Attachment G

GE-NE-0000-0005-7308-01, "DRESDEN UNIT 2 AND 3 – ELIMINATION OF MSIV CLOSURE AND LOW CONDENSER VACUUM SCRAM FUNCTION DURING STARTUP MODE," REVISION 1, DECEMBER 2002
(NON-PROPRIETARY VERSION)

GE Nuclear Energy

General Electric Company
175 Curtner Avenue
San Jose, CA 95125

GE-NE-0000-0005-7308-01
Revision 1
Class I
December 2002

Dresden Unit 2 and 3 - Elimination of MSIV Closure and Low Condenser Vacuum Scram Function During Startup Mode

DISCLAIMER

IMPORTANT NOTICE REGARDING THE CONTENTS OF THIS REPORT

Please Read Carefully

The only undertakings of the General Electric Company (GE) respecting information in this document are contained in the contract between the company receiving this document and GE. Nothing contained in this document shall be construed as changing the applicable contract. The use of this information by anyone other than a customer authorized by GE to have this document, or for any purpose other than that for which it is intended, is not authorized. With respect to any unauthorized use, GE makes no representation or warranty, and assumes no liability as to the completeness, accuracy or usefulness of the information contained in this document, or that its use may not infringe privately owned rights

Table of Contents

1.0 Summary

The Dresden Unit 2 and 3 current Technical Specifications require a reactor scram if vessel pressure exceeds 600 psig with the reactor mode switch in startup and the Main Steam Isolation Valves (MSIVs) closed or Main Condenser Vacuum low. This current scram logic is the result of experience gained during the startup of an earlier BWR in 1966 when operators had difficulty in controlling reactor power above approximately 600 psig without pressure control. Subsequent to that time and after Dresden plant startup, GE recommended that the scram requirement be eliminated (Ref 2) following successful tests during startup of a BWR/4 plant (Ref 3). The purpose of this evaluation (Ref 1) is to support the elimination of the scram requirement at high pressure during startup with the MSIV closed, or Main Condenser Vacuum low, for the Dresden Unit 2 and 3.

The result of the evaluation is that the requirement to establish pressure control prior to exceeding 600 psig reactor pressure can be eliminated for Dresden. [

]

2.0 Introduction

The Dresden Unit 2 and 3 current Technical Specifications require a reactor scram if vessel pressure exceeds 600 psig with the reactor mode switch in startup and the Main Steam Isolation Valves (MSIVs) closed or Main Condenser Vacuum low. This current scram logic is the result of experience gained during the startup of an earlier BWR in 1966 when operators had difficulty in controlling reactor power above approximately 600 psig without pressure control. Subsequent to that time and after Dresden plant startup, GE recommended that the scram requirement be eliminated (Ref 2) following successful tests during startup of a BWR/4 plant (Ref 3). The purpose of this evaluation (Ref 1) is to support the elimination of the scram requirement at high pressure during startup with the MSIV closed, or Main Condenser Vacuum low, for the Dresden Unit 2 and 3.

3.0 Analysis Basis and Assumptions

The evaluation to justify an increase in the attainable reactor pressure required during startup, prior to establishing pressure control, is based on the applicability of the Ref 3 test to the Dresden plant. [

]

The utility has also provided additional information pertaining to the same reactor pressure setpoint change in the similar Quad Cities plants (Ref 4). The information includes FSAR markups indicating that at the higher pressure, in the startup conditions, the transient analyses would also be bounded by those at the licensed conditions. The scram at high pressure in startup conditions when MSIVs close and/or Main Condenser vacuum is low does not impact limiting accident or transient analyses. This information is also applicable to the Dresden plant, though it is not justified in this evaluation.

4.0 Evaluation

This section presents the results of the evaluation to justify the elimination of the scram function at high pressure during plant startup with isolation valves closed or main condenser vacuum low. The evaluation includes two aspects: first a discussion of the successful power maneuver test of a later, than Dresden, design BWR (Subsection 4.1) while isolated, and second a discussion of applicability to the Dresden plant characteristics (subsection 4.2). The scram at startup mode on low main condenser vacuum is not required when the plant is isolated, and is therefore also eliminated for high pressure conditions.

4.1 BWR Startup Test in an Isolated Condition

BWR operation relies on the pressure control system to prevent unplanned power changes caused by void reactivity responses to pressure perturbations. Pressure control is required prior to operation at high pressure conditions due an early dual cycle BWR experience (Ref 2) with difficult power responses while in startup mode without pressure control, i.e., with isolation valves closed or low main condenser vacuum. An automatic scram was included in the BWR design if the isolation valves are not open or when main condenser vacuum is not sufficient prior to reaching 600 psig. However, this automatic scram removes the flexibility of attaining normal reactor temperature and pressure, e.g. completing the startup, without the availability of several balance of plant systems, such as the feedwater and condenser.

After startup of the Dresden plant, a test (Ref 3) was conducted in a BWR/4 plant to characterize the reactor pressure and power responses to a startup in an isolated condition. The objective of the test was to determine the conditions which can lead to undesirable changes in pressure and power, i.e., continuous or large power and pressure increase or decrease. Two types of tests were performed, one perturbing power by control

rod movement, and another by perturbing pressure by bypass valve movement. The results of both tests were that the power and pressure responses were acceptable, i.e., the changes were small and limited in magnitude. [

]

4.2 Application of Test to Dresden

The characteristics of Dresden do not differ significantly from those of the startup test plant. [

] Therefore, the Reference 3 test results are judged to be applicable to Dresden.

5.0 Conclusions

This report presents the results of the evaluation to support an increase in the reactor pressure, prior to establishing pressure control, during startup for the Dresden Unit 2 and 3 plants.

The result of the evaluation is that the requirement to establish pressure control prior to exceeding 600 psig reactor pressure can be eliminated for the Dresden units. The basis for the conclusion is that the test of the later BWR is applicable to the Dresden conditions and therefore acceptable power and pressure response is expected at the reactor conditions for the startup mode, up to and including the maximum design pressure.

6.0 References

1) GE Work Authorization DR203: Elimination of Dresden 2 and 3 MSIV Closure and Low Condenser Vacuum Scram Function During Startup Mode with Reactor Pressure above 600 psig.

2) SIL Number 107, Increasing Reactor Flexibility, October 31, 1974.

3) NEDO-20697, Bottled-Up Operation of a BWR, November 1974.

4) Byron Lee Jr (ComEd) to John F O'Leary (US AEC), Proposed Modification 72-1 to the Quad Cities Station Safety Analysis Report AEC Dockets 50-254 and 50-265, November 16, 1972.

Attachment H

GENERAL ELECTRIC COMPANY AFFIDAVIT

General Electric Company

AFFIDAVIT

I, David J. Robare, state as follows:

(1) I am Technical Projects Manager, Technical Services, General Electric Company ("GE") and have been delegated the function of reviewing the information described in paragraph (2) which is sought to be withheld, and have been authorized to apply for its withholding.

(2) The information sought to be withheld is contained in GE report GE-NE-0000-0005-7308-01P, *DresdenUnit 2 and 3 – Elimination of MSIV Closure and Low Condenser Vacuum Scram Function During Startup Mode* ,Revision 2, Class III, dated December, 2002. The proprietary information is identified by a double underline inside square brackets.

(3) In making this application for withholding of proprietary information of which it is the owner, GE relies upon the exemption from disclosure set forth in the Freedom of Information Act ("FOIA"), 5 USC Sec. 552(b)(4), and the Trade Secrets Act, 18 USC Sec. 1905, and NRC regulations 10 CFR 9.17(a)(4), 2.790(a)(4), and 2.790(d)(1) for "trade secrets and commercial or financial information obtained from a person and privileged or confidential" (Exemption 4). The material for which exemption from disclosure is here sought is all "confidential commercial information", and some portions also qualify under the narrower definition of "trade secret", within the meanings assigned to those terms for purposes of FOIA Exemption 4 in, respectively, Critical Mass Energy Project v. Nuclear Regulatory Commission, 975F2d871 (DC Cir. 1992), and Public Citizen Health Research Group v. FDA, 704F2d1280 (DC Cir. 1983).

(4) Some examples of categories of information which fit into the definition of proprietary information are:

a. Information that discloses a process, method, or apparatus, including supporting data and analyses, where prevention of its use by General Electric's competitors without license from General Electric constitutes a competitive economic advantage over other companies;

b. Information which, if used by a competitor, would reduce his expenditure of resources or improve his competitive position in the design, manufacture, shipment, installation, assurance of quality, or licensing of a similar product;

c. Information which reveals cost or price information, production capacities, budget levels, or commercial strategies of General Electric, its customers, or its suppliers;

d. Information which reveals aspects of past, present, or future General Electric customer-funded development plans and programs, of potential commercial value to General Electric;

e. Information which discloses patentable subject matter for which it may be desirable to obtain patent protection.

The information sought to be withheld is considered to be proprietary for the reasons set forth in both paragraphs (4)a. and (4)b., above.

(5) The information sought to be withheld is being submitted to NRC in confidence. The information is of a sort customarily held in confidence by GE, and is in fact so held. The information sought to be withheld has, to the best of my knowledge and belief, consistently been held in confidence by GE, no public disclosure has been made, and it is not available in public sources. All disclosures to third parties including any required transmittals to NRC, have been made, or must be made, pursuant to regulatory provisions or proprietary agreements which provide for maintenance of the information in confidence. Its initial designation as proprietary information, and the subsequent steps taken to prevent its unauthorized disclosure, are as set forth in paragraphs (6) and (7) following.

(6) Initial approval of proprietary treatment of a document is made by the manager of the originating component, the person most likely to be acquainted with the value and sensitivity of the information in relation to industry knowledge. Access to such documents within GE is limited on a "need to know" basis.

(7) The procedure for approval of external release of such a document typically requires review by the staff manager, project manager, principal scientist or other equivalent authority, by the manager of the cognizant marketing function (or his delegate), and by the Legal Operation, for technical content, competitive effect, and determination of the accuracy of the proprietary designation. Disclosures outside GE are limited to regulatory bodies, customers, and potential customers, and their agents, suppliers, and licensees, and others with a legitimate need for the information, and then only in accordance with appropriate regulatory provisions or proprietary agreements.

8) The information identified in paragraph (2), above, is classified as proprietary because it contains responses containing or based on detailed results of analytical models, methods and processes, including computer codes for BWRs.

The development of the evaluation process along with the interpretation and application of the analytical results is derived from the extensive experience database that constitutes a major GE asset.

(9) Public disclosure of the information sought to be withheld is likely to cause substantial harm to GE's competitive position and foreclose or reduce the availability of profit-making opportunities. The information is part of GE's comprehensive BWR safety and technology base, and its commercial value extends beyond the original development cost. The value of the technology base goes beyond the extensive physical database and analytical methodology and includes development of the expertise to determine and apply the appropriate evaluation process. In addition, the technology base includes the value derived from providing analyses done with NRC-approved methods.

The research, development, engineering, analytical and NRC review costs comprise a substantial investment of time and money by GE.

The precise value of the expertise to devise an evaluation process and apply the correct analytical methodology is difficult to quantify, but it clearly is substantial.

GE's competitive advantage will be lost if its competitors are able to use the results of the GE experience to normalize or verify their own process or if they are able to claim an equivalent understanding by demonstrating that they can arrive at the same or similar conclusions.

The value of this information to GE would be lost if the information were disclosed to the public. Making such information available to competitors without their having been required to undertake a similar expenditure of resources would unfairly provide competitors with a windfall, and deprive GE of the opportunity to exercise its competitive advantage to seek an adequate return on its large investment in developing these very valuable analytical tools.

I declare under penalty of perjury that the foregoing affidavit and the matters stated therein are true and correct to the best of my knowledge, information, and belief.

Executed on this 17th day of December, 2002.

David J. Robare
General Electric Company

Attachment I

NEDO-20697, "BOTTLED-UP OPERATION OF A BWR," NOVEMBER 1974

NEDO-20697
74NED69
Class I
November 1974

BOTTLED-UP OPERATION OF A BWR

D. G. Carroll

Reviewed: E. C. Eckert, Manager
System Dynamics and Control

Approved: L. K. Holland, Manager
System Control and Transient Analysis

BOILING WATER REACTOR SYSTEMS DEPARTMENT • GENERAL ELECTRIC COMPANY
SAN JOSE, CALIFORNIA 95125

GENERAL ELECTRIC

DISCLAIMER OF RESPONSIBILITY

TABLE OF CONTENTS

LIST OF ILLUSTRATIONS

ABSTRACT

"Bottled-up" operation of a BWR refers to that condition where the main steam isolation valves (MSIVs) are closed, thus preventing any significant steam flow. Historically, there has been a reactor scram condition if vessel pressure rises above 600 psig with the MSIVs closed and with the mode switch in "startup." This document describes the results of a special test conceived and performed on a typical BWR/4 design to determine the necessity of this plant scram function. It is concluded that the pressure scram function can be raised, so that bottled-up hot standby operation is permitted up to full pressure and temperature conditions.

1. INTRODUCTION

Bottled-up operation became an identified topic at an early dual-cycle reactor startup. During heatup, with the main steam isolation valves (MSIVs) closed and pressure at about 600 psi, the operator experienced difficulty in controlling power. The phenomenon was observed as follows: After notching a control rod out, pressure would begin to increase, as would power. There appeared to be no leveling-out tendency, so the rod (or rods) was partially inserted to stop the rise. Pressure and power would then level off and start to fall, as if overcorrected. Rods were then partially withdrawn to stop the fall of pressure and power. Again, as if overcorrected, pressure and power would rise, showing no sign of leveling off. This continued until it was suggested that bypassing steam to gain pressure control (and thus hold void reactivity constant) might stabilize the plant. This method proved to be effective, pressure control was subsequently recommended for use during startup. In addition, scram logic was added to prohibit operation above 600 psi with the MSIVs closed.

Experience on later plant startups indicates that the early experience may not be inherent to the BWR design. In fact, it is reported that heatup is commonly accomplished with the MSIVs open, but with no flow through the turbine bypass valves. In this case, the pressure regulator pressure setpoint is kept above the operating pressure. Thus, steam flow is limited to seal steam, steam to the steam jet air ejectors plus losses. This is very close to the bottled-up condition (MSIVs closed), and leads us to question the possibility of stable operation with the MSIVs closed.

2. BOTTLED-UP OPERATION SPECIAL TEST

To demonstrate whatever capability a contemporary BWR might have to operate in the bottled-up condition, a special test was added to the startup test program at Browns Ferry Unit 1, a plant judged to be a typical BWR/4 design. A copy of the procedure used at BF-1 may be found in Appendix A. Data from the test were taken in two basic blocks: reactivity perturbations and pressure perturbations.

Figures 1 through 8 show data taken by the Startup Test Design and Analysis Unit during the reactivity perturbation tests. These traces show no signs of possible instability or generally unpredictable behavior. The maneuvers demonstrated in the figures were performed with MSIVs closed, reactor power at about 0.3%, dome pressure at about 920 psig, and recirculation pumps at minimum speed.

Figure 1 shows reactor wide range pressure as the rods were inserted to drop the pressure to approximately 650 psig, then withdrawn to increase pressure again to approximately 920 psig in about 20 minutes.

Figures 2 and 3 are IRM traces which show only relative power changes. Sudden jumps in the traces on the order of an inch are due to changing the instrument range to keep them on scale.

Figure 4 was taken during the heatup ramp, and Figures 5 through 8 were taken at 920 psig while Control Rod 34-27 was being inserted, withdrawn and scrammed. All traces are broad due to noise, which is common. The APRM and LPRM traces show an amplitude modulated characteristic which is also due to noise.

The pressure perturbation tests were run with the MSIVs open to allow the use of the bypass valves to disturb pressure. The auxiliary boiler was used to supply seal steam and steam to the steam jet air ejectors plus any other losses. In this manner, vessel steam flow was kept at near zero (about 0.25%). Thus, the only effective difference between MSIV open and MSIV closed was the added steam line volume between the MSIVs and the bypass valves. The effect of this extra volume on low power stability is judged to be negligible. Other reactor conditions were the same as for the reactivity perturbations. The pressure perturbation of primary interest is the first one (Figure 9), where one bypass valve is opened quickly (about 0.1 sec), held for a short time (about 15 sec) and closed rapidly (about 0.1 sec). The time of primary importance to the question addressed by the test is that following reclosure of the bypass valves (the bottled-up condition). The traces show that, following the disturbance caused by opening the bypass valves, all parameters return to steady-state values and are well-behaved.

Several events occur during the time that the bypass valve is open in the fast open-fast close event. As soon as the valve is opened, turbine inlet pressure goes through a small oscillation of about 5 psi in magnitude and 1.6 Hz — a hint of possible steam line resonance. After about 0.4 seconds delay (propagation time for the pressure wave in the steam line), the dome pressure begins to drop off, which causes a large inventory density change due to the near-saturated condition of the vessel water at the operating point; this results in the level swell shown. About 3 seconds after dome pressure begins to fall (it has droppedabout 16 psi), core flow begins to fall off, suggesting the start of boiling in the channels. This is followed by an oscillation of about 0.36 Hz in pressure and core flow which suggests a "chugging" effect, or thermal hydraulic oscillation. The two cycles before the bypass valves close decay by a factor of about 0.7, and are not considered a detriment to stable control of the plant at this power.

Figure 10 is a trace showing the results of slowly opening and closing two bypass valves. Once again, pressure drops and level swells as the valves are opened, and return to normal when the valves are closed.

Figure 11 is an IRM trace showing response to the two bypass valve transients.

Figure 12 is a process chart showing narrow range water level response to the transients.

3. CONCLUSIONS

The data taken at the Browns Ferry 1 site indicate that BF-1 can be controlled adequately in the bottled-up condition at pressures well in excess of 600 psig. Thus, there is no reason to assume an unacceptable operating region and scram the reactor when vessel pressure exceeds 600 psig with the MSIVs closed. In fact, on the Browns Ferry 1 plant, the scram set point may be set to coincide with the Technical Specification high vessel pressure scram set point with no apparent BWR stability problem.

Browns Ferry is a typical BWR/4 design; therefore, the result of the test at BF-1 may be extended to cover all BWR/4 product line projects.

A test procedure similar to the one found in the Appendix will be performed at each future "first-of-a-product-line" plant during startup testing to verify continued capability for bottled-up operation. Because of its design-unique nature, each pre-BWR/4 product must be considered on an individual basis to determine bottled-up operating capability by a similar test procedure. Thus, no generic BWR/1, 2 or 3 bottled-up operation permission is, or will be, available.

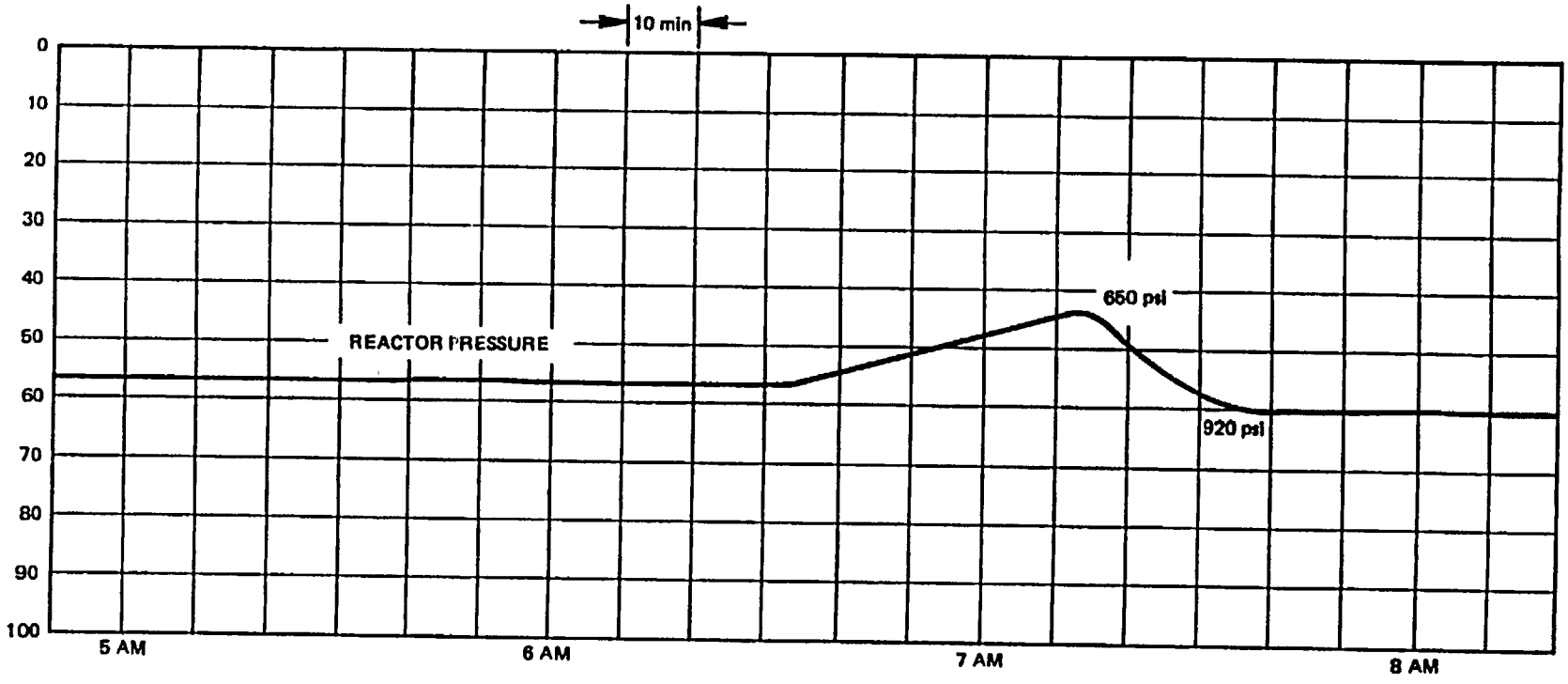

Figure 1. Bottled-Up Pressure Maneuver Using Control Rods

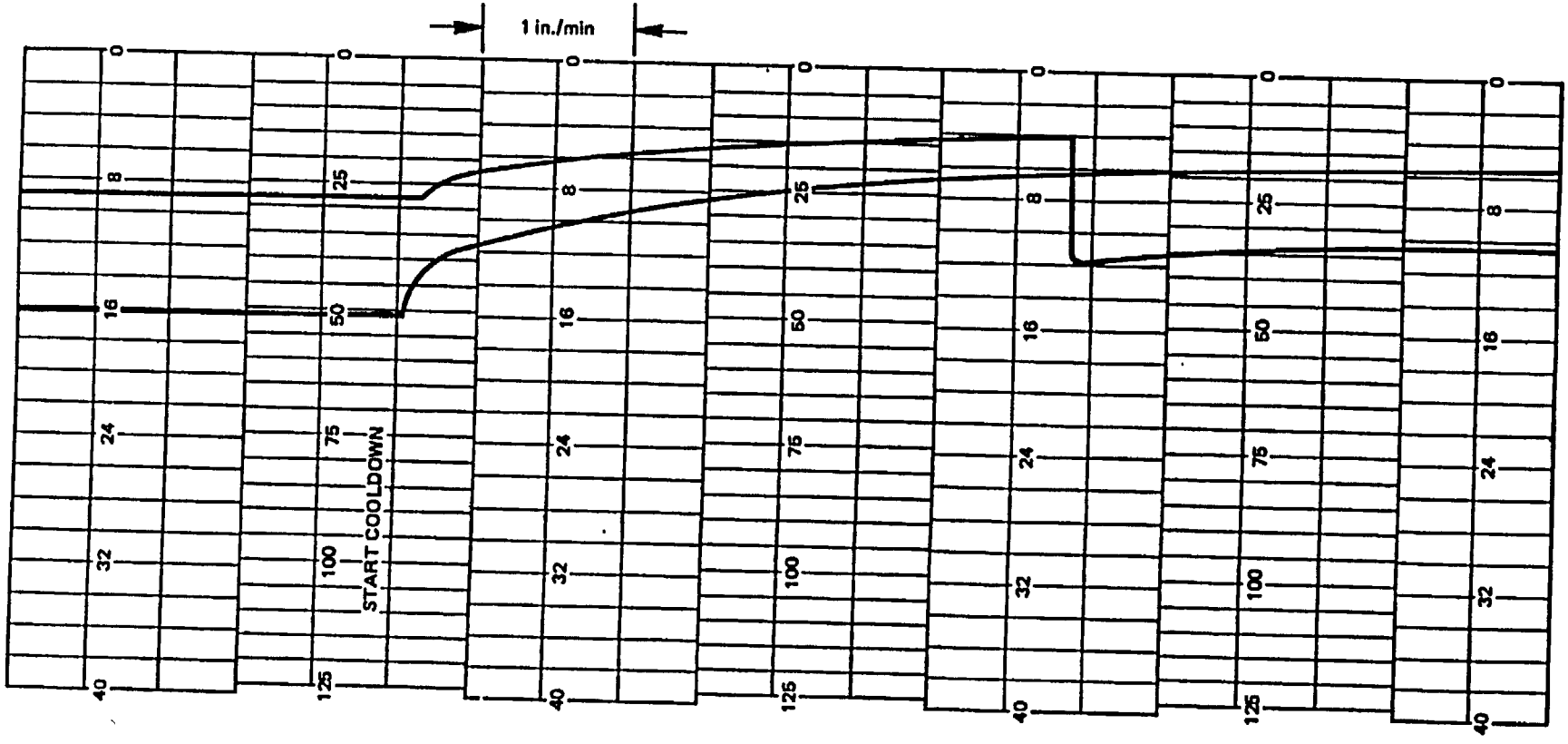

Figure 2. IRM Traces of a Bottled-Up Control Rod Maneuver (Insert)

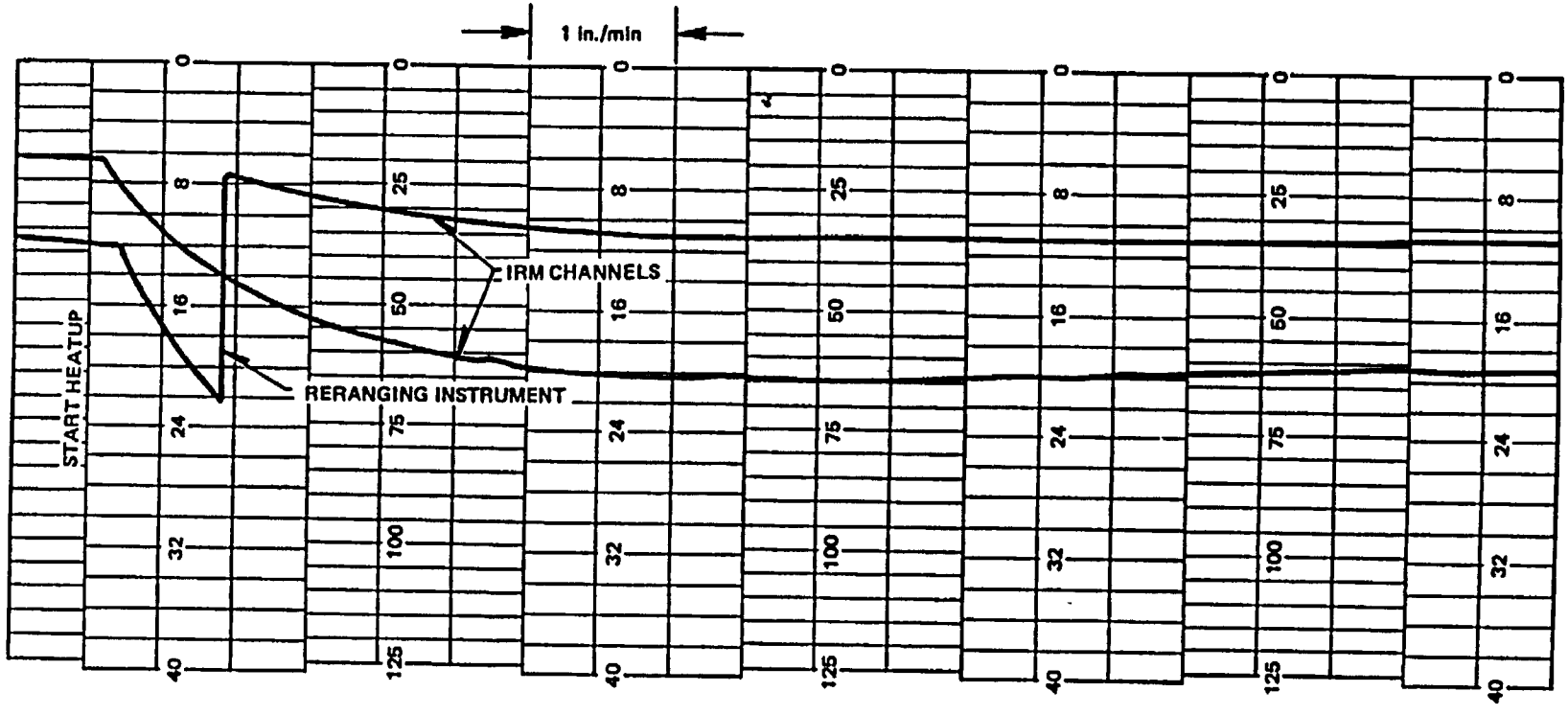

Figure 3. IRM Traces of a Bottled-Up Control Rod Maneuver (Withdraw)

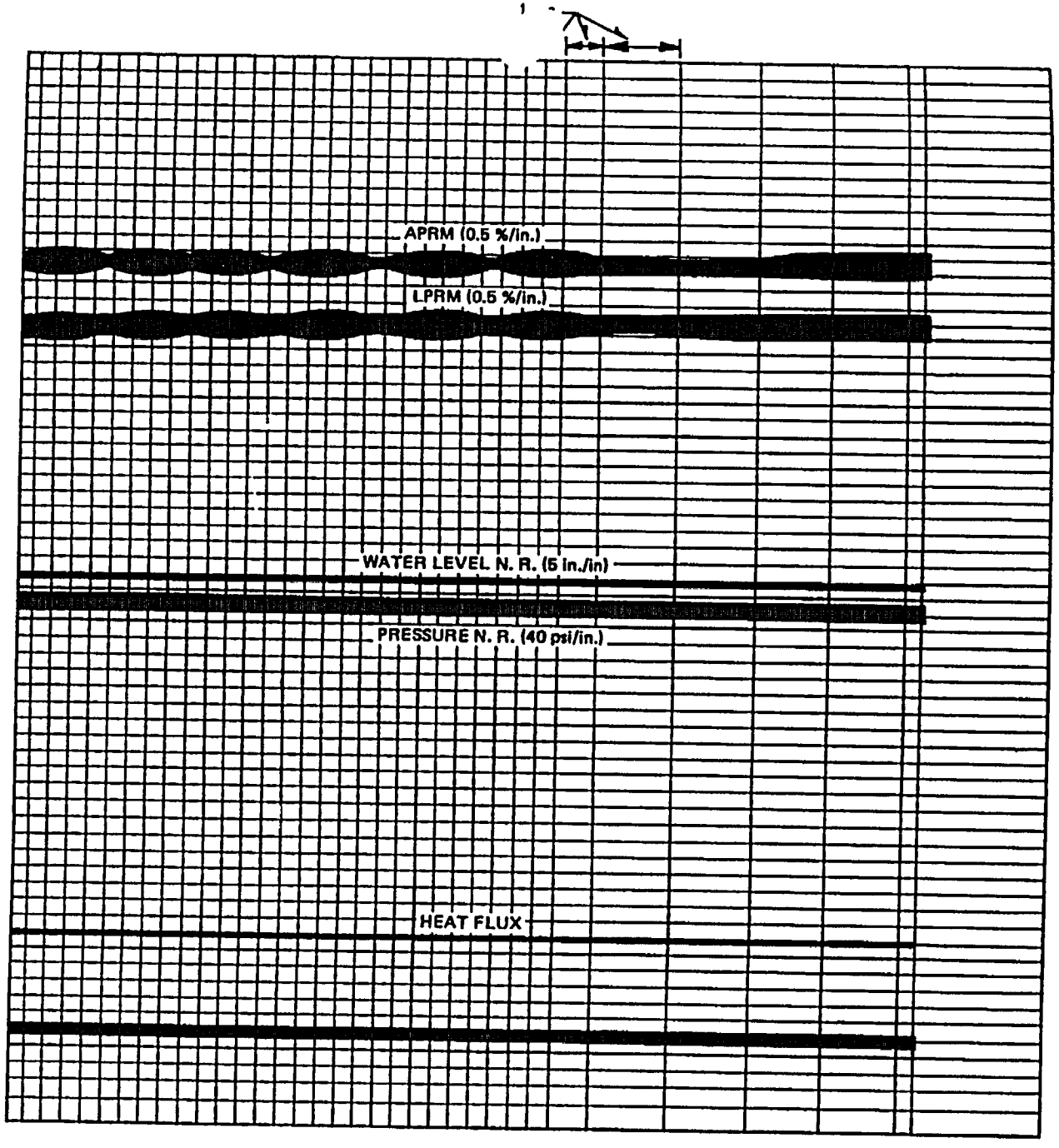

Figure 4. Parameter Behavior During Heatup Ramp

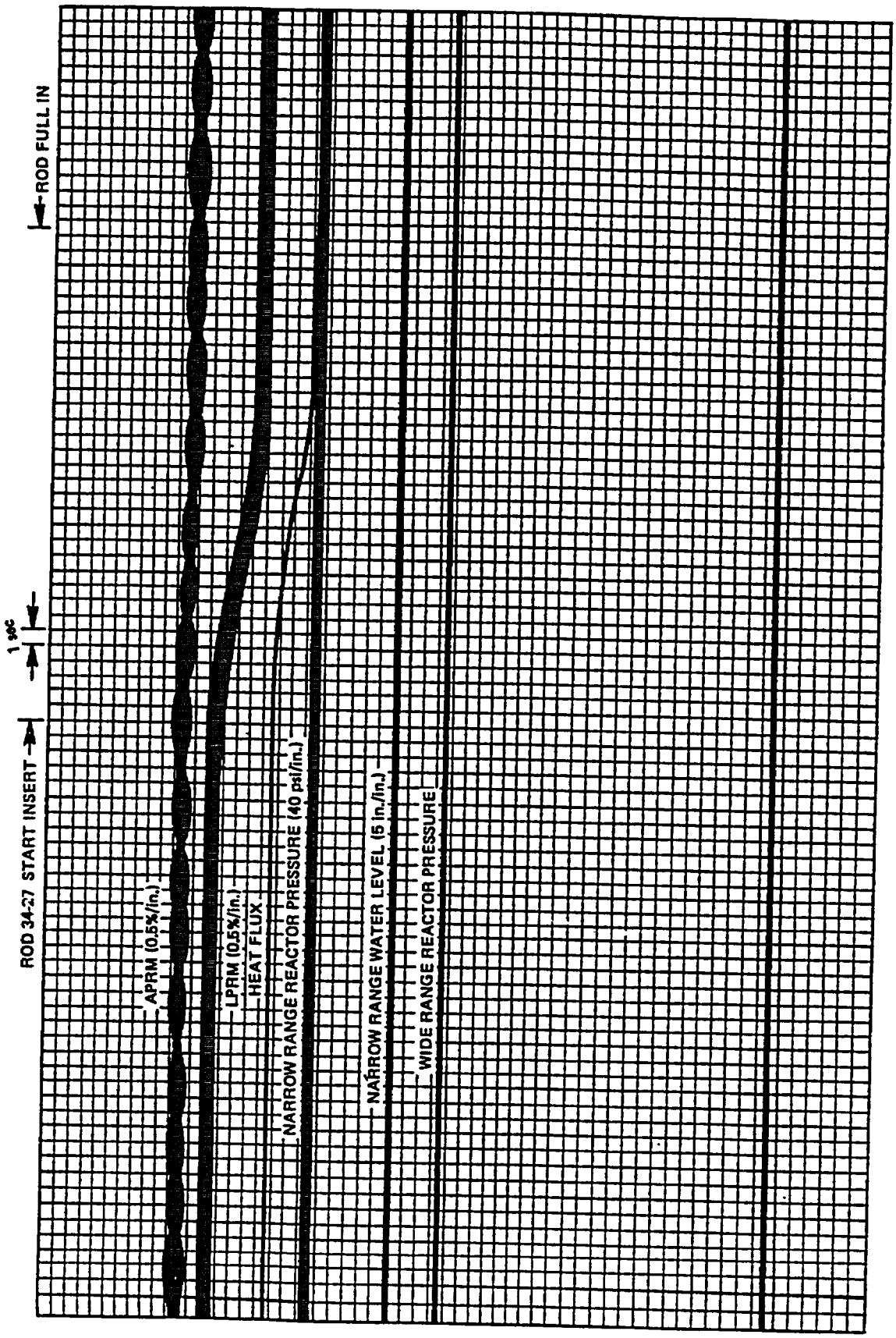

Figure 5. Control Rod Insertion

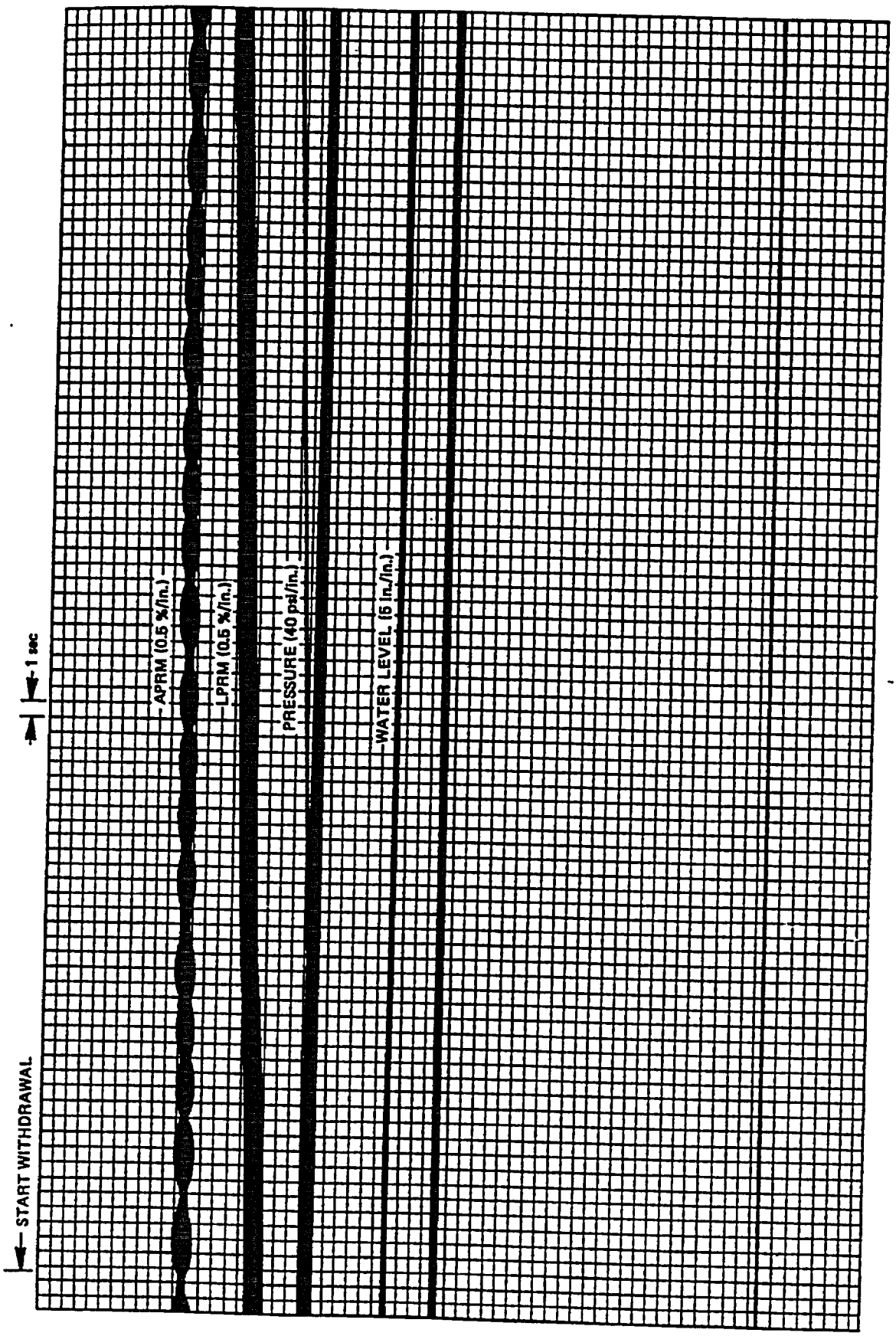

Figure 6. Control Rod Withdrawal

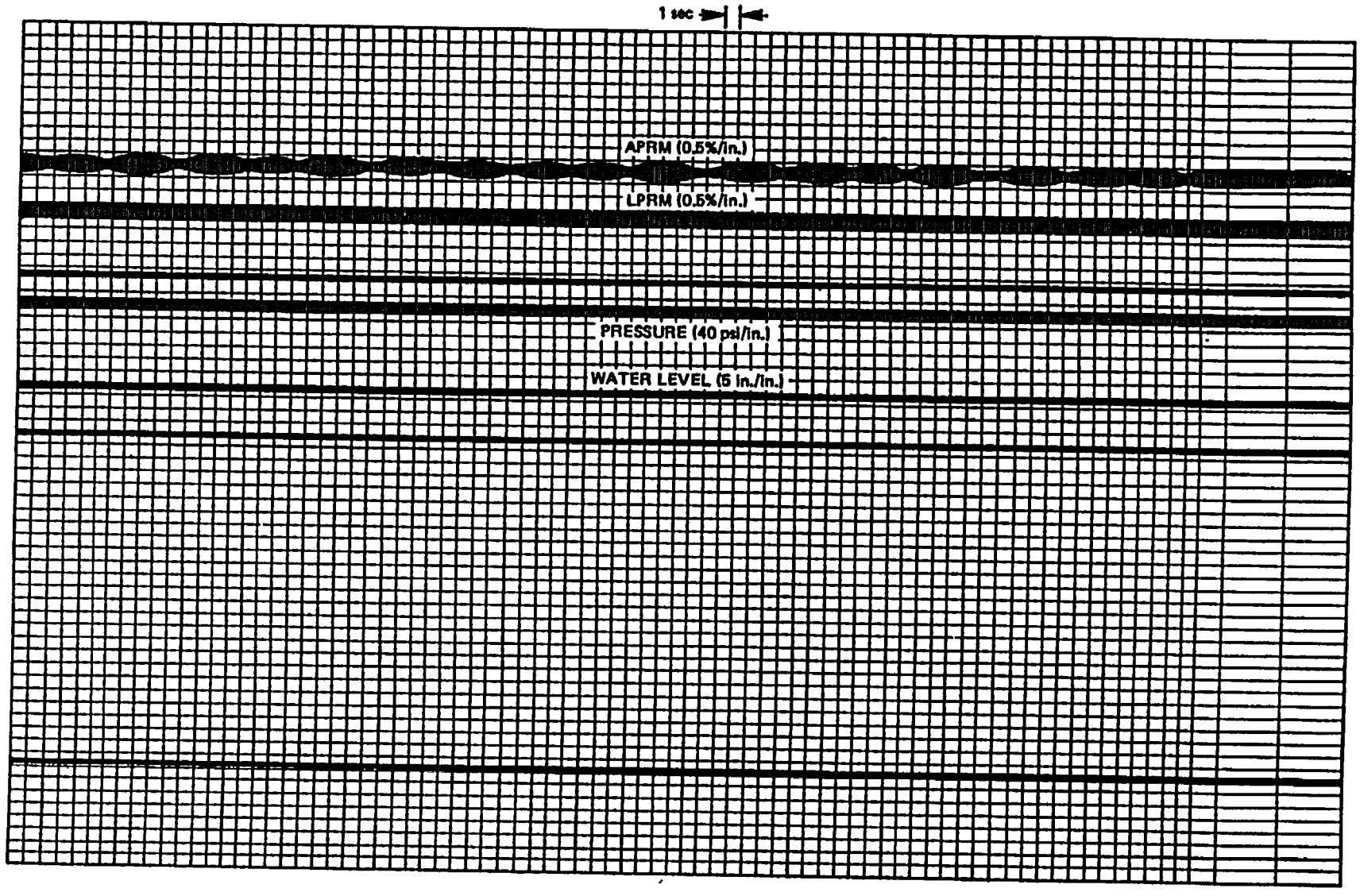

Figure 7. Control Rod Withdrawal

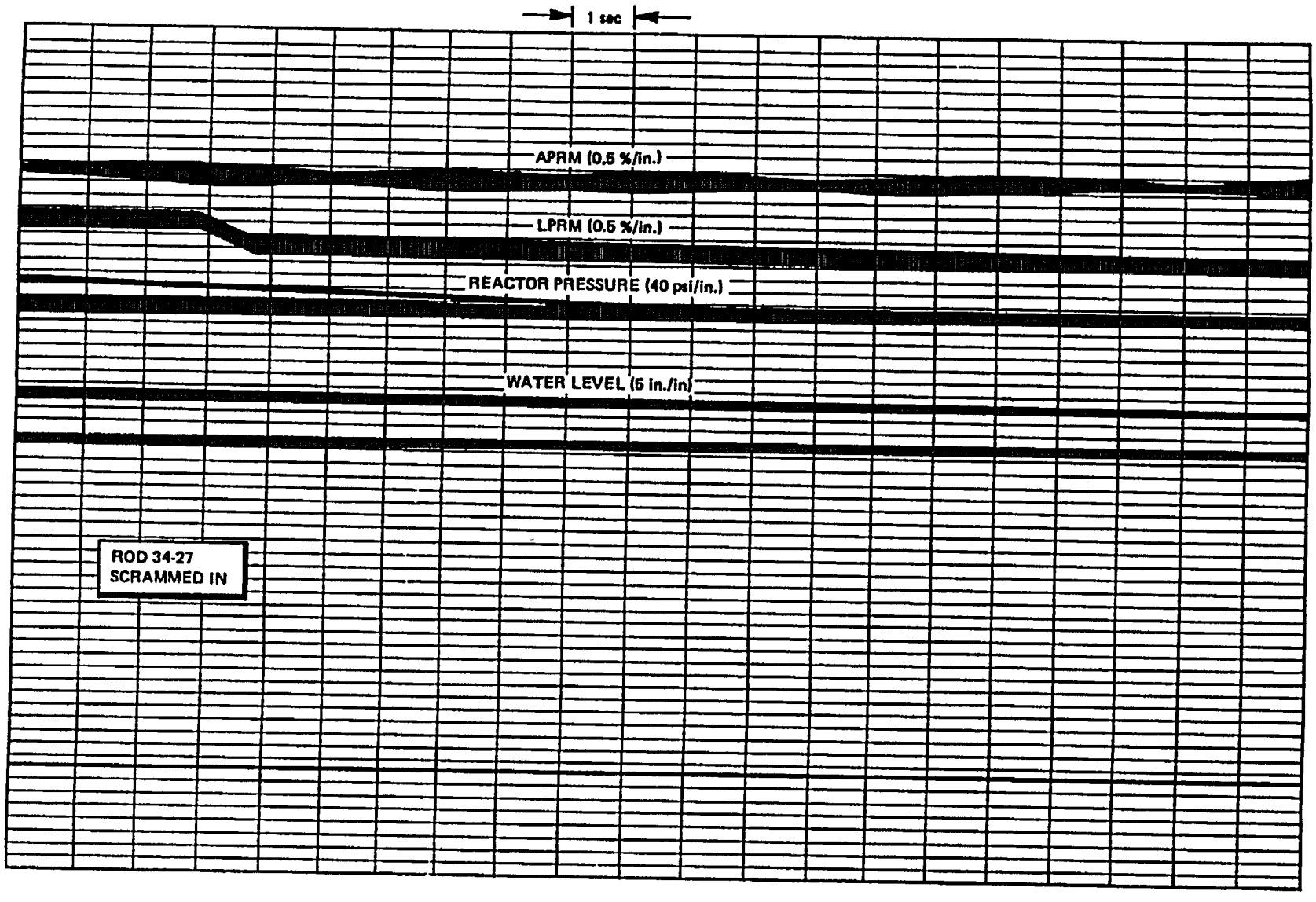

Figure 8. Control Rod 34-27 Scrammed

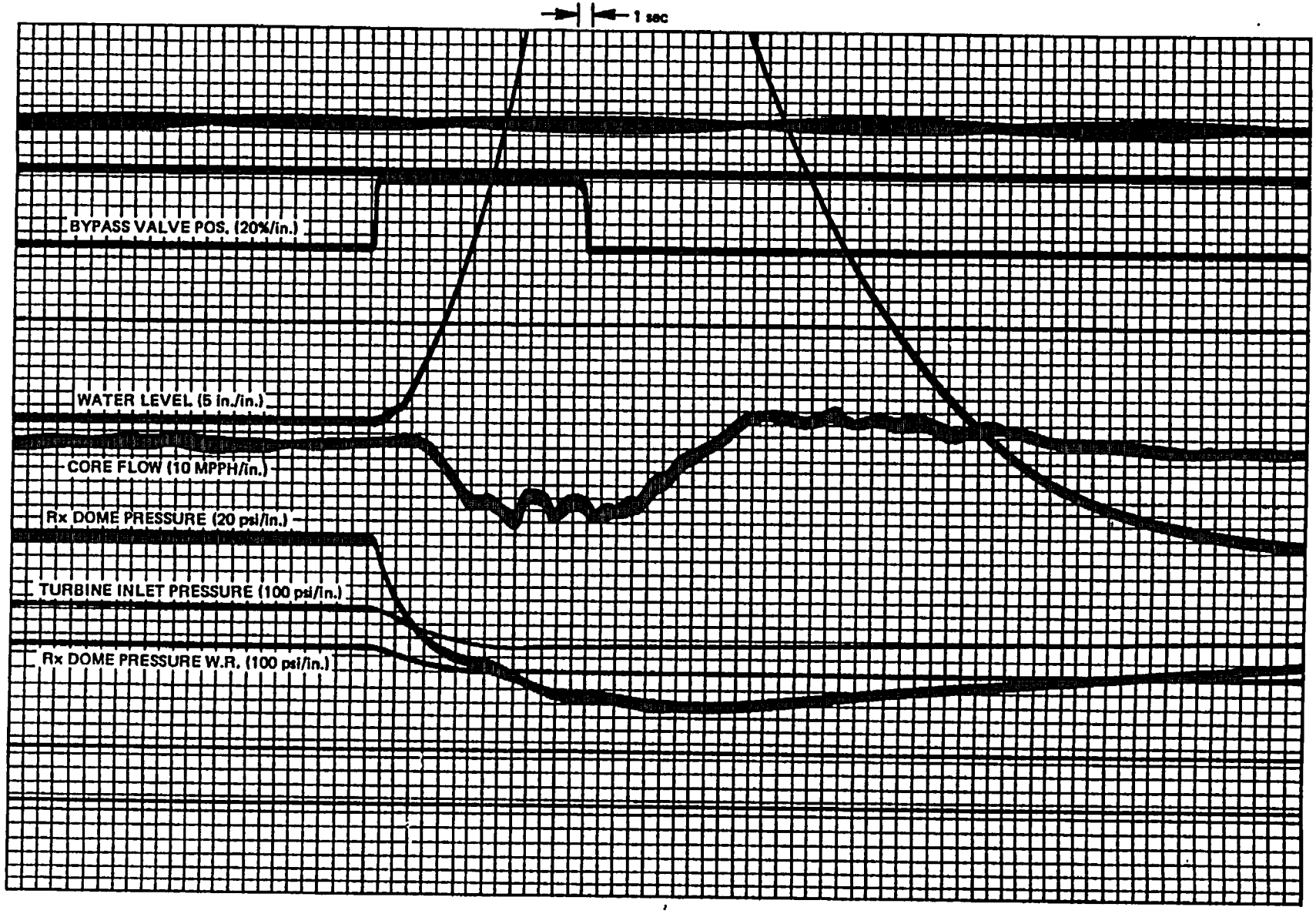

Figure 9. One Bypass Valve, Fast Open-Fast Close

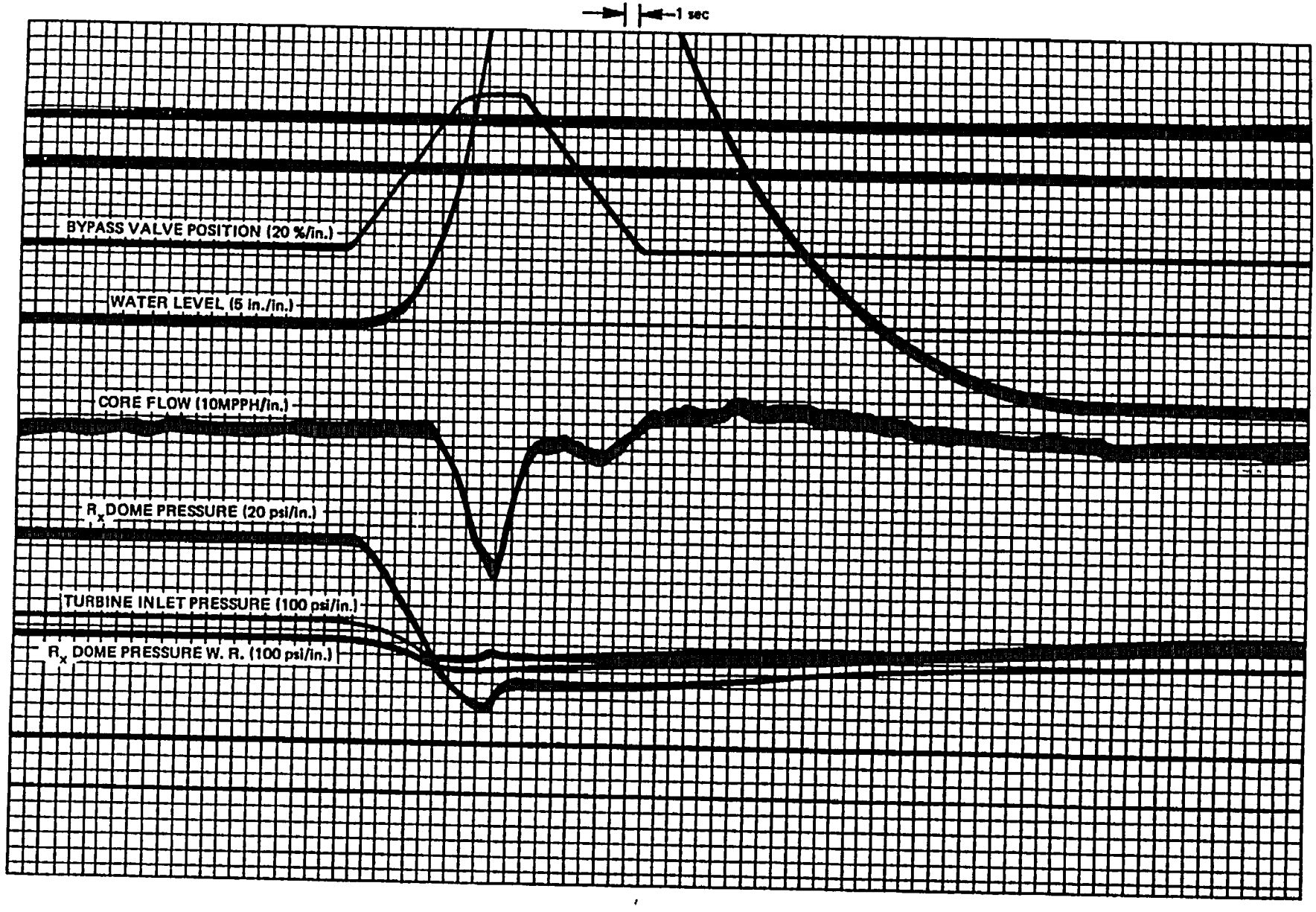

Figure 10. Two Bypass Valves, Ramp Open-Ramp Closed

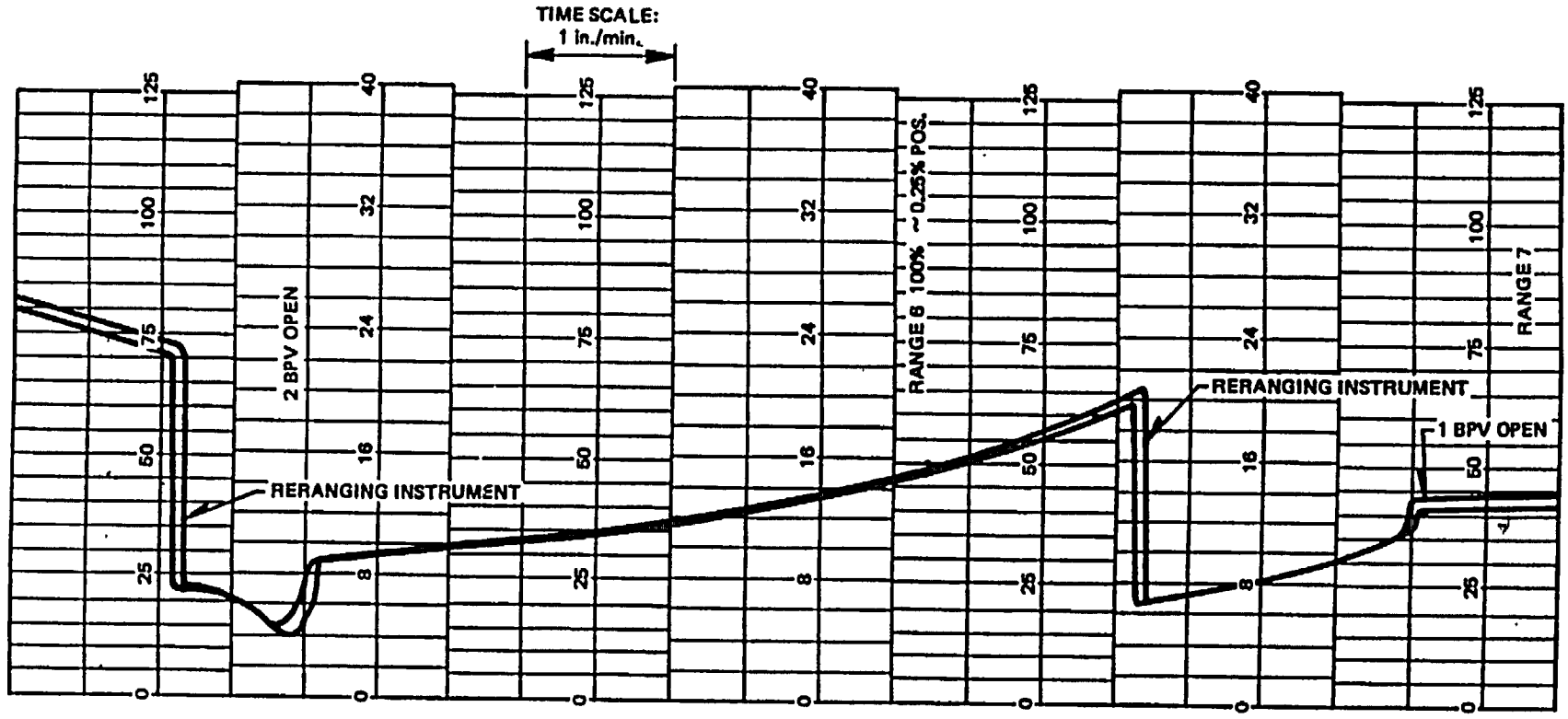

Figure 11. IRM Response to Pressure Distrubances

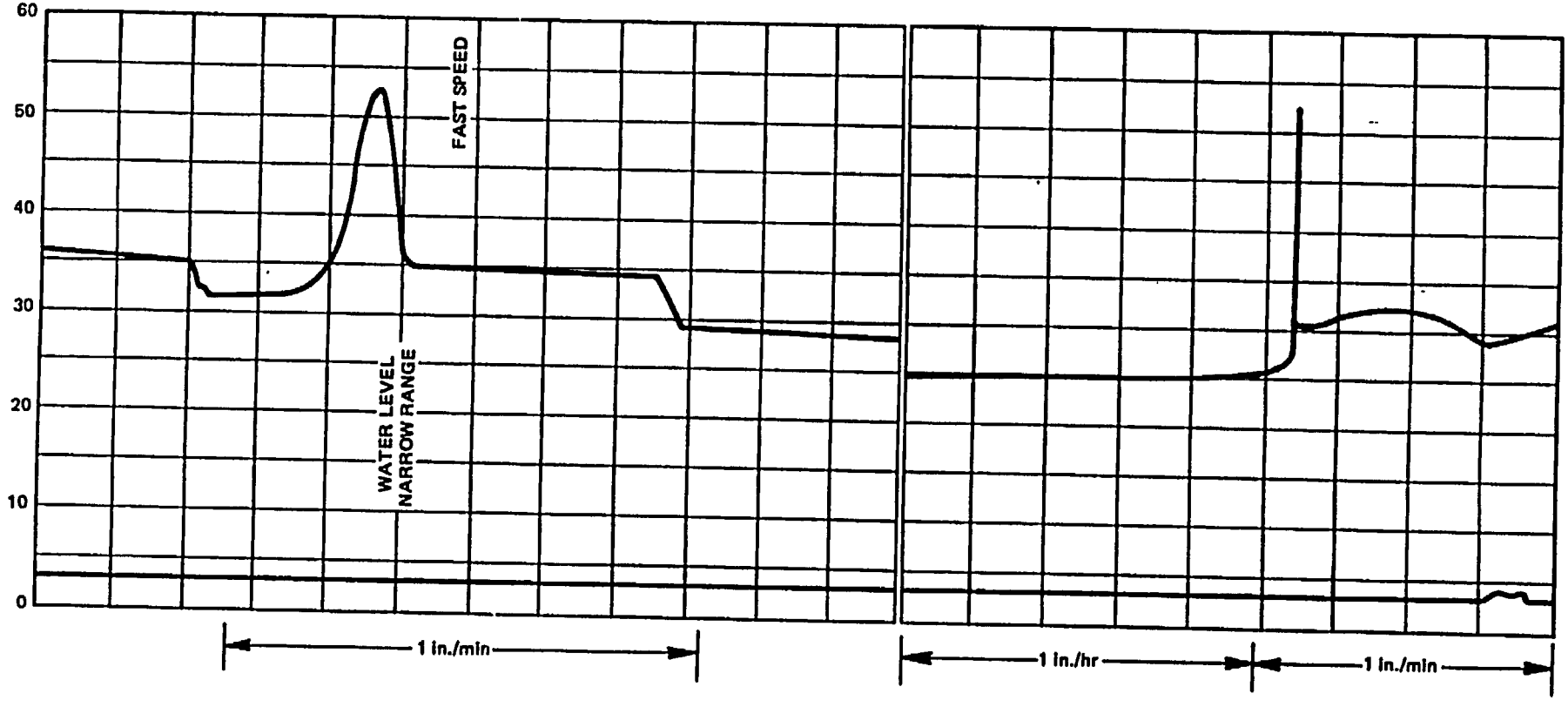

Figure 12. Water Level Response to Pressure Disturbances

APPENDIX A

BROWNS FERRY UNIT 1
BOTTLED-UP STABILITY TEST PROCEDURE

Plant:	Browns Ferry Unit 1
Test Title:	Bottled-Up Stability (Special Test)
Date:	December 12, 1973

PREPARED BY:

Startup Test Design and Analysis Unit
Startup and Training Subsection
Atomic Power Equipment Department
San Jose, California

1. PURPOSE

The purpose of this test is to demonstrate that the reactor can safely withstand pressure and reactivity perturbations at rated pressure while in a bottled-up condition without pressure regulation.

2. DESCRIPTION

2.1 Standard operating procedure at this plant permits operating up to rated pressure with the main steam isolation valves (MSIVs) closed. Heatup in this condition and transfer to and from this condition following turbine trips has been satisfactorily accomplished on several occasions. No incipient instabilities were qualitatively observed at any time; however, in an earlier plant (KRB), there were some indications of possible instability when bottled-up above 600 psig. Design Engineering at San Jose General Electric has therefore requested that a formal test be performed to verify bottled-up stability at rated pressure.

2.2 The test will be in two parts. The first will involve making a reactivity perturbation, and the second will be a pressure perturbation. Both will be initiated from bottled-up hot standby conditions, with the MSIVs open and the main turbine stop valves (MTSVs) closed. The feedwater turbines will be shut off, and the main turbine gland seal and the steam jet air ejector (SJAE) will be operating from the auxiliary boiler. The pressure regulator will be set approximately 20 psi above the actual reactor pressure. This will produce a bottled-up condition that closely simulates having the MSIVs closed, but will permit lowering of the pressure setpoint to open bypass valves if instability does occur.

2.3 Heatup data will be collected during normal operation with MSIVs closed at close to rated pressure. Normal heatup rates and rod insertions and withdrawals are sufficient for reactivity insertions.

3. CRITERIA

3.1 Level 1

The test will be terminated if vessel pressure is unstable or if the limit cycle exceeds ±20 psi, or if limit cycles with periods less than 10 seconds exceed ± 10 psi. The test will be terminated if the flux oscillation is so large that a flux-initiated scram is likely. In this case, the Technical Specification will be changed to forbid bottled-up operation above 600 psig.

3.2 Level 2

Limit cycles greater than ± 10 psi will require that the data be analyzed by Design Engineering, and consent be received prior to further bottled-up operation above 600 psig.

4. INSTALLATION INSTRUCTIONS

None

5. INITIAL CONDITIONS

5.1 The reactor pressure will be at 920 ± 5 psig. All normal plant surveillance procedures shall be satisfied.

5.2 The control rod drive and cleanup systems will be operating to the reactor vessel.

5.3 The reactor feed pumps and their turbines will be off and isolated from the reactor vessel.

5.4 The main turbine will be on turning gear with the gland seal and the (SJAE) operating from an auxiliary boiler.

5.5 The MSIVs will be open, and the MTSVs will be closed.

5.6 The pressure regulator setpoint will be set 20 ± 5 psi above the actual reactor pressure. This will be set by reducing setpoint until incipient bypass action is observed and coming up 20 psi from this point.

5.7 The transient recorder will be ready for operation with the following signals connected: narrow-range reactor pressure, wide-range reactor pressure, narrow-range reactor water level, bypass valve No. 1 position, APRM, LPRM, and core flow.

5.8 Recirculation M/G sets will be at minimum speed.

6. PROCEDURE

6.1 Reactivity Perturbation

6.1.1 With the reactor operating stably at the initial conditions set forth in Section 5, select a fully withdrawn control rod in the central region of the reactor. Take appropriate data, such as TIP trace, OD-7, and OD-8 computer printouts, to verify that rapid insertion of this rod will not result in the compromise of any fuel warranty limits.

6.1.2 Take base steady-state data and start the transient recorder.

6.1.3 Continuously insert the control rod from Position 48 to Position 00. It is desirable to obtain data on any oscillations that might occur; therefore, if any occur and they are not too large, record them for several minutes, or until Level 1 criteria are approached. To end any such oscillations, reduce the pressure regulator setpoint until the bypass valve opens. If criteria are reached, terminate testing and stop the transient recorder.

6.1.4 If criteria are not reached in Step 6.1.3, keep the transient recorder running and continuously withdraw the control rod to Position 48. When the reactor is again stable, and with the transient recorder running, scram the control rod to Position 00. Continue as in Step 6.1.3.

6.1.5 Withdraw the control rod to its full-out position and stop the transient recorder. This completes the reactivity perturbation test. If either Level 1 or Level 2 criteria are reached, concurrence of Design Engineering is to be obtained before proceeding.

6.2 Pressure Perturbation

6.2.1 After satisfactory completion of Step 6.1, and with the reactor operating stably at the initial conditions set forth in Section 5, take base data and start the transient recorder.

6.2.2 Rapidly open fully, and then close, one main steam bypass valve No. 1. Observe and accommodate any oscillations as in Step 6.1.3.

6.2.3 If criteria are not reached in Step 6.2.2, repeat the test for simultaneous full opening of two bypass valves.

6.2.4 The above completes the pressure perturbation test.

6.3 Reactivity Perturbation with MSIV Closed (Optional)

6.3.1 If sufficient reactivity perturbation data have not been obtained during normal startup, proceed to Step 6.3.2.

6.3.2 With the reactor at about 600 psig and closed MSIVs, increase power to heatup, maintaining a high, but reasonable, rate of heatup (less than 100°F/hr).

6.3.3 Record rod pattern and the following data at 30-minute intervals: vessel pressure, vessel level, and recirculation loop temperature.

6.3.4 Continue the heatup until rated pressure is reached.

6.3.5 As before, if oscillations are observed, start the transient recorder. It is desirable to obtain data while the reactor state is unchanged; however, if oscillations become large, rapidly insert control rods until the reactor is subcritical, and terminate the test.

6.3.6 If no instabilities are observed during this heatup, repeat Steps 6.1.1 through 6.1.5.

7. ANALYSIS

If no oscillations are observed, or if oscillations do not approach the criteria, the system will be considered stable under bottled-up hot standby conditions. If measurable oscillations are observed which approach the criteria, Design Engineering is to evaluate them and recommend subsequent action. Design Engineering is to be supplied with all data, irrespective of results obtained.

8. SUPPORTING INFORMATION

8.1 The steam volume of the reactor dome and steam lines out to the MSIVs is approximately 11,740 ft^3. The corresponding volume of the reactor dome and steam lines out to the MTSVs is approximately 14,540 ft^3. This difference should not make being bottled-up against the MTSVs significantly different from being bottled-up against the MSIVs, in terms of steam pressure transients.

8.2 One bypass valve full open passes about 400,000 lb/hr of steam. This compares with 800,000 lb/hr for one relief valve. Thus, opening two bypass valves will approximate the transient associated with opening one relief valve.

8.3 In selecting the control rod to be inserted, the main concern would be if an adjacent rod were at a high flux peak location. Such a position would be Position 08, which also corresponds to the end of a gadolinia zone.

NUCLEAR ENERGY DIVISION • GENERAL ELECTRIC COMPANY
SAN JOSE, CALIFORNIA 95125

GENERAL ELECTRIC

TECHNICAL INFORMATION SERIES

TITLE PAGE

AUTHOR	SUBJECT	NO. 74NED69
D. G. Carroll	BWR Operation	DATE November 1974
TITLE		GE CLASS I
Bottled-Up Operation of a BWR		GOVT. CLASS
REPRODUCIBLE COPY FILED AT TECHNICAL PUBLICATIONS, R&UO, SAN JOSE, CALIFORNIA		NO. PAGES 23

SUMMARY

"Bottled-up" operation of a BWR refers to that condition where the main steam isolation valves (MSIVs) are closed, thus preventing any significant steam flow. Historically, there has been a reactor scram condition if vessel pressure rises above 600 psig with the MSIVs closed and with the mode switch in "startup." This document describes the results of a special test conceived and performed on a typical BWR/4 design to determine the necessity of this plant scram function. It is concluded that the pressure scram function can be raised, so that bottled-up hot standby operation is permitted up to full pressure and temperature conditions.

By cutting out this rectangle and folding on the center line, the above information can be fitted into a standard card file.

NED DOCUMENT NUMBER NEDO-20697

INFORMATION PREPARED FOR General Electric Company

TESTS MADE BY D. G. Carroll

COUNTERSIGNED L. K. Holland SECTION SC&TA

BUILDING AND ROOM NO. 1850 So. 10th Street LOCATION San Jose, Ca.