

PLANT SHUTDOWN FROM HOT STANDBY TO COLD SHUTDOWN

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CDM SITE

1.0 OBJECTIVE

- 1.1 Provides instruction for plant shutdown from Hot Standby to Cold Shutdown.

2.0 REFERENCES

- 2.1 SONGS Unit 1 Technical Specifications.
- 2.2 Westinghouse Nuclear Service Division Technical Bulletin No. NSD-TB-80-10, Subject: Reactor Coolant Pump No.1 Seal Water Bypass Valve, dated: September 25, 1980.

3.0 PREREQUISITES

- 3.1 Operating Instruction S01-3-4, "Plant Shutdown From Full Power to Hot Standby" is completed, if applicable.

4.0 PRECAUTIONS AND LIMITATIONS

- 4.1 The containment spray system, the refueling water storage tank, their associated valves and interlocks shall remain operable per Tech. Spec. 3.3 while above 200°F in the reactor coolant system.
- 4.2 One shutdown group of control rods must be 320 steps withdrawn whenever positive reactivity is being inserted by boron dilution, xenon decay or cooldown.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:
- 4.2.1 The Reactor Coolant System has been borated to at least the Hot Standby, xenon free, boron concentration and is being maintained at Hot Standby conditions.
- 4.2.2 The Reactor Coolant System has been borated to the Cold Shutdown boron concentration.
- 4.3 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.
- 4.4 The cooldown rate of the Reactor Coolant System shall not exceed 100°F/hr. 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 the cooldown curve, Attachment 8.2.

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PLANT SHUTDOWN FROM HOT STANDBY TO COLD SHUTDOWN

4.0 PRECAUTIONS AND LIMITATIONS (Cont'd)

- 4.5 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 coolant system has been cooled to the cold condition (<200°F).
- 4.6 During the solid water phase of cooldown, reactor coolant pump(s) 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.
- 4.7 At the completion of cooldown, a reactor coolant pump shall be run a sufficient amount of time to insure that the reactor coolant system and steam generator metal temperatures have equalized with reactor coolant liquid temperatures.
- 4.8 Tests or maintenance activities that might affect reactor coolant system pressure shall not be performed during solid system operation.
- 4.9 During Cold Shutdown conditions, either two (2) RHR pumps and heat exchangers shall be operable or in service or one (1) RHR pump and heat exchanger shall be in service and a minimum of one (1) steam generator shall be available for decay heat removal.
- 4.10 To limit the consequences of a steam line break, establish >4 ΔK/K shutdown, Hot Standby, xenon free, all rods in, prior to removing the safety injection system from service.
- 4.11 Maintain steam generator levels at ~50% on narrow range recorder during cooldown. If a steam generator(s) feeding is uncovered (<26% narrow range level), feedwater flow shall be reduced to or maintained <150 gpm to that steam generator(s) until level is >26%.
- 4.12 The manual bonnet vent valves for HV-853A and HV-853B must be closed when the main feedpumps are depressurized to preclude drainage of RWST to reheater pit sump via the feedpump seals.

5.0 CHECK-OFF LISTS

Not Applicable.

6.0 INSTRUCTION

INITIALS

- 6.1 If required, commence degassing the RCS and purging the volume control tank (VCT) with nitrogen as per Operating Instruction SO1-4-8, "Degassing the Reactor Coolant System."

PLANT SHUTDOWN FROM HOT STANDBY TO COLD SHUTDOWN

6.0 INSTRUCTION (Cont'd) INITIALS

NOTE: If the RCS is to be opened for maintenance, degassing must continue until the hydrogen concentration is <5cc/Kg.

6.2 Surveillance requirements prior to and during cooldown:

6.2.1 Determine the shutdown margin required using Surveillance Instruction S01-12.9-2, "Determination of Just Critical Rod Position and Reactor Shutdown margin." Record the required boron concentration _____ ppm, and quantity of boric acid required _____ gallons.

NOTE: The reactor shutdown will normally be >4% with all rods inserted. If the RCS is to be opened, a shutdown margin of >5% is required, if the head is to be removed, a shutdown margin of >10% is required.

6.2.2 Complete S01-12.8-10, "Containment Sphere and RCS Inspection" while in Mode 3. _____

6.2.3 If the cold shutdown is expected to last longer than 48 hours, perform S01-12.7-1, "Inservice Testing of Valves" during the cooldown. N/A if completed within the previous 92 days. _____

6.2.4 The Watch Engineer shall review S01-0-112, "Operating Surveillance Requirements Unit 1", Exhibit A, to determine what additional surveillance requirements need be completed between Modes 3 and 6. (More specifically the 12.7, 12.8 and 12.9 series Surveillance Instructions.) _____

6.2.5 Perform applicable section of S01-12.3-18, "Fire System Valve Alignment and Operability Check," when the containment is accessible.

6.2.6 Complete Check-Off List 5.3 of S01-12.3-6, "Safety Related Valve Alignment, for the Residual Heat Removal System."

NOTE: If necessary, prepare additional batches of boric acid to refill the boric acid storage tank using Operating Instruction S01-4-14, "Boric Acid Batching and Transfer."

PLANT SHUTDOWN FROM HOT STANDBY TO COLD SHUTDOWN

6.0 INSTRUCTION (Cont'd) INITIALS

CAUTION Maintain a level of >64% in the boric acid storage tank at all time when fuel is in the reactor.

6.3 Borate the RCS to the required shutdown valve using Step 6.3.2 or 6.3.3 as desired.

6.3.1 At least one (1) RCP is in operation and one shutdown group of control rods are withdrawn to 320 steps.

NOTE: RCP A and B must be used for spray flow for equalizing the boron concentrations.

NOTE: If the pressure level indication is $\geq 80\%$ of span, assign an operator to monitor RCS pressure until such time the OMS is in service.

6.3.2 Place the reactor makeup controls for automatic operation:

.1 Set FC-1102B, boric acid flow controller, to a boron concentration approximately equal to the value determined in Step 6.2.

.2 Place the Boric Acid Blend System mode selector switch to the AUTO makeup position.

NOTE: Primary makeup water flow may be set at a flow rate of 45 gpm to 90 gpm on YT-1102A. This controller is located behind the CONTROL BOARD in Rack-R-6.

.3 Place the boric acid blend device outlet to blend to the charging pump header.

.4 Depress the Boric Acid Blend System start pushbutton.

6.3.3 Borate using Boric Acid Transfer Pumps.

.1 Determine the change in the Boric Acid Tank level required based on the amount of boric acid to be added as determined in Step 6.2.

NOTE: One (1) percent of the Boric Acid Tank level is equivalent to 58 gallons of boric acid.

PLANT SHUTDOWN FROM HOT STANDBY TO COLD SHUTDOWN

6.0 INSTRUCTION (Cont'd) INITIALS

6.3 (Cont'd)

6.3.3.2 Start a boric acid transfer pump.

.3 Open CV-334, boric acid pump discharge to charging pumps.

.4 Monitor seal water injection temperature while borating.

NOTE: It may be necessary to stop the boric acid transfer pump and allow sealwater injection temperature to decrease and then re-start the boration.

.5 Verify boric acid flow on flow recorder FR-1102.

.6 Verify boric acid tank level is decreasing.

.7 Stop the boric acid transfer pump when the required volume of boric acid has been added to the RCS.

6.3.4 Verify the proper boron concentration at the blend device outlet, if used.

6.3.5 Periodically sample the following:

.1 Boron concentration of the RCS and pressurizer liquid.

.2 Dissolved hydrogen gas concentration.

6.3.6 Required RCS boron concentration is achieved and verified. Record boron concentration _____ ppm

W.E. Operator

6.4 RCS Cooldown to Hot Shutdown (Mode 4).

CAUTION: Do not exceed a cooldown rate as shown on the pressure temperature curve. Refer to Attachment 8.2.

CAUTION: If the cooldown rate exceeds 50°F/hr. the contraction of the RCS may exceed the automatic makeup capability.

PLANT SHUTDOWN FROM HOT STANDBY TO COLD SHUTDOWN

6.0	<u>INSTRUCTION</u>	(Cont'd)	<u>INITIALS</u>
	6.4	(Cont'd)	
	6.4.1	Switch off all the pressurizer heaters.	_____
	6.4.2	If TR-430, pressurizer temperature recorder, is not in service, pressurizer liquid and RCS liquid temperature and pressure readings will be taken every 30 minutes until Cold Shutdown condition is reached. Record the values on Attachment 8.1.	_____
	6.4.3	Place the steam dump controller PC-418A, on manual control and Steam Dump Mode Selector to Pressure Control Atmosphere-Condenser and slowly adjust the steam dump control to increase the dumping rate.	_____
		NOTE: Maintain steam dump to condenser only, if possible.	
		NOTE: Maintain steam generator levels at ~50% on narrow range recorder during cooldown. If a steam generator(s) feeding is uncovered (<26% narrow range level), feedwater flow shall be reduced to or maintained <150gpm to that steam generator(s) until level is >26%.	
	6.4.4	Start Pressurizer Cooldown and RCS Depressurization.	
		<u>CAUTION</u> Pressurizer cooldown rate of 195°F/hr. shall not be exceeded.	
		<u>CAUTION</u> The temperature difference between the pressurizer and RCS should not exceed a maximum of 200°F between TI-430C and TI-430B, or TR-402 depending on which RCP is in operation.	
	.1	Transfer the spray valves PC-430C and PC-430H to manual control.	_____
	.2	Slowly, open a spray valve on a loop with an operating RCP and maintain the RCS pressure within the limits specified in Attachment 8.2.	_____

PLANT SHUTDOWN FROM HOT STANDBY TO COLD SHUTDOWN

6.0 INSTRUCTION (Cont'd) INITIALS

6.4 (Cont'd)

6.4.4.2 (Cont'd)

NOTE: The spray flow must be controlled to limit the rate of pressurizer cooldown to 195°F.

NOTE: Use spray valve PC-430C, if RCP B is to be used for cooldown.

6.4.4.3 Stop all RCP's, except RCP B, to reduce the heating of the RCS.

NOTE: RCP B must be operated for spray flow. If RCP B is not available, RCP's A and C will be used.

6.4.5 Manually block the safety injection actuation circuit when the ALERT BLOCK AUTO INJECTION alarm is received, or when the RCS pressure is ~ 1800 psig.

6.4.6 As Cooldown progresses, attempt to maintain the pressurizer level at ~90% of span.

CAUTION: Do not collapse the bubble at this time.

NOTE: An operator must be assigned to monitor the RCS pressure with the pressurizer level >80% of span.

NOTE: The high pressurizer level promotes better cooling of the metal in the upper steam space.

6.4.7 As the letdown flow decreases, open additional letdown orifices to maintain the desired letdown flow.

NOTE: Letdown flow may be varied as required by system operating conditions.

6.4.8 Continue to cooldown by periodically resetting the steam dump controller, PC-418A.

PLANT SHUTDOWN FROM HOT STANDBY TO COLD SHUTDOWN

6.0 INSTRUCTION (Cont'd) INITIALS

6.4 (Cont'd)

6.4.9 When ALL of the following conditions listed below are met, open CV-276, RCP No.1 Seal bypass valve (Reference 2.2):

NOTE: If the conditions are not met at this time, continue to monitor during the remainder of the cooldown or until the pumps have been stopped.

6.4.9.1 Either the RCP pump bearing temperature or the No. 1 seal leakoff temperature approaches its alarm level.

NOTE: RCP bearing temperatures may be monitored on TRC-446, points #13(RCP C), #14 (RCP A) and #15 (RCP B). The high reactor coolant water bearing temperature limit is 175°F. When 175°F is reached, RC pump BEARING HI ALARM will actuate.

NOTE: The seal water return high temperature limit is 205°F. When 205°F is reached, SEAL WATER RETURN HI TEMPERATURE ALARM will actuate.

.2 RCS pressure is <1000 psig. _____

.3 RCP No. 1 seal leakoff valve is open. _____

.4 RCP No. 1 seal leakoff flowrate is < one (1) gpm. _____

.5 Seal injection flow rate to each pump(s) is >6 gpm. _____

6.4.10 Before RCS pressure decreases below 500 psig, establish two (2) positive barriers between the feedwater and RCS. Refer to Operating Instruction SO1-4-17, "Safety Injection System Operation."

W.E. Operator

PLANT SHUTDOWN FROM HOT STANDBY TO COLD SHUTDOWN

6.0	<u>INSTRUCTION</u>	(Cont'd)	<u>INITIALS</u>
6.4	(Cont'd)		
6.4.11	When the RCS pressure decreases to 400 psig, place the Over Pressurization Mitigation System (OMS) in operation by placing PORV CV-545 and PORV CV-546 OMS Lo Press Setpoint to the ENABLE position.		_____
	NOTE:	An Operator is not required to monitor RCS pressure, if the OMS is operational.	
6.4.12	If RCS cooldown is to progress to Cold Shutdown, start to align the RHR System per SO1-4-9, "Placing the Residual Heat Removal System in Service."		_____
6.4.13	When condenser vacuum is no longer required:		
	.1	Open the condenser vacuum breaker.	_____
	.2	Stop the condenser vacuum pumps and/or secure steam to the air ejectors.	_____
6.4.13.3	Stop both the gland seal condenser exhausters blowers.		_____
	.4	When the condenser is at atmospheric pressure, secure steam to the turbine gland seal system.	_____
6.5	RCS Cooldown to Cold Shutdown (Mode 5)		
	NOTE:	If going to Refueling conditions (Mode 6), an RCS boron concentration of >2900 ppm is required.	
6.5.1	When RCS is at ~350 psig and 350°F;		
	.1	Place the RHR System in service per SO1-4-9, "Placing the Residual Heat Removal System in Service."	
	CAUTION:	On loss of one (1) saltwater cooling pump, immediately reduce cooldown rate while monitoring component cooling water temperature.	

PLANT SHUTDOWN FROM HOT STANDBY TO COLD SHUTDOWN

6.0 INSTRUCTION (Cont'd) INITIALS

6.5 (Cont'd)

6.5.1.1 (continued)

CAUTION: To provide relief paths to
RV-206 and normal letdown by
PCV-1105, do not close MOV-813,
MOV- 814, LCV-1112, CV-202, CV-203,
CV-204, MOV-834 and MOV-833.

NOTE: At the completion of plant cooldown,
the reactor coolant pump shall be run
until the reactor coolant system and
steam generator metal temperatures
have equalized with the RCS liquid
temperatures.

.2 Place Auto Auxiliary Feedwater System in
manual depressing Auxiliary Feedwater
System Mode MANUAL for Train A and B.

6.5.2 When the R.C.S. temperature is $<200^{\circ}\text{F}$,
close the Containment Spray Header
Manual isolation valve, 6-1500-444.

NOTE: Containment Spray is blocked
to prevent spraying the contain-
ment due to an inadvertant
initiation.

6.5.3 When the main steam pressure reaches
approximately atmospheric:

.1 Apply a nitrogen blanket to the main steam
lines.

NOTE: The above step is not required,
if it is certain that personnel
entry into the steam generator
secondary side is to be made or
upon direction of the Watch
Engineer.

.2 Close the trap free blow valves as required.

PLANT SHUTDOWN FROM HOT STANDBY TO COLD SHUTDOWN

6.0	<u>INSTRUCTION</u>	(Cont'd)	<u>INITIALS</u>
6.5	(Cont'd)		
6.5.4	Start to raise the water level in the steam generators to ~120% of indicated level (narrow range).		_____
	NOTE:	As the steam generator levels increase, measure the rate of change to calculate the time to reach ~120% level.	
6.5.5	When the final or desired RCS temperature is reached:		
	.1	Stop the last RCP(s).	_____
	.2	Place Yellow Caution Tags at each RCP control switch indicating the RCS temperature at the time the last RCP was stopped.	_____
	.3	Open CV-305, auxiliary spray valve.	_____
	.4	Close CV-304, charging line isolation.	_____
	.5	Close CV-430C and CV-430H, pressurizer spray valves.	_____
6.5.6	Continue to circulate through the auxiliary spray line until the pressurizer temperature is approximately equal to RCS temperature as indicated by TI-430A		_____
6.5.7	Maintain RCS pressure as follows:		
	.1	Manually adjust FC-1112 to obtain a set charging flow.	
	.2	Control the RCS pressure at ~350 psig with PC-1105, letdown pressure controller.	
6.6	Secure equipment as operating conditions dictate, or as directed by the Watch Engineer.		
6.7	Complete S01-12.6-1, "Fire System Valve Cycling Exercise," Section 1.14 for the sphere fire spray system if not completed within the previous 12 months. N/A if done within the previous 12 months.		_____

PLANT SHUTDOWN FROM HOT STANDBY TO COLD SHUTDOWN

6.0 INSTRUCTION (Cont'd) INITIALS

6.8 Complete SO1-12.3-18, "Fire System Valve Alignment And Operability Check" if not completed within the previous thirty one (31) days. N/A if performed within the previous thirty one (31) days.

COMPLETED BY: _____

REVIEWED BY: _____
Watch Engineer

7.0 RECORDS

7.1 This instruction and its attachments shall be filed in the Outage Package.

8.0 ATTACHMENTS

8.1 Pressurizer and RCS Pressure - Temperature Readings. (1 page).

8.2 RCS Cooldown Limitations. (1 page)


H. E. MORGAN
OPERATIONS MANAGER

GH:64g:sss

PRESSURIZER AND RCS PRESSURE - TEMPERATURE READINGS

($\frac{1}{2}$ HR. INTERVALS)

Date _____

Time	Press. Temp.	R.C.S. Temp.	R.C.S. Press.	Time	Press. Temp.	R.C.S. Temp.	R.C.S. Press.	Time	Press. Temp.	R.C.S. Temp.	R.C.S. Press.

Reviewed by _____ (Watch Engineer)

RCS COOLDOWN LIMITATIONS

