump. This facility may be used after initial plant start-up to collect system flushes warranted after system modification. Alternatively, the flush wastes may be collected in tanks and disposed of in accordance with applicable regulations.

3.3.2 Water Treatment

Water treatment systems for the new AP1000 units include technologies and methods to treat water supplies similar to those in use for the existing nuclear units. Some treatment systems, such as potable water, could be shared among all units. Treatment systems will be required for systems supplied by surface water and groundwater, including circulating water make-up, reactor water make-up, service water make-up, condensate, potable water, radwaste, fire protection, and utility water.

The Savannah River will be used to supply make-up water for the new units' circulating water system. Biocides will be injected at the intake structure to control biofouling in the circulating water system and associated piping. Additional chemicals will be added in the cooling tower basins to control scaling, corrosion, and solids deposition. The circulating water system chemical treatment regime will be very similar to the program for the existing units.

Groundwater supplied from site wells will provide make-up for the service water system, demineralized water system, potable water system, fire protection system, and other miscellaneous groundwater users.

Service water system make-up water may not require significant treatment. A biocide may be added to the cooling tower basin to control biofouling, if needed. The cooling tower cycles will be adjusted to prevent scale formation or deposition that could affect cooling tower performance.

Demineralized water for plant uses is produced by the plant demineralization system. Water is systematically treated by filtration and primary and secondary demineralization processes. These treatment processes result in highly purified water for various plant systems. Reverse osmosis is the primary demineralization treatment process designed to reduce solids, salts, organics, and colloids in the treated water. In the secondary stage of the purification process, an electrodeionization system or mixed bed is used to remove dissolved gaseous carbon dioxide and a majority of the remaining ions. The purified water is used as make-up to the following systems:

- Condensate system (including the condenser, condensate polishers, auxiliary boiler, and startup feedwater pumps)
- Reactor coolant system via the chemical and volume control system (CVS)

Treated condensate serves as a source of feedwater to the steam generators. The condensate passes through a condensate polisher resin bed to continuously remove contaminants and produce the high purity water to minimize corrosion in the condensate and feedwater systems. Wastewater generated by the regeneration of the condensate polishing system is discharged to the circulating water system. The auxiliary boiler also receives demineralized make-up water via the condensate system.

The demineralization system also provides pure water make-up to the reactor coolant system as needed through the CVS. Make-up water is supplied to the CVS make-up pumps to compensate for core burn-up and during start-up following refueling operations.

In addition to the services identified above, the demineralized water make-up system supplies make-up to other uses, including the spent fuel pool, turbine building closed cooling water system, component cooling water system, chilled water systems, and radwaste systems. Chemical corrosion inhibitors are used to treat the high quality demineralized water to minimize system component corrosion.

Discharges from the systems using demineralized water for make-up are routed to plant sumps or the liquid radwaste system prior to discharge.

The potable water system consists of a storage tank, pressure maintenance equipment, disinfection system, and distribution system. Additional water treatment such as filtration and corrosion control will be added, if necessary.

The fire protection system consists of make-up supply from groundwater wells, storage tanks, pressure maintenance equipment, and a distribution system. Treatment of the well water for fire system use consists of filtration through strainers as needed to prevent system fouling. This system does not normally require disinfection or other treatment. Additional treatment needs will be evaluated and implemented as appropriate. In addition to its use for fire suppression, the fire protection water system provides a back-up supply of water to other water systems, including the AP1000 passive containment cooling system.

Site wells also provide utility water for miscellaneous plant uses, including rinse water for demineralization system prefilter rinse and equipment washdown.

Figure 3.3-2 provides a diagram of plant systems supplied by groundwater.