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AUTH.NAME AUTHOR AFFILIATION
WILLIAMS,J.W. Florida Power & Light Co.
RECIP.NAME RECIPIENT AFFILIATION
THOMPSON,H.L. Division of Licensing

SUBJECT: Forwards discussion of dropped control rod transient analysis in support of 850215 application to amend Licenses DPR-31 & DPR-41;changing Tech Specs to revise moderator temp. coefficient.

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FLORIDA POWER & LIGHT COMPANY

MAY 8 1985

L-85-184

Office of Nuclear Reactor Regulation
Attention: Mr. Hugh L. Thompson, Jr., Director
Division of Licensing
U. S. Nuclear Regulatory Commission
Washington, D.C. 20555

Dear Mr. Thompson

Re: Turkey Point Units 3 and 4
Dockets 50-250 and 50-251
Proposed License Amendment
Moderator Temperature Coefficient

On February 15, 1985 Florida Power & Light Company submitted a request to amend the Turkey Point Units 3 and 4 operating licenses to revise the moderator temperature coefficient (MTC) technical specification. That request was supplemented on April 17, 1985.

The attached discussion of the dropped control rod transient analysis is provided to support the conclusion regarding that analysis stated in the above submittals. The dropped rod event was reanalyzed taking credit for a +5 pcm/°F MTC at full power. The previous analysis had assumed a zero MTC (no reactivity feedback) at full power.

The other transients sensitive to a positive MTC discussed in the above submittals were reviewed by the NRC in conjunction with the issuance of Amendments 76/70 and 98/92 to the Turkey Point Units 3 and 4 operating licenses.

If you have any questions, please call us.

Very truly yours,

for J. W. Williams, Jr.
Group Vice President
Nuclear Energy

JWW/TCG/cab

cc: Dr. J. Nelson Grace, Region II, USNRC
Harold F. Reis, Esquire

Lyle Jerrett, Ph.D, Director
Office of Radiation Control
Dept. Health and Rehabilitative Services
1323 Winewood Boulevard
Tallahassee, FL 32301

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ROD CLUSTER CONTROL ASSEMBLY (RCCA) DROP

Identification of Causes and Accident Description

Dropping of full-length RCCA occurs when the drive mechanism is deenergized. This would cause a power reduction and an increase in the hot channel factor. If no protective action occurred, the Reactor Control System would restore the power to the level which existed before the incident. This would lead to a reduced safety margin or possibly DNB, depending upon the magnitude of the resultant hot channel factor.

If an RCCA drops into the core during power operation, it would be detected by either a rod bottom signal, by an out-of-core chamber, or both. The rod bottom signal device provides an indication signal for each RCCA. The other independent indication of a dropped RCCA is obtained by using the out-of-core power range channel signals. This rod drop detection circuit is actuated upon sensing a rapid decrease in local flux and is designed such that normal load variations do not cause it to be actuated.

A rod drop signal from any rod position indication channel, or from one or more of the four power range channels, initiates the following protective action: reduction of the turbine load by a present adjustable amount and blocking of further automatic rod withdrawl. The turbine runback is achieved by acting upon the turbine load limit and/or on the turbine load reference. The rod withdrawal block is redundantly achieved.

Analysis of Effects and Consequences

Method of Analysis

The transient following a dropped RCCA accident is determined by a detailed digital simulation of the plant. The dropped rod causes a step decrease in reactivity and the core power generation is determined using the LOFTRAN code (Reference 1). The overall response is calculated by simulating the turbine load runback and preventing rod withdrawal. The analysis is presented for the case in

which the load cutback very closely match the power decrease from the negative reactivity for a dropped rod (600 pcm) and also for the case in which the load cutback is greater than that required to match the worth of the dropped rod (75 pcm). In both cases the load is assumed to be cut back from 100 to 84% of full load at a conservatively slow rate of approxmately 1% per second.

For the 600 pcm case, the most negative values of moderator and Doppler temperature coefficients of reactiveity are used in this analysis resulting in the highest heat flux during the transient. These are a constant moderator density coefficient of reactivity of .43 $\Delta\rho$/gm/cc (corresponds to a moderator temperature coefficient of approximately -50 pcm/^{o}F over the range of the transient) and a Doppler temperature coefficient of reactivity of -2.9 pcm/^{o}F.

For the 75 pcm case, the least negative values of moderator and Doppler temperature coefficients of reactivity are used in this analysis resulting in the highest heat flux during the transient. These are a constant moderator temperature coefficient of reactivity of +5 pcm/^{o}F and Doppler temperature coefficent of reactivity of -0.91 pcm/^{o}F.

Results

Figures 1 through 3 illustrate the transient response following a dropped rod of worth 600 pcm, with the rod drop assumed to occur at 10 seconds. The coolant temperature decreases initially due to the fact that more energy is taken out from the secondary than produced in the primary, then increases under the influence of the negative reactivity effect of the moderator and Doppler temperature coefficients. The peak heat flux following the initial response to the dropped rod is 89% of nominal.

Figures 4 through 6 illustrate the transient response following a dropped rod of worth 75 pcm, with the rod drop assumed to occur at 10 seconds. With positive reactivity feedback, nuclear power slowly increases above the power level corresponding to that caused by the dropped rod. Primary reactor power is greater than turbine power, resulting in a heatup of the primary coolant. A reactor trip on overtemperature ΔT occurs, terminating the event. Analysis of a range of dropped RCCA worths verifies that the DNB design basis is met for this event.

Conclusions

Results of the analysis show that a dropped RCCA event does not adversely affect the core, since the DNBR remains above the limit value for a range of dropped RCCA worths.

Reference

1. Burnett, T. W. T., et al., "LOFTRAN Code Description", WCAP-7907-P-A (Proprietary), WCAP-7907-A (Non-Proprietary), April 1984.

48/48/12066-1

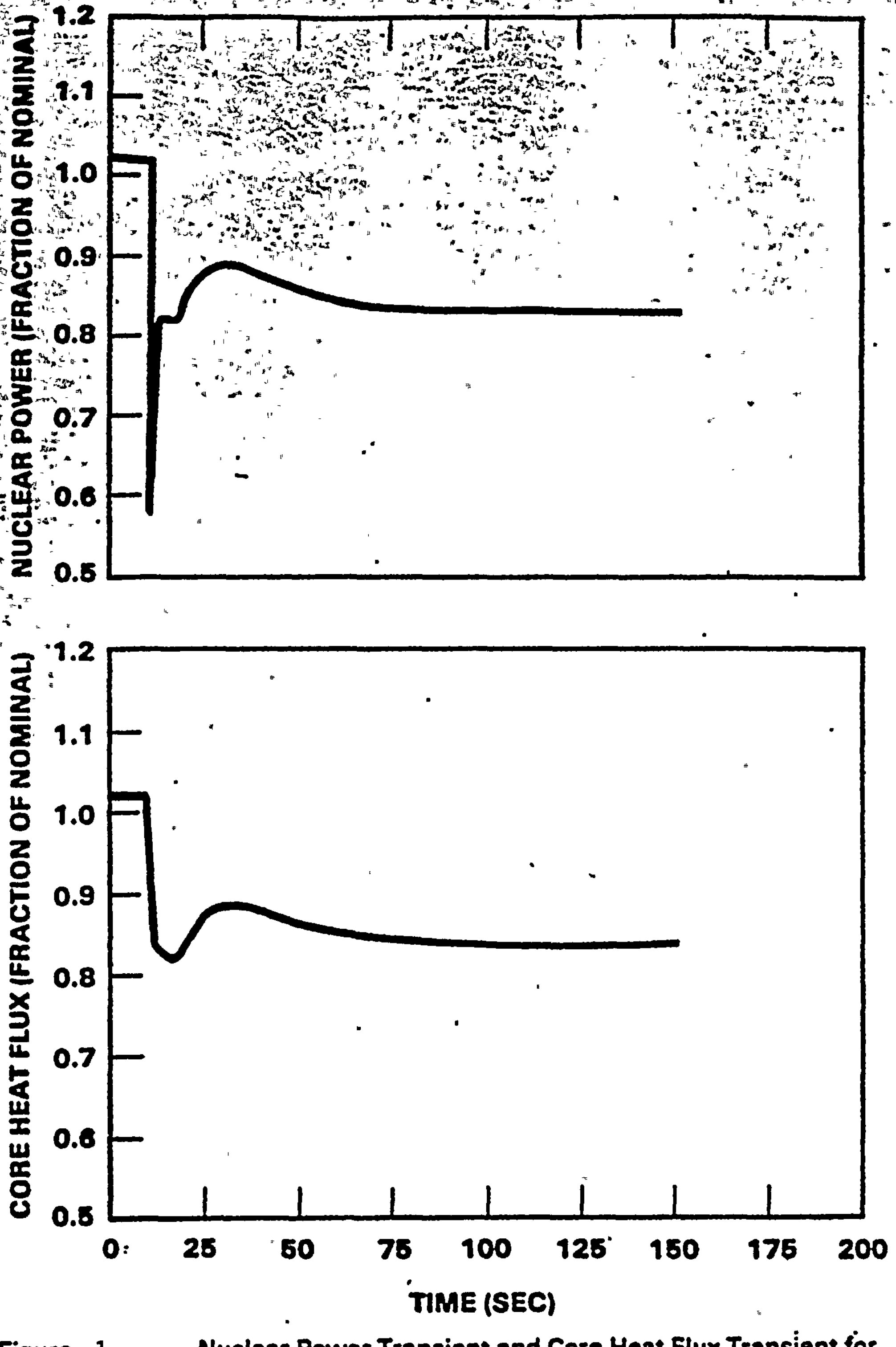

Figure 1 Nuclear Power Transient and Core Heat Flux Transient for Dropped RCCA of Worth = 600 pcm

48/48/12056-2

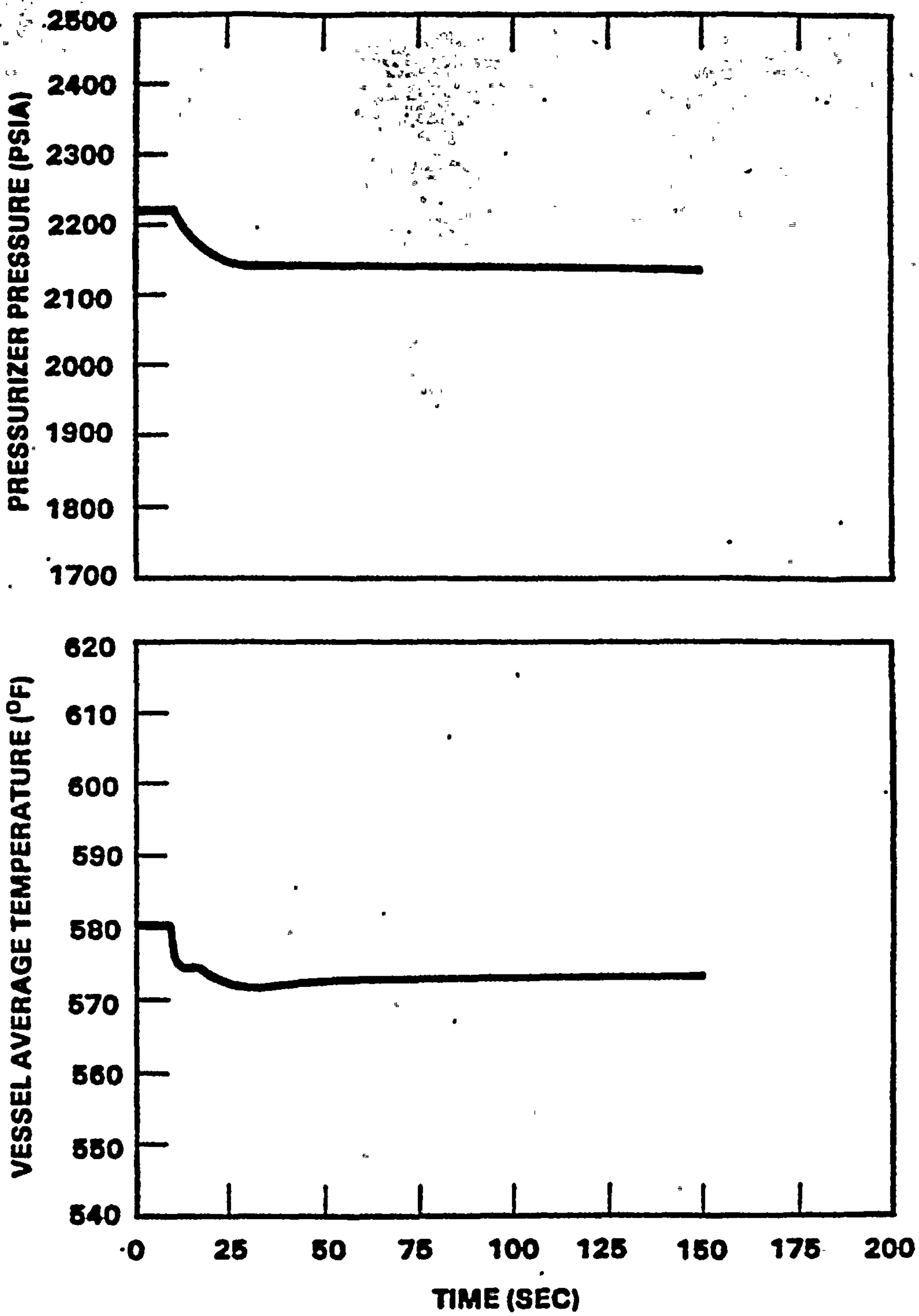

Figure 2 Pressurizer Pressure Transient and Vessel Average Temperature Transient for Dropped RCCA of Worth = 600 pcm

48/48/12056-3

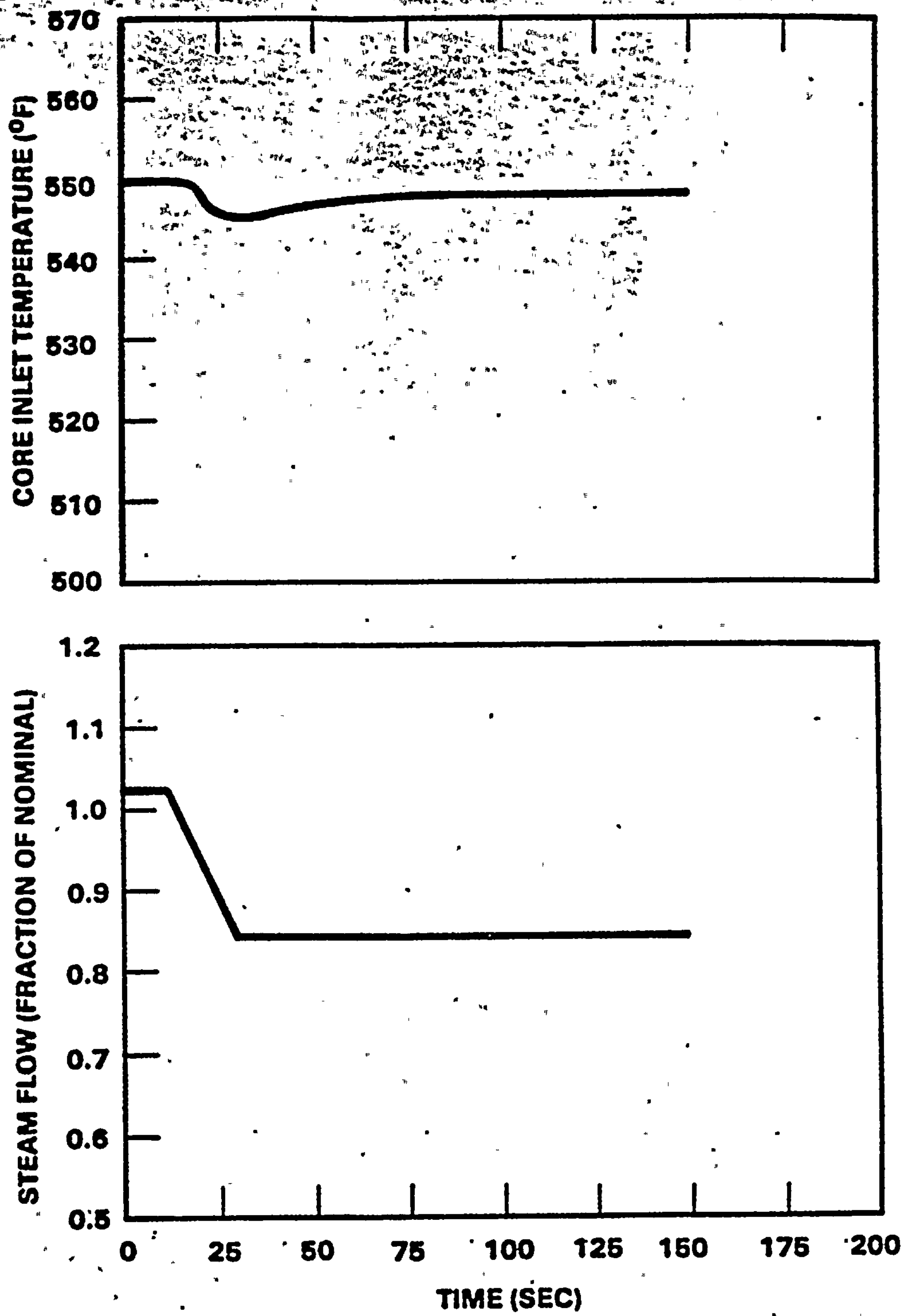

Figure 3 Core Inlet Temperature Transient and Steam Flow Transient for Dropped RCCA of Worth = 600 pcm

48/48/12056-4

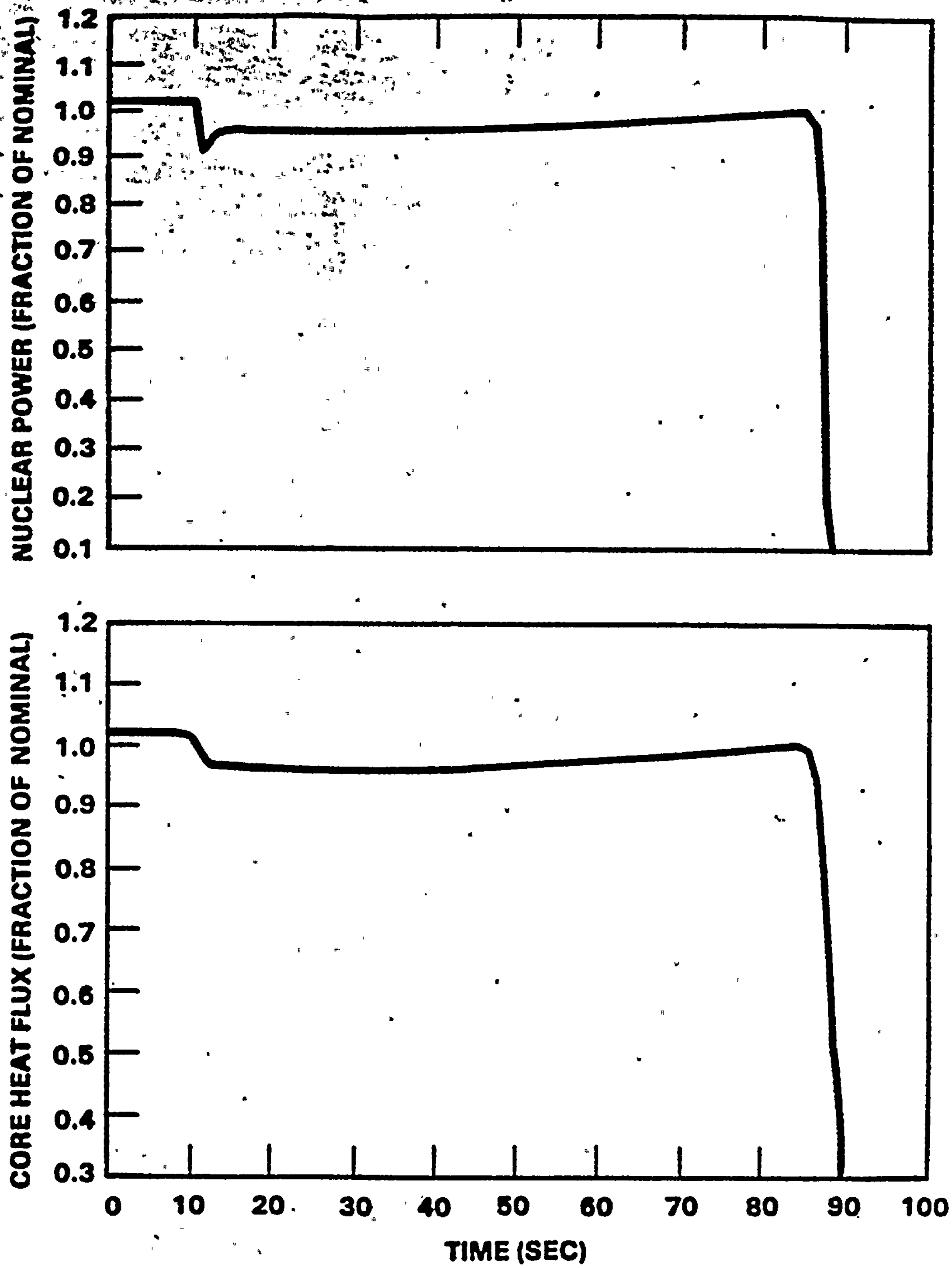

Figure 4 Nuclear Power Transient and Core Heat Flux Transient for Dropped RCCA of Worth = 75 pcm

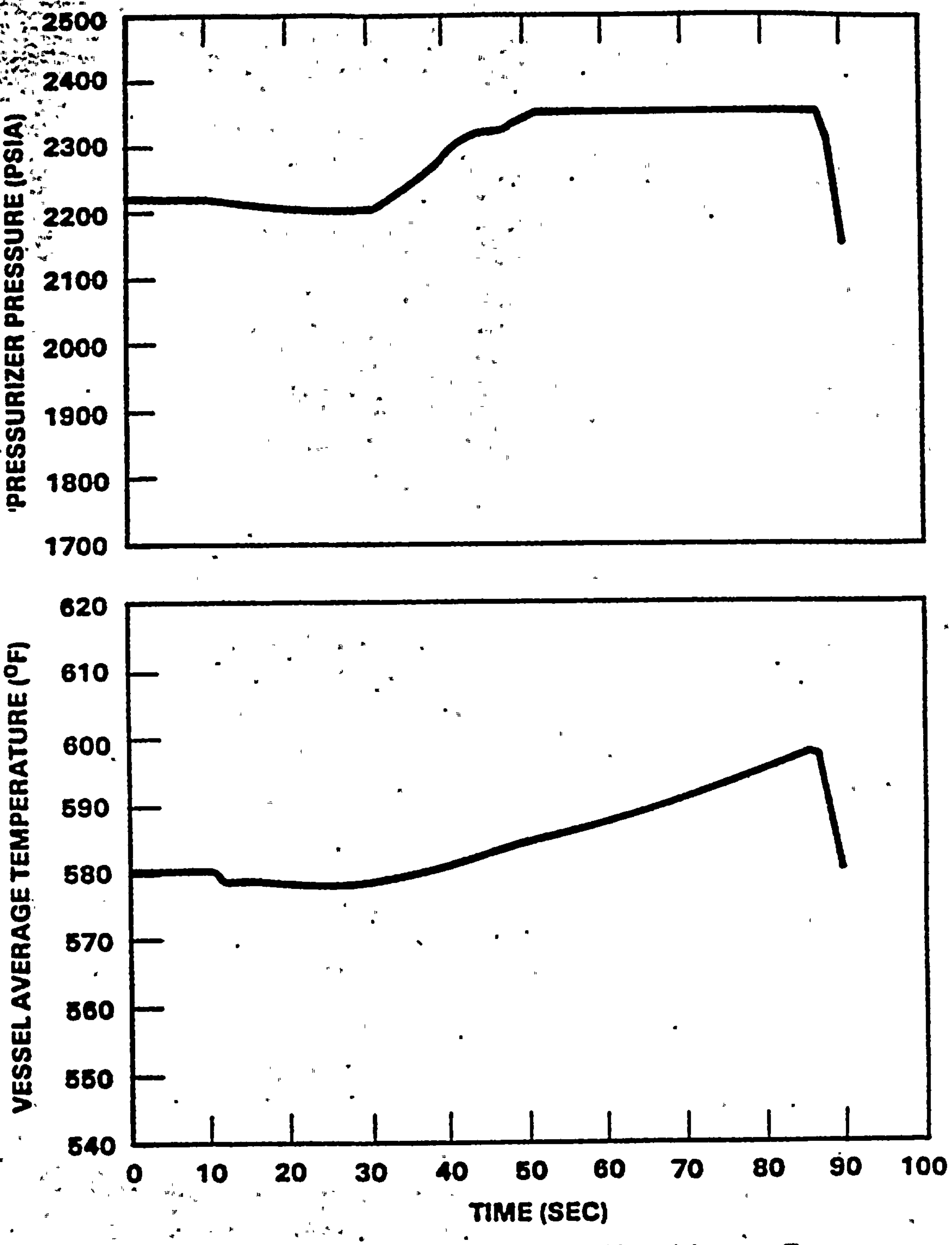

Figure 5 Pressurizer Pressure Transient and Vessel Average Temperature Transient for Dropped RCCA of Worth = 75 pcm

48/48/12066-6

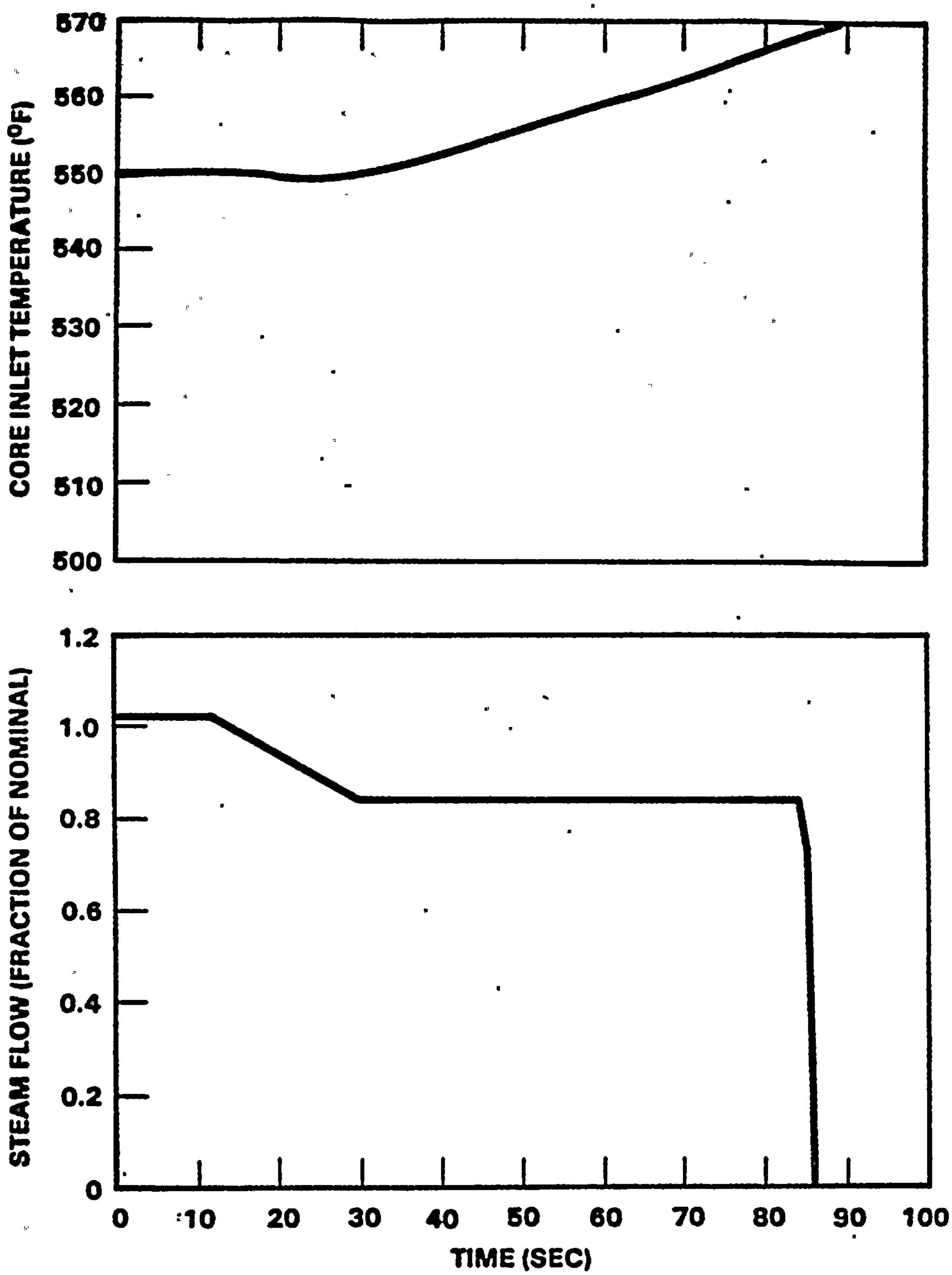

Figure 6 Core Inlet Temperature Transient and Steam Flow Transient for Dropped RCCA of Worth = 75 pcm