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THREE MILE ISLAND NUCLEAR STATION UNIT #2 ABNORMAL PROCEDURE 2203-1.4 RCP & MOTOR EMERGENCIES

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Unit 1 Staff Recommends Approval

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Cognizant Dept. Head

Unit 2 Staff Recommends Approval

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Cognizant Dept. Head

Unit 1 PORC Recommends Approval

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Chairman of PORC

Unit 2 PORC Recommends Approval

D. F. Tillish Date 5/2/78
v. Chairman of PORC

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THREE MILE ISLAND NUCLEAR STATION
UNIT #2 ABNORMAL PROCEDURE 2203-1.4
RCP & MOTOR EMERGENCIES

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THREE MILE ISLAND NUCLEAR STATION
UNIT #2 ABNORMAL PROCEDURE 2203-1.4

RCP & MOTOR EMERGENCIES

1.0 LOSS OF SEAL INJECTION TO PUMPS

1.1 Symptoms

1.1.1 ALARM: "Reactor Coolant Pump Loop Seal Inject Flowlow" (8:B.27).

1.1.2 ALARM: "Reactor Coolant Pump Total Injection Loop Flow/Hi/Lo"
(8:A.27).

1.1.3 Seal Inlet Flow (individual) decreasing (panel 3).

1.1.4 RC Pump Total Seal Inlet Flow decreasing (panel 3).

1.2 Immediate Action

1.2.1 Automatic Action

a. None

1.2.2 Manual Action (Loss of Injection).

a. If seal injection flow to operating pumps is lost, the pumps may continue operation provided intermediate cooling water flow is maintained and seal temperatures remain within the following limits.

$$T_1 < 185^{\circ}\text{F}$$

$$T_2 < 170^{\circ}\text{F}$$

$$T_4 < 185^{\circ}\text{F}$$

If seal injection flow to idle reactor coolant pumps is lost the associated seal return isolation valve (MU-V33 A,B,C or D) must be closed within one minute to prevent seal damage.

b. During loss of injection, monitor seal bleedoff temperature Pump Bearing Outlet temperature, seal bleedoff flow, and

seal leakage flow carefully. If seal leakage plus seal returns exceeds 1.9 gpm, trip the pump, cooldown, and inspect the seals.

- c. Close the injection flow control valve (MU-V32) to prevent high injection flow upon recovery of injection.
- d. The seal bleedoff flow control valves (MU-V33 A, B, C, D) should remain open as long as the motors remain energized.

1.2.3 Follow Up Action (Recovery of Injection)

- a. When injection fluid is available, reestablish injection flow as follows:
 - 1. Slowly open the injection flow control valve (MU-V32) to establish a flow of 2 gpm per pump. Continue at this flow rate for a period of 2 minutes.
 - 2. Increase injection flow to 5 gpm per pump for a 2 minute period.
 - 3. If seal return valves, MU-V33 A, B, C, or D has closed, reopen them at this time.
 - 4. Increase injection flow to normal flow of about 10 gpm per pump.

1.3 Follow Up Action

- 1.3.1 In the event the pump must be shutdown during a loss of injection mode, the following steps should be taken:

NOTE: The pump should not be shutdown when injection flow is lost unless it is absolutely necessary.

- a. Reduce power to within RPS limits.
- b. Trip the RCP. The appropriate seal return isolation valve (MU-V33 A, B, C or D) must be closed within one

minute after pump shutdown. Shutdown Oil Lift System at zero speed.

- c. Continue flow of intermediate cooling water at normal flow until Reactor Coolant System temperature is less than 200°F and pressure is below 200 psig.
- d. Do not restart pump until injection flow is available. Recover injection flow per section 1.2.3 above.
- e. If RCP seal temperatures T_1 or T_4 have exceeded 185°F, or if seal leakage plus seal return exceeds 1.9 gpm, do not restart the pump. Cooldown and inspect the seals for damage.

2.0 SEAL FAILURE

2.1 Symptoms

- 2.1.1 Abnormal Pump Seal Cavity Pressure
- 2.1.2 Excessive Pump vibration

2.2 Immediate Action.

2.2.1 Automatic Action.

a. None.

2.2.2 Manual Action.

- a. The affected RCP must be tripped if the seal cavity pressures exceed 2500 psig.
- b. If the sum of seal bleedoff flow and seal leakoff flow exceeds 3.0 gpm - TRIP THE RCP.

2.3 Follow Up Action

2.3.1.a Determine degree of seal failure as follows:

- a.1 Failure of No. 1 seal is indicated by Pump Seal Cavity pressure between seal 1 and 2 at approximately system pressure.
- a.2 Failure of No. 2 seal is indicated by Pump Seal Cavity pressure between seal 2 & 3 at approximately $\frac{1}{2}$ system pressure.
- a.3 Failure of No. 3 seal is indicated by Pump Seal Cavity pressure between seal 2 & 3 at approximately 50 psig.
- a.4 Failure of No. 1 and No. 2 seals is indicated by Pump Seal Cavity pressure between seal 1 & 2 and 2 & 3 at approximately system pressure.
- a.5 Failure of No. 2 and No. 3 seals is indicated by Pump Seal Cavity pressure between seal 1 & 2 at approximately 50 psig.
- a.6 Failure of No. 1 and No. 3 seals is indicated by pump seal cavity pressure between seal #1 and 2 at approximately system pressure, and pressure between seal #2 and 3 at approximately 50 psig.

NOTE: All values are approximate. Destaging may cause only partial ΔP cross a seal.

- 2.3.2 If two seals are leaking, the pump may be operated, however, a planned unit shutdown should be scheduled.
- 2.3.3 In the event the pump must be shutdown, the following steps should be taken:
 - a. Reduce power to within RPS limits.
 - b. Trip the RCP.
 - c. When pump reaches zero speed, Lift Pump and Back Stop Pumps should be stopped.
 - d. Continue flow of Cooling Water and Seal Injection until RC System Pressure is below 200 psig, and temperature is below 200°F.
 - e. Do not attempt to restart pump until seal problem has been fixed.

3.0 PUMP AND MOTOR VIBRATION

3.1 Symptoms

- 3.1.1 Excessive shaft vibration on IRD System greater than 30 mils for first four hours of one pump per loop operation. Greater than 25 mils for one or two pump per loop operation.

3.2 Immediate Action.

3.2.1 Automatic Action

- a. None.

3.2.2 Manual Action.

- a. Reset shaft vibration alarm on IRD System Panel 10.
- b. If vibration alarms reoccur immediately, reduce power to within RPS limits and trip affected RCP per normal procedure.

3.3 Follow Up Action.

3.3.1 Determine cause and repair.

4.0 REVERSE ROTATION

4.1 Symptoms.

4.1.1 Excessive vibration due to a backstop failure.

4.2 Immediate Action.

4.2.1 Automatic Action.

a. None.

4.2.2 Manual Action.

a. Start oil lift system on affected pump.

b. Commence a normal plant shutdown and cooldown of the
R.C.S. per 2101-3.2.

4.3 Follow Up Action.

4.3.1 Determine cause and repair.

5.0 LUBE OIL EMERGENCY

5.1 Symptoms.

5.1.1 Low lift pump discharge oil pressure alarm (1800 PSIG) on
computer.

- 5.1.2 High bearing temp. alarms Radial 185°F, 8.331, Thrust 200°F
8.E31 for Upthrust temp H1 and F31 for downthrust temp H1.
- 5.1.3 H1/Lo Levels alarms on upper and lower oil pots annunciated on
computer.
Upper Oil Pot - H1 12.2 INC.
Lo 8.2 DEC.
Lower Oil Pot - H1 13.8 INC.
Lo 9.8 DEC.
- 5.1.4 RCP lube oil flow Lo. (7.0 gpm on computer).
- 5.1.5 RCP Backstop oil flow low. (0.24 gpm on computer).
- 5.2 Immediate Action.
 - 5.2.1 Automatic Action
 - 5.2.2 Manual Action.
 - a. Start O.C. oil lift pump.
 - b. In the event of high motor bearing temps. (Radial > 185°F,
thrust > 200°F), reduce reactor power to 75% and trip
affected pump.
- 5.3 Follow Up Action
 - 5.3.1 If low exists on lift and/or backstop system, start lift
and/or backstop pumps on affected RCP.
 - 5.3.2 If H1/Lo levels exist in oil pots, reduce reactor power to 75%
and secure affected pump.
 - 5.3.3 A possibility of oil fire exists if the oil systems have
ruptured. To prevent oil fire, the unit will be shutdown and
cooled down to 50°F below the Flash point of the oil used in
the system. The flash point of the oil is 450°F.

5.3.4 Determine cause and repair.

6.0 PUMP MOTOR SEPARATION - DROPPED IMPELLER

6.1 Symptoms.

6.1.1 Low motor current.

6.1.2 Low R.C.S. flow.

6.1.3 H1 vibration:

a. Motor stand Vibraswitch alarms.

b. Shaft - IRD System Panel 10.

6.2 Immediate Action.

6.2.1 Automatic Action.

a. Possible reactor trip on power to flow.

6.2.2 Manual Action.

a. Reduce power and trip reactor.

b. Secure affected RCP.

c. Commence shutdown and cooldown of the RCS.

6.3 Follow Up Action.

6.3.1 Determine cause and repair.