Sequoyah Nuclear Plant

8005140432

SPECIAL TEST NO. 1

NATURAL CIRCULATION TEST

Prepared By: E. Saputa

Revised By: S. R. Maehr

Submitted By: J R Bynum
Supervisor

PORC Review: 5/6/80
Date

Approved By: [signature]
Superintendent

Date Approved: 5/6/80

DISTRIBUTION

1C	Plant Master File
	Superintendent
1U	Assistant Superintendent (Ope.)
	Assistant Superintendent (Maint.)
	Administrative Supervisor
	Maintenance Supervisor (M)
	Assistant Maintenance Supervisor (M)
	Maintenance Supervisor (E)
	Assistant Maintenance Supervisor (E)
1U	Maintenance Supervisor (I)
1U	Results Supervisor
1U	Operations Supervisor
1U	Quality Assurance Supervisor
	Health Physics Supervisor
	Public Safety Services Supv.
	Chief Storekeeper
	Preop Test Program Coordinator
	Outage Director
	Chemical Engineer (Results)
	Radiochem Laboratory
	Instrument Shop
1C	Reactor Engineer (Results)
	Instrument Engineer (Maint. I)
	Mechanical Engineer (Results)
	Staff Industrial Engineer (Plt Svs)
	Training Center Coordinator
	PSO - Chickamauga Engrg Unit - SNP
	Public Safety Services - SNP
1C	Shift Engineer's Office
1C	Unit Control Room
	QA&A Rep. - SNP
	Health Physics Laboratory
1U	Nuclr Document Control Unit, 606 EB-C
1U	Superintendent, WBNP
	Superintendent, BFNP
	Superintendent, BENP
1U	NEB, W9C174C-K
	Supv., NPHPS ROB, MS
	NRC-IE:II
	Power Security Officer, 620 CST2-C
	Nuclr Materials Coord. - 1410 CUBB-C
	Manager, OP-QA&A Staff
1C	Resident NRC Inspector - SNP
1C	NSRS, 249A HBB-K
	Technical Support Center
1C	Shift Technical Advisor

Rev. No.	Date	Revised Pages	Rev. No.	Date	Revised Pages
0	5/6/80	All			

The last page of this instruction is Number 46

SPECIAL TEST NO. 1

NATURAL CIRCULATION TEST

NATURAL CIRCULATION TEST

Table of Contents

	Page
Natural Circulation Test	1
Special Operator Instruction	2
1.0 OBJECTIVES	3
2.0 PREREQUISITES	3
3.0 PRECAUTIONS	6
4.0 SPECIAL TEST EQUIPMENT	8
5.0 INSTRUCTIONS	9
6.0 ACCEPTANCE CRITERIA	12
DATA SHEETS	13
APPENDIX A - References	17
APPENDIX B - Deficienci/	18
APPENDIX C - Power Measurement Techniques	19
APPENDIX D - Computer Points	30
APPENDIX E - Safeguard Blocking Procedure	34
APPENDIX F - Technical Specifications Exceptions	45
TABLE 1 - Loop Flow and Core ΔT for Various Power Levels and Isolation Configurations	46

NATURAL CIRCULATION TEST

TEST DESCRIPTION

The test will be initiated by simultaneously tripping all reactor coolant pumps while at 3% power. The transient response will be monitored and establishment of natural circulation verified. Core exit thermocouples will be monitored to determine the core flow distribution. After stable conditions have been established, forced circulation will be reestablished.

SPECIAL OPERATOR INSTRUCTION

*An operator initiated safety injection should be performed only for one or more of the following conditions:

Reactor Coolant System Subcooling	≦ 10°
Sudden Unexplained Decrease in Pressurizer Level to or Sudden Unexplained Decrease of	≦ 10% Indicated 10%
Sudden Unexplained Decrease in Any S/G Level to	≦ 76% Wide Range ≦ 0% Narrow Range
Unexplained Pressurizer Pressure Drop	≧ 200 PSI
Containment Pressure Hi - (1.54 psig)	Annunciator XA-55-6B Window 6 initiates

An operator initiated reactor trip should be performed for any of the following conditions:

Reactor Coolant System Subcooling	≦ 15°
Sudden Unexplained Decrease in Pressurizer Level to Or a Sudden Unexplained Decrease of	≦ 17% 5%
1/3 Excores	≧ 10%
Any Loop Δ T	> 65°F
Tavg	> 578°F
Core Exit Temperature (Highest)	> 610°F
Any Uncontrolled Rod Movement	

*SI termination should be in accordance with plant EMERGENCY OPERATING PROCEDURES.

1.0 OBJECTIVES

1.1 To demonstrate the capability to remove decay heat by natural circulation.

1.2 To verify that the pressurizer pressure and level control systems can respond automatically to loss of forced circulation from all four reactor coolant pumps and maintain RCS pressure within acceptable limits during the coastdown transient.

1.3 To verify that steam generator level and feedwater flow can be controlled under conditions of natural circulation to maintain adequate cooling of the reactor coolant system.

1.4 To provide operator training. All operating shifts will perform this test.

NOTE: Data acquisition does not need to be repeated for multiple test performances.

2.0 PREREQUISITES

2.1 Low Power Physics Testing has been completed to the extent necessary for conduct of this test.

_____ _____
Date

2.2 Reactor is critical and manually controlled at approximately 3% power with control bank D at ~ 160 steps or as specified by test engineer. (Power determined as indicated in Appendix C).

_____ _____
Date

2.3 All four reactor coolant pumps are in operation.

_____ _____
Date

2.4 Pressurizer pressure control and level control are in automatic, maintaining RCS pressure at approximately 2235 psig and pressurizer level at approximately 27 to 28%.

_____ _____
Date

2.5 Steam dump valves are in the pressure control mode, maintaining steam generator pressure at approximately 1005 psig.

_____ _____
Date

2.0 (Continued)

2.6 Steam generator level is being maintained at approximately 33% on the narrow range indicators with auxiliary feedwater.

_____ _____
Date

2.7 RCS temperature (T_{avg}) is being maintained at approximately 550°F.

_____ _____
Date

2.8 Record the following parameters.

NOTE: Data acquisition steps need not be repeated for multiple test performances. N/A sign offs for these steps.

2.8.1 Install recorders to record data at the following locations.

Recorder No. 1	Connect To:	Monitoring
Channel No. 1	1-R-1, FP-414B	RCS Flow, Loop 1
Channel No. 2	1-R-1, FP-424B	RCS Flow, Loop 2
Channel No. 3	1-R-1, FP-434B	RCS Flow, Loop 3
Channel No. 4	1-R-1, FP-444B	RCS Flow, Loop 4
Channel No. 5	1-R-1, PP-455B	Pressurizer Pressure
Channel No. 6	1-R-1, LP-459B	Pressurizer Level

Recorder No. 2	Connect To:	Monitoring
Channel No. 1	1-R-3, PP-514B	Steam Gen.#1 Pressure
Channel No. 2	1-R-23, LP-501	Steam Gen.#1 Level
Channel No. 3	1-R-3, FP-512B	Steam Gen.#1 Steam Flow
Channel No. 4	1-R-3, PP-524B	Steam Gen.#2 Pressure
Channel No. 5	1-R-23, LP-502	Steam Gen.#2 Level
Channel No. 6	1-R-3, FP-522B	Steam Gen.#2 Steam Flow

Recorder No. 3	Connect To:	Monitoring
Channel No. 1	1-R-4, PP-534B	Steam Gen.#3 Pressure
Channel No. 2	1-R-23, LP-503	Steam Gen.#3 Level
Channel No. 3	1-R-4, FP-532B	Steam Gen.#3 Steam Flow
Channel No. 4	1-R-4, PP-544B	Steam Gen.#4 Pressure
Channel No. 5	1-R-23,LP-504	Steam Gen.#4 Level
Channel No. 6	1-R-4, FP-542B	Steam Gen.#4 SteamFlow

2.0 (Continued)

Recorder No. 4	Connect To:	Monitoring
Channel No. 1	1-R-3, FP-510B	Main Feed Flow, SG#1
Channel No. 2	1-R-3, FP-520B	Main Feed Flow, SG#2
Channel No. 3	1-R-4, FP-530B	Main Feed Flow, SG#3
Channel No. 4	1-R-4, FP-540B	Main Feed Flow, SG#4

NOTE: If auxiliary feedwater is to be used in place of main feedwater, brush recorder #4 should be installed in the auxiliary control room to record data at the following locations.

Recorder No. 4	Connect To:	Monitoring
Channel No. 1	F-3-163,TP13,1-L-11B	Aux.FeedFlow to SG#1
Channel No. 2	F-3-155,TP13,1-L-11A	Aux.FeedFlow to SG#2
Channel No. 3	F-3-147,TP12,1-L-11B	Aux.FeedFlow to SG#3
Channel No. 4	F-3-170,TP12,1-L-11A	Aux.FeedFlow to SG#4

/

NOTE: Record the following on each strip chart:

a) Unit number
b) Date
c) Procedure number
d) Parameter scale and range
e) Chart speed
f) Name of person recording data
g) Recorder ID number

2.8.2 Record on ρ-computer recorder

a. Flux
b. Average wide range T_{cold}
c. Average wide range T_{hot}
d. Average Steam generator pressure
e. Reactivity

/

2.9 A steady feed to the steam generators should be set up to minimize temperature variation in the RCS.

/

2.0 (Continued)

2.10 Verify the input logic of safety injection on Hi steam line ΔP has been blocked in accordance with Appendix E.

_____ / _____

2.11 Verify the Hi steam flow coincident with Lo S/G pressure or Lo Tav input to safety injection has been modified in accordance with Appendix E.

_____ / _____

2.12 Verify the automatic actuation of safety injection has been blocked in accordance with Appendix E.

_____ / _____

2.13 Verify the following UHI isolation valves are gagged.

FCV 87-21 _____ / _____

FCV 87-22 _____ / _____

FCV 87-23 _____ / _____

FCV 87-24 _____ / _____

2.14 Intermediate and power range (low setpoint) high level reactor trip setpoints have been set to 7% in accordance with Appendix C and D of SU-8.5.2.

Power Range _____ / _____

Intermediate Range _____ / _____

3.0 PRECAUTIONS

3.1 Do not exceed 5% nuclear power.

3.2 Abort test if any of the following temperature limits are exceeded:

3.2.1 $610^{\circ}F$ for any core outlet thermocouple.

3.2.2 $65^{\circ}F$ for any loop Delta-T.

3.2.3 $578^{\circ}F$ for any loop T_{avg}.

3.0 (Continued)

3.3 Avoid rapid changes in steam pressure, steam generator level, and feedwater flow to prevent rapid cooling of the reactor coolant.

3.4 Maintain reactor coolant pump seal and thermal barrier differential requirements as given in SOI 68.2.

3.5 After the reactor coolant pumps are tripped, the normal T_{avg} and ΔT indications will become unreliable. ΔT and T_{avg} should be calculated by taking the difference and the average of the hot and cold leg temperatures indications respectively.

3.6 Maintain T_{cold} at the pretrip temperatures by adjusting the steam dump setpoint.

3.7 Should a reactor trip take place during the conduct of this test, restart at least one reactor coolant pump (#2) prior to closing the reactor trip breaker.

3.8 Maintain D bank at $\geq$ 100 steps during the conduct of this test. Should this limit be reached boran concentration will have to be increased.

4.0 SPECIAL TEST EQUIPMENT

Instrument	Specification	Identification	Calibration Verification
Strip Chart Recorder (4)	Brush 260 or equivalent		
Reactivity Computer	Westinghouse		
Recorder (1)	HP 7100B or equivalent		

If test instruments are changed during this test, the instrument information must be recorded here and an entry made in the chronological log book explaining this change.

5.0 INSTRUCTIONS

NOTE: Data acquisition steps need not be repeated for multiple test performances. N/A sign offs for these steps.

5.1 Prepare the plant computer to record data as specified in Appendix D. Record the initial steady state values for these points on Data Sheet 5.1.

_____ /

5.2 Start the brush recorders in the auxiliary instrument room and start monitoring of data points on the computer trend typewriter.

_____ /

CAUTION: Continuously monitor main-steam line pressures and carefully control feedwater addition during the transient to ensure that differential pressure between any two steam lines does not exceed 100 psid.

NOTE: Steam generator pressure, level, and flow conditions should be held as close as possible to stable conditions through the duration of the transient. Reactor coolant system cold leg temperatures should be maintained within $\pm$ 5°F of the initial values.

NOTE: At the initiation of natural circulation (RCP trip) the following response is expected.

a) Wide range T_{hot}, - increase
b) Wide range T_{cold}, - slight increase or constant
c) Core exit thermocouple, - increase
d) T_{avg} indication, - unreliable
e) Delta-T indications, - unreliable
f) Pressurizer level and pressure, - increase

5.3 Simultaneously trip all four reactor coolant pumps in accordance with SOI 68.2.

_____ /

5.4 Maintain RCP seal flow at a minimum of 6 gpm to each pump.

_____ /

5.0 (Continued)

5.5 Maintain pressurizer pressure control in automatic and manually adjust charging flow to match letdown and maintain a constant RCS water mass.

_____ _____ /_____

NOTE: Pressurizer heaters and auxiliary spray may be controlled manually as needed.

5.6 Carefully control additions of feedwater to the steam generators to maintain levels at approximately 33%. Do not allow steam generator level to drop below 24% on narrow range indicators.

_____ /_____

NOTE: Natural circulation flow will be stable when:

a) ΔT between wide range T_{hot} and T_{cold} is constant.
b) ΔT between wide range T_{cold} and core exit T/C average temperature is constant.
c) Wide range T_{hot} ~ core exit T/C average temperature. (See Table 1).

5.7 After steady state conditions have been reached mark each recorder chart to indicate equilibrium has been reached and continue recording data.

_____ /_____

5.8 Insert control bank D as specified by test engineer until the hot zero power test range is reached.

_____ /_____

CAUTION. Ensure pressurizer spray controller outputs are approximately zero before starting RCP's 1 or 2.

5.9 After reactor coolant pumps have been shutdown for at least 30 minutes, restart the RCP #2 in accordance with SOI 68.2. Continue to collect data through the restart.

_____ /_____

5.10 After steady state conditions have been reached, restart reactor coolant pump #1 in accordance with SOI 68.2. Continue to collect data through the restart.

_____ /_____

5.0 (Continued)

5.11 After steady state conditions have been reached restart reactor coolant pump #3 in accordance with SOI 68.2. Continue to collect data through the restart.

_____ / _____

5.12 After steady state conditions have been reached restart reactor coolant pump #4 in accordance with SOI 68.2. Continue to collect data through the restart.

_____ / _____

5.13 Stop the brush recorders in the auxiliary instrument room, and terminate trend recording on the plant computer.

_____ / _____

5.14 Incorporate the brush recorder charts and computer printouts on Data Sheet 5.2.

_____ / _____

5.15 Remove the block of input logic of safety injection on Hi steam line ΔP in accordance with Appendix E, unless the next test to be performed requires the block to be installed. If this is the case, disregard this step, place N/A in the signature line and initial.

_____ / _____

5.16 Remove modification to Hi steam flow coincident with Lo S/G pressure or Lo Tav input to safety injection in accordance with Appendix E, unless the next test to be performed requires the modification to be made. If this is the case, disregard this step, place N/A in signature line and initial.

_____ / _____

5.17 Remove block of automatic initiation of safety injection in accordance with Appendix E, unless the next test to be performed requires the modification to be made. If this is the case, disregard this step, place N/A in signature line and initial.

_____ / _____

5.0 (Continued)

5.18 Remove the gag from the following UHI isolation valves unless the next test to be performed requires the valves to be gagged. If this is the case, disregard this step, place N/A in signature line and initial.

FCV 87-21 _____ / _____

FCV 87-22 _____ / _____

FCV 87-23 _____ / _____

FCV 87-24 _____ / _____

5.19 Reset the intermediate and power range high level reactor trip setpoints as indicated by the test director in accordance with Appendix C and D of SU-8.5.2 unless the next test to be performed requires this adjustment. If this is the case, disregard this step, place N/A in the signature line, and initial.

Power Range _____ / _____

Intermediate Range _____ / _____

6.0 ACCEPTANCE CRITERIA

6.1 Core exit T/C temperature does not exceed 610°F.

_____ / _____

6.2 Delta-T for any loop does not exceed 65°F.

_____ / _____

6.3 T_{avg} for any loop does not exceed 578°F.

_____ / _____

6.4 Delta-T established between wide T_{hot} and T_{cold} is stable and less than 65°F.

_____ / _____

6.5 Delta-T established between wide range T_{cold} and core exit T/C average temperature is stable and less than 65°F.

_____ / _____

DATA SHEET 5.1

INITIAL CONDITIONS

Unit _____ Date _____ Time _____

Pressurizer Pressure PR-68-340	_____	psig
Pressurizer Level LR-68-339	_____	%
RCS Loop 1 Hot Leg Temperature TR-68-1	_____	°F
RCS Loop 1 Cold Leg Temperature TR-68-18	_____	°F
RCS Loop 2 Hot Leg Temperature TR-68-1	_____	°F
RCS Loop 2 Cold Leg Temperature TR-68-18	_____	°F
RCS Loop 3 Hot Leg Temperature TR-68-43	_____	°F
RCS Loop 3 Cold Leg Temperature TR-68-60	_____	°F
RCS Loop 4 Hot Leg Temperature TR-68-43	_____	°F
RCS Loop 4 Cold Leg Temperature TR-68-60	_____	°F
Steam Generator 1 Level (NR) (LI-3-42)	_____	%
Steam Generator 2 Level (NR) (LI-3-97)	_____	%
Steam Generator 3 Level (NR) (LI-3-110)	_____	%
Steam Generator 4 Level (NR) (LI-3-110)	_____	%

Recorded by _____ / _____

DATA SHEET 5.1

INITIAL CONDITIONS

Unit _____ Date _____ Time _____

Steam Generator 1 Level (WR) LR-3-43 Pen 1	_____	%
Steam Generator 2 Level (WR) LR-3-43 Pen 2	_____	%
Steam Generator 3 Level (WR) LR-3-98 Pen 1	_____	%
Steam Generator 4 Level (WR) LR-3-98 Pen 2	_____	%
Steam Generator 1 Pressure PI-1-2A	_____	psig
Steam Generator 2 Pressure PI-1-9A	_____	psig
Steam Generator 3 Pressure PI-1-20A	_____	psig
Steam Generator 4 Pressure PI-1-27A	_____	psig
Steam Generator 1 Feedwater Flow (FI-3-35A)	_____	gpm
Steam Generator 2 Feedwater Flow (FI-3-48A)	_____	gpm
Steam Generator 3 Feedwater Flow (FI-3-90A)	_____	gpm
Steam Generator 4 Feedwater Flow (FI-3-103A)	_____	gpm
Steam Generator 1 Steam Flow (FI-1-3A)	_____	lbs/hr
Steam Generator 2 Steam Flow (FI-1-10A)	_____	lbs/hr

Recorded by _____/_____

DATA SHEET 5.1

INITIAL CONDITIONS

Unit _____ Date _____ Time _____

Steam Generator 3 Steam Flow (FI-1-21A)	_____	lbs/hr
Steam Generator 4 Steam Flow (FI-1-28A)	_____	lbs/hr
Loop 1 Tavg (TI-68-2E)	_____	^{o}F
Loop 2 Tavg (TI-68-25E)	_____	^{o}F
Loop 3 Tavg (TI-68-44E)	_____	^{o}F
Loop 4 Tavg (TI-68-67E)	_____	^{o}F
Loop 1 ΔT (TI-68-2D)	_____	^{o}F
Loop 2 ΔT (TI-68-25D)	_____	^{o}F
Loop 3 ΔT (TI-68-44D)	_____	^{o}F
Loop 4 ΔT (TI-68-67D)	_____	^{o}F
NIS Channel N-41	_____	%
NIS Channel N-42	_____	%
NIS Channel N-43	_____	%
NIS Channel N-44	_____	%

Recorded by _____ / _____

Checked by _____ / _____

DATA SHEET 5.2

Attach copies of the computer trend printout and brush recorder charts to this page.

APPENDIX A

References

1. FSAR
2. Technical Specifications
3. Plant Operating Instructions EOI-5
   SOI-68.2

APPENDIX B

Test Deficiencies #_____

Test Deficiency

Recommended Resolution

Final Resolution

Originator _____ / _____
Signature Date

PORC Review of Final Resolution _____
Date

Approval of Final Resolution _____ / _____
Plant Superintendent Date

APPENDIX C

Procedure for Determining Core Power Level

APPENDIX C

Outline

I. Core Power Determination

A. Primary Side Calorimetric (Forced Circulation Only)

1. Reference (~ 550°F) Calorimetric (Before NC test)

a) Output used to adjust M/D Power Monitor Program's power conversion constant.

B. M/D Power Monitor Program

1. Power Conversion Constant Adjustment.

a) The output of the REF primary calorimetric will give a percent power output; this output must be input to the M/D Power-Monitor Program so that the program output will be in percent power and equal to the primary calorimetric output.

2. Power Monitoring

a) The M/D Power Monitor Program will calculate the integral power as seen by one pass of 5 or 6 detectors. After the output has been calibrated to be equal to the REF primary calorimetric it will be rerun up to once every 2 minutes or as necessary to continuously monitor core power.

APPENDIX C

CORE POWER DETERMINATION

PART A: Primary side calorimetric - Data Sheet C.1 (Forced Circulation)

C.1 Use two DVMs and measure the voltage at the test points specified for each loop as rapid as possible.

C.2 Calculate the ΔT; multiply that ΔT by the specific heat and the Westinghouse best estimate flow rate of the core average temperature (Table C-1). (Special Test No. 9 uses wide range ΔT so a correction factor is required to compensate for pump heating, refer to Appendix D of ST-9A).

C.3 Sum the loop heat rates and convert to a percent reactor power. The output is used in Part B.

APPENDIX C

CORE POWER DETERMINATION

PART B: M/D Power Monitor Program

1. Set up the movable detector system for a 1 pass partial core flux map as per TI-53. Select flux thimbles as per the table below for the flux map.

Drive	10-Path Position	Core Location
A	10	L-5
B	10	L-11
C	10	E-5
D	10	E-11
E	6	J-8
F	8	P-9

These positions may be altered by the test engineer, based upon low-power physics testing results and previous special testing experience.

2. Determine the detector normalization constants and enter them into the P-250 as follows:

   a) Enter a value of 1.0 into the P-250 for the addresses shown in the table below.

   b) With all 5-path selector switches set to normal, run a flux trace.

   c) With all 5-path selector switches set to Emergency, run a second flux trace.

   d) Determine the detector normalization constants from Data Sheet C.2.

APPENDIX C

CORE POWER DETERMINATION

PART B: (Continued)

e) Enter these detector normalization constants into the P-250 as shown in the table below.

Drive	P-250 Address
A	K0908
B	K0909
C	K0910
D	K0911
E	K0912
F	K0913

3. Verify that the P-250 parameters listed in the following table have the proper value and that the P-250 time and date are current. Update as required.

Address	Value	Function
K0901	1	Set the Power Normalization Factor
K5525	1	Selects the Modified "Flux Map Print" Programs
K0900	0	Initiated Pass Number
K0864	Variable(1)	Calibration Constant for M/D Power Monitor

(1) Variable: The value entered is a ratio of the Primary Calorimetric Indicated Power (Item B on Data Sheet C.1) to the M/D calculated power (U0906) times the current value entered in (K0864). If no value has been entered into (K0864) enter 0.25.

$$\text{New (K0864)} = \text{Current (K0864)} \times \frac{\text{Item \#8 Data Sheet C.1}}{\text{(U0906)}}$$

APPENDIX C

CORE POWER DETERMINATION

PART B: (Continued)

4. For power determination, obtain a partial core flux map as per TI-53. The M/D's need not be withdrawn between passes, and passes may be repeated as often as a power determination is required.

NOTE: The calculated power (U0906) is printed after each pass and may be trended by the P-250 if desired. The individual detector normalized integrals and axial offsets are also printed.

5. The M/D Power Monitor printout should be attached to this procedure.

APPENDIX C

PART C: Using Thermocouples

The incore thermocouples can be used as an indication of both core flow distribution and power shifts during natural circulation.

Prior to running a thermocouple map or trending the eight quadrant tilts (four center lines and four diagonal tilts) the following should be verified:

K0701-K0765 = 1, For the flow mixing factors

K5501 = 0, Indicates the measured core ΔT is unreliable

K0791 = 0.075, Core bypass flow fraction

K5010 = 8, Tells thermocouple program how many readings of thermocouples are required for averaging before calculation is done. This in turn sets the running frequency of the Thermocouple Averaging Program at 1, 2, ... X 8 seconds or 64 seconds for us.

The thermocouple programs breaks the core down into eight quandrants--four centerline and four diagonal quandrants (see Figure C-1). Quadrants 1-4 can be directly correlated with the excore detectors but quadrants 5-8 cannot.

The quadrant tilts are indicative of power shifts and should be trended at approximately a 2-minute frequency. The following addressable values are the quadrant tilts:

Quadrant	Addressable Value
1	U1159
2	U1160
3	U1161
4	U1162
5	U1151
6	U1152
7	U1153
8	U1154

A Short Form Map should be run periodically or upon request from the test engineer as an indication of core flow distribution. It should be put on the Utility Typewriter if possible. The P-250 Operator's Console Reference Manual provides instructions for obtaining thermocouple maps.

The trend output and Short Form Maps should be attached to this procedure at the end of the test.

APPENDIX C

TABLE C-1

Temp °F	Cp[1] BTU/lbm°F	$\dot{m}$ lbm/hr
556	1.260	3.6448×10^7
554	1.255	3.6553×10^7
552	1.250	3.6659×10^7
550	1.245	3.6765×10^7
548	1.240	3.6862×10^7
546	1.236	3.6959×10^7
544	1.231	3.7057×10^7
542	1.226	3.7155×10^7
540	1.221	3.7254×10^7
538	1.217	3.7348×10^7
536	1.213	3.7443×10^7
534	1.209	3.7538×10^7
532	1.206	3.7633×10^7
530	1.202	3.7729×10^7

(1) These values are from the 1967 ASME Steam Tables. Values are for a pressure of 2250 psia.

APPENDIX C

FIGURE C.1

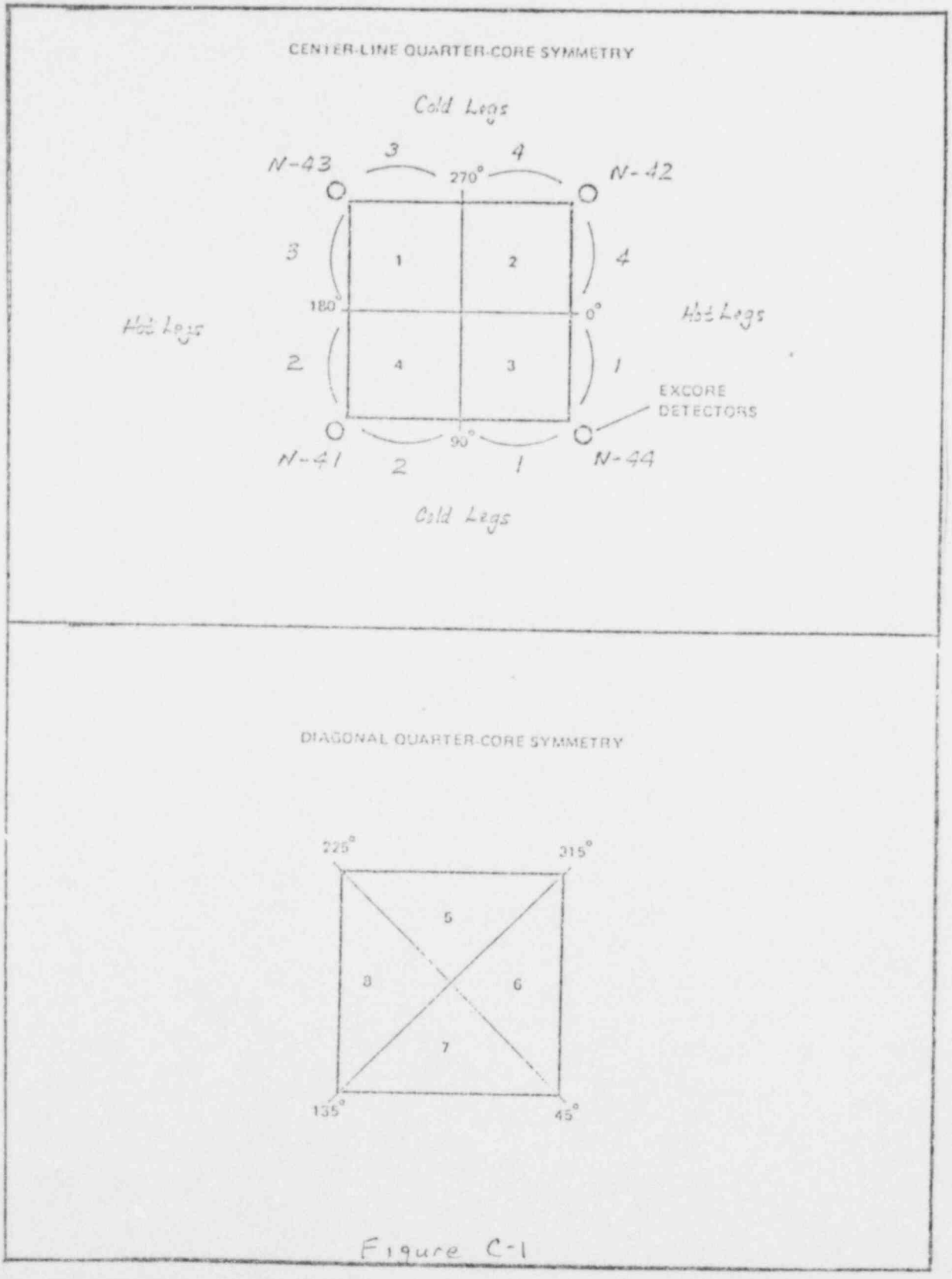

Figure C-1

APPENDIX C

Data Sheet C.1

Date _____ Time _____ Unit _____ Power _____ Tavg _____ °F

Item #	Calculation Procedure	Units	Loop 1 R2/TP-411J	Loop 2 R6/TP-421J	Loop 3 R10/RP-431J	Loop 4 R1 /RP-441J
		Test Point				
1	Loop Δ T - Inservice (at test point)	Volts				
2	Loop Δ T = (#1) x (1)	°F				
3	Loop Δ H = (#2) x Cp (from Table C.1)	BTU/lbm				
4	Loop RCS Flow (from Table C.1)	10^6 lbm/hr				
5	Loop Reactor Power = (#3) x (#4)	10^6 BTU/hr				
6	Total Reactor Power = (#5) Loop 1 + Loop 2 + Loop 3 + Loop 4	10^6 BTU/hr				
7	Reactor Power = (#6) x 0.29307	MWT				
8	% Reactor Power = (#7) x 0.02932	%				

(1) Conversion factor for ΔT obtained from scaling document.

Remarks:

Date By: _____

Checked By: _____

APPENDIX C

DATA SHEET C.2

A_N = _____ B_N = _____ C_N = _____ D_N = _____ E_N = _____ F_N = _____

A_E = _____ B_E = _____ C_E = _____ D_E = _____ E_E = _____ F_E = _____

$N_A = 1.00$

$$N_B = \frac{A_N}{B_N} = \frac{N_A A_E}{B_N} = \text{_____}$$

$$N_C = \frac{A_N}{C_N} = \frac{N_B B_E}{C_N} = \text{_____}$$

$$N_D = \frac{A_N}{D_N} = \frac{N_C C_E}{D_N} = \text{_____}$$

$$N_E = \frac{A_N}{E_N} = \frac{N_D D_E}{E_N} = \text{_____}$$

$$N_F = \frac{A_N}{F_N} = \frac{N_E E_E}{F_N} = \text{_____}$$

Definitions:

A_N, B_N, C_N, D_N, E_N, F_N = Normalized integral from summary map for each detector in a normal path in the first pass

A_E, B_E, C_E, D_E, E_E, F_E = Normalized integral from summary map for each detector in an emergency path in the second pass

N_A, N_B, N_C, N_D, N_E, N_F = Detector normalization factor for each detector

Remarks:

Data By: _____ Date _____

Checked By: _____ Date _____

APPENDIX D

Procedure For Use Of Computer System For Data Collection

The following parameters will be monitored during this test using the plant computer system.

Parameter	Computer Point
Pressurizer Pressure	P0480A
Pressurizer Level	L0480A
RCS Loop 1 Hot Leg Temperature	T0419A
RCS Loop 1 Cold Leg Temperature	T0406A
RCS Loop 2 Hot Leg Temperature	T0439A
RCS Loop 2 Cold Leg Temperature	T0426A
RCS Loop 3 Hot Leg Temperature	T0459A
RCS Loop 3 Cold Leg Temperature	T0446A
RCS Loop 4 Hot Leg Temperature	T0479A
RCS Loop 4 Cold Leg Temperature	T0466A
Steam Generator 1 Pressure	P0400A
Steam Generator 1 Narrow Range Leve	L0400A
Steam Generator 2 Pressure	P0420A
Steam Generator 2 Narrow Range Level	L0420A
Steam Generator 3 Pressure	P0440A
Steam Generator 3 Narrow Range Level	L0440A
Steam Generator 4 Pressure	P0460A
Steam Generator 4 Narrow Range Level	L0460A
Power Range Channel 1 (Quadrant 4)	N0049A
Power Range Channel 2 (Quadrant 2)	N0050A
Power Range Channel 3 (Quadrant 1)	N0051A
Power Range Channel 4 (Quadrant 3)	N0052A
Incore Thermocouples	T0001A through T0065A

APPENDIX D

The computer trend typewriter will be used to monitor the following computer points. (Additional points may be added as required by the test director).

BLOCK 1

Column	Point	Column	Point	Column	Point
1	P0480A	7	T0459A	13	P0420A
2	L0480A	8	T0446A	14	L0420A
3	T0419A	9	T0479A	15	P0440A
4	T0406A	10	T0466A	16	L0440A
5	T0439A	11	P0400A	17	P0460A
6	T0426A	12	L0400A	18	L0460A

BLOCK 2

Column	Point	Column	Point
1	N0049A	7	T0017A
2	N0050A	8	T0043A
3	N0051A	9	T0059A
4	N0052A	10-13	Hottest T/C from each core Quadrant
5	T0002A	14-18	As Required
6	T0013A		

To initially clear each data block perform the following step for each block to be used.

1. Push DIGITAL TREND button
2. Select block number (1 to 6) on keyboard
3. Push VALUE 1 button
4. Select 0 on keyboard
5. Push VALUE 2 button
6. Push STOP button

Repeat the above 6 steps for each data block to be used.

NOTE: A Block Trend Error message will occur if the data block is initially clear.

APPENDIX D

To set up the data blocks, perform the following series of steps for each point to be monitored.

1. Push the DIGITAL TREND button
2. Select the point address (i.e. PO480A) on the alphanumeric keyboard
3. Push ADDRESS button
4. Select block number (1 to 6) on keyboard.
5. Push VALUE 1 button
6. Select column number (1 to 18) on keyboard
7. Push VALUE 2 button
8. Push START button

Once the blocks are set up they can be initiated by performing the following steps for each block.

1. Push DIGITAL TREND button.
2. Select block number (1 to 6) on keyboard
3. Push VALUE 1 button
4. Select internal number 0 = 30 sec., 1 = 1 minute, 2 = 2 minute, etc.) The 30-second interval is recommended for the duration of the test transient
5. Push VALUE 3 button
6. Push START button

If it is necessary to change the trend interval of a block or trend, perform the following.

1. Push DIGITAL TREND button
2. Select block number (1 to 6) on keyboard
3. Push VALUE 1 button
4. Select new interval number (0 = 30 sec., 1 = 1 min., 2 = 2 min., etc) on keyboard
5. Push VALUE 3 button
6. Push START button

To stop trending or block perform the following:

1. Push DIGITAL TREND button
2. Select block number (1 to 6) on keyboard
3. Push VALUE 1 button
4. Select C on keyboard
5. Push VALUE 3 button
6. Push STOP button

APPENDIX D

In addition to the data recorded on the trend typewriter, the following points will be monitored on analog trend recorded.

T0056A (Core exit temp).
Others as needed (Recommend pressurizer pressure, steam generator level (WR) and steam generator pressure).

After selecting the per to be used to record a value, ensure that it is cleared by performing the following steps.

1. Push ANALOG TREND function button
2. Select per number (1 to 12) on keyboard
3. Push VALUE 1 button
4. Push STOP button

To start an analog trend perform the following steps.

1. Push ANALOG TREND function button
2. Select the computer point address (i.e. T0043A) on the alphanumeric keyboard
3. Push ADDRESS button
4. Select per number (1 to 12) on keyboard
5. Push VALUE 1 button
6. Select per position on keyboard. This is the minimum value of the parameter to be monitored
7. Select range on the keyboard
8. Push VALUE 3 button
9. Push START button

Repeat these steps until all of the desired analog points are being recorded.

Prior to initiation of the transient, and as required thereafter, incore thermocouple maps will be recorded at the programmers console in the computer room. To initiate an incore T/C map at that location, perform the following steps.

1. Push IN-CORE T/C Map function button
2. Select 25 on keyboard for short form map
3. Push VALUE 1 button
4. Select output device code number 20 (on keyboard)
5. Push VALUE 2 button
6. Select 1 on keyboard for short form map
7. Push VALUE 3 button
8. Push START button

APPENDIX E

Safeguard Blocking Procedure

The first step blocks automatic initiation of a safety injection. The safety injection alarm, manual S.I handswitch, and the reactor trip portion of the protection logic will remain in operation. If conditions exist that would normally initiate a safety injection; (1) the safety injection alarm will initiate telling the operator that the condition exists and what the problem is. (2) a reactor trip will take place automatically. (3) a safety injection can be initiated manually from the switch in the control room if conditions warrant.

1. Install temporary jumpers and temporary alteration control tags to logic cards A216, test point 1, to the logic ground on the logic test panels in R-47 and R-50.

   NOTE: These jumpers will be specially made for this purpose and installed by an instrument mechanic.

   R-47 Panel Performed by: _____ / _____

   Verified by: _____ / _____

   R-50 Panel Performed by: _____ / _____

   Verified by: _____ / _____

Procedure for blocking automatic actuation of a safety injection on high steamline Delta-P. This block will prevent a reactor trip from occuring during the natural circulation tests from high ΔP caused by degraded test conditions. (This block will also defeat all ΔP SI alarms).

2. Verify status lights 1-XX-55-6B/1, 2, 3, 4, 25, 26, 27, 28, 50, 51, 73, 76 are all clear prior to starting blocking procedure.

3. Move test trip switch PS-515A in 1-R-7 to the trip position and verify the amber light above the switch comes on.

   Performed by: _____ / _____

   Verified by: _____ / _____

CAUTION: In the next step, and all following steps in which a voltage is being applied to the indicated terminals, ensure the applied voltage is of the same polarity as the terminals. This check should be done for every step that a voltage source is applied. Failure to apply the correct polarity will ground the rack power supply. (This problem can be avoided if only the hot wire from the voltage source in the rack is applied to the first terminal indicated in each step [the lower numbered terminal]. The

APPENDIX E

ground will already be made up through the trip switch). The wire on the rack side of the terminal block must be lifted and taped for the terminal point where the jumper wire is connected The TACF tag will be attached to the bistable switch and the TACF must note the jumper and the lifted wire.

NOTE: Orange "Out of Service" stickers should be placed on all status/alarm windows as the 120V source is connected.

4. Lift and tape the wire on the rack side of terminal L-9 in the rear of 1-R-7. Apply a 120-VAC source to terminals L-9 and L-10 in the rear of 1-R-7 and verify 1-XX-55-6B/25 is clear.

Performed by: _____ /_____

Verified by: _____ /_____

5. Move test trip switch PS-515B in 1-R-7 tc the trip position and verify the amber light above the switch comes on.

Performed by: _____ /_____

Verified by: _____ /_____

6. Lift and tape the wire on the rack side of terminal L-7 in the rear of 1-R-7. Apply a 120-VAC source to terminals L-7 and L-8 in the rear of 1-R-7 and verify 1-XX-55-6B/27 is clear.

Performed by: _____ /_____

Verified by: _____ /_____

7. Move test trip switch PS-516C in 1-R-12 to the trip position and verify the amber light above the switch comes on.

Performed by: _____ /_____

Verified by: _____ /_____

8. Lift and tape the wire on the rack side of terminal L-5 in the rear of 1-R-7. Apply 120-VAC source to terminals L-5 and L-6 in the rear of 1-R-12 and verify 1-XX-55-6B/73 is clear.

Performed by: _____ /_____

Verified by: _____ /_____

APPENDIX E

9. Move test trip switch PS-516D in 1-R-12 to the trip position and verify the amber light above the switch comes on.

Performed by: _____ /

Verified by: _____ /

10. Lift and tape the wire on the rack side of terminal L-7 in the rear of 1-R-12. Apply 120-VAC source to terminals L-7 and L-8 in the rear of 1-R-12 and verify 1-XX-55-6B/76.

Performed by: _____ /

Verified by: _____ /

11. Move test trip switch PS-525B in 1-R-8 to trip position and verify the amber light above the switch comes on.

Performed by: _____ /

Verified by: _____ /

12. Lift and tape the wire on the rack side of terminal L-7 in the rear of 1-R-8. Apply 120-VAC source to terminals L-7 and L-8 and verify 1-XX-55-6B/28 is clear.

Performed by: _____ /

Verified by: _____ /

13. Move test trip switch PS-525A in 1-R-8 to the trip position and verify the amber light above the switch comes on.

Performed by: _____ /

Verified by: _____ /

14. Lift and tape the wire on the rack side of terminal L-9 in the rear of 1-R-8. Apply 120-VAC source to terminals L-9 and L-10 and verify that XX-55-6B/26 is clear.

Performed by: _____ /

Verified by: _____ /

15. Move test trip switch PS-526D in I-R-11 to the trip position and verify the amber light above the switch comes on.

Performed by: _____ /

Verified by: _____ /

APPENDIX E

16. Lift and tape the wire on the rack side of terminal L-7 in the rear of 1-R-11. Apply 120-VAC source to terminals L-7 and L-8 in the rear of 1-R-11 and verify that XX-55-6B/51 is clear.

Performed by: _____ /_____

Verified by: _____ /_____

17. Move test trip switch PS-526C in 1-R-11 to the trip position and verify the amber light above the switch comes on.

Performed by: _____ /_____

Verified by: _____ /_____

18. Lift and tape the wire on the rack side of terminal L-5 in the rear or 1-R-11. Apply a 120-VAC source to terminals L-5 and L-6 and verify 1-XX-55-6B/50 is clear.

Performed by: _____ /_____

Verified by: _____ /_____

Temporary Modification to High Steam Flow Coincident with Low S.G. Pressure or Low-Low T_{avg} Safety Injection

19. Verify annunciators XA-55-6A/30 and XA-55-6A/31 are clear or can be cleared.

Performed by: _____ /_____

Verified by: _____ /_____

NOTE: If the alarms will not clear, do not proceed with this modification as a reactor trip may result. The input bistables should be checked and the source of the problem corrected.

20. Move test trip switch TS412D in R-2 to the trip position and verify the amber light above the switch comes on.

Performed by: _____ /_____

Verified by: _____ /_____

21. Lift and tape the wire on the rack side of terminal M-3 in the rear of 1-R-2. Apply a 120-VAC source to terminals M-3 and M-4 and verify XA-55-6A/30 will clear.

Performed by: _____ /_____

Verified by: _____ /_____

APPENDIX E

22. Move test trip switch TS-422D in R-6 to the trip position and verify the amber light above the switch comes on.

Performed by: _____ /_____

Verified by: _____ /_____

23. Lift and tape the wire on the rack side of terminal M-3 in the rear of 1-R-6. Apply a 120-VAC source to terminals M-3 and M-4 and verify XA-55-6A/30 will clear.

Performed by: _____ /_____

Verified by: _____ /_____

24. Move test trip switch TS432D in R-10 to the trip position and verify the amber light above the switch comes on.

Performed by: _____ /_____

Verified by: _____ /_____

25. Lift and tape the wire on the rack side of terminal M-3 in the rear of 1-R-10. Apply a 120-VAC source to terminals M-3 and M-4 and verify XA-55-6A/30 will clear.

Performed by: _____ /_____

Verified by: _____ /_____

26. Move test trip switch TS-442D in R-13 to the trip position and verify the amber light above the switch comes on.

Performed by: _____ /_____

Verified by: _____ /_____

27. Lift and tape the wire on the rack side of terminal M-3 in the rear of 1-R-13. Apply a 120-VAC source to terminals M-3 and M-4 and verify XA-55-6A/30 will clear.

Performed by: _____ /_____

Verified by: _____ /_____

NOTE: The T_{avg} inputs to the high steam flow S.I and steam dump interlock are now blocked. The next steps will trip the steam flow inputs to the high steam flow Safety Injection signal so that an S.I. signal will be initiated on low steam generator pressure alone (600 psig). (This would result in a reactor trip, an S. I. alarm, but no S. I. initiation.)

APPENDIX E

28. Move test trip switch FS512B in R-3 to the trip position and verify the amber light and annunciator XA-55-6B/2 come on.

Performed by: _____ /_____

Verified by: _____ /_____

29. Move test trip switch FS522B in R-3 to the trip position and verify the amber light and annunciator XA-55-6B/ come on.

Performed by: _____ /_____

Verified by: _____ /_____

NOTE: These two trips will supply the 2 out of 4 logic required to get a Safety Injection Signal.

30. Apply Temporary Alteration Control Tags forms to all the above test trip switches to ensure that they remain in the trip position. Damage to the bistable could occur if the switch is moved back to the normal position. Record the temporary alteration numbers below:

RACK	TEST SWITCH	TEMP ALT. NO.
R-7	PS515A	_____ / _____
R-7	PS515B	_____ / _____
R-12	PS516C	_____ / _____
R-12	PS516D	_____ / _____
R-8	PS525B	_____ / _____
R-8	PS525A	_____ / _____
R-11	PS526D	_____ / _____
R-11	RS526C	_____ / _____
R-2	TS412D	_____ / _____
R-6	TS422D	_____ / _____
R-10	TS432D	_____ / _____
R-13	TS442D	_____ / _____
R-3	FS512B	_____ / _____
R-3	FS522B	_____ / _____

To return the steamline Delta-P S.I. to normal condition, the following steps should be followed.

APPENDIX E

NOTE: The orange "Out of Service" stickers should be removed from the alarm/status window as each bistable is put back in service.

31. Remove the 120-VAC source from L-5 and L-6 in 1-R-11. Reterminate wire on L-5.

Performed by: _____ /_____

Verified by: _____ /_____

32. Move test trip switch PS-526C in 1-R-11 to the normal position and verify the amber light above the switch and 1-XX-55-6B/50 are clear.

Performed by: _____ /_____

Verified by: _____ /_____

33. Remove the 120-VAC source from L-7 and L-8 in 1-R-11. Reterminate wire on L-7.

Performed by: _____ /_____

Verified by: _____ /_____

34. Move test trip switch PS-526D in 1-R-11 to the normal position and verify the amber light above the switch and 1-XX-55-6B/51 are clear.

Performed by: _____ /_____

Verified by: _____ /_____

35. Remove the 120-VAC source from L-9 and L-10 in 1-R-8. Reterminate wire on L-9.

Performed by: _____ /_____

Verified by: _____ /_____

36. Move test trip switch PS-525A in 1-R-8 to the normal position and verify the amber light and 1-XX-55-6B/26 are clear.

Performed by: _____ /_____

Verified by: _____ /_____

37. Remove the 120-VAC source from L-7 and L-8 in 1-R-8. Reterminate wire on L-7.

Performed by: _____ /_____

Verified by: _____ /_____

APPENDIX E

38. Move test trip switch PS-525B in 1-R-8 to the normal position and verify the amber light above the switch and 1-XX-5-6B/28 are clear.

Performed by: _____ /_____

Verified by: _____ /_____

39. Remove the 120-VAC source from terminals L-7 and L-8 in 1-R-12. Reterminate wire on L-7.

Performed by: _____ /_____

Verified by: _____ /_____

40. Move test trip switch PS-516D in 1-R-12 to the normal position and verify the amber light above the switch and 1-XX-55-6B/76 are clear.

Performed by: _____ /_____

Verified by: _____ /_____

41. Remove the 120-VAC source from terminals L-5 and L-6 in 1-R-12. Reterminate wire on L-5.

Performed by: _____ /_____

Verified by: _____ /_____

42. Move test trip switch PS-516C in 1-R-12 to the normal position and verify the amber light above the switch and 1-XX-55-6B/73 are clear.

Performed by: _____ /_____

Verified by: _____ /_____

43. Remove the 120-VAC source from terminals L-7 and L-8 in 1-R-7. Reterminate wire on L-7.

Performed by: _____ /_____

Verified by: _____ /_____

44. Move test trip switch PS-515B in 1-R-7 to the normal position and verify the amber light and 1-XX-55-6B/27 are clear.

Performed by: _____ /_____

Verified by: _____ /_____

APPENDIX E

45. Remove the 120-VAC source from terminals L-9 and L-10 in 1-R-7. Retermi-nate wire on T-9.

Performed by: _____ _____/_____

Verified by: _____/_____

46. Move test trip switch PS-515A to the normal position and verify the amber light above the switch and 1-XX-55-6B/25 are clear.

Performed by: _____/_____

Verified by: _____/_____

NOTE: At this point the steamline Delta-P safety injection is in a normal operating mode.

To return the high steam flow coincident with low steam generator pressure or low-low T_{avg} to normal, perform the following steps.

47. Move test trip switch FS522B in R-3 to the normal position and verify the amber light goes out and XA-55-6B/9 will clear.

Performed by: _____/_____

Verified by: _____/_____

48. Move test trip switch FS512B in R-3 to the normal position and verify the amber light goes out and XA-55-6B/2 will clear.

Performed by: _____/_____

Verified by: _____/_____

49. Remove the 120-VAC source from terminals M-3 and M-4 in R-13. Retermi-nate wire on M-3.

Performed by: _____/_____

Verified by: _____/_____

50. Move test trip switch TS442D in R-13 to the normal position and verify the amber light goes out and XA-55-6A/30 will clear.

Performed by: _____ _____/_____

Verified by: _____/_____

APPENDIX E

51. Remove the 120-VAC source from terminals M-3 and M-4 in R-10. Reterminate wire on M-3.

Performed by: _____ /_____

Verified by: _____ /_____

52. Move test trip switch TS432D in R-10 to the normal position and verify the amber light goes out and XA-55-6A/30 will clear.

Performed by: _____ /_____

Verified by: _____ /_____

53. Remove the 120-VAC source from terminals M-3 and M-4 in R-6. Reterminate wire on M-3.

Performed by: _____ /_____

Verified by: _____ /_____

54. Move test trip switch TS442D in R-6 to the normal position and verify the amber light goes out and XA-55-6A/30 will clear.

Performed by: _____ /_____

Verified by: _____ /_____

55. Remove the 120-VAC source from terminals M-3 and M-4 in R-2. Reterminate wire on M-3.

Performed by: _____ /_____

Verified by: _____ /_____

56. Move test trip switch TS412D in R-2 to the trip position and verify the amber light comes on and XA-55-6A/30 will clear.

Performed by: _____ /_____

Verified by: _____ /_____

APPENDIX E

57. Remove the Temporary Alteration Tags on the following test trip switches:

RACK	TEST SWITCH	TEMP ALT. NO.
R-7	PS515A	_____/_____
R-7	PS515B	_____/_____
R-12	PS516C	_____/_____
R-12	PS516D	_____/_____
R-8	PS525B	_____/_____
R-8	PS525A	_____/_____
R-11	PS526D	_____/_____
R-11	RS526C	_____/_____
R-2	TS412D	_____/_____
R-6	TS422D	_____/_____
R-10	TS432D	_____/_____
R-13	TS442D	_____/_____
R-3	FS512B	_____/_____
R-3	FS522B	_____/_____

58. Remove the jumpers and the Temporary Alteration Tags from logic cards A216, test point 1, to the logic ground on the logic test panels in R-47 and R-50.

R-47 Panel Performed by: _____/_____
Verified by: _____/_____

R-50 Panel Performed by: _____/_____
Verified by: _____/_____

NOTE: All reactor safeguard systems modified for the special startup tests are back in a normal configuration at this time.

APPENDIX F

Technical Specifications Exceptions

The table below identifies those technical specification items which are temporarily bypassed or require special test exceptions to the limiting conditions for operation during the performance of this and all other special tests.

TECHNICAL SPECIFICATION	Natural Circulation 1	Loss of Offsite Power 2	Natural Circ. w/o Przr Htrs. 3	Natural Circ. Isolate SG 4	Natural Circ. Reduced Pressure 5	Charging and Letdown Cooldown 6	Blackout 7	Stagnant Start 8	Forced Flow Cooldown 9A	Boron Mixing Cooldown 9B
Containment HI Pressure SI (3.3.2.1)	X	X	X	X	X	X	X	X	X	X
Safety Limits (2.1.1)	X	X	X	X	X	X	X	X		X
OPΔT (3.3.1) Inoperable because of low flow	X	X	X	X	X		X	X	X	X
OTΔT (3.3.1) Inoperable because of low flow	X	X	X	X	X		X	X	X	X
Minimum temperature (3.1.1.4)				X				X	X	X
Moderator temperature coefficient (3.1.1.3)				X				X	X	X
Steamline ΔP SI (3.3.2.1) bypassed	X	X	X	X	X	X	X	X	X	X
High Steamflow coincidental w/low steamline pressure or low-low T_{avg} SI										
Reset flow to 0% and T_{avg} blocked	X	X	X	X	X	X	X	X	X	X
Reset low steamline pressure				X					X	X
Low pressurizer pressure SI (3.3.2.1)	X	X	X	X	X	X	X	X	X	X
SG level low AFW start reset (3.3.2.1)		X					X			
Pressurizer (3.4.4)			X		X		X			
UHI (3.5.1.2)	X	X	X	X	X	X	X	X	X	X
AFW (3.7.1.2)		X					X			
Diesel Gens. (3.8.1.1)		X					X			
A.C. Electrical Boards (3.8.2.1)		X					X			
Batteries (3.8.2.3)		X					X			
RCS Flowrate (3.2.3)	X	X	X	X	X		X	X		X
Control Rod Insertion Limits (3.1.3.6)	X	X	X	X	X		X	X		
Reactor Coolant Loops Normal Operation (3.4.1.2)	X	X	X	X	X		X	X		X

TABLE 1

Loop Flow and Core ΔT for
Various Power Levels and
Isolation Configurations

(Computer Estimates)

	No. of Loops Operating (Nat. Circ.)			
Power Level	4	3	2	1
.5%	W_L = 3.7 ΔT = 10.3	W_L = 3.6 ΔT = 12.5	W_L = 4.1 ΔT = 16.4	W_L = 5.2 ΔT = 26
.75%	W_L = 3.7 ΔT = 13.5	W_L = 4.1 ΔT = 16.3	W_L = 4.7 ΔT = 21.4	W_L = 5.9 ΔT = 34
1%	W_L = 4.1 ΔT = 16.3	W_L = 4.5 ΔT = 19.8	W_L = 5.2 ΔT = 26	W_L = [illegible].5 ΔT = [illegible].1
1.5%	W_L = 4.7 ΔT = 21.4	W_L = 5.2 ΔT = 26	W_L = 5.9 ΔT = 34	W_L = 7.5 ΔT = 54
2%	W_L = 5.2 ΔT = 26	W_L = 5.7 ΔT = 31.4	W_L = 6.5 ΔT = 41	W_L = 8.2 ΔT = 65.4
2.5%	W_L = 5.6 ΔT = 30.1	W_L = 6.2 ΔT = 36.5	W_L = 7.1 ΔT = 47.1	W_L = 8.9 ΔT = 75.9
3%	W_L = 5.9 ΔT = 34	W_L = 6.5 ΔT = 41.2	W_L = 7.5 ΔT = 54	W_L = 9.7 ΔT = 85.7

NOTE: W_L is % of 97,000 gpm flow through operable loop.

ΔT = Loop ΔT in °F.