PLANT HOT SHUTDOWN TO COLD CONDITIONS

I. OBJECTIVE

This instruction describes a safe and efficient method of cooling down and depressurizing the reactor cycle from the hot shutdown to a cold or refueling condition in which the reactor coolant temperature is maintained less than 150°F.

II. CONDITIONS

A. The plant is in the hot shutdown condition. One shutdown group shall be withdrawn to the "cocked" position except for the conditions listed under "Precautions," Item III-A.

B. Primary Makeup Water and Boric Acid Systems have sufficient storage to compensate for reactor coolant shrinkage.

III. PRECAUTIONS

A. One shutdown group of control rods must be 320 steps withdrawn whenever positive reactivity is being inserted by boron dilution, xenon decay or cooldown. The following two exceptions to this rule may be applied:

1. The Reactor Coolant System has been borated to at least the hot, xenon free, boron concentration and is being maintained at hot shutdown conditions.

2. The Reactor Coolant System has been borated to the cold shutdown boron concentration and the primary plant is being cooled down.

B. The pressurizer spray valves shall be operated as necessary to maintain the pressurizer boron concentration within +150 ppm to -50 ppm of the main coolant boron concentration to minimize the amount of reactivity tied up in this manner.

C. The cooldown rate of the Reactor Coolant System shall not exceed 100°F/hr.

NOTE: The maximum allowable cooldown rate is subject to change during plant life as the observed or expected shift in design transition temperature (DTT) increases (refer to heatup and cooldown curve).

D. To limit the consequences of a steam line break establish 4% ΔK/K shutdown, hot, xenon free, all rods in, prior to removing the safety injection system from service.

E. Component cooling to the reactor coolant pumps must be supplied any time a reactor coolant pump is operating and must not be terminated to an idle pump until the reactor cycle has been cooled to the cold condition (< 200°F).

F. Do not maintain the pressurizer level above 80% unless required for system cooldown or startup operations.

G. The containment spray system, the refueling water storage tank, the associated valves and interlocks shall remain operable per Tech. Spec. 3.3 while above 200°F in the reactor coolant system.

H. During the solid water phase of cooldown, reactor coolant pumps must be run continuously. Should abnormal or unusual conditions cause securing of all reactor coolant pumps, restart is permitted only after evaluating RCS temperature gradients.

In addition, at the completion of cooldown the reactor coolant pump shall be run sufficient additional time to insure that all reactor coolant systems and steam generator metal temperatures have equalized with reactor coolant liquid temperatures.

I. Tests or maintenance activities that might affect reactor coolant system pressure shall not be performed during solid system operation.

IV. CHECK-OFF LIST

See PSSO-119

V. INSTRUCTIONS

Important Steps	Key Points
1. If the Reactor Coolant System is to be opened for repair or refueling, initiate degassing of the reactor coolant in accordance with Instruction S-3-1.12, Reactor Dissolved Gas Concentration Control.	
2. Borate the Reactor Coolant System to the cold shutdown concentration in accordance with Operating Instructions S-3-2.5 and S-3-1.3.	2. a. The reactor coolant system must be borated to the cold shutdown concentration and verified by sample analysis before a controlled cooldown is initiated.

Important Steps	Key Points
NOTE: The reactor shutdown will normally be 3% with all rods inserted. When the reactor coolant system is to be opened, a shutdown margin $\geq$ 5% will be maintained and $\geq$ 10% with the reactor head removed.	b. A minimum of one reactor coolant pump must be in operation during any boron concentration change. Pump A or B must be used for spray flow for equalizing boron concentrations.
NOTE: If a Chemical Technician is not on duty, operators will establish a main coolant sample line flush for 15 minutes and then draw a sample properly labeled for analysis as soon as Chemical Technician arrives on site.	c. During this operation, the pressurizer liquid level is allowed to increase above the no load programmed level. Place FCV-1112 on manual and set the flow for approximately 110 gpm until the boron addition is complete or the pressurizer level indication is near the upper limit. If possible, do not allow letdown diversion to radwaste or volume control system to makeup.
3. Prepare additional batches of boric acid to refill the boric acid storage tank.	
4. Set the reactor coolant makeup control for automatic makeup at the refueling or cold shutdown boron concentration, whichever is applicable.	4. a. Verify that a normal level in the volume control tank is maintained during the cooldown. b. Verify proper boron concentration at blend device outlet.
5. Periodically sample the reactor coolant and pressurizer liquid.	5. a. Confirm that the intended boron concentration change is accomplished. b. Check the reduction in coolant activity. c. Check the dissolved hydrogen concentration.

Important Steps	Key Points
6. Switch off all pressurizer heaters. Pressurizer liquid and RCS liquid temperature and pressure readings will be taken every 30 minutes until cold shutdown condition is reached, unless recorder TR-430, Pressurizer Temperature is in service.	6. a. Use reading sheet included in check-off sheet form PSSO-119.
7. Begin cooldown of the Reactor Coolant System. Place steam dump controller 418A on manual control and if possible maintain steam dump to condenser only.	7. a. Slowly adjust the steam dump control to increase the dumping rate. b. Do not exceed a cooldown rate as shown on the pressure temperature curve. Caution: If cooldown exceeds 50°F/hr contraction of the reactor coolant may exceed the automatic makeup capacity.
8. Begin cooldown of the pressurizer and depressurization of the Pressurizer and Reactor Coolant System.	8. a. Transfer spray valves PC-430C and PC-430H to manual control. b. Slowly open a spray valve and maintain the reactor coolant pressure within the limits shown on the pressure-temperature curve. c. The spray flow must be controlled to limit the rate of pressurizer cooldown to 195°F/hr. d. The temperature differenc between the pressurizer and reactor coolant shoul not exceed a maximum of 200°F between TI-430C and TI-430B, or TR-402 depending on which reacto coolant pump is operating

Important Steps	Key Points
9. Stop all reactor coolant pumps except B to reduce heating of the Reactor Coolant System.	9. a. Pump B must be operated for spray flow. If Pump B is not available, pumps A and C will be used.
10. Add additional boric acid as required if refueling concentration is to be achieved.	10. a. Sample the pressurizer liquid and reactor coolan for boron concentration.
11. Manually block the safety injection actuation circuit when the alert to block safety injection alarm is received or when pressure is approximately 1750 psig. (See Precaution D)	
12. As cooldown progresses, maintain the pressurizer liquid as high as possible.	12. a. Promotes better cooling of the metal in the upper steam space. b. Do not collapse the bubble at this time. Maintain approximately 90% level.
13. As the letdown flow decreases, open additional letdown orifices to maintain desired letdown flow.	13. Letdown flow may be varied as required by system operating conditions.
14. Open reactor coolant pump seal bypass flow Valve CV-276 when any one of the three seal leak-off flows is (1) gpm on a running pump and the pressure is 1500 psig.	
15. Continue to cooldown by periodically resetting the steam dump control.	
16. At 500 psig, establish two positive barriers between the feedwater and reactor coolant system.	16. a. Refer to O.I. S-3-2.21.
17. When system pressure decreases to 400 psi, arm the OMS by operating CS-3A and CS-6 to the enable position.	
18. When the reactor coolant pressure decreases to 400 psig, start preliminary alignment of the Residual Heat Removal System. See Operating Instruction S-3-2.12.	

Important Steps	Key Points
19. Break vacuum from the condenser when no longer needed.	19. a. Open the condenser vacuum breaker. b. Stop the condenser vacuum pumps and/or secure steam to the air ejectors. c. Stop both gland seal condenser exhauster blowers. d. When the condenser is at atmospheric pressure, shut off the steam to the Turbine Gland Seal System.
20. Place the residual heat removal loop in service in accordance with Operating Instruction S-3-2.12.	
21. When the residual heat removal loop is in service, increase the pressurizer level and collapse the bubble as indicated by LI-435.	21. a. Place FC-1112 on manual and increase the charging flow. Do not allow pressure to exceed 400 psig.
22. The reactor coolant system is filled and solid, therefore; a. Assign a reactor operator to monitor the RCS pressure. b. Do not close MOV813 and 814, residual heat removal inlets or LCV1112, CV202, 203 and 204, normal letdown, except as required for RCS hydrostatic tests.	22. a. Operator monitoring is not required when the OMS is operational. b. To provide relief paths to RV206 and normal letdown by PCV1105.
23. Continue to operate reactor coolant pump "B" during the cooldown to obtain a uniform cooldown rate of all coolant loops and provide spray requirements to cool the pressurizer.	23. Do not reduce pressure below RC pump NPSH requirements.
24. When the main steam pressure reaches approximately atmospheric, apply a nitrogen blanket to the main steam lines and close the trap free blow valves as required.	
25. Raise the water level in the steam generators to approximately 120% of indicated level.	25. As steam generator levels increase, measure rate of change to calculate time to reach 120% level.

Important Steps	Key Points
26. Stop the last reactor coolant pump when the final cold shutdown temperature is reached. Hang caution tags on the RCP control switches indicating the RCS temperature at the time the last pump was stopped. Restart of the RCP's will only be affected after determining that RV-206 is available as a relief flow path and carefully assessing RCS temperature gradients or evaluating the potential for having developed temperature gradients.	26. a. Open auxiliary spray valve CV-305, close charging line CV-304 and spray valves CV-430C and H. b. Adjust the charging line flow controller FC-1112 to continue the desired cool-down rate of the pressurizer c. Continue to circulate throug the auxiliary spray line until the pressurizer temperature is approximately 150°F, indicated by TI-430A.
27. The Reactor Coolant System may be maintained at pressure as follows: a. Manually adjust FC-1112 to obtain a set charging flow. b. Control the pressure automatically with the letdown system pressure controller PC-1105.	
28. When the desired shutdown temperature is achieved and the reactor coolant pumps have been taken out of service, some auxiliary coolant system components may be taken out of service, dependent upon Cooling System heat load.	28. a. Residual heat removal pump. b. Component cooling pump. c. Residual heat exchanger. d. Component cooling heat exchanger.

VI. FINAL CONDITIONS

The unit is in the cold shutdown condition.

R. R. BRUNET
SUPERINTENDENT, UNIT 1

APPROVED:

J. M. CURRAN
PLANT MANAGER

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