DRAFT

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FARLEY NUCLEAR PLANT

UNIT 2

PHASE III TEST PROCEDURE

501-7-002

NATURAL CIRCULATION

DRAFT

Approved:

_____
Plant Manager

Date Issued: _____

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FARLEY NUCLEAR PLANT
UNIT 2
PHASE III TEST PROCEDURE
501-7-002
NATURAL CIRCULATION

1.0 Purpose

This procedure contains the information necessary to verify plant performance capabilities and provide operator experience and training in the following conditions:

1.1 Core heat removal by NATURAL CIRCULATION after all RCP's are stopped.

1.2 Continued NATURAL CIRCULATION WITH LOSS OF PRESSURIZER HEATERS.

1.3 Core heat removal by NATURAL CIRCULATION AT REDUCED RCS PRESSURE.

2.0 Initial Conditions

____ 2.1 T_{ave} is approximately 547°F. The Steam Dump is operating (or available) to maintain T_{ave} in the Steam Pressure Mode.

____ 2.2 Pressurizer pressure is being maintained at approximately 2235 psig by automatic operation of the Pressurizer Pressure Control System.

____ 2.3 Pressurizer level is being maintained at approximately 22% by automatic operation of the Pressurizer Level Control System.

____ 2.4 The S/G's are being maintained at approximately 33%. The Main Feedwater or AFW System is operating (or available) to maintain S/G levels.

____ 2.5 All three RCP's are running.

____ 2.6 The CVCS is in a normal at-power lineup.

____ 2.7 Excess letdown is available for operation.

____ 2.8 Both Shutdown Banks are fully withdrawn.

____ 2.9 The reactor is critical at approximately 3% power.

____ 2.10 RCS boron concentration and control bank D position have been adjusted to establish a zero moderator temperature coefficient.

____ 2.11 The Core Subcooling Monitor is operable

____ 2.12 Temporary Instrumentation has been installed as required by Appendix B of this procedure.

____ 2.13 The computer trend printer is set up to monitor the parameters specified in Appendix C of this procedure.

____ 2.14 All test equipment to be used during the performance of this procedure is operational and in calibration, as verified on the Test Equipment Record, Data Sheet 1 of this procedure.

____ 2.15 The temporary SSPS and ESF modifications specified in Appendix D of this procedure have been made.

____ 2.16 The shift supervisor has been notified of the impending performance of this procedure.

____ 2.17 S/G chemistry is in a condition such that blowdown may be isolated for the duration of the test.

____ 2.18 One of the MCB trend recorders is set up to monitor the highest reading T/C in the two hottest core quadrants, as determined by the P-250 incore T/C map.

____ 2.19 Prior to commencing this test, record the following information (as applicable) on each recorder strip chart.

Test Procedure Number
Recorder Number
Time and Date
Chart Speed
Scale of each Pen
Input to each Pen

3.0 Precautions and Limitations

3.1 During Natural Circulation operation, reactor coolant flow rates are a small fraction of normal 100% flow. Consequently temperature trends are of great valve in evaluating plant conditions.

3.2 Avoid rapid changes in the feeding or steaming rate. Temperature changes will be delayed due to the relatively long loop transit time, pressure change however, can occur suddenly with large fluctuations.

3.3 The Operational Safety Criteria is to be prominently displayed in the control room. During the performance of this test, operation of the plant will be in accordance with the guidelines presented in the Operational Safety Criteria, Appendix A.

3.4 After the RCP's have been tripped, the normal ΔT and T_{ave} indications will become unreliable (due to low flow in the RTD manifolds). ΔT and T_{ave} shall be calculated using wide range T_{Hot} and T_{Cold}. Incore thermocouples will also be monitored to provide additonal T_{Hot} indication.

3.5 Maintain T_{Cold} at approximately the Pre-RCP Trip temperature in order to reduce the errors in the NIS instruments.

3.6 Do not exceed 5% thermal power at anytime during the test.

3.7 Do not exceed a primary to secondary differential pressure of 1600 psi.

3.8 Maintain < 100 psi differential pressure between any two steam lines and steam generator pressure greater than 585 psig.

3.9 Limit the pressurizer heatup rate to 100°F/HR.

3.10 Limit the pressurizer cooldown rate to 200° F/HR.

3.11 Reactor Coolant System heatup and cooldown rate should be limited to 50°F/HR.

3.12 The combination of Reactor Coolant System pressure and temperature should be limited to the restrictions of figure 3.4-2 and 3.4-3 in Technical Specifications.

3.13 It is anticipated that the moderator temperature coefficient will be zero or slightly negative during the performance of this test. It is possible however, that the moderator temperature coefficient will become slightly positive. The operator should be aware of the effect of a positive moderator coefficient on reactivity control.

3.14 Do not borate while in Natural Circulation with the reactor critical.

3.15 Ensure RCP seal injection flow is maintained between 6 and 13 gpm to each RCP. Adjustment of RCP seal injection may become necessary with decreasing primary pressure.

3.16 Should a reactor trip occur while in natural circulation oepration, close the Aux Spray valve 2-CVC-HV-8145, open normal charging valve 2-CVC-HV-8146 close spray valves PCV-444C & D, and restart RCP 2B prior to reclosing the reactor trip breakers.

3.17 Maintain control bank D greater than 100 steps withdrawn during the conduct of this test. If control rod position cannot meet this criteria, fully insert control bank D and restart 2B Reactor Coolant Pump. Contact the reactor engineer for further instructions.

3.18 The maximum differential temperature between the pressurizer and the spray water is 320°F.

3.19 Do not use Auxiliary Spray if letdown is isolated.

3.20 During the conduct of this test the Test Supervisor will make determinations relating to the amount of data being recorded (i.e. speed of recorders, collecting of data, etc.) This determination will be based on the ability of the collected data to adequately reproduce the natural circulation conditions. The Test Supervisor will meet the qualifications of a Test Supervisor as defined in FNP-0-AP-31.

3.21 Anytime speed is changed on any recorder; initials, time, date and speed should be listed on the recorder chart.

4.0 Instructions

____ 4.1 Prepare the plant computer to record the Data specified in Appendix C. Record the initial plant conditions on Data Sheet 2.

____ 4.2 Place the pressurizer level controller LK 459F in manual and adjust as necessary to establish constant pressurizer level before tripping the Reactor Coolant Pumps.

____ 4.3 Record the time on the recorder charts in the instrument rack area and/or control room and start the recorders at an appropriate speed determined by the Test Supervisor.

____ 4.4 Begin recording on the reactivity computer.

____ 4.5 On a signal from the Test Supervisor simultaneously trip all three Reactor Coolant Pumps.

NOTE

Steam Generator pressure, level and flow conditions should be held as close as possible to stable conditions as natural circulation develops. Reactor Coolant System cold leg temperatures should be maintained within ±5°F of 547°F.

CAUTION

Continously monitor main steam line pressures and carefully control feedwater addition during the transient to insure that differential pressure between any two steam lines is < 100 psid.

____ 4.6 Place the spray valve controllers in manual and open the spray valves.

NOTE

At the initiation of Natural Circulation (RCP Trip), the following system response is expected:

a.) Wide Range T_{Hot}-increase (26 to 45°F at ~3% power)

b.) Wide range T_{Cold}-slight decrease or constant

c.) Core exit thermocouples-increase (26 to 45°F at ~3% power)

d.) Pressurizer level-increase (10 to 16 percent at ~3% power)

e.) Pressurizer pressure-increase.

CAUTION

After tripping the Reactor Coolant Pumps, Reactor Coolant System pressure is expected to increase as much as 50 psi depending on the power level. Be prepared to use Aux Spray to control pressure.

CAUTION

Following Reactor Coolant Pump trip, T_{ave} and ΔT indication will be unreliable.

___ 4.7 If Reactor Coolant System pressure exceeds 2285 psig, open the Auxiliary Spray valve 2-CVC-HV-8145. Maintain regenerative heat exchanger charging outlet temperature above 350°F by increasing letdown, if necessary. Confirm that the 320°F maximum temperature differential between pressurizer and spray water is not being violated.

____ 4.8 If RCS pressure exceeds 2310 psig, close charging line valve 2-CVC-HV-8146 and manually throttle spray valves 444C & 444D as required to maintain RCS Pressure below 2310 psig.

CAUTION

If Auxiliary Spray is initiated to limit RCS pressure, insure that a minimum continuous Auxiliary Spray flow is maintained to the pressurizer by turning on one bank of back up pressurizer heaters and adjusting the position of PCV 444C & 444D to maintain the RCS pressure at approximately 2235 psig.

____ 4.9 Maintain RCP seal injection between 6 and 13 gpm to each RCP.

____ 4.10 Maintain a constant Reactor Coolant System mass by ensuring charging flow is matched with letdown flow.

NOTE

Pressurizer level will increase as T_{Hot} increases. After T_{Hot} becomes stable maintain constant pressurizer level by adjusting charging flow.

____ 4.11 Carefully control steam generator levels at approximately 33% level.

NOTE

After tripping Reactor Coolant Pumps the level may shrink slightly, then swell as natural circulation develops.

____ 4.12 If required, adjust the pressure setpoint on the steam dump pressure controller to maintain RCS cold leg temperatures within ±5°F of 547°F.

NOTE

Natural circulation flow will be stable (within approximately 10 to 20 minutes) when:

a. ΔT is constant.

b. Wide range T_{Hot} is approximately equal to core exit thermocouple average temperature.

____ 4.13 After natural circulation steady state conditions have been reached, mark each recorder. Continue recording data for a minimum of 30 minutes.

NOTE

Once equilibrium has been established adjust the trend printer printout intervals as specified by the Test Supervisor. Mark the printout with time, initials and the new printing interval.

____ 4.14 Complete auxiliary spray test Appendix F (this can be performed in conjunction with the above step 4.13)

____ 4.15 Record the data indicated in Data Sheet 4.

NOTE

The following steps will allow the pressurizer to cool and slowly decrease system pressure. The purpose is to determine the time that saturation margin can be maintained without the use of pressurizer heaters and then verify the margin can be re-established through charging or secondary steam flow.

____ 4.16 Turn off the pressurizer heater Groups 2A, 2B, 2C, 2D, and 2E. Mark the recorder.

____ 4.17 Stop pressurizer spray by opening PCV444C & D.

NOTE

The primary system pressure will now be monitored to determine the rate of depressurization. The saturation margin should be monitored closely. Increase RCS charging flow when the saturation margin approaches 20°F or as directed by the Test Supervisor. Slowly increase the steam flow to the steam dump by manually operating PK 464 when RCS pressure indicates an increasing trend.

____ 4.18 Complete Data Sheet 3, Depressurization Rate.

____ 4.19 As Reactor Coolant System pressure decreases, reduce RCP seal injection flow rate to maintain 6 to 13 gpm flow to all RCP seals.

____ 4.20 When RCS pressure decreases to 2000 psig verify the P-11 permissive and block the low pressurizer pressure safety injection signal, and close both PORV Block Valves, 2-RC-MOV-8000A and B.

4.21 When the Test Supervisor determines that sufficient data has been collected to determine depressurization rate, mark the recorders.

4.22 Set up conditions for low pressure natural circulation test.

4.22.1 Decrease RCS pressure slowly to between 20-30°F saturation margin using auxiliary spray, if necessary.

CAUTION

Do not go below 20°F saturation margin. As indicated by the margin to saturation meters.

4.22.2 Once it is determined by the Test Supervisor that RCS pressure and saturation margin meet the intent of this test, establish an increasing RCS pressure by increasing charging flow. Then slowly increase steam dump flow to increase saturation margin by 10°F.

CAUTION

Excessive steam dump flow could cause a large decrease in RCS pressure.

4.23 Once control of saturation margin using charging has been demonstrated or if it cannot be increased in the above mode, turn the pressurizer heaters on and place the pressurizer pressure controller in automatic with a setpoint corresponding to 2235 psig.

4.23.1 When RCS pressure increases above 2000 psig, open the PORV Block Valves 2-RC-MOV-8000A & B.

4.23.2 Verify safety injection block is reset above 2000 psig.

4.24 Place the steam dump steam pressure controller PK 464 in automatic with a setpoint corresponding to ≅ 1005 psig.

4.25 Fully insert Control Bank D. Verify with the Reactivity Computer that the Reactor is shutdown.

4.26 Continue collecting data while the ΔT reduces to less than 5°F.

4.27 When the ΔT is < 5°F prepare to start RCP 2B by performing the following:

4.27.1 If pressure has been controlled with auxiliary spray open the normal charging valve 2-CVC-HV-8146 and close the aux. spray valve 2-CVC-HV-8145.

4.27.2 Place pressurizer spray valve controllers in manual - closed.

4.28 Verify ΔT is < 5°F. Start RCP 2B using FNP-2-SOP-1.1. Record data through the restart.

4.29 When steady state conditions have been reached, restart RCP 2A in accordance with FNP-2-SOP-1.1. Continue recording data through the restart.

4.30 When steady state conditions have been reached, start RCP 2C in accordance with FNP-2-SOP-1.1.

4.31 Stop the recorders and trend printers.

4.32 Return pressurizer level control to automatic.

4.33 Verify that the pressurizer pressure controller is in automatic, then place both spray valve controllers in automatic.

4.34 Remove ESF and Solid State Protection actuation blocks in accordance with Appendix D, unless the next test to be performed requires this modification. If the next test requires ESF & Solid State Protection modification, place N/A in the signature line of the appendix and initial.

NOTE

Reinstate all safety functions if a delay of testing of 12 hours or more is anticipated.

____ 4.35 Notify the shift supervisor that the test is completed.

____ 4.36 Using ASME steam tables, determine the saturation margin using the pressure and temperature recorded on Data Sheet 4 and plot these values along with saturation margins taken from the margin to saturation meters vs. time and attach to this procedure.

____ 4.37 An evaluation of the accuracy of the saturation meter should be done at this time.

NOTE

This evaluation should include a check of the margin to saturation meter using meter inputs and an evaluation that these meter inputs are representitive of the Reactor Coolant System conditions.

____ 4.38 Attach the printouts and charts from the recorders and trend printer to this procedure and remove the temporary instrumentation if this concludes the Natural Circulation testing.

Completed by: _____

Time/Date: _____

5.0 Acceptance Criteria

___ 5.1 Natural circulation is established.

___ 5.2 Saturation margin is maintained without pressurizer spray flow.

___ 5.3 Saturation margin is maintained without pressurizer heaters and reactor coolant pump flow.

___ 5.4 Saturation meters indicate a saturation margin within 1.0 degree fahrenheit of the margin as determined from the steam tables.

___ 5.5 RCS depressurization rate with loss of pressurizer heaters is determined.

___ 5.6 Effects of charging and steam flows on saturation margins are determined.

6.0 References

6.1 PLS Document

6.2 Farley Unit 2 Technical Specifications

6.3 VEPCO North Anna Unit 2 Procedure 2-ST-8

6.4 Westinghouse Safety Evaluation for Farley Unit 2 Natural Circulation Testing.

7.0 Data Sheets, Appendices, and Attachments

501-7-002 Data Sheet 1: TEST EQUIPMENT RECORD

501-7-002 Data Sheet 2: INITIAL PLANT CONDITIONS

501-7-002 Data Sheet 3: DEPRESSURIZATION RATE

501-7-002 Data Sheet 4: MARGIN TO SATURATION

501-7-002 Appendix A: OPERATIONAL SAFETY CRITERIA

501-7-002 Appendix B: TEMPORARY RECORDERS

501-7-002 Appendix C: PROCESS COMPUTER TREND BLOCKS

501-7-002 Appendix D: ESF AND REACTOR PROTECTION MODS.

501-7-002 Appendix E: CORE ΔT WITH NATURAL CIRCULATION

501-7-002 Appendix F: AUXILIARY SPRAY TEST

502-7-002 Attachment 1: TRAINING ATTENDANCE SHEET

DATA SHEET 1

TEST EQUIPMENT RECORD

TEST EQUIPMENT* DESCRIPTION	FNP or ID NUMBER	CAL DUE DATE	DATES USED

* This applies only to temporarily installed test equipment or instrumentration. Permanent instrumentation which is part of the system and shown on drawings, should not be included.

Test Supervisor _____ / _____
Signature Date

DATA SHEET 2

INITIAL PLANT CONDITIONS - STEADY STATE

REACTOR COOLANT SYSTEM

Pressurizer Pressure PR-444 (Red Pen) _____ psig

Pressurizer Level LR-459 (Red Pen) _____ %

RCS Loop 1 Hot Leg Temperature TR-413 (Red Pen) _____ °F

RCS Loop 1 Cold Leg Temperature TR-410 (Red Pen) _____ °F

RCS Loop 2 Hot Leg Temperature TR-413 (Blue Pen) _____ °F

RCS Loop 2 Cold Leg Temperature TR-410 (Blue Pen) _____ °F

RCS Loop 3 Hot Leg Temperature TR-413 (Green Pen) _____ °F

RCS Loop 3 Cold Leg Temperature TR-410 (Green Pen) _____ °F

Reactor Coolant Loop 2A T_{avg} TI-412D _____ °F

Reactor Coolant Loop 2B T_{avg} TI-422D _____ °F

Reactor Coolant Loop 2C T_{avg} TI-432D _____ °F

Reactor Coolant Loop 2A ΔT TI-412A _____ %

Reactor Coolant Loop 2B ΔT TI-422A _____ %

Reactor Coolant Loop 2C ΔT TI-432A _____ %

STEAM GENERATORS

Steam Generator 2A Level (NR) LI-474 _____ %

Steam Generator 2B Level (NR) LI-484 _____ %

Steam Generator 2C Level (NR) LI-494 _____ %

Steam Generator 1 Level (WR) LR-477 Pen 1 (Red) _____%

Steam Generator 2 Level (WR) LR-477 Pen 2 (Green) _____%

Steam Generator 3 Level (WR) LR-477 Pen 3 (Blue) _____%

Steam Generator 2A Pressure PI-474 _____ psig

Steam Generator 2B Pressure PI-484 _____ psig

Steam Generator 2C Pressure PI-494 _____ psig

Steam Generator 2A Feedwater Flow FI-476 _____ x 10^6 #/hr.

Steam Generator 2B Feedwater Flow FI-486 _____ x 10^6 #/hr.

Steam Generator 2C Feedwater Flow FI-496 _____ x 10^6 #/hr.

Steam Generator 2A Steam Flow FI-474 _____ x 10^6 lbs/hr.

Steam Generator 2B Steam Flow FI-484 _____ x 10^6 lbs/hr.

Steam Generator 2C Steam Flow FI-494 _____ x 10^6 lbs/hr.

REACTOR POWER

NIS Channel N-41 _____%

NIS Channel N-42 _____%

NIS Channel N-43 _____%

NIS Channel N-44 _____%

NIS Channel NI-35 _____amps

NIS Channel NI-36 _____amps

NOTE

Attach a copy of the computer printout of the Incore Thermocouple Temperature Map.

MISCELLANEOUS

TDAFW Pump Room Temperature (Test Inst.) _____°F

Control Room Temperature (Test Inst.) _____°F

Outside Air Temperature (Computer) _____°F

Data Taken by _____/_____
Signature Date

DATA SHEET 3

DEPRESSURIZATION RATE

Using data from the Computer Trend printout and the Brush Recorder charts, starting after equilibrum has been reached, calculate the Depressurization Rate and the Pressurizer Cooldown Rate (liquid temperature) and record results below.

NOTE

Attach copies of the Computer Trend printout and the Brush Recorder charts to this page.

Depressurization Rate _____ psig/hr.

Pressurizer Cooldown Rate _____ °F/hr.

Calculated by _____

Reviewed by _____

Date _____

NOTE

A plot of the RCS Depressurization Rate vs. time can be made from the attached data if desired.

DATA SHEET 4

MARGIN TO SATURATION

ime	Pressure* (psi)	Temperature* (°F)	Margin to Saturation Meters			
			Channel 1		Channel 2	
			"RTD" Position **	"T/C" Position **	"RTD" Position**	T/C" Position**

Data Taken by _____ / _____
Signature Date

*Pressure and temperature channel to be recorded for the Reactor Coolant System to be specified by the Test Supervisor.

**Indicate position of selector switch on MCB Margin to Saturation Meters.

APPENDIX A

OPERATIONAL SAFETY CRITERIA

During the performance of these tests, plant operations will be controlled or limited by the following set of criteria for operation.

1. Operational Guidelines (for all Tests)

a.	Primary System Subcooling (T_{sat} Margin)	(later)
b.	Steam Generator Water Level	~ 33 percent
c.	Pressurizer Water Level	
	(1) With RCP's running	$\geq$ 22 percent Span
	(2) Natural Circualtion	$\geq$ Value when RCP's are tripped
d.	Loop ΔT	(later)
e.	T_{ave}	(later)
f.	Core Exit Temperature (highest)	(later)
g.	Power Range Neutron Flux	< 5 percent Reactor Power
h.	Control Bank D	(later)

2. Reactor Trip and Test termination must occur if any of the following limits are reached.

a.	Primary System Subcooling (T_{sat} Margin)	(later)
b.	Steam Generator Water Level	< 5 percent Narrow Range Span
c.	NIS Power Range, 2 Channels	> 7 percent Reactor Power
d.	Pressurizer Water Level	$\leq$ 17 percent Span or an unexplained decrease of more than (later) percent not concurrent with a T_{avg} change

e.	Any Loop ΔT	(later)
f.	T_{ave}	(later)
g.	Core Exit Temperature	(later)
h.	Uncontrolled Rod Motion	(later)

3. Safety Injection must be manually initiated if any of the following limits are reached.

a.	Primary System Subcooling (T_{sat} Margin)	(later)
b.	Steam Generator Water Level	< 0 percent Narrow Range Span or Equivalvent Wide Range level
c.	Containment Pressure	(later)
d.	Pressurizer Water Level	< 10 percent Span or an unexplained decrease of more than 10 percent not concurrent with a T_{avg} change.
e.	Pressurizer Pressure	Decreases by 200 psi or more in an unexplained manner.

NOTE

Safety Injection termination will be in accordance with the termination criteria set forth in FNP-2-EOP-0.

APPENDIX B

TEMPORARY RECORDERS

Connect temporary strip-chart recorders as indicated below.

1.0 Reactivity-Computer Recorder

a. Flux

b. Average wide range T_{COLD}

c. Average wide range T_{HOT}

d. Reactivity

NOTE

Set the chart speed on the following records to 125 mm/min.

2.0 Strip-Chart Recorder No. 1

Channel	Connection	Monitoring
1	FP-414B, C1-432	RCS Flow, Loop 1
2	FP-424B, C1-433	RCS Flow, Loop 2
3	FP-434B, C1-434	RCS Flow, Loop 3
4	PP-455F, C1-428	Pressurizer Pressure
5	LP-459B, C1-442	Pressurizer Level

3.0 Strip Chart Recorder No. 2

Channel	Connection	Monitoring
1	PP-474D, C2-443	S/G No. 1 Pressure
2	LP-474B, C1-429	S/C No. 1 Level
3	FP-474B, C3-741	S/G No. 1 Steam Flow
4	PP-484B, C2-444	S/G No. 2 Pressure
5	LP-484B, C1-430	S/G No. 2 Level
6	FP-484B, C3-746	S/G No. 2 Steam Flow

4.0 Strip-Chart Recorder No. 3

Channel	Connection	Monitoring
1	PP-494B, C2-445	S/G No. 3 Pressure
2	LP-494B, C1-431	S/G No. 3 Level
3	FP-494B, C3-748	S/G No. 3 Steam Flow
4	FQ-3229A, CJ-234, Pins 21 & 22	S/G No. 1 Aux Feed Flow
5	FQ-3229B, CJ-234, Pins 29 & 30	S/G No. 2 Aux Feed Flow
6	FQ-3229C, CJ-234, Pins 33 & 34	S/G No. 3 Aux Feed Flow

5.0 Strip-Chart Recorder No. 4

Channel	Connection	Monitoring
1	FQY-122, C6-522	RCS Charging Flow
2	FQY-150, C6-433	RCS Letdown Flow
3	PP-403B, C4-433	Wide Range RCS Pressure
4	TD-454, C6-636	Pressurizer Steam Temp.
5	TD-453, C6-636	Pressurizer Liquid Temp

6.0 Strip-Chart Recorder No. 5

Channel	Connection	Monitoring
1	TP-413A, C1-435	Wide Range T_{HOT} Loop 1
2	TP-410A, C2-435	Wide Range T_{COLD} Loop 1
3	TP-423A, C1-436	Wide Range T_{HOT} Loop 2
4	TP-420A, C2-436	Wide Range T_{COLD} Loop 2
5	TP-433A, C1-441	Wide Range T_{HOT} Loop 3
6	TP-430A, C2-441	Wide Range T_{COLD} Loop 3

The above installation has been completed and check-out is satisfactory.

Completed by: _____ / _____
Signature Date

Test Supervisor _____ / _____
Signature Date

The above installation has been removed.

Completed by: _____ / _____
Signature Date

Test Supervisor _____ / _____
Signature Date

APPENDIX C

PROCESS COMPUTER TREND BLOCK A

COLUMNS	ADDRESS	PARAMETER	UNITS
1	T0406A	RCL A T_{COLD}	°F
2	T0426A	RCL B T_{COLD}	°F
3	T0446A	RCL C T_{COLD}	°F
4	T0419A	RCL A T_{HOT}	°F
5	T0439A	RCL B T_{HOT}	°F
6	T0459A	RCL C T_{HOT}	°F
7	T0400A	T_{AVG} LOOP A	°F
8	T0420A	T_{AVG} LOOP B	°F
9	T0440A	T_{AVG} LOOP C	°F
10	T0403A	ΔT LOOP A	%
11	T0423A	ΔT LOOP B	%
12	T0443A	ΔT LOOP C	%
13	F0128A	CHARGING FLOW	GPM
14	F0134A	LETDOWN FLOW	GPM
15	U1250	HIGHEST REL FUEL ASSY PWR	
16	L0480A	PRESSURIZER LEVEL	%
17	L0112A	VCT LEVEL	%
18	U1251	HIGHEST REL ASSY PWR INDENT	

PROCESS COMPUTER TREND BLOCK B

COLUMNS	ADDRESS	PARAMETER	UNITS
1	L0400A	S/G A LEVEL	%
2	L0420A	S/G B LEVEL	%
3	L0440A	S/G C LEVEL	%
4	P0400A	S/G A PRESS	PSIG
5	P0420A	S/G B PRESS	PSIG
6	P0440A	S/G C PRESS	PSIG
7	P0483A	PRESSURIZER P	PSIG
8	P0499A	RC SYSTEM P	PSIG
9	P0142A	CHARGING PRESS	PSIG
10	U0482	AVG PZR PRESS	PSIG
11	U0483	AVG PZR LEVEL	%
12	U1118	RX THERMAL POWER	MW
13	U1170	AVG T/C TEMP	°F
14	AS REQUIRED	HOTTEST T/C (QUADRANT 1)	°F
15	AS REQUIRED	HOTTEST T/C (QUADRANT 2)	°F
16	AS REQUIRED	HOTTEST T/C (QUADRANT 3)	°F
17	AS REQUIRED	HOTTEST T/C (QUADRANT 4)	°F

PROCESS COMPUTER TREND BLOCK C

COLUMNS	ADDRESS	PARAMETER	UNITS
1	T0003A	INCORE T/C	°F
2	T0006A	INCORE T/C	°F
3	T0002A	INCORE T/C	°F
4	T0005A	INCORE T/C	°F
5	T0020A	INCORE T/C	°F
6	T0024A	INCORE T/C	°F
7	T0022A	INCORE T/C	°F
8	T0023A	INCORE T/C	°F
9	T0045A	INCORE T/C	°F
10	T0033A	INCORE T/C	°F
11	T0036A	INCORE T/C	°F
12	T0029A	INCORE T/C	°F
13	T0030A	INCORE T/C	°F
14	T0046A	INCORE T/C	°F
15	T0048A	INCORE T/C	°F
16	T0044A	INCORE T/C	°F
17	P0499A	RC SYSTEM P	PSIG
18	P0484A	PRESSURIZER P	PSIG

APPENDIX D

ENGINEERED SAFETY FEATURES AND REACTOR PROTECTION MODIFICATIONS

During the performance of these tests, modifications will be made to the Engineered Safety Features and the Reactor Protection Systems. The systems will operate as specified below.

1. All auto Safety Injection (SI) functions, except Reactor Trip will be blocked. A Safety Injection actuation signal will result in the following:

   a. Reactor Trip.

   b. Control Room Trip Indication and Alarms.

2. Safety Injection actuation can be initiated by manual switch operation.

3. The High Steam Line Differential Pressure signal will be blocked.

4. Containment Spray and actuation system will not be changed.

5. Containment Phase A Isolation will not operate automatically. It can be initiated manually by Phase A manual actuation or Safety Injection manual actuation.

6. Phase B Isolation system will not be changed.

7. Steam Line Isolation will result from any one of the following:

   a. Containment Pressure - High 2.

   b. Steam Line Pressure Low with Manual Unblock.

   c. High Steam Flow coincident with Low-Low T_{ave} with Manual Unblock.

8. Feedwater Isolation will result from:

   a. High-High Steam Generator Water Level.

   b. Manual Safety Injection.

   c. Reactor Trip with Low T_{ave}.

9. Motor Driven Auxiliary Feedwater Pumps will start from any one of the following:

   a. LOSP Sequencer signal.

   b. Main Feedwater Pump Trip and NO Blackout signal present.

   c. 2 of 3 Low-Low Level signals on one Steam Generator.

NOTE

Setpoint is changed from 17 percent NR Level to 5 percent NR Level.

   d. ESS Sequencer signal following Manual initiation of Safety Injection.

10. Turbine Driven Auxiliary Feedwater Pump will start from any one of the following:

   a. Undervoltage on 2 of 3 Reactor Coolant Pump Buses.

   b. 2 of 3 Low-Low Levels on 2 of 3 Steam Generators.

11. The following Reactor Trip signals will be blocked.

   a. Overtemperature ΔT

   b. Overpower ΔT

12. The following Reactor Trip signals will be blocked by the <u>normal</u> P-7 interlock.

   a. Low Primary Coolant Flow.

   b. Undervoltage

   c. Underfrequency

   d. Pressurizer Low Pressure

   e. Pressurizer High Level

   f. Turbine Trip signal

13. The following Reactor Trip signals will be operable at the setpoint specified.

a.	Power Range, Low Range Neutron Flux	(later) percent Reactor Power
b.	Intermediate Range, Neutron Flux	(later) percent Reactor Power.
c.	Steam Generator Water Level	(later) percent NR Level

14. The following Reactor Trip signals will <u>not</u> <u>be</u> changed.

a. Pressurizer High Pressure

b. Low Feedwater Flow

c. Safety Injection input

d. Manual Reactor Trip

e. Power Range, Neutron Flux High Positive Rate

f. Power Range, Neutron Flux High Negative Rate

g. Source Range, Neutron Flux

h. Power Range, High Range Neutron Flux.

1.0 Modify the Solid State Protection System for performing Natural Circulation Testing as follows:

1.1 Place Train A Solid State Protection System in Test as follows:

1.1.1 Place the Multiplexer Test switch for <u>Train A</u> in the INHIBIT position. Then, have the Operator close the BYPASS breaker which parallels the reactor trip breaker for Train A. Confirm this action by verifying the following:

<u>NOTE</u>

The Operator must rack-in the BYPASS breaker prior to closing.

1.1.1.1 The General Warning lamp for Train A illuminates.

1.1.1.2 The red breaker position indicator BYA (for Train A under test) is illuminated on the MCB.

1.1.1.3 Annunciator E24, SSPS TR A TROUBLE actuates.

1.1.2 On the Output Relay Test Panel, place the Mode Selector switch in the TEST position and verify that the OPERATE lamp goes off.

1.1.3 On the Logic Test Panel, place the Input Error Inhibit switch in the INHIBIT position.

1.2 Install Test Jumpers in Train A Solid State Protection Cabinet as follows:

1.2.1 Using a Test Jumper, connect Universal Board A313 pin 36 to logic ground.

A313-36 to logic ground-Train A _____

1.2.2 Using a Test Jumper, connect Universal Board A213 pin 36 to logic ground.

A213-36 to logic ground-Train A _____

1.2.3 Using a Test Jumper, connect Universal Board A213 pin 42 to logic ground.

A213-42 to logic ground-Train A _____

1.2.4 Using a Test Jumper, connect Universal Board A216 pin 36 to logic ground.

A216-36 to logic ground-Train A _____

1.2.5 Using a Test Jumper, connect Universal Board A312 pin 4 to logic ground.

A312-4 to logic ground-Train A _____

1.2.6 Using a Test Jumper, connect Universal Board A313 pin 4 to logic ground.

A313-4 to logic ground-Train A _____

1.3 Return Train A Solid State Protection System to service as follows:

1.3.1 Place the Mode Selector switch to OPERATE.

1.3.2 Have the Operator place the following manual block switches for Trains A and B in the BLOCK position.

NOTE

Blocks will not be set unless their associated permissives are present.

1.3.2.1 Source Range Block and Reset

1.3.2.2 Intermediate Range Block

1.3.2.3 Power Range Block LO S.P.

1.3.2.4 LO T_{ave} SI-A(B) Block and Reset

1.3.2.5 LO PRZ SI-A(B) Block and Reset

1.3 3 Place the Input Error Inhibit switch to NORMAL.

1.3.4 Verify that both Reactor Trip Breakers are closed.

1.3.5 Have the Operator open and rack out the BYPASS breaker which was closed in Step 1.1.1.

NOTE

The General Warning lamp should go off.

CAUTION

Prior to performing Step 1.3.6, ensure that a General Warning does not exist for the opposite Train.

1.3.6 Return the Multiplexer Test switch for Train A to the NORMAL position.

1.3.7 Verify that MCB annunciator E24 for Train A is extinguished.

1.4 Place Train B Solid State Protection System in Test as follows:

1.4.1 Place the Multiplexer Test switch for Train B in the INHIBIT position. Then, have the Operator close the BYPASS breaker which parallels the reactor trip breaker for Train B. Confirm this action by verifying the following:

NOTE

The Operator must rack-in the BYPASS breaker prior to closing.

1.4.1.1 The General Warning lamp for Train B illuminates.

1.4.1.2 The red breaker position indicator BYB (for Train B under test) is illuminated on the MCB.

1.4.1.3 Annunciator E25, SSPS TR B TROUBLE actuates.

1.4.2 On the Output Relay Test Panel, place the Mode Selector switch in the TEST position and verify that the OPERATE lamp goes off.

1.4.3 On the Logic Test Panel place the Input Error Inhibit switch in the INHIBIT position.

1.5 Install Test Jumpers in Train B Solid State Protection Cabinet as follows:

1.5.1 Using a Test Jumper, connect Universal Board A313 pin 36 to logic ground.

A313-36 to logic ground-Train B _____

1.5.2 Using a Test Jumper, connect Universal Board A213 pin 36 to logic ground.

A213-36 to logic ground-Train B _____

1.5.3 Using a Test Jumper, connect Universal Board A213 pin 42 to logic ground.

A213-42 to logic ground-Train B _____

1.5.4 Using a Test Jumper, connect Universal Board A216 pin 36 to logic ground.

A216-36 to logic ground-Train B _____

1.5.5 Using a Test Jumper, connect Universal Board A312 pin 4 to logic ground.

A312-4 to logic ground-Train B _____

1.5.6 Using a Test Jumper, connect Universal Board A313 pin 4 to logic ground.

A313-4 to logic ground-Train B _____

1.6 Return Train B Solid State Protection System to service as follows:

1.6.1 Place the Mode Selector switch to OPERATE.

1.6.2 Have the Operator place the following manual block switches for Trains A and B in the BLOCK position.

NOTE

Blocks will not be set unless their associated permissives are present.

1.6.2.1 Source Range Block and Reset

1.6.2.2 Intermediate Range Block

1.6.2.3 Power Range Block LO S.P.

1.6.2.4 LO T_{ave} SI-A(B) Block and Reset

1.6.2.5 LO PRZ SI-A(B) Block and Reset

1.6.3 Place the Input Error Inhibit switch to NORMAL.

1.6.4 Verify that both Reactor Trip Breakers are closed.

1.6.5 Have the Operator open and rack out the BYPASS breaker which was closed in Step 1.4.1.

NOTE

The General Warning lamp should go off.

CAUTION

Prior to performing Step 1.6.6, ensure that a General Warning does not exist for the opposite Train.

1.6.6 Return the Multiplexer Test switch for Train B to the NORMAL position.

1.6.7 Verify that MCB annunciator E25 for Train B is extinguished.

Test Supervisor _____ / _____
Signature Date

2.0 The following Instrumentation Setpoint changes will be made for performing Natural Circulation Testing.

2.1 Change 17% Steam Generator Lo Lo trip to _____% by adjusting the signal comparator card to _____ VDC trip and _____ VDC reset per the following Procedure.

Signal Comparator Card	Procedure No.
LT 474A	FNP-2-STP-213.1
LT 475A	FNP-2-STP-213.2
LT 476A	FNP-2-STP-213.3
LT 484A	FNP-2-STP-213.4
LT 485A	FNP-2-STP-213.5
LT 486A	FNP-2-STP-213.6
LT 494A	FNP-2-STP-213.7
LT 495A	FNP-2-STP-213.8
LT 496A	FNP-2-STP-213.9

2.2 Verify Power Range Low Neutron flux trip is set at _____ percent Reactor Power per FNP-2-STP-228.5, 228.6, 228.7, and 228.8.

2.3 Verify Intermediate Range Neutron flux is set at IR Amps equivalent to _____ percent Reactor Power per FNP-2-STP-228.3 and 228.4.

Test Supervisor _____/_____
Signature Date

3.0 Return the Solid State Protection System to Normal, following completion of Natural Circulation Testing or when directed by the Test Supervisor, as follows:

3.1 Place Train A Solid State Protection System in Test in accordance with Steps 1.1.1 through 1.1.3.

3.2 Remove the Test Jumpers from Train A Solid State Protection Cabinet that were installed in Section 1.2.

3.2.1 Test Jumpers removed:

A313-36 to logic ground-Train A _____

A213-36 to logic ground-Train A _____

A213-42 to logic ground-Train A _____

A216-36 to logic ground-Train A _____

A312-4 to logic ground-Train A _____

A313-4 to logic ground-Train A _____

3.3 Return Train A Solid State Protection System to service in accordance with Section 1.3.

3.4 Place Train B Solid State Protection System in Test in accordance with Steps 1.4.1 through 1.4.3.

3.5 Remove the Test Jumpers from Train B Solid State Protection Cabinet that were installed in Section 1.5.

3.5.1 Test Jumpers removed:

A313-36 to logic ground-Train B _____

A213-36 to logic ground-Train B _____

A213-42 to logic ground-Train B _____

A216-36 to logic ground-Train B _____

A312-4 to logic ground-Train B _____

A313-4 to logic ground-Train B _____

3.6 Return Train B Solid State Protection System to service in accordance with Section 1.6.

Test Supervisor _____ / _____
Signature Date

4.0 Return Instrumentation Setpoints to Normal, following completion of Natural Circulation Testing or when directed by the Test Supervisor, as follows:

4.1 Return Steam Generator Lo-Lo level trip from _____ percent to 17% per the following procedures.

Signal Comparator Card.	Procedure No.
LT 474A	FNP-2-STP-213.1
LT 475A	FNP-2-STP-213.2
LT 476A	FNP-2-STP-213.3
LT 484A	FNP-2-STP-213.4
LT 485A	FNP-2-STP-213.5
LT 486A	FNP-2-STP-213.6
LT 494A	FNP-2-STP-213.7
LT 495A	FNP-2-STP-213.8
LT 496A	FNP-2-STP-213.9

4.2 Return the Power Range Low Neutron flux trip Setpoint to 25% Reactor power, per FNP-2-STP-228.5, 228.6, 228.7 and 228.8.

4.3 Return the Intermediate Range Neutron flux trip Setpoint to Normal per FNP-2-STP-213.3 and 213.4.

Test Supervisor _____ /
Signature Date

APPENDIX E

CORE ΔT WITH NATURAL CIRCULATION
(Estimated Range)

POWER LEVEL (%)	(2) OPERATING LOOPS	(3) OPERATING LOOPS
1	(later)	(later)
1 ½	(later)	(later)
3		(later)

NOTE

These values of ΔT reflect an uncertainty of 0.5% core power.

APPENDIX F

AUXILIARY SPRAY TEST

_____ 1.0 Verify steady state Pressurizer conditions by observing a straight-line trace of Pressurizer pressure on Pressure Recorder PR-444.

_____ 1.1 Record Pressurizer pressure as indicated on PI-444.

Pressure _____psig

_____ 2.0 Place Spray Valve controllers PK-444C and D in Manual and open Spray Valves 2-RC-PCV-444C and D.

CAUTION

The following steps place the plant in a condition for the establishment of initial baseline data. A sufficient degree of uncertainty exists such that spray flow may be initiated upon the execution of any step. Observe ALL available indications of RCS pressure.

Do not allow RCS pressure to fall below 2135 psig.

Immediately upon any sudden or uncontrolable pressure decrease, shut Auxiliary Spray Valve 2-CVC-HV-8145 and open Normal Charging Line Valve 2-CVC-HV-8146.

If system pressure response becomes unduly sensitive to changes in valve position under these conditions, establish minimum Letdown, balance the Charging Flow for constant Pressurizer level, and reattempt this Test.

_____ 3.0 Open Auxiliary Spray Valve 2-CVC-HV-8145 and observe system pressure response.

_____ 4.0 Close Normal Charging Line Valve 2-CVC-HV-8146 and observe the system pressure response.

____ 5.0 Begin slowly closing Pressurizer Spray Valve 2-RC-PCV-444C and then, if necessary, slowly close 2-RC-PCV-444D, while continously observing RCS pressure indications.

____ 5.1 Record the following data:

5.1.1 Spray Valves 2-RC-PCV-444C and D positions at which system pressure decrease is first obtained.

2-RC-PCV-444C position_____

2-RC-PCV-444D position_____

5.1.2 Charging (Aux. Spray) Flow.

FI-122 _____ gpm

5.1.3 Charging (Aux. Spray) temperature

TI-123 _____ °F

____ 5.2 Under the direction of the Shift Supervisor, establish the optimum Spray Valve position operating range for pressure control under these conditions.

CAUTION

During the following step, observe the Margin to Saturation Meters and do not allow the system to fall below a 20°F Saturation Margin.

____ 6.0 Reposition Spray Valves 2-RC-PCV-444C and D to the positions established in step 5 above, to maintain minimum Auxiliary Spray flow and observe restoration of system pressure by Automatic Pressurizer Heater Operation.

____ 7.0 Re-establish Charging and Letdown to the conditions existing prior to step 4.14 in the body of the procedure.

NOTE

The Training Attendance Sheet will be provided in the Control Room by the Training Department, prior to the performance of this procedure.