INDIAN POINT STATION

UNIT NO. 2

POP-1.1 REV. 0

PLANT HEATUP FROM COLD SHUTDOWN CONDITION

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Plant Heatup From Cold Shutdown Condition

1.0 Purpose

To provide a procedure for heatup of the plant from a cold shutdown condition.

2.0 Precautions and Limitations

2.1 In accordance with Technical Specifications the following items apply:

2.1.A The reactor shall be maintained subcritical by at least 1% ΔK/K until normal water level, approximately 23% of span, is established in the pressurizer.

2.1.B The minimum Technical Specification shutdown margin (specified in Figure RCS-5 of the Graphs Book) shall be maintained throughout.

NOTE: This shutdown margin will be assured if the minimum boron concentration is maintained above the appropriate values shown in curve RCS-4 of the Graphs Book.

2.1.C At least one reactor coolant pump, or RHR pump, when connected to the Reactor Coolant System, shall be in operation when a reduction is made in the boron concentration of the reactor coolant.

2.1.D The maximum allowable ΔT between the pressurizer and the reactor coolant loops is 320°F.

2.1.E The auxiliary spray should not be used if the ΔT between pressurizer and spray fluid exceeds 320°F.

2.1.F The maximum allowable heatup rate for the pressurizer is 200°F per hour. Administratively it should be limited to 100°F/hr.

2.1.G The secondary side of the steam generator must not be pressurized above 200 psig if the temperature of the steam generator is below 70°F.

2.1.H RCS heatup rate shall not exceed 50°F/hr. for temperatures at or below 220°F. For temperatures above 220°F it shall not exceed 100°F/hr.

2.1.I Containment Integrity must be established prior to exceeding 200°F in the RCS.

2.1.J RCS pressure shall not exceed 500 psig for temperatures below 220°F.

2.1.K At least one pressurizer code safety valve shall be operable whenever the reactor head is on the vessel, except for hydrostatic tests. All pressurizer safety valves shall be operable whenever the reactor is critical.

2.1.L Before the Reactor Coolant System is heated above 250°F, the following chemistry specifications must be met:

Oxygen - Less than 0.10 ppm
Chloride - Less than 0.15 ppm
Fluoride - Less than 0.15 ppm

2.1.M The reactor shall not be heated above 350°F unless the following conditions are met:

1) A minimum ASME code approved steam relieving capability of 20 main steam valves shall be operable (except for testing).

2) Two of the three auxiliary feedwater pumps must be operable.

3) A minimum of 360,000 gallons of water in the condensate storage tank.

4) System piping and valves directly associated with the above components operable.

5) The main steam stop valves are operable and capable of closing in five seconds or less.

6) The total Iodine activity of I-131 and I-133 on the secondary side of the steam generator shall be less than or equal to .15 uCi/cc.

7) City Water System piping and valves directly associated with providing backup supply to the auxiliary feedwater pumps are operable.

2.1.N The total specific activity of the reactor coolant, excluding tritium due to nuclides with half lives of more than 30 minutes shall not exceed $60/\bar{E}$ uCi/cc, whenever the reactor is critical or average reactor coolant temperature is greater than 500°F.

2.2 If the count rate of either source range channel increases by a factor of two or more during any step involving boron concentration change, the operation must be stopped immediately and suspended until a satisfactory evaluation of the situation has been made by the Watch Foreman.

2.3 The shutdown banks must be at the fully withdrawn position whenever positive reactivity is being inserted by boron and xenon changes, reactor coolant temperature change, or motion of part length rods or control banks other than the shutdown banks. The following exception to this rule may be applied: The Reactor Coolant System has been borated to at least the xenon free shutdown margin consistent with the temperature being maintained. Refer to Figure RCS-4 of the Graphs Book.

2.4 The heatup rate for the Reactor Coolant System should not exceed 50°F per hour. This is an administrative limit, the Technical Specification limit is 100°F/hour above 220°F.

2.5 The reactor coolant pressure must be maintained in accordance with the pressure-temperature heatup curve (Figure RCS-1A of the Graphs Book).

2.6 Following a 25 ppm change in reactor coolant boron concentration, actuate one group of pressurizer backup heaters to permit the pressurizer spray valves to adjust the pressurizer boron concentration to the reactor coolant loop boron concentration. Verify final equalization of boron concentrations by either sampling pressurizer liquid space and reactor coolant system or by noting that rod movement is no longer necessary to maintain power level.

2.7 Do not admit steam downstream of the Main Steam Stop Valves unless the main turbine generator and main boiler feedwater pumps are placed on the turning gear.

2.8 The reactor coolant pumps must be started, operated and shutdown in accordance with SOP-1.3.

2.9 Pressurizer level indication is calibrated for specific temperatures. Reference should be made to the calibration curves located on Figure RCS-3A & 3B of the Graphs Book to obtain the true level when pressurizer temperature is between 70°F and 650°F.

2.10 Steam generator level indication is calibrated for specific temperatures. Reference should be made to the calibration curves located on Figure SP-1A & 1B of the Graphs Book when between 70°F and 547°F.

2.11 During secondary plant warmup, draw steam off slowly and regulate feedwater additions carefully to avoid uncontrolled cooling of the Reactor Coolant System. Steam removal from the steam generators which exposes the reactor to large, unexpected, energy withdrawals while the reactor coolant is at low temperatures must be avoided. Therefore, when the reactor is critical:

a) Steam must not be admitted to the main turbine, condenser steam dump, atmospheric steam relief or auxiliary steam driven feed pump until the reactor coolant temperature is above 400°F.

b) Steam must not be used to increase the main turbine speed above 600 rpm until the reactor coolant temperature is at the reactor plant no-load temperature (547°F).

c) Steam may be withdrawn at any reactor coolant temperature to warm lines, to operate the air ejector and gland steam system or other auxiliary uses as directed by the W.F.

2.12 Do not exceed 600 psig reactor coolant system pressure until the reactor vessel head studs have been fully tensioned.

NOTES: 1) No pressure may be applied to the reactor vessel unless the vessel metal, flange and bolt temperature is 70°F or greater.

2) Reactor Coolant System pressure shall not exceed 600 psi unless the vessel metal, flange and bolt temperature is 93°F or greater.

3) The maximum stud elongation which may be performed below 93°F yet above 70°F is .015 inches.

2.13 If hydrazine is added to scavenge oxygen during heatup, the demineralizers should be bypassed.

2.14 Hydrazine should not be added to the reactor coolant system with RCS temperature above 250°F since it is ineffective above this temperature. Hydrazine should not be added unless the volume control tank gas blanket contains less than 0.5% oxygen.

2.15 The Startup Checkoff list should be completed as this procedure is being done.

3.0 Initial Conditions

3.1 The required system checkoff lists have been completed.

3.2 Nuclear and conventional support systems are in operation as required or are available for plant startup when required.

3.3 The reactor is shutdown with all full length rod banks fully inserted.

3.4 The Reactor Coolant System has been filled, vented and pressurized between 400 psig and 450 psig per SOP-1.1 with charging, letdown and low pressure purification in service.

3.5 The Reactor Coolant System is 200°F or less.

3.6 The residual heat removal loop is in service.

3.7 The steam generator levels are greater than 35% of span. If full, nitrogen blanket being used for corrosion control.

3.8 The reactor coolant boron concentration is at or above the cold shutdown concentration.

4.0 Procedure

4.1 Obtain permission from the Watch Foreman to commence the heatup.

4.2 Notify plant personnel that heatup of the primary plant is about to begin and evacuate all unnecessary personnel from containment.

4.3 Establish containment integrity as per SOP-10.6.1.

4.4 Lift water on one circulating water box per condenser and start the associated circulating water pumps per SOP-2.3.1.

NOTE: Normally only one circulator is required to blowdown steam generators.

4.5 Secure the nitrogen blanket on all steam generators per SOP-8.2.

4.6 Adjust steam generator level between 35-65% of span by draining or using the Auxiliary Feedwater System per SOP-2.1.3.

4.7 Sample the reactor coolant system for dissolved oxygen, chloride and fluoride concentration. If concentrations are not within specification (oxygen $\leq$ .1 ppm, chloride $\leq$ .15 ppm, fluoride $\leq$ .15 ppm) refer to SOP-8.1.

4.8 When oxygen concentration is below 0.1 ppm, establish a hydrogen blanket in the volume control tank per SOP-8.1 and return the letdown demineralizers to service.

4.9 Maintain Reactor Coolant System pressure to between 400-450 psig by varying charging pump speed and/or adjusting letdown flow.

4.10 Start reactor coolant pump 23 or 24 per SOP-1.3.

NOTE: Additional pumps may be run as necessary but it should be borne in mind that it is desirable to draw the pressurizer steam bubble before Reactor Coolant System temperature is increased above 200°F.

4.11 When reactor coolant pressure is stabilized, shutdown the running RHR pump.

CAUTION

When the RCS is solid and the RHR pumps are shutdown, a pressure spike will occur due to the decreased letdown flow through HCV-133. When the pump is tripped, HCV-133 will have to be opened further to re-establish the letdown flow to the previous value.

4.12 Place the PAB hot penetration blowers in service prior to exceeding 150°F in the reactor coolant system per SOP-11.3 The blowers associated with the feedwater and steam piping must be placed in service before exceeding 200°F.

4.13 If not previously done, place the safety injection logics back in service for channel I and channel II by installing the lead lifted from the automatic master relay. Refer to POP-3.3 for terminal location.

4.14 Prior to exceeding 250°F in the Reactor Coolant System or pressurizer verify plant chemistry meets the following Technical Specification requirements.

Oxygen less than .1 ppm
Fluorides less than .15 ppm
Chlorides less than .15 ppm

4.15 Establish a steam bubble in the pressurizer per SOP-3.3.

NOTE: Pressurizer temperature must not be raised above 250°F unless chemistry is within allowable limits.

4.16 When normal water level (approximately 23%) is established in the pressurizer, isolate the RHR System per SOP-4.2.1.

4.17 Place pressurizer level controller in automatic as per SOP-1.5 and adjust to maintain a level of 23%.

4.18 Start additional reactor coolant pumps to continue plant heatup. Pressurizer heaters may also be used to supplement the heatup rate.

CAUTION

Maintain heatup rate at or below 50°F/hr. Technical Specifications limits heatup rate to 100°F/hr.

4.19 Place at least four Containment Fan Cooler units in service.

4.20 Increase pressurizer pressure to 2235 psig during the heatup while observing the proper pressure-temperature relationships required by curve RCS-1A of the Graphs Book.

NOTE: Maintain the temperature differential between the pressurizer and reactor coolant system below 320°F.

4.21 Reduce letdown flow as heatup and pressurization continues by isolating letdown orifices as required so as not to exceed 120 gpm.

4.22 Before Reactor Coolant System pressure is increased above 1000 psig, open accumulator isolation valves 894A, B, C and D, de-energize the valve motor operators and lock their disconnect switches in the open position at MCC-26A and MCC-26B.

4.23 Prior to exceeding 250°F start the rod drive cooling fans.

4.24 When No. 1 seal return flow has increased above 1 gpm on all RCP's, close the No. 1 seal bypass valve. This should occur at approximately 1500 psig.

4.25 When pressurizer pressure is at 1900 psig, verify that pressurizer pressure/pressurizer level safety injection block has cleared (permissive light extinguished) and place the High Head Safety Injection pump control switches in Auto.

4.26 When normal operating pressure of 2235 psig is established, place pressurizer pressure control in automatic per SOP-1.4.

4.27 The reactor shall not be heated above 350°F unless the following conditions are met in accordance with Technical Specifications:

1) A minimum ASME code approved steam relieving capability of 20 main steam valves shall be operable (except for testing).

2) Two of the three auxiliary feedwater pumps must be operable.

3) A minimum of 360,000 gallons of water in the condensate storage tank.

4) System piping and valves directly associated with the above components operable.

5) The main steam stop valves are operable and capable of closing in five seconds or less.

6) The total Iodine activity of I-131 and I-133 on the secondary side of the steam generator shall be less than or equal to .15 uCi/cc.

7) City Water System piping and valves directly associated with providing backup supply to the auxiliary feedwater pumps are operable.

4.28 Calculate a critical rod estimate or boron concentration per SOP-15.4 when time permits. Adjust reactor coolant system boron concentration as necessary.

NOTE: If the adjustment requires diluting below the cold shutdown margin depicted in curve RCS-4 of the Graphs Book do not dilute below the xenon free shutdown margin consistent with the existing temperature. Since the cold shutdown margin is based on a xenon free core, it is permissible to dilute below its value when xenon is present. To perform a dilution of this nature requires prior withdrawal of the shutdown rods.

4.29 When the temperature at which the ECP has been calculated is reached; commence reactor startup per POP-1.2. If criticality is to be delayed until Tavg is at 547°F continue heatup utilizing reactor coolant pumps and pressurizer heaters as desired.

4.30 Place a condensate pump in service on recirculation per SOP-20.2.

4.31 When the reactor coolant system reaches approximately 400°F, secondary plant warmup may be initiated and the main steam isolation valves opened in accordance with SOP-18.1.

NOTES: 1) Ensure main turbine and main boiler feedwater pumps are on turning gear before admitting steam downstream of the main steam isolation valves.

2) Avoid withdrawing steam if it will significantly compromise the Reactor Coolant System heatup rate.

4.32 When the reactor is critical, increase reactor power as desired to assist plant heatup.

NOTE: A power level of approximately 2 X 10^{-6} amperes will start to add sensible heat.

4.33 When normal operating temperature of approximately 547°F is achieved, place the atmospheric steam dump control in the automatic mode to maintain 1005 psig.

4.34 Start all remaining operable circulating water pumps per SOP-23.1.

4.35 Establish gland steam to the main turbine and main boiler feed pump turbines and establish condenser vacuum per SOP-20.1.

NOTE: This operation will require the reactor to be critical.

4.36 When sufficient vacuum is established place steam dump control in automatic or manual pressure mode, and verify atmospheric steam dumps are closed and set for 1005 psig.

4.37 Refer to POP-1.3 - Plant Startup from Zero Power Condition to Full Power.