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DESCRIPTION: Ltr re our 3-14-75 ltr...trans the following:

ENCLOSURES: Post Accedent Operation of the Emergency Core Cooling System to Control Concentration of Boric Acid in the Reactor Vessel.......

PLANT NAME: Turkey Point 3 & 4

FOR ACTION/INFORMATION 4-9-75 ehf

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FLORIDA POWER & LIGHT COMPANY

April 4, 1975
L-75-170

Mr. George Lear, Chief
Operating Reactors Branch #3
Division of Reactor Licensing
Office Of Nuclear Reactor Regulation
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

Dear Mr. Lear:

Re: Turkey Point Unit Nos. 3 & 4
Docket Nos. 50-250 & 50-251
Post Accident Operation of The Emergency
Core Cooling System to Control Concentration
of Boric Acid in the Reactor Vessel

In response to your letter of March 14, 1975, regarding the potential problem of boric acid concentration in the reactor vessel during the long term recirculation phase following the hypothetical rupture of one of the reactor coolant system (RCS) cold leg pipes, we submit the following:

The concentration of boric acid will be controlled by injecting core cooling water into the reactor vessel via the existing Safety Injection System connections to the RCS hot leg piping. The attached operating procedure describes the details of how the hot leg injection flow will be established. This hot leg injection flow will allow the proper concentration of boric acid to be circulated through the core maintaining a safe shutdown condition and precluding the precipitation of boric acid in the reactor vessel.

For the postulated reactor coolant system cold leg rupture, the Safety Injection System is designed to ensure that flow from both hot leg injection lines reaches the core even in the event of a single component failure. The system provides for redundant, parallel hot leg injection isolation valves such that there is always flow to both hot leg injection lines even if one valve cannot be opened. The system also provides the minimum combination of safeguards pumps, as discussed in Section 6.2 of the FSAR, for delivery of hot leg flow during post accident recirculation even in the event of the most conservative single failure.

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Only the Safety Injection System hot leg isolation valves are potentially affected by the post accident containment environment. However, as discussed in Section 6.2 of the FSAR, tests conducted during the design phase of the plant qualified these valves for operation in the post accident containment environment.

In summary, the boric acid concentration will be controlled by utilizing core cooling flow via the Safety Injection System hot leg injection lines. The Safety Injection System design satisfactorily ensures hot leg injection flow while withstanding both a single failure and the adverse post accident containment environment. In light of this, it is concluded that the system is satisfactory to provide long term core cooling with the proper boron concentration and that no equipment modifications are required.

Very truly yours,

Robert E. Uhrig
Vice President

REU:GEL:nch
Attachment

cc: Mr. Norman C. Moseley
Jack R. Newman, Esquire

1.0 Title:

LOSS OF REACTOR COOLANT

2.0 Approval and List of Effective Pages:

2.1 Approval:

Reviewed by Plant Nuclear Safety Committee June 1 1971
Approved by *JRBowden* Plant Supt. June 4 1971
Change dated 3/20/75 Reviewed by PNSC March 28 1975
Approved by *[signature]* Plant Supt. *March 31,* 1975

2.2 List of Effective Pages:

Page	Date/Rev	Page	Date/Rev	Page	Date/Rev	Page	Date/Rev
1	3/28/75	3	3/28/75	5	Rev. 4	7	3/28/7
2	3/28/75	4	Rev. 4	6	3/28/75	8	3/28/7
						9	3/28/7
						10	3/28/7
						11	3/28/7

3.0 Purpose and Discussion:

3.1 Purpose

This procedure provides instructions to be followed in the event of a break in the reactor coolant boundary of either unit which resul in the loss of reactor coolant in excess of charging pump capacity.

3.2 Discussion

It is considered to be advantageous to maintain the non-affected unit in operation during the initial phases of this type accident, as long as the requirements of Technical Specifications, Section 3.4, are not violated. The second unit should, however, be brought to hot shutdown as soon as practical without endangering the reliability of the off-site power supply.

Breaks of 6 inches or larger result in the momentary uncovering of the core, which may result in clad rupture, with resulting release of fuel rod gap activity.

The safety injection system provides the first line of defense by deluging the core with a continuous flow of borated water. This flow provides core cooling to prevent fuel melting, which would result in the release of additional fission products.

High temperature subcooled water escaping from the rupture flashes into steam and rapidly increases containment pressure. The initial pressure peak during a large rupture is in excess of 40 psi and is limited only by the ability of the free volume of the containment to absorb large amounts of energy.

Containment emergency coolers and containment sprays provide the energy removal means to limit further pressure increase from core residual heat, and also provide enough excess energy removal capability to condense steam and reduce containment pressure.

Either two spray pumps or three emergency coolers provide adequate heat removal capacity to rapidly reduce containment pressure following blowdown of the RCS. Reduction incontainment pressure reduces leakage of activity from the containment.

The containment emergency filters start automatically on Safety Injection and act to reduce containment airborne activity. Radioactive iodine is the nuclide of major concern regarding offsite dose. Two of the three filters operating for the first 2 hours after the accident reduce the iodine concentration to 2% of it's original value. Failure of a filter unit after 2 hours presents a problem in that the decay heat of the absorbed iodine may ignite charcoal and re-release the iodine. Normal fan air flow through the filters provide adequate cooling. The loss of air flow automatically opens valves which supply borated water spray to the filter elements from the containment spray system. Thermocouples are provided to monitor charcoal temperatures. Sprays may be operated manually if required. Containment sprays must be in service if filter spray is required.

Post accident measures include the addition of chemicals to control the pH of the recirculation fluid. This minimizes the possibility of chloride stress corrosion in the post accident environment. Detailed instructions for the post accident chemical injection into the RCS are included in Appendix A of this procedure.

Power supply for the safeguards equipment is from the FPL system via the startup transformer. Initiation of Safety Injection results in the tripping of the affected unit, the automatic transfer of A and B 4160V buses from auxiliary power to startup power and the A and B emergency diesels start and attain rated speed/voltage. All safeguards equipment starts. If both 4160V buses are de-energized for a period of 1/4 sec. both buses are stripped, the A and B Emergency Diesel generators (which would have been started by SI) breakers close. Safeguards loads are automatically started in sequence by the emergency load sequencer. One emergency diesel generator provides adequate capability to provide safeguards loads for the accident unit and power to maintain the second nuclear unit in a hot shutdown condition.

Symptoms first observed by the operator will be low pressurizer level and low pressurizer pressure. These parameters are also common to steam line break accidents and steam generator tube rupture. A steam line break reduces pressurizer level and pressure due to a reduction in reactor coolant volume by cooldown. The loss of pressurizer level and pressure associated with a loss of coolant results from a reduction in primary coolant mass. Rupture of the RCS boundary of such a size to result in the actuation of safety injection within 30 seconds would be accompanied by only a small change in Tavg, i.e. 5 - 10 F. A steam break producing equivalent effect on pressurizer level and pressure would be accompanied by a reduction in Tavg of 50 F or more.

Loss of reactor coolant and a steam line break inside containment both result in increases in containment pressure. A reactor coolant system rupture of approximately 10" diameter or the total rupture of a main steam line inside containment would result in a containment pressure of greater than 25 psi within 30 seconds. The distinguishing feature of the loss of coolant is a high radiation alarm. Area monitors located in containment (Channels 2 & 3, Unit #3 and Channels 5 & 6, Unit #4) would reach the alarm point very quickly in the case of a large break. Process monitor R12 would alarm prior to being isolated when containment pressure reached 4.0 psig. R11 would not alarm until approximately 20 min. later.

Channels R11 and R12 are the most sensitive means of detecting small leaks. Leakage of less than 1 gpm can be detected by R11.

Operator action in the event of a large break consists basically of verifying that required automatic actions have occurred and performing the manual valve alignment for high head recirculation. High head recirculation is used for the first 24 hours regardless of the RCS pressure. This method is used as the possibility exists that the break is in a low head injection line at it's point of attachment to the cold leg. A break at this point could result in the steam being generated by the high initial residual heat, holding the check valves closed in the other two low head injection lines. In this event the low flow resistance of the low head injection lines would permit the entire recirculation flow to be diverted to the break. The high head lines have very high flow resistance, therefore, only about one third of the recirculation flow would escape through the break.

As a result of post design information on emergency core cooling, the presently install high head hot leg injection flow path will not be used. The first 24 hours, flow via this path is blocked by closing valve 866A & 866B and locking open their respective MCC breakers 0732 & 0621. At 24 hours after break, unlock and close MCC breakers *-0732 (866A) and *-0621(866B), open MOV-*-866A, MOV-*-866B and check to be open MOV-*-869 and establish high head hot leg flow. Then close MOV-*-843A and MOV-*843B. If second train of RHR is available and RCS pressure is within 10 psi of containment pressure, low head recirculation can begin.

It will be necessary to check the SJAE Radiation Monitor R15 and the Steam Generator Liquid Sample Monitor R19. R19 will have been isolated by the SI signal and it will be necessary to return it to service. If high activity is noted in a steam generator, refer to Operating Procedure 1508.2, Steam Generator Tube Failure.

4.0 Symptoms:

4.1 High Containment Radiation (Unique)

4.2 Decreasing pressurizer pressure

4.3 Decreasing pressurizer level

4.4 Rising containment pressure

4.5 Rising water level in containment sump

5.0 Instructions:

5.1 Immediate Automatic Action on affected unit

1. Reactor trip

2. Turbine generator trip

3. Auxiliaries transfer to startup transformer

4. Safety injection actuation

   Steam generator feed pumps trip
   Feedwater control & bypass valves close
   Auxiliary feed pumps start
   Charging pumps A, B & C trip
   Pressurizer heater control & backup groups trip
   Diesel generator A & B start
   Containment isolation phase A (bright white lights Panel B)
   Containment ventilation isolation & control room ventilation isolation
   Safety injection pumps 3A, 4A, 3B, and 4B start
   RHR pumps A & B start
   Emergency containment coolers A,B,C start
   Emergency containment filters A,B,C start
   Valves receiving "S" signal assume required position as indicated by bright white lights on Panel B.

5. High High containment pressure (20 psig)(large break)

   Containment isolation Phase B (bright white lights Panel B)
   Containment spray initiation
   Main steam isolation valve closure

5.2 Immediate Operator Action

On affected unit:

1. Trip the reactor manually

2. Verify all full length rods fully inserted

3. Trip the turbine manually

4. Verify turbine stop and control valves are closed

5. Actuate safety injection manually

6. Verify safety injection has been initiated:

   4 SI pumps running satisfactorily
   Valve positions indicated by bright white lights SI initiation section Panel B
   Flow through BA injection tank FI 3-943

7. Verify that LCV-3-460 letdown stop valve is closed

8. Verify power supply

   Both 4160V buses energized from startup transformer
   A & B diesel running at 60 Hz and 4160V.
   If offsite power was lost refer to OP. 20,001

9. Notify Duty Call Supervisor.

On Non-Affected Unit:

1. Maintain the non affected unit as near as possible to steady state conditions during initial phase of accident.

2. Close steam generator blowdowns on non affected unit to conserve condensate storage tank water.

3. After verifying that the high head SIS pumps on the non affecte unit are operating, close SIS sectionalizing valves MOV-878A & 878B.

4. When the SIS signal has been reset stop the high head SIS pumps on the non affected unit and return their switches to auto.

5.3 Subsequent Action

On affected unit:

1. Verify initiation of containment spray at hi hi containment pressure (20 psig).

2. Verify emergency containment coolers and emergency containment filters are operating:

   Cooler fans running
   Cooler CC flow FI 1464, FI 1465 indicate total flow approximately 6000 GPM
   Filter fans running

3. Verify containment isolation phase A and containment ventilation isolation have taken place as indicated by bright white lights containment isolation section of Panel B.

4. If only one auxiliary feedwater pump is operable, steam dump must be minimized and reactor coolant pumps should be stopped as required to minimize heat input to the reactor coolant system.

   Reactor Coolant Pumps should be stopped whenever minimum conditions for their operation cannot be met.

5. Reset SI after 2 min. or more have elapsed.

6. If RCS pressure appears to be stabilizing at 1000 psi or above within 2 or 3 minutes after SI initiation, initiate the following action. If pressure does not appear to be stabilizing, proceed to Step 5.3.7.

   Place steam generator blowdown radiation monitor R19 in service

a. Turn A & B feed pump control switch to OFF.
b. Reset feedwater isolation.
c. Reset containment isolation.

d. Place control switch for SG Liquid Sample Valves MOV- -1425 MOV- -1426, MOV -1427 in OPEN.

If high activity is noted on R19, determine leaking SG by sampling each SG individually. Refer to OP 1508.2.

If activity levels are normal, begin dumping steam using condenser steam dump. If steam dump is not available, use atmospheric steam dump.

Coordinate the dumping of steam and the addition of auxiliary feed water to establish cooldown rate of 80 - 90 F/hour. Do not exceed steam generator flows of $0.5x10^6$ lb/hr, to prevent steam line isolation.

7. If RCS pressure is above 130 psig approximately 15 minutes after the accident stop both RHR pumps. If RCS is below 130 psig and both RHR pumps are operating stop one RHR pump.

8. Begin valve alignment to separate the A and B Component Cooling System headers in preparation for the recirculation phase. Start a second CC water pump to provide one CC water pump for each CCW header. Seperate headers as follows:

___*-787B	CC Pump B to C Suction Tie	Open
___*-787D	CC Pump B to C Discharge Tie	Open
___*-787G	CC Hx Outlet B to C Tie	Open
___*-787H	CC Hx Outlet B to C Tie	Open

_____Close required CC pump discharge tie *-787C.

_____Close required CC Hx outlet ties *-787E and *-787F.

_____Close required CC pump suction tie *-787A

9. If offsite power is reliable stop A and B Emergency diesel generators.

10. When the low level alarm is reached on the RWST reduce operating pumps to:
2 - SI pumps
1 - RHR pump (if operating)
1 - Containment Spray (if operating)

Unlock and close the MCC breakers for the following MOV's

Breaker Number	Breaker Location	Valve Number
_____*_0720	C MCC	MOV-*-862 A
_____*_0616	B MCC	MOV-*-862 B
_____*_0712	C MCC	MOV-*-864 A
_____*_0605	B MCC	MOV-*-864 B

11. When RWST low/low level alarm is reached, stop operating SI, RHR and Containment Spray Pumps. Recirculating sump level lights should be lit.

12. Isolate the affected unit RWST as follows:

_____	*-856A SI Pump Recirc. to RWST	close
_____	*-856B SI Pump Recirc. to RWST	close
_____	*-862A RWST to RHR	close
_____	*-862B RWST to RHR	close
_____	*-864A RWST outlet	close
_____	*-864B RWST outlet	close
_____	892A SI Sectionalizing Recirc Isol	close
_____	892B SI Sectionalizing Recirc Isol	close

13. Align the following valves to provide high head recirculation:

_____	MOV-*-863A A RHR HX to SI Suction	open
_____	MOV-*-863B B RHR HX to SI Suction	open
_____	MOV-*-860B Recirc. Sump to A RHR pump	open
_____	MOV-*-861B Recirc. Sump to A RHR pump	open
_____	MOV-*-860A Recirc. Sump to B RHR pump	open
_____	MOV-*-861A Recirc. Sump to B RHR pump	open
_____	MOV-*-744A RHR Return to RCS	close
_____	MOV-*-744B RHR Return to RCS	close

14. Open MOV-*-749A CC from *A RHR HX and start *A RHR pump <u>or</u> open MOV-*-749B CC from B RHR HX and start *B RHR pump.

15. Start 2 SI pumps.

16. Verify recirculation flow to core by checking FI 943.

17. If the operable Emergency Containment Coolers cannot maintain containment pressure below 30 psig, use containment spray in the recirculation mode. Open MOV*-880A and start *A CSP or open MOV*-880B and start *B CSP. Do not operate both CSP simultaneously.

18. After starting CSP check FI 943. If use of the CSP results in a reduction of flow to the core, of 20% or more, discontinue using spray.

19. Verify that Emergency Containment filter fans continue to run. If a filter fan fails monitor the charcoal temperature. If a temperature of 325F is exceeded, initiate filter sprays. NOTE: Containment spray is required for filter spray.

20. Continue to operate all three Emergency Containment Coolers if containment pressure is 2 psig or above.

21. Establish chemistry controls on the recirculation flow as soon as practical as directed by the Radiochemist in accordance with Appendix A of this procedure

22. After 24 hours, unlock and close breakers MCC-*-0732 (MOV-*-866A) and MCC-*-0621 (MOV-*-866B). Open MOV-*-866A, MOV-*-866B and check to be open MOV-*-869. After flow has been established on high head hot legs, close high head cold legs MOV-*-843A and MOV-*-843B for several hours.

23. If RCS pressure is higher than containment pressure by 10 psi or less after 24 hours, and second train of RHR pumps and RHR heat exchangers are available, start second RHR pump and close the corresponding MOV-*-863A or MOV-*-863B. On the RHR pump and RHR heat exchanger being used to recirculate to high head SI pumps, close corresponding valve *-759A or *-759B (these have a reach rod to auxiliary building North/South corridor). Then perform the following steps for low head recirculation:

NOTE: If the second RHR train is not available, try to make it operable for this purpose.

____MOV-*-744A	RHR return to RCS	open
____MOV-*-744B	RHR return to RCS	open
____HCV-758	RHR Temperature Control	open

24. If flow on FI 605 is less than flow obtained in the high head recirculation mode, return to high head recirculation.

25. If any of the following symptoms occur, a malfunction of low head recirculation is indicated.

1. Flow in excess of 5000 gpm on FI605 with one RHR pump in service.
2. Increasing containment pressure
3. Increasing water level in RHR sump

26. If a serious leak develops in the single line flow path of low head recirculation, the alternate low head recirculation path can be utilized as follows:

____Stop Running RHR Pump	
____759A A RHR HX Outlet	close
____759B B RHR HX outlet	close
____MOV-*-863A A RHR HX Outlet to SI Suction	open
____MOV-*-863B B RHR HX Outlet to SI Suction	open
____MOV-*-860A Recirc. Sump to A RHR Pump	open
____MOV-*-861A Recirc. Sump to A RHR Pump	open
____MOV-*-860B Recirc. Sump to B RHR Pump	open
____MOV-*-861B Recirc. Sump to B RHR Pump	open
____MOV-*-872 Alternate low Head	open
____Start one RHR pump	
____Verify that RHR pump discharge pressure PI-600 is between 110 and 120 psig.	

6.0 References:

6.1 Westinghouse Procedures E-0 and E-1.

6.2 FSAR, Sections 6 and 14.

6.3 Chemistry Criteria and Specification for Westinghouse Pressurized Water Reactor.

6.4 Operating Procedure 20001, Blackout Operation.

6.5 Off-Normal Operating Procedure 1508.2, Steam Generator Tube Failure

7.0 Records Required:

7.1 Log entries.

APPENDIX A
POST ACCIDENT CHEMICAL INJECTION TO RCS

Transfer the Borax (Sodium Tetraborate Decahydrate) located in the SE corner or the "Old Bechtel Warehouse" to the batch tank area by the most practical method available.

Verify that the BA Batching Tank and related systems are operable as per Operating Procedure 2603.5, CVCS Batching and Transferring.

Add 650 gallons of primary water (78% level) to the batching tank.

Preheat water to at least 150 degrees prior to adding borax (Sodium Tetraborate Decahydrate)

Add 8 barrels of Borax Sodium Tetraborate Decahydrate (1300 lbs.) to the batch tank and stir with the mixer until thorough mixing is achieved.

To minimize changes in valve alignments, use 3A or 3B BA Transfer Pump is Unit 3 is the affected unit, 4A or 4B transfer pump if Unit 4 is the affected unit.

Secure the normal suction to the transfer pump to be used (close valve #338, 334, 392, or 393, whichever is appropriate).

Open batch tank outlet valve #325 and transfer pump suction valve #398 A, B, C, or D whichever is appropriate.

Align pump discharge to bypass the BA filter (Refer to Dwg. CVCS Sheet 2 (attached) for proper valve alignment).

Check to be closed BA tank recirculation HCV 104, HCV 105, and HCV 110. Minimal recirculation will be maintained to protect pump by the orifice in the recirculation line.

Check for adequate VCT level prior to starting a charging pump. If VCT level is low and 115B has not auto opened, open 115B.

Close inlet valves to seal water injection filters (293B & 293D).

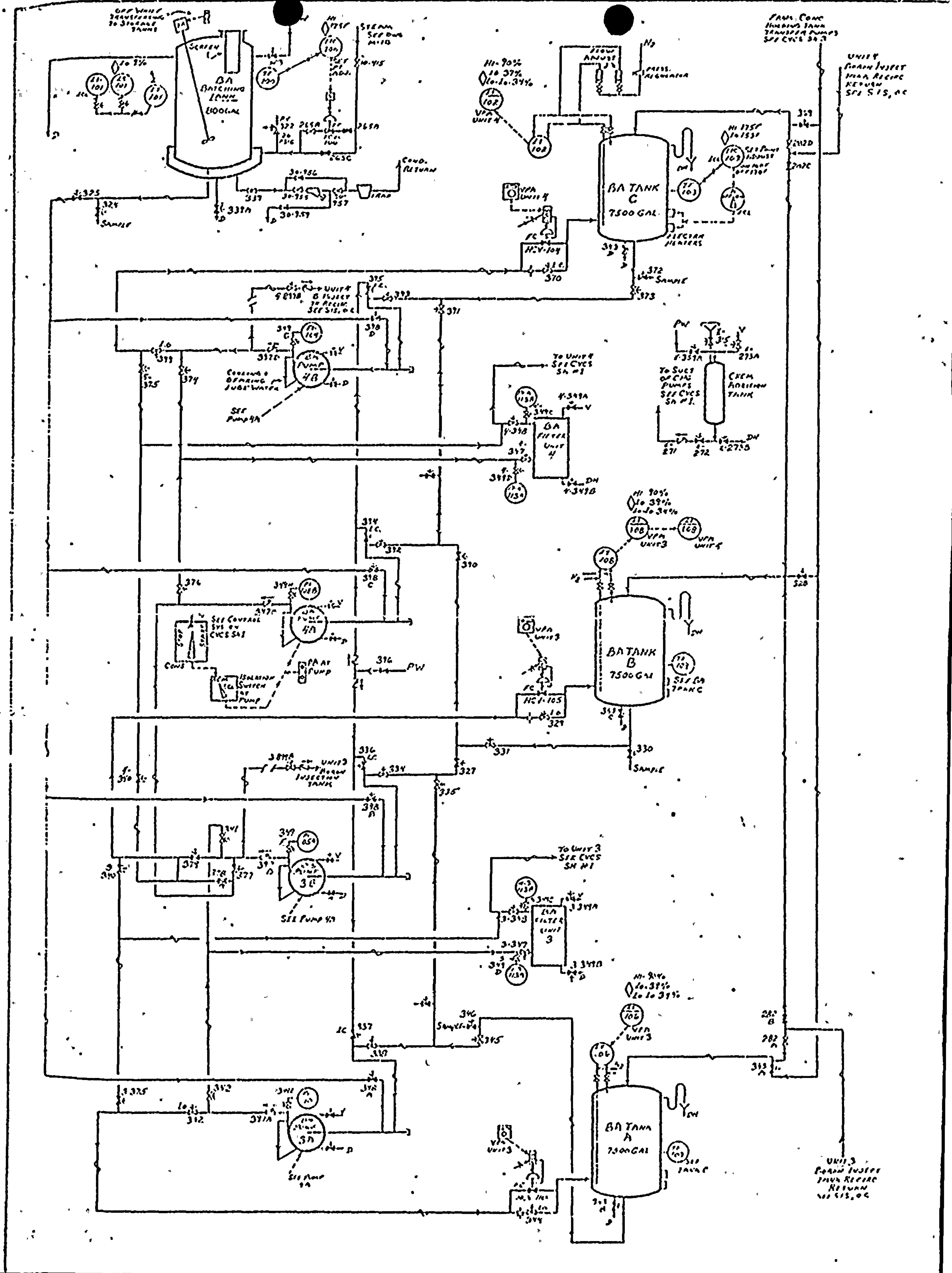
Observe that HCV 121 is full open and that either 310A or 310B is open.

Start the appropriate BA transfer pump. Open MOV 350. Start a charging pump.

Monitor FI 110 (Emergency Boration - VPA) and FI 122 (Charging Flow - VPA) for adequate flow (approximately 60 GPM).

Batching tank will empty in approximately 5 minutes. It is imperative that the batch tank level be monitored and the pump stopped before the level is gone to preclude burning up the pump.

Trip the running charging pump after each batch of Borax has been injected into the RCS.


BA TANK C
7500 GAL
BA TANK B
7500 GAL
BA TANK A
7500 GAL
BA BATCHING TANK
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HCV-105
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SEE PUMP 4A
SEE PUMP 3A