THREE MILE ISLAND NUCLEAR STATION
UNIT #1 EMERGENCY PROCEDURE 1202-2 & 2A
STATION BLACKOUT AND STATION BLACKOUT WITH LOSS OF BOTH DIESEL GENERATORS

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Approval N/A Date —

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Approval N/A Date —

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THREE MILE ISLAND NUCLEAR STATION
UNIT #1 EMERGENCY PROCEDURE 1202-2 & 2A
STATION BLACKOUT AND STATION BLACKOUT WITH LOSS OF BOTH DIESEL GENERATORS

2.1 Symptoms

1. Separation from the 230 KV system and generator tripped as indicated by:

   a. Zero volts on 230 KV bus voltmeters on substation panel.

   b. Generator breakers open (amber and green lights above extension controls on console CL).

2.2 Immediate Action

A. Automatic Action

1. Reactor trips because of loss of voltage to the control rod drive system.
2. Turbine trips.
3. Control room DC lighting comes on.
4. Emergency turbine driven feedwater pump starts due to loss of all four reactor coolant pumps.
5. The ICS (Integrated Control System) maintains OTSG (Once Through Steam Generator) level at 21' (50% operate range).
6. Atmospheric steam dump valves (MS-V4A/B) control main steam pressure at 1010 psig.
7. Main steam relief valves open if pressure reaches 1040 psig.
8. Electromatic relief valve opens when primary system pressure reaches 2450 psig.

9. Pressurizer relief valves open if primary system pressure reaches 2500 psig.
10. Generator DC emergency seal oil pump starts.
11. DC lube oil pumps start on the main turbine and feed pump turbines.
12. The DC oil lift pumps for the reactor coolant pumps start.
13. The screenhouse and circulating water house diesel fire pumps start because of loss of AC power.
14. The station batteries supply power to all five inverters.
15. The 1A and 1B diesel generators start.
16. 1D 4KV and 1E 4KV buses are energized by the diesel generators thus energizing the P, S, R and T 480V buses and the ES control centers.
17. The battery chargers are energized by 1A and 1B ES motor control centers.
18. The inverters switch back to their normal 480V AC source.
19. The standby intermediate closed cooling pump starts and supplies cooling water to the thermal barrier heat exchanger of the RC pumps.
20. The nuclear services closed and nuclear services river water standby pump starts.
21. The lead instrument air compressor starts (1AP1A or B).
22. The air compressors for control tower ventilation start (AH-P8A/B and AH-P9A/B).

23. The diesel generator ventilation fans start if they were previously running (AH-E29A & B).

24. The AC oil lift pumps start on the RC pumps. The DC lift pumps stop when the RC pumps reach zero speed.

25. If not manually started, the AC turbine lift pumps will start automatically when the main turbine reaches zero speed.

26. The main turbine turning gear starts and engages when the turbine reaches zero speed.

B. Manual Action

The parameters marked with an asterisk (*) shall be reverified as the first step in follow-up action.

*1. Verify the following:

a. Reactor is tripped and rods have inserted.

b. Emergency feedwater pumps start (EF-P1, EF-P2A and EF-P2B) and discharge pressure comes up to 1010 psig.

c. Both diesel generators start.

d. Turbine is tripped and both generator breakers open.

2. Close MU-V3.

3. Restore makeup and seal injection as follows:

a. Take manual control at the hand auto station and close MU-V32 and MU-V17.

b. Verify that lube pump (MU-P3A) is running.

c. Open MU-V14A, close MU-V12.

d. Start MU-P1A, DC-P1A and DR-P1A.

e. Slowly reopen MU-V32 and MU-V17.

f. Throttle open MU-V16B as needed to maintain pressurizer level.

g. If pressurizer level continues to decrease open MU-V16A and/or initiate high pressure injection.

NOTE: This action is to preserve the mass of hot water stored in the pressurizer which is providing the margin to saturation after loss of pressurizer heaters.

4. Verify the following:

*a. Steam generator level is being maintained at 50% on the operate range.

*b. RC pressure stable or decreasing slowly and RC-R-V2 and pressurizer relief valves closed.

*c. Steam generator pressure is being maintained at 900 psig.

*d. Diesel generator voltage is between 4000 and 4200 volts and frequency is 59 to 61 hertz.

e. P, S, R and T bus voltage is between 440 and 500 volts.

f. Natural circulation has been initiated by observing a delta T of 20 to 40^{o} and Th of <600^{o}F and decreasing.

*g. Verify that the RCS is subcooled by at least 20^{o}F. Increase steam generator level to enhance natural circulation cooling. Increase makeup flow to maintain pressurizer level constant.

h. Nuclear instrumentation is in the expected range for a reactor trip and count rate is decreasing.

i. Instrument air compressor running IA-P1A or B.

NOTE: If ES has been initiated the instrument air compressors will be locked out.

2.3 Follow-Up Action

Objective:

The objectives of this procedure are to preserve the hot water in the pressurizer as a margin to saturation, establish natural circulation cooling with heat removal thru the steam generators, borate the RCS to assure the reactor remains subcritical, commence cooldown at a rate determined by heat loss from the pressurizer and to restore power to RC pumps and pressurizer heaters as soon as possible.

1. Using redundant indication if possible reverify the parameters in manual action that are indicated with an asterisk (*).
2. If 230 KV line voltage is available, obtain dispatcher concurrence and reenergize an auxiliary transformer, RC pumps (one per loop), and pressurizer heaters.
3. If power is not available refer to OP 1102-16, Natural Circulation Cooling.

NOTE: Primary system pressure will decrease approximately 70 to 150 psi/hour because of pressurizer heat loss. Cooldown rate must be controlled to maintain a >20^{o}F subcooled margin. (See Figure #1)

4. Add 4814 gal of 12,250 ppm boron or equivalent (906 cu. ft. of 8700 ppm) to the makeup tank to assure shutdown margin is maintained during cooldown. Open MU-V12 and if necessary close MU-V14A to get the boric acid into the RCS.

5. Verify MU-V14A is open and close MU-V12. Makeup for additional contraction from the BWST thru MU-V14A.

   CAUTION: Do not exceed 3 MW load on the die l generator.

6. Verify or start the following ventilation fans:

   a. Emergency feed pump room AH-E-24A.

   b. Decay Heat/Nuc Service closed.

      Pump room AH-E-15A

   c. Screen House AH-E-27.

   d. Diesel Generator Fans AH-E-29A/B

   e. Control tower ventilation

      1. Air compressors AH-P-8A/B and AH-P-9A/B.

      2. Chilled water pump.

      3. Standby chiller.

      4. AH-E-19A or B

      5. AH-E-17A or B

      6. AH-E-95A or B

7. Verify or start the following components:

   a. One Nuc Services River Pp NRP1A(B)(C)

   b. One Nuc Service Closed NCP1A(B)(C)

   c. One Secondar River Pp SRP1A(B)(C)

   d. Intermediate Closed Pp ICP1A(B)

   e. Spent Fuel Cooling Pp SFP1A(B)

   f. Penetration Cooling Fan AHE9A(B)

8. Energize the N bus by closing N1-02 breaker.

   CAUTION: Do not exceed 3 MW on either diesel generator.

9. Start SCP1C to provide turbine lube oil cooling.

10. Energize the 1H and 1J 480V turbine plant bus through the tie breaker to the 1N 480V bus.

    NOTE: The normal feeder breaker to the bus must be tripped before the tie can be closed.

    The following equipment is energized without operator action when the tie is closed.

    a. Aircraft warning lights on cooling tower.

    b. Access bridge lighting.

    c. Feed pump turbine turning gear if the feed pump has stopped.

11. Verify that the main turbine turning gear starts and engages when the main turbine coasts to a stop.

12. If reactor building temperature exceeds 140°F provide cooling as follows:

    a. Open RR-V4A and start RR-P1B.

    b. Open RR-V1B to provide cooling water to the reactor building cooling units.

    c. Start AH-E1A.

STATION BLACKOUT WITH LOSS OF BOTH DIESEL GENERATORS

2.A.1 Symptoms

1. Separation from the 230 KV system and generator tripped as indicated by:
   a. Zero volts on 230 KV bus voltmeters on substation panel.
   b. Generator breakers open (amber and green lights above extension controls on console CL).
2. Failure of both diesel generators to energize the 1D 4KV and 1E 4KV buses.

2.A.2 Immediate Action

A. Automatic Action

1. Reactor trips because of loss of voltage to the control rod drive system.
2. Turbine trips.
3. Control room DC lighting comes on.
4. Emergency turbine driven feedwater pump starts due to loss of all four reactor coolant pumps.
5. The ICS (Integrated Control System) maintains OTSG (Once Through Steam Generator) level at 21 ft. (50% operate range).
6. Atmospheric steam dump valves (MS-V4A/B) control main steam pressure at 1010 psig.
7. Mainsteam relief valves open if pressure reaches 1040 psig.

8. Electromatic relief valve opens when primary system pressure reaches 2450 psig.

9. Pressurizer relief valves open if primary system pressure reaches 2500 psig.

10. Generator DC emergency seal oil pump starts.

11. DC lube oil pumps start on the main turbine and feed pump turbines.

12. The DC oil lift pumps for the reactor coolant pumps start.

13. The screenhouse and circulating water house diesel fire pumps start.

14. The station batteries supply power to all five inverters.

B. Manual Action

NOTE: The parameters indicated with an asterisk (*) will be reverified as the first step in follow-up action.

1. Verify:

*a. The emergency feedwater pumps start and raise water level in OTSG's to 21 ft. (50% operate range).

b. Atmospheric steam dump valves (MS-V4A/B) open when steam generator pressure reaches 1010 psig.

c. The following DC pumps start:

(1) Turbine generator DC emergency seal oil pump.

(2) DC lube oil pumps for main and feed pump turbines.

(3) DC oil lift pumps for RC pumps.

*2. Close the letdown block valve MU-V3 and seal return isolation valve MU-V26 to maintain water inventory in the primary system. (Total blackout prevents makeup pump operation to compensate for contraction during cooldown.)

3. Verify that both feeder breakers to D and E 4KV buses have opened, if not trip the breakers.

4. Attempt to start the diesel generators by depressing the start pushbutton on console CR. If diesel starts wait until diesel is up to speed and voltage and then close diesel generator breakers.

2.A.3 Follow-Up Action

Objective:

The objective of this procedure is to conserve RCS inventory and minimize shrink to keep the loops full and establish natural circulation cooling. Power must be restored as soon as possible to establish makeup and borate the RCS.

1. Reverify the parameters in immediate manual action marked with an asterisk (*).

2. For diesel start failure check the following and take action as indicated:

a. Verify air pressure in tanks and manual air valves are open.

b. Diesel Trouble Alarm - Main Annunciator Light Box A and B - proceed to local alarm panel, note local alarm and follow action outlined in alarm response procedure.

c. Open engine mounted relay box door and determine whether SDR relay and 5A relay are energized. If energized, tit will not protrude.

d. If the SDR or 5A relay is energized check the following:

1. Press the reset pushbutton located at the EMIP.

2. If SDR relay de-energizes as a result of pressing reset pushbutton and the 5A relay is energized, check and reset the 86 lockout at the 4160V diesel generator breaker.

3. If diesel starts and comes up to speed but breaker does not close, check the following:

a. Both bus feeder breakers and the tie breaker to the affected bus are open.

b. DC control power available as evidenced by energized breaker status light at the control switch.

c. Lockouts located at the D (E) switchgear are reset: 86B/1D(E) and 86 G.

d. Diesel generator voltage and frequency are normal (>4100V and 60.0 to 60.5 Hz.). If no voltage is present assure DC power is available for field flashing.

If above conditions are satisfied, obtain shift supervisor concurrence and close the breaker by lifting the close plunger at the bottom of the diesel generator breaker at the D (E) 4KV bus.

4. If efforts to restore diesel or offsite power were unsuccessful notify NRC and offsite agencies and set up radiation monitoring teams both onsite and offsite.

5. If natural circulation is present increase turbine header pressure setpoint to 905 psig. (Main steam pressure will control at 1030 because of 125 psi bias.)

   NOTE: The increased steam pressure will limit the decrease in Tave thus keeping the RCS shrinkage to a minimum to keep the loops full.

6. Attempt to restore one 230 KV line, bus and auxiliary transformer according to the direction of the dispatcher.

7. Control cooldown by natural circulation (per 1102-16) using the turbine driven emergency feed pump, 21 foot (50% operate range) level in OTSG and the turbine atmospheric relief valve hand control (IC 12 A/B MCS Hand/Auto Station) to control cooldown rate until Instrument Air loss causes turbine atmospheric relief valve closure. When air is lost take local manual control of emergency feedwater and atmospheric relief valves.

   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 70 to 150 psi/hr decrease in primary system pressure. Plot pressure and temperature. Refer to Figure #1 for margin from saturation.

8. When natural circulation is interrupted due to voids in the RCS loops increase level in the steam generator to 95%. RCS pressure will tend to increase because of increasing T hot. Open MS-V4A(B) to attempt to control the RCS pressure increase and prevent primary safety valves from opening.

9. Verify that all outside reactor building isolation valves are closed. Observe radiation monitors for any increase in levels that may indicate failed fuel.

10. When instrument air depletes to 60 psi:

    a. Emergency feedwater valves fail as is, use handwheel valve operator to position EF-V30A/B for OTSG level control.

    b. The atmospheric dump valves failed closed, use handwheel valve operator to position MS-V4A/B as requ' ed to control Th.

    c. The team supply valves to the emergency feed pump tur ine MS-V13A/B and MS-V6 fail open, use handwheel valve operator on MS-V6 to control steam inlet pressure to the EFP turbine.

11. Once the turbine has rolled to a stop manually turn the turbine shaft 1/2 turn every 15 minutes. 1/2 turn of the turbine shaft corresponds to hand rotation of the turning gear motor shaft for 300 turns.

12. Break vacuum in the condenser and shutoff the seal steam to the main turbine thus reducing the amount of heat transferred to the turbine lube oil system.

13. Commence venting main generator hydrogen pressure to 0.5-1 psig.

14. Consider removing the following DC loads to maintain battery reserve when battery voltage drops to 115V.

    NOTE: The batteries are capable to sustaining a load of 150 amps, for 8 hours (1200 ampere hours).

    a. 1A Station Battery

        (1) 1E Inverter (computer).

        (2) RC pump DC oil pumps: RC-P-2A-2 and RC-P-2C-2 (after the RC pumps have stopped rotating).

        (3) Main turbine emergency bearing oil pump LO-P-6 (only if turbine cannot be hand jacked).

        (4) FW pump turbine DC oil Pp LO-P-9A.

    b. 1B Station Battery

        (1) RC pump DC oil pumps: RC-P-2B-2, RC-P-2D-2 (after the RC pumps have stopped rotating).

        (2) FW pump turbine DC oil Pp LO-P-9B.

        (3) (Vent H_2) Generator emergency seal oil Pp GN-P-2.

15. Loss of AC power for several hours to the 230 KV breakers may result in a low SF_6 gas pressure interlock that prevents 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:

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

    b. Coordinate closing of the breaker with the dispatcher and Lebanon Relay Department.

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

    d. Close the breaker.

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

    e. Energize the line from the other end (Middletown Junction).

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

    g. When gas pressure is automatically restored in ≈ 1 to 2 hrs. replace trip fuses and remove jumper in the closing circuit.

16. When power is restored start MU-P1A, DC-P1A and DR-P1A and open MU-V16B or initiate high pressure injection if natural circulation cooling was interrupted.

17. Start turning gear oil pump and lift pumps.

18. Monitor turbine eccentricity recorder and turning gear ammeter, above control switch, start and engage turning gear.

19. If eccentricity indicates Hi and/or T.G. ammeter indicated Hi (in red for >5 seconds), secure turning gear so that rotor is 180^{o} from start.

20. Repeat step #19 until unit can be placed on T.G. and remain on gear.

FIGURE 1

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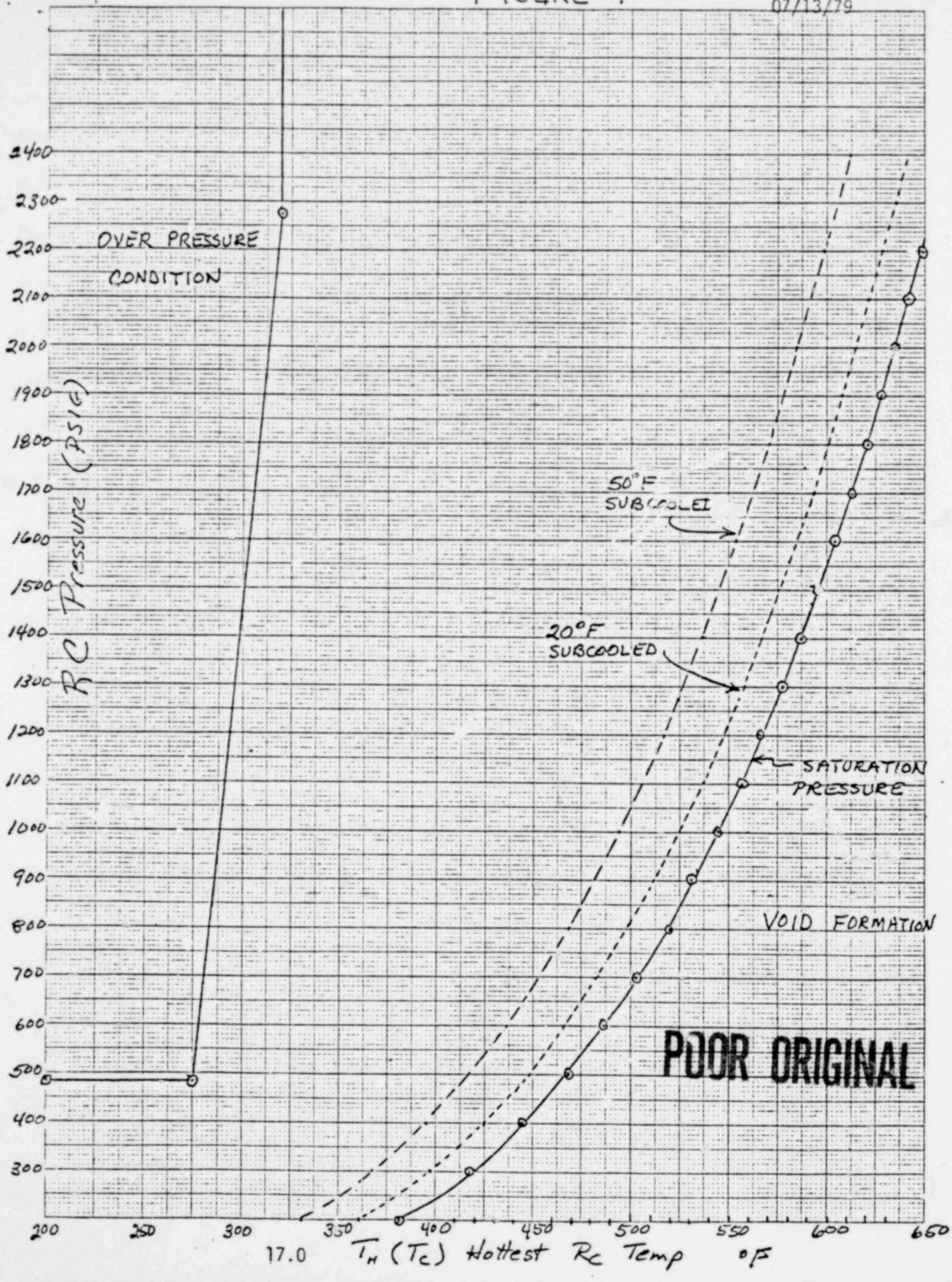

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