GE Nuclear Energy

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REVISION STATUS SHEET

DOCUMENT TITLE IOP-9, MAINTAINING HOT STANDBY OR HOT SHUTDOWN

LEGEND OR DESCRIPTION OF GROUPS

TYPE: OPERATING PROCEDURE

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TABLE OF CONTENTS

1.0 SCOPE/APPLICABILITY

This procedure provides the detailed instructions for maintaining the reactor in either the Hot Standby or the Hot Shutdown condition, using the main condenser or the suppression pool as the primary heat sink.

2.0 DISCUSSION

It is assumed that the desired reactor temperature and pressure conditions have been established prior to entering this procedure by completion of IOP-8, "Unit Off-Line to Hot Standby or Hot Shutdown".

The plant conditions of Hot Standby and Hot Shutdown are defined as follows:

Condition	Mode Switch Position	Average Reactor CoolantTemperature
Hot Standby	STARTUP/HOT STANDBY	Any temperature
Hot Shutdown	SHUTDOWN	> 93 °C

In the Hot Standby condition, the reactor is critical with the MSIVs open. In the Hot Shutdown condition, all control rods are fully inserted and the MSIVs may be either open or closed. The steps in this procedure are intended to be operation guidelines for maintaining the reactor in either state. As such, the steps need not be performed in the sequence listed.

3.0 PRECAUTIONS AND LIMITATIONS

3.1 Operation in a Hot Standby or Hot Shutdown condition with reactor pressure greater than 28 kg/cm^2 should be minimized to prevent excessive thermal stresses due to high differential temperature between feedwater and saturation temperature of the reactor coolant.

3.2 While operating in the Hot Standby condition with the reactor critical, closely monitor the neutron instruments for indicated changes in reactivity or power due to xenon transients. Insert control rods as necessary to prevent inadvertent power increases.

3.3 Operation of the reactor in the Hot Shutdown or in Hot Standby with reactor coolant temperature greater than 93 °C should be with the reactor maintained in a vented condition via steam flow through the turbine bypass valves. This will prevent non-condensible gas buildup in the reactor coolant.

3.4 Operation of the reactor in the Hot Standby condition should be performed with a minimum amount of steam flow through the turbine bypass valves. This will limit the amount of cold feedwater flow to the reactor vessel for makeup.

3.5 Maintain reactor water chemistry within the following limits:

Chlorides	< 10 ppb
Conductivity at 25 °C	< 0.20 µS/cm
pH at 25 °C	6.4 – 7.8
Dissolved Oxygen	< 200 ppb
Silica (SiO_2)	< 100 ppb
Sulfate	< 10 ppb
Total Iron (Fe)	< 10.0 ppb
Copper (Cu)	< 0.5 ppb
All other metals	< 4.5 ppb

3.0 PRECAUTIONS AND LIMITATIONS(continued)

3.6 Maintain feedwater chemistry within the following limits:

Chlorides	< 0.16 ppb
Conductivity at 25 °C	< 0.057 µS/cm
Dissolved Oxygen	20.0 – 30.0 ppb
Silica (SiO_2)	< later ppb
Sulfate	< 0.16 ppb
Iron, insoluble (Fe)	< 1.0 ppb
Iron, soluble (Fe)	< 0.1 ppb
Total Copper (Cu)	< 0.05 ppb
All other metals	< 0.35 ppb

4.0 PREREQUISITES

The reactor is operating in the Hot Standby condition as established per IOP-8, "Unit Off-Line to Hot Standby or Hot Shutdown".

5.0 PROCEDURE

The steps in this procedure are intended as guidelines and need not be performed in the sequence listed.

5.1 Maintaining Hot Standby

It is desired to maintain the reactor pressure at approximately 28 kg/cm^2 to minimize the temperature differential between the feedwater and the reactor, to provide steam to auxiliary systems, and to maintain the HPCP feed capability.

5.1.1 Maintain the Reactor Recirculation Pumps at minimum speed [30%].

5.1.2 Maintain the reactor water level in the normal operating range of 425.5 cm to 445.5 cm on the Narrow Range water level instruments. Verify that reactor water level is being controlled with one LPCP and one HPCP in the Low Flow Control Mode per SOP-C31 and SOP-[later].

5.1.3 To minimize the effect of feedwater cyclings on the feedwater nozzle, perform the following steps:

5.1.3.1 Establish a CUW reject flow of [later, m^3/hour] to the main condenser, and

5.1.3.2 Set the setpoint of the Pressure Regulator at the desired pressure and using the manual jack, open bypass valve No. 1 to [20-30 %] position.

5.1.4 Adjust control rod position as necessary to maintain the reactor critical on [SRNMS heating range].

5.1.5 If directed, proceed to IOP-10, "Unit On-Line from Hot Standby or Hot Shutdown", or to IOP-6, "Cooldown to Cold Shutdown, Main Condenser Available".

5.2 Maintaining Hot Shutdown

5.2.1 Maintain the Reactor Recirculation Pumps at minimum speed [30%].

5.2.2 When reactor pressure falls below [40 kg/cm^2] and decreasing, control reactor water level in the Startup Level Control mode with one LPCP and one HPCP. Refer to SOP–C31 and SOP–[later].

5.2.3 Maintain reactor pressure at the desired pressure by performing the following steps:

5.2.3.1 To minimize the effect of feedwater cyclings on the feedwater nozzle, perform the following steps:

- Establish a CUW reject flow of [later, m^3/hour] to Radwaste, and
- If the main condenser is available, set the setpoint of the Pressure Regulator at the desired pressure and using the manual jack, open bypass valves No. 1 to [20–30 %] position.

5.2.3.2 If the main condenser is NOT available, maintain pressure by performing the following steps:

- Operate the RCIC System in the Test Mode per SOP-E51, "Reactor Core Isolation Cooling System",
- Supplement pressure control by using the Reactor Safety Relief valves if necessary; open the SRVs in the following sequence, as required: [later]
- Control suppression pool temperature to below [limit, later] by operating the RHR System in the Suppression Pool Cooling Mode per SOP-E11, "Residual Heat Removal System".

5.2 Maintaining Hot Shutdown(continued)

5.2.4 If the MSIVs are open and if the decay heat load decreases such that reactor pressure can not be maintained at the desired pressure, perform the following:

- Close main steam drain valves B21-F152 and F211.

- Shift the turbine gland sealing steam from the Steam Seal Evaporator to the Auxiliary Boiler.

CAUTION

Do not start the Mechanical Vacuum Pumps until both of the turbine-driven reactor feedpumps have been secured and all turbine steam bypass valves are closed.

- If pressure continues to decrease

  - If a Steam Jet Air Ejector is still in service, shift to the startup Steam Jet Air Ejectors per SOP-[later], "Condenser Evacuation System".

  - Close the turbine bypass valves and manipulate the bypass valve jack to control pressure as necessary.

5.2.5 If directed, proceed to IOP-10, "Unit On-Line from Hot Standby or Hot Shutdown", IOP-6, "Cooldown to Cold Shutdown, Main Condenser Available", or IOP-7, "Cooldown to Cold Shutdown, Main Condenser Not Available", as appropriate.

6.0 REFERENCES

6.1 General Electric Service Information Letter SIL-208, "Minimizing Feedwater Nozzle Thermal Duty", Revision 1, October, 1978.

6.2 Water Quality Specification, 22A8479, Revision 2, PAE No. 1.A.9.