PLANT SHUTDOWN FROM HOT STANDBY TO COLD SHUTDOWN

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4.2 One shutdown group of control rods must be 320 steps withdrawn whenever positive reactivity is being inserted by boron dilution, xenon decay or cooldown.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.

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) feedring 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%.

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." _____

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

PLANT SHUTDOWN FROM HOT STANDBY TO COLD SHUTDOWN

INITIALS

6.0 INSTRUCTION (Cont'd)

6.2 Surveillance requirements prior to and during cooldown:

6.2.1 Determine the shutdown margin required using Surveillance Instruction SO1-12.9-2, "Determination of Just Critical Rod Position and Reactor Shutdown margin." Record the required boron concentration_____ppm, and quanity 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 SO1-12.8-10,"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 SO1-12.7-1, "Inservice Testing of Valves" during the cooldown. N/A if completed within the previous 92 days. _____

6.2.4 The Watch Engineer shall review SO1-0-112," 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 SO1-12.3-18, "Fire System Valve Alignment and Operability Check," when the containment is accessible.

6.2.6 Complete Check-Off List 5.3 of SO1-12.3-6, "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 SO1-4-14, "Boric Acid Batching and Transfer."

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

PLANT SHUTDOWN FROM HOT STANDBY TO COLD SHUTDOWN

6.0 INSTRUCTION (Cont'd) INITIALS

6.3 Borate the RCS to the required shutdown value 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 ≥ 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

6.3.3.2 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 beed 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.

6.4.1 Switch off all the pressurizer heaters. _____

PLANT SHUTDOWN FROM HOT STANDBY TO COLD SHUTDOWN

6.0 INSTRUCTION (Cont'd) INITIALS

6.4.2 If TR-430, pressurizer temperature recorder, is not in 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) feed-ring 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%.

6.4.4 Start Pressurizer Cooldown and RCS Depressurization.

CAUTION: Pressurizer cooldown rate of 195°F/hr. shall not be exceeded.

CAUTION: 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. _____

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.

PLANT SHUTDOWN FROM HOT STANDBY TO COLD SHUTDOWN

6.0 INSTRUCTION (Cont'd)

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 ~ 1750 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. _____

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.

PLANT SHUTDOWN FROM HOT STANDBY TO COLD SHUTDOWN

6.0 INSTRUCTION (Cont'd) INITIALS

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

6.4.11 When the RCS pressure decreases to 400 psig, place the 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. _____

PLANT SHUTDOWN FROM HOT STANDBY TO COLD SHUTDOWN

6.0 INSTRUCTION (Cont'd) INITIALS

6.4.13.3 Stop both the gland seal condenser exhauster 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.

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 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.

PLANT SHUTDOWN FROM HOT STANDBY TO COLD SHUTDOWN

6.0 INSTRUCTION (Cont'd) INITIALS

6.5.2.2 Close the trap free blow valves as required. _____

6.5.3 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.

6.5.4 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. _____

6.5.5 Continue to circulate through the auxiliary spray line until the pressurizer temperature is approximately equal to RCS temperature as indicated by TI-430A _____

6.5.6 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 SO1-12.6-1, "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. _____

COMPLETED BY: _____

REVIEWED BY: _____
Watch Engineer

PLANT SHUTDOWN FROM HOT STANDBY TO COLD SHUTDOWN

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.

8.2 RCS Cooldown Limitations.

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APR 24 1981

OPERATING INSTRUCTION #SO1-3-5
REVISION 0
ATTACHMENT 8.1

PRESSURIZER AND RCS PRESSURE - TEMPERATURE READINGS

(½ 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)

(FILE IN OUTAGE PACKAGE)

RCS COOLDOWN LIMITATIONS