FINAL

SYSTEM DESCRIPTION
(Index No. 49)

STEAM GENERATOR SECONDARY SIDE VENTS AND DRAINS SYSTEM
(B&R Dwg. No. 2414, Rev. 7)

JERSEY CENTRAL POWER & LIGHT COMPANY

THREE MILE ISLAND NUCLEAR STATION

UNIT NO. 2

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STEAM GENERATOR SECONDARY SIDE VENTS AND DRAINS SYSTEM

1.0 INTRODUCTION

1.1 System Functions

The purpose of the drains in the steam generator secondary side vents and drains system is to drain or bleed the feedwater from the secondary side of the steam generators under reactor generating conditions of refueling shutdown or hot shutdown respectively. They also provide a means of sampling the secondary side feedwater to measure its quality and the level of radioactivity caused by primary to secondary side leakage.

The purpose of the vents in the steam generator secondary side vents and drains system is to vent the secondary side to atmosphere while filling or draining. They also provide a vent connection to the radwaste disposal - gas system to purge the radioactive gases from the secondary side after draining the radioactivly contaminated water.

The steam generator secondary side vents and drains system has interfaces with the following systems (Drawing numbers refer to Burns and Roe flow diagrams):

1. Radwaste Disposal Reactor Coolant - Liquid System (Dwg. No. 2027)
2. Radwaste Disposal - Gas System (Dwg. No. 2028)
3. Secondary Sampling System (Dwg. No. 2015)
4. Nitrogen for Nuclear and Radwaste System (Dwg. No. 2036)
5. Steam Generator Chemical Cleaning System (Dwg. No. 2606)
6. F.W. Heater Drains (Dwg. No. 2009)
7. Feed and Condensate (Dwg. No. 2005)

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1.2 Summary Description of the System (Refer to B&R Dwg. No. 2414, Rev.7

Each of the two steam generators has eight secondary side drain connections and one vent connection that are used in the steam generator secondary side vents and drains system. The drain connections are located to allow complete draining of the secondary side of the steam generators. This includes draining the steam annulus between the upper baffle and the shell in the steam section and also the feedwater annulus between the lower baffle and the shell in the feedwater section.

Two of the drain connections in the feedwater section of each steam generator are used to allow secondary side feedwater samples to be taken to measure the quality of the secondary side feedwater and the level of radioactivity caused by primary coolant (reactor coolant) leaking into the secondary side. Electric motor operated valves provide remote sampling of the feedwater from the steam generator to the secondary sampling system. (Refer to Secondary Sampling System Description, Index No. 12).

A vent connection to atmosphere is provided for venting while draining the secondary side of "clean" water that is within the radioactivity level allowed to be drained into the Susquehanna River after dilution as specified by the Atomic Energy Commission regulations 10CFR Part 50, Appendix "I". The steam generator secondary side drain pump discharges the "clean" water to the radwaste disposal reactor coolant - liquid system discharge where continuous radioactivity monitoring is provided. (Refer to the Radwaste Disposal Reactor Coolant Liquid System Description, Index No. 21)

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A flexible nitrogen connection to the main steam line vents is provided to pressurize the secondary side in order to drain it when the radioactivity is above the allowable "clean" water level. (Refer to the Nitrogen for Nuclear and Radwaste System Description, Index No. 30). The secondary side drain header discharge line has a spool piece to change from the steam generator secondary side drain pump suction to the reactor coolant drain header. (Refer to the Radwaste Disposal Reactor Coolant-Liquid System Description, Index No. 21). A flexible nitrogen connection to the secondary side common drain discharge line and a flexible radwaste gas disposal connection to the steam generator vent line are provided to purge the steam generator of radioactive gas after draining the secondary side of all radioactive liquid. (Refer to the Radwaste Disposal - Gas System, Index No. 22).

One steam generator hot drain cooler is provided to cool feedwater drained from either steam generator while at their full design temperature and pressure. The feedwater is cooled by chromate treated demineralized cooling water (Refer to Intermediate Closed Cooling Water System, Index No. 23). The secondary side steam generator hot drain cooler discharges the cooled feedwater through a pressure reducing orifice to the Heater Drain Tank (Refer to F.W. Heater Drains, Index No. 7).

The flexible nitrogen connection to the main steam line vents is used for pressure testing to determine the location of leaking tubes, during chemical cleaning of the steam generators (Refer to the Steam Generator Chemical Cleaning System, Index No. 60), and for dry layup of the steam generator.

1.3 System Design Requirements

The steam generator secondary side vents and drains system is a nuclear N-2 type system except the steam generator secondary side drain pump and the steam generator hot drain cooler including their immediate suction and discharge piping and the piping outside the reactor building downstream of the isolation valve which are of conventional design. All system piping is designed, fabricated, inspected and erected in accordance with their respective codes. The applicable code for nuclear piping of 2 inches diameter and smaller is ASME Nuclear Power Plant Components Section III, the code for nuclear piping larger than 2 inches diameter is ANSI B31.7 Nuclear Power Piping and the code for conventional piping is ANSI B31.1.0 Power Piping. The system seismic design classification is Class I for nuclear N-2 type components and Class II for conventional components.

Each steam generator is able to be sampled and drained independently since the secondary side of one steam generator can be radioactively contaminated because of a primary to secondary leak while the secondary side of the other steam generator may not be contaminated.

A nitrogen connection to each main steam line vent is provided to pressurize the secondary side. A nitrogen connection to the common drain header discharge line is provided to purge the secondary side of radioactive gases after draining the radioactively contaminated liquid.

Connections to the radwaste disposal - gas system and the radwaste disposal reactor coolant - liquid system are provided to treat radioactive gas and liquid from the secondary side of the steam generators.

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A vent connection from each steam generator to atmosphere and a common drain connection to the steam generator secondary side drain pump are installed to drain the secondary side of "clean" water.

Either steam generator can be drained to the hot drain cooler to provide the ability to lower their water level while at full design temperature and pressure. The hot drain capability is used, in conjunction with the Feed and Condensate System (Index No. 4A) during unit shutdown, to correct chemical upset conditions and to maintain minimum feedwater flow to prevent feedwater cooldown.

2.0 DETAILED DESCRIPTION OF SYSTEM

2.1 Components

2.1.1 Steam Generator Secondary Side Drain Pump SV-P-1

The steam generator secondary side drain pump (see Table 1) is a horizontal, centrifugal pump with a capacity of 125 gpm at a total discharge head of 115 feet. The pump takes suction from the steam generators secondary side common drain header and discharges to the mechanical draft cooling tower normal discharge. The pump is driven by a 7-1/2 hp induction motor. Pump control and indication is local. The pump is powered from Bus 2-32A. The pump is located in the Reactor Building at elevation 282'-6".

2.1.2 Steam Generator Hot Drain Cooler SV-C-1

The steam generator hot drain cooler (see Table 2) cools the secondary side steam generator water for passage from the Reactor Building to the Heater Drain Tank in the Turbine Building by heat transfer to the intermediate closed Cooling Water System. The cooler is a single pass shell and tube type with

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the steam generator secondary side feedwater on the shell side and the Intermediate Closed Cooling Water on the tube side. The cooler is designed in accordance with the ASME Code, Section VIII, TEMA "C". Tubes are seal welded into the tube sheet. The cooler is located in the Reactor Building at elevation 282'-6".

2.1.3 Major System Valves

Steam Generator Secondary Side Sampling Valves SV-V10A,10B,11A,11B

Two sampling valves are provided on the secondary side of each steam generator.

Each valve is Class N-2, motor operated ½ inch globe valve designed for 1050 psig and 600°F. Remote manual operation of the valves is available from TMI No. 2 nuclear sampling panel No. 329 in the nuclear sampling room located in the TMI No. 1 plant. Power is supplied to the valve motor operators from MCC 2-32B and 2-42B for SV-10A/11A and SV-10B/11B respectively. Valve position indicating lights for each valve are provided on the Turbine Auxiliaries Monitoring Panel 17.

2.2 Instruments, Controls, Alarms and Protective Devices

2.2.1 Instruments and Controls

The only instrumentation and controls associated with the steam generator secondary side vents and drains system are the remote hand switches SV-FHS-3774, 3775, 3776 and 3777 to operate the secondary side sampling valves SV-V10A, 10B, 11A and 11B respectively. The hand switches are on the TMI No. 2 sampling panel No. 329 located in the nuclear sampling room in TMI No. 1 plant.

The tube side is provided with a safety relief valve SV-R2 set at (later) with a 1" inlet and a 2" discharge which is piped to the Reactor Building Sump.

3.0 PRINCIPAL MODES OF OPERATION

3.1 Startup

The steam generator secondary side vents are not used during plant startup but the secondary side drains may be used.

When the turbine bypass valves are closed during heatup. (refer to the Main and Reheat Steam System Description, Index No. 1) the feedwater control valves will close (refer to the Feedwater and Condensat System Description, Index No. 4A). The feedwater in the feedwater lines between the feedwater control valves and the steam generators will begin to cool. To prevent the feedwater from cooling below the minimum temperature allowed to enter the steam generator, the secondary side drain valves are opened and lined up to the steam generator hot drain cooler. This will decrease the level in the steam generator and the feedwater control valves will open. This operation is illustrated in Figure 1A-7 of Babcock and Wilcox Specification for Steam Generator No. CS(F)-3-92/NSS-6/1070.

3.2 Normal Operation

During normal plant operation the steam generator secondary side vents and drains system is not used for venting or draining the secondary side of the steam generators. The secondary side sampling valves are used to periodically take samples of the secondary side feedwater to measure the quality and level of radioactivity.

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3.3 Shutdown

After the plant is shut down, the secondary side of the steam generators may be drained by the Radwaste Disposal Reactor Coolant-Liquid System after being cooled to at least 200°F and after taking samples of the secondary side feedwater to measure the radioactivity level of each steam generator.

If the radioactivity level of the secondary side feedwater of a steam generator is within the "clean" water level as described in section 1.2 of the system description, the secondary side is drained to the radwaste disposal reactor coolant-liquid system discharge. The steam generator vent to atmosphere is first opened, the drain valves are opened and the steam generator secondary side drain pump is put into operation.

If the radioactivity level of the secondary side feedwater of a steam generator is above the "clean" water level, the secondary side is drained to the reactor coolant drain header for treatment. (Refer to the Radwaste Disposal Reactor Coolant - Liquid System Description, Index No. 21). The secondary side of the steam generator is first pressurized with nitrogen through the main steam line vent, the spool piece in the secondary side common drain line is connected to the reactor coolant drain header and then the drain valves are opened. After the secondary side is drained of water, it is purged of radioactive gases by disconnecting the nitrogen supply to the vent connection, connect the vent to the radwaste disposal - gas system and then the nitrogen supply is connected to the secondary side common drain line discharge header. The nitrogen is used to purge the radioactive gases from the secondary side of the steam generator to the radwaste disposal - gas system.

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For a chemical upset condition in the steam generator, the full water inventory of the steam generator can be changed within two hours with the plant in a hot shutdown condition. After the plant is in hot shutdown, the secondary side feedwater of the steam generators may be changed by maintaining steam generator water level and bleeding and feeding feedwater to bring the chemistry into spec. The cooling water is first valved to the steam generator hot drain cooler before valving either steam generator drains to the hot drain cooler. Two orifices are provided in the hot drain cooler discharge to monitor flow and to reduce pressure into the Heater Drain Tank.

3.4 Special or Infrequent Operation

3.4.1 Steam Generator Chemical Cleaning

The steam generator secondary side vents and drains system is used during the chemical cleaning operation of the steam generators. The steam generator secondary side drain pump (SV-P-1) may be operated at a temperature of 200°F with NPSH of 12 feet. This requires that the 5 psig nitrogen blanket be maintained throughout this operation. Refer to Babcock and Wilcox Pressurized Water Reactor Technology, Volume 2 and Babcock, Wilcox Once-Through Steam Generator Instruction Manual No. 620-0006, and Steam Generator Chemical Cleaning System (System Description No. 60).

3.4.2 Steam Generator Tube Leak Detection

The steam generator secondary side vents and drains system is used during the tube leak detection operation of the steam generators. Refer to Babcock and Wilcox Pressurized Water Reactor Technology, Volume 2 and Babcock and Wilcox Once Through Steam Generator Instruction Manual No. 620-0006.

3.4.3 Steam Generator Wet and Dry Layup

The steam generator secondary side vents and drains system is used during wet and dry layup operations of the steam generator. Refer to Babcock and Wilcox Once-Through Steam Generator Instruction Manual, No. 620-0006.

3.5 Emergency

There are no emergency operations or procedures associated with the steam generator secondary side vents and drains system.

4.0 HAZARDS AND PRECAUTIONS

Only one steam generator at a time is to be drained. This will prevent radioactive contamination of one steam generator from entering the other which may not be contaminated from primary to secondary leakage.

The steam generator hot drain cooler cooling water flow should first be established in the cooler tube side prior to draining hot, pressurized steam generator feedwater to the shell side. This will prevent excessive tube side pressurization and safety relief valve actuation.

TABLE 1

STEAM GENERATOR SECONDARY SIDE DRAIN PUMP

Pump Details	
Identification	SV-P-1
Number Installed	1
Manufacturer	Crane-Deming
Model No.	3062
Type	Process
Rated Speed, RPM	3,500
Rated Capacity, GPM	125
Rated Total Dynamic Heat, ft.	115
NPSH required at rated flow, ft.	5
Casing Design Pressure, psig	100
Design Temperature, ^{o}F	70-100
Lubricant/Coolant	Oil/NA
Min. Flow Requirements, GPM	3

Motor Details	
Manufacturer	Westinghouse
Type	Induction
Enclosure	Open
Rated Horsepower, HP	7½
Speed, RPM	3,500
Lubricant/Coolant	Oil/Air
Power Requirements	460V, 3Ø, 60 Hz, 9.9 amps (full load)
Power Source	MCC 2-32A

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TABLE 1 (Continued)

STEAM GENERATOR SECONDARY SIDE DRAIN PUMP

Classification	Level
Code	C
Quality Control	4
Seismic	II
Cleanliness	D

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TABLE 2

STEAM GENERATOR HOT DRAIN COOLER

Identification	SV-C-1
Number Installed	1
Manufacturer	Whitlock
Model No.	12-B-174
Cleanliness Factor, %	80
Heat Transfer, Btu/hr	2.37×10^7
Tube Side	
Flow, GPM	461
Source	I.C.C.W.
Design Pressure, psig	150
Design Temperature, ^oF	600
Material	Carbon Steel
Pressure Drop, psi	4
Shell Side	
Flow, GPM	120
Source	S/G Secondary Side
Design Pressure, psig	1050
Design Temperature, ^oF	600
Material	Carbon Steel
Pressure Drop, psi	2
Classification	**Level**
Code	C
Quality Control	4
Seismic	II
Cleanliness	D

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TMI DOCUMENTS

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