POWER AUTHORITY OF THE STATE OF NEW YORK

INDIAN POINT NO. 3 NUCLEAR POWER PLANT

SOP-SG-2 REV. 2

SECONDARY PLANT CHEMISTRY CONTROL

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Effective Date _____

*This procedure has been extensively revised.

This procedure is sub-divided into several inter-related procedures, as indexed below, to allow more rapid access to the information desired.

Number	Title
SOP-SG-2A	Steam Generator Draining and Dry Layup
SOP-SG-2B	Steam Generator Filling and Wet Layup
SOP-SG-2C	Chemistry Specifications

Steam Generator Draining And Dry Layup

1.0 Intent

To provide a procedure for steam generator draining and dry layup.

2.0 Precautions and Limitations

2.1 To preclude various corrosion concerns S/G dry lay-up periods shall be minimized and unblanket lay-ups shall not exceed 96 hours unless approved by the Superintendent of Power.

2.2 Whenever possible, Steam Generators shall be nitrogen blanketed when in dry lay-up.

2.3 If secondary side maintenance or inspection of a steam generator is intended, it should be drained while still warm (greater than 150°F) in order to remove all moisture, which in the presence of oxygen, is highly corrosive.

2.4 The following are limits for chemicals discharged to the river:

2.4.1

CHEMICAL	AMOUNT	CONCENTRATION IN CANAL
Boric Acid	210 lb/day avg.	1 ppm

2.4.B At least one circulating water pump must be in service while draining a steam generator to the river to provide dilution flow.

NOTE: Credit may be taken for Con Ed Circulating Water Pumps with the permission of the Unit 2 Control Room Operator.

2.5 Replace manway and handhold covers or provide temporary covers where feasible, whenever work is not being done in a drained steam generator to prevent of entry of moist air.

3.0 Initial Conditions

3.1 The Residual Heat Removal System has been established for cooling the Reactor Coolant System, prior to draining all steam generators.

4.0 Procedure

4.1 Draining a Steam Generator for Maintenance/Inspection

CAUTION

This procedure is to be used only when access to the steam generator is required as so to make impractical placing the generator in dry layup per 4.2. The period of exposure to air shall be minimized and shall not exceed 96 hours unless approved by the Superintendent of Power.

4.1.1 With the Residual Heat Removal System in service, the Steam Generator should now be drained via the steam generator blowdown system. The maximum rate of blowdown is dependent on the chemical concentration.

NOTE: Draining the steam generator should commence before the system temperature has been reduced below 120°F in order to insure the maximum removal of moisture from steam generator shell area.

4.1.2 As soon as the steam generator is completely drained, the secondary manway and the handhole covers on the steam generator should be removed.

4.1.3 Blowers should be used to circulate the warm air through the handholes and out the manway.

4.1.4 If it has been necessary to drain a cool steam generator, trays of desiccant should be placed in the steam generator to remove as much moisture as possible from the generator.

4.1.5 As soon as the maintenance or inspection has been completed, the steam generator should be filled and placed in the wet layup condition per SOP-SG-2B.

4.2 Draining a Steam Generator and Placing it in Dry Lay-Up

4.2.1 The nitrogen blanketing system should be placed in service when the steam generator pressure decreases to 25 psig during RCS cooldown as follows:

a. Sample nitrogen supply truck to ensure it is oxygen free (less than 0.2% O_2). In lieu of sampling truck, gas certification is acceptable.

b. Close root valve SGN34, and makeup truck connection.

c. Place the valves on the main steam traps for the steam generator(s) to be drained (MST-1, MST-2, MST-3 and/or MST-4) in the following positions:

Close MS-67 (Trap Inlet).
Close MS-105A (Trap Outlet).
Close MS-105B (Condensate Return).
Open MS-68 (Trap Bypass).

d. Close the outlet valves from the nitrogen pressure regulators SGN-31 and SGN-33.

e. Open the nitrogen inlet valves for the steam generators to be drained SGN-26, 27, 28 and 29, for Steam Generator(s) 32, 31, 33 and 34 respectively.

f. Set nitrogen regulators PCV-1319 and PCV-1320 at 5 psig.

g. When local pressure gauge PI-1361 indicates 25 psig or below open the full valve SGN-34 and valves SGN-31 and SGN-30 on the outlet of the nitrogen pressure regulators, PCV-1319 and PCV-1320.

h. With the RHR System in service the steam generator should now be drained via the steam generator blow down system. The maximum rate of blowdown is dependent on the chemical concentration.

NOTE: Draining of the steam generator should commence before the system temperature has been reduced below 120°F in order to insure the maximum removal of moisture from steam generator shell area.

4.2.2 Once the steam generators have been drained, the nitrogen pressure may be reduced to 2 psig.

4.2.3 Where feasible, the generators shall be maintained pressurized with nitrogen.

Steam Generator Filling and Wet Layup

1.0 Intent

To provide a procedure for filling and placing the steam generators in wet layup.

2.0 Precautions and Limitations

2.1 Maintain steam generator water chemistry within the values specified in SOP-SG-2C.

2.2 Whenever the steam generators are to be completely filled, the hangers in the main steam headers should be pinned. When returning from wet layup the pins should be removed.

2.3 The following are limits for chemicals discharged to the river:

2.3.1

CHEMICAL	AMOUNT	CONCENTRATION IN CANAL
Boric Acid	210 lb/day avg.	1 ppm

2.3.2 At least one circulating water pump must be in service while draining a steam generator to the river to provide dilution flow of at least 100,000 gpm.

NOTE: 1) Credit may be taken for Con Ed Circulating Water Pumps with the permission of the Unit 2 Control Room Operator.

2) Credit may be taken for some of Con Edisons effluent limits with the permission from the Unit 2 Shift Supervisor.

3.0 Initial Conditions

3.1 The Residual Heat Removal System is in operation for cooling of Reactor Coolant System.

3.2 The motor driven auxiliary feedwater pumps are operable.

4.0 Procedure

4.1 Filling Steam Generator for Layup

4.1.1 Insert pins in the hangers for the main steam header for the generators to be filled.

4.1.2 Have Shift Chemist adjust steam generator chemistry as required by adding chemicals steam generators as per chemistry depart procedures.

4.1.3 Open the drain valves (MS-33A, MS-33B, MS-33C and/or MS-33D) upstream of each of the main steam line isolation valves and the vents on the main steam isolation valves for the steam generators to be filled.

4.1.4 Start the auxiliary feedwater pump(s), for the steam generator(s) to which chemicals have just been added. When the water level increases to approximately 100% stop the pump(s).

4.1.5 To mix the chemicals throughout the steam generator(s) using the nitrogen circulation system:

a. Open the isolation valves on each side of the N_2 ball valve for the appropriate steam generator(s).

Steam Generator 31 - SGN-2 and SGN-14
Steam Generator 32 - SGN-1 and SGN-13
Steam Generator 33 - SGN-3 and SGN-15
Steam Generator 34 - SGN-4 and SGN-16

b. Close the sample line isolation valves (989) for the appropriate steam generator(s).

c. Close the manual blowdown angle valves in the blow down storage tank room for the appropriate steam generator.

d. Place nitrogen truck in service and open SGN-41.

e. Adjust nitrogen pressure control valve (PCV-1321) to maintain 50 psi as indicated on local pressure indicator.

f. Open the ball valve (SGN-6 for Steam Generator No. 31, SGN-5 for Steam Generator No. 32, SGN-7 for Steam Generator No. 33 or SGN-8 for Steam Generator No. 34) and bubble the contents of the nitrogen truck through the steam generator for approximately 20 minutes.

4.1.6 Have Shift Chemist sample the steam generator to assure that chemistry will be within specifications when the steam generator is completely filled.

4.1.7 Start the motor driven auxiliary feed water pump and fill the steam generator until water issues from drain then secure the pump if the motor driven aux. boiler feed pump was.

4.2 Adding Chemicals While in Wet Layup

4.2.1 Partially drain the steam generator(s) via the steam generator blowdown system as required, then close the blowdown valve.

CAUTION

Observe precautions on chemical release to river.

4.2.2 Have Shift Chemist adjust Steam Generator chemistry as required by adding chemicals to Steam Generators as per chemistry department procedures.

4.2.3 Start the Auxiliary feedwater pump(s), for the steam generator(s) to which chemicals have just been added. When the water level increases to approximately 100% stop the pump(s).

4.2.4 To mix the chemicals throughout the steam generator(s) using the nitrogen circulation system.

a. Open the isolation valves on each side of the N_2 ball valve for the appropriate steam generator(s).

Steam Generator 31 - SGN-2 and SGN-14
Steam Generator 32 - SGN-1 and SGN-13
Steam Generator 33 - SGN-3 and SGN-15
Steam Generator 34 - SGN-4 and SGN-16

b. Close the sample line isolation valves (989) for the appropriate steam generator(s).

c. Close the manual blowdown angle valves in the blowdown storage tank room for the appropriate steam generator.

d. Place nitrogen truck in service and open SGN-41.

e. Adjust nitrogen pressure control valve (PCV-1321) to maintain 50 psi as indicated on local pressure indicator PI-1407.

f. Open the ball valve (SGN-6 for Steam Generator No. 31, SGN-5 for Steam Generator No. 32, SGN-7 for Steam Generator No. 33 or SGN-8 for Steam Generator No. 34) and bubble the contents of the nitrogen truck through the steam generator.

4.2.5 Have Shift Chemist sample the steam generator to assure that chemistry will be within specifications when the steam generator is refilled.

4.2.6 Start the motor driven auxiliary feed water pump and fill the steam generator until water issues from drain then secure the pump.

Chemistry Specifications

1.0 Intent

To detail the secondary chemistry specifications and action limits for cold shutdown, hot shutdown and power operation.

2.0 Initial Conditions

2.1 None

3.0 Precautions and Limitations

3.1 As the concentrations of contaminants in the steam generators increases, immediate corrective action, in the form of increased blowdown, shall be initiated.

3.2 If steam generator blowdown alone is not sufficient to bring the steam generator chemistry within chemical specifications, additional corrective action, up to and including bringing the plant to cold shutdown, shall be immediately initiated by the Shift Supervisor in accordance with sections 4.4.1 and 4.4.2. The rate of load reduction of cooldown should be based upon the level of contaminants and its rate of change.

3.3 Excessive hydrazine addition must be avoided as the residual hydrazine decomposes to ammonia which in turn increases copper corrosion in the feedwater heater and condenser tubes.

3.4 If one or more sextant gross conductivity monitors read greater than 20 micromhos in conjunction with the condensate pump discharge sodium greater than 1000 ppb and the high pressure feedwater cation conductivity greater than 5 micromhos, the CST should be immediately isolated from the hotwells and the unit should be tripped immediately and brought to a cold shutdown condition in accordance with appropriate operations procedures.

3.5 Secondary water chemistry data review as referred to in Attachment A is maintained by the following:

3.5.1 The Nuclear Plant Operator will record chemistry data during his shift.

3.5.2 The Senior Reactor Operator will initial the Control Room Chemistry Data Log Book which is maintained by the Watch Chemist.

3.5.3 The Shift Supervisor shall be informed of any abnormal chemistry data and the Shift Supervisor should notify the Operations Superintendent of abnormal chemistry data.

3.5.4 The Operations Superintendent shall notify the Superintendent of Power of any significant abnormal chemistry data.

4.0 PROCEDURE

4.1 Status Modes

4.1.1 Steam Generator status modes are as follows: Cold Shutdown, Hot Shutdown Power Operation.

A) Partial Drain, Lay-up Cold Shutdown is when the Steam Generator/RCS temperature is $\geq 200^{\circ}F$.

The steam generator should be placed in full wet layup with chemically treated water when ever practical, and a nitrogen overpressure applied to minimize air ingress. Mixing of the bulk water shall be accomplished by nitrogem sparging. The cold shutdown period shall be utilized to reduce the steam generator impurity inventory.

B) Partial Drain is a cold shutdown condition where the S/G level is less than normal operating water level.

C) Dry Lay-up

The Steam Generator is completely drained and a nitrogen blanket/overpressure should be maintained whenever practical.

B and C are the least desirable condition for steam generator protection. If partial drain is necessary for maintenance the period of a partial drain/dry lay-up condition should be minimized.

D) Hot Shutdown is when the Steam Generator/RCS temperature is $> 200^{\circ}$.

E) Power Operation is when steam is admitted to the main turbine electrical generator and reactor power is > 2% rated power.

4.2 Maintain the following Chemical Specifications:

4.2.1 Cold Shutdown

Parameter	Frequency (Max. Freq.)	Normal Value	Initiate action	Value Prior to Heat Up
pH	3/week*	> 9.8	< 9.8	8.5 - 9.2
Hydrazine (ppm)	3/week*	> 75	< 75	
Chloride ppb	3/week*	-	-	
Sodium (ppb)	3/week* (-)	< 1000	> 1000	< 100
Diss. Oxygen (ppb)	3/week*	-		
Cation Cond. umho/cm	3/week* (-)	< 20.0	> 20.0	< 10.0

* Every other day until stable then weekly.

4.2.2 Cold Shutdown, Auxiliary Feed Water

Parameter	Frequency	Normal Value	Initiate Action
Dissolved Oxygen	Weekly	**	**

** - Dissolved oxygen concentration in the Condensate Storage Tank shall be minimized by the addition of hydrazine and/or recirculating the CST on the makeup water degasifier.

4.3 Hot Shutdown

Parameter	Frequency (max. Freq.)	Normal Value	Initiate Action	Value Prior to Power Escalation
pH	continuous (3/daily)	8.5-9.2 ($>7.0^1$)	<8.5 ($<7.0^1$) >9.2	- - -
Cation Cond. umho/cm	continuous (-)	<10.0	>10.0	<10.0
Diss. Oxy.(ppb)	3/daily	<5	>10	-
Sodium (ppb)	continuous (-)	<100	>100	<100
Chloride (ppb)	3/daily	<150	>150	<150

1 - If Borid Acid added to steam generator.

4.3.1 Hot Shutdown Auxiliary Feed Water

Parameter	Frequency	Normal Value	Initiate Action
Dissolved Oxygen (ppb)	daily	**	**

4.4 Power Operation

Power Operation

Parameter	Frequency (max. Freq.)	Normal Value	Action Level 1	2	3
pH	continuous (3/daily)	8.5 - 9.2 ($>7.0^1$)	<8.5, ($<7.0^1$) >9.2		
Cation Cond. umho/cm	continuous (-)	<10.0	>10	-	
Sodium (ppb)	continuous (-)	<50	>100		
Chloride (ppb)	3/daily	<100	≥ 150	≥ 500	≥ 750
Silica (ppb)	Weekly	<500	>500		

Feedwater
Power Operation

Parameter	Frequency	Normal Value	Action Level 1
pH	Continuous	8.8-9.2	>9.2, <8.8
Sodium (ppm)	Continuous	<3	>3
Dissolved Oxygen (ppb)	Continuous	<3	>5
Hydrazine	Continuous	3 X O_2	<3 X O_2
Ammonia	Daily	*	
Total Iron (ppb)	Weekly Integrated	<20	>20
Total Copper (ppb)	Weekly Integrated	<10	>15
Cation Cond.	Continuous	<0.8	≥ 1.0

* Consistent with pH.

4.4.2 Condensate
Power Operation

Parameter	Frequency (max. Freq.)	Normal Value	Level 1
Diss. oxy. (ppb)	Continuous (3/Daily)	< 10	> 15

Action Level 1

a) Identify and correct the cause for the out of normal parameter.

b) Return parameter to within normal value range within seven days after initial detection.

c) If parameter is not within normal range after seven days of initial detection go to action level 2 if applicable.

Action Level 2

a) Reduce power to 60% within eight hours of initiation of action level 2.

b) Return parameter to within normal value within 100 hrs after initiation of level 2 or go to level 3.

Action Level 3

3) Proceed to hot shutdown within six hours and clean up to within normal values by feed and bleed and draining and refilling.

CHEMISTRY DATA REVIEW