ABNORMAL OPERATING PROCEDURE

LOSS OF RESIDUAL HEAT REMOVAL

PURPOSE

The purpose of this procedure is to identify and correct a loss of RHR capability. The scope of this procedure includes contingency actions for the following cases:

A. LOSS OF RESIDUAL HEAT REMOVAL WHILE IN MODES 4 OR 5.

B. LOSS OF RESIDUAL HEAT REMOVAL WHILE IN MODE 6 (Head Removed)

SYMPTOMS

- Unexplained change in RHR flow or discharge pressure.
- Detected RHR system excessive leakage while RHR is in operation.
- Any unexplained raise in RCS temperature while RHR is in operation.
- Any observed loss of RHR system capability while RHR is in operation.

A. LOSS OF RESIDUAL HEAT REMOVAL WHILE IN MODES 4 OR 5

ACTION/EXPECTED RESPONSE | RESPONSE NOT OBTAINED

CAUTION

During midloop operation with HL dams installed and inadequate RCS venting, a loss of RHR cooling will result in saturated RCS conditions within 10 minutes subsequently resulting in core uncovery and requiring containment closure initiation by initiating 14210, CONTAINMENT BUILDING PENETRATION VERIFICATION - REFUELING.

NOTE

- System status information on loss of RHR:

  Figure 2 - Time to Boiling
  Figure 3 - Time for Core Uncovery
  Figure 4 - Heatup Rate

- Continue performing Steps A1 thru A3 until exiting this subprocedure.

A1. Monitor Core Exit TCs.

a. IF RHR is lost while in Mode 5, THEN check Core Exit TCs less than 200°F.

A1.

a.

- Initiate 91001-C, EMERGENCY CLASSIFICATION AND IMPLEMENTATING INSTRUCTIONS.
- Evacuate non-essential personnel and initiate Containment Isolation.
- Go to A11 and initiate charging for core heat removal.

ACTION/EXPECTED RESPONSE		RESPONSE NOT OBTAINED
b.	IF while operating at mid-loop Core Exit TC indication is lost, THEN raise the RCS level to 188 ft. 3 in. (Top of Hot Leg) AND monitor the RCS temperature with the wide range T-hot.	
A2.	Check One Train Of RHR - OPERATING.	A2. • Suspend all operation involving a reduction of RCS boron concentration. • IF in Mode 4 AND IF SGs are available for RCS cooling, THEN Maintain Tavg below 350°F by maintaining at least one SG filled in the NR and by using steam dumps or SG ARVs. Go to Step A6.

NOTE

When there are indications of RHR pump cavitation while in Section A of this procedure, return to Step A3.

A3.	Monitor operating RHR pump - NOT CAVITATING: • RHR Pump Amps - NOT FLUCTUATING. • Discharge flow - NORMAL FOR RCS PRESSURE. • Discharge pressure - STABLE.	A3. IF running RHR pump is cavitating, THEN stop affected RHR pump(s). Realign misaligned valves in affected RHR train. Vent affected RHR pump: • HV-10465 (Train A) • HV-10466 (Train B) Go to Step A5.

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
A4. Check Core Exit TCs - STABLE OR LOWERING. Go To Appropriate UOP.	A4. IF Core exit TCs rising, THEN verify affected train RHR and CCW flow - Normal. IF Flows Are Normal, AND Core Exit TCs rising, THEN go to Step A6.
NOTE If opening the RHR HL suction valves from the QMCB is blocked due to HV-8804A or HV-8804B being disabled, the HL suction valves may be opened from the Remote Shutdown Panels.	
A5. Check Affected RHR Suction Valves - OPEN: • HV-8701A (Train A) • HV-8701B (Train A) • HV-8702A (Train B) • HV-8702B (Train B)	A5. Depressurize RCS - LESS THAN 365 PSIG: a. Use Normal sprays. b. Use Aux Spray if letdown in service. c. Use PRZR PORVs. Check IF RCS Is Above Mid-loop: • RVLIS FR level - GREATER THAN 72% with NO RCPs running.. • Local or Remote indications - GREATER THAN 187 FT. ELEV. IF RCS is NOT Above Mid-Loop, THEN go to Step A6. IF RCS is above midloop, THEN Open RHR Loop Suction valves AND THEN go to Step A6. -OR- AND THEN go to Step A9. IF neither Train RHR Suction Valves can be opened, THEN go to Step A11 for alternate RCS cooling.

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED

NOTE

If in Mode 5 it may be necessary to vent reactor vessel by opening RHR suction vents or RV head vents to allow gravity flow from RWST.

A6. Check Reactor Vessel level indications above RCS mid-loop:

- RVLIS FR level - GREATER THAN 72% with NO RCPs Running.
- Local Or Remote indications - GREATER THAN 187 FT. ELEV.

A6. a. Dispatch an Operator to locate and isolate any identified leaks.

b. Adjust charging flow to a closed cold leg as necessary to restore RCS level to 189 ft. elev.

c. IF charging NOT available, THEN gravity fill by initiating 13011, RESIDUAL HEAT REMOVAL SYSTEM.

d. IF Reactor Vessel Level NOT restored, THEN shut RHR Suction Valves, one loop at a time, to isolate leak.

e. Initiate ECCS flow using any pumps available:

- SIPs.
- RHR in Injection Mode (depressurize RCS if necessary to obtain injection flow).

f. IF Reactor Vessel Level restored above mid loop:

- RVLIS FR level - GREATER THAN 72% with NO RCPs running.
- Local or Remote indications - GREATER THAN 187 ft.

THEN go to Step A9.

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
NOTE If either train of RHR becomes inoperable, shut inoperable RHR Train HL Suction valves and shut HL Cross-Connect valves HV-8716A and HV-8716B.	
A7. Start Other RHR Train By Initiating 13011, RESIDUAL HEAT REMOVAL SYSTEM, with flow throttled - LESS THAN 1300 GPM.	A7. IF Other Train RHR can not be established, THEN go to Step A9.
A8. Slowly increase RHR flow to 3000 gpm, while monitoring for cavitation actions. Return To Step A3.	
A9. IF Open Due To Cavitating RHR Pump, THEN Shut RHR Suction Vent Valves In Affected RHR Train: • HV-10465 (Train A) • HV-10466 (Train B)	
A10. Restart RHR Pump With Flow throttled - LESS THAN 1300 GPM. Slowly increase RHR flow to 3000 gpm, while monitoring for cavitation actions. Return To Step A3.	A10. Go to Step A11 for alternate RCS cooling.
A11. Check if RCS Intact. • No RCS manways open.	A11. IF RCS manways are open, THEN go to Step A26.

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
A12. Determine what alternate RCS Cooling Is Desired: a. RCS Temperature - LESS THAN 200°F. b. Maintain RCS cooled by maintaining PRZR level - GREATER THAN 9% using: • CCP -OR- • IF SGs are available for RCS cooling, SG AFW Feed with SGBD bleed.	A12. IF RCS Temperature is greater than 200°F AND IF SGs are available for RCS cooling, THEN Maintain RCS Temperature using: • Steam Dumps. -OR- • SG ARVs. IF NO SGs are available for RCS cooling, THEN Open SI Accumulators discharge MOVs for RCS cooling.
A13. IF SGs are available for RCS cooling, THEN verify At Least Two SGs - GREATER THAN 17% NR.	
A14. Start All CRDM Fans.	
A15. Start all Containment Cooling Fans.	
A16. Control RCS Pressure - AT 365 PSIG. • IF PRZR has bubble, THEN operate PRZR heaters or sprays to control RCS pressure. • IF PRZR is solid, THEN control charging and letdown.	
A17. Try To Start An RCP On An Operable SG By Initiating 13003, REACTOR COOLANT PUMP OPERATION.	A17. Continue with Step A19.

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
A18. Initiate Repairs And Applicable Tech. Spec. Requirements.	
A19. Check Core Exit TCs - STABLE OR LOWERING.	A19. Go to Step A21.
A20. Continue Attempts To Start One Train RHR. IF one train RHR started, THEN return to Step A3.	
A21. Arm COPS And Open Both PRZR PORVs Or Head Vents.	
A22. Operate CCPs At Required Flowrate Per Figure 1.	A22. Start PDP or align SI Accumulators to establish flowrate. Align flowpath as required.
A23. Check RHR and RCP Status - a. RHR in operation. -OR- b. One RCP operating on operable SG with two SG levels - GREATER THAN 17% NR.	A23. Consult TSC For Appropriate Contingency Actions.
A24. Terminate RCS Bleed And Feed.	
A25. Consult TSC For Appropriate UOP.	
A26. Evacuate all non-essential personnel from containment and ensure all personnel are clear of RCS openings.	

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
NOTE Charging should be directed to closed Cold Leg(s) if possible.	
A27. Control Charging Flowrate Using Figure 1 To Maintain Core Heat Removal And Vessel Level Above Midloop.	A27. Dispatch an operator to rack in SI Accumulator's Discharge MOV's Breakers. Open Accumulator discharge MOV's. Continue attempts to inject borated water into RCS. Align RWST for gravity drain to RCS.
A28. WHEN Reactor Vessel level Restored Above Midloop, THEN Continue Controlling Level And Return to Step A7.	
A29. Consult TSC for recovery actions.	

END OF SUB-PROCEDURE TEXT

B. LOSS OF RESIDUAL HEAT REMOVAL WHILE IN MODE 6

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
B1. Check RCS level - ABOVE RV FLANGE WITH CAVITY FILLED.	B1. Go To Section A of this procedure.
B2. Suspend all operations involving a reduction of boron concentration.	
B3. Verify Hot Leg loop suction valves - OPEN: • HV-8701A Train A • HV-8701B Train A • HV-8702A Train B • HV-8702B Train B	B3. Stop affected RHR pump(s) and open loop suction valves.
B4. Check reactor cavity level - GREATER THAN 23 FEET ABOVE RV FLANGE (ELEVATION 217 FT).	B4. Suspend all fuel movement.
B5. a. Check for NO LOSS of RCS Inventory: • Local Tygon tube steady 23 ft or more above RV flange. • Remote indications 23 ft or more above RV flange.	a. Maintain RCS level above RV flange. -OR- Go to Section A of this procedure.
b. Go to Step B8.	
B6. Check AUX BLDG & CNMT leak detection system - NORMAL.	B6. Stop the RHR pumps if a break occurs on RHRS. Dispatch an operator to locate and isolate any leaks.

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
B7. Initiate repairs and applicable Technical Specification requirements.	
B8. IF either train of RHR becomes inoperable while in this section, THEN shut inoperable train HL Suction Valves and shut HL Cross-connect Valves HV-8716A and HV-8716B.	
B9. Try to place either RHR train in operation by initiating 13011, RESIDUAL HEAT REMOVAL SYSTEM.	
B10. WHEN RHR in operation THEN return to procedure in effect.	
B11. Start all Containment Cooling Fans.	
B12. Initiate 13719, SPENT FUEL POOL COOLING AND PURIFICATION SYSTEM, to place both trains in service.	
B13. Place a Normal FHB HVAC train (one normal supply, one normal exhaust, and 3 recirc units) in service by initiating 13320, FUEL HANDLING BUILDING HVAC SYSTEM.	
B14. Check RCS temperature - GREATER THAN 185°F.	B14. Return to Step B9.

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
B15. Establish RCS feed path from RWST: • CCPs - AT LEAST ONE RUNNING. -OR- • Verify valve alignment for operating pumps.	B15. Manually start pump and align valves as necessary. IF a feedpath can NOT be established, THEN return to Step B9.

ACTION/EXPECTED RESPONSE

RESPONSE NOT OBTAINED

B16. Establish RCS bleed path:

a. Dispatch an operator to open the following valves inside CNMT:

- Drain valves on at least one RCS loop. (At intermediate legs)

  Loop 1: 1201-U4-001
  1201-U4-002

  Loop 2: 1201-U4-052
  1201-U4-208

  Loop 3: 1201-U4-030
  1201-U4-209

  Loop 4: 1201-U4-071
  1201-U4-206

- 1901-U6-242 (RCDT pump suction)

b. Dispatch an operator to open the following valves in AUX BLDG on applicable unit:

UNIT 1

- 1-1901-U4-041 (Room RA27)
- 1-1901-U4-002 (Room RA49)

UNIT 2

- 2-1901-U4-041 (Room RA73)
- 2-1901-U4-002 (Room RA97)

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
B17. Operate RCDT pumps as required to maintain reactor cavity level greater than 23 feet above reactor vessel flange (elevation 217 ft) and temperature less than 185°F.	
B18. Check RHR status - AVAILABLE: Place RHR in operation.	B18. Return to Step B9.
B19. Terminate bleed and feed.	
B20. Go to appropriate UOP.	

END OF PROCEDURE TEXT

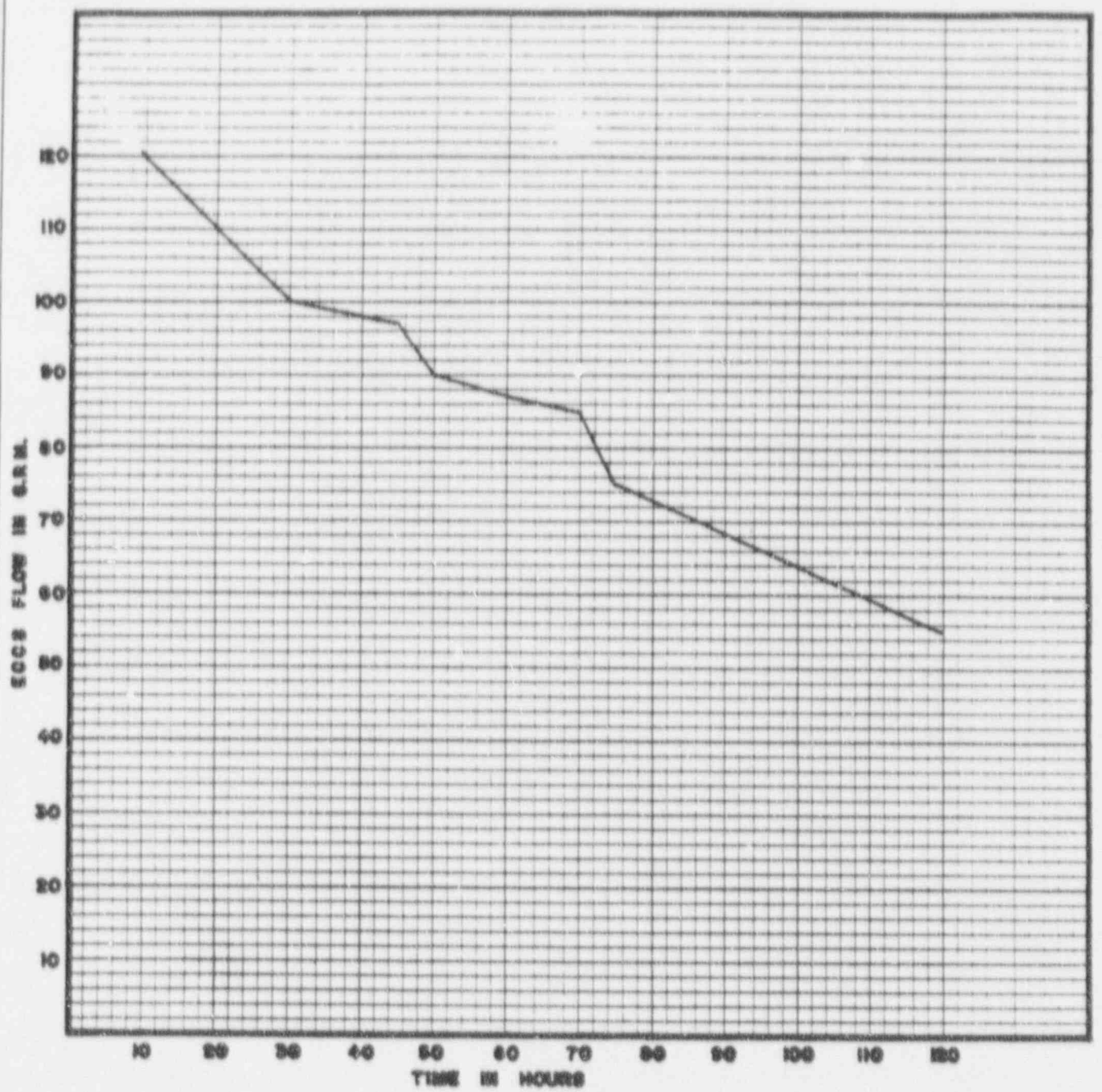

FIGURE 1 - MINIMUM ECCS FLOW VERSUS TIME AFTER REACTOR SHUTDOWN

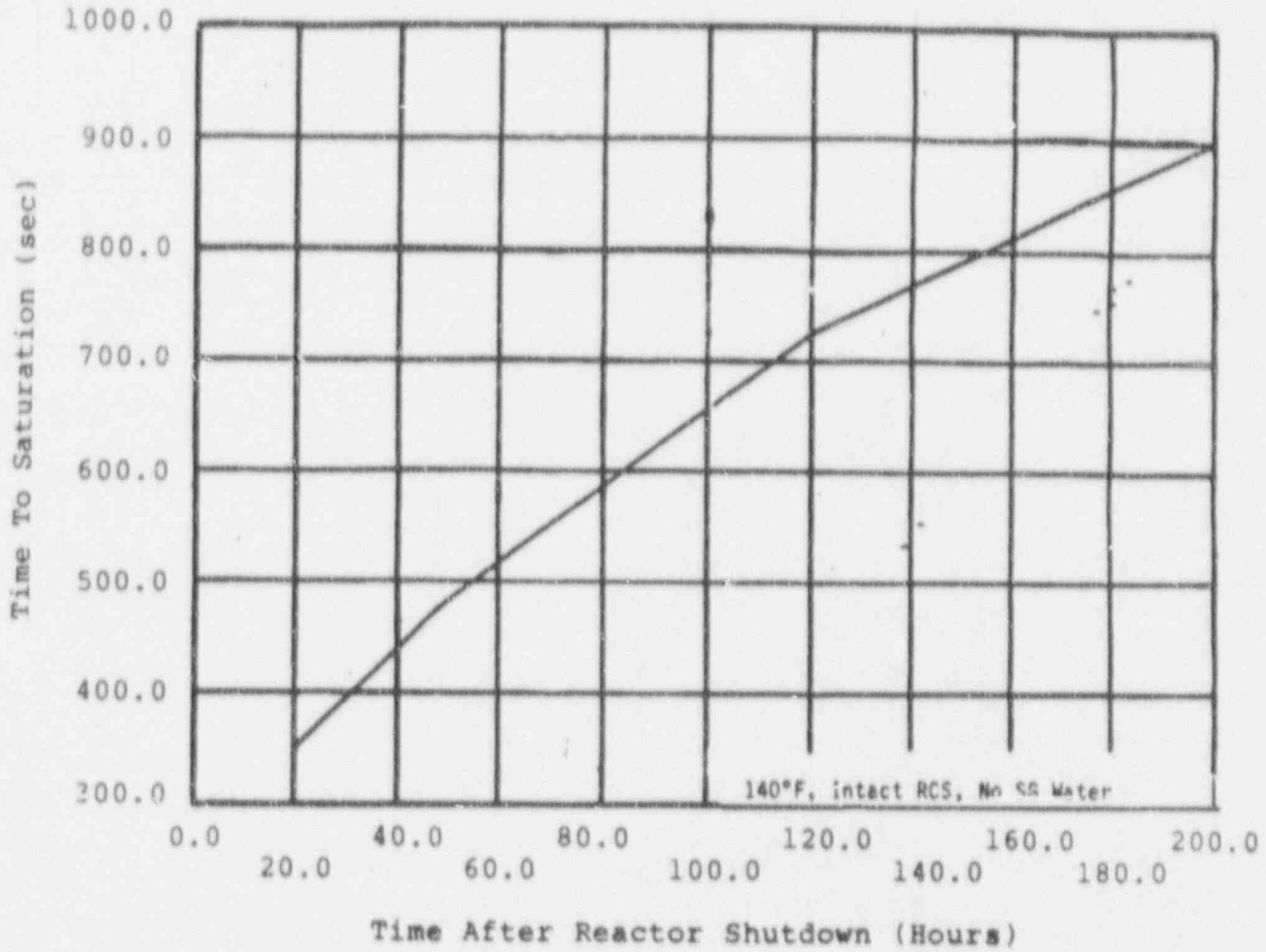

FIGURE 2 - TIME TO BOILING

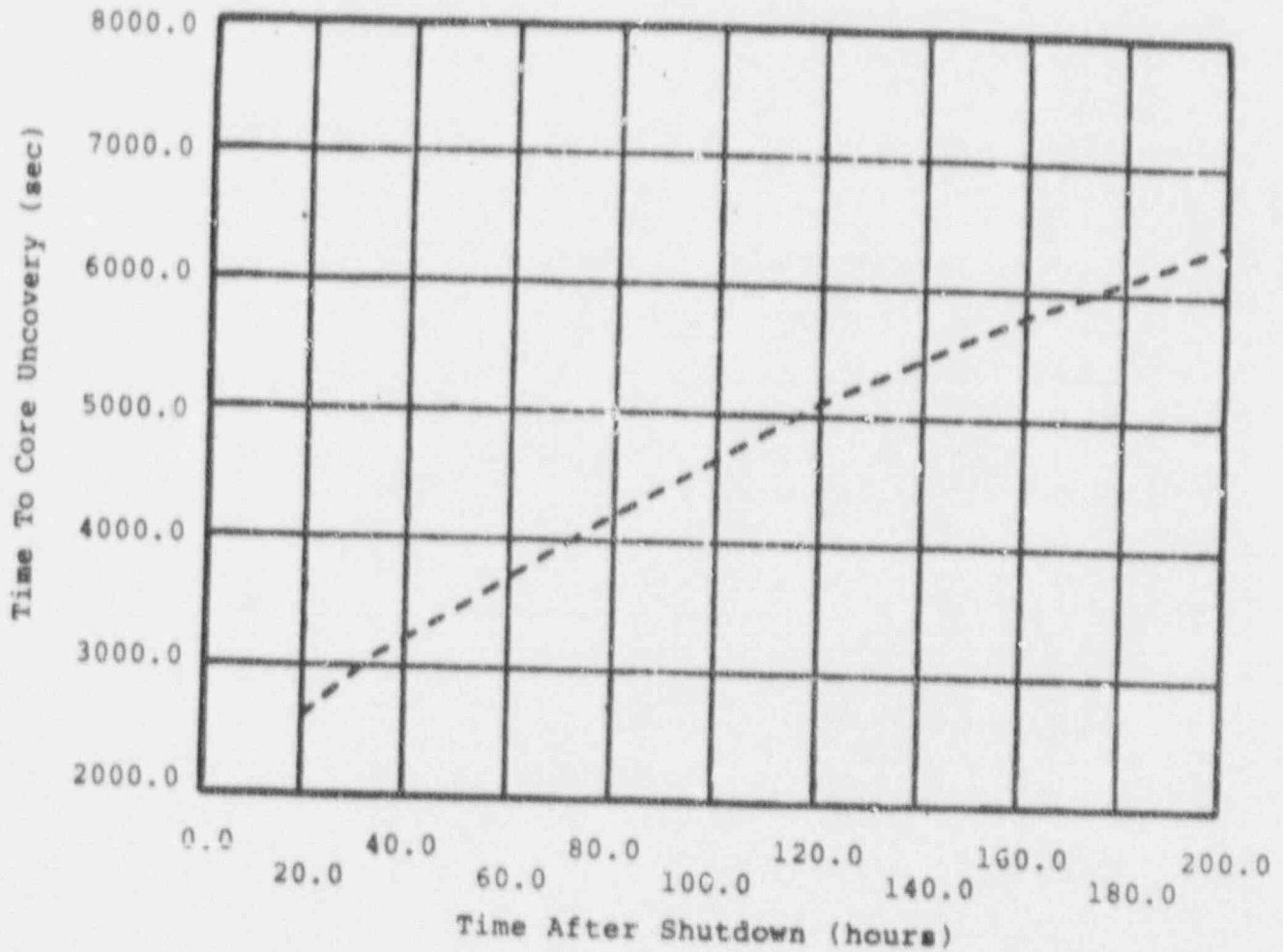

FIGURE 3 - TIME FOR CORE UNCOVERY

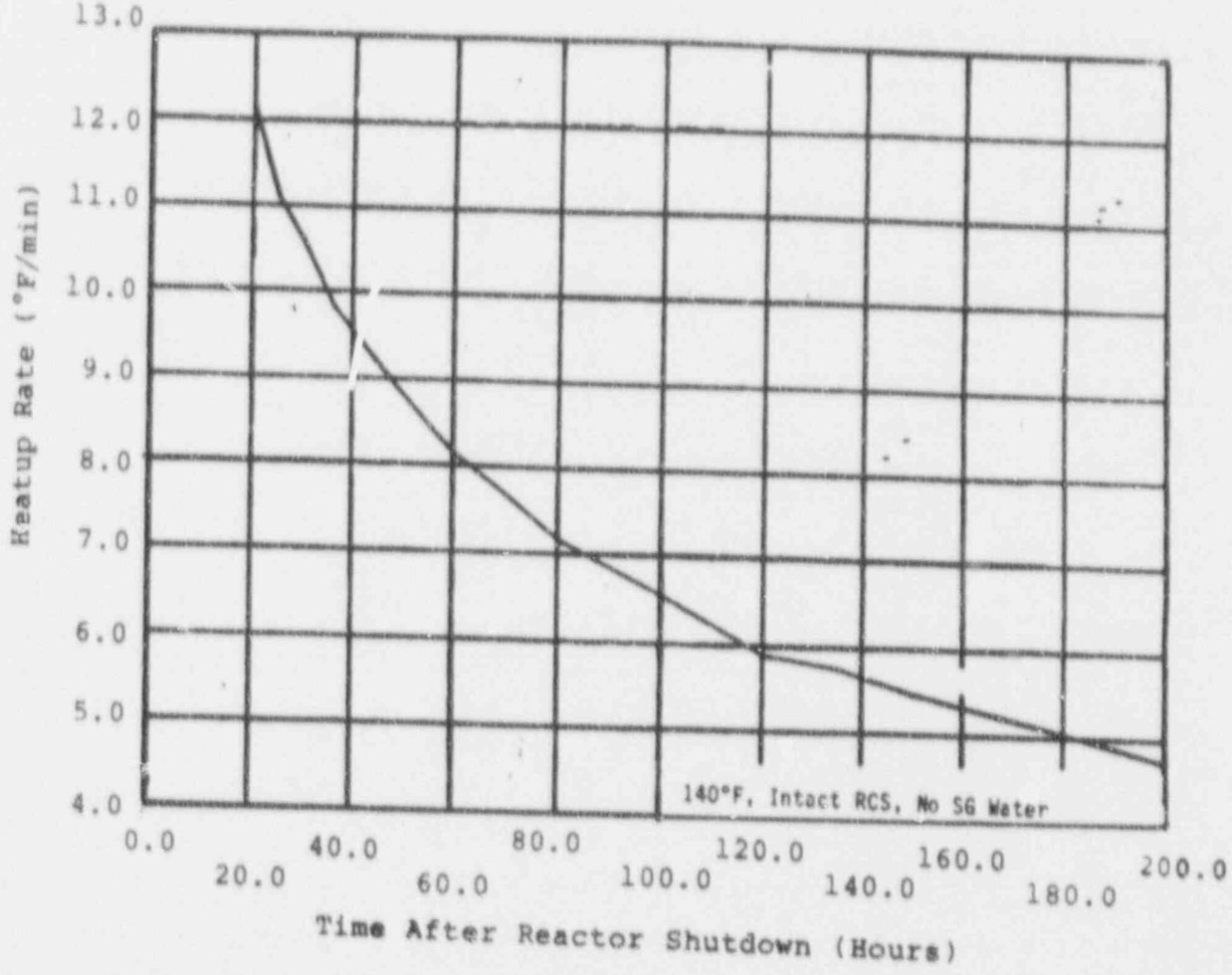

FIGURE 4 - HEATUP RATE