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DGP 2-1
Revision 8
February 1979

UNIT 2/3 NORMAL UNIT SHUTDOWN

8005080531

A. PURPOSE

The purpose of this procedure is to outline the steps necessary to shutdown the unit from a power/generator mode to a shutdown cooling mode.

B. REFERENCES

1. DOA 201-4, Loss of Temperature Recorders During Heatup or Cooldown.
2. DOP 600-4, Removing the Main Feedwater Regulator from Service.
3. DOP 700-1, Source Range Monitor Operation (SRM).
4. DOP 700-2, Intermediate Range Monitor Operation (IRM).
5. DOP 1000-1, Fill and Vent Shutdown Reactor Cooling System.
6. DOP 1000-3, Shutdown Cooling Mode of Operation.
7. DOP 1200-2, Reactor Water Cleanup System Operation and Shutdown.
8. DOP 3200-5, Reactor Feed Pump Shutdown.
9. DOP 5400 series, Off-Gas System.
10. DOP 5600-2, Gland Seal System.
11. DGP 3-2, Normal Control Room Inspection.
12. DOP 5670-1, Economics Generation Control (E.G.C.) Settings.

C. PREREQUISITES

	INITIAL
1. Permission has been obtained from the load dispatcher to shutdown the unit.	_____
2. The Rod Worth Minimizer is operational or a qualified person is available to verify rod movements in accordance with the rod sequence chosen prior to reactor power reaching 20%.	_____
3. If required, fill and vent shutdown cooling system prior to reaching 350°F in accordance with DOP 1000-1.	_____

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D. PROCEDURE INITIAL

1. If reactor recirculation flow controller is in EGC or Master Automatic Mode, shift controller to Master Manual. _____

2. With the reactor recirculation flow controller in master manual, decrease reactor recirculation pump speed to minimum (28%). Recirculation pumps may be decreased to minimum speed (28%) in master automatic mode with load select button on panel 902-7 (903-7).

   a. Continuously monitor power decrease on APRMs.

   b. Maintain load set point ≈ 10% above generator output.

   c. On EGC module on 902-5 (903-5) maintain settings in accordance with DOP 5670-1.

3. As condensate demineralizer differential pressure decreases, isolate units one at a time to maintain 20-40 psid across operating demineralizers.

4. Insert control rods in the selected rod sequence.

5. At approximately 4 X 10^6 lbm/hr total feedwater flow (≈40% power) remove second RFP from service in accordance with DOP 3200-5. _____

CAUTION

Maintain condensate/booster pump amps between 150 amps (min.) and 255 amps (max.) utilizing the min. flow line when necessary. However, 3D condensate/booster pump motor must be maintained > 170 amps to prevent excessive axial vibration during low flow conditions (new impeller design).

6. Remove third condensate/booster pump from service. _____

   a. Verify reactor feed pump suction pressure >350 psig. _____

   b. Place condensate/booster pump standby select switch to OFF. _____

   c. STOP one condensate/booster pump. _____

   d. Put condensate/booster pump on STANDBY with the condensate/booster pump standby select switch when the condensate/booster pump discharge header pressure have stabilized.

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7. Continue inserting control rods in the selected rod sequence. _____

8. At 20% reactor power, verify the Rod Worth Minimizer (RWM) transition window is lit, the Position/Error message window is clear of errors, and the control rod positions are in accordance with the RWM sequence. If the above conditions cannot be met notify the Shift Engineer immediately. _____

9. Place final feedwater temperature, F-247, F-148, or F-249 (F-347, F-348, or F-349) and Recirc. loop temperature W-226, W-227, W-228 or W-229 (W-326, W-327, W-328 or W-329) on the computer trend recorder (record both points on one chart) utilize scale of 50°F to 550°F and log major events during startup, shutdown, etc. When transient condition is over remove chart and submit to surveillance engineer with appropriate checklist. _____

10. At a convenient time, below 200 MWe, remove feedwater heaters from service. _____

NOTE

Minimize the rate of change in final feedwater temp. whenever possible.

11. At approximately 2 X 10^6 lbm/hr feedwater flow. _____

    a. Observe that the recirculation loop A and B flow limit alarms annunciate.

    b. Verify the RWM Low Power Set Point (LLPSP) window is lit and the transition window is not lit, the Position/Error message window is clear of errors, and the control rod positions are in accordance with the RWM sequence. _____

12. Insert the IRM detectors in accordance with DOP 700-2.

13. Perform IRM/Average Power Range Monitor (APRM) overlap calibration check:

    a. This check is to be performed by the operator below 200 MWe and at the end of a rod group so that the control rod pattern will be symmetric.

    b. Place IRMs on scale 10 (1,000 MWt = 100%).

    c. Run OD-3 "Core Thermal Power and APRM Calibration" on the process computer.

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d. Calculate the IRM setting using the following equation:

$$\text{IRM Setting (\%)} = \frac{\text{Core Thermal Power (MWt)}}{1000\ \text{MWt}} \times 100\%$$

e. Give IRM setting to instrument mechanic (IM) for calibration and hold reactor power level constant until calibration is completed. _____

14. START the turbine bearing lift pumps, run for 10 minutes to check proper operation then STOP. _____

CAUTION

Do not start the turning gear motor during the performance of the next step.

15. Dispatch an operator to the turbine reservoir and check the auto start of:

a. Emergency Bearing Oil Pump (EBOP). _____

b. Motor Suction Pump (MSP). _____

c. Turning Gear Oil Pump (TGOP). _____

16. Transfer auxiliary power from TR 21(31) to TR 22(32) as follows:

a. Notify Load Dispatcher of power transfer.

CAUTION

Do not allow buses to be in parallel any longer than necessary. Failure to trip breaker immediately may result in a trip of both breaker from high circulating current.

b. Turn the synchroscope switch ON for TR 22(32) to Bus 21(31) breaker.

c. Check that TR 21(31) and TR 22(32) are synchronized and the voltage are equal.

(1) Depending upon conditions in the 345 KV and 138 KV system, they may not be in perfect synchronization on Unit 2.

d. Close TR 22(32) to Bus 21(31) breaker.

(1) Check for breaker closed indication.

(2) Check for parallel feed alarm.

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e. Open TR 21(31) to Bus 21(31) breaker.

(1) Check for breaker open indication.

(2) Reset parallel feed alarm.

f. Turn the synchroscope switch OFF for TR 22(32) to Bus 21(31).

g. Turn the synchroscope switch ON for TR 22(32) to Bus 21(31).

h. Check that TR 21(31) and TR 22(32) are synchronized and the voltages are equal.

(1) Depending upon conditions in the 345 KV and 138 KV system, they may not be in perfect synchronization on Unit 2.

l. CLOSE TR 22(32) to Bus 23(33) breaker.

(1) Check for breaker closed indication.

(2) Check for parallel feed alarm.

j. OPEN TR 21(31) to Bus 23(33) breaker.

(1) Check for breaker open indication.

(2) Reset parallel feed alarm.

k. Turn the synchoscope switch OFF for TR 22(32) to bus 23(33).

17. Continue inserting control rods in the selected rod sequence.

18. When the feedwater total flow is $\leq$ 10% rated transfer level control to the low flow control valve in accordance with DOP 600-4.

19. Request permission from the load dispatcher to separate the generator.

20. STOP inserting control rods when generator output is at 50 MWe.

21. Place the turbine supervisory instruments on HI speed and turbine RPM (T-246/T-346) on number three digital readout, if desired.

CAUTION

During the performance of the next steps if the OCB's do not trip within 30 seconds after reaching zero output, manually TRIP the generator output breakers.

22. START turbine bearing D.C. Emergency Oil Pump.

23. With the load set reduce generator output to 10 MWe and establish VAR's at zero.

24. TRIP the turbine with the remote trip button and verify the following:

    a. All stop and control valves close. _____

    b. All intercept valves close. _____

    c. The extraction check valves close and the AO extraction bypass valves open. _____

    d. Generator OCB's auto trip after 30 seconds time delay. _____

CAUTION

Opening the vacuum breaker at high RPMs (>1200) imposes excessive loads on the turbine last stage buckets. Do not open the vacuum breaker unless it is necessary to quickly reduce turbine RPM and do not lower the vacuum below 25 inches of Hg (no greater than 5 inches of Hg back pressure).

25. Notify the Load Dispatcher that the turbine is tripped and receive orders to OPEN the unit disconnects and reclose the 345 KV ring bus. Notify the Equipment Operator before closing the 345 KV OCBs.

26. Monitor turbine vibration and if vibration is excessive (>15 mills) through the critical speed range (1200 rpm) open the vacuum breaker to drop vacuum ≈ 2" which will slow turbine sufficiently.

27. Verify the Motor Suction Pump (MSP) and the Turning Gear Oil Pump (TGOP) automatically start as turbine lube oil pressure decreases to 20 psig.

28. Verify the turning gear motor starts and the turning gear engages as the turbine comes to rest. _____

30 Set the turbine oil cooler outlet temperature at 90°f.

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31. Press the vent pushbutton at the hydrogen panel to place the hydrogen system in a vent status.

32. OPEN turbine startup drain MO 3004A, B, C & D, and MO 3005 after turbine is tripped.

33. If main condenser is available as a heat sink and reactor is to be depressurized, OPEN main steam line drain valves MO 220-1, MO 220-2.

34. Observe the following cooldown limits:

    a. Reactor cooldown at less than 100°F per hour.

    b. Reactor vessel flange to shell differential temperature less than 140°F.

    c. Maintain vessel level between +20 and +40 inches to prevent relatively cool water from contacting the hot upper area of the vessel shell.

    d. Maintain the reactor vessel temperature above the applicable curve of Tech. Spec. Fig. 3.6.1 for the given reactor pressure.

35. If reactor cooling rate is too rapid, CLOSE MO 220-4 to stay within cooling limitations.

36. Insert control rods in the selected sequence.

37. When reactor power is between 5% to 10% transfer the reactor mode switch to STARTUP in accordance with DOP 700-2.

CAUTION

Transfer of mode switch to startup results in a reactor scram at $\geq$ 15% power.

38. Verify the Recirculation Loop Temperature Recorder and Vessel flange temperature recorder are operating as required by Tech. Specs. If not refer to DOA 201-4 to plot temperatures during cooldown.

39. Fully insert all control rods in selected sequence.
    a. Change range switches on IRMs as required to keep all channels on scale.

    b. Insert SRM detectors in accordance with DOP 700-1 before IRM readings decay to lowest range.

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40. Verify that all control rods are inserted and move the mode switch to refuel. The mode switch should be placed in shutdown if so directed by a Shift Supervisor or if this action is warranted in the opinion of the NSO. Placing the mode switch in shutdown should be avoided to prevent drive seal damage from a scram with all rods at zero. _____

41. START pressure reduction by opening No. 1 bypass valve slightly (10% to 15% on valve indication) with the bypass valve opening jack. Adjust bypass valve position as necessary to maintain cooldown rate. _____

    a. Maintain the EHC pressure regulator setpoint approximately 50 pounds greater than reactor pressure.

    b. Observe that the Channel A and B Main Steam Line Low Pressure alarm annunciates at ≈ 850 psig. _____

42. At approximately 700 psig OPEN the recombiner Off Gas Steam Jet Air Ejector pressure controller bypass valves.

    a. RM 2-3099-57 (2A).

    b. RM 2-3099-51 (2B).

43. At approximately 500 psig shutdown the rechar system per DOP 5400-7.

CAUTION

If reactor vessel flooding is to be conducted, ensure that reactor water temperature at approximately 450°F.

44. If flooding the reactor vessel is required, continue cooldown in accordance with DGP 2-2. If vessel is not to be flooded, proceed to step D.45.

45. At ≤ 300 psig shutdown the remaining reactor feed pump in accordance with DOP 3200-5 then shutdown a condensate pump as follows:
    a. Place condensate pump select switch in OFF.

    b. STOP the condensate pump. _____

46. Observe the vacuum decrease as the steam pressure to air ejector jet decreases. If the cooldown rate is too fast at this point, it may be necessary to start the mechanical vacuum pump and secure the SJAE.

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47. At approximately 250-300 psig OPEN the gland seal steam bypass valve to maintain gland steam seal pressure at 4.0 psig. _____

48. When reactor water temperature is below 350°F place the Shutdown Cooling System in operation in accordance with DOP 1000-3. _____

49. When steam pressure is too low to support air ejector operation and off gas flow approaches zero, shutdown the Off Gas System in accordance with appropriate DOP 5400 series procedures. Use mechanical vacuum pump to maintain vacuum if necessary. _____

50. As feedwater flow to the reactor decreases verify a condensate pump recirculation flow path is available and pump amps are maintained greater than 150. _____

51. At about 50 psig, shift RWCU system for recirculation pumps to auxillary pumps in accordance with DOP 1200-2. _____

52. When it is no longer possible to maintain steam seal pressure, OPEN condenser vacuum breaker to break vacuum. _____

53. Shutdown the gland seal steam in accordance with DOP 5600-2. _____

54. If required, CLOSE the MSIV's and verify the following valve lineup:

    a. MO 220-90A, B, C and D closed. _____

    b. MO 220-1, MO 220-2, MO 220-4 closed. _____

    c. MO 220-3 open. _____

55. Adjust diesel generator NORMAL-BYPASS key switch according to DOP 6600-8 when Rx temperature goes below 212°F. _____

56. The RPV head vent should only be opened at the direction of the Shift Engineer or Shift Foreman or when necessary to provide for personnel safety during work on the primary system. It should, under any circumstances, only be opened when both the Rx moderator temperature is $\leq$ 190°F and when the RPV in the area of the flange is < 190°F. If secondary containment is to be broken the RPV must be vented. _____

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NOTE

The reactor vessel shall be vented when the reactor vessel temperature is less than that shown in Curve C of Tech Spec Fig. 3.6.1.

57. Cooldown to the reactor vessel temperature specified by the Shift Engineer, but no lower than 105° F. _____

58. The vessel shell temperature immediately below the vessel flange must be maintained greater than 100°F until the reactor vessel head studs are detensioned. _____

59. Remove computer trend recorder points for feedwater temperature and recirc. loop temperature and submit chart trace to surveillance engineer. _____

Unit _____

Date/Time _____

Reviewed _____
Shift Engineer

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