

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 and non-seismic. Table 3.2.2-1 provides the seismic and other design classifications for the components in the SEWSS.

9.2.7.2 System Description

9.2.7.2.1 General Description

The SEWSS flow diagram is provided in Figure 9.2.7-1—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), SB 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:

- 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.

Refer to Section 12.3.6.5.8 for seal water supply system design features which demonstrate compliance with the requirements of 10 CFR 20.1406.

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. The SEWSS pump is continuously running to fill the buffer tanks during normal plant operation and outages. During a loss of offsite power (LOOP), the buffer tanks are not supplied by the seal water pump.

Buffer Tanks

The buffer tanks provide a stored volume of seal water to the chemical and volume control system pump seals during normal plant operation and LOOP conditions, and to the severe accident heat removal system in the event of a severe accident. 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. The SEWSS supply solenoid valves fail in the closed position on loss of power. A pressure relief valve is provided for each buffer tank.

Buffer Tank Isolation Valves

Isolation valve (30GHW45 AA005) downstream of the solenoid-operated isolation valve is normally open. However, this valve can be closed to isolate the buffer tank for maintenance or in the event of tank failure.

A valve is not provided downstream of the solenoid-operated isolation valve (30GHW44 AA002) because the severe accident heat removal (JMQ) pump seal is only supplied by seal water from the buffer tank during severe accidents.

Seal Water Check Valves

Check valves are installed on the upstream piping of each SEWSS user. These check valves automatically close on reverse flow to mitigate potential radiation cross contamination with other users and process piping during a loss of supply pressure. The check valves are installed as close as possible to the user to minimize the amount of piping that can be contaminated during reverse flow.

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. Normal pump flow and minimum recirculation flow are listed in Table 9.2.7-1—Seal Water Supply System Parameters.

The SEWSS average consumption flow is listed in Table 9.2.7-1.

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 tank users are normally open. The valves upstream of the solenoid valves are adjusted and locked in the open 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.

The normal source of seal water to the CVCS charging pumps is the Fuel Building buffer tank during plant operation and loss of offsite power (LOOP) conditions.

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 are supplied by the buffer tank during a LOOP condition. The CVCS pump and severe accident pump trip due to low seal water pressure because of low inventory in the buffer supply tanks. The FB buffer tank isolation valves are normally open. 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. When the entire system has been filled and vented, one seal water pump receives a START signal to deliver seal water flow at the required pressure. The second pump remains on STANDBY and receives an automatic changeover START signal when the first pump fails to operate. In the event of low level in the demineralized water storage tanks, the pumps receive an "off" command from the PAS to maintain sufficient pump NPSH.

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 users in the Radioactive Waste Processing Building 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.

Table 9.2.7-1—Seal Water Supply System Parameters

| Description | Technical Data |
|--|-------------------------------|
| Seal Water Pumps 30GHW11/12 AP001 Normal flow rate | 2.43 E+04 lb _m /hr |
| Seal Water Pumps 30GHW11/12 AP001 Minimum recirculation flow rate | 2.21 E+04 lb _m /hr |
| Seal Water System Design Pressure | 235 psig |
| Seal Water System Design Temperature | 140°F |
| Seal Water Average Consumption Flow | 28.7 lb _m /hr |

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