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Our ref: LTR-NRC-06-44

July 14, 2006

Subject: Transmittal of LTR-NRC-06-44 NP-Attachment, "Response to NRC Request for Additional Information on the Analyzed Break Spectrum for the Small Break Loss of Coolant Accident (SBLOCA) NOTRUMP Evaluation Model (NOTRUMP EM), Revision 1", (Non-Proprietary)

Reference: LTR-NRC-05-55, "Response to NRC Request for Additional Information on Analyzed Break Spectrum for the Small Break Loss of Coolant Accident Evaluation Model NOTRUMP," September 15, 2005.

Enclosed is LTR-NRC-06-44 NP-Attachment "Response to NRC Request for Additional Information on the Analyzed Break Spectrum for the Small Break Loss of Coolant Accident (SBLOCA) NOTRUMP Evaluation Model (NOTRUMP EM), Revision 1". Reference 1 transmitted our initial response to NRC's request for additional information. This revision addresses additional questions and comments raised by the Staff at several public meetings and reviews held with regard to the Beaver Valley and R. E. Ginna power uprate programs.

The enclosed material does not contain proprietary information.

Any questions regarding this document should be addressed to J. A. Gresham, Manager, Regulatory Compliance and Plant Licensing, Westinghouse Electric Company LLC, P.O. Box 355, Pittsburgh, Pennsylvania 15230-0355.

Very truly yours,

A handwritten signature in black ink, appearing to read 'J. A. Gresham', written in a cursive style.

J. A. Gresham, Manager
Regulatory Compliance and Plant Licensing

Enclosure

cc: G. Shukla/NRR

7008

**“Response to NRC Request for Additional Information on
Analyzed Break Spectrum for the Small Break Loss of
Coolant Accident (SBLOCA) NOTRUMP Evaluation Model
(NOTRUMP EM), Revision 1”**

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**Response to NRC Request for Additional Information on Analyzed Break Spectrum for the Small
Break Loss of Coolant Accident (SBLOCA) NOTRUMP Evaluation Model (NOTRUMP EM),
Revision 1**

Background

During the review of several small break loss of coolant accident (SBLOCA) analyses performed for extended power uprates and replacement steam generators, the Nuclear Regulatory Commission (NRC) Staff generated several requests for additional information (RAIs). One of the RAIs expressed a concern that the break spectrum analyzed in the NOTRUMP evaluation model (EM) might be too coarse and that further refinement should be considered. Specifically, the Staff questioned if the resolution of the break spectrum used in the NOTRUMP EM (1.5, 2, 3, 4 and 6 inch cases) was fine enough to capture the limiting peak clad temperature as per 10 CFR 50.46. In addition, results from Staff audit calculations for one of the plants under review indicated that calculated peak clad temperatures for certain break sizes might exceed the 10 CFR 50.46 acceptance criteria. In subsequent conversations and meetings with the Staff, Westinghouse agreed to investigate the concern generically, and determine if similar behavior was exhibited with the NOTRUMP EM.

Preliminary work performed by Westinghouse showed that in some cases, more limiting results could be obtained by executing non-integer break sizes; however, the magnitude of the effect was less severe than observed in the Staff calculations. Nevertheless, Westinghouse performed evaluations to determine the safety significance of the issue and to determine if all currently operating plants would maintain compliance with the 10 CFR 50.46 acceptance criteria when considering a refined SBLOCA break spectrum.

Screening

Rather than performing explicit analyses for all currently operating plants with NOTRUMP EM analyses, screening criteria were developed to determine what class of plants would be impacted by a finer break spectrum. An initial screening criterion was chosen where plants with maximum reported SBLOCA peak clad temperatures (PCTs) greater than 1,700°F were explicitly analyzed to determine the quantitative effect of using a finer break spectrum. This PCT criterion was chosen because it provides significant margin to the 10 CFR 50.46 PCT limit of 2,200°F and because fuel rods below 1,700°F do not experience significant metal-water reaction (i.e., oxidation).

A review of all domestic SBLOCA analyses performed by Westinghouse showed that nine (9) units utilizing the NOTRUMP EM have a SBLOCA cumulative PCT (analysis-of-record (AOR) with assessments) above 1,700°F. Seven (7) of these units were specifically investigated with a refined break spectrum to determine potential impacts on the existing margin to 10 CFR 50.46 acceptance criteria. The remaining two (2) units were sister plants, one of which had been recently reanalyzed with a resulting PCT significantly below 1,700°F. Due to the similarities between the units, it is expected that the sister unit would exhibit similar results if reanalyzed.

For the remaining plants (i.e., SBLOCA PCTs less than 1,700°F), the cumulative PCTs were compared with the corresponding Large Break LOCA (LBLOCA) cumulative PCTs. In all cases, the LBLOCA PCT significantly exceeded the SBLOCA PCT (by at least 300°F), such that even if the most conservative PCT penalty calculated due to the refined break spectrum were to be applied (e.g., ~85°F, as discussed below) the LBLOCA PCT would remain limiting. Therefore, it is Westinghouse's position that the "most severe postulated loss-of-coolant accidents are calculated" for these plants, thus complying with 10 CFR 50.46.

Evaluations and Results

To evaluate the effects of the refined break spectrum, 0.25 inch variations in break size, instead of the typical 1 inch equivalent size variations, were considered in the break size ranges of interest. Justification for the 0.25 inch increments is discussed below.

The explicit analyses for the plants with SBLOCA PCTs greater than 1,700°F demonstrated continued 10 CFR 50.46 compliance, meeting both PCT and oxidation criteria. For this class of plants, the maximum difference observed between an integer break size beginning-of-life (BOL) PCT and a non-integer break size BOL PCT was on the order of +85°F. Note that consideration of burst behavior with increasing burnup would likely result in a slightly larger PCT difference. Figures 1 through 3 show the core mixture level, reactor coolant system (RCS) pressure and PCT behavior vs. break size for a sample 3-loop plant (Plant A) with a PCT greater than 1,700°F, for which the refined break spectrum was analyzed. Figures 4 through 6 show the same set of plots for a sample 4-loop plant (Plant B) with a PCT greater than 1,700°F. It can be seen for this plant that there was no increase in PCT due to the refined break spectrum (i.e., integer break size remained limiting).

Additional calculations were performed for a subset of plants with low SBLOCA PCTs (i.e., less than 1,700°F), which is characteristic of the majority of NOTRUMP EM analyses held by Westinghouse. These calculations showed that use of the finer break spectrum resulted in little to no impact on the overall PCT. Figures 7 through 12 show the core mixture level, RCS pressure and PCT behavior vs. break size for a sample 4-loop plant and 2-loop plant (Plants C and D, respectively) with PCTs much lower than 1,700°F for which the refined break spectrum was analyzed. These representative calculations show that there is adequate margin to conclude that additional explicit analyses do not need to be performed at this time for those plants whose current SBLOCA PCT is less than 1,700°F. The specific calculations for these low-PCT plants showed that either the limiting break had been captured in the original analysis or use of the refined break spectrum had only a minor effect, if any, on results. Therefore, because of the significant margin (i.e., at least 300°F) between these low SBLOCA PCTs and corresponding LBLOCA PCTs, continued compliance with the requirements of 10 CFR 50.46 is assured.

Examination of Figures 1 through 12 also reveals that the break size interval of 0.25 inch shows a good characteristic behavior and demonstrates that no extreme outliers likely exist within the ranges considered. Given this, the 0.25 inch break size interval is considered adequate.

In all calculations, compliance with 10 CFR 50.46 PCT and oxidation criteria was demonstrated.

Forward Fit Application and Customer Notification Plan

For the plants which have SBLOCA PCTs exceeding the screening criterion, the calculated impacts will become part of the analysis licensing basis, to be reported under 10 CFR 50.46. For plants that do not exceed the screening criterion, and whose LBLOCA PCT is significantly greater than the SBLOCA PCT, no further action is considered necessary at this time.

Westinghouse is in the process of preparing 10 CFR 50.46 notification letters to all utilities with NOTRUMP EM SBLOCA analyses which are impacted by this change. For the affected plants, SBLOCA PCT assessments will be provided. For the unaffected plants (i.e., those below the screening criteria), no SBLOCA PCT penalty will be assessed.

On future applications of the NOTRUMP EM, if any integer break size PCT is approximately equal to or greater than 1,700°F, or if the PCT results are close to or greater than the corresponding LBLOCA PCT results, the analysis will include a refined break spectrum to assure 10 CFR 50.46 compliance.

It is the Westinghouse position that the NOTRUMP EM topical report, Reference 1, does not require an update to reflect a refined break spectrum. The integer break spectrum is discussed in Reference 1 as an application of the NOTRUMP-EM methodology only. This letter is a clarification of that methodology.

Summary

The analysis work performed in support of the refined SBLOCA break spectrum demonstrates that there is no safety significance associated with this issue and that all plants are expected to remain in compliance with 10 CFR 50.46 criteria. Affected utilities (i.e., those receiving a PCT assessment) will be notified via the 10 CFR 50.46 reporting process.

Note that Westinghouse has discussed both the dispositions of the operating plant analyses discussed herein as well the forward fit approach with the NRC Staff PWR Systems Branch Chief, J. Nakoski on May 17, 2006. In this informal discussion it was agreed that both approaches appeared to be reasonable for demonstrating satisfaction of the 10 CFR 50.46 requirement to capture the most limiting break with regard to the 10 CFR 50.46 acceptance criteria.

Reference

1. WCAP-10054-P-A, "Westinghouse Small Break ECCS Evaluation Model Using the NOTRUMP Code," August 1985.

FIGURE 1

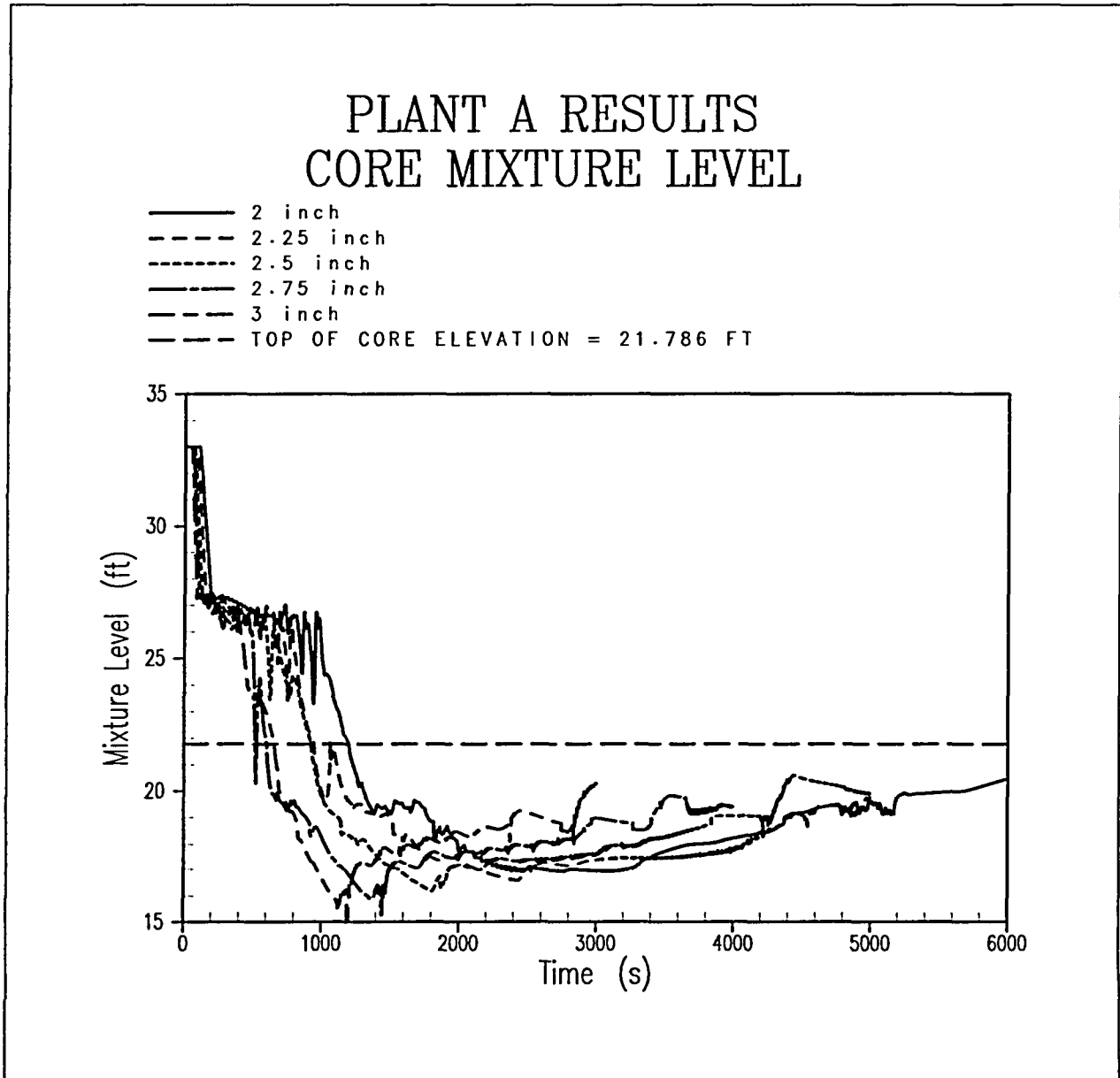


FIGURE 2

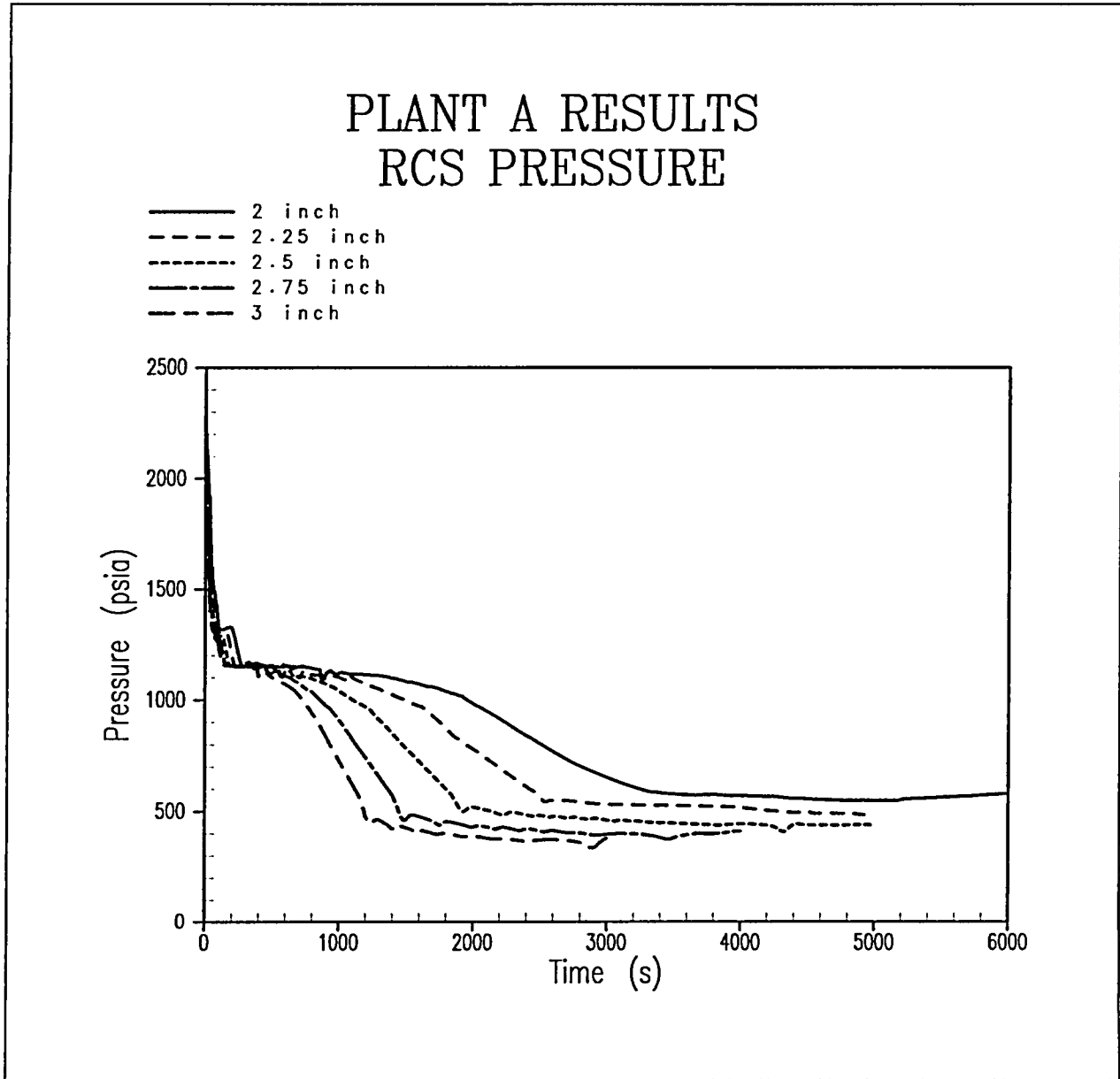


FIGURE 3

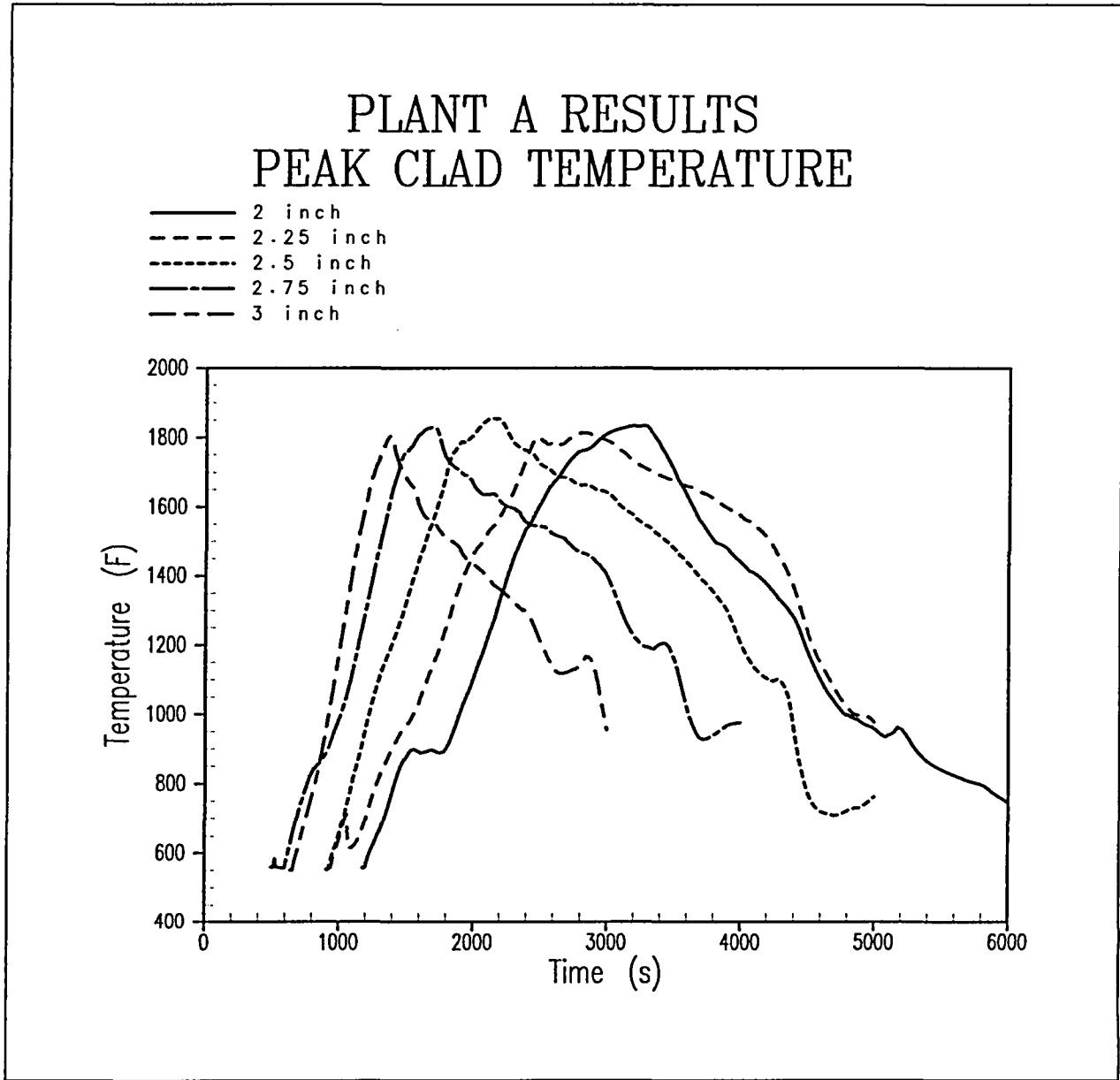


FIGURE 4

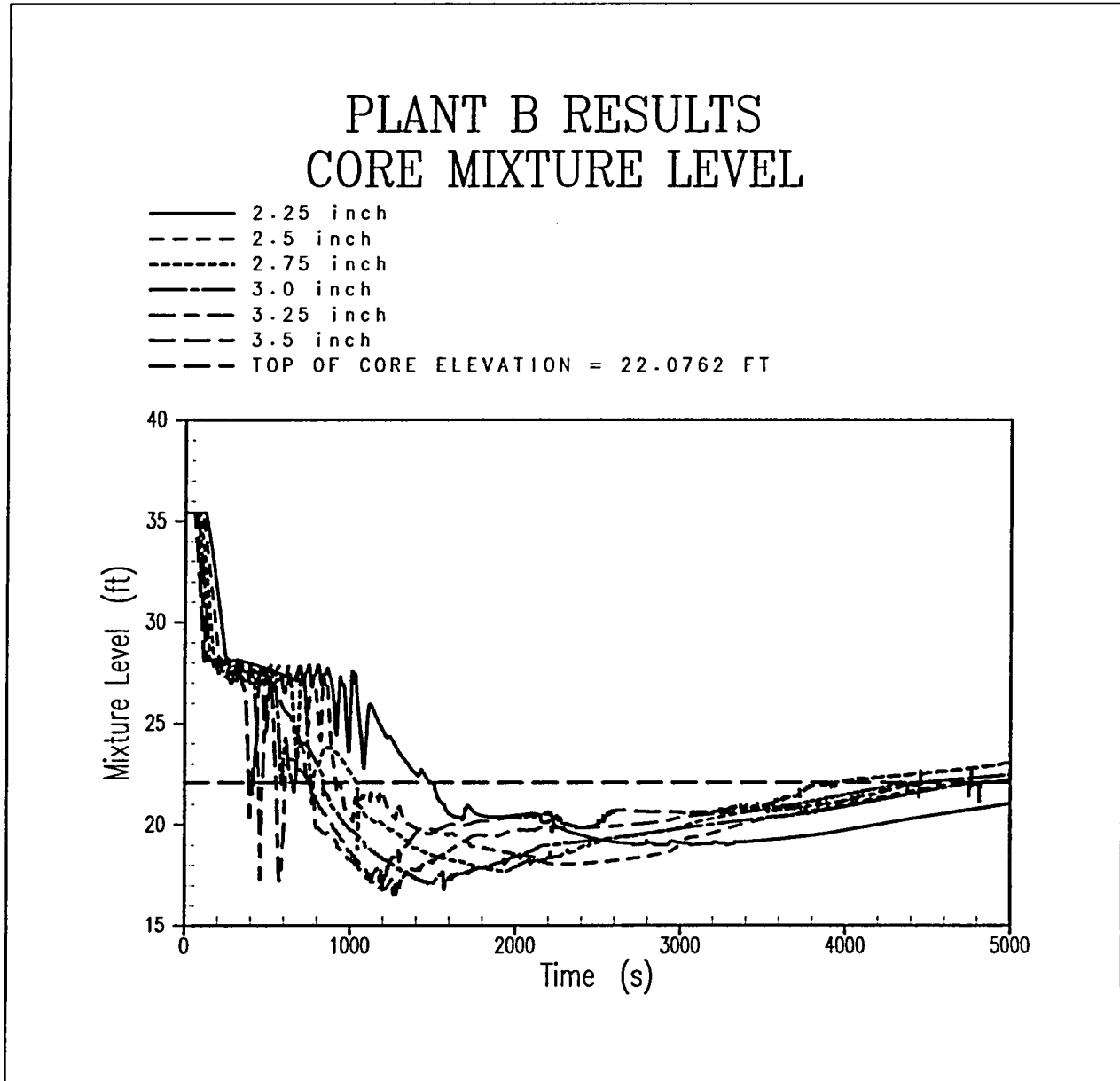


FIGURE 5

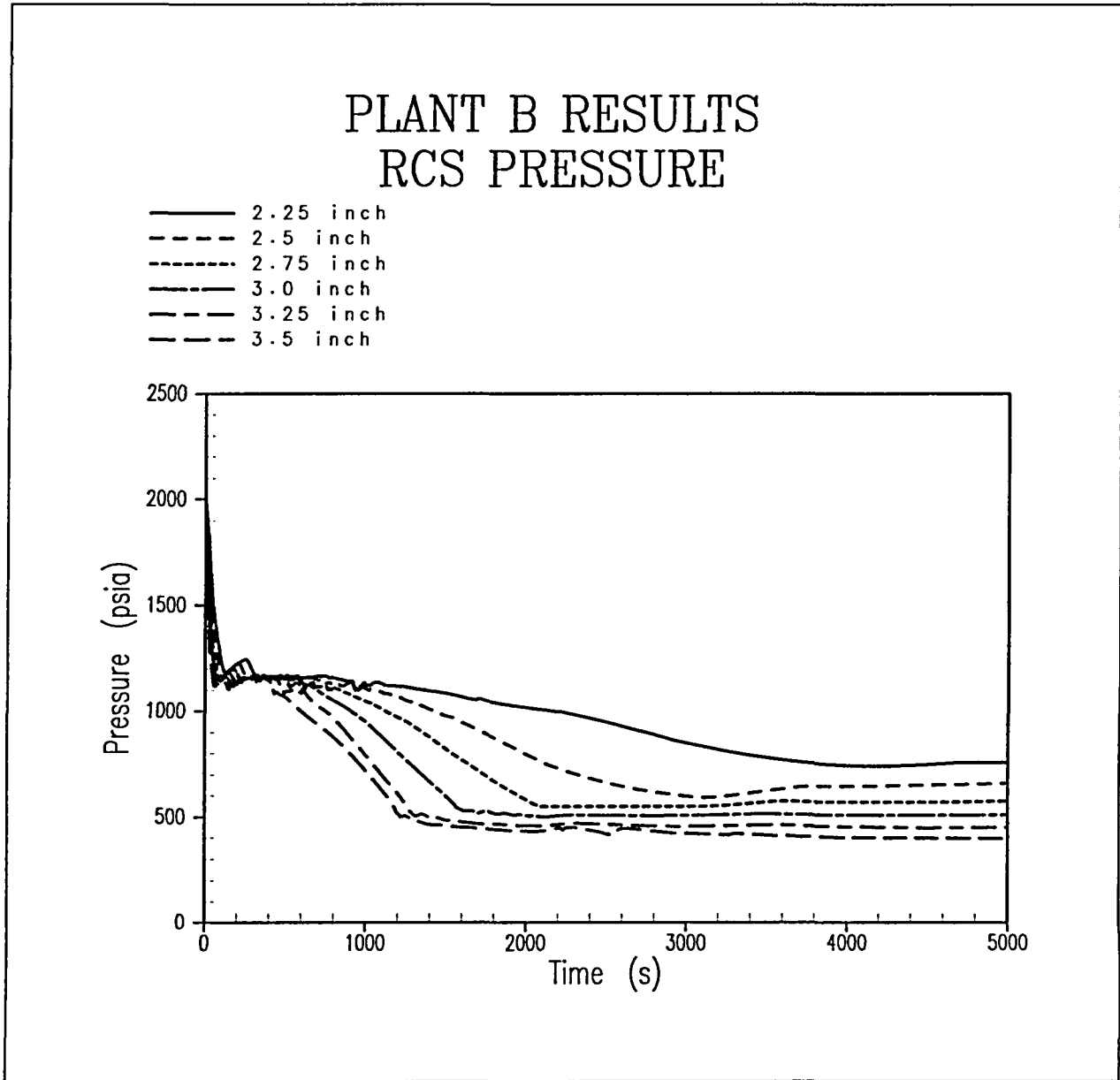


FIGURE 6

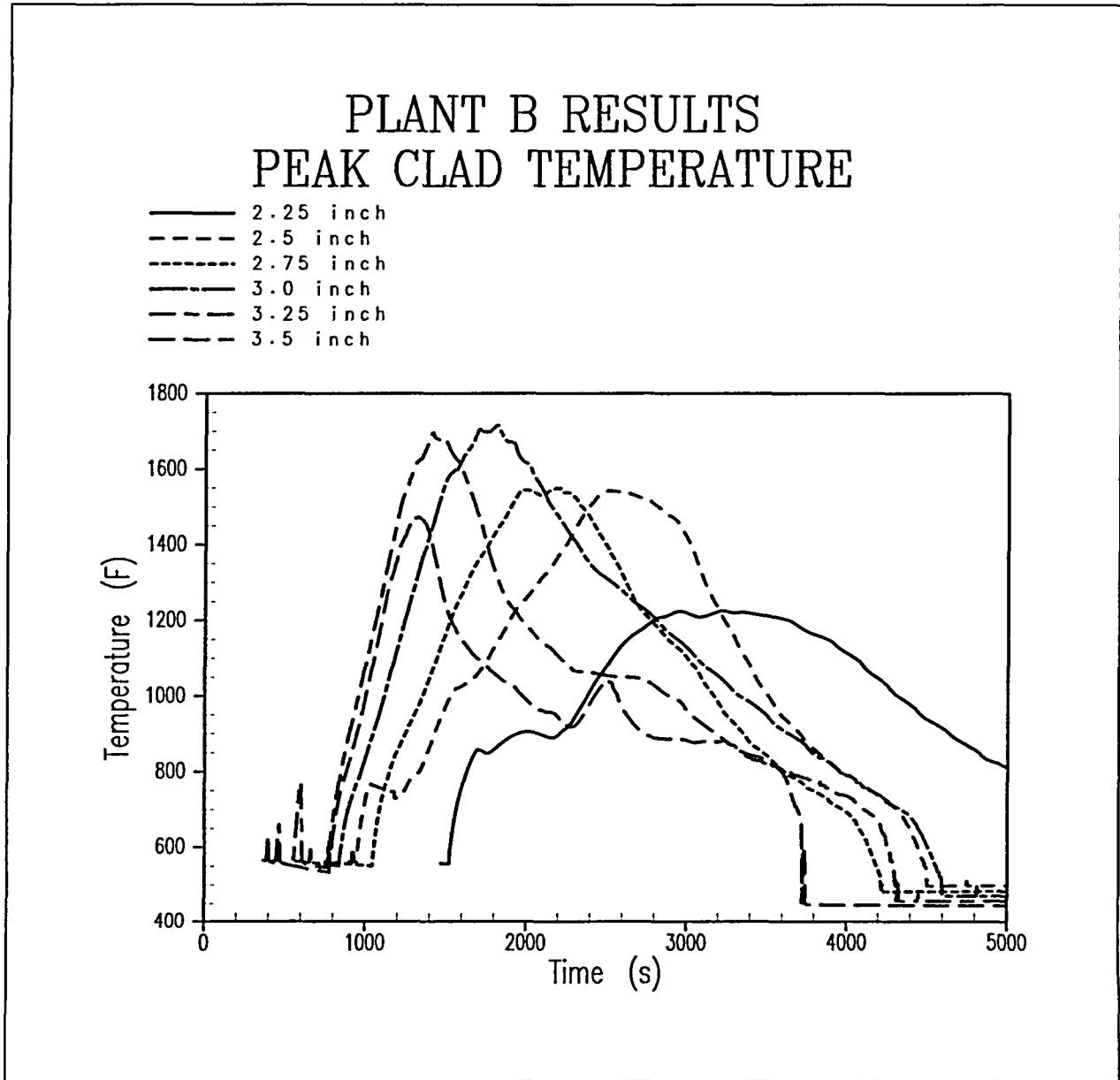


FIGURE 7

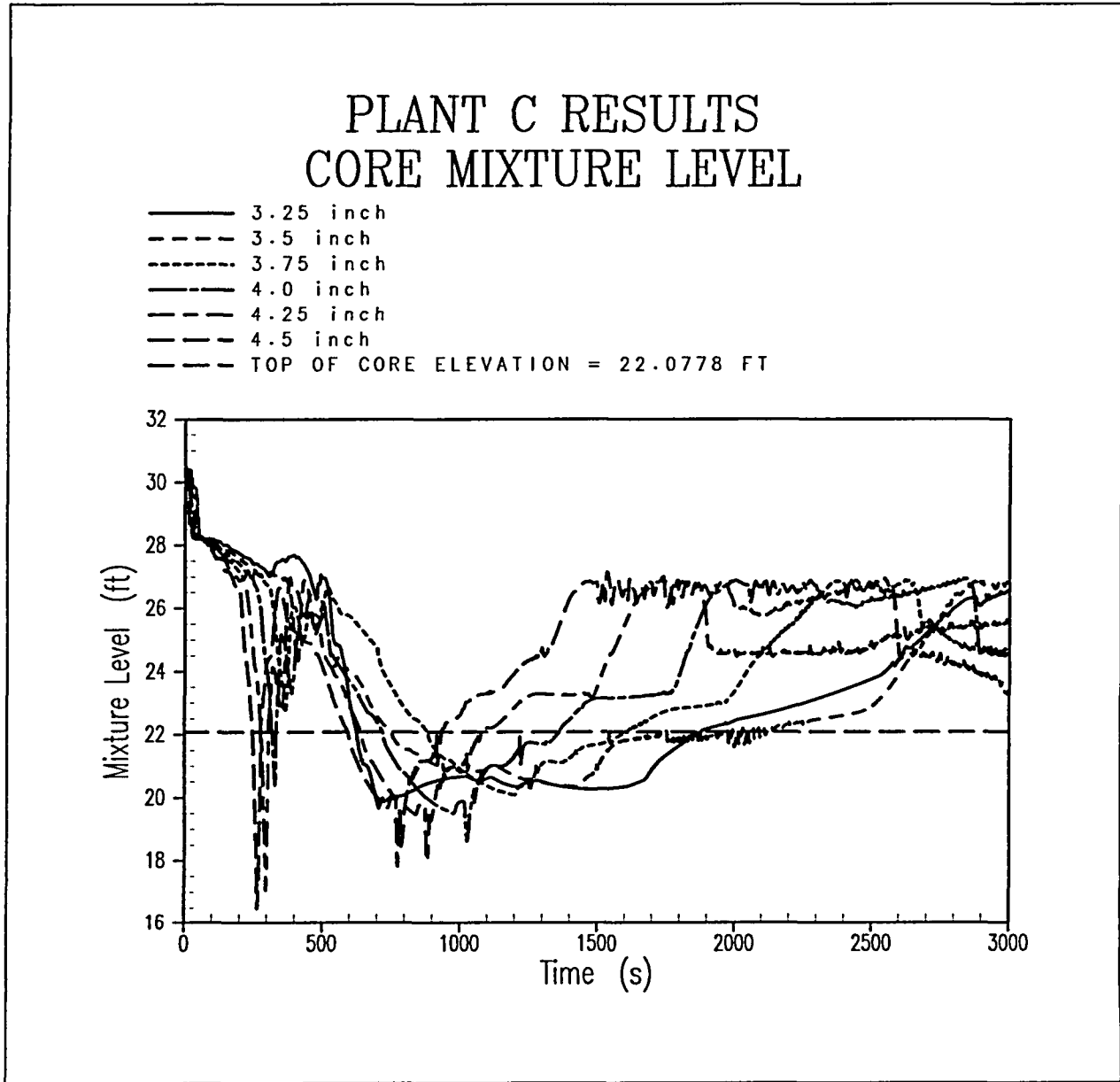


FIGURE 8

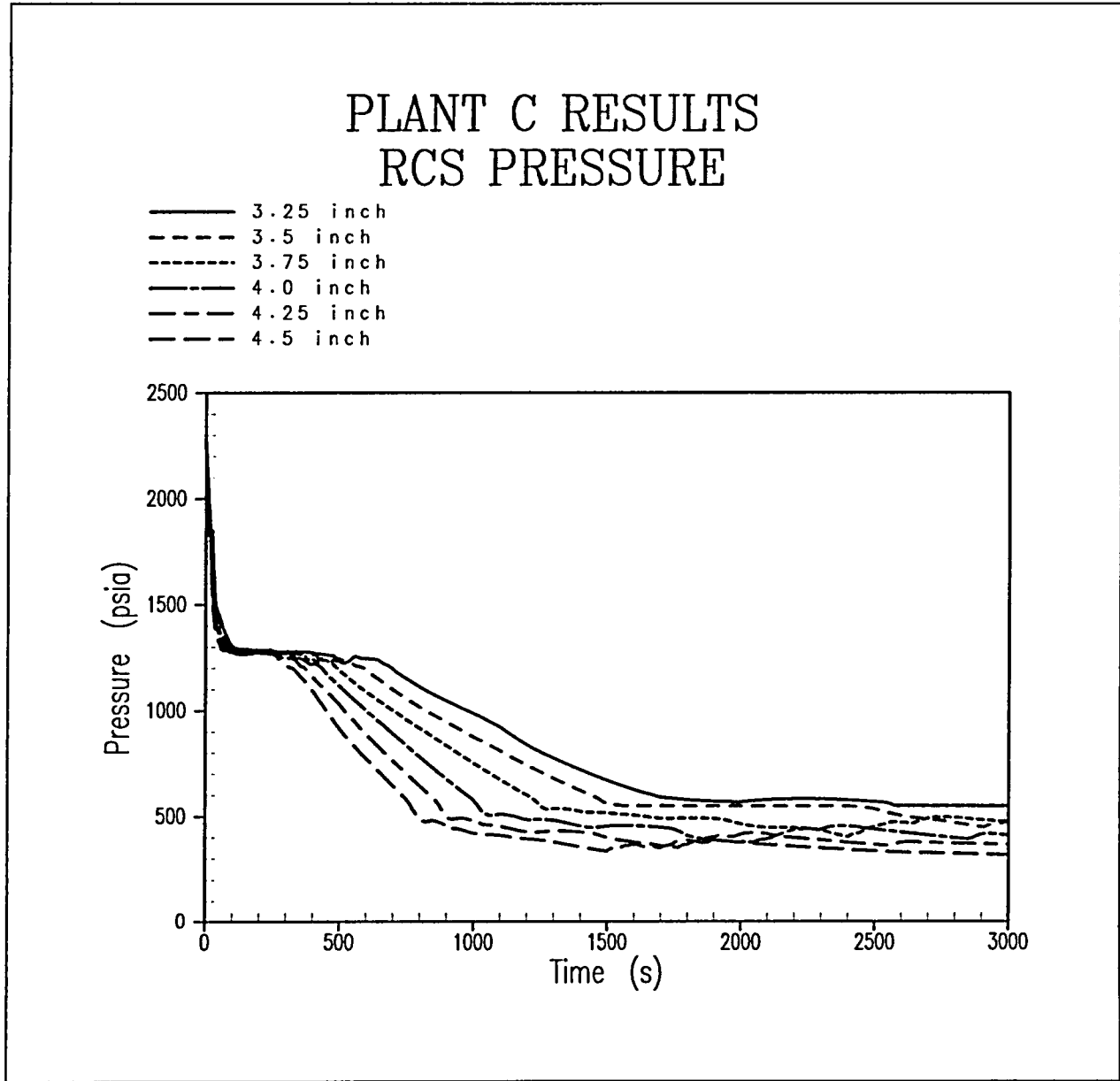


FIGURE 9

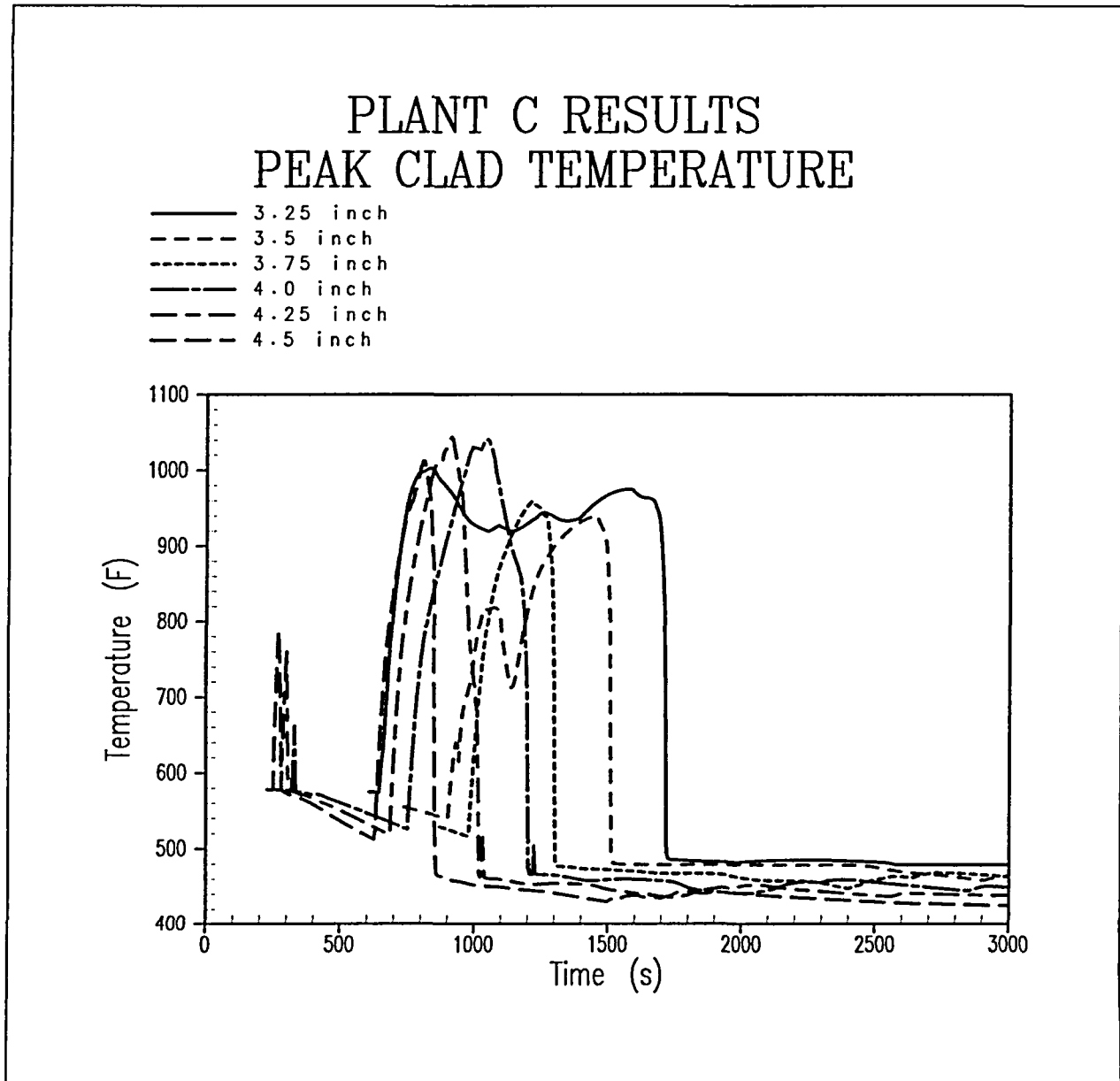


FIGURE 10

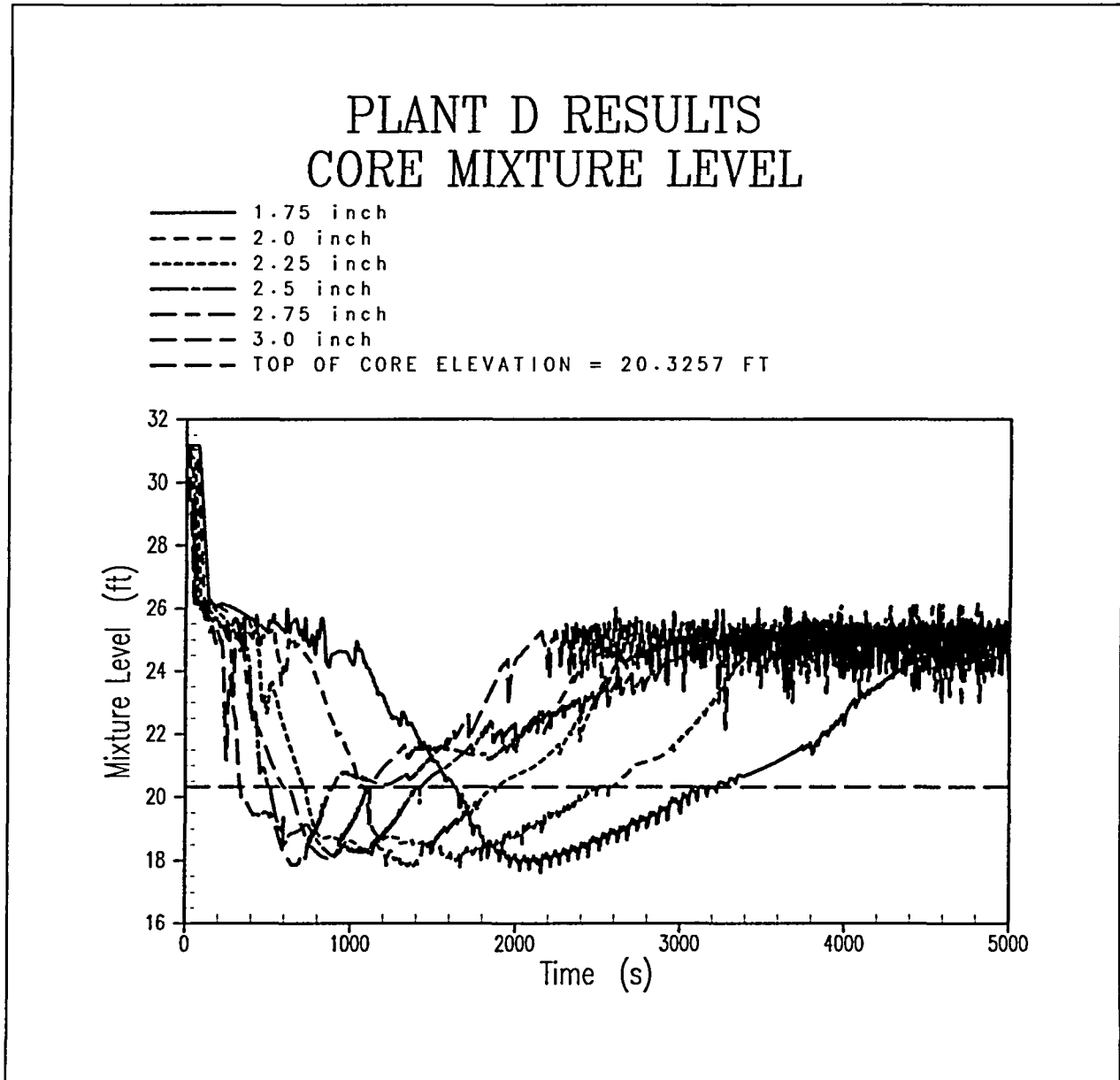


FIGURE 11

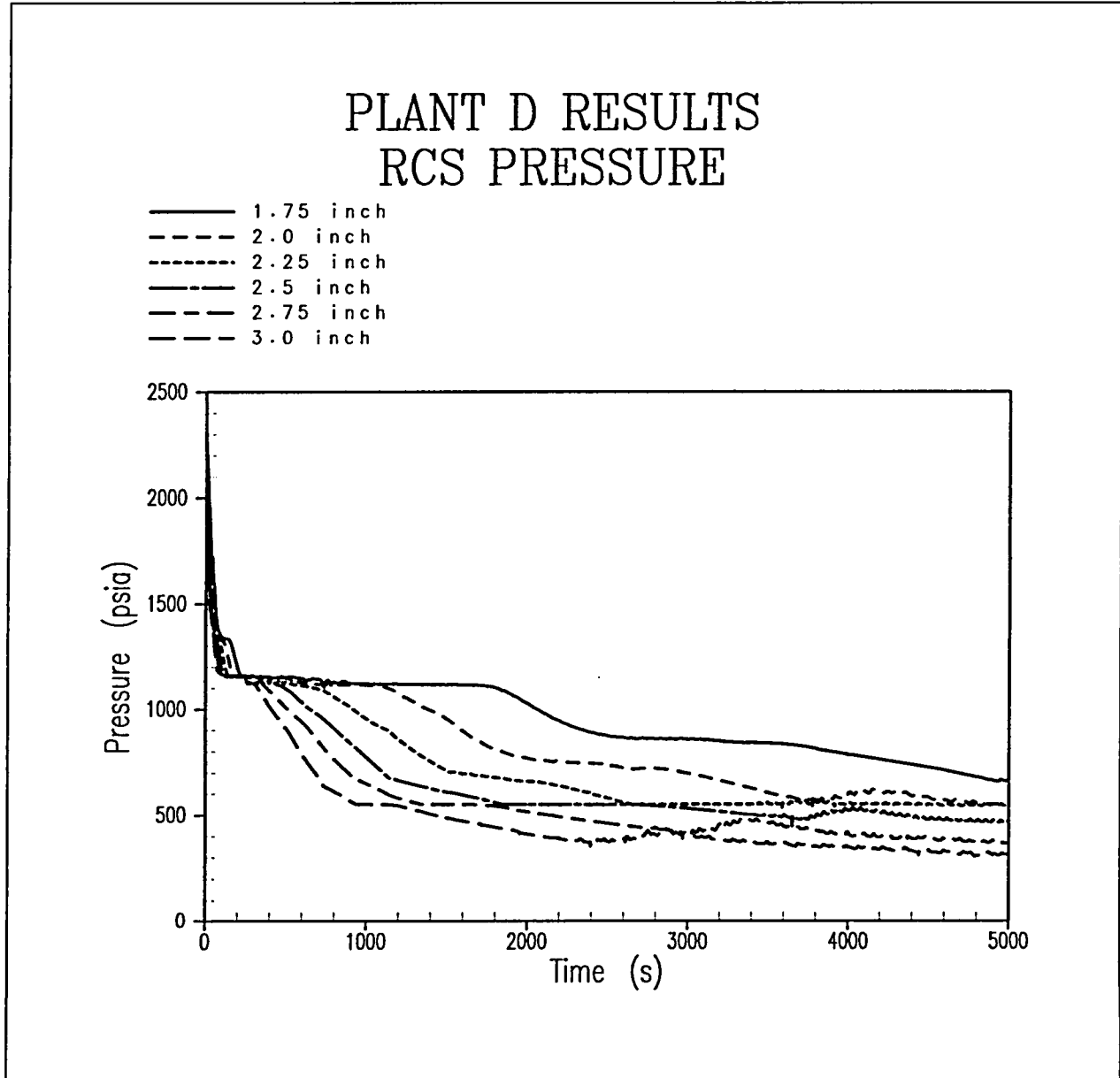


FIGURE 12

