Public Service Company of Colorado
P. O. Box 361, Platteville, CO 80651

June 11, 1979
Fort St. Vrain
Unit No. 1
P-79127

Mr. George Kuzmycz, Project Manager
Division of Project Management-Special Projects
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Subject: Power Ascension Program

Reference: P-79094

Dear Mr. Kuzmycz:

Per your request, please find enclosed one (1) copy of RT-486. This test has been written to checkout the operability of the instrumentation that will be utilized in fluctuation monitoring including the checkout and calibration of the ICRD's (Instrumented Control Rod Drives).

This test is being forwarded for your information. If you have any questions or need any further information, please let me know.

Very truly yours,

Don Warembourg
Don W. Warembourg
Manager, Nuclear Production

DWW/vt

Enc.

cc/w Attachment
Mr. Duane Frye
Instrument Control Division
P. O. Box X
Oak Ridge, Tenn. 37830

D002
S
1/1

Test Ref. No. RT- 486

System Ref. No. 12

FORT ST. VRAIN NUCLEAR GENERATING STATION

REQUEST FOR TEST

Prepared By: _____ Date

Reviewed By: Roger Heller 6-15-79
Date

Original Issue Reviewed, PORC # PORC 312 JUN 15 1979 Date

Approved & Issued: s/ _____ 6/15/79
Date

Safety Significant: Yes____ No 1 NFSC Review: _____

RECORD AND CONTROL OF REVISIONS

Rev. No.	Prepared By	PORC Approval	Approved & Issued Effective Date of Revision
1			
2			
3			
4			
5			
6			
7			

Completed Test Reviewed: _____
Superintendent, Operations (or designee)

PROCEDURE CHANGES: ☐ Permanent ☐ Temporary

PAGE NO.	DESCRIPTION AND REASON FOR CHANGE OR DEVIATION	SAFETY EVALUATION

APPROVALS:

Plant Management Staff (Senior License) — Date

Plant Management Staff — Date

NOTICE TO TEST CONDUCTOR

IT IS MANDATORY THAT THIS DEVIATION BE REVIEWED BY PORC NO LATER THAN 14 DAYS FROM THE DATE OF SIGNATURE. YOU ARE RESPONSIBLE FOR HAVING THIS DONE.

Test Ref. No. RT-486

System Ref. No. 12

Request for Test - Sheet 5

10) TEST EQUIPMENT (If required)

Name	Identification Number	Last Calibration Date
Data Logger		
RT-508		

11) TEST CONDUCTOR
(Include all assistants)

Permission to initiate test _____
Shift Supervisor Date

12) PROCEDURE (See attached pages):

Test Ref. No. RT-486

System Ref. No. 12

Request for Test - Sheet 6

13) VERIFY THAT THE SYSTEM HAS BEEN RETURNED TO NORMAL:

s/Shift Supervisor Date

14) TECHNICAL SERVICES ACTION:

10 CFR 50.59 Report Required: Yes____ No____

Tech Spec Report Required: Yes____ No____

Reviewed by_____
Signature Date

GA RT -486

PCT REF --

REE Ref --

DATE 6-12-79

ISSUED 6/14/79

REQUEST FOR TEST

REQUESTER K. Asmussen/R. Hirschl   SYSTEM 12

PURPOSE/OBJECTIVE - To correctly interpret signals from ICRD instruments during fluctuations, it is necessary to perform in-situ calibration. This will be accomplished by comparing data collected from ICRDs with that from calibrated plant instrumentation during the normal rise to power and with specified normal plant perturbations.

DESCRIPTION OF TEST

PART I - Collect data from specified data systems periodically during power ascension program. Compare ICRD data with that from calibrated plant instruments.

PART II - Collect data from specified data systems between 30 and 40% power while normal plant perturbations are performed. These perturbations include varying helium flow in specified core regions and moving specified control rods.

PART III - Repeat Part II at a convenient high power between 65 and 70% after the fluctuation threshold has been established.

DATA REQUIRED

1. All data from ICRD is included in FM Data System (RT-503, Rev. 2).
2. Reactor and core performance data from Data Logger.
3. Other FM data system data (RT-503, Rev. 2).

ANTICIPATED RESULTS/ACCEPTANCE CRITERIA

The collected data will be used to calibrate the signals from ICRDs. Data will be recorded on magnetic tape and sent to General Atomic in San Diego for analysis and calibration. There are no anticipated results or acceptance criteria.

REF SOP OR ABNORMAL CONDITIONS

SOP 12-01 and 12-04

T.S. LCO 4.1.3, 4.1.7, 4.1.9

SCHEDULE REQUIREMENTS

Power ascension program (2 - 70%) for Cycle 2 operation.

SAR & APPROVAL SHEET ATTACHED

WORK ASSIGNED BY ________ 6/14/79 TO PSC OPERATIONS GA - HIRSCHL
NAME/DATE

EVALUATION COMPLETED ________
NAME/DATE

REVIEWED BY ________
NAME/DATE

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This SAR is in Support of RT-486 and is enclosed as Page 2 of 13
of that RT even though the SAR is a separate Uncontrolled Document.

(CHECK WITH DOCUMENT CENTER FOR LATEST ISSUE)

GENERAL ATOMIC COMPANY
FORT ST. VRAIN NUCLEAR GENERATING STATION
SAFETY ANALYSIS REPORT

1. INITIATING DOCUMENT: RT-486

		YES	NO
2.	CATEGORY: PLANT CHANGE		X
	CLASS I		X
	SAFE SHUTDOWN COOLING		X
3.	FAILURE MODES AFFECTED		X
4.	SAFETY RELATED COMPONENT, SYSTEM OR STRUCTURE CHANGE		X
5.	SAFETY SIGNIFICANT CHANGE		X
6.	UNREVIEWED SAFETY QUESTION		X
7.	TECH SPECIFICATION CHANGE		X
8.	FSAR CHANGE		X

DOCUMENT CHANGE ONLY ☐
MAINTENANCE ☐
TEST ☒

STATE IN ITEM 10 THE BASIS FOR THE BOXES CHECKED

9. APPLICABLE FSAR OR TECH SPEC SECTIONS REVIEWED: SOP 12-01, SOP 10-04
T.S. LCO 4.1.3, 4.1.7, 4.1.9

10. BASIS FOR SAFETY EVALUATION: (Add additional Sheets if Required):
This test is primarily data gathering. During the power ascension program for Cycle 2, the plant will be operated in a normal manner and all control rod movements will be made using the prescribed sequence. All temperature limits will be adhered to. The plant perturbations requested in Parts II and III involve normal operation and they will be done in such a manner that fluctuations are not anticipated. Plant operation with the ICRDs installed has already been evaluated and approved. The performance of this test will not affect plant operation or safety.

11. IS SAN DIEGO SAFETY ANALYSIS/LICENSING REVIEW REQUIRED? YES ☐ NO ☒
12. HAS SAN DIEGO SAFETY ANALYSIS/LICENSING REVIEW BEEN PERFORMED? YES ☐ NO ☒
13. Rutherford 6.12.79
DIRECTOR/DATE LICENSING/DATE
14. GAC ENGR. REVIEW/DISPOSITION: I concur with above safety evaluation

ENG'R. DATE 6/12/79

INTRODUCTION

Two instrumented control rod drive assemblies (ICRDs) have been installed in Regions 5 (S/N 20) and 35 (S/N 43). The instrument packages on these ICRDs consist of the following:

- fission chamber
- self-powered neutron detector, SPND
- fission-couple
- thermocouples at three axial locations
- orifice delta-P transducer
- microphone
- linear variable differential transducer, LVDT (Region 35 only)

The relative axial location for each of the instruments is illustrated on Figure 1. These ICRDs are expected to provide new diagnostic information to aid the understanding of the fluctuation phenomenon. However, it is essential to interpret the recorded signals correctly. In order to correctly interpret the data, the ICRD instruments must first be calibrated in-situ. This will be done by making deliberate controlled perturbations to the reactor system and recording the response of the instruments on the ICRDs and the response of existing plant and other fluctuation instruments. The ICRDs responses can then be calibrated by comparing the signals of the ICRD instruments with those of the other existing instruments (see Table 1). Similarly, useful calibration data will be obtained by recording the ICRDs and other existing instrumentation's signals during the normal rise to power program; e.g., as control rods are withdrawn, as load is increased, as the core heats up, in going from full to partial arc operation, etc.

The deliberate perturbations which will be made to the reactor system to facilitate calibration of the ICRD instrumentation are the following:

- vary region flow (via orifice valve position)
- jog regulating rod
- jog rod pair adjacent to ICRD region

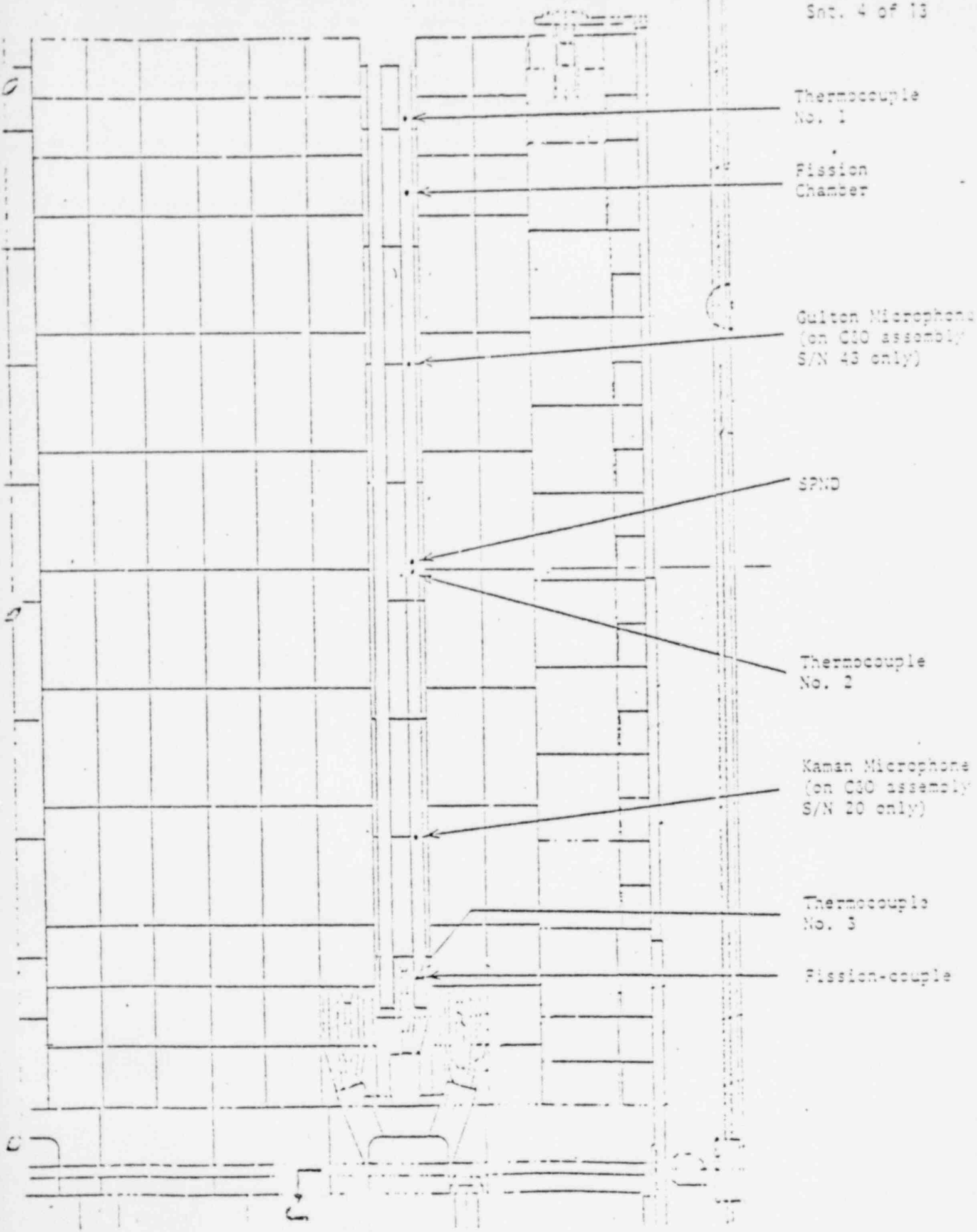
Thermocouple
No. 1
Fission
Chamber
Gulton Microphone
(on C10 assembly
S/N 43 only)
SPND
Thermocouple
No. 2
Kaman Microphone
(on C10 assembly
S/N 20 only)
Thermocouple
No. 3
Fission-couple

TABLE 1. COMPARISONS FOR IN-SITU CALIBRATION OF ICRD INSTRUMENTS

COMPARISONS OF

ICRD INSTRUMENTS	WITH	OUT-OF-CORE INSTRUMENTS
FISSION CHAMBER, SPND, FISSION COUPLE		NUCLEAR CHANNELS, FISSION CHAMBERS
T/C #1		CORE T_{IN}
T/C #J		REGION T_{OUT}, TRAVERSABLE T/Cs
MICROPHONE		MONITOR CONTINUOUSLY AS FLOW CHANGES
ORIFICE ΔP		MONITOR CONTINUOUSLY AS ρ AND/OR CORE FLOW CHANGES
LVDT		MONITOR CONTINUOUSLY AS CORE HEATS UP

During subsequent fluctuation testing (e.g., RT-600), the ICRDs will record data both prior to and during fluctuations. This in-situ calibration will permit a more accurate interpretation of the ICRD instrumentation's response during fluctuation events.

Prior to the in-situ calibration portion of this RT, the FM/ICRD data acquisition system will be thoroughly checked out (Ref. RT-608, Rev. 2). At 30 - 40% power, ICRD signals will be recorded for 1 hour and the data sent to San Diego to verify the expected signals and to checkout the entire data processing/data handling procedure.

OPERATING CONSIDERATIONS

In addition to the normal plant operating procedures and limitations, the following limits should be observed:

1. Fluctuations are not expected during this test. However, should a fluctuation be encountered, immediate corrective action should be taken to reduce power to stop the fluctuation.

2. The plant is defined to be in a fluctuation operating mode when a single nuclear channel exhibits offset deviation from the average equal to or greater than 1% of full power reading on a cyclic basis not exceeding a 30-minute period.

INSTRUMENTATION/DATA SYSTEMS

Throughout the duration of this test, the following data systems shall be operating:

1. Data Logger
2. FM data acquisition system
3. Steam Gen Fox II Computer (Orifice Stroking Test for Parts II and III).

During load changes and other deliberate perturbations to the reactor system (e.g., those specified by this RT), the Data Logger should

be on fast sample rate (15 seconds or less). During this RT and the entire rise in power program, from 0 to 70%, the Data Logger should be set to automatically make a record (of control rod positions, power level, inlet temperature, orifice positions, etc.) each time the shim bank or reg rod position changes by 20 inches.

The traversable thermocouples are to be positioned per RT-824.

PART 1: CALIBRATION DATA ACQUISITION DURING POWER ASCENSION

Initial Conditions

1. Plant ready to begin startup and rise to power in Cycle 2. All data systems ready and operable.

2. The intent is to record data during as much of the rise to power as possible. However, this test will not interfere with the power rise. In addition, if the plant remains at any specific power level for more than one day, the data systems may be turned off. Some data at each power level is desirable.

Procedure

1. Set the Data Logger to automatically store a record at a 10-minute frequency. In addition, it should store a record every time either the reg rod or shim bank is moved 20 inches.

2. With the Data Logger and the FM Data Acquisition System, continuously record data during as much of the rise to power (2 to 70%) as possible, consistent with Item 2 of Initial Conditions.

3. As a precaution, selected instrument signals from each of the ICRDs will be monitored periodically (at least part of each day) as a check on the integrity of the instrument assembly. This can be done by the instrumentation in the Aux Control Room. Suggested signals are thermocouples 2 and 3 and the fission couple.

4. While the plant is at a steady power level between 30 and 40%, record at least 1 hour of base data on the data systems. This data will be used to confirm that the ICRD instrumentation is functioning as expected.

PART 2: IN SITU ICRD RESPONSE CALIBRATION AT 30 - 40% POWER

Initial Conditions

1. Plant at steady conditions between 30 - 40% power with all control systems in automatic, and with MS and HRH temperature controls set to 980°F or less. NOTE: The reason for selecting the temperature setpoint at 980°F or less vs 1000°F is to allow margin for the temperature swings that occur when control rod jogs are made.

2. The orifices are to be adjusted such that the region exit temperatures and steam generator inlet temperatures are reasonably balanced per normal procedures.

3. Plant stable for at least one hour with turbine on load limit.

Procedure

During this part of the RT, deliberate small perturbations of the reactor system will be made so that the response of the instruments on the ICRDs can be calibrated by comparison with other existing plant and fluctuation instrumentation. The perturbations are of three types:

- vary region flow (stroking of orifice valves)
- reg rod jogs
- jogs on adjacent rod pair (shim rod closest to Regions 5 and 35)

Additional calibration data will be obtained during the performance of RT-500, Rev. E, particularly from circulator speed pulse tests and load changes at various power levels.

Vary Flow in Regions 5 and 35

1. Adjust orifices such that the region exit temperature of Region 5 is near its upper limit on region mismatch, i.e., + 50 or + 100°F as

required in LCO 4.1.7. For example, if the mismatch limit is + 80°F adjust the orifice valve to give a + 40°F mismatch. If the mismatch limit is + 200°F, adjust the orifice valve to give a + 120°F mismatch.

2. If necessary, adjust other orifices such that the inlet temperatures to those modules influenced by Region 5 (35), i.e., B 1-1 and B 1-2 (B 1-5 and B 1-6), are approximately 15°F above average.

3. Using the procedures in SOP 12-04, on the Data Logger, determine the amount the orifice valve on Region 5 (35) has to be opened to give a reduction in exit temperature of ~100°F.

4. Using the fast speed orifice change mode, open the orifice valve the predetermined amount.

5. Take fast frequency data during the transient. The trend recorders on the Data Logger can be used to follow the temperature change visually. Allow the core to reach thermal equilibrium (20 - 30 minutes) and store Data Logger record of final core conditions.

6. Repeat steps 2 - 5 (to get data for a second change in region exit temperature of ~100°F).

7. Return orifices to their initial positions by performing the above orifice adjustments in reverse order. **Using the slow speed orifice change mode for the return to initial position for each region.**

8. Repeat the procedures of Steps 1 - 7 for Region 33, and possibly other regions as may be designated by the Core Performance Engineer (based upon the results from Regions 5 and 35).

Control Rod Jogs (Reg Rod and Selected Shim Rods)

1. During this portion of this RT, the automatic flux controller is to remain in the automatic mode and the reheat temperature controller is to

be placed in manual. The ability of the automatic flux controller to move #1 reg rod is to be shut off by rotating the regulating rod selector switch (HS-1218) to the OFF position. This will permit the automatic flux controller to initiate a rod runback if needed as a result of any transient during this test.

CAUTION: If a runback occurs, the reheat temperature controller should be pulled out and returned to automatic and HS-1218 returned to the #1 position as soon as possible.

2. During the time that the reheat temperature controller is in manual, power and reheat temperature may drift. If corrective action is required, either the reg rod or shim rods can be used.

3. Manually force the Data Logger to store a record of core data and set the storage frequency as desired.

4. Place TC-2256 in manual.

5. Place HS-1218 to OFF.

6. Verify that the reg rod position indication on recorders in Aux Control Room is operating.

7. Perform 3 double bumps of about 5c Δρ at 3 - 5 minute intervals. Coordinate execution of this step with activating the Data Logger's RODCAL program if this program is operable such that the reactivity changes associated with these rod movements are calculated.

8. Withdraw the reg rod 3 - 5 inches and hold for about 2 minutes, then return the reg rod to its initial position. Wait about 10 minutes and repeat. Again, activate the Data Logger's RODCAL program to calculate the associated reactivity changes.

9. Repeat Steps 7 and 8 for the control rod pair of the shim bank, closest to Region 3.

10. Repeat Steps 7 and 8 for the control rod pair of the shim bank, closest to Region 35.

11. Return plant to normal stable conditions at initial power level.

PART 3: IN SITU ICRO RESPONSE CALIBRATION AT CONVENIENT POWER LEVEL BETWEEN 55 - 70%

Initial Conditions

1. Plant at steady conditions between 55 - 70% power with all control systems in automatic, the orifices adjusted to ensure that core ΔP and resistance are low enough so that fluctuations will not occur, and with MS and HRH temperature controls set to 930°F or less. NOTE: The reason for selecting the temperature setpoint of 930°F or less vs 1000°F is to allow margin for the temperature swings that occur when control jogs are made.

2. Plant stable for at least one hour with turbine on load limit.

Procedures

Repeat the tests as described in Part II.

Test Ref. No. RT- 486

System Ref. No. 12

FORT ST. VRAIN NUCLEAR GENERATING STATION

REQUEST FOR TEST

Prepared By: _____ Date _____

Reviewed By: Roger Heller Date 6-15-79

Original Issue Reviewed, PORC # PORC 312 JUN 15 1979 Date _____

Approved & Issued: s/ _____ Date 6/15/79

Safety Significant: Yes____ No 1 NFSC Review: _____

RECORD AND CONTROL OF REVISIONS

Rev. No.	Prepared By	PORC Approval	Approved & Issued Effective Date of Revision
1			
2			
3			
4			
5			
6			
7			

Completed Test Reviewed: _____
Superintendent, Operations (or designee)

PROCEDURE CHANGES: ☐ Permanent ☐ Temporary

PAGE NO.	DESCRIPTION AND REASON FOR CHANGE OR DEVIATION	SAFETY EVALUATION

APPROVALS:

Plant Management Staff (Senior License) — Date

Plant Management Staff — Date

NOTICE TO TEST CONDUCTOR

IT IS MANDATORY THAT THIS DEVIATION BE REVIEWED BY PORC NO LATER THAN 14 DAYS FROM THE DATE OF SIGNATURE. YOU ARE RESPONSIBLE FOR HAVING THIS DONE.

Test Ref. No. RT-486

System Ref. No. 12

Request for Test - Sheet 5

10) TEST EQUIPMENT (If required)

Name	Identification Number	Last Calibration Date
Data Logger		
RT-508		

11) TEST CONDUCTOR
(Include all assistants)

Permission to initiate test _____
Shift Supervisor Date

12) PROCEDURE (See attached pages):

Test Ref. No. RT-486

System Ref. No. 12

Request for Test - Sheet 6

13) VERIFY THAT THE SYSTEM HAS BEEN RETURNED TO NORMAL:

s/Shift Supervisor Date

14) TECHNICAL SERVICES ACTION:

10 CFR 50.59 Report Required: Yes____ No____

Tech Spec Report Required: Yes____ No____

Reviewed by_____
Signature Date

GA RT -486

PCT REF --

REE Ref --

DATE 6-12-79

ISSUED 6/14/79

REQUEST FOR TEST

REQUESTER K. Asmussen/R. Nirschl SYSTEM 12

PURPOSE/OBJECTIVE - To correctly interpret signals from ICRD instruments during fluctuations, it is necessary to perform in-situ calibration. This will be accomplished by comparing data collected from ICRDs with that from calibrated plant instrumentation during the normal rise to power and with specified normal plant perturbations.

DESCRIPTION OF TEST

PART I - Collect data from specified data systems periodically during power ascension program. Compare ICRD data with that from calibrated plant instruments.

PART II - Collect data from specified data systems between 30 and 40% power while normal plant perturbations are performed. These perturbations include varying helium flow in specified core regions and moving specified control rods.

PART III - Repeat Part II at a convenient high power between 65 and 70% after the fluctuation threshold has been established.

DATA REQUIRED

1. All data from ICRD is included in FM Data System (RT-508, Rev. 2).
2. Reactor and core performance data from Data Logger.
3. Other FM data system data (RT-508, Rev. 2).

ANTICIPATED RESULTS/ACCEPTANCE CRITERIA

The collected data will be used to calibrate the signals from ICRDs. Data will be recorded on magnetic tape and sent to General Atomic in San Diego for analysis and calibration. There are no anticipated results or acceptance criteria.

REF SOP OR ABNORMAL CONDITIONS

SOP 12-01 and 12-04

T.S. LCO 4.1.3, 4.1.7, 4.1.9

SCHEDULE REQUIREMENTS

Power ascension program (2 - 70%) for Cycle 2 operation.

SAR & APPROVAL SHEET ATTACHED

WORK ASSIGNED BY [signature] 6/14/79 TO PSC OPERATIONS GA - NIRSCHL

NAME/DATE

EVALUATION COMPLETED ______

NAME/DATE

REVIEWED BY ______

NAME/DATE

Distribution:

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			J. Gahm	

This SAR is in Support of RT-486 and is enclosed as Page 2 of 10
of that RT even though the SAR is a separate Uncontrolled Document.

(CHECK WITH DOCUMENT CENTER FOR LATEST ISSUE)

GENERAL ATOMIC COMPANY
FORT ST. VRAIN NUCLEAR GENERATING STATION
SAFETY ANALYSIS REPORT

1. DESIGNATING DOCUMENT: RT-486

		YES	NO
2.	CATEGORY: PLANT CHANGE	☐	☒
	CLASS I	☐	X
	SAFE SHUTDOWN COOLING	☐	X
3.	FAILURE MODES AFFECTED	☐	X
4.	SAFETY RELATED COMPONENT, SYSTEM OR STRUCTURE CHANGE	☐	X
5.	SAFETY SIGNIFICANT CHANGE	☐	X
6.	UNREVIEWED SAFETY QUESTION	☐	X
7.	TECH SPECIFICATION CHANGE	☐	X
8.	FSAR CHANGE	☐	X

DOCUMENT CHANGE ONLY ☐
MAINTENANCE ☐
TEST ☒

STATE IN ITEM 10 THE BASIS FOR THE BOXES CHECKED

9. APPLICABLE FSAR OR TECH SPEC SECTIONS REVISED: SOP 12-01, SOP 12-04
T.S. LCO 4.1.3, 4.1.7, 4.1.9

10. BASIS FOR SAFETY EVALUATION: (Add additional Sheets if Required):
This test is primarily data gathering. During the power ascension program for Cycle 2, the plant will be operated in a normal manner and all control rod movements will be made using the prescribed sequence. All temperature limits will be adhered to. The plant perturbations requested in Parts II and III involve normal operation and they will be done in such a manner that fluctuations are not anticipated. Plant operation with the ICRDs installed has already been evaluated and approved. The performance of this test will not affect plant operation or safety.

11. IS SAN DIEGO SAFETY ANALYSIS/LICENSING REVIEW REQUIRED? YES ☐ NO ☒

12. HAS SAN DIEGO SAFETY ANALYSIS/LICENSING REVIEW BEEN PERFORMED? YES ☐ NO ☒

13. Reviewed 6.12.79
ORIGINATOR/DATE

LICENSING/DATE

14. GAC ENGR. REVIEW/DISPOSITION: I concur with above safety evaluation

ENG'R DATE 6/14/79

INTRODUCTION

Two instrumented control rod drive assemblies (ICRDs) have been installed in Regions 5 (S/N 20) and 35 (S/N 43). The instrument packages on these ICRDs consist of the following:

- fission chamber
- self-powered neutron detector, SPND
- fission-couple
- thermocouples at three axial locations
- orifice delta-P transducer
- microphone
- linear variable differential transducer, LVDT (Region 35 only)

The relative axial location for each of the instruments is illustrated on Figure 1. These ICRDs are expected to provide new diagnostic information to aid the understanding of the fluctuation phenomenon. However, it is essential to interpret the recorded signals correctly. In order to correctly interpret the data, the ICRD instruments must first be calibrated in-situ. This will be done by making deliberate controlled perturbations to the reactor system and recording the response of the instruments on the ICRDs and the response of existing plant and other fluctuation instruments. The ICRDs responses can then be calibrated by comparing the signals of the ICRD instruments with those of the other existing instruments (see Table 1). Similarly, useful calibration data will be obtained by recording the ICRDs and other existing instrumentation's signals during the normal rise to power program: e.g., as control rods are withdrawn, as load is increased, as the core heats up, in going from full to partial arc operation, etc.

The deliberate perturbations which will be made to the reactor syster to facilitate calibration of the ICRD instrumentation are the following:

- vary region flow (via orifice valve position)
- jog regulating rod
- jog rod pair adjacent to ICRD region

Instrumentation

PT-486
Sht. 4 of 13

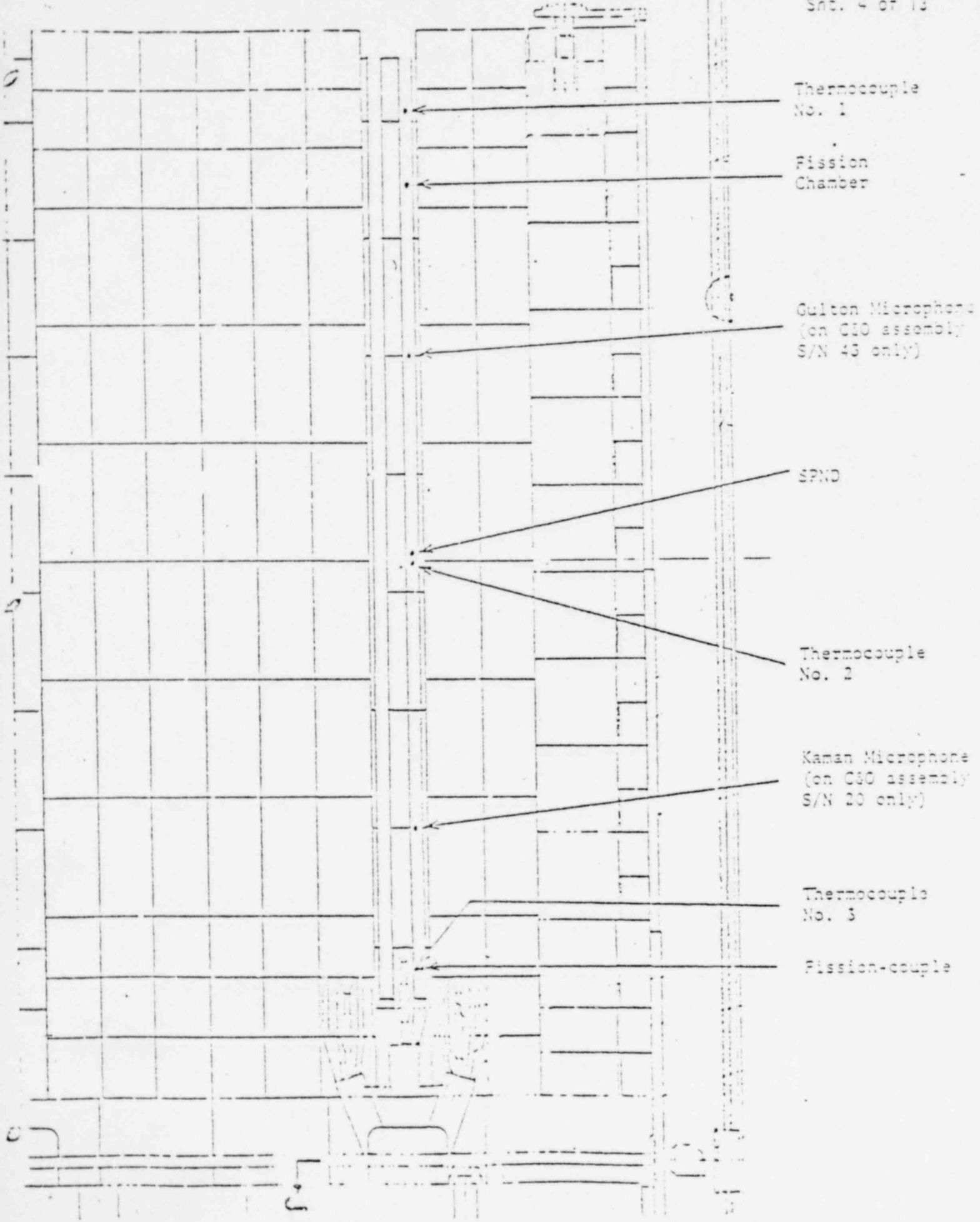

TABLE 1. COMPARISONS FOR IN-SITU CALIBRATION OF ICRD INSTRUMENTS

COMPARISONS OF ICRD INSTRUMENTS	WITH	OUT-OF-CORE INSTRUMENTS
FISSION CHAMBER, SPND, FISSION COUPLE		NUCLEAR CHANNELS / FISSION CHAMBERS
T/C #1		CORE T_{IN}
T/C #8		REGION T_{OUT}, TRAVERSABLE T/Cs
MICROPHONE		MONITOR CONTINUOUSLY AS FLOW CHANGES
ORIFICE ΔP		MONITOR CONTINUOUSLY AS δ AND/OR CORE FLOW CHANGES
LVDT		MONITOR CONTINUOUSLY AS CORE HEATS UP

During subsequent fluctuation testing (e.g., RT-600), the ICRDs will record data both prior to and during fluctuations. This in-situ calibration will permit a more accurate interpretation of the ICRD instrumentation's response during fluctuation events.

Prior to the in-situ calibration portion of this RT, the FM/ICRD data acquisition system will be thoroughly checked out (Ref. RT-503, Rev. 2). At 30 - 40% power, ICRD signals will be recorded for 1 hour and the data sent to San Diego to verify the expected signals and to checkout the entire data processing/data handling procedure.

OPERATING CONSIDERATIONS

In addition to the normal plant operating procedures and limitations, the following limits should be observed:

1. Fluctuations are not expected during this test. However, should a fluctuation be encountered, immediate corrective action should be taken to reduce power to stop the fluctuation.

2. The plant is defined to be in a fluctuation operating mode when a single nuclear channel exhibits offset deviation from the average equal to or greater than 1% of full power reading on a cyclic basis not exceeding a 30-minute period.

INSTRUMENTATION/DATA SYSTEMS

Throughout the duration of this test, the following data systems shall be operating:

1. Data Logger
2. FM data acquisition system
3. Steam Gen Fox II Computer (Orifice Stroking Test for Parts II and III).

During load changes and other deliberate perturbations to the reactor system (e.g., those specified by this RT), the Data Logger should

be on fast sample rate (15 seconds or less). During this RT and the entire rise in power program, from 0 to 70%, the Data Logger should be set to automatically make a record (of control rod positions, power level, inlet temperature, orifice positions, etc.) each time the shim bank or reg rod position changes by 20 inches.

The traversable thermocouples are to be positioned per RT-624.

PART 1: CALIBRATION DATA ACQUISITION DURING POWER ASCENSION

Initial Conditions

1. Plant ready to begin startup and rise to power in Cycle 2. All data systems ready and operable.

2. The intent is to record data during as much of the rise to power as possible. However, this test will not interfere with the power rise. In addition, if the plant remains at any specific power level for more than one day, the data systems may be turned off. Some data at each power level is desirable.

Procedure

1. Set the Data Logger to automatically store a record at a 15-minute frequency. In addition, it should store a record every time either the reg rod or shim bank is moved 20 inches.

2. With the Data Logger and the FM Data Acquisition System, continuously record data during as much of the rise to power (2 to 70%) as possible, consistent with Item 2 of Initial Conditions.

3. As a precaution, selected instrument signals from each of the ICRDs will be monitored periodically (at least part of each day) as a check on the integrity of the instrument assembly. This can be done by the instrumentation in the Aux Control Room. Suggested signals are thermocouples 2 and 3 and the fission couple.

4. While the plant is at a steady power level between 30 and 40%, record at least 1 hour of base data on the data systems. This data will be used to confirm that the ICRD instrumentation is functioning as expected.

PART 2: IN SITU ICRD RESPONSE CALIBRATION AT 30 - 40% POWER

Initial Conditions

1. Plant at steady conditions between 30 - 40% power with all control systems in automatic, and with MS and HRH temperature controls set to 980°F or less. NOTE: The reason for selecting the temperature setpoint at 980°F or less vs 1000°F is to allow margin for the temperature swings that occur when control rod jogs are made.

2. The orifices are to be adjusted such that the region exit temperatures and steam generator inlet temperatures are reasonably balanced per normal procedures.

3. Plant stable for at least one hour with turbine on load limit.

Procedure

During this part of the RT, deliberate small perturbations of the reactor system will be made so that the response of the instruments on the ICRDs can be calibrated by comparison with other existing plant and fluctuation instrumentation. The perturbations are of three types:

- vary region flow (stroking of orifice valves)
- reg rod jogs
- jogs on adjacent rod pair (shim rod closest to Regions 5 and 05)

Additional calibration data will be obtained during the performance of RT-500, Rev. E, particularly from circulator speed pulse tests and load changes at various power levels.

Vary Flow in Regions 5 and 05

1. Adjust orifices such that the region exit temperature of Region 5 is near its upper limit on region mismatch, i.e., - 50 or - 100°F as

required in LCO 4.1.7. For example, if the mismatch limit is + 80°F adjust the orifice valve to give a + 40°F mismatch. If the mismatch limit is + 200°F, adjust the orifice valve to give a + 120°F mismatch.

2. If necessary, adjust other orifices such that the inlet temperatures to those modules influenced by Region 5 (35), i.e., B 1-1 and B 1-2 (B 1-5 and B 1-6), are approximately 15°F above average.

3. Using the procedures in SOP 12-04, or the Data Logger, determine the amount the orifice valve on Region 5 (35) has to be opened to give a reduction in exit temperature of ~100°F.

4. Using the fast speed orifice change mode, open the orifice valve the predetermined amount.

5. Take fast frequency data during the transient. The trend recorders on the Data Logger can be used to follow the temperature change visually. Allow the core to reach thermal equilibrium (20 - 30 minutes) and store Data Logger record of final core conditions.

6. Repeat steps 2 - 5 (to get data for a second change in region exit temperature of ~100°F).

7. Return orifices to their initial positions by performing the above orifice adjustments in reverse order. Using the slow speed orifice change mode for the return to initial position for each region.

8. Repeat the procedures of Steps 1 - 7 for Region 35, and possibly other regions as may be designated by the Core Performance Engineer (based upon the results from Regions 5 and 35).

Control Rod Jogs (Reg Rod and Selected Shim Rods)

1. During this portion of this RT, the automatic flux controller is to remain in the automatic mode and the reheat temperature controller is to

be placed in manual. The ability of the automatic flux controller to move #1 reg rod is to be shut off by rotating the regulating rod selector switch (HS-1218) to the OFF position. This will permit the automatic flux controller to initiate a rod runback if needed as a result of any transient during this test.

CAUTION: If a runback occurs, the reheat temperature controller should be pulled out and returned to automatic and HS-1218 returned to the #1 position as soon as possible.

2. During the time that the reheat temperature controller is in manual, power and reheat temperature may drift. If corrective action is required, either the reg rod or shim rods can be used.

3. Manually force the Data Logger to store a record of core data and set the storage frequency as desired.

4. Place TC-2256 in manual.

5. Place HS-1218 to OFF.

6. Verify that the reg rod position indication on recorders in Aux Control Room is operating.

7. Perform 3 double bumps of about 5c 4p at 3 - 5 minute intervals. Coordinate execution of this step with activating the Data Logger's RODCAL program if this program is operable such that the reactivity changes associated with these rod movements are calculated.

8. Withdraw the reg rod 3 - 5 inches and hold for about 2 minutes, then return the reg rod to its initial position. Wait about 10 minutes and repeat. Again, activate the Data Logger's RODCAL program to calculate the associated reactivity changes.

9. Repeat Steps 7 and 8 for the control rod pair of the shim bank, closest to Region 5.

10. Repeat Steps 7 and 8 for the control rod pair of the shim bank, closest to Region 36.

11. Return plant to normal stable conditions at initial power level.

PART 3: IN SITU ICRD RESPONSE CALIBRATION AT CONVENIENT POWER LEVEL BETWEEN 65 - 70%

Initial Conditions

1. Plant at steady conditions between 65 - 70% power with all control systems in automatic, the orifices adjusted to ensure that core ΔP and resistance are low enough so that fluctuations will not occur, and with MS and HRH temperature controls set to 980°F or less. NOTE: The reason for selecting the temperature setpoint of 980°F or less vs 1000°F is to allow margin for the temperature swings that occur when control jogs are made.

2. Plant stable for at least one hour with turbine on load limit.

Procedures

Repeat the tests as described in Part II.