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THREE MILE ISLAND NUCLEAR STATION
UNIT #2 PLANT EMERGENCY PROCEDURE #2202-2.5

Station Blackout With Loss of Both Diesel Generators

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Cognizant Dept. Head

Unit 2 Staff Recommends Approval

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Unit 1 PORC Recommends Approval

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Unit 2 PORC Recommends Approval

J. F. Colitz Date 9/22/78

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THREE MILE ISLAND NUCLEAR STATION
UNIT #2 PLANT EMERGENCY PROCEDURE #2202-2.5
Station Blackout with Loss of Both Diesel Generators

1.0 SYMPTOMS

1.1 Separation from the 230KV System and Turbine Generator trip as indicated by:

1.1.1 Zero volts on 230KV BUS voltmeter on the Electric Control Console Panel No. 6A.

1.1.2 Turbine Generator breakers open as indicated by alarms on Control Room Panel No. 18.

1.2 Failure of both Diesel Generators to energize the 4160v BUSES 2-1E, 2-3E, 2-2E, and 2-4E.

2.0 IMMEDIATE ACTION

2.1 Automatic Action

2.1.1 Reactor trips because of loss of voltage to the Control Rod Drive System.

2.1.2 Main Turbine Trips.

2.1.3 Control Room DC lighting is energized.

2.1.4 The turbine Driven Emergency Feedpump starts and commences to feed OTSG's through EF-V11A and B. I.C.S. controls OTSG Level at 50% in operating range.

2.1.5 Atmospheric Steam Dump valves, MS-V3A and B, control main steam pressure at 1010 psig. If pressure continues to increase the main steam reliefs will begin to open at 1050 psig.

CAUTION: If a primary to secondary leak is detected, immediately close the affected OTSG's atmospheric dump valve isolation valve (MS-V1A or 1B) to eliminate the potential of leakage and an unmonitored release path.

NOTE: The Atmospheric Dump valves will operate automatically only as long as the reserve air in the Instrument Air System is available, then the Atmospheric Dump valves must be operated manually.

NOTE: The Turbine Driven Emergency Feedpump Steam Pressure Regulator will only operate as long as the reserve air in the Instrument Air System and the Turbine Driven Emergency Feedpump Steam Pressure Regulator Accumulator (approximately 1 hour) is available, then the steam pressure regulator must be operated manually.

2.1.6 Turbine Generator DC Emergency Seal Oil Pump starts.

2.1.7 Turbine Generator DC Emergency Bearing Oil Pump starts.

2.1.8 The DC Emergency Bearing Oil Pump for the Main Feedpump Turbine starts.

2.1.9 The DC Oil Lift pumps for the RC pumps start.

2.1.10 Electromatic Relief will open if RCS pressure reaches 2255 psig.

2.1.11 Station batteries supply all five inverters.

3.0 MANUAL ACTION

3.1 Manually "CLOSE" the letdown block valve, MU-V376, and the seal return isolation valve MU-V377 to maintain water inventory in the primary system.

3.2 ENSURE the Diesel Generator Selector Switches are in "EMERGENCY STANDBY." The Diesel Generators should start and load automatically. If the Diesel Generators do not start automatically attempt to start them by depressing the start pushbutton on Panels No. 26 and

29. If either Diesel starts verify that the Diesel Generator Breaker closes automatically when frequency is up to 60 Hz and bus voltage is 4160V.

3.3 Verify:

3.3.1 The Turbine Driven Emergency Feedpump starts.

3.3.2 The following DC pumps start.

3.3.2.1 Turbine Generator DC Emergency Seal Oil Pumps.

3.3.2.2 Turbine Generator, DC Emergency Bearing. Oil Pump.

3.3.2.3 DC Emergency Bearing Oil pump for the Main Feedpump Turbine.

3.3.2.4 DC Oil Lift pumps for the RC pumps.

3.4 I.C.S. Maintaining an emergency high level of 50% on operating range in the OTSG's.

3.5 Atmospheric steam dump valves, MS-V3A and B, open when steam pressure reaches 1010 psig.

4.0 FOLLOW-UP ACTION

4.1 For Diesel start failure, check the following and take action as indicated:

4.1.1 Note alarm on Panesl No. 26 and 29 and follow procedure outlined in appropriate Alarm Response.

4.1.2 Observe annunciator panel window "OPERATING ENGINE ALARM RESET" to determine if the Shutdown Relay, SDR, is energized (If SDR is energized, window will alarm 29.C8, 29.C8).

4.1.3 Open engine mounted relay box door and determine if the Auxiliary Stopping Relay, SA, is energized. If energized, Tit will not protrude.

4.1.4 Depress the Reset pushbutton at the Diesel Generator.

4.1.4.1 If the SDR and 5A relays de-energize, correct the cause for the Diesel start failure and attempt to start the Diesel Generators.

4.1.4.2 If the SDR relay de-energizes and the 5A relay remains energized, check the 86 lockout at the 4160V Diesel Generator Breaker and in Diesel Generator Panels No. 308 and 309.

4.2 Attempt to correct problem and start the Diesel Generators.

CAUTION: If Diesel Generator(s) are restored to operation reset and manually open fuel oil pump suction valves. (These valves fail closed on loss of power)

4.3 Attempt to restore one 230KV line and BUS according to direction of the Dispatcher.

4.4 Control cooldown by natural circulation using the Turbine Driven Emergency Feedpump and EF-V11A and B to maintain 50% in operating range in OTSG's. Control cooldown rate by manual control of the Atmospheric Dump valves, MS-V3A and B.

CAUTION: Cooldown ONLY to maintain the RC System hot leg temperature, T_{HL} 30° to 35°F below Pressurizer temperature. The shrinkage due to cooldown will cause the Pressurizer to empty if the RC System T_{ave} reaches 515°F. This will cause the bubble to shift from the Pressurizer to the hot leg and terminate natural circulation.

NOTE: Pressurizer spray and heaters are not available for pressure control. Primary system pressure decrease will be dictated by Pressurizer heat losses to ambient which will cause approximately 100 to 200 psi/hr decrease in primary system pressure.

NOTE: The Instrument Air Compressors are not available. When residual air in the system is used, the Atmospheric Dump valves must be operated manually. The Turbine Driven Emergency Feedpump Steam Pressure Regulator, MS-V14, is provided with an accumulator which will provide approximately one additional hour of automatic operation, after which MS-V14 must be manually operated.

4.5 During natural circulation cooldown (following a complete loss of AC with Diesel Generator failure) observe the following limits:

4.5.1 Upper OTSG downcomer to cold leg ΔT max. = 25°F.

4.5.2 Pressure and temperature limits associated with natural circulation cooldown curve. (Figure 1)

4.5.3 Maintain T_H between 30°F and 35°F below the Pressurizer temperature by utilizing manual control of the Atmospheric Dump valves MS-V3A and B.

CAUTION: Maintain T_H more than 30°F below Pressurizer saturation temperature to prevent boiling in the hot leg.

CAUTION: Maintain T_H within 35°F of the Pressurizer saturation temperature to minimize the shrinkage of the primary system due to cooldown. Since there is no make-up to the RC System, this ensures the maximum time available in which to restore power prior to loss of Pressurizer level.

4.5.4 The following table gives saturation temperature for given pressure, T_H max. to prevent hot leg boiling and primary shrinkage assuming an initial T_{ave} = 582° and a normal pressurizer water volume of 800 $ft.^3$.

Pressure (abs)	Tsat	Th Max.	RC System Shrinkage, ft^3
2155	646	616	-
2000	635	605	-
1800	621	591	-
1500	596	566	90
1200	567	537	495
1000	545	515	775
950	538	508	860

CAUTION: The above table points out that power must be restored to at least one make-up pump prior to RC temperature reaching 515°F.

4.6 If Pressurizer temperature has decreased to 545°F and power has not been restored, "STOP" cooldown as follows:

4.6.1 "CLOSE" the Atmospheric Dump valves, MS-V3A and B.

4.6.2 "CLOSE" the Turbine Driven Emergency Feedpump Steam Supply valve, MS-V207.

4.6.3 Break vacuum in the condenser and shutoff gland seal steam to the Main Turbine and the Main Feedpump Turbines.

4.6.4 Make every possible effort to restore power either to the 230KV transformers from the Dispatcher, by starting one Emergency Diesel Generator.

4.7 Once the Main Turbine has rolled to a stop manually turn the turbine shaft 180° every 30 minutes. One turn of the turbine shaft is equivalent to 701 hand rotations of the turning gear shaft.

4.8 Consider removing the following DC loads to maintain battery reserve when battery voltage decreases to 115V.

4.8.1 Station Battery 2-1SB.

4.8.1.1 Invert 2-SV (Computer).

4.8.1.2 DC High Pressure Oil Lift pumps for RC-P-1A and RC-P-1B (after the RC pumps have stopped rotating).

4.8.1.3 DC Emergency Bearing Oil pump for the Main Feedpump Turbine, FW-P-1A.

4.8.1.4 Purge the Main Generator with CO_2 and stop the Generator H_2 Seal Oil Pump SO-P-2.

4.8.2 Station Battery 2-2SB.

4.8.2.1 DC High Pressure Oil Lift pumps for RC-P-2A and RC-P-2B (after the RC pumps have stopped rotating).

4.8.2.2 DC Emergency Bearing Oil pump for the Main Feedpump Turbine, FW-P-1B.

4.8.2.3 Turbine Generator DC Emergency Bearing Oil pump (only if the Main Turbine cannot be hand jacked).

4.9 Loss of AC power for several hours to the 230KV breakers may result in low SF_6 gas pressure and the SF_6 gas pressure interlock would prevent closing the breakers. If the Diesel Generators are not yet available and enough air remains in the compressed air tank, the breakers may be closed as follows:

4.9.1 Verify that the line and bus on each side of the breaker are de-energized.

4.9.2 Co-ordinate closing of the breaker with the dispatcher and Lebanon Relay Department.

4.9.3 Pull the fuses for both Trip circuits and jumper out the closing interlock (under direction of the relay department).

4.9.4 "CLOSE" the breaker.

CAUTION: Do not trip the breaker after energizing until SF_6 gas pressure is restored.

4.9.5 Energize the line from the Middletown junction.

4.9.6 Restore 480V AC power to the breaker compressors. (Both air and SF_6 gas compressor).

4.9.7 When gas pressure is automatically restored in approximately one or two hours, replace the trip fuses and remove the jumper in the closing circuit.

FIGURE 1

HEAT UP/COOLDOWN CURVE

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