9.2.7 Seal Water Supply System

The seal water supply system (SEWSS) supplies seal water to equipment and components in systems carrying radioactive fluids to prevent the escape of radioactive fluids from the shaft seals of pumps and agitators. The SEWSS also feeds the sealing liquid tanks of the gaseous waste processing system and the piping of the operational chilled water system.

The SEWSS system consists of two pumps, two buffer tanks and its associated valves and piping.

9.2.7.1 Design Bases

The SEWSS performs no safety-related functions and is classified non-safety related. The SEWSS is Non-Seismic Category, excluding portions of the system located within the Safeguard Building (SB) 4 and the Fuel Building (FB). Refer to Section 3.2 for details of the seismic and system quality group classification of the SEWSS.

9.2.7.2 System Description

9.2.7.2.1 General Description

The SEWSS flow diagram is provided in Figure 9.2.12–1—Seal Water Supply System.

The demineralized water stored in the outdoor demineralized water storage tanks supplies makeup to the SEWSS. Two 100 percent capacity seal water pumps are located in the Switchgear Building (SWGB) near the demineralized water storage tanks. The pumps are installed in parallel. Both pumps are capable of taking suction from either demineralized water storage tank. A check valve, installed in the discharge line of each pump, prevents back flow through the non-operating pump. During low seal water flow demand, a recirculation line back to the demineralized water storage tanks allows the minimum flow requirements of the pumps to be met.

The discharge lines of the pumps combine into a common header which distributes the seal water to the various consumers in the Nuclear Auxiliary Building (NAB), Radioactive Waste Processing Building (RWB), SBs 1 and 4, and FB via piping, isolation valves, check valves, and buffer tanks.

The buffer tanks, located in SB 4 and the FB, are supplied from the demineralized water storage tanks by the seal water pumps through solenoid valves that are controlled based on water level in the tanks.

The seal water piping in the RWB operates at a reduced pressure that is provided by a pressure reducing valve. To protect the downstream lower pressure piping in the event of a reducing valve failure, a safety relief valve is provided.

The seal water system consumers can be isolated from the seal water supply by a motor-operated isolation valve located in the NAB.

The SEWSS provides a reliable supply of seal water to pumps in radioactive fluid carrying systems and feeds the gaseous waste processing system liquid tanks. The SEWSS supplies the plant consumers requiring seal water from the following systems:

- Decontamination equipment for apparatus and vessels.
- Decontamination system for small machine components.
- Severe accident heat removal system.
- Chemical and volume control system (CVCS).
- Coolant purification system.
- Coolant treatment system.
- Radioactive concentrates processing system.
- Liquid waste processing system.
- Liquid waste storage system.
- Operational chilled water system (OCWS) for gaseous waste processing system.

9.2.7.2.2 Component Description

Seal Water Pumps

There are 2 x 100 percent seal water pumps designed to operate during normal plant operation and during outages. Normally, one pump is running continuously at minimum flow, with the excess discharge flow returned to the demineralized water tank. The second pump is in standby.

Buffer Tanks

The buffer tanks provide a stored volume of seal water to supply the system users at sufficient pressure during loss of offsite power (LOOP) conditions. Each buffer tank has a nitrogen gas cushion of sufficient pressure to provide the required seal pressure for any seal water level in the tank. Each buffer tank is protected from excessive nitrogen pressure by a safety valve in the nitrogen supply line.

9.2.7.3 System Operation

9.2.7.3.1 Normal Operation

During normal operation, one seal water pump is continuously operating to deliver seal water at the required pressure to the seal water consumers. The second pump is on standby. The minimum recirculation flow required for the operating pump is returned to the demineralized water storage tanks via the pump minimum flow line.

The isolation valves in the suction, discharge, and minimum flow lines are positioned fully open; the suction and minimum flow isolation valves are locked fully open. The isolation valves for the buffer tanks consumers are locked closed. The valves downstream of the solenoid valves are adjusted and locked in the proper throttled position. The solenoid valves that supply makeup to the buffer tanks are in automatic operation, controlled by their respective buffer tank level. The pressure reducing valve in the RWB maintains proper pressure in the downstream piping to the consumers.

In the event of a failure of the operating pump, the standby pump automatically starts to provide proper pressure and flows to the seal water consumers. If maintenance of the operating pump is required, the standby pump can be manually started from the main control room and the pump requiring maintenance can be removed from service, isolated and repaired.

9.2.7.3.2 Abnormal Operation

In the event of an LOOP, the seal water pumps are not available because the pumps are not provided with emergency or backup power, and the operational consumers are switched off because of low seal water supply header pressure. The CVCS pumps can be supplied by the buffer tanks by unlocking and opening the CVCS seal water supply valves from the buffer tank. Additionally, in the event of an anticipated transient without scram (ATWS) with LOOP and with the CVCS pumps available; these pumps can be supplied by the buffer tanks as required. During LOOP, supplying seal water makeup to the buffer tanks and sealing liquid tanks is not possible because the seal water pumps are not available. Seal water to the gaseous waste processing system liquid tanks during abnormal operation is not required because of sufficient water inventory in these tanks.

9.2.7.4 Safety Evaluation

The operation of the SEWSS is not required for the safe shutdown of the plant or for mitigating the consequences of a design basis accident; therefore, the SEWSS has no safety-related function and does not require a nuclear safety evaluation.

9.2.7.5 Inspection and Testing Requirements

Refer to Section 14.2, Test #045, for initial plant testing of the SEWSS.

Periodic testing includes pressure testing of the buffer tanks and testing of the safety valve. The safety valve and buffer tanks will be tested in accordance with ASME B31.1 (Reference 1) and ASME Boiler and Pressure Vessel Code, Section VIII, Division 1 (Reference 2).

9.2.7.6 Instrumentation Requirements

All instrumentation and control functions are performed by the process automation system (PAS). The SEWSS is controlled from the main control room. Interlocks for the system and components provide safe and reliable operation.

The seal water pumps are equipped with controls that provide automatic changeover from the operating pump to the standby pump in case of pump failure. In the event of low level in the demineralized water storage tanks, the pumps receive an "off" command from the PAS.

The seal water supply solenoid valves open and close on low and high water level, respectively, in their associated buffer tank as measured by the tank level instrumentation. The buffer tank solenoid supply valves receive an "off" command on low seal water pump discharge pressure. Seal water consumers receive an "off" command on low seal water header pressure.

Pressure gauges are installed in the pump suction and discharge lines, discharge header, each buffer tank, and upstream and downstream of each pressure reducing valve to provide pressure indication.

A warning is provided for a "not closed"safety valve position.

Buffer tank level indication and solenoid "on/off" indication is provided.

9.2.7.7 References

1. ANSI/ASME B31.1-2004, "Power Piping," The American Society of Mechanical Engineers, 2004.

2. ASME Boiler and Pressure Vessel Code, Section VIII, Division 1: "Rules for Construction of Pressure Vessels," The American Society of Mechanical Engineers, 2004.