Georgia Power Company
40 Inverness Center Parkway
Post Office Box 1295
Birmingham, Alabama 35201
Telephone 205 877-7279

J. T. Beckham, Jr.
Vice President - Nuclear
Hatch Project

Georgia Power
the southern electric system

July 24, 1996

Docket No. 50-321 HL-5192

U. S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, D. C. 20555-0001

Edwin I. Hatch Nuclear Plant - Unit 1
Power Uprate Startup Test Report

Gentlemen:

In accordance with regulatory commitments, Georgia Power Company hereby submits the Unit 1 Power Uprate Startup Test Report for Cycle 17. This report summarizes the startup testing performed on Unit 1 following implementation of power uprate during the sixteenth refueling outage. Power uprate was implemented in accordance with Unit 1 Technical Specifications Amendment No. 197.

As expected, the testing identified no major problems. The Unit 1 startup test program was very similar to the Unit 2 startup testing performed following the Fall 1995 outage.

If you have any questions in this regard, please contact this office.

Sincerely,

J. T. Beckham, Jr.

J. T. Beckham, Jr.

GKM/eb

Enclosure: Edwin I Hatch Nuclear Plant - Unit 1
Power Uprate Startup Test Report for Cycle 17

cc: (See next page.)

IE26/1

cc: <u>*Georgia Power Company*</u>
Mr. H. L. Sumner, Nuclear Plant General Manager
NORMS

<u>*U. S. Nuclear Regulatory Commission, Washington D. C.*</u>
Mr. K. Jabbour, Licensing Project Manager - Hatch

<u>*U. S. Nuclear Regulatory Commission, Region II*</u>
Mr. S. D. Ebneter, Regional Administrator
Mr. B. L. Holbrook, Senior Resident Inspector - Hatch

EDWIN I. HATCH NUCLEAR PLANT

UNIT 1

POWER UPRATE STARTUP TEST REPORT
for
CYCLE 17

Prepared by: S.K. McElroy Date: 7/18/96
Power Uprate Project Manager

Reviewed by: H.L. Brown Date: 7/18/96
Southern Company Services
Engineering

Edwin I. Hatch Nuclear Plant - Unit 1
Power Uprate Startup Test Report
for
Cycle 17

Table of Contents

Edwin I. Hatch Nuclear Plant - Unit 1
Power Uprate Startup Test Report
for
Cycle 17

1.0 EXECUTIVE SUMMARY

The Plant Hatch Unit 1 Power Uprate Startup Test Report is submitted to the Nuclear Regulatory Commission (NRC) in accordance with regulatory commitments contained in Unit 2 Final Safety Analysis Report (FSAR) Section 13.6.4. The report summarizes the startup testing performed on Unit 1 following implementation of power uprate during the sixteenth refueling outage. Power uprate was implemented in accordance with Amendment No. 197 to Facility Operating License No. DPR-57.

Unit 2 was uprated after the Fall 1995 refueling outage. Unit 2 utilized a very similar startup test program, and the test report was submitted to the NRC by Georgia Power Company (GPC) letter HL-5101, dated March 4, 1996.

Power uprate resulted in an increase in reactor power equal to 5% of the original rated thermal power. The testing specified in Unit 1 FSAR Section 13.6 was addressed and evaluated for applicability to this increased licensed power rating.

The Reactor Mode Switch was placed in the Startup position on April 27, 1996. The final synchronization to the grid was performed on May 2, 1996, marking the official end to the Unit 1 sixteenth refueling outage. The new 100% power (2558 MWt) was first achieved on May 7, 1996. The gross electrical output, which may vary over the year due to ambient conditions, was approximately 835 MWe. The required power uprate startup tests were completed by May 15, 1996.

To successfully achieve the uprated power level, six Special Purpose Procedures were written and implemented in combination with various Surveillance Test procedures described in this report. No unusual online adjustments were required for the following plant systems: Electrohydraulic Control (EHC) - Pressure Regulation, Feedwater, Recirculation, Reactor Core Isolation Cooling (RCIC), and High Pressure Coolant Injection (HPCI). All systems performed in a stable manner during both plant startup and transient testing. The unit is operating satisfactorily at power uprated conditions.

2.0 PURPOSE

The Plant Hatch Unit 1 Power Uprate Startup Test Report summarizes the testing performed on Unit 1 following the implementation of power uprate which resulted in an increase in reactor power equal to 5% of the original rated thermal power. The testing specified in Unit 1 FSAR section 13.6 was addressed and evaluated for applicability to the increased licensed power rating. Each test performed for power uprate is described in section 6.0. This report is submitted in accordance with regulatory requirements.

3.0 PROGRAM DESCRIPTION

The power uprate startup testing requirements were developed primarily from the review of Unit 1 FSAR section 13.6, section 10.3 of the General Electric (GE) Power Uprate Safety Analysis Report for Edwin I. Hatch Nuclear Plant Units 1 and 2, and the GE Uprate Test Program Recommendations. The testing was conducted following the Unit 1 sixteenth refueling outage. The results of this testing verified the unit's ability to operate at the uprated power level. Where possible, testing took credit for existing surveillance procedures. Table 1 lists the FSAR section 13.6 startup tests and delineates the testing performed for power uprate.

The majority of testing falls within the following categories:

1. Verifying the control systems (i.e., Feedwater, EHC - Pressure Regulation, and Recirculation) are stable at power uprate conditions.

2. Verifying the high pressure injection systems (i.e., RCIC and HPCI) operate acceptably at uprated pressures.

3. Collecting data for comparison to original plant rated conditions (i.e., radiation surveys, thermal performance, and plant steady-state data).

Table 2 presents the Test Conditions at which startup testing was performed. Reactor core flow could be any flow within the safe operating region of the power/flow map (Figure 1) that will produce the required power level. Testing at a given Test Condition was completed prior to proceeding to the subsequent Test Condition. Prior to increasing power, the Test Lead's approval was required. Prior to exceeding the old rated power level of 2436 MWt, the Nuclear Plant General Manager's approval was required.

4.0 ACCEPTANCE CRITERIA

Level 1 Variable or Criteria: Data trend, singular value, or information which relates to Technical Specifications margin and/or plant design in such a manner that requires strict observance.

Failure to meet Level 1 criteria constitutes failure of the specific test. The Test Lead is required to resolve the problem, and if necessary, the test is repeated.

Level 2 Variable or Criteria: Data trend, singular value, or information relative to system or equipment performance which does not fall under the definition of Level 1 criteria.

Level 2 criteria do not constitute a test failure or acceptance; they serve as information only.

5.0 POWER UPRATE STARTUP TEST PROGRAM SUMMARY

The test program began when the Mode Switch was placed in Startup on April 27, 1996, and ended with all required Power Uprate Startup Tests complete on May 15, 1996. The unit was synchronized to the grid on May 2, 1996, marking the official end to the Unit 1 sixteenth refueling outage. The new uprated 100% power (2558 MWt) was first achieved on May 7, 1996.

The unit is operating satisfactorily at the uprated conditions. No unanticipated online adjustments were required to control systems for the following: EHC - Pressure Regulation, Feedwater, Recirculation, RCIC, or HPCI Systems. All systems performed in a stable manner.

Data collected at uprated conditions showed that the 5% increase in reactor power has little, if any, effect on reactor water chemistry and radiological conditions throughout the plant.

These Power Uprate Startup Tests were performed satisfactorily during startup from the sixteenth refueling outage. Table 3 identifies all the required power uprate startup tests and the Test Conditions in which each test was performed. No Level 1 test failures occurred. One Level 2 criterion associated with control rod drive speed was evaluated by engineering and determined to be satisfactory.

6.0 TESTING REQUIREMENTS

Each of the tests discussed in Unit 1 FSAR section 13.6 was evaluated for applicability to power uprate. Throughout the following discussion, the test numbers and titles, and format are consistent with the FSAR. Section 6.1 identifies each section 13.6 test not required to be performed for power uprate. The purpose of the test and the rationale for exempting the test from the power uprate program are discussed. Section 6.2 identifies each test required to be performed for power uprate. The purpose of the test, a description of the test, and the test results are included.

Table 1 identifies the section 13.6 tests and their applicability to power uprate. Table 2 lists the five Test Conditions and the associated uprate power level. Table 3 lists the section 13.6 tests performed for power uprate and the Test Condition(s) for each test. Note that many surveillance tests similar to the original chapter 13 FSAR tests are performed periodically, often during each startup. Therefore, the power uprate test program took credit for many existing plant procedures.

6.1 FSAR Section 13.6 Tests Not Required for Power Uprate

6.1.1 Test (3) - Fuel Loading

This test demonstrates the ability to safely and efficiently load fuel to the full core size. Fuel loading is performed during every refueling outage in accordance with site procedures. Power uprate has no impact on this evolution; therefore, no additional testing was required for power uprate.

6.1.2 Test (6) - Source Range Monitor Response and Control Rod Sequence

The source range monitor (SRM) portion of this test demonstrates that the operational sources, SRM instrumentation, and rod withdrawal sequences provide adequate information to the operator during startup. Technical Specifications and plant procedures ensure proper SRM response during startup. This portion of Test (6) was not repeated for power uprate.

The control rod sequence portion of Test (6) demonstrates the ability to achieve, in a safe and efficient manner, criticality for each of the specified withdrawal sequences. The effect of rod motion on reactor power at various operating conditions is also determined. The manner in which criticality is achieved is not changed by power uprate. The current withdrawal sequence is performed in accordance with banked position withdrawal sequence. The rod patterns for intermediate power levels up to uprated power are evaluated using a three-dimensional simulator code. Performance of this test was not required for power uprate.

6.1.3 Test (7) - Intermediate Range Monitor Performance

This test ensures the ability to adjust the intermediate range monitors (IRMs) to obtain optimum overlap with the SRMs and average power range monitors (APRMs). Technical Specifications and plant procedures ensure proper IRM response during startup. This test was not repeated for power uprate.

6.1.4 Test (10) - Process Computer

This test verifies the performance of the process computer under plant operating conditions. The functions of the process computer were not affected by power uprate, although some input variables required modification. The input changes were verified correct for the new power level and this test was not required for power uprate.

6.1.5 Test (13) - Selected Process Temperatures

This test establishes the minimum recirculation pump speed needed to maintain water temperature in the bottom head of the reactor vessel within 145°F of reactor coolant saturation temperature determined by reactor pressure. This test assures that the measured bottom head drain line thermocouple is adequate to measure the bottom head coolant temperature during normal operations. Temperature stratification limits are defined in the Technical Specifications. This test was not required for power uprate.

6.1.6 Test (14) - System Expansion

This test verifies that reactor drywell piping and major equipment are unrestrained with regard to thermal expansion. An analysis for power uprated conditions indicated that the piping systems were acceptable for power uprate; therefore, further testing was not required.

6.1.7 Test (15) - Core Power Distribution

This test determines core power distribution in three dimensions, confirms reproducibility of traversing incore probe (TIP) System readings, and determines core power symmetry. Existing site procedures verify proper TIP operation and core power symmetry. Power uprate did not significantly impact these parameters. TIP operation was not affected.

6.1.8 Test (17) - Steam Production

This test demonstrates the ability to operate continuously at rated reactor power, demonstrating that the nuclear steam supply system (NSSS) provides steam at a sufficient rate and quality. This was for the initial warranty run and is not applicable to power uprate.

6.1.9 Test (18) - Flux Response to Rods

This startup test demonstrates stability in the power reactivity loop with increasing reactor power and determines the effect of control rod movement on reactor stability. Power uprate had only a minor impact on stability margin; operation on a slightly higher flow control (rod) line is allowed. However, no testing related to thermal-hydraulic stability was performed for power uprate. Routine operation in the high power/low flow corner of the power-to-flow map is no longer permitted per NRC-approved interim corrective actions for thermal hydraulic stability.

6.1.10 Test (20) - Feedwater Control System

The five objectives of this startup test are to:

1. Demonstrate reactor water level control.
2. Evaluate and adjust feedwater controls.
3. Demonstrate the capability of the automatic flow runback feature to prevent a low water level scram following a single feedwater pump trip.
4. Demonstrate adequate response to feedwater heater loss.
5. Demonstrate general reactor response to inlet subcooling changes.

During initial startup, these objectives were demonstrated through the performance of different tests. The tests performed for power uprate are included in section 6.2.11. The tests that were not performed for power uprate are as follows:

<u>Loss of Feedwater Heating (LOFH)</u>

The LOFH test performed during initial startup testing demonstrates adequate response to LOFH. The transient event is caused by an equipment failure or operator error which causes isolation of one or more feedwater heaters. For Unit 1, the limiting equipment failure results in < 100°F decrease in final feedwater temperature if the LOFH occurred at either old rated power (2436 MWt) or the current rated power level (2558 MWt). Transient analyses show acceptable response relative to fuel thermal limits; i.e., Minimum Critical Power Ratio (MCPR) and fuel overpower. The LOFH transient was reanalyzed for power uprate and fuel thermal limits were acceptable. Therefore, the LOFH test was not required for power uprate.

<u>Single Reactor Feedwater Pump (RFP) Trip</u>

This initial startup test verifies the capability of the automatic recirculation pump runback to prevent a low water level scram following a single RFP trip. The only impact of power uprate on this design feature is that power uprate allows operation on a slightly higher flow control (rod) line. Therefore, the core power level may be slightly higher (< 5%) following the recirculation runback. This increase in power requires slightly higher flow from the remaining RFP to maintain level.

Prior to startup, transient analyses were performed to determine the required capacity of the remaining RFP. During startup, the actual pump capacity was verified to be larger than required for power uprate conditions. Therefore, tripping a RFP at high power was not necessary for power uprate.

6.1.11 Test (21) - Bypass Valves

This test demonstrates the ability of the pressure regulator to minimize disturbances to the reactor during an abrupt change in reactor steam flow. This test also demonstrated that the turbine bypass valves can be functionally tested at or near rated power without causing a scram.

Bypass valves are routinely tested at high power, and response time tested prior to startup. Power uprate operation will not change bypass valve operation. Therefore, this startup test was not performed specifically for power uprate.

6.1.12 Test (22) - Main Steam Isolation Valves

The three objectives of this test are to:

1. Functionally check the Main Steam Isolation Valves (MSIVs) for proper operation at selected power levels.

2. Determine the reactor transient behavior during and following simultaneous full closure of all MSIVs and following closure of one valve.

3. Determine MSIV closure times.

Large transient testing performed at high power during the initial startup demonstrated the adequacy of protection. Analysis shows that should these transients occur at power uprate conditions, the change in unit performance will be small; therefore, testing the unit's response to full closure of the MSIVs at the uprated power level was not required. MSIVs will continue to be surveillance tested per existing site procedures.

6.1.13 Test (23) - Safety Relief Valves

This test verifies proper operation of dual-purpose safety relief valves (SRVs), including determination of capacity and leaktightness verification following operation. SRV capacity was not affected by power uprate. SRV setpoints were increased 3% for power uprate. During the outage, the new setpoints were reset and tested prior to installation. The SRVs were exercised at low power using existing procedures. This startup test, as described in the FSAR, was not required for power uprate.

6.1.14 Test (24) - Turbine Trip and Generator Load Rejection Demonstration

This test demonstrates the response of the reactor and its control systems to protective trips initiated by the turbine and generator. Large transient testing performed at high power levels during the initial startup demonstrated the adequacy of protection. Analysis shows that should these transients occur at uprated conditions, the change in unit performance will be small; therefore, testing the unit's response to turbine and generator trips at uprated conditions was not required.

6.1.15 Test (25) - Shutdown from Outside the Main Control Room (MCR)

This test demonstrates the ability to shut down the reactor from normal steady-state operating conditions to the point where cooldown is initiated and under control with reactor pressure and water level controlled from outside the MCR. Power uprate did not alter the capability of the reactor to be shut down from outside the MCR; therefore, this test was not repeated for power uprate.

6.1.16 Test (26) - Flow Control

This startup test determines the plant response to changes in recirculation flow, and thereby, adjusts the local control loops. Also, the load following capability of the plant is established. Power uprate does not significantly affect the recirculation flow control system or licensed core flow limits. Therefore, the recirculation flow control startup test was not required for power uprate.

6.1.17 Test (27) - Recirculation System

The two objectives of this test are to:

1. Determine the transient responses and steady-state conditions following recirculation pump trips and obtain jet pump performance data.

2. Verify that no recirculation system cavitation occurred.

The initial startup test determined the transient response during recirculation pump trips, flow coastdown, and pump restarts. Power uprate did not affect the ability of the recirculation system to respond acceptably to these transients, as demonstrated during the initial startup test program. Therefore, further testing for power uprate was not required.

6.1.18 Test (28) - Loss of Turbine-Generator and Off-Site Power

This test demonstrates proper performance of the reactor and the plant electrical equipment and systems during the loss of auxiliary power transient. Power uprate does not change the ability of the electrical systems to function properly during a loss of the main turbine-generator and a loss of offsite power (LOSP). The ability of the reactor systems (e.g., HPCI and RCIC) to function properly at uprated conditions was demonstrated during the power ascension to uprate conditions; therefore, this test was not required for power uprate.

6.1.19 Test (30) - Vibration Measurements

This initial startup test demonstrates the mechanical integrity of the reactor system under conditions of flow induced vibration, by taking vibration measurements correlating it to analytical models. The impact of power uprate on reactor internals vibration was evaluated at uprated power and maximum core flow. The maximum licensed core flow was not increased for power uprate, and it was determined the reactor vessel internals design continued to comply with existing structural requirements. The 5% change in power was not expected to affect the internals vibration levels enough to warrant extensive testing.

6.1.20 Test (31) - Main Turbine Stop Valve Surveillance Test

The purpose of this original startup test is to demonstrate acceptable procedures for turbine stop valve surveillance tests at a power level as high as possible without producing a reactor scram. Plant Hatch has years of experience testing stop and control valves. During the uprate startup the valves were tested using existing site procedures at power levels and pressures where experience shows no problems occur. If GPC chooses to optimize the power levels for this testing, it will be done at a later date. Therefore, this startup test was not performed for power uprate.

6.1.21 Test (32) Recirculation and Jet Pump Instrument Calibration

The purpose of this initial startup test was to obtain an integrated calibration of the installed jet pump and recirculation pump flow instrumentation with the reactor shutdown prior to jet pump flow calibration. Power uprate does not significantly affect the ability to calibrate this instrumentation and this test was not repeated.

6.1.22 Test (33) - RWC System

This initial startup test demonstrates the specific aspects of the mechanical operability of the reactor water cleanup (RWC) system. Detailed evaluations show the impact of a 5% increase in thermal power causes minor changes in RWC system operating performance requirements; however, the changes are well within the system's design parameters. No specific RWC testing was required for power uprate.

6.1.23 Test (34) - RHR System

This test demonstrates the ability of the residual heat removal (RHR) system to:

1. Remove decay heat from the NSSS so that refueling and servicing can be performed.

2. Condense steam while the reactor is isolated from the main condenser.

The capability of the RHR system to remove residual and decay heat has been demonstrated many times over the years. Power uprate's effect on system performance is a small increase in reactor cooldown time; the system will continue to perform acceptably. The steam condensing mode of RHR was removed and thus, is not a factor. Therefore, the RHR System startup test was not required for power uprate.

6.1.24 Test (35) - Drywell Atmosphere Cooling System

This startup test demonstrates the ability of the primary containment cooling system to maintain drywell temperatures within the temperatures assumed in the safety analysis.

Power uprate was expected to have a minimal impact (1 to 2°F) on drywell temperature. The ability of the Unit 1 cooling system to maintain acceptable average drywell gas temperature is strongly dependent on river temperature, and summertime conditions may cause the average (bulk) drywell temperature to approach its design temperature of 135°F. However, uprate itself does not affect the cooling system significantly and it will not cause the cooling system to be operated differently. Therefore, no additional testing for uprate was performed. (Note the bulk drywell Technical Specification limit was recently increased to 150°F.)

6.1.25 Test (36) - Cooling Water Systems

The purpose of this test was to verify the performance of the reactor and turbine building closed cooling water, and service water systems were adequate with the reactor at rated temperature. The impact of power uprate operation on these systems was evaluated and found to be small and within the design heat loads. Selected steady-state temperature data for specific loads (e.g., main generator stator cooling) was obtained during startup, but no specific uprate tests were performed.

6.2 FSAR Section 13.6 Tests Required for Power Uprate

6.2.1 Test (1) - Chemical and Radiochemical Tests

Purpose: To determine the effects of power uprate on reactor coolant chemistry.

Description: Chemical and radiochemical samples were taken in accordance with plant procedures at the original 100% power level (95% uprated), 98% uprated power level, and 100% uprated power level.

Acceptance Criteria:

Level 1: Per Procedure 60AC-HPX-010-0S, "Plant Sampling and Monitoring Program," and the Unit 1 Technical Requirements Manual (TRM).

Level 2: None

Results: Procedure 60AC-HPX-010-0S was performed satisfactorily at 95%, 98%, and 100% uprated power. Hydrogen injection was not in service. All Acceptance Criteria were satisfied.

Chemistry Results

Parameter	Actual Data (95%)	Actual Data (100%)	Acceptance Criteria
Primary Reactor Coolant Conductivity	0.18 $umhos/cm^2$	0.22 $umhos/cm^2$	$\leq$ 2.0 $umhos/cm^2$
Primary Reactor Coolant Chloride	4.6 ppb	4.1 ppb	$\leq$ 200 ppb

6.2.2 Test (2) - Radiation Measurements

Purpose: To measure radiation levels at selected locations and power conditions to assure the protection of plant personnel and continual compliance with the guidance of 10 CFR 20 during plant operation.

Description: Radiation levels were measured at various locations in the plant at uprated power levels of 95%, 98%, and 100% in accordance with plant procedures.

Acceptance Criteria:

Level 1: Radiation doses of plant origin and occupancy times of personnel in radiation zones are controlled consistent with the guidance on standards for protection against radiation found in 10 CFR 20.

Level 2: None

Results: Radiation surveys were conducted at uprated power levels of 95%, 98%, and 100% in accordance with applicable sections of Departmental Instruction DI-RAD-03-1087N, "Survey/Inspection Frequency and Work Scheduling." The radiation data were taken at normal water chemistry conditions. The dose rates were the same as those experienced at the original power levels. No postings were changed as a result of achieving the uprated 100% power level. Radiation dose rates remain within the standards for protection against radiation outlined in 10 CFR 20.

6.2.3 Test (4) - Shutdown Margin

Purpose: To demonstrate that throughout the fuel cycle, the reactor will be subcritical with the analytically determined highest worth control rod capable of being fully withdrawn and all other rods fully inserted.

Description: SDM demonstrations were performed in accordance with Procedure 42CC-ERP-010-0S, "Shutdown Margin Demonstration." The demonstration was performed analytically during the Cycle 17 BOC, using an insequence critical control rod with the reactor core in a Xenon-free state. Correction factors were used to adjust to startup conditions.

Acceptance Criteria:

Level 1: SDM is $\geq 0.38\% \, \Delta k/k + R$, as specified in the Technical Specifications and Procedure 42CC-ERP-010-0S, "Shutdown Margin Determination."

Level 2: None

Results: For Unit 1 Cycle 17, the required SDM was > 0.38% $\Delta k/k$ + R. (SDM is lowest at BOC conditions; therefore, R = 0%.) Demonstration of SDM was performed during withdrawal of an insequence control rod rather than solely by calculation.

As Unit 1 reached criticality, SDM was calculated in accordance with Procedure 42CC-ERP-010-0S. Cycle 17 SDM was determined to be 1.98% $\Delta k/k$, thus satisfying the Level 1 Acceptance Criteria.

6.2.4 Test (5) - Control Rod Drive

Purpose: To demonstrate that the control rods meet Technical Specifications requirements for scram times.

Description: Scram timing of control rods was performed in accordance with Procedure 42SV-C11-003-0S, "Control Rod Scram Testing." CRD timing was performed in accordance with Procedure 34SV-C11-004-1S, "CRD Timing."

Acceptance Criteria:

Level 1: Per Procedure 42SV-C11-003-0S and applicable Technical Specifications.

Level 2: Per Procedure 34SV-C11-004-1S.

Results: Scram time testing was performed for selected control rods during either the RPV leakage test or below 40% of uprated thermal power during startup. All Level 1 Acceptance Criteria, per Procedure 42SV-C11-003-0S, were satisfied. The Scram Time Acceptance Criterion for each control rod shown below is the required scram insertion time from the fully withdrawn position. An individual control rod that fails to meet criteria is declared a "SLOW" rod. However, all 137 control rods met the Acceptance Criteria.

Scram Time Testing Results

Position Inserted from Fully Withdrawn	Acceptance Criteria (seconds)
46	0.44
36	1.08
26	1.83
06	3.35

CRD Timing data for insertion and withdrawal speeds met the Level 2 Acceptance Criteria of 38.4 to 57.6 seconds specified in Procedure 34SV-C11-004-1S. For CRDs with an adjusted drive speed, the criteria ranged from 43.2 to 52.8 seconds. One CRD which had its drive speed adjusted did not meet the 43.2 to 52.8 second criteria but met the 38.4 to 57.6 seconds specified, and was evaluated as satisfactory.

6.2.5 Test (8) - Local Power Range Monitor Calibration

Purpose: To calibrate the local power range monitors (LPRMs).

Description: The LPRM channels were calibrated to make the LPRM readings proportional to the neutron flux in the narrow-narrow water gap at the chamber elevation. This calibration was performed in accordance with Procedure 52SV-C51-005-1S, "LPRM Calibration."

Acceptance Criteria:

Level 1: Per Procedure 52SV-C51-005-1S.

Level 2: None

Results: Using site procedures, LPRMs were successfully calibrated at 100% uprated power. Average LPRM gain adjustment factor values for all operable LPRM channels were within specified limits.

6.2.6 Test (9) - Average Power Range Monitor Calibration

Purpose: To calibrate the APRMs to actual core thermal power, as determined by a heat balance.

Description: Each APRM channel reading was adjusted to be consistent with core thermal power as determined by the heat balance. This calibration was performed in accordance with Procedure 34SV-SUV-021-0S, "APRM Adjustment to Core Thermal Power."

Acceptance Criteria:

Level 1: At least two or more APRMs per RPS trip system are calibrated to rated thermal power. These readings agree with the heat balance values within ± 2%.

Level 2: None

Results: APRM gain adjustments were performed at different power levels during the Power Uprate Startup Test Program. Each was completed satisfactorily, and no problems occurred during the tests.

6.2.7 Test (11) - Reactor Core Isolation Cooling System

Purpose: To verify proper operation of the RCIC System at the uprated operating pressure and provide baseline data for future surveillance testing.

Description: As part of the normal plant startup, Procedure 34SV-E51-004-1S, "RCIC Pump Operability 150 psig Test," was performed to demonstrate adequate control of the turbine and rated flow capability.

Using Procedure 34SV-E51-002-1S, "RCIC Pump Operability," a condensate storage tank (CST) injection was performed at ≥ 920 psig to demonstrate acceptable operation at the lower end of the operating pressure range for power uprate and to provide a benchmark to which future surveillance tests are compared.

At the uprated operating pressure, a Cold Quick Start was performed in accordance with Procedure 34SV-E51-002-1S. As part of the analysis of the RCIC quick start at rated conditions, all control parameters (e.g., speed and flow) were analyzed for proper performance.

Using the HPCI/RCIC Data Acquisition System, proper control system tuning was verified.

Acceptance Criteria:

Level 1:

1. RCIC surveillance procedures are satisfactorily completed. This includes requiring the system to deliver rated flow (400 gpm) at any reactor pressure between 150 psig and rated pressure at power uprate conditions. The system must deliver rated flow within 45 seconds from the automatic initiation at any reactor pressure ≥ 920 psig.

2. The RCIC turbine cannot trip or isolate during auto or manual starts.

Level 2:

1. The barometric condenser is capable of preventing steam leakage to the atmosphere during operation.

2. The differential pressure (dP) switches for the steamline isolation are properly calibrated.

Other:

1. The first and subsequent speed peaks associated with the startup transient are not more than 5% faster than the rated RCIC turbine speed.

2. The decay ratio of any RCIC System-related variable is not > 0 25.

Results: The RCIC pump surveillance procedure was performed satisfactorily. RCIC operability was verified at 155 psig. The pump flow rate was 400 gpm at a turbine speed of 2360 rpm. All Acceptance Criteria were satisfied.

With reactor pressure at ~ 920 psig, the RCIC pump surveillance procedure was performed satisfactorily. The RCIC turbine did not trip; a rated flow > 400 gpm was achieved with a discharge pressure > 100 psig above reactor pressure in < 45 seconds, thus satisfying all Level 1 Acceptance Criteria. All Level 2 Acceptance Criteria were satisfied. The control system tuning parameter checks also met the Acceptance Criteria.

The RCIC pump surveillance procedure was performed satisfactorily at uprated pressure. A Cold Quick Start was performed. RCIC pump flow was 400 gpm at a pressure of 1230 psig. The response time to rated flow was approximately 27 seconds, with no perceptible initial speed spike. No tuning was needed; the system ran smoothly. The decay ratio for the speed control loop was zero. All Level 1 and 2 Acceptance Criteria were satisfied.

6.2.8 Test (12) - High Pressure Coolant Injection System

Purpose: To verify proper operation of the HPCI System at the uprated operating pressure and provide baseline data for future surveillance testing.

Description: As part of the normal plant startup, Procedure 34SV-E41-005-1S, "HPCI Pump Operability 165 psig Test," was performed to demonstrate adequate control of the turbine and rated flow capability.

Using Procedure 34SV-E41-002-1S, "HPCI Pump Operability," a CST injection was performed at ≥ 920 psig to demonstrate acceptable operation at the lower end of the operating pressure range for power uprate and provide a benchmark to which future surveillance tests will be compared.

At the uprated operating pressure, a Cold Quick Start was performed in accordance with Procedure 34SV-E41-002-1S.

Acceptance Criteria:

Level 1:

1. HPCI surveillance procedures are satisfactorily completed. This includes requiring the system to deliver rated flow (4250 gpm) at any reactor pressure between 165 psig and rated pressure at power uprate conditions. The system must deliver rated flow within 49 seconds from the automatic initiation at any reactor pressure ≥ 920 psig.

2. The HPCI turbine cannot trip or isolate during auto or manual starts.

Level 2:

1. The barometric condenser is capable of preventing steam leakage to the atmosphere during operation.

2. The dP switches for the steamline isolation are properly calibrated.

Other:

1. The first speed peak associated with the startup transient is at least 15% (of rated turbine speed) below the overspeed trip. Subsequent speed peaks are not more than 5% faster than the rated HPCI turbine speed.

2. The decay ratio of any HPCI System-related variable is not > 0.25.

Results: The HPCI pump surveillance procedure was performed satisfactorily at approximately 165 psig. A pump flow rate of 4250 gpm was achieved. Turbine speed was 2138 rpm; the turbine did not trip. All Level 1 and Level 2 Acceptance Criteria were satisfied.

The HPCI pump surveillance was completed satisfactorily at 925 psig. The following acceptance criteria were met:

Parameter	Acceptance Criteria	Test Results
Rated Flow	≥ 4250 gpm	4250 gpm
Pump Discharge Pressure	≥ 1135 psig	1266 psig
Decay Ratio	≤ 0.25	~ 0.0
Response Time	≤ 49.0 sec	20.5 sec

No speed requirements were exceeded. The speed and flow control loops did not require any adjustment. The decay ratio was < 0.25, thereby satisfying all acceptance criteria.

The HPCI pump surveillance was performed satisfactorily at 100% uprated power. A cold quick start was performed in conjunction with a stability (tuning) check. No turbine trip or isolation occurred. The following acceptance criteria were satisfied:

Parameter	Acceptance Criteria	Test Results
Rated Flow	≥ 4250 gpm	4250 gpm
Pump Discharge Pressure	≥ 1135 psig	1192 psig
Decay Ratio	≤ 0.25	~ 0.0
Response Time	≤ 49.0 seconds	19 seconds

The transient start peak speed was well below the limit of 4400 rpm and subsequent peaks were well below the 4260 rpm limit. All Acceptance Criteria were met.

6.2.9 Test (16) - Core Performance - Thermal Limits

Purpose: To evaluate the core performance parameters to assure plant thermal limits are maintained during the ascension to uprated conditions.

Description: As power is increased, core thermal power was measured at all five Test Conditions up to 100% uprate power, using the current plant methods of monitoring reactor power.

In accordance with Procedure 34SV-SUV-020-0S, "Core Parameter Surveillance," demonstration of fuel thermal margin was performed at each test condition. Fuel thermal margin was projected to the next test point to show expected acceptance margin and was satisfactorily confirmed by the measurements taken at each test point before advancing further.

Acceptance Criteria:

Level 1:

The following thermal limits are ≤ 1.000:

1. MFLPD (Maximum Fraction of Limiting Power Density)
2. MFLCPR (Maximum Fraction of Limiting Critical Power Ratio)
3. MAPRAT (Core Maximum Average Planar Linear Heat Generation Rate Fraction)

Level 2: None

Results: Thermal limits were continuously monitored during power ascension. The surveillance procedure was performed satisfactorily at each test condition, thus meeting all acceptance criteria. Results for Test Conditions 2 through 5 are as follows:

	Uprated Power Level			
Thermal Limit	90%	95%	98%	100% *
MFLCPR	0.802	0.806	0.806	0.801
MFLPD	0.825	0.877	0.905	0.925
MAPRAT	0.870	0.900	0.913	0.925

* Steady-State Xenon

6.2.10 Test (19) - Pressure Regulator

Purpose:

1. To confirm that recommended pressure control system tuning parameters provide acceptable performance by analysis of the transients induced in the reactor pressure control system by means of pressure step input to the pressure regulators.

2. To demonstrate that affected plant parameters are within acceptable limits during pressure regulator-induced transients.

3. To verify that variation in incremental regulation is within acceptable limits (linear).

Description: The steamline pressure transmitters were replaced and functionally tested during the outage. The pressure regulator was tuned and tested prior to startup per the guidance of Service Information Letter (SIL) 589, "Pressure Regulator Tuning." Electronics were replaced and tested, as necessary, to assure stable turbine control valve operation.

During startup, 3-, 6-, and 10- psi step changes in reactor pressure were simulated, and the resulting transient was recorded. The data for each step change were analyzed for acceptable performance and scram margins prior to performing the next increased pressure step change. Step changes were first performed with pressure regulator "A" in control and second with pressure regulator "B" in control. This test was performed while on turning gear with the bypass valves controlling reactor pressure (~ 25% power), at an intermediate power level (65-75%), and at Test Condition 3 (95% power).

Starting at ~ 200 MWe, steam flow, MWe, first-stage pressure, and pressure regulator output (E_L) were recorded at every 2% power increase until full power was achieved. The data were plotted to confirm pressure regulation linearity.

Acceptance Criteria:

Level 1: The transient response of the turbine inlet (throttle) pressure to any test input cannot diverge (decay ratio = < 1). This can be visually verified by observing that the successive peaks of the same polarity are of equal or decreasing amplitude.

Level 2:

1. The decay ratio of the turbine inlet (throttle) pressure is ≤ 0.25, when operating above the minimum core flow of the master flow control range. Below this minimum core flow, the decay ratio must be ≤ 0.50. The decay ratio of each control system should be adjusted to ≤ 0.25, unless a performance loss involved at higher power levels is identified.

2. The response time from pressure setpoint input until the pressure peak of the turbine inlet pressure is ≤ 10 seconds.

3. Pressure control system deadband and delay are small enough that steady-state limit cycles (if any) produce steam flow variations no larger than ± 0.5 % of rated steam flow.

4. Peak neutron flux and peak vessel pressure remain below scram settings by 7.5 % and 10 psi, respectively.

Results: Pressure regulator stability testing was performed at uprated power levels of ~ 20%, 75%, and 95% power. Selected data obtained during each test condition are summarized in the tables below.

The system response to step changes at each power level was satisfactory. No signs of divergence or oscillations occurred. Pressure response time and margins to scram setpoints were adequate in all cases. No limit cycles were observed. All Level 1 and Level 2 Acceptance Criteria were satisfied.

Pressure Regulator "A" Step Change Data

Power Level	Step (+/-)	Peak Pressure Change (psig)	Pressure Response Time (sec)	Peak Power (%)	Steady State Cycles
17% (Turning Gear)	3	3.6	2.3	19	0
	6	6.5	2.5	20	0
	10	11.0	2.4	22	0
76%	3	3.3	2.0	79	0
	6	6.0	2.5	80	0
	10	10.0	2.9	82	0
95%	3	3.0	1.3	96	0
	6	6.0	1.5	98	0
	10	10.5	2.8	100	0

Pressure Regulator "B" Step Change Data

Power Level	Step (+/-)	Peak Pressure Change (psi)	Pressure Response Time (sec)	Peak Power (%)	Steady State Cycles
17% (Turning Gear)	3	3.5	2.2	19	0
	6	6.5	2.2	20	0
	10	11.2	2.5	22	0
75%	3	3.6	2.3	77	0
	6	5.8	2.5	79	0
	10	10.0	3.5	81	0
95%	3	3.0	1.5	96	0
	6	6.0	1.6	98	0
	10	10.5	2.7	100	0

Pressure regulator linearity was also recorded at every 2% power increase by comparing pressure regulator output (E_L) to MWe and turbine first stage pressure. The regulator output remained linear.

6.2.11 Test (20) - Feedwater Control System

Purpose: To verify that the Feedwater Control System has been adjusted to provide acceptable reactor water level control at uprated conditions. Section 6.1.10 lists the five objectives of the original startup test and identifies the tests that were not repeated for power uprate. The description below provides information on the feedwater system testing performed for power uprate.

Description: The Unit 1 Reactor Feed Pump Turbine (RFPT) speed controls were upgraded to a GE Mark V governor system with speed feedback. Also, the RFPT electrical stops were increased slightly prior to startup to compensate for power uprate operation on higher flow control (rod) lines. The testing for the upgraded turbine controls was integrated with power uprate testing. Key uprate-related tests include:

I. Step Changes: Small step changes in water level (2 to 5 in.) were inserted to evaluate level control stability and any oscillatory response. Single-pump tests were conducted at lower power (~ 35% power), and dual pump tests were performed at ~ 70% power and at Test Condition 3.

Acceptance Criteria:

Level 1:

1. Level control system-related variables contain oscillatory modes of response. In these cases, the decay ratio for each controlled mode of response is ≤ 0.25.
2. The variation in incremental regulation (feedwater flow demand change divided by actual feedwater flow change for small disturbances) does not exceed a factor of 2 to 1 between feedwater flow demand and feedwater flow.
3. The turbine speed regulation variation between the two feed pumps must match within ± 5% of rated speed.

Level 2: None

Results: Feedwater Stability Testing was performed at uprated power levels of 35%, 70%, and 95%. Both 2-in. and 5-in. positive and negative level setpoint changes were input, and system response was monitored. These step changes were performed in both single-element and three-element control. System response was not oscillatory and showed no signs of divergence. No system adjustments were required. All Acceptance Criteria related to system stability were satisfied.

Data were taken and plotted for both single- and two-pump configurations, and the variation in incremental regulation was ≤ 2:1 for both conditions.

II. RFP Capacity: The capacity of one RFP was verified during startup to determine the maximum power level at which one RFP can maintain reactor vessel water level. The purpose of this test is to help determine if one RFP, in conjunction with a RRS runback, can maintain water level above the low reactor vessel water level scram setpoint in the event of an RFPT trip.

Acceptance Criteria:

Level 1: None

Level 2: Vessel water level, RFP turbine speed and vibration, and RFP suction pressure remain within the limits specified below.

Results: The test was terminated at 72% of uprated power. Key parameters collected at this power level are tabulated below.

Parameter	Parameter Value	Parameter Limit
Reactor thermal power (MWt)	1837	NA
RPV water level (in.)	40.4	≥ 34 in.
RFP turbine speed (rpm)	5420	≤ 5700 rpm
RFP suction pressure (psig)	355	≥ 250 psig
RFP turbine vibration (mils, p-to-p)	2.7	< 4.5 mils
RFP turbine vibration (mils, p-to-p)	1.1	< 4.5 mils

6.2.12 Test (29) - Recirculation MG Set Speed Control

Purpose: To perform a calibration of the installed recirculation system flow instrumentation, including specific signals to the plant process computer. The original startup test also included determination of "individual characteristics of the recirculation control system." However, these characteristics have previously been determined and uprate will not significantly affect the recirculation system components.

Description: At operating conditions which allow the RRS to operate at the speeds required for rated flow at 100% uprated power, the jet pump flow instrumentation was adjusted to provide correct flow indication based on jet pump flow. The total core flow signal to the process computer was calibrated to accurately read the total core flow. This recalibration of the RRS was performed in accordance with Procedure 57CP-CAL-271-1S, "Core Flow Measurement." The recirculation pump stops were adjusted, as required.

Acceptance Criteria:

Level 1: Per Procedure 57CP-CAL-271-1S.

Level 2: None.

Results: Core flow calibration was performed per site procedures. Data were collected. Core flow calculations were performed, and M-ratios were determined. Jet pump flow summer amplifier gain adjustment factors were calculated and evaluated. Required adjustments were made in accordance with site procedures. All acceptance criteria were met.

Existing instrumentation associated with the recirculation pumps (e.g., recirculation pump motor vibration alarms) were monitored, and no indications of high vibration were observed.

6.2.13 Steady-State Data Collection

Purpose: To obtain steady-state data of important plant parameters during startup at Test Conditions 1 through 5. The selected data taken at power levels > 100% were extrapolated to predict conditions at 100% uprated power.

Results. Data were collected for over 100 plant parameters at each test condition. The data tracked very well. Extrapolations were made for various instruments recording turbine first-stage pressure, total reactor steam flow, reactor feedwater temperatures, and turbine control valve positions.

During startup and ascension to old rated power, EHC pressure was set at 920 psig. As reactor power increased above 2436 MWt, fine adjustments to pressure set were made to increase reactor pressure and turbine throttle pressure, allowing for a complete set of data at 2436 MWt prior to ascension to 2558 MWt.

At Test Condition 5, reactor steam dome pressure was 1035 psig, and turbine throttle pressure was 985 psig. The steamline pressure drop closely matched pre-test conditions.

6.2.14 Thermal Performance

Purpose: To obtain steady-state data on thermal performance when the unit reached original 100% power (2436 MWt). The same data were collected at steady-state conditions at the uprated power level of 100% (2558 MWt).

Results: The thermal performance data were collected in accordance with special purpose procedures. This test was designed to baseline the thermal performance of Unit 1 at uprated conditions and determine the gross/net generator electrical output change which occurs as a result of implementing power uprate. No acceptance criteria apply to this test.

6.2.15 Water Level Measurement

Purpose: To check the wide- and narrow-range vessel water level instrumentation.

Description: A channel check of various water level instruments was performed at all five test conditions.

Acceptance Criteria:

Level 1: None

Level 2: Narrow-range water level instruments agree within ± 1.5 in. of the average reading. Wide-range indicators agree within ± 6 in. of each other.

Results: The water level indications were acceptable at all five test conditions. Results at 95% and 100% of uprated power are tabulated below.

Water Level Measurements

Indicator	Test Results 95%	Test Results 100%	Acceptance Criteria
1C32-R606A,B,C	0.3 in.	0.9 in.	± 1.5 in.
1B21-R604A,B	0.5 in.	1.5 in.	± 6.0 in.
1B21-R623A,B	0.5 in.	0.0 in.	± 6.0 in.

TABLE 1

UNIT 1 FSAR SECTION 13.6 TESTS (SHEET 1 OF 2)

FSAR Test No.	Test	Required for Power Uprate
1	Chemical and Radiochemical	Yes[a]
2	Radiation Measurements	Yes[a]
3	Fuel Loading	No
4	Shutdown Margin	Yes[a]
5	Control Rod Drive	Yes[a]
6	SRM Response and Control Rod Sequence	No
7	IRM Performance	No
8	LPRM Calibration	Yes[a]
9	APRM Calibration	Yes[a]
10	Process Computer	No
11	Reactor Core Isolation Cooling	Yes[a]
12	High Pressure Coolant Injection	Yes[a]
13	Selected Process Temperatures	No
14	System Expansion	No
15	Core Power Distribution	No
16	Core Performance	Yes[a]
17	Steam Production	No
18	Flux Response to Rods	No
19	Pressure Regulator	Yes[b]
20	Feedwater System	Yes[b]
21	Bypass Valves	No
22	Main Steam Isolation Valves	No
23	Safety Relief Valves	No
24	Turbine Trip and Generator Load Rejection	No
25	Shutdown From Outside the MCR	No
26	Flow Control	No
27	Recirculation System	No
28	Loss of Turbine Generator and Offsite Power	No
29	Recirculation MG Set Speed Control	Yes[a]

TABLE 1

UNIT 1 FSAR SECTION 13.6 TESTS (SHEET 2 OF 2)

FSAR Test No.	Test	Required for Power Uprate
30	Vibration Measurements	(No)[a]
31	Main TSV Surveillance Test	No
32	Recirculation and Jet Pump Instr. Cal.	No
33	RWC System	No
34	RHR System	No
35	Drywell Atmosphere Cooling System	No
36	Cooling Water Systems	No

a. Credit for existing procedures was used.

b. During the original startup test program, this test was divided into several subtests to satisfy all criteria. Only some of the original subtests were required for power uprate testing.

TABLE 2

TEST CONDITIONS

Test Condition	Uprated Power Level	Uprated MWt
1	$\leq$ 85%	$\leq$ 2174
2	90%	2302
3	95% (Note 1)	2436 (old rated)
4	98%	2506
5	100% (Note 2)	2558

Notes:

1. Original 100% power is equal to 95.2% uprated power.
2. 100% uprated power is equal to 2558 MWt.

TABLE 3

TESTS PERFORMED FOR POWER UPRATE

FSAR Test No.	Test	--------Test Condition-------- < 1	1	2	3	4	5
1	Chemical and Radiochemical				x	x	x
2	Radiation Measurements				x	x	x
4	Shutdown Margin	x					
5	Control Rod Drive	x					
8	LPRM Calibration						x
9	APRM Calibration	x				x	x
11	RCIC (150 psig)	x					
11	RCIC (≥ 920 psig)	x					
11	RCIC Cold Quick Start						x
12	HPCI (165 psig)	x					
12	HPCI (≥ 920 psig)	x					
12	HPCI Cold Quick Start						x
16	Core Performance		x	x	x	x	x
19	Pressure Regulator	x			x		
20	Feedwater System	x			x		
29	Recirc MG Set Speed Control						x
N/A	Thermal Performance				x		x
N/A	Steady-State Data Collection		x	x	x	x	x
N/A	Water Level Measurement		x	x	x	x	x

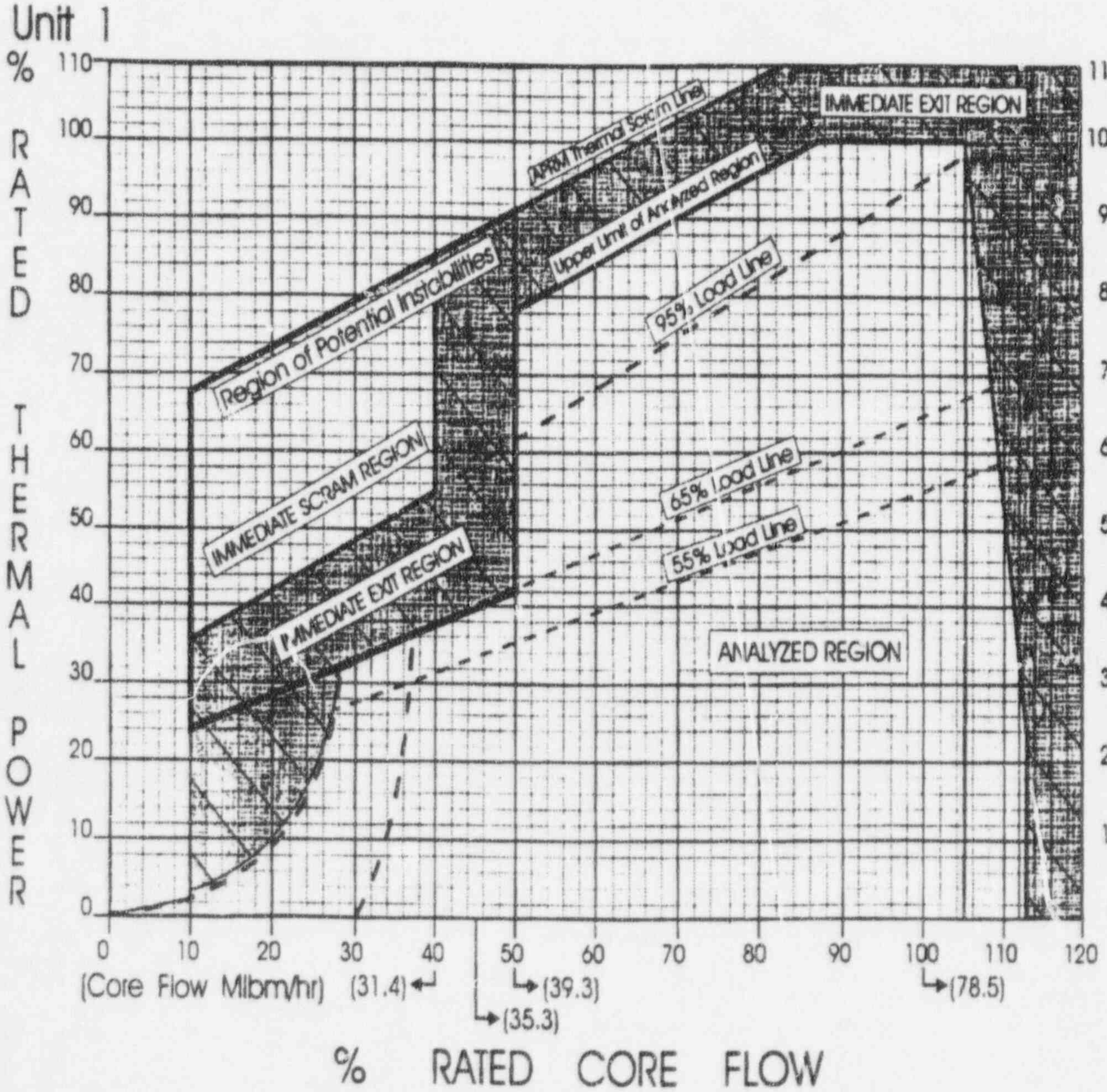

FIGURE 1
POWER/FLOW MAP