ILLINOIS POWER COMPANY

CLINTON POWER STATION

MAIN CONTROL ROOM SIMULATOR

SIMULATOR CERTIFICATION REPORT

March, 1991

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I. INTRODUCTION

This report is submitted in accordance with Title 10, Code of Federal Regulations, Part 55.45, and Regulatory Guide 1.149. The report was written as prescribed by Appendix A of the American National Standards Institute/American Nuclear Society standard, ANSI/ANS 3.5-1985, "Nuclear Power Plant Simulators for Use in Operator Training", for the Clinton Power Station (CPS) Main Control Room Training Simulator.

This report makes reference to two different types of procedures, Nuclear Training Department (NTD) procedures and Simulator Test Procedures (STPs). NTD procedures provide the administrative guidelines that maintain the certification program and update the simulator. These are designated as NTD X.XX procedures in this report. STP procedures have been established to demonstrate the simulator's compliance to certification requirements. These are designated as STP X.XX procedures in this report.

II. SIMULATOR INFORMATION

A. General Information

1. Owner/Operator/Manufacturer

The simulator is owned and operated by Illinois Power Company's (IP) Nuclear Training Department (NTD). The simulator is located at the CPS site training facility.

The simulator was originally manufactured by Singer-Link Corporation, Simulation Systems Division, of Silver Spring, Maryland.

2. Reference Plant/Type/Rating

The simulator is used for training the CPS plant operators. CPS is a 985 MWe/2894 MWt General Electric Boiling Water Reactor (BWR-6), with a Mark III containment and nuclenet control room. The CPS operating license was issued in September 1986 and commercial operation commenced in April 1987.

3. Date Available for Training

The simulator was available for operator training beginning January 5, 1985.

4. Type of Certification Report

This is the initial Simulator Certification Report for the CPS simulator, which is considered a plant-specific simulator for Clinton Power Station.

5. History of the CPS Simulator

Illinois Power Company awarded the contract to construct the simulator in early 1982. The simulator was constructed from plant design drawings. However, the simulator's design data was frozen in April, 1982.

Since CPS was under active construction at the time the simulator was being built, and the simulator's design was frozen, many post-Three Mile Island and other plant design changes were not included on the simulator prior to its delivery to the plant site in late 1984. Consequently, the simulator had already fallen behind the design of the plant,

especially in the areas of Regulatory Guide 1.97 accident instrumentation and human factors related changes to panels as a result of the control room design review effort.

Additionally, a major control panel was added to the primary control area of the control room prior to plant licensing. This panel was not included in the simulator's original scope. This panel provided controls for a new Containment Continuous Purge system and a new Supplemental Drywell Cooling system. As this was a major change to the plant design, a replica of this panel was manufactured and installed in the simulator following its delivery. This new simulator panel was released for training in January, 1987.

In the Fall of 1987, in preparation for the initial certification of the simulator, an intensive effort was begun to update the simulator to better reflect the physical and dynamic fidelity of the actual plant. A Simulator Update Plan was developed and implemented to systematically identify simulator/plant differences, evaluate the differences for training value, and begin making major hardware and software changes to the simulator.

During this program, the core, reactor thermodynamics, and containment thermodynamics models were replaced with advanced simulation models. All other simulation models were overhauled. Hundreds of legend plates and annunciator windows were replaced. Hundreds of switches, lights, meters, and recorders were added, replaced, or removed. Specific tests were developed and conducted to test the changes as they were installed. These specific tests were performed in addition to the certification tests described in Section V of this report.

The three-year update effort was essentially complete in November, 1990, in time to conduct certification testing of the simulator in preparation for this submittal.

B. Control Room/Simulator Comparison

1. Physical Arrangement

The simulator consists of a main area having the primary control panels and backpanels, a separate room having the remote shutdown panel, and adjacent Simulator Support Group working areas (i.e., software engineers office, hardware laboratory, simulator computer room, power supply room, etc.).

The main open area can be described generally as having two areas. The primary control consoles are located in the first area. These primary control consoles include panels P680, P870, P800, P801, P877, and P601. This area is commonly known as the "horseshoe". The arrangement of panels in the "horseshoe" area is identical to the arrangement of the corresponding plant Main Control Room (MCR) panels.

The backpanels are located in the second area. These backpanels include panels P803 and P864 (both visually simulated only), P678, P632, P855, P607, P845, and P669. The panels in this backpanel area exist in the same general area of the simulator as in the plant.

The simulated remote shutdown panel is located in a separate room adjacent to the "horseshoe" area. The simulated remote shutdown panel is essentially identical to the plant panel; however, the actual plant panel is remote from the control room by several minutes walking time.

For comparison, see Figure 1, "Main Control Room Arrangement", and Figure 2, "Simulator Arrangement".

Figure 1 -- Main Control Room Arrangement

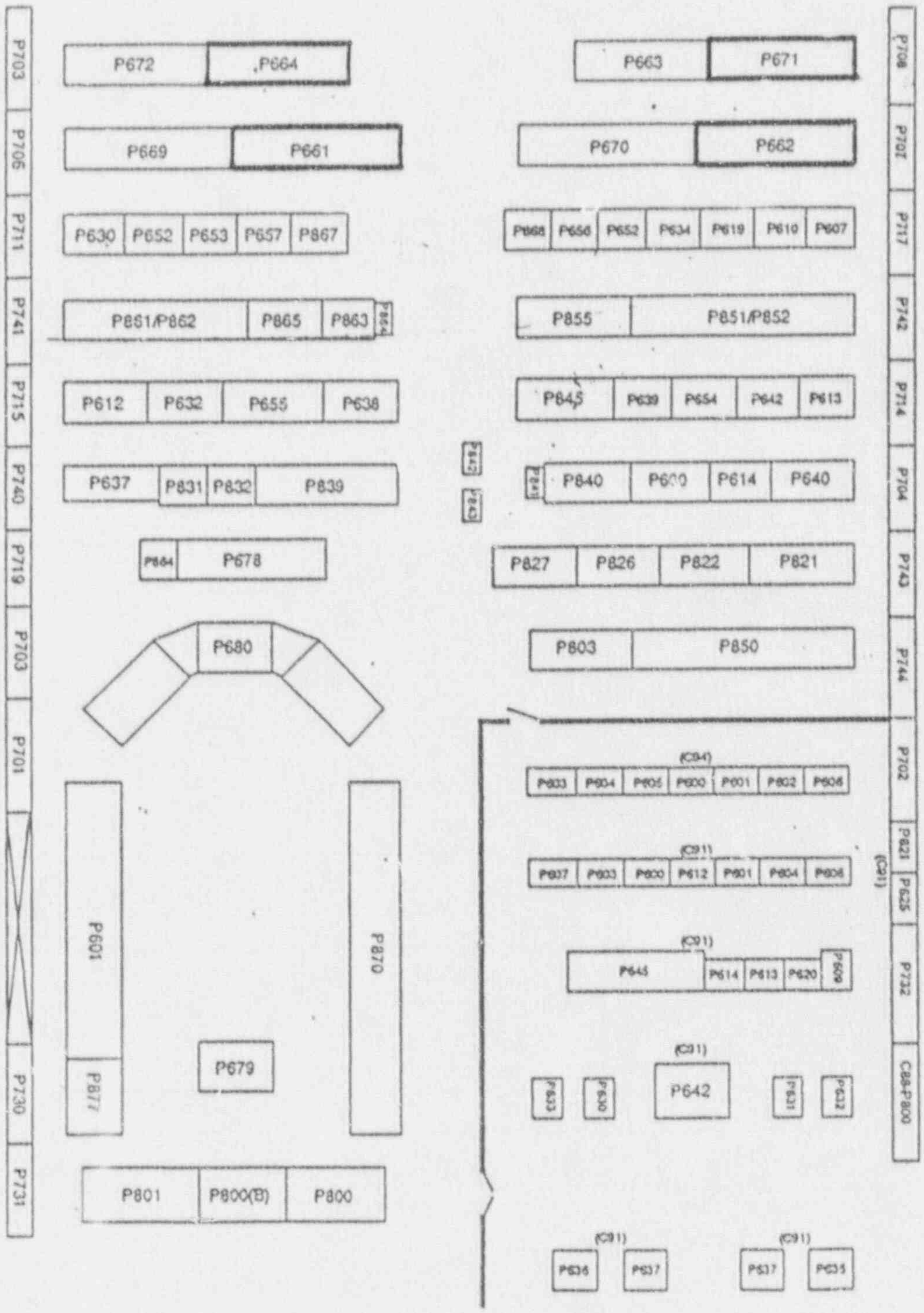
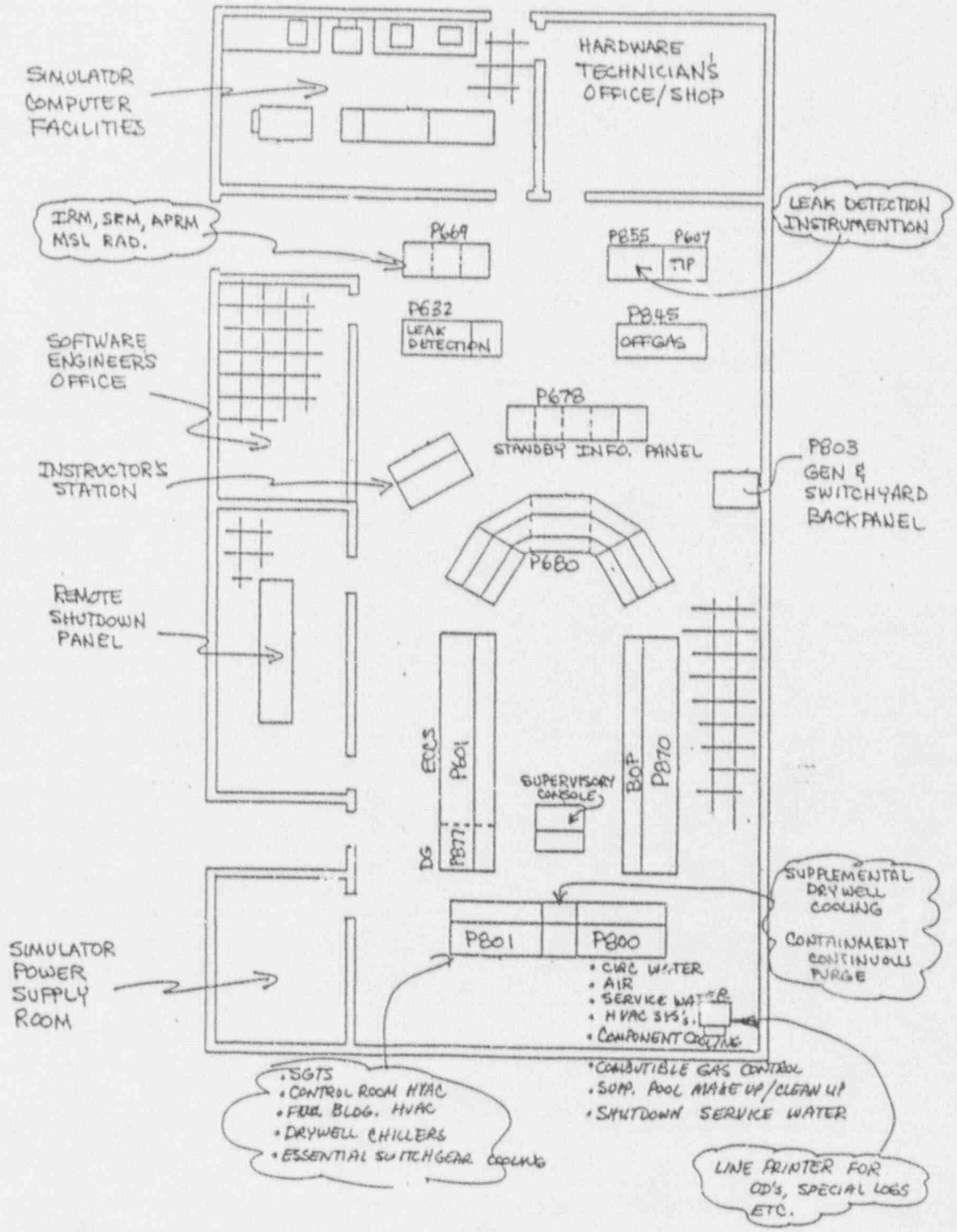


Figure 2 -- Simulator Arrangement



2. Panels/Equipment

The simulator has sufficient panels, controls, instrumentation, alarms, and other man-machine interfaces to enable the student to conduct the normal plant evolutions described in ANSI/ANS 3.5-1985, section 3.1.1, and to respond to malfunctions, including those described in ANSI/ANS 3.5-1985, section 3.1.2, that are appropriate to CPS. The simulator panels were designed to duplicate the size, shape, color, and configuration of the plant control room panels. There are minor deviations in panel dimension and arrangement in the "horseshoe" area. Additionally, the simulator backpanels do not in all cases duplicate the entire plant backpanel. However, these minor deviations do not detract from training.

Simulator panels are essentially identical to the plant panels. The layout of the panels, instrumentation, and controls are verified against drawings and photographs of those of the actual plant. The criteria used in the review include:

-- ensuring that systems and components are located on the same simulator panel as on the plant,

-- ensuring that the relative locations of systems and components on simulator panels are the same as those of plant panels, and

-- ens ing that legend plates, annunciator windows, meter scales, and mimics are identical to that of the actual plant, in size, shape, color, wording, and arrangement.

Equipment and controls on the simulator panels duplicate the corresponding style, type, size, shape, color, and configuration of the functional controls on the plant panels. There may be minor dimensional deviations in the configuration of components and instrumentation, but these deviations are minor and do not detract from training.

Information is displayed on the simulator in the same form and units as in the plant. Meters, recorders, switches, annunciators, controllers, computer interface hardware, and other components and displays that function during normal, abnormal, and emergency evolutions are available to the operator on the simulator.

Simulator instrumentation and controls are verified against plant drawings and photographs.

Nearly all simulator hardware is functionally simulated. However, some hardware components located on simulated panels are only visually simulated. Among these are panel P864, Area Radiation Monitor/Process Radiation Monitor Central Control Terminal (CCT), and panel P803, Switchyard Panel.

3. Systems

Systems controlled from the plant control room necessary to conduct the normal plant evolutions of ANSI/ANS 3.5-1985, section 3.1.1, and respond to the malfunctions of ANSI/ANS 3.5-1985, section 3.1.2, are included on the simulator and simulated to the degree necessary to support operator training and licensing.

It is possible for the operator to perform manipulations on the simulator and observe a response typical of that of the actual plant, including system interactions, and total integrated system response.

The simulator design data base list is maintained up-to-date in accordance with procedure NTD 3.7, Simulator Design Data Base. The process of maintaining the simulator design data base is further discussed in Section III.B. of this certification report.

4. Simulator Environment

The simulator reflects the plant control room ambient environment in areas of lighting, noise, alarm horns and other signals, and communications. Consideration has been given to simulating as much of the control room environment as is reasonable and practical. However, there are subtle differences in noise level, alarm horns, and communication devices which are being evaluated further to ensure the minor differences do not detract from training (see STP 4.01 test summary in Section VI).

Removable computer flooring is used in the simulator area. However, special flooring is used in the actual control room to meet certain fire and separation criteria. The ceiling in the control room backpanel area is a few feet lower than in the simulator. The fact that the simulator flooring and backpanel area ceiling are different does not detract from training. The simulator environment is verified against the plant control room environment by:

-- conducting a review of data related to normal and emergency control room lighting to ensure both are properly simulated including correct illumination levels and lighting fixture locations,

-- conducting a review of data related to control room alarms, signals and incidental noise to ensure that they are simulated to the extent necessary to support operator training and licensing examinations,

-- conducting a review of data related to control room communications systems that would be used for communicating with auxiliary operators during training and licensing examinations, and

-- conducting a review of documentation, including panel drawings and photographs, of operator cuing and informational aids such as background shading, mimics, coding and labeling schemes, and demarcation to ensure compatibility with the plant.

C. Instructor Interface

1. Initial Conditions (ICs)

The simulator exceeds the minimum requirement for storage of twenty (20) initialization conditions. The instructor may choose an initial condition from a set of up to 40 ICs. These ICs provide the instructor with a variety of plant operating conditions.

All present operational ICs include information on critical plant parameters, plant operating history, fission product poison concentration, and time in core life. The ICs also include the configuration and operating status of applicable systems and components.

The IC's are controlled in accordance with procedure NTD 2.19, Simulator Initial Condition Control.

2. Malfunctions

The simulator is capable of simulating, in real time, abnormal and emergency events including malfunctions to demonstrate

inherent plant response and automatic plant control functions. The simulation is capable of continuing until such time that a stable, controllable, and safe condition is attained which can be continued to cold shutdown conditions, or until simulator limits are reached. This means for most malfunctions where it is possible on the plant, the operator is capable of taking action to recover from and/or mitigate the consequences of malfunctions on the simulator.

The simulator supports the instructor's capability to insert and terminate simultaneously, sequentially, or by both methods, those malfunctions that can be expected to occur by design or plant operational experience. These malfunctions include those specified by ANSI/ANS 3.5-1985, section 3.1.2. The simulator is capable of simulating a variety of additional malfunctions associated with electrical, auxiliary, engineered safety feature, reactor coolant, and control and instrumentation systems.

The malfunctions can be introduced into the training scenario without alerting the operator of the pending malfunctions in any manner other than would occur from the actual plant. Table 1, "Simulator Malfunctions", lists all malfunctions included in the scope of simulation in effect at the time of this writing.

The simulator is capable of simulating each category of accident analyzed in the CPS Updated Safety Analysis Report (USAR) that results in observable indications to the operator in the control room for which training is appropriate. Among these catagories of accidents are:

-- Decrease in Core Coolant Temperature,
-- Increase in Reactor Pressure,
-- Decrease in Reactor Core Coolant Flow Rate,
-- Reactivity and Power Distribution Anomalies,
-- Increase in Reactor Coolant Inventory,
-- Decrease in Reactor Coolant Inventory,
-- Radiological Releases, and
-- Anticipated Transient Without Scram.

The Simulator Support Group has the capability to add or change simulator malfunctions as training needs dictate. Many changes have been made to existing malfunctions, and numerous new malfunctions have been added to the simulator since its original delivery. The additions were made to better accomodate training objectives, take advantage of plant operating experience, and to provide malfunctions for systems added to the simulator. The following are examples:

-- Three variations of failure to scram malfunctions have been been added to the simulator. These were added to allow training on Anticipated Transient Without Scram (ATWS) events, and to provide training on new ATWS related systems such as Alternate Rod Insertion (ARI).

-- Several new suppression pool leak malfunctions were added to allow for Emergency Operating Procedure (EOP) training on low suppression pool level actions, and on Secondary Containment Control actions.

-- New malfunctions were added to cause leaks in the Condensate Storage Tank and the Reactor Core Isolation Cooling (RCIC) Storage Tank.

-- A malfunction was added to simulate high winds which, from plant experience, causes problems in operating secondary containment ventilation.

-- New malfunctions related to the Standby Liquid Control (SLC) system were added to allow for better training in this area.

-- Numerous new malfunctions were added to the simulator Containment and Heating, Ventilation, and Air Condition (HVAC) models, including valve binding, fan trips, chiller trips, various system leaks, and a containment hydrogen burn.

The instructor can select up to 15 active or pending simultaneous malfunctions from an inventory of approximately 800 discrete malfunctions at any time during the training exercise. Malfunctions can be initiated instantly by the instructor, or on a timer of up to four hours in one second intervals. Many of the malfunctions have adjustable rates, especially if operator actions are dependant upon the severity of the malfunction.

Simulator malfunctions are tested as described in Section V. The response of the simulator is compared to actual plant response or best estimate information. If the simulator performance must be compared to Updated Safety Analysis Report (USAR) information, and significant discrepancies appear, the discrepancies are resolved using best engineering estimate results.

3. Remote Operators

The simulator provides the instructor the capability to perform the functions of an auxiliary operator, or other operations or functions remote from the control room. Through this capability, the operator is able to interface with activities remote from the control room in the same manner as he would in the actual plant.

Examples of remote functions that the instructor is able to insert while acting in the capacity of an auxiliary operator include changing valve position, operating mechanical equipment, resetting electrical/mechanical trips, and opening or closing electrical breakers. The instructor can also change variable parameters such as electrical grid frequency and voltage, condenser fouling, or lake cooling water temperature. Table 2, "Simulator Remote Functions", lists all remote functions included in the scope of simulation in effect at the time of this writing.

The Simulator Support Group has the capability to add or change simulator remote functions as training needs dictate. As

amples, simulator remote functions have been added to provide local control of plant chill water chillers, operate scores of 480 volt breakers for various ventilation systems, and perform flushing operations.

4. Special Instructor/Training Features

The simulator provides the instructor with the capability to perform simulator control features such as freezing simulation, fast time, slow time, backtrack, and snapshot. A brief description of each simulator control feature is provided as follows:

-- The "Reset/Restart" pushbutton is used to initiate the simulator to some preset condition. This condition may be derived from a snapshot, a backtrack, or one of the fixed set of initial conditions.

-- The "Backtrack" switch enables the instructor to backtrack to a past simulation condition. Existing conditions are automatically recorded at backtrack record time of 1 to 10 minutes, selectable by the instructor. When no backup record time interval is selected, the interval is automatically set at 1 minute. A maximum of 60 condition sets can be recorded.

-- The "Reverse/Forward" pushbutton is used with the backtrack function to control the direction of stepping through the backtrack file. When Backtrack is first activated, the step direction will be reverse. Depressing the "Forward/Reverse" switch will change the step direction to forward.

-- The "Freeze" switch is a momentary contact switch. Each time it is depressed, the simulator condition changes state. When in the Freeze condition, the switch is backlit amber and computations of simulation parameters are frozen at their values at the instant of freeze. When Freeze is removed by depressing the pushbutton a second time, simulation continues from the point where it stopped.

-- The "Switch Check Override" pushbutton is used to override any misaligned panel controls and switch settings when the simulator is initialized.

-- The "Slow Time" pushbutton allows the simulation to occur at one-tenth the normal rate, causing the entire operation to slow down.

-- The "Fast Time" allows the instructor to accelerate the buildup of xenon and/or core decay heat producers. The fast time operation is variable from normal real times up to 100 times the normal real time rate.

-- Depressing the "Master Lamp Check" switch will cause all simulator lamps to illuminate. This pushbutton places the simulator in Freeze and illuminates simulator lamps in sequence until all lamps are on. The lamps will remain on for ten minutes, turn off for five minutes, and then illuminate again. This cycle will continue until the lamp check is complete or the "Master Lamp Check" pushbutton is depressed a second time. To resume normal simulation, the "Freeze" pushbutton is depressed to take the simulator out of Freeze.

The simulator also monitors critical parameters, and alerts the Simulator Instructor when(if) the simulation has gone beyond plant or simulator design limits. The instructor console includes an annunciator that indicates when simulated conditions have progressed to the point where key simulation model assumptions are no longer valid (gross fuel failure, suppression pool temperature exceeding design, etc.). A "Simulation Not Valid" light illuminates when a simulation value exceeds the design parameter, as follows:

-- Suppression pool temperature greater than or equal to 212 degrees,

-- Containment pressure greater than or equal to 29.7 psia,

-- Drywell pressure greater than or equal to 44.7 psig,

-- Fuel Clad temperature exceeds 2200 degrees F,

-- Drywell temperature greater than 330 degrees, or

-- Turbine speed greater than or equal to 2500 rpm.

Through the use of strip chart recorders, special logs, and/or specialized data recording routines used by the Simulator Support Group, it is also possible to obtain hardcopy transient data in the form of plots, printouts, and ASCII files of critical parameters during the normal evolutions described in ANSI/ANS 3.5-1985, section 3.1.1, and the malfunctions described in ANSI/ANS 3.5-1985, section 3.1.2. This monitoring capability provides up to 0.5 second resolution, which is sufficient to determine compliance with applicable testing criteria. This monitoring capability was used to produce the graphs found in Section VI of this certification report.

D. Operating Procedures

The simulator is primarily used as a training device to provide initial and requalification training for the CPS operators. It is also used for operator licensing examinations.

In order to ensure that the extent of simulation is such that the operator takes the same action on the simulator to conduct an evolution as he would in the plant, actual plant operating procedures are used during training, and during certification testing when appropriate.

TABLE 1 -- SIMULATOR MALFUNCTIONS

The following is a listing of simulator malfunctions currently supported by the simulator. The table provide the status of each malfunction as of the date of this certification report, the simulator test procedure number used to test the malfunction, the malfunction identification, and the description of the malfunction. The definition of terms used in the status field are as follows:

Certified -- The malfunction may be used in the operator training program, and has been tested and verified to meet applicable ANSI/ANS 3.5-1985 criteria.

Not Certified -- Malfunction was tested and has failed to meet some aspect of ANSI/ANS 3.5-1985 standard. See the associated test summary for details. A Simulator Problem Report (SPR) has been written. The malfunction is not used for training until the SPR is resolved.

Not Used -- The malfunction is not presently used in the operator training program. No credit is taken for any certification testing performed on these malfunctions. These malfunctions are not considered certified at this time. If one of these malfunctions is needed for operator training in the future, the malfunction will be tested to verify it meets ANSI/ANS 3.5-1985 criteria prior to its use.

Status	STP Used	Designation	Description
Certified	4.03	AN01	Annunciator Actuation
Certified	4.03	AN02	Annunciator Failure to Actuate
Certified	4.03	CR01	Fuel Cladding Leak
Certified	4.03	CU01	RWCU Pump Trip
Certified	4.03	CU02	RWCU Drain Valve Failure, 1G33-F033
Not Used	N/A	CU03	RWCU Demineralizer High Differential Pressure
Certified	4.03	CU04	RWCU Demineralizer Resin Depletion
Certified	4.03	CU05	RWCU System Rupture
Certified	4.03	CU06	RWCU System Isolation

TABLE 1 -- SIMULATOR MALFUNCTIONS

Status	STP Used	Designation	Description
Certified	4.03	CU07	RWCU Non-Regenerative Heat Exchanger Tube Leak
Certified	4.03	CU08	High Conductivity
Certified	4.03	CW01	Circulating Water Pump Trip
Certified	4.03	CW02	Main Condenser Tube Leak
Certified	4.03	CW03	Component Cooling Water Heat Exchanger Tube Failure
Certified	3.11	CW04	Shutdown Service Water Pump Trip
Certified	3.11	CW05	Plant Service Water Pump Trip
Certified	3.13	CW06	Component Cooling Water Pump Trip
Certified	4.03	CW07	Component Cooling Water Temperature Controller Failure
Certified	4.03	CW08	Turbine Building Closed Cooling Water (TBCCW) Pump Trip
Certified	4.03	CW09	TBCCW Temperature Controller Failure
Certified	4.03	CW10	Reactor Recirculation Pump Motor High Temperature
Certified	4.03	DC01	Loss of Display Control System
Certified	4.03	DC02	Loss of Display Generator
Certified	4.03	DC03	Display Control System (DCS) Acquisition Processor Halt
Not Certified	4.03	DC04	DCS/Performance Monitoring System (PMS) Point Failure
Certified	3.05	DG01	Emergency Diesel Generator Failure to Start
Certified	3.05	DG02	Emergency Diesel Generator Trip
Certified	3.03	ED01	345 KV Line Ground Fault
Certified	4.03	ED02	345 KV Line Directional Relaying Trip
Certified	3.07	ED03	6.9 KV Bus Overcurrent Trip
Certified	3.07	ED04	4.16 KV Bus Overcurrent Trip
Certified	3.06	ED05	480 V Bus Overcurrent
Certified	3.04	ED06	Reserve Auxiliary Transformer Lockout
Certified	3.04	ED07	Emergency Reserve Auxiliary Transformer Lockout
Certified	4.03	ED08	Unit Auxiliary Transformer Lockout
Certified	3.08	ED09	120 VAC Bus Overcurrent Trip
Certified	3.08	ED10	125 VDC Bus Overcurrent Trip
Certified	4.03	ED11	Battery Charger Trip
Not Used	N/A	ED12	Inverter Trip
Certified	3.26	EG01	Generator Load Reject
Certified	4.03	EG02	Generator Trip
Not Used	4.03	EG03	Generator Auto Voltage Regulator Trip
Certified	4.03	EG04	Stator Cooling Water Temperature Controller Failure
Certified	4.03	EG05	Stator Cooling Water Pump Trip
Certified	4.03	EG06	Hydrogen Temperature Controller Failure

TABLE 1 -- SIMULATOR MALFUNCTIONS

Status	STP Used	Designation	Description
Certified	4.03	EG07	Generator Hydrogen Leak
Not Used	N/A	EG08	Main Transformer Lockout
Certified	4.03	FW01	Condensate Pump Trip
Certified	4.03	FW02	Condenser Hotwell Makeup Controller Failure
Certified	4.03	FW03	Condenser Hotwell Dump Controller Failure
Certified	4.03	FW04	Condensate Demineralizer Resin Depletion
Certified	4.03	FW05	Condensate Demineralizer High Differential Pressure
Certified	4.03	FW06	Condensate Booster Pump Trip
Certified	4.03	FW07	Loss of Feedwater Heater String
Certified	3.14	FW08	Feedwater Pump Trip
Certified	3.14	FW09	Feedwater Pump Control Signal Failure
Certified	4.03	FW10	Feedwater Pump Low Lube Oil Pressure
Certified	4.03	FW11	Feedwater Controller Failure
Certified	4.03	FW12	Feedwater Flow Sensor Failure
Certified	3.21	FW13	Feedwater Line Rupture Outside of Containment
Certified	4.03	FW14	HP/LP Heater Tube Leak
Certified	4.03	FW15	HP/LP Heater Level Control Failure
Certified	4.03	FW16	Flash Tank Level Control Failure
Certified	4.03	FW17	Reheater Drain Tank/Separator Drain Tank Level Failure
Certified	4.03	FW18	Condensate Storage Tank Leak
Certified	3.18	HP01	HPCS Failure to Automatically Start
Certified	4.03	HP02	HPCS Spurious Automatic Initiation
Certified	4.03	HP03	HPCS Pump Trip
Certified	3.23	HP04	Failure of HPCS Injection Valve 1E22A-F004
Certified	3.23	HP05	Valve 1E22-F301 Shut
Not Used	N/A	HP06	HPCS Pump Suction Failure to Automatically Transfer
Not Used	N/A	HP07	HPCS Line Break
Certified	3.18	HP08	LPCS Failure to Automatically Start
Not Used	N/A	HP09	LPCS Pump Trip
Certified	3.23	HP10	LPCS Injection Valve 1E21-F005 Failure
Not Used	N/A	HP11	LPCS Line Break
Certified	3.23	HP12	Valve 1E21-F309 Shut
Certified	3.01c	HP13	Main Steam Relief Failure
Certified	4.03	HP14	Main Steam Relief Failure to Reseat

TABLE 1 -- SIMULATOR MALFUNCTIONS

Status	STP Used	Designation	Description
Certified	4.03	HP15	LPCS Leak From Suppression Pool Suction Line
Certified	4.03	HP16	HPCS Leak From Suppression Pool Suction Line
Certified	4.03	HP17	HPCS Leak From RCIC Storage Tank Suction Line
Certified	4.03	HP18	Instrument Air Leak at Accumulator
Certified	4.03	HP19	HPCS Valve F012 Fails Open
Certified	4.03	HP20	LPCS Valve F011 Fails Open
Certified	3.02	IA01	Instrument Air System Rupture
Certified	3.02	IA02	Air Compressor Trip
Certified	3.17	LC01	Control Rod Drift Out
Certified	3.17	LC02	Control Rod Stuck
Certified	3.17	LC03	Control Rod Uncoupled
Certified	4.03	LC04	Control Rod Accumulator Trouble
Certified	4.03	LC05	Control Rod Drive Worn Seals
Certified	4.03	LC06	Leaking Scram Discharge Valve
Certified	4.03	LC07	CRD Flow Control Valve Failure
Certified	4.03	LC08	CRD Hydraulic Pump Failure
Certified	4.03	LC09	Scram Discharge Volume Vent Valve C11-F010 Fails as is
Certified	4.03	LC10	Scram Discharge Volume Drain Valve C11-F011 Fails as is
Certified	4.03	LC11	Scram Discharge Volume Vent Valve C11-F180 Fails as is
Certified	4.03	LC12	Scram Discharge Volume Drain Valve C11-F181 Fails as is
Not Used	N/A	LS01	Rod Control & Information System (RC&IS) Channels Disagree
Certified	4.03	LS02	RC&IS Failure (Open Reed Switch)
Certified	4.03	LS03	RC&IS Failure (Closed Reed Switch)
Not Used	N/A	LS04	Rod Control & Information System (RC&IS) Timer Malfunction
Certified	4.03	LS05	Rod Control & Information System (RC&IS) Self Test Failure
Certified	4.03	LS06	Rod Pattern Controller Failure
Certified	3.10	MC01	Condenser Air Inleakage
Certified	4.03	MC02	Steam Jet Air Ejector (SJAE) Steam Supply Failure
Certified	4.03	MS01	Steam Seal Evaporator Pressure Regulator Failure
Certified	4.03	MS02	Main Steam Flow Summer C34-K644 Failure
Not Used	N/A	MS03	Main Steam Valve Packing Failure
Certified	4.03	MS04	Steam Seal Evaporator Shell Level Controller Failure
Certified	4.03	MS05	Steam Line Rupture in the Drywell
Certified	3.20b	MS06	Steam Line Rupture in the Tunnel
Certified	3.20a	MS07	Steam Line Rupture in the Turbine Building
Certified	4.03	MS08	Main Steam Isolation Valve Failure

TABLE 1 -- SIMULATOR MALFUNCTIONS

Status	STP Used	Designation	Description
Certified	4.03	MS09	Turbine Gland Seal Pressure Regulator Failure
Certified	4.03	MS11	Divisional Trip Override
Certified	4.03	NM03	Source Range Monitor (SRM) Channel Erratic Indication
Certified	4.03	NM04	Source Range Monitor (SRM) Channel Inoperative
Certified	4.03	NM05	Source Range Monitor (SRM) Detector Stuck
Certified	4.03	NM06	Local Power Range Monitor (LPRM) Detector Failure
Certified	3.22	NM07	Intermediate Range Monitor (IRM) Channel Upscale
Certified	4.03	NM08	Intermediate Range Monitor (IRM) Channel Erratic Indication
Certified	4.03	NM09	Intermediate Range Monitor (IRM) Channel Inoperative
Certified	4.03	NM10	Intermediate Range Monitor (IRM) Detector Stuck
Certified	3.22	NM11	Intermediate Range Monitor (IRM) Channel Downscale
Certified	3.22	NM12	Average Power Range Monitor (APRM) Channel Downscale
Certified	3.22	NM13	Average Power Range Monitor (APRM) Channel Upscale
Certified	4.03	NM14	Average Power Range Monitor (APRM) Channel Erratic Indication
Certified	4.03	NM15	Average Power Range Monitor (APRM) Channel Inoperative
Certified	4.03	NM16	Average Power Range Monitor (APRM) Flow Converter Failure
Certified	4.03	OG01	Offgas Vault Bypass Valve Failure
Certified	4.03	OG02	Offgas Recombiner Preheater Steam Supply Failure
Certified	4.03	PC01	Plant Chilled Water Chiller Trip
Certified	4.03	PC02	Heating, Ventilation, and Air Conditioning (HVAC) Fan Trip
Certified	4.03	PC03	Loss of Standby Gas Treatment System (SCTS) Flow Control
Certified	4.03	PC04	Loss of Drywell Chiller
Certified	4.03	PC05	Drywell Cooler Leak
Certified	4.03	PC06	Isolation Valve Binding
Certified	4.03	PC07	Hydrogen Burn in Containment
Certified	4.03	PC08	Spent Fuel Pool Leak
Certified	4.03	PC09	Fuel Pool Cooling and Cleanup Pump Trip
Certified	4.03	PC10	Leak in the Suppression Pool Cleanup System
Certified	4.03	PC11	Inadvertent Dump of the Upper Containment Pool
Not Certified	4.03	PC12	Instrument Line Break in the Fuel Building
Certified	4.03	PC13	High Wind Levels
Certified	4.03	PC14	Leak Between the Drywell and the Containment
Certified	4.03	PM01	Loss of the Performance Monitoring System (PMS)
Not Used	N/A	PM02	Performance Monitoring System (PMS) Processor Halt

TABLE 1 -- SIMULATOR MALFUNCTIONS

Status	STP Used	Designation	Description
Certified	3.18	RH01	Residual Heat Removal (RHR) Failure to Automatically Start
Not Used	N/A	RH02	Residual Heat Removal (RHR) Pump Trip
Not Used	N/A	RH03	Residual Heat Removal (RHR) Heat Exchanger Tube Leak
Not Used	N/A	RH06	Low Pressure Coolant Injection (LPCI) Line Break
Certified	3.23	RH07	Low Pressure Coolant Injection (LPCI) Injection Valve Failure
Certified	3.23	RH08	Valve 1E12-F029A, B, or C Shut
Not Used	N/A	RH09	Residual Heat Removal (RHR) Heat Exchanger Bypass Valve Failure
Certified	3.12	RH10	Loss of Shutdown Cooling
Certified	4.03	RH11	Residual Heat Removal (RHR) Suppression Pool A Suction Leak
Certified	4.03	RH12	Residual Heat Removal (RHR) Suppression Pool B Suction Leak
Certified	4.03	RH13	Residual Heat Removal (RHR) Suppression Pool C Suction Leak
Certified	3.18	RI01	Reactor Core Isolation Cooling (RCIC) Automatic Start Failure
Not Used	N/A	RI02	Reactor Core Isolation Cooling (RCIC) Turbine Trip
Certified	3.27	RI03	RCIC Turbine Speed Controller Failure
Certified	4.03	RI04	Reactor Core Isolation Cooling (RCIC) Steam Line Break
Certified	4.03	RI05	Reactor Core Isolation Cooling (RCIC) System Isolation
Not Used	N/A	RI06	RCIC Pump Suction Valve Failure to Automatically Transfer
Certified	4.03	RI07	Loss of Mass from the RCIC Storage Tank
Certified	3.28	RM01	Process Radiation Monitor (PRM) High Radiation
Not Certified	4.03	RM02	Area Radiation Monitor (ARM) High Radiation
Certified	3.18 & 3.24	RP01	Automatic and Manual Scram Failure
Certified	4.03	RP02	Automatic Scram Failure
Certified	4.03	RP03	Partial Scram of Selected Rod Group
Not Used	N/A	RP04	Alternate Rod Insertion/Recirculation Pump (ARI/RPT) Scram
Certified	4.03	RR01	Recirculation Valve Inner Packing Failure
Certified	4.03	RR02	Recirculation Pump Trip
Certified	3.01a & 3.23	RR03	Recirculation Loop Rupture
Certified	4.03	RR04	Recirculation Pump Shaft Break
Certified	4.03	RR05	Recirculation Pump Seizure
Certified	3.01b	RR06	Recirculation Pump Seal Failure
Not Used	N/A	RR07	Recirculation Pump Incorrect Starting Sequence

TABLE 1 -- SIMULATOR MALFUNCTIONS

Status	STP Used	Designation	Description
Certified	4.03	RR08	Recirculation Flow Control Valve (FCV) Failure
Certified	4.03	RR09	Recirculation Pump High Vibration
Not Used	N/A	RR10	Hydraulic Power Unit (HPU) Failure
Certified	3.27	RR11	Recirculation Loop FCV Position Feedback Signal Failure
Certified	4.03	RR12	Recirculation Jet Pump Failure
Certified	4.03	RR13	Feedwater Level Sensor Failure
Certified	4.03	RR14	Instrument Line Reference Leg Rupture Inside the Drywell
Certified	3.16	RR15	Reactor Vessel Level Transmitter Failure
Certified	3.16	RR16	Reactor Vessel Pressure Transmitter Failure
Certified	4.03	RR17	Instrument Line Variable Leg Rupture in the Containment
Not Used	N/A	RR18	Recirculation Controller High Rate of Change Failure
Not Used	N/A	RR19	Flow Control Valve (FCV) Valve Position Step
Certified	4.03	SL01	Standby Liquid Control (SLC) Motor Overloads Fail Open
Certified	4.03	SL02	Failure of the Squib Continuity Relay Meter
Certified	4.03	SL03	Failure of the Squib Firing Circuit to Actuate
Certified	3.19 & 3.24	TC01	Turbine Trip
Certified	3.25	TC02	Turbine Bypass Valve Failure
Certified	3.16	TC03	Turbine Control Valve Failure
Certified	3.09	TC04	Turbine Stop Valve Failure
Not Used	N/A	TC05	Combined Intermediate Valve Failure
Certified	4.03	TC06	Loss of Electrohydraulic Control (EHC) Hydraulics (Turbine)
Certified	3.25	TC07	Loss of EHC Hydraulics (Bypass Valves)
Not Used	N/A	TC08	Load Demand Failure (High/Low)
Certified	4.03	TC09	Pressure Regulator Failure (High/Low)
Certified	4.03	TC10	Pressure Regulator Oscillations
Not Used	N/A	TC11	Loss of Speed Feedback Signal(s)
Certified	4.03	TU01	Turbine-Generator Bearing Oil Low Pressure
Certified	4.03	TU02	Turbine-Generator Lube Oil Temperature Controller Failure
Certified	4.03	TU03	Turbine-Generator Bearing High Vibration
Not Used	N/A	TU04	Turbine-Generator Bearing High Temperature
Certified	4.03	TU05	Turning Gear Oil Pump Failure
Not Used	N/A	TU06	Reactor Feedwater Pump Turbine (RFPT) Aux Oil Pump Failure
Not Used	N/A	TU07	Turbine Exhaust Hood Spray Valve Failure
Certified	4.03	TU08	Hydrogen Seal Oil Pump Trip
Not Used	N/A	TU09	Seal Oil Differential Pressure Regulator Valve Failure

TABLE 2 - SIMULATOR REMOTE FUNCTIONS

CU101	RWCU Filter Demineralization A	In/Out
CU102	RWCU Filter Demineralization B	In/Out
CU103	RWCU Pump A Status	Unisolate/Isolate
CU104	RWCU Pump B Status	Unisolate/Isolate
CU105	RWCU Pump C Status	Unisolate/Isolate
CU106	In Service RWCU Heat Exchangers	Train A/Train B
CW101	CCW Supply Valves to Condenser Vacuum Pumps	Open/Shut
CW102	CCW Heat Exchanger A Status	Out/In
CW103	CCW Heat Exchanger B Status	Out/In
CW104	TBCCW Heat Exchanger Status	Out/In
CW105	CCW Storage Tank Drain Valve	Shut/Open
CW106	TBCCW Temperature Controller Valve Bypass	
CW107	TBCCW Supply Valves to Condenser Vacuum Pumps	Shut/Open
CW201	Condenser Tube Fouling (% normal flow)	
CW202	Lake Water Temperature	
DC101	Initiate DCS With Power Loss Greater than 10 minutes	Auto/Init
DG101	Reset Diesel Generator Lockout	Normal/Reset
ED101	Operate 125VDC Panel 1E to 1F tie breaker	Open/Shut
ED102	Switchyard Disconnect Switch 4501	Shut/Open
ED103	Switchyard Disconnect Switch 4503	Shut/Open
ED104	Switchyard Disconnect Switch 4504	Shut/Open
ED105	Switchyard Disconnect Switch 4505	Shut/Open
ED106	Switchyard Disconnect Switch 4507	Shut/Open
ED107	Switchyard Disconnect Switch 4509	Shut/Open
ED108	Switchyard Disconnect Switch 4511	Shut/Open
ED109	Switchyard Disconnect Switch 4517	Shut/Open
ED110	Switchyard Disconnect Switch 4519	Shut/Open
ED111	Switchyard Disconnect Switch 4520	Shut/Open
ED112	Switchyard Disconnect Switch 4523	Shut/Open
ED113	Switchyard Disconnect Switch 4525	Shut/Open
ED114	Auxiliary Power Disconnect Switch ET4	Shut/Open
ED115	Auxiliary Power Disconnect Switch ET14	Shut/Open
ED116	Auxiliary Power Disconnect Switch RT14	Shut/Open
ED117	Auxiliary Power Disconnect Switch RT16	Shut/Open
ED118	Reset of Any Shunt Trip	Normal/Reset
ED119	Switchyard Disconnect Switch 4513	Shut/Open
ED120	Switchyard Disconnect Switch 4521	Shut/Open
ED201	Grid Frequency (HZ)	

TABLE 2 - SIMULATOR REMOTE FUNCTIONS

ED202	Grid Voltage (KV)	
EG101	Generator H2 Pressure Regulator Setpoint (PSIG)	
EG102	Reset Main Generator and Transformer	Normal/Reset
EG103	Isolated Phase Bus Duct Cooling Fan A	Off/On
EG104	Isolated Phase Bus Duct Cooling Fan B	Off/On
EG105	Reset Main Generator Electrical Fault	Off/Reset
FW101	Condensate Pump 1A Discharge Valve	Close/Open
FW102	Condensate Pump 1B Discharge Valve	Close/Open
FW103	Condensate Pump 1C Discharge Valve	Close/Open
FW104	Condensate Pump 1D Discharge Valve	Close/Open
FW105	Condensate Demineralizer A Inlet & Outlet Valves	Close/Open
FW106	Condensate Demineralizer B Inlet & Outlet Valves	Close/Open
FW107	Condensate Demineralizer C Inlet & Outlet Valves	Close/Open
FW108	Condensate Demineralizer D Inlet & Outlet Valves	Close/Open
FW109	Condensate Demineralizer E Inlet & Outlet Valves	Close/Open
FW110	Condensate Demineralizer F Inlet & Outlet Valves	Close/Open
FW111	Condensate Demineralizer G Inlet & Outlet Valves	Close/Open
FW112	Condensate Demineralizer H Inlet & Outlet Valves	Close/Open
FW113	Condensate Demineralizer J Inlet & Outlet Valves	Close/Open
FW114	Moisture Separator Reheater 1A Drain Valve	Normal/Shut
FW115	Moisture Separator Reheater 1B Drain Valve	Normal/Shut
FW116	Feedwater Heater 6A Drain Valve	Normal/Shut
FW117	Feedwater Heater 6B Drain Valve	Normal/Shut
FW118	Feedwater Heater 5A Drain Valve	Normal/Shut
FW119	Feedwater Heater 5B Drain Valve	Normal/Shut
FW120	Feedwater Heater 4A Drain Valve	Normal/Shut
FW121	Feedwater Heater 4B Drain Valve	Normal/Shut
FW122	Feedwater Heater 3A Drain Valve	Normal/Shut
FW123	Feedwater Heater 3B Drain Valve	Normal/Shut
FW124	Feedwater Heater 2A Drain Valve	Normal/Shut
FW125	Feedwater Heater 2B Drain Valve	Normal/Shut
FW126	Feedwater Heater 1A Drain Valve	Normal/Shut
FW127	Feedwater Heater 1B Drain Valve	Normal/Shut
FW128	Condensate Booster Pump Discharge Valve 1A	Shut/Open
FW129	Condensate Booster Pump Discharge Valve 1B	Shut/Open
FW130	Condensate Booster Pump Discharge Valve 1C	Shut/Open
FW131	Condensate Booster Pump Discharge Valve 1D	Shut/Open
FW132	Refill the Demineralized Water Storage Tank	Off/On
FW133	A TDRFP Minimum Flow Valve	Throt/Modulate

FW134	B TDRFP Minimum Flow Valve	Throt/Modulate
FW135	C MDRFP Minimum Flow Valve	Throt/Modulate
FW136	RFP Suction Header Pressure	Auto/Override
HP101	Operate SRV "B" Solenoid 1B21F041A	Deenergize/Energize
HP102	Operate SRV "B" Solenoid 1B21F047A	Deenergize/Energize
HP103	Operate SRV "B" Solenoid 1B21F041B	Deenergize/Energize
HP104	Operate SRV "B" Solenoid 1B21F047B	Deenergize/Energize
HP105	Operate SRV "B" Solenoid 1B21F051B	Deenergize/Energize
HP106	Operate SRV "B" Solenoid 1B21F041F	Deenergize/Energize
HP107	Operate SRV "B" Solenoid 1B21F047F	Deenergize/Energize
HP108	Operate SRV "B" Solenoid 1B21F041C	Deenergize/Energize
HP109	Operate SRV "B" Solenoid 1B21F047C	Deenergize/Energize
HP110	Operate SRV "B" Solenoid 1B21F051C	Deenergize/Energize
HP111	Operate SRV "B" Solenoid 1B21F041G	Deenergize/Energize
HP112	Operate SRV "B" Solenoid 1B21F051G	Deenergize/Energize
HP113	Operate SRV "B" Solenoid 1B21F041L	Deenergize/Energize
HP114	Operate SRV "B" Solenoid 1B21F041D	Deenergize/Energize
HP115	Operate SRV "B" Solenoid 1B21F047D	Deenergize/Energize
HP116	Operate SRV "B" Solenoid 1B21F051D	Deenergize/Energize
HP117	Deenergize SRV Solenoids	Deenergize/Energize
IA101	Restore SA Header	Normal/Restore
IA102	Restore IA Radwaste Building Header	Normal/Restore
IA103	Restore IA Control Building Header	Normal/Restore
IA104	Restore SA Compressor 0SA01C Seal Pressure	Normal/Restore
IA105	Restore SA Compressor 1SA01C Seal Pressure	Normal/Restore
IA106	Restore SA Compressor 2SA01C Seal Pressure	Normal/Reset
IA107	Reset IA Dryer Trouble Annunciators	Normal/Reset
LC101	CRD Hydraulics Flow Control Valve Select	B/A
LC102	CRD Hydraulics Supply To Recirc Pump A Seals	Shut/Open
LC103	CRD Hydraulics Supply To Recirc Pump B Seals	Shut/Open
LC104	CRD Hydraulics Pump A Discharge Valve 1C11F014A	Shut/Open
LC105	CRD Hydraulics Pump B Discharge Valve 1C11F014B	Shut/Open
LC106	Open Charging Water Header Isolation Valve C11-F034	Shut/Open
LS101	RGDS Rod Drive Bypass - Rod	Normal/Bypass
LS102	Control Rod Position Bypass - Rod	Normal/Bypass
LS103	Control Rod Position Bypass - Rod	Normal/Bypass
LS104	Control Rod Position Bypass - Rod	Normal/Bypass
LS105	Control Rod Position Bypass - Rod	Normal/Bypass

TABLE 2 - SIMULATOR REMOTE FUNCTIONS

LS106	Control Rod Position Bypass - Rod	Normal/Bypass
LS107	Control Rod Position Bypass - Rod	Normal/Bypass
LS108	Control Rod Position Bypass - Rod	Normal/Bypass
LS109	Control Rod Position Bypass - Rod	Normal/Bypass
MC101	Vacuum Pump X-Connect Valve 0CA005	Shut/Open
MS101	Moisture Separator Reheater Steam Pressure Control Valve	
MS102	Auxiliary Boiler Status	Off/On
MS103	Actuate/Secure Inboard MSIV-LCS	Secure/Actuate
MS104	NS4 Division 1 Sensor Channel Bypass	Off/Bypass
MS105	NS4 Division 2 Sensor Channel Bypass	Off/Bypass
MS106	NS4 Division 3 Sensor Channel Bypass	Off/Bypass
MS107	NS4 Division 4 Sensor Channel Bypass	Off/Bypass
MS108	Actuate/Secure Outboard MSIV-LCS	Secure/Actuate
MS109	Main Steam Supply to Offgas Recombiner A 1B21F411A	Shut/Open
MS110	Main Steam Supply to Offgas Recombiner B 1B21F411B	Shut/Open
MS111	RPV Bottom Head Drain Valve B21-F001	Energize/Deenergize
NM101	APRM A Gain Adjustment Factor	
NM102	APRM B Gain Adjustment Factor	
NM103	APRM C Gain Adjustment Factor	
NM104	APRM D Gain Adjustment Factor	
NM105	Bypass LPRM XX-YYZ	Normal/Bypass
NM106	Bypass LPRM XX-YYZ	Normal/Bypass
NM107	Bypass LPRM XX-YYZ	Normal/Bypass
NM108	Bypass LPRM XX-YYZ	Normal/Bypass
NM109	Bypass LPRM XX-YYZ	Normal/Bypass
NM110	Bypass LPRM XX-YYZ	Normal/Bypass
NM111	Bypass LPRM XX-YYZ	Normal/Bypass
NM112	Bypass LPRM XX-YYZ	Normal/Bypass
NM113	Bypass LPRM XX-YYZ	Normal/Bypass
NM114	Bypass LPRM XX-YYZ	Normal/Bypass
NM115	Bypass LPRM XX-YYZ	Normal/Bypass
NM116	Bypass LPRM XX-YYZ	Normal/Bypass
NM117	Bypass LPRM XX-YYZ	Normal/Bypass
NM118	Bypass LPRM XX-YYZ	Normal/Bypass
NM119	Bypass LPRM XX-YYZ	Normal/Bypass
NM120	Bypass LPRM XX-YYZ	Normal/Bypass
NM121	Bypass LPRM XX-YYZ	Normal/Bypass
NM122	Bypass LPRM XX-YYZ	Normal/Bypass
NM123	Bypass LPRM XX-YYZ	Normal/Bypass
NM124	Bypass LPRM XX-YYZ	Normal/Bypass

TABLE 2 - SIMULATOR REMOTE FUNCTIONS

NM125	Bypass LPRM XX-YYZ	Normal/Bypass
OG101	Air Purge to Offgas Recombiner A 1N66F004A	Shut/Open
OG102	Air Purge to Offgas Recombiner B 1N66F004B	Shut/Open
OG103	In Service Regeneration Train	Train A/Train B
OG104	Offgas System Auto Sequence Status	Startup/Normal
PC101	Fuel Building HVAC Supply Fan A	Off/On
PC102	Fuel Building HVAC Supply Fan B	Off/On
PC103	Control Room HVAC Chiller A	Off/On
PC104	Control Room HVAC Chiller B	Off/On
PC105	Drywell Chiller A	Off/On
PC106	Drywell Chiller B	Off/On
PC107	Chill Water Chiller A	Off/On
PC108	Chill Water Chiller B	Off/On
PC109	Chill Water Chiller C	Off/On
PC110	Chill Water Chiller D	Off/On
PC111	Chill Water Chiller E	Off/On
PC113	RHR FPC & CU ASSIST MAN VALVE L/U	NO/YES
PC114	Fuel Building HVAC Exhaust Fan A	Off/On
PC115	Fuel Building HVAC Exhaust Fan B	Off/On
PC116	Auxiliary Building HVAC Supply/Exhaust Fan A	Off/On
PC117	Auxiliary Building HVAC Supply/Exhaust Fan B	Off/On
PC118	Enable/Disable Suppression Pool Makeup Dump Valves Div. 1	Enable/Disable
PC119	Enable/disable Suppression Pool Makeup Dump Valves Div. 2	Enable/Disable
PC120	Fuel Pool Heat Load	
PC121	Turbine Building HVAC Supply/Exhaust Fan A	Off/On
PC122	Turbine Building HVAC Supply/Exhaust Fan B	Off/On
PC123	Chill Water Pump A MCR/Local	MCR/Local
PC124	Chill Water Pump B MCR/Local	MCR/Local
PC125	Chill Water Pump C MCR/Local	MCR/Local
PC126	Chill Water Pump D MCR/Local	MCR/Local
PC127	Chill Water Pump E MCR/Local	MCR/Local
PC128	FC Transfer Suppression Pool to Condensate Storage Tank	Close/Open
RH101	RHR Water Leg Valve 1E12F085B	Open/Shut
RH102	RHR Loop B Flush Valve 1E12F044B	Shut/Open
RH103	RHR Loop A Flush	Normal/Flush
RH104	E12-F008 Supply Breaker	Shut/Open
RI101	RCIC Turbine Mechanical Reset	Normal/Reset
RI102	RCIC Water Leg Pump Discharge Valve E51-F062	Shut/Open
RP101	SRM Shorting Link Status	Remove/Install

TABLE 2 - SIMULATOR REMOTE FUNCTIONS

RP102	Position NSPS Scram Breakers	Shut/Open
RR101	Reset Recirculation Pump A Lockout Relay	Normal/Reset
RR102	Reset Recirculation Pump B Lockout Relay	Normal/Reset
RR103	Hydraulic Power Unit (HPU) A Status	Normal/Startup
RR104	Hydraulic Power Unit (HPU) B Status	Normal/Startup
RR105	Flow Control Valve +/- Step Change	Increase/Decrease
TC101	Remote Turbine Load Set Motor Control	
SL101	Inject To Lower Plenum Valve C41F008	Shut/Open

III. SIMULATOR DESIGN DATA

The simulator was originally constructed and is updated based on actual or predicted plant configuration and performance.

Simulator configuration is the process of controlling the hardware and software design of the simulator. Simulator configuration documents include such items as simulator construction drawings, model software source code, Malfunctions Cause and Effects Manual, and the Simulator Design Data Base List. These documents are maintained up-to-date as simulator changes are made.

A. Simulator Initial Design Data

The simulator design data consists of available plant data which form the basis for the existing simulator design. Various types of simulator design data exist. Among these are plant electrical and mechanical drawings, plant startup test procedure data, system descriptions, vendor manuals, strip charts and other documentation of actual plant performance,

plant design change packages, plant procedures, instrument data sheets, Licensee Event Reports (LERs), Updated Safety Analysis Report (USAR), RETRAN Analyses, etc.

The specific design documents used to construct and/or modify the simulator are listed on the Simulator Design Data Base List, which is maintained up-to-date as simulator changes are made. Copies of many of the documents listed on the Simulator Design Data Base List are available in the Simulator Support Group files. Other documents are easily obtainable through the plant's document control system.

B. <u>Simulator Update Design Data</u>

The simulator update design data consists of plant design change packages/documents.

Before a plant design change is made, a design change package/document is prepared. In accordance with plant procedures, the plant design change package/document is reviewed by the Simulator Support Group for simulator impact and by the Operations Training Group for training impact.

If the plant design change will result in a corresponding simulator change, a Simulator Problem Report (SPR) is written identifying the needed change to the simulator. A listing of pending update design changes may be obtained by querying the open SPR database.

Training priorities usually dictate when the simulator change will be made. For changes with relatively high training value, normally the simulator is changed before the plant design change is implemented. Simulator changes that are not implemented before the plant design change are made before the end of the calendar year following implementation on the plant.

In the process of implementing the change on the simulator, the plant design change package/document is added to the Simulator Design Data Base List.

IV. SIMULATOR PROGRAM ADMINISTRATION

The purpose of this section is to describe the administration of the simulator program. The program is managed by a capable Simulator Support Group and involves impact assessment, problem identification and correction, simulator changes, and simulator design document control. These aspects of the program are described below. Other major aspects of the program are simulator design data which has been discussed in section III, and simulator testing which is discussed in section V of this report.

A. Simulator Support Group

Illinois Power Company maintains a Simulator Support Group of five full-time professional employees, and a full-time hardware maintenance contractor. Additional utility and contractor personnel are used when necessary. The Simulator Support Group reports directly to the Manager-Nuclear Training.

The Simulator Support Group staff consists of a supervisor, two simulator software engineers, a simulator test coordinator, and a simulator configuration coordinator, in addition to the

hardware maintenance contractor. Testing assistance is provided by other licensed personnel when needed (e.g. operations shift crew members, experienced training instructors, etc.).

B. <u>Impact Assessment</u>

Procedure NTD 3.18, Simulator Impact Assessment, provides instructions on performing two types of impact assessment related to the simulator.

The first type of assessment is required by the overall plant design change control process used at CPS. When a design change is proposed for the actual plant, the change is evaluated by the Simulator Support Group to determine the extent of impact on the simulator, if any. Such impacts may involve changes to simulator hardware or changes in system design which would affect the simulator software models. This type of simulator impact assessment is also discussed in section III.B.

The second type of assessment is known as a training impact assessment. Differences between the plant and the simulator can be evaluated to determine the relative degree of training impact associated with a simulator/plant difference. Training

impact assessments may be used to provide information on the relative importance of making a simulator change to correct a difference, or the priority by which a difference will be addressed.

The training impact assessment process was modeled after methodolgy described in the Electric Power Research Institute publication entitled, "Evaluation of Simulator Discrepancies on the Basis of Operational Impact", EPRI NP-5746, published in April, 1988. Several factors considered when performing the assessment are:

-- applicability to current industry regulations and guidelines,

-- criticality of operator tasks associated with the discrepancy,

-- obviousness of the discrepancy to the least experienced crew member, and

-- potential for plant recovery from an operational error.

These factors are weighed together to arrive at a numerical value for training impact. The numerical assessment can range from 1 (for differences that are regarded as having extremely high training impact), to 8 (for differences that are regarded as having extremely low amount of training impact). Some assessments may result in a numerical value of 0 which indicates that no measureable training impact exists.

C. <u>Simulator Problem Reports</u>

Procedure NTD 3.8, Simulator Problem Reports and Repair Requests, provides instructions for documenting and tracking the resolution of differences that exist or develop between the simulator and the plant. Simulator Problem Reports (SPRs) may be written by Simulator Support Group personnel, simulator training instructors, or students participating in the initial licensing or requalification training programs. An SPR is used to document an observed simulator performance problem. The originator of the SPR must provide a description of the problem, the status of the simulator when the problem occurred, and references to actual plant documentation which substantiate that the problem exists.

Once an SPR is originated, pertinent data is entered into and tracked by a computerized tracking system. Hard copy information is also maintained in the event the computerized system becomes inoperative. The SPR is then forwarded to the supervisor where it is reviewed, investigated if necessary, and dispositioned.

An SPR may be handled in one of three ways. It may be rejected if the problem is a duplicate of an earlier SPR, the problem could not be recreated, or the problem is not substantiated by actual plant design data. The SPR may be handled as a change needed to bring the simulator up to the current plant design, in which case the change is scheduled and made based, generally, on a training impact assessment. The SPR may be handled as a simulator change associated with a pending plant design change, in which case the implementation of the simulator change is coordinated along with the associated plant design change.

Unless the SPR is rejected, a change to the simulator will normally result. The supervisor has two options for bringing about the simulator change as discussed in the next section.

D. Simulator Work Orders

Procedure NTD 3.10, Simulator Work Orders, provides instructions on making changes to the simulator.

Simulator changes are authorized and documented using either a Simulator Problem Report (SPR) or a Simulator Work Order (SWO).

If the change needed to resolve an SPR is relatively simple to make, the change is implemented and documented on the SPR. If the change needed to resolve an SPR is complex, a Software Work Order is initiated. The SWO is associated with an SPR and shares the same tracking number. Additionally, more than one SPR can be addressed by the same SWO.

The SWO form allows the initiator to provide detailed information related to the simulator modification. This information includes:

-- Preparing a detailed synopsis of the work to be completed by the SWO including hardware, software, and testing requirements,

-- Providing specific hardware requirements, as applicable, including panel, computer, and interface hardware,

-- Listing all documentation impacted as a result of changes, including the Malfunction Cause & Effects Manual, Simulator Design Data Base List, Simulator Drawings, Simulator Vendor Manuals, etc.,

-- Providing copies of software changes including annotated "before" and "after" coding sheets,

-- Providing a description of any affected Simulator Test Procedure including marked-up change pages, and

-- Providing a Simulator Verification and Validation Test for the simulator modification including acceptance criteria, test steps, and test results.

E. Simulator Design Document Control

Procedure TD 3.15, Simulator Design Document Control, provides instructions for closing out simulator change packages and ensuring that simulator design documentation is maintained up-to-date. The Simulator Design Document Control process is a method by which simulator documentation is reviewed and controlled to ensure that it accurately reflects the simulator configuration.

When a SWO or SPR package is ready for closure, the Simulator Configuration Coordinator will take the actions necessary for ensuring that all simulator configuration documents are updated.

V. SIMULATOR TESTS

The purpose of the Simulator Test Program is to verify that the performance of the simulator is in full compliance with the requirements of 10 CFR 55.45(b) and follows the criteria provided in ANSI/ANS 3.5-1985 as endorsed by Regulatory Guide 1.149. All testing conducted on the simulator has been documented and copies of the procedures are available for review. A summary of these certification tests and results are provided in this report.

The simulator test program is divided into five parts. Each part is further described later in this section of the certification report:

-- Steady State Tests
-- Normal Plant Evolution Tests
-- Malfunction Tests
-- Miscellaneous Tests
-- Benchmark Transient Tests

The performance of the simulator was established by preparing simulator tests, conducting the tests, and comparing the simulator's performance against the response expected from the

actual plant (as represented in simulator design data) within the requirements of the applicable acceptance criteria outined in Section V, Part A.

The following paragraphs describe the acceptance criteria used in testing, the different catagories of simulator tests, and the testing schedule planned for the next four year period until recertification.

A. Acceptance Criteria

The acceptance criteria specified in ANSI/ANS 3.5-1985, section 4.0, are used in the simulator test program. The type of simulator test determines the acceptance criteria that will be used for that type of test. In most cases, the acceptance criteria used are discussed in the sections of this report that discuss the specific type of test. However, several acceptance criteria apply uniformly to both Normal Plant Evolution Tests and Malfunction tests. These acceptance criteria are as follows:

-- Where appropriate, simulator test acceptance criteria are the same as plant startup test acceptance criteria,

-- Observable changes in the parameters correspond in the direction to those expected from the best estimate for the simulated transient and do not violate the physical laws of nature,

-- The simulator shall not fail to cause an alarm or automatic action if the actual plant would have caused an alarm or automatic action, and conversely, the simulator shall not cause an alarm or automatic action if the actual plant does not cause an alarm or automatic action.

B. Steady State Tests

Steady State Tests verify the simulator's ability to correctly represent the steady state response of the plant at different power levels for which plant data is available. Plant data was collected at approximately 50%, 75% and 100% rated thermal power and compared to simulator response. For these tests, the simulator instrument error is no greater than that of the comparable meter, transducer, and related instrument system of the actual plant.

Simulator Test Procedure STP 1.01, Principal Mass and Energy Balances, is a test which demonstrates that principal mass and energy balances are satisified. This test is conducted at three points over the power range. The first part of the test confirms that the mass flows which enter the primary system balance those mass flows that exit the primary system. The second part of the test confirms that the energy added to the primary system balances the energy leaving the primary system.

Procedure STP 1.02, Simulator Stability, is a test which demonstrates that the simulator computer values for steady state, full power operation, in a normal plant line up, are stable and do not vary by more than +/- 2% from their initial values over an hour.

Procedures STP 1.04 through STP 1.06, Steady State Performance, are tests conducted at three steady state power levels. The acceptance criteria requires that critical parameters, including those listed in ANSI/ANS 3.5-1985, section 4.1(3), match corresponding plant parameters within 2%, and that non-critical parameters, as discussed in ANSI/ANS 3.5-1985, section 4.1(4), match corresponding plant parameters within 10%. There are Simulator Operating Test (SOT) computer

programs used by the Simulator Support Group to collect simulator data for these steady state tests. The programs compare simulator performance against plant performance and flag any critical or non-critical parameters which fall outside the acceptance criteria.

C. Normal Plant Evolution Tests

The Normal Plant Evolution Tests verify the simulator's ability to conduct plant operations in a continuous manner, using plant procedure steps, without any requirements for math model or IC changes. These tests demonstrate the simulator's ability to calculate system parameters corresponding to specific plant operating conditions, display those parameters on the appropriate simulator instrumentation, and provide the same alarm and protective system response. The Normal Plant Evolution Tests are outlined in procedures STP 2.01 through STP 2.09, and are listed in Table 3, "Simulator Test Procedures".

D. Malfunction Tests

The Malfunction Tests verify the simulator's ability to conduct in real time abnormal, off-normal, and emergency events in

order to demonstrate inherent plant response and automatic plant control functions. The tests also verify the simulator's ability to adjust the severity of a malfunction to better represent the potential plant conditions, including adjusting the severity to reflect functional operator actions. The Malfunction Tests for those malfunctions listed in ANS/ANSI 3.5-1985, section 3.1.2, are outlined in procedures STP 3.01a through STP 3.28, and are listed in Table 3, "Simulator Test Procedures".

E. Miscellaneous Tests

Miscellaneous simulator tests have been developed to demonstrate the simulator's capability to perform other ANSI/ANS 3.5-1985 requirements. Specifically, these tests have been designed to demonstrate the requirements of (1) ANSI/ANS 3.5-1985, section 3.2, for Simulator Environment, (2) ANSI/ANS 3.5-1985, section 3.3, for Simulator Training Capabilities, (3) the testing of additional malfunctions not specifically listed in ANS/ANSI 3.5-1985, section 3.1.2, and (4) ANSI/ANS 3.5-1985 requirements for Computer Real Time capabilities.

STP 4.01, Simulator Physical Fidelity/Human Factors Verification Criteria, is used to verify simulator

compatibility in the areas of panel simulation, instrument and control configuration, and also ambient environment. These areas must generally indicate that there are no significant differences between the plant control room and the simulator. Deviations may exist but they must not detract from an NRC examiner's ability to evaluate a candidate's performance during an operator licensing examination. STP 4.01 also provides the means for documenting all identified differences.

STP 4.02, Simulator Instructor Station Capabilities, is used to verify that the instructor station can support simulator training with respect to the following capabilities as required by ANS/ANSI 3.5-1985:

-- produce a variety of initial conditions (ICs) and malfunctions,

-- freeze the simulation,

-- allow the instructor to perform the actions of auxiliary or remote operators,

-- detect or determine when simulation has gone beyond plant or simulator design limits, and

-- monitor and record critical activities.

STP 4.03, Malfunction Performance Test, is used to demonstrate the satisfactory response of the simulator following the activation of certain malfunctions. These tests are intended

to meet the requirements of ANSI/ANS 3.5-1985, section 4.2.2, for those simulator malfunctions not specifically listed in section 3.1.2 of the standard, or tested by a Malfunction Test procedure as described in STP-3.01a through STP-3.28.

The STP 4.03 results are compared to best estimate or other available information, and in accordance with ANSI/ANS 3.5-1985, are verified against an acceptance criteria that states:

-- the simulator shall cause appropiate parameters to change in the direction expected, and

-- the simulator shall not violate physical laws of nature.

In addition to the acceptance criteria required by the ANSI Standard for these malfunctions, CPS has opted to require that the malfunctions cause proper alarms and automatic actions to occur.

Procedure STP 4.04, Computer Real Time Test, describes how the simulator is tested for real time capacities. The simulator is capable of simulating continuously, and in real time, plant operations of CPS. The real time simulator computer test verifies and documents that the simulator software completes execution within the design time interval. Additionally, the

real time test ensures that no noticeable differences which adversely impact training are observable between the simulator and the plant in time base relationships, sequences, durations, rates, and accelerations.

F. Benchmark Transient Tests

Procedures STP 5.01 through STP 5.11 describe the Simulator Benchmark Transient Tests. The Simulator Benchmark Transient Tests are a set of operability tests run to verify simulator performance using a benchmark set of transients, and comparing the resulting data with actual plant results (if available), analytical data, design data, or results from similar operating plants. The tests are generally run from an initial condition of approximately 100% reactor power, steady state xenon and decay heat, with no operator follow-up action unless specified before commencement of test.

G. Simulator Performance Testing Schedule

In accordance with procedure NTD 3.12, Simulator Performance Testing, the following tests will be performed annually to verify the overall simulator model:

-- Steady State Tests, conducted at 50%, 75%, and 100% rated thermal power, will be performed annually and documented on STP 1.04 through STP 1.06.

-- Transient Tests, verifying simulator performance using a benchmark set of transients, will be performed annually and documented on STP 5.01 through STP 5.11.

-- Approximately 25% of the Malfunction Tests, verifying simulator ability to conduct abnormal, off-normal, and emergency plant events, will be performed and documented on STP 3.01a through STP 3.28.

-- Approximately 25% of the additional malfunctions used in training will be tested annually and documented on STP 4.03.

All malfunctions will be tested in their entirety every four years. New malfunctions developed as a result of plant experience will become part of the simulator training program and will be added to the malfunction testing schedule.

Additionally, the entire battery of simulator tests will be performed if simulator design changes result in significant simulator configuration or performance variations.

When limited simulator changes are made, specific tests are performed to ensure the changes are operating correctly before the changes are used in the operator training program.

TABLE 3 -- SIMULATOR TEST PROCEDURE LIST

STEADY STATE TEST PROCEDURES

-- STP 1.01, Principal Mass and Energy Balance
-- STP 1.02, Simulator Stability
-- STP 1.04, Steady State Performance - 50% Power
-- STP 1.05, Steady State Performance - 75% Power
-- STP 1.06, Steady State Performance - 100% Power

NORMAL PLANT EVOLUTION TEST PROCEDURES

-- STP 2.01, Plant Cold Startup to Hot Standby
-- STP 2.02, Nuclear Startup from Hot Standby to Rated Power
-- STP 2.03, Turbine Startup and Generator Synchronization
-- STP 2.04, Reactor Trip Followed By Recovery to Rated Power
-- STP 2.05, Operations at Hot Standby
-- STP 2.06, Load Changes
-- STP 2.07, Startup, Shutdown, and Power Operations With Less Than Full Reactor Coolant Flows
-- STP 2.08, Core Performance Testing
-- STP 2.09, Operator Conducted Surveillance Testing

MALFUNCTION TEST PROCEDURES

-- STP 3.01a, Large Break LOCA Inside Primary Containment
-- STP 3.01b, Small Break LOCA Inside Primary Containment
-- STP 3.01c, Stuck Open SRV
-- STP 3.02, Loss of Service/Instrument Air
-- STP 3.03, Loss of Offsite Power
-- STP 3.04, Loss of Emergency Power
-- STP 3.05, Loss of Emergency Diesel Generators
-- STP 3.06, Loss of Selected 480 Volt Buses
-- STP 3.07, Loss of 6900 and 4160 Volt Buses

TABLE 3 -- SIMULATOR TEST PROCEDURE LIST

MALFUNCTION TEST PROCEDURES (Cont'd):

-- STP 3.08, Loss of Instrument Buses(AC and DC)
-- STP 3.09, Recirculation Pump(s) Trip
-- STP 3.10, Loss of Condenser Vacuum/Hotwell Level Control
-- STP 3.11, Loss of Service Water
-- STP 3.12, Loss of Shutdown Cooling
-- STP 3.13, Loss of Component Cooling
-- STP 3.14, Feedwater System/Control Failure
-- STP 3.15, Loss of Injection Capability
-- STP 3.16, Loss of Protective System Channel
-- STP 3.17, Control Rod Failures
-- STP 3.18, Fuel Clad Failure
-- STP 3.19, Turbine Trip
-- STP 3.20a, Large Steamline Break Outside Containment
-- STP 3.20b, Small Steamline Break Outside Containment
-- STP 3.21, Feedwater Line Break Outside Containment
-- STP 3.22, Nuclear Instrumentation Failures
-- STP 3.23, Passive Malfunctions
-- STP 3.24, Reactor Protection System Failure (ATWS)
-- STP 3.25, Turbine Bypass Failure
-- STP 3.26, Generator Trip
-- STP 3.27, Failure of Reactor Recirculation and Reactor Core Isolation Cooling Flow Controllers
-- STP 3.28, Process Instrumentation Failures

MISCELLANEOUS TEST PROCEDURES

-- STP 4.01, Simulator Physical Fidelity/Human Factors Verification Criteria
-- STP 4.02, Simulator Instructor Station Capabilities
-- STP 4.03, Malfunction Performance Test
-- STP 4.04, Computer Real Time Test

TABLE 3 -- SIMULATOR TEST PROCEDURE LIST

BENCHMARK TRANSIENT TEST PROCEDURES

-- STP 5.01, Manual Scram
-- STP 5.02, Simultaneous Trip of All Feedwater Pumps
-- STP 5.03, Simultaneous Closure of MSIV's
-- STP 5.04, Simultaneous Trip of All Recirculation Pumps
-- STP 5.05, Single Recirculation Pump Trip
-- STP 5.06, Main Turbine Trip (At Max Power Level Without An Immediate Scram)
-- STP 5.07, Maximum Rate Power Ramp Down to Approximately 75% then Back up to 100%
-- STP 5.08, Maximum Size Reactor Coolant System Rupture Combined With Loss of All Offsite Power
-- STP 5.09, Maximum Size Unisolable Main Steam Line Rupture
-- STP 5.10, Simultaneous Closure of All MSIV's Combined With Single Stuck Open Safety Relief Valve (Inhibit High Pressure ECCS Activation)
-- STP 5.11, Generator Trip (LER 89-028)

VI. SIMULATOR TEST SUMMARIES

The entire battery of tests described in Section V were performed for this initial certification. Test summary pages have been prepared for each of the certification tests. The simulator summary pages provide the following information:

-- Identification number and title of each test,

-- A description of each test, including a brief overview of the results, and identification of the ANSI/ANS 3.5-1985 section the test was meant to satisfy,

-- The features of the simulator tested, including the malfunctions demonstrated,

-- The initial and final conditions of the test,

-- A description of any deficiencies identified during the test and the associated Simulator Problem Report number written for resolving the deficiency,

-- The corrective actions planned and schedule for resolving any test deficiencies, and

-- If a deficiency is identified that violates a requirement in ANSI/ANS 3.5-1985, and corrective actions are not planned to correct the deficiency, then the test summary page will identify a request and justification for an exemption from the requirements.

The test deficiencies reported on the test summary pages are those which were in existence at the time of this certification report. Deficiencies that may have been identified during the performance of a particular test, which have already been corrected and retested satisfactorily, may not be identified on the test summary pages.

Certain deficiencies are common to more than one certification test. Therefore, the same deficiency may appear on more than one test summary page.

Test summary pages for Benchmark Transient Tests also identify the parameters of interest for each transient, the source of baseline data, and information on how the simulator performed when compared against the available baseline data.
For each parameter of interest, graphs of simulator data and baseline data have been provided for comparison.

SIMULATOR CERTIFICATION TEST SUMMARY

Test Name: STP 1.01, Principal Mass and Energy Balance

Description: This test demonstrated that principal mass and energy for the primary system were balanced. The test was conducted at three different power levels, including full power and two intermediate power levels.

The test involved collecting data and performing two manual calculations. The first verified the balance between the mass flows which entered the primary system and those that exited the primary system. The second calculation verified the balance between the energy flows which entered the primary system and those that exited the primary system.

The procedure demonstrated that the simulator-computed values for mass flows and energy balances at three different power levels met the requirements of ANSI/ANS 3.5-1985, section 4.1(2). The acceptance criteria chosen for this test were that both mass and energy must balance to within 2 percent for each of the three power levels tested.

Simulator Features Tested:

PMS Group Point Displays
PMS Points

Initial Conditions:

Normal stable plant lineup (at three different power levels).

Final Conditions:

Primary system mass and energy flows were verified as being balanced to within 0.8% or less, thus meeting the test acceptance criteria.

Baseline Data Description:

Plant procedure CPS No. 2208.01, Core Thermal Power Determination, was used in developing the test methodology.

SIMULATOR CERTIFICATION TEST SUMMARY

Test Name: STP 1.01, Principal Mass and Energy Balance (Cont'd)

Deficiencies Found:

None

Corrective Actions Planned (and schedule):

None

Exceptions Taken/Justification:

None

SIMULATOR CERTIFICATION TEST SUMMARY

Test Name: STP 1.02, Simulator Stability

Description: This test was conducted at full power. While conducting this test, a special computer program was activated that recorded the values of initial simulator critical and non-critical parameters important to operations. Every minute thereafter, the program polled the simulator for the current values of the parameters, and then compared the current values to the initial values recorded earlier to calculate a percent deviation. The results of this comparison were printed every minute.

Any parameter found to deviate from its initial value by 2 percent or more was automatically flagged by the computer program. This process was allowed to continue for at least 1 hour. All the minute-by-minute printouts were reviewed to determine if any parameter was flagged as being outside the acceptance criteria at any point during the 1 hour run, and the last printout was carefully reviewed to ensure that the parameters remained within 2 percent of their original values over the entire 1 hour run.

This test demonstrated that the CPS simulator-computed values for steady state, full power operation were stable and met the acceptance criteria of section 4.1 of ANSI/ANS-3.5-1985.

Simulator Features Tested:

Simulator model stability

Initial Conditions:

The simulator was set up in a normal full power lineup.

SIMULATOR CERTIFICATION TEST SUMMARY

Test Name: STP 1.02, Simulator Stability (Cont'd)

Final Conditions:

The test ran for at least 60 minutes. The monitored parameters remained stable and within the acceptance criteria specified at all times for the duration of the test.

Baseline Data Description:

Not Applicable (simulator parameters compared to themselves)

Deficiencies Found:

None

Corrective Actions Planned (and schedule):

None

Exceptions Taken/Justification:

None

SIMULATOR CERTIFICATION TEST SUMMARY

Test Name: STP 1.04, Steady State Performance - 50% Power

Description: This test was conducted at approximately 50% reactor power. A special computer program was activated during this test that polled simulator values for critical and non-critical parameters important to operations. The program then compared the simulator values to known plant data and calculated a deviation for each parameter.

The computer program automatically flagged any critical parameter that deviated by 2 percent or more, or any non-critical parameter that deviated by 10 percent or more. The results of the comparison were then printed. The computer program continued to make comparisons every minute until the program was terminated. This allowed the test operator to make necessary adjustments to simulator controls (i.e.: feedwater level control, recirculation flow control valve position, etc.) to get all parameters within specification.

The parameters were fine tuned to stabilize within the acceptance criteria, and the test was terminated.

This test demonstrated that the CPS simulator met the requirements of section 4.1 of ANSI/ANS-3.5-1985 at approximately 50% steady state power.

Simulator
Features Tested:

Simulator's ability to compare favorably to the actual plant performance in the area of critical and non-critical parameters during steady state operation.

Initial Conditions:

The simulator was set up in a steady state lineup at approximately 50% power.

SIMULATOR CERTIFICATION TEST SUMMARY

Test Name: STP 1.04, Steady State Performance - 50% Power (Cont'd)

Final Conditions:

Simulated critical parameters compared to actual plant critical parameters within 2%. Simulated non-critical parameters important to operations compared to the actual plant parameters within 10%.

Baseline Data Description:

Actual plant PMS Computer Point dump at 53.91% power taken on July 1, 1989.

Deficiencies Found:

None

Corrective Actions Planned (and schedule):

None

Exceptions Taken/Justification:

None

SIMULATOR CERTIFICATION TEST SUMMARY

Test Name: STP 1.05, Steady State Performance - 75% Power

Description: This test was conducted at approximately 75% reactor power. A special computer program was activated during this test that polled simulator values for critical and non-critical parameters important to operations. The program then compared the simulator values to known plant data and calculated a deviation for each parameter.

The computer program automatically flagged any critical parameter that deviated by 2 percent or more, or any non-critical parameter that deviated by 10 percent or more. The results of the comparison were then printed. The computer program continued to make comparisons every minute until the program was terminated. This allowed the test operator to make necessary adjustments to simulator controls (i.e.: feedwater level control, recirculation flow control valve position, etc.) to get all parameters within specification.

The parameters were fine tuned to stabilize within the acceptance criteria, and the test was terminated.

This test demonstrated that the CPS simulator met the requirements of section 4.1 of ANSI/ANS-3.5-1985 at approximately 75% steady state power.

Simulator Features Tested:

Simulator's ability to compare favorably to the actual plant performance in the area of critical and non-critical parameters during steady state operation.

Initial Conditions:

The simulator was set up in a steady state lineup at approximately 75% power.

SIMULATOR CERTIFICATION TEST SUMMARY

Test Name: STP 1.05, Steady State Performance - 75% Power (Cont'd)

Final Conditions:

Simulated critical parameters compared to actual plant critical parameters within 2%. Simulated non-critical parameters important to operations compared to the actual plant parameters within 10%.

Baseline Data Description:

Actual plant PMS Computer Point dump at 74.55% power taken on June 26, 1989.

Deficiencies Found:

None

Corrective Actions Planned (and schedule):

None

Exceptions Taken/Justification:

None

SIMULATOR CERTIFICATION TEST SUMMARY

Test Name: STP 1.06, Steady State Performance - 100% Power

Description: This test was conducted at approximately 100% reactor power. A special computer program was activated during this test that polled simulator values for critical and non-critical parameters important to operations. The program then compared the simulator values to known plant data and calculated a deviation for each parameter.

The computer program automatically flagged any critical parameter that deviated by 2 percent or more, or any non-critical parameter that deviated by 10 percent or more. The results of the comparison were then printed. The computer program continued to make comparisons every minute until the program was terminated. This allowed the test operator to make necessary adjustments to simulator controls (i.e.: feedwater level control, recirculation flow control valve position, etc.) to get all parameters within specification.

The parameters were fine tuned to stabilize within the acceptance criteria, and the test was terminated.

This test demonstrated that the CPS simulator met the requirements of section 4.1 of ANSI/ANS-3.5-1985 at approximately 100% steady state power.

Simulator
Features Tested:

Simulator's ability to compare favorably to the actual plant performance in the area of critical and non-critical parameters during steady state operation.

Initial Conditions:

The simulator was set up in a steady state, full power lineup.

SIMULATOR CERTIFICATION TEST SUMMARY

Test Name: STP 1.06, Steady State Performance - 100% Power (Cont'd)

Final Conditions:

Simulated critical parameters compared to actual plant critical parameters within 2%. Simulated non-critical parameters important to operations compared to the actual plant parameters within 10%.

Baseline Data Description:

Actual plant PMS Computer Point dump at 99.94% power taken on August 14, 1989.

Deficiencies Found:

None

Corrective Actions Planned (and schedule):

None

Exceptions Taken/Justification:

None

SIMULATOR CERTIFICATION TEST SUMMARY

Test Name: STP 2.01, Plant Cold Startup to Hot Standby

Description: This test demonstrated simulator performance during startup from a cold shutdown condition with all control rods fully inserted and Residual Heat Removal (RHR) operating in shutdown cooling mode, to the point of adding heat with reactor coolant temperature slightly above 200 degrees F and the plant in a hot standby condition.

Plant procedures were used during the startup, and simulator response was compared to expected plant response.

This procedure tested the normal evolution referred to in ANSI/ANS-3.5-1985, section 3.1.1 (1), and verified that the simulator met the performance criteria established in section 4.2.1 of the standard.

Simulator Features Tested:

Integrated plant startup using actual plant procedures
Control Rod Withdrawal to Criticality
Source Range Monitor (SRM) count rate with detectors fully inserted
SRM/IRM overlap
Increasing recirculation loop temperatures and nuclear instrumentation count rates

Initial Conditions:

Simulator in cold shutdown (Mode 4)

Final Conditions:

Simulator was critical with a positive reactor period and moving into the heating power range. The acceptance criteria were satisfied.

SIMULATOR CERTIFICATION TEST SUMMARY

Test Name: STP 2.01, Plant Cold Startup to Hot Standby (Cont'd)

Baseline Data Description:

CPS Technical Specification Table 4.3.1.1-1, and sections 4.3.7.6.c and 4.4.6.1.3

Plant Operating Procedures:
CPS No. 2202.01F001, Control Rod Sequence
CPS No. 2202.02F002, Control Rod Maneuver Review
CPS No. 3001.01, Approach to Critical
CPS No. 3002.01, Heatup and Pressurization
CPS No. 3003.01, Heatup and Pressurization, Condenser Isolated and Condenser Recovery
CPS No. 3306.01, Source Range Monitors/Intermediate Range Monitors
CPS No. 3305.01, Reactor Protection System
CPS No. 3312.01, Residual Heat Removal
CPS No. 3408.01, Containment Building/Drywell HVAC (VR/VQ)

Deficiencies Found:

None

Corrective Actions Planned (and schedule):

None

Exceptions Taken/Justification:

None

SIMULATOR CERTIFICATION TEST SUMMARY

Test Name: STP 2.02, Nuclear Startup from Hot Standby to Rated Power

Description: This test demonstrated simulator performance during power ascension from hot standby to rated power.

The test was a natural continuation of STP 2.01, Plant Cold Startup to Hot Standby. STP 2.03, Turbine Startup and Generator Synchronization, was also performed concurrent with this test to provide an uninterrupted progression of steps necessary to test simulator power ascension.

Plan procedures were used during the power ascension and simulator response was compared to expected plant response.

This procedure tested the normal evolution referred to in ANSI/ANS-3.5-1985, section 3.1.1 (2), and verified that the simulator met the performance criteria established in section 4.2.1 of the standard.

Simulator Features Tested:

- Integrated nuclear plant heatup and power ascension using actual plant procedures
- Control Rod Withdrawal
- Establishing condenser vacuum
- Operation of the turbine bypass valves
- Increasing reactor temperatures and pressure
- Increasing nuclear instrumentation indications
- Turbine shell and chest warming

Initial Conditions:

The simulator was in a hot standby condition (Mode 3).

Final Conditions:

The simulator achieved a normal full power lineup. The acceptance criteria were satisfied.

SIMULATOR CERTIFICATION TEST SUMMARY

Test Name: STP 2.02, Nuclear Startup from Hot Standby to Rated Power (Cont'd)

Baseline Data Description:

CPS Technical Specification Sections 3.1.4.2, 3.4.6.1, 3.6.2.5, 4.1.4.1, 4.1.3.4, 4.3.4.2, and Table 4.3.6-1, items 1.a and 1.b

Plant Operating Procedures:

CPS No. 2202.01F001, Control Rod Sequence
CPS No. 3002.01, Heatup and Pressurization
CPS No. 3002.01C002, Mode 1 Checklist
CPS No. 3005.01, Unit Power Changes
CPS No. 3101.01, Main Steam (MS, IS & ADS)
CPS No. 3103.01, Feedwater (FW)
CPS No. 3104.01, Condensate/Condensate Booster (CD/CB)
CPS No. 3105.01, Turbine (TG, EHC, TS)
CPS No. 3106.01, Moisture Separator Reheater
CPS No. 3107.01, Turbine Gland Seal (GS)
CPS No. 3112.01, Condenser Vacuum
CPS No. 3113.01, Circulating Water (CW)
CPS No. 3215.01, Off Gas (OG)
CPS No. 3303.01, Reactor Water Cleanup (RT)
CPS No. 3304.01, Control Rod Hydraulic and Control (RD)
CPS No. 3306.01, Source/Intermediate Range Monitors
CPS No. 3408.01, Containment Building/Drywell HVAC
CPS No. 3310.01, Reactor Core Isolation Cooling (RI)
CPS No. 9000.09D002, CPS Control Rod Manipulation Log
CPS No. 9000.06D001, Heatup/Cooldown, Inservice Leak and Hydrostatic Testing 30 Minute Temperature Log

Deficiencies Found:

None

Corrective Actions Planned (and schedule):

None

Exceptions Taken/Justification:

None

SIMULATOR CERTIFICATION TEST SUMMARY

Test Name: STP 2.03, Turbine Startup and Generator Synchronization

Description: This test demonstrated simulator performance during startup of the turbine and synchronization of the generator. Instructions for coordinating the individual system operations required for turbine startup and generator synchronization on the simulator were provided.

This test was performed concurrent with STP 2.02, Nuclear Startup From Hot Standby to Rated Power.

Plant procedures steps were used during the turbine startup and generator synchronization. The simulator response was compared to expected plant response.

This procedure tested the normal evolution referred to in ANSI/ANS-3.5-1985, section 3.1.1 (3), and verified that the simulator met the performance criteria established in section 4.2.1 of the standard.

Simulator Features Tested:

Turbine roll and speed control
Generator synchronization
Operation of Moisture Separator Reheaters
Three element automatic feedwater control
Transfer of Reactor Recirculation Pumps to fast speed
Increasing turbine shell and chest temperatures; turbine speed; main generator voltage, power, current; reactor power; and reactor recirculation pump speeds

Initial Conditions:

The simulator was at approximately 15% reactor power with the turbine/generator off line, condenser vacuum established, turbine shell and chest warming complete, and the prerequisites for generator startup complete.

SIMULATOR CERTIFICATION TEST SUMMARY

Test Name: STP 2.03, Turbine Startup and Generator Synchronization (Cont'd)

Final Conditions:

The simulator was at approximately 35% power with the generator online. The test acceptance criteria were satisfied.

Baseline Data Description:

Plant Operating Procedures:

CPS No. 3002.01, Heatup and Pressurization
CPS No. 3004.01, Turbine Startup and Generator Synchronization
CPS No. 3005.01, Unit Power Changes
CPS No. 3102.01, Extraction Steam/Heater Vent and Drains
CPS No. 3103.01, Feedwater (FW)
CPS No. 3104.01, Condensate/Condensate Booster (CD/CB)
CPS No. 3105.01, Turbine (TG, EHC, TS)
CPS No. 3105.05, Generator (TG)
CPS No. 3106.01, Moisture Separator Reheater
CPS No. 3107.01, Turbine Gland Seal (GS)
CPS No. 3113.01, Circulating Water (CW)
CPS No. 3302.01, Reactor Recirculation (RR)
CPS No. 3501.01, High Voltage Auxiliary Power System

Deficiencies Found:

None

Corrective Actions Planned (and schedule):

None

Exceptions Taken/Justification:

None

SIMULATOR CERTIFICATION TEST SUMMARY

Test Name: STP 2.04, Reactor Trip Followed by Recovery to Rated Power

Description: This test demonstrated simulator performance during a reactor trip followed by recovery to rated power. The reactor trip was initiated manually by closing the Main Steam Isolation Valves (MSIVs) with their control switches. Immediate actions were taken to stabilize the plant and bring the plant to a hot standby condition. Once the plant was stabilized, the systems necessary to support plant startup were operated and the simulated plant was restarted and brought back to rated power.

The simulator was initialized at full power. The Main Steam Isolation Valves (MSIVs) were then manually closed. The reactor automatically scrammed as appropriate. Following the scram, the position of control rods was verified. Automatic actions such as the low-low set feature of the safety relief valves, turbine and generator trip, and electrical bus transfer, were verified as being proper for the transient.

After the plant had stabilized, the reactor restart commenced. Plant procedures were used to achieve criticality and to return to rated power operations.

This procedure tested the normal evolution referred to in ANSI/ANS-3.5-1985, section 3.1.1 (4), and verified that the simulator met the performance criteria established in section 4.2.1 of the standard.

Simulator Features Tested:

Automatic reactor scram
On-demand program OD-7 Control Rod Position Edit
Integrated system dynamic and logical response

Initial Conditions:

The simulator was initialized at full power. The Main Steam Isolation Valves (MSIVs) were then manually closed. The reactor scrammed.

SIMULATOR CERTIFICATION TEST SUMMARY

Test Name: STP 2.04, Reactor Trip Followed by Recovery to Rated Power (Cont'd)

Final Conditions:

The simulator responded properly to the reactor trip and subsequent restart to return to full power operations.

Baseline Data Description:

Plant Startup Test Procedure 25B-6, MSIV-Full Reactor Isolation
Emergency Operating Procedures

Plant Operating Procedures:

CPS No. 3101.01, Main Steam
CPS No. 3103.01, Feedwater
CPS No. 3105.01, Turbine
CPS No. 3106.01, Moisture Separator Reheaters
CPS No. 3112.01, Condenser Vacuum
CPS No. 3202.01, Operating Electrode Boilers and Reboilers
CPS No. 3215.01, Off Gas
CPS No. 3310.01, Reactor Core Isolation Cooling
CPS No. 3319.01, Standby Gas Treatment
CPS No. 3408.01, Containment Building/Drywell HVAC
CPS No. 4001.01, Reactor Scram
CPS No. 4001.02, Automatic Isolation
CPS No. 3001.01, Approach to Critical
CPS No. 9000.09D002, CPS Control Rod Manipulation Log
CPS No. 9014.02, Rod Pattern Control System Rod Sequence Check
CPS No. 3002.01, Heatup and Pressurization
CPS No. 3004.01, Turbine Startup and Generator Synchronization

Deficiencies Found:

None

SIMULATOR CERTIFICATION TEST SUMMARY

Test Name: STP 2.04, Reactor Trip Followed by Recovery to Rated Power (Cont'd)

Corrective Actions Planned (and schedule):

None

Exceptions Taken/Justification:

None

SIMULATOR CERTIFICATION TEST SUMMARY

Test Name: STP 2.05, Operations at Hot Standby

Description: This test demonstrated simulator performance during operations at hot standby.

The simulator is initialized at approximately 35% power with the generator on line. Feedwater was manually switched to the Startup Level Controller. Reactor recirculation pumps were shifted to slow speed and flow control was switched to manual control. Using plant procedures, control rods were inserted to decrease reactor power. Electrical buses were transferred to their reserve supplies. Generator load was decreased and the turbine-generator was tripped. Reactor power was decreased further, Intermediate Range Monitors (IRMs) were inserted, and the reactor was shut down.

Operations at hot standby were then performed. Bypass valves were adjusted to establish the desired cooldown rate. The Residual Heat Removal system was flushed and warmed up in preparation for shutdown cooling. The feedwater heaters were shut down. The feedwater pumps were secured. Reactor water level was controlled using the condensate booster and reactor water cleanup systems. The Steam Jet Air Ejectors (SJAEs) were taken out of service. Seal steam was transferred from the gland seal system to the auxiliary steam system. The main condenser was shut down. Shutdown cooling was established.

Plant procedure steps were used during the performance of this test and simulator response was compared to expected plant response.

This procedure tested the normal evolution referred to in ANSI/ANS-3.5-1985, section 3.1.1 (5), and verified that the simulator met the performance criteria established in section 4.2.1 of the standard.

Simulator Features Tested:

Normal Plant Shutdown
System operating interlocks/setpoints
Integrated system dynamic and logical response

SIMULATOR CERTIFICATION TEST SUMMARY

Test Name: STP 2.05, Operations at Hot Standby (Cont'd)

Initial Conditions:

The simulator was operating at approximately 35% power.

Final Conditions:

The simulator was shut down with Residual Heat Removal in Shutdown Cooling mode. Simulator performance was consistent with expected plant performance.

Baseline Data Description:

Plant Operating Procedures:

CPS No. 2201.01F001, Control Rod Sequence
CPS No. 3101.01, Main Steam
CPS No. 3101.01, Feedwater
CPS No. 3104.01, Condensate/Condensate Booster System
CPS No. 3105.01, Turbine
CPS No. 3105.04, Steam Bypass and Pressure Regulator
CPS No. 3106.01, Moisture Separator Reheater
CPS No. 3107.01, Turbine Gland Seal
CPS No. 3112.01, Condenser Vacuum
CPS No. 3113.01, Circulating Water System
CPS No. 3211.01, Shutdown Service Water
CPS No. 3212.01, Plant Service Water
CPS No. 3215.01, Off Gas
CPS No. 3214.01, Plant Air
CPS No. 3302.01, Reactor Recirculation
CPS No. 3306.01, Source Range Monitors/Intermediate Range Monitors
CPS No. 3310.01, Reactor Core Isolation Cooling
CPS No. 3312.01, Residual Heat Removal
CPS No. 3318.01, Suppression Pool Cleanup/Transfer
CPS No. 3501.01, High Voltage Auxiliary Power System
CPS No. 3502.01, 480V Distribution
CPS No. 3503.01, Battery and DC Distribution
CPS No. 3507.01, Station Lighting and Low Voltage System
CPS No. 3509.01, Instrument Power System

SIMULATOR CERTIFICATION TEST SUMMARY

Test Name: STP 2.05, Operations at Hot Standby (Cont'd)

Baseline Data Description (cont'd):

CPS No. 3812.11, Accumulator Pressure Check
CPS No. 3006.01, Unit Shutdown
CPS No. 3004.01, Turbine Startup and Generator Synchronization
CPS No. 3002.01, Heatup and Pressurization

Deficiencies Found:

None

Corrective Actions Planned (and schedule):

None

Exceptions Taken/Justification:

None

SIMULATOR CERTIFICATION TEST SUMMARY

Test Name: STP 2.06, Load Changes

Description: This test demonstrated simulator performance for plant load changes while reactor power was above 35% of rated thermal power. Load increases and decreases between 35 and 100% were performed during this test.

The simulator was initialized above 35% power with the generator online. Reactor power was then increased by withdrawing control rods and increasing reactor recirculation flow control. Reactor power and generator load increased as expected. Alarms and indications responded properly as reactor power was increased to 100%.

Reactor power was then decreased by decreasing reactor recirculation flow and by inserting control rods in sequence. Reactor power and generator load decreased accordingly. Alarms and indications responded properly as reactor power was decreased to 35%.

Plant procedure steps were used during the performance of this test and simulator response was compared to expected plant response.

This procedure tested the normal evolution referred to in ANSI/ANS-3.5-1985, section 3.1.1 (6), and verified that the simulator met the performance criteria established in section 4.2.1 of the standard.

Simulator Features Tested:

Normal Plant Power and Load Changes
Integrated Plant System Response

Initial Conditions:

The simulator was operating at approximately 35% power.

SIMULATOR CERTIFICATION TEST SUMMARY

Test Name: STP 2.06, Load Changes (Cont'd)

Final Conditions:

The simulator was returned to approximately 35% power following various changes in load. The simulator performance was consistent with plant performance.

Baseline Data Description:

Plant Operating Procedures:

CPS No. 3005.01, Unit Power Changes
CPS No. 3006.01, Unit Shutdown

Deficiencies Found:

None

Corrective Actions Planned (and schedule):

None

Exceptions Taken/Justification:

None

SIMULATOR CERTIFICATION TEST SUMMARY

Test Name: STP 2.07, Startup, Shutdown, and Power Operations With Less than Full Reactor Coolant Flow

Description: This test demonstrated simulator performance during a Reactor Recirculation Flow Control Valve (FCV) closure from 100% to minimum and during natural circulation conditions. This test established the required initial conditions, simultaneously shut both FCVs, and tripped both reactor recirculation pumps. Comparisons were then made between the simulator and the the actual plant while the FCVs were being shut, and during the natural circulation conditions.

The simulator was initialized at approximately 75% power. Reactor recirculation flow was incrementally decreased to the minimum attainable with the reactor recirculation pumps in fast speed. Then both reactor recirculation pumps were tripped from fast to slow speed, then tripped from slow speed to off. The reactor recirculation flow control valves were then fully opened to achieve natural circulation flow.

Under natural circulation conditions, control rods were withdrawn to achieve the maximum reactor power allowed under the conditions. A reactor shutdown then commenced and reactor power was observed to decrease, as expected, following the natural circulation rod line of the CPS Power to Flow Map.

The simulator was then reset to approximately 75% power. Total core flow and core plate differential pressure were recorded initially, and then following the trip of each reactor recirculation pump.

This procedure tested the normal evolutions referred to in ANSI/ANS-3.5-1985, sections 3.1.1 (7) and 3.1.1 (8), and verified that the simulator met the performance criteria established in section 4.2.1 of the standard.

Simulator Features Tested:

Correlation between reactor power and core flow.

SIMULATOR CERTIFICATION TEST SUMMARY

Test Name: STP 2.07, Startup, Shutdown, and Power Operations With Less than Full Reactor Coolant Flow (Cont'd)

Initial Conditions:

The simulator was set to approximately 75% rated power and 100% rated core flow using a middle of life core.

Final Conditions:

The evaluation of simulator performance data against plant data indicated that the simulator response was consistent with actual and expected plant response.

Baseline Data Description:

Startup Test Procedure 30C-3, Reactor Recirculation System
Recirculation Flow Characteristics, EAS-87-678, dated 11/5/87
Report on Core Flow Characteristics, JWP-87-692, dated 11/18/87
CPS Power to Flow Map

Deficiencies Found:

Acceptance criteria for this test were demonstrated. The simulator demonstrated its capability to maneuver through various power levels with less than full recirculation flow.

However, the test procedure required the use of On-Demand programs to collect simulator data for comparison against plant data. The simulator On-Demand program did not print out correctly for all parameters.

Corrective Actions Planned (and schedule):

Simulator Problem Report (SPR) No. 91-026 was written to investigate and correct the On-Demand program printout.

Exceptions Taken/Justification:

None

SIMULATOR CERTIFICATION TEST SUMMARY

Test Name: STP 2.08, Core Performance Testing

Description: This test in combination with other test results demonstrated proper simulator core performance.

The simulator was initialized six times during the performance of this test, corresponding to the six points in the CPS Startup Test Program when tests were conducted on the actual plant, and for which actual plant performance data is available. The tests were taken at 18.5%, 21.6%, 69.8%, 68.9%, and 95.1% rated power, and at 31.6% power under natural circulation conditions. During each test, an On-Demand OD-3, Core Thermal Power and APRM Calibration, and a P-1, Periodic NSS Core Performance Log, were taken on the simulator, and then compared to OD-3 and P-1 reports taken during the plant startup tests.

There was agreement between the plant and the simulator for core thermal power and total core flow. However, there were differences in data for the Maximum Linear Heat Generation Rate (MRPD), Minimum Critical Power Ratio (MCPR), and Maximum Average Planar Linear Heat Generation Rate (MAPLHGR). This is because the simulator core model has been upgraded from a single node model to a multi-nodal model, and the simulator OD-3 and P-1 programs have not been changed to reflect the upgraded geometry. This has been identified as a deficiency as outlined below.

However, as part of other simulator tests, proper simulator core performance has been demonstrated. Source Range Monitor (SRM) - Intermediate Range Monitor (IRM) overlap has been demonstrated. Intermediate Range Monitor (IRM) - Average Power Range Monitor (APRM) overlap has also been demonstrated. Startup and shutdowns have demonstrated proper neutron flux performance. Criticality has been demonstrated to occur at points very near those on the actual plant for a particular core configuration and exposure.

Thus, it has been concluded that the simulator meets the requirements for the normal evolution referred to in ANSI/ANS-3.5-1985, section 3.1.1 (9), and the performance criteria established in section 4.2.1.

SIMULATOR CERTIFICATION TEST SUMMARY

Test Name: STP 2.08, Core Performance Testing (Cont'd)

Simulator
Features Tested:

Core dynamics
On-Demand and Periodic Log functions

Initial Conditions:

See above discussion.

Final Conditions:

See above discussion.

Baseline Data Description:

Plant Startup Test 19, Core Performance
CPS Technical Specifications

Deficiencies Found:

The simulator OD-3 and P-1 programs used to collect simulator data for comparison against plant data did not provide correct information.

Corrective Actions Planned (and schedule):

Simulator Problem Report (SPR) No. 91-026 was written to investigate and correct the On-Demand and Periodic Log programs. This SPR will be resolved by August 1, 1992.

Exceptions Taken/Justification:

None

SIMULATOR CERTIFICATION TEST SUMMARY

Test Name: STP 2.09, Operator Conducted Surveillance Testing

Description: This test demonstrated that the operator is able to perform operator conducted surveillance tests for systems within the scope of simulation.

The baseline data outlined below identifies those operator conducted surveillances performed during this test.

The actual plant surveillance procedures were used during the performance of this test and simulator response was compared to expected plant response.

This procedure tested the normal evolution referred to in ANSI/ANS-3.5-1985, section 3.1.1 (10), and verified that the simulator met the performance criteria established in section 4.2.1 of the standard.

Simulator Features Tested:

See baseline data.

Initial Conditions:

Various

Final Conditions:

Operators could perform operator conducted surveillances on the simulator.

Baseline Data Description:

Plant Surveillance Procedures:

CPS No. 9000.05, Suppression Pool Temperature Verification
CPS No. 9000.06, Heatup and Cooldown Limits
CPS No. 9000.09, Control Rod Coupling
CPS No. 9011.01, Control Rod Operability
CPS No. 9014.01, Rod Pattern Control System

SIMULATOR CERTIFICATION TEST SUMMARY

Test Name: STP 2.09, Operator Conducted Surveillance Testing (Cont'd)

Baseline Data Description (cont'd):

CPS No. 9014.02, Rod Pattern Control System
CPS No. 9031.06, Main Turbine Valve Test
CPS No. 9041.01, Jet Pump Operability
CPS No. 9054.01, RCIC Pump Operability
CPS No. 9054.06, System Flow Path Verification
CPS No. 9056.02, Manually Operating ADS Valves
CPS No. 9031.07, Main Turbine Control Valves
CPS No. 9051.01, HPCS Pump Operability
CPS No. 9051.02, HPCS Valve Operability
CPS No. 9052.01, LPCS Pump Operability
CPS No. 9052.02, LPCS Valve Operability
CPS No. 9053.01, LPCI A and B Operability
CPS No. 9053.02, LPCI C Operability
CPS No. 9053.07, RHR Pump Operability
CPS No. 9054.05, RCIC Operability (Low Press)
CPS No. 9064.01, Drywell Post LOCA Vacuum Breaker
CPS No. 9067.03, SGTS Operability
CPS No. 9012.01, SDV Vent and Drain Valve Operability
CPS No. 9015.01, SLC Operability
CPS No. 9072.01, BPV Operability
CPS No. 9031.10, MSLIV Channel Functional
CPS No. 9061.04, Containment/Drywell Isolation Auto Actuation
CPS No. 9070.01, Control Room Filter Operability
CPS No. 9080.02, Diesel Generator 1C Operability
CPS No. 9080.01, Diesel Generator 1A (1B) Operability
CPS No. 9065.02, Secondary Containment Integrity

Deficiencies Found:

None

Corrective Actions Planned (and schedule):

None

Exceptions Taken/Justification:

None

SIMULATOR CERTIFICATION TEST SUMMARY

Test Name: STP 3.01a, Large Break LOCA Inside Primary Containment

Description: This test demonstrated simulator performance during a large break Loss of Coolant Accident (LOCA) inside the primary containment.

The simulator was initialized at full power. A Reactor Recirculation Loop Rupture malfunction was activated at maximum severity. Values of parameters important to the transient were collected and then examined to ensure that the parameters trended in the correct direction and compared reasonably to the expected plant response. Automatic actions were verified to occur, such as reactor scram, emergency core cooling system start, and appropriate containment isolations. Alarms appropriate for the transient were also verified as being correct.

This procedure tested one of the required malfunctions listed in ANSI/ANS-3.5-1985, section 3.1.2 (1), and verified that the simulator met the performance criteria established in section 4.2.1 of the standard.

Simulator Features Tested:

ECCS automatic actuations
Automatic isolations
Automatic trips
PMS Special logs
Freeze
Integrated system dynamic and logical response
Malfunction RR03, Recirculation Loop Rupture
Simulation not valid alarm

Initial Conditions:

The simulator was set to a normal full power lineup, end of life, equilibrium xenon.

SIMULATOR CERTIFICATION TEST SUMMARY

Test Name: STP 3.01a, Large Break LOCA Inside Primary Containment (Cont'd)

Final Conditions:

All safety system automatic actuations, trips, and isolations occurred. Simulator monitored parameters changed in the direction expected.

Baseline Data Description:

Various system electrical and mechanical drawings
Emergency Operating Procedures (EOPs)
USAR section 6.3

Plant Operating Procedures:

CPS No. 3312.02, Residual Heat Removal
CPS No. 3309.01, High Pressure Core Spray
CPS No. 3313.01, Low Pressure Core Spray
CPS No. 3101.01, Diesel Generator
CPS No. 3103.01, Feedwater
CPS No. 3319.01, Standby Gas Treatment
CPS No. 4001.02, Automatic Isolation

Deficiencies Found:

None

Corrective Actions Planned (and schedule):

None

Exceptions Taken/Justification:

None

SIMULATOR CERTIFICATION TEST SUMMARY

Test Name: STP 3.01b, Small Break LOCA Inside Primary Containment

Description: This test demonstrated simulator performance during a small break Loss of Coolant Accident (LOCA) inside the primary containment.

The simulator was initialized at full power. A small break LOCA was simulated by causing a failure of both shaft seals on a Reactor Recirculation pump. This caused a reactor coolant leak of approximately 50 gpm into the drywell. The values of parameters important to the transient were recorded and then examined to ensure that they trended in the direction expected for the transient. Automatic actions such as sump pump operation were checked. Alarms appropriate for the transient were also verified as being correct.

This procedure tested one of the malfunctions listed in ANSI/ANS-3.5-1985, section 3.1.2 (1), and verified that the simulator met the performance criteria established in section 4.2.1 of the standard.

Simulator Features Tested:

Malfunctions RR06A and RR06B, Recirculation Pump Seal Failure
Integrated system dynamic and logical response
PMS group point displays
SPDS displays
Backpanel monitoring instrumentation

Initial Conditions:

The simulator was set to a normal full power lineup, end of life, equilibrium xenon.

Final Conditions:

The leak through the reactor recirculation loop was isolated, thus terminating the small break LOCA into the drywell.

SIMULATOR CERTIFICATION TEST SUMMARY

Test Name: STP 3.01b, Small Break LOCA Inside Primary Containment (Cont'd)

Baseline Data Description:

Floor Drain System Electrical Drawings
Equipment Drain System Electrical Drawings
Computer Point Identification List

Plant Operating Procedures:

CPS No. 3302.01, Reactor Recirculation
CPS No. 3408.02, Containment Building/Drywell HVAC
CPS No. 4001.01, Reactor Coolant Leakage

Deficiencies Found:

None

Corrective Actions Planned (and schedule):

None

Exceptions Taken/Justification:

None

SIMULATOR CERTIFICATION TEST SUMMARY

Test Name: STP 3.01c, Stuck Open SRV

Description: This test demonstrates simulator performance during a stuck open Safety Relief Valve (SRV) event.

The simulator was initialized at full power. A stuck open Safety Relief Valve malfunction was activated. This caused some steam to be directed to the suppression pool and reduced steam flow to the main turbine. The values of parameters important to the transient were recorded and then examined to ensure that they trended in the direction expected for the transient. No automatic actions were required for this test. However, alarms appropriate for the transient were verified as being correct.

This procedure tests the malfunction listed in ANSI/ANS-3.5-1985, section 3.1.2 (1) (d), and verified that the simulator met the performance criteria established in section 4.2.1 of the standard.

Simulator Features Tested:

Malfunction HP13A, Main Steam Relief Failure
PMS special logs
Freeze
Integrated system dynamic and logical response

Initial Conditions:

The simulator was set to a normal full power lineup, end of life, equilibrium xenon

Final Conditions:

Simulator monitored parameters changed in the direction expected for this transient. Appropriate alarms were received.

SIMULATOR CERTIFICATION TEST SUMMARY

Test Name: STP 3.01c, Stuck Open SRV (Cont'd)

Baseline Data Description:

Plant Startup Test Procedure 26-1, SRV Operability Verification
USAR Chapter 15, section 15.1.4

Plant Operating Procedures:

CPS No. 4009/01, Inadvertent Opening Safety/Relief Valve
CPS No. 3101.01, Main Steam

Deficiencies Found:

None

Corrective Actions Planned (and schedule):

None

Exceptions Taken/Justification:

None

SIMULATOR CERTIFICATION TEST SUMMARY

Test Name: STP 3.02, Loss of Servic‹ ‹strument Air

Description: This test demonstrated simulator performance during a loss of service/instrument air. Loss of complete air systems and loss of individual air headers were evaluated in this test.

The simulator was initialized at full power. The test consisted of multiple parts to check loss of individual building ring headers for the Radwaste Building, Control Building, Containment Building, and Turbine/Auxiliary/Fuel Buildings, and to check the complete loss of the air system. The values of parameters important to the transient, such as air header pressure and compressor current, were observed and recorded, and then examined to ensure that they trended in the direction expected for the transient. Automatic actions such as automatic start of air compressors and isolation of affected air headers were verified. Alarms appropriate for the transient were verified as being correct.

This procedure tested the malfunctions referred to in ANSI/ANS-3.5-1985, section 3.1.2 (2), and verified that the simulator met the performance criteria established in section 4.2.1 of the standard, except as described below.

Simulator Features Tested:

Malfunctions IA01A through IA01D, Instrument Air System Rupture
Malfunction IA02, Air Compressor Trip
Instructor Remote Operators IA101 and IA102
Variable severity capabilities
Proper dynamic and logical responses

SIMULATOR CERTIFICATION TEST SUMMARY

Test Name: STP 3.02, Loss of Service/Instrument Air (Cont'd)

Initial Conditions:

The simulator was set to a normal full power lineup, end of life, equilibrium xenon

Final Conditions:

Appropriate building air headers were isolated and were then restored to service using instructor remote operators.

Baseline Data Description:

Instrument Air System electrical and mechanical drawings
Service Air System electrical and mechanical drawings
USAR Chapter 15

Plant Operating Procedures:

CPS No. 3214.01, Plant Air (IA & SA)
CPS No. 4004.01, Instrument Air Loss

Deficiencies Found:

Some air operated components were found to be operating off the incorrect building air header.

Corrective Actions Planned (and schedule):

Simulator Problem Report (SPR) No. 91-038 has been written to investigate the deficiencies identified during performance of STP 3.02. Deficiencies will be corrected and retested satisfactorily by August 1, 1991.

Exceptions Taken/Justification:

No exception is being taken to the standard for this test. The deficiencies noted above will be corrected in a timely fashion.

SIMULATOR CERTIFICATION TEST SUMMARY

Test Name: STP 3.03, Loss of Offsite Power

Description: This test demonstrated simulator performance during a simultaneous loss of the turbine generator and offsite power sources.

The test initialized the simulator with the Emergency Reserve Auxiliary Transformer (ERAT) deenergized. Simulator malfunctions were inserted causing the main generator and Reserve Auxiliary Transformer (RAT) breakers to trip. This resulted in a loss of power to all electrical buses (except DC powered) until the emergency diesel generators reached rated speed and began to pick up safety loads. Simulator response was then compared to actual plant startup test data.

This procedure tested one of the malfunctions referred to in ANSI/ANS-3.5-1985, section 3.1.2 (3), and verified that the simulator met the performance criteria established in section 4.2.1 of the standard.

Simulator Features Tested:

Malfunctions ED01A and ED01B, 345 KV Line Ground Fault
Proper dynamic and logical responses
Automatic trips and transfers of electrical breakers
Automatic alarms
Automatic start of emergency diesel generators

Initial Conditions:

The simulator was set to a normal low power lineup, with the Emergency Reserve Auxiliary Transformer (ERAT) deenergized.

SIMULATOR CERTIFICATION TEST SUMMARY

Test Name: STP 3.03, Loss of Offsite Power (Cont'd)

Final Conditions:

The test was allowed to run for 25 minutes. Emergency diesel generators were carrying safety loads at the end of the test.

Baseline Data Description:

Plant Startup Test Procedure 31-1, Loss of Turbine Generator and Offsite Power
Offnormal operating procedures
System electrical drawings

Deficiencies Found:

None

Corrective Actions Planned (and schedule):

None

Exceptions Taken/Justification:

None

SIMULATOR CERTIFICATION TEST SUMMARY

Test Name: STP 3.04, Loss of Emergency Power

Description: This test demonstrated simulator performance during a loss of emergency power supplies. The test was performed by activating simulator malfunctions that introduce faults into the Reserve Auxiliary Transformer (RAT) or Emergency Reserve Auxiliary Transformer (ERAT) protective systems. This causes a trip of the associated supply bus and an automatic transfer to the standby supply bus without a loss of any safety loads. Indications and alarms were also observed.

This procedure tested one of the malfunctions referred to in ANSI/ANS-3.5-1985, section 3.1.2 (3), and verified that the simulator met the performance criteria established in section 4.2.1 of the standard, except as described below.

Simulator Features Tested:

Malfunction ED06, Reserve Auxiliary Transformer Lockout
Malfunction ED07, Emergency Reserve Auxiliary Transformer Lockout
Proper logical response

Initial Conditions:

The simulator was set to a normal full power lineup.

Final Conditions:

The safety buses transferred successfully to their standby source of electrical power (either RAT or ERAT).

Baseline Data Description:

Auxiliary Power System electrical drawings

SIMULATOR CERTIFICATION TEST SUMMARY

Test Name: STP 3.04, Loss of Emergency Power (Cont'd)

Deficiencies Found:

None

Corrective Actions Planned (and schedule):

None

Exceptions Taken/Justification:

None

SIMULATOR CERTIFICATION TEST SUMMARY

Test Name: STP 3.05, Loss of Emergency Diesel Generators

Description: This test demonstrated simulator performance during a failure of the emergency diesel generators. The first part of the test demonstrated failure of diesel generators to start. The second part of the test demonstrated a trip of an operating diesel generator. All three emergency diesel generators were individually tested. Automatic actions were verified, and alarms and indications were determined to be appropriate.

This procedure tested one of the malfunctions referred to in ANSI/ANS-3.5-1985, section 3.1.2 (3), and verified that the simulator met the performance criteria established in section 4.2.1 of the standard.

Simulator Features Tested:

Malfunctions DG01A, DG01B, and DG01C, Emergency Diesel Generator Failure to Start
Malfunctions DG02A, DG01B, and DG02C, Emergency Diesel Generator Trip

Initial Conditions:

The simulator was set to a normal full power lineup.

Final Conditions:

The respective emergency diesel generators tripped or failed to start, as appropriate for the simulator malfunction activated at the time.

Baseline Data Description:

Auxiliary Power System electrical drawings

SIMULATOR CERTIFICATION TEST SUMMARY

Test Name: STP 3.05, Loss of Emergency Diesel Generators (Cont'd)

Deficiencies Found:

None

Corrective Actions Planned (and schedule):

None

Exceptions Taken/Justification:

None

SIMULATOR CERTIFICATION TEST SUMMARY

Test Name: STP 3.06, Loss of Selected 480 Volt Buses

Description: This test demonstrated simulator performance during a loss of individual 480 Volt Unit Substations. The test involved inserting a simulated electrical fault on individual 480 Volt Unit Substations, one at a time, and verifying that the correct buses and plant equipment deenergize. Proper alarms were also verified. Simulator response was compared to expected plant response as derived from plant electrical drawings.

This procedure tested one of the malfunctions referred to in ANSI/ANS-3.5-1985, section 3.1.2 (3), and verified that the simulator met the performance criteria established in section 4.2.1 of the standard.

Simulator Features Tested:

Malfunction ED05, 480 V Bus Overcurrent (for all 480 volt buses)

Initial Conditions:

The simulator was set to a normal full power lineup.

Final Conditions:

Except as described below, components tripped/deenergized properly in response to loss of power to their respective buses. Indications and alarms were consistent with expected plant response.

Baseline Data Description:

Auxiliary Power System electrical drawings
CPS Load List

SIMULATOR CERTIFICATION TEST SUMMARY

Test Name: STP 3.06, Loss of Selected 480 Volt Buses (Cont'd)

Deficiencies Found:

Plant battery 1F indicated it was being charged when its battery charger should have been deenergized. Some alarms and recorders for the Offgas System failed to alarm or deenergize when required. However, thousands of other components responded appropriately.

Corrective Actions Planned (and schedule):

Simulator Problem Report (SPR) No. 91-040 was written to investigate the deficiencies identified above. The deficiencies were corrected just prior to the issuance of this certification report. No further corrective actions are necessary.

Exceptions Taken/Justification:

None

SIMULATOR CERTIFICATION TEST SUMMARY

Test Name: STP 3.07, Loss of 6900 and 4160 Volt Buses

Description: This test demonstrated simulator performance during a loss of individual 6900 and 4160 Volt switchgear. The test involved inserting a simulated electrical fault on individual 6900 and 4160 Volt buses, one at a time, and verifying that the correct buses and plant equipment deenergize. Simulator response was compared to expected plant response as derived from plant electrical drawings.

This procedure tested one of the malfunctions referred to in ANSI/ANS-3.5-1985, section 3.1.2 (3), and verified that the simulator met the performance criteria established in section 4.2.1 of the standard.

Simulator Features Tested:

Malfunctions ED03A and ED03B, 6.9 KV Bus Overcurrent
Malfunctions ED04A, ED04B, ED04A1, ED04B1, ED04C1, 4.16 KV Bus Overcurrent

Initial Conditions:

The simulator was set to a normal full power lineup.

Final Conditions:

Components trip/deenergize appropriately as a result of loss of power to their respective buses.

Baseline Data Description:

Auxiliary Power System electrical drawings
CPS Load List

SIMULATOR CERTIFICATION TEST SUMMARY

Test Name: STP 3.07, Loss of 6900 and 4160 Volt Buses (Cont'd)

Deficiencies Found:

None

Corrective Actions Planned (and schedule):

None

Exceptions Taken/Justification:

None

SIMULATOR CERTIFICATION TEST SUMMARY

Test Name: STP 3.08, Loss of Instrumentation Buses

Description: This test demonstrated simulator performance during a loss of individual AC and DC instrumentation buses. The test involved inserting a simulated electrical fault on individual AC and DC instrumentation buses, one at a time, and verifying that the correct buses and plant equipment deenergized. Simulator response was compared to expected plant response as derived from plant electrical drawings.

This procedure tested one of the malfunctions referred to in ANSI/ANS-3.5-1985, section 3.1.2 (3), and verified that the simulator met the performance criteria established in section 4.2.1 of the standard.

Simulator Features Tested:

Malfunctions ED09A through ED09H, 120 VAC Bus Overcurrent
Manual initiation of ECCS systems
Manual initiation of Engineered Safety Feature (ESF) systems
Malfunctions ED10A through ED10F, 125 VDC Bus Overcurrent

Initial Conditions:

The simulator was set to a normal full power lineup. Some safety systems were manually initiated initially to prepare for performance of sections of this test.

Final Conditions:

Components tripped/deenergized as appropriate in response to loss of power to their respective buses.

SIMULATOR CERTIFICATION TEST SUMMARY

Test Name: STP 3.08, Loss of Instrumentation Buses (Cont'd)

Baseline Data Description:

Reactor Protection System electrical drawings
Reactor Core Isolation Cooling system electrical drawings
Residual Heat Removal system electrical drawings
Low Pressure Core Spray system electrical drawings
Nuclear Boiler system electrical drawings
Neutron Monitoring system electrical drawings
Instrument Power system electrical drawings
Plant Process Computer system electrical drawings
Main Steam system electrical drawings
Rod Drive system electrical drawings
Main Power system electrical drawings
DC Distribution system electrical drawings
Auxiliary Power system electrical drawings
Diesel Generator system electrical drawings
VR HVAC system electrical drawings
Drywell Cooling system electrical drawings
Post Accident Sampling system electrical drawings
Diesel Generator HVAC system electrical drawings
Essential Switchgear HVAC system electrical drawings
Fuel Pool Cooling and Cleanup system electrical drawings
Shutdown Service Water system electrical drawings
Control Room HVAC system electrical drawings
Low Voltage system electrical drawings
Drywell Purge system electrical drawings
Remote Shutdown system electrical drawings
High Pressure Core Spray system electrical drawings
Component Cooling Water system electrical drawings
Condensate system electrical drawings
Condensate Booster system electrical drawings
Plant Chill Water system electrical drawings
Plant Service Water system electrical drawings
Service Air system electrical drawings
Circulating Water system electrical drawings
Turbine Building HVAC system electrical drawings
Offgas system electrical drawings

SIMULATOR CERTIFICATION TEST SUMMARY

Test Name: STP 3.08, Loss of Instrumentation Buses (Cont'd)

Baseline Data Description (Cont'd):

Stator Cooling system electrical drawings
Makeup Condensate system electrical drawings
Turbine Building Closed Cooling Water system electrical drawings
Turbine system electrical drawings
Reactor Water Cleanup system electrical drawings
Reactor Recirculation system electrical drawings
Condenser Vacuum system electrical drawings
Feedwater System electrical drawings
Suppression Pool Cleanup system electrical drawings

Deficiencies Found:

None

Corrective Actions Planned (and schedule):

None

Exceptions Taken/Justification:

None

SIMULATOR CERTIFICATION TEST SUMMARY

Test Name: STP 3.09, Recirculation Pump Trip

Description: This test was performed in two parts and demonstrated simulator performance during a loss of forced core coolant flow. The first part of the test tripped the Reactor Recirculation pump and manipulated the Flow Control Valves to verify simulator performance compared against actual plant startup test data.

The second part of the test tripped the turbine and subsequently caused the Reactor Recirculation pumps to transfer to the Low Frequency Motor Generator (LFMG). Simulator performance was compared to actual plant startup test data.

This procedure tested the malfunctions referred to in ANSI/ANS-3.5-1985, section 3.1.2 (4), and verified that the simulator met the performance criteria established in section 4.2.1 of the standard.

Simulator Features Tested:

PMS special log
On demand programs
Malfunctions TC04A and TC04B, Turbine Stop Valve Failure

Initial Conditions:

The simulator was set to a normal full power lineup.

Final Conditions:

The simulator reached a stable condition following each of the transients described in the test procedure. Parameters changed in the direction expected. Automatic actions such as recirculation pump transfer to the Low Frequency Motor Generator (LFMG) occurred as expected.

SIMULATOR CERTIFICATION TEST SUMMARY

Test Name: STP 3.09, Recirculation Pump Trip (Cont'd)

Baseline Data Description:

Plant Startup Test Procedure 30A-3, Recirculation System - One Pump Trip
Plant Startup Test Procedure 29B-3, Recirculation System - Two Pump Trip
Plant Startup Test Procedure 35-3, Recirculation System Flow Calibration
CPS Technical Specifications, Section 3.3.4.2

Deficiencies Found:

All acceptance criteria for this test were demonstrated. However, an On-Demand program used to collect simulator data for comparison against plant data did not provide a correct printout.

Corrective Actions Planned (and schedule):

Simulator Problem Report (SPR) No. 91-026 has been written to investigate the deficiency identified during performance of STP 3.09. The deficiency will be evaluated to determine if it needs to be corrected to support training objectives. Based on this evaluation, the On Demand program will either be corrected or removed from the scope of simulation by August 1, 1992.

Exceptions Taken/Justification:

No exception is being taken to the standard for this test. The deficiency noted above will be resolved in a timely fashion.

SIMULATOR CERTIFICATION TEST SUMMARY

Test Name: STP 3.10, Loss of Condenser Vacuum/Hotwell Level Control

Description: This test demonstrated simulator performance during a loss of condenser vacuum and during a loss of hotwell level control. Simulator performance was then compared to actual plant data and expected plant response.

The simulator was initialized at approximately 55 to 60% power. The first section of this test simulated a loss of condenser vacuum by using a malfunction which caused a crack in the condenser casing. The second section of this test simulated a loss of hotwell level control by using malfunctions to fail the hotwell make-up and overflow controller output signals high and low.

For both sections, values of parameters important to the transient were collected and then examined to ensure that the parameters trended in the direction and compared reasonably to actual or expected plant response. Automatic actions were verified to occur, such as turbine trip, main steam line isolation, and reactor scram. Alarms appropriate for the transients were also verified as being correct.

This procedure tested the malfunctions referred to in ANSI/ANS-3.5-1985, section 3.1.2 (5), and verified that the simulator met the performance criteria established in section 4.2.1 of the standard.

Simulator Features Tested:

PMS special log
Malfunction MC01, Condenser Air Inleakage
Malfunction FW02, Condenser Hotwell Makeup Controller Failure
Malfunction FW03, Condenser Hotwell Dump Controller Failure

SIMULATOR CERTIFICATION TEST SUMMARY

Test Name: STP 3.10, Loss of Condenser Vacuum/Hotwell Level Control (Cont'd)

Initial Conditions:

The simulator was set to a normal 55-60% power lineup.

Final Conditions:

None

Baseline Data Description:

Plant GETARS data of 8/25/87 scram on loss of condenser vacuum
Plant operating procedures
System electrical drawings

Deficiencies Found:

None

Corrective Actions Planned (and schedule):

None

Exceptions Taken/Justification:

None

SIMULATOR CERTIFICATION TEST SUMMARY

Test Name: STP 3.11, Loss of Service Water

Description: This test demonstrated simulator response during loss of service water and cooling to plant components. This test involved inserting various simulator malfunctions to trip individual Plant Service Water (WS) pump(s), Shutdown Service Water (SX) pump(s), and then all pumps resulting in a complete loss of both WS and SX flow.

The simulator was initialized at full power. Various Service Water and Shutdown Service Water pump trip malfunctions were activated individually and in combination to cause disturbances and then a total loss of cooling flow to plant equipment. Values of parameters important to the transient, especially temperature indications, were collected and then examined to ensure that the parameters trended in the direction and compared reasonably to the expected plant response. Automatic actions were verified to occur, such as automatic start of standby pumps. Alarms appropriate for the transient were also verified as being correct.

This procedure tested the malfunctions referred to in ANSI/ANS-3.5-1985, section 3.1.2 (6), and verified that the simulator met the performance criteria established in section 4.2.1 of the standard.

Simulator Features Tested:

Malfunctions CW05A through CW05C, Plant Service Water Pump Trip
Malfunctions CW04A through CW04C, Shutdown Service Water Pump Trip
Proper dynamic and logical responses
PMS special log

SIMULATOR CERTIFICATION TEST SUMMARY

Test Name: STP 3.11, Loss of Service Water (Cont'd)

Initial Conditions:

The simulator was set to a normal full power lineup.

Final Conditions:

All plant service water pumps and shutdown service water pumps tripped when required by the malfunctions. Proper trip indications were received. Automatic starts of standby pumps occurred properly. Temperature and water pressure parameters changed in the directions expected.

Baseline Data Description:

Plant Startup Acceptance Test ATP-WS-01, Plant Service Water
Plant Preoperational Test PTP-SX-01, Shutdown Service Water
Plant Operating Procedures CPS No. 3211.01, CPS No. 3212.01
System electrical drawings

Deficiencies Found:

None

Corrective Actions Planned (and schedule):

None

Exceptions Taken/Justification:

None

SIMULATOR CERTIFICATION TEST SUMMARY

Test Name: STP 3.12, Loss of Shutdown Cooling

Description: This test demonstrated simulator response during loss of shutdown cooling. This test involved inserting a simulator malfunction that caused the shutdown cooling inboard suction isolation valve E12-F009 to automatically shut. The test verified that the loss of shutdown cooling resulted in increasing reactor coolant temperature and pressure. Simulator response was compared to expected plant response.

The simulator was set to a normal cold shutdown lineup following a period of high power operation. Residual Heat Removal (RHR) A was in shutdown cooling. The initial values of parameters important to the test were recorded, such as recirculation loop temperatures, reactor pressure, reactor water cleanup inlet temperature, and RHR A heat exchanger inlet temperature. A malfunction was then activated which shut the shutdown cooling inboard suction isolation valve which resulted in a loss of shutdown cooling. The values of parameters were observed and once positive indication of increasing reactor pressure was achieved, the final values of the parameters were recorded. The initial and final parameter values were then examined to verify that the parameters changed in the direction expected for the parameter. No automatic actions or alarms were associated with this test.

This procedure tested the malfunction referred to in ANSI/ANS-3.5-1985, section 3.1.2 (7), and verified that the simulator met the performance criteria established in section 4.2.1 of the standard.

Simulator Features Tested:

PMS special logs
Malfunction RH10, Loss of Shutdown Cooling

SIMULATOR CERTIFICATION TEST SUMMARY

Test Name: STP 3.12, Loss of Shutdown Cooling (Cont'd)

Initial Conditions:

The simulator was set to a normal cold shutdown lineup following a period of high power operation. Residual Heat Removal (RHR) A was in shutdown cooling.

Final Conditions:

The shutdown cooling mode of the Residual Heat Removal system was isolated and various reactor temperature and pressure indications were increasing.

Baseline Data Description:

Significant Operating Experience Report (82-2), Reactor Pressure Vessel Pressurization

Deficiencies Found:

None

Corrective Actions Planned (and schedule):

None

Exceptions Taken/Justification:

None

SIMULATOR CERTIFICATION TEST SUMMARY

Test Name: STP 3.13, Loss of Component Cooling

Description: This test demonstrated simulator performance during a loss of component cooling water and cooling to plant components. The test involved inserting simulator malfunctions that resulted in the failure of Component Cooling Water (CC) pumps.

The simulator was initialized at full power. Malfunctions were then activated which tripped all three component cooling water pumps. Values of parameters important to the transient, especially temperature indications, were collected and then examined to ensure that the parameters trended in the direction and compared reasonably to the expected plant response. Automatic actions were verified to occur, such as automatic transfer of reactor recirculation pump cooling water supply to shutdown service water, trip of the running air compressors, and isolation of the reactor water cleanup system due to lack of cooling water supply. Alarms appropriate for the transient were also verified as being correct.

This procedure tested the malfunction referred to in ANSI/ANS-3.5-1985, section 3.1.2 (8), and verified that the simulator met the performance criteria established in section 4.2.1 of the standard.

Simulator Features Tested:

PMS special logs
Malfunctions CW06A through CW06C, Component Cooling Water Pump Trips
Proper dynamic and logical response

Initial Conditions:

The simulator was set to a normal full power lineup.

SIMULATOR CERTIFICATION TEST SUMMARY

Test Name: STP 3.13, Loss of Component Cooling (Cont'd)

Final Conditions:

All component cooling water pumps were tripped. Plant automatically tripped as expected due to loss of heat sink.

Baseline Data Description:

System mechanical and electrical drawings

Deficiencies Found:

None

Corrective Actions Planned (and schedule):

None

Exceptions Taken/Justification:

None

SIMULATOR CERTIFICATION TEST SUMMARY

Test Name: STP 3.14, Feedwater System/Control Failure

Description: This test demonstrated simulator performance during various failures of the Feedwater System and the Feedwater Level Control System. The test was divided into several sections which demonstrate a trip of a turbine driven reactor feedwater pump, a failure of a turbine driven reactor feedwater pump control system, and a failure of a motor driven reactor feedwater pump control system.

For test sections involving the turbine driven feedwater pumps or their control system, the simulator was initialized at approximately 96.8% power, to correspond to the conditions at which actual plant startup test data was taken. For the test section involving the motor driven reactor feedwater pump, the simulator was initialized at approximately 30% power.

Values of parameters important to the transient, such as feedwater flow, feedwater pump turbine speed, reactor water level, and reactor power, were collected and then examined to ensure that the parameters trended in the correct direction and compared reasonably to the expected plant response. Automatic actions were verified to occur, such as automatic runback of reactor recirculation system flow control valve positions. Alarms appropriate for the transient were also verified as being correct.

This procedure tested the malfunctions referred to in ANSI/ANS-3.5-1985, section 3.1.2 (9), and verified that the simulator met the performance criteria established in section 4.2.1 of the standard.

Simulator Features Tested:

- PMS special logs
- Malfunction FW08A, Turbine Feedwater Pump A Trip
- Malfunction FW09A, Turbine Feedwater Pump Controller Failure
- Malfunction FW09C, Motor Driven Feedwater Pump Controller Failure
- Proper Recirculation Flow Control Valve dynamic response

SIMULATOR CERTIFICATION TEST SUMMARY

Test Name: STP 3.14, Feedwater System/Control Failure (Cont'd)

Initial Conditions:

For the turbine feedwater pump trip tests, the simulator was set to approximately 96.8% power, beginning of life core, two turbine driven feedwater pumps in operation, and three element feedwater level control.

For the motor driven feedwater pump test, the simulator was set to approximately 30% rated power with only the motor driven feedwater pump in service.

Final Conditions:

The feedwater pumps tripped and the control signals failed appropriately for the malfunction being tested. The change in parameters, automatic actions, and alarms were appropriate and consistent with actual plant startup test data and expected plant response.

Baseline Data Description:

Plant Startup Test Procedure 23C, Feedwater Pump Trip
Feedwater system electrical drawings

Plant Operating Procedure:

CPS No. 3103.01, Feedwater (FW)

Deficiencies Found:

None

Corrective Actions Planned (and schedule):

None

Exceptions Taken/Justification:

None

SIMULATOR CERTIFICATION TEST SUMMARY

Test Name: STP 3.15, Loss of Injection Capability

Description: This test demonstrated simulator performance during a complete loss of normal and emergency feedwater (injection) systems.

The simulator was initialized at full power. Malfunctions were activated which would cause High Pressure Core Spray (HPCS), Reactor Core Isolation Cooling (RCIC), Low Pressure Core Spray (LPCS), and Low Pressure Coolant Injection (LPCI) to fail to automatically start. Condensate (CD), Condensate Booster (CB), Feedwater (FW), and Control Rod Hydraulic pumps were then manually tripped and placed in pull-to-lock so that they could not provide makeup water to the reactor. As reactor water level decreased, a reactor scram occurred and water level dropped below the top of the active fuel. Reactor water level was allowed to continue to drop which then resulted in fuel damage indications.

Values of parameters important to the transient, especially reactor water level, suppression pool temperature, and containment and drywell hydrogen and radiation levels, were collected and then examined to ensure that the parameters trended in the correct direction and compared reasonably to the expected plant response. Automatic actions were verified to occur, such as reactor scram, autostart of emergency diesel generators, and automatic containment isolations. Emergency Core Cooling Systems (ECCS) attempted to start but failed due to the active failure to start malfunctions. Alarms appropriate for the transient were also verified as being correct.

This procedure tested the malfunction referred to in ANSI/ANS-3.5-1985, section 3.1.2 (10), and verified that the simulator met the performance criteria established in section 4.2.1 of the standard.

Simulator Features Tested:

Malfunction HP01, HPCS Failure to Start
Malfunction HP08, LPCS Failure to Start
Malfunction RH01A through RH01C, RHR Pump Failure to Start
Malfunction RI01, RCIC Auto Start Failure
Automatic isolations
Automatic start of emergency diesel generators
Automatic start of Standby Gas Treatment System (SGTS)
PMS group point display
Proper integrated system dynamics

SIMULATOR CERTIFICATION TEST SUMMARY

Test Name: STP 3.15, Loss of Injection Capability (Cont'd)

Initial Conditions:

The simulator was set to a normal full power lineup with an end of life core history.

Final Conditions:

Injection of all normal and emergency feedwater to the reactor was terminated. Reactor water level decreased to a very low level. The fuel began to heat up and hydrogen was produced due to zircalloy-water reaction. Radiation levels increased as the fuel cladding deteriorated.

Baseline Data Description:

Emergency Operating Procedures (EOPs)

Deficiencies Found:

None

Corrective Actions Planned (and schedule):

None

Exceptions Taken/Justification:

None

SIMULATOR CERTIFICATION TEST SUMMARY

Test Name: STP 3.16, Loss of Protective System Channel

Description: This test demonstrated simulator performance during a loss of Reactor Protection System (RPS) channels.

The test involved initializing the simulator to full power, bypassing each Nuclear Steam Supply Shutoff System (NSSS) channel, and inserting manual scram signals and NSSS isolation signals.

Automatic actions were verified not to occur (because of loss of associated protective channels), such as the failure of containment isolations, failure of portions of the reactor scram systems, and failure of certain data recorders. Alarms were also verified as being correct.

This procedure tested the malfunction referred to in ANSI/ANS-3.5-1985, section 3.1.2 (11), and verified that the simulator met the performance criteria established in section 4.2.1 of the standard.

Simulator Features Tested:

Instructor Remote Operators MS104 through MS107, Bypass Divisional NS4 Scram Pushbuttons
Malfunction RR15P, B21-N081B Instrument Failure
Malfunction TC03A, Turbine Control Valve Failure
Malfunction TC04A, Turbine Stop Valve Failure
Automatic isolations

Initial Conditions:

The simulator was set to a normal full power lineup.

Final Conditions:

Simulator performance was consistent with expected plant performance.

SIMULATOR CERTIFICATION TEST SUMMARY

Test Name: STP 3.16, Loss of Protective System Channel (Cont'd)

Baseline Data Description:

Nuclear Boiler System electrical drawings
Reactor Protection System electrical drawings

Deficiencies Found:

None

Corrective Actions Planned (and schedule):

None

Exceptions Taken/Justification:

None

SIMULATOR CERTIFICATION TEST SUMMARY

Test Name: STP 3.17, Control Rod Failures

Description: This test demonstrated simulator performance during various control rod failures. Among the different control rod failures tested were control rod drift, stuck control rod, and uncoupled rods leading to control rod drop. Simulator performance was then compared to expected plant response.

The simulator was initialized at full power. A malfunction was activated which caused a selected control rod to drift out of the core. Increases in Local Power Range Monitor (LPRM) indications near the control rod were verified. Appropriate rod drift and rod block indications and alarms were verified as correct. Once the control rod had drifted full out, the control rod was driven back to its full in position. LPRM indications changed as expected. The control rod then began drifting outward again because the simulator malfunction was still active.

The simulator was initialized at full power. A malfunction was activated which stuck a selected control rod. Attempts to insert or withdraw the control rod verified that the control rod would not move. Control Rod Drive (CRD) Hydraulic pressures and flows were observed and verified to respond as expected. LPRM indications near the control rod did not change, as was expected. The reactor was then manually scrammed and the control rod did not move. LPRM indications decreased as expected following the scram.

The simulator was initialized to a startup condition, one control rod manipulation away from criticality. The control rod gang on which criticality was expected to occur was identified. A malfunction was then activated which caused all the rods of this gang to become uncoupled from their drive mechanisms. Another malfunction was activated which caused these control rods to stick at their present positions. Control rod withdrawal then continued using plant procedures until criticality was achieved. The selected gang of rods was withdrawn as far as conditions would permit. The rod stuck malfunction was then deactivated and the selected gang of control rods fell to the position of its drive mechanisms. A sharp increase in reactor power and short reactor period were observed.

SIMULATOR CERTIFICATION TEST SUMMARY

Test Name: STP 3.17, Control Rod Failures (Cont'd)

Description (cont'd):

This procedure tested the malfunctions referred to in ANSI/ANS-3.5-1985, section 3.1.2 (12), and verified that the simulator met the performance criteria established in section 4.2.1 of the standard.

Simulator Features Tested:

Malfunction LC01, Control Rod Drift
Malfunction LC02, Stuck Rod
Malfunction LC03, Uncoupled Rod
Control rod drift and rod block interlocks and indications
Dynamic response to a control rod drop event

Initial Conditions:

As discussed above.

Final Conditions:

Not applicable

Baseline Data Description:

USAR Chapter 15, section 15.4

Deficiencies Found:

None

Corrective Actions Planned (and schedule):

None

Exceptions Taken/Justification:

None

SIMULATOR CERTIFICATION TEST SUMMARY

Test Name: STP 3.18, Fuel Clad Failure

Description: This test demonstrated simulator performance during a situation resulting in likely fuel failure. The test involved a low level scram followed by a total loss of injection resulting in an extended reactor core uncovery. Simulator performance indicative of fuel failure was noted and compared to expected plant response.

The simulator was initialized at full power. Malfunctions were activated which would cause High Pressure Core Spray (HPCS), Reactor Core Isolation Cooling (RCIC), Low Pressure Core Spray (LPCS), and Low Pressure Coolant Injection (LPCI) to fail to automatically start, and the reactor protection system to fail. Condensate (CD), Condensate Booster (CB), Feedwater (FW), and Control Rod Hydraulic (CRD) pumps were then manually tripped and placed in pull-to-lock so that they could not provide makeup to the reactor. As reactor water level decreased, a reactor scram failed to occur, and water level continued to drop below the top of the active fuel. Reactor water level was allowed to drop to a level which resulted in fuel damage indications.

Values of parameters important to the transient, especially reactor water level, and containment and drywell hydrogen and radiation levels, were collected and then examined to ensure that the parameters trended in the correct direction and compared reasonably to the expected plant response. Automatic actions were verified to occur, such as an attempt to reactor scram. Alarms appropriate for the transient were also verified as being correct.

This procedure tested the malfunction referred to in ANSI/ANS-3.5-1985, section 3.1.2 (14), and verified that the simulator met the performance criteria established in section 4.2.1 of the standard.

See also STP 4.03 test for malfunction CR01, Fuel Cladding Failure.

SIMULATOR CERTIFICATION TEST SUMMARY

Test Name: STP 3.18, Fuel Clad Failure (Cont'd)

Simulator
Features Tested:

Malfunction HP01, HPCS Failure to Start
Malfunction HP08, LPCS Failure to Start
Malfunction RH01A through RH01C, RHR Pump Failure to Start
Malfunction RI01, RCIC Auto Start Failure
Malfunction RP01, Failure to Scram
PMS special logs

Initial Conditions:

The simulator was set to a normal full power lineup with and end of life core history.

Final Conditions:

Reactor water level fell far below the top of the active fuel and fuel damage was indicated.

Baseline Data Description:

USAR Chapter 15

Deficiencies Found:

Certain steps of the test procedure required the use of the simulated Area Radiation/Process Radiation (AR/PR) Central Control Terminal (CCT). However, the simulator AR/PR CCT is currently only visually simulated because of pending plant design changes. Simulator Problem Report SPR 91-023 has been written to resolve the issue once more details on the pending plant change are known. In the meantime, other simulated radiation monitors, such as containment/drywell high range accident monitors, fission product monitors, and main steam line radiation monitors, provide the operator adequate indications of radiation in the simulator. These indications performed as expected for this test.

SIMULATOR CERTIFICATION TEST SUMMARY

Test Name: STP 3.18, Fuel Clad Failure (Cont'd)

Corrective Actions Planned (and schedule):

None

Exceptions Taken/Justification:

None

SIMULATOR CERTIFICATION TEST SUMMARY

Test Name: STP 3.19, Turbine Trip

Description: This test demonstrated simulator performance during a turbine trip.

The simulator was initialized at approximately 28% power. A malfunction was activated which caused a main turbine trip.

Values of parameters important to the transient, especially turbine stop and control valve positions, turbine bypass valve positions, and turbine speed, were observed to ensure that the parameters trended in the correct direction and compared reasonably to expected plant response, and actual plant startup test performance. Automatic actions were verified to occur such as reverse power trip of the generator, and turbine bypass valve operation. As expected at the low initial power level (within bypass capability), the reactor did not scram and Safety Relief Valves did not open. Alarms appropriate for the transient were verified to be correct.

This procedure tested the malfunction referred to in ANSI/ANS-3.5-1985, section 3.1.2 (15), and verified that the simulator met the performance criteria established in section 4.2.1 of the standard.

Simulator Features Tested:

Malfunction TC01, Turbine Trip
Integrated plant response to a low power turbine trip

Initial Conditions:

The simulator was set to approximately 28% power with a beginning of life core history.

SIMULATOR CERTIFICATION TEST SUMMARY

Test Name: STP 3.19, Turbine Trip (Cont'd)

Final Conditions:

The simulator responded properly to the turbine trip. Turbine stop and control valves shut. Main Steam Isolation Valves (MSIVs) remained open. Turbine bypass valves opened to control reactor pressure. The reactor remained in operation. The simulator stabilized following the turbine trip consistent with expected and actual plant performance.

Baseline Data Description:

Plant Startup Test Procedure 27-6, Turbine Trip and Generator Load Rejection

Deficiencies Found:

None

Corrective Actions Planned (and schedule):

None

Exceptions Taken/Justification:

None

SIMULATOR CERTIFICATION TEST SUMMARY

Test Name: STP 3.20a, Large Steam Line Break Outside Containment

Description: This test demonstrated simulator performance during a large steam line break outside containment. Simulator performance was then compared to expected plant performance.

The simulator was initialized in a normal full power condition. The Reactor Core Isolation Cooling and High Pressure Core Spray Failure to Autostart malfunctions were active. A malfunction was then activated at full severity which caused a main steam line break outside the containment. Values of parameters important to the transient, especially reactor water level and pressure, total steam flow, steam line flow, and generator output power, were collected and then examined to ensure that the parameters trended in the correct direction and compared reasonably to the expected plant response. Automatic actions were verified to occur, such as main steam line isolation. Alarms appropriate for the transient were also verified as being correct.

This procedure tested one of the malfunctions referred to in ANSI/ANS-3.5-1985, section 3.1.2 (20), and verified that the simulator met the performance criteria established in section 4.2.1 of the standard.

Simulator Features Tested:

Malfunction RI01, RCIC Auto Start Failure
Malfunction HP01, HPCS Failure to Auto Start
Malfunction MS07A, Main Steam Line Rupture in the Turbine Building
PMS special logs
Automatic isolations

Initial Conditions:

The simulator was set to a normal full power lineup, with reactor recirculation flow control in master manual mode. Malfunctions RI01 and HP01 were active.

SIMULATOR CERTIFICATION TEST SUMMARY

Test Name: STP 3.20a, Large Steam Line Break Outside Containment (Cont'd)

Final Conditions:

Simulator was stable 20 minutes following the main steam line break. Parameters trended in the expected directions. Automatic actions, indications, and alarms were consistent with expected plant response.

Baseline Data Description:

USAR Chapter 15, section 15.6.4
Emergency Operating Procedures (EOPs)

Deficiencies Found:

Certain steps of the test procedure required the use of the simulated Area Radiation/Process Radiation (AR/PR) Central Control Terminal (CCT). However, the simulator AR/PR CCT is currently only visually simulated because of pending plant design changes. Simulator Problem Report SPR 91-023 has been written to resolve the issue once more details on the pending plant change are known. This had no impact on the ability to use or properly simulate the malfunction.

Corrective Actions Planned (and schedule):

None

Exceptions Taken/Justification:

None

SIMULATOR CERTIFICATION TEST SUMMARY

Test Name: STP 3.20b, Small Steam Line Break Outside Containment

Description: This test demonstrated simulator performance during a small steam line break outside containment. The steam line break tested occurred in the main steam tunnel which is inside the secondary containment boundary. Simulator performance was then compared to expected plant performance.

The simulator was initialized in a normal full power condition. A malfunction was then activated at a small severity (2%) which caused a main steam line leak outside the containment in the auxiliary building portion of the main steam tunnel. Values of parameters important to the transient, especially steam tunnel temperature and differential temperature, were monitored to ensure that the parameters trended in the correct direction and compared reasonably to the expected plant response. Automatic actions were verified to occur, such as main steam line isolation. Alarms appropriate for the transient were also verified as being correct.

This procedure tested one of the malfunctions referred to in ANSI/ANS-3.5-1985, section 3.1.2 (20), and verified that the simulator met the performance criteria established in section 4.2.1 of the standard.

Simulator
Features Tested:

PMS group point display
Malfunction MS06A, Main Steam Line A Steam Leak
Automatic isolations
Main Steam Tunnel temperature dynamics
Leak Detection logics

Initial Conditions:

The simulator was set to a normal full power lineup with reactor recirculation in master manual mode.

SIMULATOR CERTIFICATION TEST SUMMARY

Test Name: STP 3.20b, Small Steamline Break Outside Containment (Cont'd)

Final Conditions:

Steam tunnel temperature and differential temperature increased in response to the steam leak to the point where automatic isolations occurred to terminate the steam leak. The simulator then stabilized with main steam tunnel temperature indications trending downward below their trip setpoints.

Baseline Data Description:

Emergency Operating Procedures
Leak detection electrical drawings
Floor drain system mechanical drawings

Plant Operating Procedure:

CPS No. 4001.(2, Automatic Isolation

Deficiencies Found:

One step of the test procedure required the use of the simulated Area Radiation/Process Radiation (AR/PR) Central Control Terminal (CCT). However, the simulator AR/PR CCT is currently only visually simulated because of pending plant design changes. Simulator Problem Report SPR 91-023 has been written to resolve the issue once more details on the pending plant change are known. This had no impact on the ability to use or properly simulate the malfunction.

Corrective Actions Planned (and schedule):

None

Exceptions Taken/Justification:

None

SIMULATOR CERTIFICATION TEST SUMMARY

Test Name: STP 3.21, Feedwater Line Break Outside Containment

Description: This test demonstrated simulator performance during a feedwater line break outside containment. Simulator performance was then compared to expected plant performance.

The simulator was initialized in a normal full power condition. Two malfunctions were then activated which caused a rupture of both feedwater lines outside of containment in the main steam tunnel. Values of parameters important to the transient, especially steam tunnel temperature and differential temperature, reactor water level, feedwater flow, and feedwater discharge header pressure, were monitored to ensure that the parameters trended in the correct direction and compared reasonably to the expected plant response. Automatic actions were verified to occur, such as reactor scram on low water level, main steam line isolation, and feedwater pump trip. Alarms appropriate for the transient were also verified as being correct.

This procedure tested one of the malfunctions referred to in ANSI/ANS-3.5-1985, section 3.1.2 (20), and verified that the simulator met the performance criteria established in section 4.2.1 of the standard.

Simulator Features Tested:

Malfunctions FW13A and FW13B, Feedwater Line A (B) Rupture
Safety Parameter Display System (SPDS)
Steam Flow/Feedwater Flow Recorder
Feedwater Check Valve indications and associated computer points
Feedwater dynamics
Main Steam Tunnel temperature dynamics
Automatic isolations

SIMULATOR CERTIFICATION TEST SUMMARY

Test Name: STP 3.21, Feedwater Line Break Outside Containment (Cont'd)

Initial Conditions:

The simulator was set to a normal full power lineup with reactor recirculation control in master manual and feedwater in three element flow control.

Final Conditions:

Reactor water level responded to the loss of feedwater. The reactor scrammed and the main steam lines isolated due to high steam tunnel temperature and differential temperature. The feedwater pumps tripped. High Pressure Core Spray (HPCS) automatically started and restored reactor water level. Parameters changed in the direction expected. Alarms and indications were consistent with expected plant performance.

Baseline Data Description:

USAR Chapters 6 and 15
Emergency Operating Procedures (EOPs)

Plant Operating Procedure:

CPS No. 4001.02, Automatic Isolation

Deficiencies Found:

None

Corrective Actions Planned (and schedule):

None

Exceptions Taken/Justification:

None

SIMULATOR CERTIFICATION TEST SUMMARY

Test Name: STP 3.22, Nuclear Instrumentation Failures

Description: This test demonstrated simulator performance during various failures of nuclear instrumentation. The test involved demonstrating Average Power Range Monitor (APRM) upscale and downscale failures, and Intermediate Range Monitor (IRM) upscale and downscale failures.

For the first portion of the test, the simulator was initialized to full power. A malfunction was activated which caused an Average Power Range Monitor (APRM) channel to fail upscale. Thermal power upscale, neutron flux upscale, APRM upscale, and rod block alarms and indications were verified as being correct.

For the second portion of the test, the simulator was reinitialized to full power. A malfunction was activated which caused an APRM channel to fail downscale. APRM downscale and rod block alarms and indications were verified as being correct.

For the third portion of the test, the simulator was initialized to a startup condition with thermal power in the heating range. A malfunction was activated which caused an Intermediate Range Monitor (IRM) channel to fail upscale. Various upscale, trip, inop, and rod block alarms and indications were verified as being correct.

For the fourth portion of the test, the simulator was reinitialized to a startup condition with thermal power in the heating range. A malfunction was activated which caused an IRM channel to fail downscale. Various downscale and rod block alarms and indications were verified as correct.

This procedure tested the malfunctions referred to in ANSI/ANS-3.5-1985, section 3.1.2 (21), and verified that the simulator met the performance criteria established in section 4.2.1 of the standard.

SIMULATOR CERTIFICATION TEST SUMMARY

Test Name: STP 3.22, Nuclear Instrumentation Failures (Cont'd)

Simulator Features Tested:

Neutron monitoring
Malfunction NM13A, APRM Channel Upscale
Malfunction NM12A, APRM Channel Downscale
Malfunction NM07A, IRM Channel Upscale
Malfunction NM11A, IRM Channel Downscale
Associated annunciators and alarms
Associated logical trips and automatic actuations

Initial Conditions:

The simulator was set to a normal full power lineup for APRM tests. The simulator was set to the heating range for IRM tests.

Final Conditions:

Simulator performance in response to the malfunctions was consistent with expected plant performance.

Baseline Data Description:

Plant Operating Procedures:

CPS No. 3306.01, Source/Intermediate Range Monitors
CPS No. 3308.01, Local/Average Power Range Monitors

Deficiencies Found:

None

Corrective Actions Planned (and schedule):

None

Exceptions Taken/Justification:

None

SIMULATOR CERTIFICATION TEST SUMMARY

Test Name: STP 3.23, Passive Malfunctions

Description: This test demonstrated simulator performance in response to passive malfunctions -- those malfunctions which do not become evident to the operator until the affected system is called upon to function.

Many passive malfunctions were tested as a part of other Simulator Test Procedures (STPs) and were not retested here. The passive malfunctions tested by this STP were emergency diesel generator failure to start, Residual Heat Removal (RHR) pump failure to start, High Pressure Core Spray (HPCS) failure to start, Low Pressure Core Spray (LPCS) failure to start, reactor core isolation cooling system failure to start, HPCS pump discharge valve shut, LPCS pump discharge valve shut, HPCS injection valve failure, LPCS injection valve failure, Low Pressure Coolant Injection (LPCI) injection valve failure, and RHR pump discharge valve shut.

Automatic actions, the failure of automatic actions due to active malfunctions, indications, and alarms were verified.

This procedure tested the malfunctions referred to in ANSI/ANS-3.5-1985, section 3.1.2 (23), and verified that the simulator met the performance criteria established in section 4.2.1 of the standard.

Simulator Features Tested:

Malfunctions DG01A through DG01C, Diesel Generator Fail to Start
Malfunctions RH01A through RH01C, RHR Pump Failure to Start
Malfunction RI01, RCIC Failure to Start
Malfunction RR03, Reactor Recirculation Loop Rupture
Malfunctions RH07A through RH07C, LPCI Injection Valve Failure

SIMULATOR CERTIFICATION TEST SUMMARY

Test Name: STP 3.23, Passive Malfunctions (Cont'd)

Simulator
Features Tested (cont'd):

Malfunction HP10, HPCS Injection Valve Failure
Malfunctions RH08A through RH08C, Valve E12-F029A (B,C) Shut
Malfunction HP05, Valve E22-F031 Shut
Malfunction HP12, Valve E21-F039 Shut
PMS group point displays
ECCS failure annunciators

Initial Conditions:

The simulator was set to a shut down condition.

Final Conditions:

Automatic actions, the failure of automatic actions due to active malfunctions, indications, and alarms were verified. All malfunctions performed as expected.

Baseline Data Description:

Plant operating procedures:

CPS No. 3310.01, Reactor Core Isolation Cooling
CPS No. 3319.01, Standby Gas Treatment System
CPS No. 3312.01, Residual Heat Removal
CPS No. 3309.01, High Pressure Core Spray
CPS No. 3313.01, Low Pressure Core Spray
CPS No. 3506.01, Diesel Generator

Deficiencies Found:

None

Corrective Actions Planned (and schedule):

None

Exceptions Taken/Justification:

None

SIMULATOR CERTIFICATION TEST SUMMARY

Test Name: STP 3.24, Reactor Protection System Failure (ATWS)

Description: This test demonstrated simulator performance during a Reactor Protection System (RPS) failure resulting in an Anticipated Transient Without Scram (ATWS). Simulator performance was then compared to best estimate plant response.

The simulator was initialized at full power with a Reactor Protection System Failure (ATWS) malfunction already active. The transient was initiated by the introduction of a malfunction which caused a turbine trip. Values of parameters important to the transient, especially reactor power, reactor water level, reactor pressure, steam flow, feedwater flow, containment and drywell temperatures and pressures, and suppression pool temperature, were recorded and examined to ensure that the parameters trended in the correct direction and compared reasonably to expected plant response, and actual plant startup test performance. Automatic actions were verified to occur, such as generator trip and load transfer, reactor recirculation pump trip, and reactor water cleanup system trip when Standby Liquid Control (SLC) was initiated. Alarms appropriate for the transient were also verified to be correct.

This procedure tested the malfunctions referred to in ANSI/ANS-3.5-1985, section 3.1.2 (13 and 24), and verified that the simulator met the performance criteria established in section 4.2.1 of the standard.

Simulator Features Tested:

Malfunction RP01, Automatic and Manual Scram Failure
Malfunction TC01, Turbine Trip
PMS special logs
Plant Shutdown with Boron (Standby Liquid Control)

SIMULATOR CERTIFICATION TEST SUMMARY

Test Name: STP 3.24, Reactor Protection System Failure (ATWS) (Cont'd)

Initial Conditions:

The simulator was set to a normal full power lineup with reactor recirculation in master manual control and feedwater in three element control.

Final Conditions:

The simulator responded to the turbine trip from full power by attempting to automatically scram. The automatic scram failed in accordance with the malfunction. Attempts to manually scram the reactor also failed. Standby Liquid Control (SLC) was eventually used to begin shutting down the reactor. Meanwhile, the suppression pool and containment responded to the heat and energy addition consistent with expected plant response. Automatic actions and alarms also performed as expected.

Baseline Data Description:

CPS Technical Specification 3/4.1.5
USAR Chapter 15
Emergency Operating Procedures

Plant Operating Procedures:

CPS No. 4100.01, Reactor Scram
CPS No. 3314.01, Standby Liquid Control

Deficiencies Found:

None

Corrective Actions Planned (and schedule):

None

Exceptions Taken/Justification:

None

SIMULATOR CERTIFICATION TEST SUMMARY

Test Name: STP 3.25, Turbine Bypass Failure

Description: This test demonstrated simulator performance in response to turbine bypass valve failures. Response to BPVs failing open and failing shut was demonstrated. Simulator performance was then compared to expected plant response.

For the first portion of the test, the simulator was initialized at full power. A malfunction was activated at full severity which failed a turbine bypass valve full open. Values of parameters important to the transient, especially generator output power, steam equalizing header pressure, and bypass valve position were observed to ensure that the parameters trended in the correct direction and compared reasonably to expected plant response.

For the second portion of the test, the simulator was initialized at approximately 30% power. A malfunction was activated which caused a failure of the Electrohydraulic Control (EHC) for the turbine bypass valves. The main turbine was then manually tripped. Turbine bypass valves did not open due to the loss of EHC control according to the malfunction. A reactor scram occurred and safety relief valves functioned as expected.

Other alarms and automatic actions appropriate for the transients were verified as necessary.

This procedure tested the malfunction referred to in ANSI/ANS-3.5-1985, section 3.1.2 (25), and verified that the simulator met the performance criteria established in section 4.2.1 of the standard.

Simulator Features Tested:

Malfunction TC02A, Bypass Valve Failure
Malfunction TC07, EHC Failure
Manual turbine trip
Generator trip and load transfer
Automatic reactor scram

SIMULATOR CERTIFICATION TEST SUMMARY

Test Name: STP 3.25, Turbine Bypass Failure (Cont'd)

Initial Conditions:

The simulator was set to a normal full power lineup for the first portion of the test. The simulator was set up to approximately 30% power for the second part of the test.

Final Conditions:

The simulator performed properly for both malfunctions tested. For the first part, the simulator continued to operate with one bypass valve open and resultant reduction in generator output power. For the second part, the simulator properly scrammed and safety relief valves operated to automatically control reactor pressure. Alarms and automatic actions occurred consistent with expected plant response.

Baseline Data Description:

USAR Chapter 15

Deficiencies Found:

None

Corrective Actions Planned (and schedule):

None

Exceptions Taken/Justification:

None

SIMULATOR CERTIFICATION TEST SUMMARY

Test Name: STP 3.26, Generator Trip

Description: This test demonstrated simulator performance during a generator trip.

The simulator was initialized at full power. Malfunctions were then activated which tripped open circuit switches 4506 and 4510. This resulted in a generator load reject trip.

Values of parameters important to the transient, especially reactor water level and pressure, turbine speed, and bypass valve status, were collected and then examined to ensure that the parameters trended in the correct direction and compared reasonably to the expected plant response. Automatic actions were verified to occur, such as electrical bus transfers, reactor recirculation pump downshift, and feedwater level control runback. Alarms appropriate for the transient were also verified as being correct.

This procedure tested the malfunction referred to in ANSI/ANS-3.5-1985, section 3.1.2 (16), and verified that the simulator met the performance criteria established in section 4.2.1 of the standard.

Simulator Features Tested:

Malfunction EG01, Generator Load Reject
Automatic transfers of high voltage bus transfers

Initial Conditions:

Simulator was set to approximately 96% power.

Final Conditions:

Simulator stabilized following a generator trip. Simulator performance in response to the malfunctions was consistent with expected plant performance.

SIMULATOR CERTIFICATION TEST JUMMARY

Test Name: STP 3.26, Generator Trip (Cont'd)

Baseline Data Description:

Plant Startup Test Procedure 27-6, Generator Lo..
Rejection

Deficiencies Found:

None

Corrective Actions Planned (and schedule):

None

Exceptions Taken/Justification:

None

SIMULATOR CERTIFICATION TEST SUMMARY

Test Name: STP 3.27, Failure of Reactor Recirculation and Reactor Core Isolation Cooling Flow Controllers

Description: This test demonstrated simulator performance during a failure of the Reactor Recirculation Loop Flow Control Valve (FCV) Position Feedback Signal, and a failure of the Reactor Core Isolation Cooling (RCIC) Flow Controller.

The simulator was initialized at full power. A malfunction was activated which caused a reactor recirculation flow control valve position feedback signal failure. This automatically caused a flow control valve motion inhibit signal. Proper alarms and indications were received. The flow control valve could not be repositioned while the inhibit signal was in effect, as expected. The malfunction was removed, the inhibit signal was reset, and proper flow control valve position control was restored.

The simulator was initialized at full power. A malfunction was activated which failed the RCIC Flow Controller low. The RCIC system was manually initiated. Automatic actions following an RCIC initiation were verified to occur. The RCIC turbine speed increased to an abnormally low speed. The flow controller indicated zero demand as appropriate for the malfunction. The flow controller was then placed in manual operation and proper control was restored.

The simulator was initialized at full power. A malfunction was activated at full severity which failed the RCIC Flow Controller. The RCIC system was manually initiated. Automatic actions following an RCIC initiation were verified to occur. The RCIC turbine speed increased to greater than its trip setpoint, and the turbine then tripped on overspeed, as expected.

This procedure tested the malfunction referred to in ANSI/ANS-3.5-1985, section 3.1.2 (17), and verified that the simulator met the performance criteria established in section 4.2.1 of the standard.

SIMULATOR CERTIFICATION TEST SUMMARY

Test Name: STP 3.27, Failure of Reactor Recirculation and Reactor Core Isolation Cooling Flow Controllers (Cont'd)

Description (cont'd):

Malfunctions affecting core reactivity have also been demonstrated in other Simulator Test Procedures, such as STP 3.17 and STP 3.24. Another malfunction affecting core heat removal was demonstrated in STP 3.12.

Simulator Features Tested:

Malfunction RI03, RCIC Flow Controller Failure
Malfunction RR11, Recirculation Loop Flow Control Valve Position Feedback Signal Failure
PMS special log
Reactor Recirculation Flow Control Valve operation

Initial Conditions:

The simulator was set to a normal full power lineup.

Final Conditions:

The simulator responded properly to the FCV Position Feedback Signal Failure and the RCIC Flow Controller Failure.

Baseline Data Description:

USAR Chapter 15, sections 15.3.2 and 15.4.5
Plant Startup Test 14-H, RCIC System
Plant Startup Test 14-1, RCIC System
Plant Startup Test 14-2, RCIC System
Emergency Operating Procedures
Report on Core Flow Characteristics JWP-87-692

Plant Operating Procedures:

CPS No. 3310.01, Reactor Core Isolation Cooling
CPS No. 5003, Reactor Recirculation System Annunciator Procedures

SIMULATOR CERTIFICATION TEST SUMMARY

Test Name: STP 3.27, Failure of Reactor Recirculation and Reactor Core Isolation Cooling Flow Controllers (Cont'd)

Deficiencies Found:

None

Corrective Actions Planned (and schedule):

None

Exceptions Taken/Justification:

None

SIMULATOR CERTIFICATION TEST SUMMARY

Test Name: STP 3.28, Process Instrumentation Failures

Description: This test demonstrated simulator response to failures of process instrumentation that supply automatic initiation, actuation, or isolation signals. Simulator performance was then compared to expected plant performance.

The simulator was initialized at full power. For one portion of the test, the Containment Continuous Purge (CCP) system was operating in its normal lineup. For another portion of the test, the CCP system was operating in the fuel building bypass mode.

Combinations of malfunctions were activated to cause various process radiation monitor channel failures. This resulted in various automatic actions, such as autostart of the Standby Gas Treatment System (SGTS), mode changes to Control Room HVAC, and changes to the position of numerous ventilation dampers. All automatic actions and alarms were verified as being correct.

This procedure tested the malfunctions referred to in ANSI/ANS-3.5-1985, section 3.1.2 (22), and verified that the simulator met the performance criteria established in section 4.2.1 of the standard.

Simulator Features Tested:

Malfunctions RM010, F, G, P, Q, R, S, T, U, V, W, X, Y, Z, AA, AB, AC, AE, AF, AG, AH, Radiation Monitor Failure

Initial Conditions:

The simulator was set to a normal full power lineup.

SIMULATOR CERTIFICATION TEST SUMMARY

Test Name: STP 3.28, Process Instrumentation Failures (Cont'd)

Final Conditions:

Simulator remained stable. All automatic actions and alarms occurred as expected.

Baseline Data Description:

Standby Gas Treatment System electrical drawings
Control Room HVAC System electrical drawings
Process Radiation Monitoring System electrical drawings

Deficiencies Found:

Certain steps of the test procedure required the use of the simulated Area Radiation/Process Radiation (AR/PR) Central Control Terminal (CCT). However, the simulator AR/PR CCT is currently only visually simulated because of pending plant design changes. Simulator Problem Report SPR 91-023 has been written to resolve the issue once more details on the pending plant change are known. This had no impact on the ability to use or properly simulate the malfunctions.

Corrective Actions Planned (and schedule):

None

Exceptions Taken/Justification:

None

SIMULATOR CERTIFICATION TEST SUMMARY

Test Name: STP 4.01, Simulator Physical Fidelity/Human Factors Verification Criteria

Description: This test demonstrated that the simulator physical fidelity was comparable to the actual plant in the areas of panel simulation, configuration of instrumentation and controls, and ambient environment. The test involved comparing simulator panels and hardware to actual plant configuration documents, drawings, and photographs; and verifying that lighting, noise, furniture layout, and communication systems were comparable to the actual plant to the degree that any differences do not detract from training or impact the actions to be taken by the operator.

This procedure verified that the simulator met the criteria established in ANSI/ANS-3.5-1985, section 3.2.

Simulator Features Tested:

Lighting
Communications
Noise Levels

Initial Conditions:

Not Applicable

Final Conditions:

There were some minor differences in communication devices identified during the performance of this test. These are described later under STP 4.02.

The placement of normal and emergency lighting was found to be nearly identical to the plant. Light measurements indicated that simulator illumination nearly matched that of the main control room. Additionally, the illumination of both locations is adjustable.

SIMULATOR CERTIFICATION TEST SUMMARY

Test Name: STP 4.01, Simulator Physical Fidelity/Human Factors Verification Criteria (Cont'd)

Baseline Data Description:

Main Control Room Photographs
Light measurements
Background noise measurements
Plant Lighting Diagrams

Deficiencies Found:

Relatively minor differences in panel hardware were identified during this test. As an example, the word "Valve" was spelled out on an annunciator instead of being abbreviated as "Vlv". Some small pieces of panel mimic had fallen off and needed to be replaced. Most of the discrepancies were corrected on the spot. The differences that were not immediately corrected will be corrected under Simulator Problem Report (SPR) No. 91-043.

Background noise measurements were taken of the simulator and the control room. Noise intensity due to HVAC was found to be approximately 3 to 11 dB(A) higher in the main control room. Simulator Problem Report (SPR) No. 91-043 has been written to evaluate this further to ensure there is no significant training impact.

The plant control room has a different number of horn devices to alert the operator of new or reset annunciators. One set of horns are for Balance of Plant (BOP) annunciators and another set of horns are for Nuclear Steam Supply System (NSSS) annunciators. While these two sets of horns are located together and sound very similar, there is a subtle difference in the sounds. Consequently, an experienced operator can usually determine which control boards to check first based merely on the sound of the horn. The simulator has only one set of horns which are used for both BOP and NSSS annunciators. Simulator Problem Report (SPR) No. 91-043 has been written to evaluate this further to ensure there is no significant training impact.

SIMULATOR CERTIFICATION TEST SUMMARY

Test Name: STP 4.01, Simulator Physical Fidelity/Human Factors Verification Criteria (Cont'd)

Corrective Actions Planned (and schedule):

Further evaluate the subtle differences between the simulator and plant alarm horns, and the difference in noise level to ensure there is no significant training impact by August 1, 1991.

Correct minor hardware differences identified on SPR No. 91-043 by August 1, 1991.

Exceptions Taken/Justification:

None

SIMULATOR CERTIFICATION TEST SUMMARY

Test Name: STP 4.02, Simulator Instructor Station Capabilities

Description: This was a test of simulator instructor station capabilities in the following areas:

a) Number of initial conditions (minimum of 20 required),
b) Initial conditions at a variety of power levels, operating conditions, and times in core life,
c) Ability to insert and remove malfunctions,
d) Ability to activate malfunctions simultaneously or sequentially,
e) Activating malfunctions without alerting the operator to passive or pending malfunctions,
f) Ability to use malfunctions which are based on plant experience,
g) Ability to freeze the simulation,
h) Ability of the instructor to act as a remote operator,
i) Ability of the simulator to warn the instructor when the simulation is no longer valid, and
j) Instructor/operator communications.

This test demonstrated that the simulator instructor station provides the capabilities required by ANSI/ANS-3.5-1985, section 3.4.

Simulator Features Tested:

See above list.

Initial Conditions:

No special initial conditions were required for this test.

Final Conditions:

The simulator was found to have the capability to store up to 40 individual initial conditions at a variety of power levels, operating conditions, and core history.

SIMULATOR CERTIFICATION TEST SUMMARY

Test Name: STP 4.02, Simulator Instructor Station Capabilities (Cont'd)

Final Conditions (cont'd):

The simulator demonstrated its ability to activate malfunctions sequentially or simultaneously, on a time delay, by remote control, or when coming out of freeze. It was verified that the simulator does not alert the operator to passive or pending malfunctions. Malfunctions that have been added to the simulator as a result of plant operating experience were identified during the test. The simulator demonstrated its ability to be placed in and out of freeze.

All instructor remote functions were checked. A few discrepancies were noted as discussed below.

The simulator was verified to have a "Simulation Not Valid" alarm to alert the instructor that the simulation has exceeded a design parameter.

Appropriate communication devices exist for instructor and operator communications. The available devices fully satisfy the test acceptance criteria. Among the functioning devices were sound powered telephone; regular telephone; Gaitronics with alarm, public address, and party line capability; and Load Dispatcher Ringdown line. Additional specialized telephone circuits are available for use during emergency drills and exercises.

Baseline Data Description:

ANSI/ANS 3.5-1985
NUREG 1258

Deficiencies Found:

All 202 instructor remote functions were tested. Minor discrepancies were found with a few of the remote functions. Simulator Problem Report (SPR) No. 91-025 was written to investigate and correct the discrepancies as necessary.

SIMULATOR CERTIFICATION TEST SUMMARY

Test Name: STP 4.02, Simulator Instructor Station Capabilities (Cont'd)

Deficiencies (cont'd):

There are visual differences with some of the communications equipment. Additionally, an operations radio console is not simulated. These are considered minor deficiencies. Simulator Problem Report (SPR) No. 91-031 was written to investigate and correct these deficiencies if deemed appropriate.

Corrective Actions Planned (and schedule):

The Simulator Problem Reports will be resolved by August 1, 1991.

Exceptions Taken/Justification:

None

SIMULATOR CERTIFICATION TEST SUMMARY

Test Name: STP 4.03, Malfunction Performance Test

Description: This procedure provided the methodology for demonstrating simulator performance following activation of various simulator malfunctions.

This test was intended to meet ANSI/ANS-3.5-1985, section 4.2.2, for those additional simulator malfunctions used for training that were not specifically listed under section 3.1.2 of the standard. In particular, simulator malfunctions tested under this procedure were required to meet the acceptance criteria established in section 4.2.1 (b) of the standard. Specifically, these simulator malfunctions were checked to ensure that they caused appropriate parameters to change in the direction expected from best estimate information, and that they did not violate physical laws of nature.

Simulator Features Tested:

The following simulator malfunctions were tested:

AN01, Annunciator Actuation
AN02, Annunciator Failure to Actuate
CR01, Fuel Cladding Leak
CU01, RWCU Pump Trip
CU02, RWCU Drain Valve Failure, 1G33-F033
CU04, RWCU Demineralizer Resin Depletion
CU05, RWCU System Rupture
CU06, RWCU System Isolation
CU07, RWCU Non-Regenerative Heat Exchanger Tube Leak
CU08, High Conductivity
CW01, Circulating Water Pump Trip
CW02, Main Condenser Tube Leak
CW03, Component Cooling Water Heat Exchanger Tube Failure
CW07, Component Cooling Water Temperature Controller Failure
CW08, Turbine Bldg Closed Cooling Water (TBCCW) Pump Trip
CW09, TBCCW Temperature Controller Failure
CW10, Reactor Recirculation Pump Motor High Temperature
DC01, Loss of Display Control System

SIMULATOR CERTIFICATION TEST SUMMARY

Test Name: STP 4.03, Malfunction Performance Test (Cont'd)

Features Tested (cont'd):

DC02, Loss of Display Generator
DC03, Display Control System Acquisition Processor Halt
DC04, DCS/Performance Monitoring System Point Failure
ED02, 345 KV Line Directional Relaying Trip
ED08, Unit Auxiliary Transformer Lockout
ED11, Battery Charger Trip
EG02, Generator Trip
EG03, Generator Auto Voltage Regulator Trip
EG04, Stator Cooling Water Temperature Controller Failure
EG05, Stator Cooling Water Pump Trip
EG06, Hydrogen Temperature Controller Failure
EG07, Generator Hydrogen Leak
FW01, Condensate Pump Trip
FW02, Condenser Hotwell Makeup Controller Failure
FW03, Condenser Hotwell Dump Controller Failure
FW04, Condensate Demineralizer Resin Depletion
FW05, Condensate Demineralizer High Differential Pressure
FW06, Condensate Booster Pump Trip
FW07, Loss of Feedwater Heater String
FW10, Feedwater Pump Low Lube Oil Pressure
FW11, Feedwater Controller Failure
FW12, Feedwater Flow Sensor Failure
FW14, HP/LP Heater Tube Leak
FW15, HP/LP Heater Level Control Failure
FW16, Flash Tank Level Control Failure
FW17, Reheater Drain Tank/Separator Drn Tank Lvl Failure
FW18, Condensate Storage Tank Leak
HP02, HPCS Spurious Automatic Initiation
HP03, HPCS Pump Trip
HP14, Main Steam Relief Failure to Reseat
HP15, LPCS Leak From Suppression Pool Suction Line
HP16, HPCS Leak From Suppression Pool Suction Line
HP17, HPCS Leak From RCIC Storage Tank Suction Line
HP18, Instrument Air Leak at Accumulator
HP19, HPCS Valve F012 Fails Open
HP20, LPCS Valve F011 Fails Open
LC04, Control Rod Accumulator Trouble

SIMULATOR CERTIFICATION TEST SUMMARY

Test Name: STP 4.03, Malfunction Performance Test (Cont'd)

Features Tested (cont'd):

LC05, Control Rod Drive Worn Seals
LC06, Leaking Scram Discharge Valve
LC07, CRD Flow Control Valve Failure
LC08, CRD Hydraulic Pump Failure
LC09, Scram Discharge Vol Vent Valve C11-F010 Fail as is
LC10, Scram Discharge Vol Drn Valve C11-F011 Fail as is
LC11, Scram Discharge Vol Vent Valve C11-F180 Fail as is
LC12, Scram Discharge Vol Drn Valve C11-F181 Fail as is
LS02, RC&IS Failure (Open Reed Switch)
LS03, RC&IS Failure (Closed Reed Switch)
LS05, Rod Control & Information System Self Test Failure
LS06, Rod Pattern Controller Failure
MC02, Steam Jet Air Ejector (SJAE) Steam Supply Failure
MS01, Steam Seal Evaporator Pressure Regulator Failure
MS02, Main Steam Flow Summer C34-K644 Failure
MS04, Steam Seal Evaporator Shell Level Control Failure
MS05, Steam Line Rupture in the Drywell
MS08, Main Steam Isolation Valve Failure
MS09, Turbine Gland Seal Pressure Regulator Failure
MS11, Divisional Trip Override
NM03, Source Range Monitor Channel Erratic Indication
NM04, Source Range Monitor (SRM) Channel Inoperative
NM05, Source Range Monitor (SRM) Detector Stuck
NM06, Local Power Range Monitor (LPRM) Detector Failure
NM08, Intermediate Range Monitor (IRM) Channel Erratic Indication
NM09, Intermediate Range Monitor Channel Inoperative
NM10, Intermediate Range Monitor (IRM) Detector Stuck
NM14, Average Power Range Monitor (APRM) Channel Erratic Indication
NM15, Average Power Range Monitor (APRM) Channel Inop
NM16, Average Power Range Monitor (APRM) Flow Converter Failure
OG01, Offgas Vault Bypass Valve Failure
OG02, Offgas Recombiner Preheater Steam Supply Failure
PC01, Plant Chilled Water Chiller Trip
PC02, Heating, Ventilation, and Air Conditioning (HVAC) Fan Trip

SIMULATOR CERTIFICATION TEST SUMMARY

Test Name: STP 4.03, Malfunction Performance Test (Cont'd)

Features Tested (cont'd):

- PC03, Loss of Standby Gas Treatment System (SGTS) Flow Control
- PC04, Loss of Drywell Chiller
- PC05, Drywell Cooler Leak
- PC06, Isolation Valve Binding
- PC07, Hydrogen Burn in Containment
- PC08, Spent Fuel Pool Leak
- PC09, Fuel Pool Cooling and Cleanup Pump Trip
- PC10, Leak in the Suppression Pool Cleanup System
- PC11, Inadvertent Dump of the Upper Containment Pool
- PC12, Instrument Line Break in the Fuel Building
- PC13, High Wind Levels
- PC14, Leak Between the Drywell and the Containment
- RH11, Residual Heat Removal (RHR) Suppression Pool A Suction Leak
- RH12, Residual Heat Removal (RHR) Suppression Pool B Suction Leak
- RH13, Residual Heat Removal (RHR) Suppression Pool C Suction Leak
- RI04, Reactor Core Isolation Cooling (RCIC) Steam Line Break
- RI05, Reactor Core Isolation Cooling (RCIC) System Isolation
- RI07, Loss of Mass from the RCIC Storage Tank
- RM02, Area Radiation Monitor (ARM) High Radiation
- RP02, Automatic Scram Failure
- RP03, Partial Scram of Selected Rod Group
- RR01, Recirculation Valve Inner Packing Failure
- RR02, Recirculation Pump Trip
- RR04, Recirculation Pump Shaft Break
- RR05, Recirculation Pump Seizure
- RR08, Recirculation Flow Control Valve (FCV) Failure
- RR09, Recirculation Pump High Vibration
- RR12, Recirculation Jet Pump Failure
- RR13, Feedwater Level Sensor Failure
- RR14, Instrument Line Reference Leg Rupture Inside the Drywell

SIMULATOR CERTIFICATION TEST SUMMARY

Test Name: STP 4.03, Malfunction Performance Test (Cont'd)

Features Tested (cont'd):

RR17, Instrument Line Variable Leg Rupture in the Containment
SL01, Standby Liquid Control (SLC) Motor Overloads Fail Open
SL02, Failure of the Squib Continuity Relay Meter
SL03, Failure of the Squib Firing Circuit to Actuate
TC06, Loss of Electrohydraulic Control (EHC) Hydraulics (Turbine)
TC09, Pressure Regulator Failure (High/Low)
TC10, Pressure Regulator Oscillations
TU01, Turbine-Generator Bearing Oil Low Pressure
TU02, Turbine-Generator Lube Oil Temperature Controller Failure
TU03, Turbine-Generator Bearing High Vibration
TU05, Turning Gear Oil Pump Failure
TU08, Hydrogen Seal Oil Pump Trip

Initial Conditions:

Various

Final Conditions:

Except as noted below, all malfunctions met the acceptance criteria found in ANSI/ANS 3.5-1985, section 4.2.1 (b).

Baseline Data Description:

Malfunction Causes and Effects Manual

SIMULATOR CERTIFICATION TEST SUMMARY

Test Name: STP ..03, Malfunction Performance Test (Cont'd)

Deficiencies Found:

For malfunction RM02, Area Radiation Monitor (ARM) High Radiation, the malfunction could not be properly demonstrated because the ARM system components are only visually simulated at this time due to a pending plant design change. Simulator Problem Report (SPR) No. 91-023 has been written to resolve the issue once more details on the pending plant change are known.

Malfunction DC04, Display Control System/Performance Monitoring System (DCS/PMS) Point Failure, did not function. SPR 91-017 has been written to resolve the deficiency.

Malfunction PC12, Instrument Line Break in the Fuel Building, is a new malfunction being added to the simulator, but it is not yet ready for use.

Corrective Actions nned (and schedule):

SPR 23 will be implemented within 12 months of the corr nding plant design change.

SPR 91 17 will be investigated and resolved by August 1, 1991.

Exceptions Taken/Justification:

None

SIMULATOR CERTIFICATION TEST SUMMARY

Test Name: STP 4.04, Computer Timing Test

Description: This test procedure calculates simulator computer timing to aid in demonstrating that the simulator operates in real time as required by ANSI/ANS 3.5-1985. Timing reports are generated which are used to verify that no computer frame calls execute within a time which is greater than the allocated time for the computer frame. As a result, all system modules execute within the time allocated. Results of this test, together with the results from all other simulator tests, observations, and reviews, were used to conclude that the simulator does operate in real time.

Simulator Features Tested:

Real time simulation

Initial Conditions:

The simulator was put through a major transient while the computer timing tests were performed.

Final Conditions:

The results of the timing test indicated all processors had adequate spare time on all frames, and no frame slippage was indicated. This is consistent with the results of all other simulator tests in which events were observed to be in the correct time sequence. Therefore, it was concluded that the simulator operates in real time.

Baseline Data Description:

None

SIMULATOR CERTIFICATION TEST SUMMARY

Test Name: STP 4.04, Computer Timing Test (Cont'd)

Deficiencies Found:

None

Corrective Actions Planned (and schedule):

None

Exceptions Taken/Justification:

None

SIMULATOR CERTIFICATION TEST SUMMARY

Test Name: STP 5.01, Manual Scram

Description: This test provides a benchmark comparison between the simulator and plant for a manual scram.

The simulator was initialized at full power. Data recording began. Approximately 10 seconds later, the reactor was manually scrammed. No other operator actions were taken. The simulator was allowed to stabilize. After 5 minutes the simulator was placed in freeze and data recording was terminated.

Simulator performance was observed during the transient to ensure that alarms, automatic actions, and indications were appropriate for the transient. No violations of the physical laws of nature were observed.

This test was intended to meet the objectives of ANSI/ANS-3.5-1985, Appendix B, and footnote 3 of the standard.

Simulator Features Tested:

Simulator data recording capability at a resolution of 0.5 seconds.

Initial Conditions:

The simulator was operating in a normal full power lineup.

Final Conditions:

The simulator was stable following a manual reactor scram.

Baseline Data Source:

Clinton Power Station RETRAN Code

SIMULATOR CERTIFICATION TEST SUMMARY

Test Name: STP 5.01, Manual Scram (Cont'd)

Comparison:

The following simulator parameters were compared to the available baseline data. The magnitude and direction of change of all parameters were evaluated as acceptable.

Parameter	Evaluation
Reactor Power	Satisfactory
Total Steam Flow	Satisfactory
Feedwater Flow	Satisfactory
Reactor Pressure (WR)	Satisfactory
Reactor Pressure (NR)	RETRAN Data Unavailable
Reactor Level (WR)	Satisfactory
Reactor Level (NR)	Satisfactory
Generator Power	RETRAN Data Unavailable
Turbine Steam Flow	RETRAN Data Unavailable
Total Core Flow	Satisfactory
Total RR Loop Flow	RETRAN Data Unavailable

There are some differences between simulator and RETRAN feedwater flow. While this has been evaluated as satisfactory, the simulator Feedwater Level Control System is being evaluated for possible future improvements.

CPS licensed operators have reviewed the simulator data for the parameters having no corresponding RETRAN data, and have judged simulator performance to be acceptable and consistent with that expected for the transient.

Graphs of simulator and RETRAN data follow this test summary. When all parameters are considered, the overall simulator response to this transient is satisfactory.

Deficiencies Found:

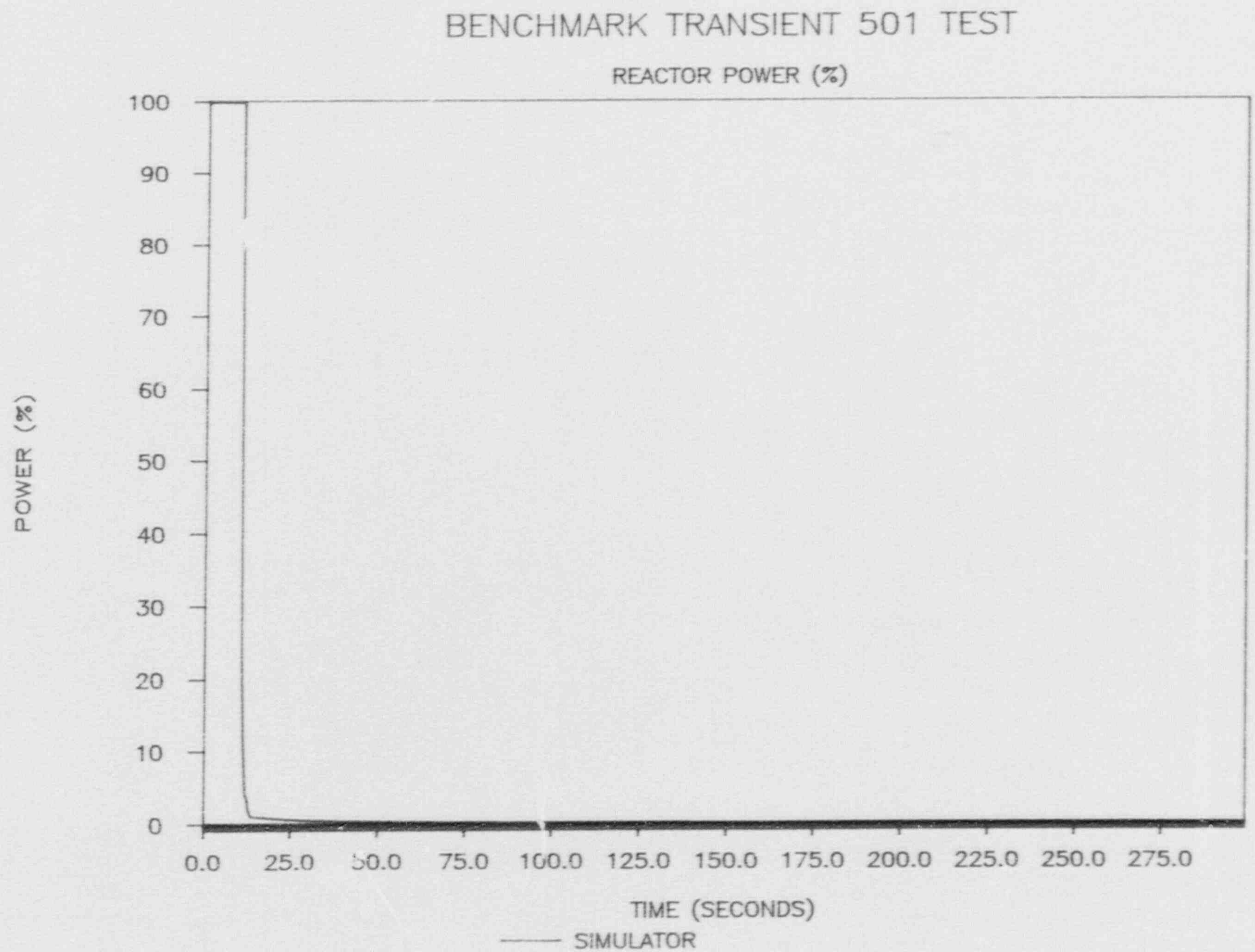
None

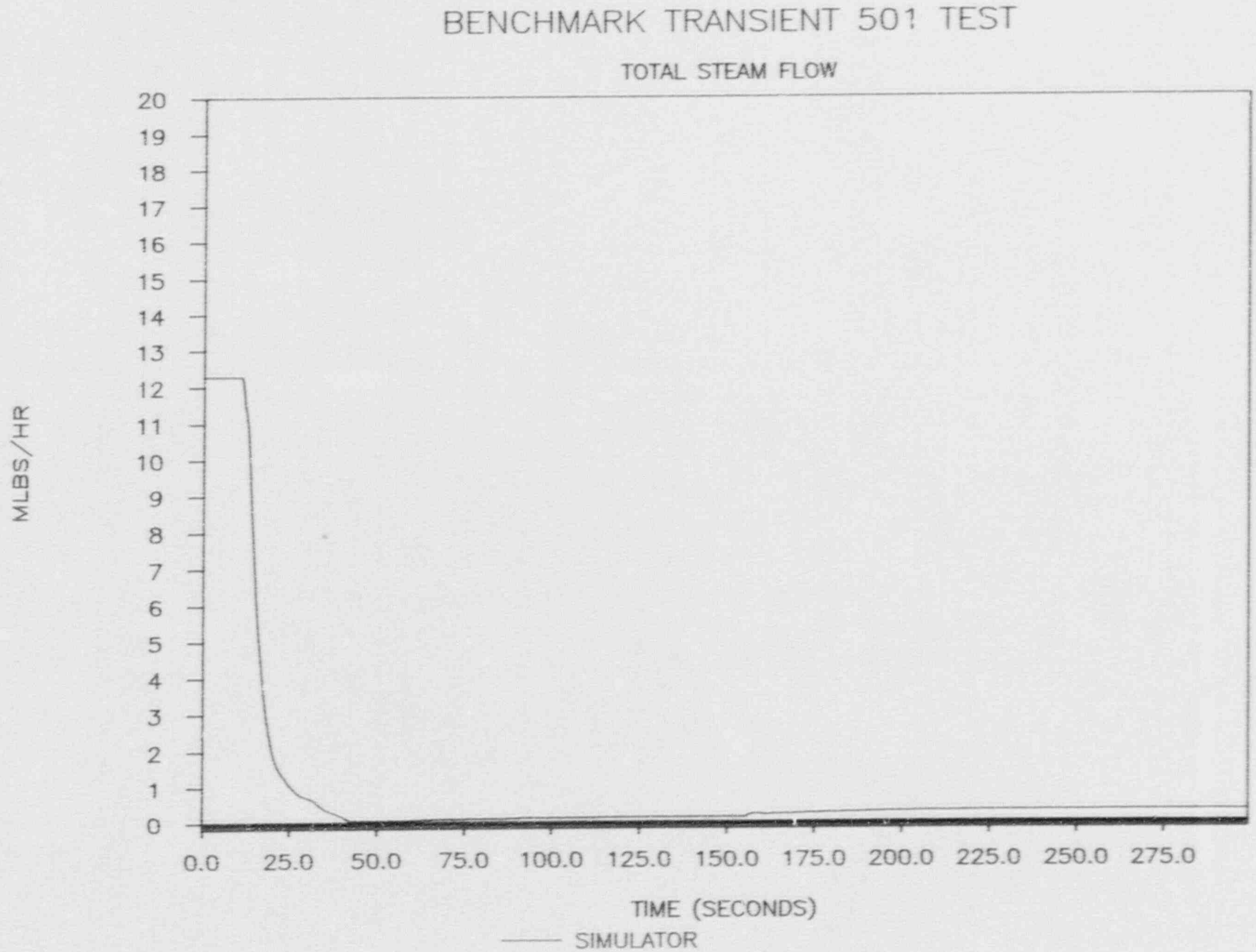
Corrective Actions Planned (and schedule):

None

Exceptions Taken/Justification:

None

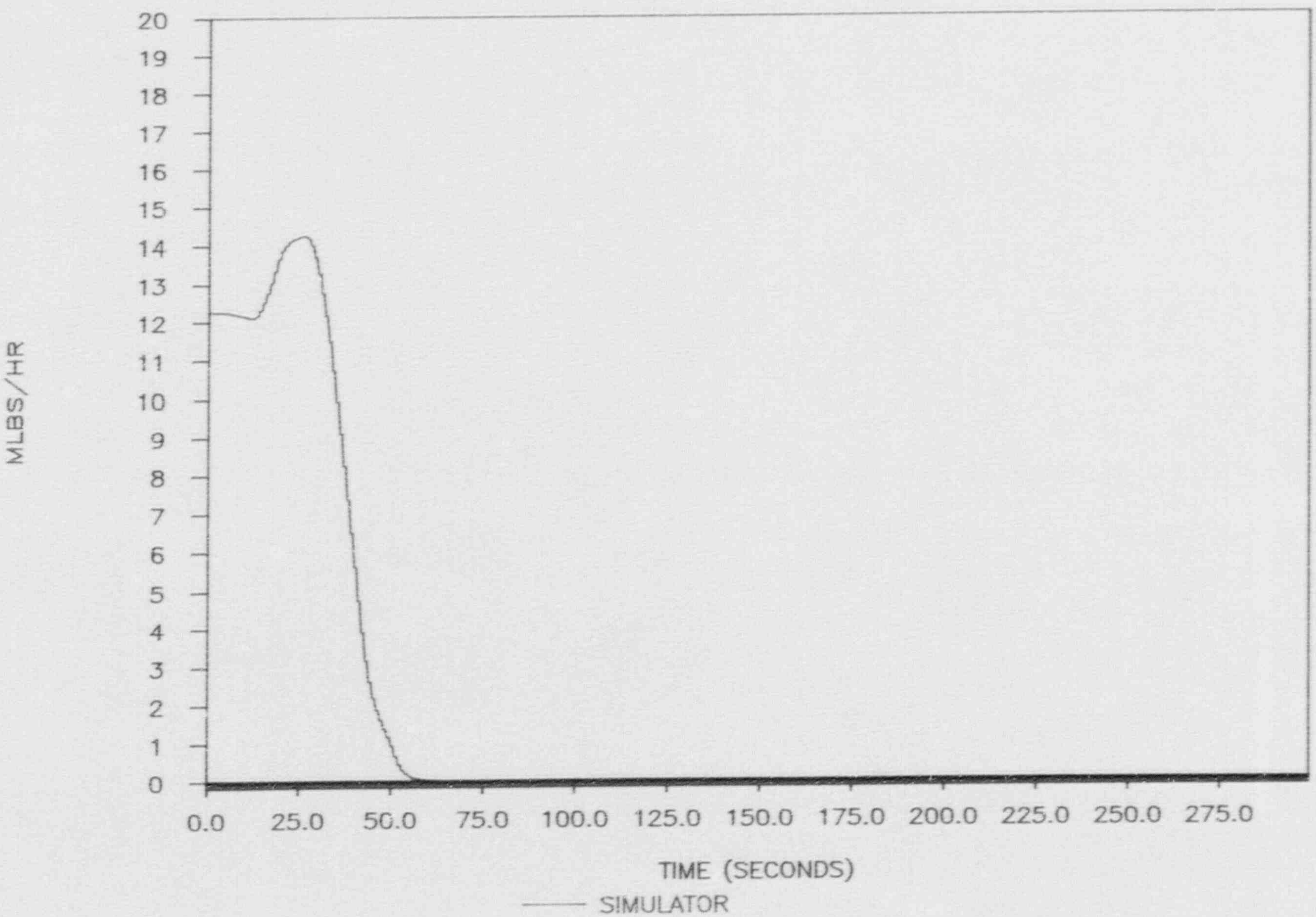

BENCHMARK TRANSIENT 501 TEST
REACTOR POWER (%)
POWER (%)
100
90
80
70
60
50
40
30
20
10
0
0.0
25.0
50.0
75.0
100.0
125.0
150.0
175.0
200.0
225.0
250.0
275.0
TIME (SECONDS)
SIMULATOR



BENCHMARK TRANSIENT 501 TEST
TOTAL STEAM FLOW
MLBS/HR
20
19
18
17
16
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
0.0
25.0
50.0
75.0
100.0
125.0
150.0
175.0
200.0
225.0
250.0
275.0
TIME (SECONDS)
SIMULATOR

BENCHMARK TRANSIENT 501 TEST

TOTAL FEEDWATER FLOW



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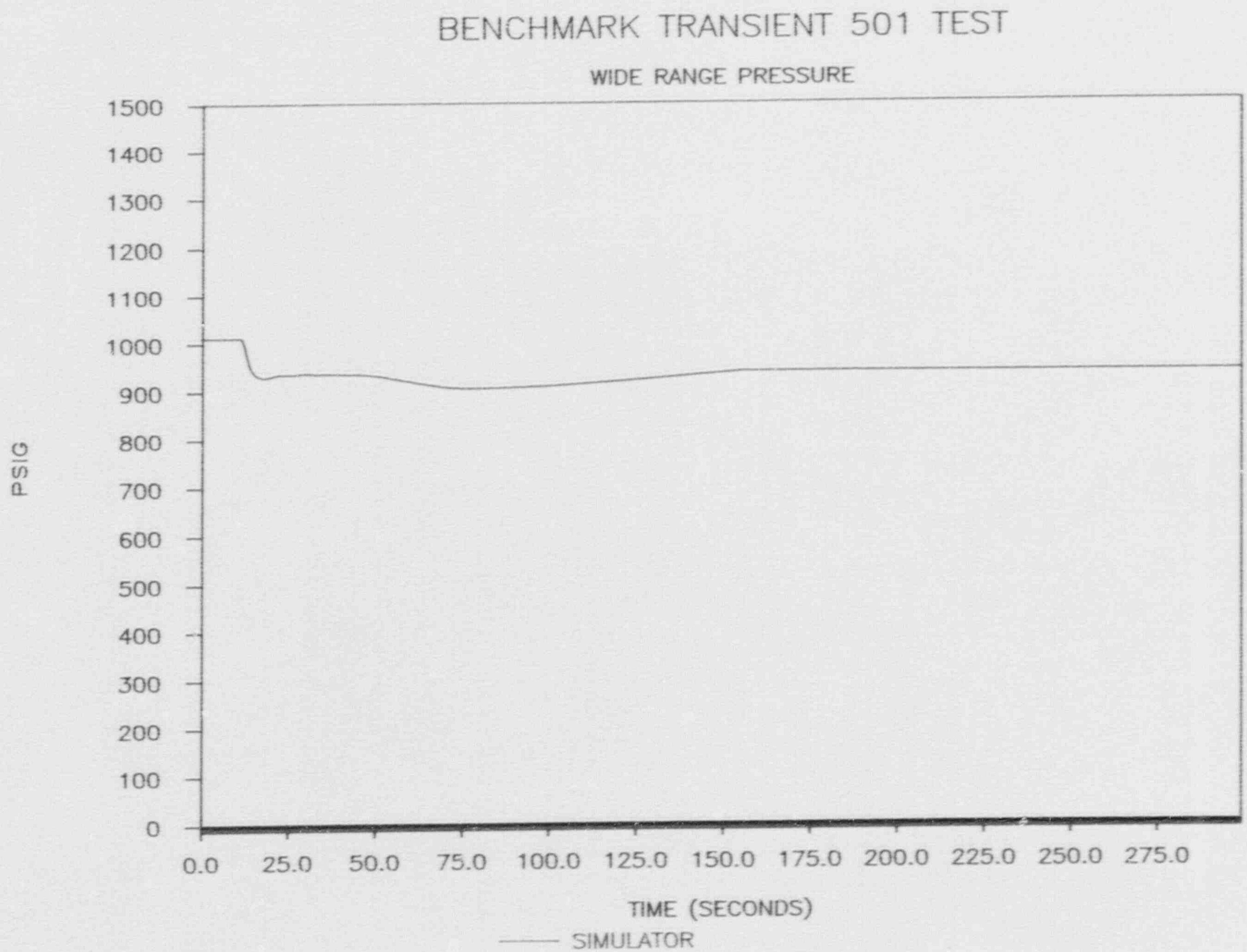
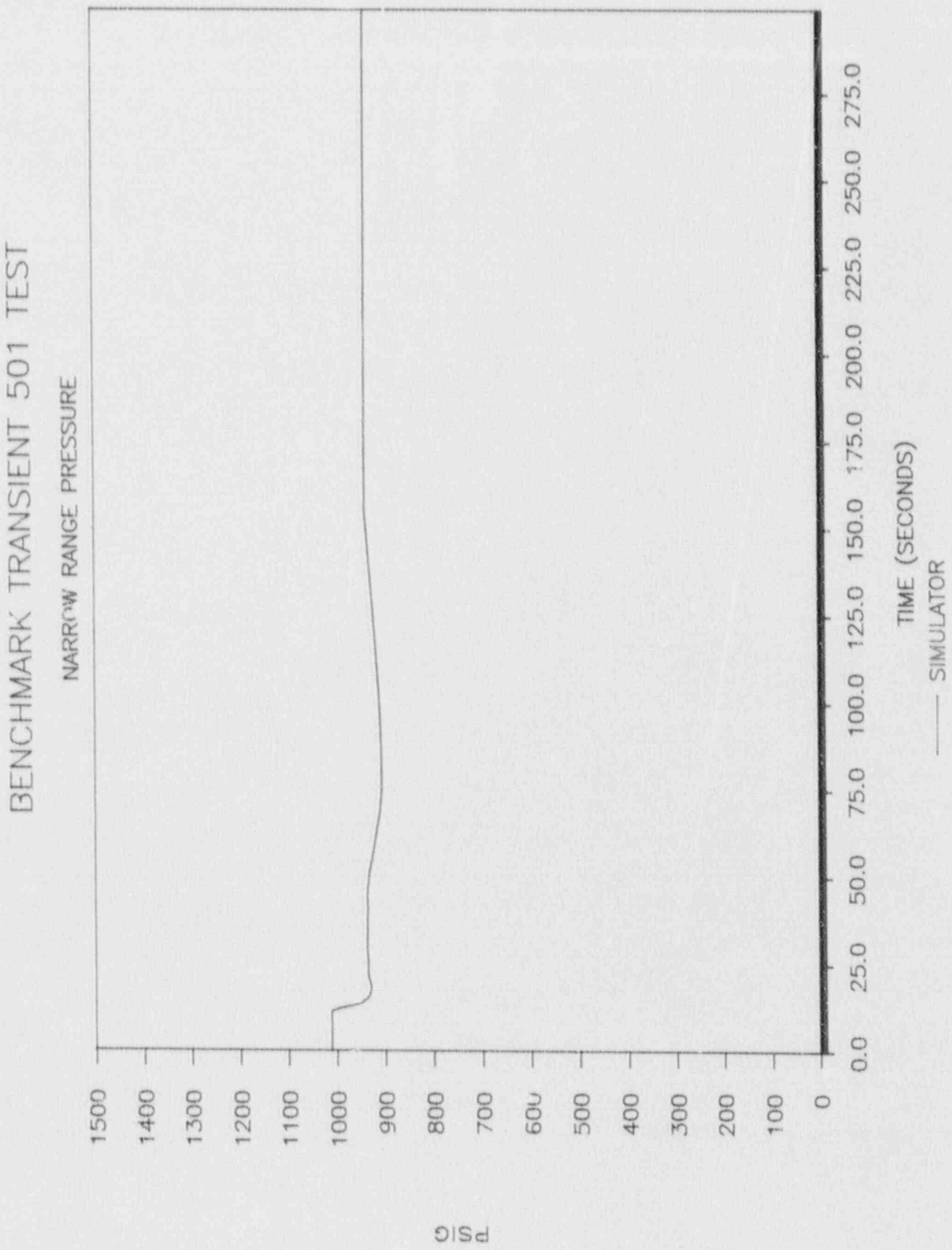
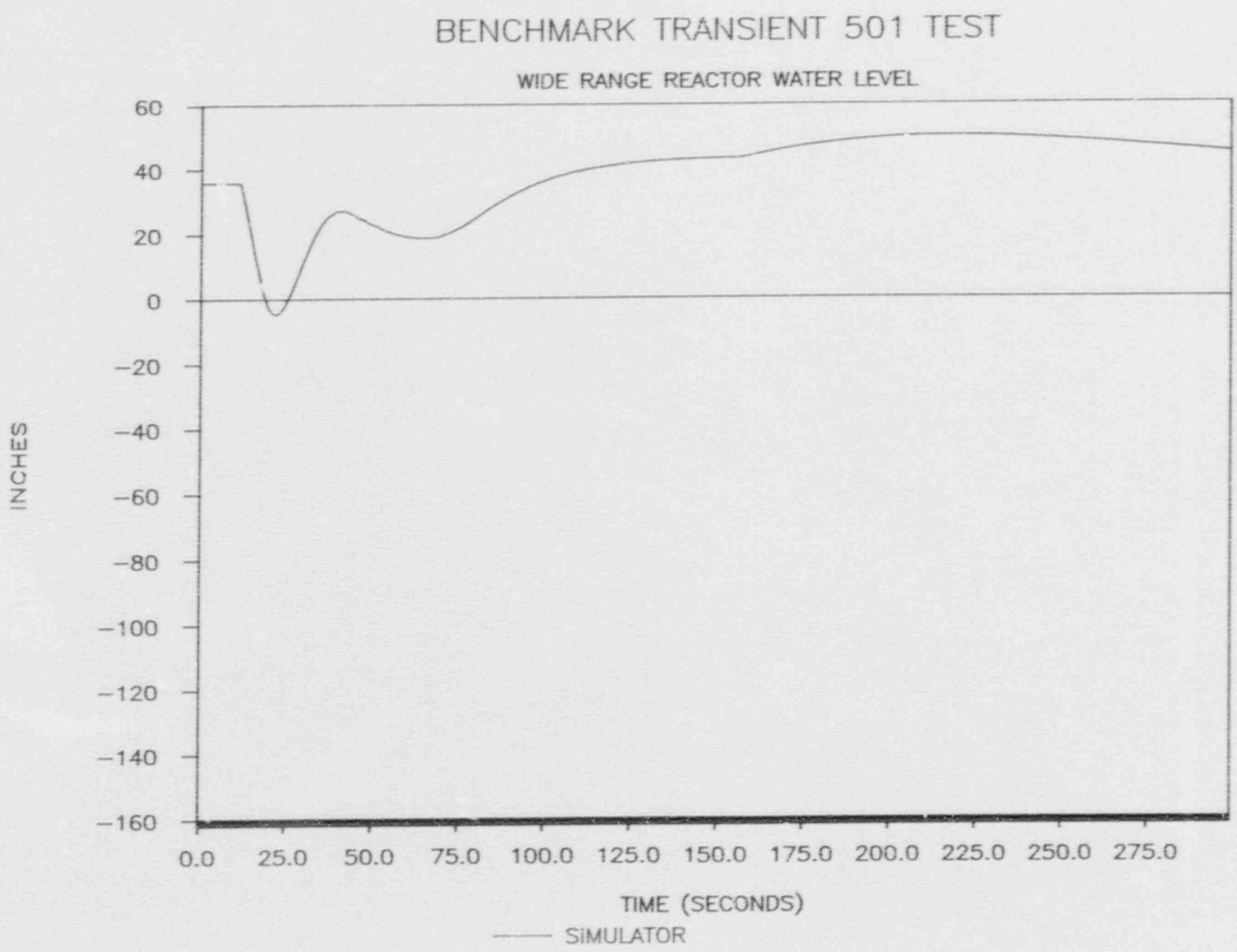

BENCHMARK TRANSIENT 501 TEST
WIDE RANGE PRESSURE
PSIG
1500
1400
1300
1200
1100
1000
900
800
700
600
500
400
300
200
100
0
0.0
25.0
50.0
75.0
100.0
125.0
150.0
175.0
200.0
225.0
250.0
275.0
TIME (SECONDS)
SIMULATOR

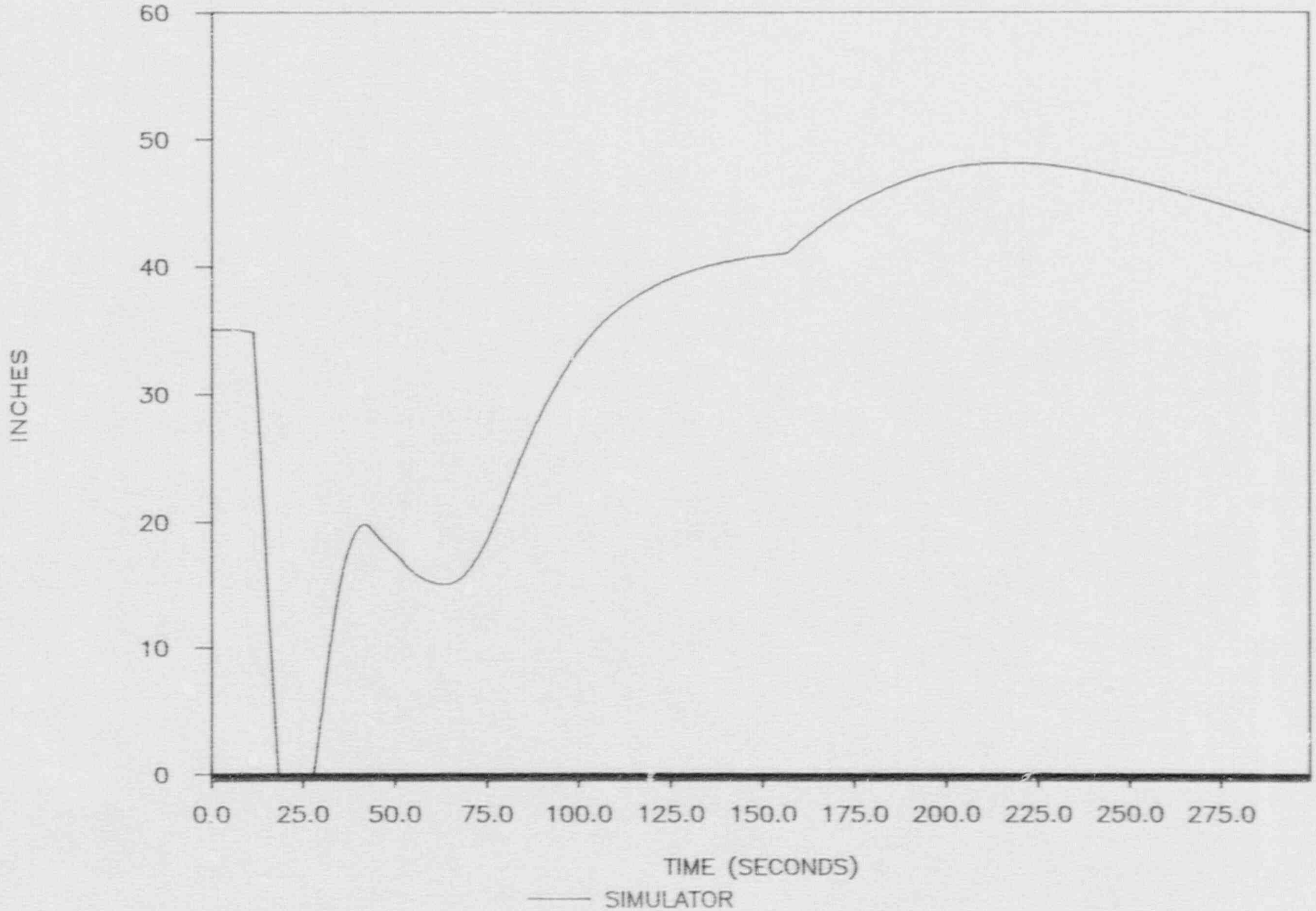

BENCHMARK TRANSIENT 501 TEST
NARROW RANGE PRESSURE
PSIG
1500
1400
1300
1200
1100
1000
900
800
700
600
500
400
300
200
100
0
0.0
25.0
50.0
75.0
100.0
125.0
150.0
175.0
200.0
225.0
250.0
275.0
TIME (SECONDS)
SIMULATOR



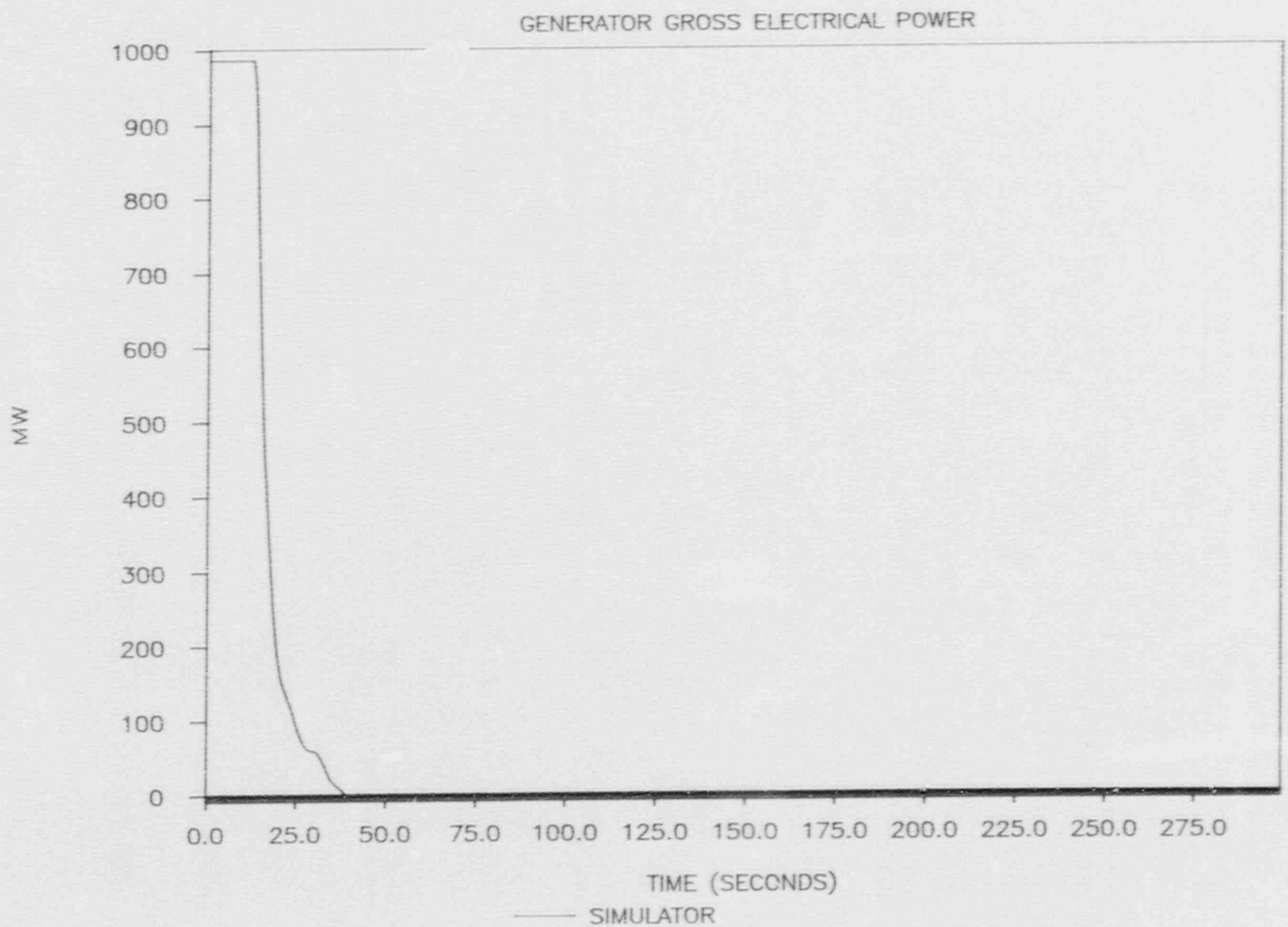
BENCHMARK TRANSIENT 501 TEST
WIDE RANGE REACTOR WATER LEVEL
60
40
20
0
−20
−40
−60
−80
−100
−120
−140
−160
INCHES
0.0
25.0
50.0
75.0
100.0
125.0
150.0
175.0
200.0
225.0
250.0
275.0
TIME (SECONDS)
SIMULATOR

BENCHMARK TRANSIENT 501 TEST

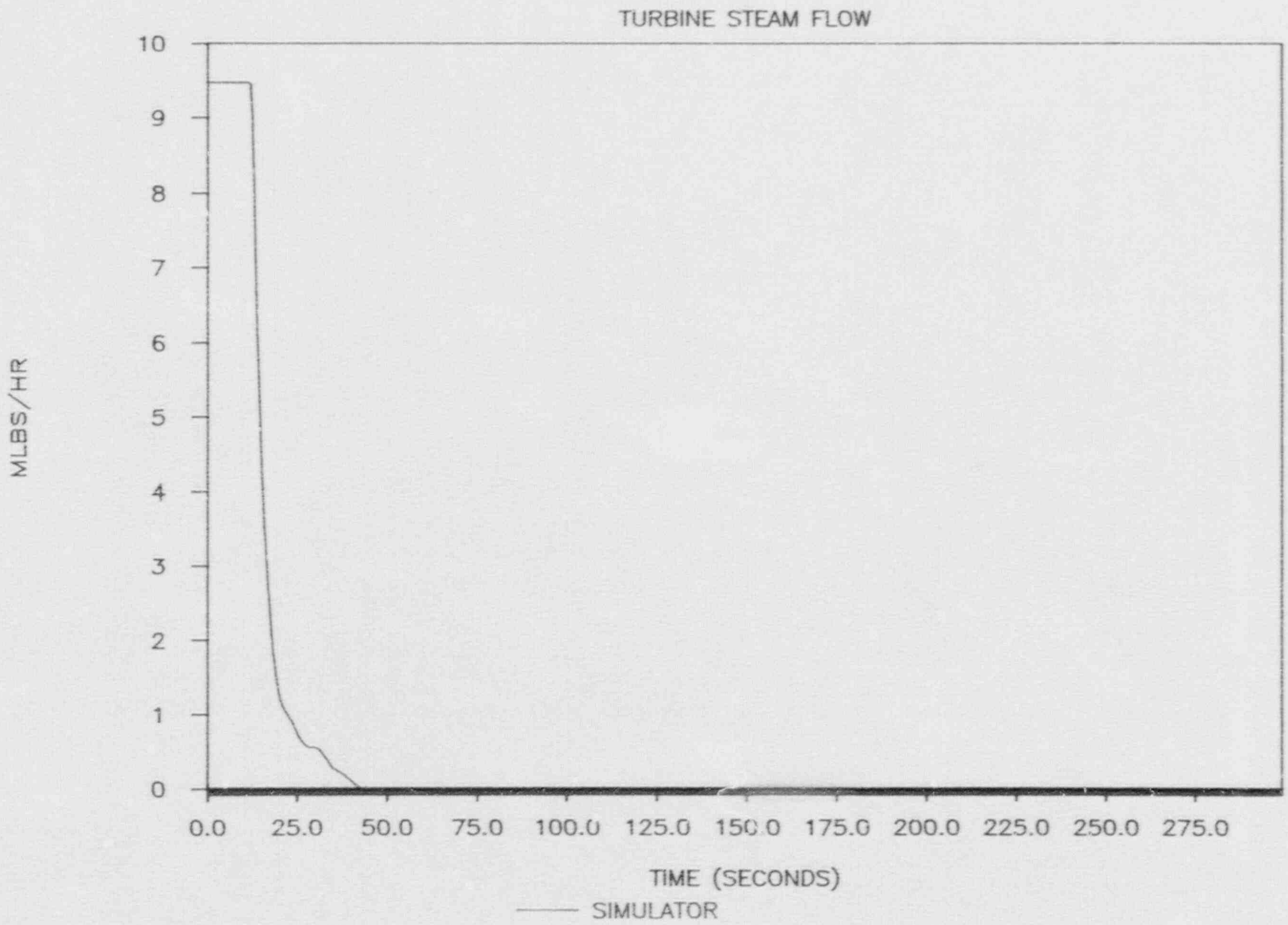
NARROW RANGE REACTOR WATER LEVEL

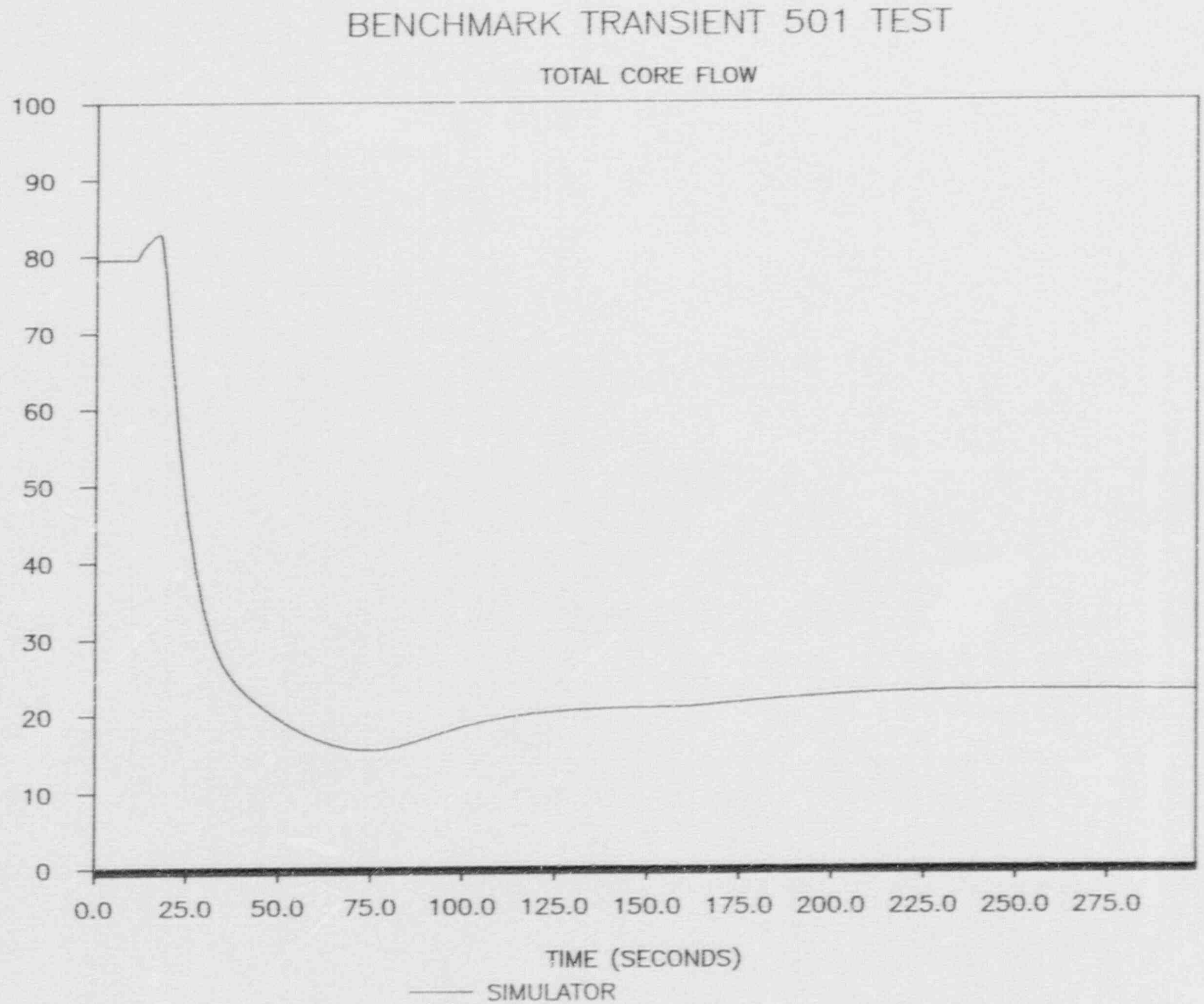


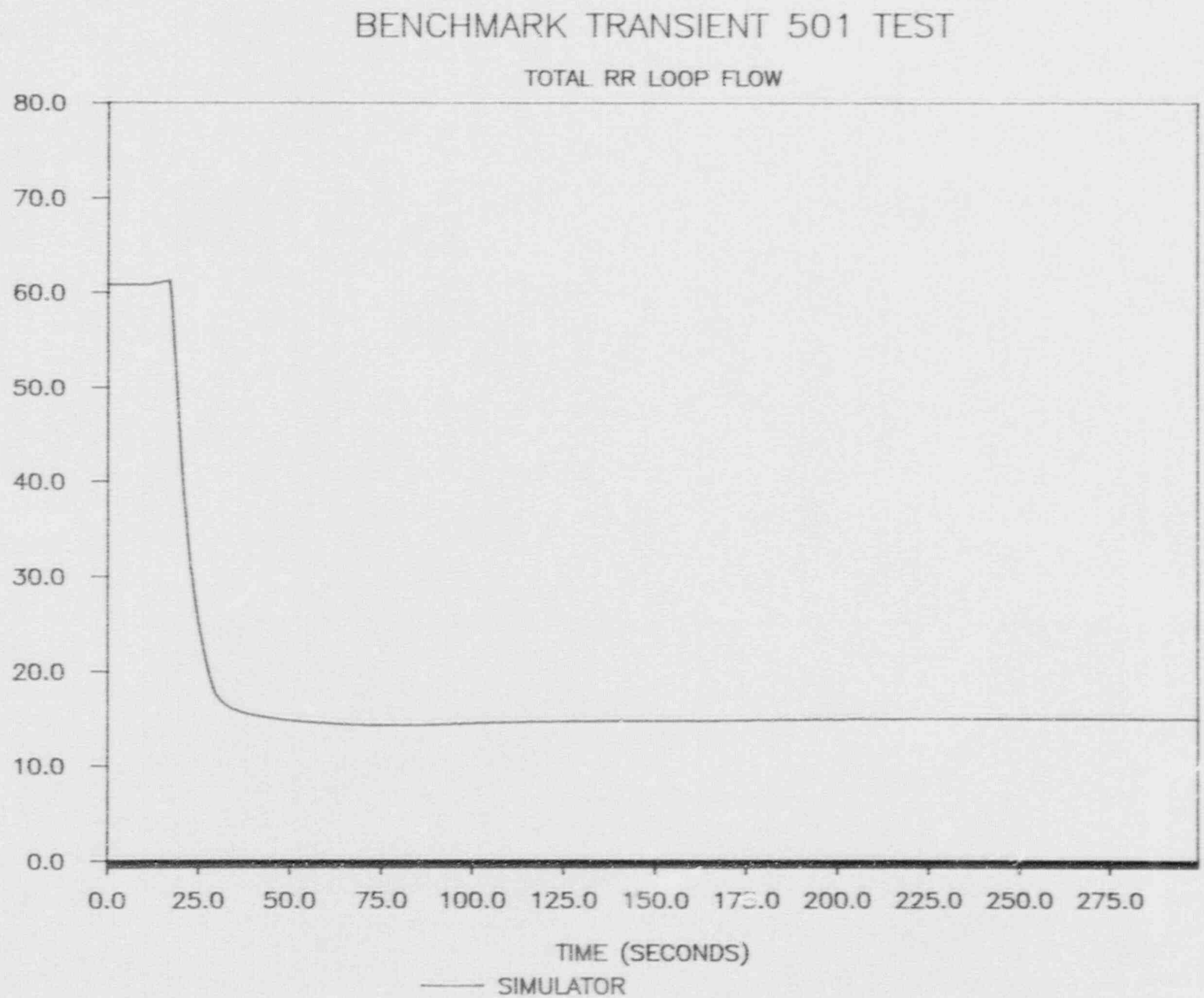
BENCHMARK TRANSIENT 501 TEST



BENCHMARK TRANSIENT 501 TEST

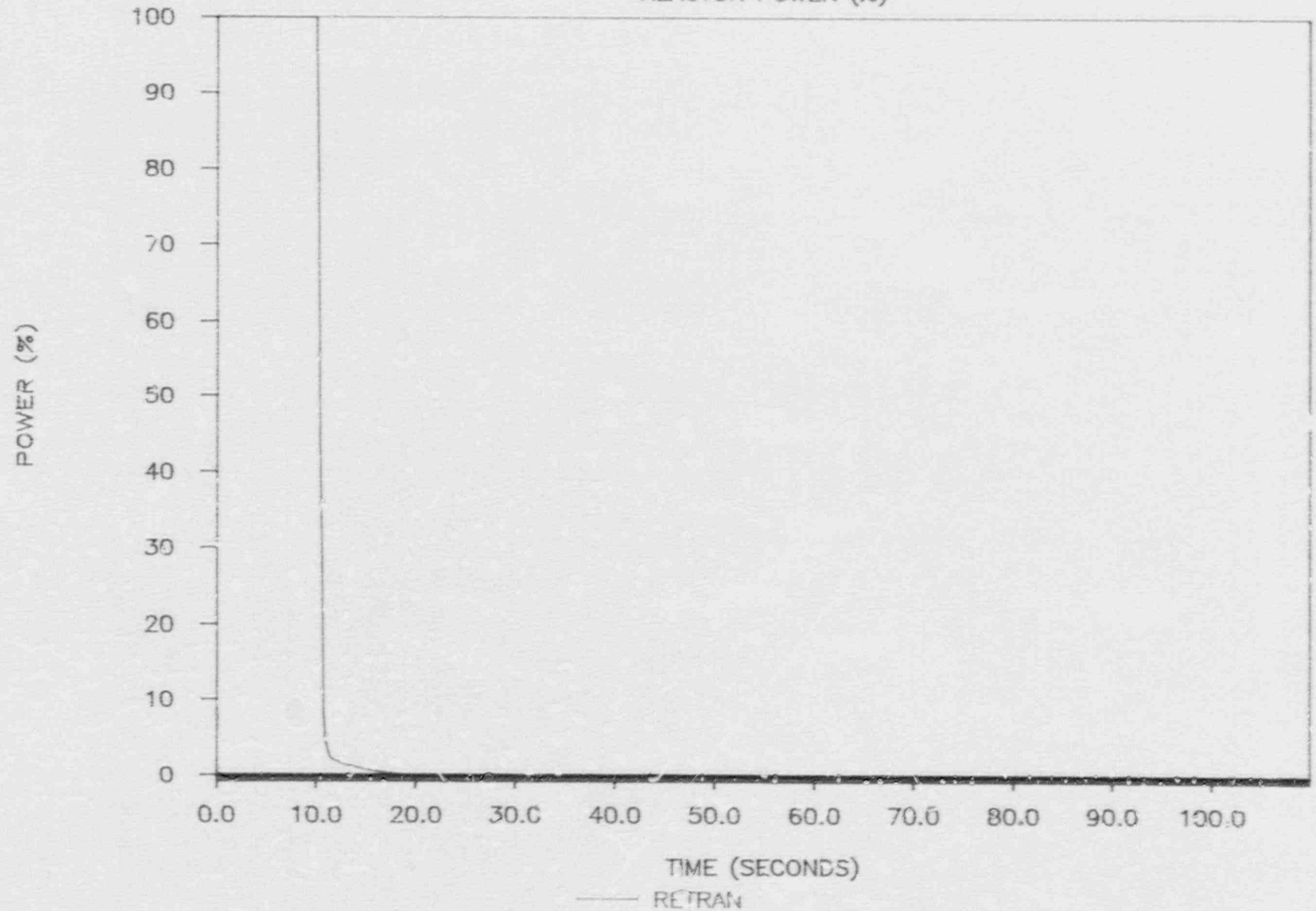


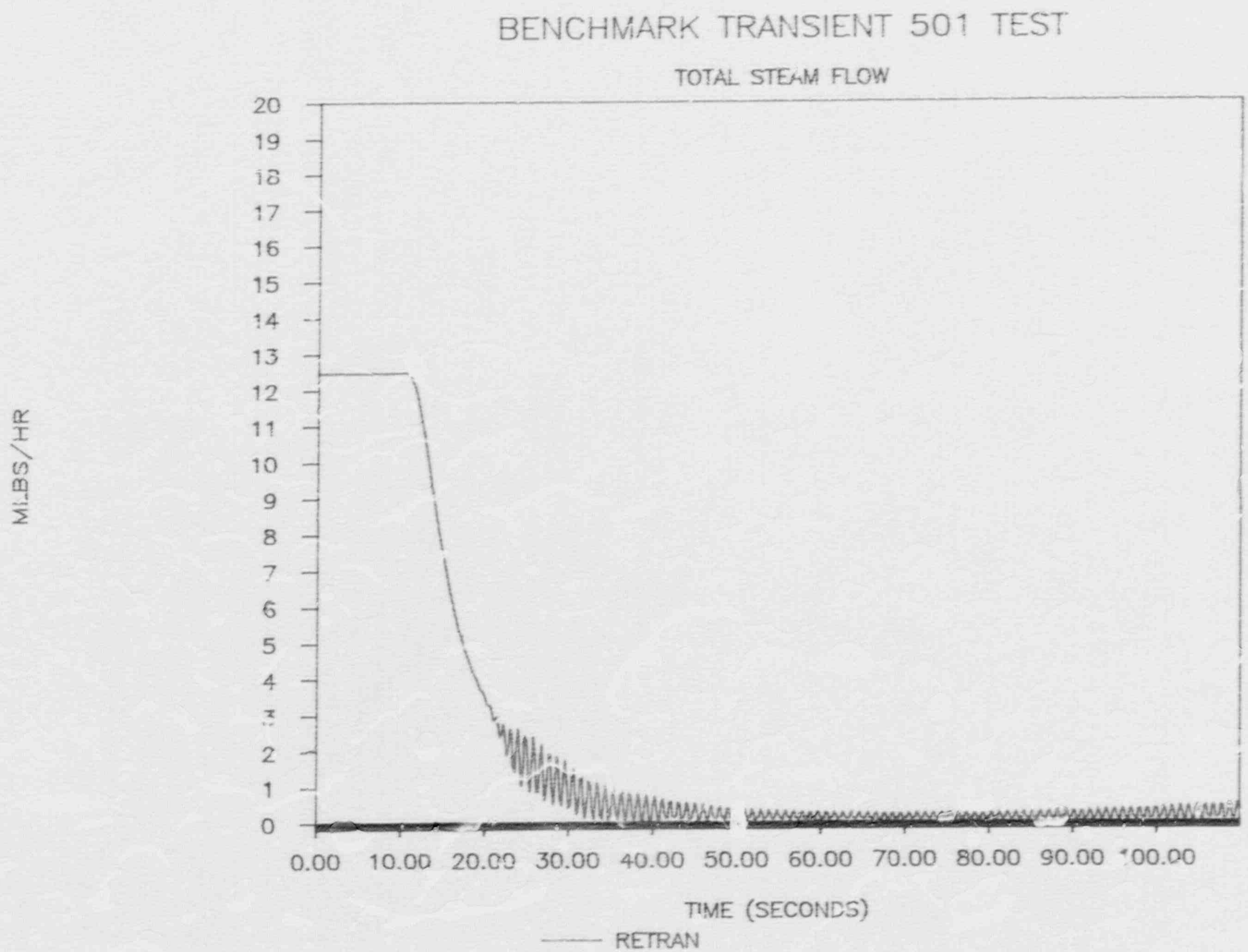

BENCHMARK TRANSIENT 501 TEST
TOTAL CORE FLOW
MLBS/HR
0
10
20
30
40
50
60
70
80
90
100
0.0
25.0
50.0
75.0
100.0
125.0
150.0
175.0
200.0
225.0
250.0
275.0
TIME (SECONDS)
SIMULATOR


BENCHMARK TRANSIENT 501 TEST
TOTAL RR LOOP FLOW
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
GPM
(Thousands)
0.0
25.0
50.0
75.0
100.0
125.0
150.0
200.0
225.0
250.0
275.0
TIME (SECONDS)
SIMULATOR

BENCHMARK TRANSIENT 501 TEST

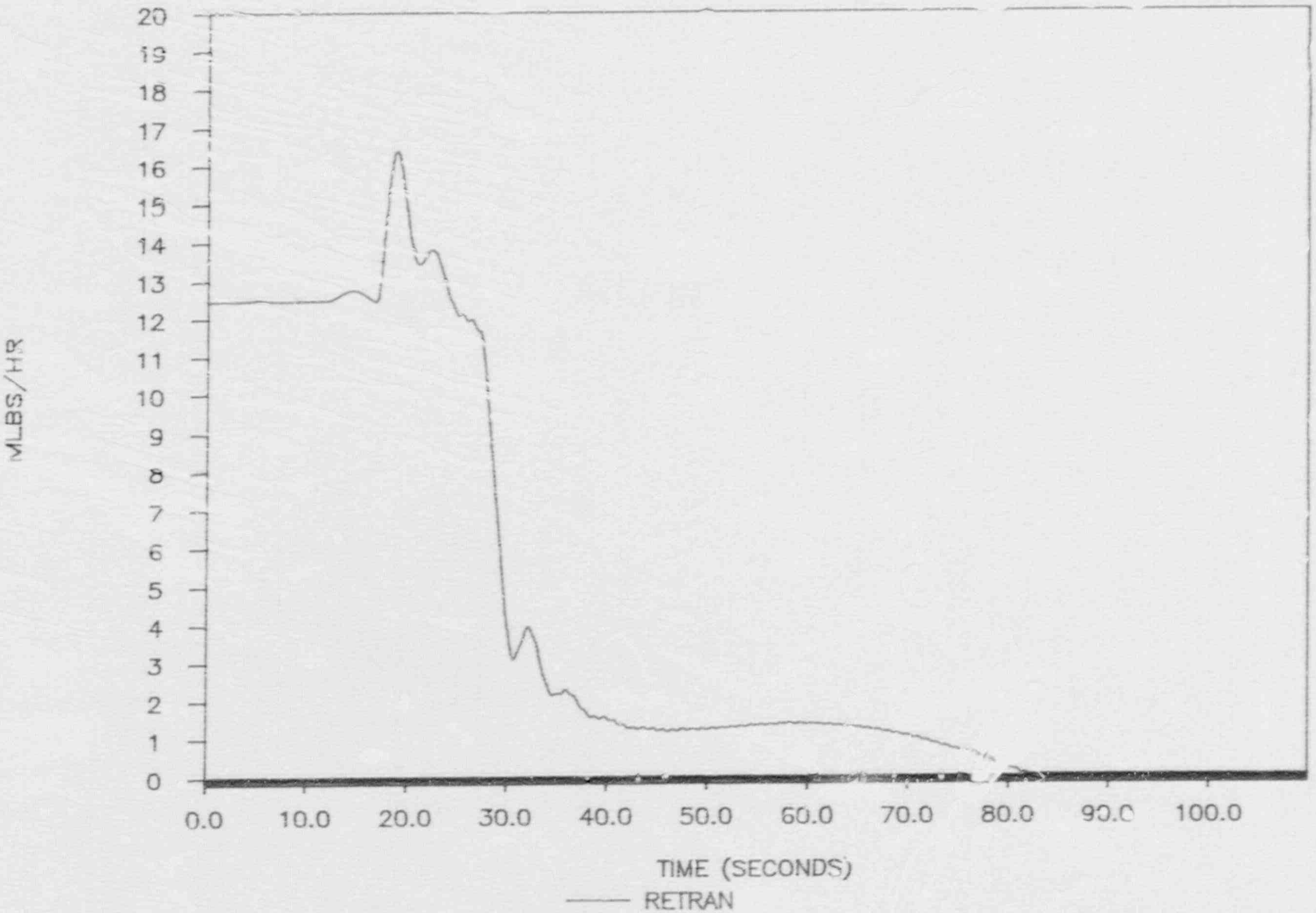
REACTOR POWER (%)

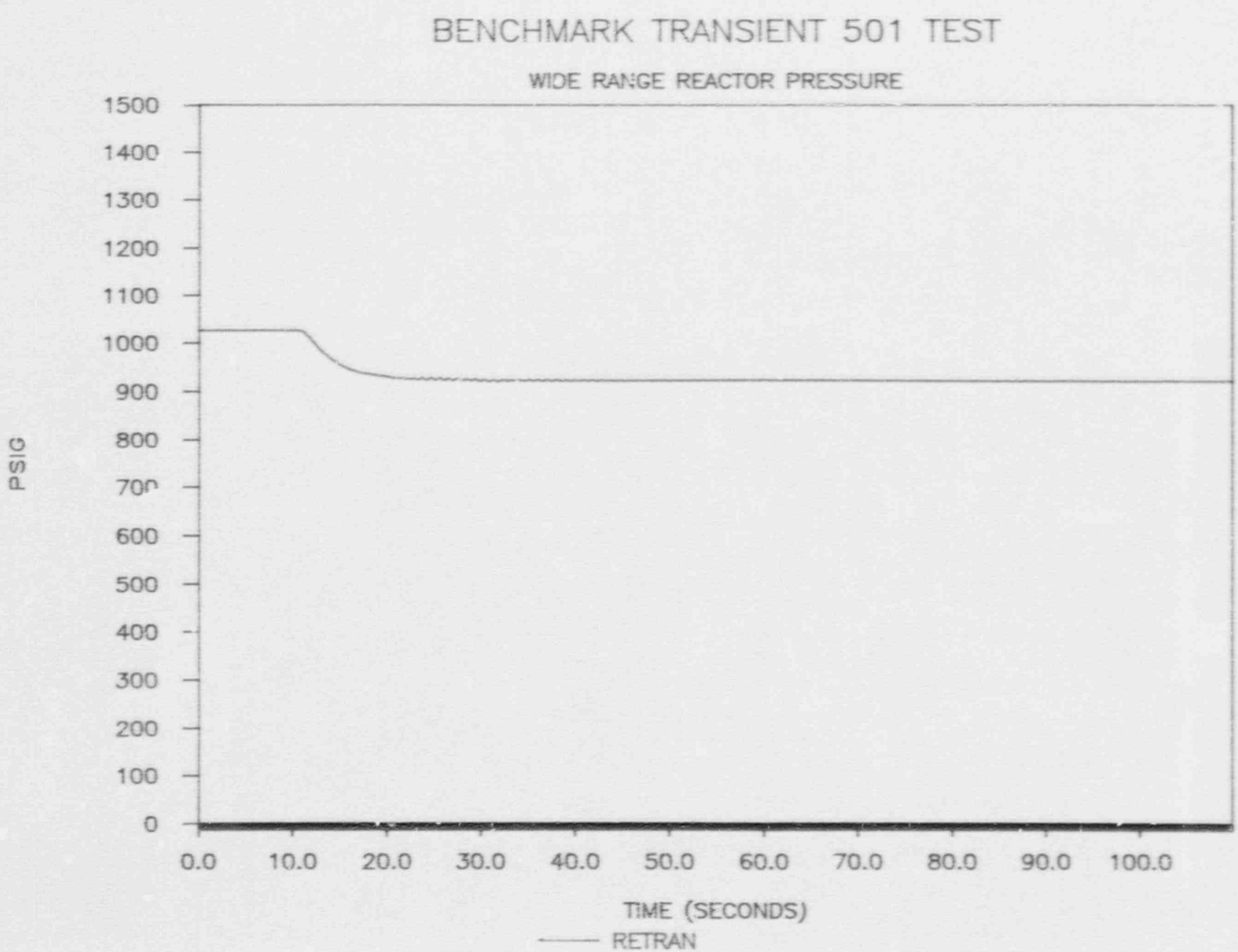


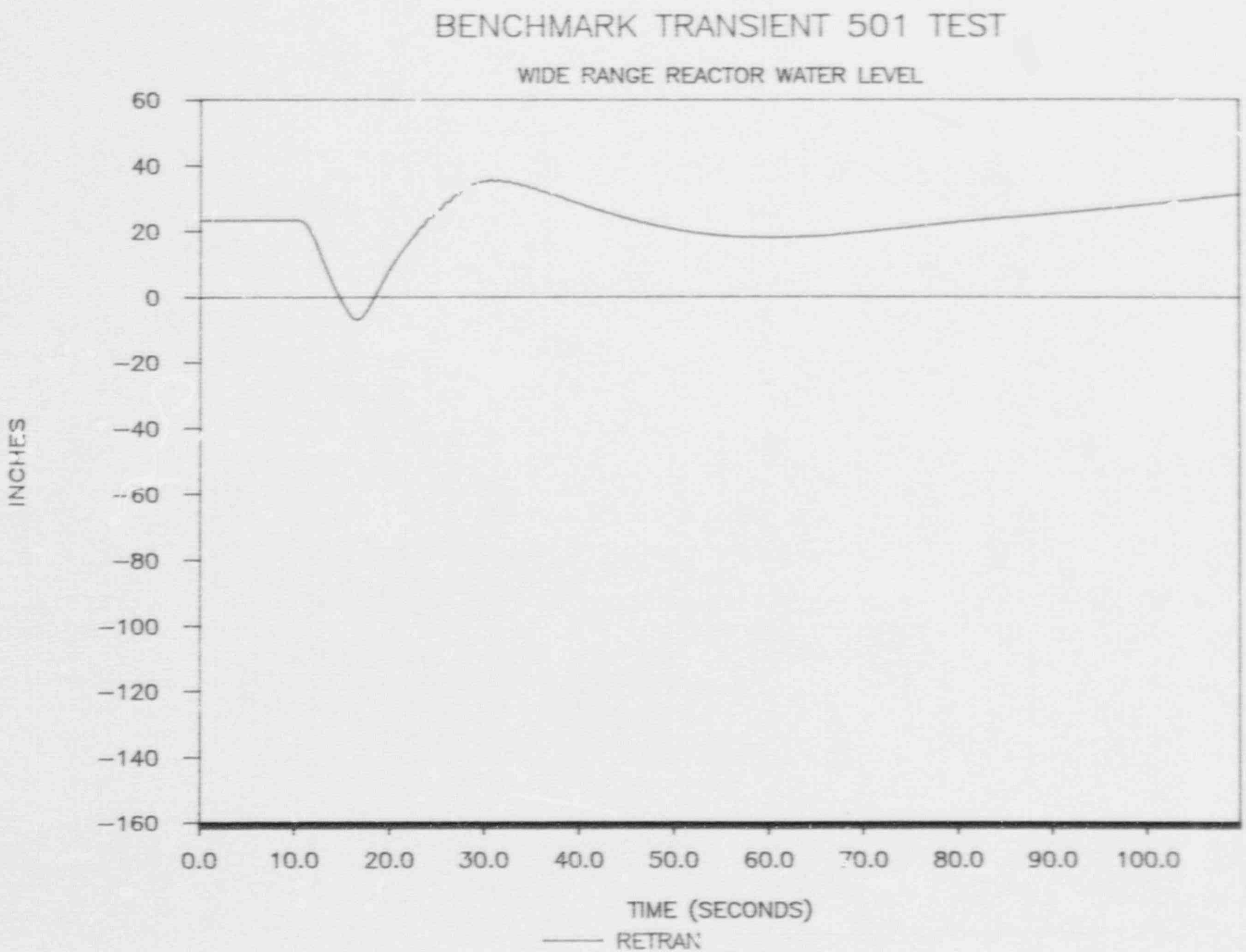

BENCHMARK TRANSIENT 501 TEST
TOTAL STEAM FLOW
MLBS/HR
20
19
18
17
16
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
0.00
10.00
20.00
30.00
40.00
50.00
60.00
70.00
80.00
90.00
100.00
TIME (SECONDS)
RETRAN

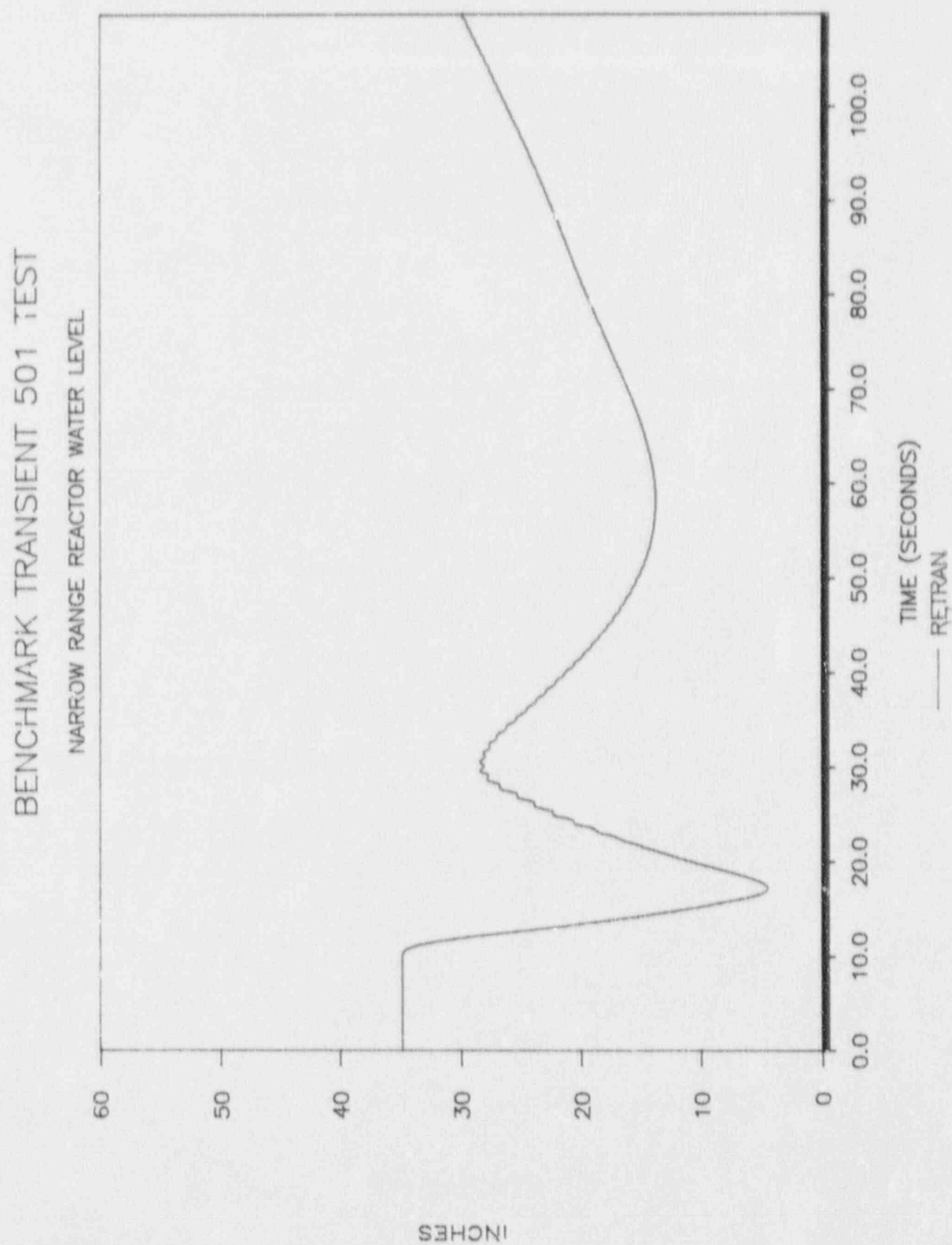
BENCHMARK TRANSIENT 501 TEST

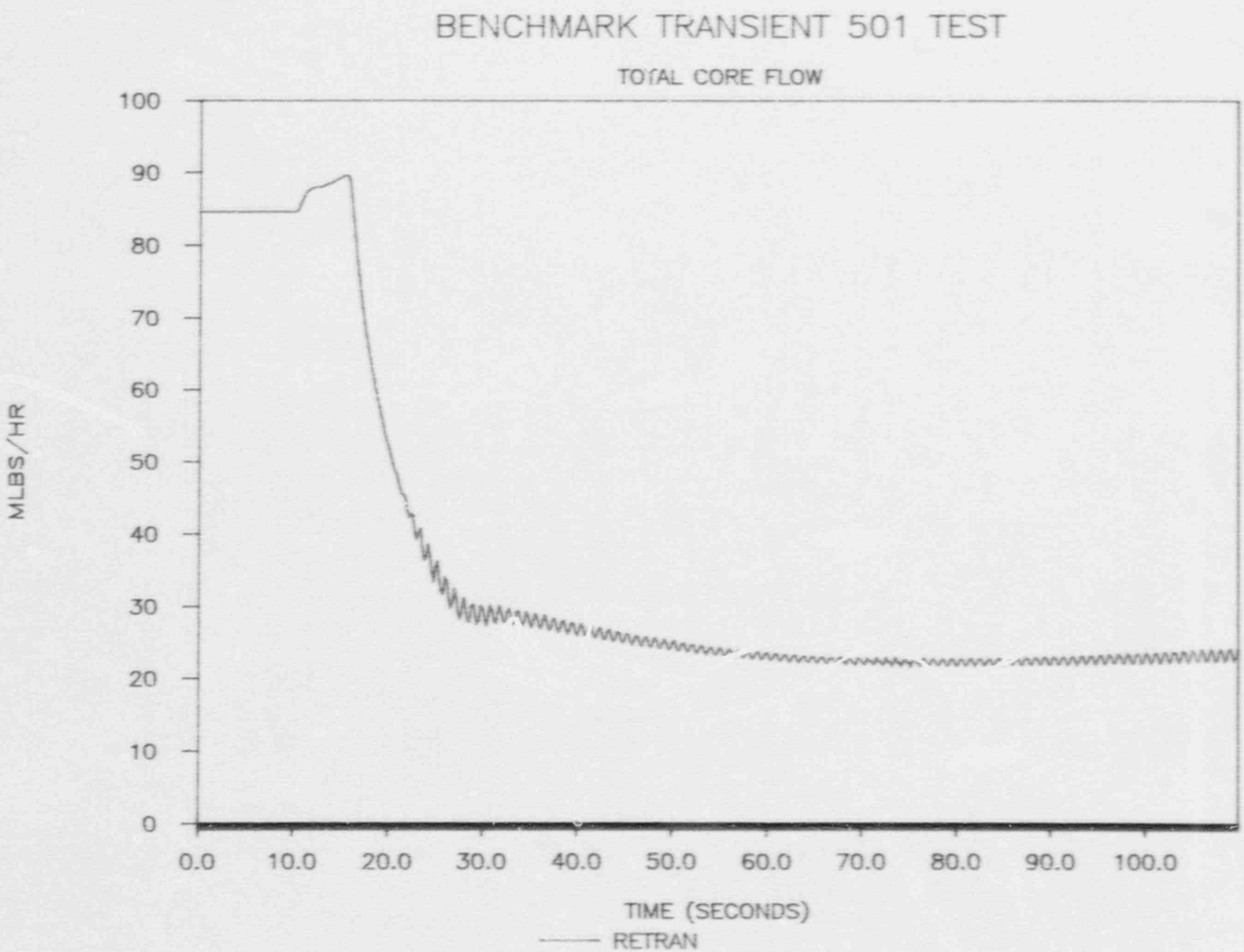
TOTAL FEEDWATER FLOW




BENCHMARK TRANSIENT 501 TEST
WIDE RANGE REACTOR PRESSURE
PSIG
1500
1400
1300
1200
1100
1000
900
800
700
600
500
400
300
200
100
0
0.0
10.0
20.0
30.0
40.0
50.0
60.0
70.0
80.0
90.0
100.0
TIME (SECONDS)
RETRAN


BENCHMARK TRANSIENT 501 TEST
WIDE RANGE REACTOR WATER LEVEL
INCHES
60
40
20
0
−20
−40
−60
−80
−100
−120
−140
−160
0.0
10.0
20.0
30.0
40.0
50.0
60.0
70.0
80.0
90.0
100.0
TIME (SECONDS)
RETRAN


BENCHMARK TRANSIENT 501 TEST
NARROW RANGE REACTOR WATER LEVEL
INCHES
0
10
20
30
40
50
60
0.0
10.0
20.0
30.0
40.0
50.0
60.0
70.0
80.0
90.0
100.0
TIME (SECONDS)
RETRAN



BENCHMARK TRANSIENT 501 TEST
TOTAL CORE FLOW
MLBS/HR
100
90
80
70
60
50
40
30
20
10
0
0.0
10.0
20.0
30.0
40.0
50.0
60.0
70.0
80.0
90.0
100.0
TIME (SECONDS)
RETRAN

SIMULATOR CERTIFICATION TEST SUMMARY

Test Name: STP 5.02, Simultaneous Trip of all Feedwater Pumps

Description: This test provides a benchmark comparison between the simulator and the plant for a simultaneous trip of all feedwater pumps.

The simulator was initialized at full power. Data recording began. Approximately 10 seconds later, malfunctions were simultaneously activated which tripped all feedwater pumps. No operator action was taken. The simulator was allowed to stabilize. After 5 minutes the simulator was placed in freeze and data recording was terminated.

Simulator performance was observed during the transient to ensure that alarms, automatic actions, and indications were appropriate for the transient. No violations of the physical laws of nature were observed.

This test was intended to meet the objectives of ANSI/ANS-3.5-1985, Appendix B, and footnote 3 of the standard.

Simulator Features Tested:

Simulator data recording capability at a resolution of 0.5 seconds.

Initial Conditions:

The simulator was operating in a normal full power lineup.

Final Conditions:

The simulator was stable following a simultaneous trip of all feedwater water pumps.

SIMULATOR CERTIFICATION TEST SUMMARY

Test Name: STP 5.02, Simultaneous Trip of all Feedwater Pumps (Cont'd)

Baseline Data Source:

CPS Final Safety Analysis Report (FSAR) which is now known as the Updated Safety Analysis Report (USAR)

Comparison:

The following simulator parameters were compared to the available baseline data. The magnitude and direction of change of all parameters were evaluated as acceptable.

Parameter	Evaluation
Reactor Power	Satisfactory
Total Steam Flow	Satisfactory
Total Feedwater Flow	Satisfactory
Reactor Pressure (WR)	Satisfactory
Reactor Pressure (NR)	USAR Data Unavailable
Reactor Level (WR)	Satisfactory
Reactor Level (NR)	USAR Data Unavailable
Generator Power	USAR Data Unavailable
Turbine Steam Flow	Satisfactory
Total Core Flow	Satisfactory
Total RR Loop Flow	USAR Data Unavailable

The USAR does not assume that a Reactor Recirculation System Flow Control Valve Runback occurs during this transient. Consequently, the differences seen between the simulator data and USAR data for reactor power, reactor pressure, and reactor water level are due to this assumption.

CPS licensed operators have reviewed the simulator data for the parameters having no corresponding USAR data, and have judged simulator performance to be acceptable and consistent with that expected for the transient.

Graphs of simulator and USAR data follow this test summary. When all parameters are considered, the overall simulator response to this transient is satisfactory.

SIMULATOR CERTIFICATION TEST SUMMARY

Test Name: STP 5.02, Simultaneous Trip of all Feedwater Pumps (Cont'd)

Deficiencies Found:

None

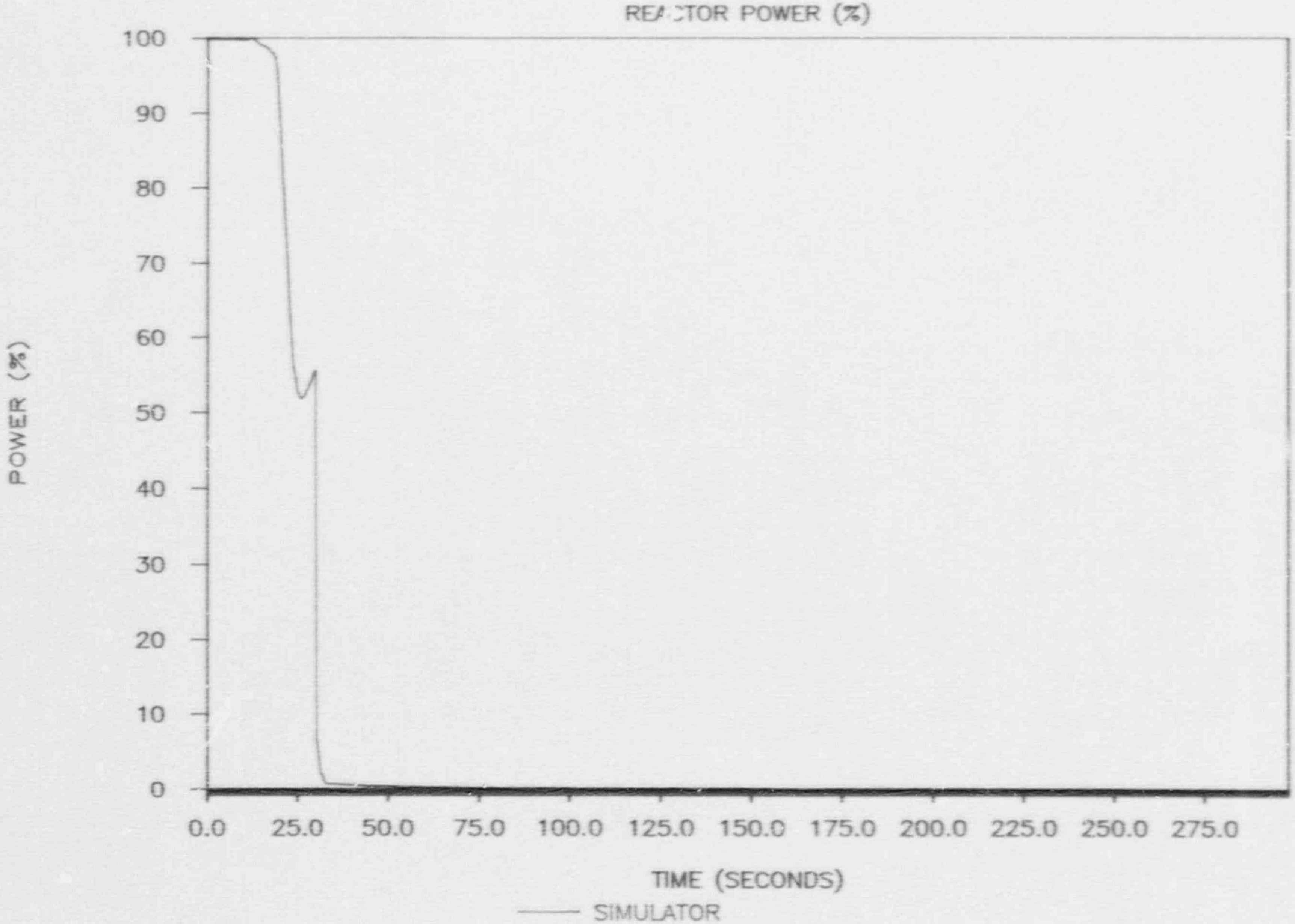
Corrective Actions Planned (and schedule):

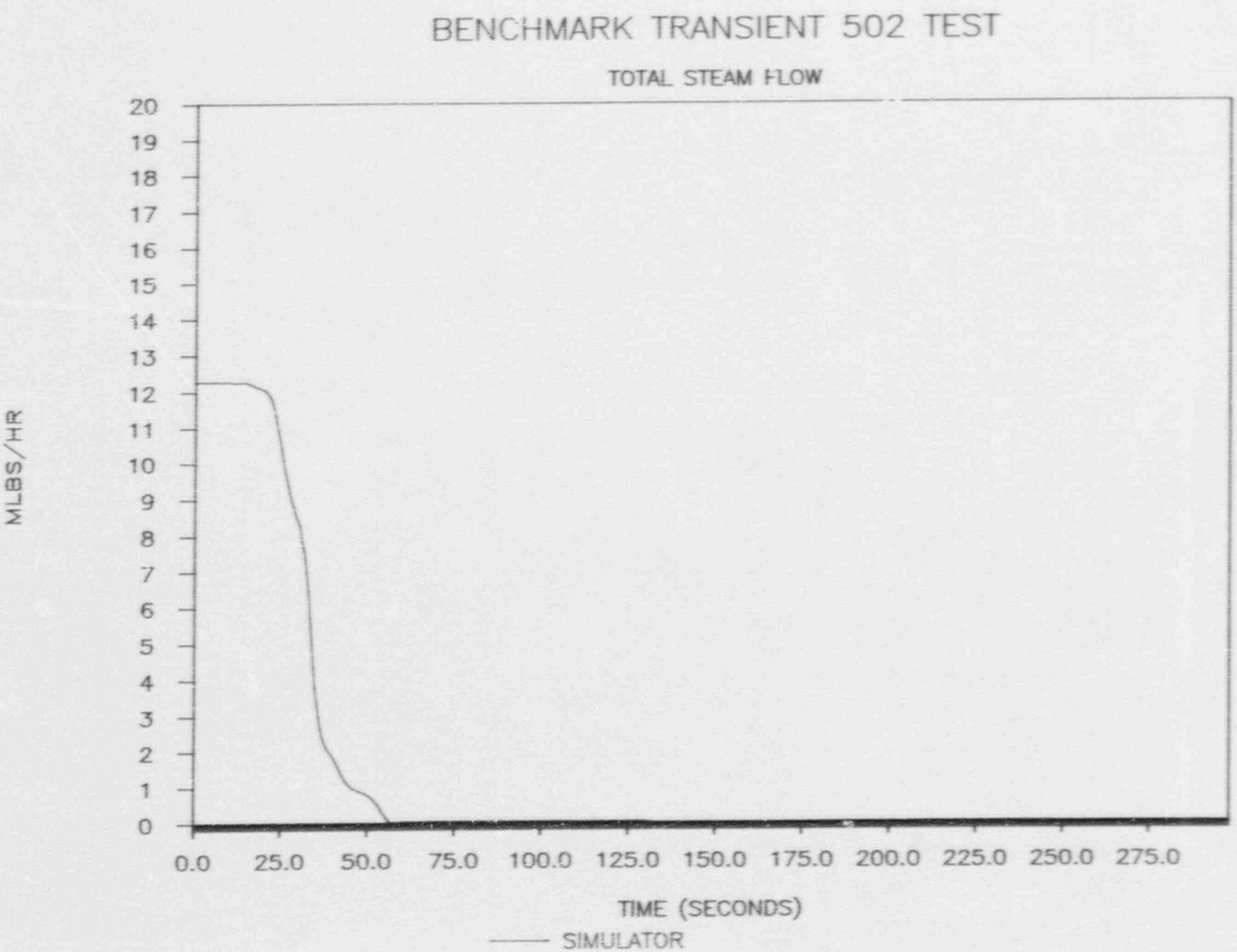
None

Exceptions Taken/Justification:

None

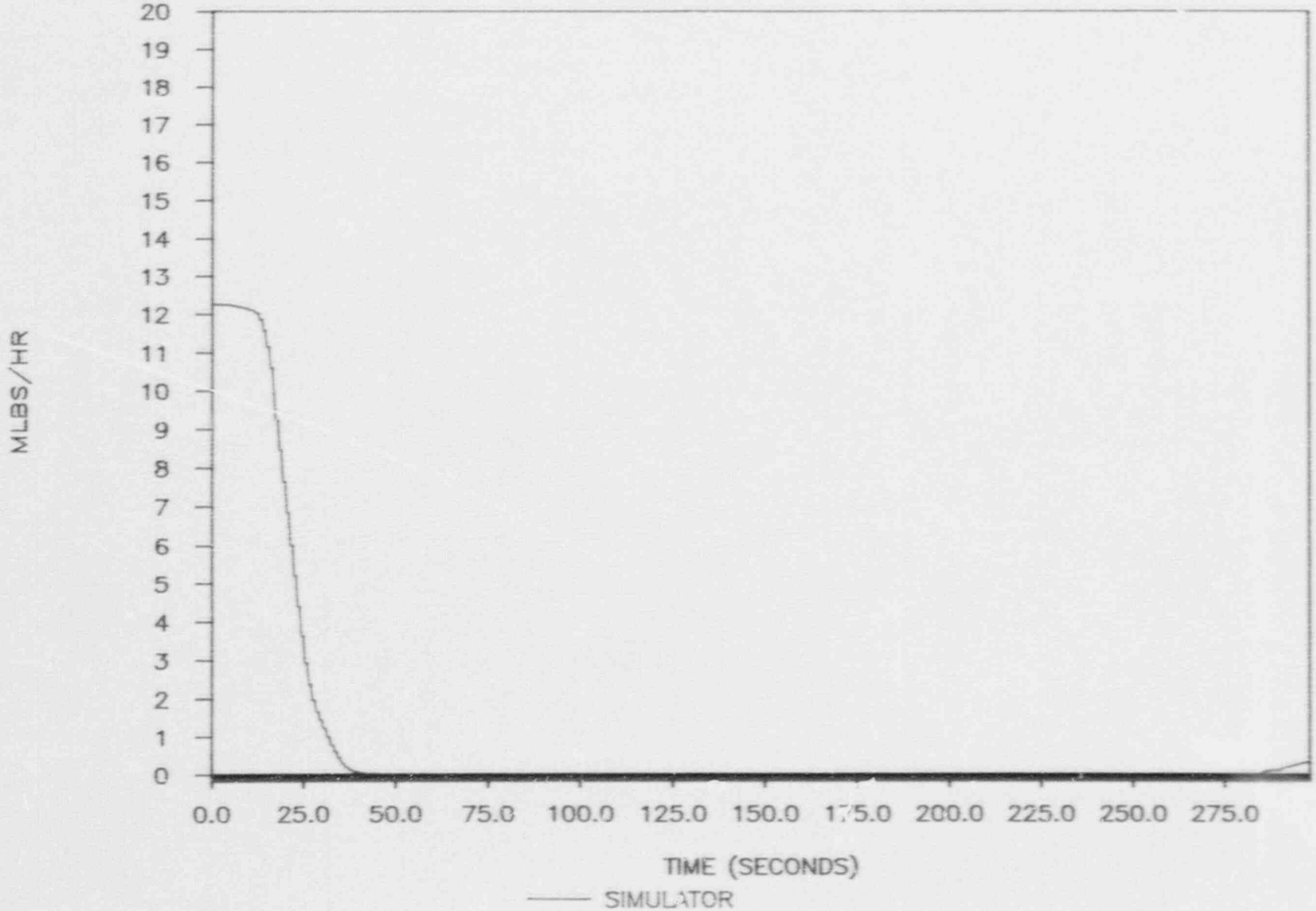
BENCHMARK TRANSIENT 502 TEST

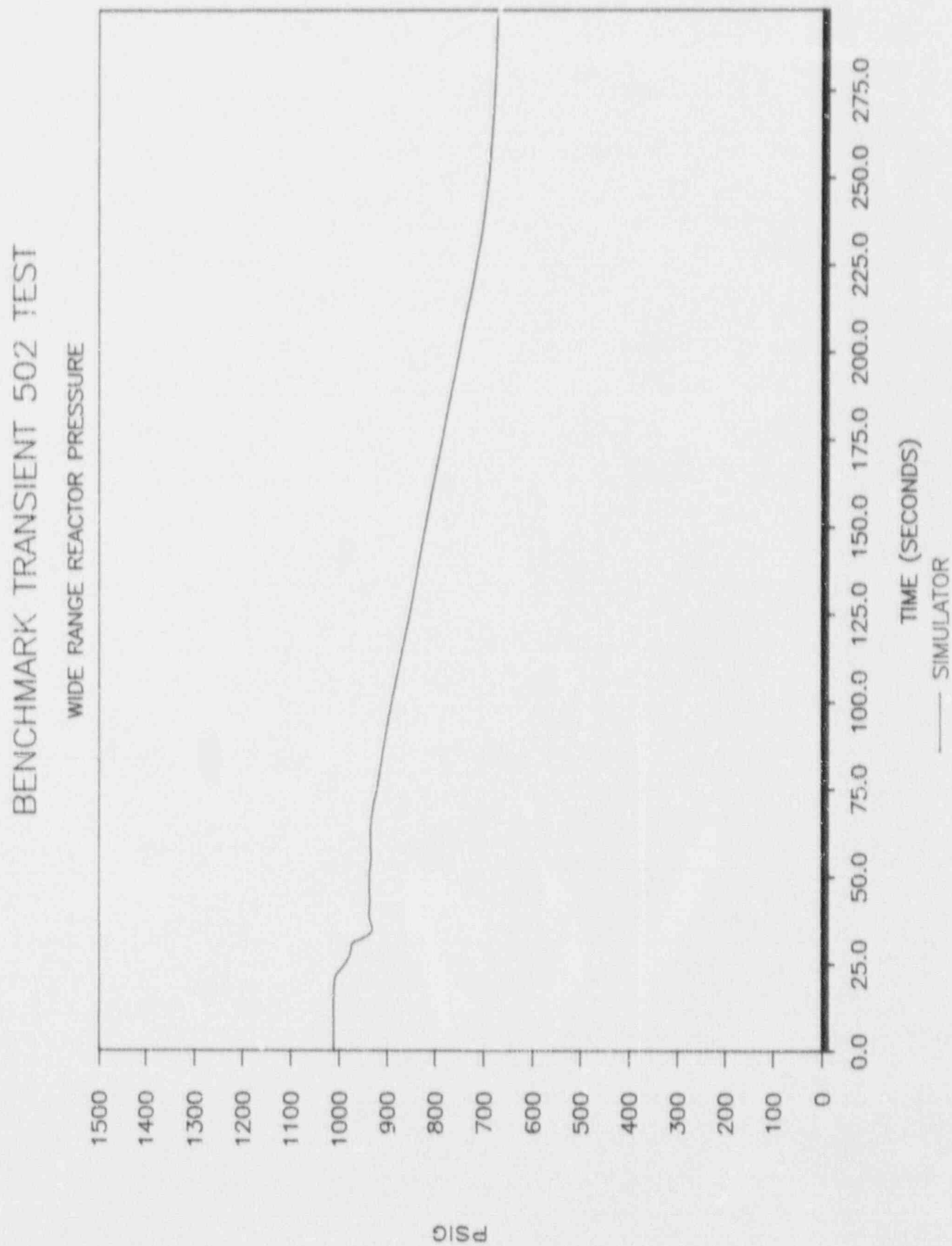



BENCHMARK TRANSIENT 502 TEST
TOTAL STEAM FLOW
MLBS/HR
20
19
18
17
16
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
0.0
25.0
50.0
75.0
100.0
125.0
150.0
175.0
200.0
225.0
250.0
275.0
TIME (SECONDS)
SIMULATOR

BENCHMARK TRANSIENT 502 TEST

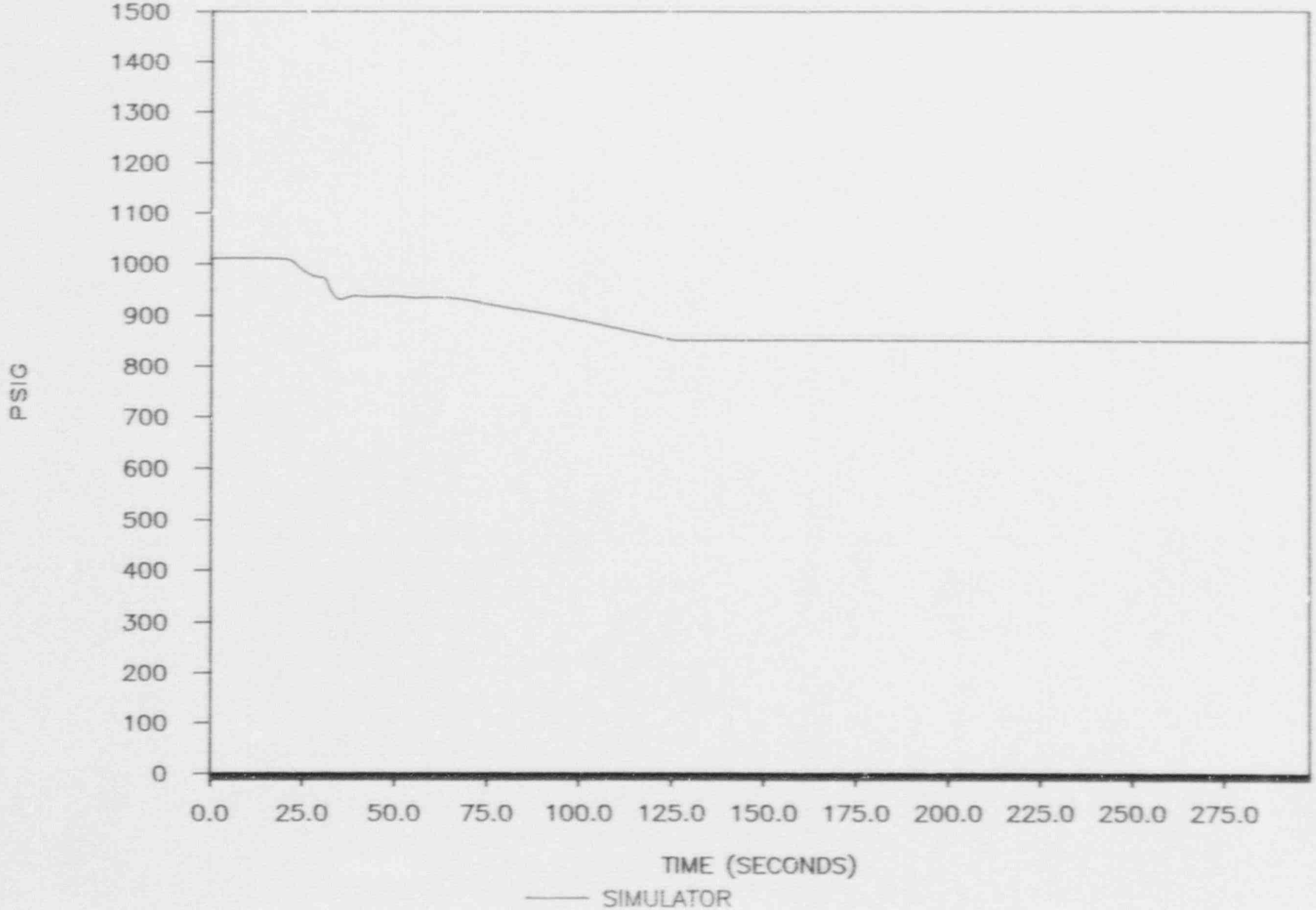
TOTAL FEEDWATER FLOW

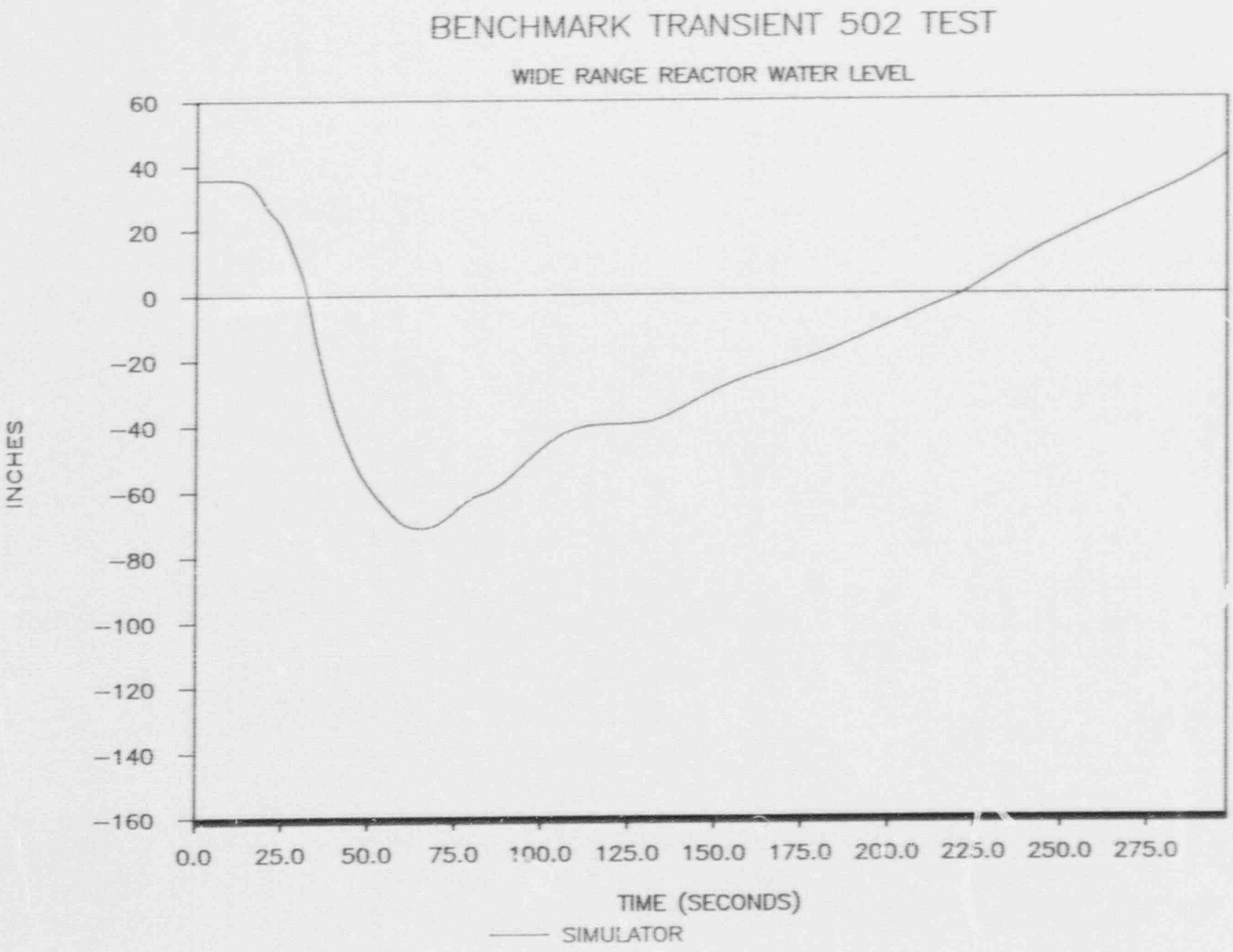



BENCHMARK TRANSIENT 502 TEST
WIDE RANGE REACTOR PRESSURE
PSIG
1500
1400
1300
1200
1100
1000
900
800
700
600
500
400
300
200
100
0
0.0
25.0
50.0
75.0
100.0
125.0
150.0
175.0
200.0
225.0
250.0
275.0
TIME (SECONDS)
— SIMULATOR

BENCHMARK TRANSIENT 502 TEST

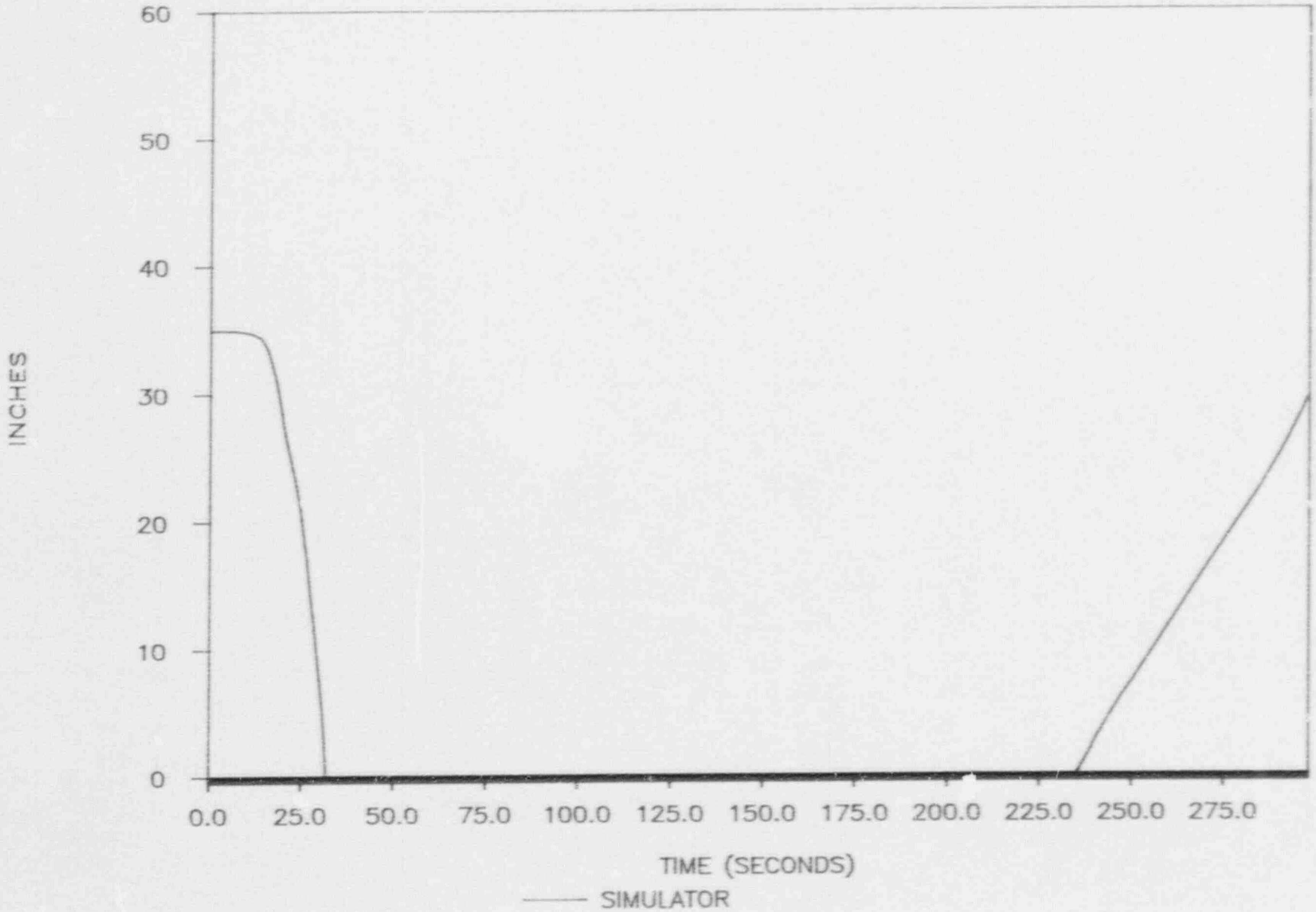
NARROW RANGE REACTOR PRESSURE




BENCHMARK TRANSIENT 502 TEST
WIDE RANGE REACTOR WATER LEVEL
60
40
20
0
−20
−40
−60
−80
−100
−120
−140
−160
INCHES
0.0
25.0
50.0
75.0
100.0
125.0
150.0
175.0
200.0
225.0
250.0
275.0
TIME (SECONDS)
SIMULATOR

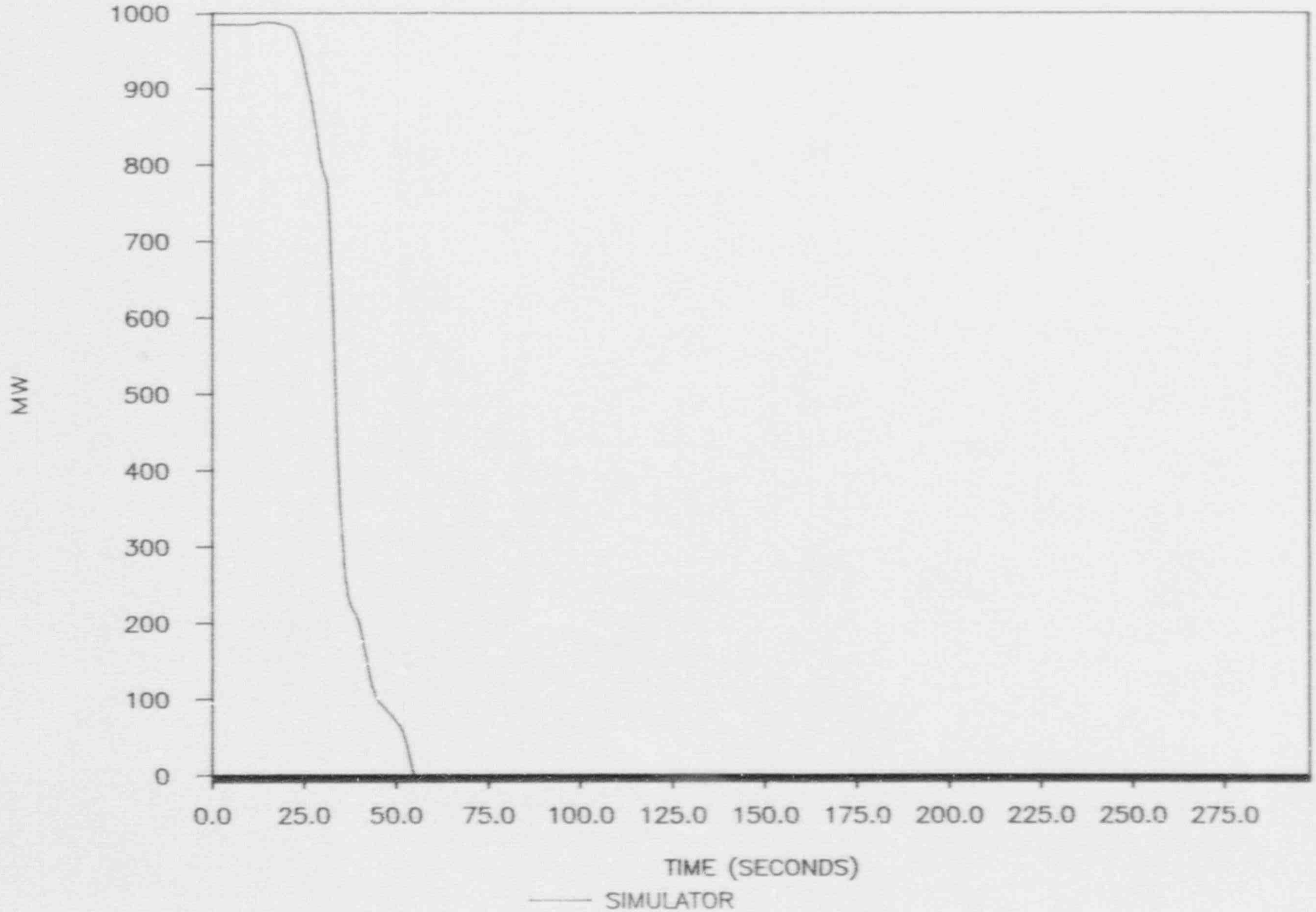
BENCHMARK TRANSIENT 502 TEST

NARROW RANGE REACTOR WATER LEVEL

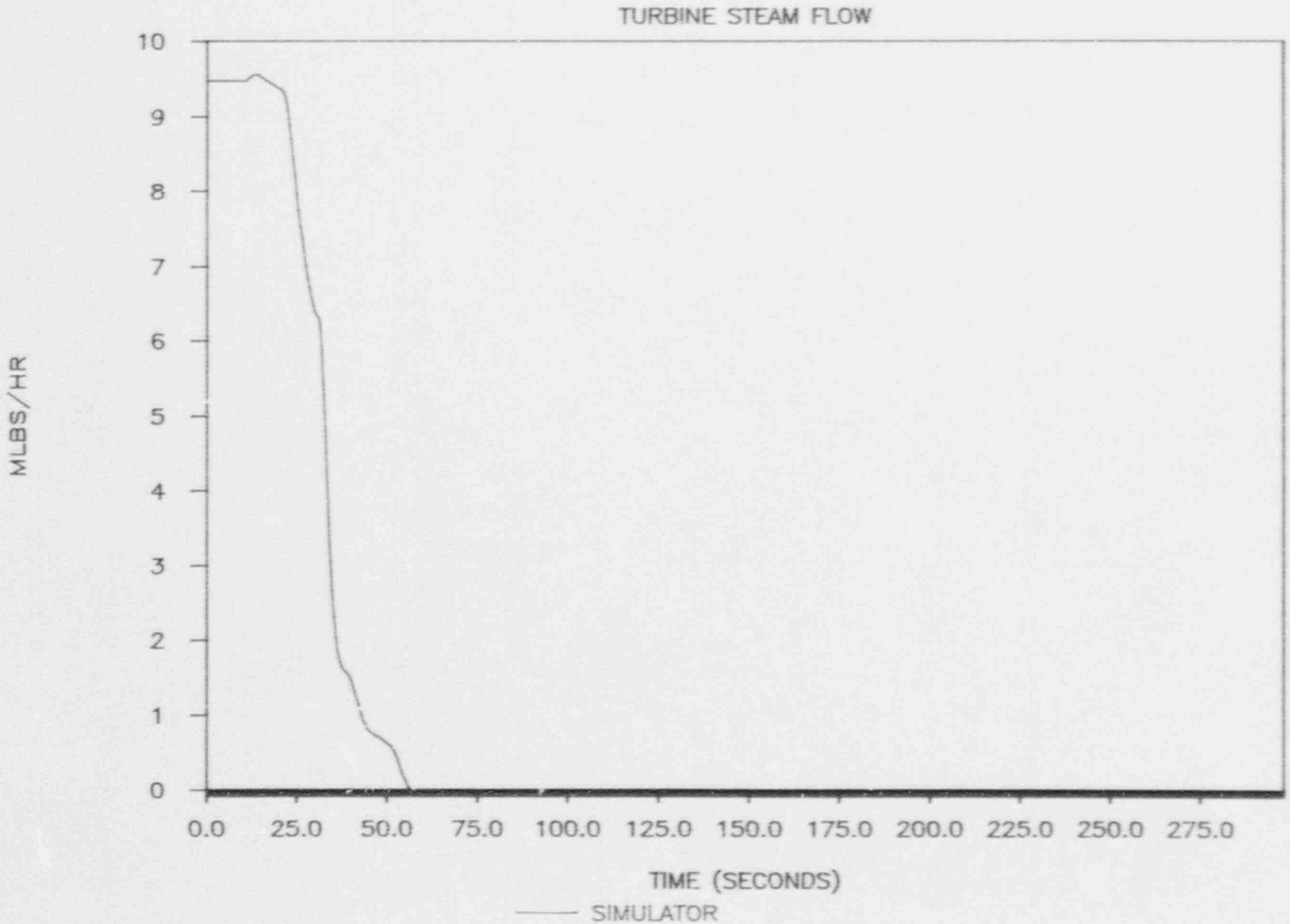


BENCHMARK TRANSIENT 502 TEST

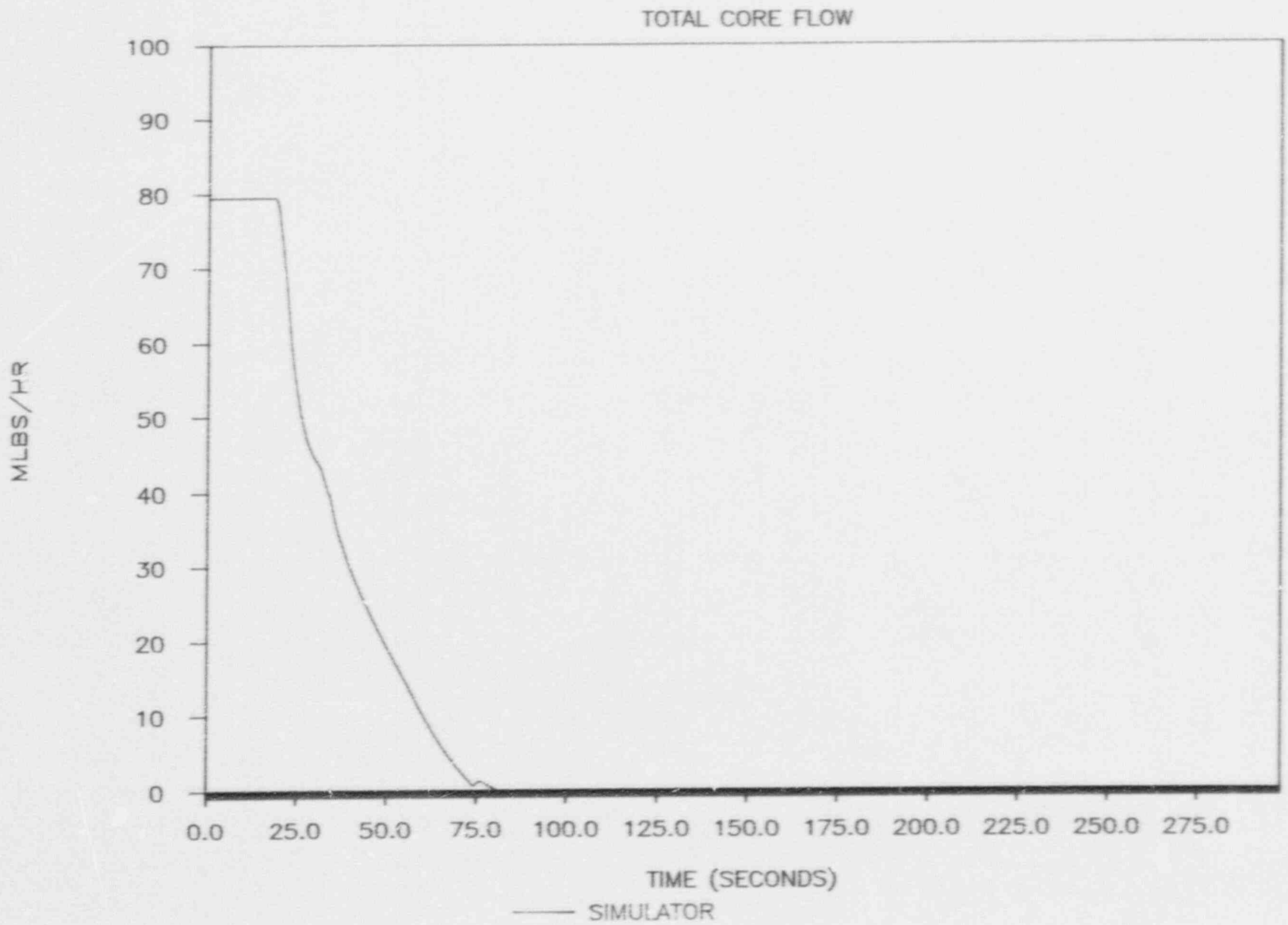
GENERATOR GROSS ELECTRICAL POWER

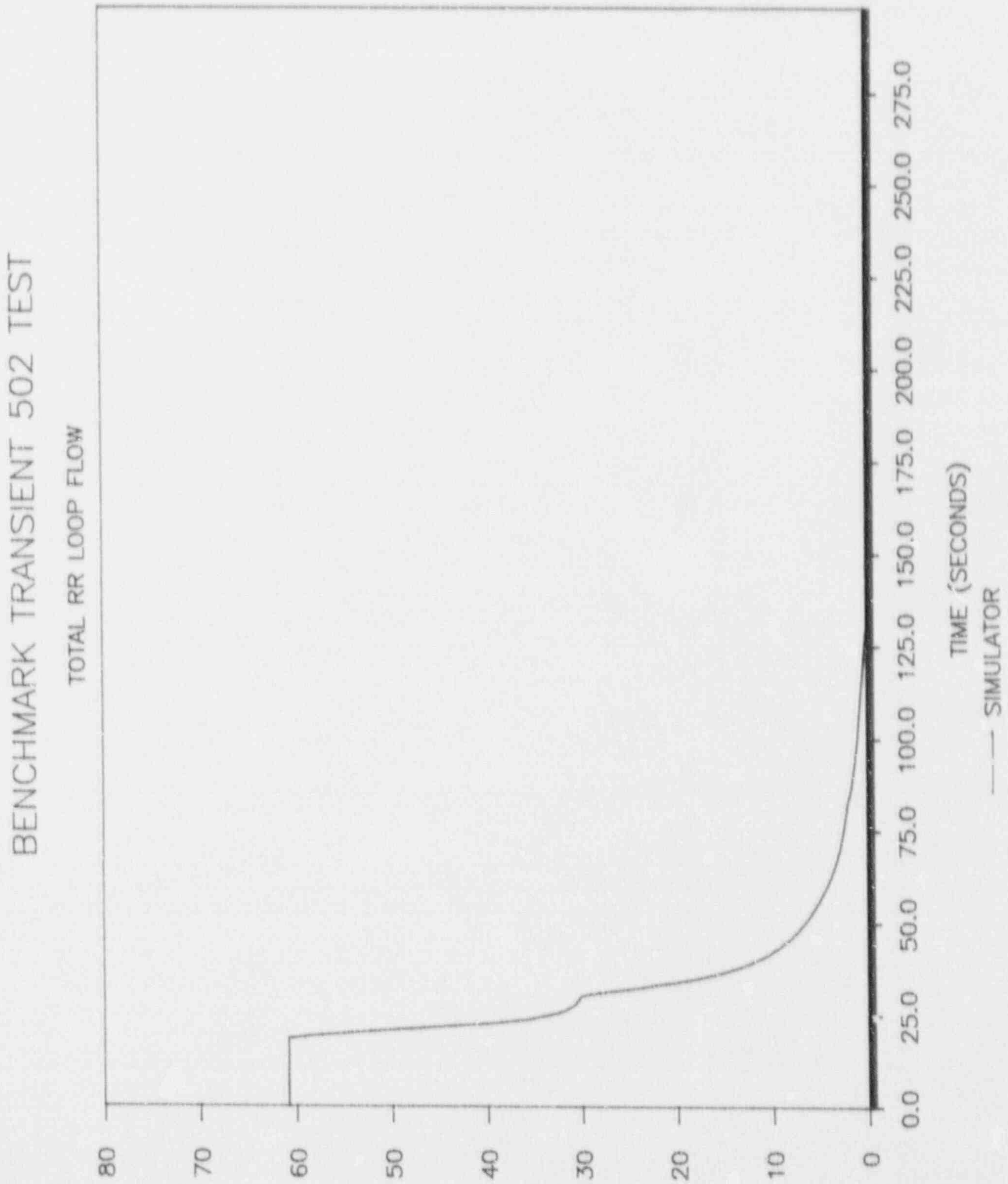


BENCHMARK TRANSIENT 502 TEST



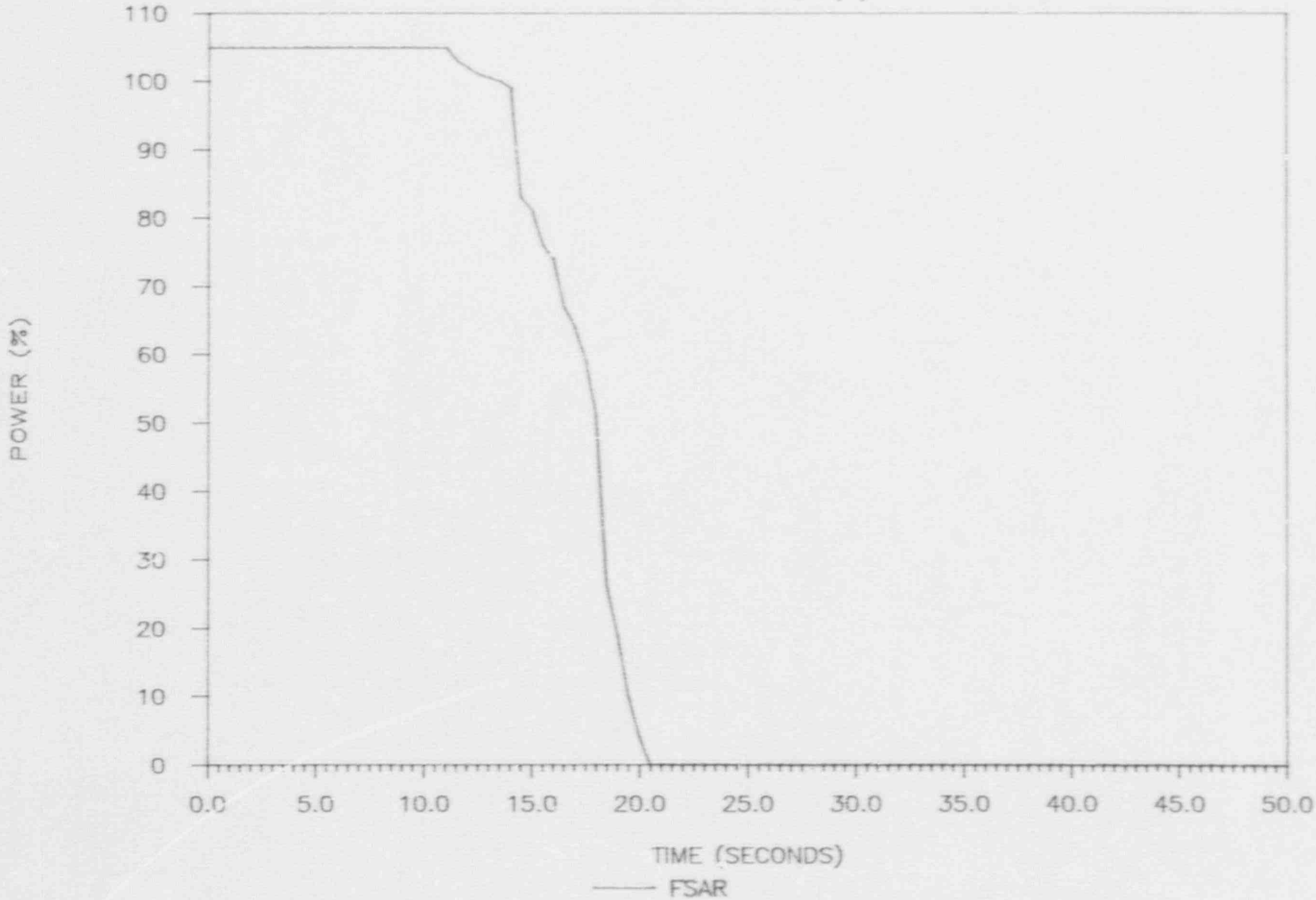
BENCHMARK TRANSIENT 502 TEST

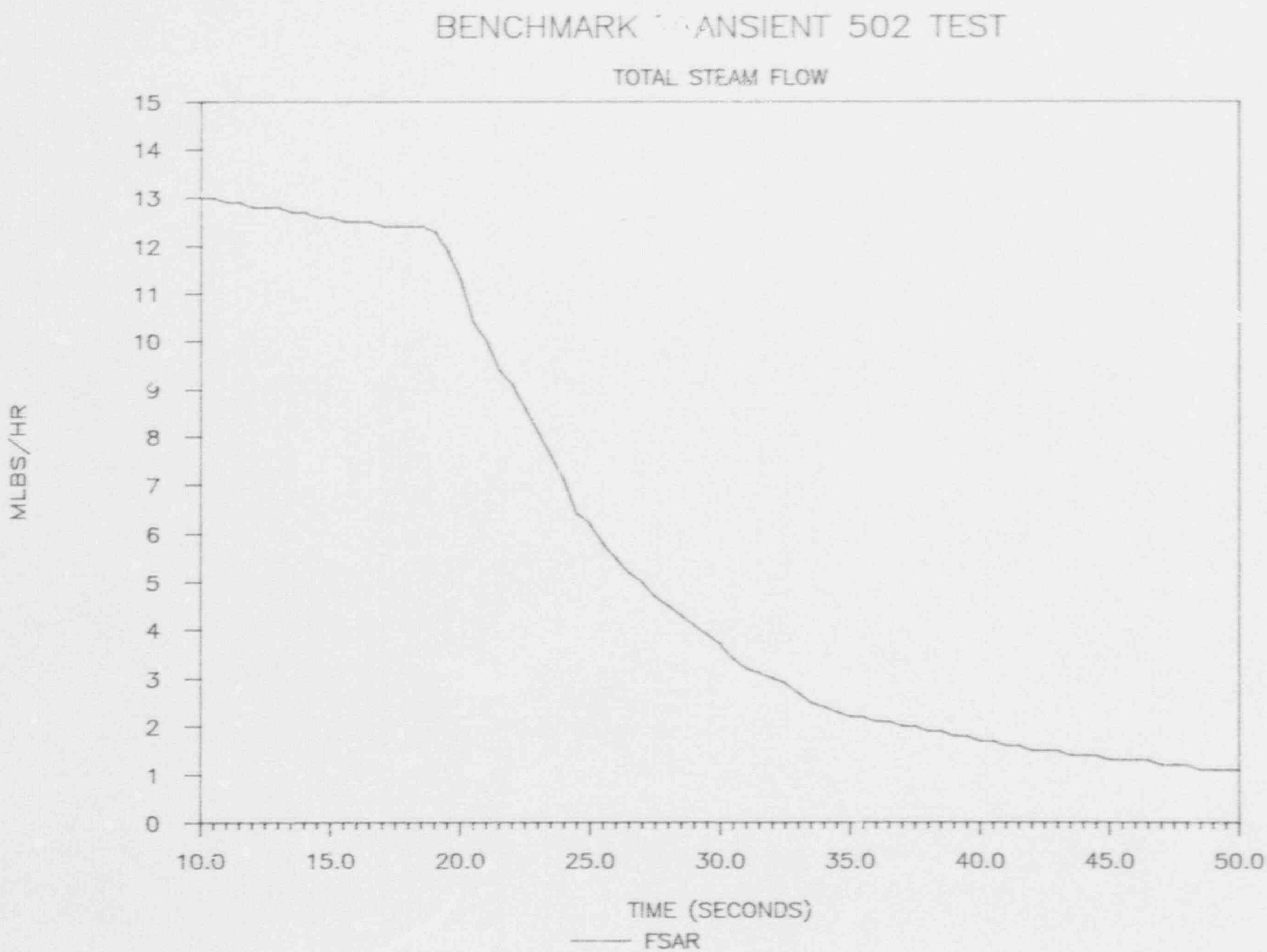


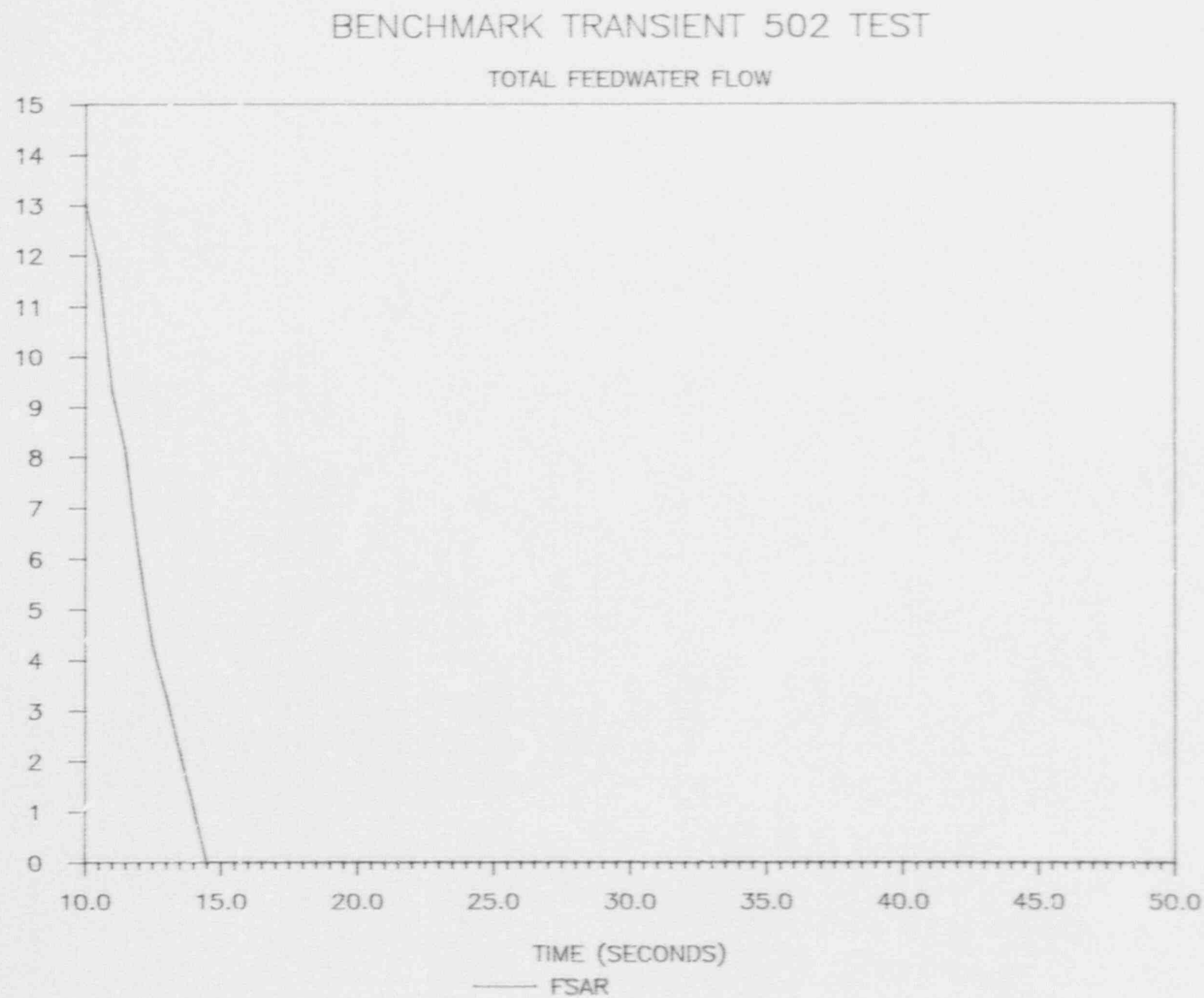

BENCHMARK TRANSIENT 502 TEST
TOTAL RR LOOP FLOW
GPM
(Thousands)
80
70
60
50
40
30
20
10
0
0.0
25.0
50.0
75.0
100.0
125.0
150.0
175.0
200.0
225.0
250.0
275.0
TIME (SECONDS)
SIMULATOR

BENCHMARK TRANSIENT 502 TEST

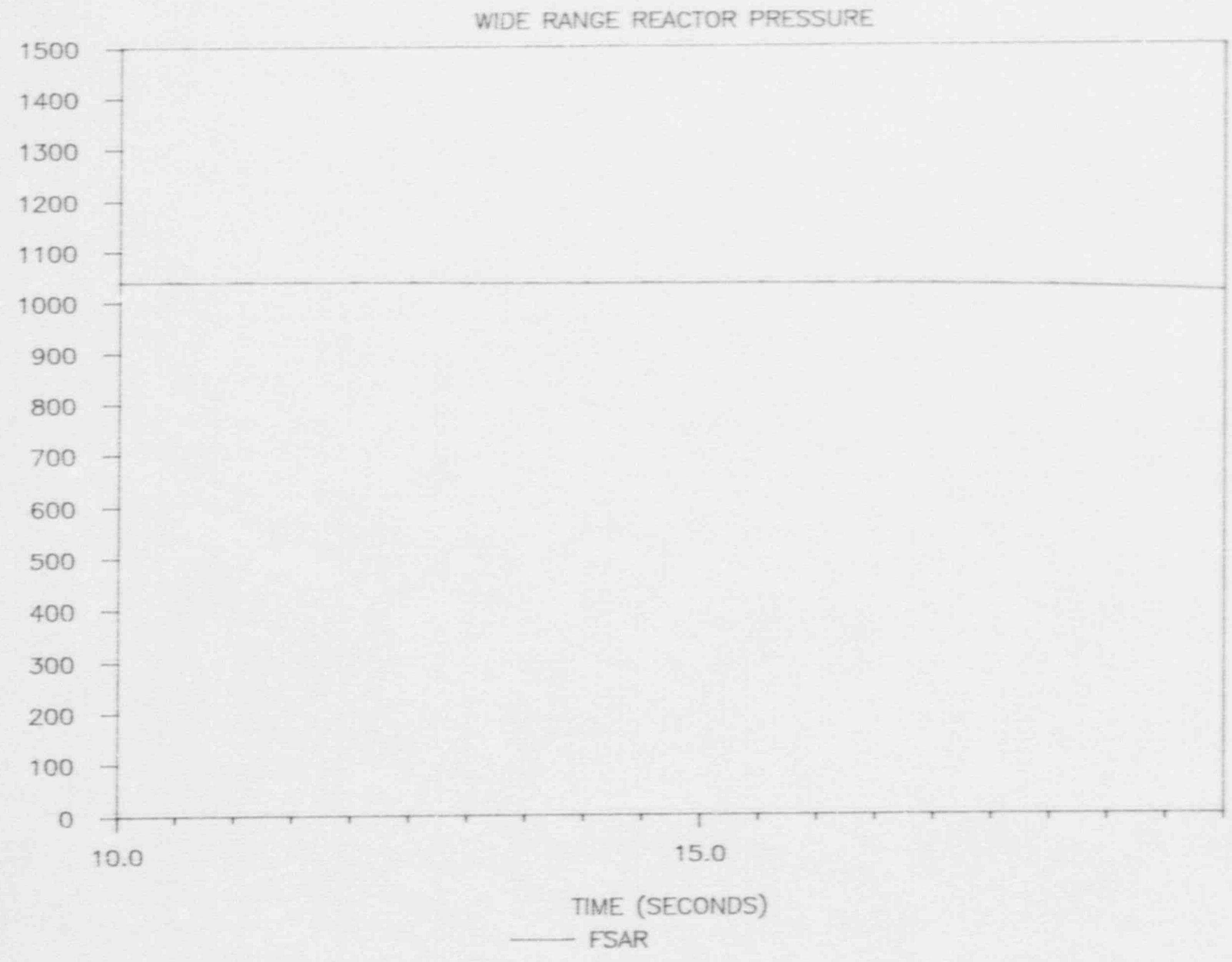
REACTOR POWER (%)

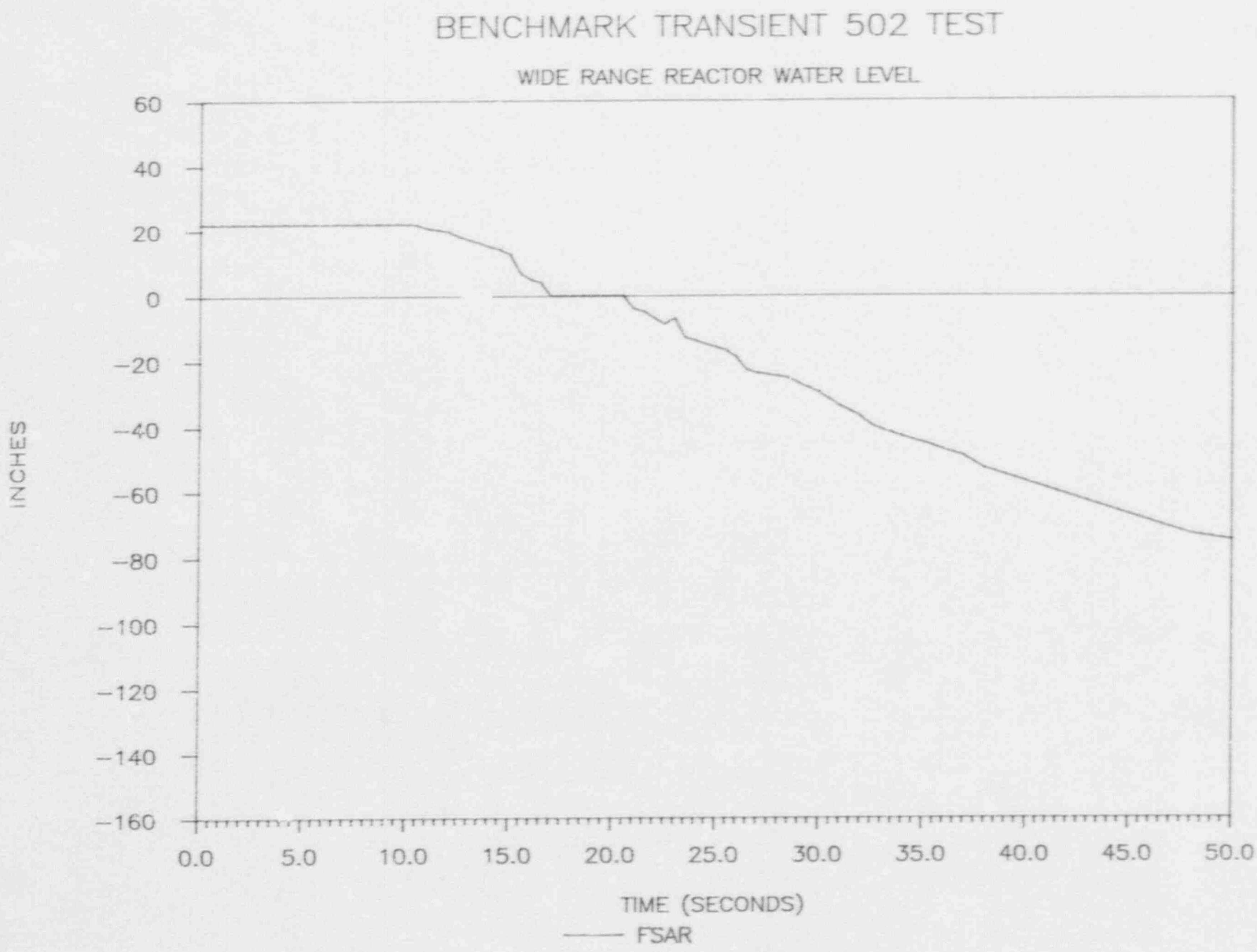



BENCHMARK [illegible]ANSIENT 502 TEST
TOTAL STEAM FLOW
MLBS/HR
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
10.0
15.0
20.0
25.0
30.0
35.0
40.0
45.0
50.0
TIME (SECONDS)
FSAR


BENCHMARK TRANSIENT 502 TEST
TOTAL FEEDWATER FLOW
MLBS/HR
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
10.0
15.0
20.0
25.0
30.0
35.0
40.0
45.0
50.0
TIME (SECONDS)
FSAR

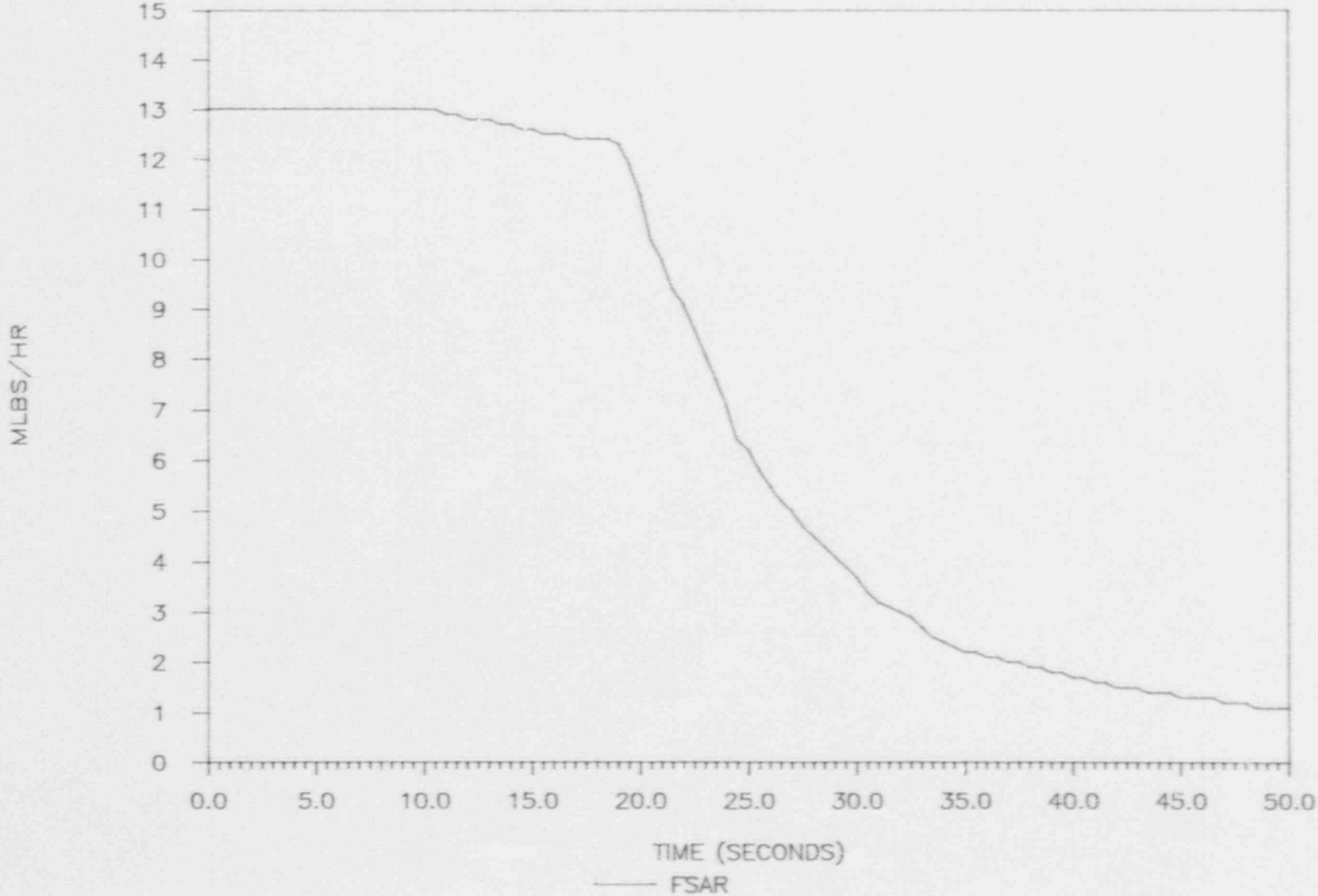
BENCHMARK TRANSIENT 502 TEST

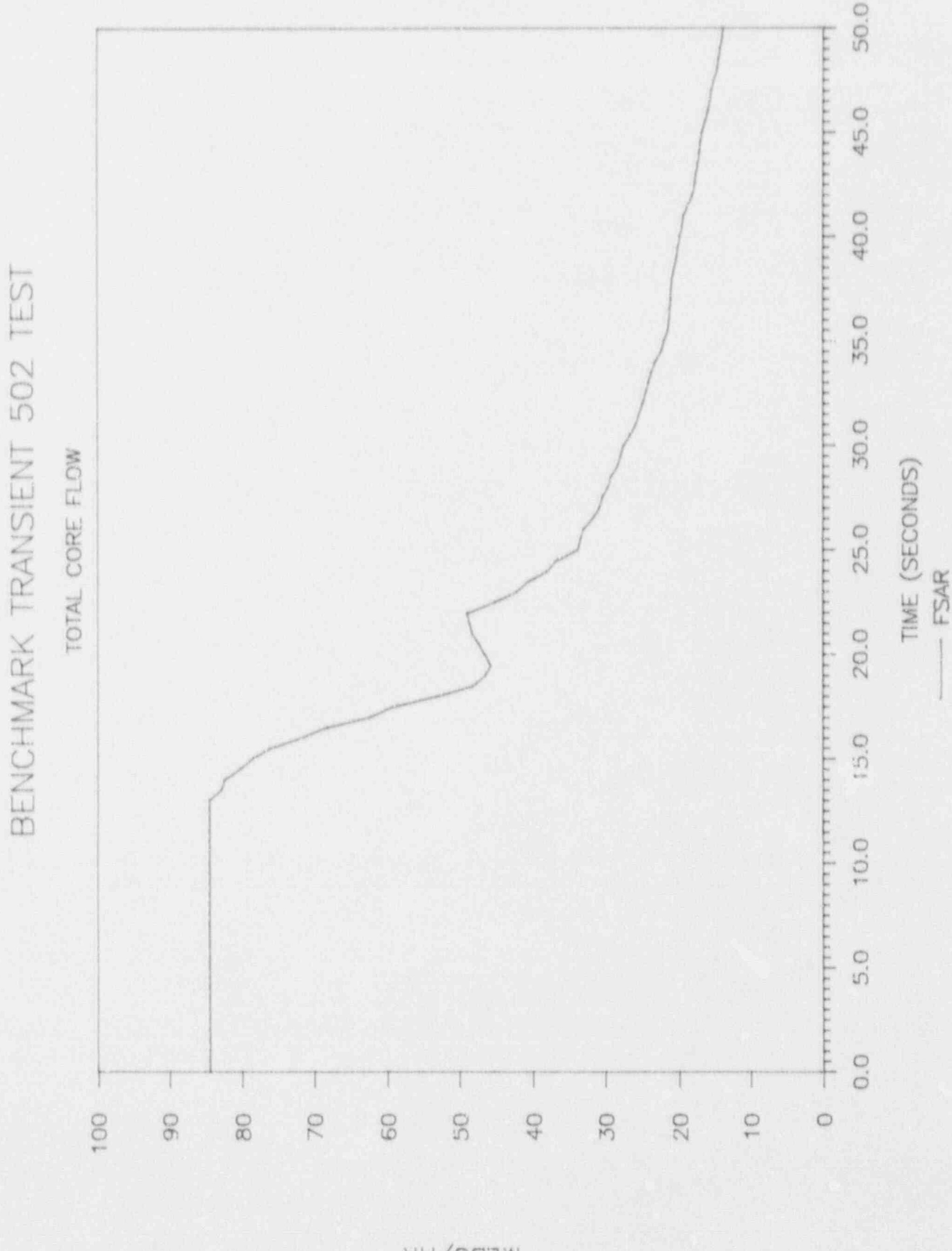



BENCHMARK TRANSIENT 502 TEST
WIDE RANGE REACTOR WATER LEVEL
INCHES
60
40
20
0
-20
-40
-60
-80
-100
-120
-140
-160
0.0
5.0
10.0
15.0
20.0
25.0
30.0
35.0
40.0
45.0
50.0
TIME (SECONDS)
FSAR

BENCHMARK TRANSIENT 502 TEST

TURBINE STEAM FLOW




BENCHMARK TRANSIENT 502 TEST
TOTAL CORE FLOW
MLBS/HR
100
90
80
70
60
50
40
30
20
10
0
0.0
5.0
10.0
15.0
20.0
25.0
30.0
35.0
40.0
45.0
50.0
TIME (SECONDS)
FSAR

SIMULATOR CERTIFICATION TEST SUMMARY

Test Name: STP 5.03, Simultaneous Closure of all MSIVs

Description: This test provides a benchmark comparison between the simulator and plant for a simultaneous closure of all MSIVs.

The simulator was initialized at full power. Data recording began. Approximately 10 seconds later, malfunctions were activated which simultaneously closed all inboard Main Steam Isolation Valves (MSIVs). No operator action was taken. The simulator was allowed to stabilize. After 5 minutes the simulator was placed in freeze and data recording was terminated.

Simulator performance was observed during the transient to ensure that alarms, automatic actions, and indications were appropriate for the transient. No violations of the physical laws of nature were observed.

This test was intended to meet the objectives of ANSI/ANS-3.5-1985, Appendix B, and footnote 3 of the standard.

Simulator Features Tested:

Simulator data recording capability at a resolution of 0.5 seconds.

Initial Conditions:

The simulator was operating in a normal full power lineup.

Final Conditions:

The simulator was stable following a simultaneous closure of all inboard MSIVs.

SIMULATOR CERTIFICATION TEST SUMMARY

Test Name: STP 5.03, Simultaneous Closure of all MSIVs (Cont'd)

Baseline Data Source:

Plant Data-GE Transient Recording System (GETARS)

Comparison:

The following simulator parameters were compared to the available baseline data. The magnitude and direction of change of all parameters were evaluated as acceptable.

Parameter	Evaluation
Reactor Power	Satisfactory
Total Steam Flow	Satisfactory
Total Feedwater Flow	Satisfactory
Reactor Pressure (WR)	Satisfactory
Reactor Pressure (NR)	Satisfactory
Reactor Level (WR)	Satisfactory
Reactor Level (NR)	Satisfactory
Generator Power	Satisfactory
Turbine Steam Flow	GETARS Data Unavailable
Total Core Flow	Satisfactory
Total RR Loop Flow	Satisfactory

Simulator generator power decreased to zero immediately following the transient, while plant GETARS data indicates that the decrease was not nearly as rapid. This has been judged to be acceptable because the parameter changed in the correct direction. However, Simulator Problem Report (SPR) No. 91-042 has been written to evaluate this further.

CPS licensed operators have reviewed the simulator data for the parameter having no corresponding GETARS data, and have judged simulator performance to be acceptable and consistent with that expected for the transient.

SIMULATOR CERTIFICATION TEST SUMMARY

Test Name: STP 5.03, Simultaneous Closure of all MSIVs (Cont'd)

Comparison (cont'd):

Graphs of simulator and GETARS data follow this test summary. When all parameters are conside ed, the overall simulator response to this transient is satisfactory.

Deficiencies Found:

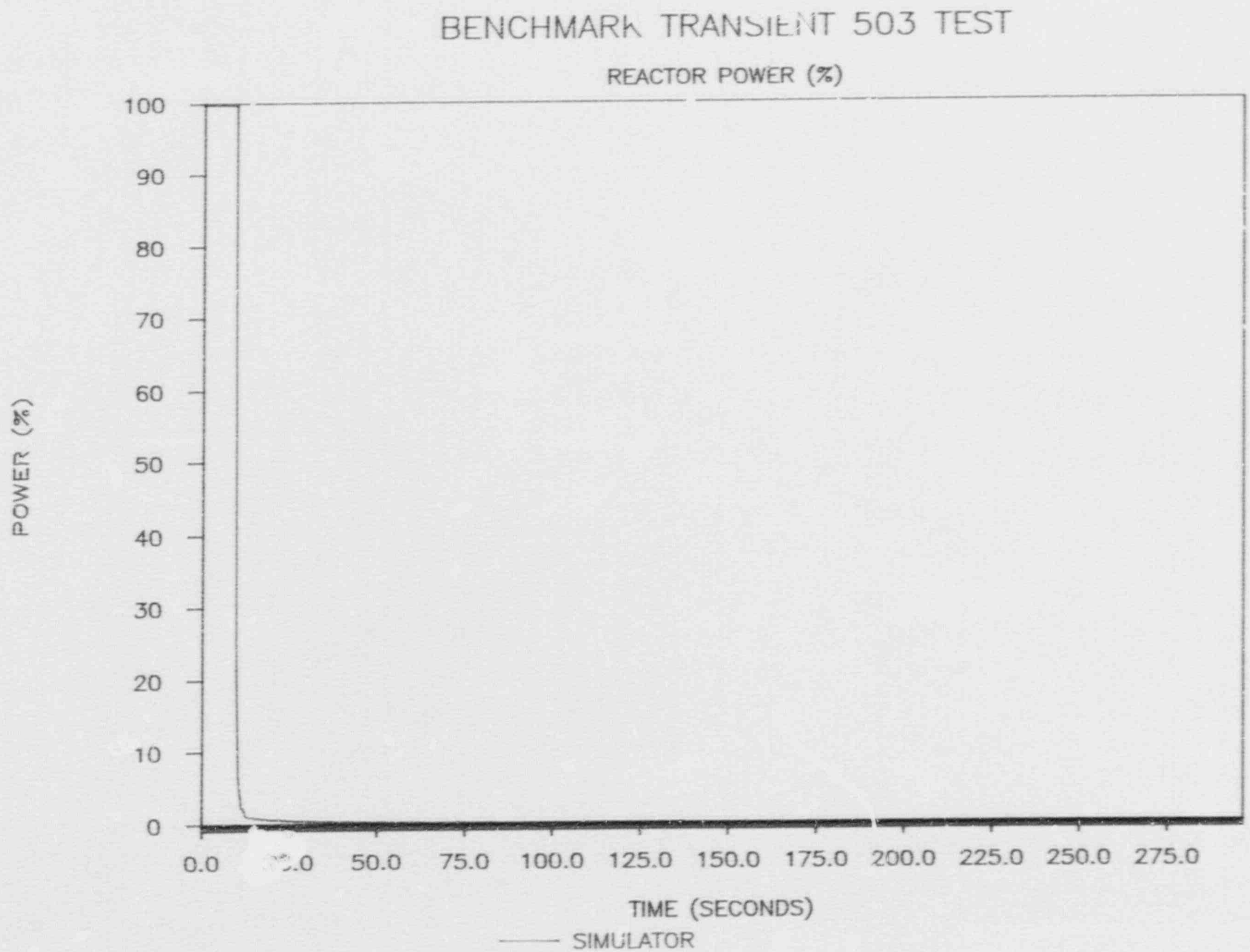
None

Corrective Actions Planned (and schedule):

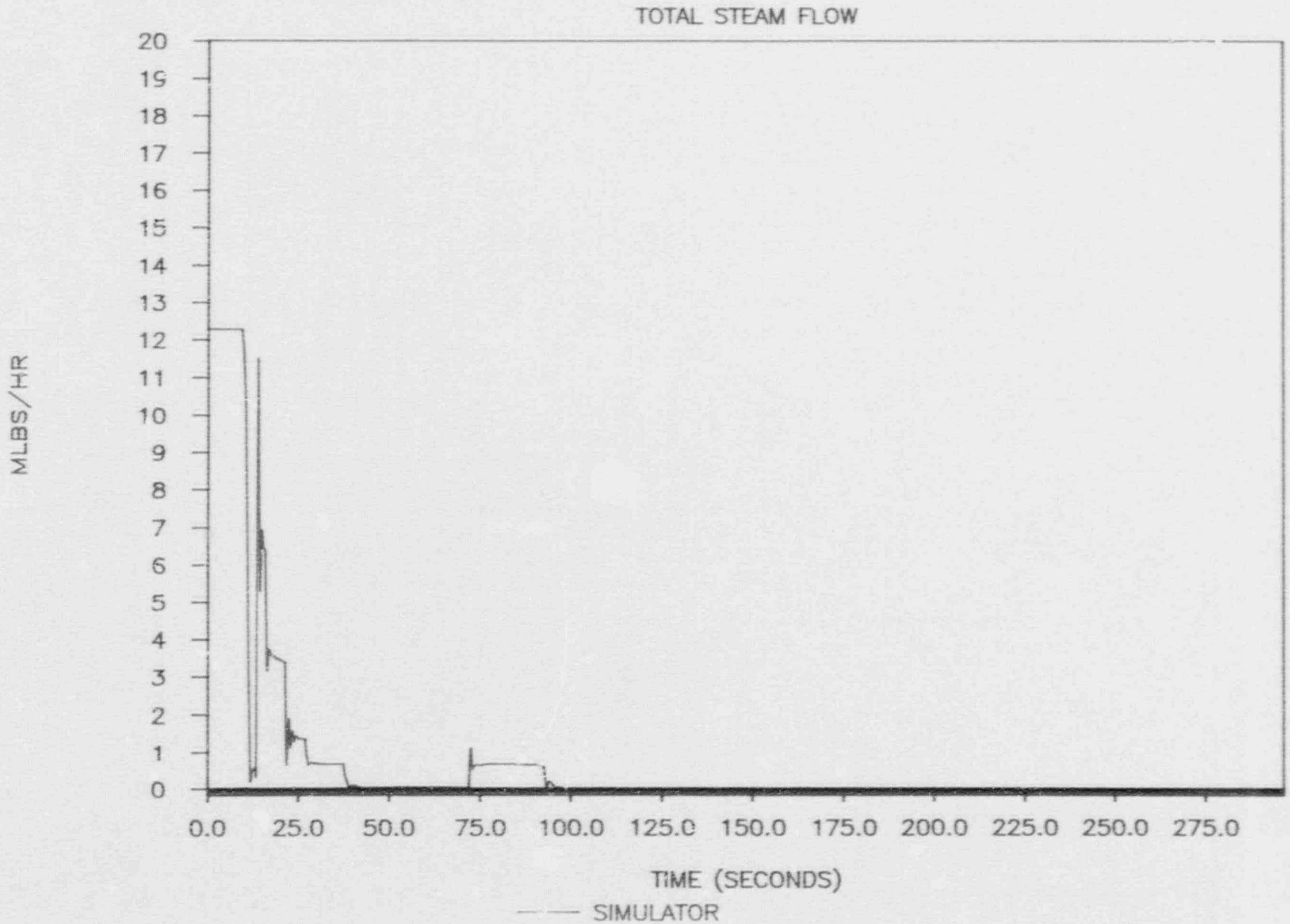
None

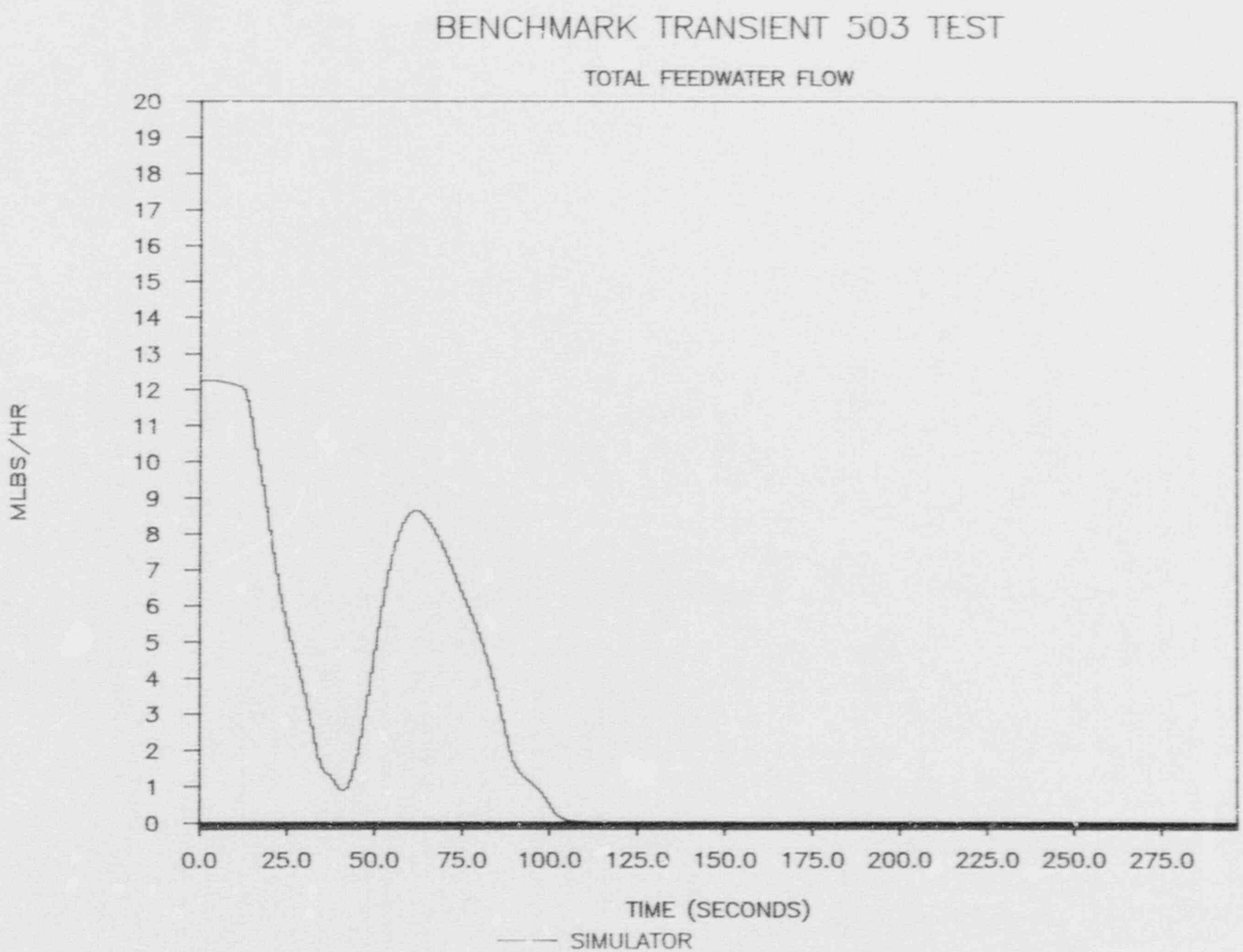
Exceptions Taken/Justification:

None


BENCHMARK TRANSIENT 503 TEST
REACTOR POWER (%)
POWER (%)
100
90
80
70
60
50
40
30
20
10
0
0.0
.0
50.0
75.0
100.0
125.0
150.0
175.0
200.0
225.0
250.0
275.0
TIME (SECONDS)
SIMULATOR

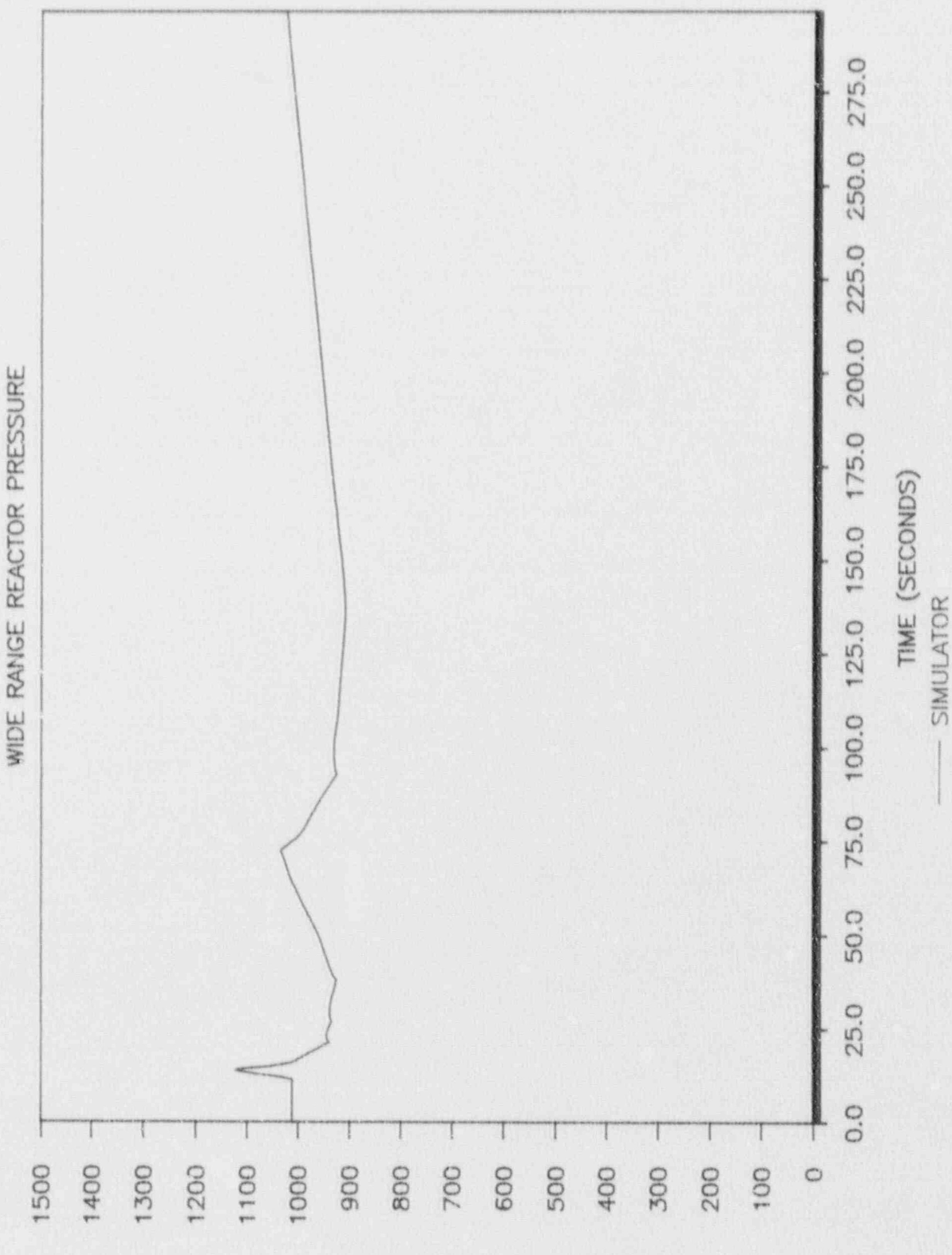
BENCHMARK TRANSIENT 503 TEST



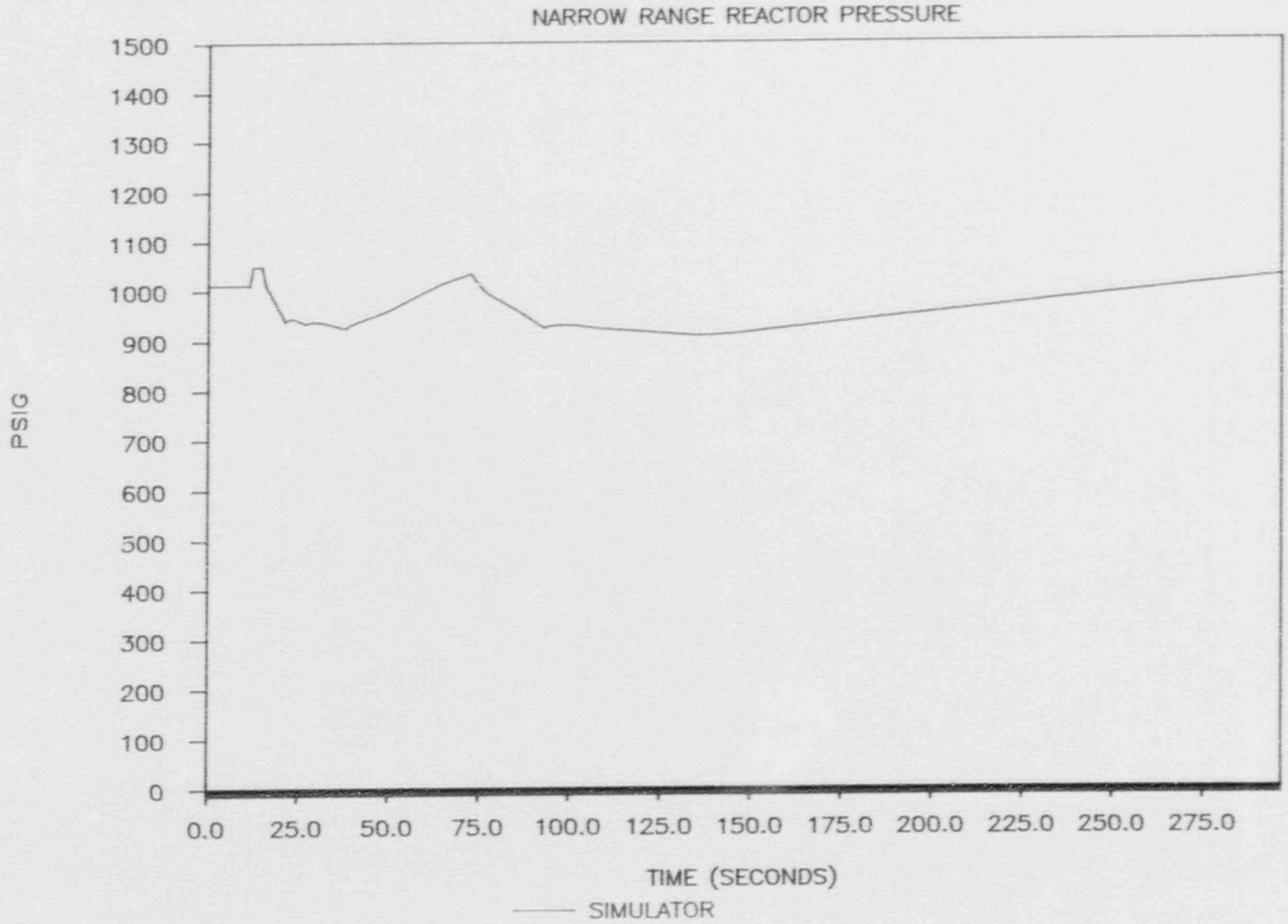

BENCHMARK TRANSIENT 503 TEST
TOTAL FEEDWATER FLOW
MLBS/HR
20
19
18
17
16
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
0.0
25.0
50.0
75.0
100.0
125.0
150.0
175.0
200.0
225.0
250.0
275.0
TIME (SECONDS)
SIMULATOR

BENCHMARK TRANSIENT 503 TEST

WIDE RANGE REACTOR PRESSURE

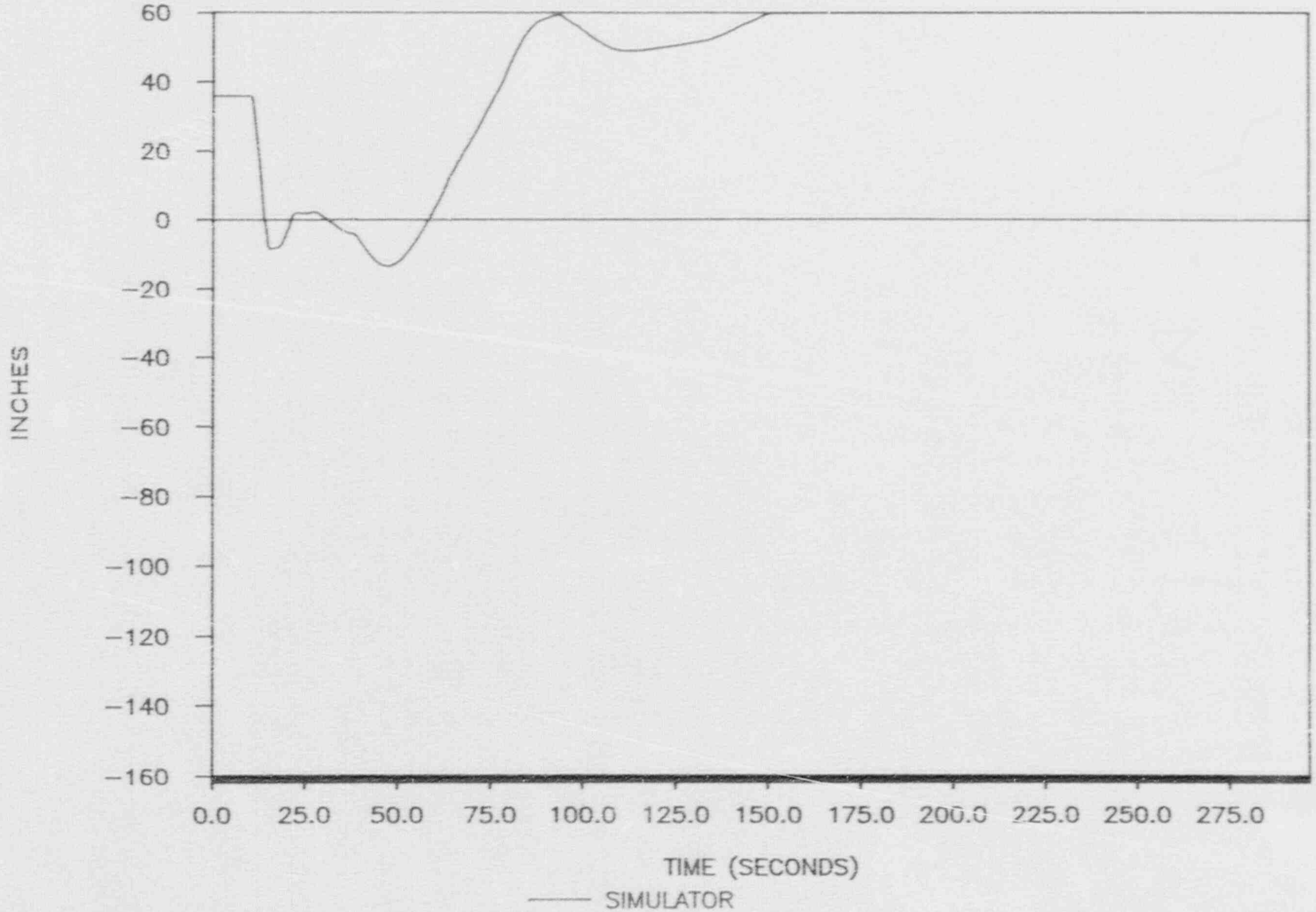


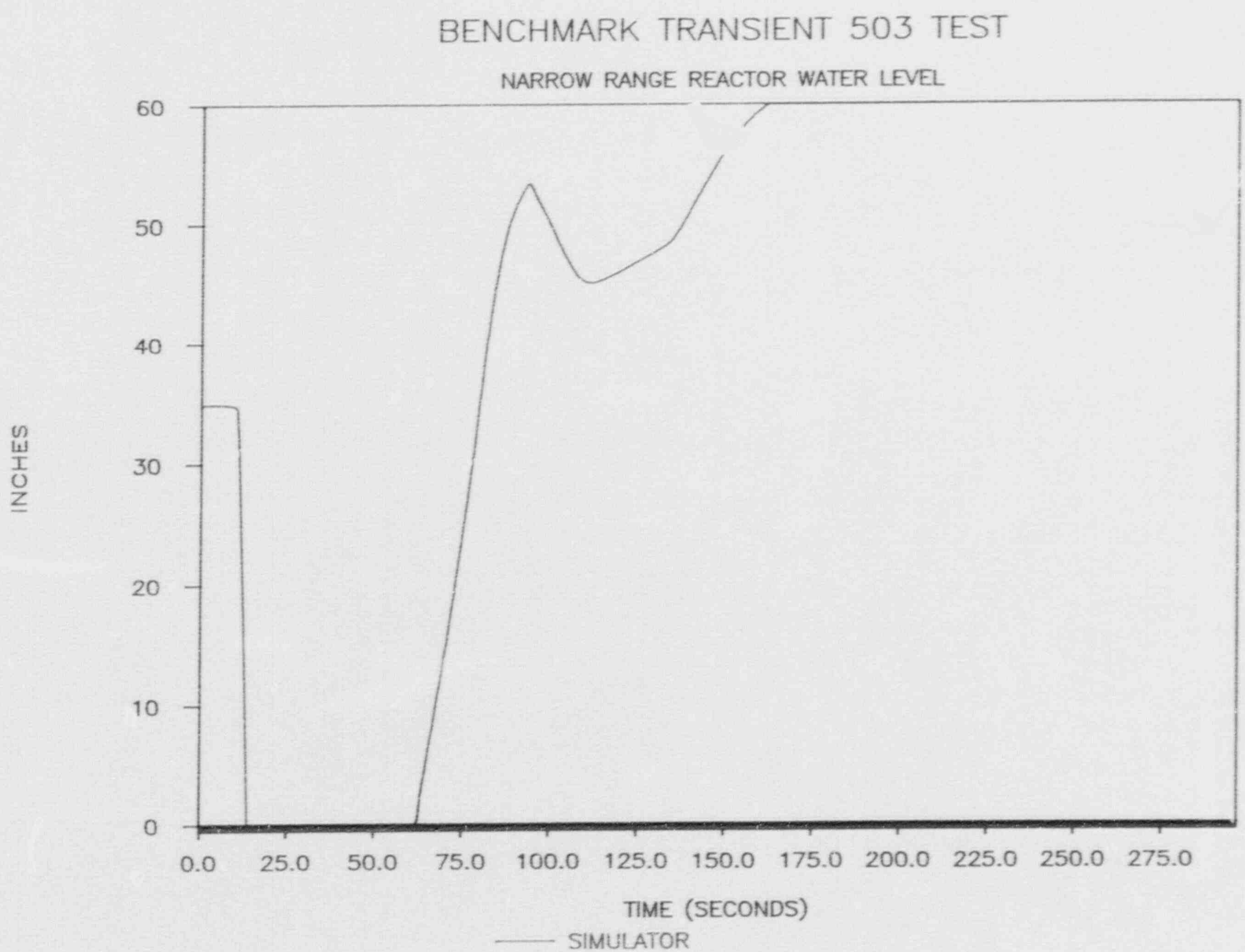
BENCHMARK TRANSIENT 503 TEST



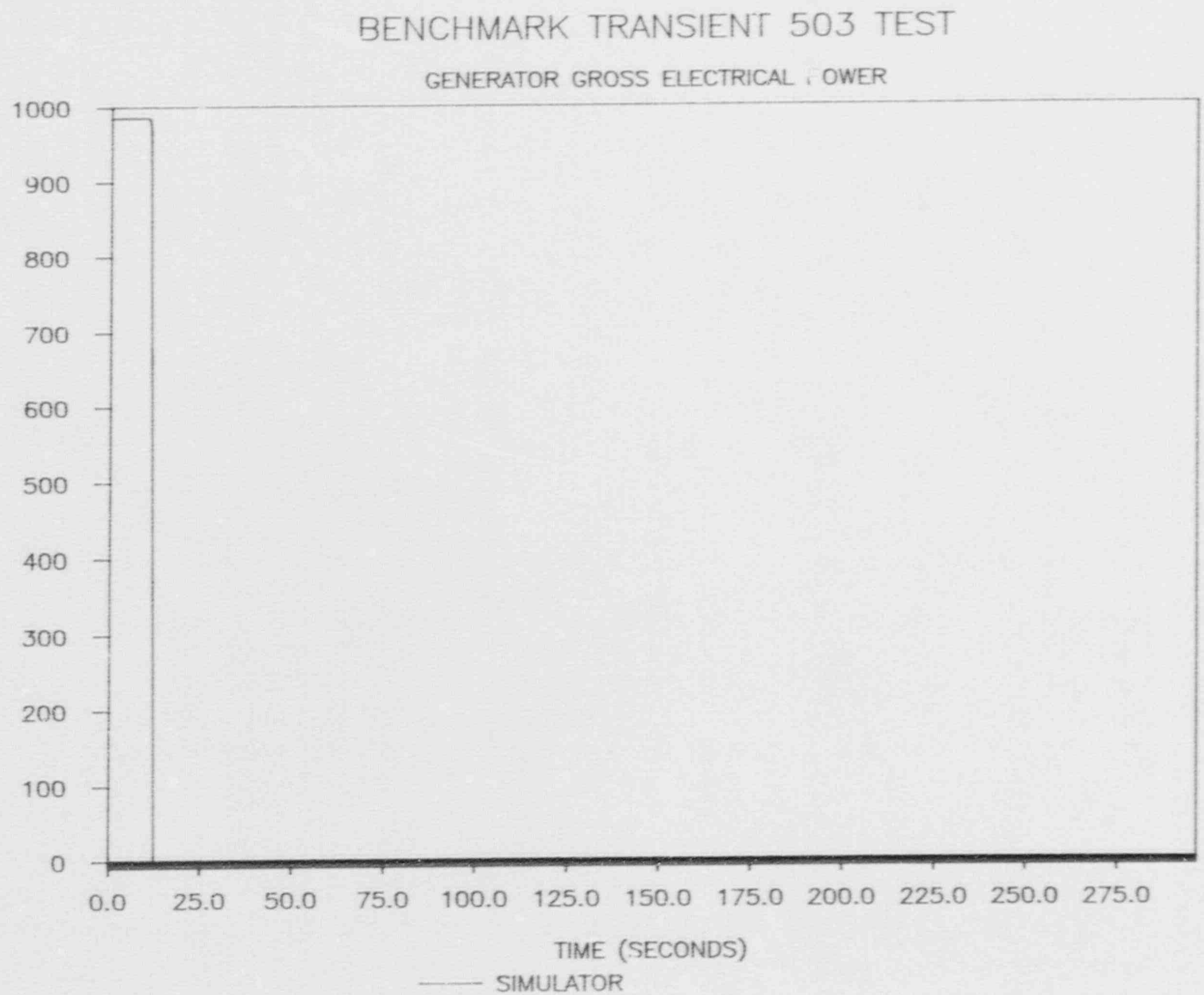
BENCHMARK TRANSIENT 503 TEST

WIDE RANGE REACTOR WATER LEVEL

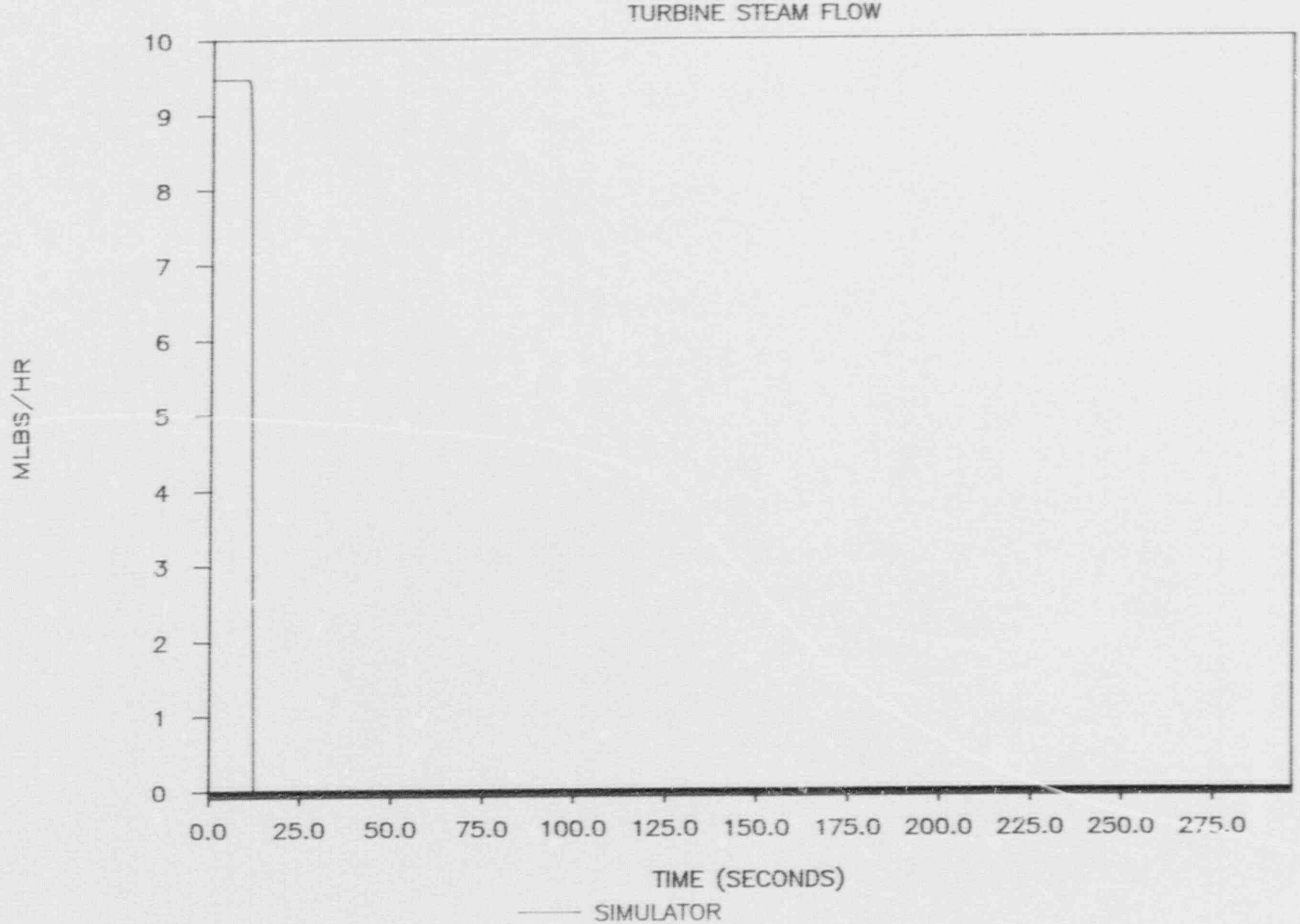


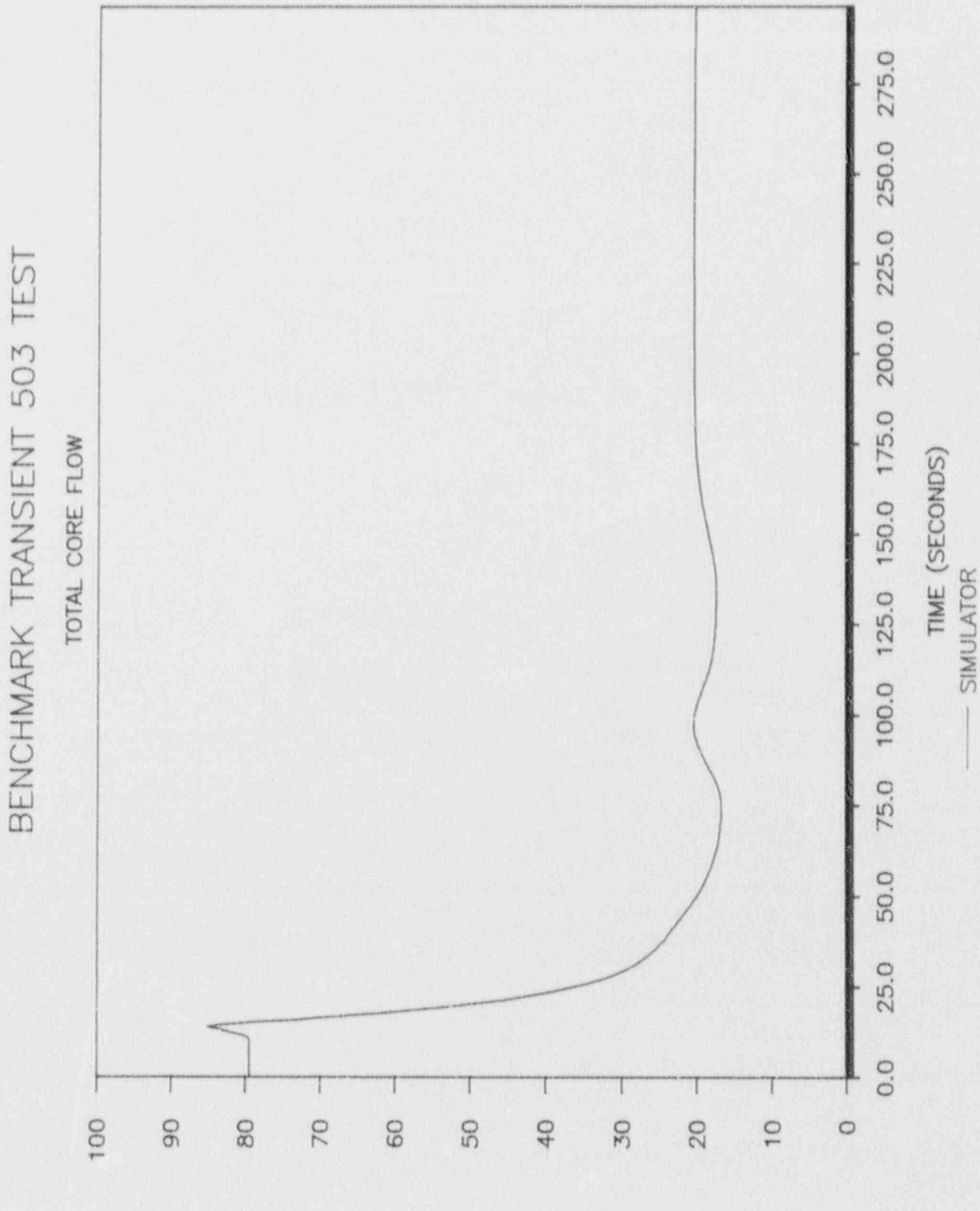


BENCHMARK TRANSIENT 503 TEST
NARROW RANGE REACTOR WATER LEVEL
INCHES
60
50
40
30
20
10
0
0.0
25.0
50.0
75.0
100.0
125.0
150.0
175.0
200.0
225.0
250.0
275.0
TIME (SECONDS)
SIMULATOR


BENCHMARK TRANSIENT 503 TEST
GENERATOR GROSS ELECTRICAL POWER
MW
1000
900
800
700
600
500
400
300
200
100
0
0.0
25.0
50.0
75.0
100.0
125.0
150.0
175.0
200.0
225.0
250.0
275.0
TIME (SECONDS)
SIMULATOR

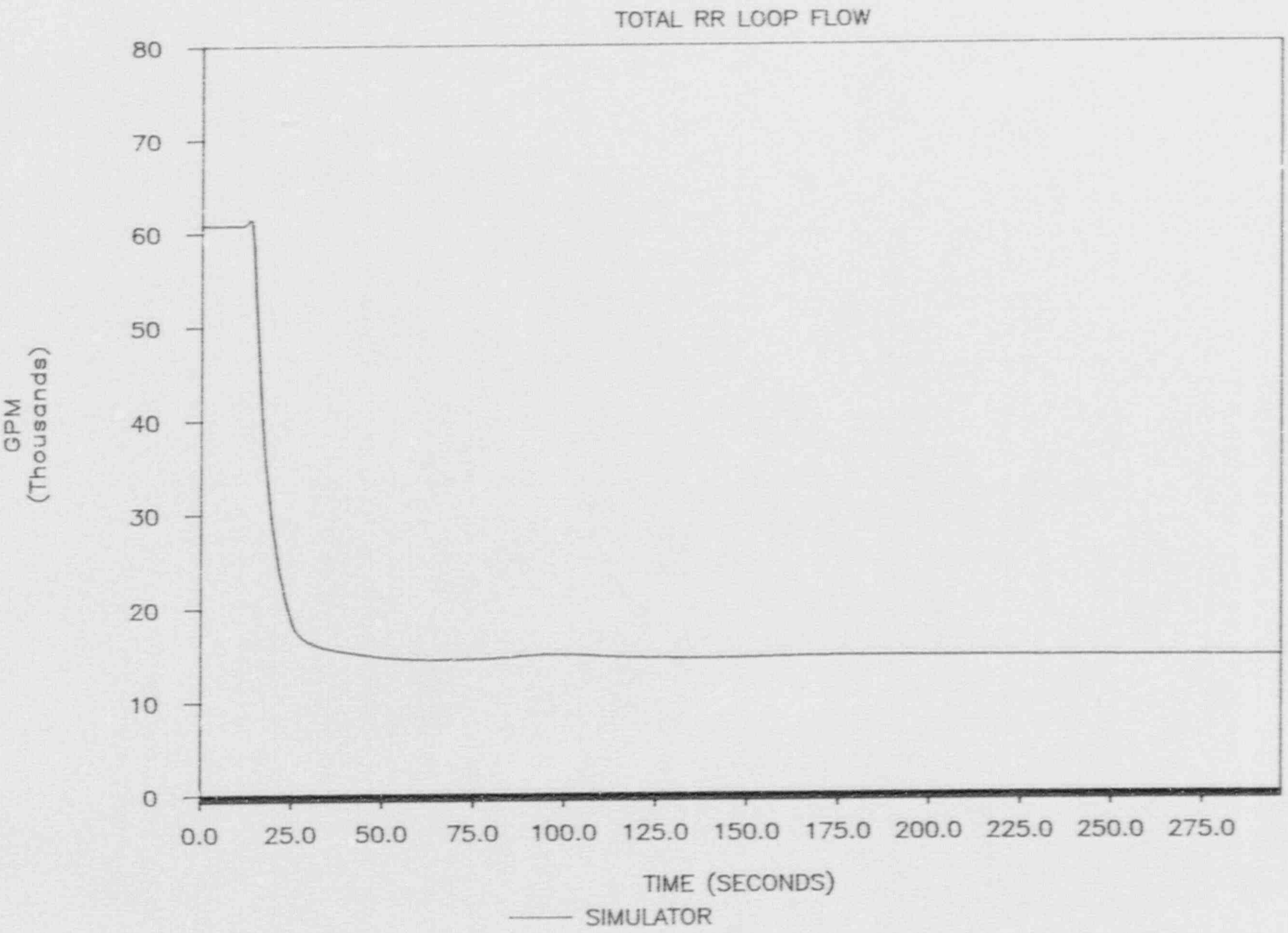
BENCHMARK TRANSIENT 503 TEST



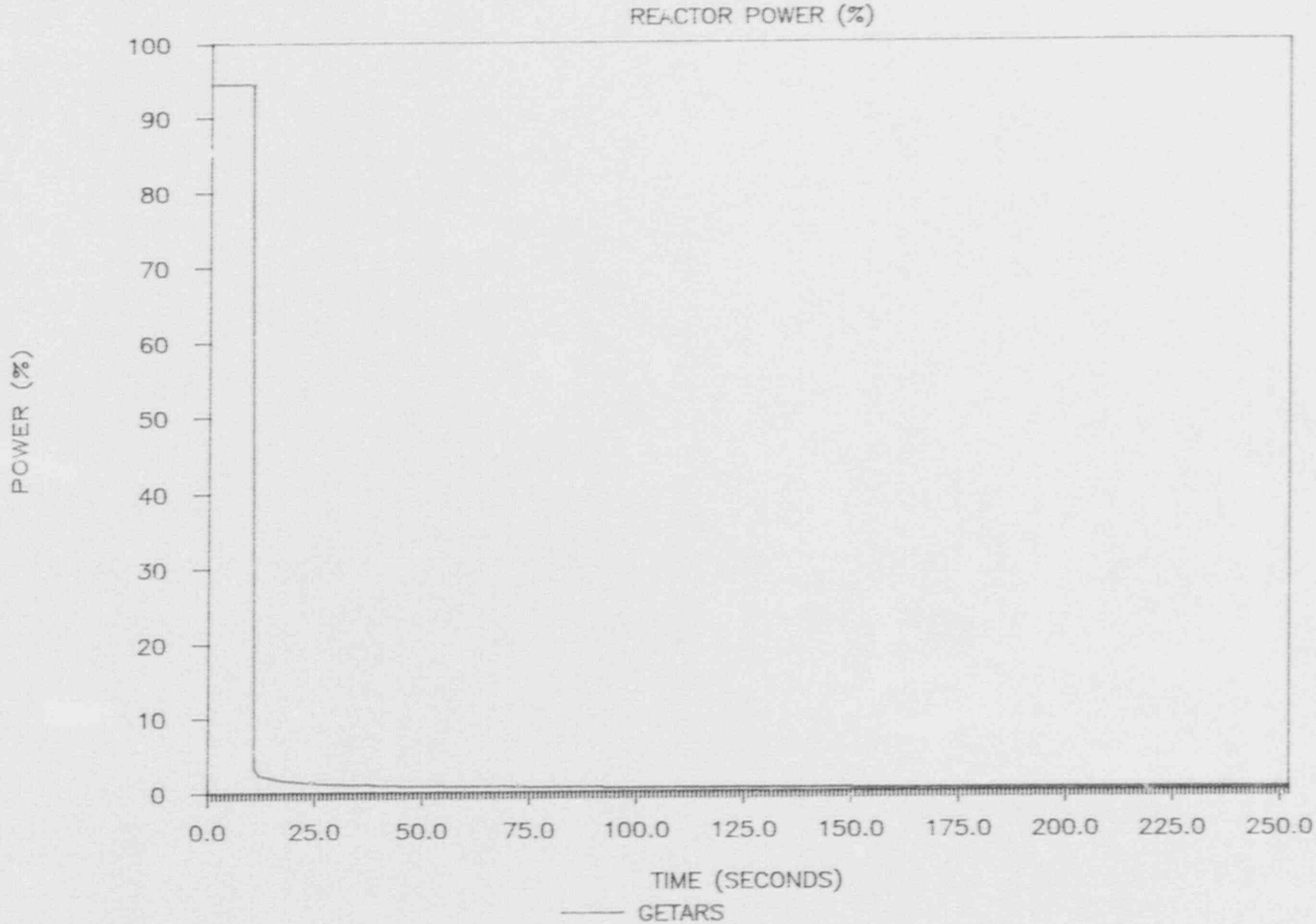


BENCHMARK TRANSIENT 503 TEST
TOTAL CORE FLOW
MLBS/HR
100
90
80
70
60
50
40
30
20
10
0
0.0
25.0
50.0
75.0
100.0
125.0
150.0
175.0
200.0
225.0
250.0
275.0
TIME (SECONDS)
SIMULATOR

BENCHMARK TRANSIENT 503 TEST

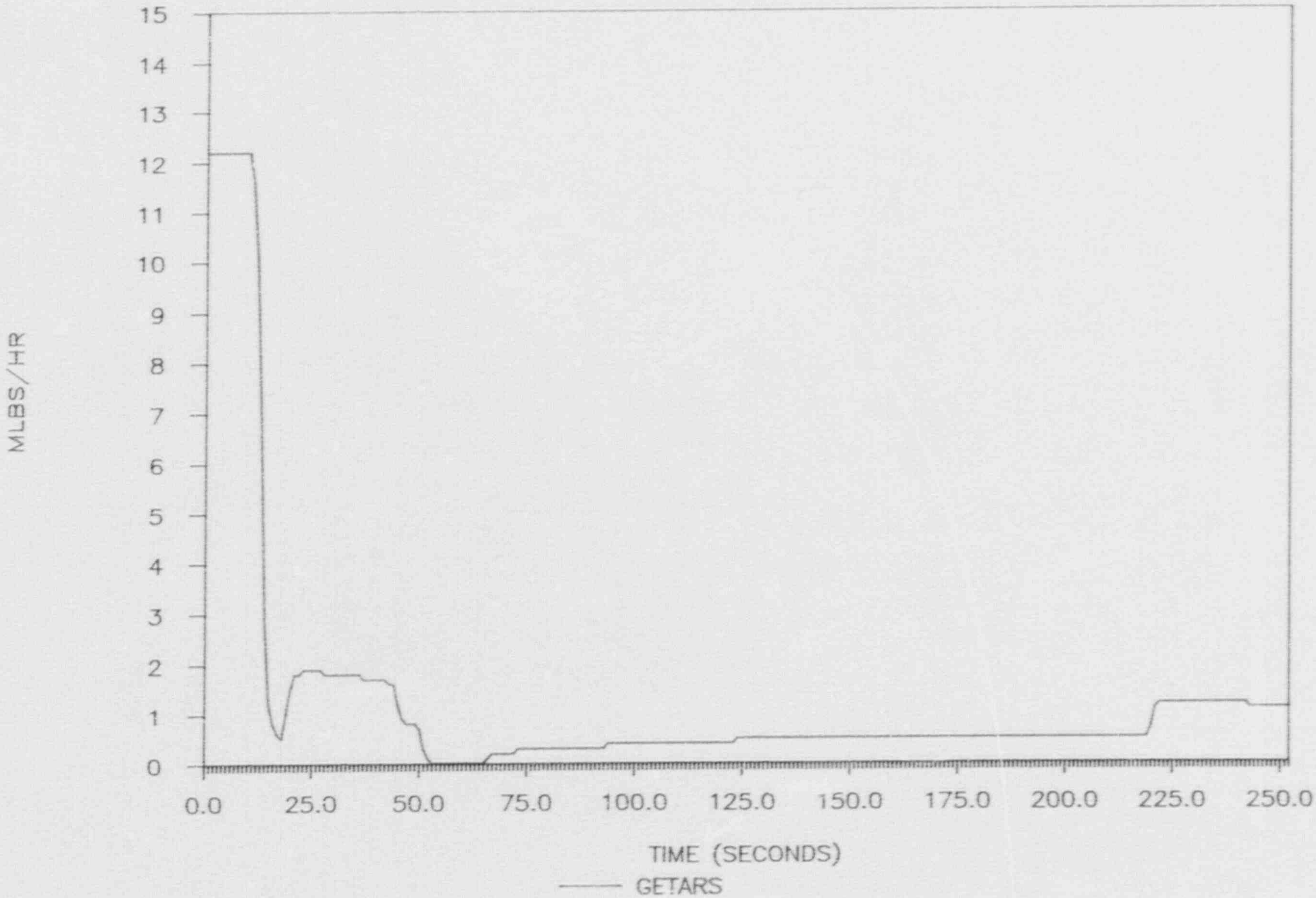


BENCHMARK TRANSIENT 503 TEST



BENCHMARK TRANSIENT 503 TEST

TOTAL STEAM FLOW



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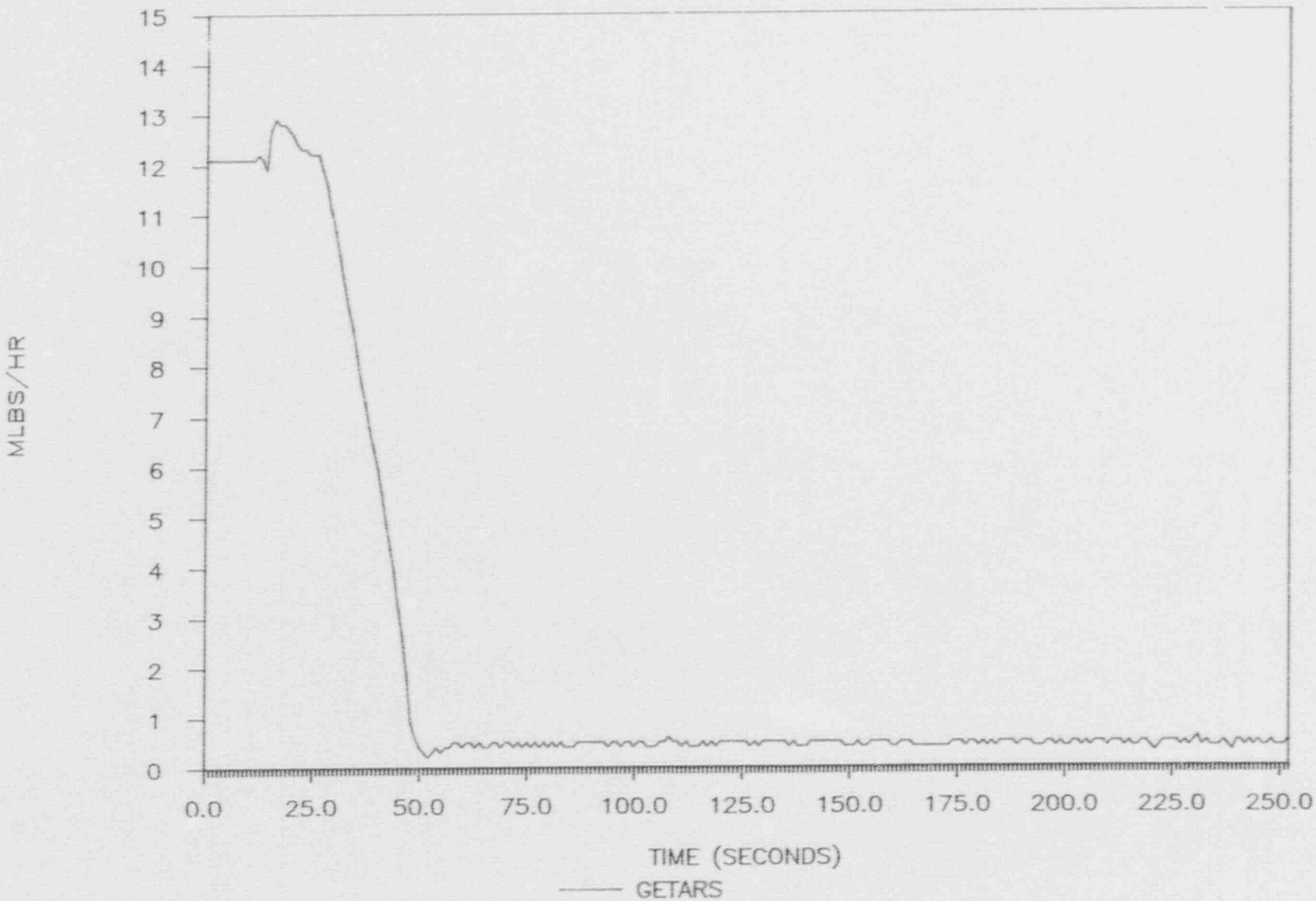
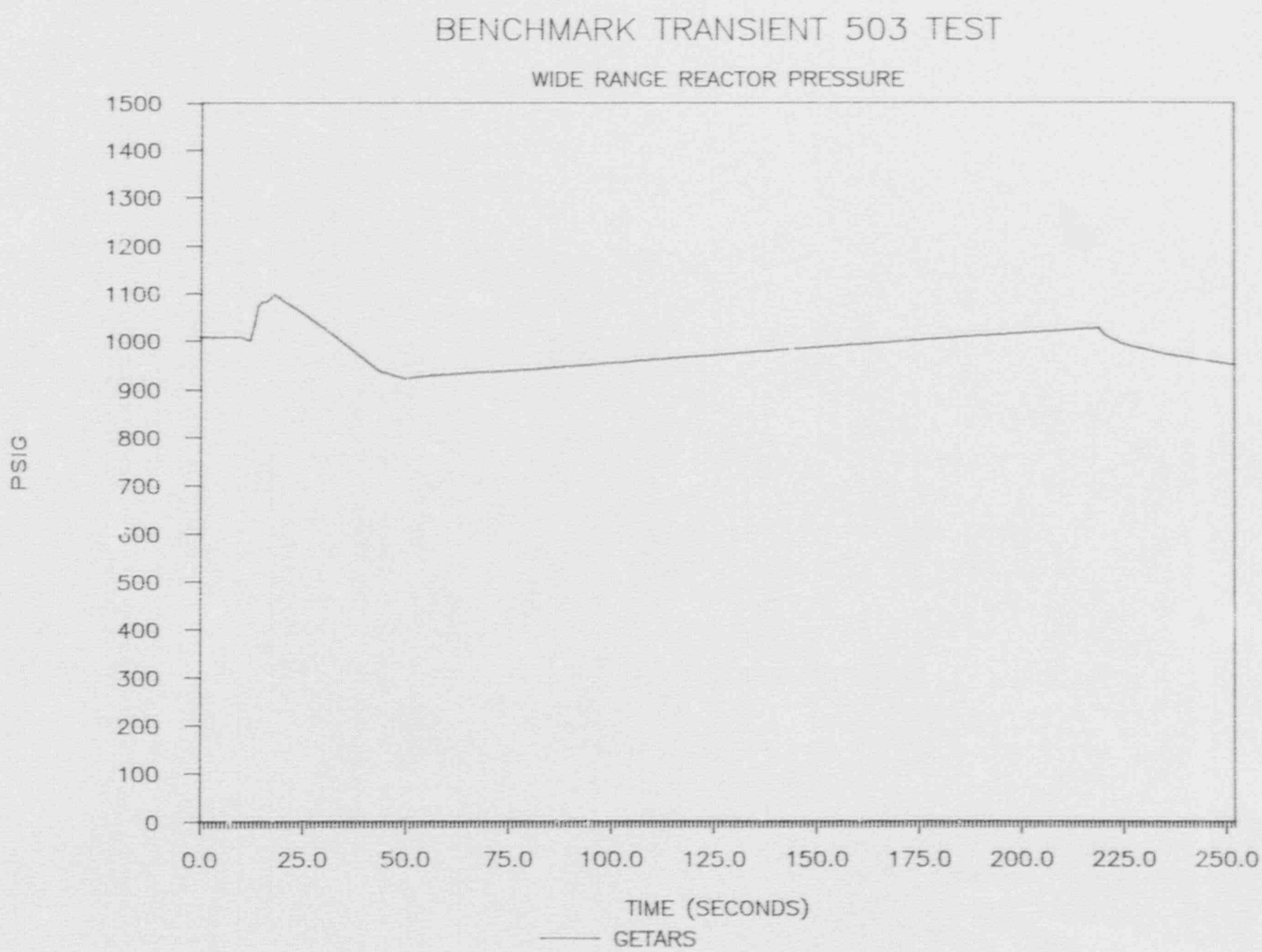
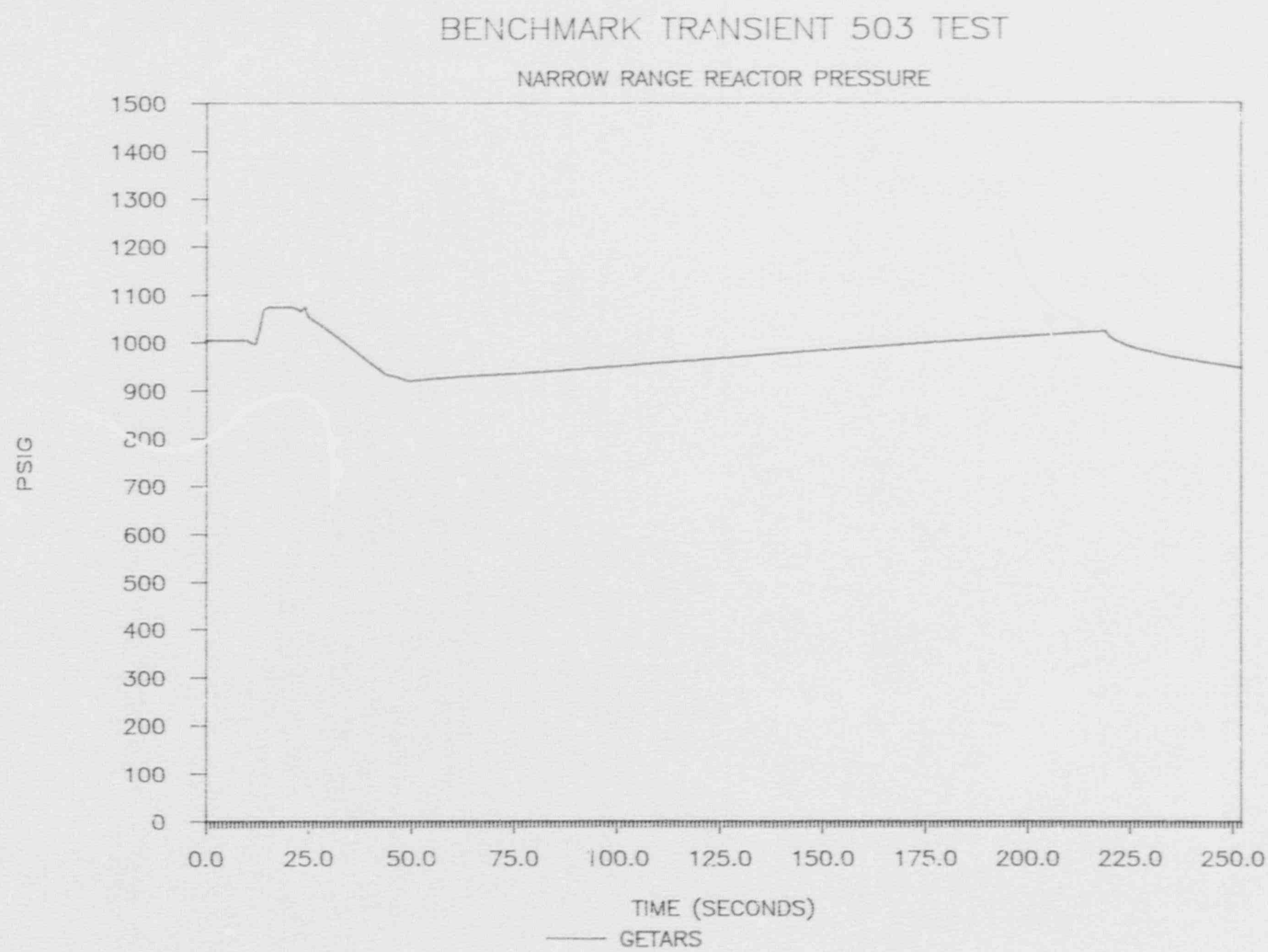
BENCHMARK TRANSIENT 503 TEST

TOTAL FEEDWATER FLOW

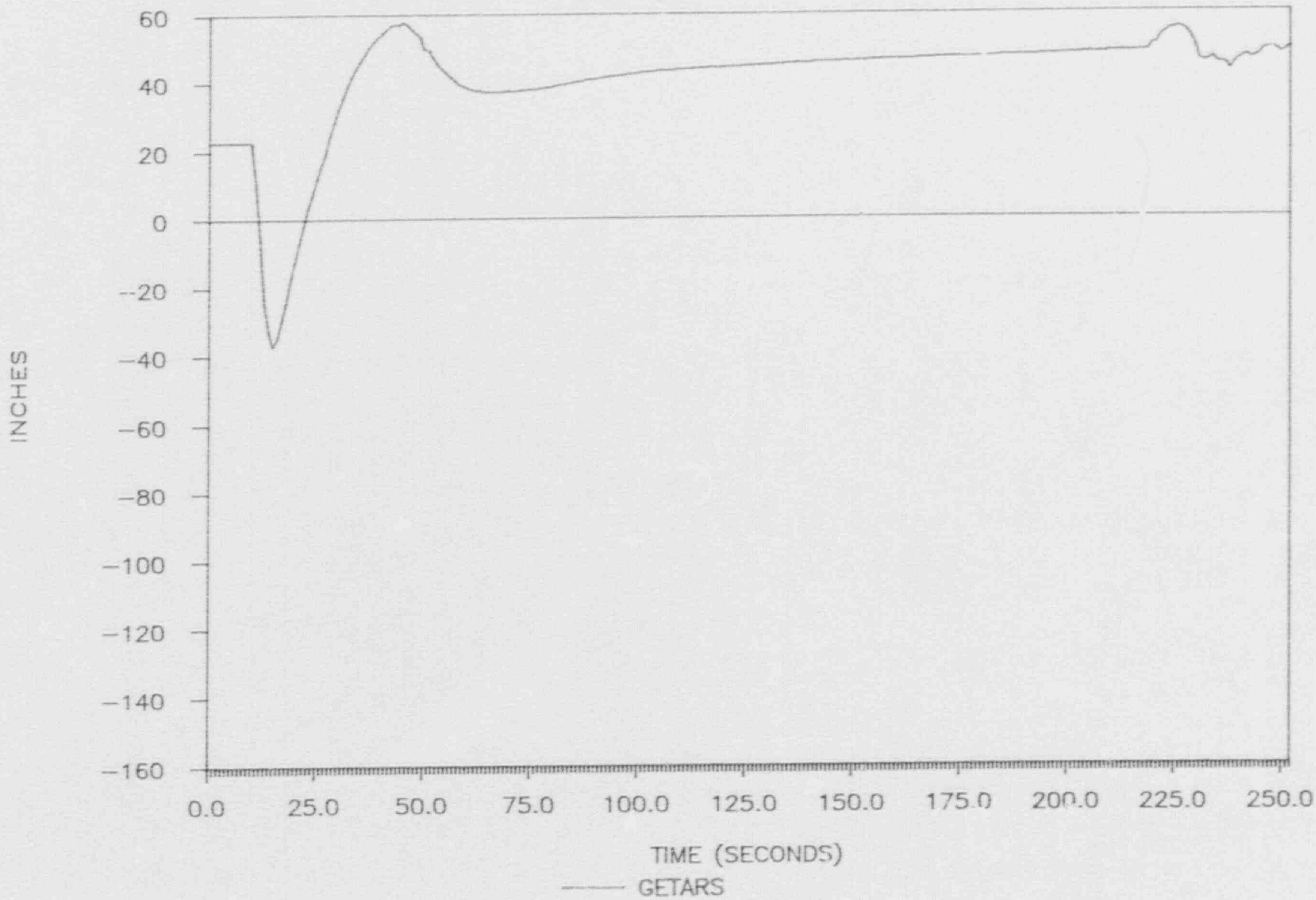



BENCHMARK TRANSIENT 503 TEST
WIDE RANGE REACTOR PRESSURE
PSIG
1500
1400
1300
1200
1100
1000
900
800
700
600
500
400
300
200
100
0
0.0
25.0
50.0
75.0
100.0
125.0
150.0
175.0
200.0
225.0
250.0
TIME (SECONDS)
GETARS


BENCHMARK TRANSIENT 503 TEST
NARROW RANGE REACTOR PRESSURE
PSIG
1500
1400
1300
1200
1100
1000
900
800
700
600
500
400
300
200
100
0
0.0
25.0
50.0
75.0
100.0
125.0
150.0
175.0
200.0
225.0
250.0
TIME (SECONDS)
GETARS

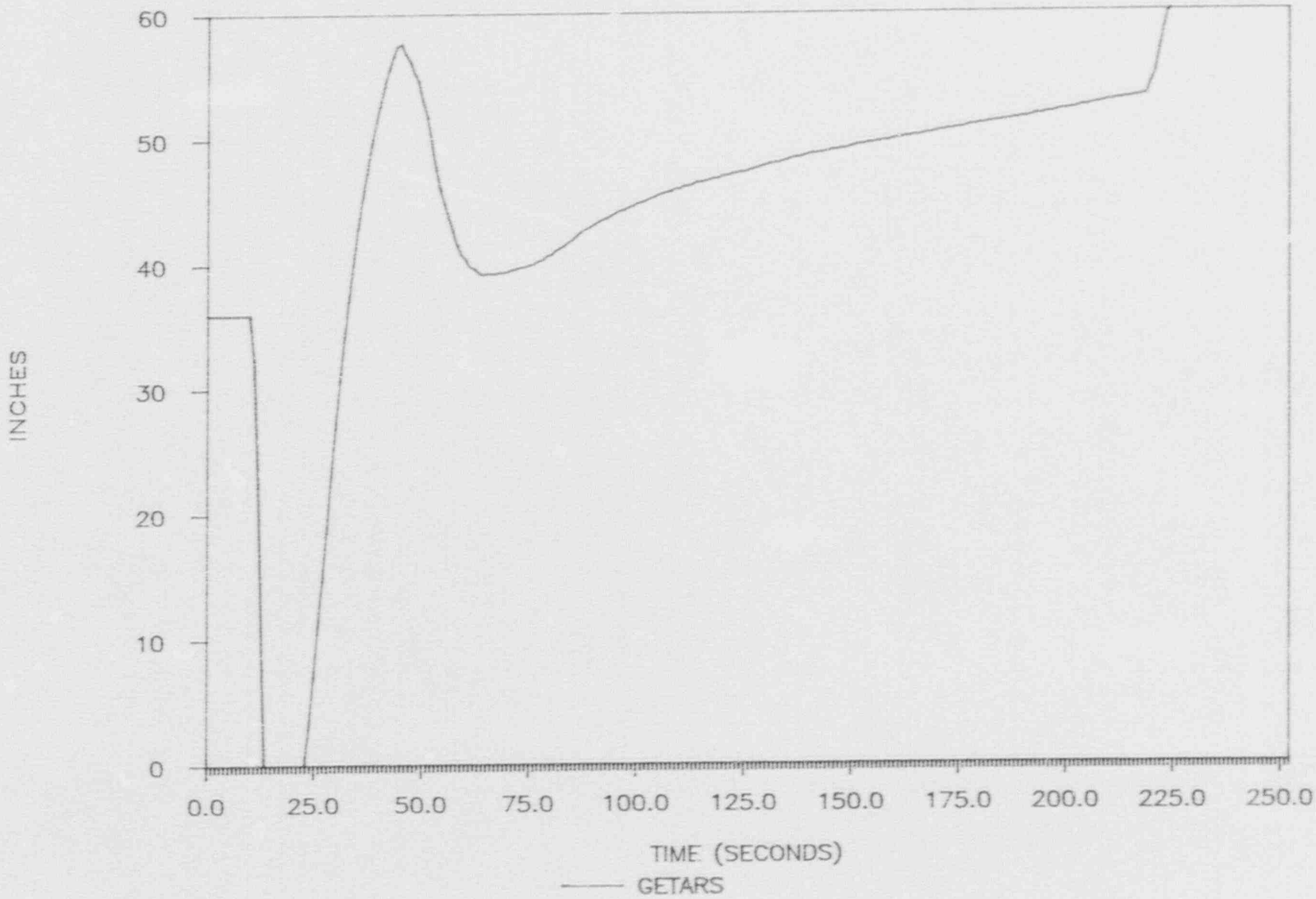
BENCHMARK TRANSIENT 503 TEST

WIDE RANGE REACTOR WATER LEVEL



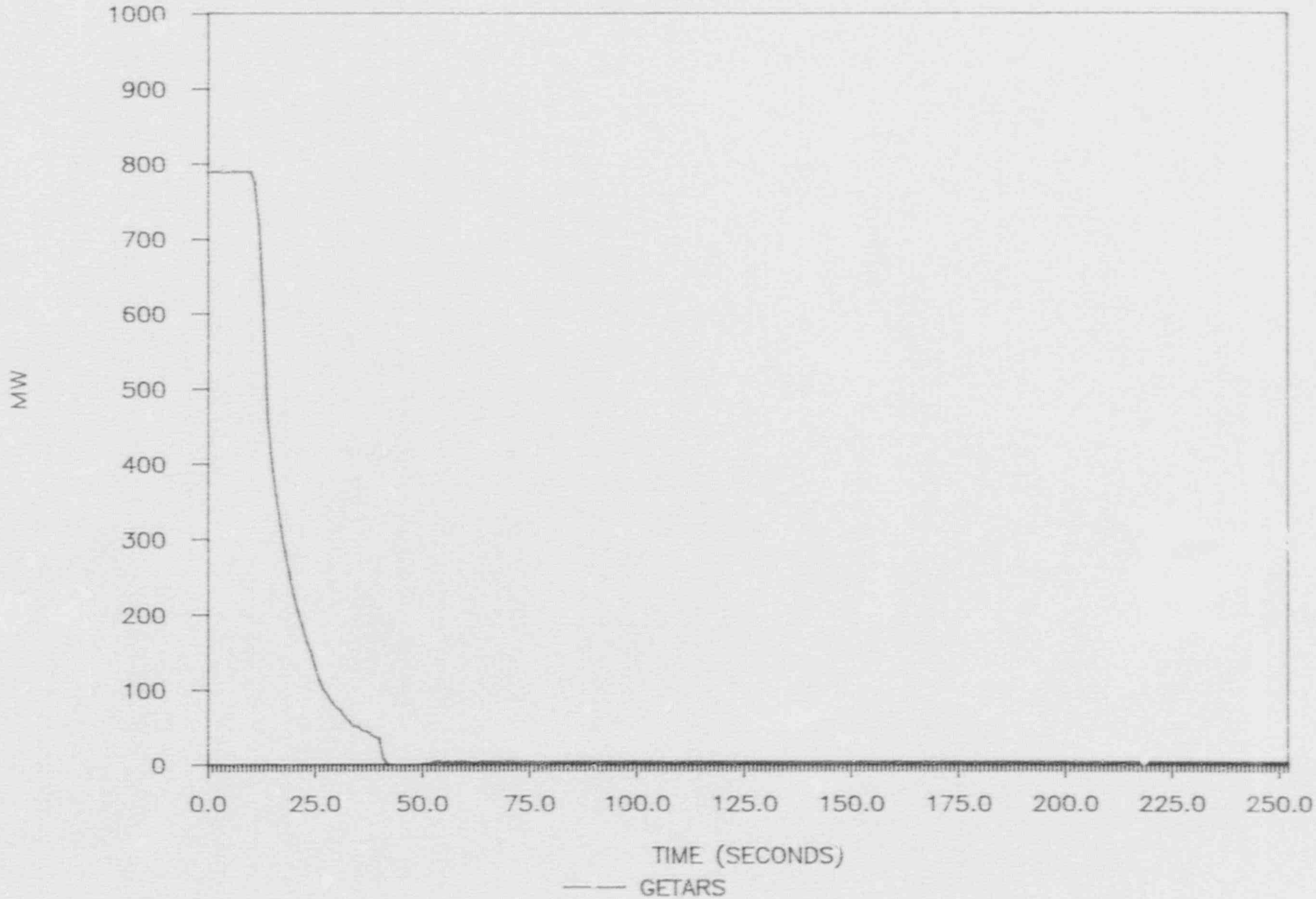
BENCHMARK TRANSIENT 503 TEST

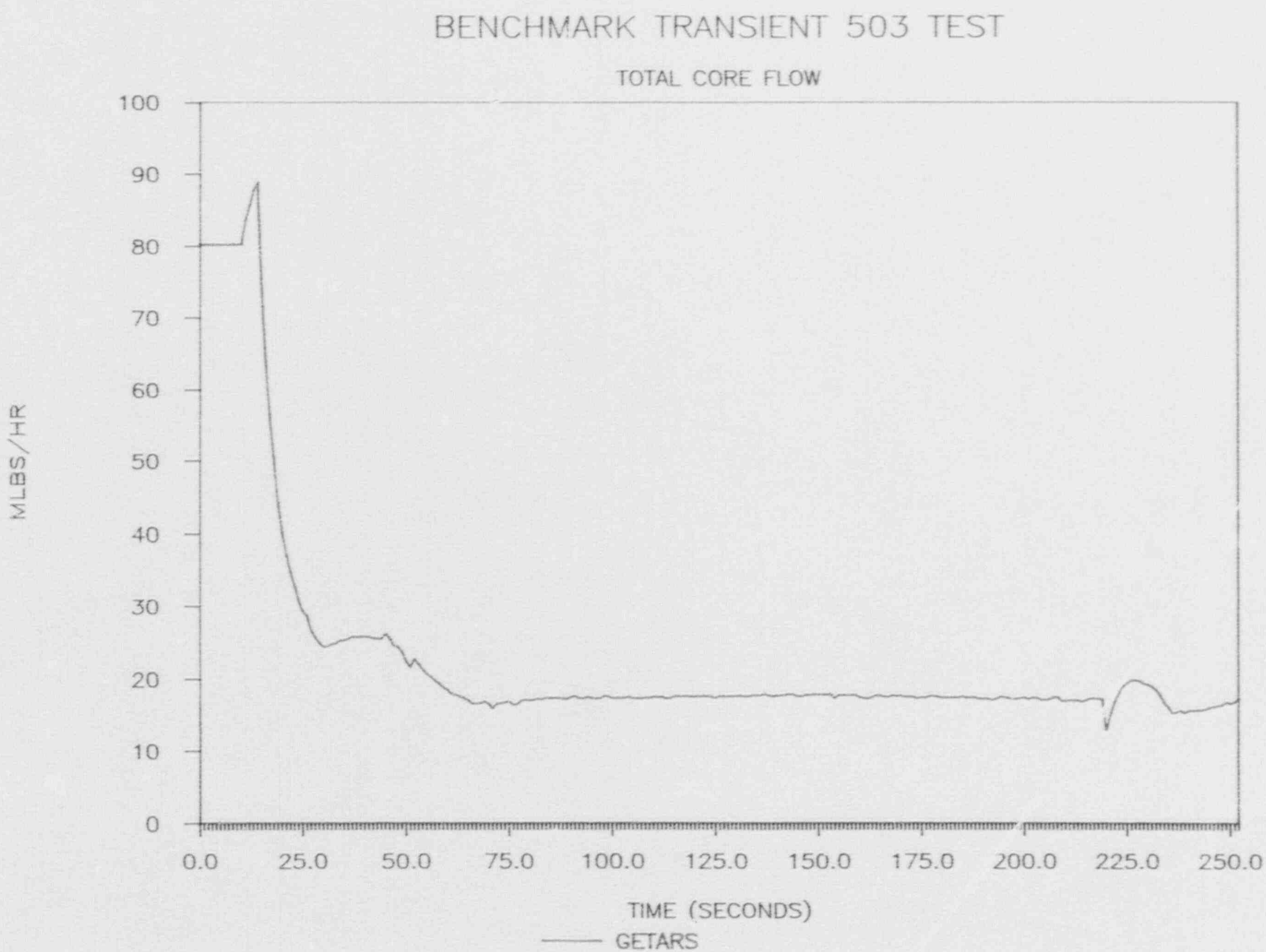
NARROW RANGE REACTOR WATER LEVEL

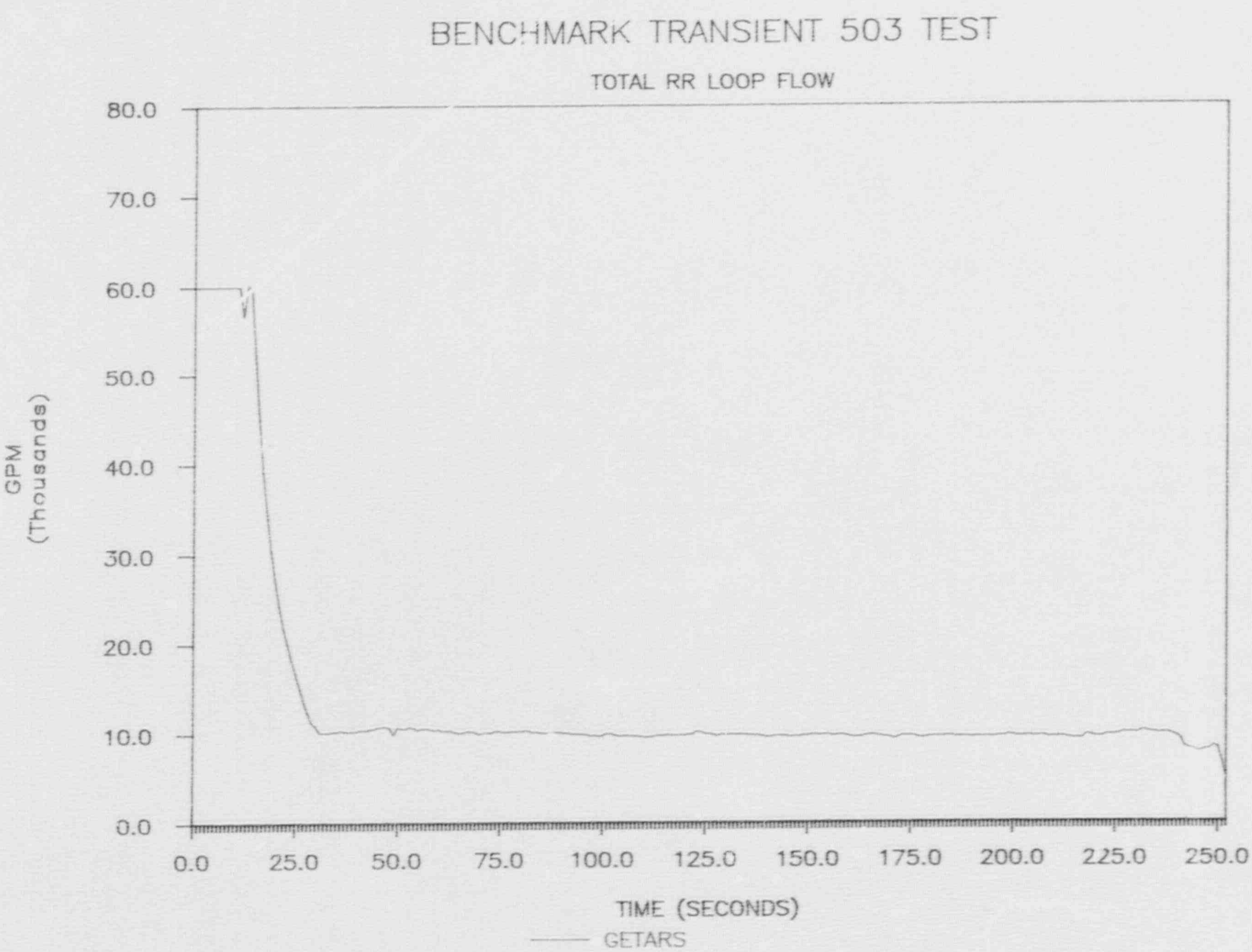


BENCHMARK TRANSIENT 5C3 TEST

GENERATOR GROSS ELECTRICAL POWER




BENCHMARK TRANSIENT 503 TEST
TOTAL CORE FLOW
MLBS/HR
100
90
80
70
60
50
40
30
20
10
0
0.0
25.0
50.0
75.0
100.0
125.0
150.0
175.0
200.0
225.0
250.0
TIME (SECONDS)
GETARS



BENCHMARK TRANSIENT 503 TEST
TOTAL RR LOOP FLOW
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
GPM
(Thousands)
0.0
25.0
50.0
75.0
100.0
125.0
150.0
175.0
200.0
225.0
250.0
TIME (SECONDS)
GETARS

SIMULATOR CERTIFICATION TEST SUMMARY

Test Name: STP 5.04, Simultaneous Trip of all Recirculation Pumps

Description: This test provides a benchmark comparison between the simulator and plant for a simultaneous trip of all reactor recirculation pumps.

Since this test closely resembled plant Licensee Event Report 90-012, for which plant data was available, the simulator was initialized and the test was conducted in a manner corresponding to plant conditions at the time LER 90-012 occurred.

The simulator was initialized at approximately 43.3% power, on the 75% flow control line, with both reactor recirculation pumps in fast speed. Data recording began. Approximately 10 seconds later, a malfunction was activated which tripped the B reactor recirculation pump to off. Coincident with the trip, the A reactor recirculation pump was manually placed in slow speed. Approximately 3 minutes following the pump trip, a manual scram was inserted. The simulator was then allowed to stabilize. After 5 minutes the simulator was placed in freeze and data recording was terminated.

Simulator performance was observed during the transient to ensure that alarms, automatic actions, and indications were appropriate for the transient. No violations of the physical laws of nature were observed.

This test was intended to meet the objectives of ANSI/ANS-3.5-1985, Appendix B, and footnote 3 of the standard.

Simulator Features Tested:

Simulator data recording capability at a resolution of 0.5 seconds.

Initial Conditions:

The simulator was operating at approximately 43.3% power.

SIMULATOR CERTIFICATION TEST SUMMARY

Test Name: STP 5.04, Simultaneous Trip of all Recirculation Pumps (Cont'd)

Final Conditions:

The simulator was stable following a recirculation pump trip, a recirculation pump shift to slow speed, and a manual reactor scram.

Baseline Data Source:

Plant Data-GE Transient Recording System (GETARS)

Comparison:

The following simulator parameters were compared to the available baseline data. The magnitude and direction of change of all parameters were evaluated as acceptable.

Parameter	Evaluation
Reactor Power	Satisfactory
Total Steam Flow	Satisfactory
Total Feedwater Flow	Satisfactory
Reactor Pressure (NR)	Satisfactory
Reactor Level (NR)	Satisfactory
Total Core Flow	Satisfactory
Individual RR Loop Flow	Satisfactory
Calibrated Jet Pump Flow	Satisfactory

There are some differences between simulator and GETARS feedwater flow. While this has been evaluated as satisfactory, the simulator Feedwater Level Control System is being evaluated for possible future improvements.

SIMULATOR CERTIFICATION TEST SUMMARY

Test Name: STP 5.04, Simultaneous Trip of all Recirculation Pumps (Cont'd)

Comparison (cont'd):

There are differences between simulator data and GETARS data for total core flow and individual loop flow. The GETARS data points used may not be appropriate for comparison purposes for transients involving natural circulation or reverse flow conditions. Based on a review of the simulator data, the simulator performance has been judged to be acceptable, since the parameters changed in the direction expected. However, Simulator Problem Report (SPR) No. 91-044 has been written to evaluate this further.

Graphs of simulator and GETARS data follow this test summary. When all parameters are considered, the overall simulator response to this transient is satisfactory.

Deficiencies Found:

None

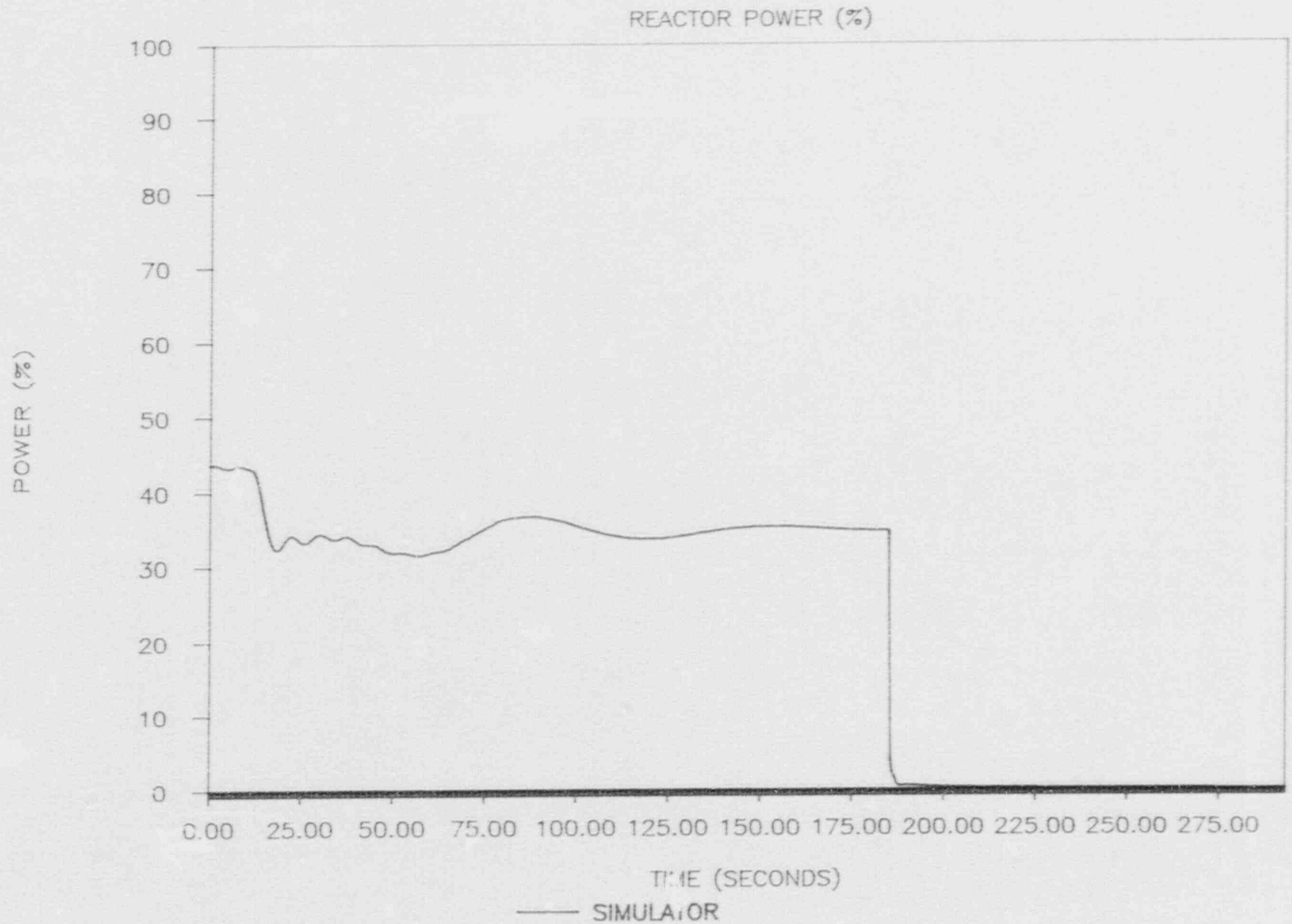
Corrective Actions Planned (and schedule):

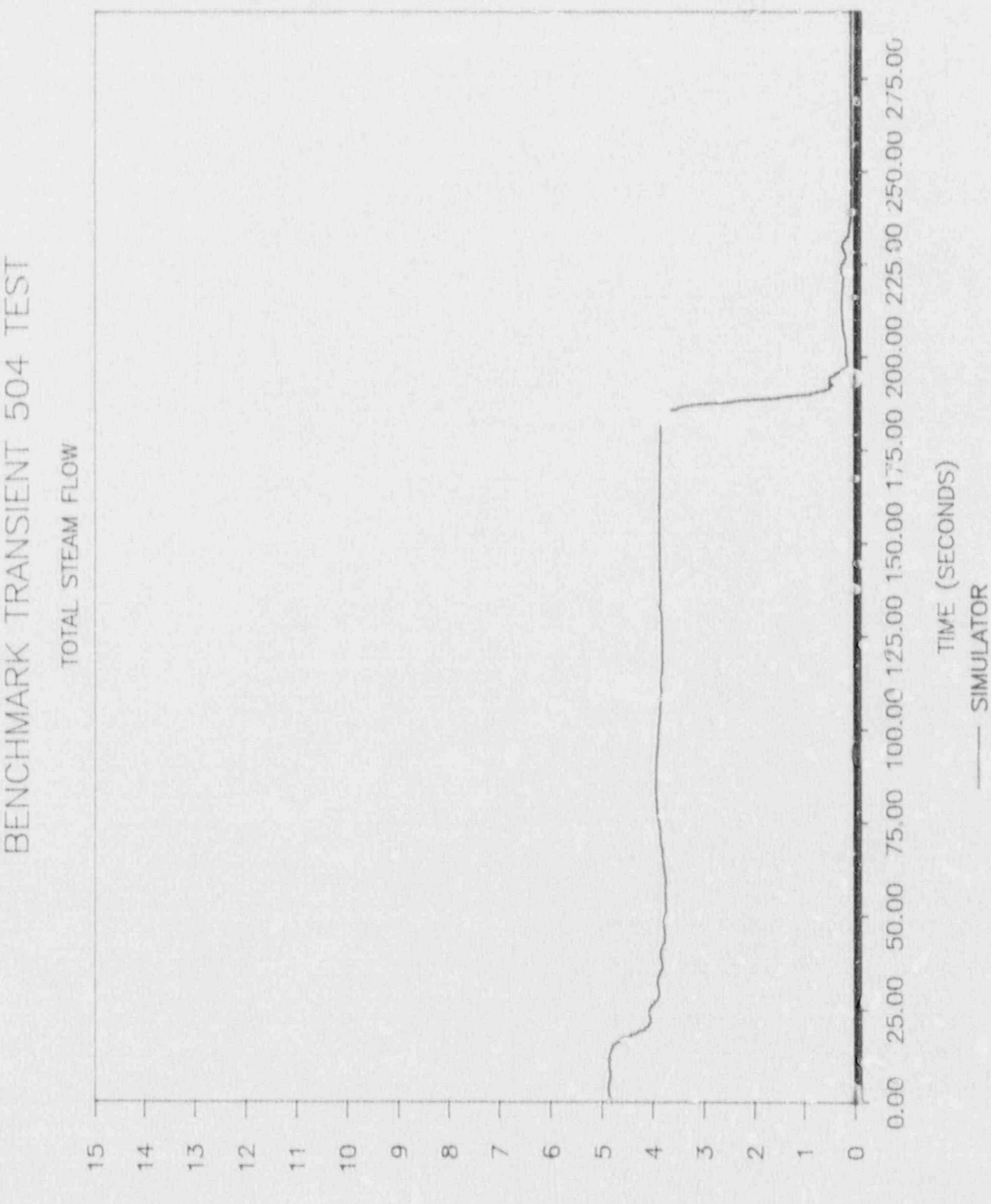
None

Exceptions Taken/Justification:

None

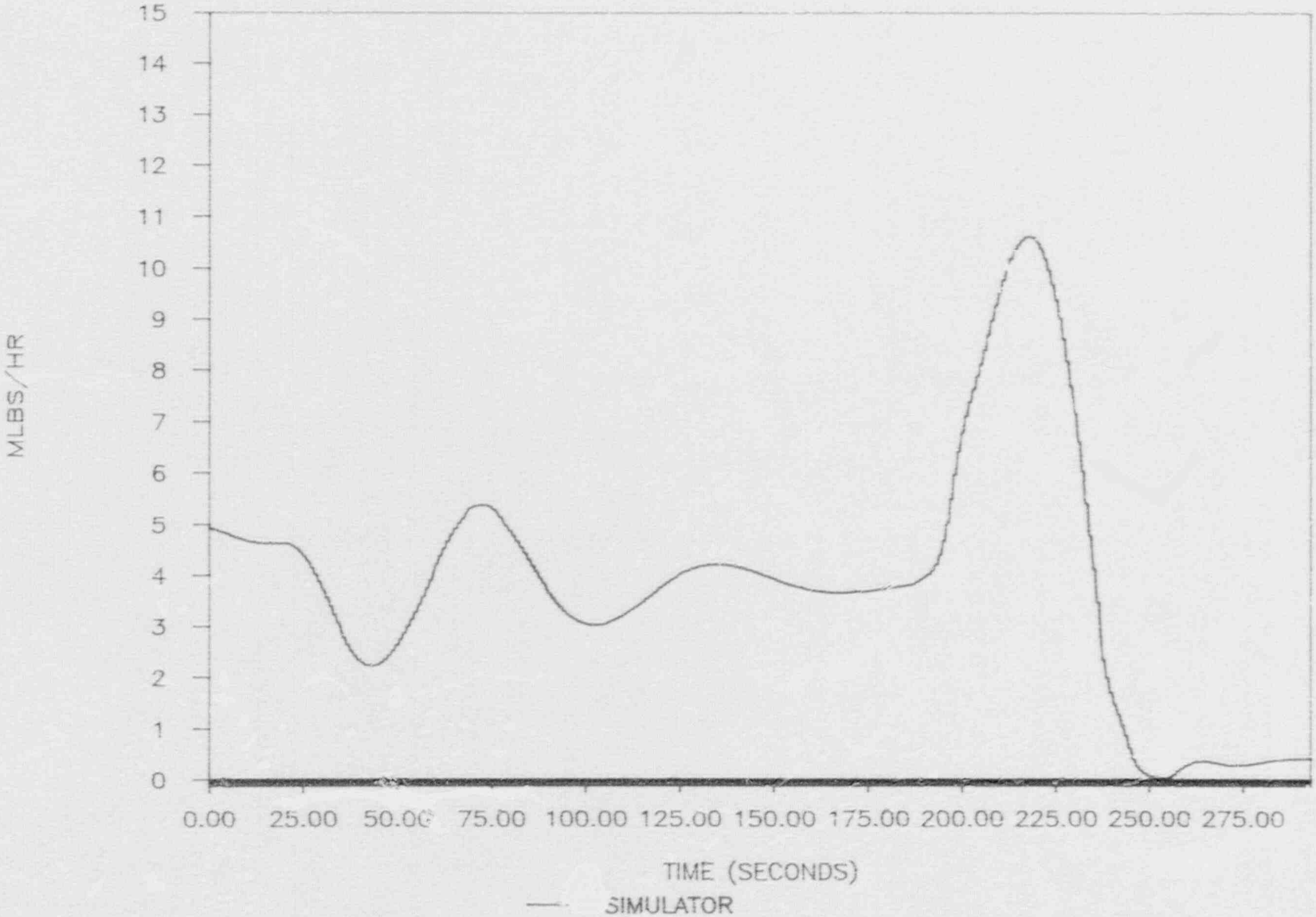
BENCHMARK TRANSIENT 504 TEST

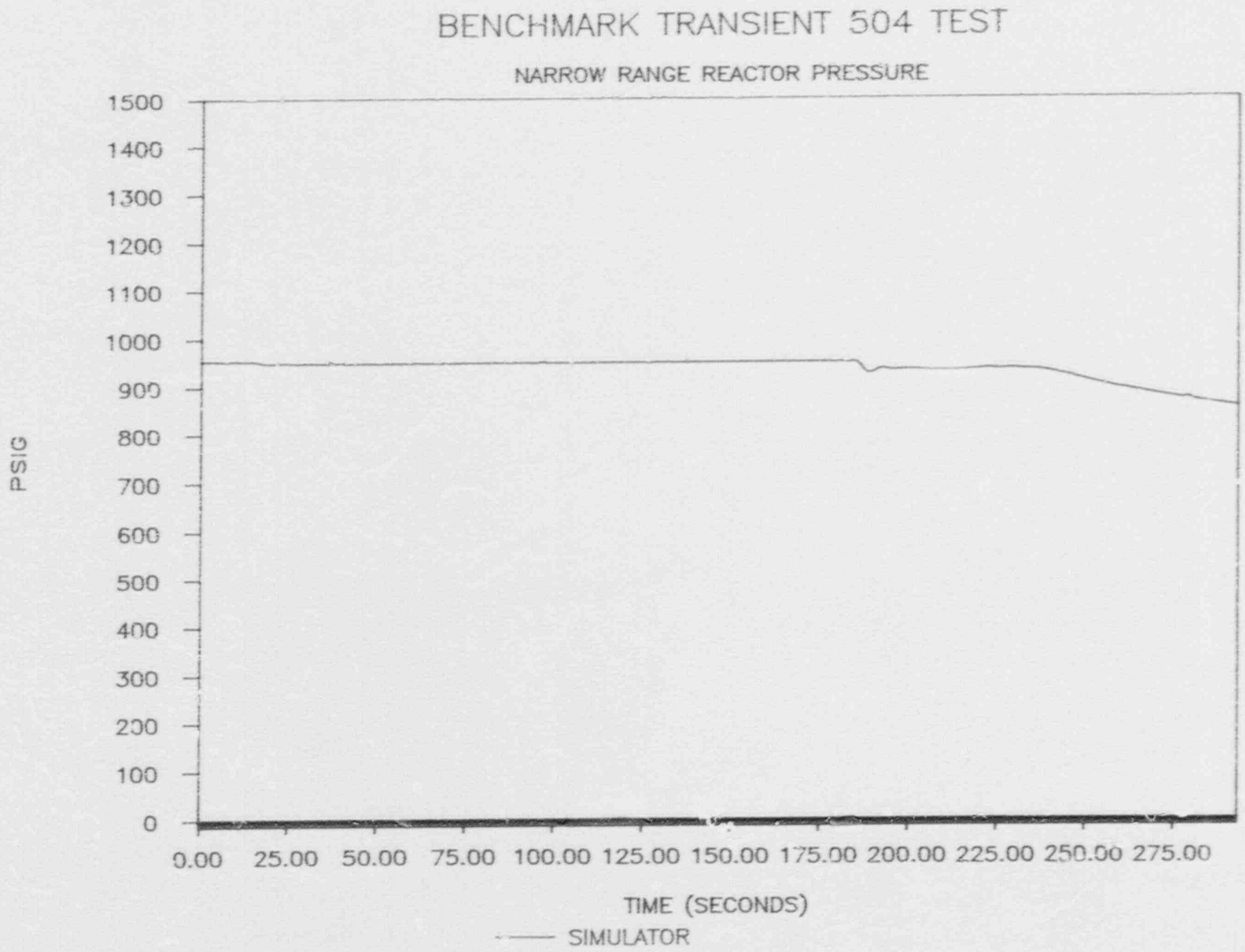



BENCHMARK TRANSIENT 504 TEST
TOTAL STEAM FLOW
MLBS/HR
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
0.00
25.00
50.00
75.00
100.00
125.00
150.00
175.00
200.00
225.00
250.00
275.00
TIME (SECONDS)
SIMULATOR

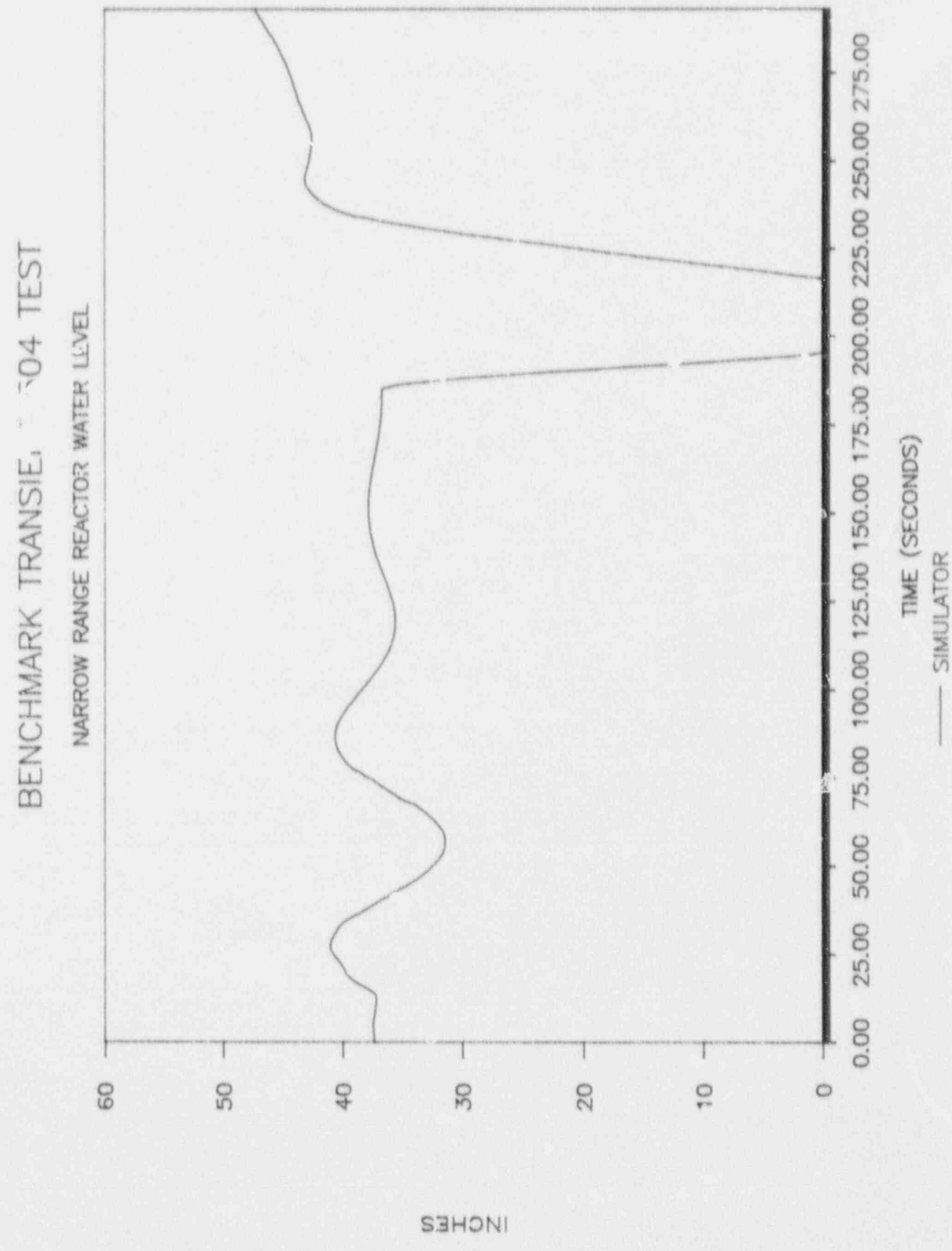
BENCHMARK TRANSIENT 504 TEST

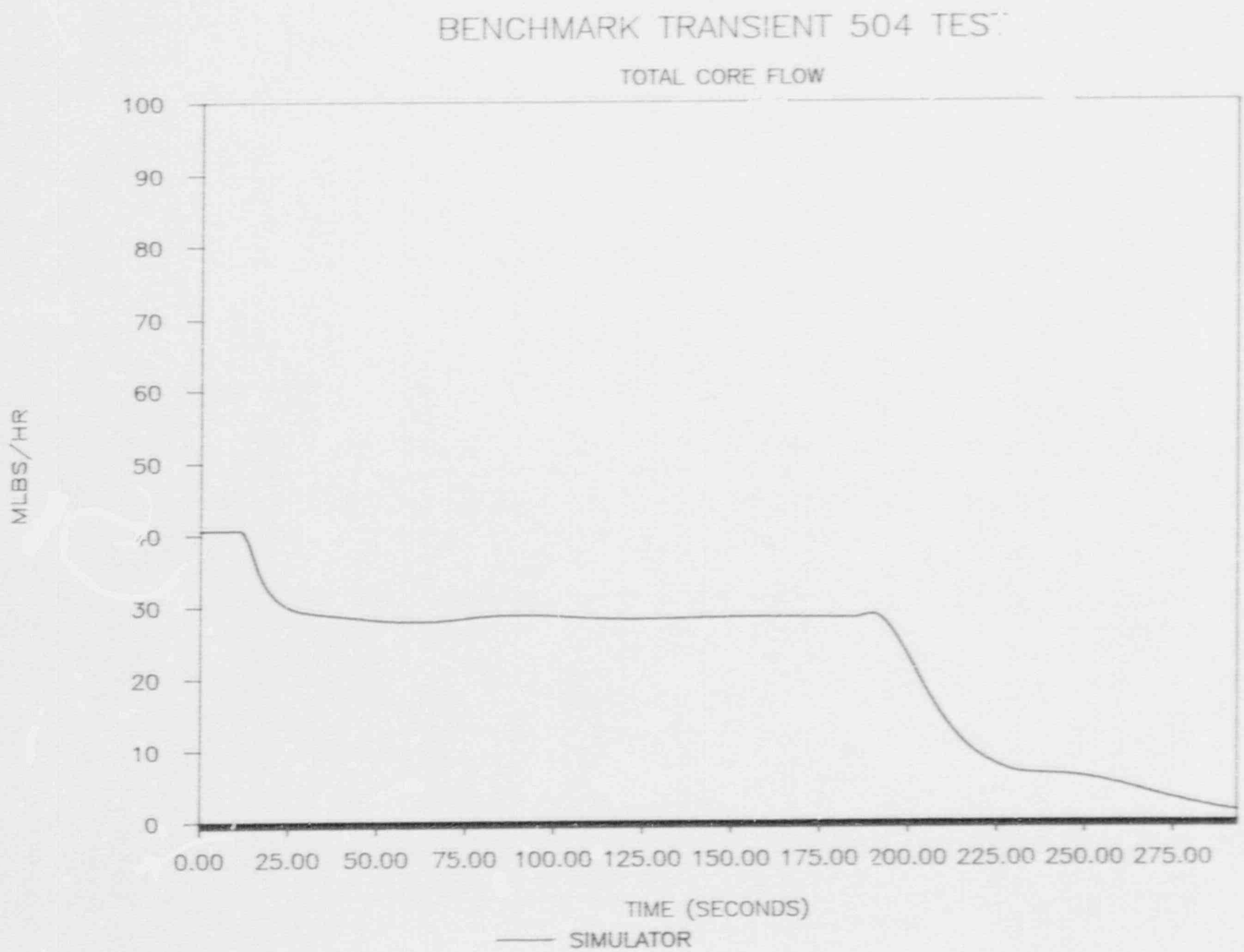
TOTAL FEEDWATER FLOW

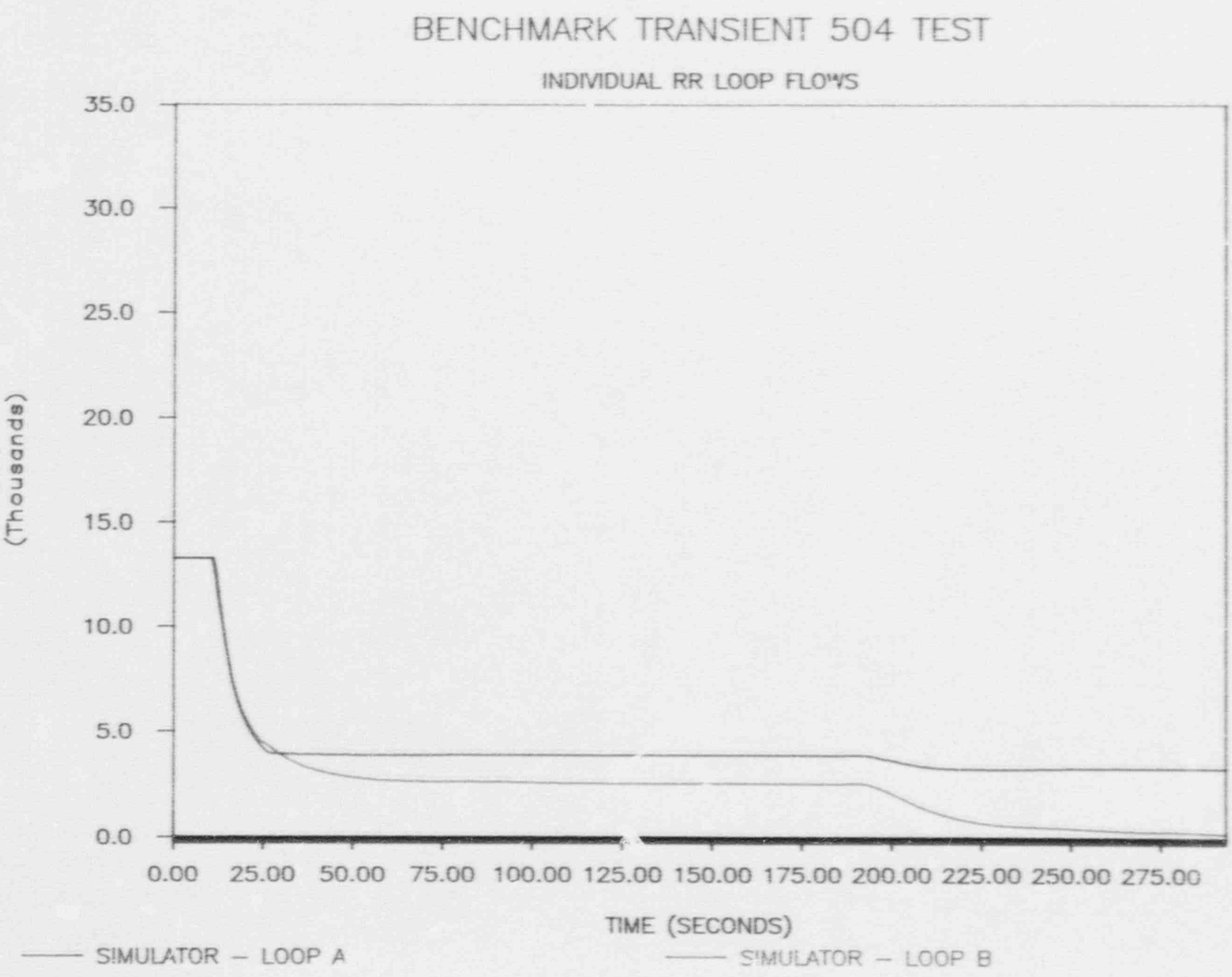


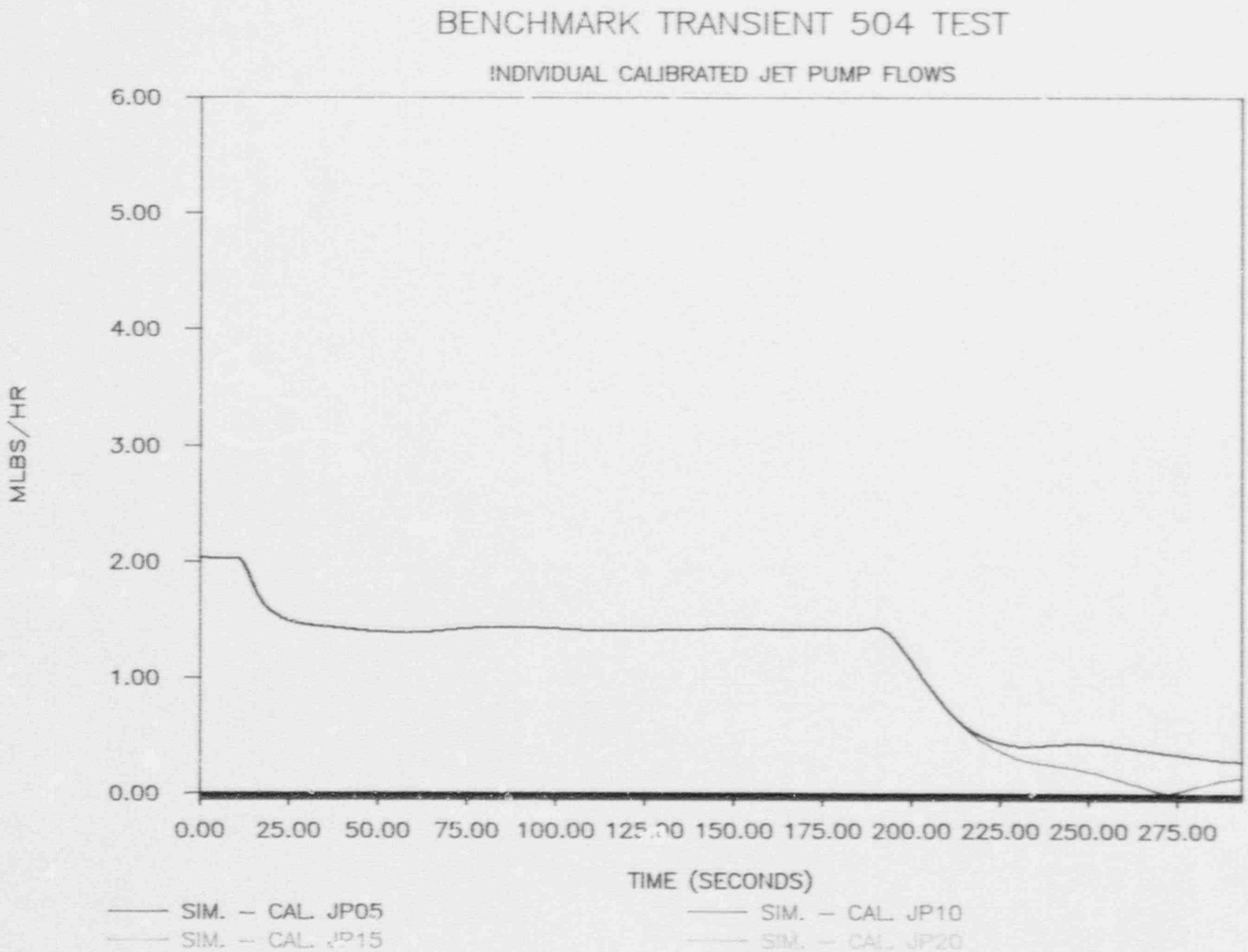


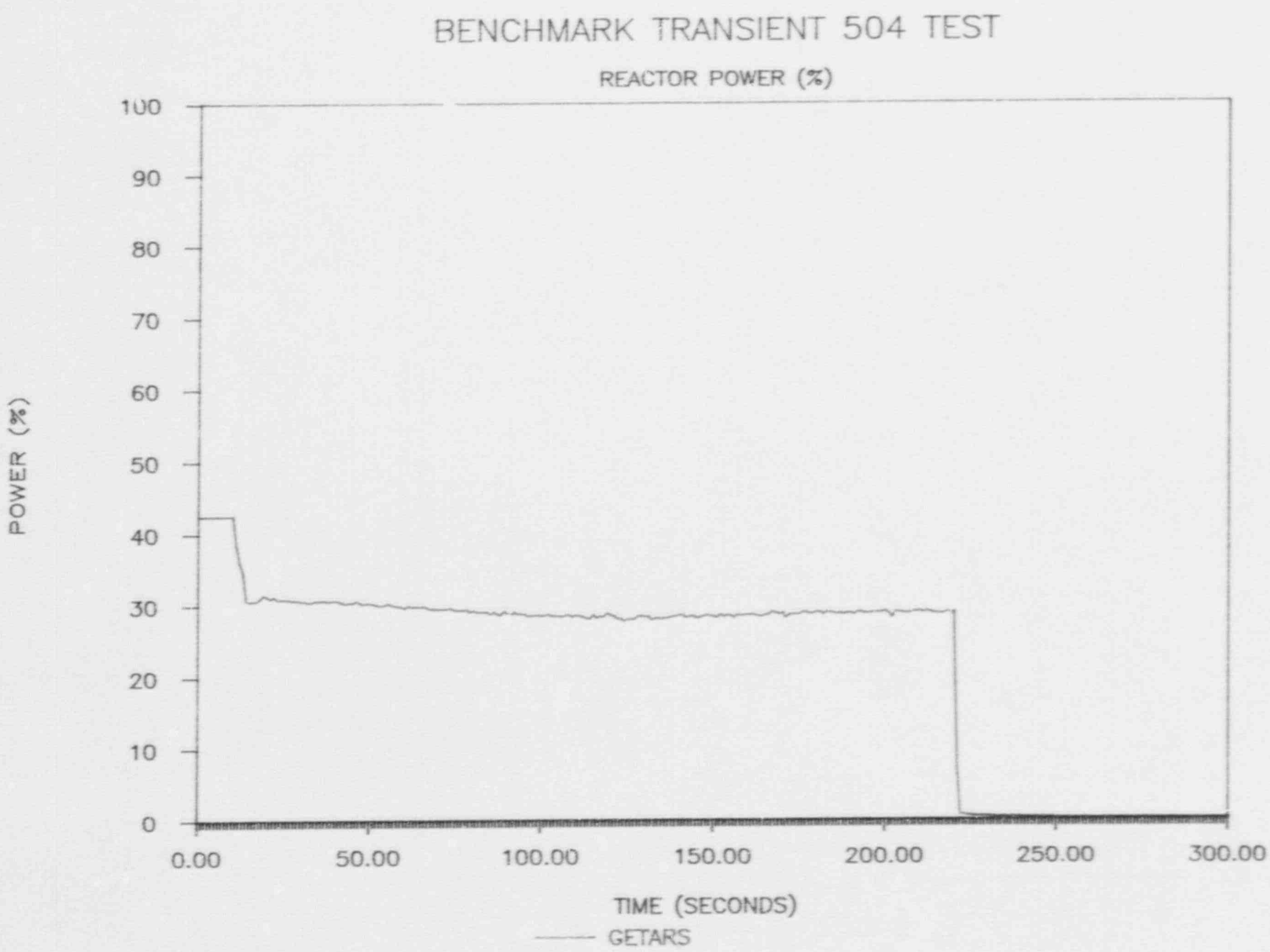
BENCHMARK TRANSIENT 504 TEST
NARROW RANGE REACTOR PRESSURE
PSIG
1500
1400
1300
1200
1100
1000
900
800
700
600
500
400
300
200
100
0
0.00
25.00
50.00
75.00
100.00
125.00
150.00
175.00
200.00
225.00
250.00
275.00
TIME (SECONDS)
SIMULATOR


BENCHMARK TRANSIE. ‘04 TEST
NARROW RANGE REACTOR WATER LEVEL
INCHES
60
50
40
30
20
10
0
0.00
25.00
50.00
75.00
100.00
125.00
150.00
175.00
200.00
225.00
250.00
275.00
TIME (SECONDS)
— SIMULATOR

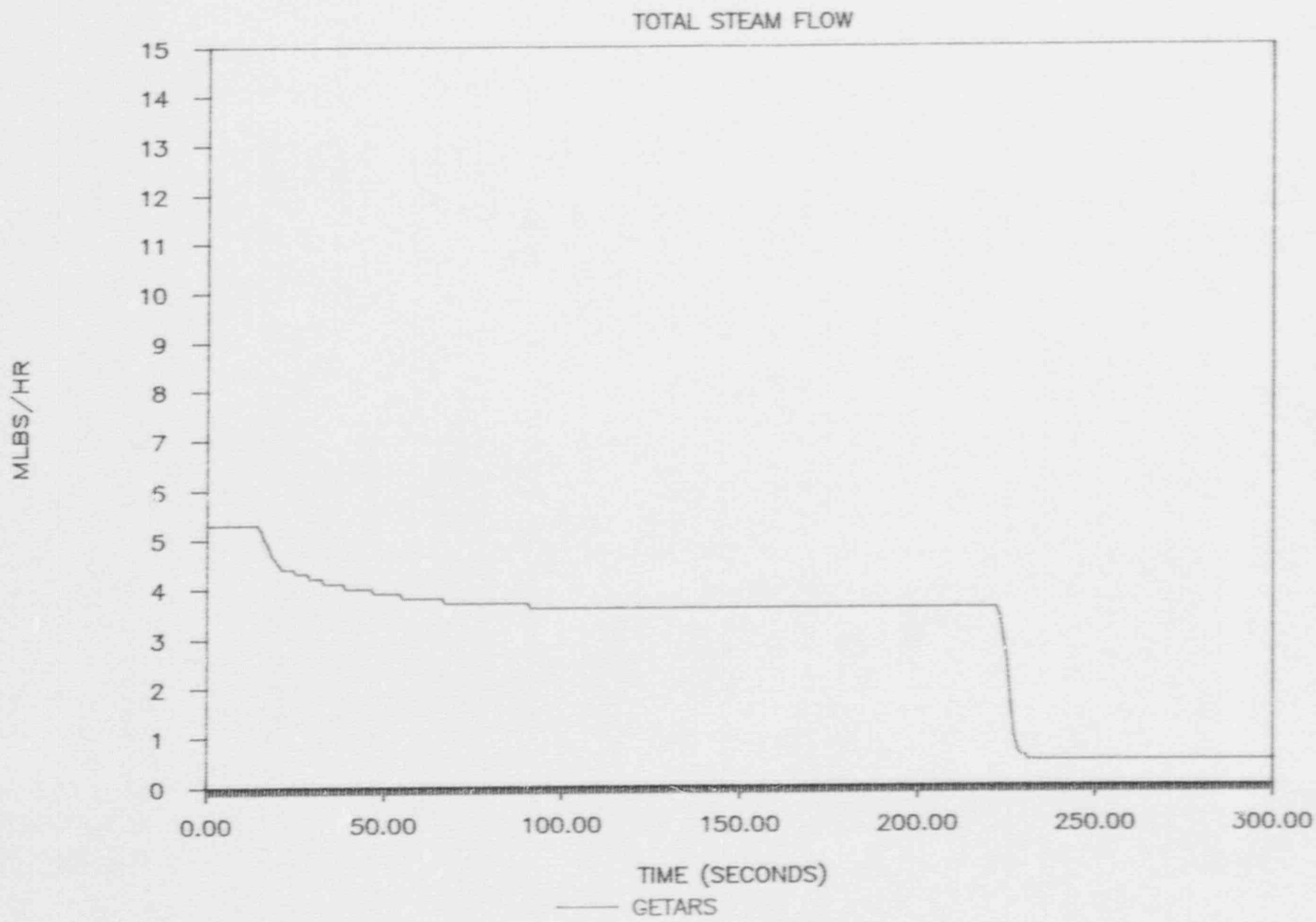

BENCHMARK TRANSIENT 504 TES
TOTAL CORE FLOW
MLBS/HR
100
90
80
70
60
50
30
20
10
0
0.00
25.00
50.00
75.00
100.00
125.00
150.00
175.00
200.00
225.00
250.00
275.00
TIME (SECONDS)
SIMULATOR

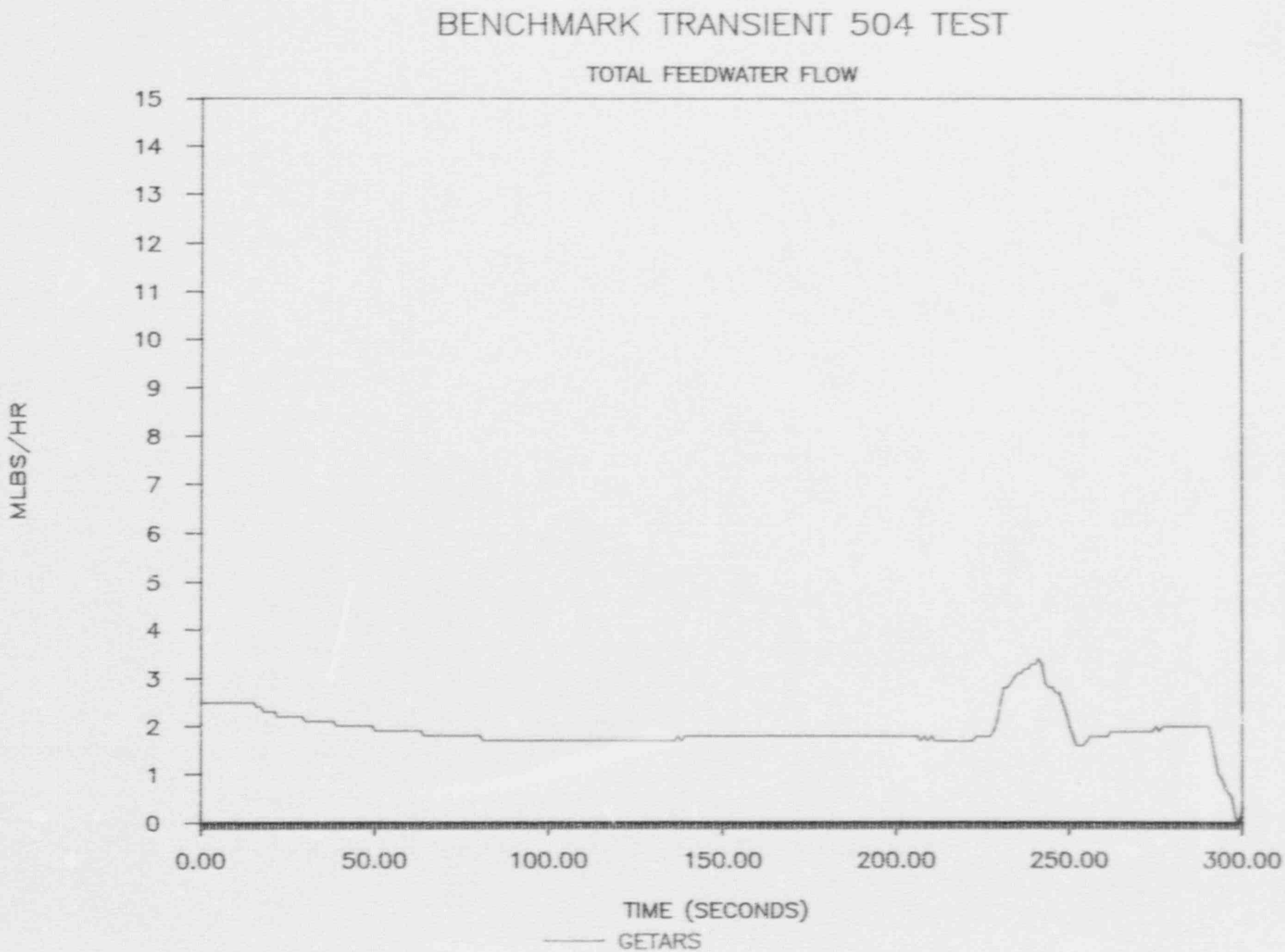

BENCHMARK TRANSIENT 504 TEST
INDIVIDUAL RR LOOP FLOWS
GPM (Thousands)
35.0
30.0
25.0
20.0
15.0
10.0
5.0
0.0
0.00
25.00
50.00
75.00
100.00
125.00
150.00
175.00
200.00
225.00
250.00
275.00
TIME (SECONDS)
SIMULATOR – LOOP A
SIMULATOR – LOOP B

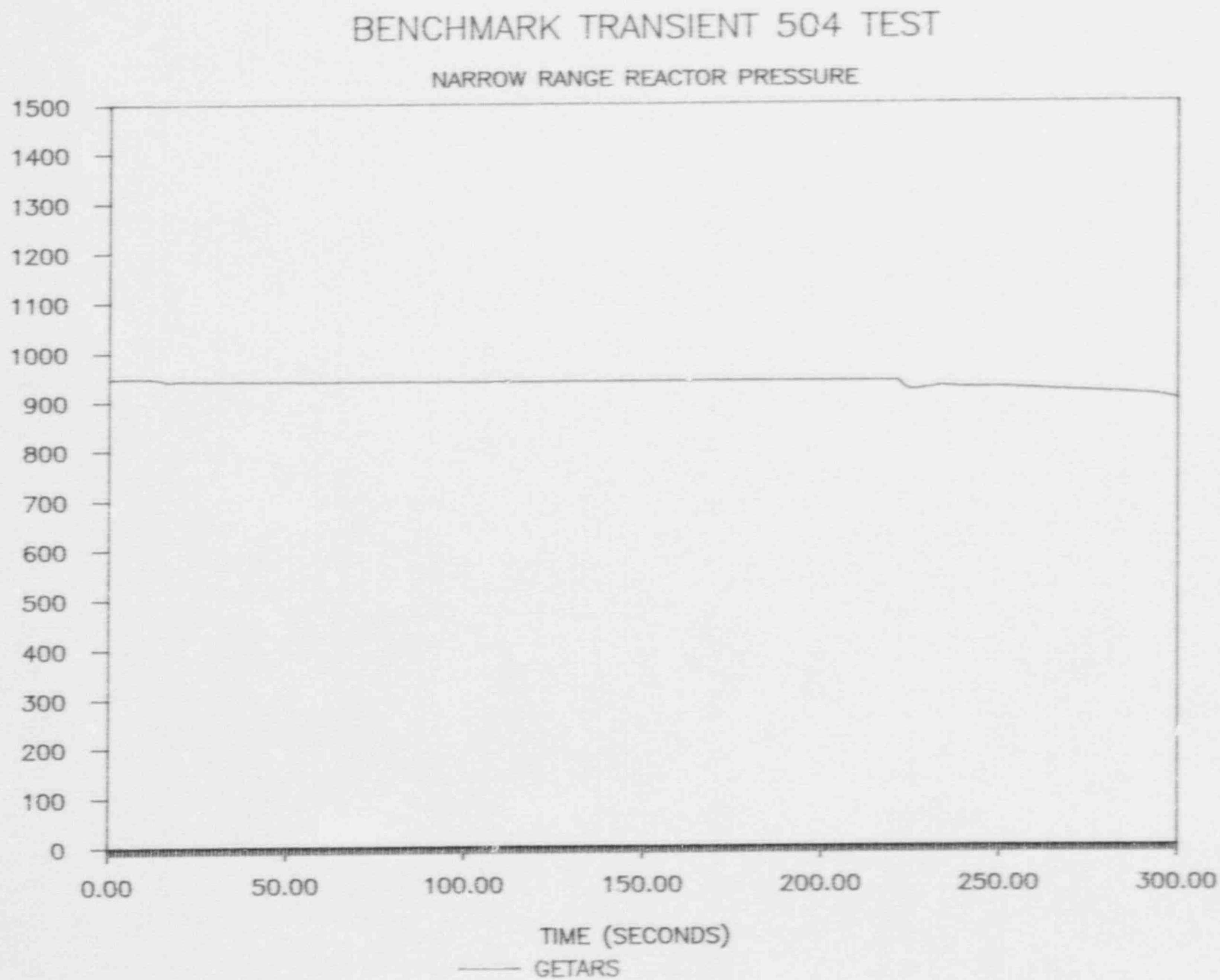

BENCHMARK TRANSIENT 504 TEST
INDIVIDUAL CALIBRATED JET PUMP FLOWS
MLBS/HR
6.00
5.00
4.00
3.00
2.00
1.00
0.00
0.00
25.00
50.00
75.00
100.00
150.00
175.00
200.00
225.00
250.00
275.00
TIME (SECONDS)
SIM. – CAL. JP05
SIM. – CAL. JP10
SIM. – CAL. JP20


BENCHMARK TRANSIENT 504 TEST
REACTOR POWER (%)
POWER (%)
100
90
80
70
60
50
40
30
20
10
0
0.00
50.00
100.00
150.00
200.00
250.00
300.00
TIME (SECONDS)
GETARS

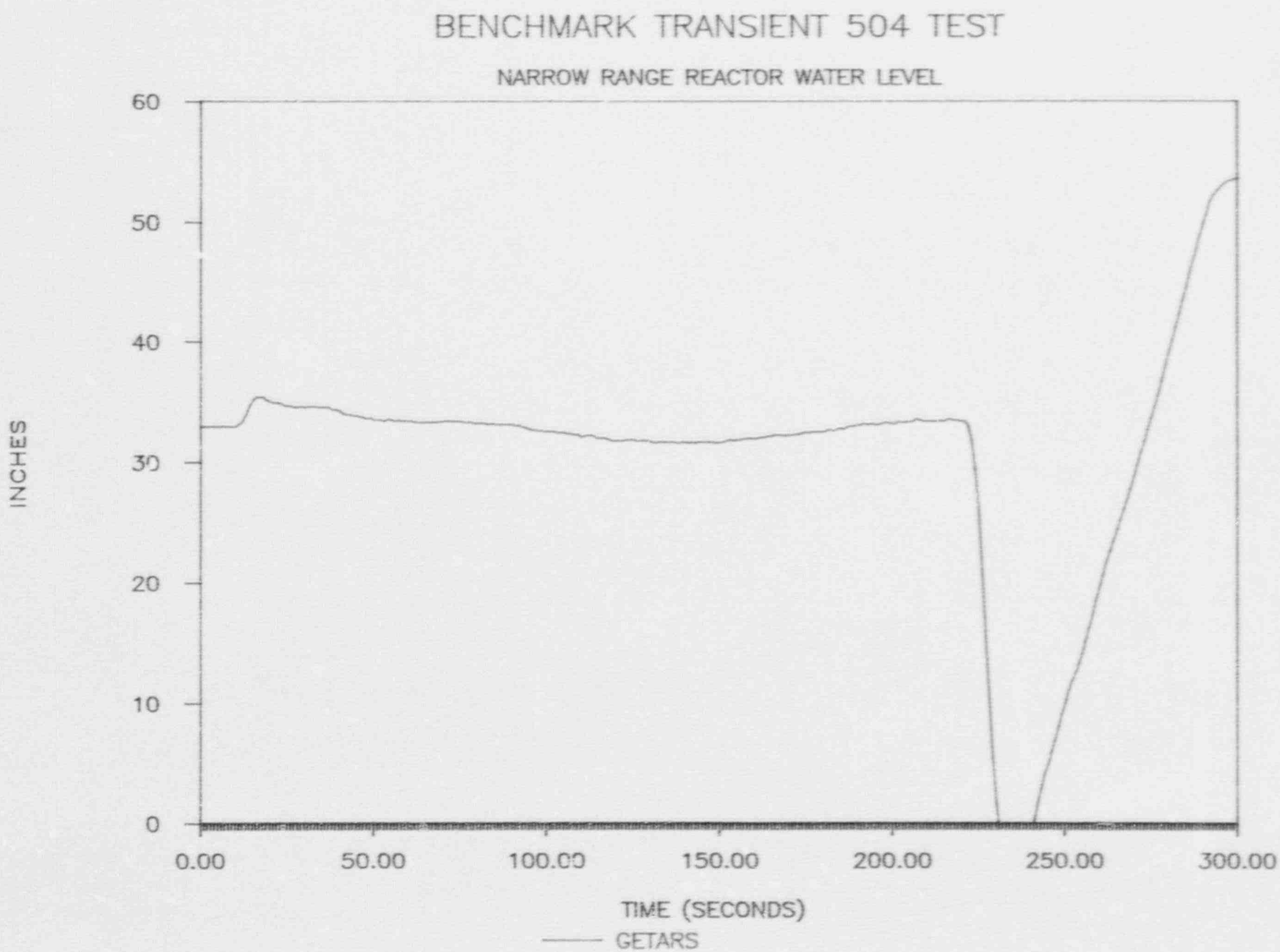
BENCHMARK TRANSIENT 504 TEST

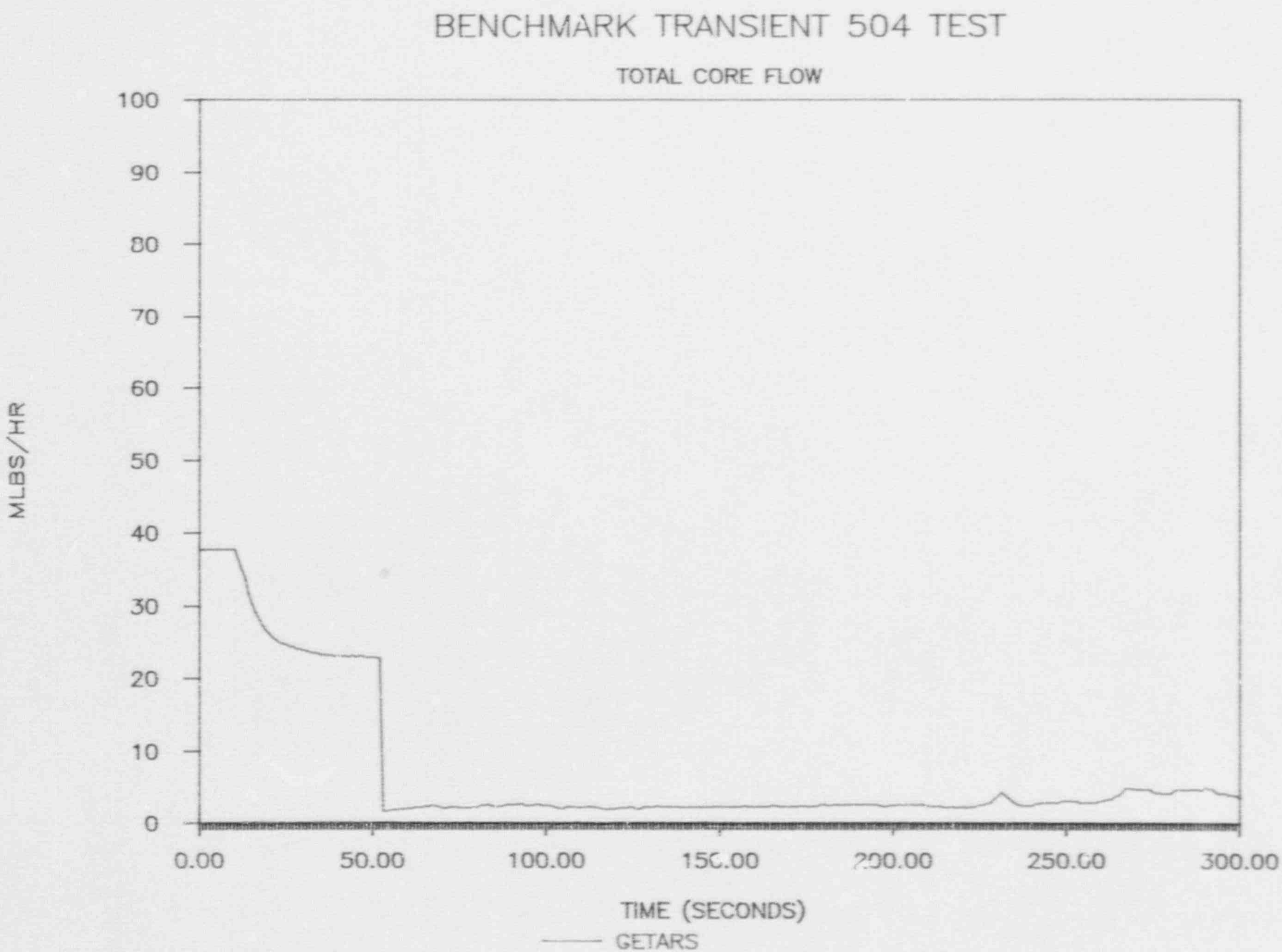



BENCHMARK TRANSIENT 504 TEST
TOTAL FEEDWATER FLOW
MLBS/HR
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
0.00
50.00
100.00
150.00
200.00
250.00
300.00
TIME (SECONDS)
GETARS



BENCHMARK TRANSIENT 504 TEST
NARROW RANGE REACTOR PRESSURE
PSIG
1500
1400
1300
1200
1100
1000
900
800
700
600
500
400
300
200
100
0
0.00
50.00
100.00
150.00
200.00
250.00
300.00
TIME (SECONDS)
GETARS


BENCHMARK TRANSIENT 504 TEST
NARROW RANGE REACTOR WATER LEVEL
INCHES
60
50
40
30
20
10
0
0.00
50.00
100.00
150.00
200.00
250.00
300.00
TIME (SECONDS)
GETARS



BENCHMARK TRANSIENT 504 TEST
TOTAL CORE FLOW
MLBS/HR
100
90
80
70
60
50
40
30
20
10
0
0.00
50.00
100.00
150.00
200.00
250.00
300.00
TIME (SECONDS)
GETARS

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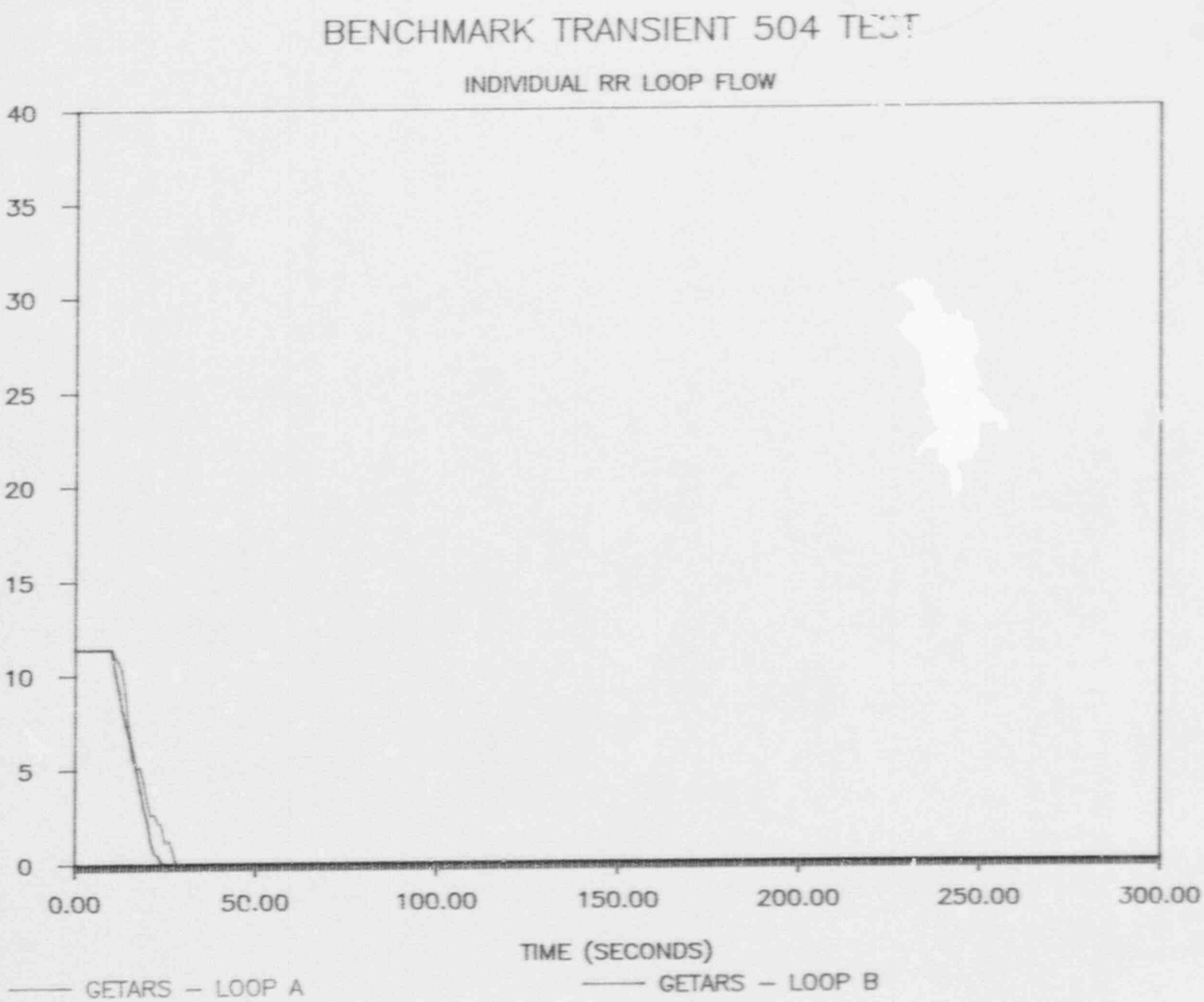
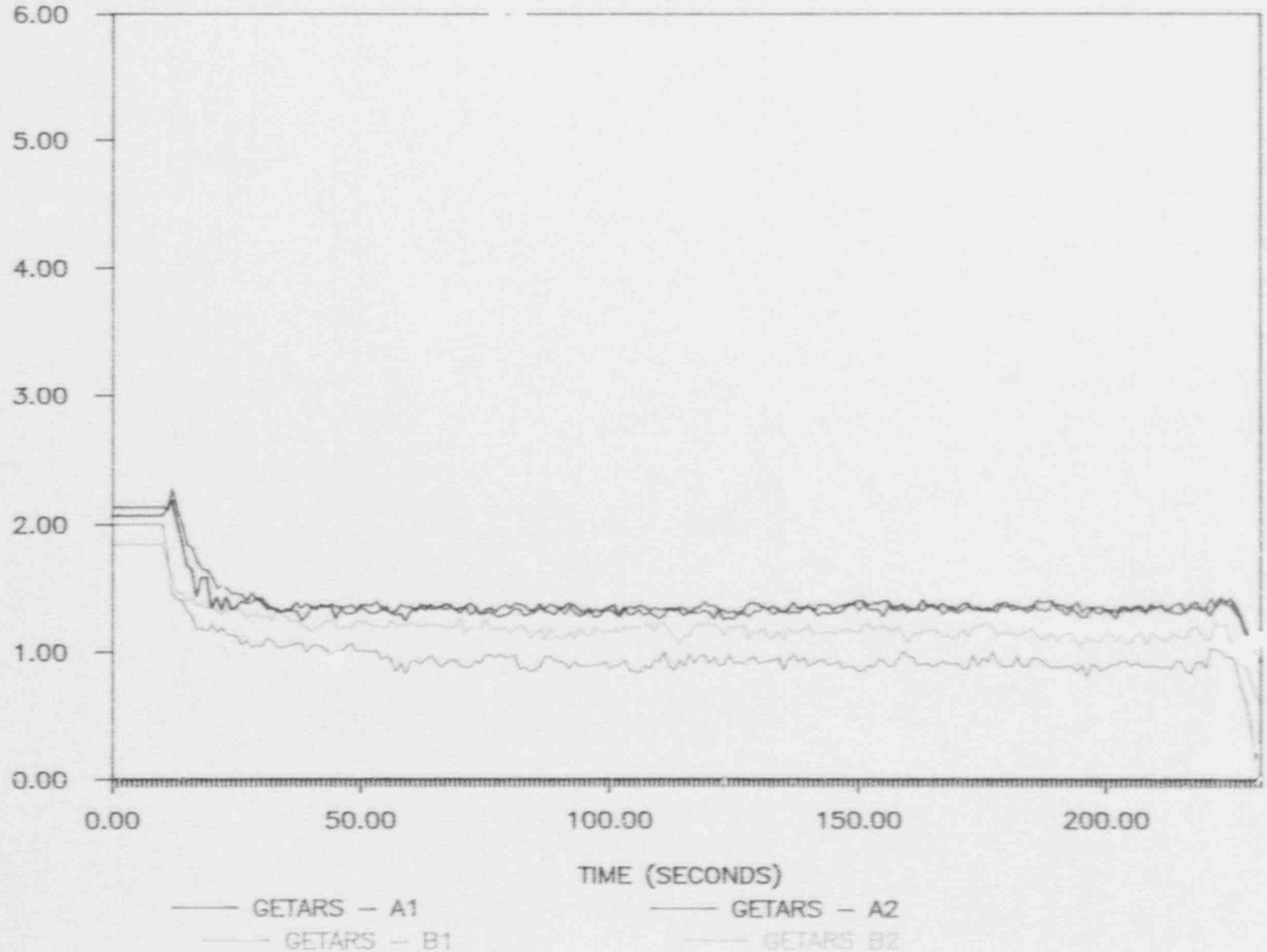


BENCHMARK TRANSIENT 504 TEST
INDIVIDUAL RR LOOP FLOW
GPM (Thousands)
40
35
30
25
20
15
10
5
0
0.00
50.00
100.00
150.00
200.00
250.00
300.00
TIME (SECONDS)
GETARS – LOOP A
GETARS – LOOP B

BENCHMARK TRANSIENT 504 TEST

INDIVIDUAL CALIBRATED JET PUMP FLOW



SIMULATOR CERTIFICATION TEST SUMMARY

Test Name: STP 5.05, Single Recirculation Pump Trip

Description: This test provides a benchmark comparison between the simulator and plant for a single recirculation pump trip.

The simulator was initialized at full power. Data recording began. Approximately 10 seconds later, a malfunction was activated which tripped the A reactor recirculation pu[illegible] No operator actions were taken. The simulator wa[illegible] allowed to stabilize. After 5 minutes the simulator was placed in freeze and data recording was terminated.

Simulator performance was observed during the transient to ensure that alarms, automatic actions, and indications were appropriate for the transient. No violations of the physical laws of nature were observed.

This test was intended to meet the objectives of ANSI/ANS-3.5-1985, Appendix B, and footnote 3 of the standard.

Simulator Features Tested:

Simulator data recording capability at a resolution of 0.5 seconds.

Initial Conditions:

The simulator was operating in a normal full power lineup.

Final Conditions:

The simulator was stable following a single reactor recirculation pump trip.

SIMULATOR CERTIFICATION TEST SUMMARY

Test Name: STP 5.05, Single Recirculation Pump Trip (Cont'd)

Baseline Data Source:

Plant Data-GE Transient Recording System (GETARS)

Comparison:

The following simulator parameters were compared to the available baseline data. The magnitude and direction of change of all parameters were evaluated as acceptable.

Parameter	Evaluation
Reactor Power	Satisfactory
Total Steam Flow	Satisfactory
Total Feedwater Flow	Satisfactory
Reactor Pressure (NR)	Satisfactory
Reactor Level (NR)	Satisfactory
Total Core Flow	Satisfactory
RR Loop Flows	Satisfactory
Calibrated JP Flows	Satisfactory

There are differences between simulator data and GETARS data for total core flow and individual loop flow. The GETARS data points used may not be appropriate for comparison purposes for transients involving natural circulation or reverse flow conditions. Based on a review of the simulator data, the simulator performance has been judged to be acceptable, since the parameters changed in the direction expected. However, Simulator Problem Report (SPR) No. 91-044 has been written to evaluate this further.

Graphs of simulator and GETARS data follow this test summary. When all parameters are considered, the overall simulator response to this transient is satisfactory.

SIMULATOR CERTIFICATION TEST SUMMARY

Test Name: STP 5.05, Single Recirculation Pump Trip (Cont'd)

Deficiencies Found:

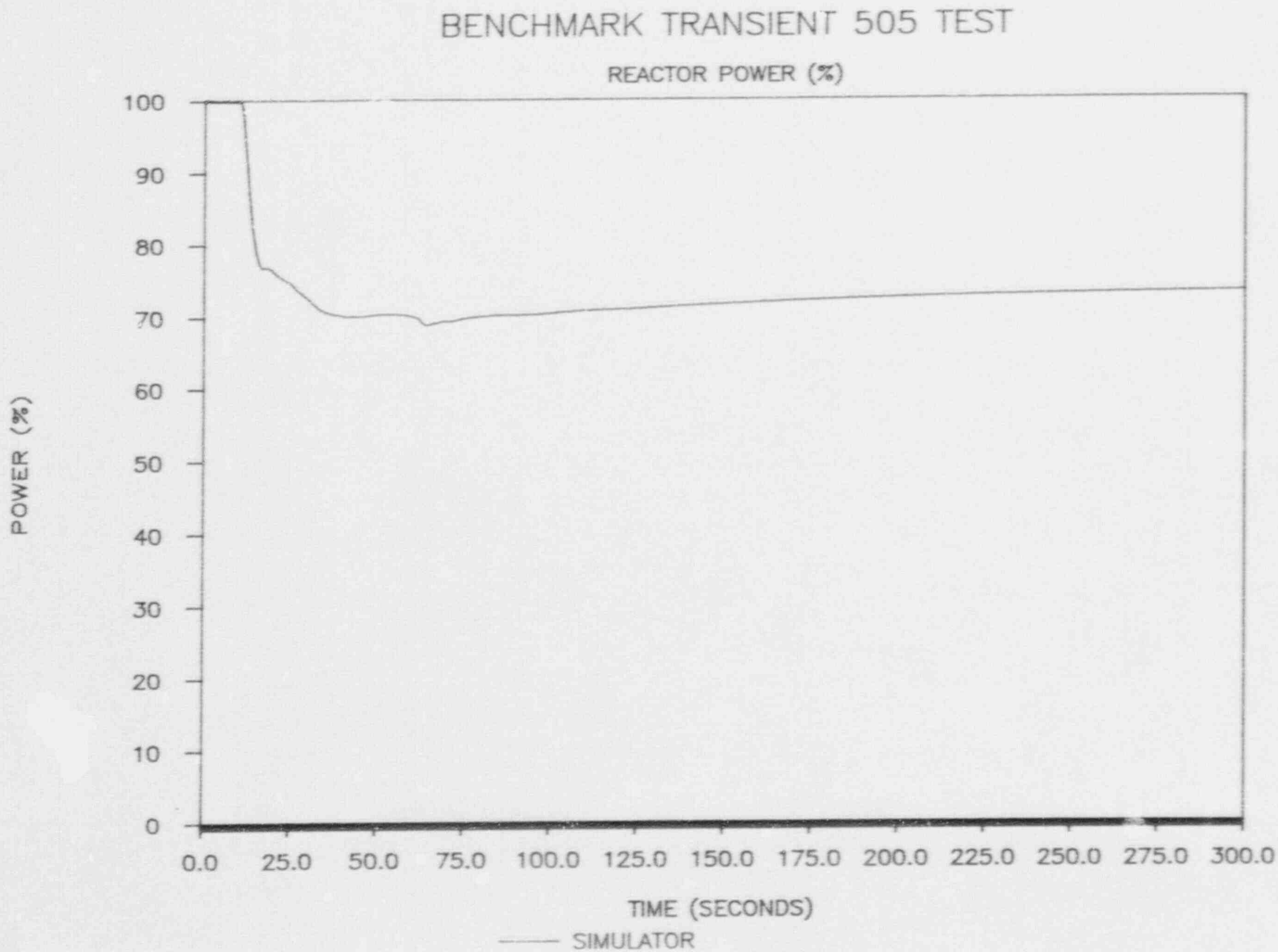
None

Corrective Actions Planned (and schedule):

None

Exceptions Taken/Justification:

None



BENCHMARK TRANSIENT 505 TEST
REACTOR POWER (%)
POWER (%)
100
90
80
70
60
50
40
30
20
10
0
0.0
25.0
50.0
75.0
100.0
125.0
150.0
175.0
200.0
225.0
250.0
275.0
300.0
TIME (SECONDS)
SIMULATOR

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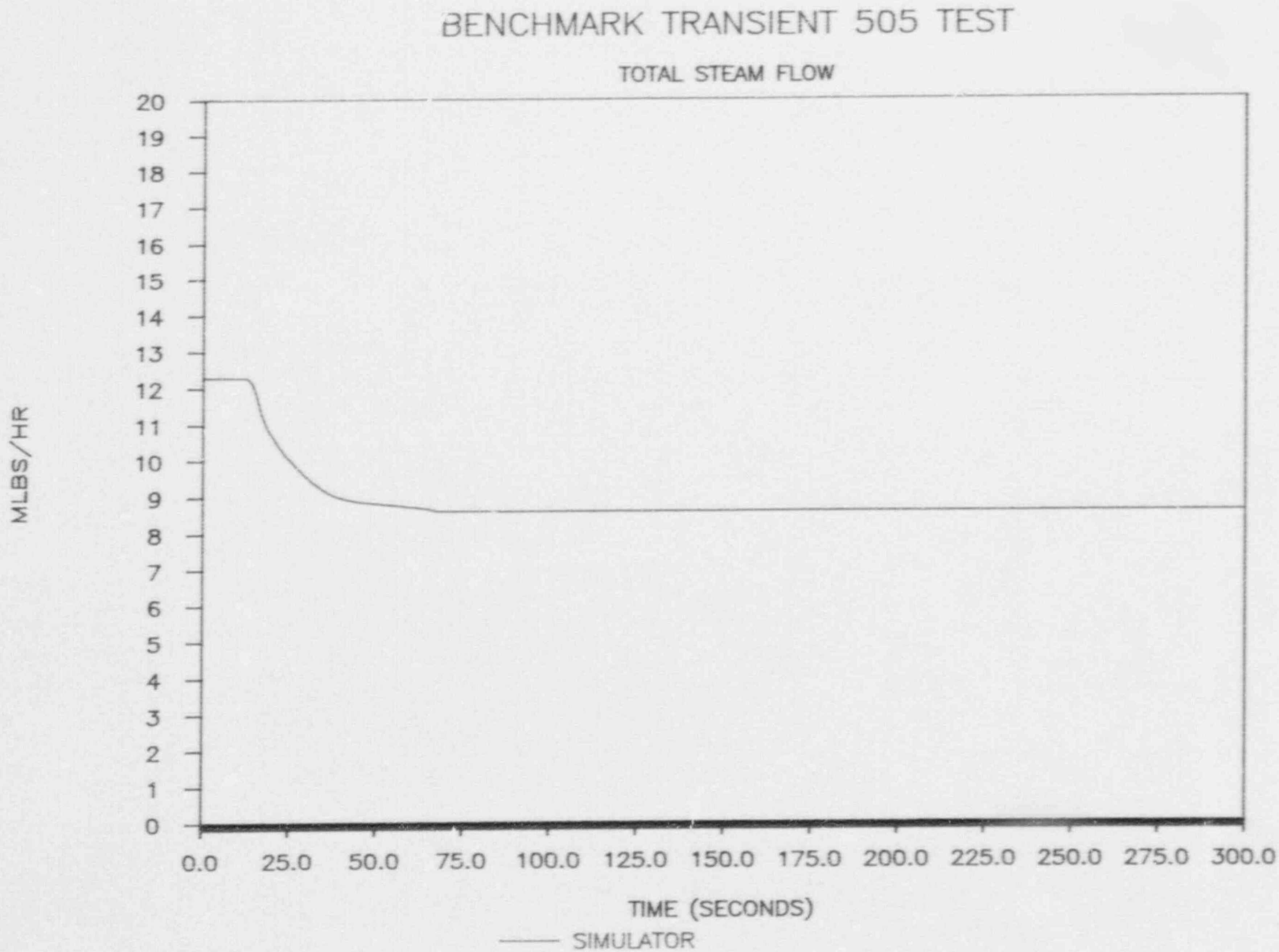
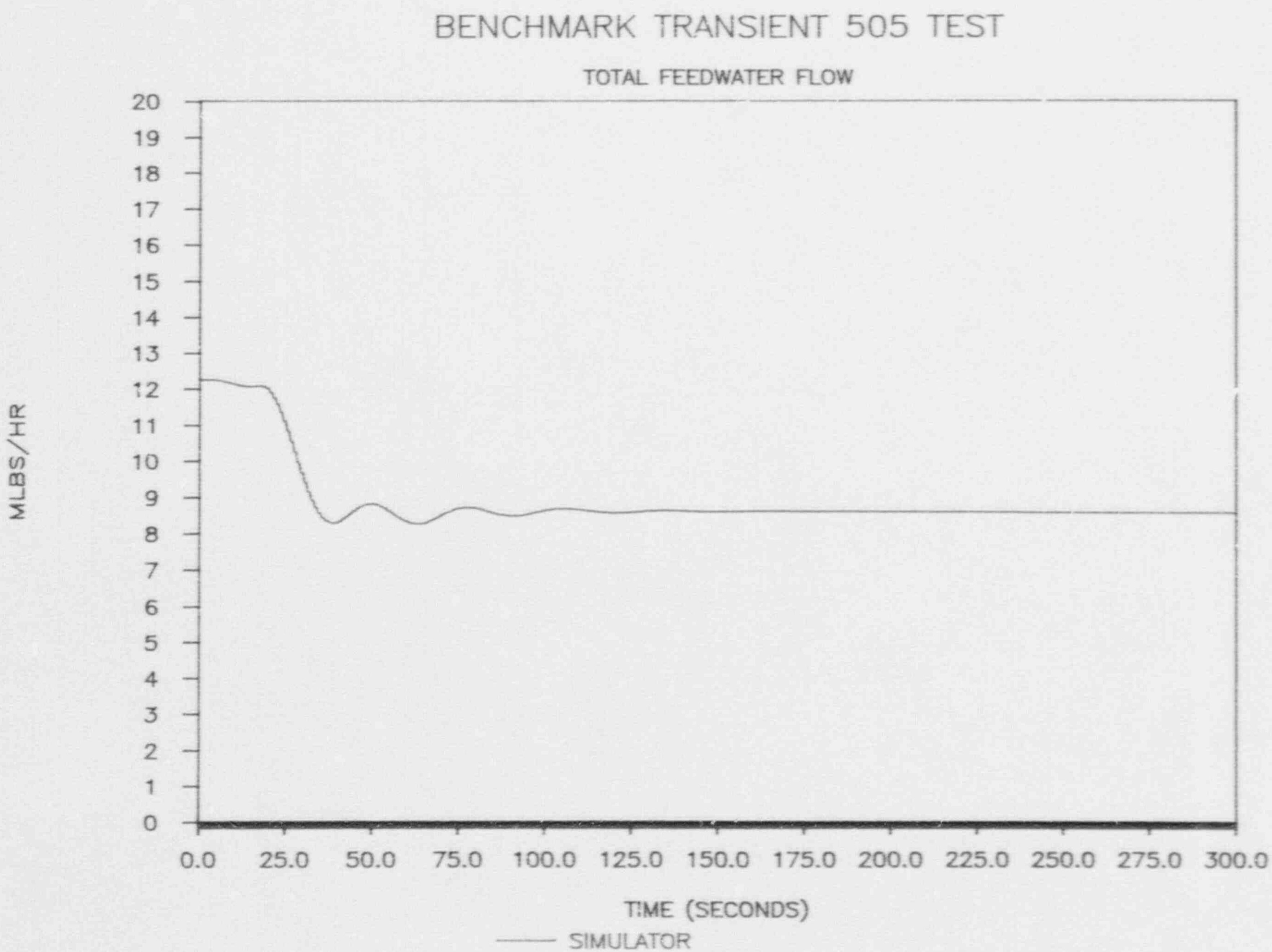
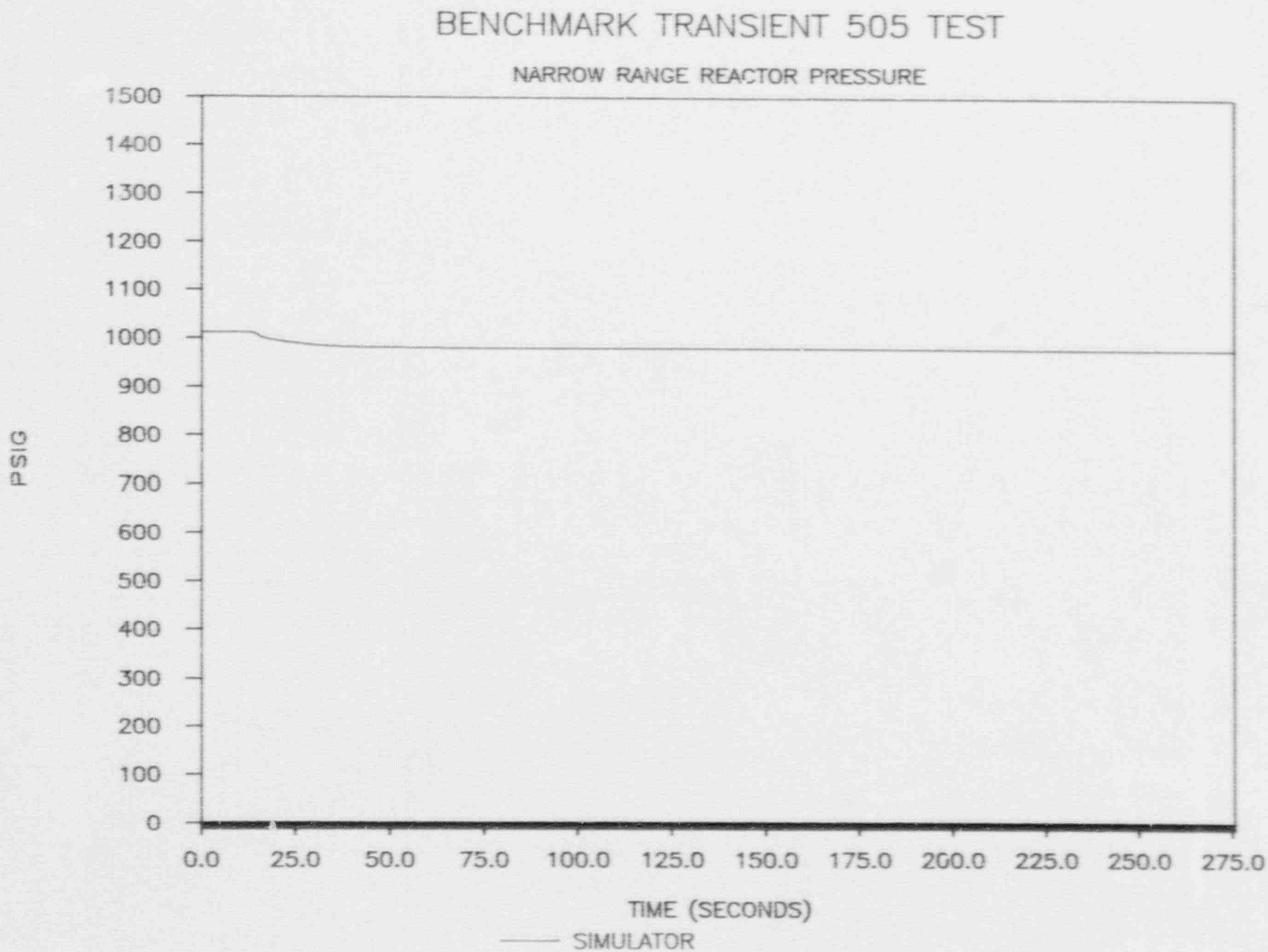
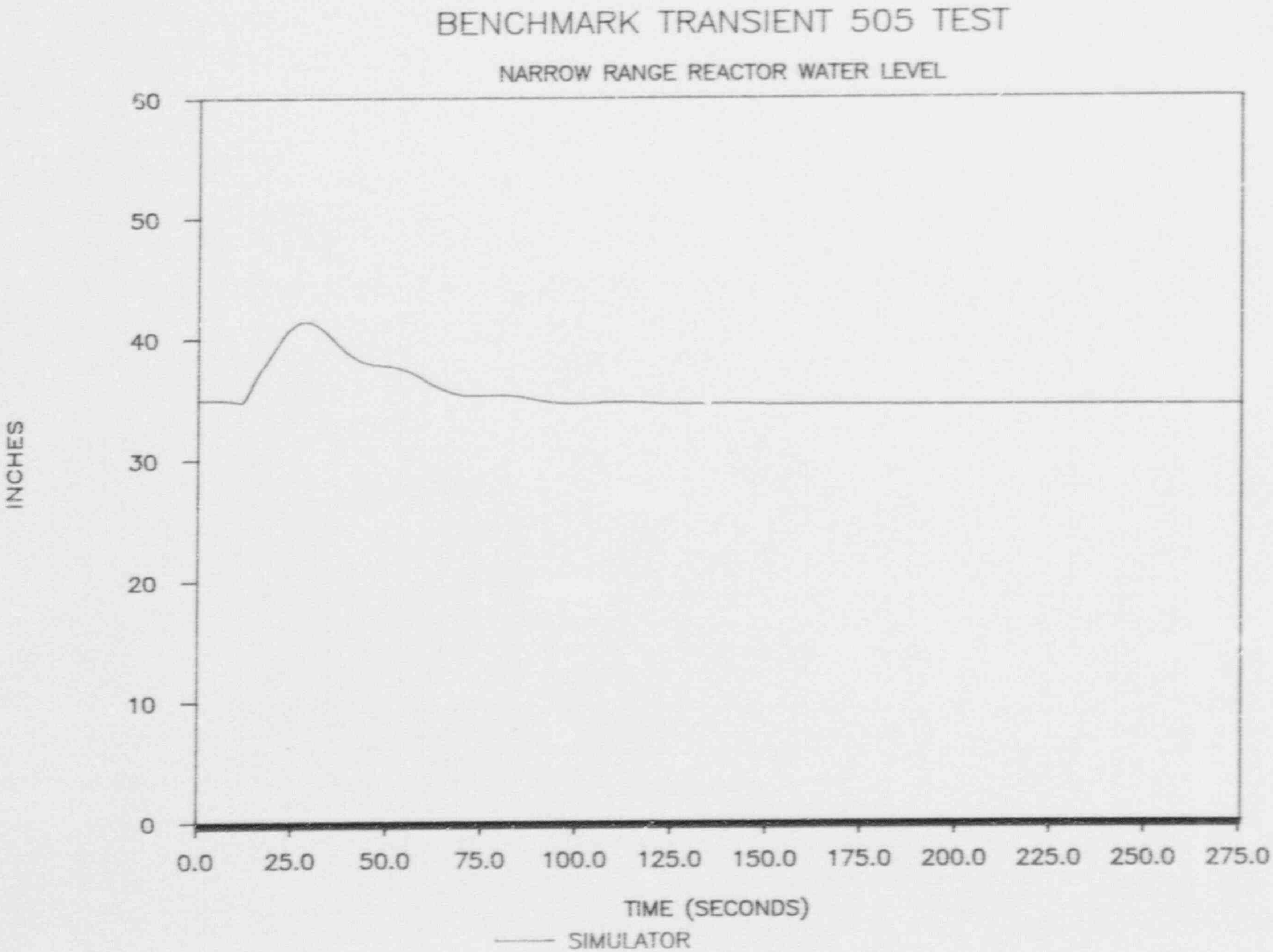
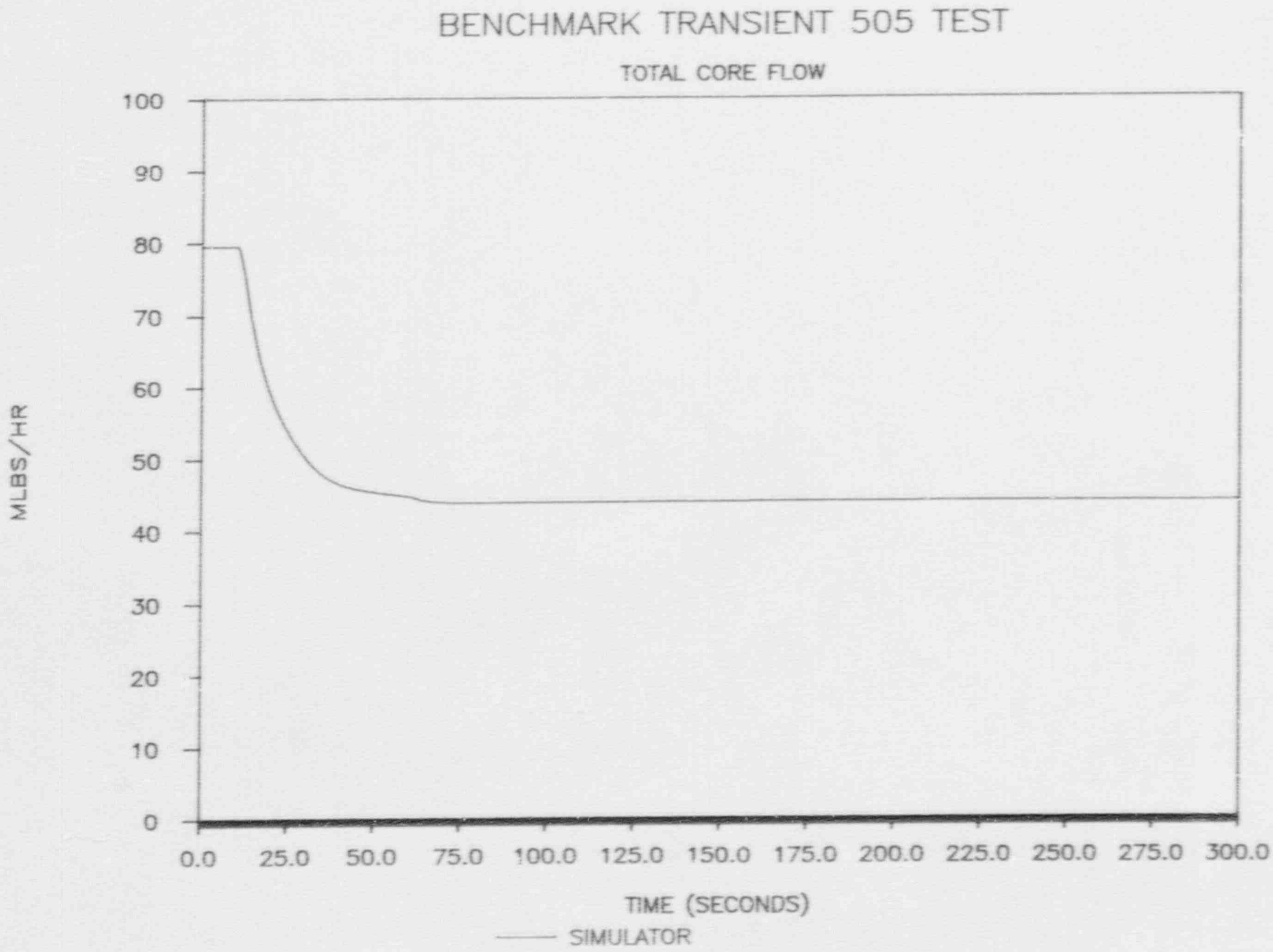
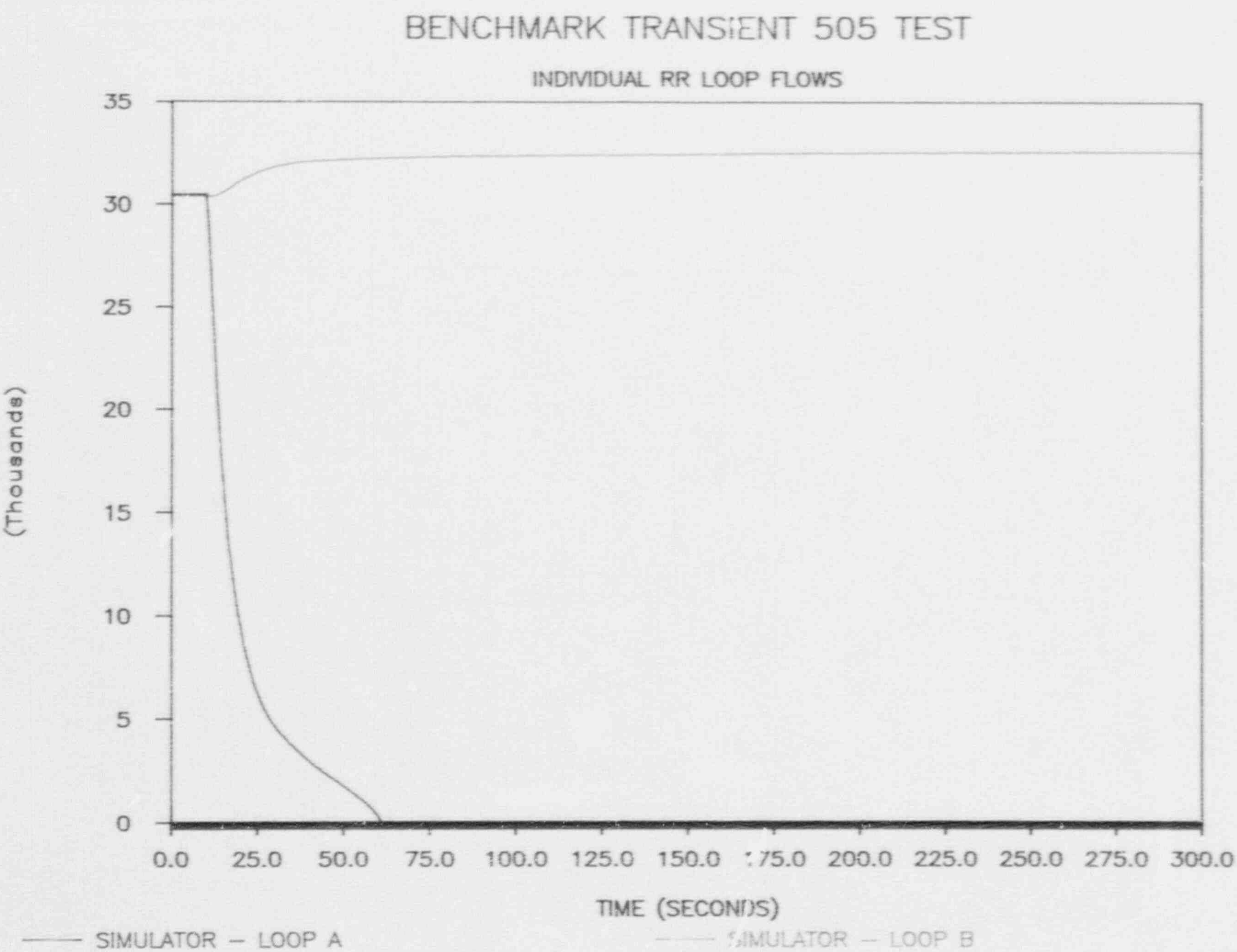

BENCHMARK TRANSIENT 505 TEST
TOTAL STEAM FLOW
MLBS/HR
20
19
18
17
16
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
0.0
25.0
50.0
75.0
100.0
125.0
150.0
175.0
200.0
225.0
250.0
275.0
300.0
TIME (SECONDS)
SIMULATOR

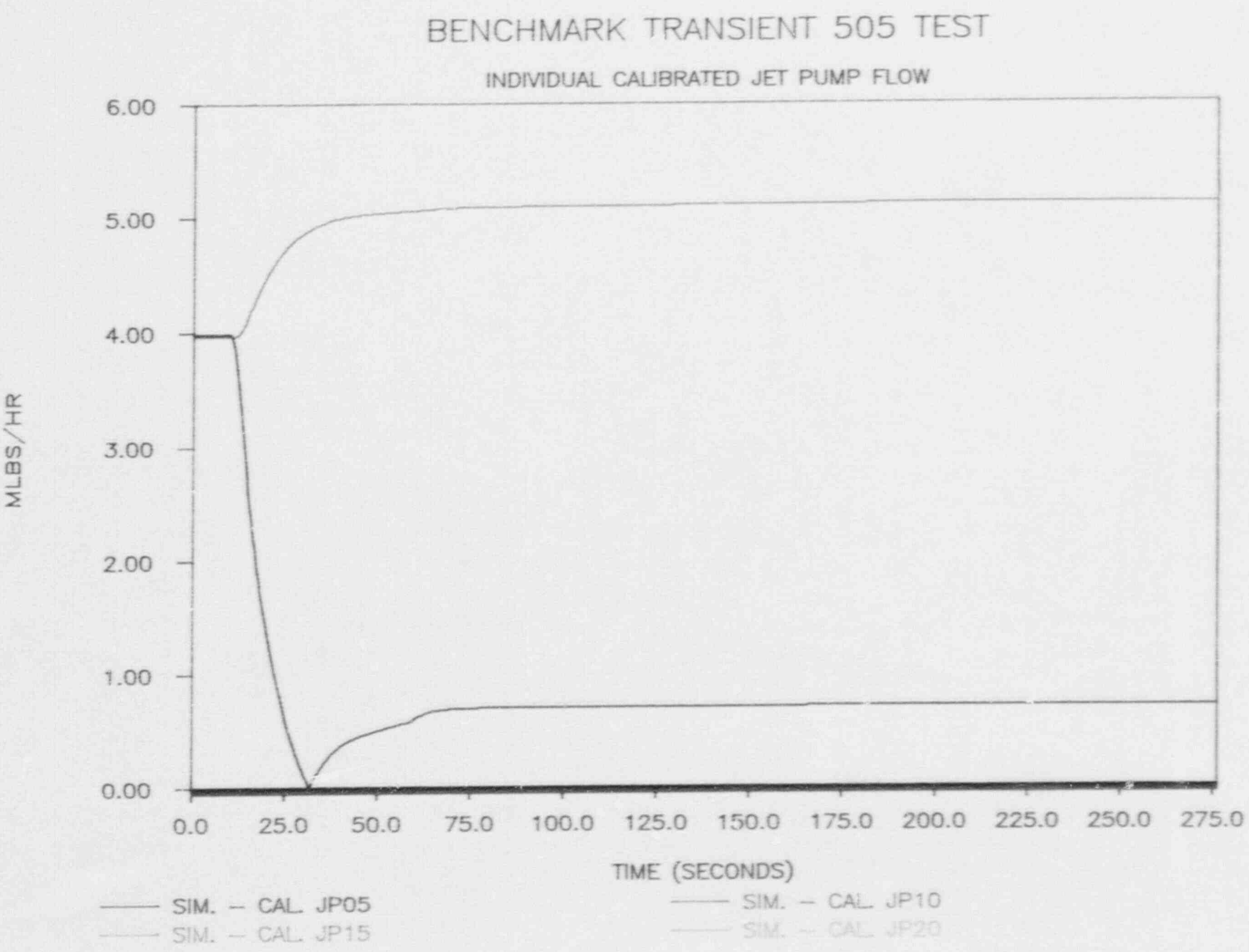

BENCHMARK TRANSIENT 505 TEST
TOTAL FEEDWATER FLOW
MLBS/HR
20
19
18
17
16
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
0.0
25.0
50.0
75.0
100.0
125.0
150.0
175.0
200.0
225.0
250.0
275.0
300.0
TIME (SECONDS)
SIMULATOR

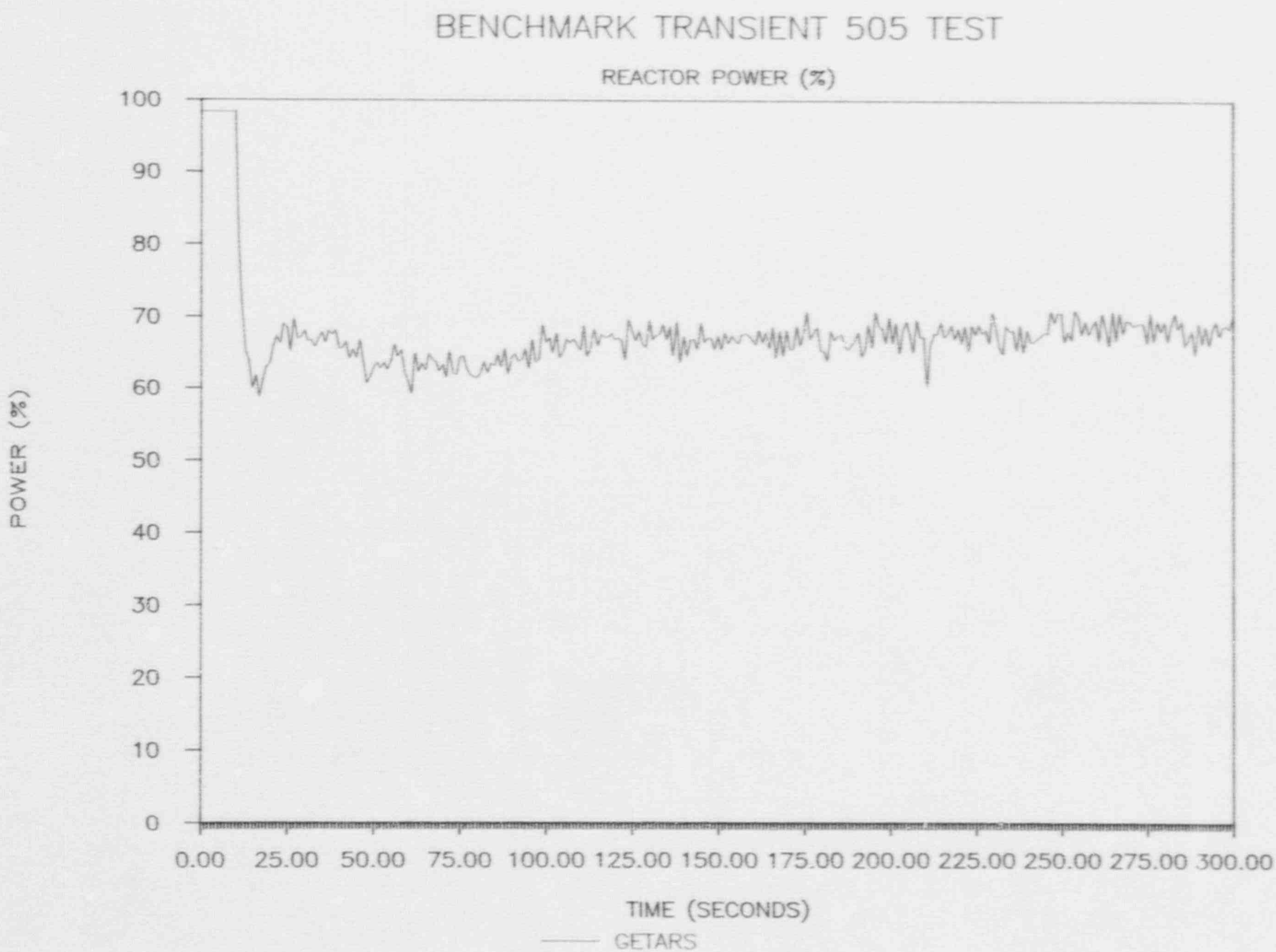

BENCHMARK TRANSIENT 505 TEST
NARROW RANGE REACTOR PRESSURE
PSIG
1500
1400
1300
1200
1100
1000
900
800
700
600
500
400
300
200
100
0
0.0
25.0
50.0
75.0
100.0
125.0
150.0
175.0
200.0
225.0
250.0
275.0
TIME (SECONDS)
SIMULATOR

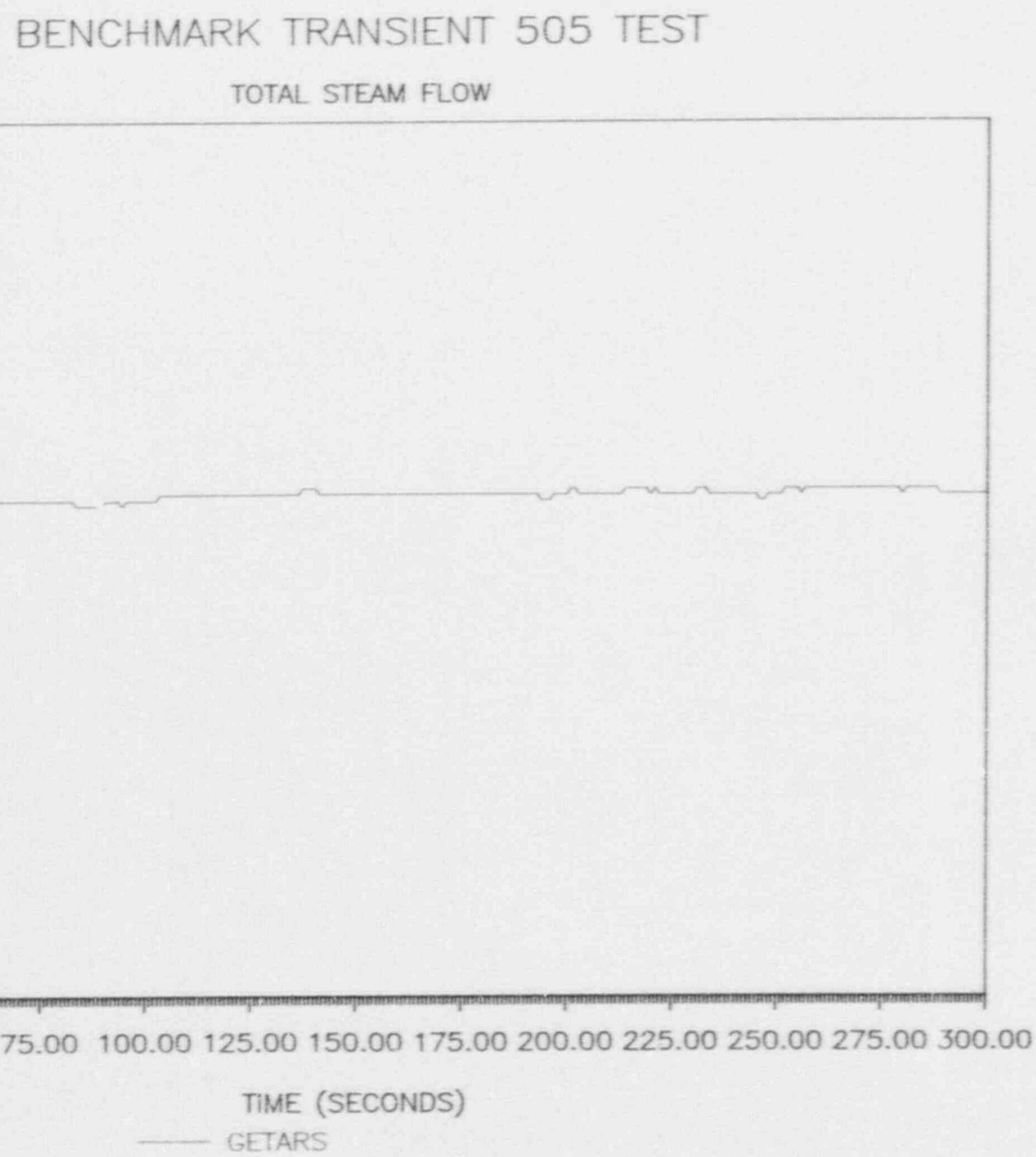

BENCHMARK TRANSIENT 505 TEST
NARROW RANGE REACTOR WATER LEVEL
INCHES
0
10
20
30
40
50
60
0.0
25.0
50.0
75.0
100.0
125.0
150.0
175.0
200.0
225.0
250.0
275.0
TIME (SECONDS)
SIMULATOR

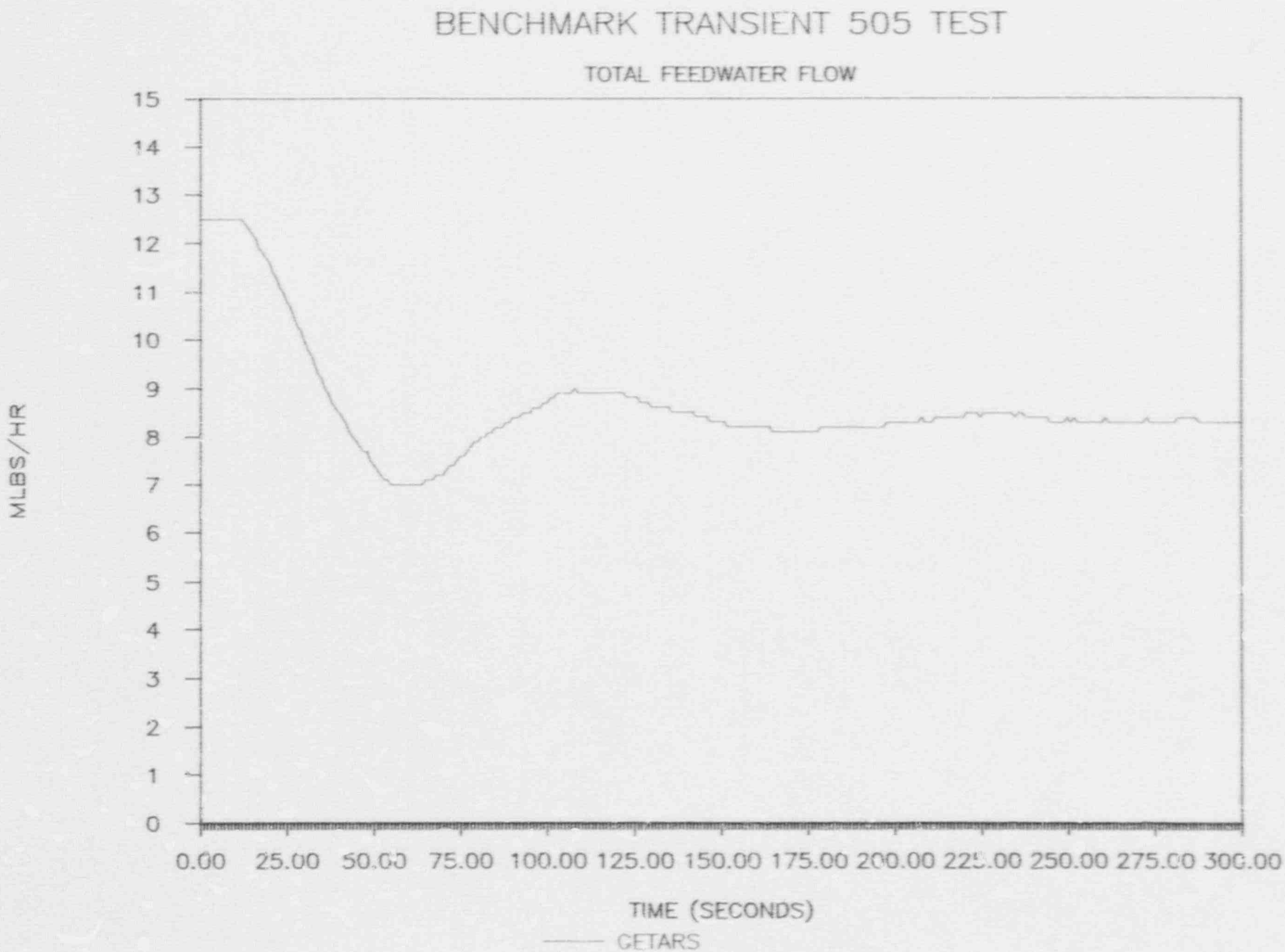

BENCHMARK TRANSIENT 505 TEST
TOTAL CORE FLOW
100
90
80
70
60
50
40
30
20
10
0
MLBS/HR
0.0
25.0
50.0
75.0
100.0
125.0
150.0
175.0
200.0
225.0
250.0
275.0
300.0
TIME (SECONDS)
SIMULATOR


BENCHMARK TRANSIENT 505 TEST
INDIVIDUAL RR LOOP FLOWS
GPM (Thousands)
35
30
25
20
15
10
5
0
0.0
25.0
50.0
75.0
100.0
125.0
150.0
175.0
200.0
225.0
250.0
275.0
300.0
TIME (SECONDS)
SIMULATOR – LOOP A
SIMULATOR – LOOP B


BENCHMARK TRANSIENT 505 TEST
INDIVIDUAL CALIBRATED JET PUMP FLOW
MLBS/HR
6.00
5.00
4.00
3.00
2.00
1.00
0.00
0.0
25.0
50.0
75.0
100.0
125.0
150.0
175.0
200.0
225.0
250.0
275.0
TIME (SECONDS)
SIM. – CAL. JP05
SIM. – CAL. JP10
SIM. – CAL. JP15
SIM. – CAL. JP20

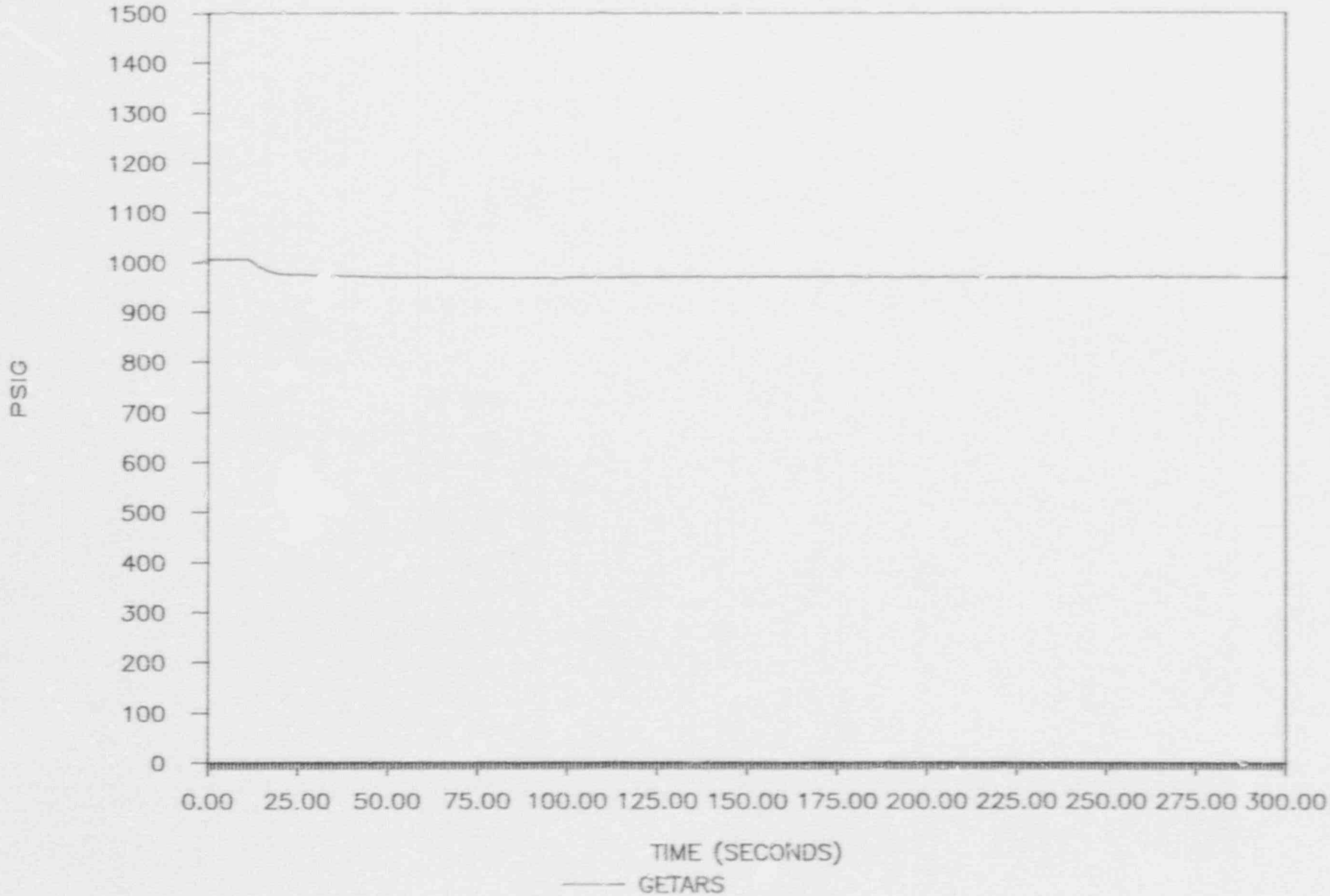

BENCHMARK TRANSIENT 505 TEST
REACTOR POWER (%)
POWER (%)
100
90
80
70
60
50
40
30
20
10
0
0.00
25.00
50.00
75.00
100.00
125.00
150.00
175.00
200.00
225.00
250.00
275.00
300.00
TIME (SECONDS)
GETARS


BENCHMARK TRANSIENT 505 TEST
TOTAL STEAM FLOW
MLBS/HR
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
0.00
25.00
50.00
75.00
100.00
125.00
150.00
175.00
200.00
225.00
250.00
275.00
300.00
TIME (SECONDS)
GETARS


BENCHMARK TRANSIENT 505 TEST
TOTAL FEEDWATER FLOW
MLBS/HR
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
0.00
25.00
50.00
75.00
100.00
125.00
150.00
175.00
200.00
225.00
250.00
275.00
300.00
TIME (SECONDS)
GETARS

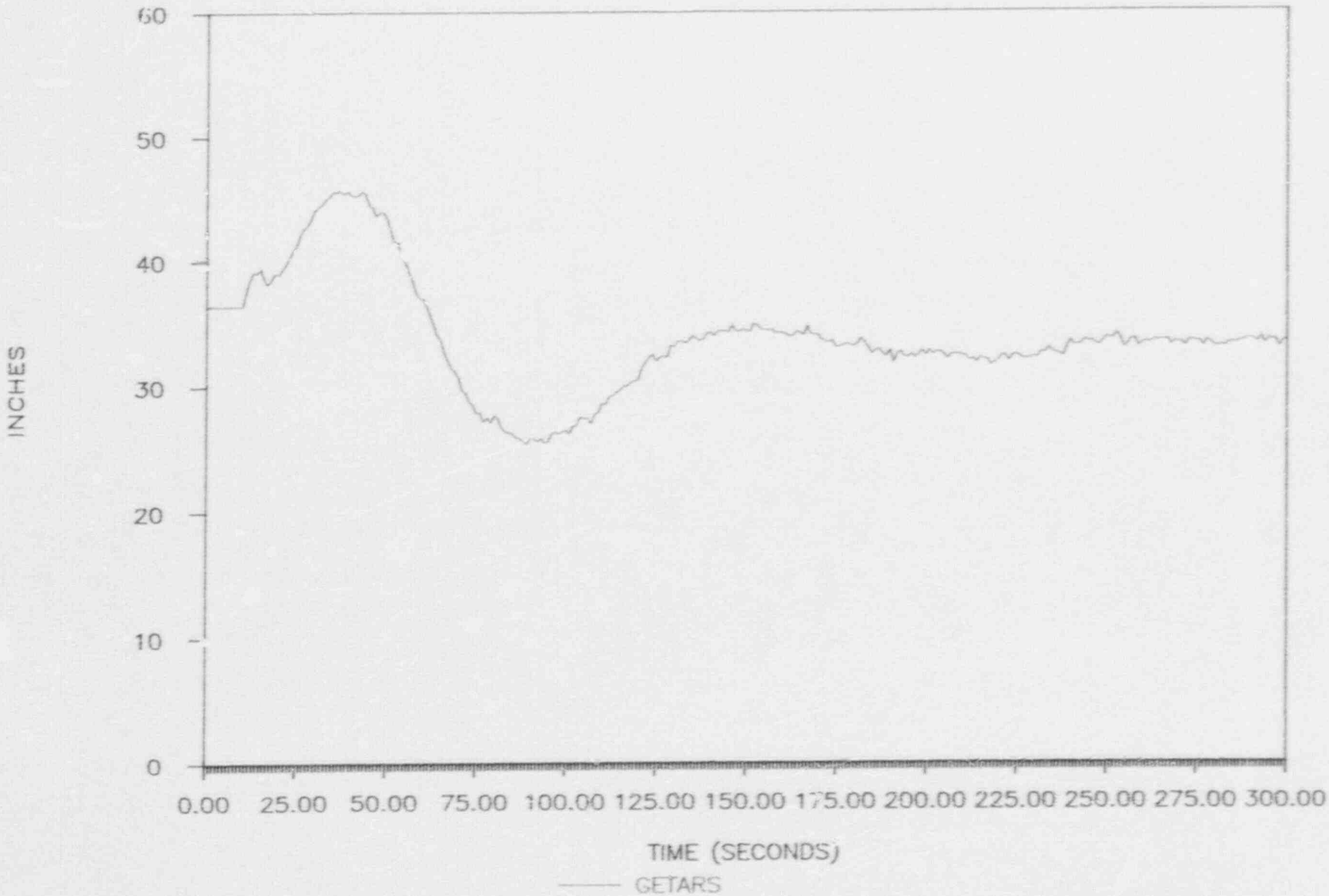
BENCHMARK TRANSIENT 505 TEST

NARROW RANGE REACTOR PRESSURE



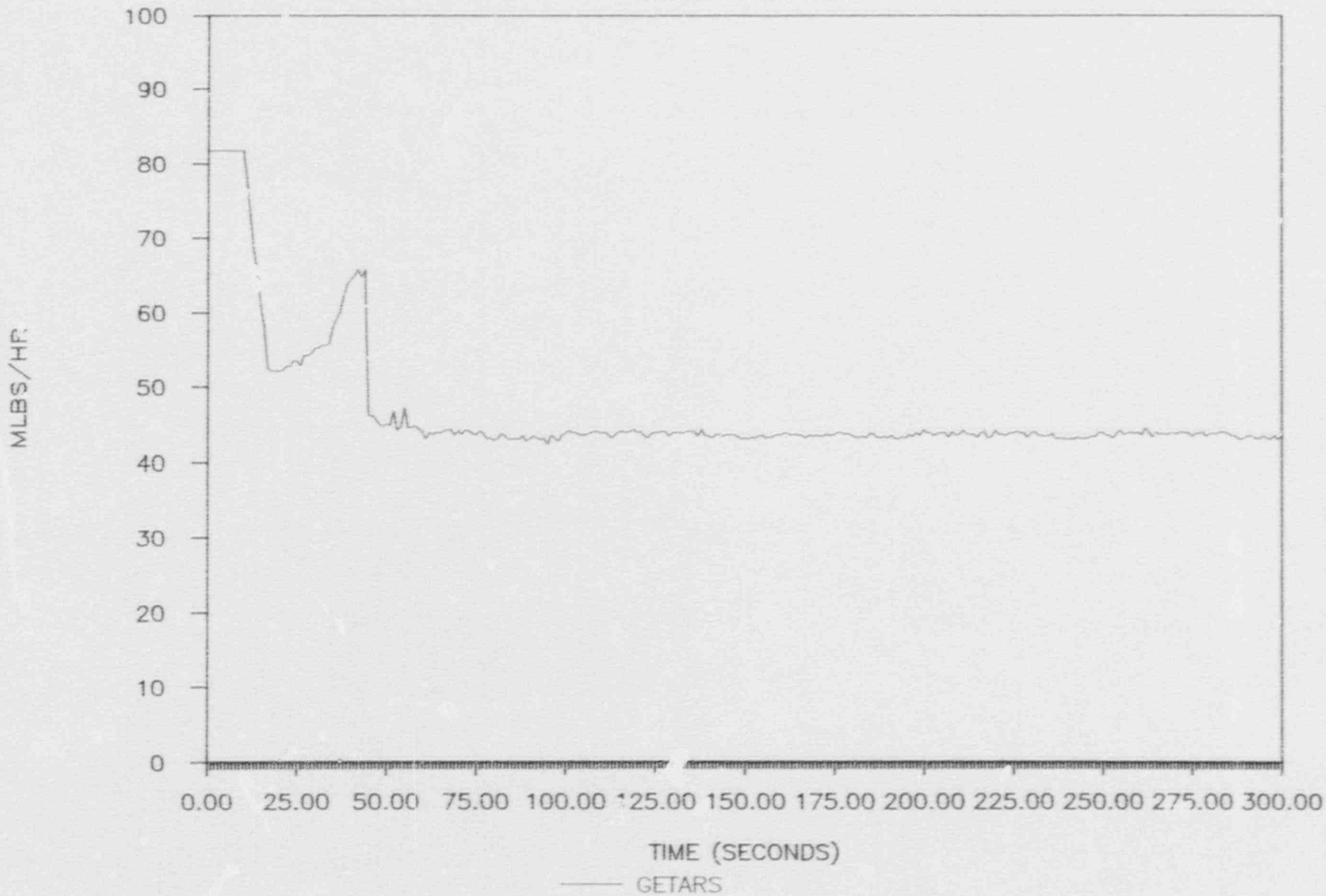
BENCHMARK TRANSIENT 505 TEST

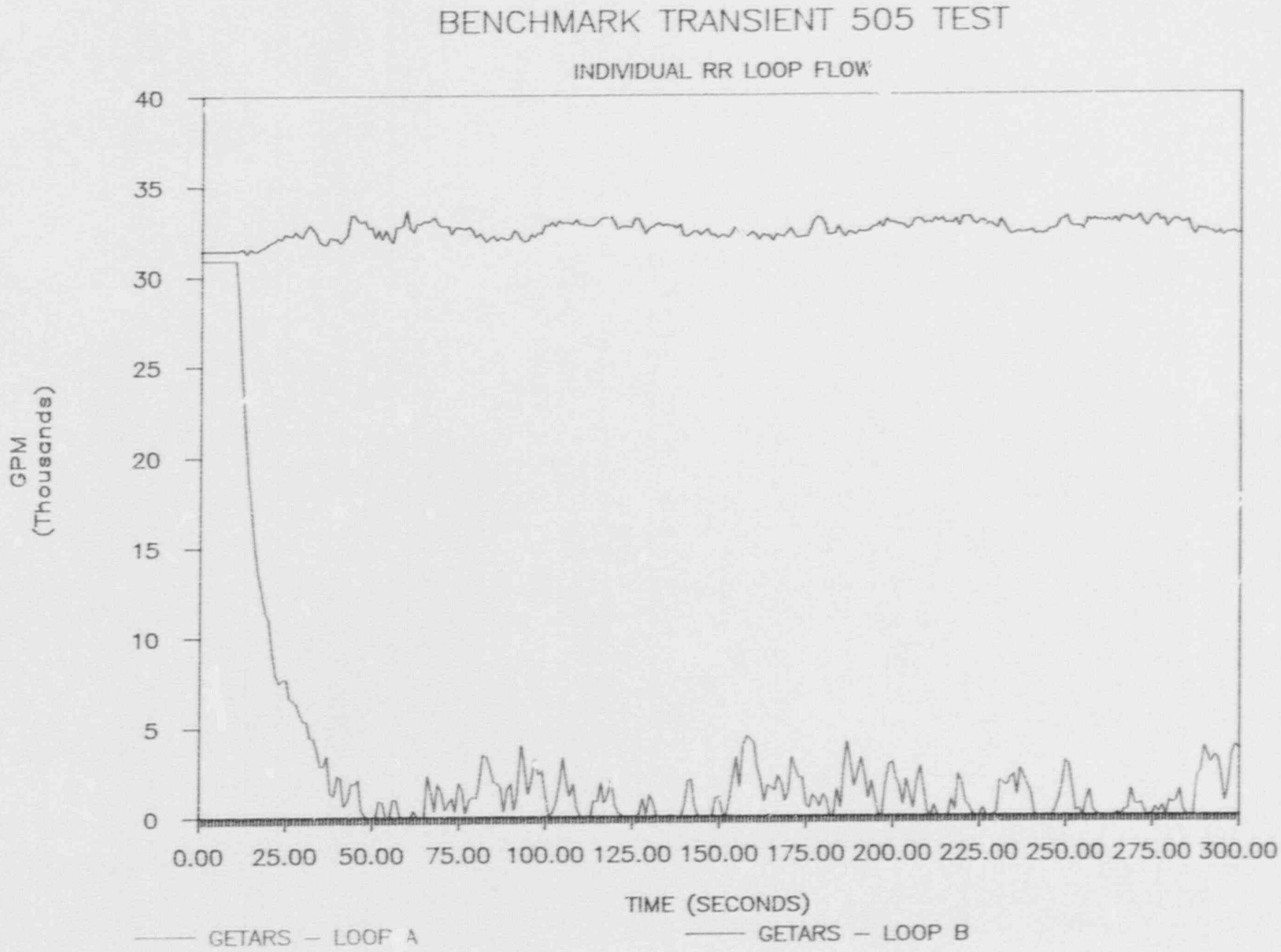
NARROW RANGE REACTOR WATER LEVEL



BENCHMARK TRANSIENT 505 TEST

TOTAL CORE FLOW




BENCHMARK TRANSIENT 505 TEST
INDIVIDUAL RR LOOP FLOW
GPM
(Thousands)
40
35
30
25
20
15
10
5
0
0.00
25.00
50.00
75.00
100.00
125.00
150.00
175.00
200.00
225.00
250.00
275.00
300.00
TIME (SECONDS)
GETARS – LOOP A
GETARS – LOOP B

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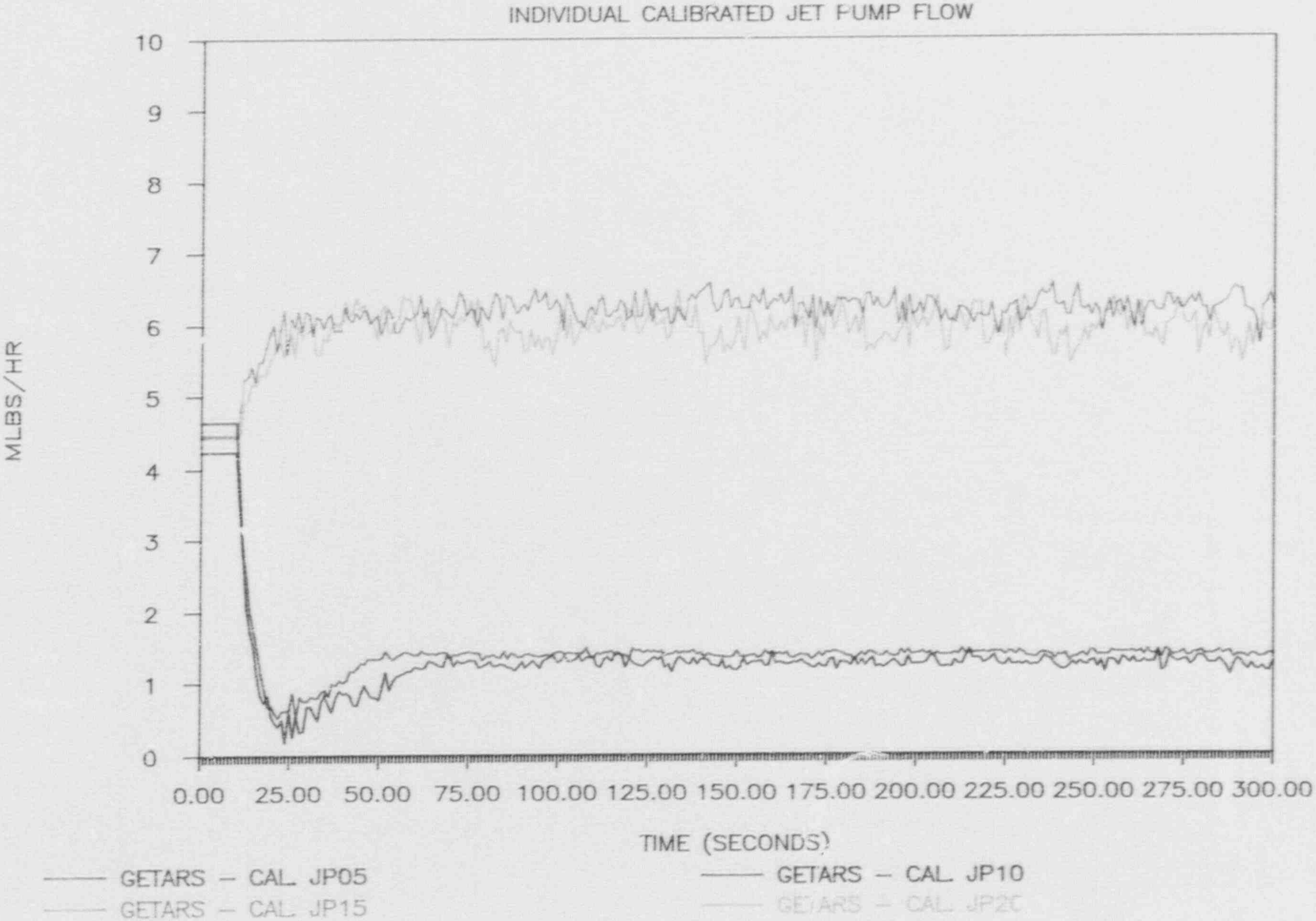
BENCHMARK TRANSIENT 505 TEST



SIMULATOR CERTIFICATION TEST SUMMARY

Test Name: STP 5.06, Main Turbine Trip (At Max Power Without Scram)

Description: This test provides a benchmark comparison between the simulator and plant for a main turbine trip, at a power level within the steam bypass capability.

The simulator was initialized at approximately 32% power. Data recording began. Approximately 10 seconds later, a malfunction was activated which tripped the main turbine. No operator actions were taken. The simulator was allowed to stabilize. After 3 minutes the simulator was placed in freeze and data recording was terminated.

Simulator performance was observed during the transient to ensure that alarms, automatic actions, and indications were appropriate for the transient. No violations of the physical laws of nature were observed.

This test was intended to meet the objectives of ANSI/ANS-3.5-1985, Appendix B, and footnote 3 of the standard.

Simulator Features Tested:

Simulator data recording capability at a resolution of 0.5 seconds.

Initial Conditions:

The simulator was operating at approximately 32% power.

Final Conditions:

The simulator was stable following a turbine trip from approximately 32% power.

SIMULATOR CERTIFICATION TEST SUMMARY

Test Name: STP 5.06, Main Turbine Trip (At Max Power Without Scram) (Cont'd)

Baseline Data Source:

Plant Dat -GE Transient Recording System (GETARS)

Comparison:

The following simulator parameters were compared to the available baseline data. The magnitude and direction of change of all parameters were evaluated as acceptable.

Parameter	Evaluation
Reactor Power	Satisfactory
Total Steam Flow	Satisfactory
Total Feedwater Flow	Satisfactory
Reactor Pressure (WR)	Satisfactory
Reactor Pressure (NR)	Satisfactory
Reactor Level (WR)	Satisfactory
Reactor Level (NR)	Satisfactory
Generator Power	Satisfactory
Turbine Steam Flow	GETARS Data Unavailable
Total Core Flow	Satisfactory
Total RR Loop Flow	Satisfactory

There are some differences between simulator and GETARS feedwater flow. Additionally, there are small variations in reactor water level indications. While these have been evaluated as satisfactory, the simulator Feedwater Level Control System is being evaluated for possible future improvements.

CPS licensed operators have reviewed the simulator data for the parameter having no corresponding GETARS data, and have judged simulator performance to be acceptable and consistent with that expected for the transient.

SIMULATOR CERTIFICATION TEST SUMMARY

Test Name: STP 5.06, Main Turbine Trip (At Max Power Without Scram) (Cont'd)

Comparison (cont'd):

Graphs of simulator and GETARS data follow this test summary. When all parameters are considered, the overall simulator response to this transient is satisfactory.

Deficiencies Found:

None

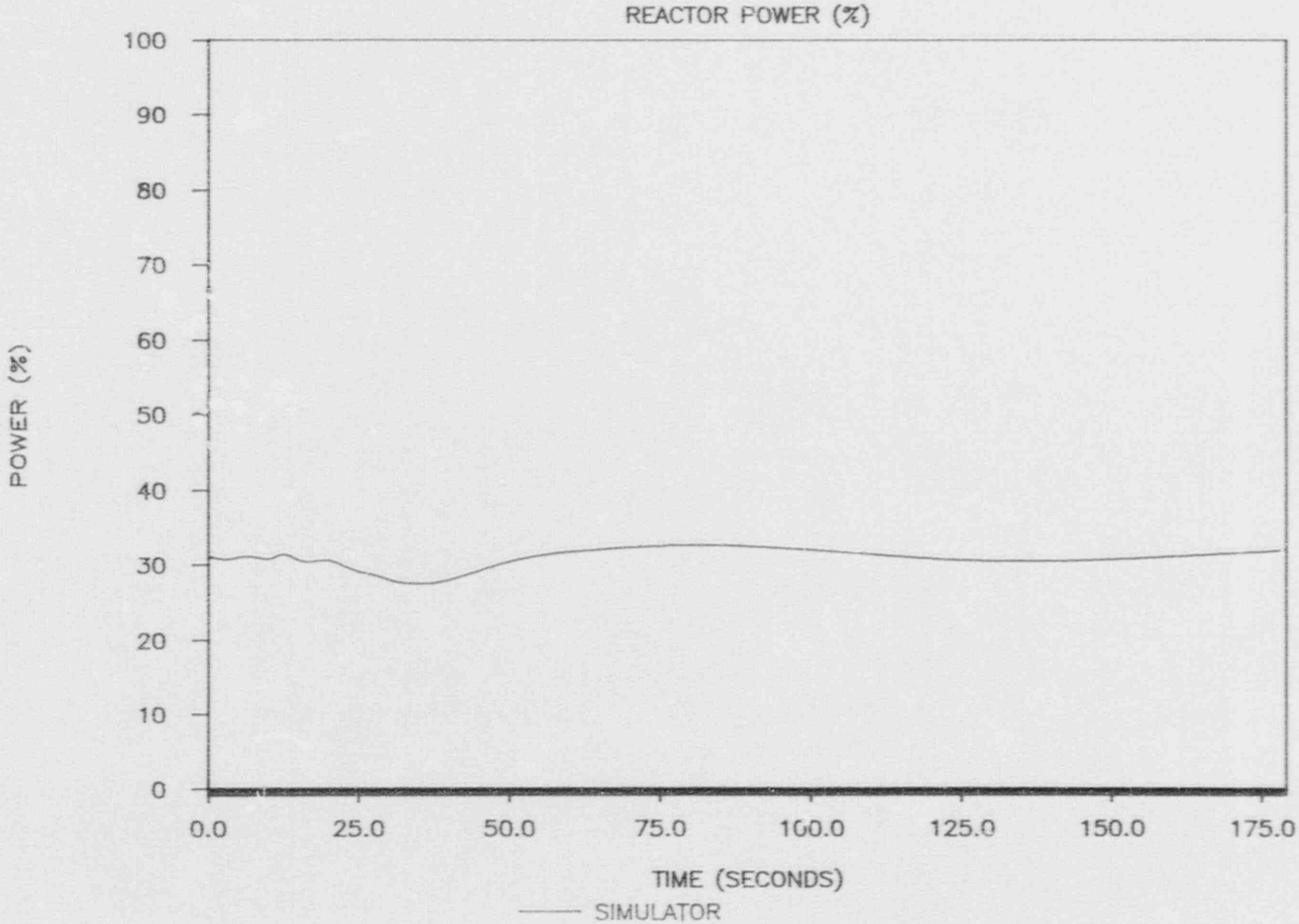
Corrective Actions Planned (and schedule):

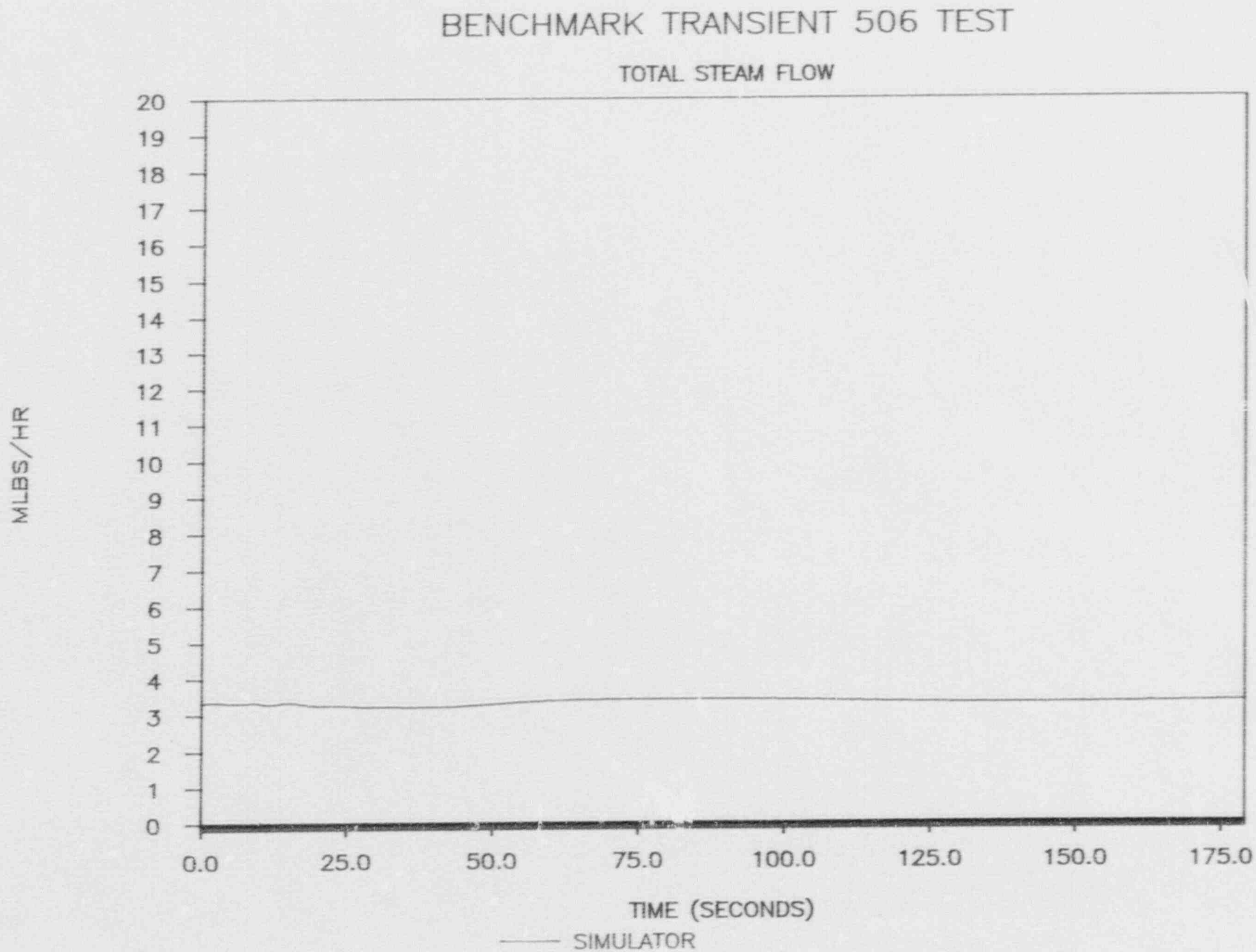
None

Exceptions Taken/Justification:

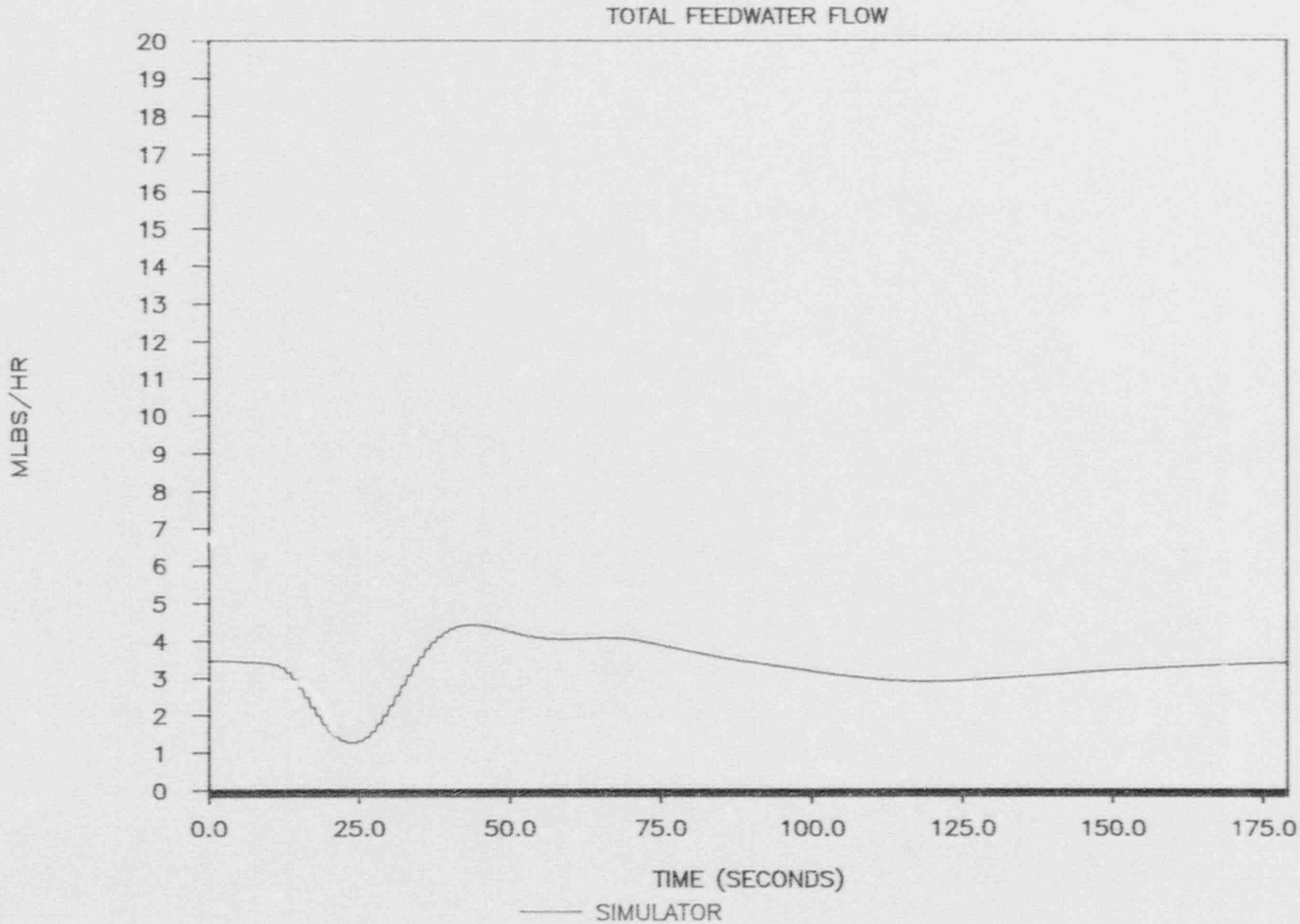
None

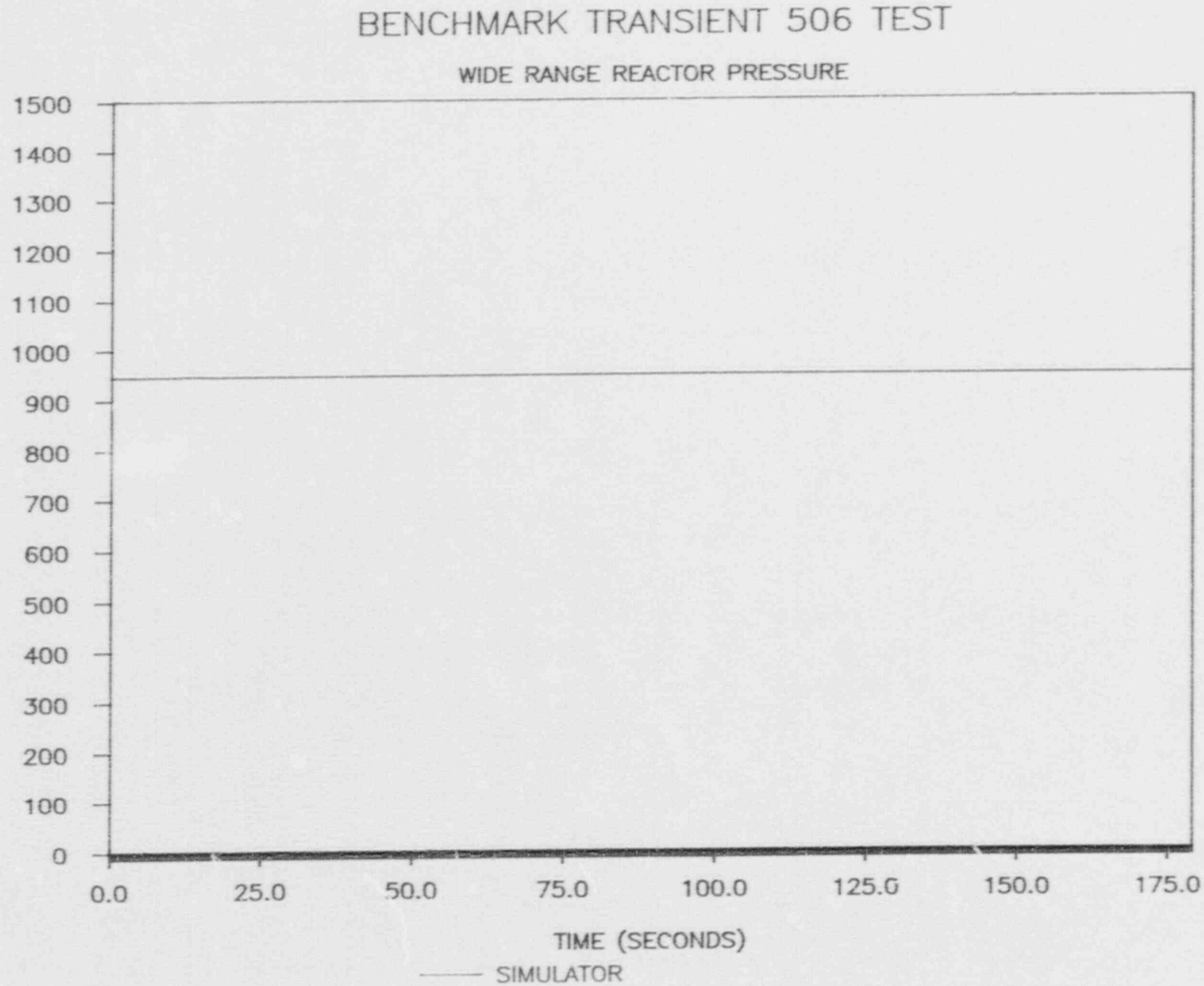
BENCHMARK TRANSIENT 506 TEST



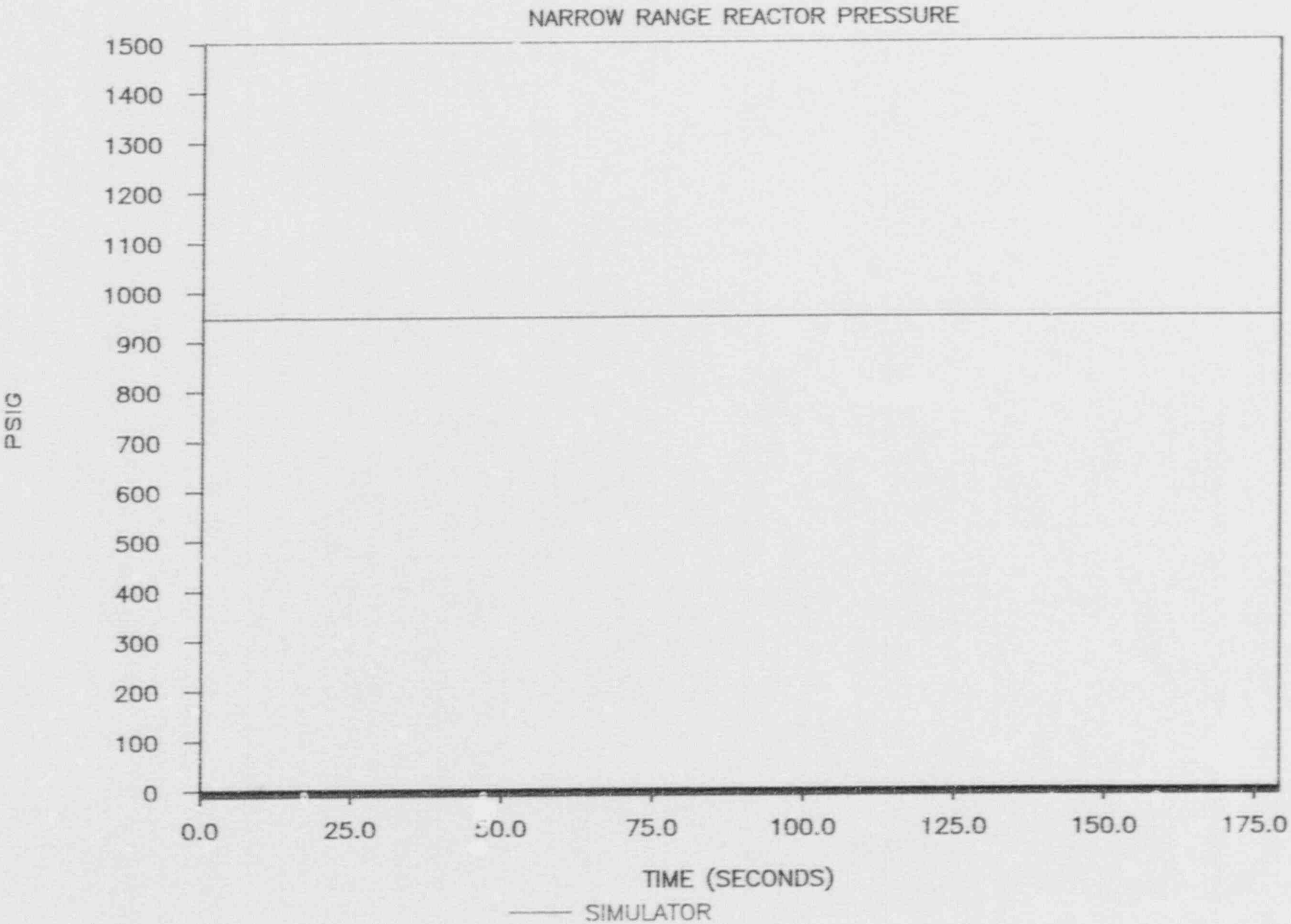

BENCHMARK TRANSIENT 506 TEST
TOTAL STEAM FLOW
MLBS/HR
20
19
18
17
16
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
0.0
25.0
50.0
75.0
100.0
125.0
150.0
175.0
TIME (SECONDS)
SIMULATOR

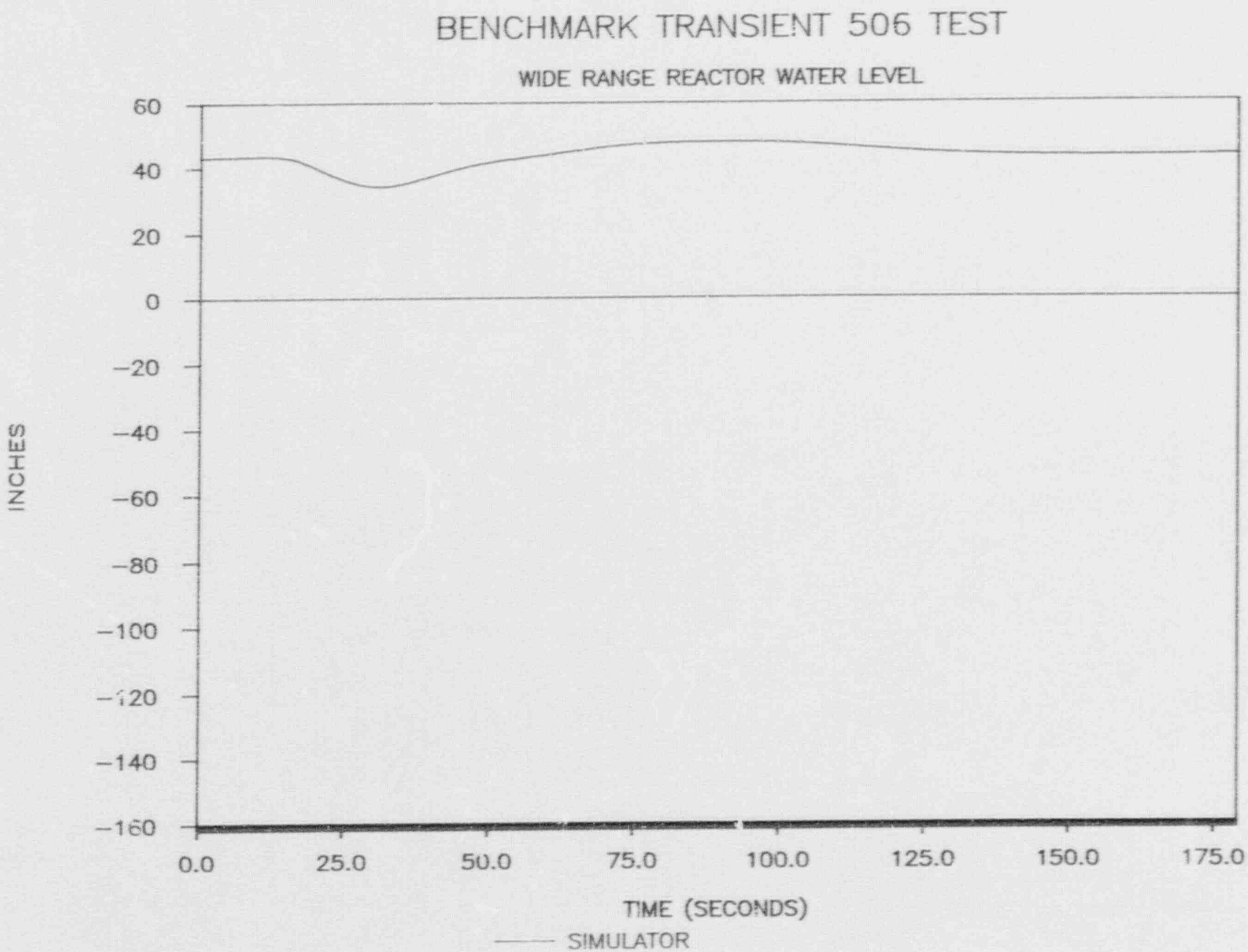
BENCHMARK TRANSIENT 506 TEST




BENCHMARK TRANSIENT 506 TEST
WIDE RANGE REACTOR PRESSURE
PSIG
1500
1400
1300
1200
1100
1000
900
800
700
600
500
400
300
200
100
0
0.0
25.0
50.0
75.0
100.0
125.0
150.0
175.0
TIME (SECONDS)
SIMULATOR

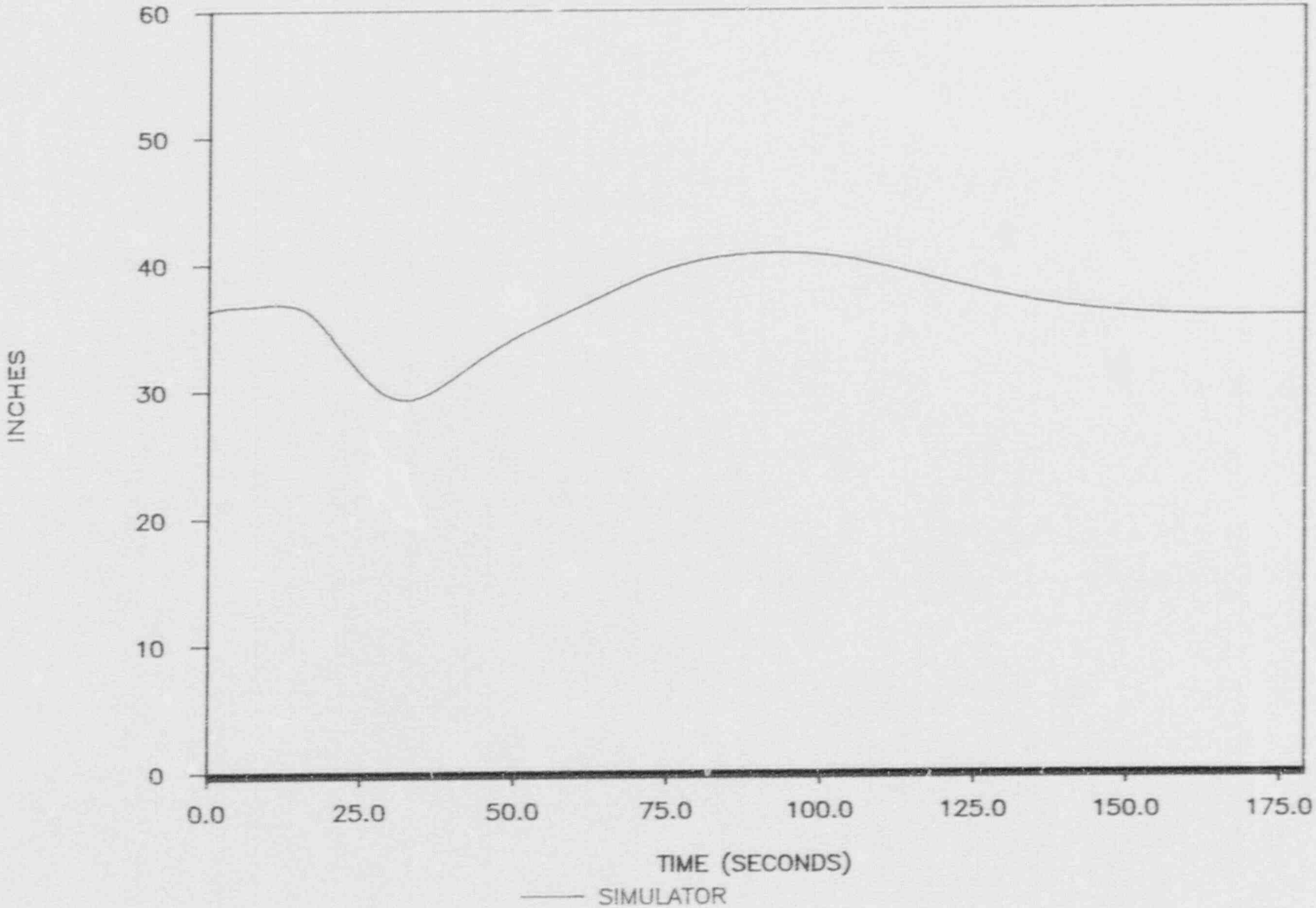
BENCHMARK TRANSIENT 506 TEST

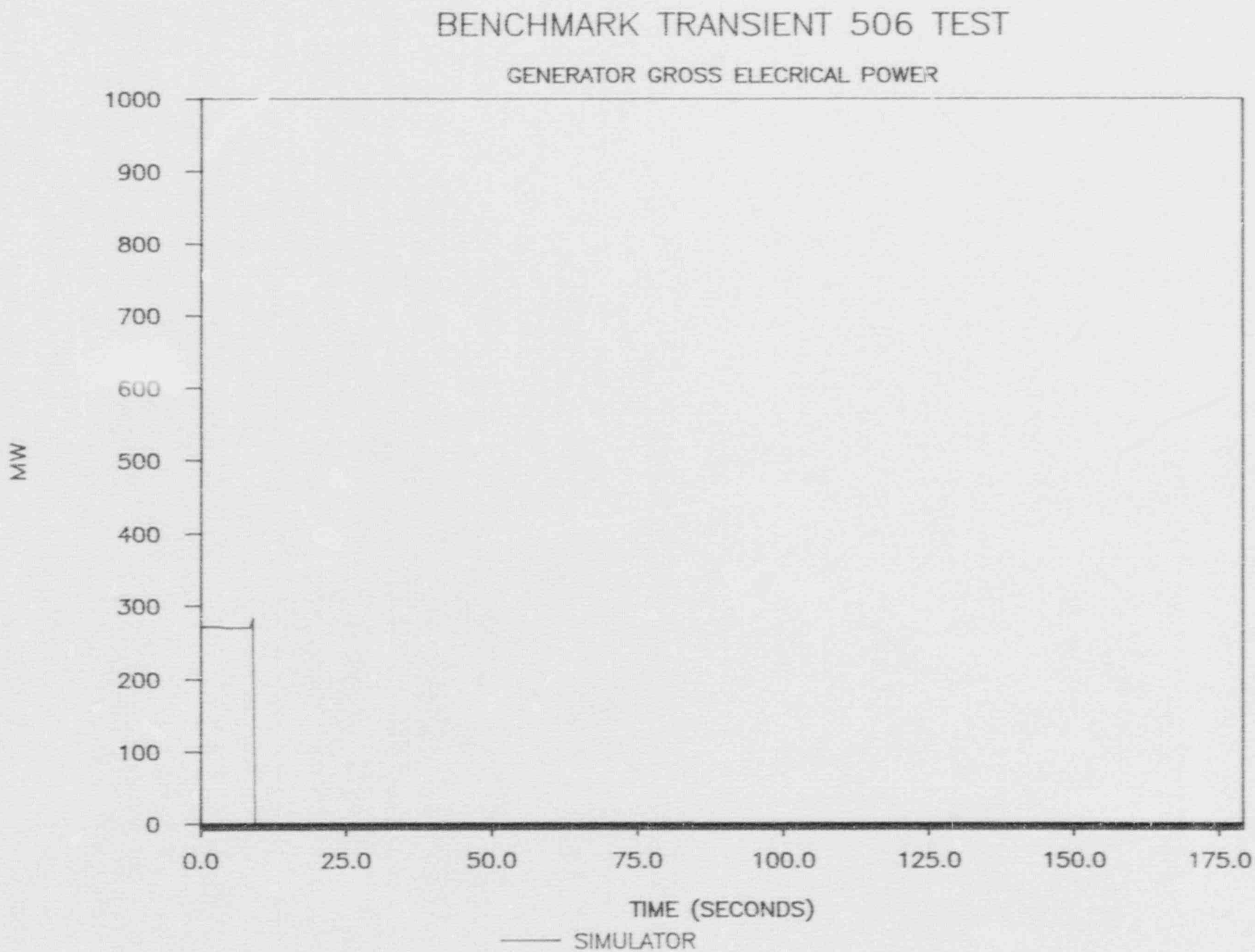



BENCHMARK TRANSIENT 506 TEST
WIDE RANGE REACTOR WATER LEVEL
INCHES
60
40
20
0
−20
−40
−60
−80
−100
−120
−140
−160
0.0
25.0
50.0
75.0
100.0
125.0
150.0
175.0
TIME (SECONDS)
SIMULATOR

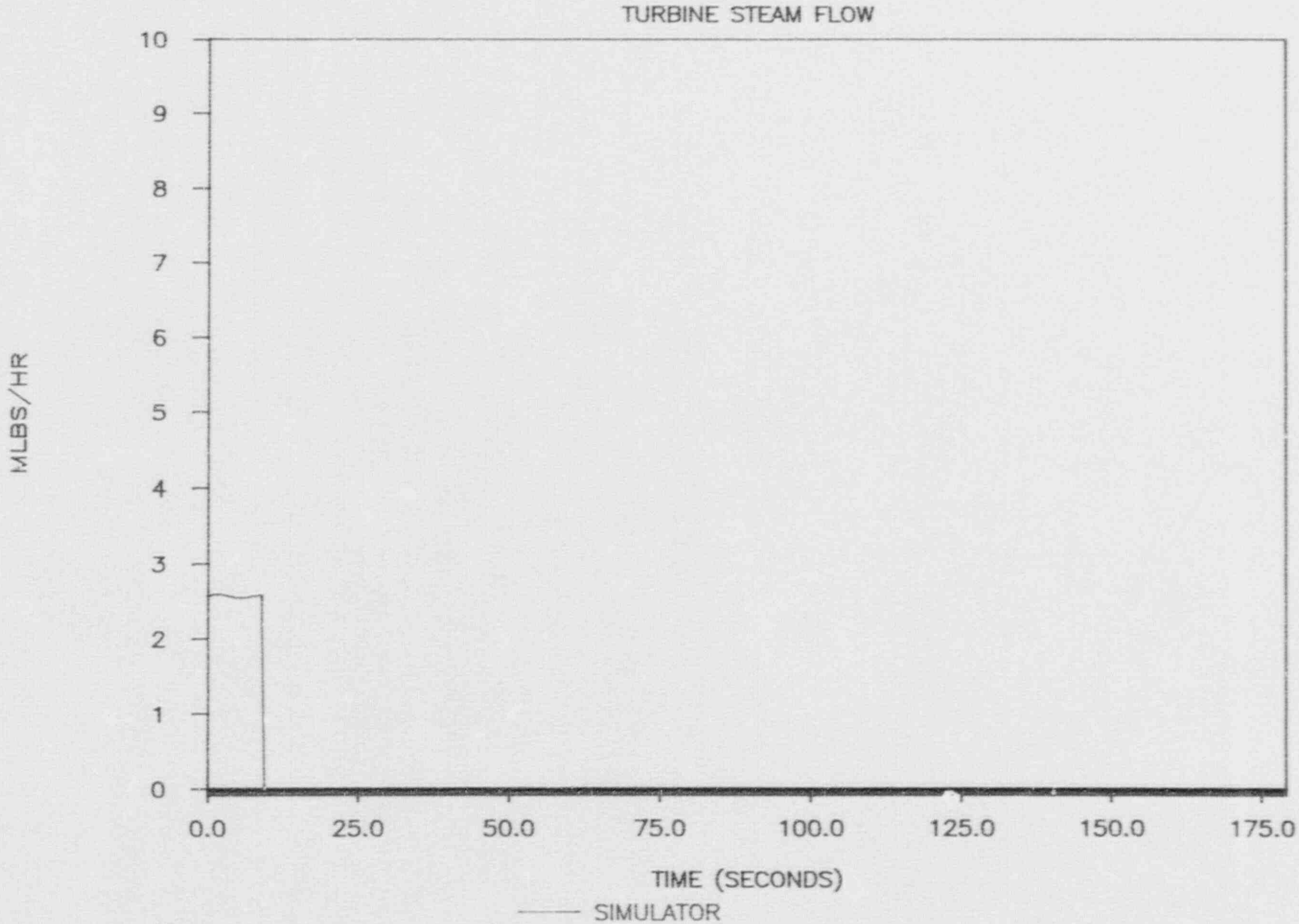
BENCHMARK TRANSIENT 506 TEST

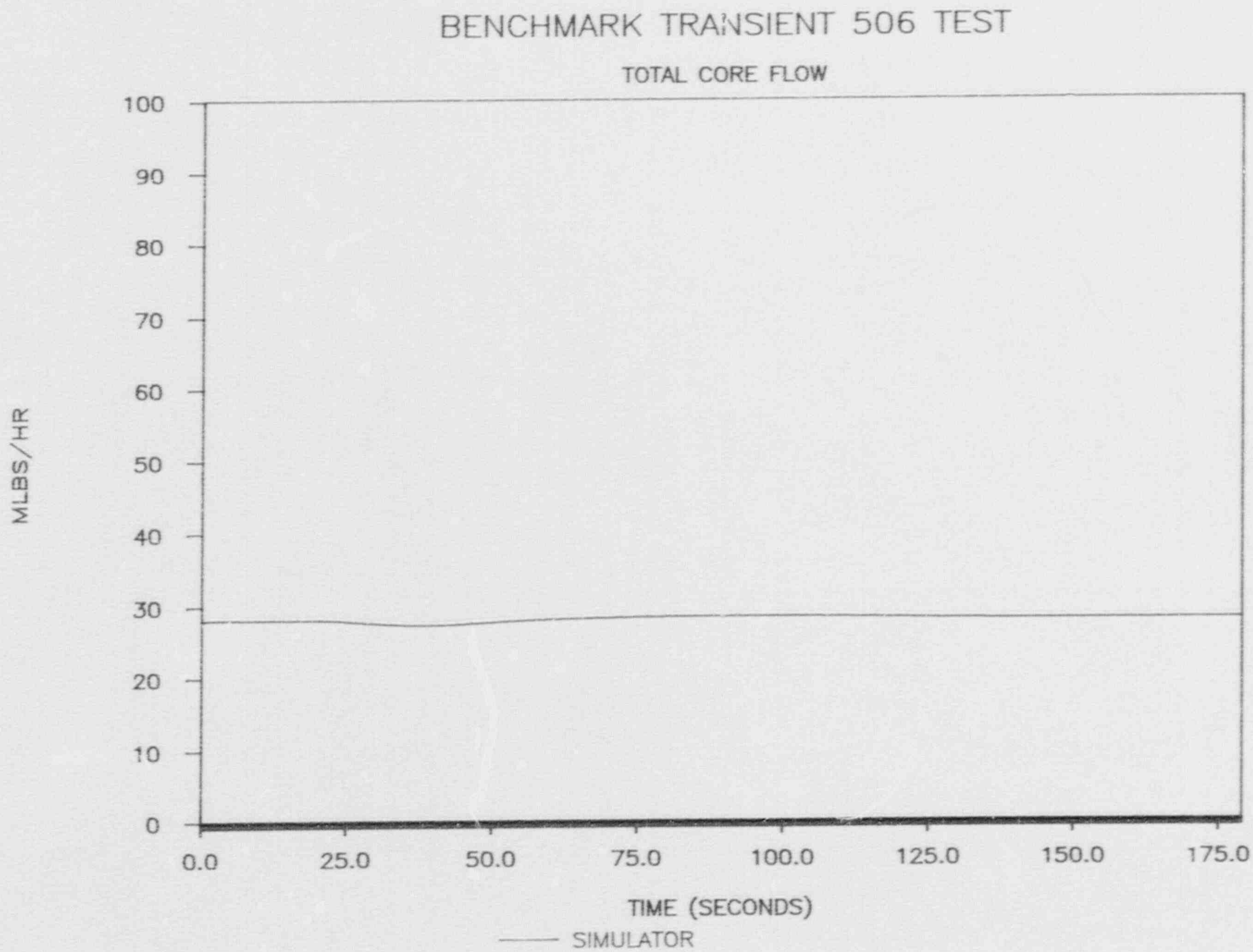
NARROW RANGE REACTOR WATER LEVEL




BENCHMARK TRANSIENT 506 TEST
GENERATOR GROSS ELECRICAL POWER
MW
1000
900
800
700
600
500
400
300
200
100
0
0.0
25.0
50.0
75.0
100.0
125.0
150.0
175.0
TIME (SECONDS)
SIMULATOR

BENCHMARK TRANSIENT 506 TEST





BENCHMARK TRANSIENT 506 TEST
TOTAL CORE FLOW
MLBS/HR
100
90
80
70
60
50
40
30
20
10
0
0.0
25.0
50.0
75.0
100.0
125.0
150.0
175.0
TIME (SECONDS)
SIMULATOR

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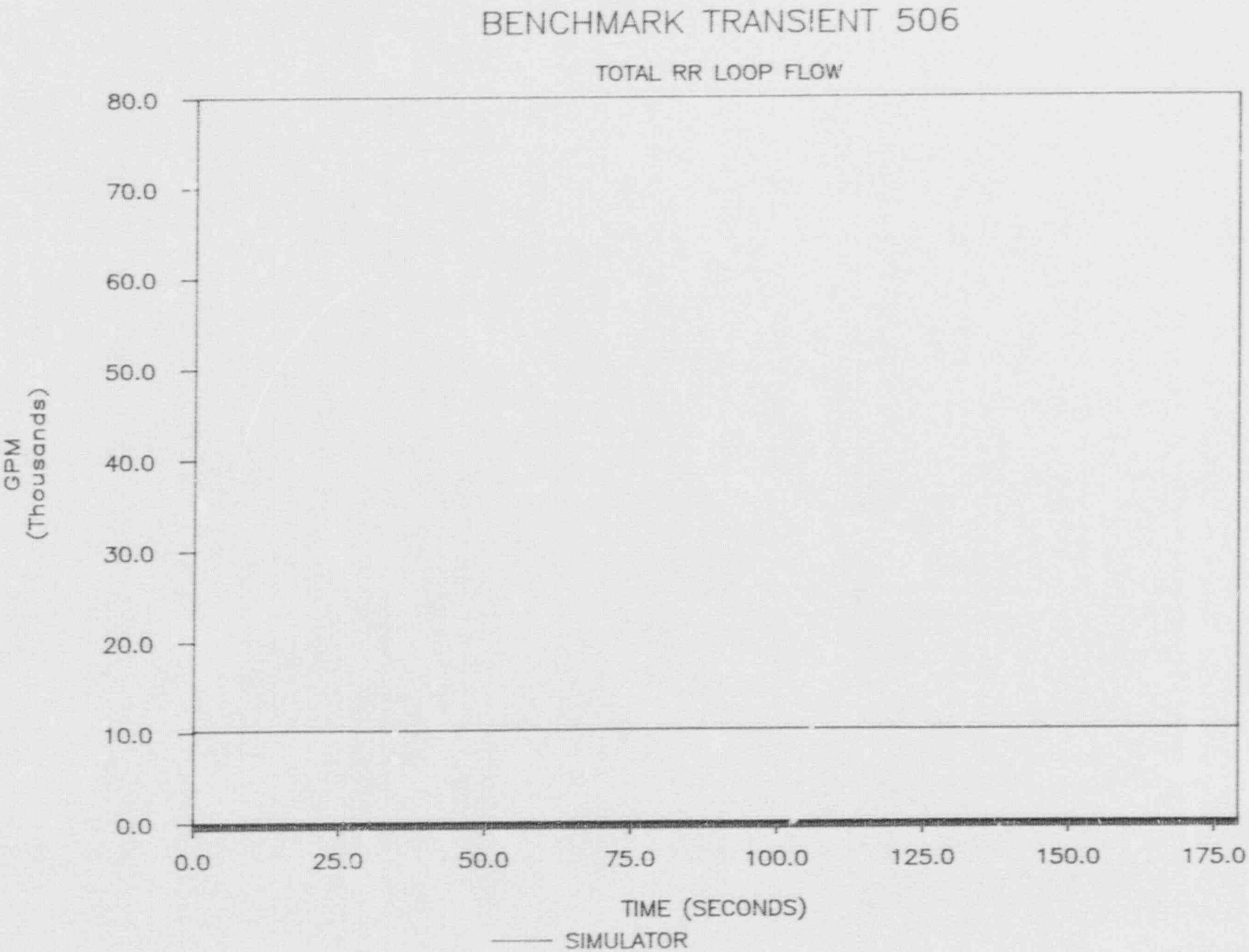
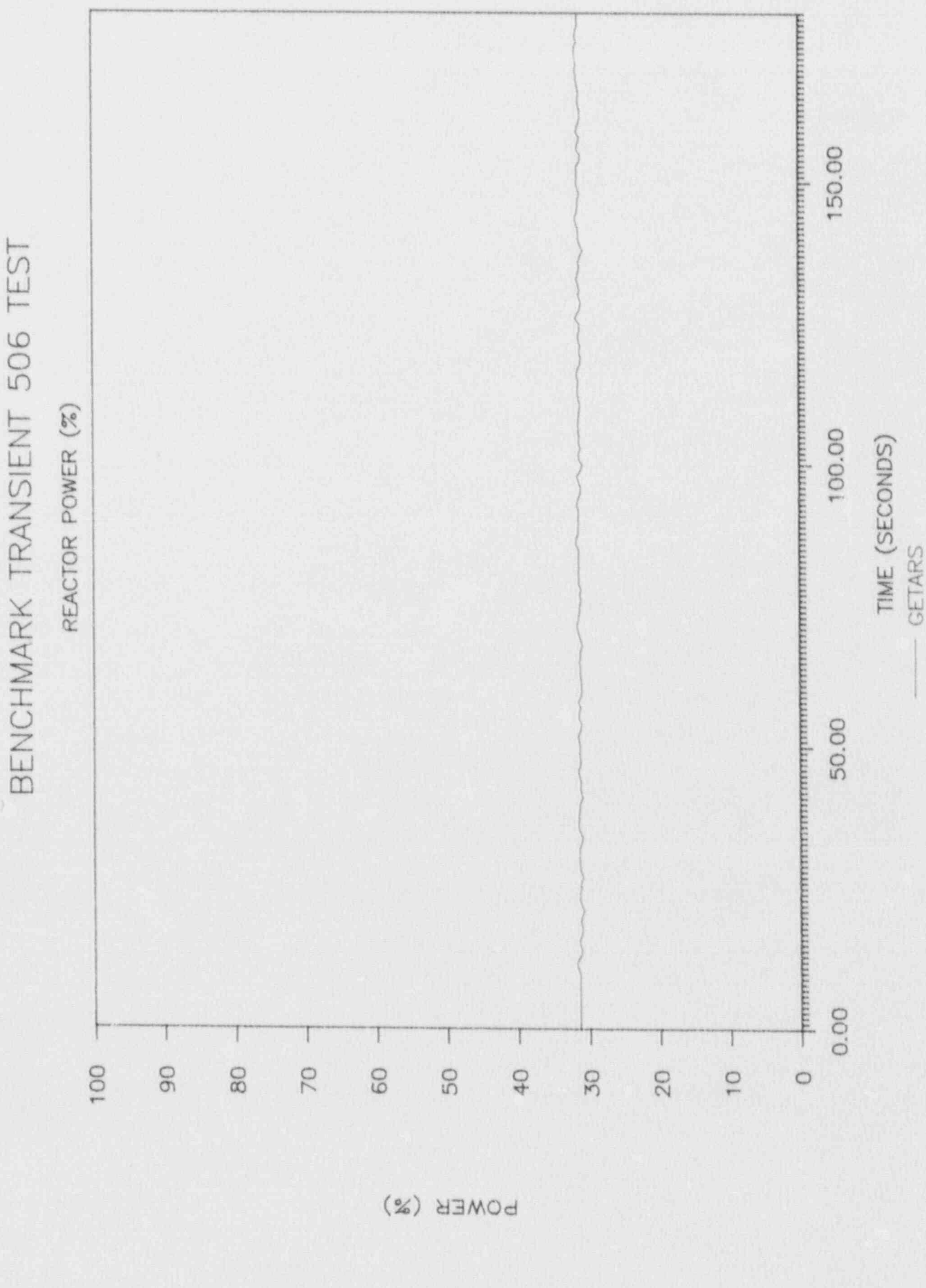
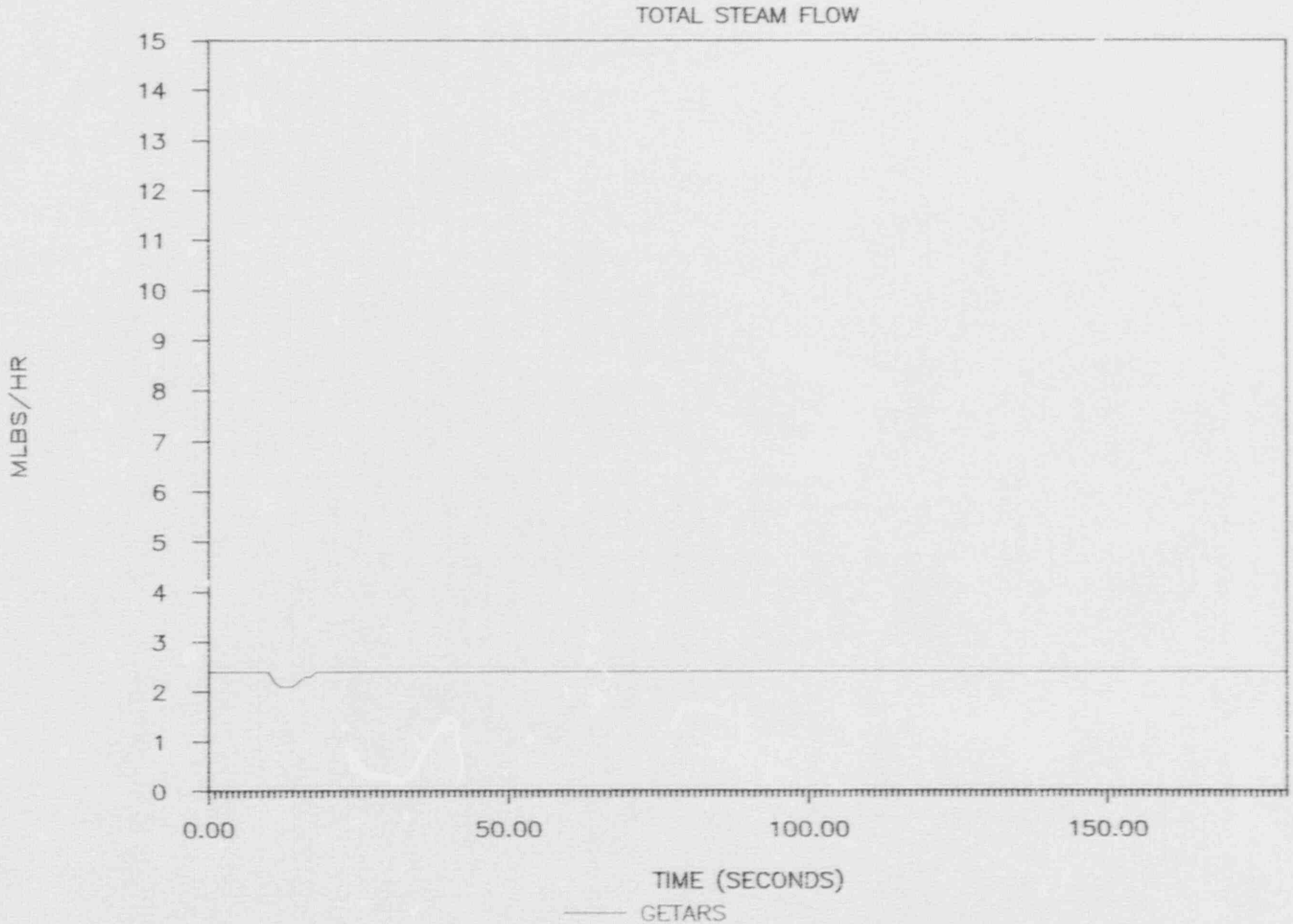
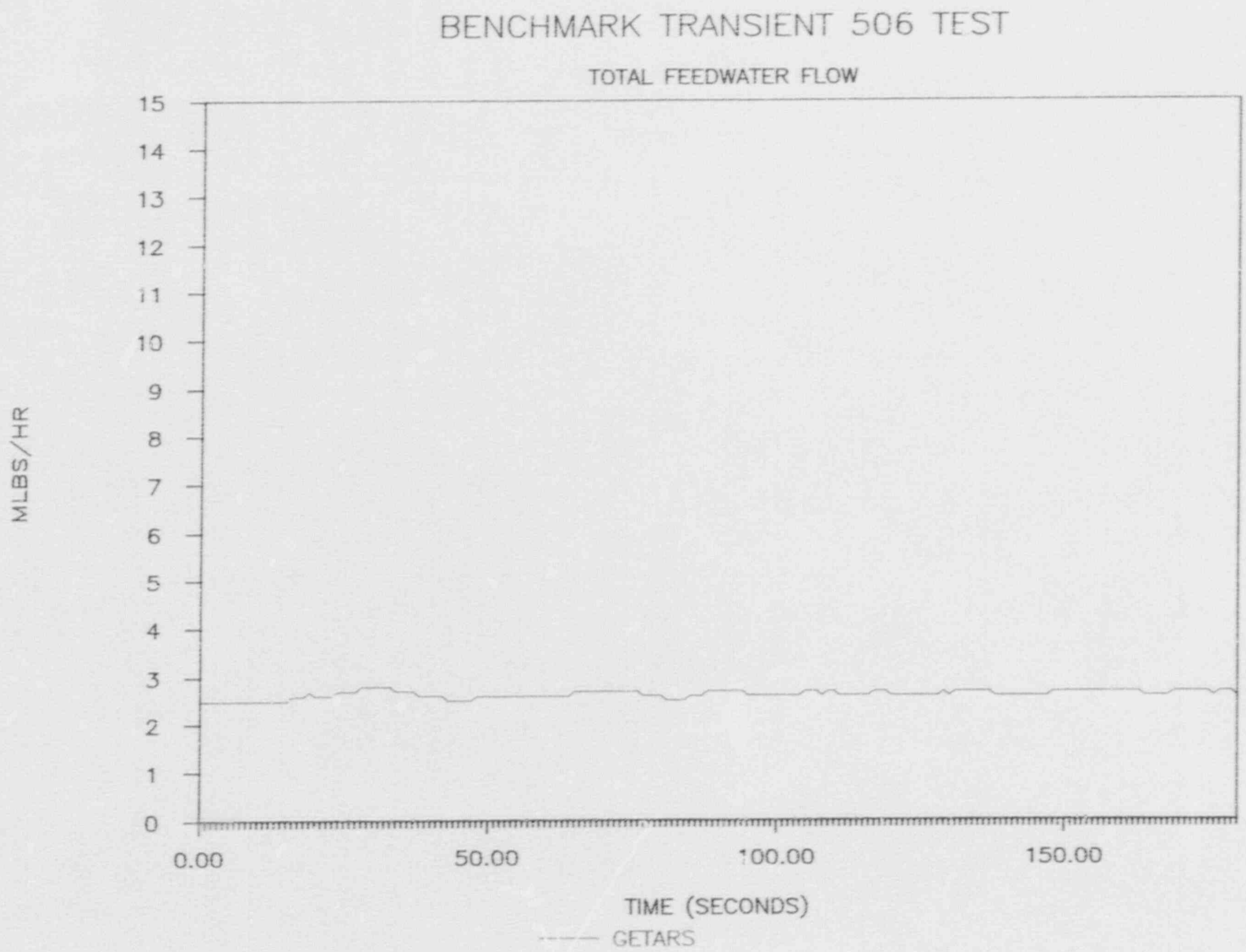

BENCHMARK TRANSIENT 506
TOTAL RR LOOP FLOW
GPM
(Thousands)
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
0.0
25.0
50.0
75.0
100.0
125.0
150.0
175.0
TIME (SECONDS)
SIMULATOR


BENCHMARK TRANSIENT 506 TEST
REACTOR POWER (%)
POWER (%)
100
90
80
70
60
50
40
30
20
10
0
0.00
50.00
100.00
150.00
TIME (SECONDS)
GETARS

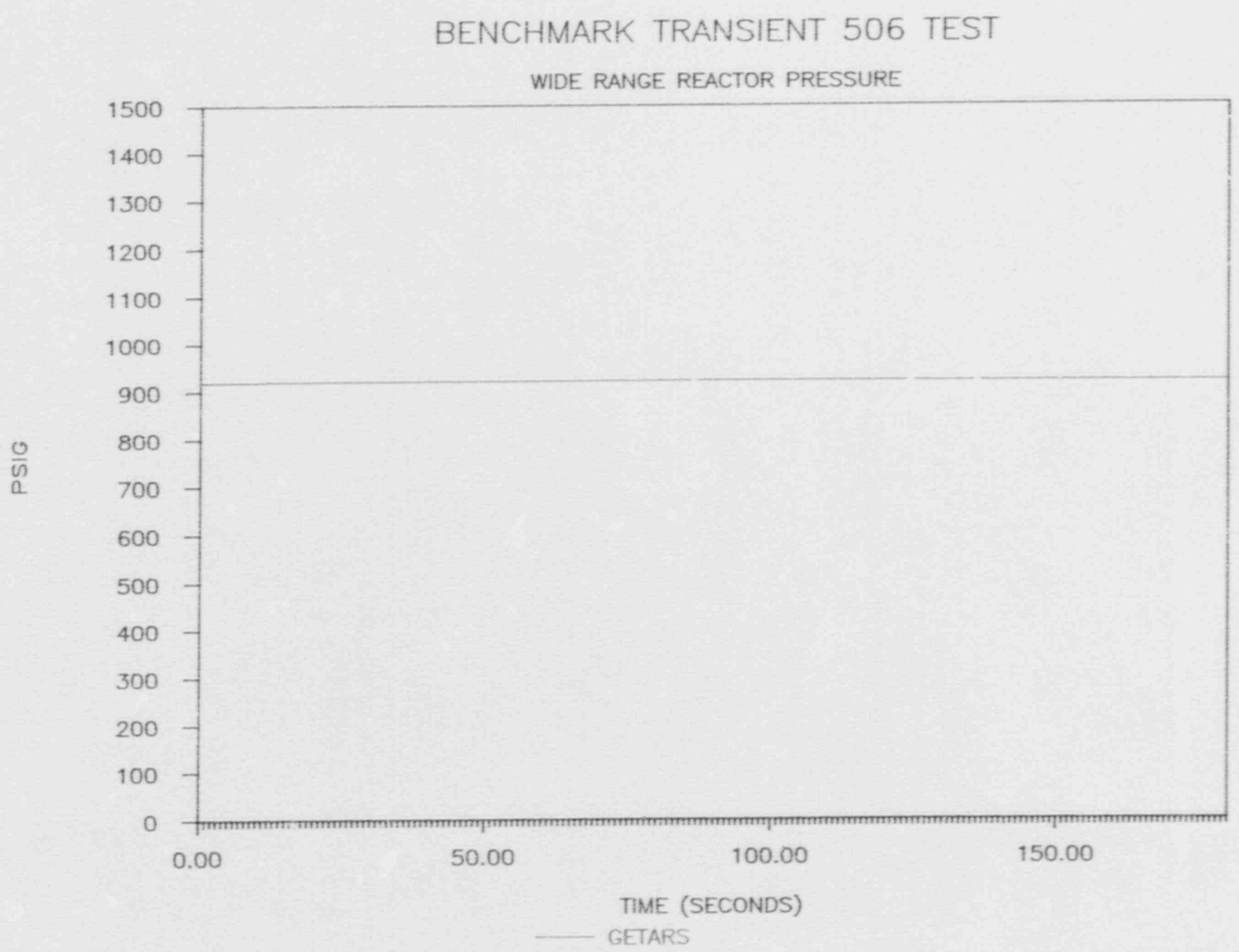
BENCHMARK TRANSIENT 506 TEST





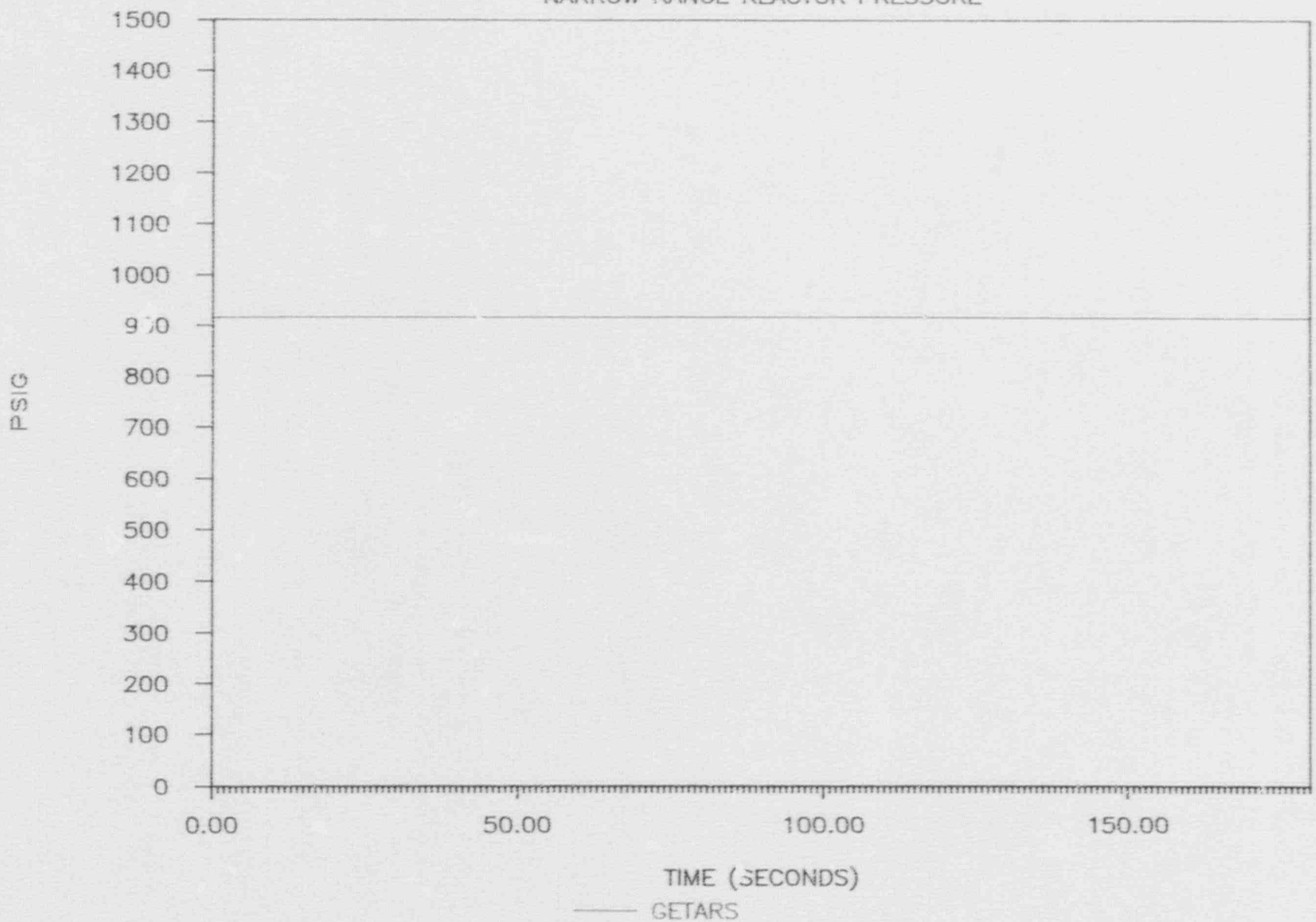
BENCHMARK TRANSIENT 506 TEST
TOTAL FEEDWATER FLOW
MLBS/HR
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
0.00
50.00
100.00
150.00
TIME (SECONDS)
GETARS

Page 296

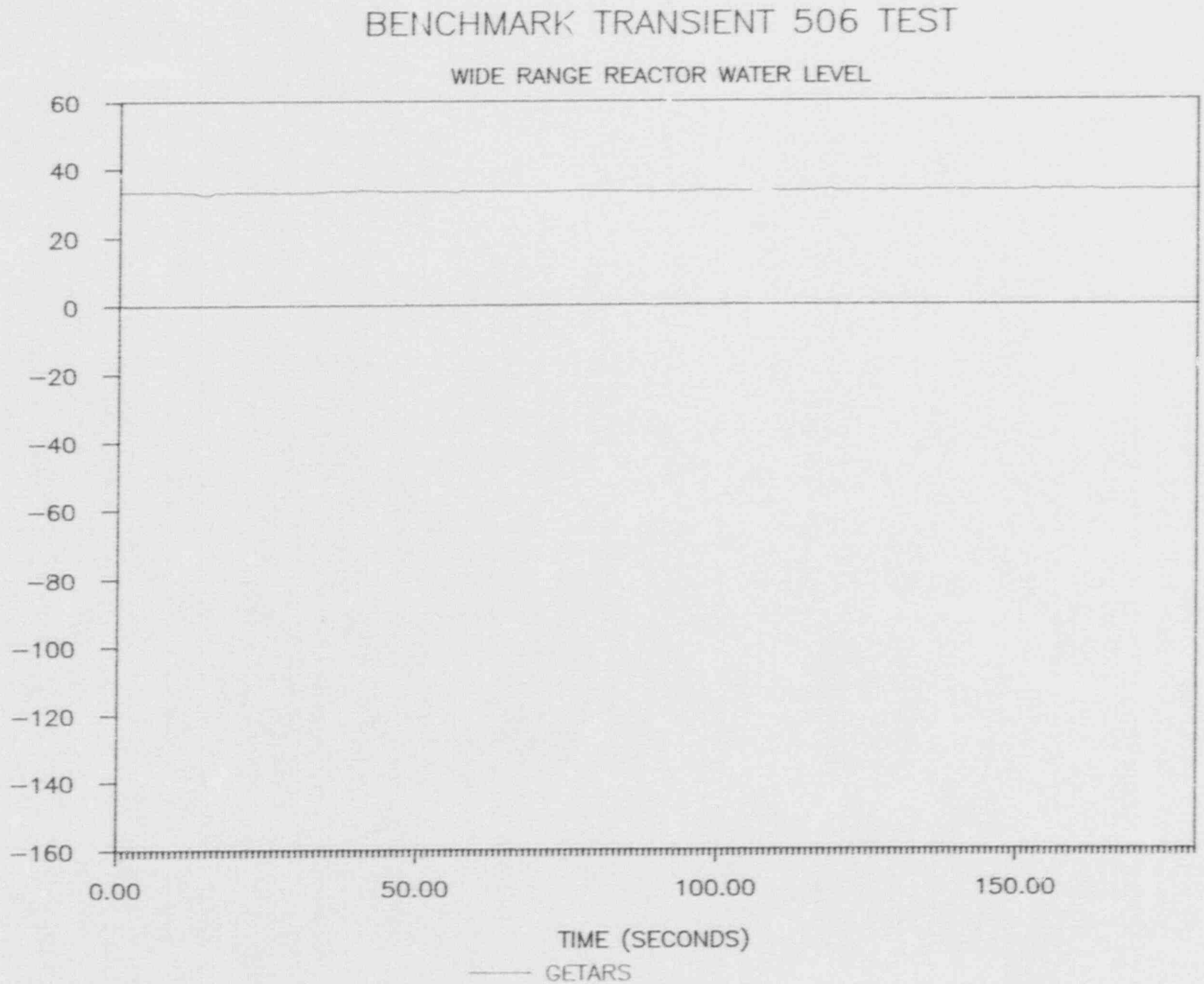

BENCHMARK TRANSIENT 506 TEST
WIDE RANGE REACTOR PRESSURE
PSIG
1500
1400
1300
1200
1100
1000
900
800
700
600
500
400
300
200
100
0
0.00
50.00
100.00
150.00
TIME (SECONDS)
GETARS

BENCHMARK TRANSIENT 506 TEST

NARROW RANGE REACTOR PRESSURE

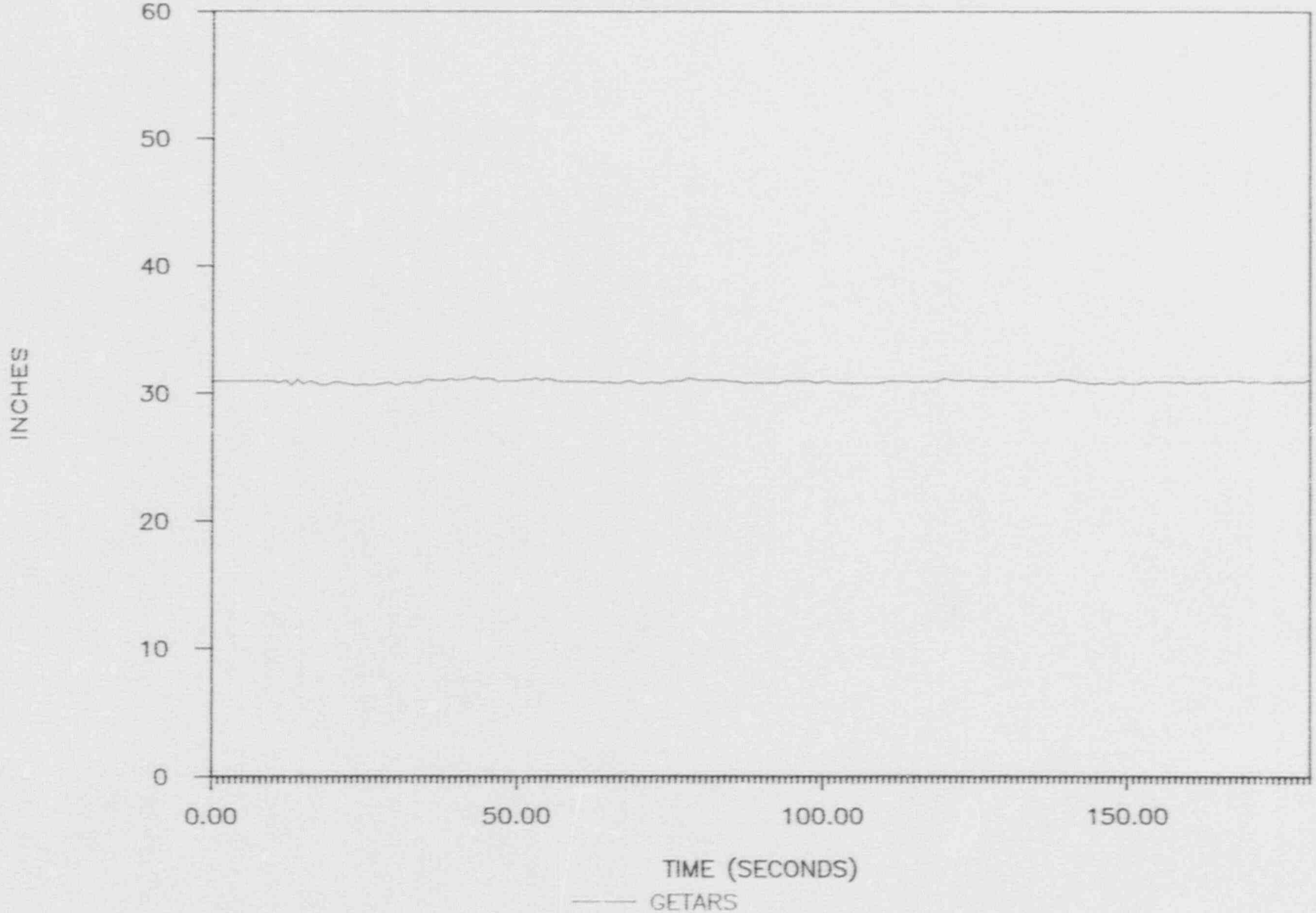


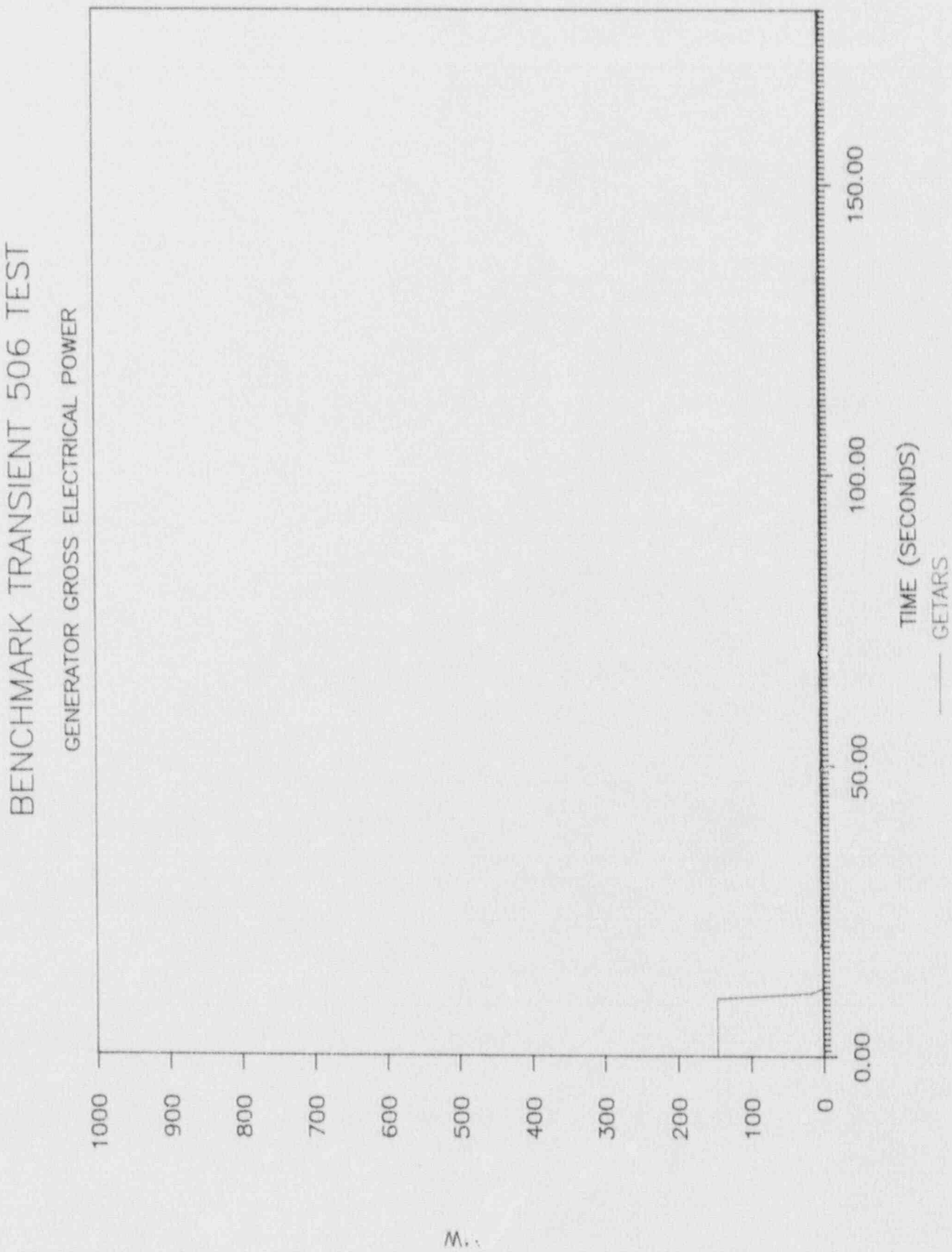
Page 299


BENCHMARK TRANSIENT 506 TEST
WIDE RANGE REACTOR WATER LEVEL
60
40
20
0
−20
−40
−60
−80
−100
−120
−140
−160
INCHES
0.00
50.00
100.00
150.00
TIME (SECONDS)
GETARS

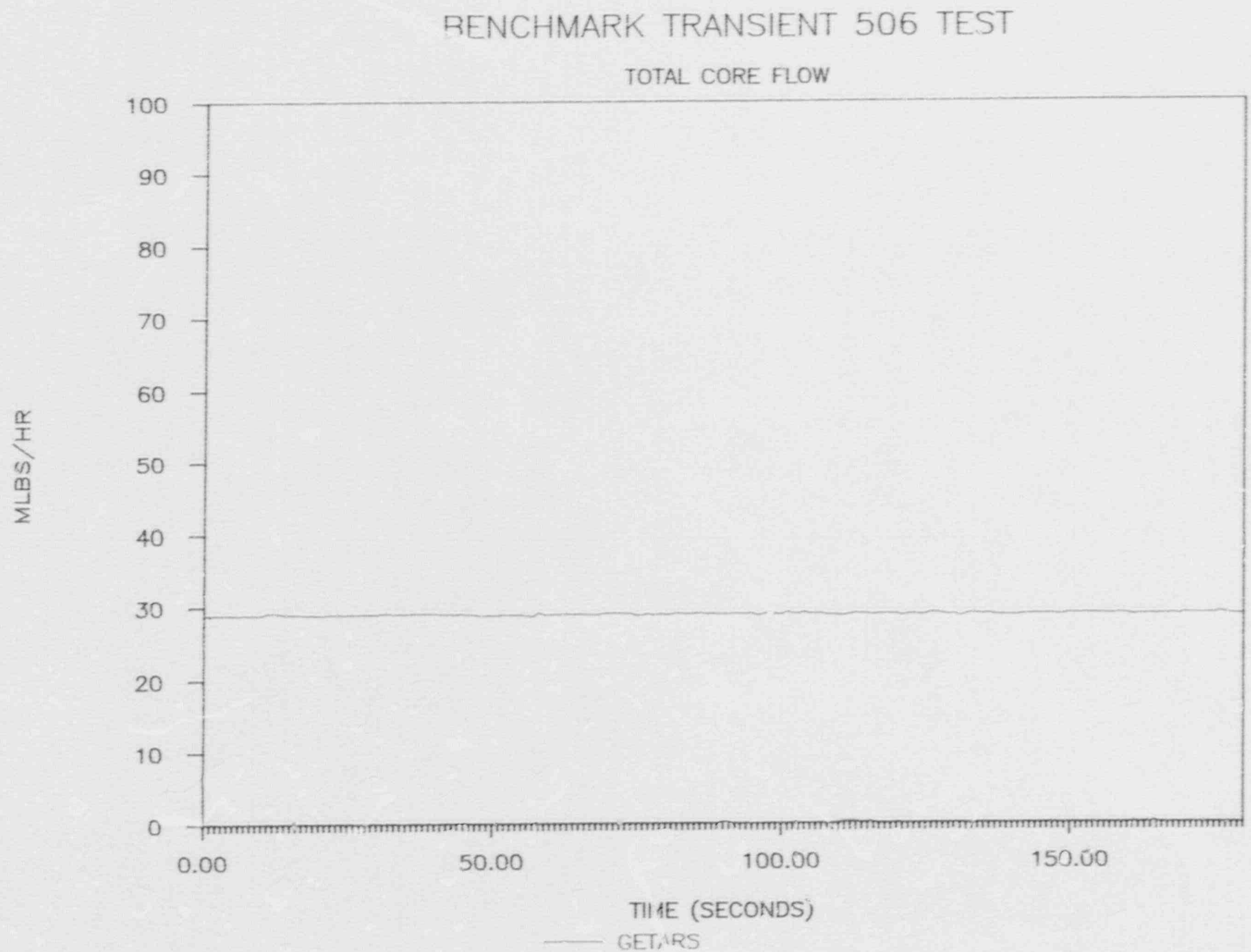
BENCHMARK TRANSIENT 506 TEST

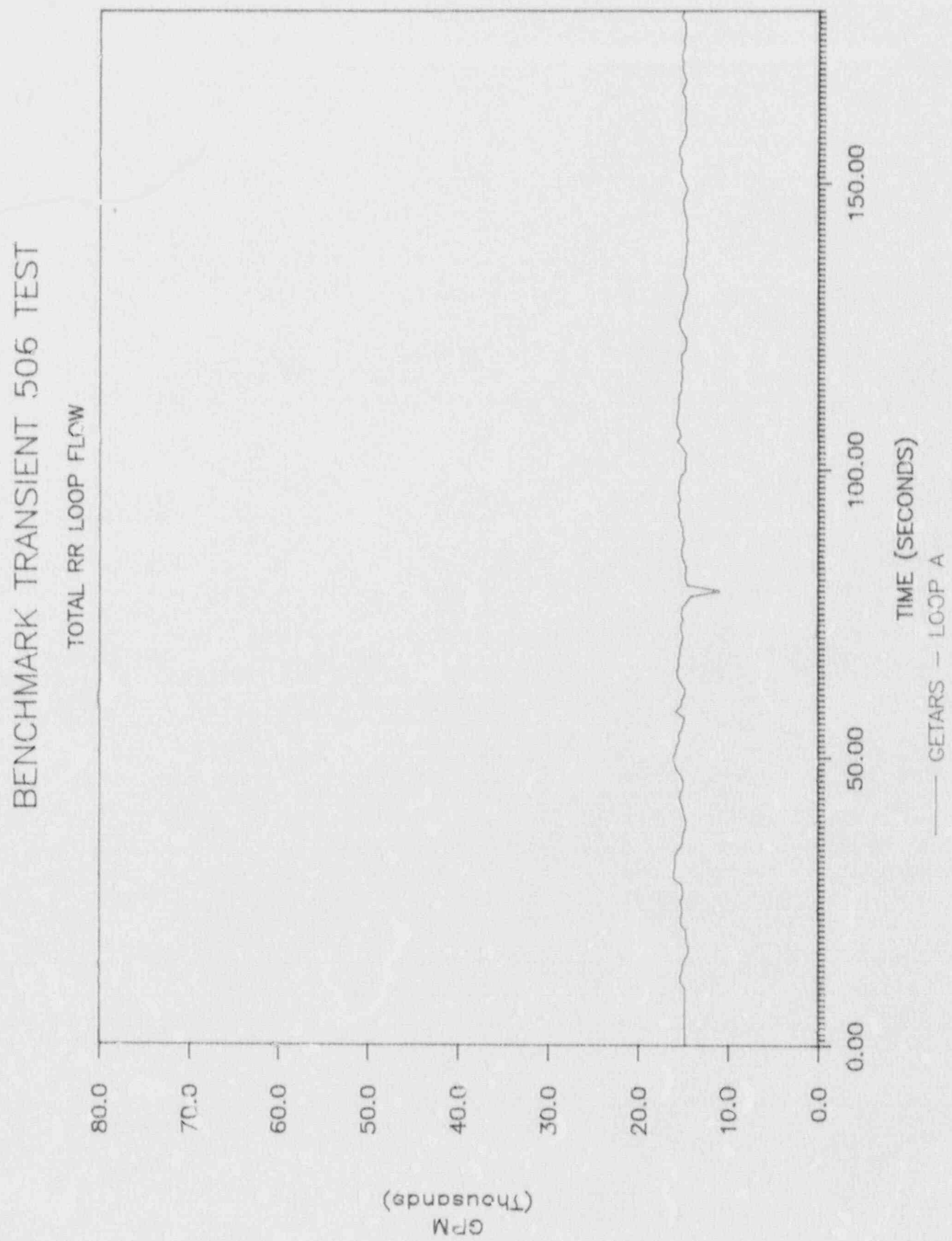
NARROW RANGE REACTOR WATER LEVEL





BENCHMARK TRANSIENT 506 TEST
GENERATOR GROSS ELECTRICAL POWER
1000
900
800
700
600
500
400
300
200
100
0
0.00
50.00
100.00
150.00
TIME (SECONDS)
GETARS


BENCHMARK TRANSIENT 506 TEST
TOTAL CORE FLOW
MLBS/HR
100
90
80
70
60
50
40
30
20
10
0
0.00
50.00
100.00
150.00
TIME (SECONDS)
GETARS


BENCHMARK TRANSIENT 506 TEST
TOTAL RR LOOP FLOW
GPM
(Thousands)
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
0.00
50.00
100.00
150.00
TIME (SECONDS)
GETARS – LOOP A

SIMULATOR CERTIFICATION TEST SUMMARY

Test Name: STP 5.07, Maxi..m Rate Power Ramp Down to Approximately 75% Then Back Up to 100%

Description: This test provides a benchmark comparison between the simulator and plant for a maximum rate of power swing.

The simulator was initialized at full power. Data recording began. Approximately 10 seconds later, reactor recirculation flow control was shifted to master manual control, and recirculation flow was ramped down to achieve 75% reactor power, and then ramped back up to return to 100% reactor power. The simulator was then allowed to stabilize. After 3 minutes the simulator was placed in freeze and data recording was terminated.

Simulator performance was observed during the transient to ensure that alarms, automatic actions, and indications were appropriate for the transient. No violations of the physical laws of nature were observed.

This test was intended to meet the objectives of ANSI/ANS-3.5-1985, Appendix B, and footnote 3 of the standard.

Simulator Features Tested:

Simulator data recording capability at a resolution of 0.5 seconds.

Initial Conditions:

The simulator was operating in a normal full power lineup.

SIMULATOR CERTIFICATION TEST SUMMARY

Test Name: STP 5.07, Maximum Rate Power Ramp Down to Approximately 75% Then Back Up to 100% (Cont'd)

Final Conditions:

The simulator was stable and operating at 100% power following a ramp in reactor power down to 75% and then back to 100% using reactor recirculation flow control.

Baseline Data Source:

Clinton Power Station RETRAN Code

Comparison:

The following simulator parameters were compared to the available baseline data. The magnitude and direction of change of all parameters were evaluated as acceptable.

Parameter	Evaluation
Reactor Power	Satisfactory
Total Steam Flow	Satisfactory
Total Feedwater Flow	Satisfactory
Reactor Pressure (WR)	Satisfactory
Reactor Pressure (NR)	RETRAN Data Unavailable
Reactor Level (WR)	Satisfactory
Reactor Level (NR)	Satisfactory
Generator Power	RETRAN Data Unavailable
Turbine Steam Flow	RETRAN Data Unavailable
Total Core Flow	Satisfactory
Total RR Loop Flow	RETRAN Data Unavailable

There are some differences between simulator and RETRAN feedwater flow. While this has been evaluated as satisfactory, the simulator Feedwater Level Control System is being evaluated for possible future improvements.

SIMULATOR CERTIFICATION TEST SUMMARY

Test Name: STP 5.07, Maximum Rate Power Ramp Down to Approximately 75% Then Back Up to 100% (Cont'd)

Comparison (cont'd):

CPS licensed operators have reviewed the simulator data for the parameters having no corresponding RETRAN data, and have judged simulator performance to be acceptable and consistent with that expected for the transient.

Graphs of simulator and RETRAN data follow this test summary. When all parameters are considered, the overall simulator response to this transient is satisfactory.

Deficiencies Found:

None

Corrective Actions Planned (and schedule):

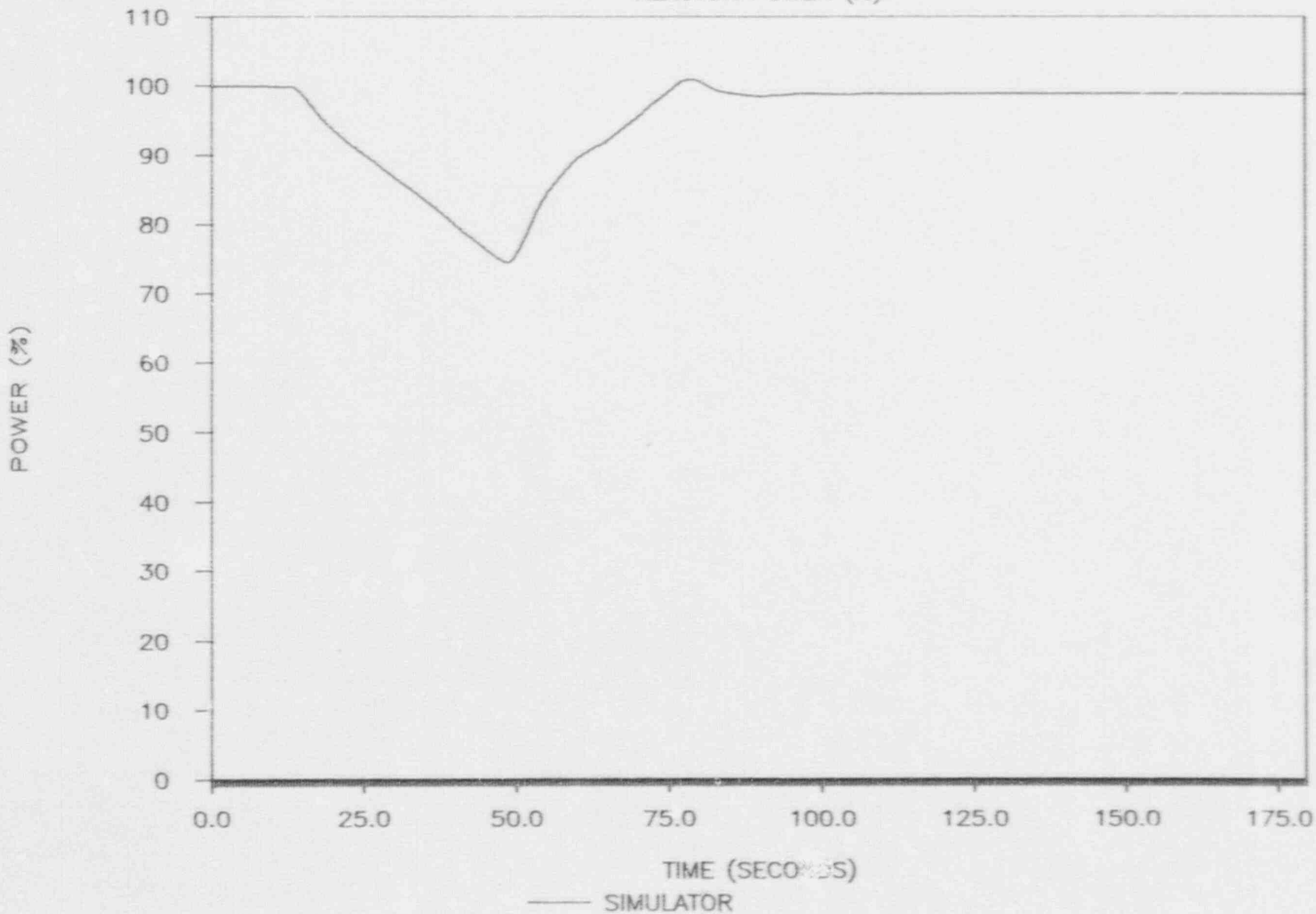
None

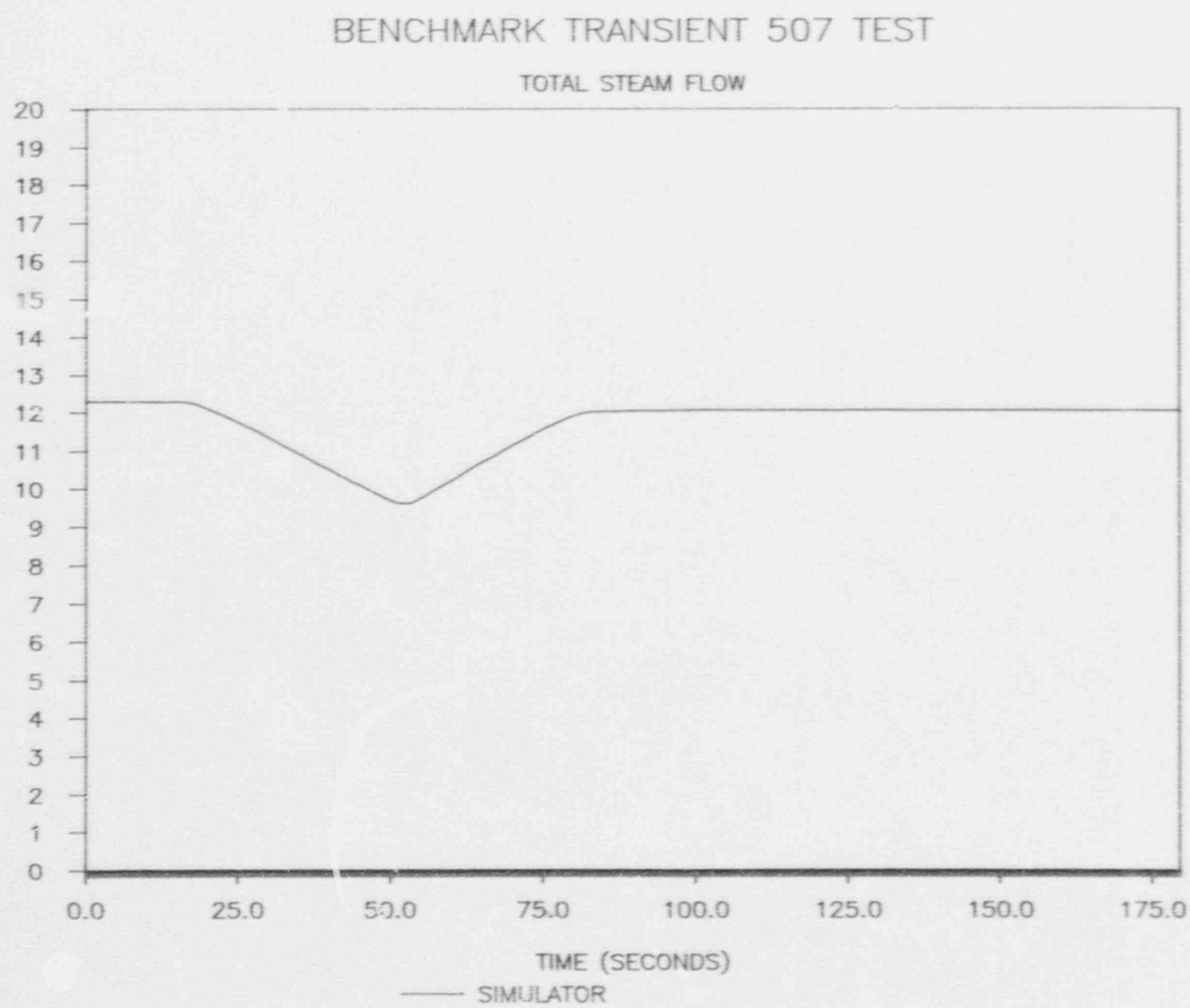
Exceptions Taken/Justification:

None

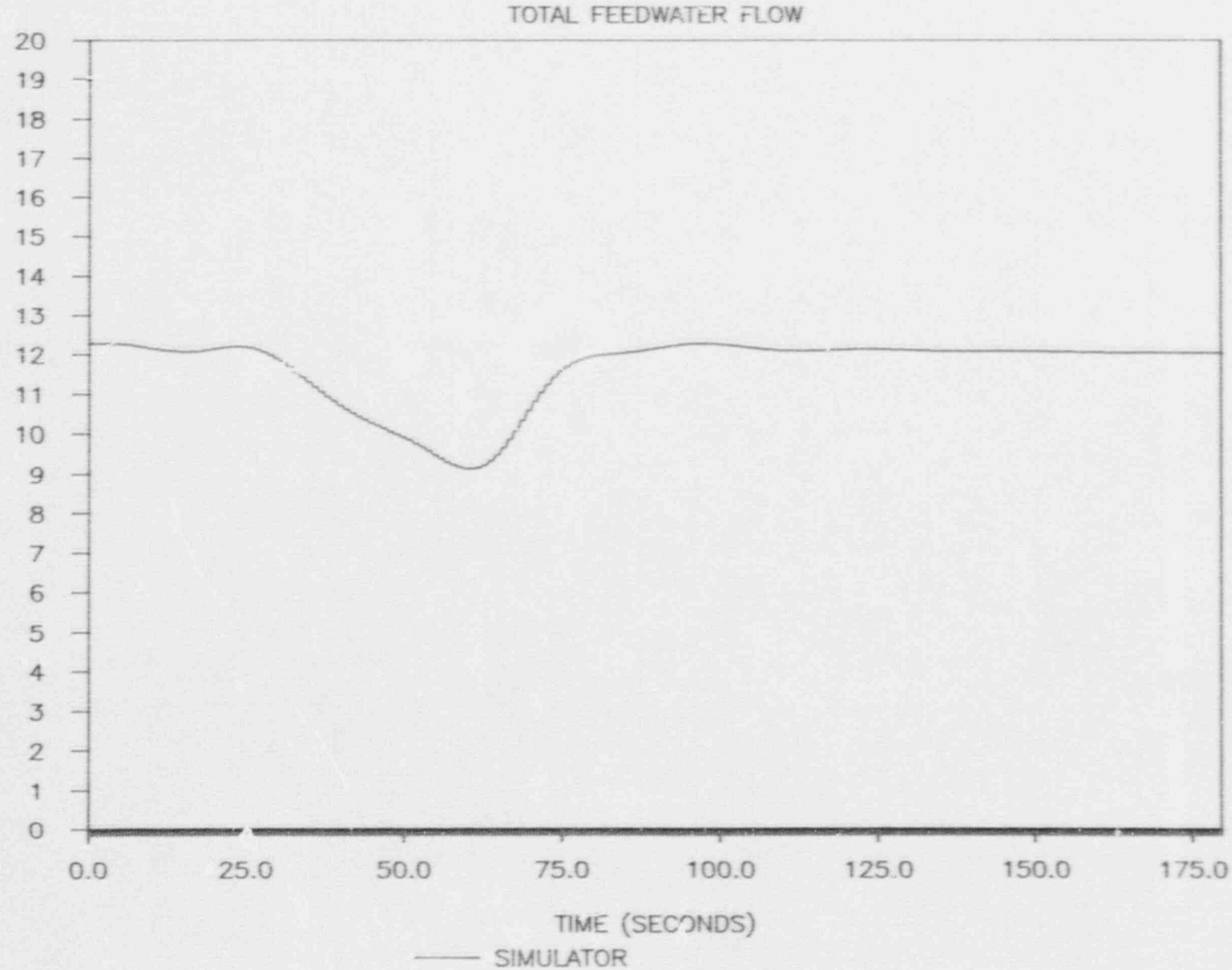
BENCHMARK TRANSIENT 507 TEST

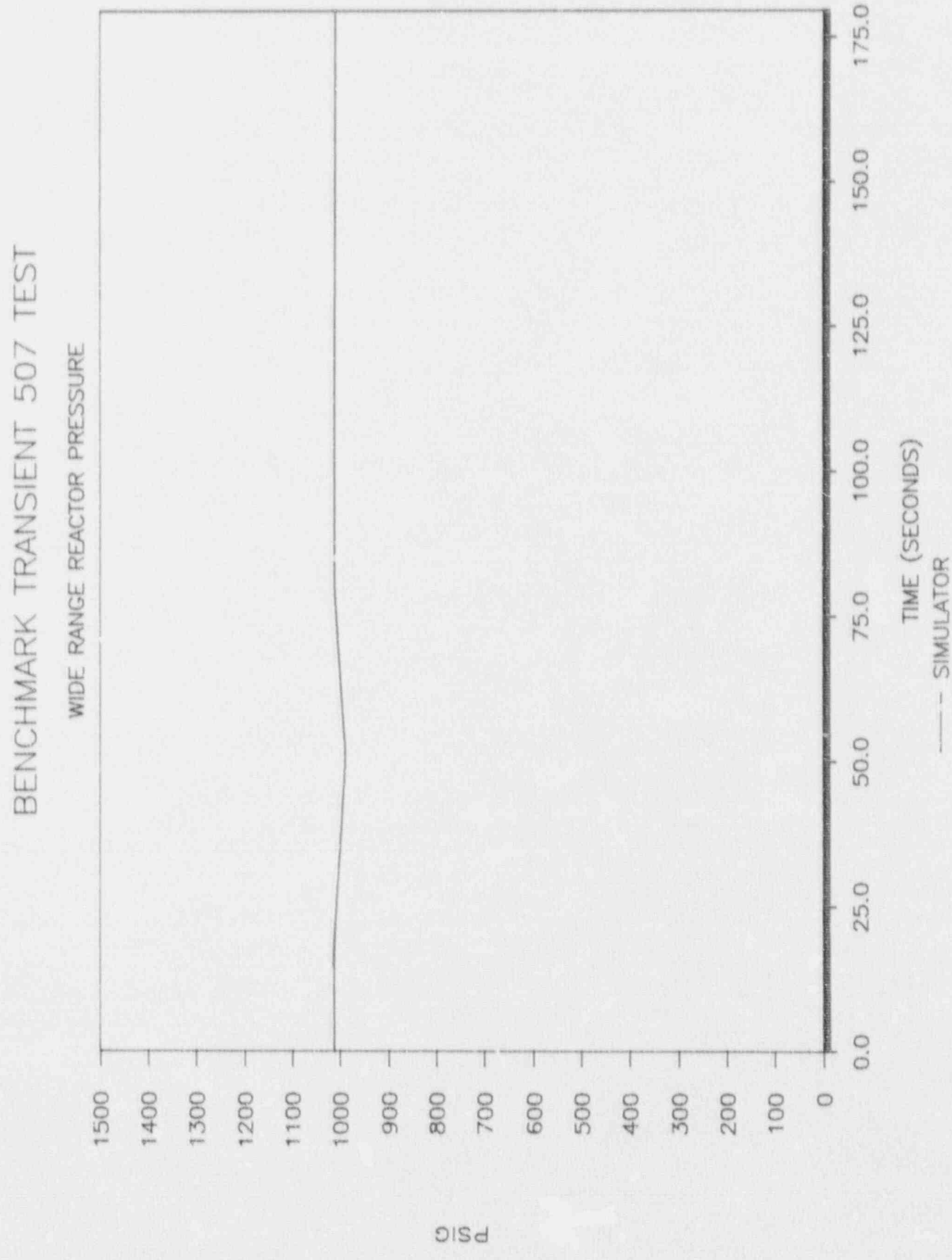
REACTOR POWER (%)

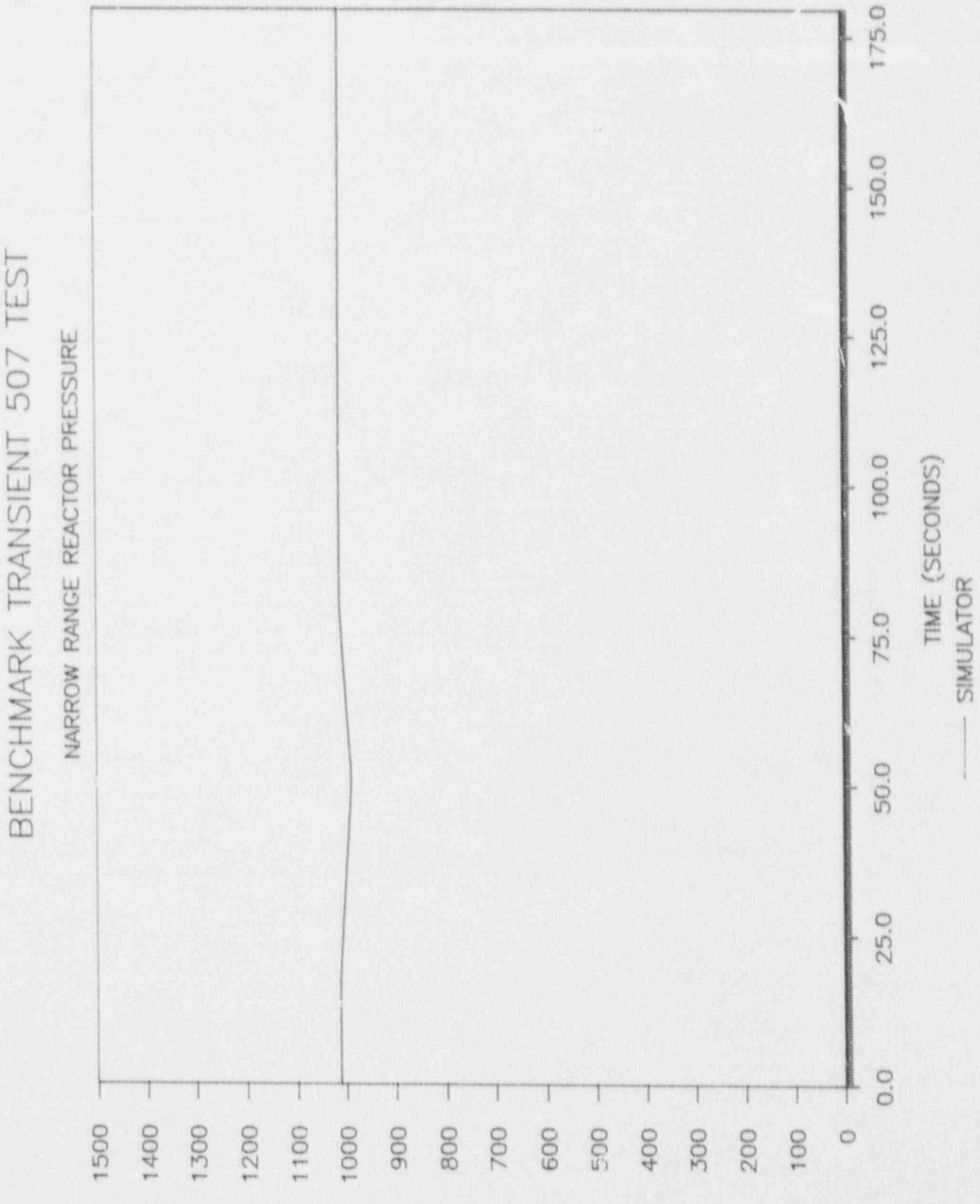



BENCHMARK TRANSIENT 507 TEST
TOTAL STEAM FLOW
MLBS/HR
20
19
18
17
16
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
0.0
25.0
50.0
75.0
100.0
125.0
150.0
175.0
TIME (SECONDS)
SIMULATOR

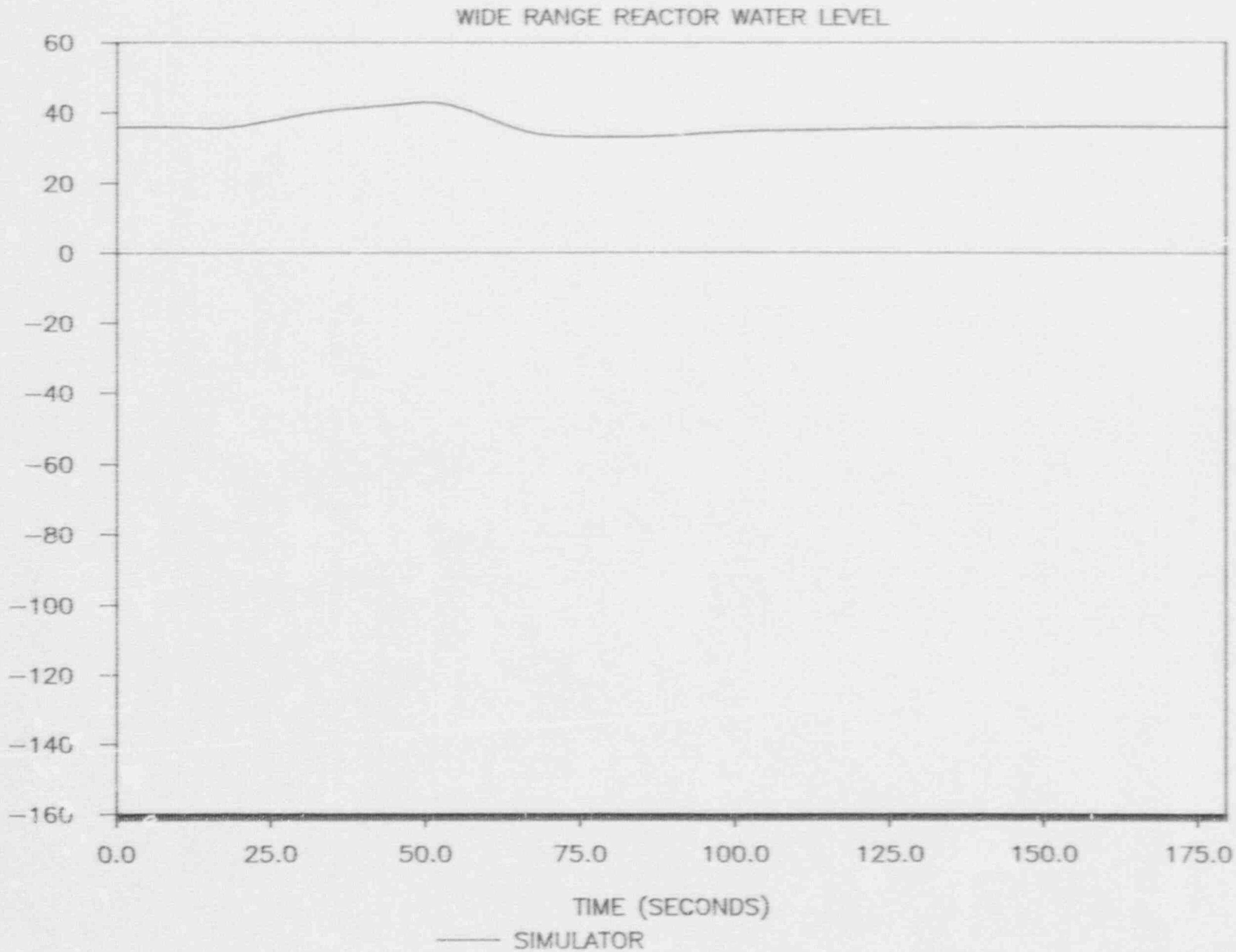
BENCHMARK TRANSIENT 507 TEST

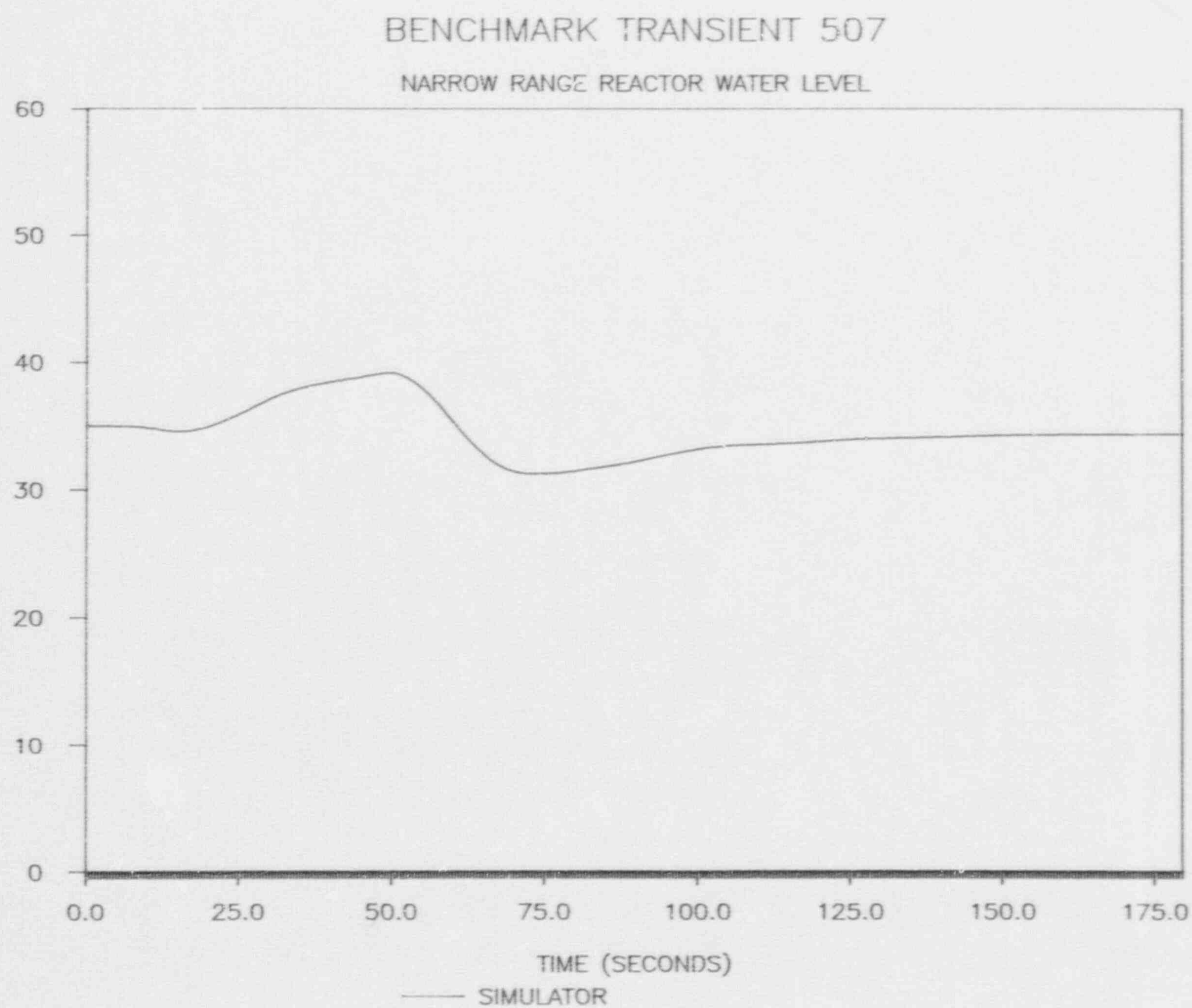



BENCHMARK TRANSIENT 507 TEST
WIDE RANGE REACTOR PRESSURE
PSIG
1500
1400
1300
1200
1100
1000
900
800
700
600
500
400
300
200
100
0
0.0
25.0
50.0
75.0
100.0
125.0
150.0
175.0
TIME (SECONDS)
SIMULATOR


BENCHMARK TRANSIENT 507 TEST
NARROW RANGE REACTOR PRESSURE
PSIG
1500
1400
1300
1200
1100
1000
900
800
700
600
500
400
300
200
100
0
0.0
25.0
50.0
75.0
100.0
125.0
150.0
175.0
TIME (SECONDS)
—— SIMULATOR

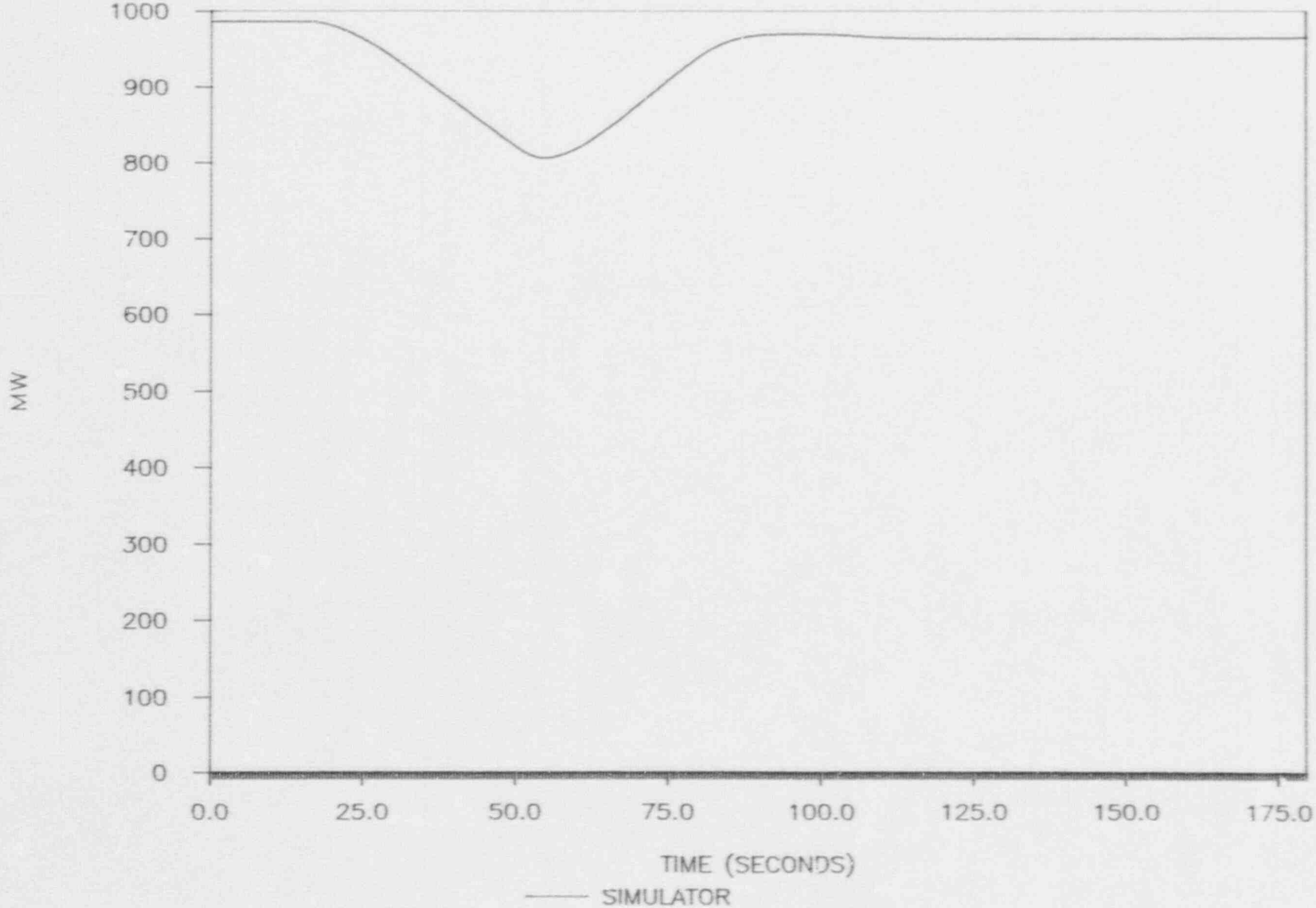
BENCHMARK TRANSIENT 507 TEST



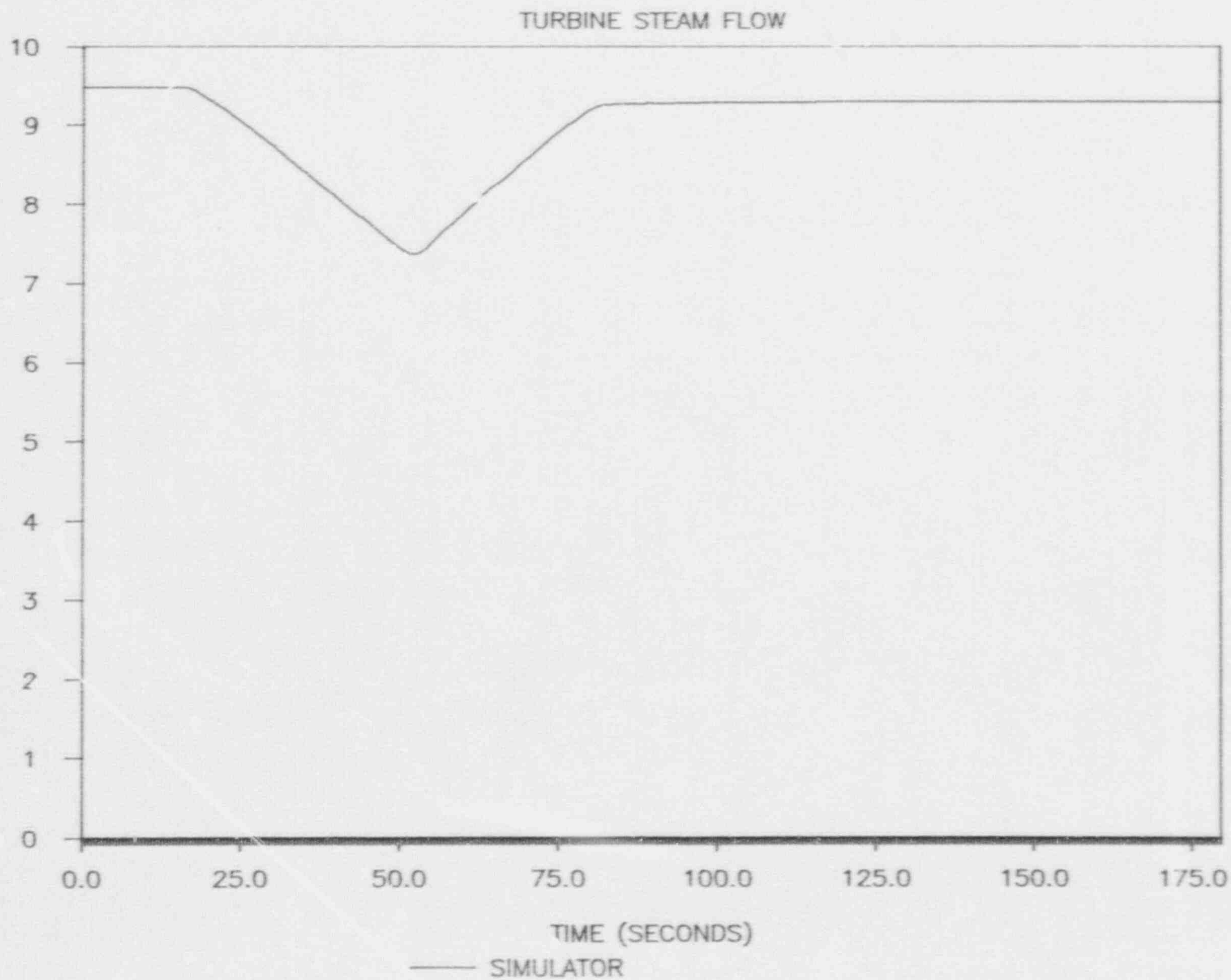

BENCHMARK TRANSIENT 507
NARROW RANGE REACTOR WATER LEVEL
INCHES
TIME (SECONDS)
SIMULATOR
0
10
20
30
40
50
60
0.0
25.0
50.0
75.0
100.0
125.0
150.0
175.0

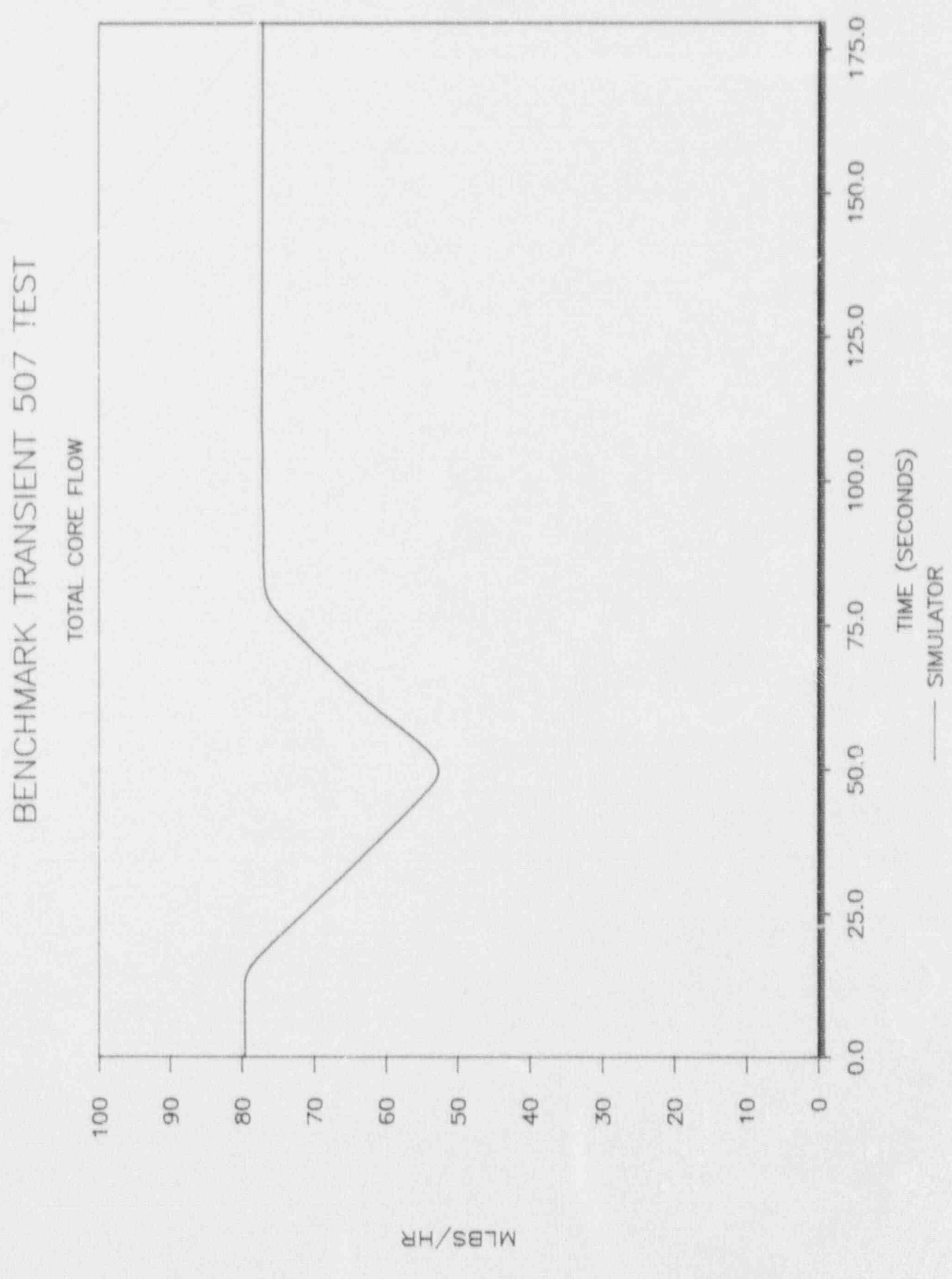
BENCHMARK TRANSIENT 507 TEST

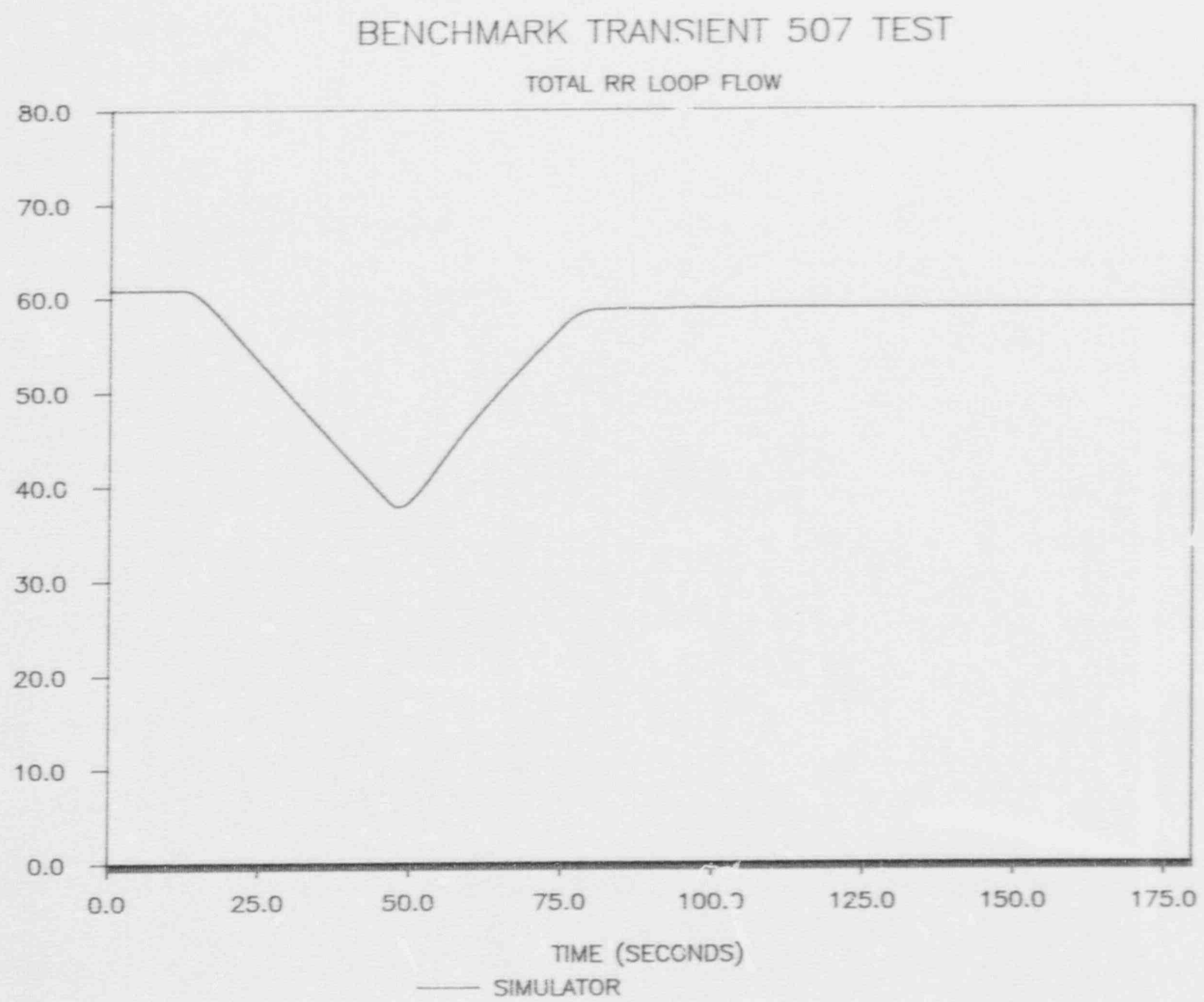
GENERATOR GROSS ELECTRICAL POWER

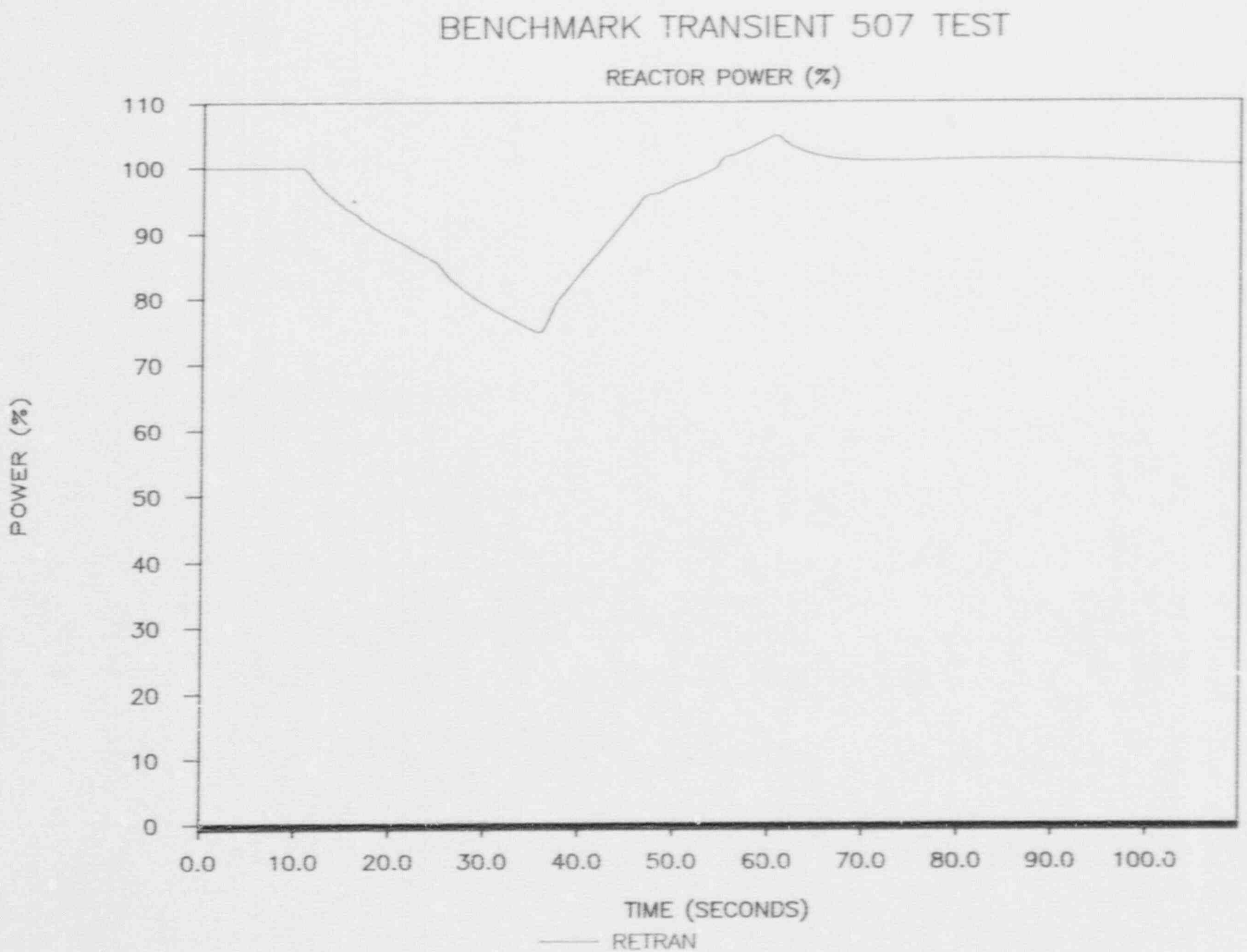


BENCHMARK TRANSIENT 507 TEST




BENCHMARK TRANSIENT 507 TEST
TOTAL CORE FLOW
MLBS/HR
100
90
80
70
60
50
40
30
20
10
0
0.0
25.0
50.0
75.0
100.0
125.0
150.0
175.0
TIME (SECONDS)
SIMULATOR


BENCHMARK TRANSIENT 507 TEST
TOTAL RR LOOP FLOW
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
GPM
(Thousands)
0.0
25.0
50.0
75.0
100.0
125.0
150.0
175.0
TIME (SECONDS)
SIMULATOR


BENCHMARK TRANSIENT 507 TEST
REACTOR POWER (%)
POWER (%)
110
100
90
80
70
60
50
40
30
20
10
0
0.0
10.0
20.0
30.0
40.0
50.0
60.0
70.0
80.0
90.0
100.0
TIME (SECONDS)
RETRAN

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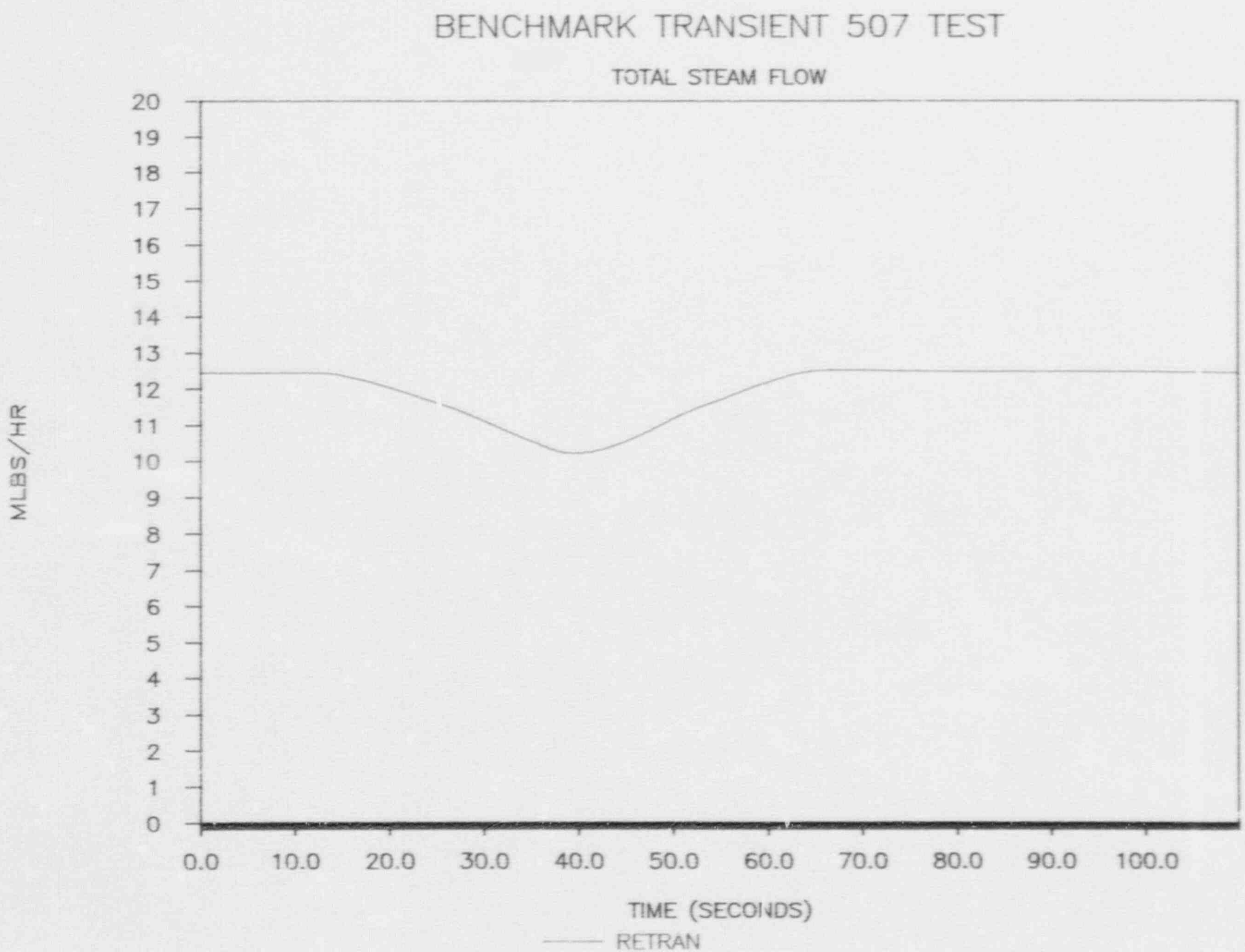
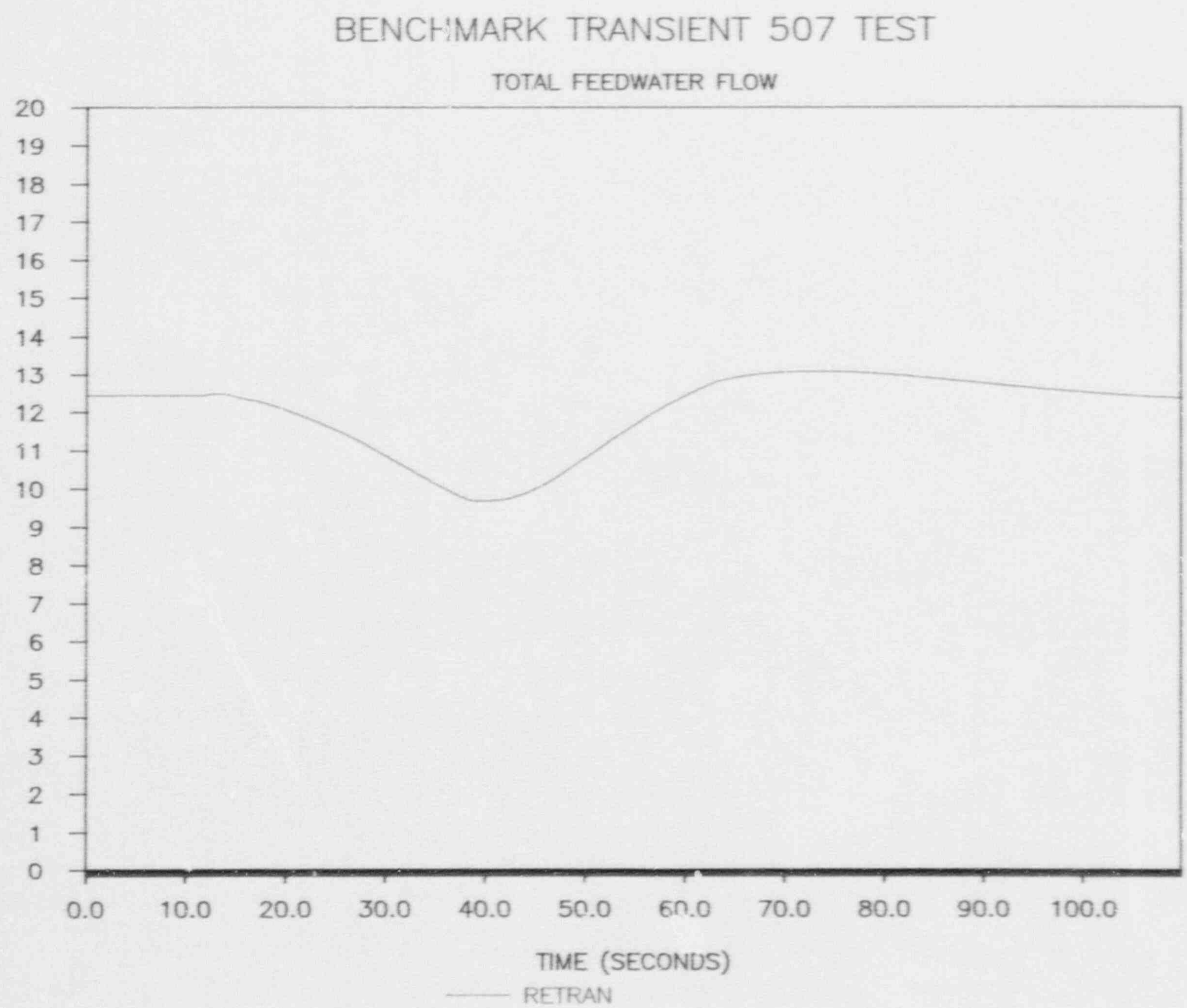
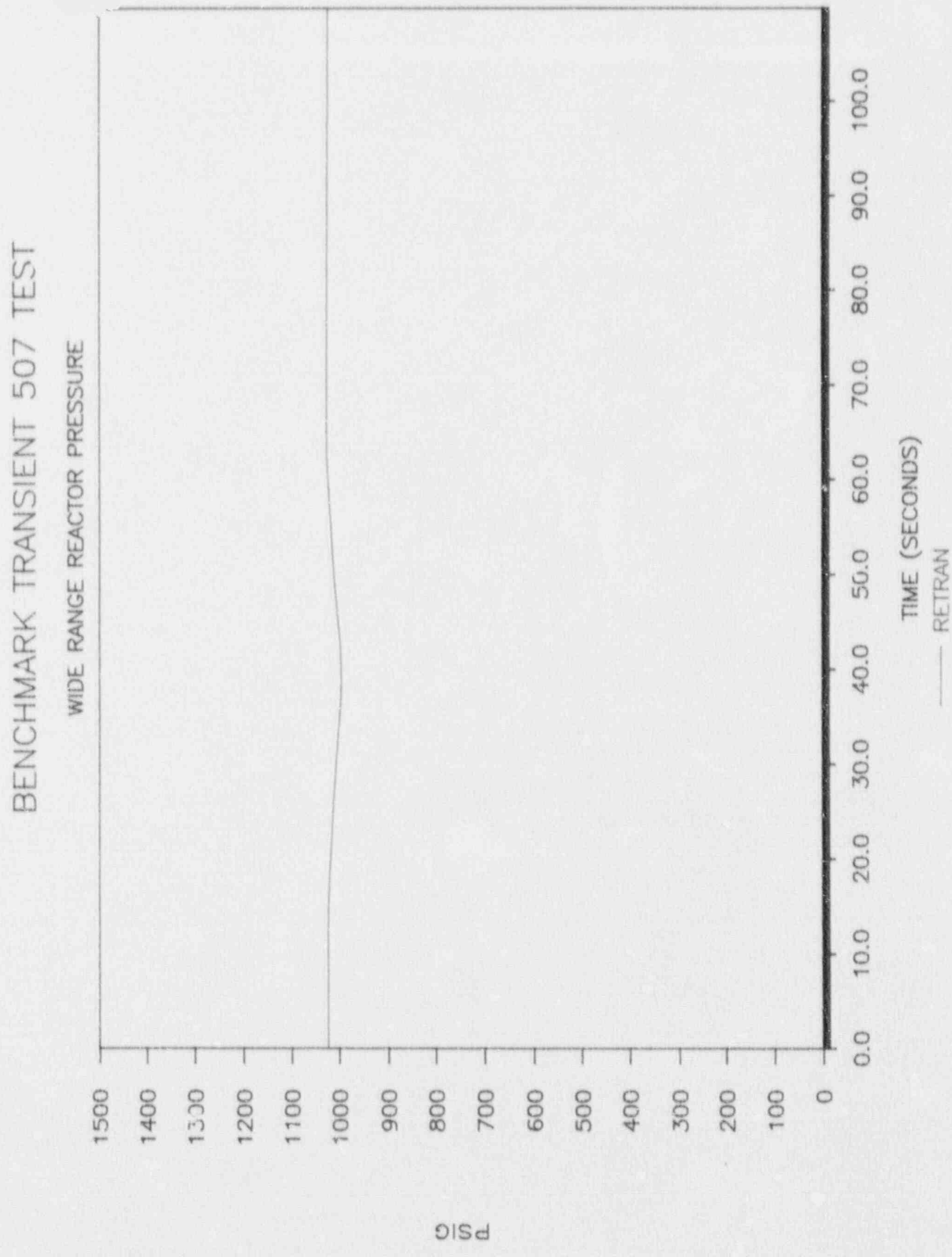
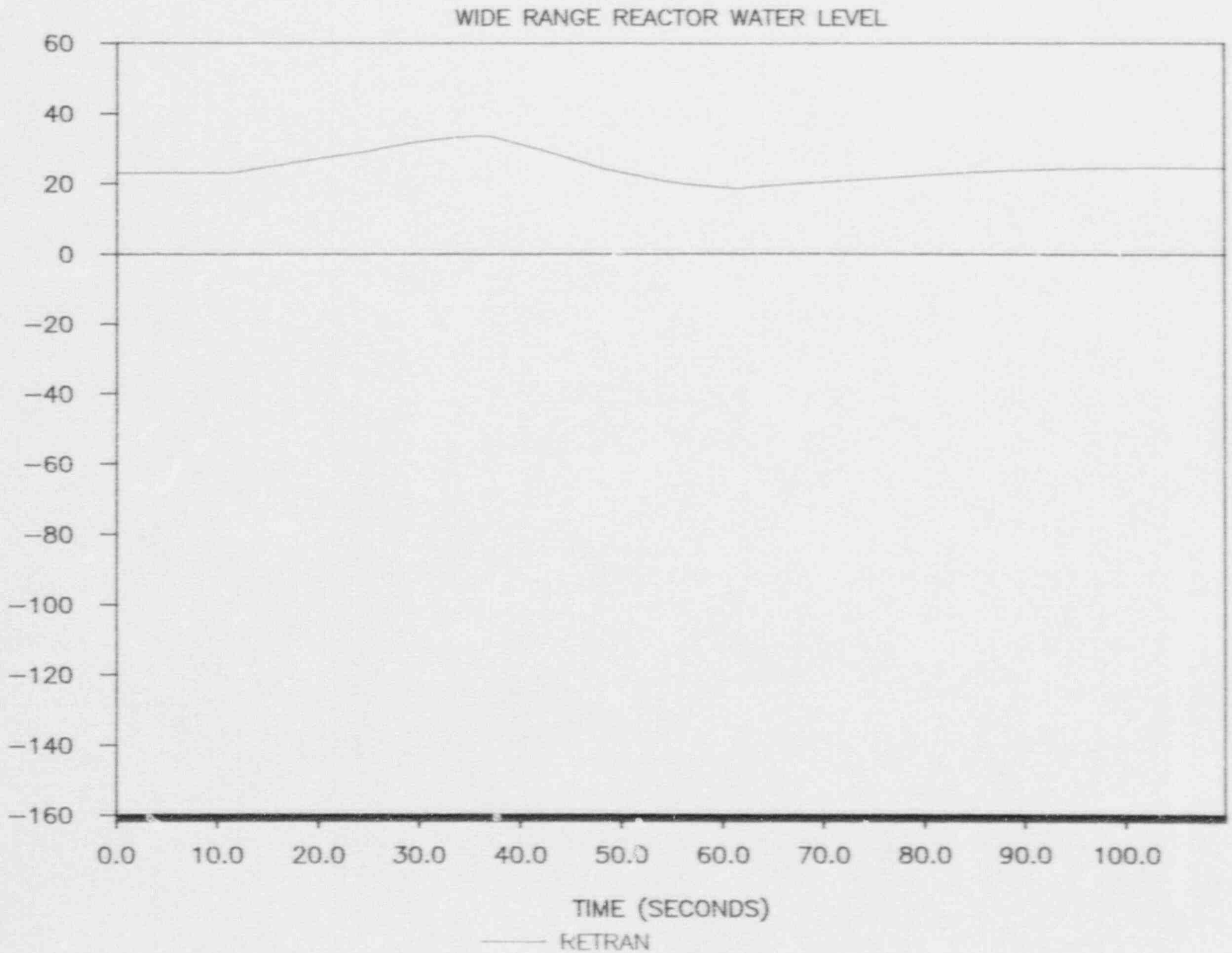
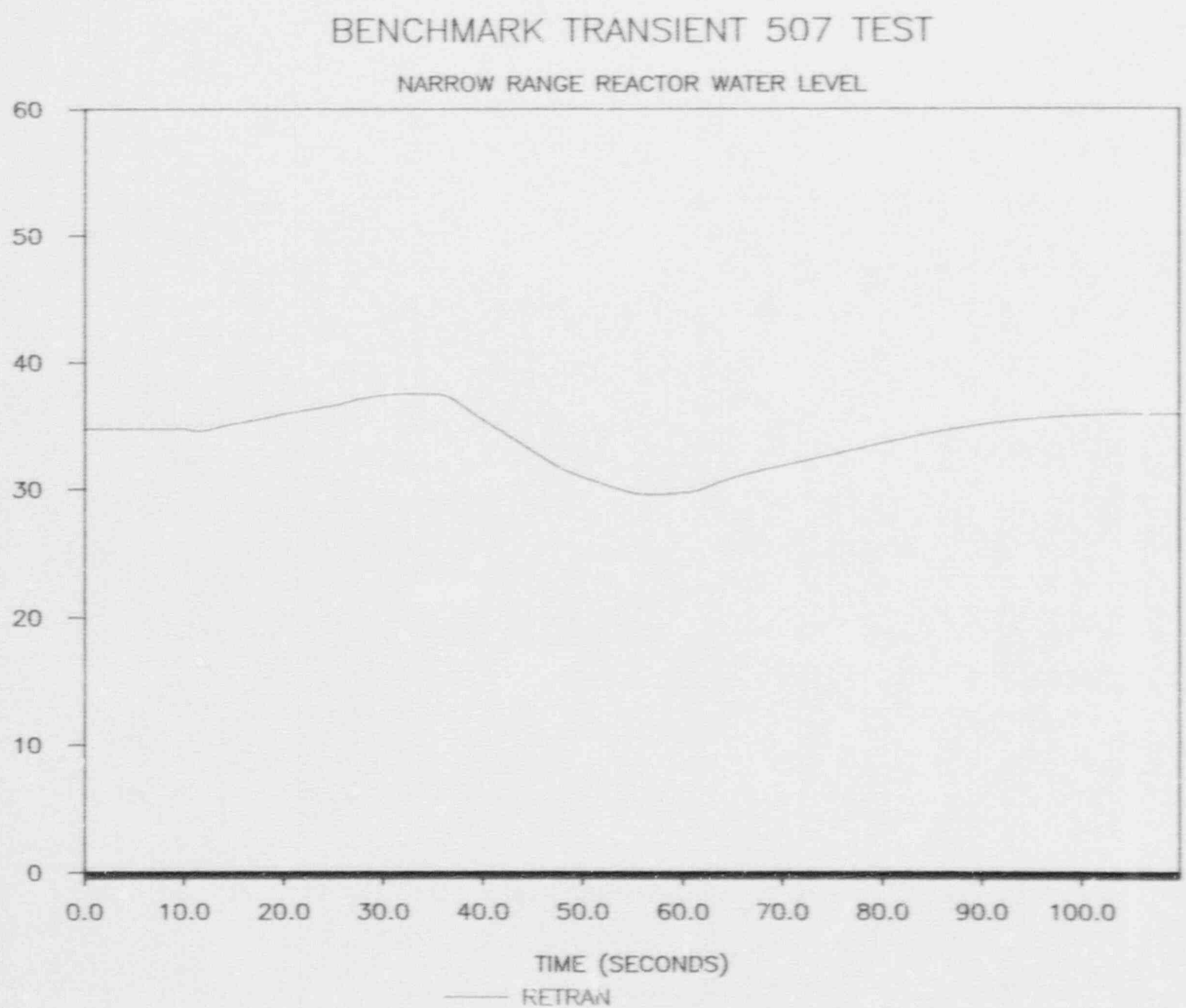

BENCHMARK TRANSIENT 507 TEST
TOTAL STEAM FLOW
MLBS/HR
20
19
18
17
16
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
0.0
10.0
20.0
30.0
40.0
50.0
60.0
70.0
80.0
90.0
100.0
TIME (SECONDS)
RETRAN


BENCHMARK TRANSIENT 507 TEST
TOTAL FEEDWATER FLOW
MLBS/HR
20
19
18
17
16
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
0.0
10.0
20.0
30.0
40.0
50.0
60.0
70.0
80.0
90.0
100.0
TIME (SECONDS)
RETRAN

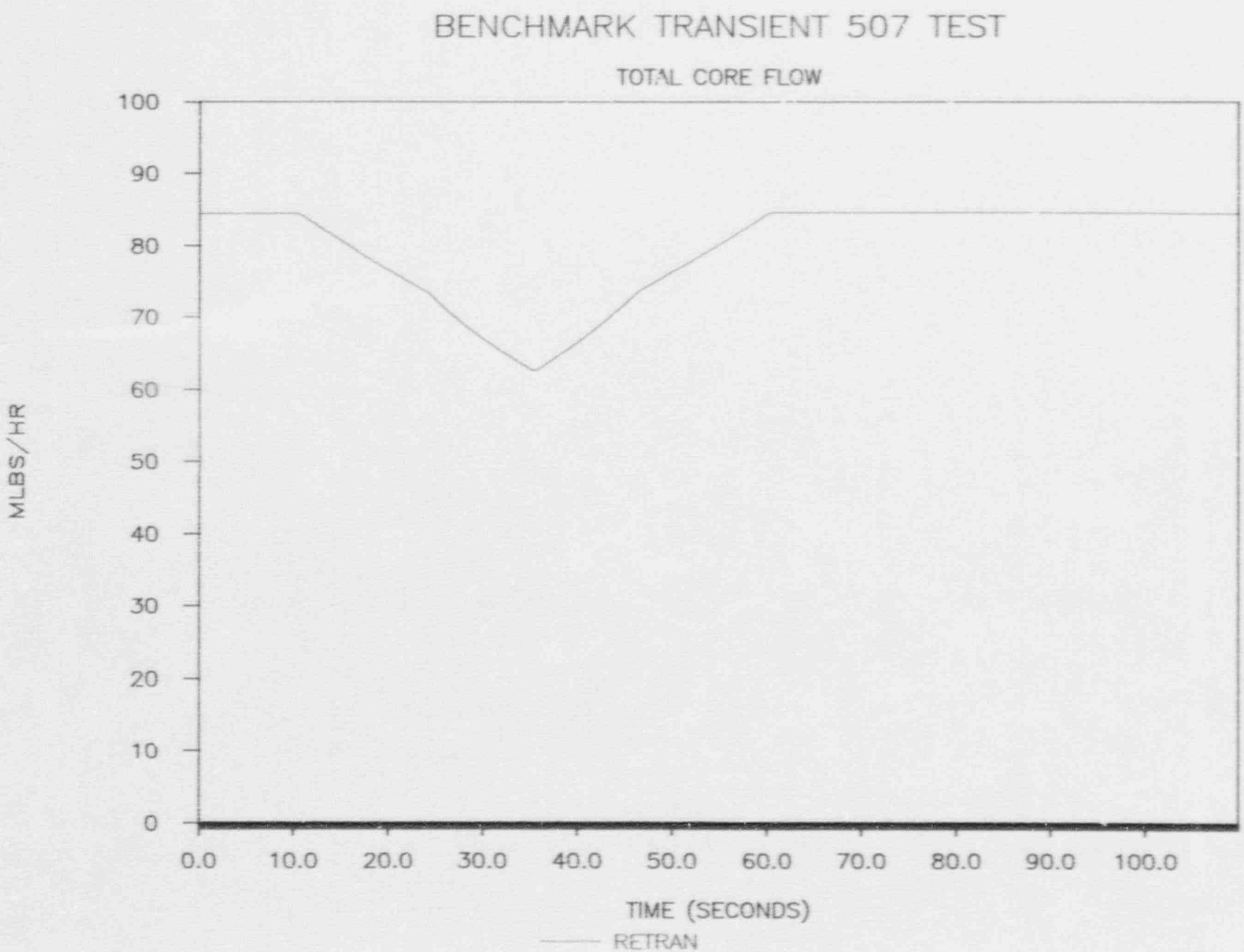

BENCHMARK TRANSIENT 507 TEST
WIDE RANGE REACTOR PRESSURE
PSIG
1500
1400
1300
1200
1100
1000
900
800
700
600
500
400
300
200
100
0
0.0
10.0
20.0
30.0
40.0
50.0
60.0
70.0
80.0
90.0
100.0
TIME (SECONDS)
RETRAN

BENCHMARK TRANSIENT 507 TEST





BENCHMARK TRANSIENT 507 TEST
NARROW RANGE REACTOR WATER LEVEL
INCHES
60
50
40
30
20
10
0
0.0
10.0
20.0
30.0
40.0
50.0
60.0
70.0
80.0
90.0
100.0
TIME (SECONDS)
RETRAN


BENCHMARK TRANSIENT 507 TEST
TOTAL CORE FLOW
MLBS/HR
100
90
80
70
60
50
40
30
20
10
0
0.0
10.0
20.0
30.0
40.0
50.0
60.0
70.0
80.0
90.0
100.0
TIME (SECONDS)
RETRAN

SIMULATOR CERTIFICATION TEST SUMMARY

Test Name: STP 5.08, Maximum Size Reactor Coolant System Rupture Combined With Loss of Offsite Power

Description: This test provides a benchmark comparison between the simulator and plant for a maximum size reactor coolant system rupture, combined with a loss of offsite power.

The simulator was initialized at full power. Data recording began. Approximately 10 seconds later, malfunctions were simultaneously activated which resulted in a Design Basis Accident (DBA) Loss of Coolant Accident (LOCA), and a complete loss of all offsite power. No operator actions were taken. The simulator was allowed to stabilize. After 5 minutes the simulator was placed in freeze and data recording was terminated.

Simulator performance was observed during the transient to ensure that alarms, automatic actions, and indications were appropriate for the transient. No violations of the physical laws of nature were observed.

This test was intended to meet the objectives of ANSI/ANS-3.5-1985, Appendix B, and footnote 3 of the standard.

Simulator Features Tested:

Simulator data recording capability at a resolution of 0.5 seconds.

Initial Conditions:

The simulator was operating in a normal full power lineup.

Final Conditions:

The simulator was relatively stable following a DBA LOCA. Safety buses were powered by emergency diesel generators.

SIMULATOR CERTIFICATION TEST SUMMARY

Test Name: STP 5.08, Maximum Size Reactor Coolant System Rupture Combined With Loss of Offsite Power (Cont'd)

Baseline Data Source:

CPS Updated Safety Analysis Report (USAR)

Comparison:

The following simulator parameters were compared to the available baseline data. The magnitude and direction of change of all parameters were evaluated as acceptable.

Parameter	Evaluation
Reactor Power	Satisfactory
Reactor Pressure (WR)	Satisfactory
Reactor Level (WR)	Satisfactory
Reactor Level (FZ)	Satisfactory
Total Steam Flow	USAR Data Unavailable
Total Feedwater Flow	USAR Data Unavailable
Containment Temp	USAR Data Unavailable
Suppression Pool Temp	USAR Data Unavailable
Containment Pressure	USAR Data Unavailable
Drywell Temperature	Satisfactory
Drywell Pressure	Satisfactory
Total RHR Flow	Satisfactory
Total LPCS Flow	Satisfactory
Total HP Injection Flow	Satisfactory

At approximately 23 seconds into the transient, a small reactor power spike is indicated on the graph. This reactor power spike was unanticipated and was coincident with the onset of flow through the Low Pressure Core Spray (LPCS) system. This anomaly was investigated and corrected just prior to the issuance of this report. No further corrective action is necessary.

SIMULATOR CERTIFICATION TEST SUMMARY

Test Name: STP 5.08, Maximum Size Reactor Coolant System Rupture Combined With Loss of Offsite Power (Cont'd)

The difference in the shape of the reactor pressure curves is due to conservatisms built into the USAR analysis. Licensed CPS operators have judged the simulator performance to be consistent with expected plant performance for this transient.

Specific USAR data for wide range and fuel zone range reactor water level is not available for this transient. However, data is available which represents reactor water level inside the vessel shroud for this transient. While this data cannot be directly compared to instrumentation data, the USAR data does indicate a decrease in reactor water level in response to this transient which is consistent with the simulator wide range and fuel zone response.

Certain simulator parameters indicate zero for approximately 6 seconds in the early stages of the transient. This is because the particular instruments monitored by the simulator data recording program were deenergized upon loss of offsite power until safety buses were reenergized by the emergency diesel generators. This is expected for the particular instruments monitored by the simulator data recording program.

Once power was restored, the simulator drywell pressure began indicating 5 psig and remained constant for the duration of the transient. This is because the particular drywell pressure instrument recorded by the simulator data recording system has an upper limit of 5 psig in accordance with plant configuration.

CPS licensed operators have reviewed the simulator data for the parameters having no corresponding USAR data, and have judged simulator performance to be acceptable and consistent with that expected for the transient.

SIMULATOR CERTIFICATION TEST SUMMARY

Test Name: STP 5.08, Maximum Size Reactor Coolant System Rupture Combined With Loss of Offsite Power (Cont'd)

Graphs of simulator and USAR data follow this test summary. When all parameters are considered, the overall simulator response to this transient is satisfactory.

Deficiencies Found:

None

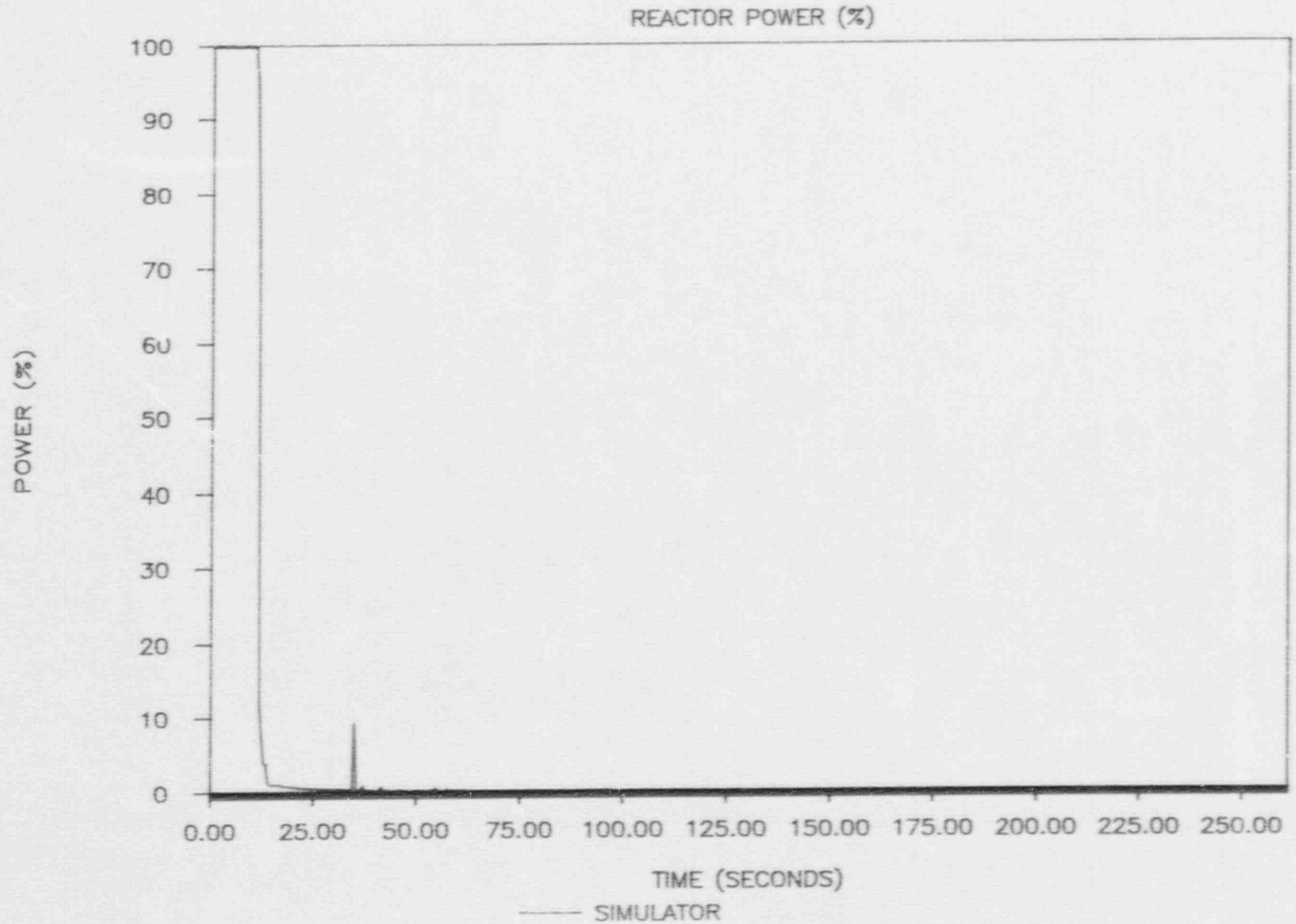
Corrective Actions Planned (and schedule):

None

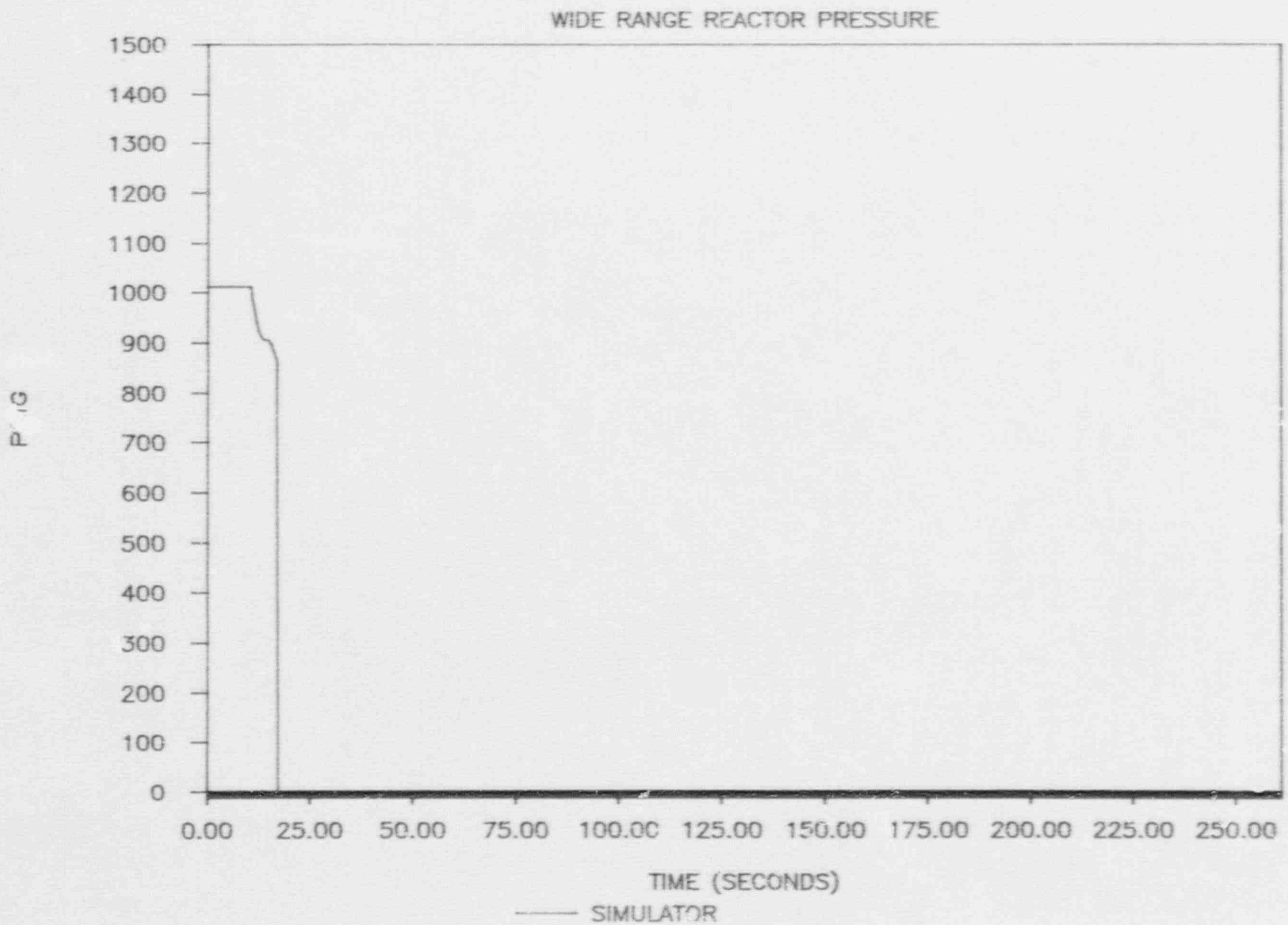
Exceptions Taken/Justification:

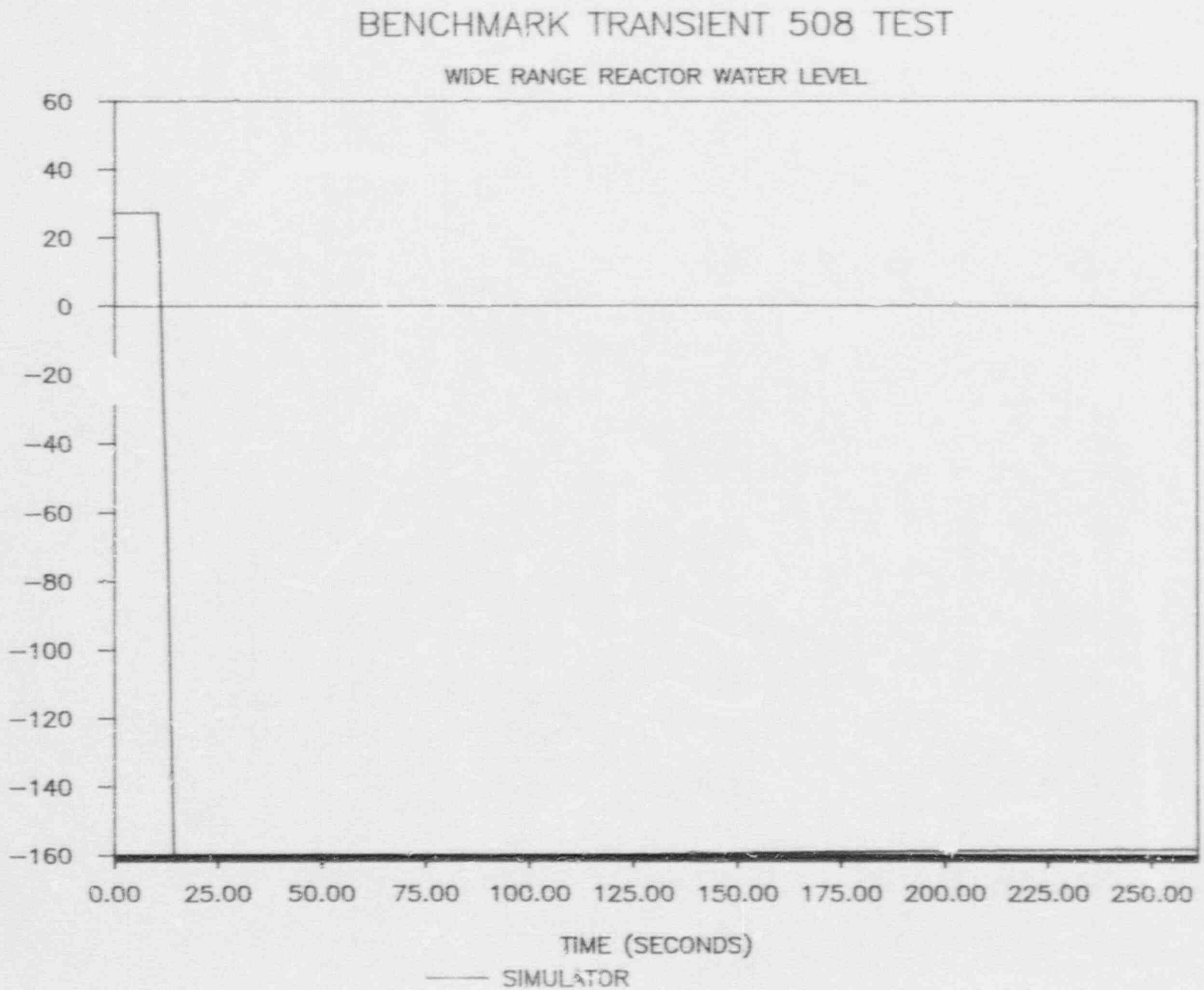
None

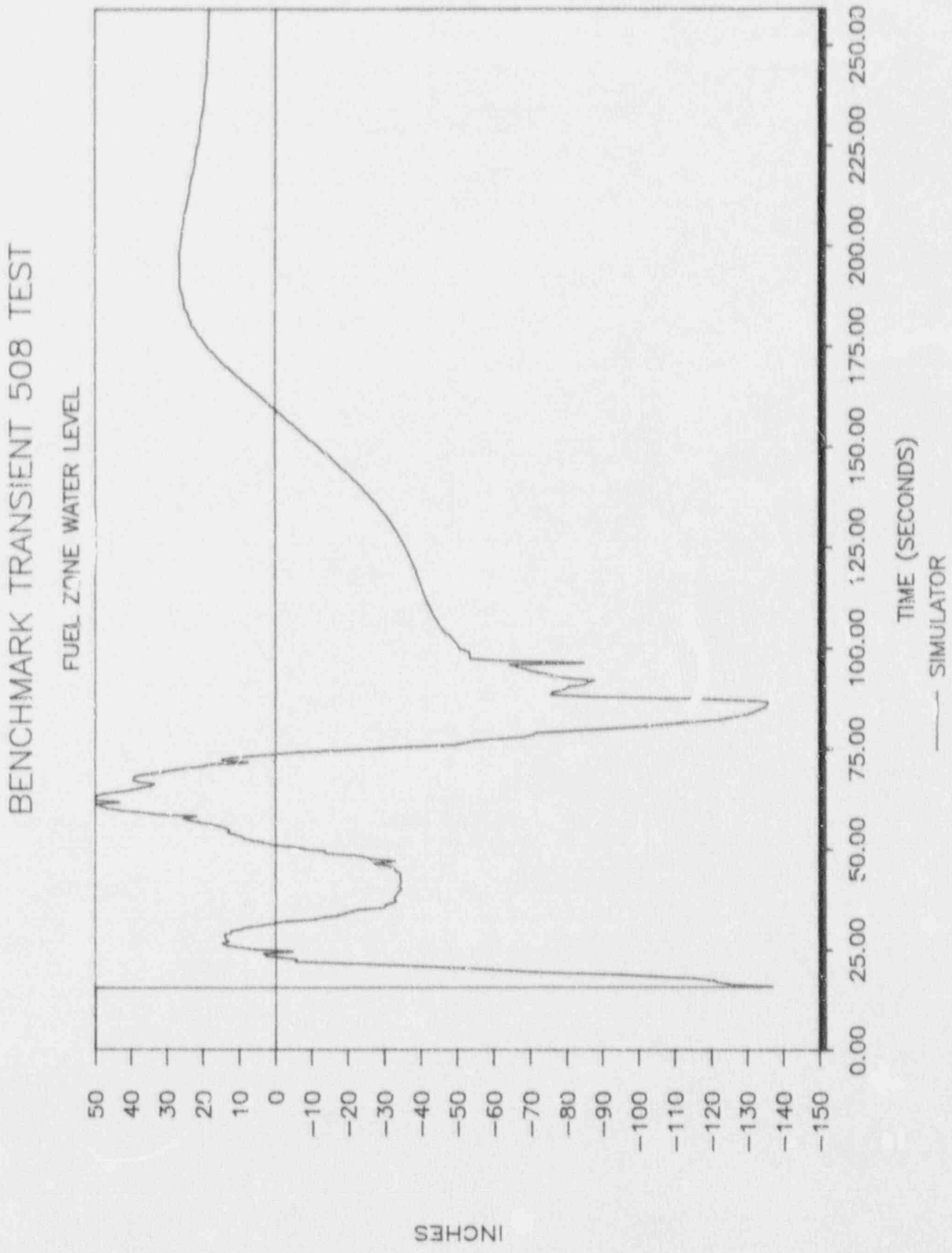
BENCHMARK TRANSIENT 508 TEST

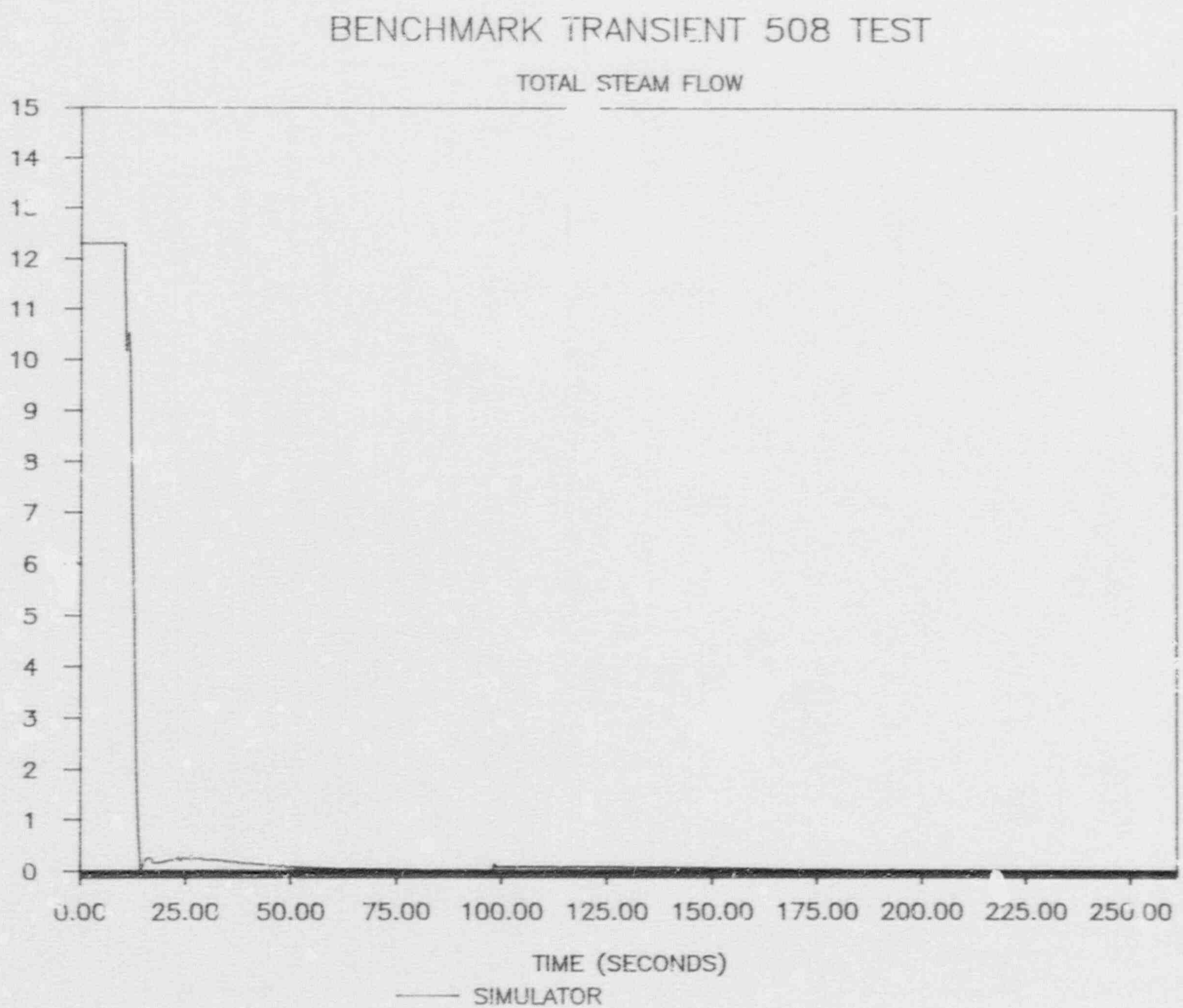


BENCHMARK TRANSIENT 508 TEST



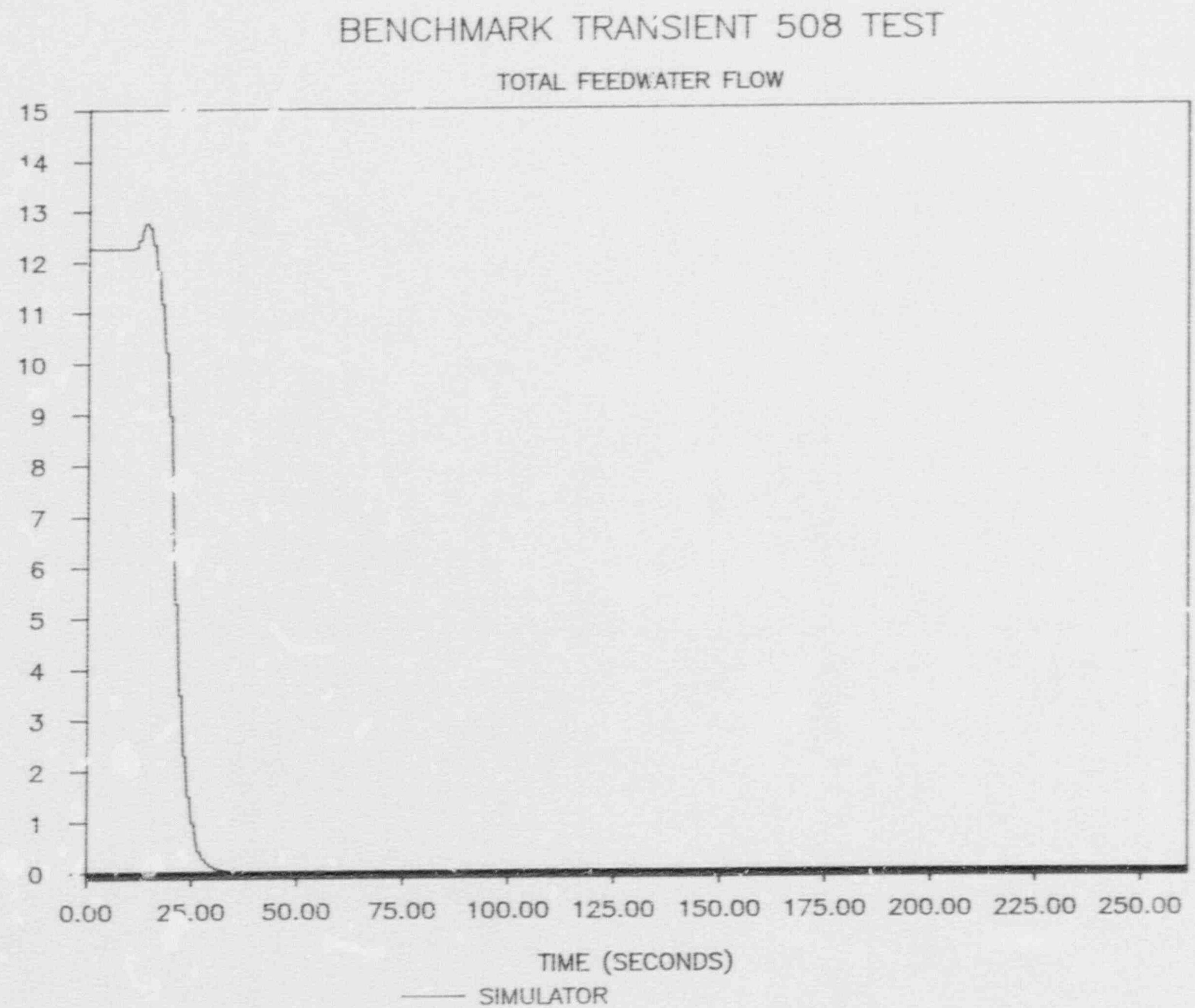

BENCHMARK TRANSIENT 508 TEST
WIDE RANGE REACTOR WATER LEVEL
60
40
20
0
−20
−40
−60
−80
−100
−120
−140
−160
INCHES
0.00
25.00
50.00
75.00
100.00
125.00
150.00
175.00
200.00
225.00
250.00
TIME (SECONDS)
SIMULATOR


BENCHMARK TRANSIENT 508 TEST
FUEL ZONE WATER LEVEL
INCHES
50
40
30
20
10
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
-110
-120
-130
-140
-150
0.00
25.00
50.00
75.00
100.00
125.00
150.00
175.00
200.00
225.00
250.00
TIME (SECONDS)
SIMULATOR



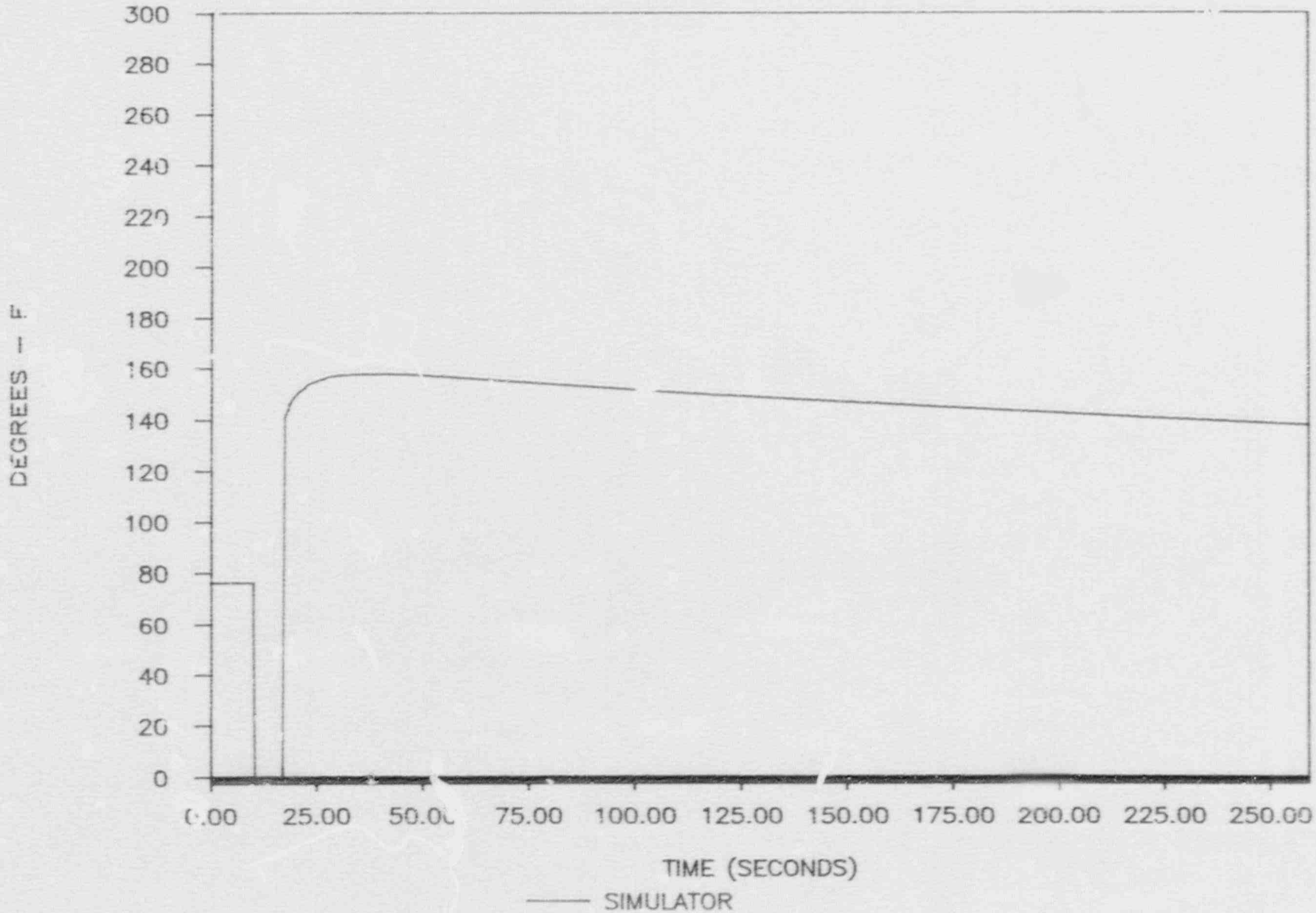
BENCHMARK TRANSIENT 508 TEST
TOTAL STEAM FLOW
MLBS/HR
15
14
12
11
10
9
8
7
6
5
4
3
2
1
0
25.00
50.00
75.00
100.00
125.00
150.00
175.00
200.00
225.00
TIME (SECONDS)
SIMULATOR

Page 333


BENCHMARK TRANSIENT 508 TEST
TOTAL FEEDWATER FLOW
MLBS/HR
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
0.00
25.00
50.00
75.00
100.00
125.00
150.00
175.00
200.00
225.00
250.00
TIME (SECONDS)
SIMULATOR

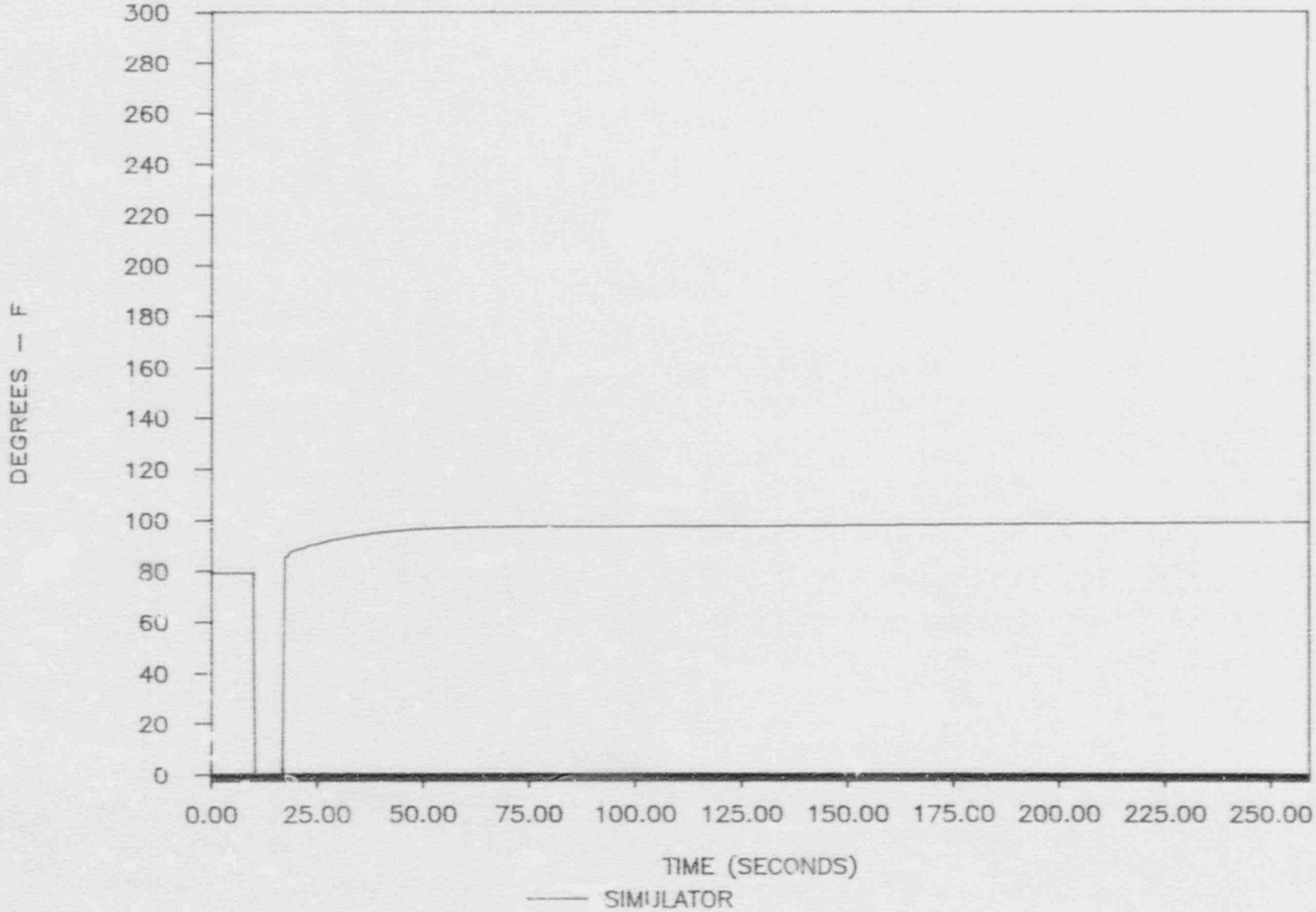
BENCHMARK TRANSIENT 508 TEST

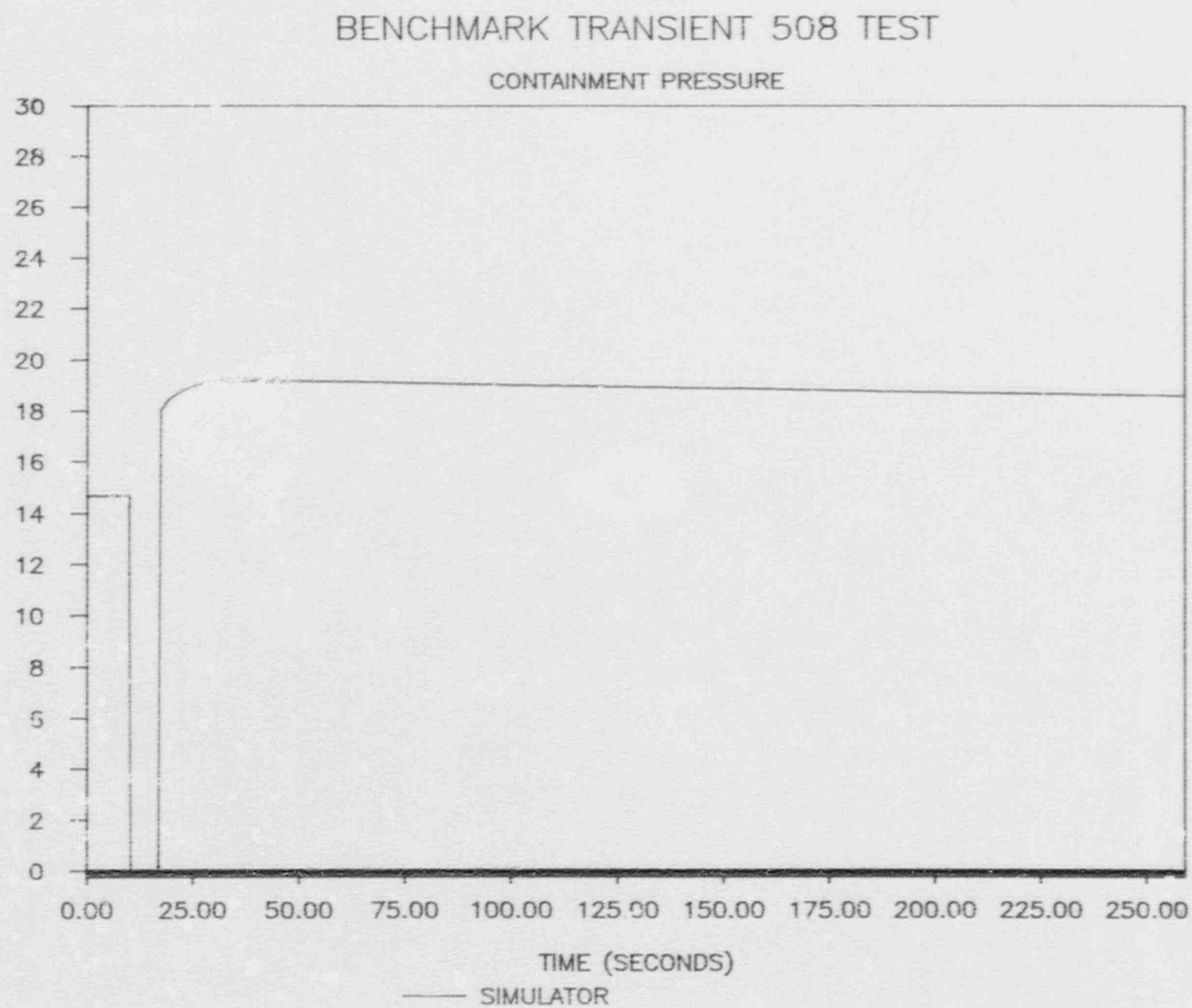
CONTAINMENT TEMPERATURE

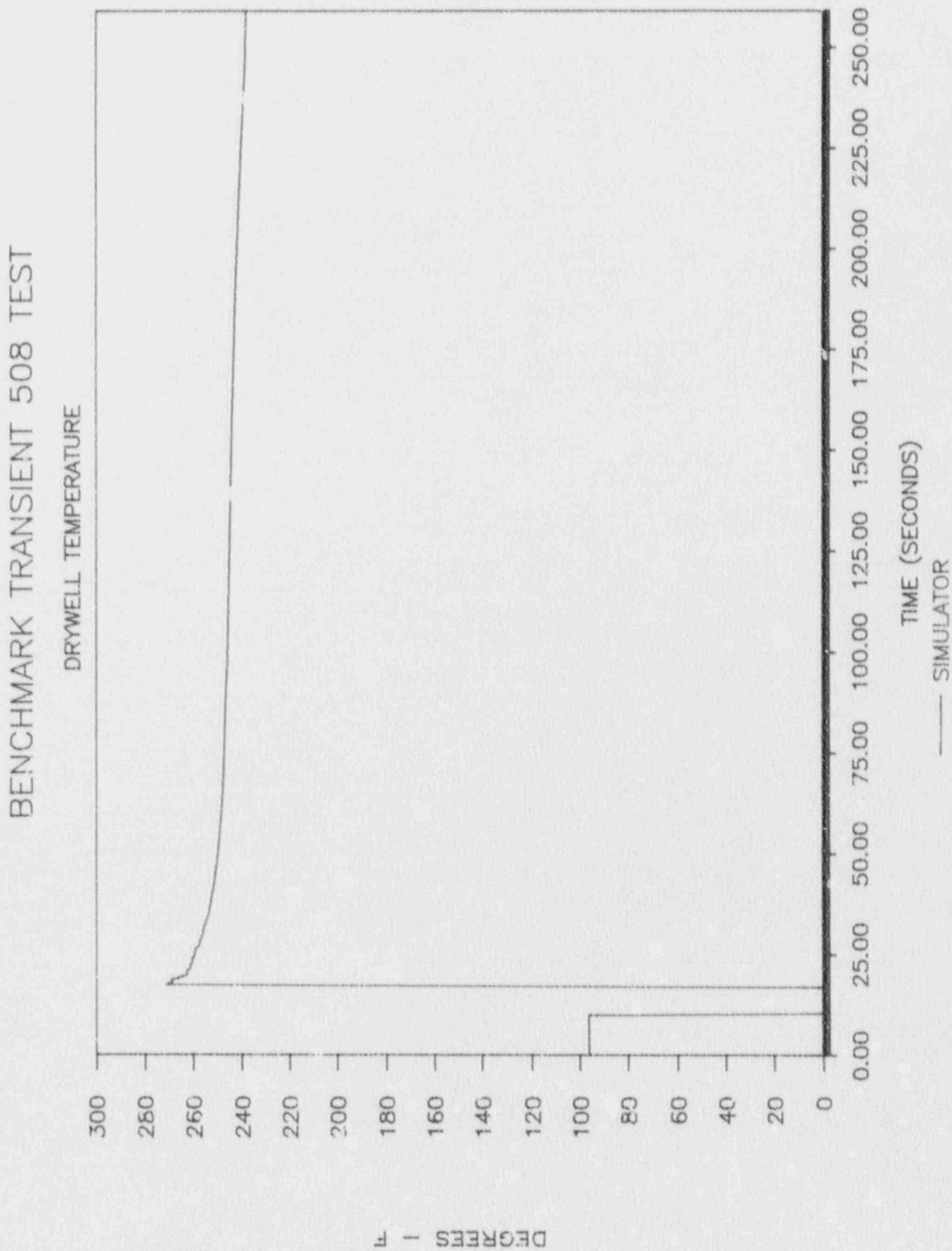


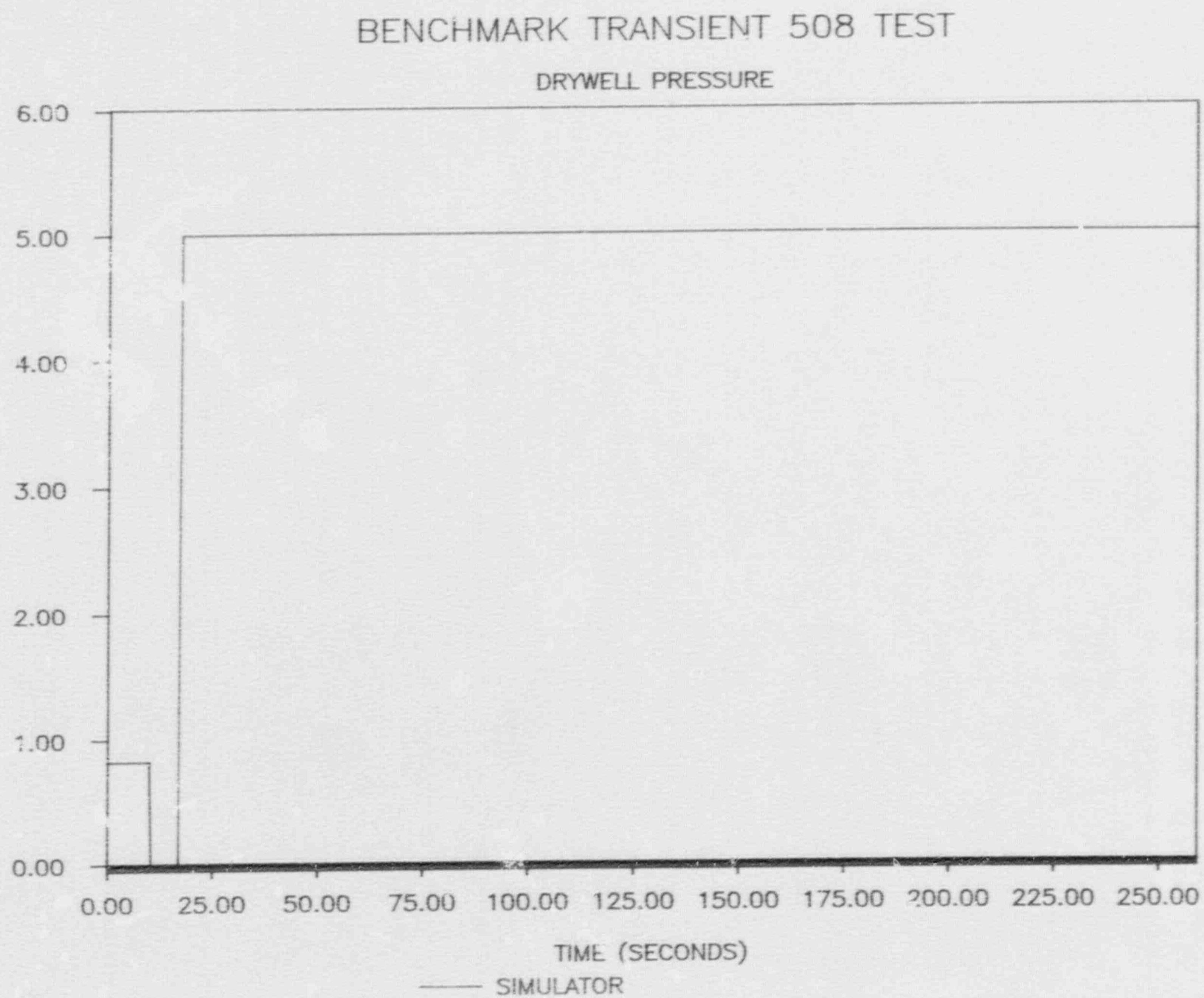
BENCHMARK TRANSIENT 508 TEST

SUPPRESSION POOL TEMPERATURE

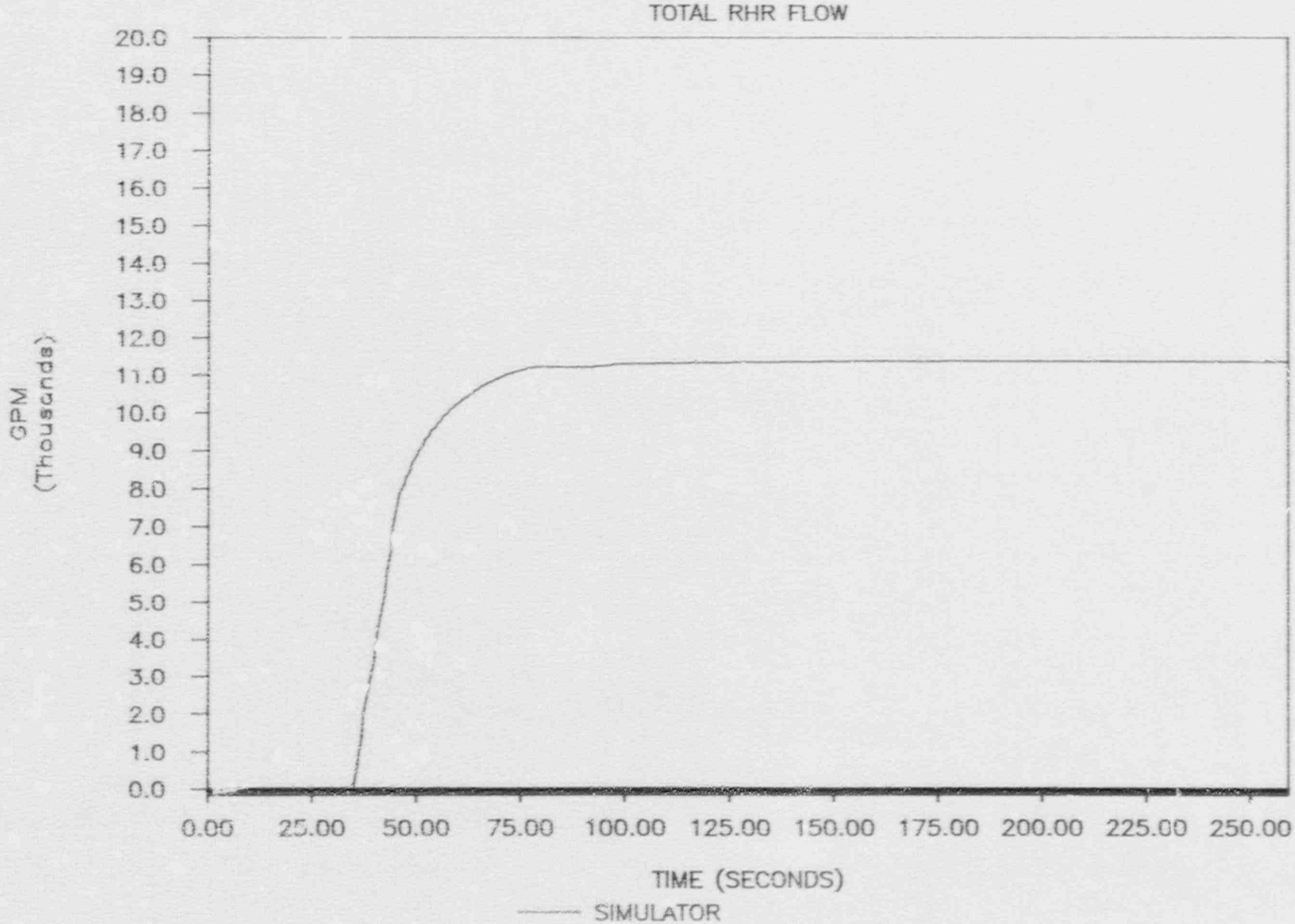


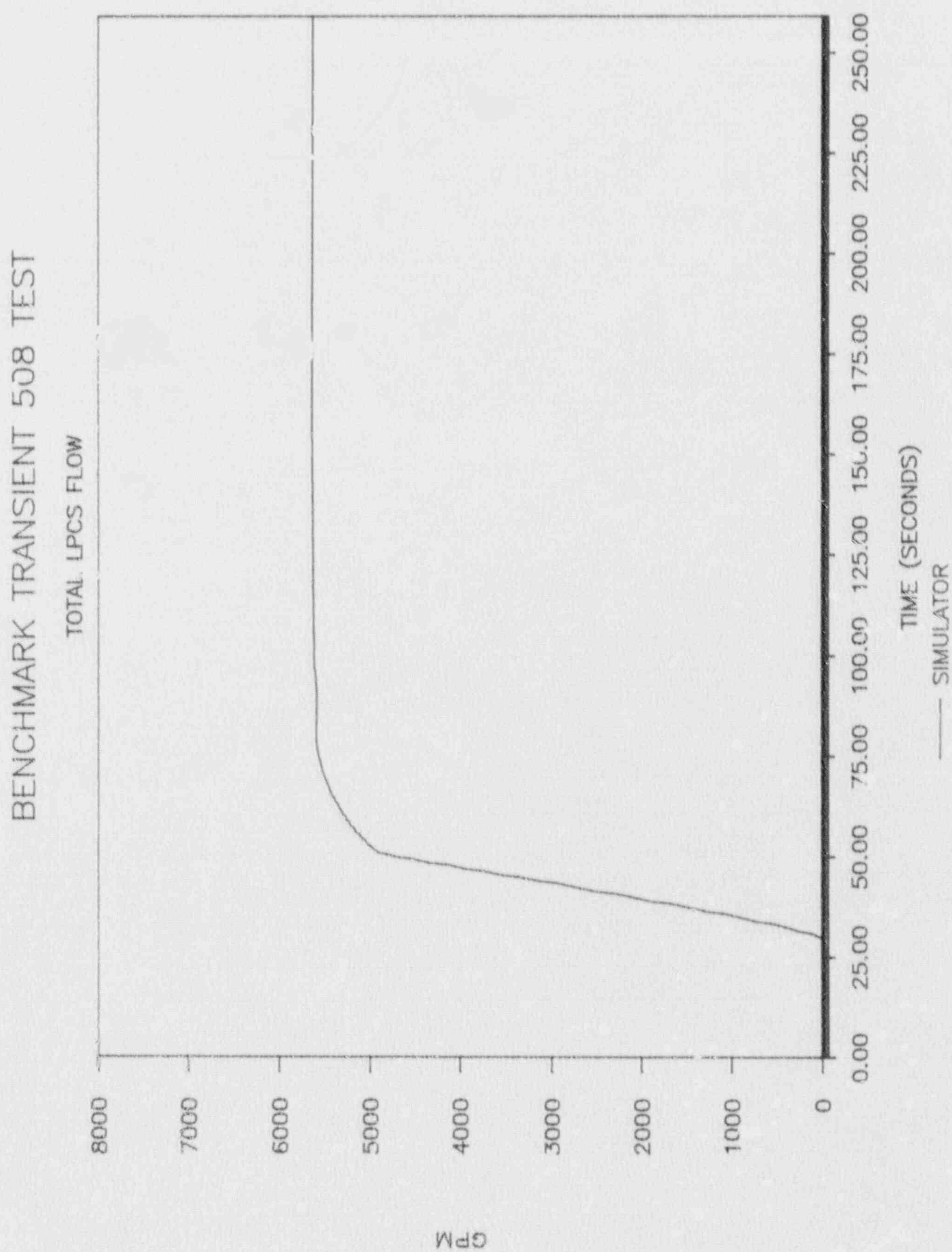

BENCHMARK TRANSIENT 508 TEST
CONTAINMENT PRESSURE
PSIA
30
28
26
24
22
20
18
16
14
12
10
8
6
4
2
0
0.00
25.00
50.00
75.00
100.00
125.00
150.00
175.00
200.00
225.00
250.00
TIME (SECONDS)
SIMULATOR

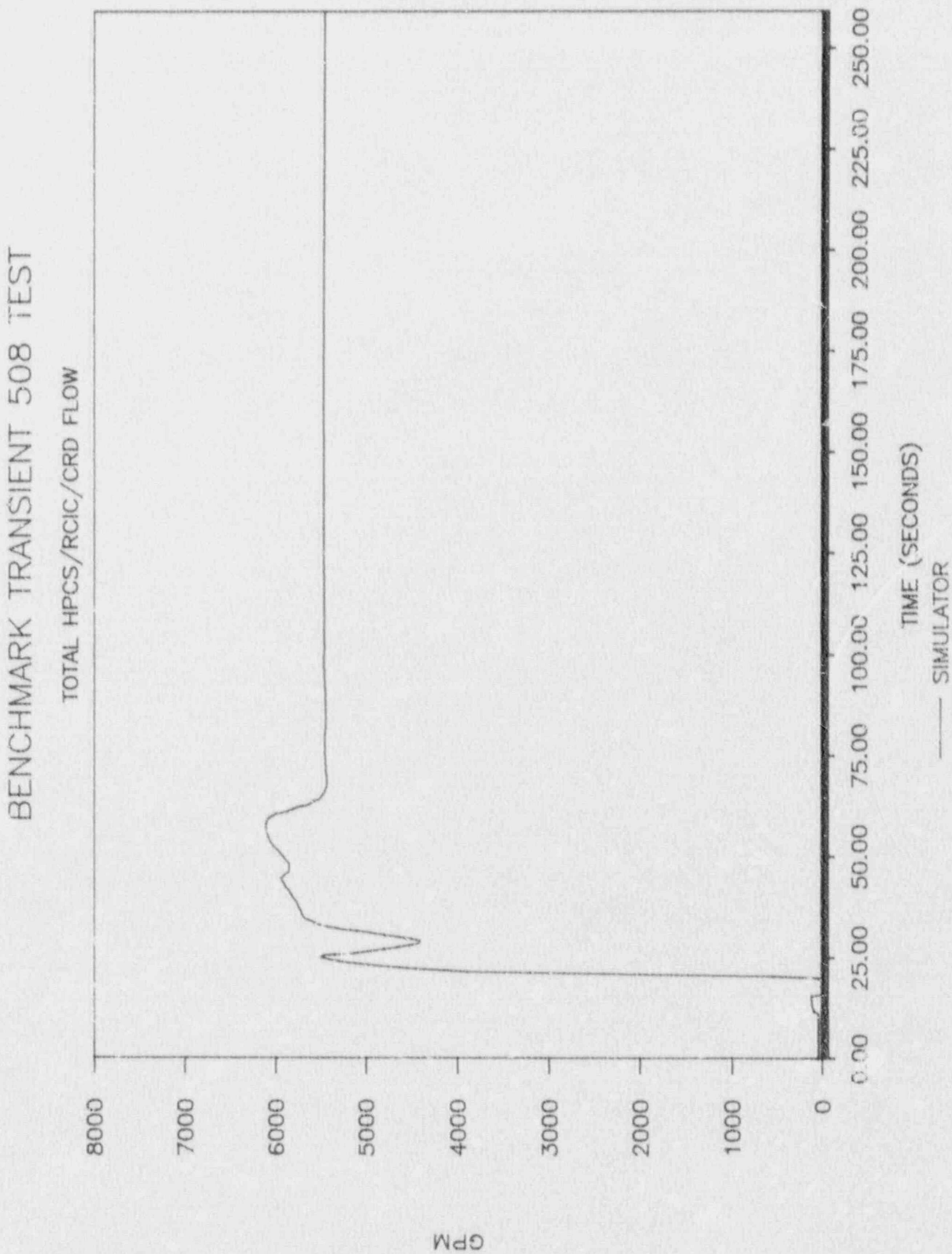

BENCHMARK TRANSIENT 508 TEST
DRYWELL TEMPERATURE
DEGREES - F
300
280
260
240
220
200
180
160
140
120
100
80
60
40
20
0
0.00
25.00
50.00
75.00
100.00
125.00
150.00
175.00
200.00
225.00
250.00
TIME (SECONDS)
SIMULATOR


BENCHMARK TRANSIENT 508 TEST
DRYWELL PRESSURE
PSIG
6.00
5.00
4.00
3.00
2.00
1.00
0.00
0.00
25.00
50.00
75.00
100.00
125.00
150.00
175.00
200.00
225.00
250.00
TIME (SECONDS)
SIMULATOR

BENCHMARK TRANSIENT 508 TEST

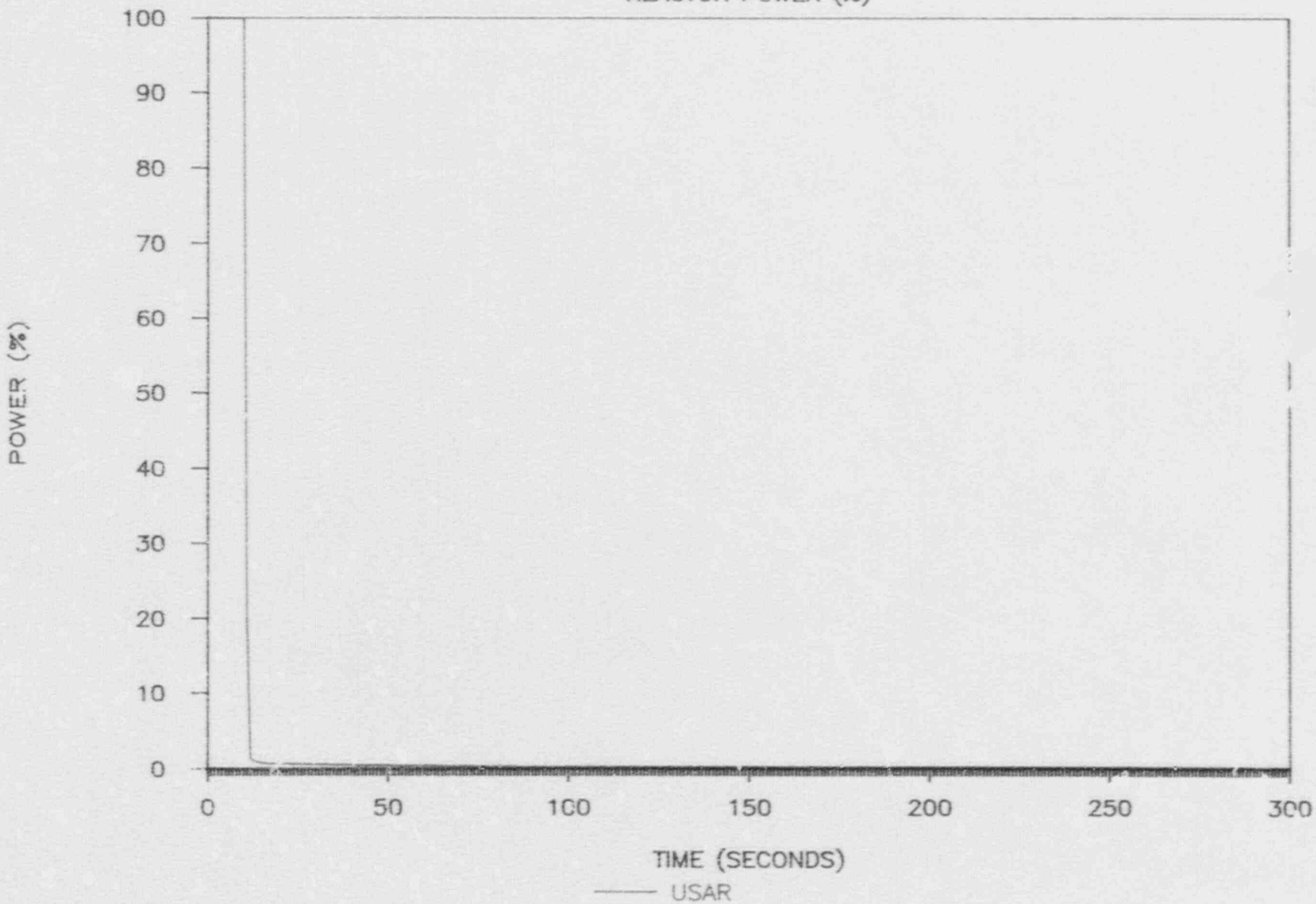


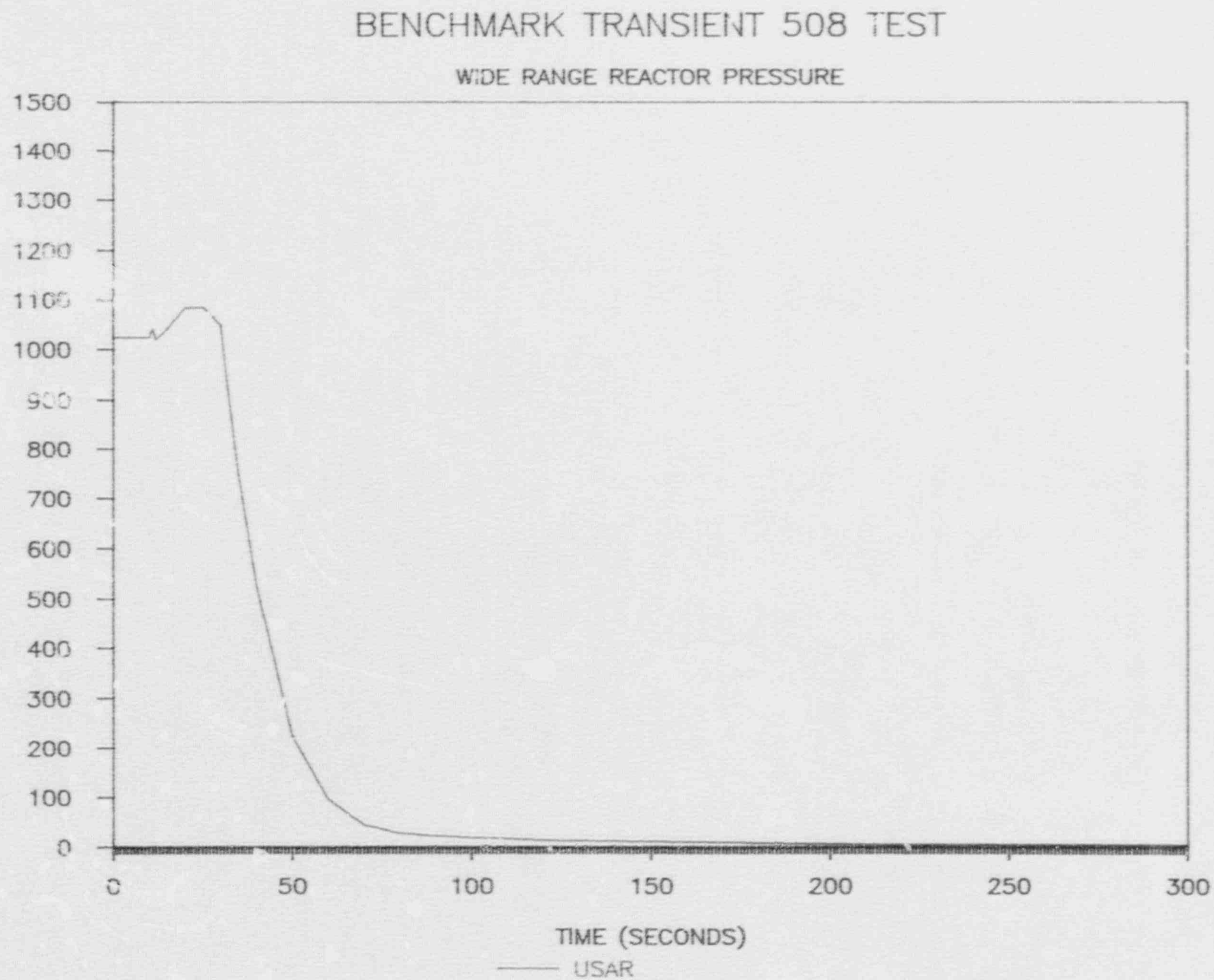

BENCHMARK TRANSIENT 508 TEST
TOTAL LPCS FLOW
GPM
8000
7000
6000
5000
4000
3000
2000
1000
0
0.00
25.00
50.00
75.00
100.00
125.00
150.00
175.00
200.00
225.00
250.00
TIME (SECONDS)
— SIMULATOR

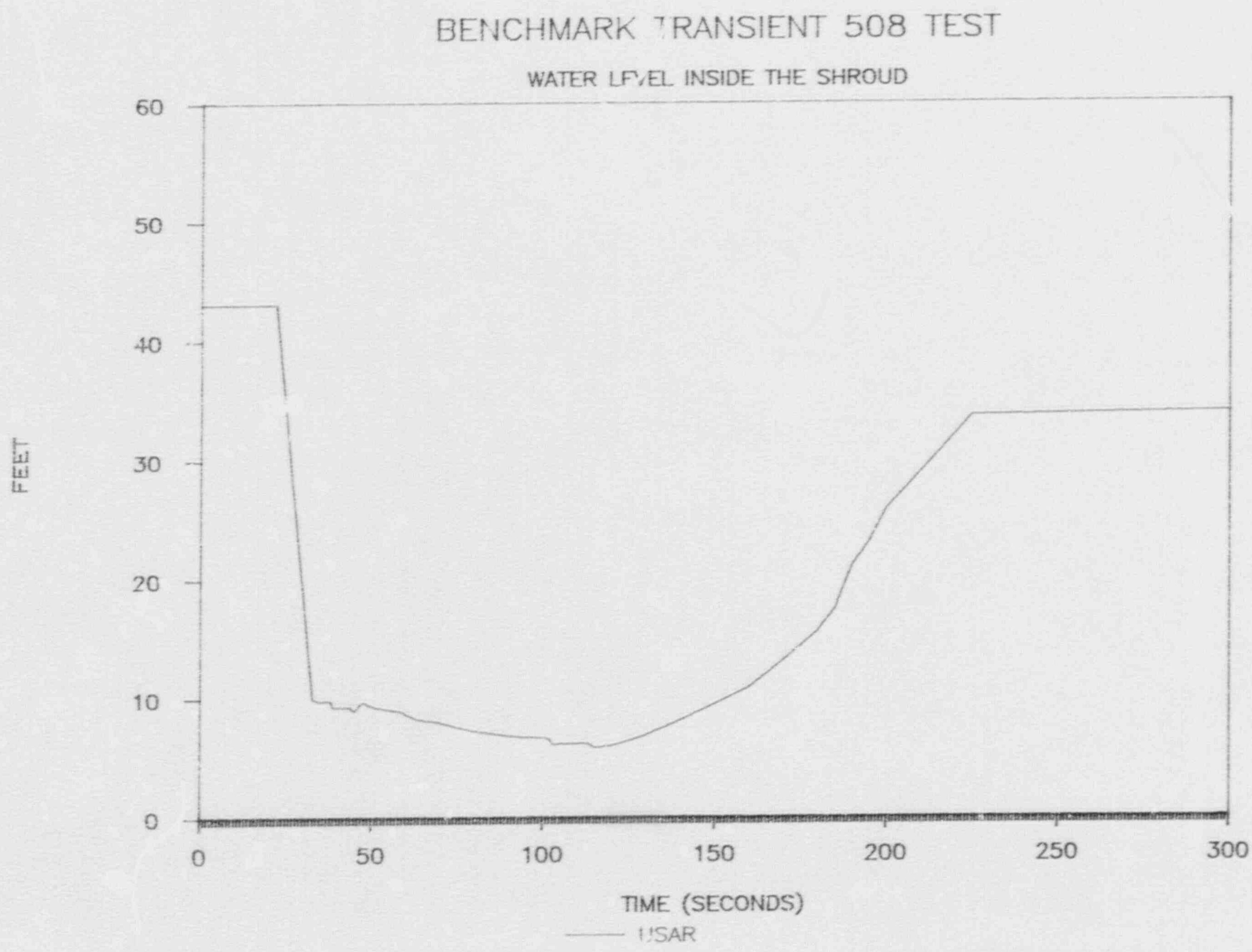

BENCHMARK TRANSIENT 508 TEST
TOTAL HPCS/RCIC/CRD FLOW
GPM
8000
7000
6000
5000
4000
3000
2000
1000
0
0.00
25.00
50.00
75.00
100.00
125.00
150.00
175.00
200.00
225.00
250.00
TIME (SECONDS)
SIMULATOR

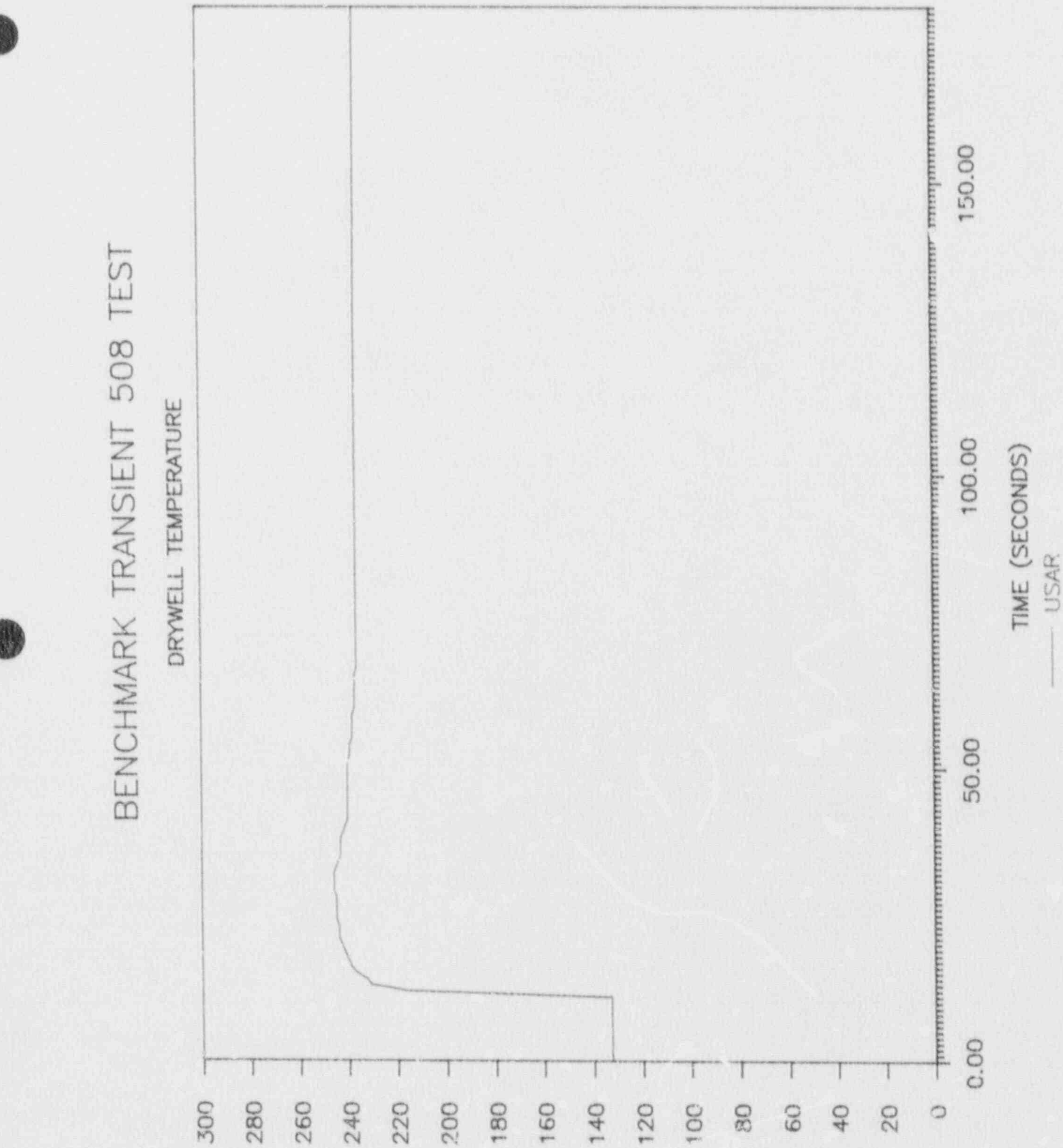
BENCHMARK TRANSIENT 508 TEST

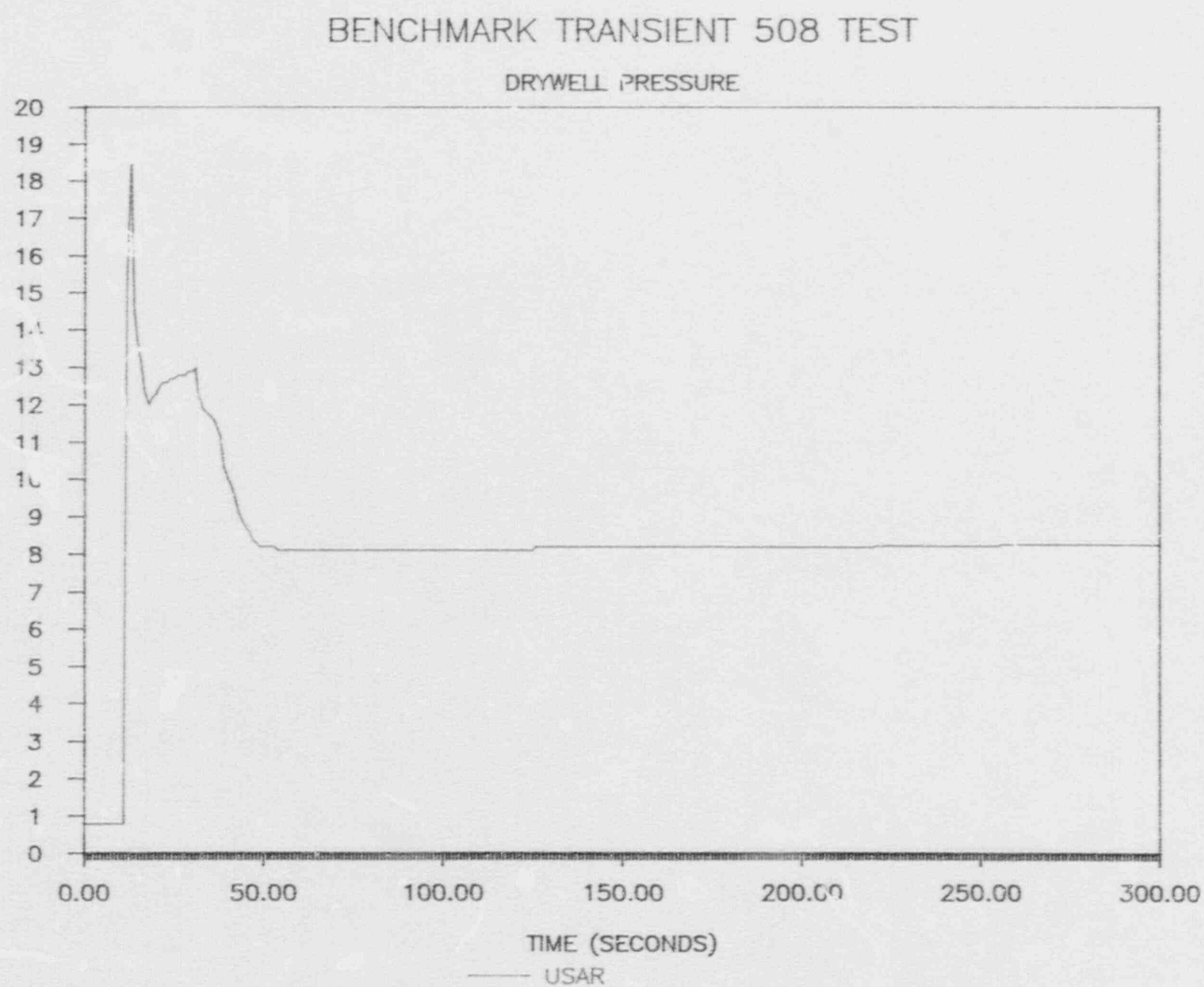
REACTOR POWER (%)



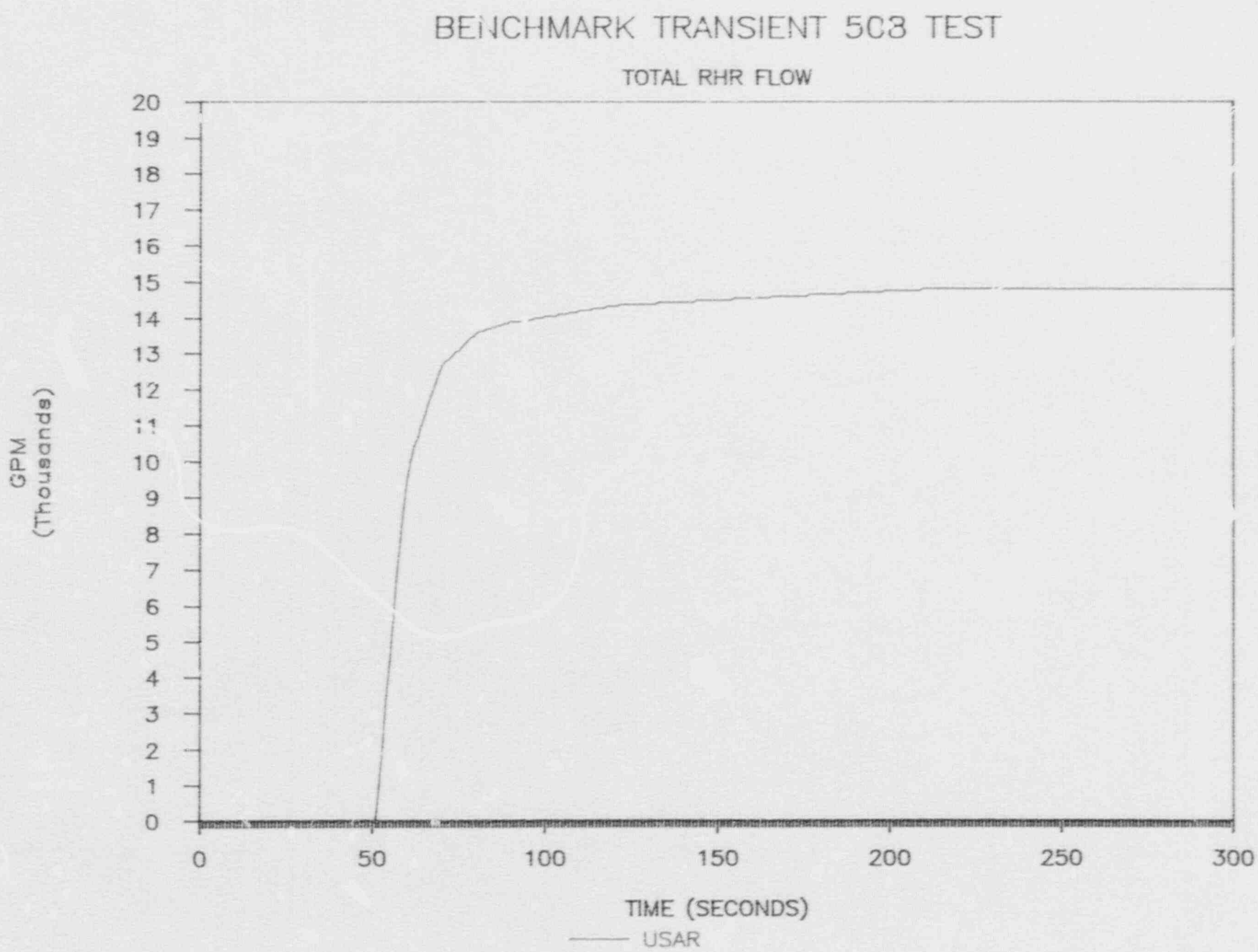

BENCHMARK TRANSIENT 508 TEST
WIDE RANGE REACTOR PRESSURE
PSIG
1500
1400
1300
1200
1100
1000
900
800
700
600
500
400
300
200
100
0
0
50
100
150
200
250
300
TIME (SECONDS)
USAR


BENCHMARK TRANSIENT 508 TEST
WATER LEVEL INSIDE THE SHROUD
60
50
40
30
20
10
0
FEET
0
50
100
150
200
250
300
TIME (SECONDS)
USAR


BENCHMARK TRANSIENT 508 TEST
DRYWELL TEMPERATURE
DEGREES — F
300
280
260
240
220
200
180
160
140
120
100
80
60
40
20
0
0.00
50.00
100.00
150.00
TIME (SECONDS)
USAR

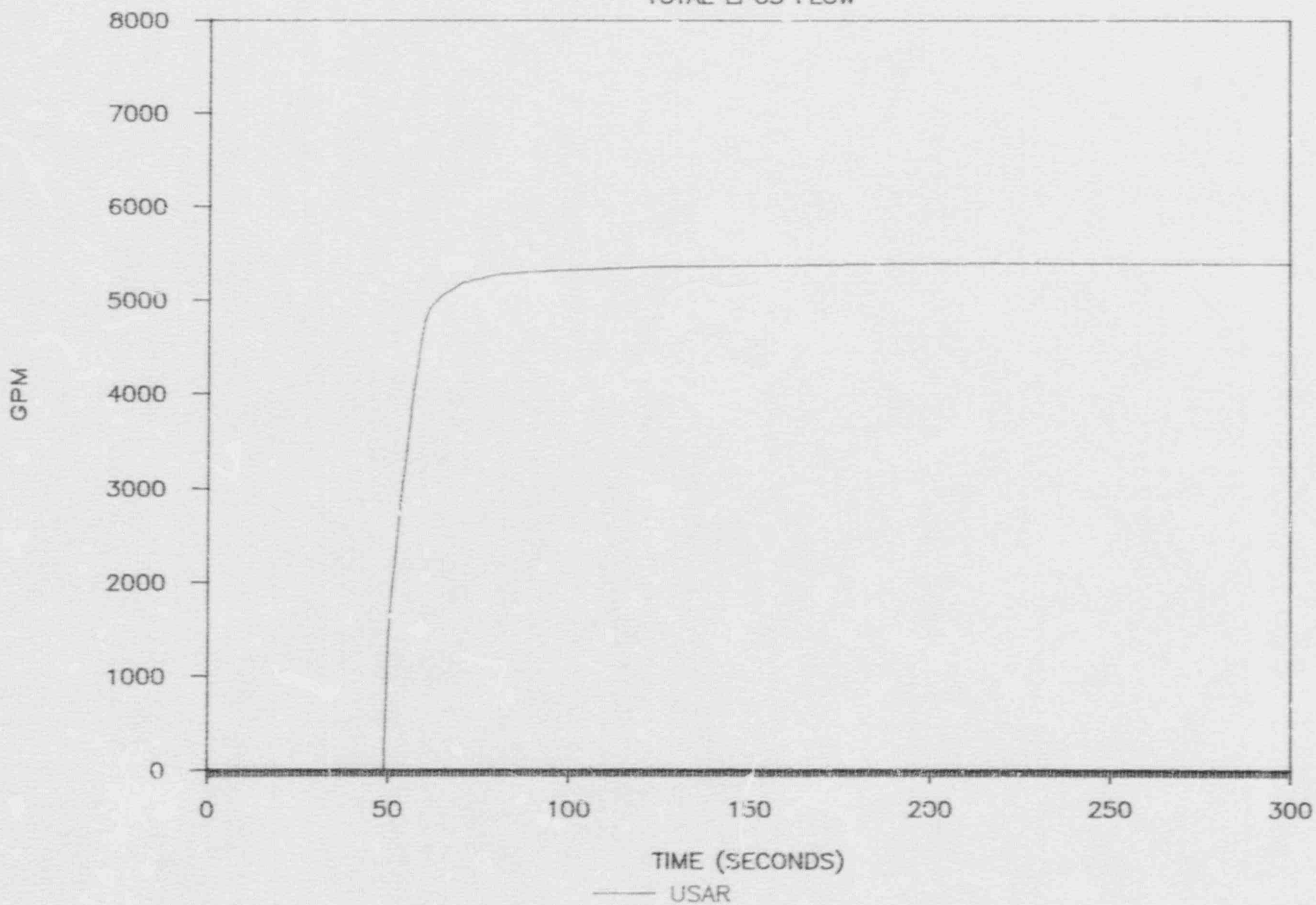


BENCHMARK TRANSIENT 508 TEST
DRYWELL PRESSURE
PSIG
TIME (SECONDS)
USAR


BENCHMARK TRANSIENT 5C3 TEST
TOTAL RHR FLOW
GPM (Thousands)
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
0
50
100
150
200
250
300
TIME (SECONDS)
USAR

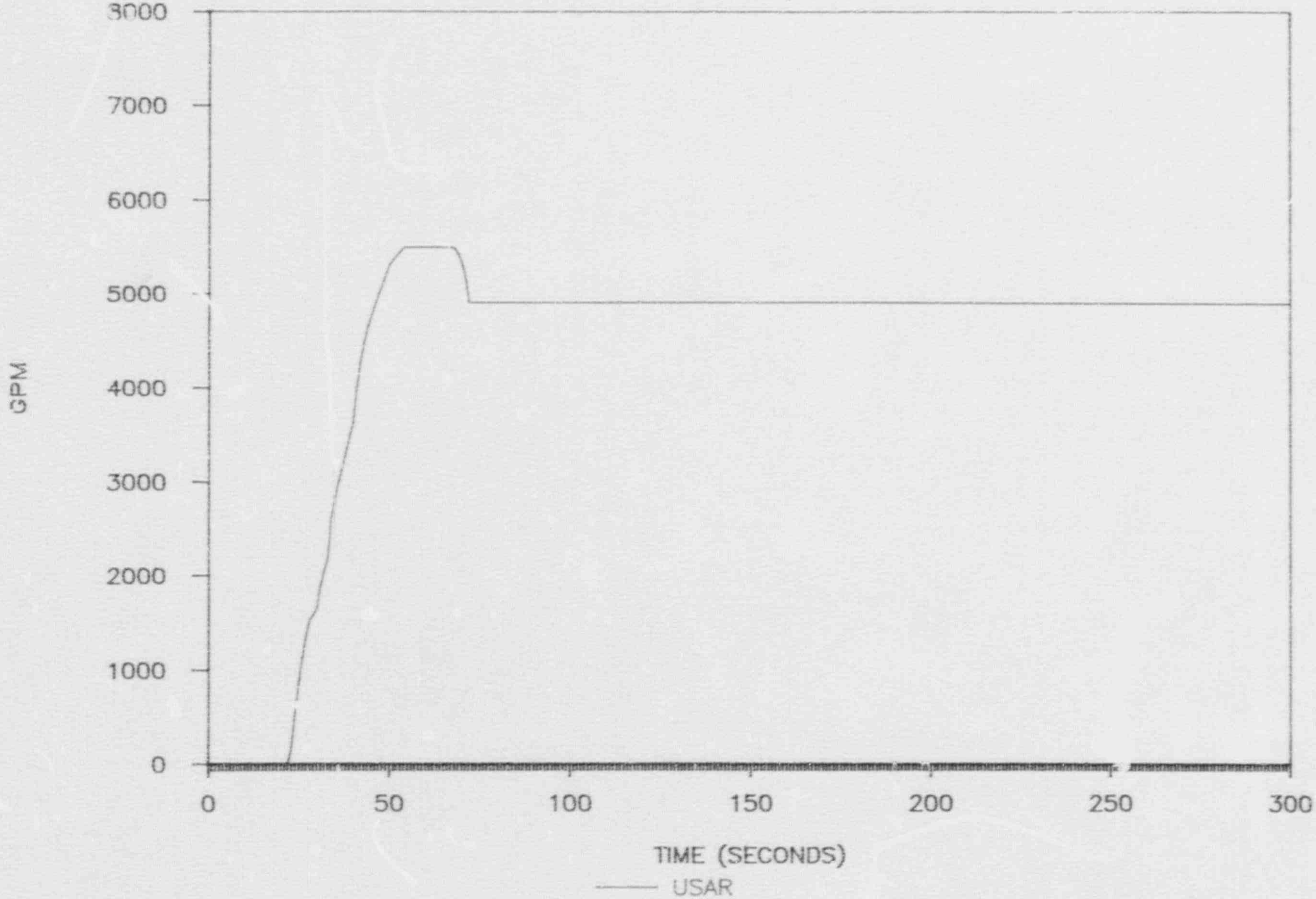
BENCHMARK TRANSIENT 508 TEST

TOTAL LPCS FLOW



BENCHMARK TRANSIENT 508 TEST

TOTAL HPCS/RCIC/CRD FLOW



SIMULATOR CERTIFICATION TEST SUMMARY

Test Name: STP 5.09, Maximum Size Unisolable Main Steam Line Rupture

Description: This test provides a benchmark comparison between the simulator and plant for a maximum size unisolatable main steam line rupture.

The simulator was initialized at full power. Data recording began. Approximately 10 seconds later, a malfunction was activated which resulted in a steam line rupture in the drywell. No operator actions were taken. The simulator was allowed to stabilize. After 5 minutes the simulator was placed in freeze and data recording was terminated.

Simulator performance was observed during the transient to ensure that alarms, automatic actions, and indications were appropriate for the transient. No violations of the physical laws of nature were observed.

This test was intended to meet the objectives of ANSI/ANS-3.5-1985, Appendix B, and footnote 3 of the standard.

Simulator Features Tested:

Simulator data recording capability at a resolution of 0.5 seconds.

Initial Conditions:

The simulator was operating in a normal full power lineup.

Final Conditions:

The simulator was stable following a rupture of a main steam line in the drywell.

SIMULATOR CERTIFICATION TEST SUMMARY

Test Name: STP 5.09, Maximum Size Unisolable Main Steam Line Rupture (Cont'd)

Baseline Data Source:

CPS Updated Safety Analysis Report (USAR)

Comparison:

The following simulator parameters were compared to the available baseline data. The magnitude and direction of change of all parameters were evaluated as acceptable.

Parameter	Evaluation
Reactor Power	Satisfactory
Reactor Pressure (WR)	Satisfactory
Reactor Level (WR)	Satisfactory
Reactor Level (FZ)	Satisfactory
Total Steam Flow	USAR Data Unavailable
Total Feedwater Flow	USAR Data Unavailable
Containment Temp	USAR Data Unavailable
Suppression Pool Temp	USAR Data Unavailable
Containment Pressure	USAR Data Unavailable
Drywell Temperature	Satisfactory
Drywell Pressure	Satisfactory
Total RHR Flow	Satisfactory
Total LPCS Flow	Satisfactory
Total HP Injection Flow	Satisfactory

Specific USAR data for wide range and fuel zone range reactor water level is not available for this transient. However, data is available which represents reactor water level inside the vessel shroud for this transient. While this data cannot be directly compared to instrumentation data, the USAR data does indicate a decrease in reactor water level in response to this transient which is consistent with the simulator wide range and fuel zone response.

SIMULATOR CERTIFICATION TEST SUMMARY

Test Name: STP 5.09, Maximum Size Unisolable Main Steam Line Rupture (Cont'd)

The short duration spike indicated on the USAR drywell temperature curve is believed to be caused by conservatisms built into the USAR analysis. Licensed CPS operators have judged the simulator performance to be consistent with expected plant performance for this transient.

Simulator drywell pressure began indicating 5 psig and remained constant for the duration of the transient, as expected. This is because the particular drywell pressure instrument recorded by the simulator data recording system has an upper limit of 5 psig in accordance with plant configuration.

CPS licensed operators have reviewed the simulator data for the parameters having no corresponding USAR data, and have judged simulator performance to be acceptable and consistent with that expected for the transient.

Graphs of simulator and USAR data follow this test summary. When all parameters are considered, the overall simulator response to this transient is satisfactory.

Deficiencies Found:

None

Corrective Actions Planned (and schedule):

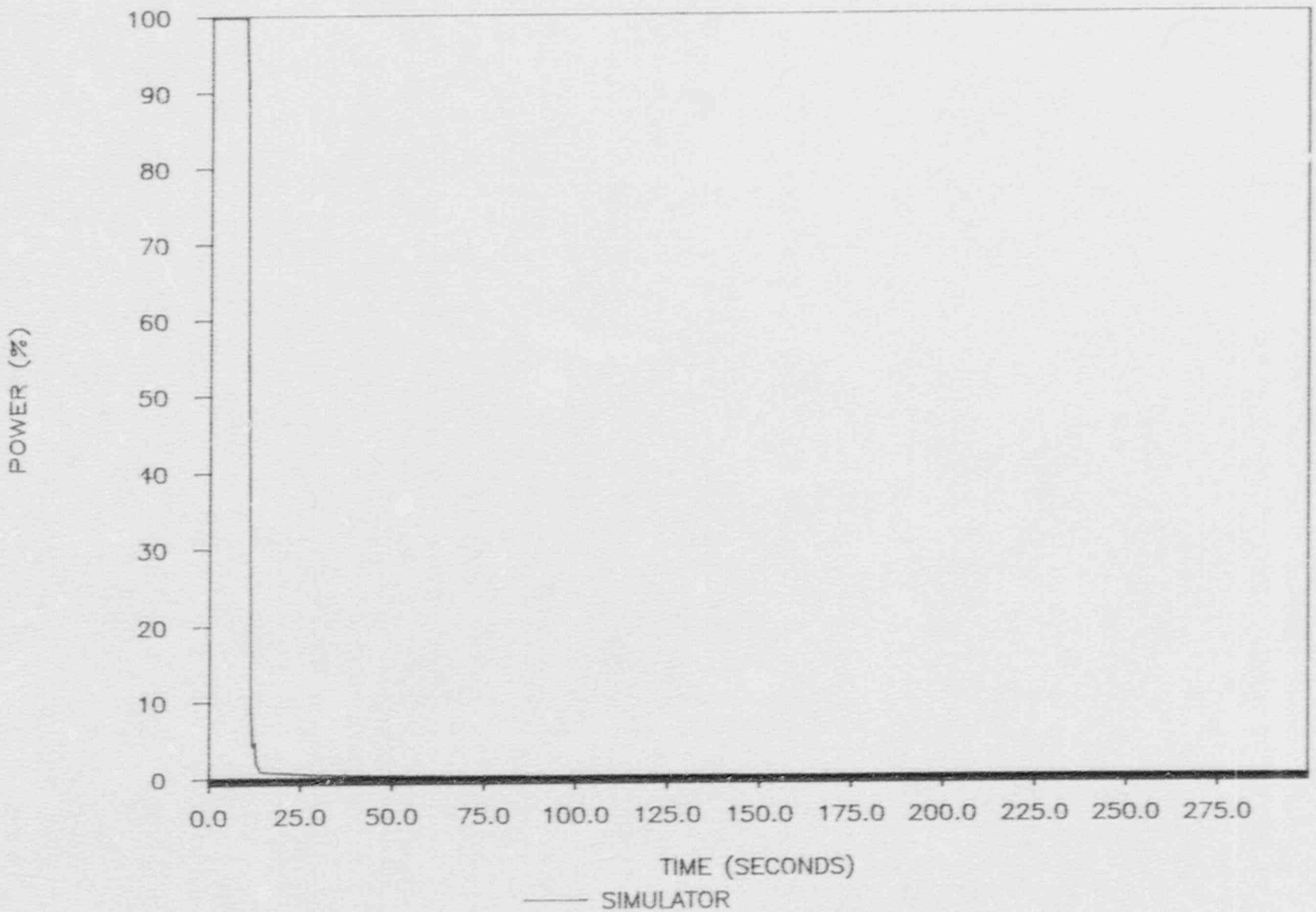
None

Exceptions Taken/Justification:

None

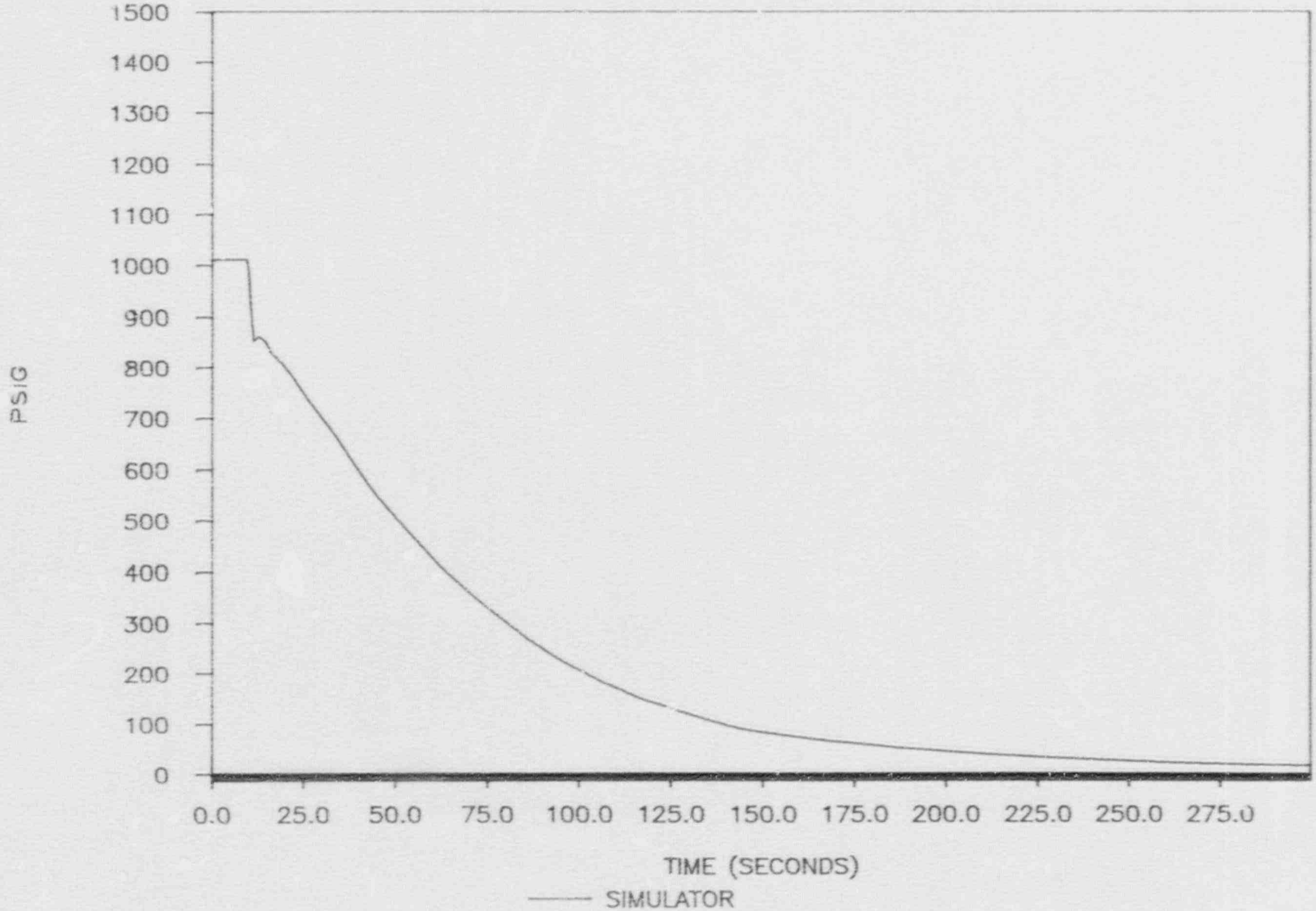
BENCHMARK TRANSIENT 509 TEST

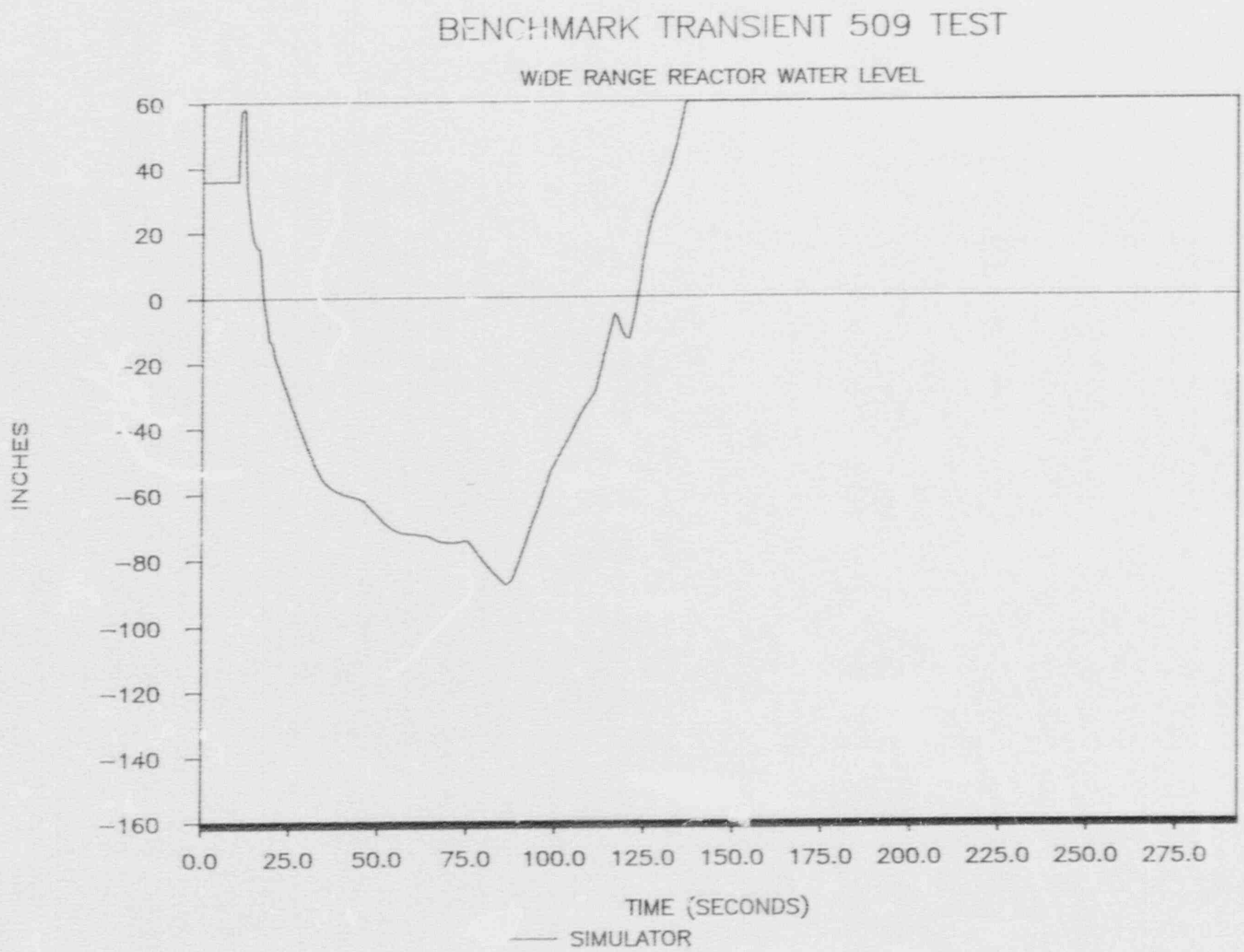
REACTOR POWER (%)



BENCHMARK TRANSIENT 509 TEST

WIDE RANGE REACTOR PRESSURE

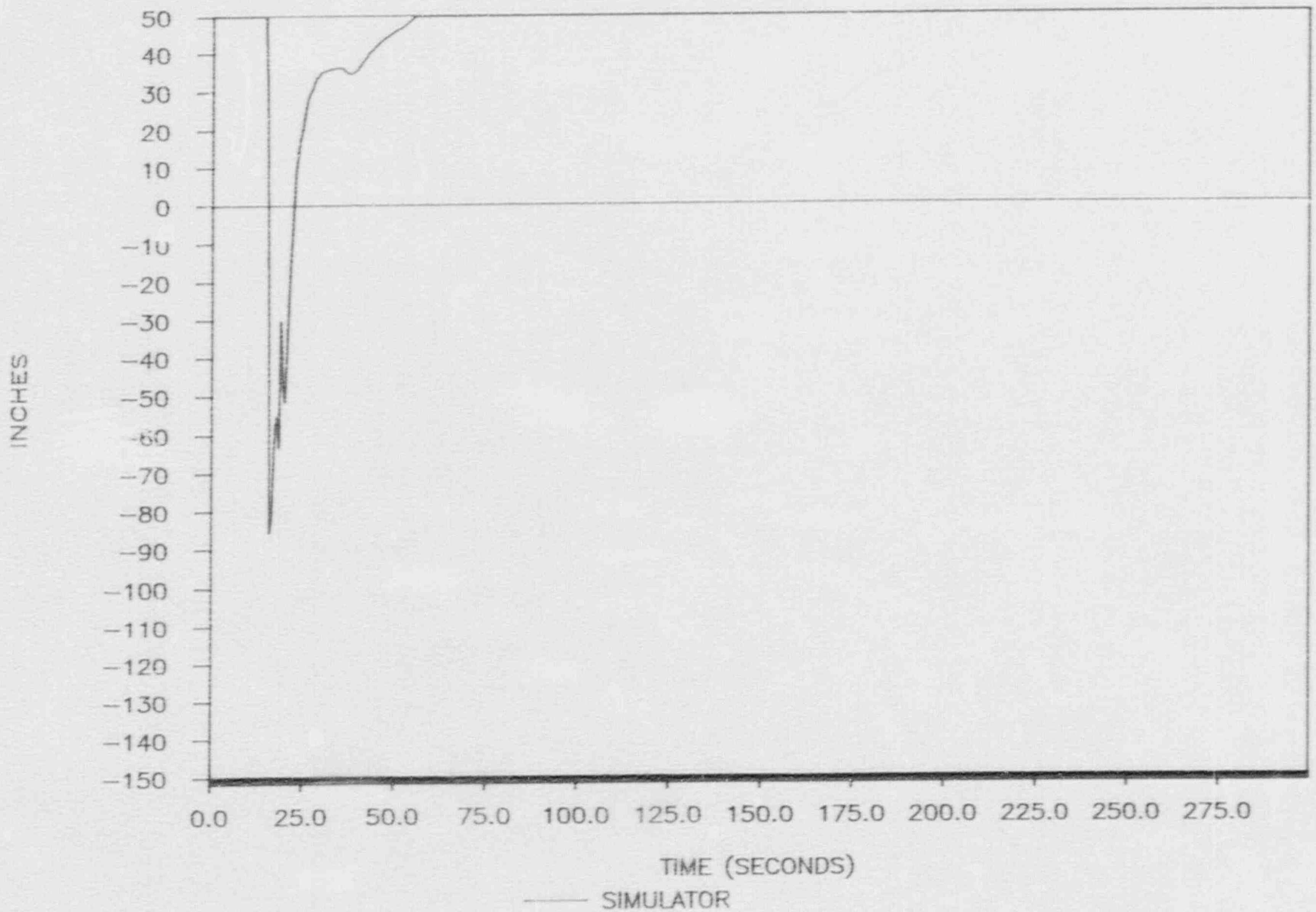




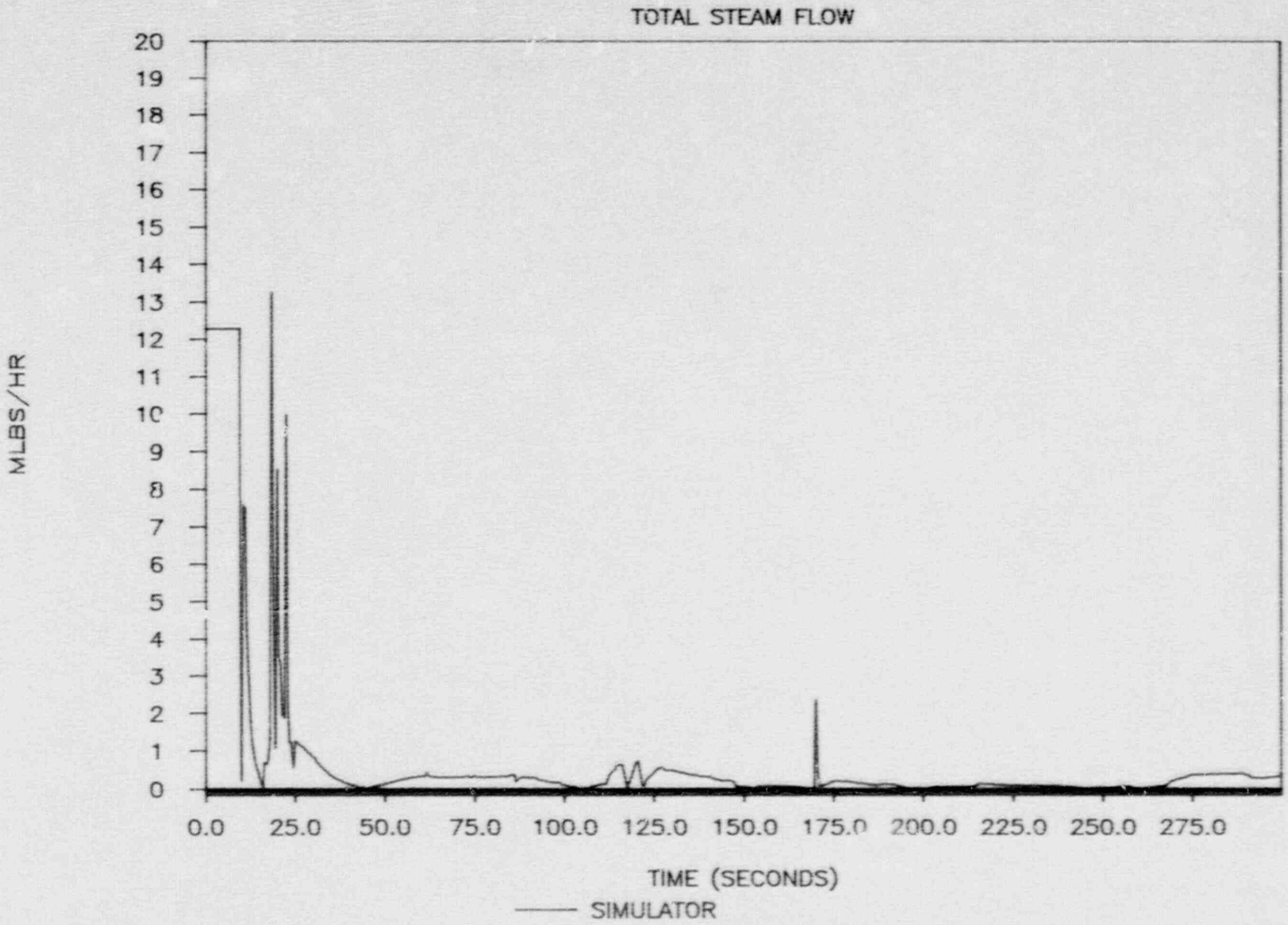
BENCHMARK TRANSIENT 509 TEST
WIDE RANGE REACTOR WATER LEVEL
INCHES
60
40
20
0
-20
-40
-60
-80
-100
-120
-140
-160
0.0
25.0
50.0
75.0
100.0
125.0
150.0
175.0
200.0
225.0
250.0
275.0
TIME (SECONDS)
SIMULATOR

BENCHMARK TRANSIENT 509 TEST

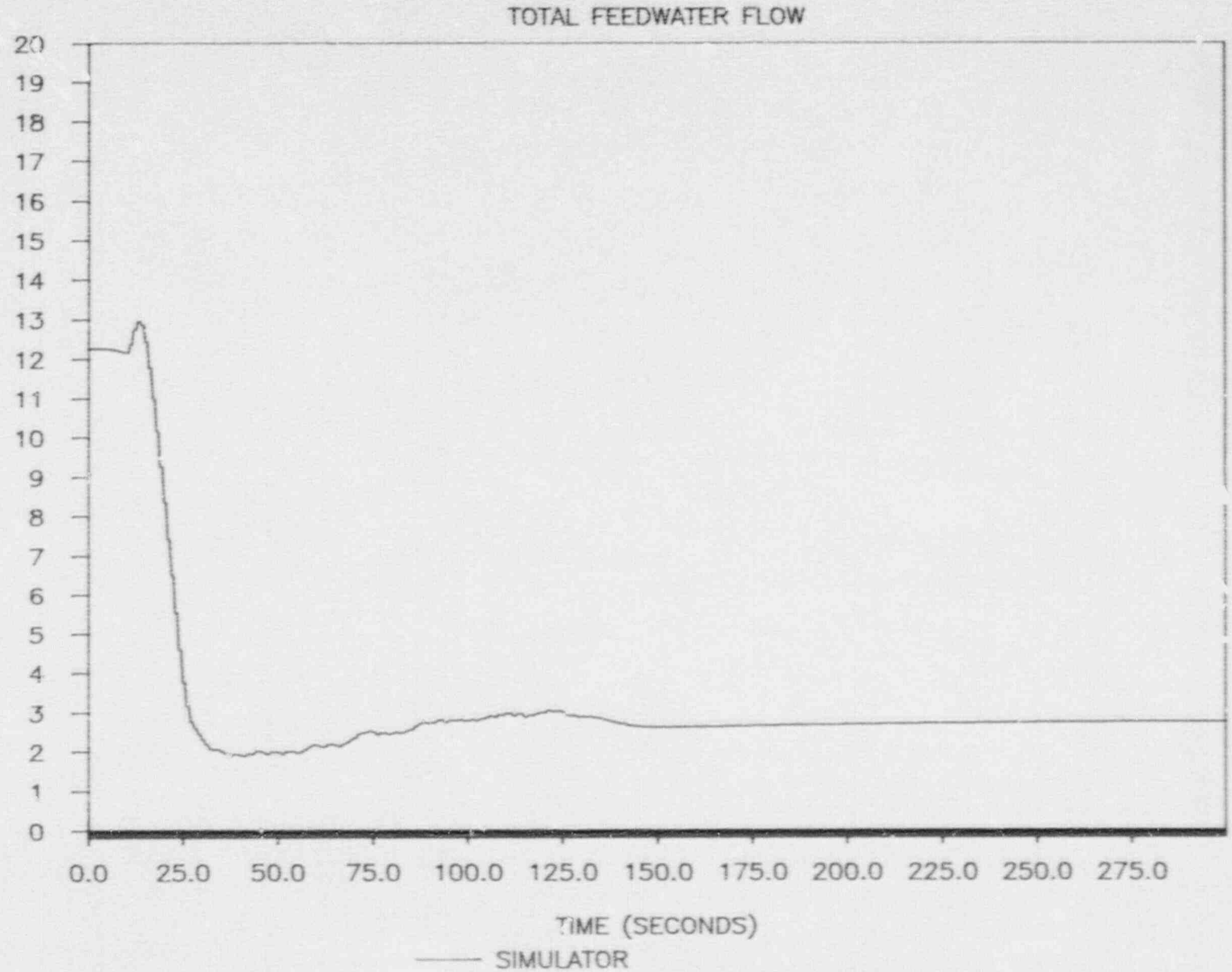
FUEL ZONE REACTOR WATER LEVEL



BENCHMARK TRANSIENT 509 TEST

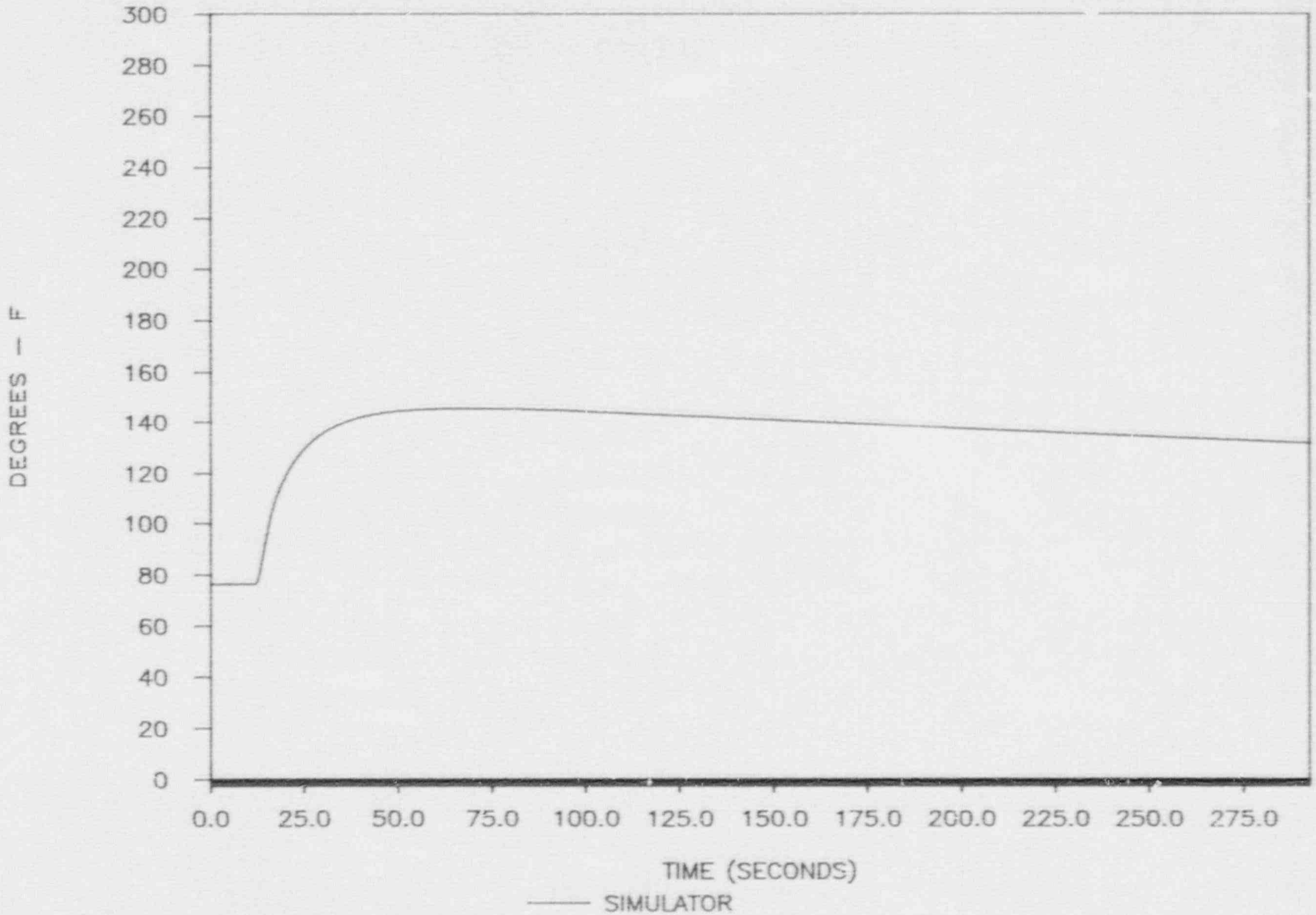


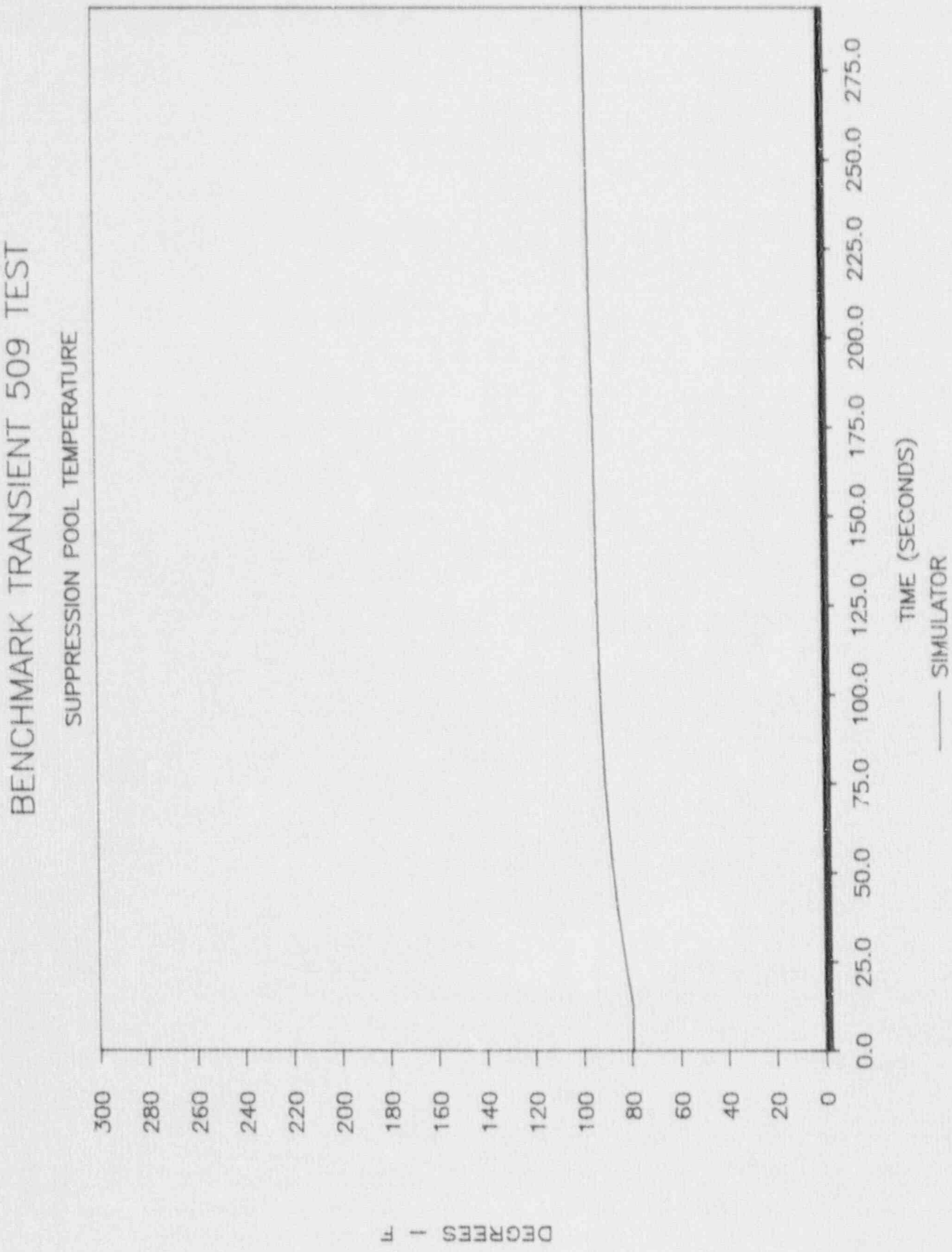
BENCHMARK TRANSIENT 509 TEST



BENCHMARK TRANSIENT 509 TEST

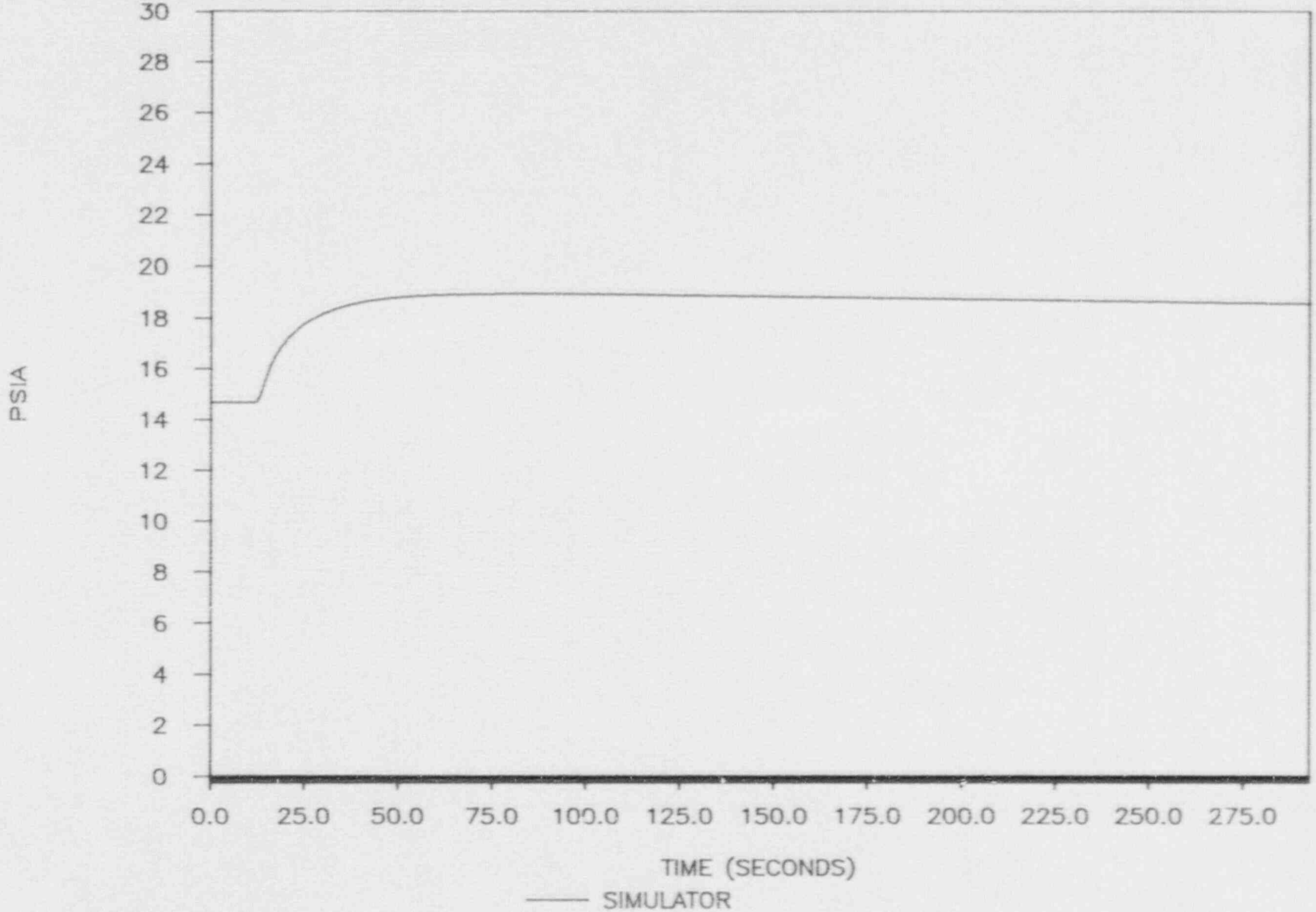
CONTAINMENT TEMPERATURE

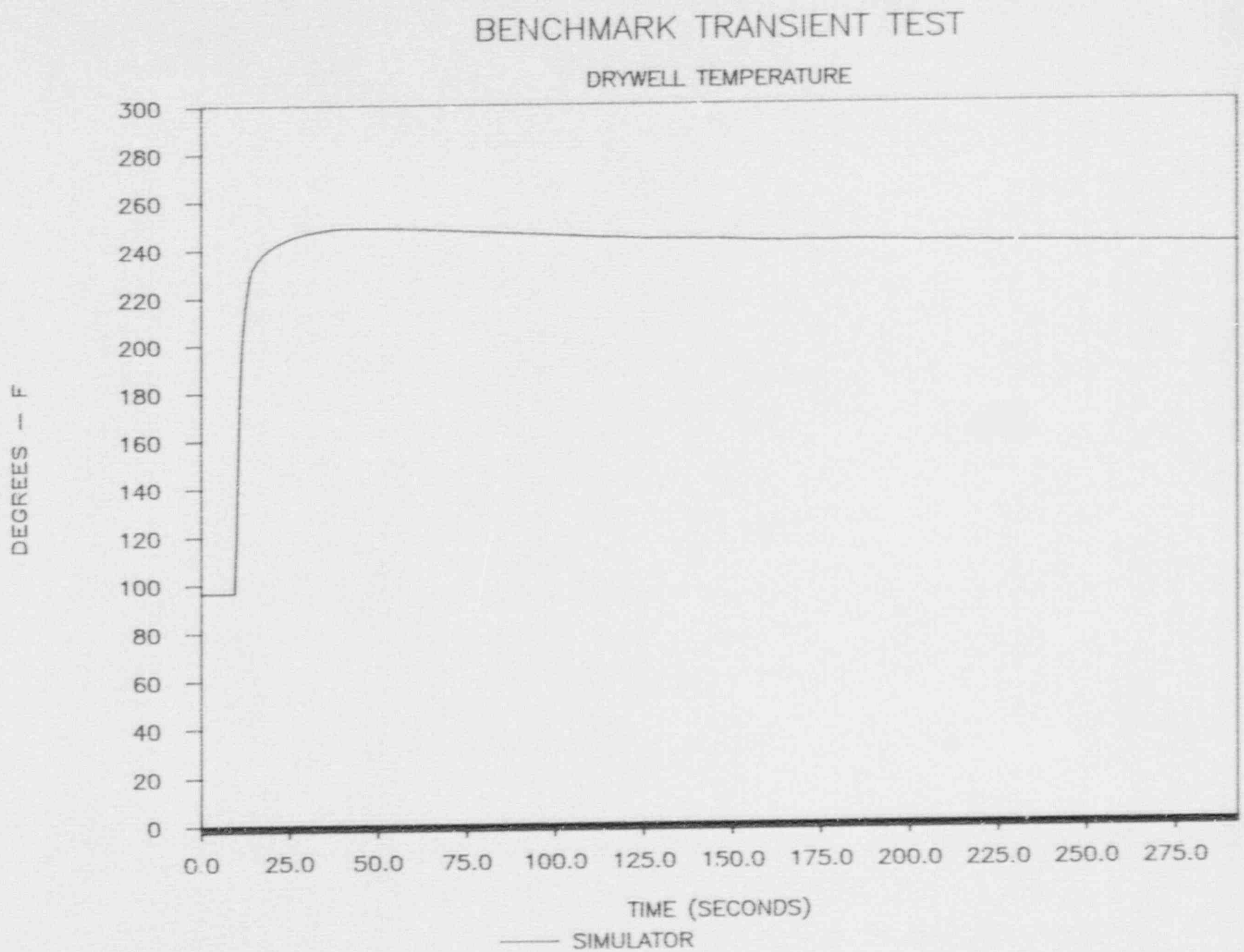


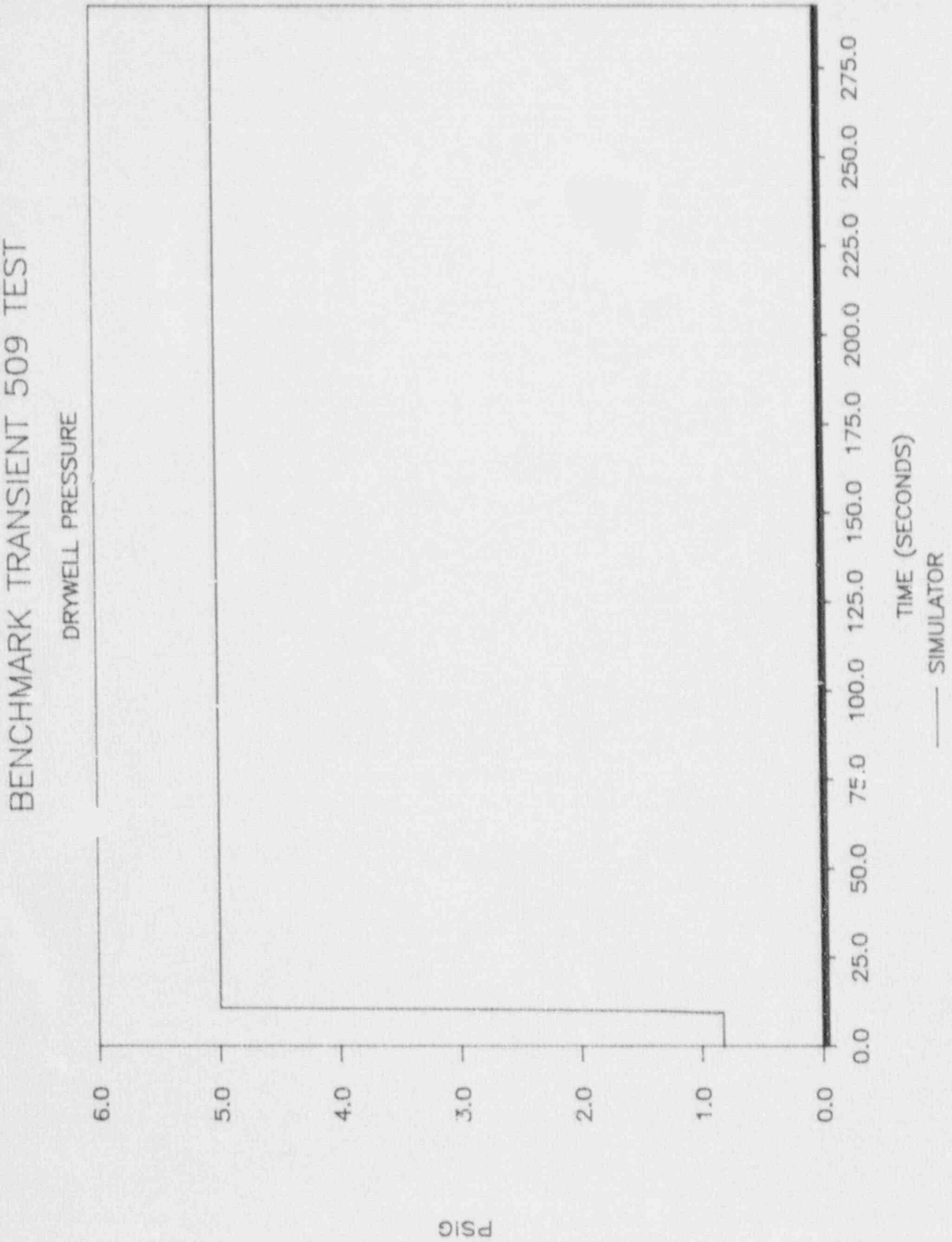

BENCHMARK TRANSIENT 509 TEST
SUPPRESSION POOL TEMPERATURE
DEGREES - F
300
280
260
240
220
200
180
160
140
120
100
80
60
40
20
0
0.0
25.0
50.0
75.0
100.0
125.0
150.0
175.0
200.0
225.0
250.0
275.0
TIME (SECONDS)
—— SIMULATOR

BENCHMARK TRANSIENT 509 TEST

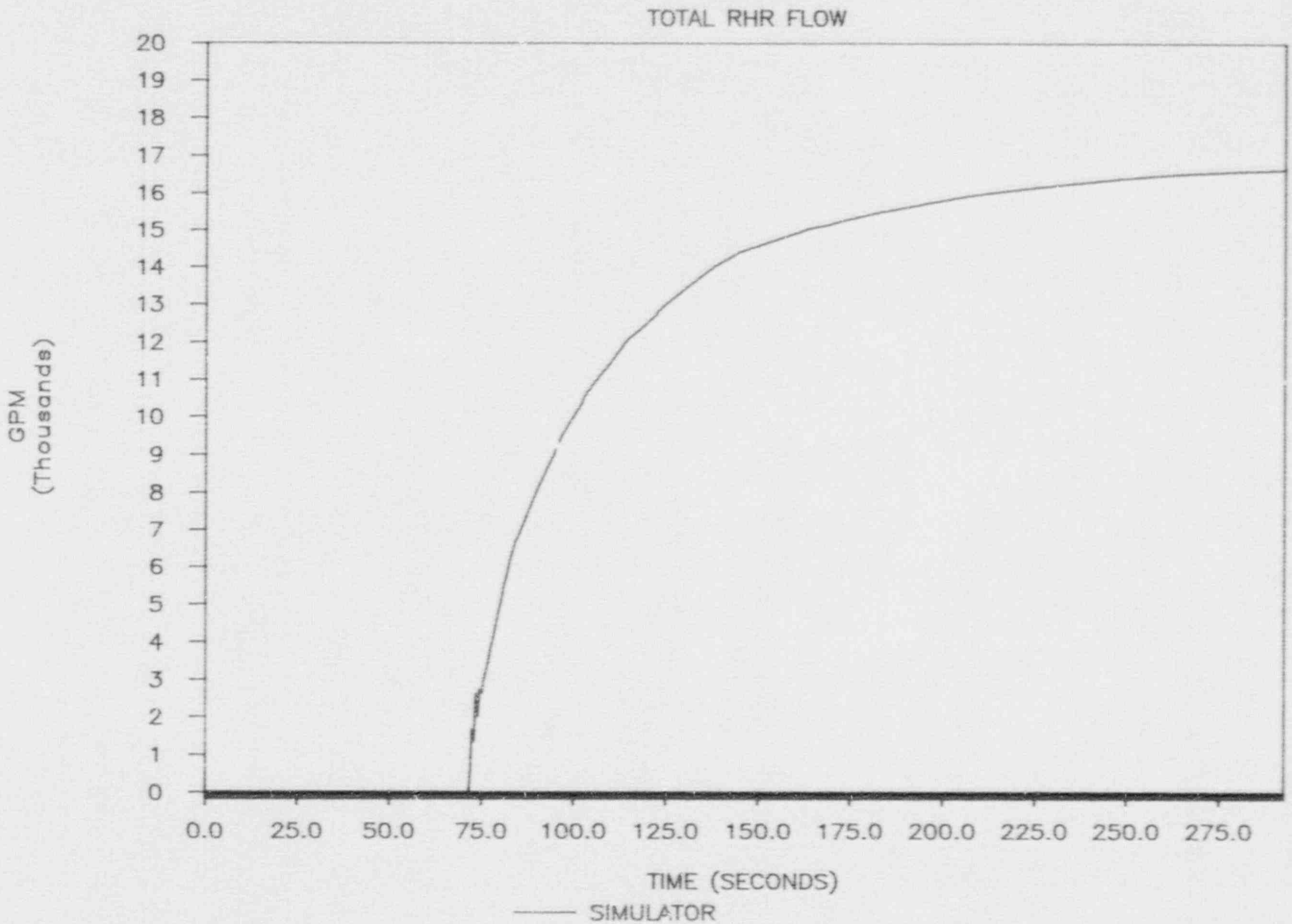
CONTAINMENT PRESSURE

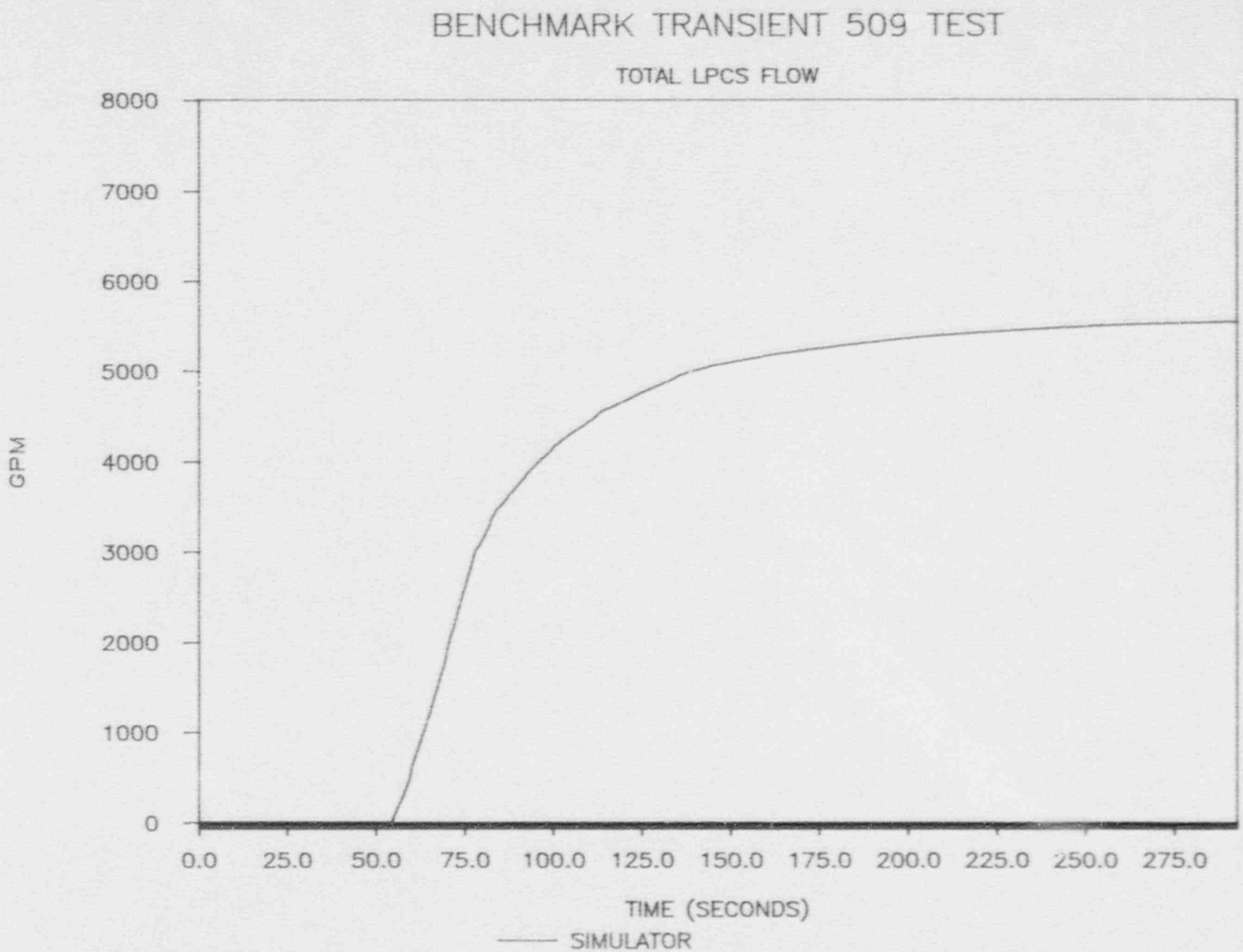


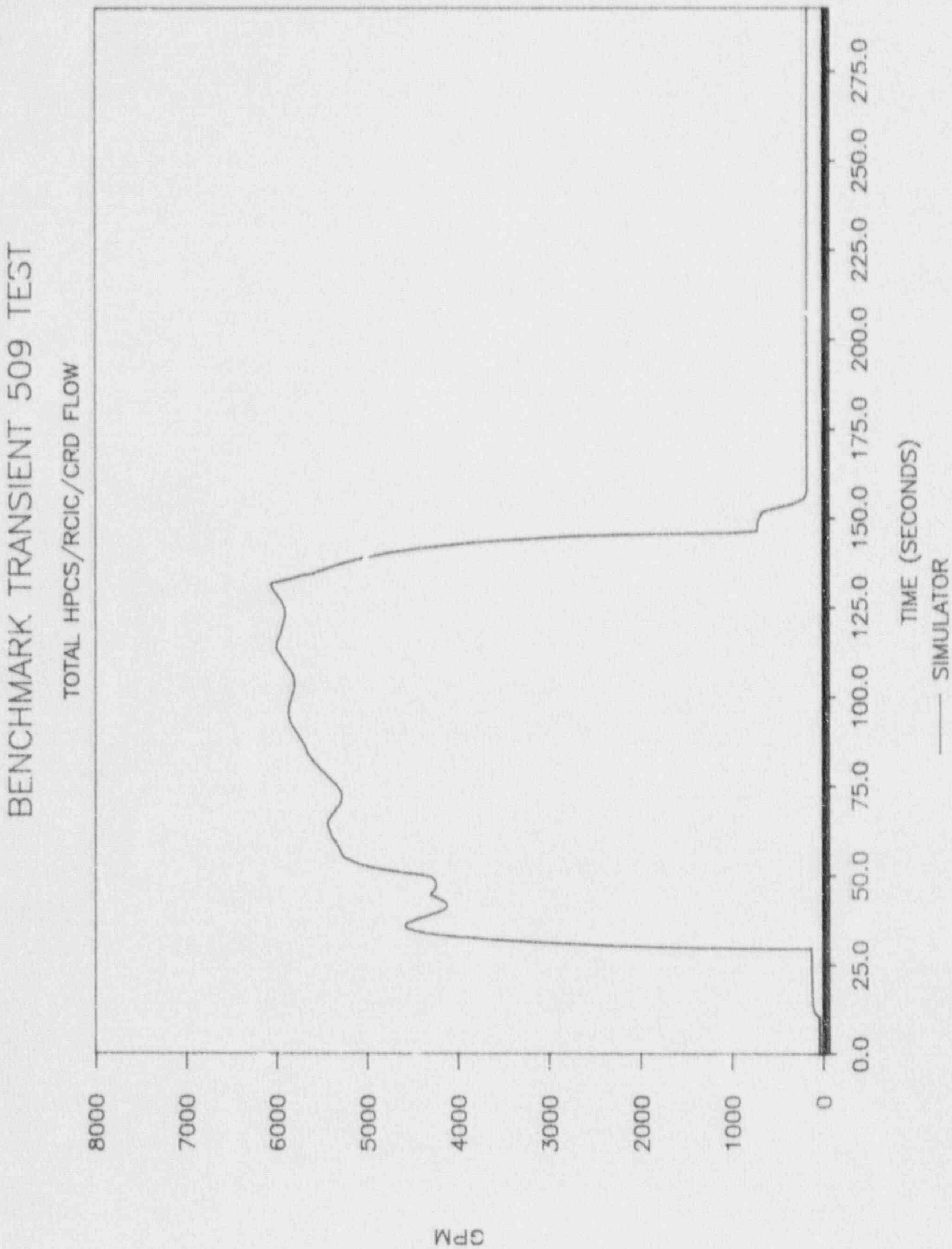

BENCHMARK TRANSIENT TEST
DRYWELL TEMPERATURE
DEGREES — F
300
280
260
240
220
200
180
160
140
120
100
80
60
40
20
0
0.0
25.0
50.0
75.0
100.0
125.0
150.0
175.0
200.0
225.0
250.0
275.0
TIME (SECONDS)
SIMULATOR


BENCHMARK TRANSIENT 509 TEST
DRYWELL PRESSURE
PSIG
6.0
5.0
4.0
3.0
2.0
1.0
0.0
0.0
25.0
50.0
75.0
100.0
125.0
150.0
175.0
200.0
225.0
250.0
275.0
TIME (SECONDS)
SIMULATOR

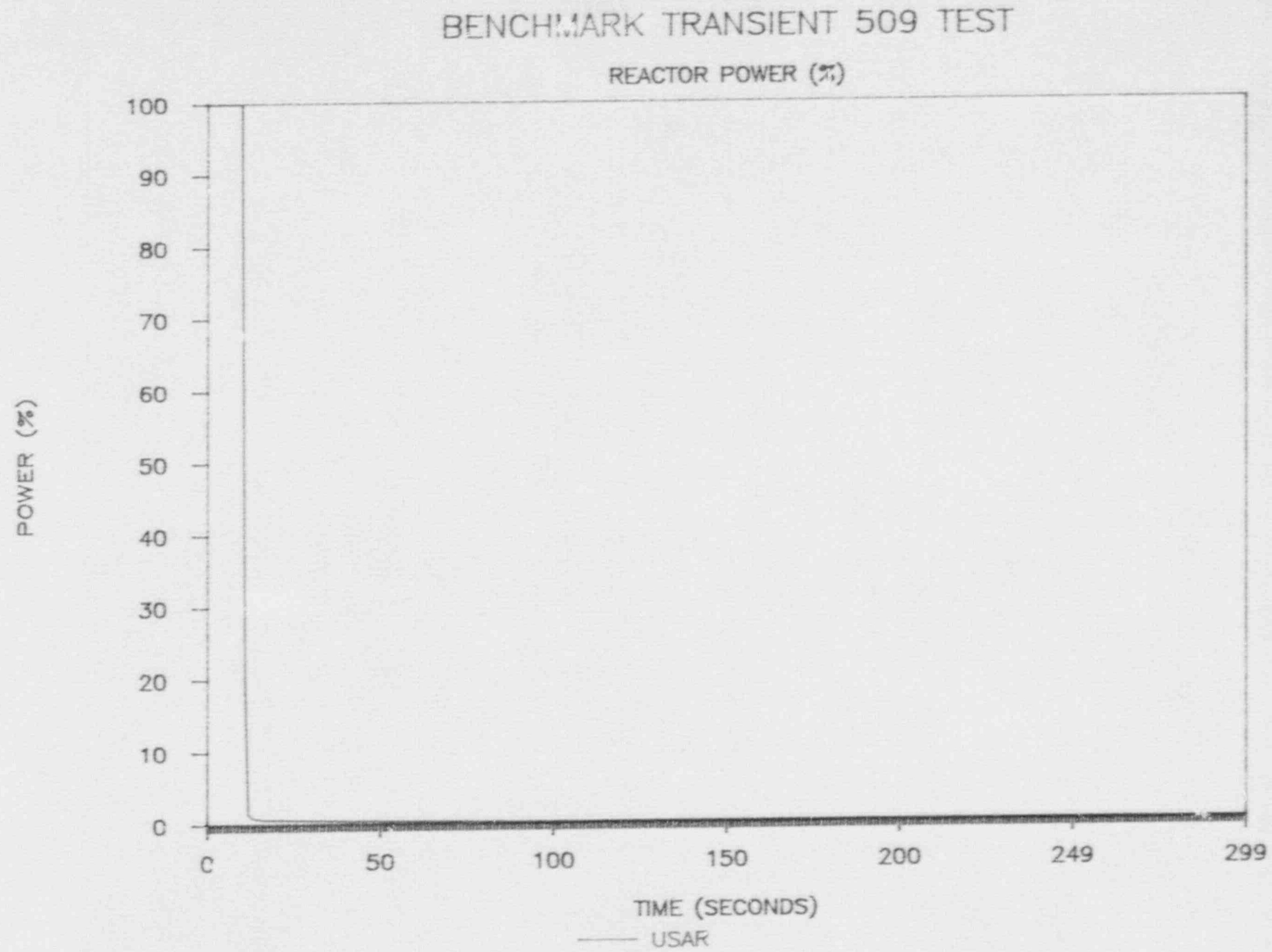
BENCHMARK TRANSIENT 509 TEST



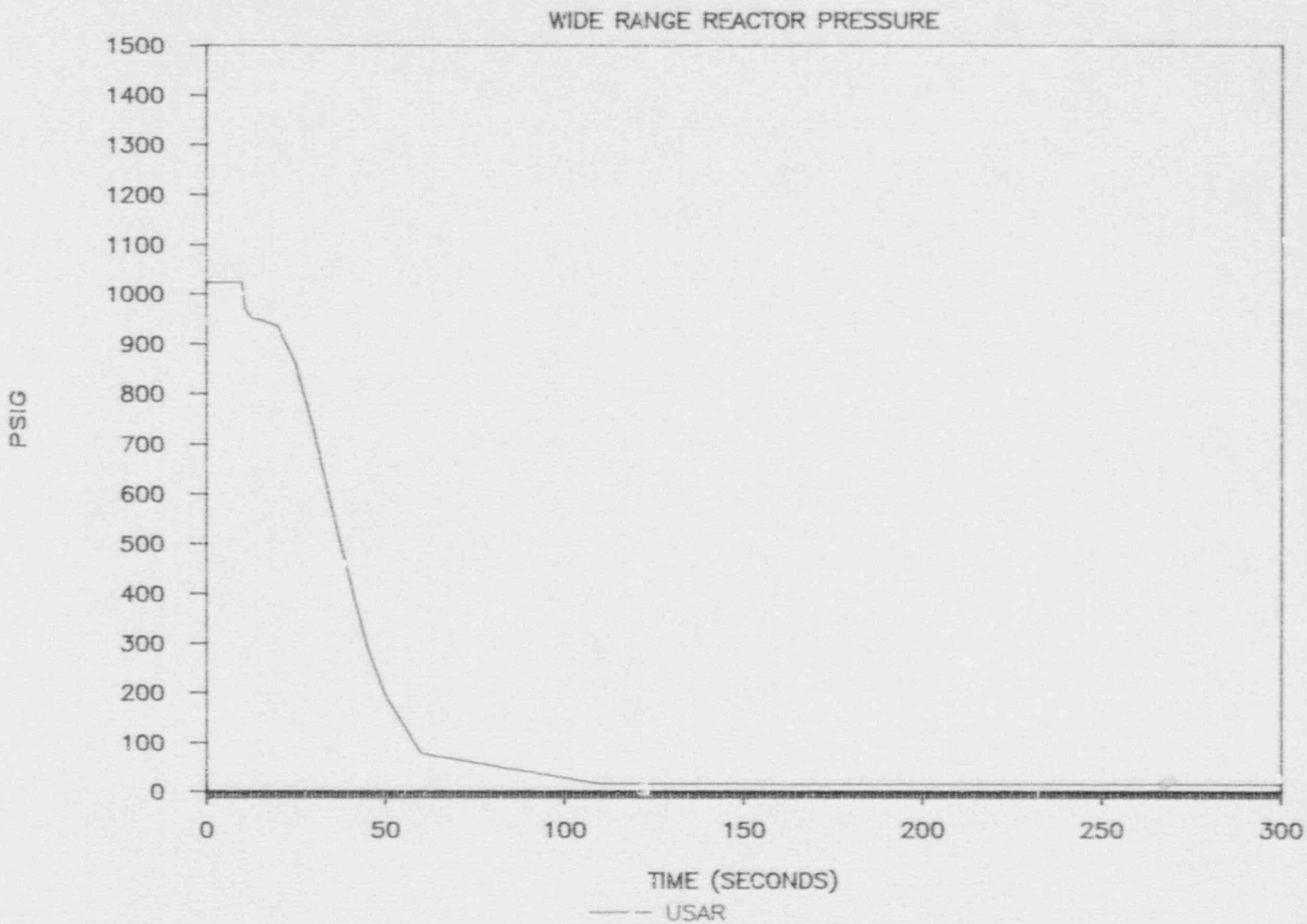

BENCHMARK TRANSIENT 509 TEST
TOTAL LPCS FLOW
GPM
8000
7000
6000
5000
4000
3000
2000
1000
0
0.0
25.0
50.0
75.0
100.0
125.0
150.0
175.0
200.0
225.0
250.0
275.0
TIME (SECONDS)
SIMULATOR



BENCHMARK TRANSIENT 509 TEST
TOTAL HPCS/RCIC/CRD FLOW
GPM
0
1000
2000
3000
4000
5000
6000
7000
8000
0.0
25.0
50.0
75.0
100.0
125.0
150.0
175.0
200.0
225.0
250.0
275.0
TIME (SECONDS)
— SIMULATOR

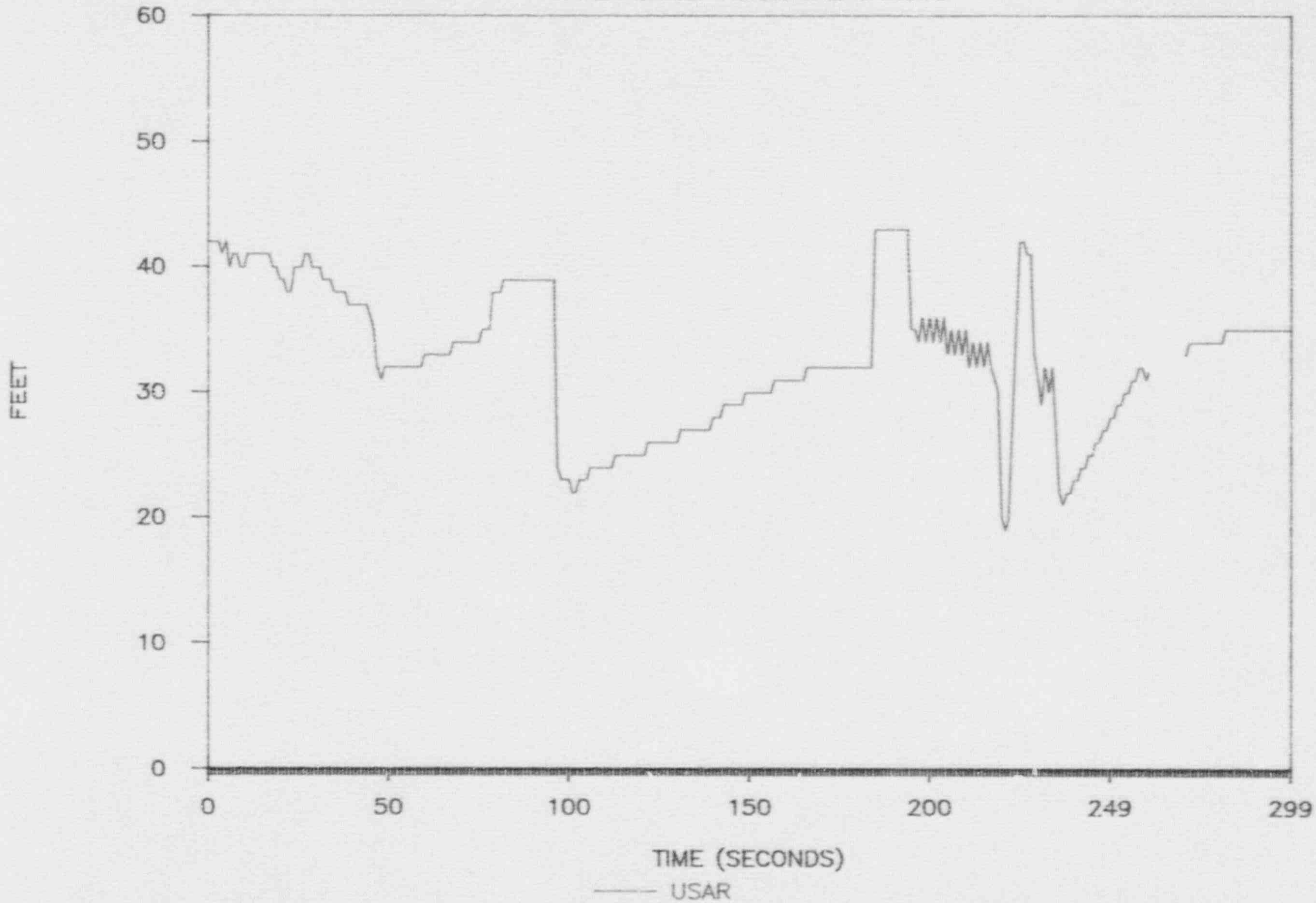

BENCHMARK TRANSIENT 509 TEST
REACTOR POWER (%)
POWER (%)
100
90
80
70
60
50
40
30
20
10
0
0
50
100
150
200
249
299
TIME (SECONDS)
USAR

BENCHMARK TRANSIENT 509 TEST

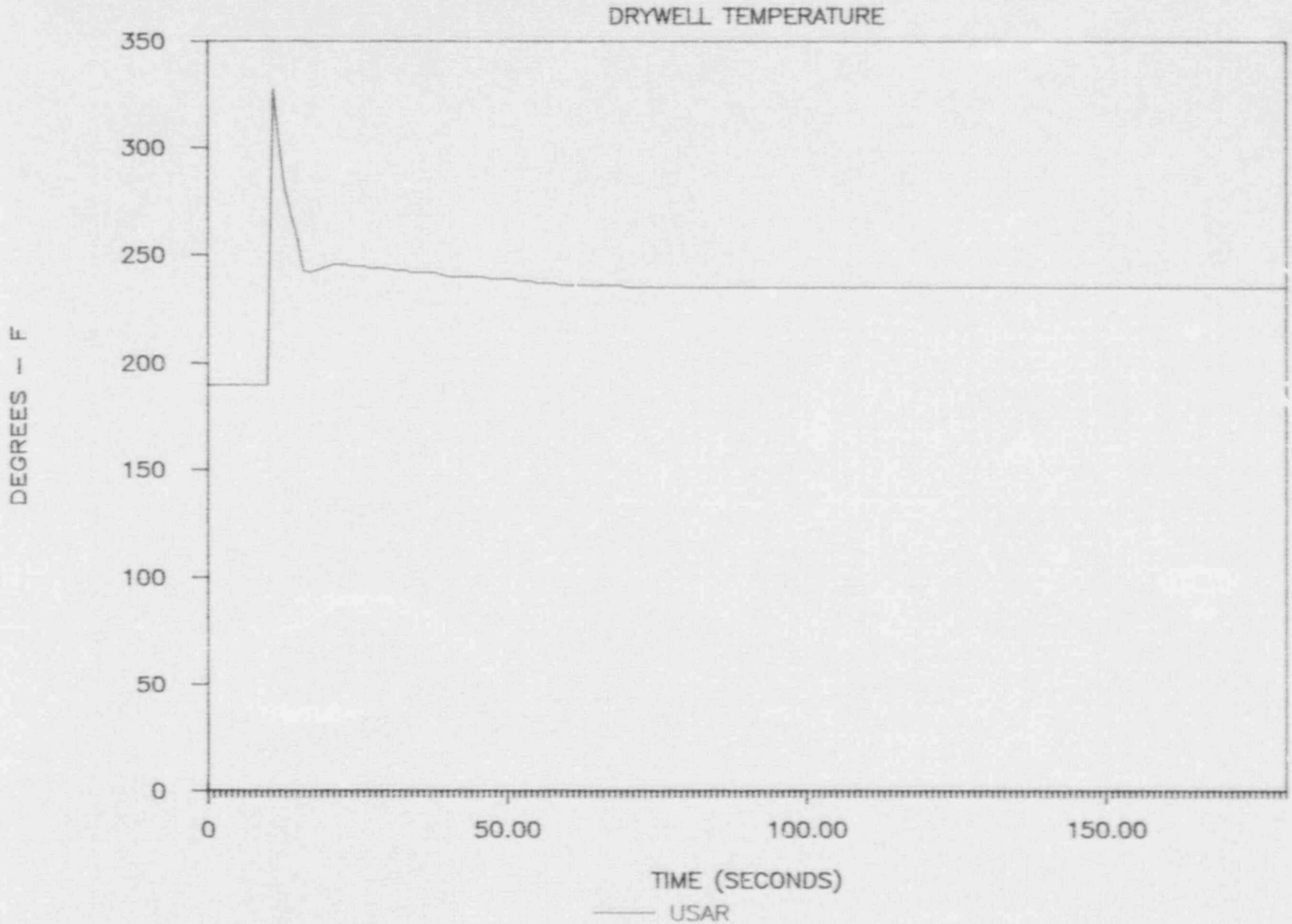


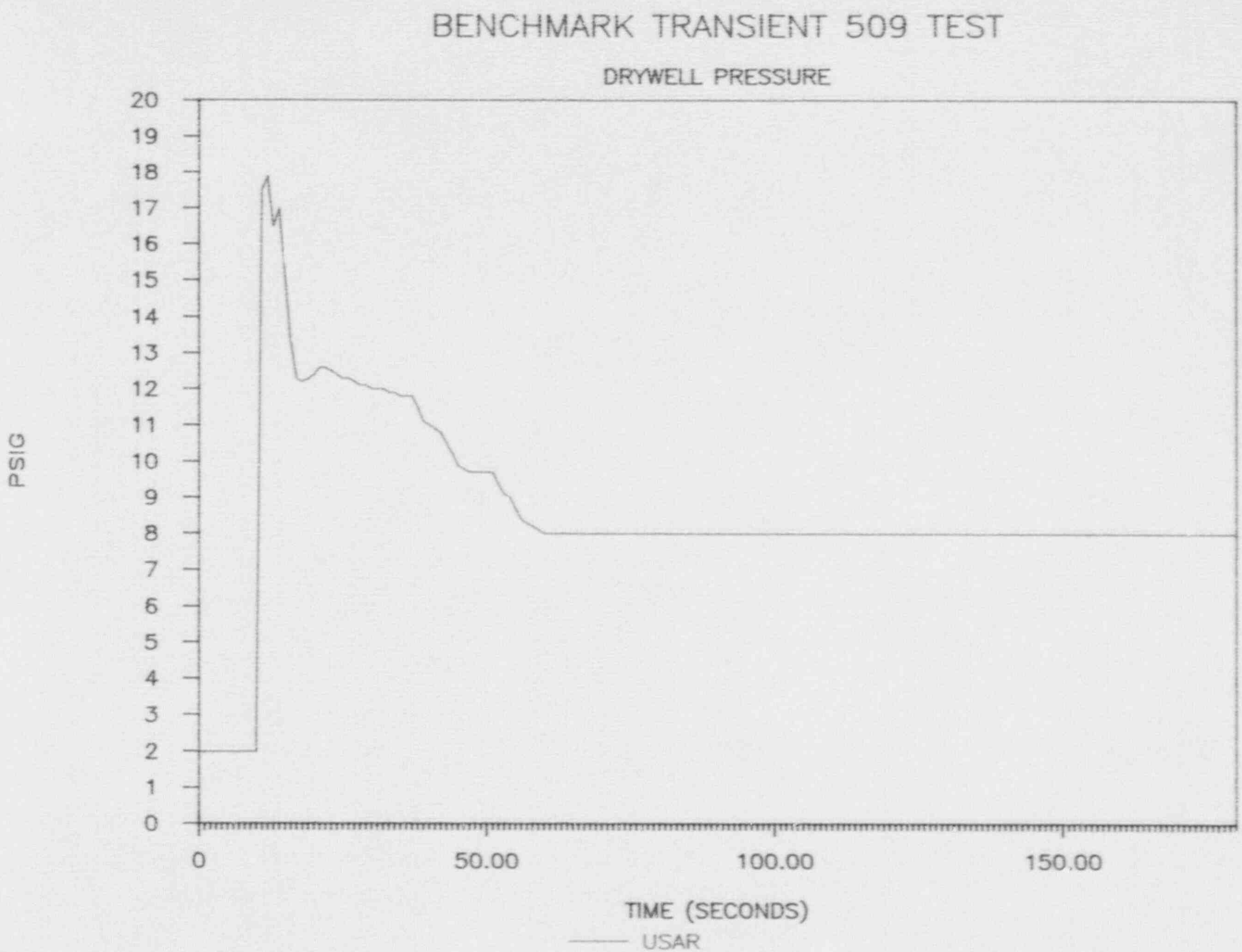
BENCHMARK TRANSIENT 509 TEST

WATER LEVEL INSIDE THE SHROUD



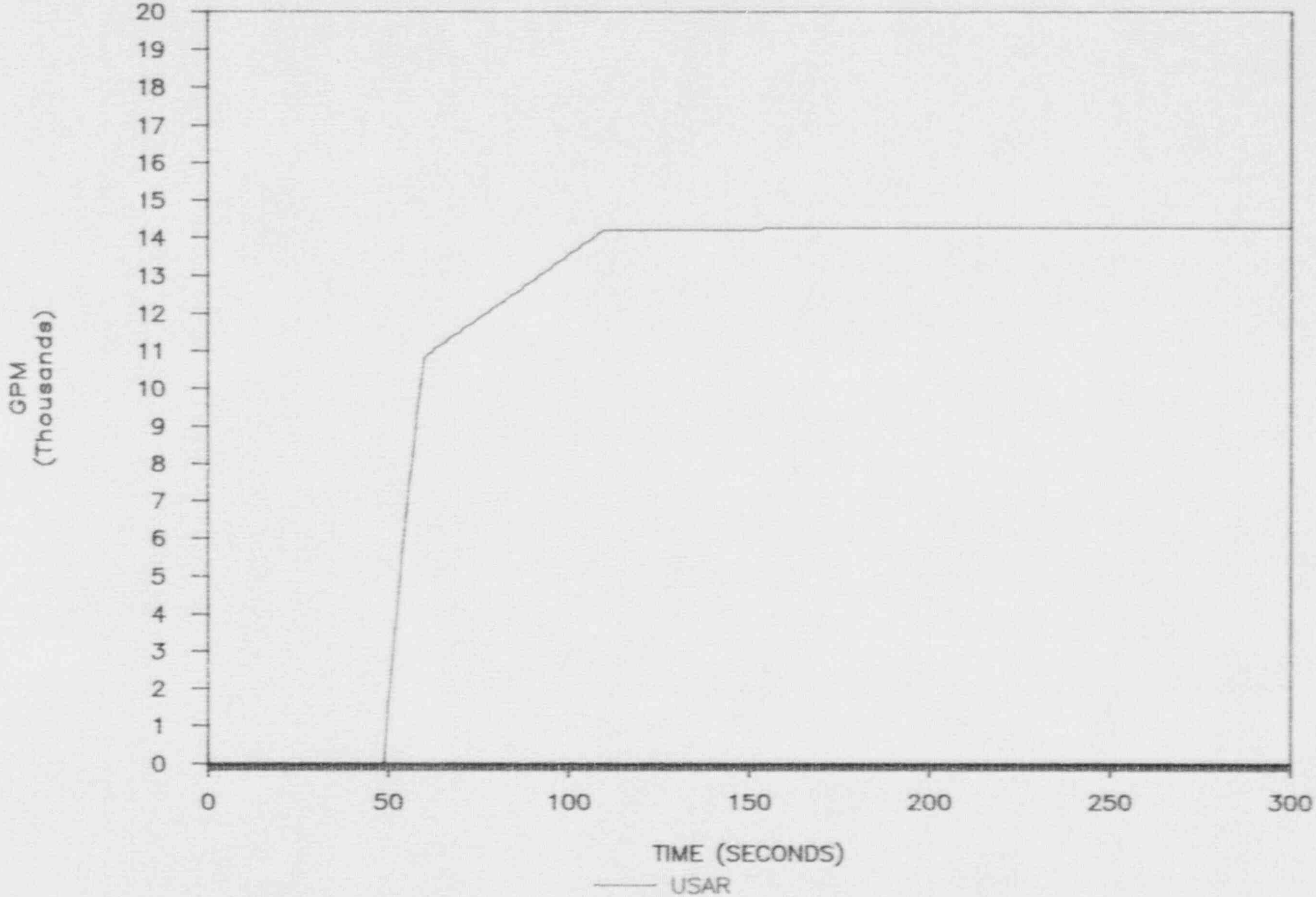
BENCHMARK TRANSIENT 509 TEST

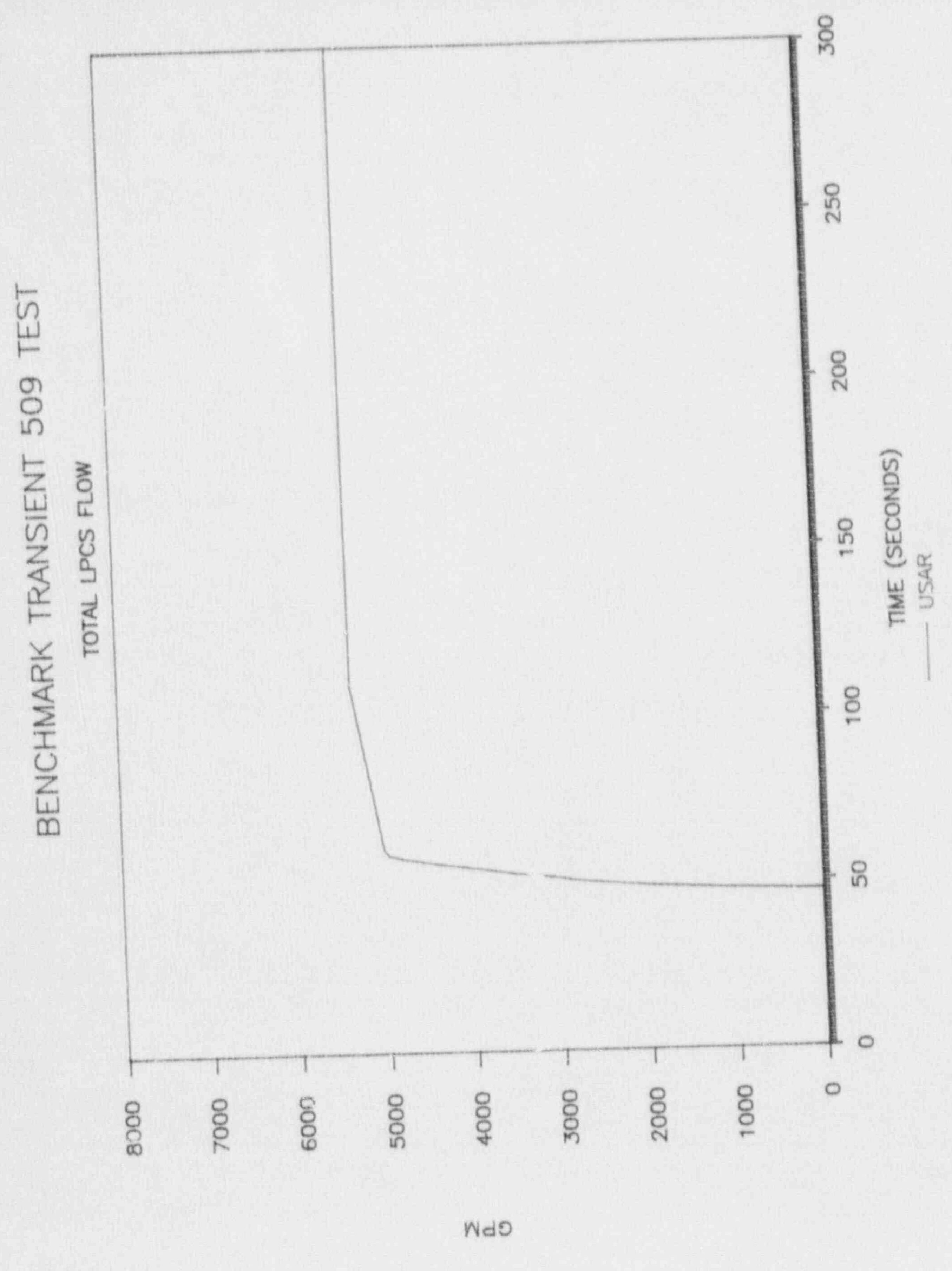



BENCHMARK TRANSIENT 509 TEST
DRYWELL PRESSURE
PSIG
20
19
18
17
16
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
0
50.00
100.00
150.00
TIME (SECONDS)
USAR

BENCHMARK TRANSIENT 509 TEST

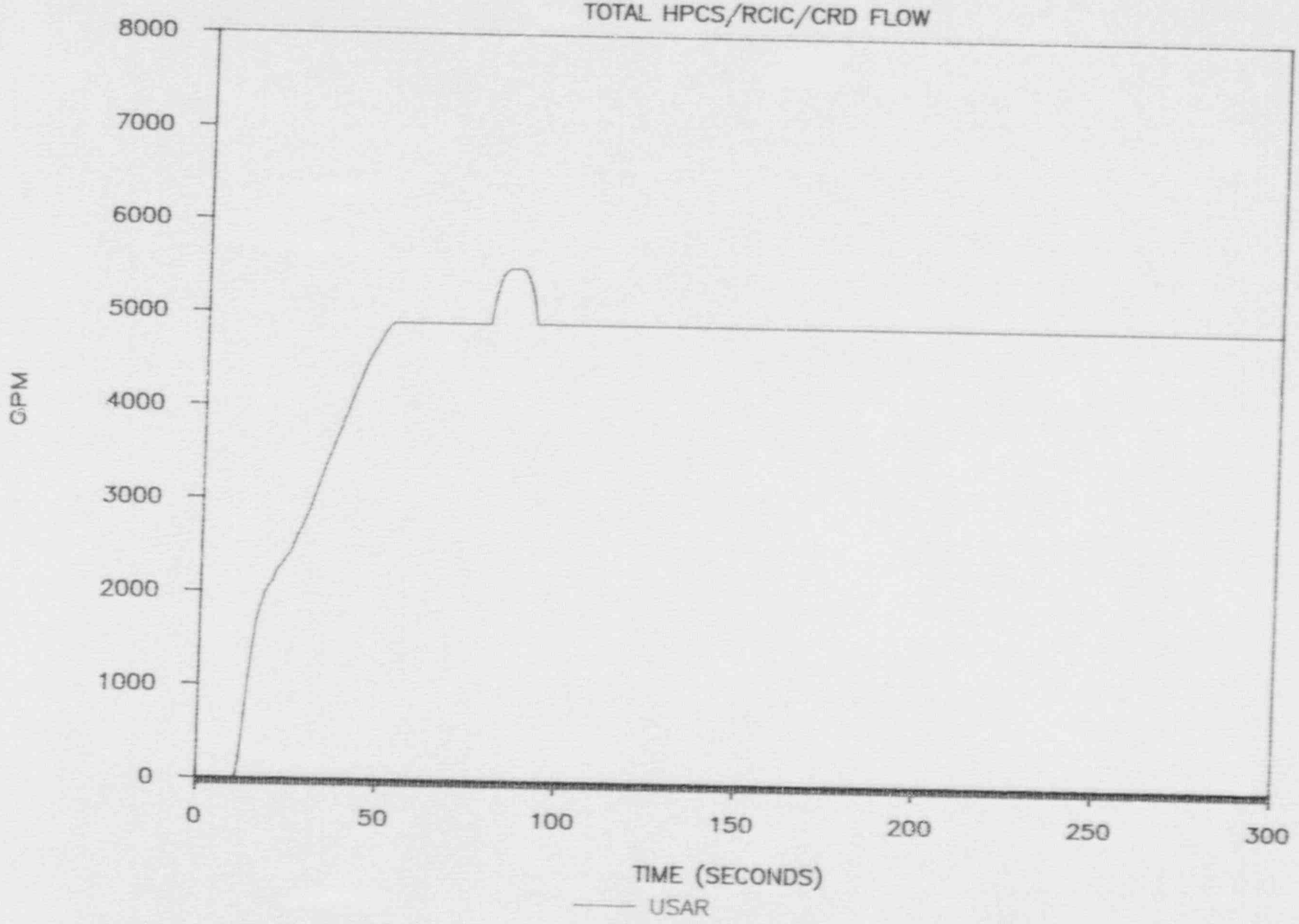
TOTAL RHR FLOW





BENCHMARK TRANSIENT 509 TEST
TOTAL LPCS FLOW
GPM
8000
7000
6000
5000
4000
3000
2000
1000
0
0
50
100
150
200
250
300
TIME (SECONDS)
USAR

BENCHMARK TRANSIENT 509 TEST



SIMULATOR CERTIFICATION TEST SUMMARY

Test Name: STP 5.10, Simultaneous Closure of all Main Steam Isolation Valves Combined With a Single Stuck Open SRV

Description: This test provides a benchmark comparison between the simulator and plant for a simultaneous closure of all Main Steam Isolation Valves (MSIVs), combined with a stuck open Safety Relief Valve (SRV). High pressure Emergency Core Cooling System (ECCS) injection was also inhibited during this test.

The simulator was initialized at full power. Data recording began. Approximately 10 seconds later, malfunctions were activated which simultaneously shut all inboard MSIVs, and inhibited the automatic start of high pressure core spray. As Safety Relief Valves (SRVs) automatically lifted, the control switch for one of the SRVs was manually placed in the open position so that the SRV would remain open for the duration of the test. No other operator actions were taken. The simulator was allowed to stabilize. After 5 minutes the simulator was placed in freeze and data recording was terminated.

Simulator performance was observed during the transient to ensure that alarms, automatic actions, and indications were appropriate for the transient. No violations of the physical laws of nature were observed.

This test was intended to meet the objectives of ANSI/ANS-3.5-1985, Appendix B, and footnote 3 of the standard.

Simulator Features Tested:

Simulator data recording capability at a resolution of 0.5 seconds.

Initial Conditions:

The simulator was operating in a normal full power lineup.

SIMULATOR CERTIFICATION TEST SUMMARY

Test Name: STP 5.10, Simultaneous Closure of all Main Steam Isolation Valves Combined With a Single Stuck Open SRV (Cont'd)

Final Conditions:

The simulator was relatively stable following a simultaneous closure of all MSIVs. One SRV remained open discharging steam to the suppression pool.

Baseline Data Source:

Clinton Power Station RETRAN Code

Comparison:

The following simulator parameters were compared to the available baseline data. The magnitude and direction of change of all parameters were evaluated as acceptable.

Parameter	Evaluation
Reactor Power	Satisfactory
Reactor Pressure (WR)	Satisfactory
Reactor Level (WR)	Satisfactory
Reactor Level (FZ)	RETRAN Data Unavailable
Total Steam Flow	Satisfactory
Total Feedwater Flow	Satisfactory
Containment Temp	RETRAN Data Unavailable
Suppression Pool Temp	RETRAN Data Unavailable
Containment Pressure	RETRAN Data Unavailable
Drywell Temperature	RETRAN Data Unavailable
Drywell Pressure	RETRAN Data Unavailable
Total RHR Flow	RETRAN Data Unavailable
Total LPCS Flow	RETRAN Data Unavailable
Total HP Injection Flow	RETRAN Data Unavailable

SIMULATOR CERTIFICATION TEST SUMMARY

Test Name: STP 5.10, Simultaneous Closure of all Main Steam Isolation Valves Combined With a Single Stuck Open SRV (Cont'd)

Comparison (cont'd):

There are some differences between simulator and RETRAN feedwater flow. While this has been evaluated as satisfactory, the simulator Feedwater Level Control System is being evaluated for possible future improvements.

CPS licensed operators have reviewed the simulator data for the parameters having no corresponding RETRAN data, and have judged simulator performance to be acceptable and consistent with that expected for the transient.

Graphs of simulator and RETRAN data follow this test summary. When all parameters are considered, the overall simulator response to this transient is satisfactory.

Deficiencies Found:

None

Corrective Actions Planned (and schedule):

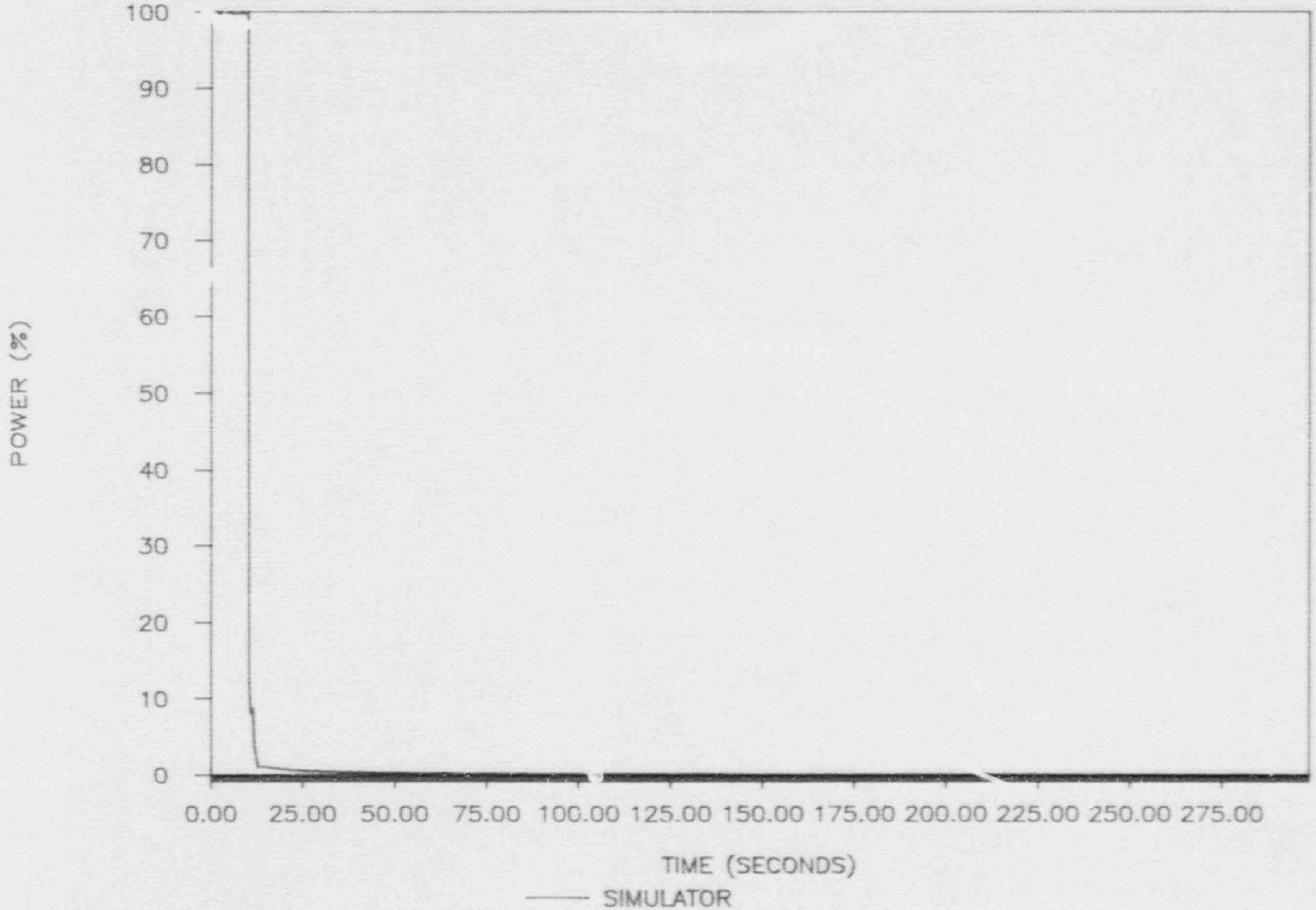
None

Exceptions Taken/Justification:

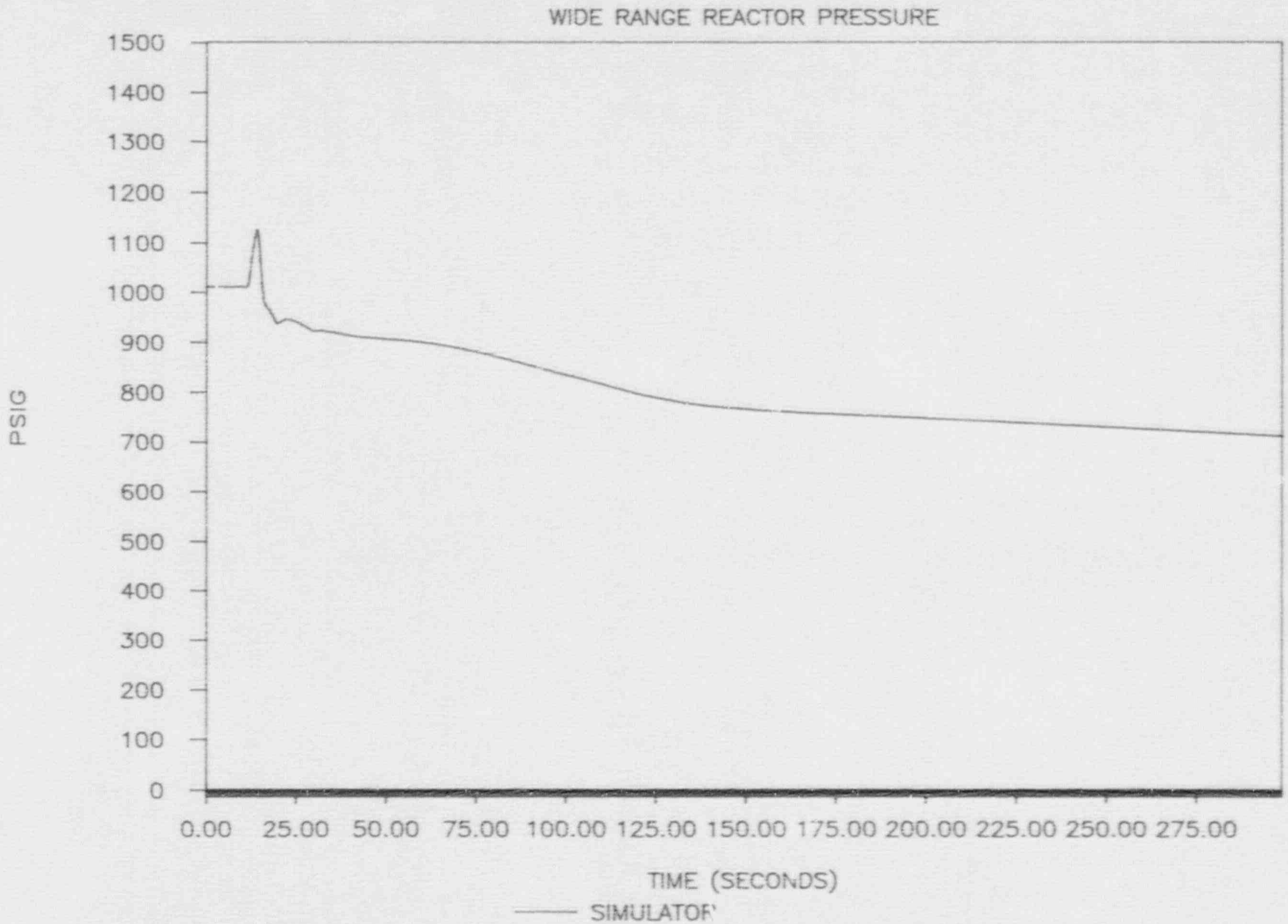
None

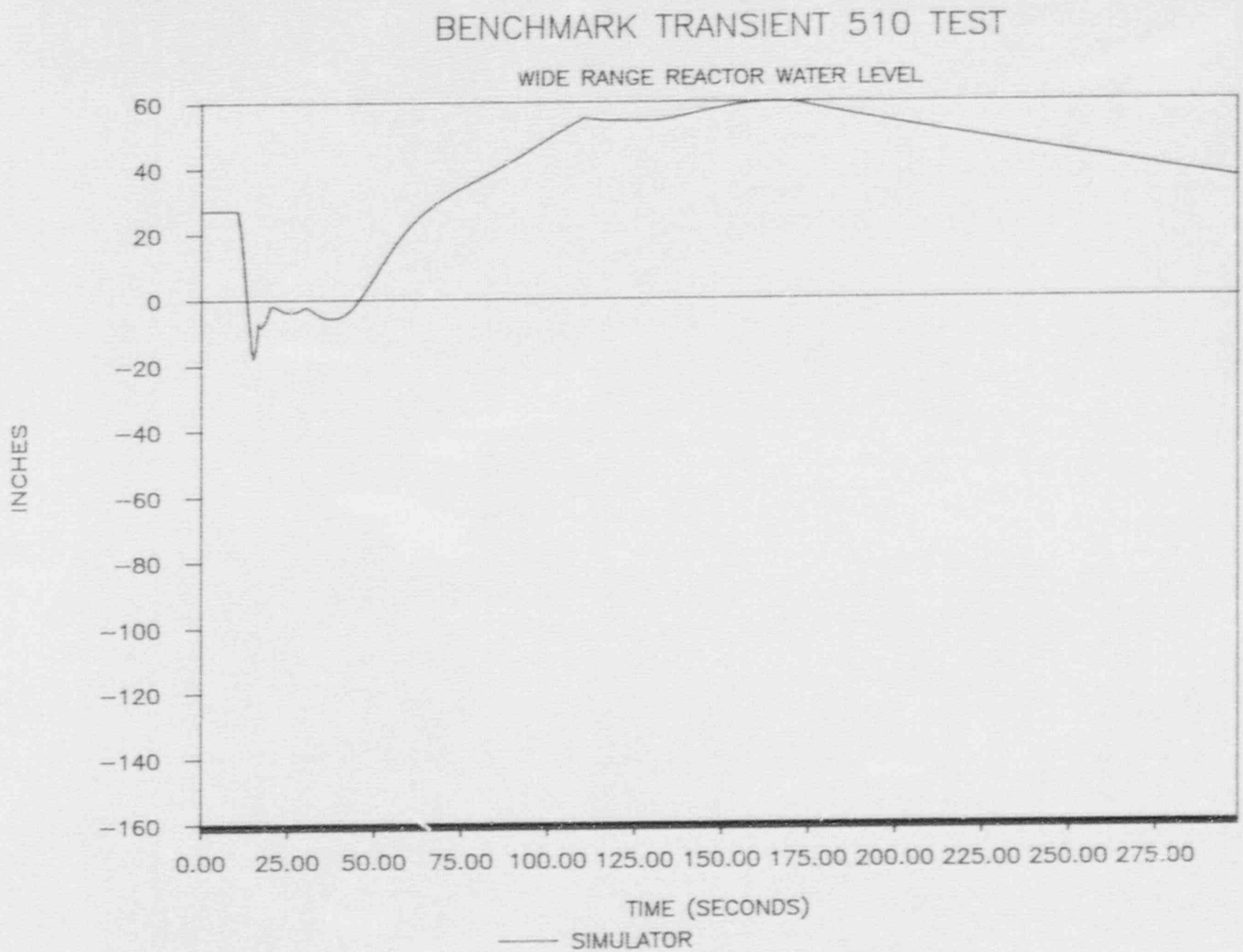
BENCHMARK TRANSIENT 510 TEST

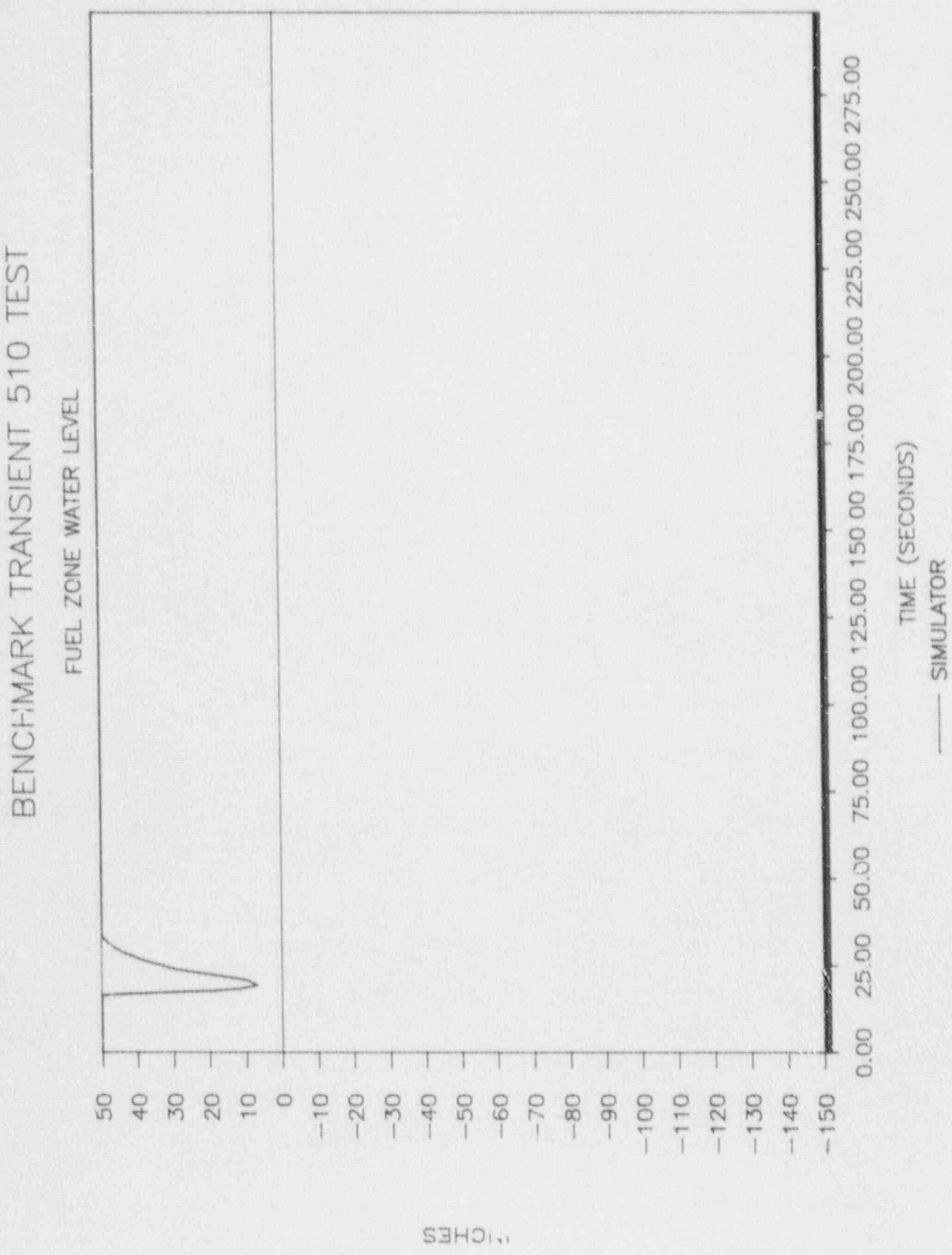
REACTOR POWER (%)



BENCHMARK TRANSIENT 510 TEST

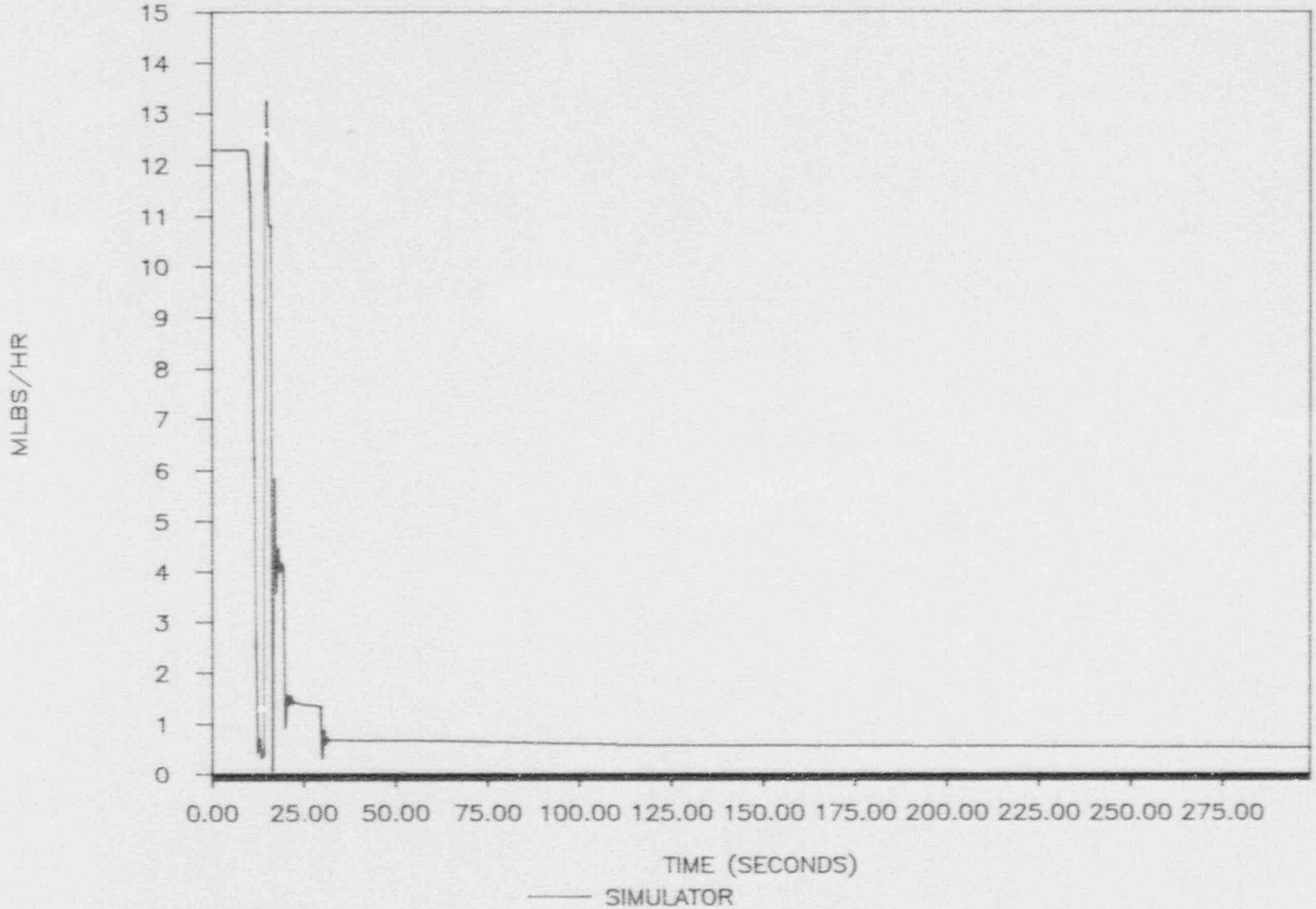



BENCHMARK TRANSIENT 510 TEST
WIDE RANGE REACTOR WATER LEVEL
INCHES
60
40
20
0
−20
−40
−60
−80
−100
−120
−140
−160
0.00
25.00
50.00
75.00
100.00
125.00
150.00
175.00
200.00
225.00
250.00
275.00
TIME (SECONDS)
SIMULATOR

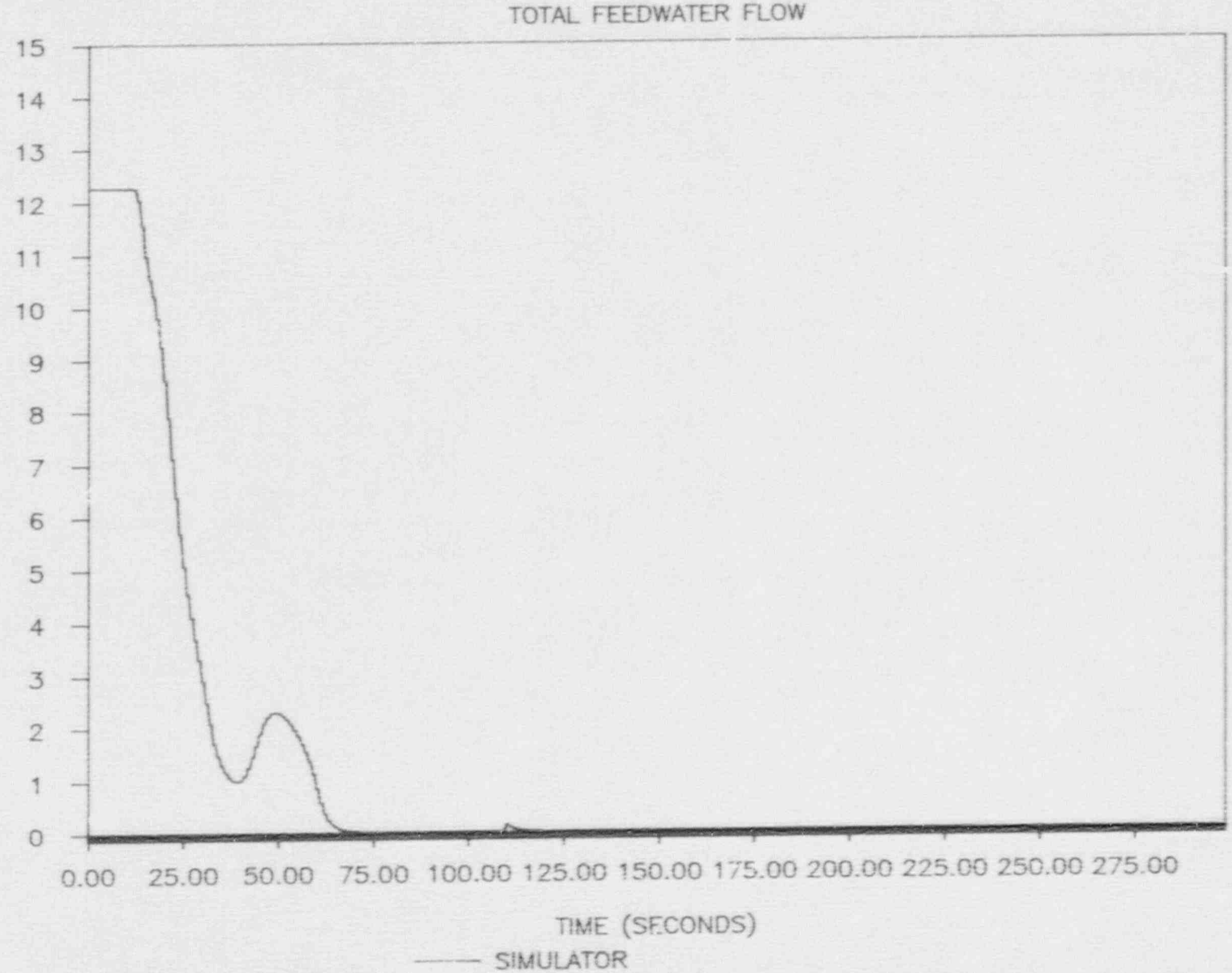

BENCHMARK TRANSIENT 510 TEST
FUEL ZONE WATER LEVEL
INCHES
50
40
30
20
10
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
-110
-120
-130
-140
-150
0.00
25.00
50.00
75.00
100.00
125.00
150 00
175.00
200.00
225.00
250.00
275.00
TIME (SECONDS)
SIMULATOR

BENCHMARK TRANSIENT 510 TEST

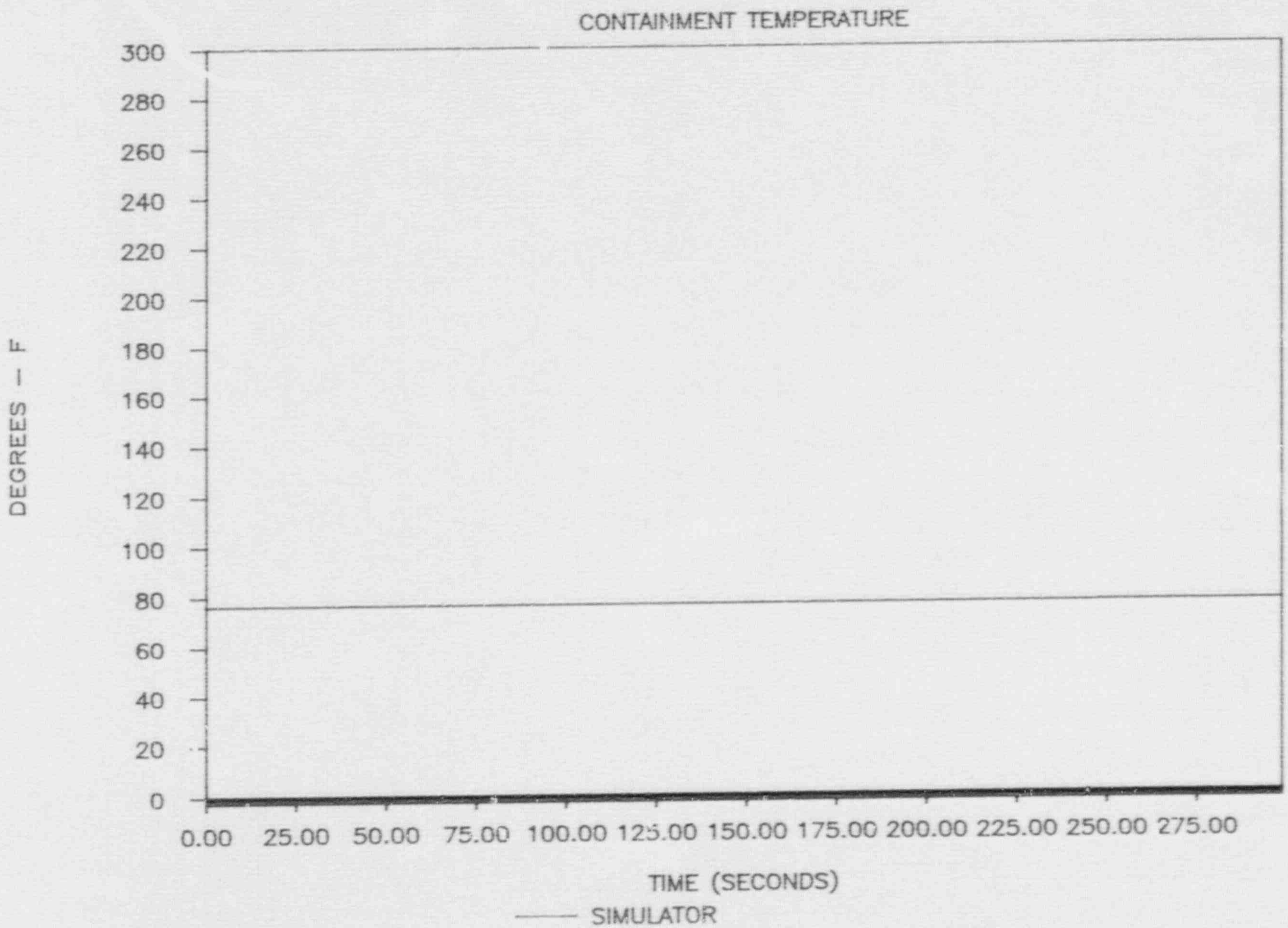
TOTAL STEAM FLOW



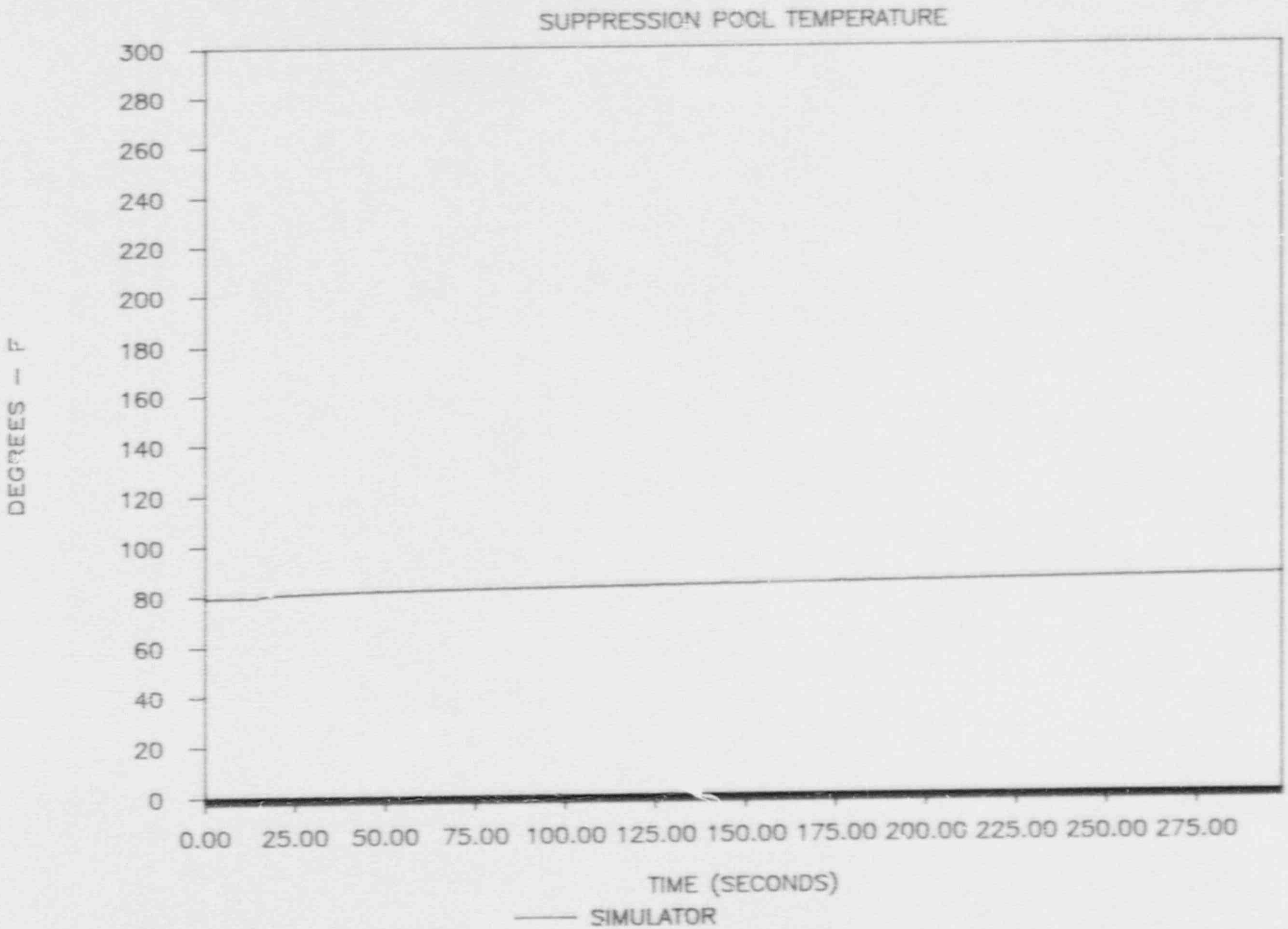
BENCHMARK TRANSIENT 510 TEST

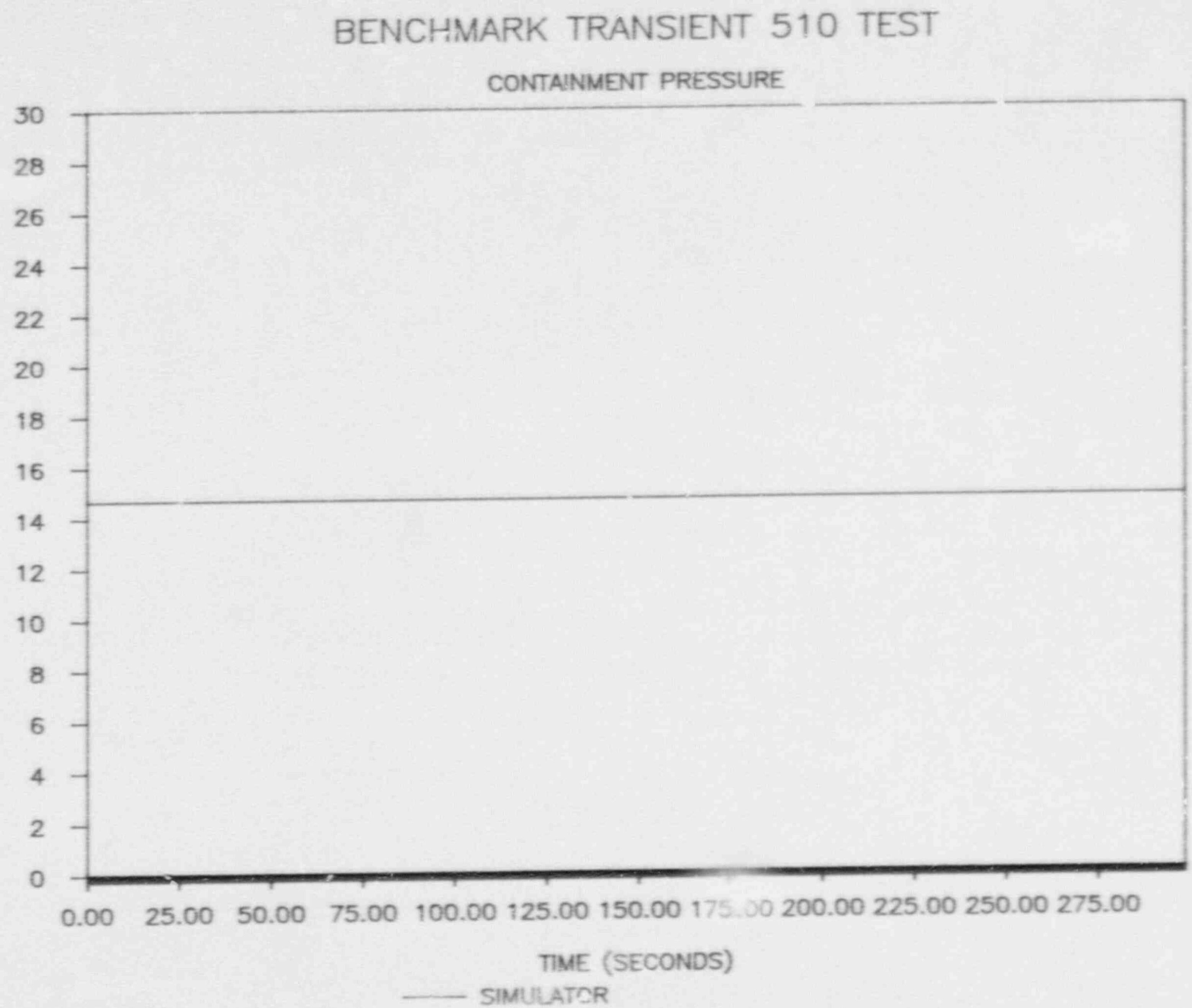


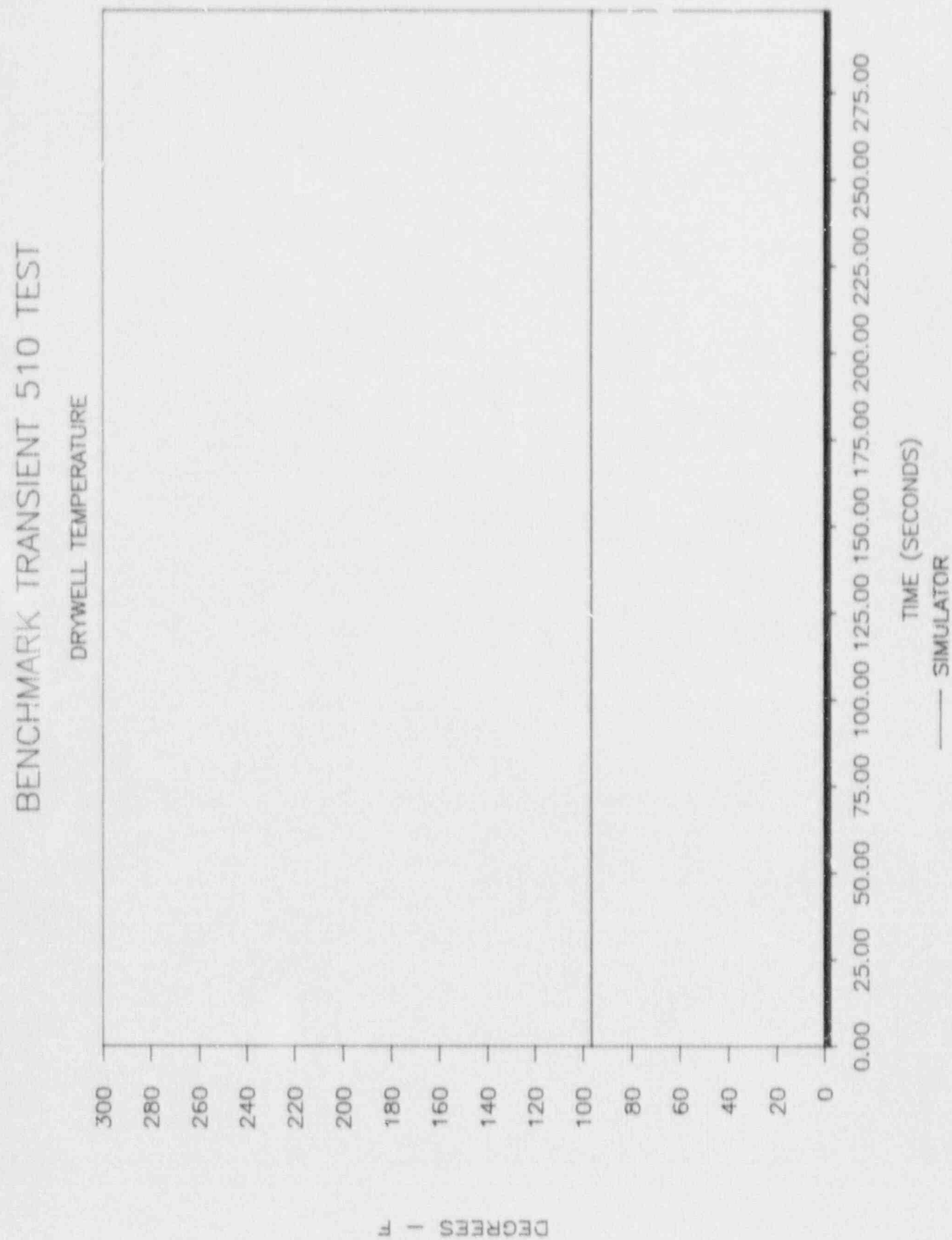
BENCHMARK TRANSIENT 510 TEST



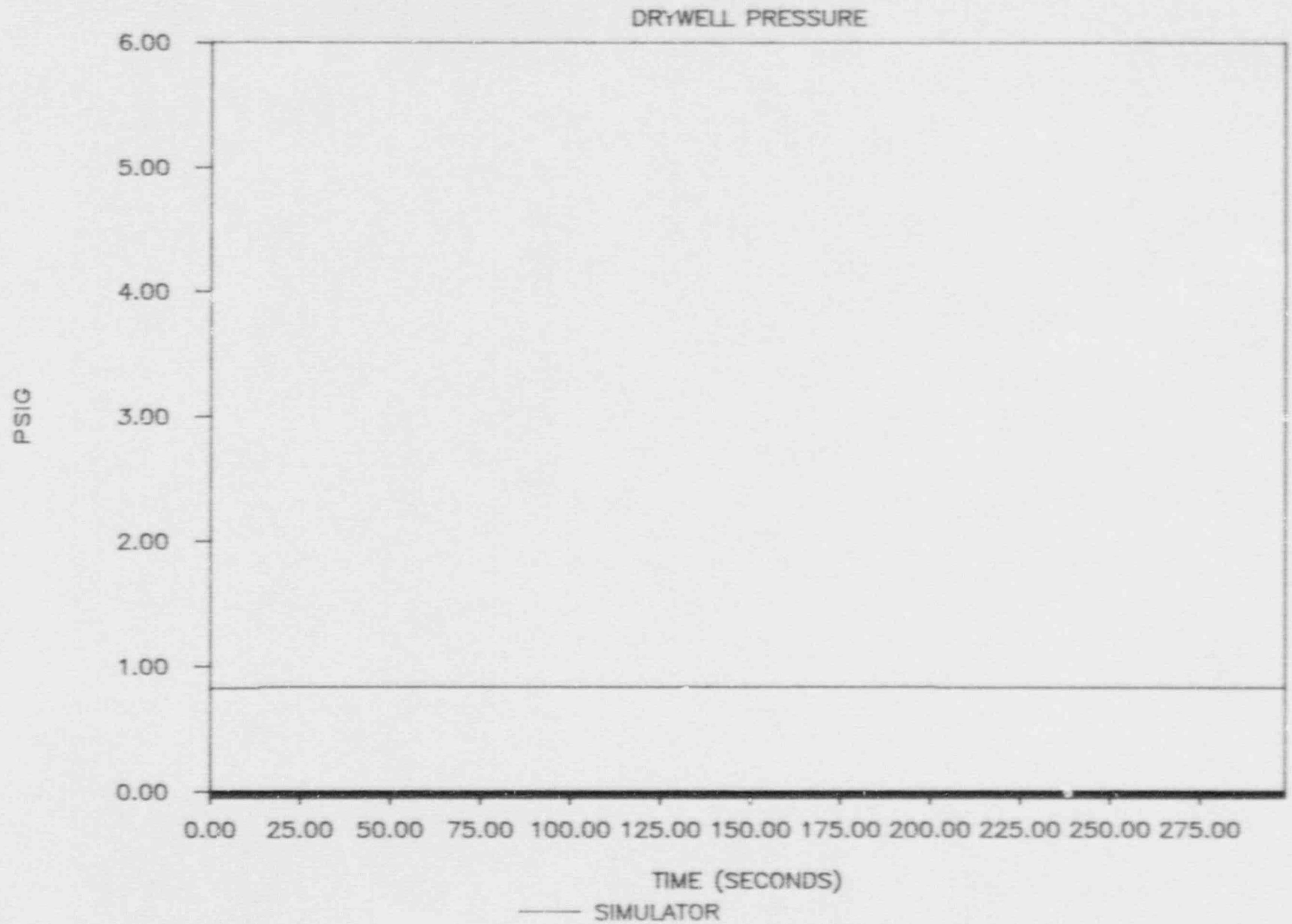
BENCHMARK TRANSIENT 510 TEST



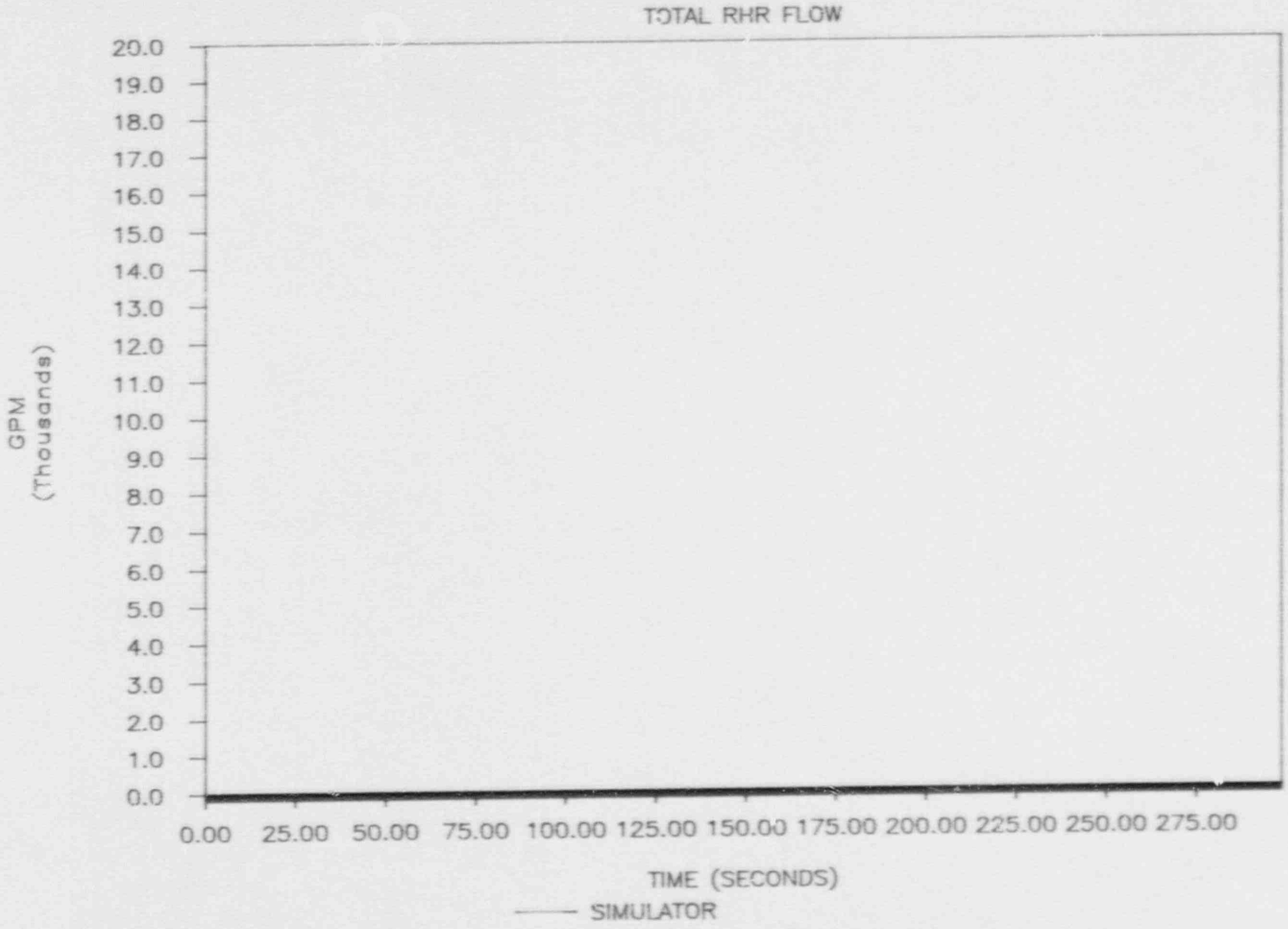

BENCHMARK TRANSIENT 510 TEST
CONTAINMENT PRESSURE
PSIA
30
28
26
24
22
20
18
16
14
12
10
8
6
4
2
0
0.00
25.00
50.00
75.00
100.00
125.00
150.00
200.00
225.00
250.00
275.00
TIME (SECONDS)
SIMULATOR

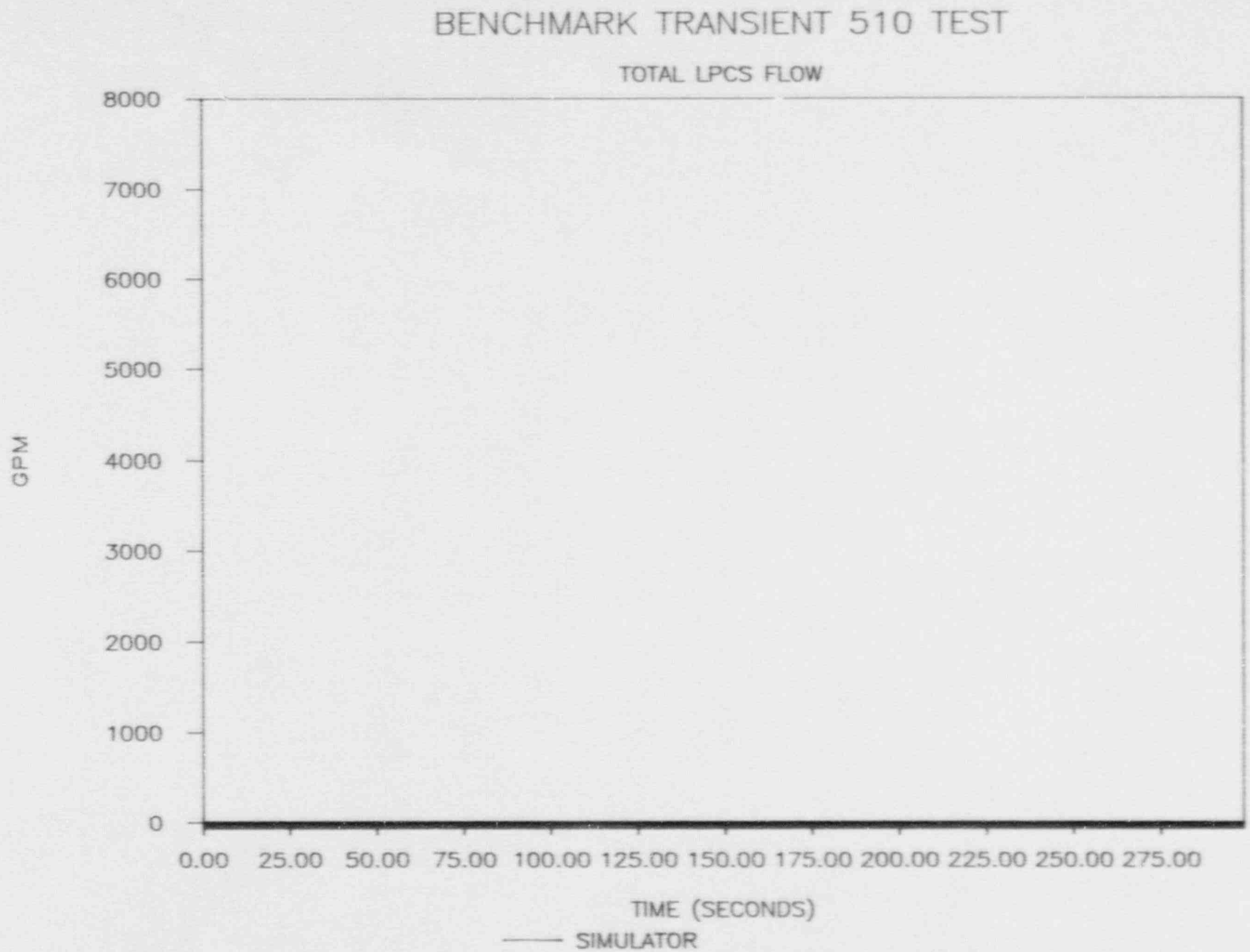

BENCHMARK TRANSIENT 510 TEST
DRYWELL TEMPERATURE
DEGREES — F
300
280
260
240
220
200
180
160
140
120
100
80
60
40
20
0
0.00
25.00
50.00
75.00
100.00
125.00
150.00
175.00
200.00
225.00
250.00
275.00
TIME (SECONDS)
— SIMULATOR

BENCHMARK TRANSIENT 510 TEST



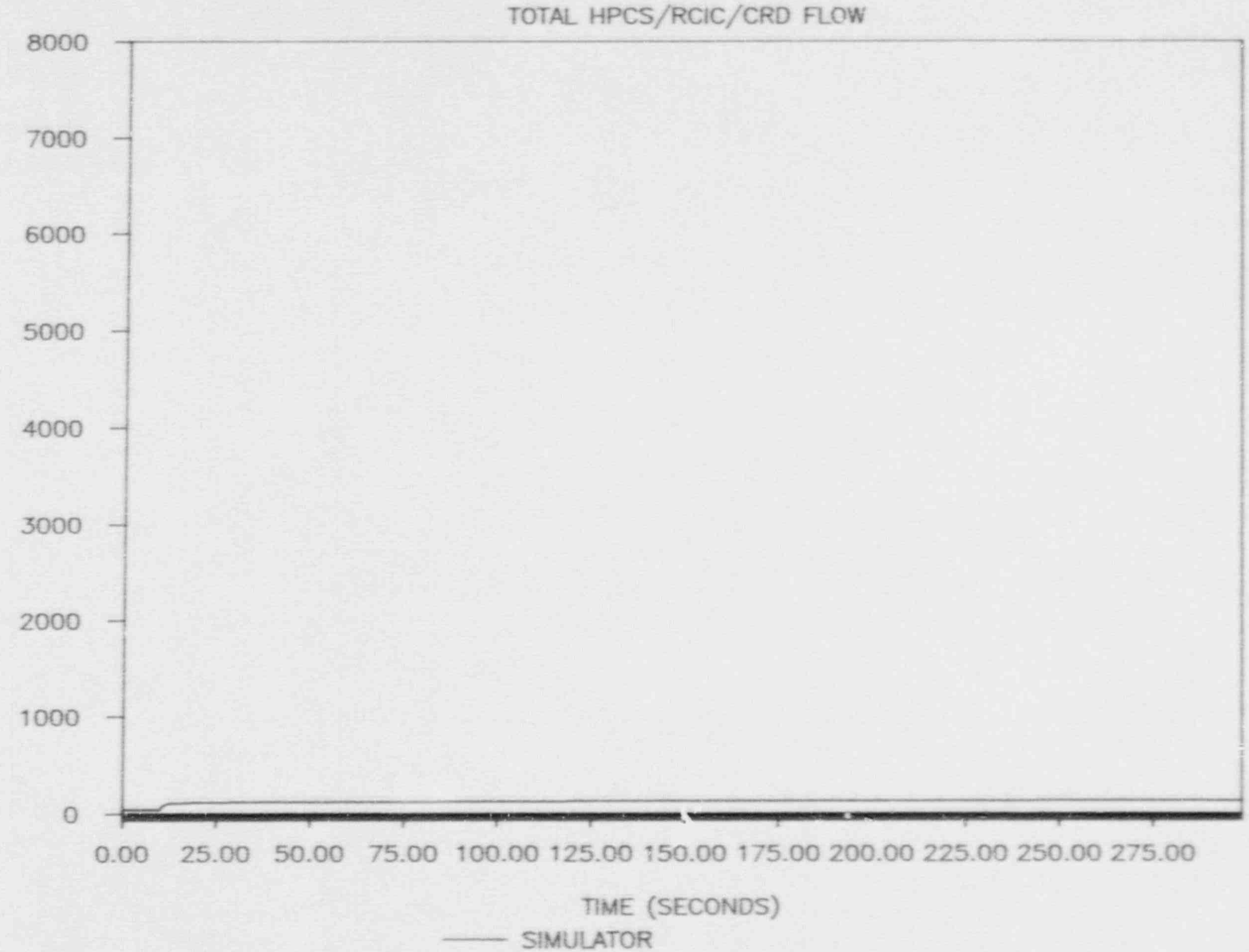
BENCHMARK TRANSIENT 510 TEST

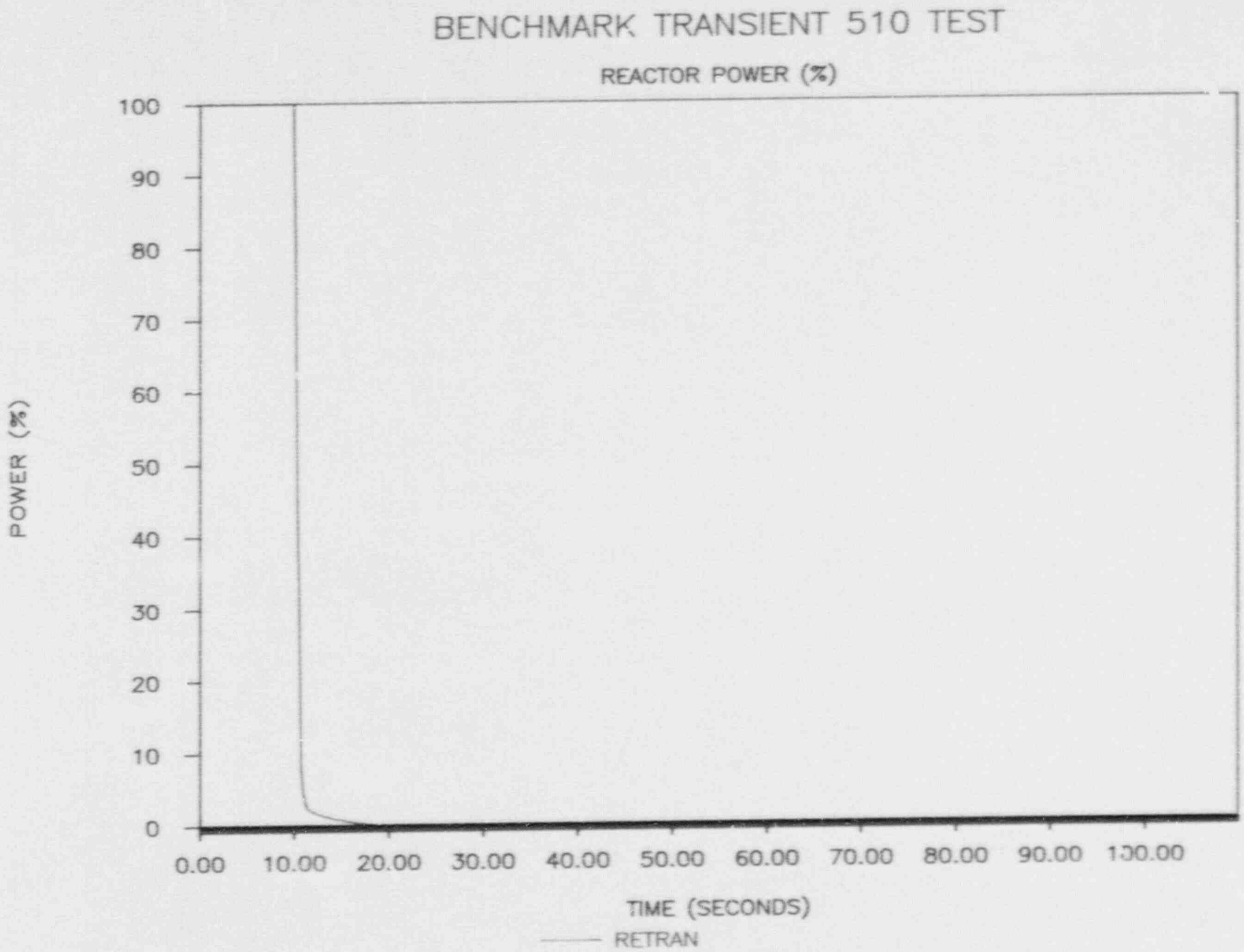




BENCHMARK TRANSIENT 510 TEST
TOTAL LPCS FLOW
GPM
8000
7000
6000
5000
4000
3000
2000
1000
0
0.00
25.00
50.00
75.00
100.00
125.00
150.00
175.00
200.00
225.00
250.00
275.00
TIME (SECONDS)
SIMULATOR

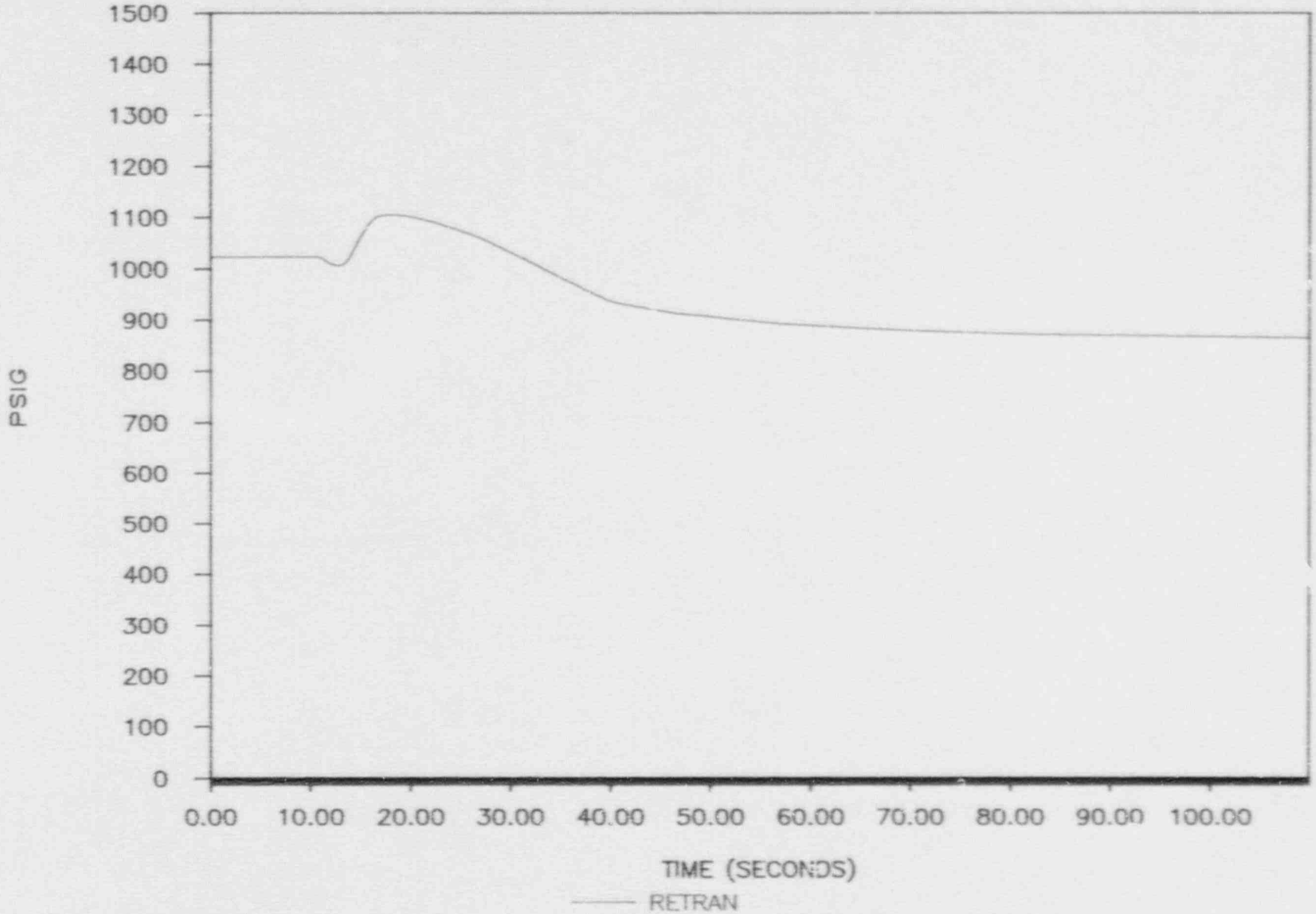
BENCHMARK TRANSIENT 510 TEST

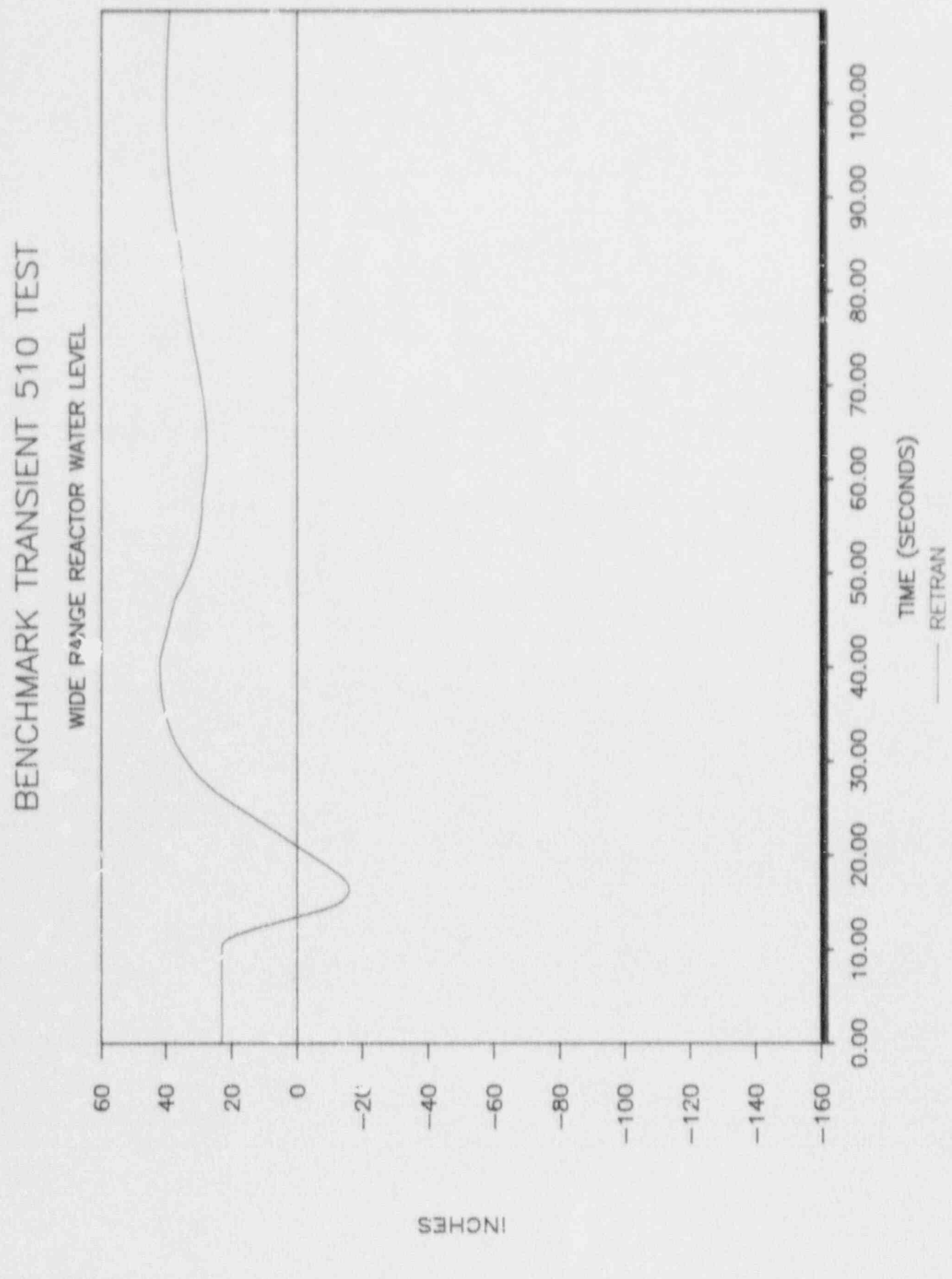



BENCHMARK TRANSIENT 510 TEST
REACTOR POWER (%)
POWER (%)
100
90
80
70
60
50
40
30
20
10
0
0.00
10.00
20.00
30.00
40.00
50.00
60.00
70.00
80.00
90.00
100.00
TIME (SECONDS)
RETRAN

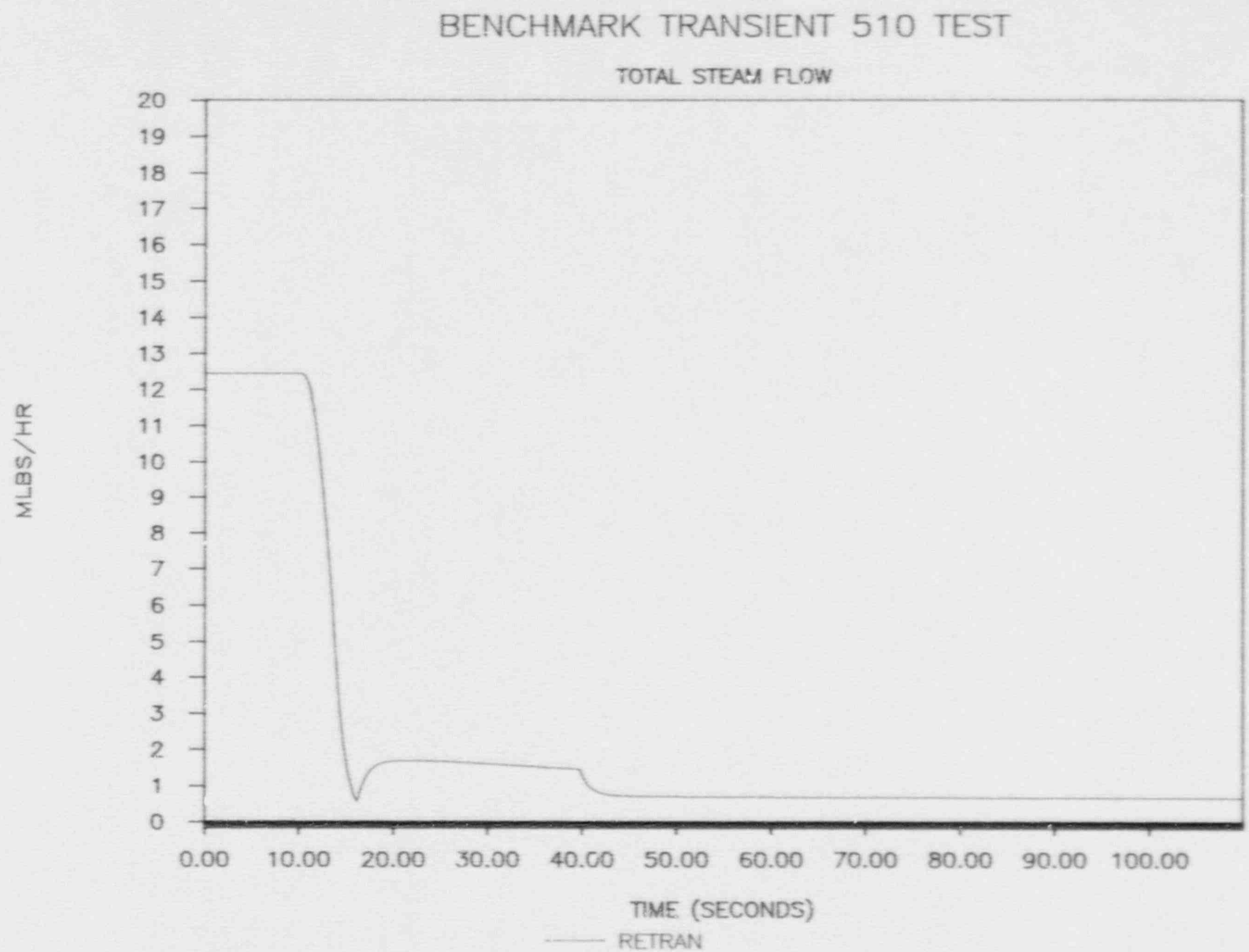
BENCHMARK TRANSIENT 510 TEST

WIDE RANGE REACTOR PRESSURE

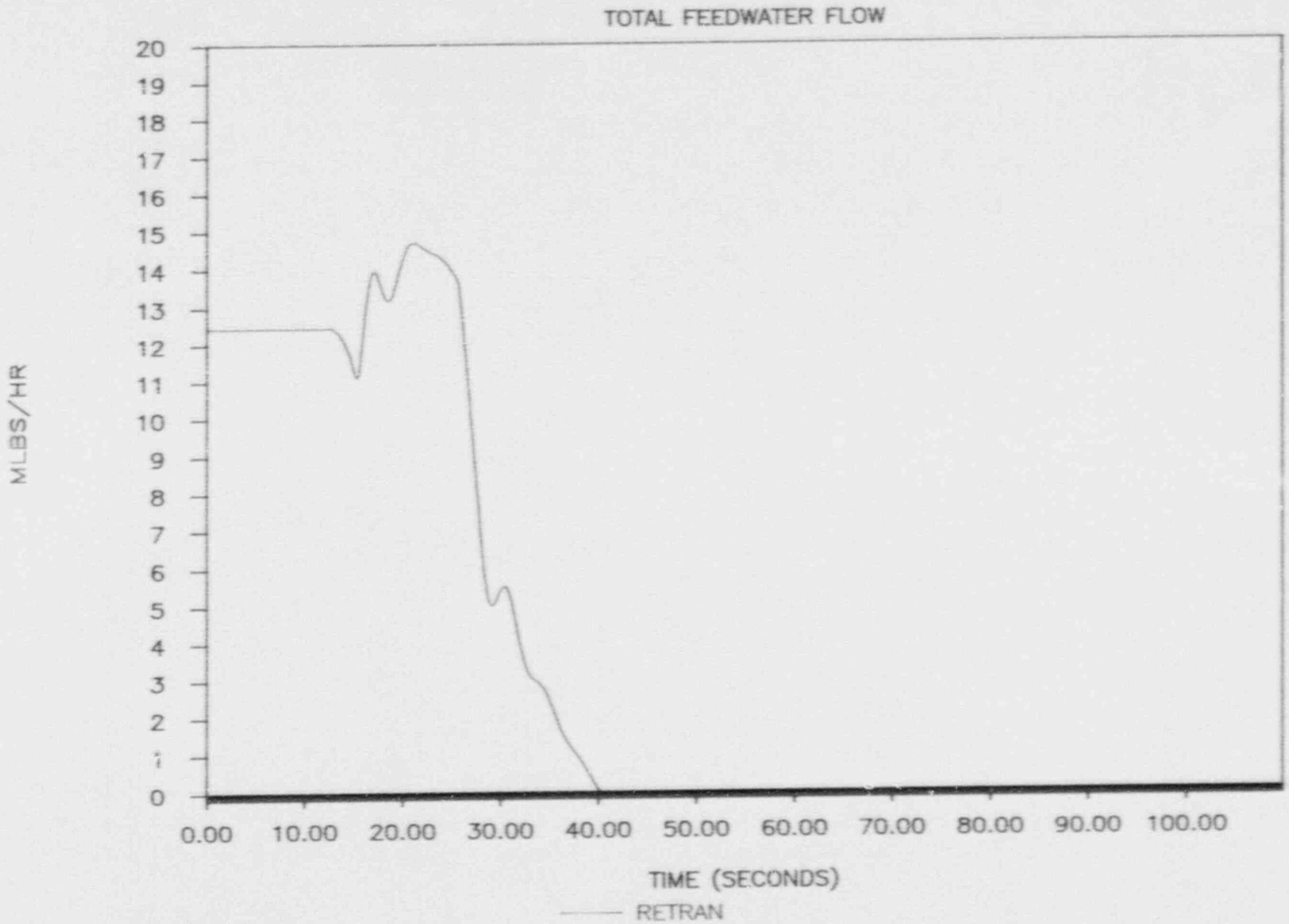




BENCHMARK TRANSIENT 510 TEST
WIDE RANGE REACTOR WATER LEVEL
INCHES
60
40
20
0
-20
-40
-60
-80
-100
-120
-140
-160
0.00
10.00
20.00
30.00
40.00
50.00
60.00
70.00
80.00
90.00
100.00
TIME (SECONDS)
RETRAN


BENCHMARK TRANSIENT 510 TEST
TOTAL STEAM FLOW
MLBS/HR
20
19
18
17
16
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
0.00
10.00
20.00
30.00
40.00
50.00
60.00
70.00
80.00
90.00
100.00
TIME (SECONDS)
RETRAN

BENCHMARK TRANSIENT 510 TEST



SIMULATOR CERTIFICATION TEST SUMMARY

Test Name: STP 5.11, Generator Trip (LER 89-028)

Description: This test provides a benchmark comparison between the simulator and plant for a generator trip event corresponding to Licensee Event Report (LER) 89-028.

The simulator was initialized at full power. Data recording began. Approximately 10 seconds later, malfunctions were activated which resulted in a generator load reject. No operator actions were taken. The simulator was allowed to stabilize. After 5 minutes the simulator was placed in freeze and data recording was terminated.

Simulator performance was observed during the transient to ensure that alarms, automatic actions, and indications were appropriate for the transient. No violations of the physical laws of nature were observed.

This test was intended to meet the objectives of ANSI/ANS-3.5-1985, Appendix B, and footnote 3 of the standard.

Simulator Features Tested:

Simulator data recording capability at a resolution of 0.5 seconds.

Initial Conditions:

The simulator was operating in a normal full power lineup.

Final Conditions:

The simulator was stable following a generator load reject from full power.

Baseline Data Source:

Plant Data-GE Transient Recording System (GETARS)

SIMULATOR CERTIFICATION TEST SUMMARY

Test Name: STP 5.11, Generator Trip (LER 89-028) (Cont'd)

Comparison:

The following simulator parameters were compared to the available baseline data. The magnitude and direction of change of all parameters were evaluated as acceptable.

Parameter	Evaluation
Reactor Power	Satisfactory
Total Steam Flow	Satisfactory
Total Feedwater Flow	Satisfactory
Reactor Pressure (WR)	Satisfactory
Reactor Pressure (NR)	Satisfactory
Reactor Level (WR)	Satisfactory
Reactor Level (NR)	Satisfactory
Generator Power	GETARS Data Unavailable
Turbine Steam Flow	GETARS Data Unavailable
Total Core Flow	Satisfactory
Total RR Loop Flow	Satisfactory

There are some differences between simulator and GETARS feedwater flow. Additionally, there are small variations in narrow range reactor water level indication. While these have been evaluated as satisfactory, the simulator Feedwater Level Control System is being evaluated for possible future improvements.

CPS licensed operators have reviewed the simulator data for the parameters having no corresponding GETARS data, and have judged simulator performance to be acceptable and consistent with that expected for the transient.

Graphs of simulator and GETARS data follow this test summary. When all parameters are considered, the overall simulator response to this transient is satisfactory.

SIMULATOR CERTIFICATION TEST SUMMARY

Test Name: STP 5.11, Generator Trip (LER 89-028) (Cont'd)

Deficiencies Found:

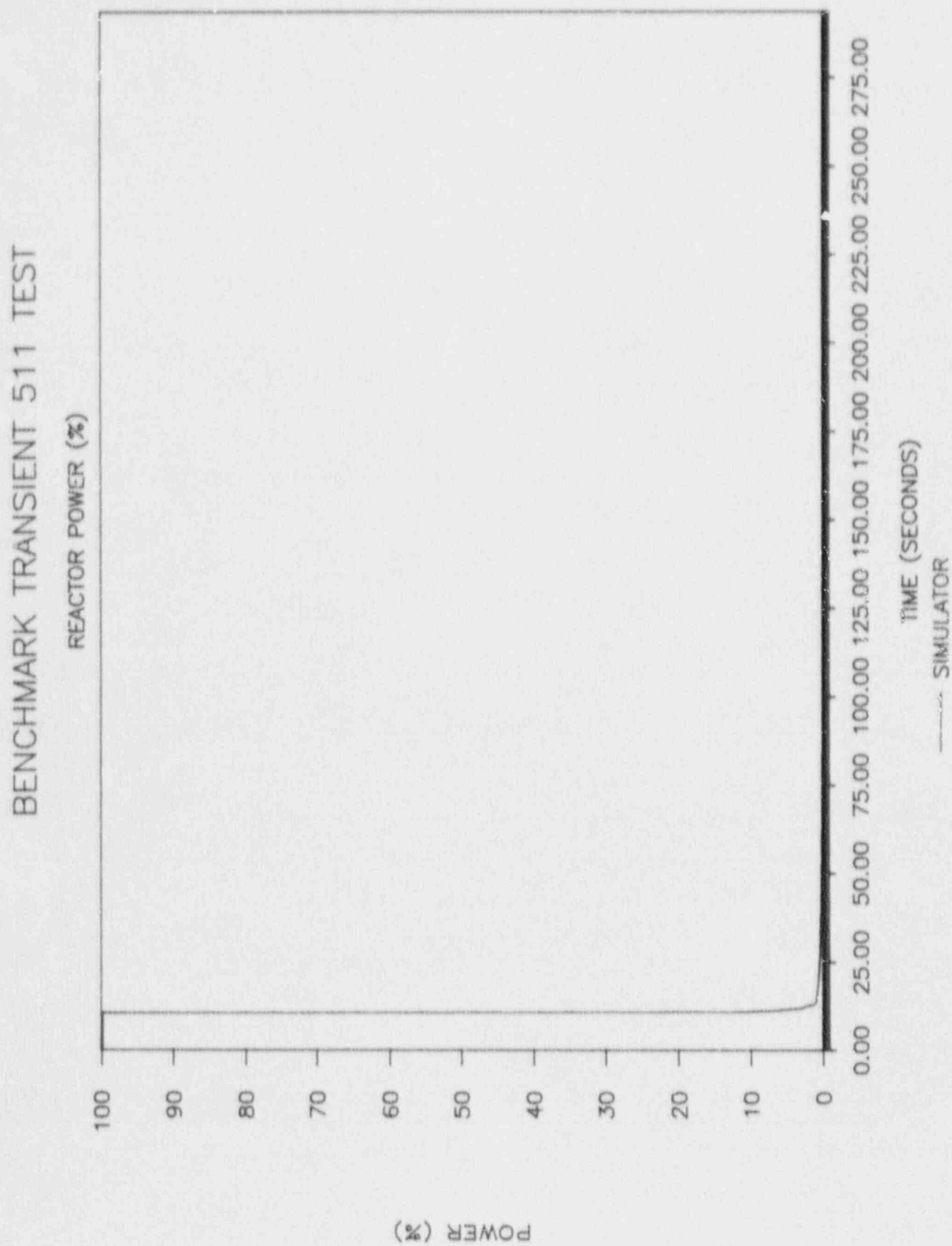
None

Corrective Actions Planned (and schedule):

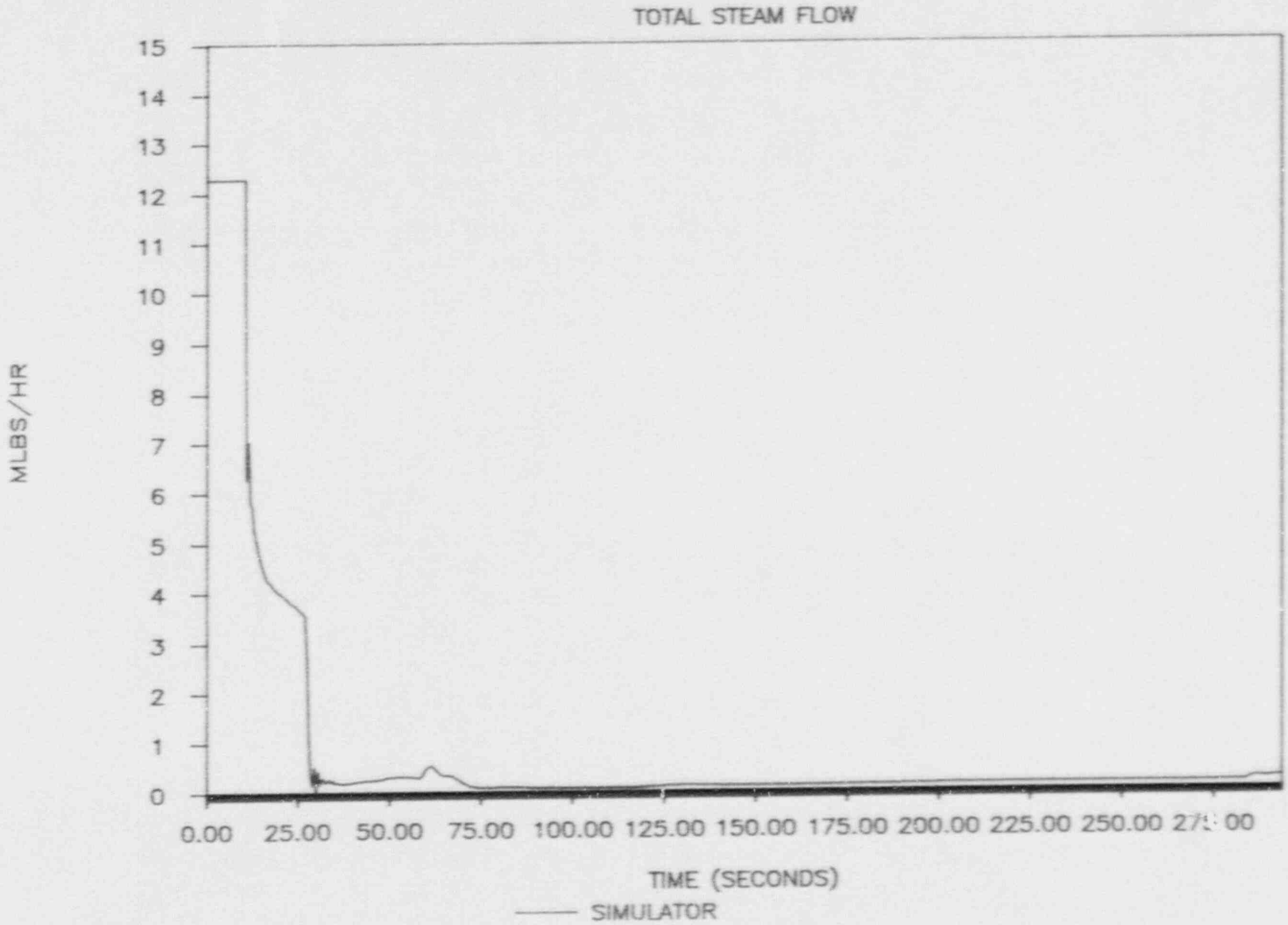
None

Exceptions Taken/Justification:

None

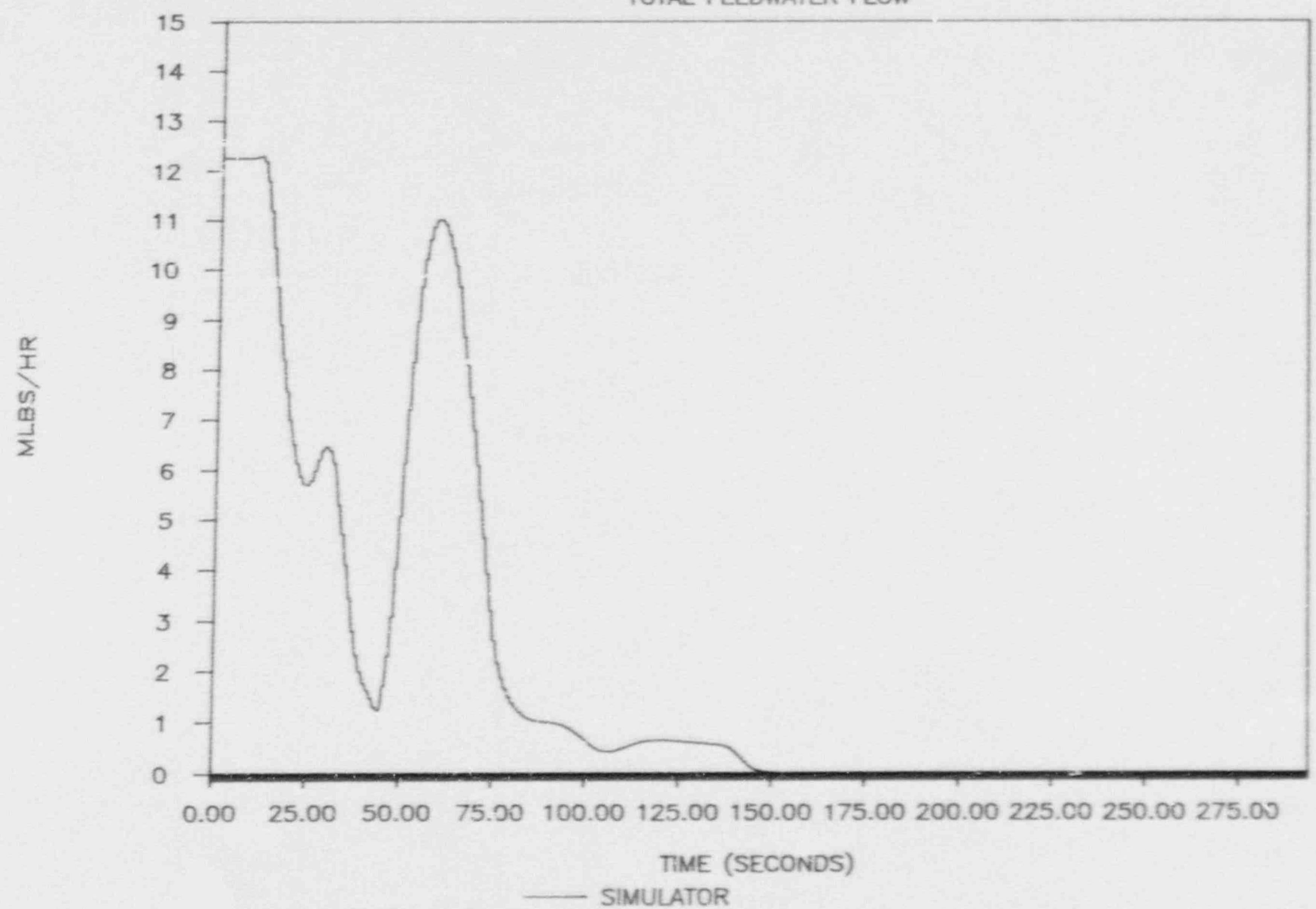

BENCHMARK TRANSIENT 511 TEST
REACTOR POWER (%)
POWER (%)
100
90
80
70
60
50
40
30
20
10
0
0.00
25.00
50.00
75.00
100.00
125.00
150.00
175.00
200.00
225.00
250.00
275.00
TIME (SECONDS)
SIMULATOR

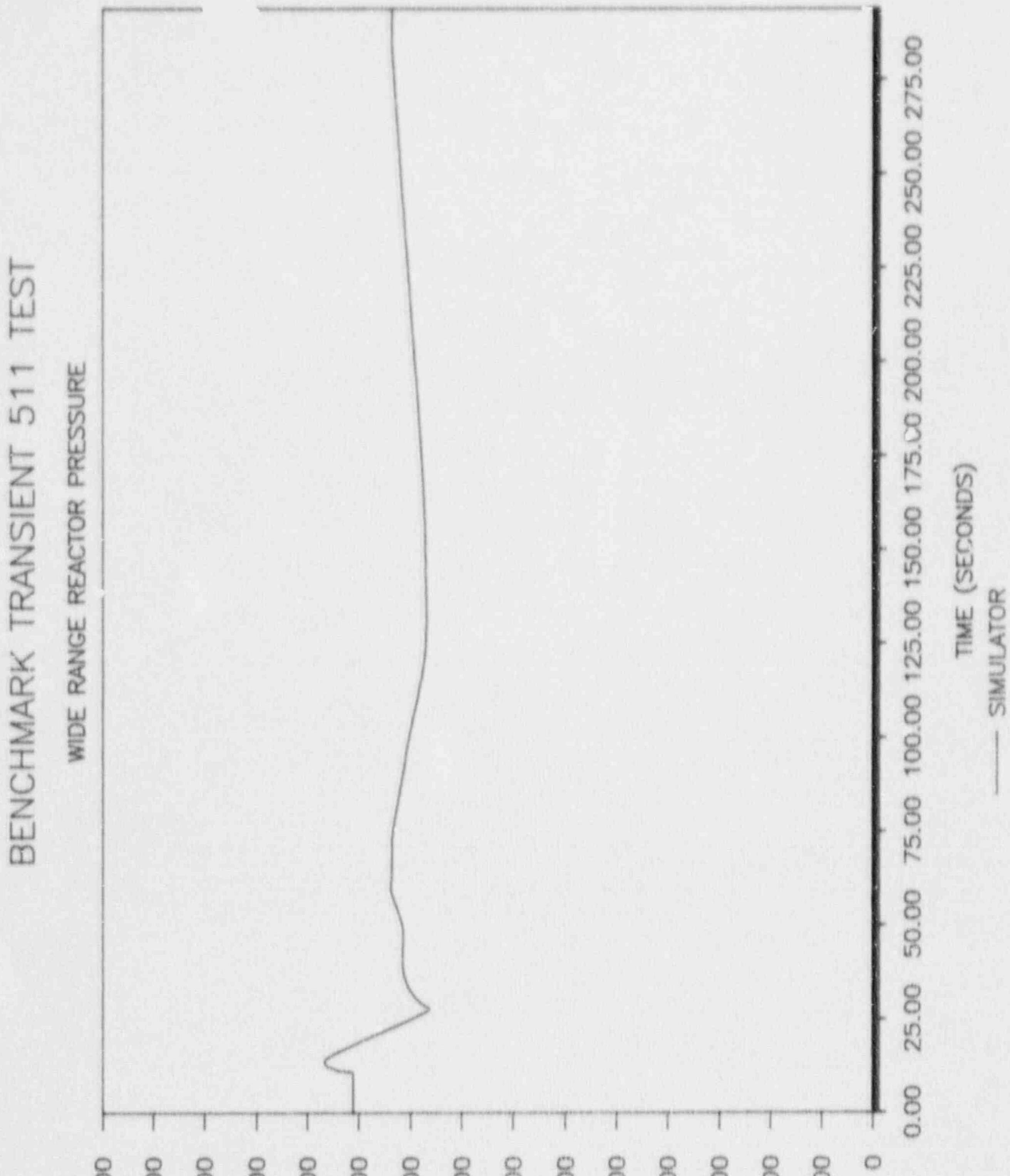
BENCHMARK TRANSIENT 511 TEST

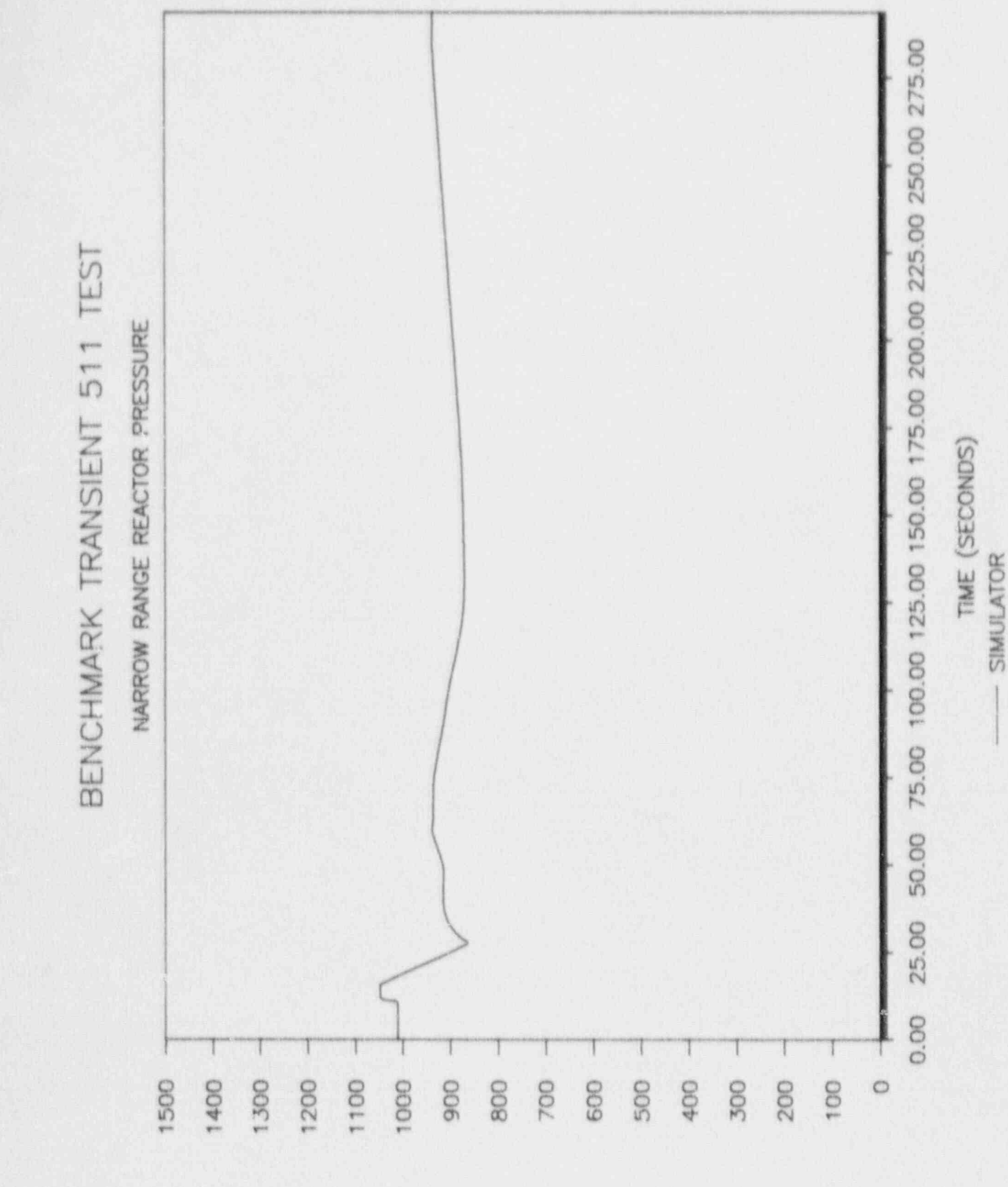


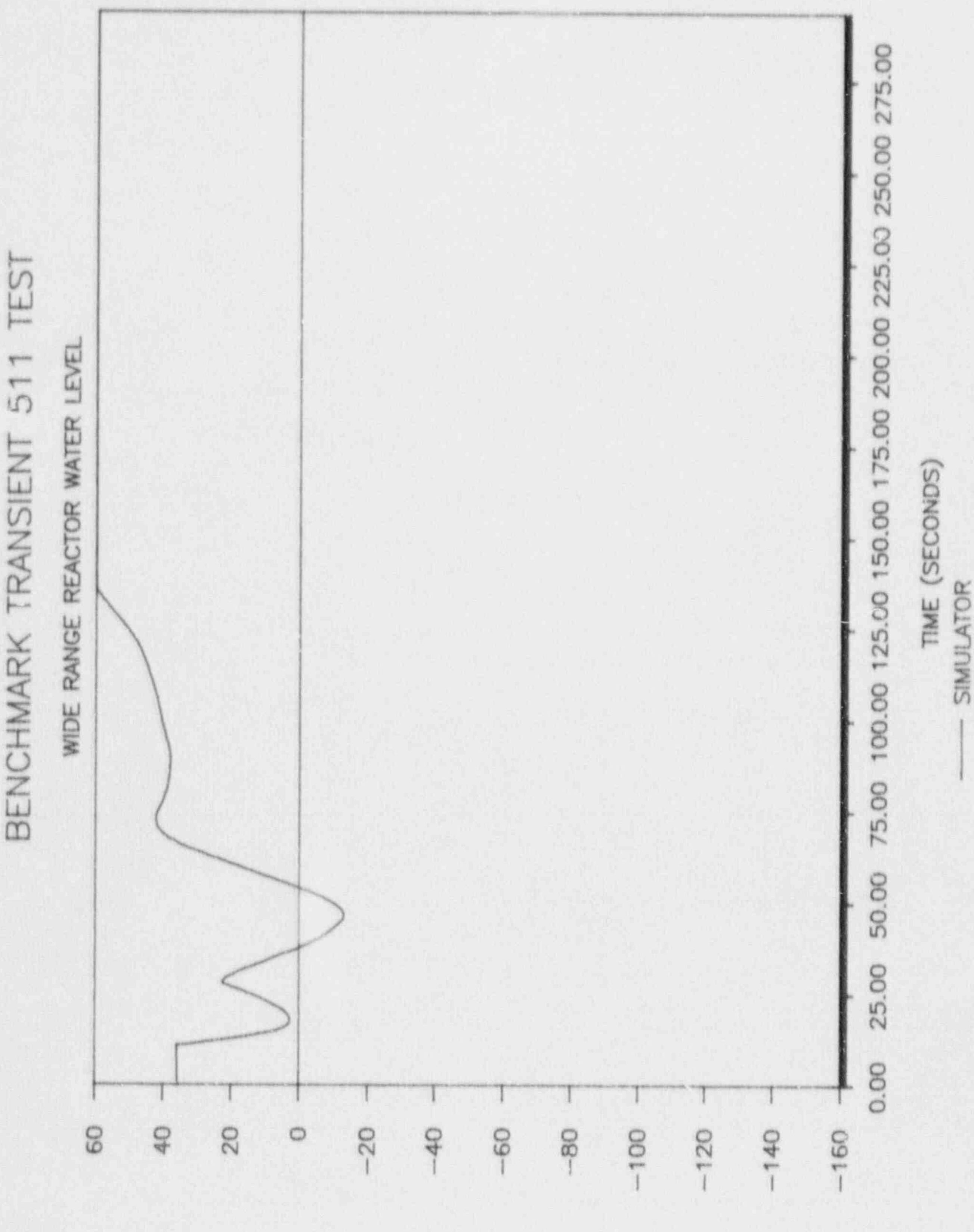
BENCHMARK TRANSIENT 511 TEST

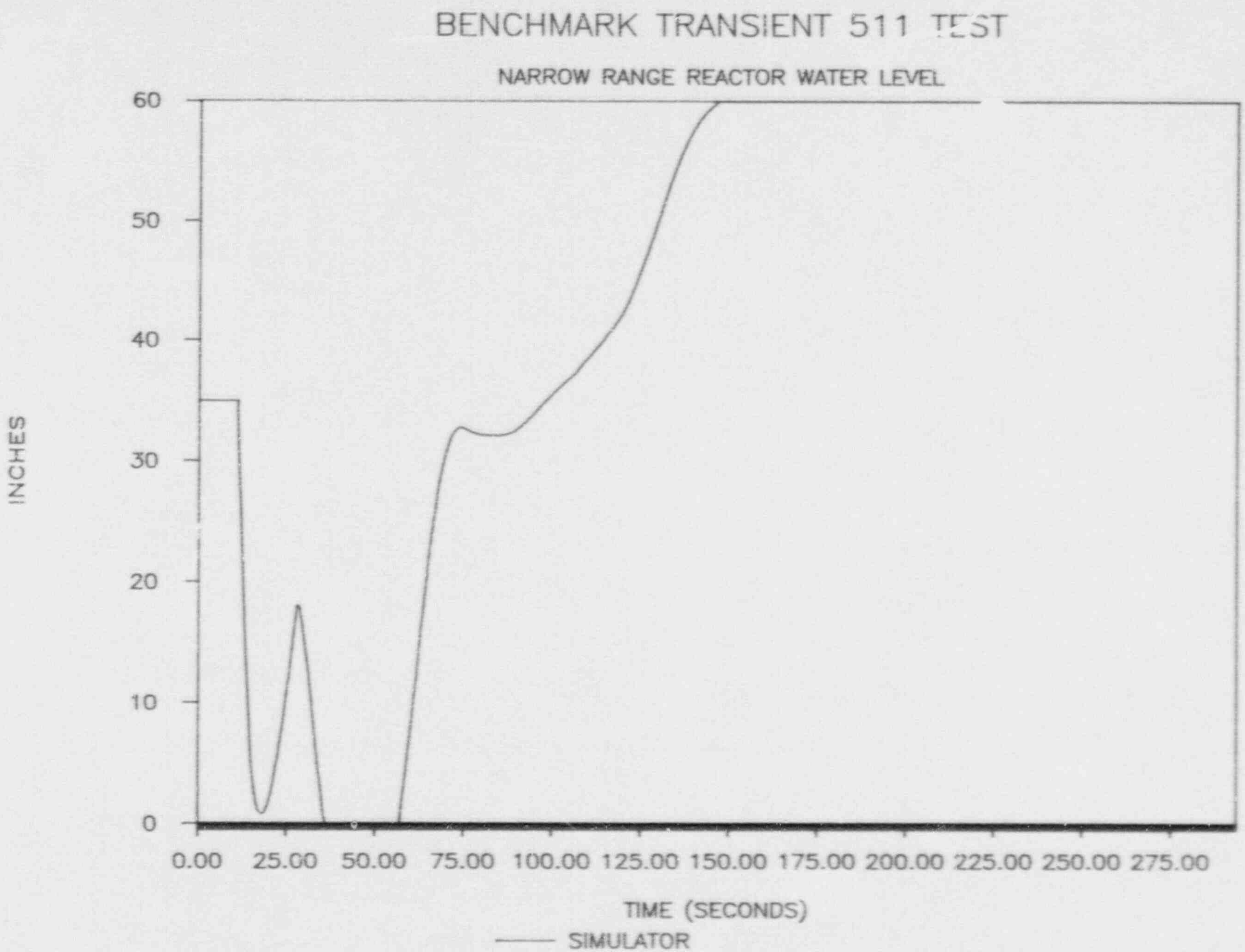
TOTAL FEEDWATER FLOW



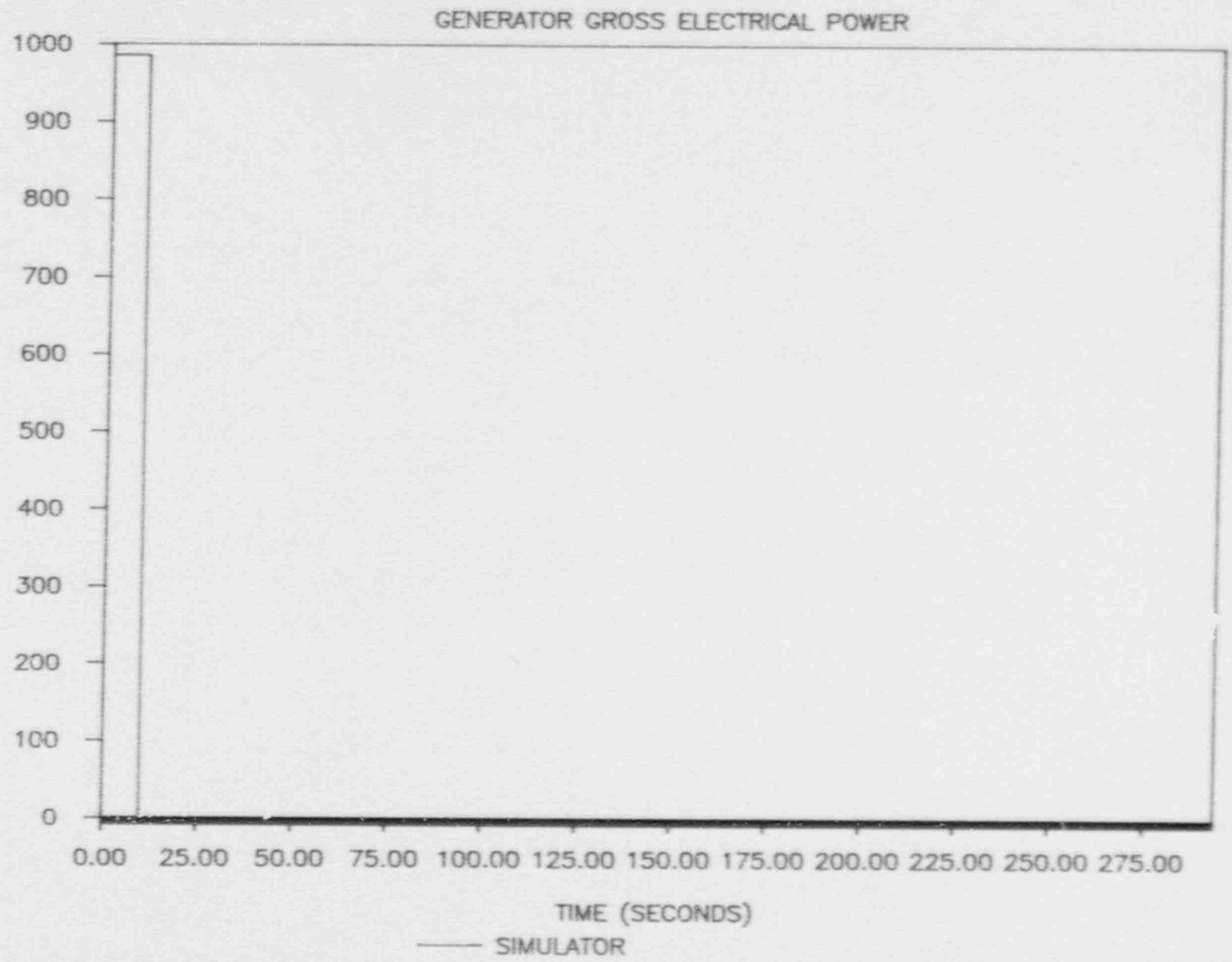

BENCHMARK TRANSIENT 511 TEST
WIDE RANGE REACTOR PRESSURE
PSIG
1500
1400
1300
1200
1100
1000
900
800
700
600
500
400
300
200
100
0
0.00
25.00
50.00
75.00
100.00
125.00
150.00
175.00
200.00
225.00
250.00
275.00
TIME (SECONDS)
SIMULATOR

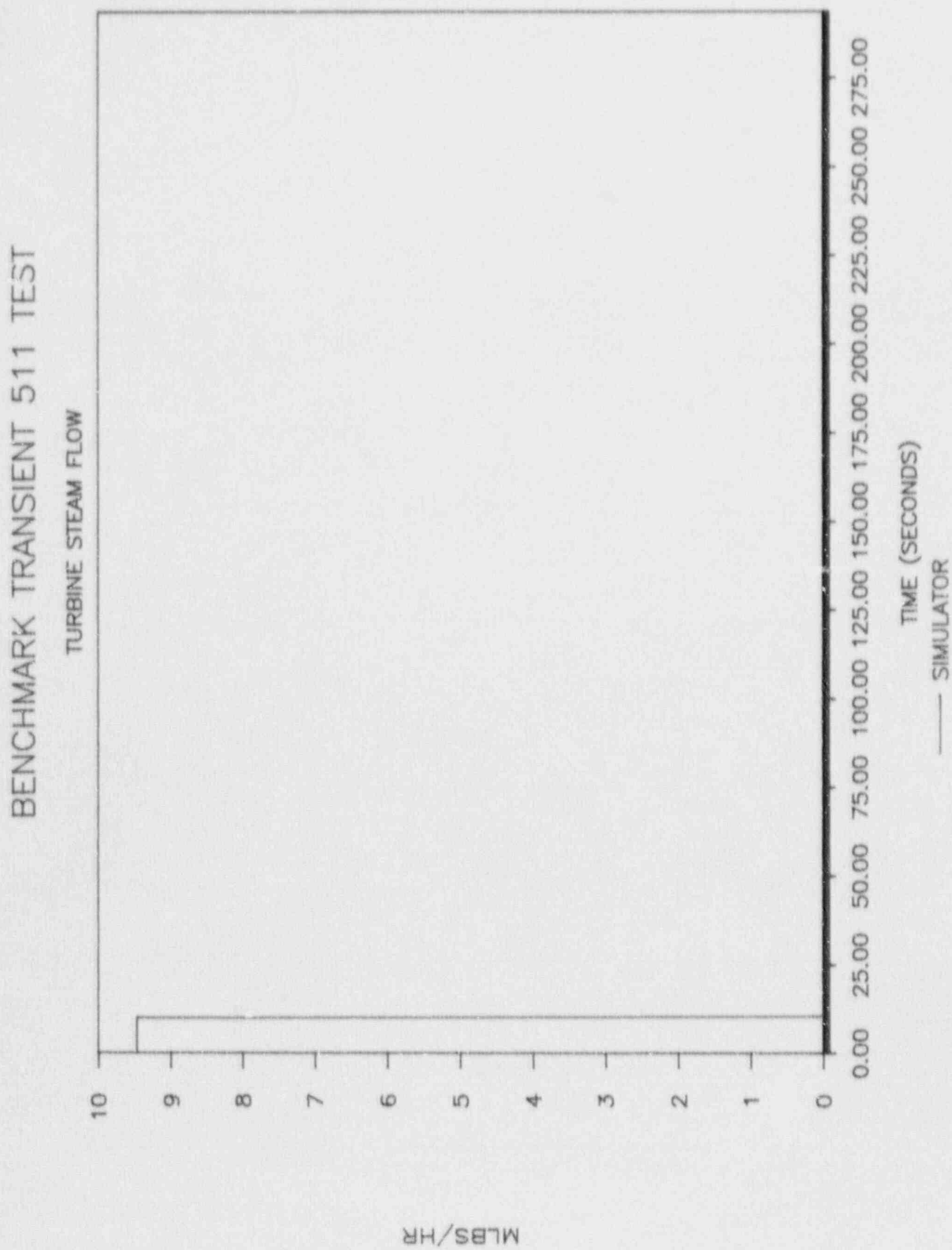

BENCHMARK TRANSIENT 511 TEST
NARROW RANGE REACTOR PRESSURE
PSIG
1500
1400
1300
1200
1100
1000
900
800
700
600
500
400
300
200
100
0
0.00
25.00
50.00
75.00
100.00
125.00
150.00
175.00
200.00
225.00
250.00
275.00
TIME (SECONDS)
— SIMULATOR


BENCHMARK TRANSIENT 511 TEST
WIDE RANGE REACTOR WATER LEVEL
INCHES
60
40
20
0
-20
-40
-60
-80
-100
-120
-140
-160
0.00
25.00
50.00
75.00
100.00
125.00
150.00
175.00
200.00
225.00
250.00
275.00
TIME (SECONDS)
— SIMULATOR

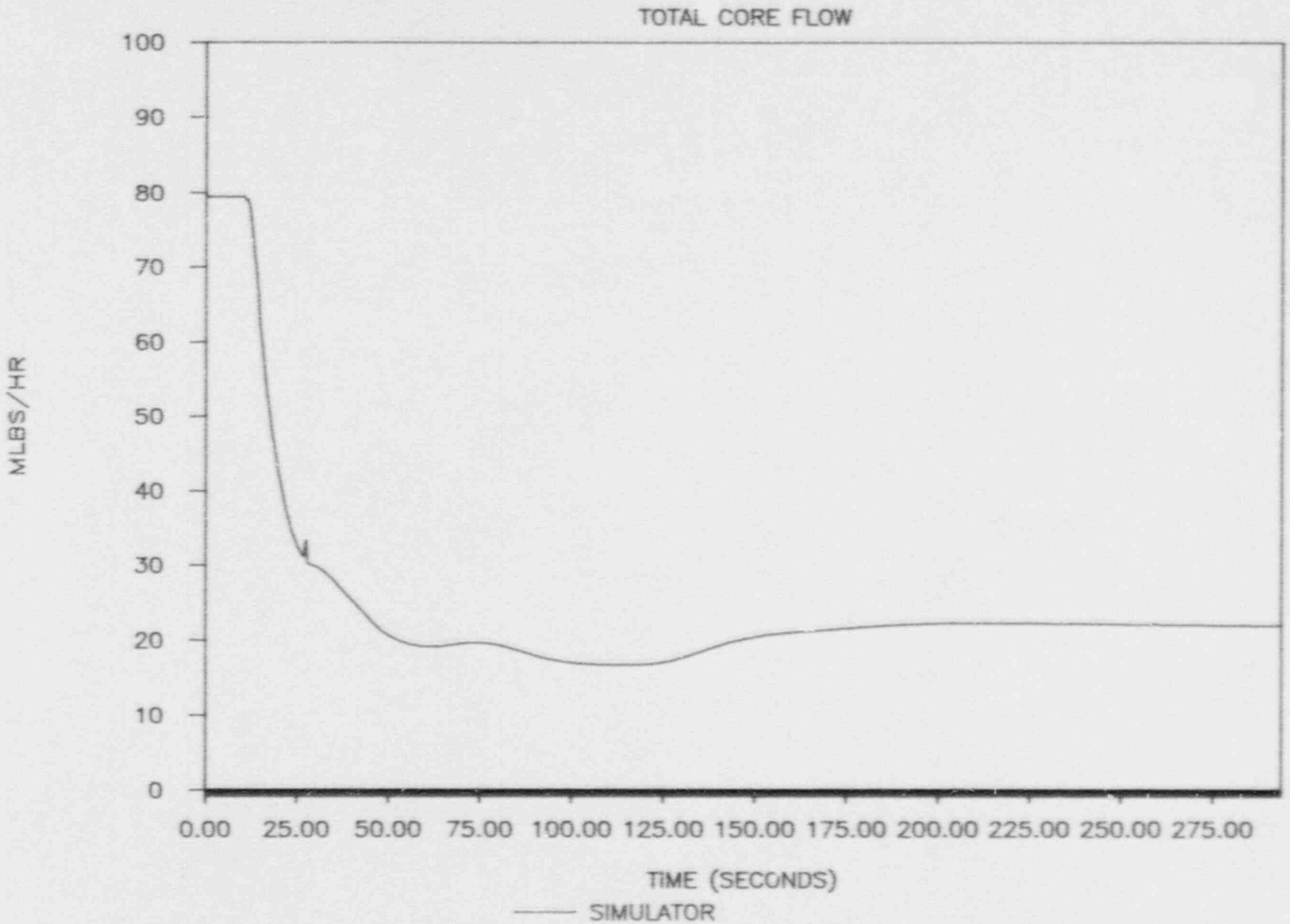

BENCHMARK TRANSIENT 511 TEST
NARROW RANGE REACTOR WATER LEVEL
INCHES
60
50
40
30
20
10
0
0.00
25.00
50.00
75.00
100.00
125.00
150.00
175.00
200.00
225.00
250.00
275.00
TIME (SECONDS)
SIMULATOR

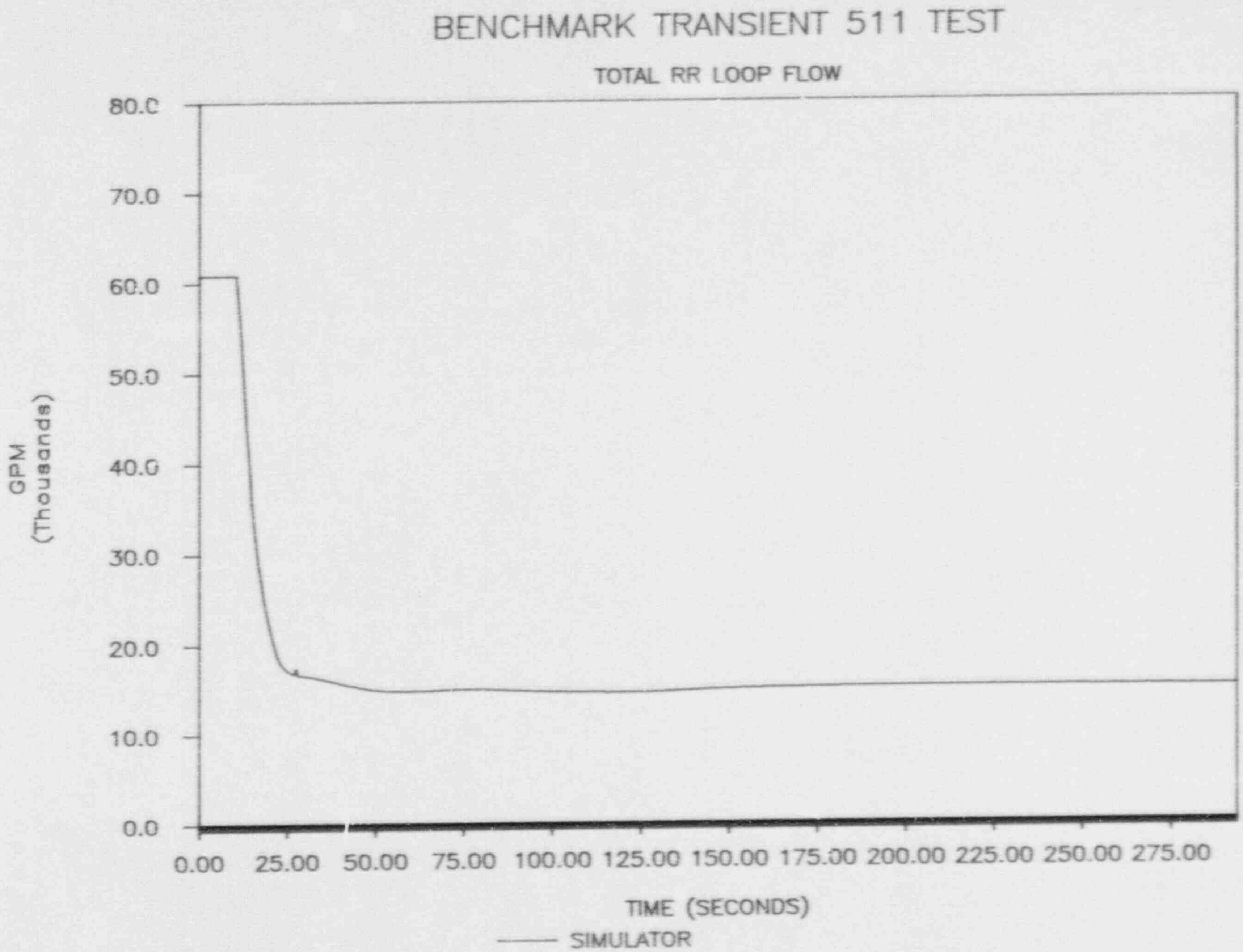
BENCHMARK TRANSIENT 511 TEST




BENCHMARK TRANSIENT 511 TEST
TURBINE STEAM FLOW
MLBS/HR
10
9
8
7
6
5
4
3
2
1
0
0.00
25.00
50.00
75.00
100.00
125.00
150.00
175.00
200.00
225.00
250.00
275.00
TIME (SECONDS)
SIMULATOR

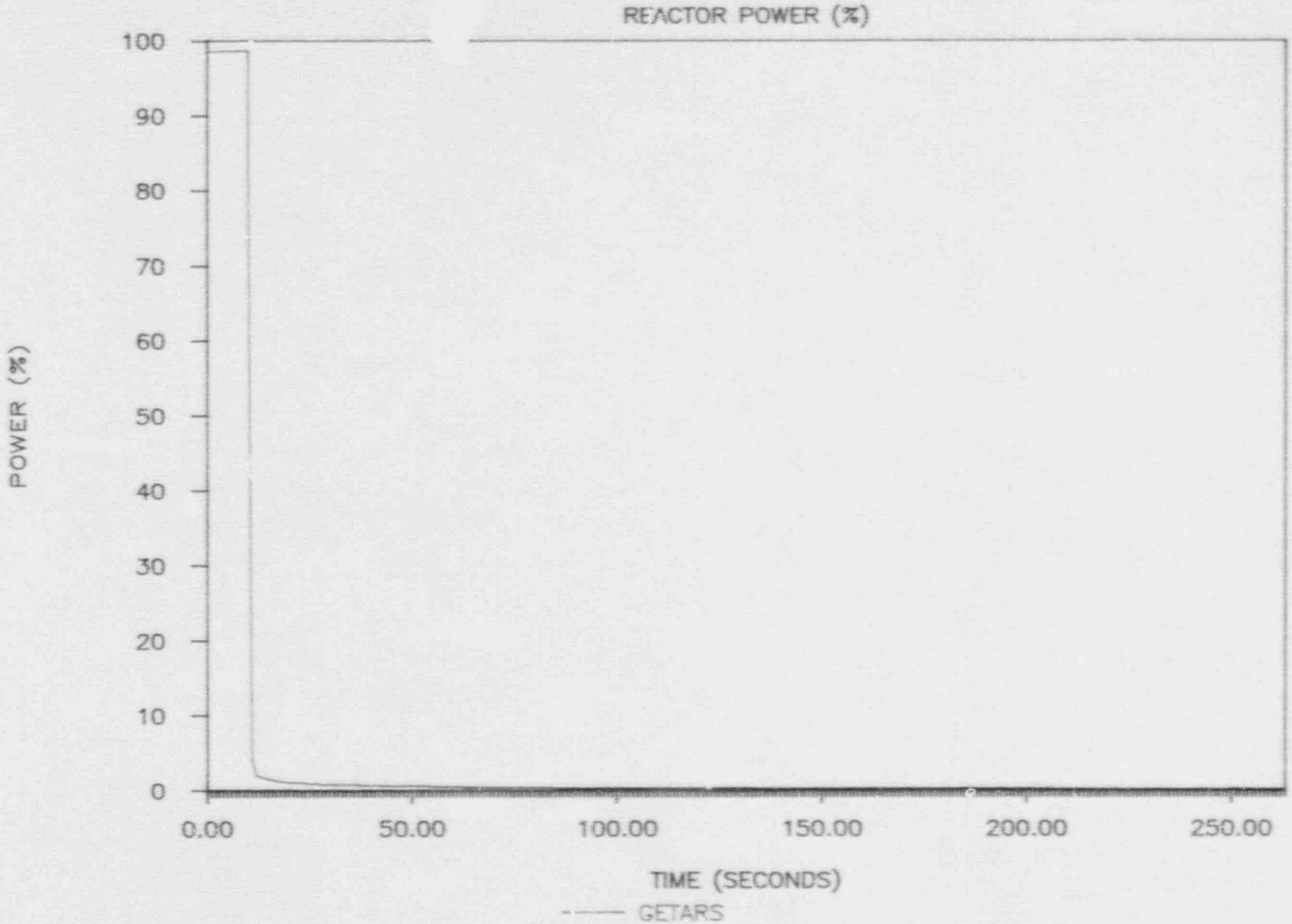
BENCHMARK TRANSIENT 511 TEST



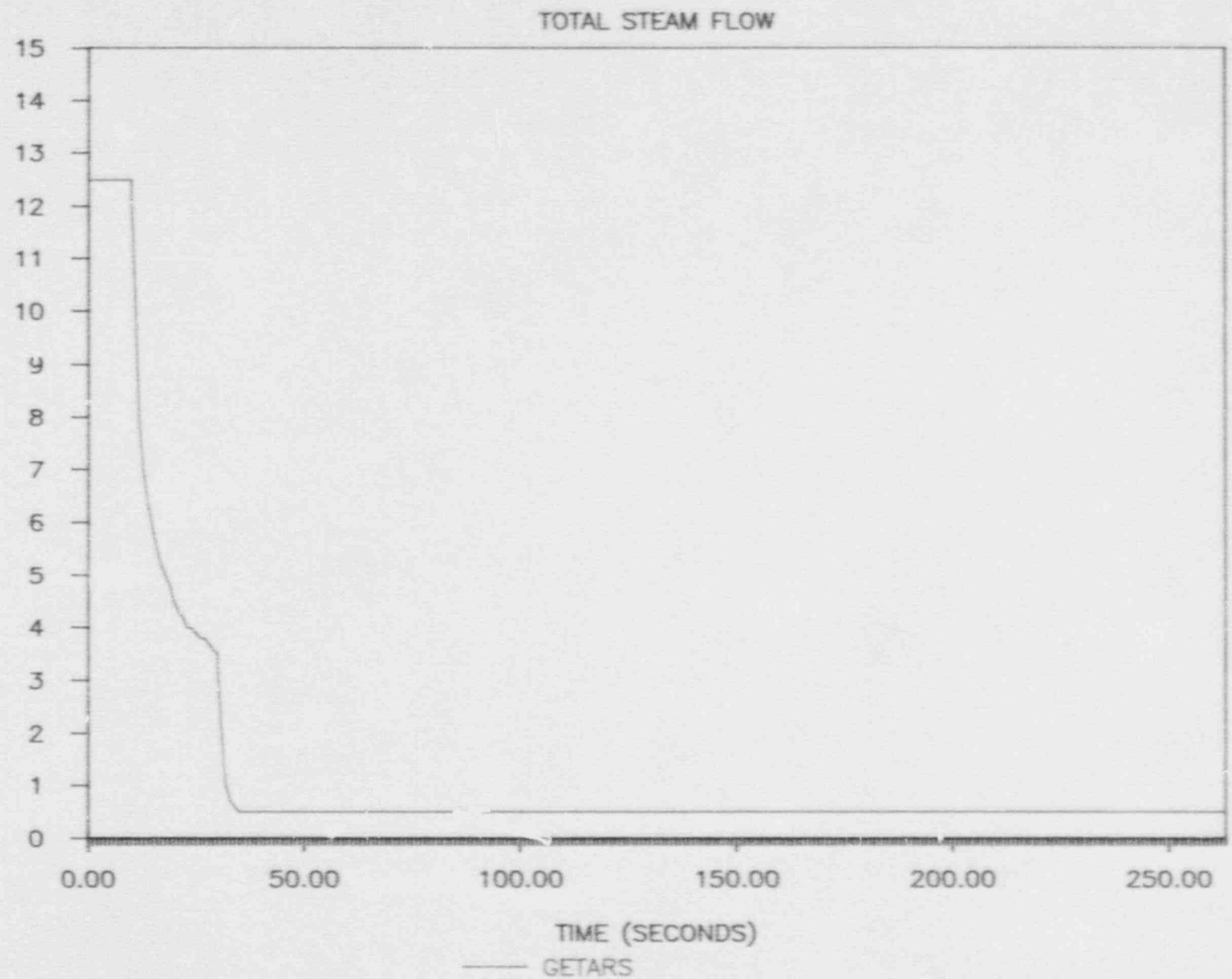

BENCHMARK TRANSIENT 511 TEST
TOTAL RR LOOP FLOW
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
GPM
(Thousands)
0.00
25.00
50.00
75.00
100.00
125.00
150.00
175.00
200.00
225.00
250.00
275.00
TIME (SECONDS)
SIMULATOR

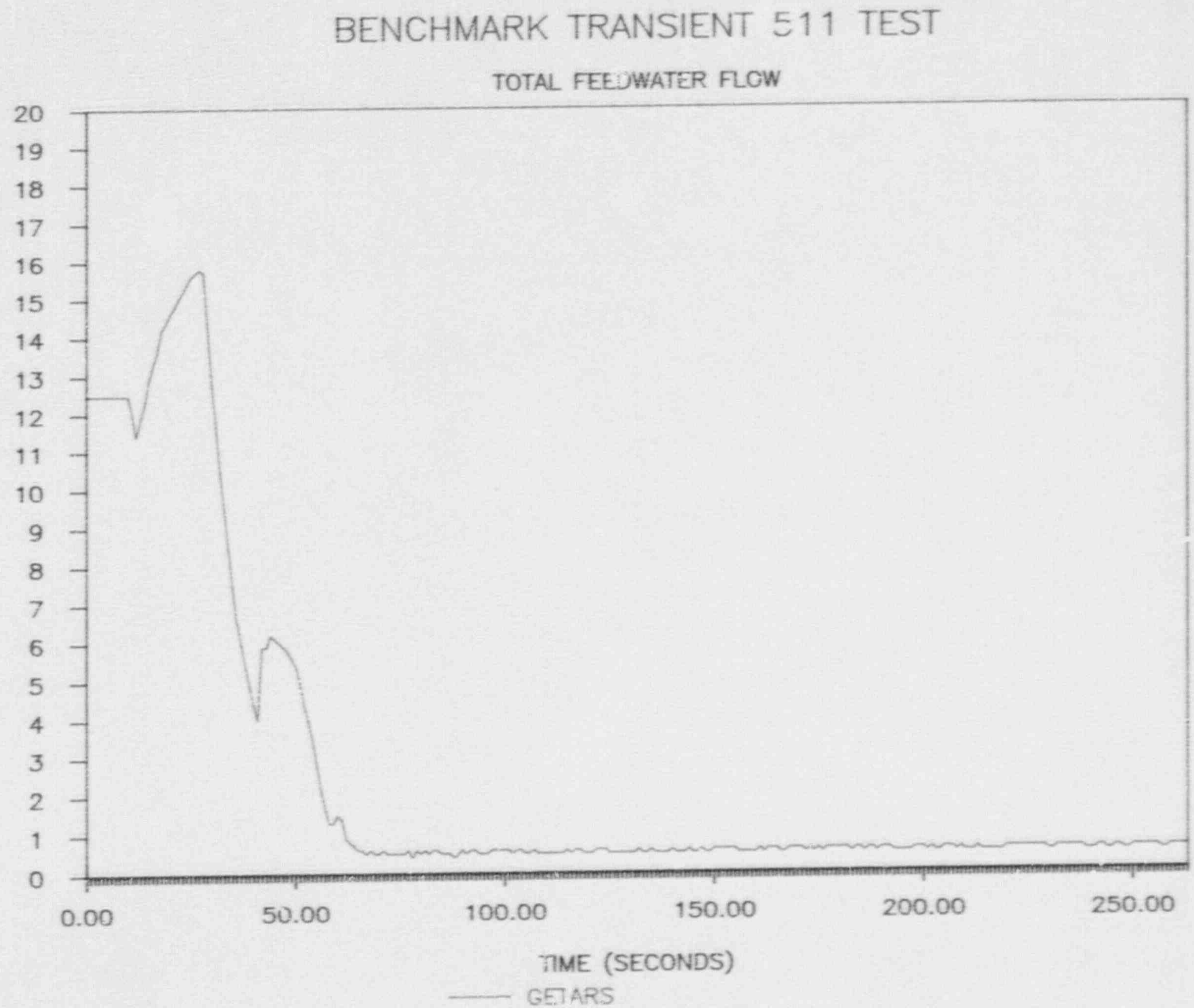
Page 411

BENCHMARK TRANSIENT 511 TEST

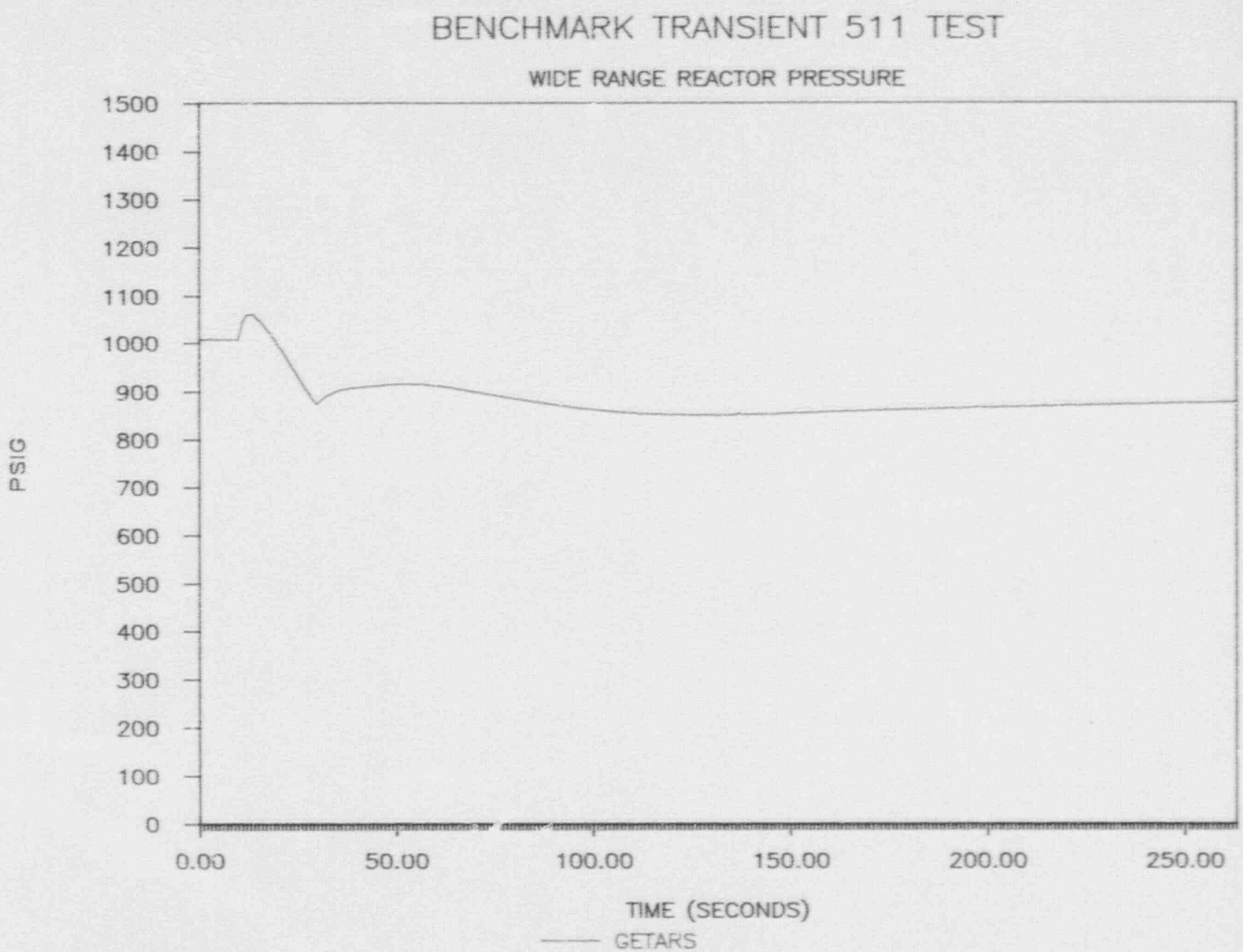


BENCHMARK TRANSIENT 511 TEST




BENCHMARK TRANSIENT 511 TEST
TOTAL FEEDWATER FLOW
MLBS/HR
20
19
18
17
16
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
0.00
50.00
100.00
150.00
200.00
250.00
TIME (SECONDS)
GETARS

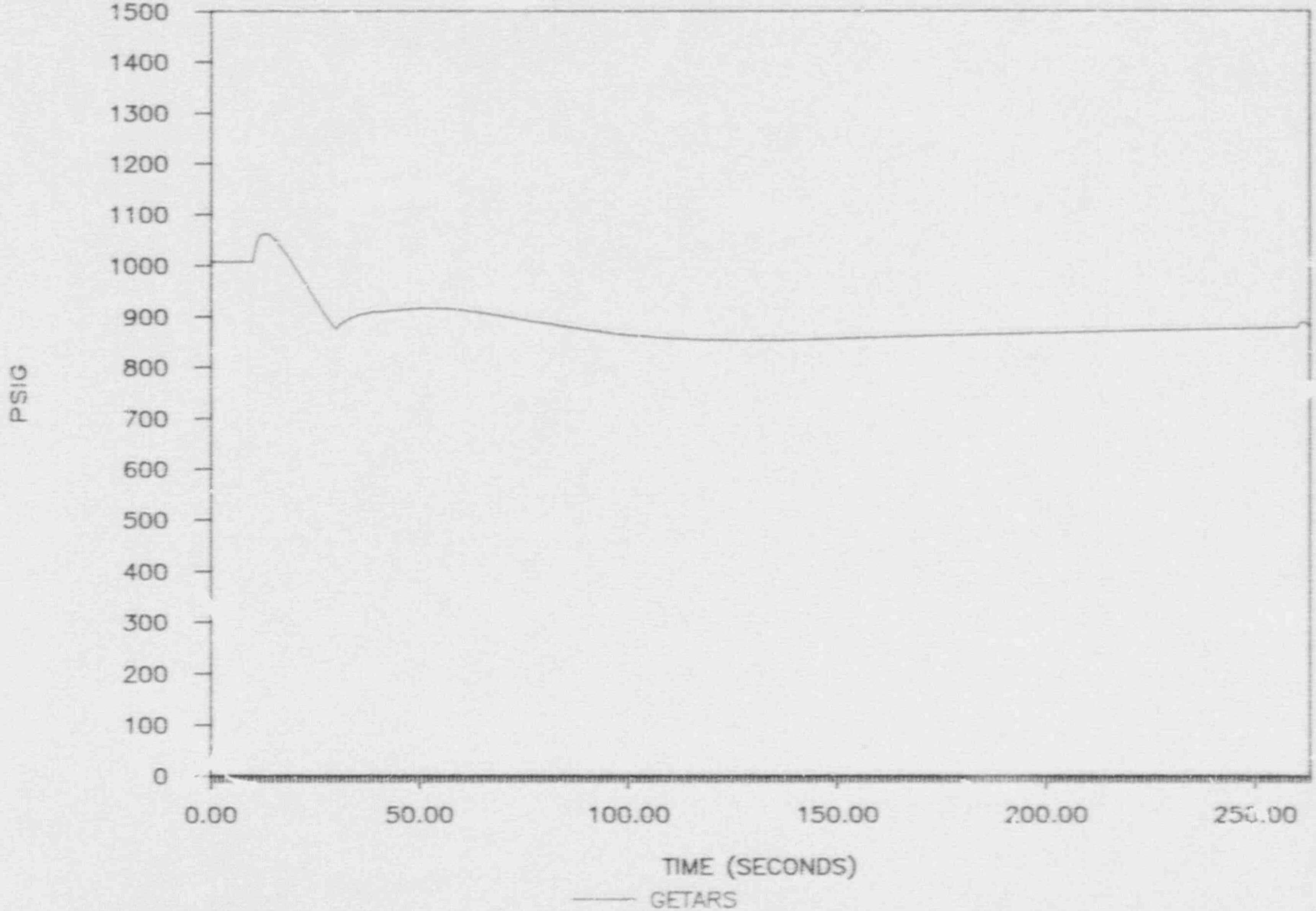
Page 415

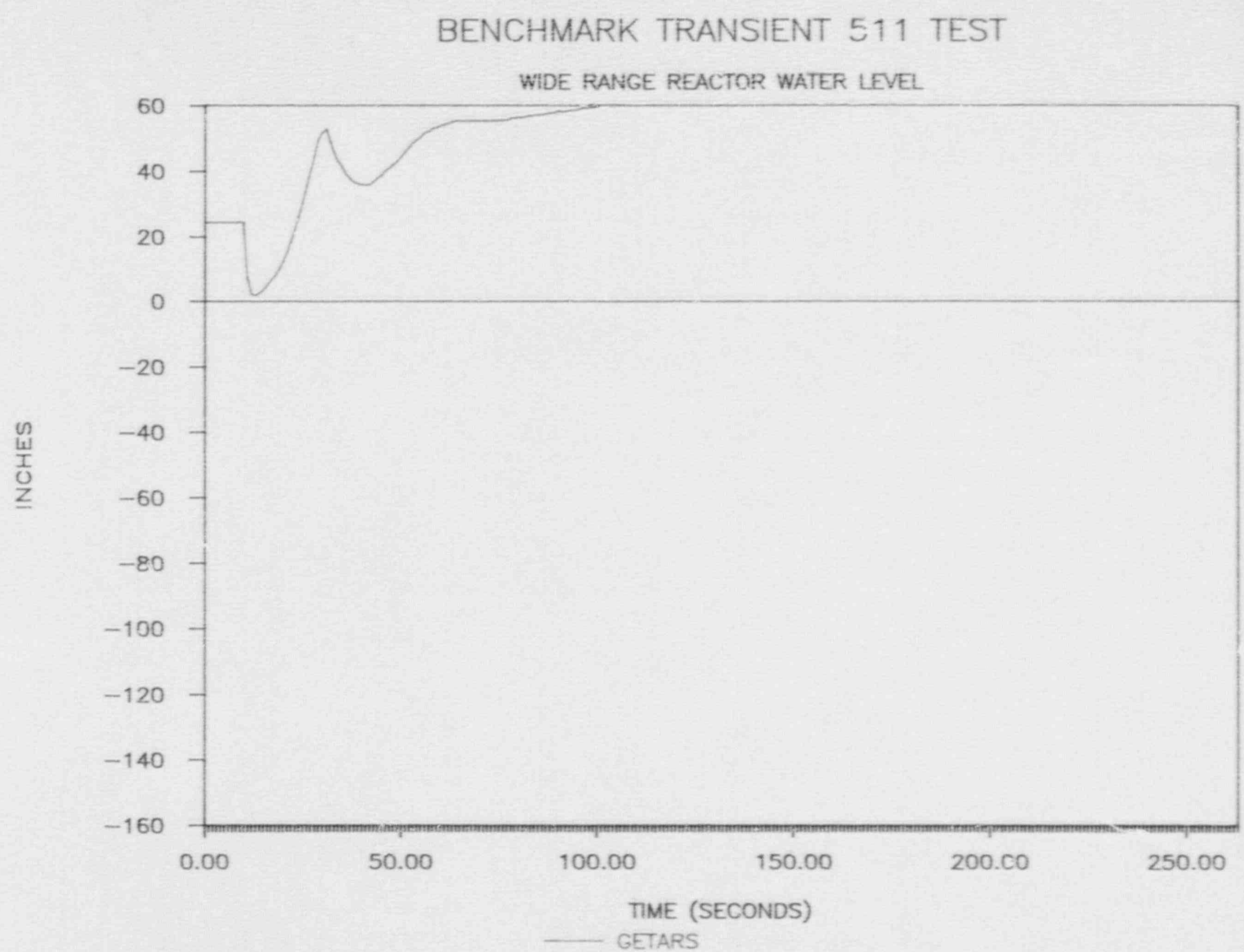


BENCHMARK TRANSIENT 511 TEST
WIDE RANGE REACTOR PRESSURE
PSIG
1500
1400
1300
1200
1100
1000
900
800
700
600
500
400
300
200
100
0
0.00
50.00
100.00
150.00
200.00
250.00
TIME (SECONDS)
GETARS

BENCHMARK TRANSIENT 511 TEST

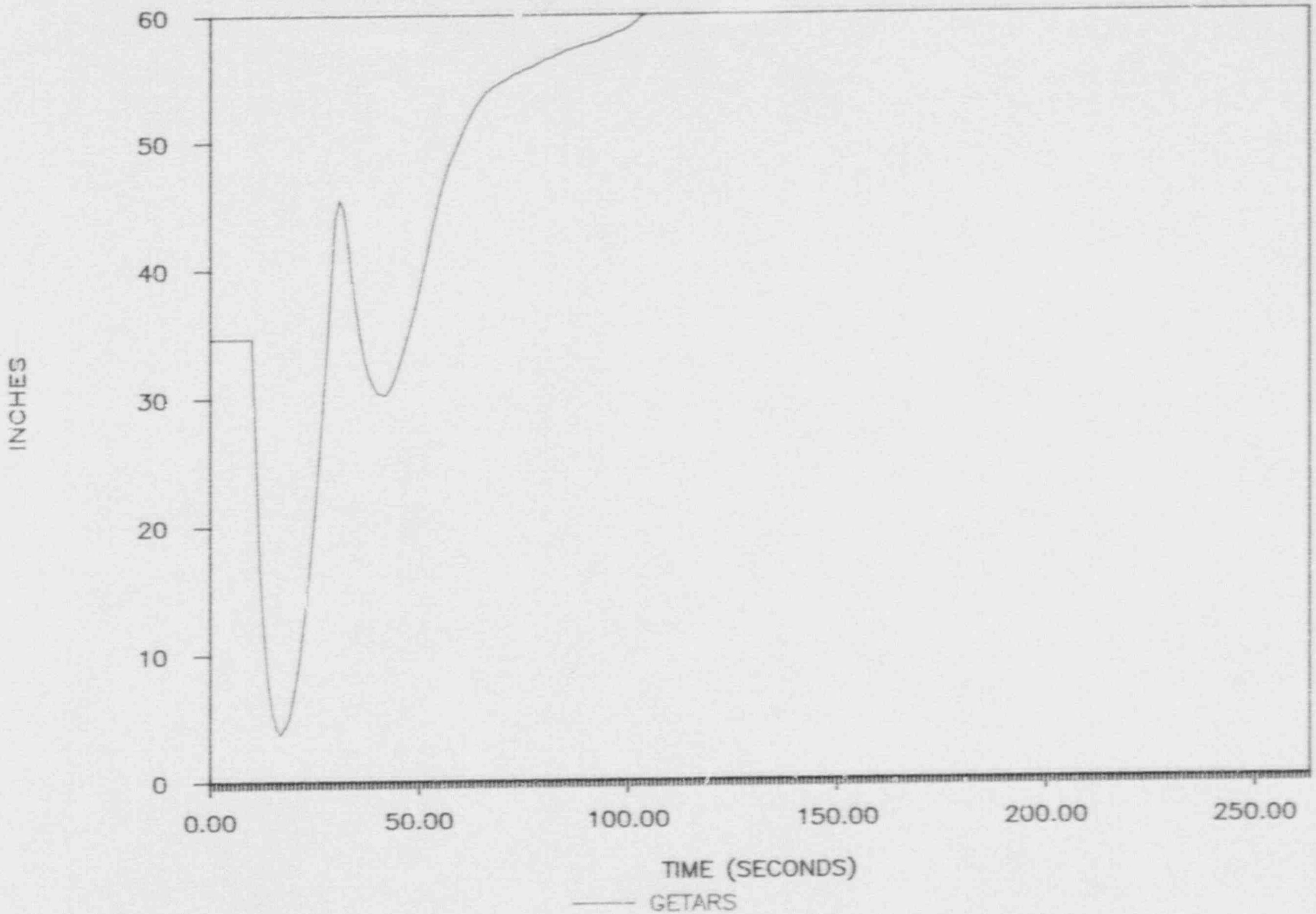
NARROW RANGE REACTOR PRESSURE

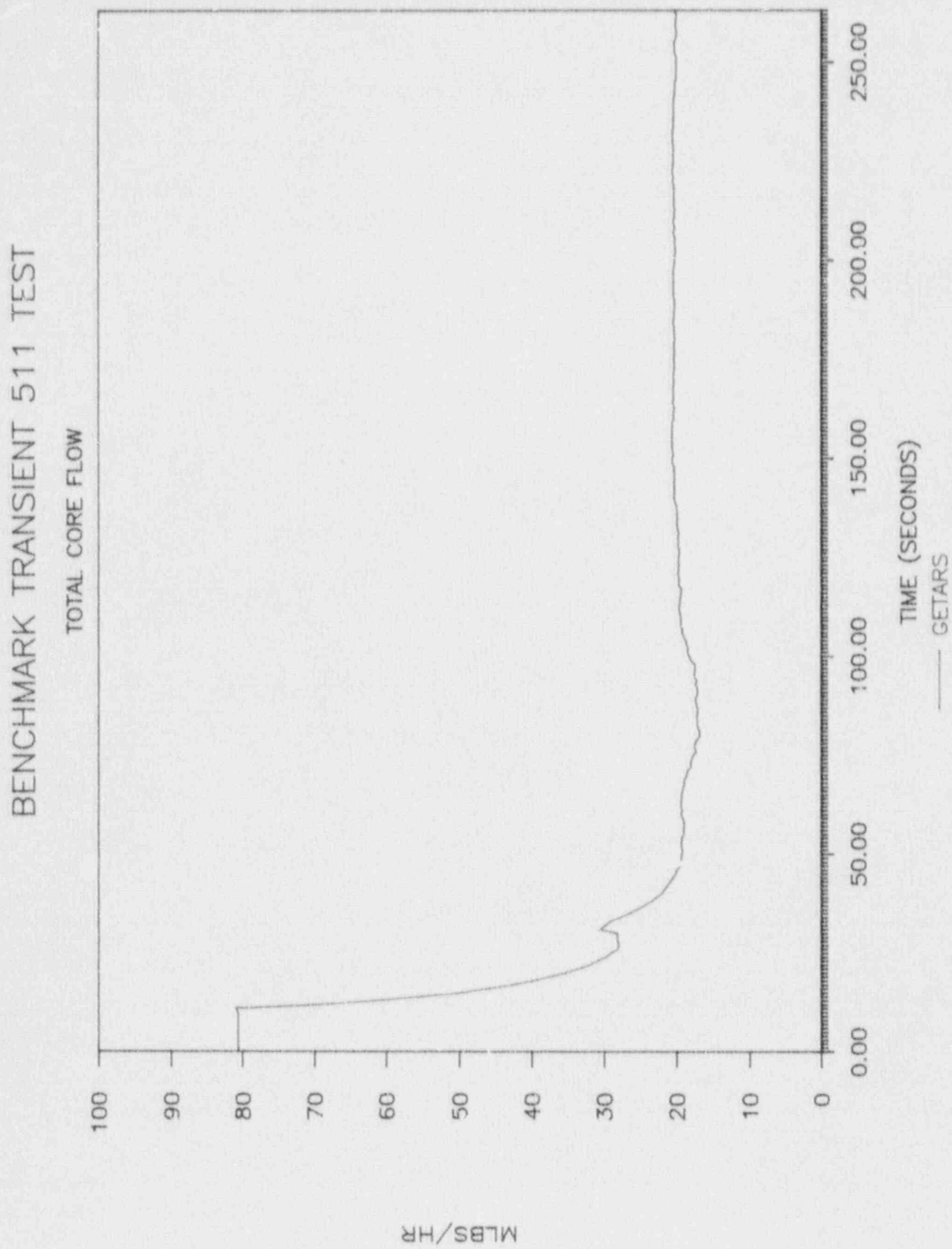


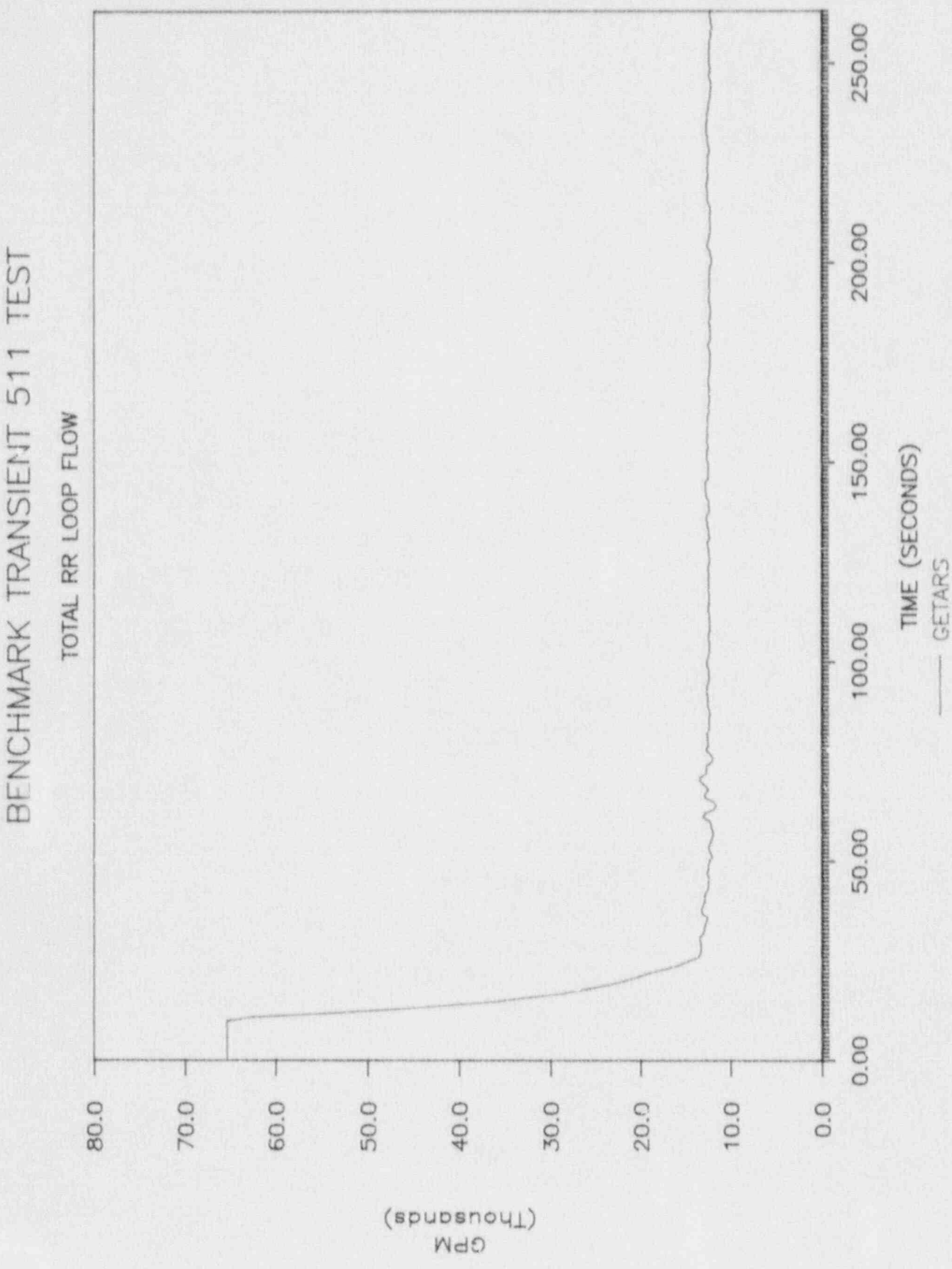

BENCHMARK TRANSIENT 511 TEST
WIDE RANGE REACTOR WATER LEVEL
INCHES
60
40
20
0
−20
−40
−60
−80
−100
−120
−140
−160
0.00
50.00
100.00
150.00
200.00
250.00
TIME (SECONDS)
GETARS

BENCHMARK TRANSIENT 511 TEST

NARROW RANGE REACTOR WATER LEVEL




BENCHMARK TRANSIENT 511 TEST
TOTAL CORE FLOW
MLBS/HR
100
90
80
70
60
50
40
30
20
10
0
0.00
50.00
100.00
150.00
200.00
250.00
TIME (SECONDS)
— GETARS


BENCHMARK TRANSIENT 511 TEST
TOTAL RR LOOP FLOW
GPM (Thousands)
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
0.00
50.00
100.00
150.00
200.00
250.00
TIME (SECONDS)
GETARS

VII. COMPLIANCE REPORT

The following is a comparison between the CPS simulator program and ANSI/ANS 3.5-1985 requirements. For each requirement in the Standard, the compliance report indicates whether the simulator complies, summarizes how the requirement is satisified or verified, and references the section(s) of this certification report where the requirement is discussed in more detail. If the simulator does not comply with a requirement, an exemption request is indicated on the compliance repor along with a justification for the exemption.

SECTION 3.0 GENERAL REQUIREMENTS

The extent of simulation shall be such that the operator is required to take the same action on the simulator to conduct an evolution as on the reference plant using similar procedures. The extent of simulation shall permit control of simulated transients to a steady state condition, provided that the simulator operating limits (section 4.3, Simulator Operating Limits) are not exceeded.

The simulator complies with this requirement.
For related information, see certification report section II.D

SECTION 3.1 SIMULATOR CAPABILITIES

The response of the simulator resulting from operator action, improper operator action, automatic plant controls, and inherent operating characteristics shall be realistic to the extent that within the limits of the performance criteria, (Section 4, Performance Criteria) the operator shall not observe a difference between the response of the simulator control room instrumentation and the reference plant.

The simulator complies with this requirement.
See discussions throughout the certification report of these general requirements.

SECTION 3.1.1 NORMAL PLANT EVOLUTIONS

The simulator shall be capable of simulating continuously, and in real time, plant operations of the reference nuclear power plant.	The simulator complies with this requirement. For related information, see certification report section V.C. This requirement is demonstrated when conducting all certification tests. See also test summary for procedure STP 4.04.
The simulator shall calculate plant system parameters corresponding to particular operating conditions, display these parameters on the appropriate instrumentation, and provide proper alarm or protective system action, or both.	The simulator complies with this requirement. For related information, see certification report section V.C. This requirement is demonstrated when conducting all certification tests.
The minimum evolutions that the simulator shall be capable of performing, using only operator action normal to the reference plant are as follows:	
A. Plant Startup - Cold to Hot Standby. The starting conditions shall be cold shutdown condition of temperature and pressure. Removal of the reactor vessel head is not a required condition for simulation.	The simulator complies with this requirement. For related information, see certification report section V.C. This requirement is demonstrated in test procedure STP 2.01.

B. Nuclear Startup from Hot Standby to Rated Power	The simulator complies with this requirement. For related information, see certification report section V.C. This requirement is demonstrated in test procedure STP 2.02.
C. Turbine Startup and Generator Synchronization.	The simulator complies with this requirement. For related information, see certification report section V.C. This requirement is demonstrated in test procedure STP 2.03.
D. Reactor Trip Followed by Recovery to Rated Power	The simulator complies with this requirement. For related information, see certification report section V.C. This requirement is demonstrated in test procedure STP 2.04.
E. Operations at Hot Standby	The simulator complies with this requirement. For related information, see certification report section V.C. This requirement is demonstrated in test procedure STP 2.05.
F. Load Changes	The simulator complies with this requirement. For related information, see certification report section V.C. This requirement is demonstrated in test procedure STP 2.06.
G. Startup, Shutdown, and Power Operations with Less than Full Reactor Coolant Flow	The simulator complies with this requirement. For related information, see certification report section V.C. This requirement is demonstrated in test procedure STP 2.07.
H. Plant Shutdown from Rated Power to Hot Standby to Cooldown to Cold Conditions	The simulator complies with this requirement. For related information, see certification report section V.C. This requirement is demonstrated in test procedures STP 2.05 and 2.07.

I. Core performance testing such as plant heat balance, determination of shutdown margin, and measurement of reactivity coefficients and control rod worth using permanently installed instrumentation	The simulator complies with this requirement. For related information, see certification report section V.C. This requirement is demonstrated in test procedure STP 2.08.
J. Operator conducted surveillance testing on safety-related equipment or systems	The simulator complies with this requirement. For related information, see certification report section V.C. This requirement is demonstrated in test procedure STP 2.09.

SECTION 3.1.2 PLANT MALFUNCTIONS

The simulator shall be capable of simulating in real time abnormal and emergency events including malfunctions to demonstrate inherent plant response and automatic plant control functions.	The simulator complies with this requirement. For related information, see certification report sections II.C.2 and V.D.
Each type of accident analyzed in the reference plant safety analysis report that results in observable indications on control room instrumentation and for which the simulator is determined to be appropriate for training shall be simulated.	The simulator complies with this requirement. For related information, see certification report section II.C.2

Where the operator actions are a function of the degree of severity of the malfunction (e.g., loss of condenser vacuum, steam line break, loss of coolant, degraded feed water flow, etc.), the simulator shall have adjustable rate for the malfunction of such a range to represent the plant malfunction.	The simulator complies with this requirement. For related information, see certification report sections II.C.2 and V.D.
The remaining events shall consist of a variety of malfunctions associated with the electrical, auxiliary, engineered safety features systems, reactor coolant system and instrumentation, and control systems.	The simulator complies with this requirement. For related information, see certification report sections II.C.2 and V.D. See also Table 3.
The malfunctions listed below shall be included:	The simulator complies with this requirement. For related information, see certification report section V.D.
1) Loss of Coolant	
(a) significant PWR steam generator leaks;	Illinois Power takes exception to this requirement since Clinton Power Station (CPS) is not a Pressurized Water Reactor (PWR).
(b) inside and outside primary containment;	The simulator complies with this requirement. This requirement is demonstrated in test procedures STP 3.01a through 3.01c, 3.20a and 3.20b, and 3.21 This capability exists using the following malfunctions: RR03, Recirculation Loop Rupture MS05, Steam Line Rupture in the Drywell MS06, Steam Line Rupture in the Tunnel MS07, Steam Line Rupture in the Turbine Building FW13, Feedwater Line Rupture Outside of Containment

(c) large and small reactor coolant breaks including demonstration of saturation condition;	The simulator complies with this requirement. This requirement is demonstrated in test procedures STP 3.01a and 3.01b. This capability exists using the following malfunctions: RR03, Recirculation Loop Rupture RR06, Recirculation Pump Seal Failure
(d) failure of safety and relief valves.	The simulator complies with this requirement. This requirement is demonstrated in test procedure STP 3.01c. This capability exists using malfunction: HP13, Main Steam Relief Failure
2) Loss of Instrument Air to the extent that the whole system or individual headers can lose pressure and affect the plant's static or dynamic performance.	The simulator complies with this requirement. This requirement is demonstrated in test procedure STP 3.02. This capability exists using the following malfunctions: IA01, Instrument Air System Rupture IA02, Air Compressor Trip
3) Loss or degraded electrical power to the station, including loss of offsite power, loss of emergency power, loss of emergency generators, loss of power to the plant's electrical distribution buses, and loss of power to the individual instrumentation busses (AC as well as DC) that provide power to control functions affecting the plant's response.	The simulator complies with this requirement. This requirement is demonstrated in test procedures STP 3.03 through 3.08. This capability exists using the following malfunctions: ED01, 345 KV Line Ground Fault ED03, 6.9 KV Bus Overcurrent Trip ED04, 4.16 KV Bus Overcurrent Trip ED05, 480 V Bus Overcurrent ED06, Reserve Auxiliary Transformer Lockout ED07, Emergency Reserve Auxiliary Transformer Lockout ED09, 120 VAC Bus Overcurrent ED10, 125 VDC Bus Overcurrent DG01, Emergency Diesel Generator Failure to Start DG02, Emergency Diesel Generator Trip

4) Loss of forced core coolant flow due to single or multiple pump failure.	The simulator complies with this requirement. This requirement is demonstrated in test procedures STPs 3.09 and 4.03. This capability exists using the following malfunctions: RR02, Recirculation Pump Trip
5) Loss of Condenser Vacuum including loss of condenser level control	The simulator complies with this requirement. This requirement is demonstrated in test procedure STP 3.10. This capability exists using the following malfunctions: MC01, Condenser Air Inleakage FW02, Condenser Hotwell Makeup Controller Failure FW03, Condenser Hotwell Dump Controller Failure
6) Loss of service water or cooling to individual components	The simulator complies with this requirement. This requirement is demonstrated in test procedure STP 3.11 This capability exists using the following malfunctions: CW05, Plant Service Water Pump Trip CW04, Shutdown Service Water Pump Trip
7) Loss of shutdown cooling	The simulator complies with this requirement. This requirement is demonstrated in test procedure STP 3.12 This capability exists using the following malfunctions: RH10, Loss of Shutdown Cooling

8) Loss of component cooling system or cooling to individual components	The simulator complies with this requirement. This requirement is demonstrated in test procedure STP 3.13 This capability exists using the following malfunctions: CW06, Component Cooling Water Pump Trip
9) Loss of normal feedwater or normal feedwater system failure	The simulator complies with this requirement. This requirement is demonstrated in test procedure STP 3.14 This capability exists using the following malfunctions: FW08, Turbine Feedwater Pump Trip FW09, Turbine Feedwater Pump Controller Failure
10) Loss of all feedwater (normal and emergency)	The simulator complies with this requirement. This requirement is demonstrated in test procedure STP 3.15 This capability exists using the following malfunctions: HP01, High Pressure Core Spray (HPCS) Failure to Start HP08, Low Pressure Core Spray (LPCS) Failure to Start RH01, Residual Heat Removal (RHR) Pump Failure to Start RI01, Reactor Core Isolation Cooling (RCIC) Automatic Start Failure
11) Loss of protective system channel	The simulator complies with this requirement. This requirement is demonstrated in test procedure STP 3.16 This capability exists using the following malfunction: RR15, Instrument Failure This capability exists using instructor remotes MS104 through MS107, Bypass Divisional NS4 Scram Pushbuttons.

12) Control rod failure, including stuck rods, uncoupled rods, drifting rods, rod drops, and misaligned rods.	The simulator complies with this requirement. This requirement is demonstrated in test procedure STP 3.17 This capability exists using the following malfunctions: LC01, Control Rod Drift LC02, Stuck Rod LC03, Uncoupled Rod
13) Inability to drive control rods.	The simulator complies with this requirement. This requirement is demonstrated in test procedure STP 3.17. See also test procedure STP 3.24. This capability exists using the following malfunctions: LC02, Stuck Rod RP03, Partial Scram of Selected Rod Group
14) Fuel cladding failure resulting in high activity in reactor coolant or offgas and the associated high radiation alarms	The simulator complies with this requirement. This requirement is demonstrated in test procedures STPs 3.18 and 4.03. This capability exists using the following malfunction: CR01, Fuel Cladding Leak
15) Turbine Trip	The simulator complies with this requirement. This requirement is demonstrated in test procedure STP 3.19 This capability exists using the following malfunction: TC01, Turbine Trip

16) Generator Trip	The simulator complies with this requirement. This requirement is demonstrated in test procedure STP 3.26 This capability exists using the following malfunction: EG01, Generator Load Reject
17) Failure in automatic control systems that affect reactivity and core heat removal	The simulator complies with this requirement. This requirement is demonstrated in test procedures STP 3.24 and 4.03. See also test procedure STP 3.12. This capability exists using the following malfunctions: RP01, Automatic and Manual Scram Failure RH10, Loss of Shutdown Cooling
18) Failure of reactor coolant pressure/volume control systems (PWR)	Illinois Power takes exception to this requirement since Clinton Power Station (CPS) is not a Pressurized Water Reactor (PWR).
19) Reactor trip	The simulator complies with this requirement. This requirement is demonstrated in test procedures STP 3.19 and 3.24 This capability exists by using various instructor overrides. This capability exists using the following malfunction: TC01, Turbine Trip
20) Main steam line as well as main feed line break (both inside and outside containment).	The simulator complies with this requirement. This requirement is demonstrated in test procedures STPs 3.20a, 3.20b, 3.21, & 4.03. This capability exists using the following malfunctions: FW13, Feedwater Line Rupture Outside of Containment MS06, Main Steam Line Rupture in the Tunnel MS07, Main Steam Line Rupture in the Turbine Building MS05, Steam Line Rupture in the Drywell

21) Nuclear instrumentation failure(s)	The simulator complies with this requirement. This requirement is demonstrated in test procedure STP 3.22 This capability exists using the following malfunctions: NM07, Intermediate Range Monitor (IRM) Channel Upscale NM11, Intermediate Range Monitor (IRM) Channel Downscale NM12, Average Power Range Monitor (APRM) Channel Downscale NM13, Average Power Range Monitor (APRM) Channel Upscale
22) Process instrumentation, alarms, and control system failures	The simulator complies with this requirement. This requirement is demonstrated in test procedures STP 3.27 and 3.28. This capability exists using the following malfunctions: RI03, RCIC Flow Controller Failure RM01, Radiation Monitor Failure
23) Passive malfunctions in systems, such as engineered safety features, emergency feedwater systems.	The simulator complies with this requirement. This requirement is demonstrated in test procedure STP 3.23 This capability exists using the following malfunctions: DG01, Diesel Generator Failure to Start RH01, Residual Heat Removal (RHR) Pump Failure to Start RI01, Reactor Core Isolation Cooling (RCIC) Failure to Start RR03, Recirculation Loop Rupture RH07, Low Pressure Coolant Injection (LPCI) Injection Valve Failure HP10, High Pressure Core Spray (HPCS) Injection Valve Failure RH08, Valve E12-F029 Shut HP05, Valve E22-F031 Shut HP12, Valve E21-F039 Shut

24) Failure of the automatic reactor trip system.	The simulator complies with this requirement. This requirement is demonstrated in test procedures STP 3.24 and 4.03. This capability exists using the following malfunctions: RP01, Automatic and Manual Scram Failure RP02, Automatic Scram Failure RP03, Partial Scram of Selected Rod Group
25) Reactor Pressure Control System failure including turbine bypass failure (BWR).	The simulator complies with this requirement. This requirement is demonstrated in test procedure STP 3.25. This capability exists using the following malfunctions: TC02, Turbine Bypass Valve Failure TC07, Loss of EHC Hydraulics (Bypass Valves)
The response of the simulator shall be compared to actual plant response or best estimate plant response (See Section 4, Performance Criteria).	The simulator complies with this requirement. For related information, see certification report section II.C.2.
Comparing simulator response to safety analysis may show significant discrepancies which shall be resolved based on best estimate results.	The simulator complies with this requirement. For related information, see certification report section II.C.2.
Where applicable to the malfunction, the simulator shall provide to the operator the capability of taking action to recover the plant, or mitigate the consequences, or both.	The simulator complies with this requirement. For related information, see certification report section II.C.2.

The simulation shall be capable of continuing until such time that a stable, controllable, and safe condition is attained which can be continued to cold shutdown conditions, or until the simulator operating limits (section 4.3, Simulator Operating Limits) are reached.	The simulator complies with this requirement. For related information, see certification report section II.C.2.

SECTION 3.2 SIMULATOR ENVIRONMENT

SECTION 3.2.1 DEGREE OF PANEL SIMULATION

The simulator shall contain sufficient operational panels to provide the controls instrumentation, alarms, and other man-machine interfaces to conduct the normal plant evolutions of 3.1.1 (Normal Plant Evolutions) and respond to the malfunctions of 3.1.2 (Plant Malfunctions).	The simulator complies with this requirement. For related information, see certification report section II.B.2. This requirement is demonstrated in test procedure STP 4.01.
The control panels and consoles that are simulated shall be designed to duplicate the size, shape, color, and configuration of the functionally simulated hardware of the reference plant.	The simulator complies with this requirement. For related information, see certification report section II.B.2. This requirement is demonstrated in test procedure STP 4.01.
There may be deviations in dimensions and arrangement of panels provided these deviations do not detract from training.	The simulator complies with this requirement. For related information, see certification report section II.B.2

SECTION 3.2.2 CONTROLS ON PANELS

The controls on panels and consoles that are simulated shall be designed to duplicate the size, shape, color, and configuration of the functionally simulated hardware of the reference plant.	The simulator complies with this requirement. For related information, see certification report section II.B.2. This requirement is demonstrated in test procedure STP 4.01.
Consideration should be given to face-front visual simulation of hardware components located on simulated panels but not used for training.	The simulator complies with this requirement. For related information, see certification report section II.B.2.
All functionally simulated and visually simulated hardware shall replicate that in the reference plant control room. There may be dimensional deviation in the configuration of components and instrumentation, provided these deviations do not impact on actions to be taken by the operator.	The simulator complies with this requirement. For related information, see certification report section II.B.2. This requirement is demonstrated in test procedure STP 4.01.
Plant information shall be displayed to the operator in the same form that it is available in the reference plant, i.e., meters, recorders, CRT, etc.	The simulator complies with this requirement. For related information, see certification report section II.B.2. This requirement is demonstrated in test procedure STP 4.01.
Meters, recorders, switches, annunciators, controllers, plant computer interface hardware, and other components or displays that would function during normal, abnormal, and emergency evolutions shall be included in the simulator.	The simulator complies with this requirement. For related information, see certification report section II.B.2. This requirement is demonstrated in test procedure STP 4.01.

SECTION 3.2.2 CONTROL ROOM ENVIRONMENT

Requirement	Compliance
Considerations shall be given to simulating as much of the control room environment as is reasonable and practical, for example, turbine noise, control rod step counter noise, flooring, obstructions, and lighting.	The simulator complies with this requirement. For related information, see certification report section II.B.4. This requirement is demonstrated in test procedure STP 4.01.
Communication systems that a control room operator would use to communicate with an auxiliary operator or other support activities shall be operational to the extent that the simulator instructor, when performing these remote activities, shall be able to communicate over the appropriate communication system.	The simulator complies with this requirement. For related information, see certification report section II.B.4. This requirement is demonstrated in test procedure STP 4.02.

SECTION 3.3 SYSTEMS TO BE SIMULATED AND THE DEGREE OF COMPLETENESS

SECTION 3.3.1 SYSTEMS CONTROLLED FROM THE CONTROL ROOM

Requirement	Compliance
The inclusion of systems of the reference plant and the degree of simulation shall be to the extent necessary to perform the reference plant evolutions described in 3.1.1 and the malfunctions described in 3.1.2.	The simulator complies with this requirement. This requirement is demonstrated when conducting all certification tests. For related information, see certification report section II.B.3.

It shall be possible to perform these control manipulations and observe plant response as in the reference plant.	The simulator complies with this requirement. For related information, see certification report section II.B.3.
This shall include system interactions with other systems simulated and shall provide total system integrated response.	The simulator complies with this requirement. This requirement is demonstrated when conducting all certification tests. For related information, see certification report section II.B.3.

SECTION 3.3.2 SYSTEMS OPERATION OR FUNCTIONS CONTROLLED OUTSIDE OF THE CONTROL ROOM

The systems that are operated outside the control room or that provide some input to the simulation model and are necessary to perform reference plant evolutions described in 3.1.1 and malfunctions described in 3.1.2 shall be simulated.	The simulator complies with this requirement. For related information, see certification report section II.C.3.

The simulator trainee shall be able to interface with the remote activity in the same manner as in the reference plant.

The simulator complies with this requirement.
For related information, see certification report section II.C.3.

SECTION 3.4 SIMULATOR TRAINING CAPABILITIES

SECTION 3.4.1 INITIAL CONDITIONS

The simulator shall possess a minimum capability for 20 initialization conditions.

The simulator complies with this requirement.
For related information, see certification report section II.C.1.

At the time of commencement of the simulator in the training program, a minimum of ten initialization conditions shall be operational and shall include a variety of plant operating conditions, fission product poison concentrations, and various times in core life.

The simulator complies with this requirement.
For related information, see certification report section II.C.1.

SECTION 3.4.2 MALFUNCTIONS

It shall be possible to conveniently insert and terminate the plant malfunctions specified in 3.1.2

The simulator complies with this requirement.
For related information, see certification report section II.C.2.
This requirement is demonstrated in test procedure STP 4.02.

The simulator shall be capable of simulating simultaneous or sequential malfunctions, or both, if these malfunctions can be expected to occur by design or operational experience.

The simulator complies with this requirement.
For related information, see certification report section II.C.2.
This requirement is demonstrated in test procedure STP 4.02.

The introduction of a malfunction shall not alert the operator to the impending malfunction in any manner other than would occur in the reference plant.	The simulator complies with this requirement. For related information, see certification report section II.C.2. This requirement is demonstrated in test procedure STP 4.02.
Provisions shall be made for incorporating additional malfunctions identified from operational experience and not included in 3.1.2 (Plant Malfunctions).	The simulator complies with this requirement. For related information, see certification report section II.C.2.

SECTION 3.4.3 OTHER CONTROL FEATURES

The simulator shall have the capability of freezing simulation. In addition, consideration should be given to incorporation of fast time, slow time, backtrack, and snapshot.	The simulator complies with this requirement. For related information, see certification report section II.C.4. This requirement is demonstrated in test procedure STP 4.02.

SECTION 3.4.4 INSTRUCTOR INTERFACE

The capability shall be provided for the instructor to act in the capacity of auxiliary or other operations remote from the control room; for example, change the operating condition of valves, breakers, or other devices.	The simulator complies with this requirement. For related information, see certification report section II.C.3. This requirement is demonstrated in test procedure STP 4.02.

SECTION 4.0 PERFORMANCE CRITERIA

SECTION 4.1 STEADY STATE OPERATION

The simulator accuracies shall be related to full power values and interim power levels for which valid reference plant information is available. The parameters displayed on the control panels may have the instrument error added to the computed values. During testing, the accuracy of computed values shall be determined for a minimum of 3 points over the power range.

The simulator complies with this requirement. For related information, see certification report section V.B.

A. The simulator instrument error shall be no greater than that of the comparable meter, transducer, and related instrument system of the reference plant.

The simulator c mplies with this requirement. For related inf rmation, see certification report section V.B.

B. Principal mass and energy balance shall be satisfied. Examples are:

The simulator complies with .. requirement. For related information, see certification report section V.B. This requirement is demonstrated in test procedure STP 1.01.

1. Net NSSS thermal power indication to generated electrical power.
2. Reactor coolant system temperature to steam generator pressure.
3. Feedwater flow to reactor power.
4. Mass balance of pressurizer.
5. Mass balance of Steam Generator.

The simulator computed values for steady state, full power operation with the reference plant control system configuration shall be stable and not vary more than +/- 2% of the initial values over a 60 minute period.	The simulator complies with this requirement. For related information, see certification report section V.B. This requirement is demonstrated in test procedure STP 1.02.
A. The simulator computed values of critical parameters shall agree within +/- 2% of the reference plant parameters and shall not detract from training. Some examples of critical parameters are: 1. Reactor Thermal Power 2. Reactor hot and cold leg temperatures 3. Feedwater Flow 4. Steam Pressure 5. Generated Electrical Power 6. Recirculation flow 7. Reactor Coolant System Pressure	The simulator complies with this requirement. For related information, see certification report section V.B. This requirement is demonstrated in test procedures STP 1.04 through 1.06. Reactor hot and cold leg temperatures are not applicable to CPS
B. The calculated values of noncritical parameters pertinent to plant operation, that are included on the simulator control room panels, shall agree within +/- 10% of the reference plant parameters and shall not detract from training.	The simulator complies with this requirement. For related information, see certification report section V.B. This requirement is demonstrated in test procedures STP 1.04 through 1.06

SECTION 4.2 TRANSIENT OPERATION

SECTION 4.2.1

Tests shall be conducted to prove the capability of the simulator to perform correctly during the limiting cases of those evolutions identified in 3.1.1 and 3.1.2.	The simulator complies with this requirement. For related information, see certification report section V.D.
Acceptance criteria for these tests shall:	
A. Where applicable, be the same as plant startup test procedure acceptance criteria.	The simulator complies with this requirement. For related information, see certification report section V.A.
B. Require that the observable change in the parameters correspond in the direction to those expected from best estimate for the simulated transient and do not violate the physical laws of nature.	The simulator complies with this requirement. For related information, see certification report section V.A.
C. Require that the simulator shall not fail to cause an alarm or automatic action if the reference plant would have caused an alarm or automatic action, and conversely, the simulator shall not cause an alarm or automatic action if the reference plant would not cause an alarm or automatic action.	The simulator complies with this requirement. For related information, see certification report section V.A.

SECTION 4.2.2

Malfunction and transients not tested in accordance with 4.2.1 shall be tested and compared to best estimate or other information and shall meet the acceptance criteria of 4.2.1 (b).

The simulator complies with this requirement.
For related information, see certification report section V.E.
This requirement is demonstrated in test procedure STP 4.03

SECTION 4.3 SIMU`TOR OPERATING LIMITS

Administrative cont ols or other means shall be provided to alert the instructor when certain parameters approach values indicative of events beyond the implemented model or known plant behavior. Conditions to be considered are:

A. Primary containment pressure greater than design limit

B. Reactor coolant system pressure greate than design limit.

C. Fuel temperature histories indicative of gross fuel failure.

D. Reactor coolant system pressure versus temperature relationship indicative of gross voiding.

The simulator complies with this requirement.
For related information, see certification report section II.C.4.
This requirement is demonstrated in test procedure STP 4.02

SECTION 4.4 MONITORING CAPABILITY

It shall be possible to obtain hardcopy transient data in the form of either plots or printouts for critical parameters during the evolutions of 3.1.1 (Normal Plant Evolutions) and the malfunctions of 3.1.2 (Plant Malfunctions).	The simulator complies with this requirement. For related information, see certification report section II.C.4.
This monitoring capability shall provide sufficient parametric and time resolution to determine compliance with the performance criteria of section 4 (Performance Criteria).	The simulator complies with this requirement. For related information, see certification report section II.C.4.

SECTION 5 SIMULATOR DESIGN CONTROL

Simulators constructed within the guidelines of the standard shall be based on actual or predicted plant configuration and performance.	The simulator complies with this requirement. For related information, see certification report section III.

SECTION 5.1 SIMULATOR DESIGN DATA

The simulator design data forms the basis for existing simulator configuration. This data base may include predicted plant performance until the reference plant has been in commercial operation for 18 months. After this period, available actual plant configuration data shall be included in the simulator design data.	The simulator complies with this requirement. For related information, see certification report section III.A.

SECTION 5.2 SIMULATOR UPDATE DESIGN DATA

The simulator update design data forms the basis for future simulator design changes. This data base shall include available plant data within 18 months after the reference plant is in commercial operation or within 18 months of the simulator operational date, whichever is later. Reference plant modifications shall be reviewed once per year and the simulator update design data shall be revised as appropriate based on engineering and training value assessment.	The simulator complies with this requirement. For related information, see certification report sections III.B. and IV.B.

SECTION 5.3 SIMULATOR MODIFICATIONS

The simulator shall be modified as required within 12 months following the annual establishment of the simulator update design data referenced in 5.2 (Simulator Update Design Data). Simulator modifications may precede reference plant modifications based on the training value.	The simulator complies with this requirement. For related information, see certification report section III.B.

SECTION 5.4 SIMULATOR TESTING

SECTION 5.4.1 SIMULATOR PERFORMANCE TESTING

Simulator performance shall be established by preparing a simulator performance test, conducting the tests, and comparing the simulator's performance with the simulator design data within the requirements of section 4 (Performance Criteria).	The simulator complies with this requirement. For related information, see certification report section V.
Testing shall be conducted and a report prepared for each of the following occasions.	The simulator complies with this requirement. For related information, see certification report section V.G.
A. Completion of initial construction.	The simulator complied with this requirement.
B. If simulator design changes result in significant simulator configuration of performance variations.	The simulator complies with this requirement. For related information, see certification report section V.G.
When a limited change is made, a specific performance test on the affected systems and components shall be performed.	The simulator complies with this requirement. For related information, see certification report section V.G.

SECTION 5.4.2 SIMULATOR OPERABILITY TESTING

A simulator test shall be conducted annually. The intent of this test is to:	The simulator complies with this requirement. For related information, see certification report section V.G.
A. Verify overall simulator model completeness and integration.	The simulator complies with this requirement. For related information, see certification report section V.G.
B. Verify simulator performance against the steady state criteria of 4.1 (Steady State Operation).	The simulator complies with this requirement. For related information, see certification report section V.G.
C. Verify simulator performance against the transient criteria for a benchmark set of transients.	The simulator complies with this requirement. For related information, see certification report sections V.G and V.F.

Footnote 2

Appendix A, Guide for Documenting Simulator Performance, provides examples of acceptance performance documentation.	The simulator complies with this requirement. The CPS certification report generally follows the outline prescribed in ANSI/ANS 3.5-1985, Appendix A.

Footnote 3

Appendix B, Simulator Operability Tests, provides examples of acceptable simulator operability tests. The simulator user should substitute other applicable steady state and transient operability tests if these tests provide a more representative comparison to actual or predicted reference plant performance. A record of the conduct of this test shall be maintained.	The simulator complies with this requirement. For related information, see certification report section V.F.