

FOR INFORMATION ONLY

CAROLINA POWER AND LIGHT COMPANY

H. B. ROBINSON SEG PLANT

PLANT OPERATING MANUAL

VOLUME 3

PART 4

END PATH PROCEDURE

EPP-8

POST LOCA COOLDOWN AND DEPRESSURIZATION

REVISION 6

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1.0 PURPOSE

This procedure provides actions to cooldown and depressurize the RCS to cold shutdown conditions following a loss of reactor coolant inventory.

2.0 ENTRY CONDITIONS

Path-1, when RCS pressure is greater than the shutoff head of the RHR Pumps.

STEP

INSTRUCTIONS

RESPONSE NOT OBTAINED

1. Open Foldout B
- * 2 IF RWST Level Decreases To Less Than 27%, THEN Align The SI System For Cold Leg Recirculation Using EPP-9, Transfer To Cold Leg Recirculation

STEP

INSTRUCTIONS

RESPONSE NOT OBTAINED

CAUTION

A loss of DC power may occur if the DC busses are at maximum load and the battery chargers are not restarted within 60 minutes of a loss of all AC power.

NOTE

Equipment electrical loads are provided in Supplement F.

3. Check Power Source for AC BUSES

a. All AC BUSES - ENERGIZED BY
OFFSITE POWER

a. Implement the following
actions for any emergency bus
NOT energized by offsite
power:

1) Verify EDG has started.

2) Verify EDG has loaded
required equipment:

- MDAFW Pumps
- CCW Pumps
- SW Pumps
- SW Booster Pumps

(CONTINUED NEXT PAGE)

STEP

INSTRUCTIONS

RESPONSE NOT OBTAINED

3. (CONTINUED)

3) Verify EDG capacity to accept additional 360 KW AND load the following equipment on the EDG:

- Charging Pumps
- Instrument air compressors.
- Battery chargers, using OP-601, DC Supply System, while continuing with this procedure.
- Energize 150 KW of PZR heaters, if needed, using EPP-21, Energizing Pressurizer Heaters From Emergency Busses, while continuing with this procedure.

4) Verify TURNING GEAR AND SEAL OIL BACKUP PUMPS running.

IF turning gear and seal oil backup pumps NOT running, THEN verify EMERG OIL PUMP running AND locally verify AIR SIDE SEAL OIL BACKUP PUMP running.

(CONTINUED NEXT PAGE)

STEP

INSTRUCTIONS

RESPONSE NOT OBTAINED

3. (CONTINUED)

5) Determine the cause of the loss of offsite power.

IF due to a failure within the plant, THEN restore power using OP-603, Electrical Distribution, after repairs are completed.

IF due to a failure of the startup transformer or switchyard, THEN request Load Dispatcher to have substation maintenance crews restore power from either the main or spare startup transformer.

IF due to a loss of the grid, THEN request power from the IC turbines and Unit One as they become available.

* 4 Check If RHR Pumps Should Be Stopped:

a. Check RCS pressure:

1) Pressure - GREATER THAN 225 PSIG [475 PSIG]

2) Pressure - STABLE OR INCREASING

b. Stop RHR PUMPS

c. IF RCS pressure decreases below 225 psig [475 psig], THEN restart the RHR Pumps

a. Go To Step 5.

STEP

INSTRUCTIONS

RESPONSE NOT OBTAINED

5. Check Charging Pump Status:

a. E-1 AND E-2 - ENERGIZED BY
OFFSITE POWER

a. Check EDG capacity for
additional 120 KW for each
charging pump to be run.

IF EDG capacity NOT
available, THEN determine
which Supplement F loads may
be shed to provide EDG
capacity AND shed those loads.

b. CHARGING PUMPS - AT LEAST ONE
RUNNING

b. Perform the following:

1) IF RCP THERM BAR COOL WTR
HI OR LO FLOW alarms
illuminated, THEN locally
isolate seal injection by
closing the following:

- CVC-297A
- CVC-297B
- CVC-297C

2) Start at least one
charging pump.

c. Align charging pump suction
to RWST:

1) LCV-115B, EMERG MU TO CHG
SUCT - OPEN

2) LCV-115C, VCT OUTLET -
CLOSED

1) Locally open CVC-358, RWST
to charging pump suction.

2) Locally close valve.

d. Verify charging flow on
FI-122A

e. Verify seal injection flow
between 6 and 8 gpm per RCP

STEP

INSTRUCTIONS

RESPONSE NOT OBTAINED

CAUTION

Alternate water source for AFW pumps will be necessary if CST level decreases to less than 10%.

6. Check Intact S/G Levels:

a. S/G levels - GREATER THAN 10%
[24%]

a. Maintain total feed flow greater than 300 gpm OR 0.2x10⁶ pph until level greater than 10% [24%] in at least one S/G.

b. Control feed flow to maintain S/G levels between 10% [24%] and 50%

b. IF level in any intact S/G continues to increase in an uncontrolled manner, THEN Go To Path-2, Entry Point J.

* 7 Contact Chemistry To Obtain Periodic Boron Samples:

a. Sample RCS

b. Sample PZR

c. WHEN boron concentration is determined by Chemistry, THEN verify cold shutdown conditions

* 8 WHEN PZR Pressure Decreases To Less Than 2000 PSIG, THEN Block PZR PRESS/HI STM LINE DP SAFETY INJECTION

9. Initiate RCS Cooldown To Cold Shutdown:

a. Maintain cooldown rate in RCS cold legs - LESS THAN 100°F IN LAST 60 MINUTES

b. Use RHR system if in service

c. Dump steam to condenser from intact S/Gs

c. Dump steam with STEAM LINE PORVs.

STEP

INSTRUCTIONS

RESPONSE NOT OBTAINED

10. Check RCS Subcooling - GREATER THAN 25°F [40°F]

Operate SI Pumps to increase subcooling.

Go To Step 20.

11. Check SI PUMPS - ANY RUNNING

Go To Step 16.

12. Control PZR Heaters To Maintain RCS Pressure And Subcooling

CAUTION

The upper head region may void during RCS depressurization. This will result in a rapidly increasing PZR level.

- *13 Depressurize RCS To Refill PZR:

- a. PZR level - GREATER THAN 21% [44%]

- a. Go To Step 13.c.

- b. Go To Step 14

- c. Depressurize RCS Using PZR normal spray

- c. Use one PZR PORV.

IF no PZR PORV available,
THEN use auxiliary spray.

- d. PZR level - GREATER THAN 21% [44%]

- d. WHEN level greater than 21% [44%], THEN perform Step 13.e.

Go To Step 14.

- e. Stop RCS depressurization

STEP

INSTRUCTIONS

RESPONSE NOT OBTAINED

14. Check If An RCP Should Be Started:

a. RCPs - ALL STOPPED

a. Stop all but one RCP.

Go To Step 15.

b. RCS subcooling - GREATER THAN 25°F [40°F]

b. Operate SI Pumps to increase subcooling.

Go To Step 20.

c. PZR level - GREATER THAN 21% [44%]

c. Observe CAUTION prior to Step 13 AND Go To Step 13.

d. Check RCP Seal cooling - PREVIOUSLY LOST

d. Go To Step 14.f.

e. Do not start RCP. Contact TSC for RCP seal status evaluation

Go To Step 15

f. Try to start one RCP:

1) Run RCPs in the priority order of C, B, A to provide PZR spray

2) Establish conditions for starting RCPs AND start one RCP using OP-101, Reactor Coolant System And Reactor Coolant Pump Startup And Operation, while continuing with this procedure

STEP

INSTRUCTIONS

RESPONSE NOT OBTAINED

CAUTION

After stopping any high head SI Pump, RCS pressure should be allowed to stabilize or increase before stopping another pump.

15. Check If One SI Pump Should Be Stopped:

a. Any SI PUMPs - RUNNING

a. IF RHR PUMP running in SI mode, THEN Go To Step 20.

IF NOT, THEN Go To Step 16.

b. Determine required RCS subcooling from table:

CHARGING PUMP STATUS	ANY RCP RUNNING		NO RCP RUNNING	
	ONE SI PUMP RUNNING	TWO SI PUMPS RUNNING	ONE SI PUMP RUNNING	TWO SI PUMPS RUNNING
NONE RUNNING	Do <u>NOT</u> stop SI pump	58°F [80°F]	Do <u>NOT</u> stop SI pump	70°F [89°F]
ONE RUNNING	284°F [337°F]	54°F [76°F]	284°F [335°F]	65°F [84°F]
TWO RUNNING	230°F [262°F]	51°F [72°F]	243°F [266°F]	61°F [80°F]
THREE RUNNING	182°F [213°F]	49°F [69°F]	204°F [230°F]	58°F [77°F]

c. RCS subcooling - GREATER THAN REQUIRED SUBCOOLING

c. IF RCS hot leg temperatures greater than 330°F [315°F], THEN Go To Step 20.

IF RCS hot leg temperatures less than 330°F [315°F], THEN start one RHR PUMP if none running. Go To Step 15.d.

IF at least one RHR PUMP can NOT be started, THEN Go To Step 20.

d. PZR level - GREATER THAN 21% [44%]

d. DO NOT STOP SI PUMP. Observe CAUTION prior to Step 13 AND Go To Step 13.

e. Stop one SI PUMP

f. Go To Step 15.a

STEP

INSTRUCTIONS

RESPONSE NOT OBTAINED

16. Check If Charging Flow Should Be Controlled To Maintain PZR Level:

a. Check RHR Pumps - ANY RUNNING
IN SI MODE

a. Go To Step 16.c.

b. Go To Step 20

c. Control charging flow to
maintain PZR level

STEP

INSTRUCTIONS

RESPONSE NOT OBTAINED

17. Check RCP Status:

a. RCPs - AT LEAST ONE RUNNING

a. Start one RCP:

- 1) IF RCP seal cooling previously lost, THEN evaluate status prior to starting affected RCP.
- 2) Run RCPs in the priority order of C, B, A to provide PZR spray
- 3) Establish conditions for starting RCPs AND start one RCP using OP-101, Reactor Coolant System and Reactor Coolant Pump Startup and Operation, while continuing with this procedure.
- 4) IF one RCP can NOT be started, THEN verify natural circulation:
 - Steam pressure - STABLE OR DECREASING
 - RCS subcooling - GREATER THAN 25°F
 - Core exit T/Cs - STABLE OR DECREASING
 - RCS hot leg temperatures - STABLE OR DECREASING
 - RCS cold leg temperatures - TRENDING TO SATURATION TEMPERATURE FOR STEAM PRESSURE

IF natural circulation NOT verified, THEN increase dumping steam.

b. Stop all but one RCP

STEP

INSTRUCTIONS

RESPONSE NOT OBTAINED

CAUTION

The upper head region may void during RCS depressurization. This will result in a rapidly increasing PZR level.

18. Depressurize RCS To Minimize RCS Leakage:

a. Use PZR normal spray

a. Use one PZR PORV.

IF no PZR PORV available,
THEN use auxiliary spray.

b. Turn on PZR heaters as required to heat insurge to saturation

c. Depressurize RCS until EITHER of the following conditions are satisfied:

- PZR level - GREATER THAN 72% [64%]

OR

- RCS subcooling - LESS THAN 35°F [50°F]

*19 Contact Chemistry To Obtain Periodic Boron Samples:

a. Sample RCS

b. Sample PZR

c. WHEN boron concentration is determined by Chemistry, THEN verify cold shutdown conditions

STEP

INSTRUCTIONS

RESPONSE NOT OBTAINED

20. Check SI Flow Not Required:

a. RCS subcooling - GREATER THAN 25°F [40°F]

a. Operate SI pumps to increase subcooling.

Go To Step 21.

b. PZR level - GREATER THAN 10% [30%]

b. Operate SI pumps to increase PZR level. Observe CAUTION prior to Step 13 AND Go To Step 13.

21. Check If Accumulators Should Be Isolated:

a. RCS subcooling - GREATER THAN 25°F [40°F]

a. IF at least two RCS hot leg temperatures less than 375°F, THEN Go To Step 22.

IF NOT, THEN observe CAUTION prior to Step 23 AND Go To Step 23.

b. PZR level - GREATER THAN 10% [30%]

b. Observe CAUTION prior to Step 13 AND Go To Step 13.

22. Isolate Accumulators:

a. Locally close breakers to ACCUMULATOR DISCHs

b. Close ACCUMULATOR DISCHs:

- SI-865A
- SI-865B
- SI-865C

b. Vent any unisolated accumulators:

1) Open the appropriate isolation valves:

- SI-853A
- SI-853B
- SI-853C

2) Open HIC-936, ACC VENT HDR FLOW.

STEP

INSTRUCTIONS

RESPONSE NOT OBTAINED

***23 Check If EDGs Should Be Stopped:**

- a. E-1 AND E-2 busses -
ENERGIZED BY OFFSITE POWER

- a. Perform the following:

1) IF offsite power is restored to either E-1 OR E-2 busses, THEN Go To Step 23.b AND implement actions for the unloaded EDG.

2) IF offsite power is NOT restored to either E-1 OR E-2 busses, THEN Go To Step 24.

- b. EDGs starting air low press annunciators - EXTINGUISHED:

- b. WHEN starting air receivers are repressurized, THEN stop the unloaded EDGs.

- APP-010-B2, EDG A START AIR LO PRESS

Go To Step 24.

- APP-010-B3, EDG B START AIR LO PRESS

- c. Stop the unloaded EDGs

24. Check RCP Cooling:

Establish normal cooling to RCPs using EPP-23, Restoration Of Cooling Water Flow To Reactor Coolant Pumps, while continuing with this procedure.

- APP-001-A1, RCP BRG COOL WTR HI TEMP annunciator - EXTINGUISHED
- APP-001-E1, RCP THERM BAR COOL WTR HI TEMP annunciator - EXTINGUISHED
- APP-001-F2, RCP SEAL WTR LO Δ P annunciator - EXTINGUISHED

STEP

INSTRUCTIONS

RESPONSE NOT OBTAINED

25. Establish RCP Seal Water Return Flow:

a. CVC-381, SEAL WTR RTRN ISO - CLOSED

a. Go To Step 26.

b. VOLUME CONTROL TANK PRESS - BETWEEN 15 PSIG AND 65 PSIG

b. Go To Step 26.

c. Charging pump suction - ALIGNED TO VCT

c. Go To Step 26.

1) LCV-115B, EMERG MU TO CHG SUCT - CLOSED

2) LCV-115C, VCT OUTLET - OPEN

d. VOLUME CONTROL TANK LEVEL - CONTROLLED BY LCV-115A CLOSED OR MODULATING

d. Go To Step 26.

e. CCW Pump - AT LEAST ONE RUNNING

e. Go To Step 26.

f. Open CVC-381, SEAL WTR RTRN ISO

*26 Check If Source Range Detectors Should Be Energized:

a. Check intermediate range flux - LESS THAN 10^{-10} AMPSa. WHEN flux less than 10^{-10} amps, THEN perform Steps 26.b and 26.c.

Go To Step 27.

b. Check source range detectors - ENERGIZED

b. Energize source range detectors by depressing both PERMISSIVE P-6 DEFEAT pushbuttons.

c. Transfer one pen on NR 45 to desired source range channel

STEP

INSTRUCTIONS

RESPONSE NOT OBTAINED

27. Shutdown Unnecessary Plant Equipment

- a. IF the following equipment is not necessary for plant operation, THEN it may be shutdown:

- Heater Drain Pumps
- Condensate Pumps
- Feedwater Pumps
- AFW Pumps
- SW Pumps
- SW Booster Pumps

- b. Shutdown additional equipment as directed by the Shift Supervisor OR SCO

28. Check RCP Status - ANY RUNNING

Go To Step 30.

29. Check If RCPs Must Be Stopped:

- a. Check the following:

a. Go To Step 30.

- APP-001-E2, RCP #1 SEAL
LEAKOFF LO FLOW -
ILLUMINATED

OR

- APP-001-F2, RCP SEAL WTR
LO Δ P - ILLUMINATED

- b. Stop affected RCPs

STEP

INSTRUCTIONS

RESPONSE NOT OBTAINED

*30 Check If AC Control Power To SI System Valves Should Be Restored:

a. RCS pressure - LESS THAN 1000 PSIG

a. WHEN RCS pressure is less than 1000 psig, THEN perform Steps 30.b, 30.c and 30.d.

Go To Step 31.

b. Energize AC control power for the following valves:

- SI-862A & B
- SI-863A & B
- SI-864A & B
- SI-866A & B
- SI-869

c. Locally close the breakers for the following valves:

- SI-865A
- SI-865B
- SI-865C
- SI-878A
- SI-878B

d. Close ACCUMULATOR DISCHs:

- SI-865A
- SI-865B
- SI-865C

d. Vent any unisolated accumulators:

1) Open the appropriate isolation valves:

- SI-853A
- SI-853B
- SI-853C

2) Open HIC-936, ACC VENT HDR FLOW.

STEP

INSTRUCTIONS

RESPONSE NOT OBTAINED

*31 Check If LTOP Can Be Placed In Service:

a. RCS temperature - LESS THAN 360°F

b. RCS pressure - LESS THAN 375 PSIG

a. Go To Step 34.

b. Perform the following:

1) Stop cooldown.

2) Depressurize RCS to less than 375 psig using PZR normal spray.

IF normal spray NOT available AND letdown in service, THEN use auxiliary spray.

IF NOT, THEN use one PZR PORV.

3) WHEN RCS pressure less than 375 psig, THEN Go To Step 31.c.

c. Place OVERPRESSURE PROTECTION in service as follows:

1) Place PZR PORV switches to AUTO

- PCV-455C

- PCV-456

2) Place PZR PORV key operated switches to LOW PRESSURE

- PCV-455C

- PCV-456

STEP

INSTRUCTIONS

RESPONSE NOT OBTAINED

32. Continue RCS Cooldown To Cold Shutdown:

a. Maintain cooldown rate in RCS cold legs - LESS THAN 100°F IN LAST 60 MINUTES

b. Dump steam to condenser from intact S/Gs

b. Dump steam with STEAM LINE PORVs.

33. Check If RHR System Can Be Placed In Service:

a. RCS temperature - LESS THAN 350°F [315°F]

a. Go To Step 34.

b. RCS pressure - LESS THAN 375 PSIG [250 PSIG]

b. Go To Step 34.

c. Check SI PUMPS - ALL STOPPED

c. Go To Step 34.

d. Perform the following:

1) Locally rack out the following breakers:

- SI Pump A Breaker
- SI Pump B Breaker
- SI Pump C Breaker

2) Locally open the following breakers:

- SI-865A Breaker
- SI-865B Breaker
- SI-865C Breaker

e. Consult Plant Operations Staff to determine if RHR system should be placed in service

STEP

INSTRUCTIONS

RESPONSE NOT OBTAINED

34. Check Containment Hydrogen Concentration:

a. Obtain a hydrogen concentration measurement from PI-8101-1, CHANNEL I H₂ ANALYZER OR PI-8111-2, CHANNEL II H₂ ANALYZER

b. Hydrogen concentration - LESS THAN 6.0%

c. Hydrogen concentration - LESS THAN 0.5%

35. Check RCS Temperature - LESS THAN 200°F

36. Evaluate Long Term Plant Status:

a. Maintain cold shutdown conditions

b. Consult Plant Operations Staff

b. Consult Plant Operations Staff for additional recovery actions.

Go To Step 35.

c. Place the hydrogen recombiner in service.

Go To Step 4.

- END -