CONNECTICUT YANKEE ATOMIC POWER COMPANY

BERLIN, CONNECTICUT
P. O. BOX 270 HARTFORD, CONNECTICUT 06101

TELEPHONE
203-666-6911

July 22, 1981

Docket No. 50-213
A00199

Director of Nuclear Reactor Regulation
Attn: Mr. Dennis M. Crutchfield, Chief
Operating Reactors Branch #5
U. S. Nuclear Regulatory Commission
Washington, D.C. 20555

References: (1) W. G. Counsil letter to D. G. Eisenhut, dated December 4, 1979.
(2) W. G. Counsil letter to D. M. Crutchfield, dated June 10, 1980.

Gentlemen:

Haddam Neck Plant
NRC Requirements for Auxiliary Feedwater Systems

By References (1) and (2), Connecticut Yankee Atomic Power Company (CYAPCO) responded to NRC recommendations for improvements in the auxiliary feedwater system at the Haddam Neck Plant. As a result of several telephone discussions with the Staff and following additional CYAPCO reviews of the open items identified in References (1) and (2), the following information is provided to resolve the remaining concerns on the auxiliary feedwater system:

1. In the Reference (1) response to additional long-term recommendation 3, reference was made to the installation of an isolation valve in the common crossconnect line. In response to the verbal Staff concern, CYAPCO notes that this valve can be manually operated locally if required. This valve will be installed by January 1, 1982 in accordance with the schedular requirements of NUREG-0737.

A001
S/1

2. In Reference (2), the response to Long-Term Recommendation GL-2 indicated that additional studies were in progress. After clarifying telephone discussions with the Staff, CYAPCO hereby identifies its intention to install a bypass valve and associated piping around the existing suction line isolation valve. CYAPCO intends to install a six inch manually operated gate valve such that valve FWV-150A can be bypassed. This valve is scheduled for installation during the 1981 refueling outage; hence the required installation date of January 1, 1982 will be met.

3. In the Reference (1) response to Recommendation GS-4, CYAPCO indicated that procedures for transferring the auxiliary feedwater pump water supply from the primary water supply to the alternate water supply were scheduled for completion by January 1, 1980. The details of the transfer are identified in Section 5.8.1 of the attached procedure EOP 3.1-9, Revision 8. This procedure was implemented with these changes as part of Revision 5 which was approved on December 19, 1979.

4. To facilitate Staff review of Recommendation GS-6, your attention is called to Section 4.11 and 7.6 of the attached procedure NOP 2.1-2, Revision 5, and the attached surveillance procedure SUR 5.1-13, Revision 8. After an extended shutdown, the turbine driven auxiliary feedwater pumps are used to verify flow path from the Demineralized Water Storage Tank to the steam generators. Normal valve lineup for this test is verified by surveillance procedure SUR 5.1-13, Revision 8.

5. Regarding Staff concerns on the annual flow verification test, your attention is called to Section 4.1 of the attached surveillance procedure SUR 5.1-14, Revision 3. This procedure became effective on December 19, 1979.

We trust the above information is sufficient to resolve the docketed Staff concerns on the auxiliary feedwater system at the Haddam Neck Plant.

Very truly yours,

CONNECTICUT YANKEE ATOMIC POWER COMPANY

W. G. Counsil
Senior Vice President

PLANT OPERATIONS REVIEW COMMITTEE APPROVAL

Connecticut Yankee
Emergency Operating Procedure No. 3.1-9

TOTAL LOSS OF A.C.

APPROVED BY STATION SUPERINTENDENT

EFFECTIVE DATE 2-13-81

ADM 3827-1 6-79

1.0 DISCUSSION

1.1 Power is normally available to the plant from two outside sources. Each source is provided with protective relay systems which will detect faults in either line section and isolate the faulted section by automatic switching. In this manner, power is maintained to the plant under most conditions.

1.2 In the event of a complete loss of normal station service AC power supplies, the resulting reactor and turbine trip and an immediate separation of the generator from the 345 KV system, the flywheel inertia of the reactor coolant pumps sustains coolant flow sufficient to assure removal of a minimum amount of heat and prevent core damage immediately following the loss of power.

1.3 As with any reactor or turbine-caused trip, all reactor coolant pumps remain in service for approximately one minute if only the 115KV lines are affected. The combined periods of full coolant flow and the subsequent pump coastdown assure adequate heat removal and prevention of core damage.

1.4 During normal operation when power is available from the 115 KV system, emergency bus sections 8 and 9 are being supplied from buses 1-2 and 1-3 and the emergency generators are not operating. Loss of voltage on both 4160V bus sections 8 and 9, after a short time delay to allow for 115 KV line reclosure or transfer of supplies, will initiate automatic operations which isolate the emergency buses 8 and 9 from their normal supply (open breakers 2T8, 8T2, 3T9 and 9T3), strip and lockout all unnecessary 480V loads; start the emergency generators, connect them to their respective emergency buses and start a service water pump. Should a core cooling signal be received, all engineered safeguards pumps, together with a containment fan will be started sequentially in each emergency bus sections.

Page 6

1.5 The restoration of normal AC supply is subject to transmission line and system conditions.

2.0 SYMPTOMS

2.1 The following indications and/or alarms will be displayed on the Main Control Board as a result of a total loss of AC power:

2.1.1 Reactor and turbine trip alarms.

2.1.2 Low flow alarms on all loops.

2.1.3 Low bus voltage indications and/or alarms on all bus sections.

2.1.4 Low voltage indications on both 115K lines.

2.1.5 Loss of normal plant lighting.

3.0 AUTOMATIC ACTION

3.1 Turbine and reactor trip.

3.2 Loss of 4160V buses 1-2 and 1-3 causes the following:

3.2.1 The 4160V supply breakers trip. Automatic closing of the supply breakers due to 115KV line restoration is blocked.

3.2.2 4160V bus 1-1A tie breaker T1A and 4160V bus 1-1B tie breaker 2T1B trip and lockout.

3.2.3 All feeder breakers on buses 1-2 and 1-3 trip, except breakers 4840 and 4970.

3.3 Loss of 4160V buses 8 and 9 causes the following:

3.3.1 Trip and lockout of:

3.3.1.1 4160V breakers 2T8, 8T2, 3T9 and 9T3.

3.3.1.2 480V bus supply breakers 4841 and 4971

3.3.1.3 480V feeder breakers to MCC-1, 2, 3, 4, 6 and 7.

3.3.1.4 480V feeder breakers to the rod drive MG sets, lighting transformers, service air compressor, turbine generator auxiliary oil pumps, electric fire pump and the information center.

3.3.1.5 480V tie breaker 5T6.

3.3.2 Trip and block automatic start of the following:

3.3.2.1 Charging pumps

3.3.2.2 Component cooling pumps

3.3.2.3 Pressurizer heaters

3.3.2.4 Service water pumps

3.3.3 Trip off:

3.3.3.1 Containment recirculation fan

3.3.3.2 High pressure safety injection pumps

3.3.3.3 Low pressure safety injection pumps

3.3.3.4 Residual heat removal pumps

3.3.3.5 Charging metering pump

3.3.3.6 Circuit breakers feeding MCC-8

3.3.4 480V tie breakers 4T5 and 6T7 closes.

3.3.5 Emergency diesel generators EG2A and EG-2B starts.

3.4 When the emergency diesel generators EG-2A and EG-2B attain speed and voltage; the following buses/equipment will automatically be initiated:

3.4.1 Diesel generator breaker EG-2A closes to energize buses 8, 4 and 5.

3.4.2 Diesel generator breaker, EG-2B closes to energize buses 9, 6 and 7.

3.4.3 If normal supply to MCC-5 is not energized, automatic throwover breaker closes to alternate supply restoring power to the:

3.4.3.1 Motor operated valves

3.4.3.2 Control air compressors

3.4.3.3 Computer and data logger

3.4.3.4 Semi-vital 120V bus

3.4.3.5 Fuel oil transfer pumps

3.4.3.6 Diesel generator auxiliaries

3.4.3.7 Closed cooling system pumps

3.5 Service water MOV's 1, 2, 3 and 4 and AOV's 8 and 9 closes.

3.6 Timers are actuated to start one service water pump on each emergency diesel generator.

3.7 If a core cooling signal exists (WL switches have operated):

3.7.1 All power operated valves associated with this system are positioned according to their program.

3.7.2 Timers are actuated to sequentially start:

3.7.2.1 1A and 1B low pressure safety injection pumps.

3.7.2.2 1A and 1B high pressure safety injection pumps.

3.7.2.3 One containment recirculation fan supplied by each emergency diesel generator.

4.0 IMMEDIATE OPERATOR ACTION

4.1 Manually trip reactor and turbine.

4.2 Verify that all relays and timers function to start the diesel generators, place the required equipment in service and properly position the associated power-operated valves.

4.3 Start auxiliary feed pump and feed steam generators through bypass valves.

4.4 Start component cooling within 2 min. to provide cooling for RCP thermal barrier.

4.5 Check RCP lower bearing temperatures less than 170°F and start a charging pump and initiate seal water flow to RCP's.

4.6 Open atmospheric dump valve and steam to hog jets as needed to maintain Tave.

4.7 Secure all chemical and radiological releases.

4.8 If loss of coolant has occurred, refer to EOP 3.1-4.

NOTE: Boration of RCS may be necessary per EOP 3.1-12 if Tave approaches 500°F.

5.0 SUBSEQUENT OPERATOR ACTION

5.1 Verify steam dump closes on loss of condenser vacuum.

5.2 Secure steam to the condenser air ejectors.

5.3 Verify turbine and generator D.C. oil pumps are operating and maintaining proper oil pressures.

5.4 If no core cooling signal exists energize such equipment that may be desirable, i.e. containment recirc. fans.

5.4.1 Open all breakers for boron recovery system equipment on MCC-8 and close the 480V supply breakers at buses #5 and #6.

5.4.2 Lockout all automatic starting 480V equipment not in service.

5.4.3 Manually open all breakers on any MCC to be re-energized.

5.4.4 Reset the lockout relays for each 480V bus.

5.4.5 Restore pressurizer level to normal.

5.4.6 Maintain coolant pressure above saturation with pressurizer heaters.

5.4.7 Start both battery chargers.

5.4.8 Place main generator AC seal oil pumps in service and stop the D.C. pump.

5.4.9 Place turning gear oil pump in service and stop the D.C. pump.

5.5 Notify higher supervision.

5.6 Contact CONVEX SOS for information as to the expected time for restoration of the normal power supply.

5.7 If unable to estimate when normal power supply will be restored or outage is to be prolonged, purge from main generator with CO_2 and commence borating reactor coolant system and initiate cooldown of RCS.

5.8 Control steam pressure and Tavg with atmospheric steam dump and feeding steam generators to maintain normal levels.

5.8.1 When level in demineralized water storage tank gets down to the low level alarm set point (54,000 gallons), line up to transfer water from the primary water storage tank to the demincralized water storage tank as follows:

(a) Check that power is available to the primary water transfer pumps by observing pump breaker position lights on Main Control Board.

(b) Check that primary water transfer pump discharge header is lined up to the turbine hall by opeing valve PW-V-111. Close PW-V-112 and check closed WD-V-397.

(c) Check line up in turbine hall to demineralized water storage tank by opening DW-V-542 and DW-V-509. Check open DW-V-504, DW-V-1135, DW-V-1634, DW-V-1637 and CD-V-632.

(d) Start primary water transfer pump and monitor both demineralized water storage tank level and primary water storage tank level.

5.9 Restoration

5.9.1 Place control switches for all equipment and bus ties on 4160V buses 1-2, 1-3, 1-1A and 1-1B in trip-pullout position.

NOTE: If charging pumps not running, place control switches in trip pullout position.

5.9.2 Check 399 T 399 OCB closed.

5.9.3 Close 3891 and 3991 ACB's.

5.9.4 Reset lockout relays 27Y/1-2 and 27Y/1-3.

5.9.5 Open 2T3 (if closed).

5.9.6 Reset lockout relay 86/1-8.

5.9.7 Reset lockout 27Y/1-8.

5.9.8 Close tie breaker 2T8.

NOTE: Control switch must be moved to open position, first, to clear amber light.

5.9.9 Adjus frequency and voltage to bring bus 1-8 into synch onism with bus 1-2.

5.9.10 Close tie breaker 8T2.

5.9.11 Reset safety injection relays (WL) 4A and 4B, if possible. See Procedure EOP 3.1-4.

5.9.12 Reset diesel start relay 4/EG2A, if 4A and 4B can be reset or have not operated.

5.9.13 Reduce load on EG2A to minimum and open generator breaker.

5.9.14 Close 4841, open 4T5.

5.9.15 Shutdown engine for EG2A and place it on standby.

5.9.16 Reset lockout relay 86/1-9

5.9.17 Reset lockout 27Y/1-9.

5.9.18 Close tie breaker 3T9.

NOTE: Control switch must be moved to open position, first, to clear amber light.

5.9.19 Reset diesel start relay 4/EG2B, if 4A and 4B are reset.

5.9.20 Adjust frequency and voltage to bring bus 1-9 into synchronism with bus 1-3.

5.9.21 Close tie breaker 9T3.

5.9.22 Reduce load on EG2B to minimum and open the generator breaker.

5.9.23 Close 4971, open 6T7.

5.9.24 Restore plant distribution to normal.

5.9.25 Start all necessary auxiliary systems.

5.9.26 Close 345 yard supply breakers on Bus 1-2 and Bus 1-3.

5.9.27 Close SWV-401A and SWV 401-B upper level of PAB.

5.9.28 Reset trip valves TV SWV 2365A, TV-SWV-2365B and TV-SWV-2210.

5.9.29 Slowly open SWV-401A and SWV 401B.

5.9.30 Close CC-V-661.

5.9.31 Reset CC-AVT-2214.

5.9.32 Slowly open CC-V-661.

5.10 File plant information report and notify Duty Officer.

PLANT OPERATIONS REVIEW COMMITTEE APPROVAL

Connecticut Yankee
Surveillance Procedure No. 5.1-13
Operations

AUXILIARY FEED PUMP MONTHLY FUNCTIONAL TEST

APPROVED BY STATION SUPERINTENDENT

EFFECTIVE DATE 12-19-79

ADM3827-1 6-79

1.0 OBJECTIVE

The objective of this test is to verify, on a monthly basis, that each auxiliary steam generator feed pump is operational. This is accomplished by operating each pump on recirculation to the DWST for a given length of time.

2.0 LICENSE OR ADMINISTRATIVE REQUIREMENTS

2.1 Technical Specifications, Section 4.8, Auxiliary Steam Generator Feed Pump.

3.0 REFERENCES

3.1 Flow Diagram 10899-RM-40A, Condensate, Feedwater and Heater Drain lines.

4.0 PREREQUISITES

4.1 The plant is operating or in the hot standby condition with steam pressure $\geq$ 300 psig available to operate turbine pump.

4.2 1A and 1B Auxiliary steam generator feed pump steam supply pressure gauges and discharge pressure gauges have been calibrated yearly.

4.3 Final valve status checklist must be completed and initialed by two independent operators.

5.0 PRECAUTIONS

5.1 Ensure that the feed pump discharge pressure does not exceed 1000 psig.

5.2 If a valve is not found in the position indicated on the valve check-off list when performing the Initial or Final Valve Alignment, immediately notify the shift supervisor. Do not proceed until the situation is resolved.

5.3 Do not adjust electrical load while conducting test.

5.4 Monitor auxiliary feed pump discharge line temp. following this test. Increased temperature indicates back leakage through check valve. (FW-CV-156-1, 2, 3, or 4).

6.0 PROCEDURE

6.1 Complete the "Initial Valve Status" column of valve checklist No. 1 and vent 1A and 1B Aux. Feed Pump casings.

6.2 Establish communications between the auxiliary feed pump area and the Control Room.

6.3 Place the 1A auxiliary turbine in operation by slowly opening the auxiliary turbine steam controller PIC-1206 on the MCB until the steam pressure is 290 to 300 psig. Observe the auxiliary feed pump discharge pressure to 800 to 1000 psig. Do not exceed 1000 psig.

6.4 Operate the 1A auxiliary feed pump for 15 minutes on recirculation. Record the auxiliary turbine steam pressure and the auxiliary feed pump discharge pressure on test data sheet 9.0.

6.5 After completing the 15 minute recirculation run, shutdown the auxiliary turbine from the MCB by closing the steam controller PIC-1206. Verify that the turbine stops.

6.6 Repeat steps 6.3 through 6.5 1B auxiliary feed pump.

6.7 Complete the "Final Valve Status" column of valve checklist No. 1.

6.8 Second operator, complete the "Final Valve Status" column of valve Checklist No. 1.

7.0 CHECKOFF

7.1 The following prerequisites of Section 4.0 are satisfied:

7.1.1 The plant is at power or at hot standby _____

7.2 The precautions of Section 5.0 have been read, understood and complied with _____

7.3 Complete functional test of each auxiliary feed pump as follows:

7.3.1 Complete the "Initial Valve Status" column of valve checklist No. 1 and vented pump casings (step 6.1). _____

7.3.2 Establish communications between auxiliary feed pump area and control room (step 6.2) _____

7.3.3 Perform Test of 1A auxiliary feed pump by completing steps 6.3 thru 6.5 _____

7.3.4 Perform Test of 1B Auxiliary Feed Pump by completing step 6.6 _____

7.3.5 Complete "Final Valve Status" column of valve checklist No. 1 (step 6.10) _____

7.3.6 "Final Valve Status" column of valve checklist no. 1 checked by second operator _____ _____

8.0 ACCEPTANCE CRITERIA

8.1 Verification of correct operation will be made both from instrumentation within the main control room and direct visual observation of the pumps.

9.0 PUMP DATA

9.1 1A Auxiliary Feed Pump Run Time _____ min.
1A Auxiliary Feed Pump inlet steam pressure _____ psig
1A Auxiliary Feed Pump Discharge pressure _____ psig

9.2 1B Auxiliary Feed Pump run time _____ min
1B Auxiliary Feed Pump inlet steam pressure _____ psig
1B Auxiliary Feed Pump discharge pressure _____ psig

Data Recorded By _____ _____
Operator Date

Valves Rechecked By _____ _____
Operator Date

Approved By _____ _____
Shift Supervisor Date

Reviewed By _____ _____
Department Head Date

AUXILIARY FEED PUMP

CONTROL FUNCTIONAL TEST

VALVE CHECKLIST NO. 1

SUR 5.1-13
Revision 8
DEC 1 9 1979

Valve Checklist

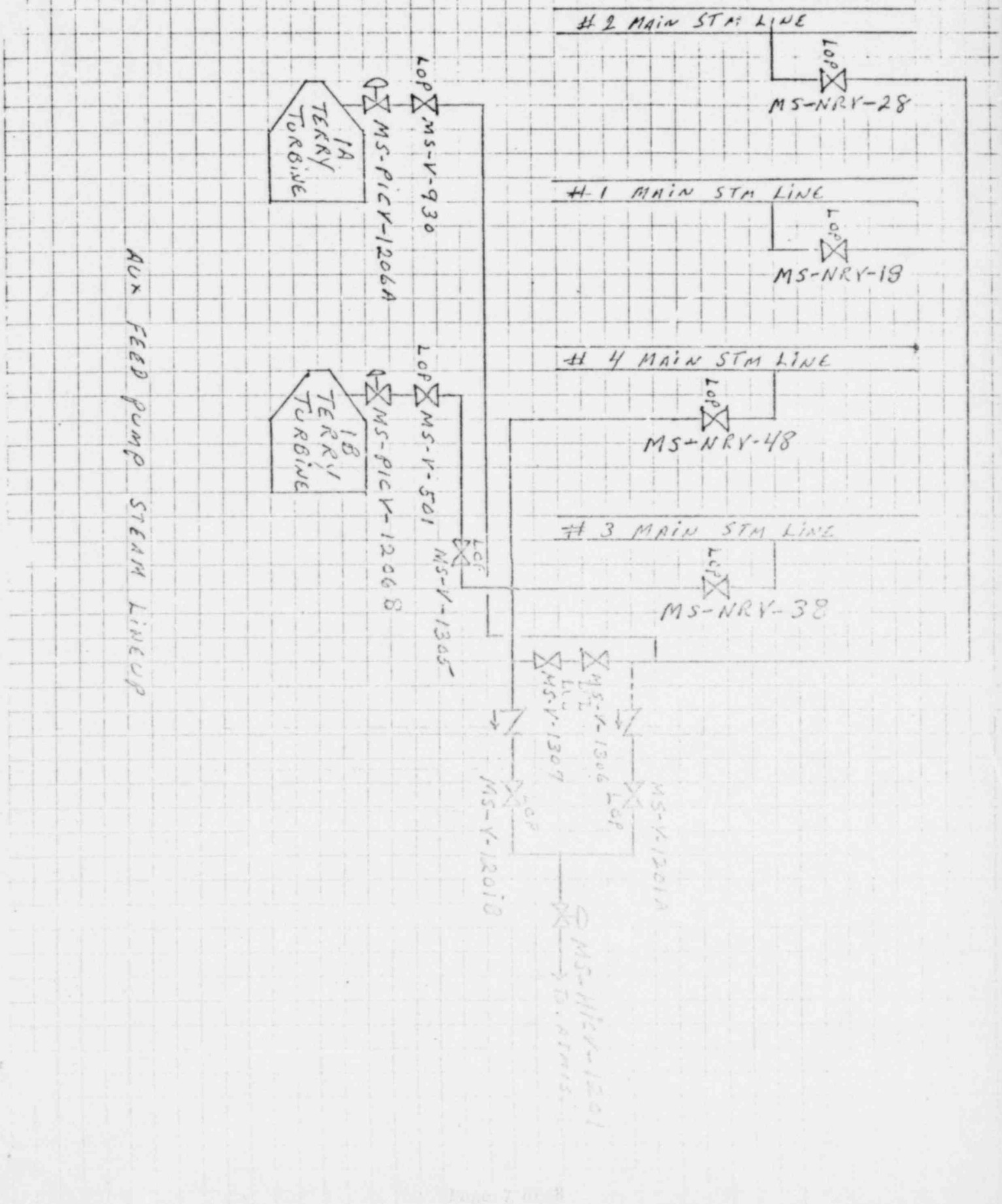
VALVE NUMBER	VALVE TITLE	VALVE LOCATION	VALVE STATUS			
			INITIAL		FINAL	
			Pos.	Oper.	Pos.	Oper.
FW-MOV-35	Containment feed valve	Terry Turb. Room	CL		CL	
FW-V-153A	Outlet to feedwater cont. sta.	Terry Turb. Room	LOP		LOP	
FW-V-181	Test connection valve	Terry Turb. Room	CL		CL	
FW-V-153	Aux. Feed Pump "A" discharge	Terry Turb. Room	LOP		LOP	
FW-V-183	Aux. Feed Pump "B" discharge	Terry Turb. Room	LOP		LOP	
FW-V-150	Aux. Feed Pump "A" Suction	Terry Turb. Room	LOP		LOP	
FW-V-190	Aux. Feed Pump "B" Suction	Terry Turb. Room	LOP		LOP	
FW-V-154	"A" Recir. orifice inlet	Terry Turb. Room	L-OP		L-OP	
-155	"A" Recir. orifice outlet	Terry Turb. Room	L-OP		L-OP	
FW-V-188	"B" Recir. orifice inlet	Terry Turb. Room	L-OP		L-OP	
FW-V-189	"B" Recir. orifice outlet	Terry Turb. Room	L-OP		L-OP	
FW-V-149	DWST outlet to Aux. F.P.	Inside DWST Shield Wall	L-OP		L-OP	
FW-V-157-1	Aux. Feed to #1 FW Bypass	Feedwater Stat.	L-OP		L-OP	

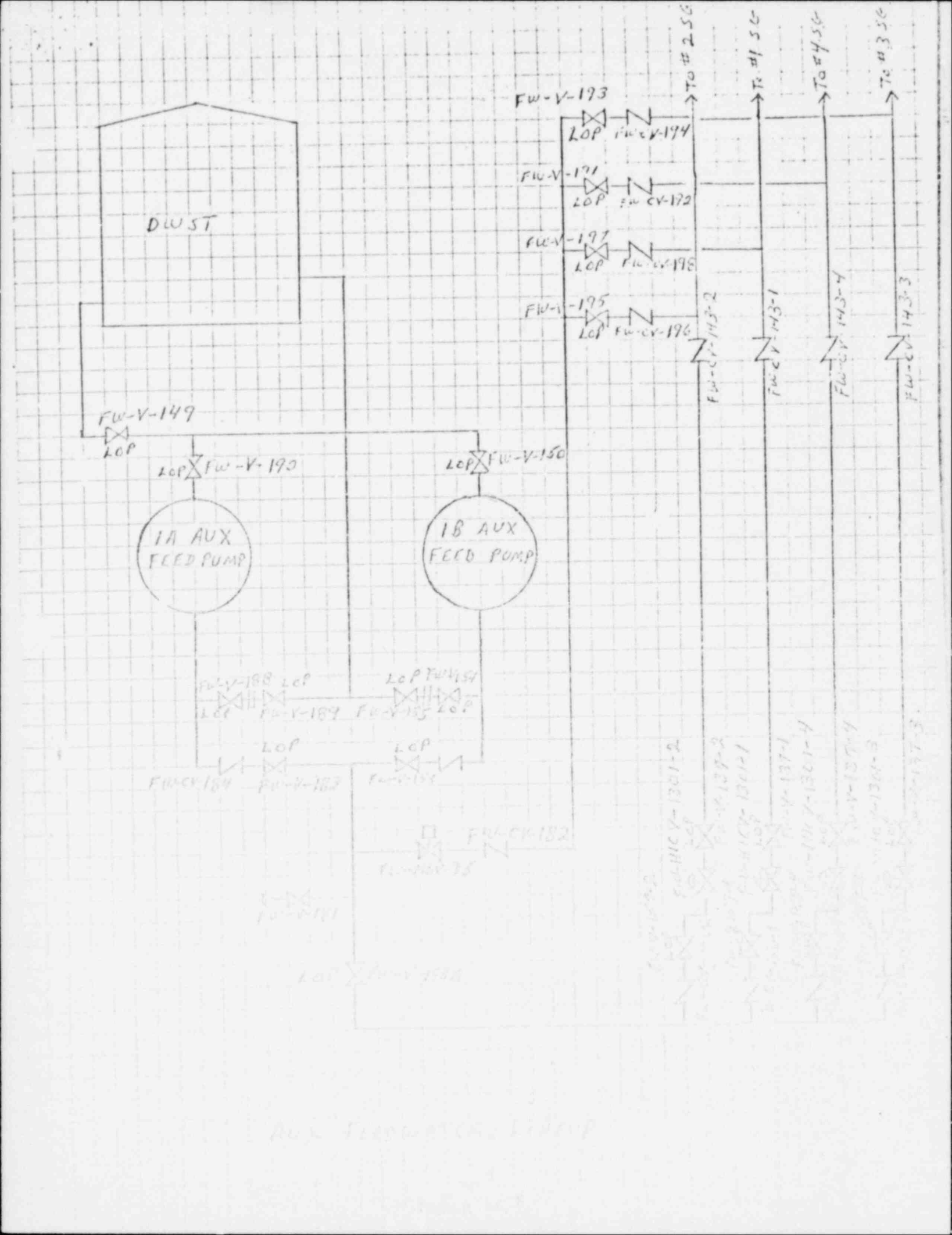
DEC 1 9 1979

/E NUMBER	VALVE TITLE	VALVE LOCATION	VALVE STATUS			
			INITIAL		FINAL	
			Pos.	Oper.	Pos.	Oper
FW-V-160A	Aux. Feed Pump 1A Bearing Cooler Supply	Terry Turb. Rm.	LOP		LOP	
FW-V-161A	Aux. Feed Pump 1A Bearing Cooler Supply	" " "	LOP		LOP	
FW-V-160B	Aux. Feed Pump 1B Bearing Cooler Supply	" " "	LOP		LOP	
FW-V-161B	Aux. Feed Pump 1B Bearing Cooler Supply	" " "	LOP		LOP	

Revision 8

DEC 1 9 1979




DWST
FW-V-149
LOP
LOP FW-V-190
1A AUX FEED PUMP
LOP FW-V-150
1B AUX FEED PUMP
FW-V-193
LOP
FW-CV-194
FW-V-191
LOP
FW-CV-192
FW-V-197
LOP
FW-CV-198
FW-V-195
LOP
FW-CV-196
FW-CV-143-2
FW-CV-143-1
FW-CV-143-4
FW-CV-143-3
To #2 SG
To #1 SG
To #4 SG
To #3 SG

Revision 3

PLANT OPERATIONS REVIEW COMMITTEE APPROVAL

[signatures]

APPROVED BY STATION SUPERINTENDENT

[signature]

EFFECTIVE DATE 12-14-79

ADM3827-1 6-79

Connecticut Yankee

Surveillance Procedure No. 5.1-14

Operations

AUXILIARY FEED PUMP FLOW CAPACITY TEST

1.0 OBJECTIVE

1.1 The objective of this test is to verify that each auxiliary steam generator feed pump can attain a flow rate of at least 450 gpm. This test will normally be conducted during each plant refueling period.

1.2 This procedure will verify full opening of auxiliary steam generator feed pump discharge check valves (FW-CV-153B and FW-CV-184.

2.0 LICENSE OR ADMINISTRATIVE REQUIREMENTS

2.1 Technical Specifications, Section 4.8, Auxiliary Steam Generator Feed Pump.

2.2 Quality Assurance Procedure 1.2-11.1, Operational Surveillance Tests

2.3 Technical Specifications, Section 4.10, Inservice Inspection and Reactor Surveillance.

3.0 REFERENCES

3.1 Flow Diagram 10899-FM-40A, Condensate, Feedwater and Heater Drain Lines.

3.2 Connecticut-Yankee System Descriptions, "Main Steam and Associated Systems"

3.3 Connecticut Yankee Inservice Inspection Program.

4.0 PREREQUISITES

4.1 The plant must be in mode 2 or mode 3 while performing this procedure.

4.2 The Demineralized Water Storage Tank (DWST) contains at least 65,000 gallons in order to comply with the technical specification requirement ($\geq$ 50,000 gal.) if reactor is critical.

4.3 Temporary piping has been installed between the auxiliary feed pump discharge header test connection and the yard sewer.

4.4 The following instrumentation has been recently calibrated and copies of the calibration results report are available:

4.4.1 DWST Level

4.4.2 Auxiliary Feed Pump Discharge Pressure

4.4.3 Auxiliary Turbine Steam Supply Pressure

4.5 Obtain a sample from the DWST and have it analyzed for radioactivity and if necessary have a Radioactive Liquid Release Form prepared.

4.6 "Final Valve Status" Checklist must be completed and initialed by two independent operators.

5.0 PRECAUTIONS

5.1 Since the test results are dependent on the accuracy of the DWST level change determinations, ensure that no operations occur, other than the test, which could affect the tank level.

5.2 Ensure that the temporary test discharge piping is securely supported and the area through which the piping runs is barricaded to prevent unauthorized access during the tests.

5.3 Do not adjust load if plant is at power.

5.4 Be prepared immediately on a plant trip to supply feedwater to feedwater station.

6.0 PROCEDURE

6.1 Complete the "Initial Valve Status" column of Valve Checklist #1.

6.2 Unlock and close FW-V-153A, discharge to feed station.
Note: Should plant trip occur during test reopen this valve immediately.

6.3 Stop the steam generator continuous blowdown by closing blowdown valves BD-V-106, BD-V-206, BD-V-306 and BD-V-406.

6.4 Isolate the water treatment plant effluent line to the DWST by closing and tagging water treatment valve DW-V-508.

6.5 Isolate the DWST from the PWST by closing outlet and bypass on neptune meter to PWST.

6.6 Isolate the condenser makeup and high level control valves CD-LCV-1317A and CD-LCV-1317B by closing makeup isolation valves CD-V-360 and CD-V-631 and high level isolation valves CD-V-635 and CD-V-636.

NOTE: If a condition arises where condenser makeup or high level discharge is required, it can be accomplished by opening bypass valves CD-MOV-10 or CD-MOV-17 until the system can be returned to normal.

6.7 Establish communications between the auxiliary feed pump area and the Control Room.

6.8 Place the feed pump to be tested in operation on recirculation by opening the steam controller to the feed pump turbine.

6.9 Slowly open test connection valve FW-V-181 to establish flow and increase the auxiliary turbine steam supply pressure to 600 psig by adjusting the steam controller on the MCB.

6.10 Adjust the test connection valve FW-V-181 to establish a pump discharge pressure of 1050 psig as indicated on pressure indicator PI-1322A or PI-1322B.

6.11 Record the PWST level and the time as indicated on the MCB.

6.12 Operate the pump for ten (10) minutes at the test conditions established, then record the DWST level and the time.

6.13 Shutdown the pump by closing the steam controller to the auxiliary turbine and close the test connection valve FW-V-181.

6.14 Open FW-V-153A and lock open.

6.15 Determine the auxiliary feed pump flow as follows:

$$\frac{\Delta L \text{ DWST}}{\text{Time}} + 100 \text{ gpm} = \text{Total pump discharge flow (gpm)}$$

Where ΔL DWST = Change in the DWST level (gal.)

Time = Elapsed pump operation time (min.)
100 gpm = Pump recirculation flow rate

Attaining 450 gpm flow verifies full opening of pump discharge check valve.

6.16 If the flow rate determined in Step 6.13 is less than 450 gpm, reconduct the test in accordance with Steps 6.6 through 6.12.

6.17 Repeat Steps 6.6 through 6.13 for the second auxiliary feed pump.

6.18 Complete the "Final Valve Status" column of Valve Checklist No. 1.

6.19 Second Operator, complete the "Final Valve Status" column of valve checklist no. 1.

Connecticut Yankee

Surveillance Procedure No. 5.1-14

Operations

AUXILIARY FEED PUMP FLOW CAPACITY TEST

7.0 CHECKOFF — INITIALS

7.1 The following prerequisites of Section 4.0 are satisfied:

7.1.1 The plant is at power or at hot standby ________

7.1.2 The DWST contains 65,000 gallons if the reactor is critical ________

7.1.3 Temporary piping installed ________

7.1.4 The following instrumentation has been calibrated:

7.1.4.1 DWST Level (LI-1307) ________

7.1.4.2 Auxiliary Feed Pump Discharge Pressure (PI-1327A + 1327B) ________

7.1.4.3 Auxiliary Turbine Steam Supply (1A & 1B) PIC-1206A + 1206B ________

7.1.5 DWST sample obtained and analyzed Radioactive Liquid Release No.________

7.2 The precautions of Section 5.0 have been read, understood and complied with. ________

7.3 Complete flow test for each auxiliary feed pump as follows:

7.3.1 Complete the "Initial Valve Lineup" column of Valve Checklist #1 (Step 6.1) ________

7.3.2 [illegible]

DEC 19 1979

		Aux. F.P. 1A	Aux. F.P. 1B
		INITIALS	
7.3.3	Establish communications between auxiliary feed pump area and Control Room		
7.3.4	Place auxiliary feed pump in operation on recirculation. (Step 6.7)		
7.3.5	Open test connection and establish discharge pressure of 1050 psig. (Steps 6.8 and 6.9)		
7.3.6	Record time and DWST level, then operate pump for 10 minutes and record time and DWST level again. Record values on Data Sheet. (Steps 6.10 and 6.11)		
7.3.7	Shutdown pump (Step 6.12)		
7.3.8	FW-V-153A locked Open		
7.3.9	Determine pump flow rate and record on data sheet (Step 6.13)		
7.3.10	Discharge Check valve verified in full open position.		
7.3.11	Recondurt test if flow rate is less than 450 gpm.		
7.3.12	Complete the "Final Valve Status" column of Valve Checklist #1.		
7.3.13	"Final Valve Status" column of valve checklist #1 completed by Operations.		

Auxiliary Feed Pump Flow Capacity Test

Valve Checklist No. 1

Valve Checklist

VALVE NUMBER	VALVE TITLE	VALVE LOCATION	VALVE STATUS			
			INITIAL		FINAL	
			Pos.	Oper.	Pos.	Oper.
BD-V-106	Steam Generator # 1 Blowdown	Sample Room	OP		OP	
BD-V-206	Steam Generator # 2 Blowdown	Sample Room	OP		OP	
BD-V-306	Steam Generator # 3 Blowdown	Sample Room	OP		OP	
BD-V-406	Steam Generator # 4 Blowdown	Sample Room	OP		OP	
CD-V-630	Condenser Makeup Isolation	Lower Level Turbine Bldg.	OP		OP	
CD-V-631	Condenser Makeup Isolation	Lower Level Turbine Bldg.	OP		OP	
CD-V-635	Condenser High Level Isolation	Lower Level Turbine Bldg.	OP		OP	
CD-V-637	Condenser High Level Isolation	Lower Level Turbine Bldg.	OP		OP	
FW-V-153A	Discharge to Feed Station	Terry Turbine Rm	LOP		LOP	
FW-MOV-35	Discharge to Cont.	Terry Turbine Rm	CL		CL	
FW-V-153	Auxiliary Feed Pump 1A discharge	Terry Turbine Rm	LOP		OP	
FW-V-183	Auxiliary Feed Pump 1B discharge	Terry Turbine Rm	LOP		OP	
FW-V-150	Auxiliary Feed Pump 1A Suction	Terry Turbine Rm	LOP		OP	
FW-V-160	Auxiliary Feed Pump 1B Suction	Terry Turbine Rm	LOP		OP	
FW-V-154	Auxiliary Feed Pump 1A Recirculation	Terry Turbine Rm	LOP		LOP	
FW-V-184	Auxiliary Feed Pump 1B Recirculation	Terry Turbine Rm	LOP		LOP	
FW-V-152	Condensate Feed Pump 1A Suction	Terry Turbine Rm	LOP		LOP	
FW-V-182	Condensate Feed Pump 1B Suction	Terry Turbine Rm	LOP		LOP	
FW-V-151	Condensate Feed Pump 1A Discharge	Terry Turbine Rm	LOP		LOP	
FW-V-181	Condensate Feed Pump 1B Discharge	Terry Turbine Rm	LOP		LOP	

VALVE NUMBER	VALVE TITLE	VALVE LOCATION	VALVE STATUS			
			INITIAL		FINAL	
			Pos.	Oper.	Pos.	Oper.
FW-V-160A	Aux. Feed Pump 1A Bearing Cooler Supply	Terry Turb. Rm.	LOP		LOP	
FW-V-161A	Aux. feed Pump 1A Bearing Cooler Supply	" " "	LOP		LOP	
FW-V-160B	Aux. Feed Pump 1B Bearing Cooler Supply	" " "	LOP		LOP	
FW-V-161B	Aux. Feed Pump 1B Bearing Cooler Supply	" " "	LOP		LOP	

9.0 DATA SHEET

	Aux. Feed Pump 1A	Aux. Feed Pump 1B
9.1 Initial DWST Level		
DWST Level (gal)	_____	_____
Time	_____	_____
9.2 Final DWST level after 10 minutes run time for pump		
DWST level (gal)	_____	_____
Time	_____	_____
9.3 Calculated pump flow rate (gpm)	_____	_____
$\frac{\Delta L \text{ DWST}}{\text{Time}} \times 100$ gpm		
9.4 Attaining required flow demonstates exercising discharge check valve for inservice inspection program.	_____	_____

SOR 5-1-16

Connecticut Yankee

Normal Operating Procedure No. 2.1-2

Plant Startup

REACTOR STARTUP

PLANT OPERATIONS REVIEW COMMITTEE APPROVAL

APPROVED BY: STATION SUPERINTENDENT

EFFECTIVE DATE 5-29-80

ADM 3827-1 6-79

1.0 OBJECTIVE

1.1 The objective of this procedure is to establish reactor criticality when the plant is at hot standby conditions.

2.0 LICENSE OR ADMINISTRATIVE REQUIREMENTS

2.1 Technical Specifications, Section 3, Limiting Conditions for Operation

2.2 Technical Specifications, Section 5.2.C.1, Control Room Staffing During Approach to Criticality

3.0 REFERENCES

3.1 Normal Operating Procedure No. 2.1-1, COLD SHUTDOWN TO HOT STANDBY

3.2 Normal Operating Procedure No. 2.1-5, REACTOR APPROACH TO CRITICALITY TRAINING

3.3 Administrative Procedure ADM 1.1-34, Required Authorization for Plant Shutdown and Related Operation.

3.4 Surveillance Procedure 5.1-10, NUCLEAR INSTRUMENTATION, OPERATOR'S CHECKOFF (SHORT)

3.5 Surveillance Procedure 5.1-9, NUCLEAR INSTRUMENTATION, OPERATOR'S CHECKOFF (LONG)

3.6 Surveillance Procedure 5.2-7, NUCLEAR INSTRUMENTATION, CHECK AND CALIBRATION

Att 4.11

3.7 Normal Operating Procedure 2.16-3 CONTROL ROD DRIVE SYSTEM PLACING IN/REMOVING FROM SERVICE

4.0 PREREQUISITES

4.1 The following setup procedures have been completed:

4.1.1 Normal Operating Procedure 2.16-3 CONTROL ROD DRIVE SYSTEM PLACING IN/REMOVING FROM SERVICE.

4.1.2 Normal Operating Procedure 5.1-10, NUCLEAR INSTRUMENTATION, OPERATOR'S CHECKOFF (SHORT) (to be completed by licensed operator when reactor shutdown more than 4 hours).

4.1.3 Surveillance Procedure 5.1-9, NUCLEAR INSTRUMENTATION, OPERATOR'S CHECKOFF (LONG) (to be completed by licensed operator if it has not been done in previous week).

4.1.4 Surveillance Procedure 5.2-7, NUCLEAR INSTRUMENTATION CHECK AND CALIBRATION (to be completed by instrumentation department when reactor shutdown more than 72 hours).

NOTE:

Additional nuclear instrumentation start-up procedures may be called for at the discretion of higher supervision or the Duty and Call Officer.

4.1.5 Surveillance procedure SUR 5.1-126, Locked Valve Check List has been completed after last cold shutdown condition.

4.2 One Source Range (SR), one Intermediate Range (IR), and three Power Range channels are operating satisfactorily.

4.3 Rod position odometers are reset to zero (if all rods in).

4.4 An estimated just-critical rod position has been computed from a reactivity balance (SUR 5.3-20) or an inverse multiplication 1/M plot is set up by a reactor engineering assistant or licensed reactor operator for use during the critical approach.

4.5 Overpower nuclear flux trip in the LOW position (25%), rod stops set at 20%.

4.6 The flux level recorder is operating satisfactorily on the selected source range channel.

4.7 The plant shall be at hot standby conditions (with the reactor shutdown) as established by Normal Operating Procedure 2.3-3, OPERATION AT HOT STANDBY - REACTOR SHUTDOWN.

4.8 A minimum of two licensed reactor operators (RO) are required to be in the control room at all times during the approach to criticality.

4.9 A minimum operating crew of five persons which include at least one Senior Reactor Operator (SRO) and two Reactor Operators (RO) are required to be on shift during the conduct of this procedure.

4.10 The pressurizer boron concentration is within 50 ppm of the coolant loop boron concentration.

4.11 Reactor shall not be critical until all applicable conditions as listed in Section 3 of Technical Specifications are satisfied and verified as per Checkoff List in Section 7.6 of this procedure.

4.12 Permission for establishing criticality has been granted by one of the following:

4.12.1 Plant Superintendent

4.12.2 Assistant Plant Superintendent

4.12.3 Operating Supervisor

4.12.4 Duty and Call Officer

5.0 PRECAUTIONS

5.1 Stop rod withdrawal when a doubling count is evident, and plot a 1/M measurement. See step 6.2.2, Note 1 and Figure 7.1.

5.2 When a just-critical control rod position, estimated or extrapolated from 1/M plot, falls below the minimum established by Technical Specifications, Figure 3.10-1 (Reference 2.1), rod withdrawal shall be suspended until the reactor coolant system boron concentration has been increased a sufficient amount to raise the anticipated just-critical control rod position above the minimum (refer to Normal Operating Procedure 2.6-3, CHEMICAL SHIM CONTROL; BORATION, DILUTION AND BLENDED MAKEUP).

5.3 Control rod banks must always be withdrawn in the prescribed sequence, except when conducting Reactor Physics Tests.

5.4 Criticality is to be anticipated at any time after commencement of control rod withdrawal.

5.5 A start-up rate greater than one decade per minute (DPM) shall not be attempted or sustained at any time.

5.6 When the reactor is subcritical, reactivity must not be changed by more than one method at a time.

5.7 When the reactor is approaching criticality, avoid any operation which may produce a change in reactor coolant temperature of 10°F or more, or a boron concentration change of 10 ppm or more. If these limits

are approached, re-calculate estimated critical position or normalize 1/M plot before proceeding.

6.0 PROCEDURE

6.1 Pre-criticality checks

6.1.1 Ascertain that trip voltage is available at the reactor trip breaker trip coils when circuit is actuated.

NOTE:

Reactor trip breakers position indicating lamps monitor reactor trip circuits.

6.1.2 Conduct rod motion check unless waived by higher supervision.

6.1.2.1 Select shutdown group and initiate "rods out" until C and D indicate 50 steps.

6.1.2.2 Scan individual rod positions with digital voltmeter to verify Control Rod Movement.

6.1.2.3 Initiate "rods in" motion until groups C and D indicate 10 steps and scan digital voltmeter.

6.1.2.4 Repeat Steps 6.1.2.1, 6.1.2.2, and 6.1.2.3 until all rods in groups A and B are at 10 steps.

6.1.2.5 Request manual reactor trip at turbine generator section of MCB and observe all rod bottom bistable lights on.

6.1.2.6 Reclose reactor trip breakers and observe that odometers re-zero.

6.2 Establish criticality

NOTE:

If a reactor trip is experienced during this portion of the procedure, refer to Section 6.3.

6.2.1 Announce commencement of critical approach.

6.2.2 Withdraw shutdown group C to the all-out position. Stop at approximately 100 step intervals to record, compute and plot 1/M values on Table 7.1 and Figure 7.1.

NOTES:

1. When the source range flux level doubles during rod withdrawal between scheduled 1/M measurements, stop, record, compute and plot the 1/M value before continuing rod withdrawal. Discontinue plotting and use the last extrapolation when 1/M values are less than 0.1.
2. A start-up rate greater than one decade per minute (DPM) shall not be attempted or sustained at any time.
3. The Operator shall routinely scan individual rod positions with the digital voltmeter to verify control rod movement at each incremental stop for 1/M measurement.

6.2.3 Withdraw shutdown rod group D to the all-out position. Stop at approximately 100 step intervals or when flux doubles to compute and plot 1/M values.

NOTE:

Switch the flux recorder to successively higher ranges, as necessary to keep flux traces on-scale.

6.2.4 Withdraw control rod group A to 230 steps, providing criticality has not already been established. Stop at approximately 50 step intervals to record, compute and plot 1/M values.

NOTE:

Observe minimum rod position limitations per Technical Specifications, Figure 3.10-1, Minimum Control Group Position vs. Power Level.

6.2.5 Commence withdrawal of overlapped control groups A and B alternating in 5 step increments. Stop rod motion at each 50 step interval or when flux level doubles. Calculate and plot 1/M values. Continue extrapolating the critical rod height from the most recent 1/M data. Discontinue plotting and use the last extrapolation at 1/M values below 0.1.

6.2.6 Continue withdrawal of A and B rod groups at a progressively slower rate until the reactor is just-critical as ascertained by a steady increase in flux level as indicated on the Source Range level meters and flux recorder, and as evidenced by a sustained start-up rate after a rod withdrawal step(s).

6.2.7 Announce that the reactor is critical; record time and conditions of criticality.

6.2.8 Observe that the Source Range detector high voltage automatically cuts out at about 5×10^{-10} amps on the intermediate range channels.

NOTE:

If source range high voltage is not automatically cut out, manually de-energize by shutting off the respective source range instrument drawer and green stripe caution tag switch. Submit maintenance request.

6.2.9 Continue start-up rate until flux level is approximately 1 x 10^{-9} amps as indicated on the Intermediate Range (IR) meters. Adjust control rod position as required to maintain just-critical condition.

6.2.10 Stabilize Power Level at 1 x 10^{-8} amps on the highest IR channel.

6.2.11 Proceed to Normal Operating Procedure 2.1-3, OPERATION AT HOT STANDBY - REACTOR CRITICAL.

6.3 Contingency procedure for recovery from a reactor trip during startup. This contingency procedure shall be used only when a reactor trip is experiences during Section 6.2 above.

6.3.1 Record reactor first out panel alarm and cause of trip.

6.3.2 Correct the cause of the trip and record the actions taken.

6.3.3 Obtain authorization to conduct critical approach per Section 6.2 of this procedure.

Connecticut Yankee

Normal Operating Procedure No. 2.1-2

Plant Startup

REACTOR STARTUP

7.0 CHECKOFF

INITIALS

7.1 Complete the Prerequisites (Section 4.0) as listed:

7.1.1	Complete Step 4.1 (Instrumentation setup)	_____
7.1.2	Complete Step 4.2 (Instrumentation checkout)	_____
7.1.3	Complete Step 4.3 (Rod position odometers)	_____
7.1.4	Complete Step 4.4 (Est. just-critical rod position); attach the reactivity balance or 1/M plot to this section	_____
7.1.5	Complete Step 4.5 (Set overpower trip)	_____
7.1.6	Complete Step 4.6 (Check flux level recorder)	_____
7.1.7	Verify conditions required by Step 4.7	_____
7.1.8	Verify that the requirements of Steps 4.8 and 4.9 are satisfied	_____
7.1.9	Verify that requirements of Step 4.10 are satisfied	_____
7.1.10	Verify that Section 7.6 of Checkoff List is completed in accordance with Step 4.11	_____
7.1.11	Complete Step 4.12 (Obtain permission to proceed)	_____

7.2 Verify that the Precautions listed in Section 5.0 have been read, understood, and complied with. _____

7.3 Perform pre-criticality checks in Section 6.1 as follows:

7.3.1	Complete Step 6.1.1 (Check trip breakers)	_____
7.3.2	Complete Step 6.1.2.1 (Move banks C and D)	_____
7.3.3	Complete Step 6.1.2.2 (Scan positions)	_____

7.3.4 Complete Step 6.1.2.3 (Step banks C and D in) _____

7.3.5 Complete Step 6.1.2.4 (Adjust all to 10 steps) _____

7.3.6 Complete Step 6.1.2.5 (Check bottom indications) _____

7.3.7 Complete Step 6.1.2.6 (Reset trip) _____

7.4 Establish criticality per Section 6.2 as follows:

7.4.1 Complete Step 6.2.1 (Announce approach) _____

7.4.2 Complete Steps 6.2.2 through 6.2.6 (Attain criticality); compute and plot 1/M values on Table 7.1 and Figure 7.1 _____

7.4.3 Complete Step 6.2.7 (Criticality announcement); record conditions below:

RC pumps operating _____

RCS boron concentration, ppm _____

RCS pressure, psig _____

T_{avg}, °F _____

Rod positions, steps: C _____

D _____

A _____

B _____

IR channel 21, (amp)/SR channel 11, (cps) _____

IR channel 22, (amp)/SR channel 14, (cps) _____

Date _____

Time _____ _____

7.4.4 Complete Step 6.2.8 (SR cutout at 5×10^{-10} amps) _____

7.4.5 Complete Step 6.2.9 (Continue startup) _____

7.4.6 Complete Step 6.2.10 (Stabilize power) _____

7.4.7 Complete Step 6.2.11 (Proceed to Normal Operating Procedure 2.1-3) _____

7.5 Recover from reactor trip during startup (if required) as follows:

7.5.1 Complete Step 6.3.1 (Determine cause of trip) _____

7.5.2 Complete Step 6.3.2 (Correct cause) _____

7.5.3 Obtain authorization to restart

Authorizing person - Name _____

Title _____ _____

7.5.4 Complete Steps 6.2.1 through 6.2.6 (Re-establish criticality); record, compute and plot 1/M values on Table 7.1 and Figure 7.1 _____

7.5.5 Complete Step 6.2.7 (Announce criticality); record conditions in Step 7.4.3 and on Figure 7.1 _____

7.5.6 Complete Step 6.2.8 (Source Range cutout at 5×10^{-10} amps) _____

7.5.7 Complete Step 6.2.9 (Continue startup) _____

7.5.8 Complete Step 6.2.10 (Stabilize power) _____

7.5.9 Complete Step 6.2.11 (Proceed to Normal Operating Procedure 2.1-3) _____

7.6 Technical Specifications Checkoff List

7.6.1 The Reactor Coolant System has been sampled and the coolant activity is less than $68/\bar{E}$ μc/ml. per Chemistry Report dated _____. _____

7.6.2 At least one steam generator is capable of performing its heat transfer function _____

7.6.3 Two charging pumps or one charging pump and metering pump operable

Dates of last operation P-18-1A _____

P-18-1B _____

P-18-1C _____ _____

7.6.4 Two boric acid pumps or one boric acid pump and gravity fill line to metering pump operable _____

Dates of last operation P-9-1A _____ _____

P-9-1B _____ _____

7.6.5 Boric acid tank level greater than 12,000 gallons of solution whose concentration is greater than 8% and less than 13% boric acid _____

7.6.5.1 BA-V-399 is locked open _____

7.6.6 At least one of the two trains of emergency core cooling equipment and the respective diesel generator must be operable and proven as such within the previous month _____

H.P. Safety Injection Pump
(P-15) - 1A_____ 1B_____

L.P. Safety Injection Pump
(P-92) - 1A_____ 1B_____

Charging Pump (P-18) - 1A_____ 1B_____

RHR Pump (P-14) - 1B_____ 1A_____

RHR Heat Exchangers (E-5) - 1A_____ 1B_____

Diesel Generator (EG) - 2B_____ 2A_____

Systems valves and interlocks for proper operation of cor cooling system operable _____

Date of last test: Core Cooling _____ _____

Diesel Generator (EG)
2A_____ 2B_____

7.6.7 Refueling water storage tank

Volume, minimum 230,000 gallons

Present volume _____ gallons _____

7.6.8 Refueling water storage tank boron concentration, not less than refueling requirement (Keff of 0.92 or less)

Boron concentration _____ ppm _____

7.6.9 Minimum turbine cycle steam relieving capability of 7,000,000 lb/hr for power level up to 1473 MWt 9,504,000 lb/hr for power level above 1473 MWt _____

7.6.10 Minimum of one steam driven auxiliary feedwater pump operable. Date of last test _____ _____

MAY 2 9 1980

7.6.11 Demineralized water storage tank minimum of 50,000 gallons

Present volume _____ gallons _____

7.6.12 Primary water storage tank minimum of 80,000 gallons

Present volume _____ gallons _____

7.6.13 Containment leakage is less than 0.25 weight percent of the contained air per 24 hours when extrapolated to 40 psig. Date of last determination _____ _____

7.6.14 Containment pressure less than 3 psig and greater than 2.0 psig vacuum _____

7.6.15 Four air recirc. fans are operable except that one fan may be inoperable for a period of time not to exceed seven days. _____

7.6.16 The containment spray system is operable _____

7.6.17 115 kv/4160 v station transformer minimum of one in service

389 _____ 399 _____ _____

7.6.18 Three of the four 480 volt buses energized

Bus 4 _____ Bus 5 _____

Bus 6 _____ Bus 7 _____ _____

7.6.19 Minimum of one emergency bus energized

Bus 8 _____ Bus 9 _____ _____

7.6.20 The station batteries have been checked, minimum of one battery charger is in operation and four 120 volt inverters are in operation supplying vital buses. Vital DC buses are energized from station batteries or battery charger _____

120 volt vital buses are energized _____

Both DC buses are energized from the station batteries _____

7.6.21 Three pressurizer safety valves are operable

PR-SV-584 _____

PR-SV-585 _____

PR-SV-586 _____

7.6.22 Either containment air particulate monitoring system or purge system available (indicate which) _____ _____

7.6.23 Core Cooling Valves Listed in Technical Specification 3.6 (B) are in designated position:

7.6.23.1 RH-FCV-602 is in locked closed position with it's air supply isolated. _____

7.6.23.2 RH-HCV-796 is in locked open position with it's air supply isolated. _____

7.6.23.3 RH-MOV-22 manual hand wheel locked so that valve and breaker can be locked open in post LOCA long term core cooling. _____

7.6.23.4 SI-MOV-24 is locked open and circuit breaker locked out. _____

7.6.23.5 SI-FCV-875 valve blocked and locked in open position. _____

7.6.23.6 RH-MOV-874 valve is locked in closed position and circuit breaker locked open. _____

Performed by _____ _____ Approved by _____ _____
Operator Date Shift Supervisor Date

Reviewed by _____ _____
Department Head Date

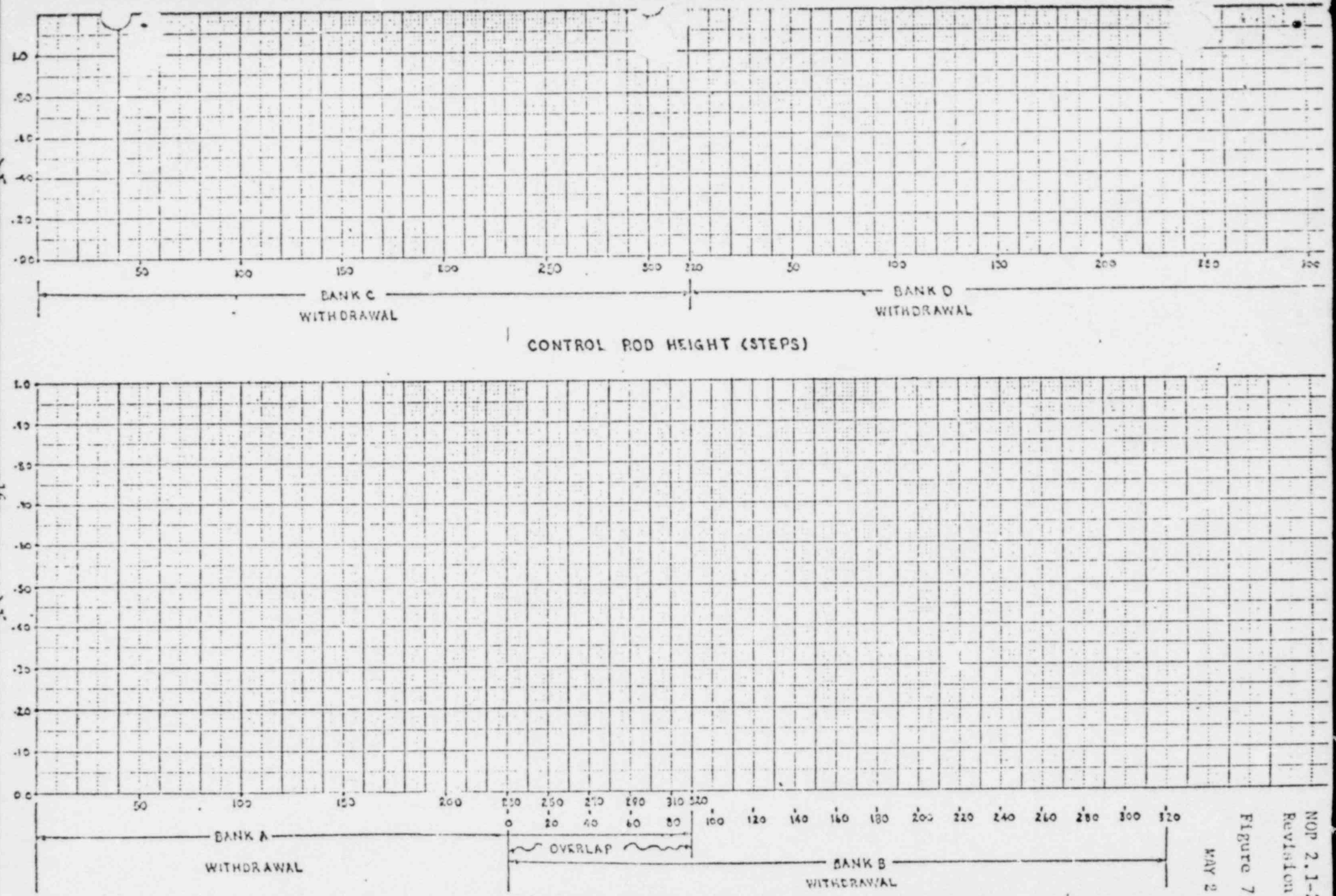
TABLE 7.1

CRITICAL APPROACH 1/M LOG

Core No. ______

DATE	CORE CONDITIONS							COUNT RATE AND INVERSE MULTIPLICATION RATE						
TIME	RCC POSITIONS (STEPS)				RCS. PRESS	RCS. TEMP	C_B	CHANNEL ______			CHANNEL ______			
	BANK C	BANK D	BANK A	BANK B	PSIG	°F	PPM	OBSERVED CPS	BASE CPS	1/M	OBSERVED CPS	BASE CPS	1/M	

LOG PAGE ____ OF ____



NOP 2.1-2
Revision 5
MAY 2 9 1990

Figure 7.1