

DISCLAIMER

CONF-851115--42

This report was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency thereof, nor any of their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.

Received by OSTI

DEC 18 1985

**The EBR-II Shutdown Heat Removal Testing
Program Results and Plans***

CONF-851115--42

DE86 004065

by

H. P. Planchon, G. H. Golden, P. R. Betten,
L. K. Chang, E. E. Feldman, and D. Mohr

To be presented
at the
American Nuclear Society
San Francisco, California
November 10-14, 1985

The submitted manuscript has been authored
by a contractor of the U. S. Government
under contract No. W-31-109-ENG-38.
Accordingly, the U. S. Government retains a
nonexclusive, royalty-free license to publish
or reproduce the published form of this
contribution, or allow others to do so, for
U. S. Government purposes.

*Work supported by the U. S. Department of Energy, Reactor System,
Development and Technology, under Contract W-31-109-Eng-38.

MASTER

DISSEMINATION OF THIS DOCUMENT IS UNLIMITED

gse

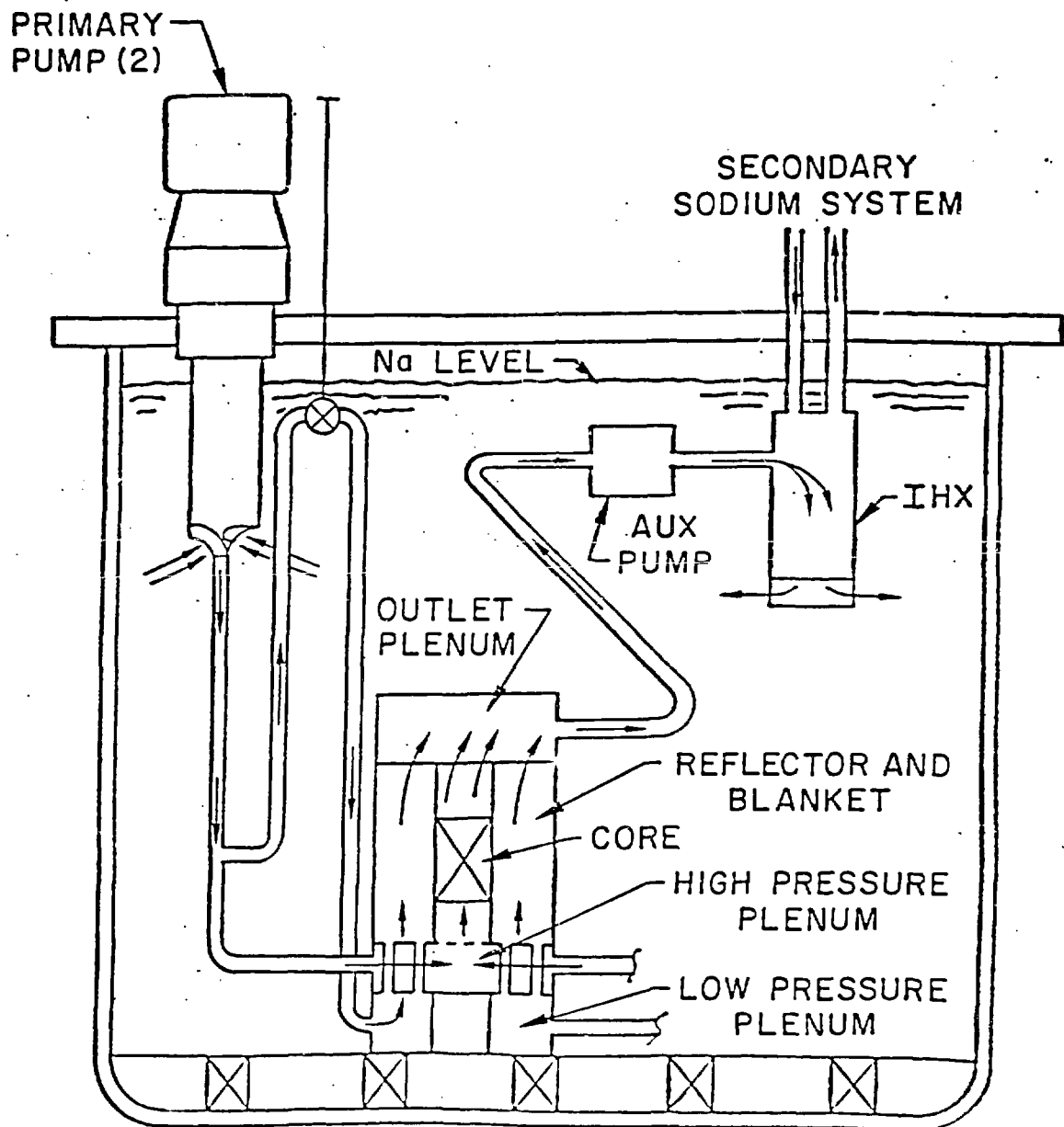
EBR-II SHRT PROGRAM

STATEMENT OF WORK

INVESTIGATE, WITH TESTS AND ANALYSIS, THE CAPABILITY OF LMR'S TO PASSIVELY REMOVE DECAY HEAT (VIA NATURAL CIRCULATION) AND TO PASSIVELY SHUT DOWN (WITHOUT SCRAM) FOR A LOSS OF FLOW OR LOSS OF HEAT SINK ACCIDENT.

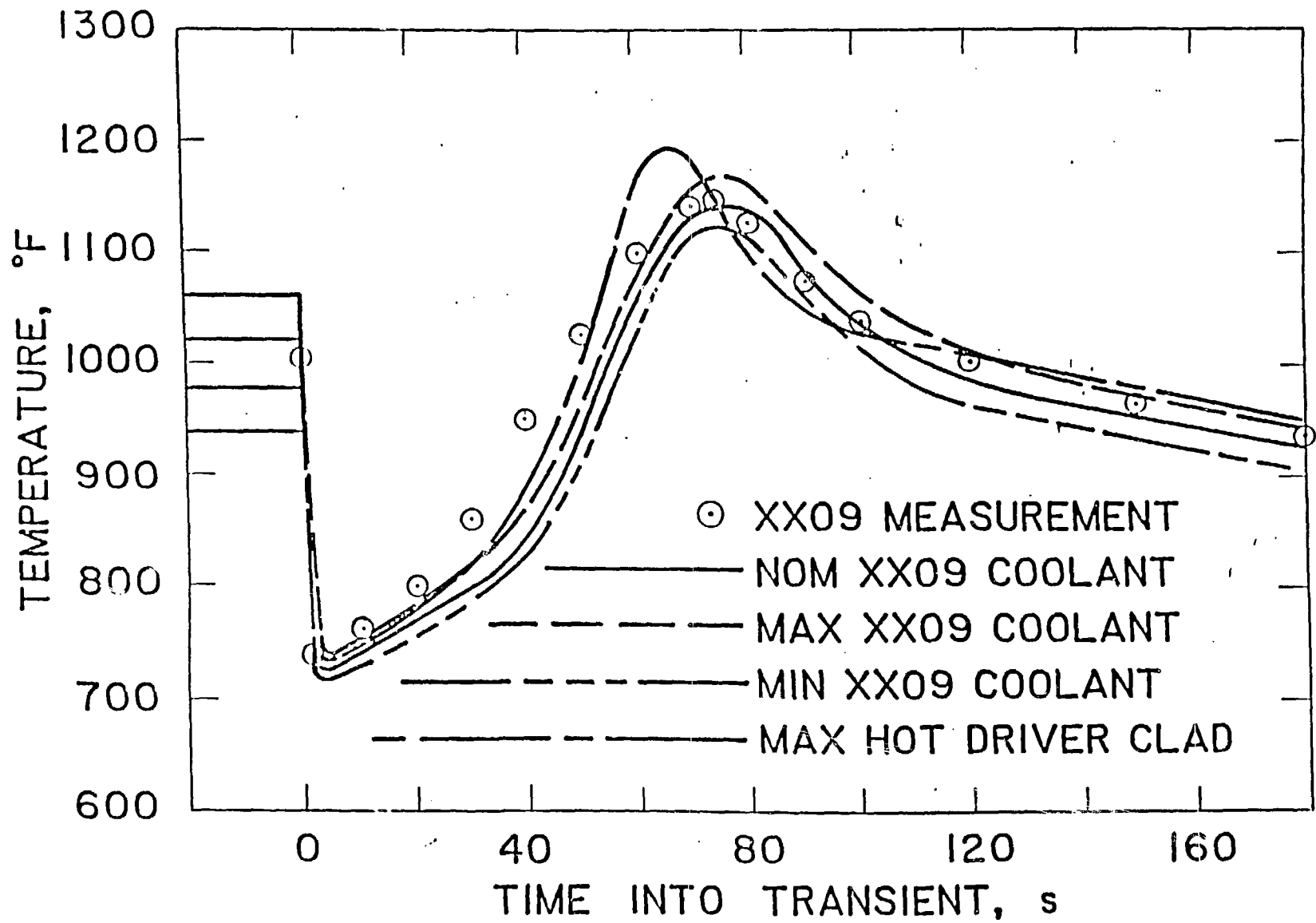
SPECIFICALLY THE OBJECTIVES ARE TO:

- DEMONSTRATE PASSIVE DECAY HEAT REMOVAL BY NATURAL CIRCULATION
- DEMONSTRATE PASSIVE SHUTDOWN FOR LOSS OF FLOW ACCIDENTS
- DEMONSTRATE PASSIVE SHUTDOWN FOR LOSS OF HEAT SINK ACCIDENTS
- PROVIDE INFORMATION TRANSFER:
 - BENCHMARK DATA FOR CODE VALIDATION
 - GUIDANCE IN DESIGN OF REACTOR AND PLANT SYSTEMS



NATURAL CIRCULATION TESTS

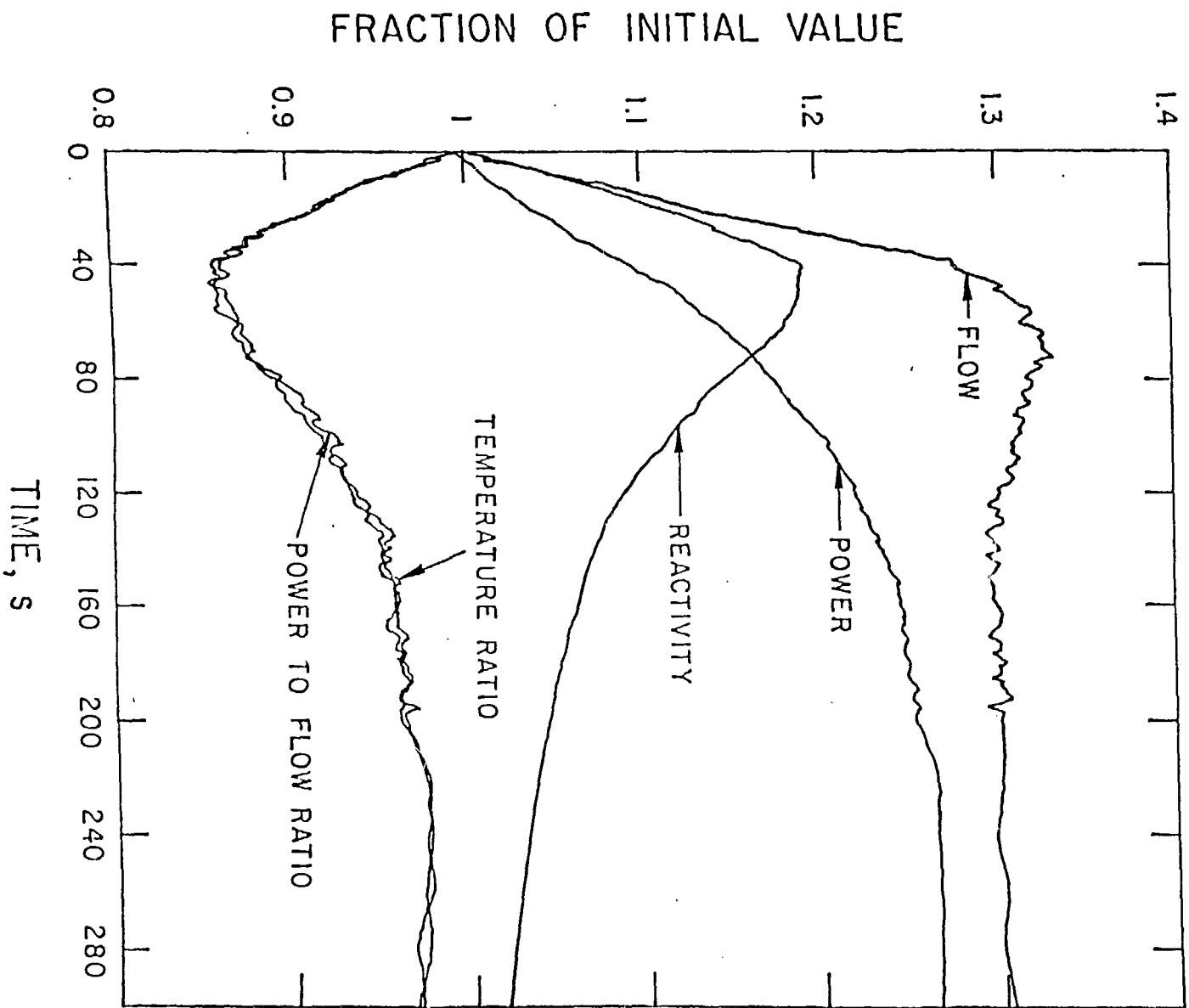
- **OBJECTIVE -** DEMONSTRATE PASSIVE DECAY HEAT REMOVAL CAPABILITIES BY NATURAL CIRCULATION: (GROUPS I-III)
- TESTING COMPLETED IN JUNE 1984
- MOST SEVERE TEST CONDUCTED FROM 100% POWER AND FLOW
 - SIMULTANEOUS SCRAM AND LOSS OF ALL PUMPING POWER
- EXCELLENT AGREEMENT BETWEEN PRETEST PREDICTIONS AND MEASUREMENTS
- OBJECTIVE HAS BEEN MET
- RESULTS SHOW NATURAL CIRCULATION IS A PREDICTABLE, DEPENDABLE MEANS OF DECAY HEAT REMOVAL. SUPPORT DECISIONS TO SIMPLIFY DESIGN BY ELIMINATING SAFETY RELATED PUMP MOTORS AND CONTROLS



LOSS OF FLOW WITHOUT SCRAM TESTS

- OBJECTIVES - DEMONSTRATE INHERENT, PASSIVE, SHUTDOWN CAPABILITIES FOR LOSS OF FLOW
- FLOW PERTURBATION TESTING COMPLETED IN JUNE 1984 (GROUP IV)
 - POWER FOLLOWED FLOW PERTURBATIONS VERY CLOSELY
 - DATA USEFUL FOR VALIDATION OF FEEDBACK MODELS
- LOSS OF FLOW TESTS FROM PART POWER WERE CONDUCTED IN MAY 1985 (GROUP V)
- LOSS OF FLOW TESTS FROM EXTENDED POWER ARE BEING PLANNED FOR FEBRUARY 1986 (GROUP VI)

MEASUREMENTS OF FLOW PERTURBATION TEST FROM
70% POWER AND FLOW



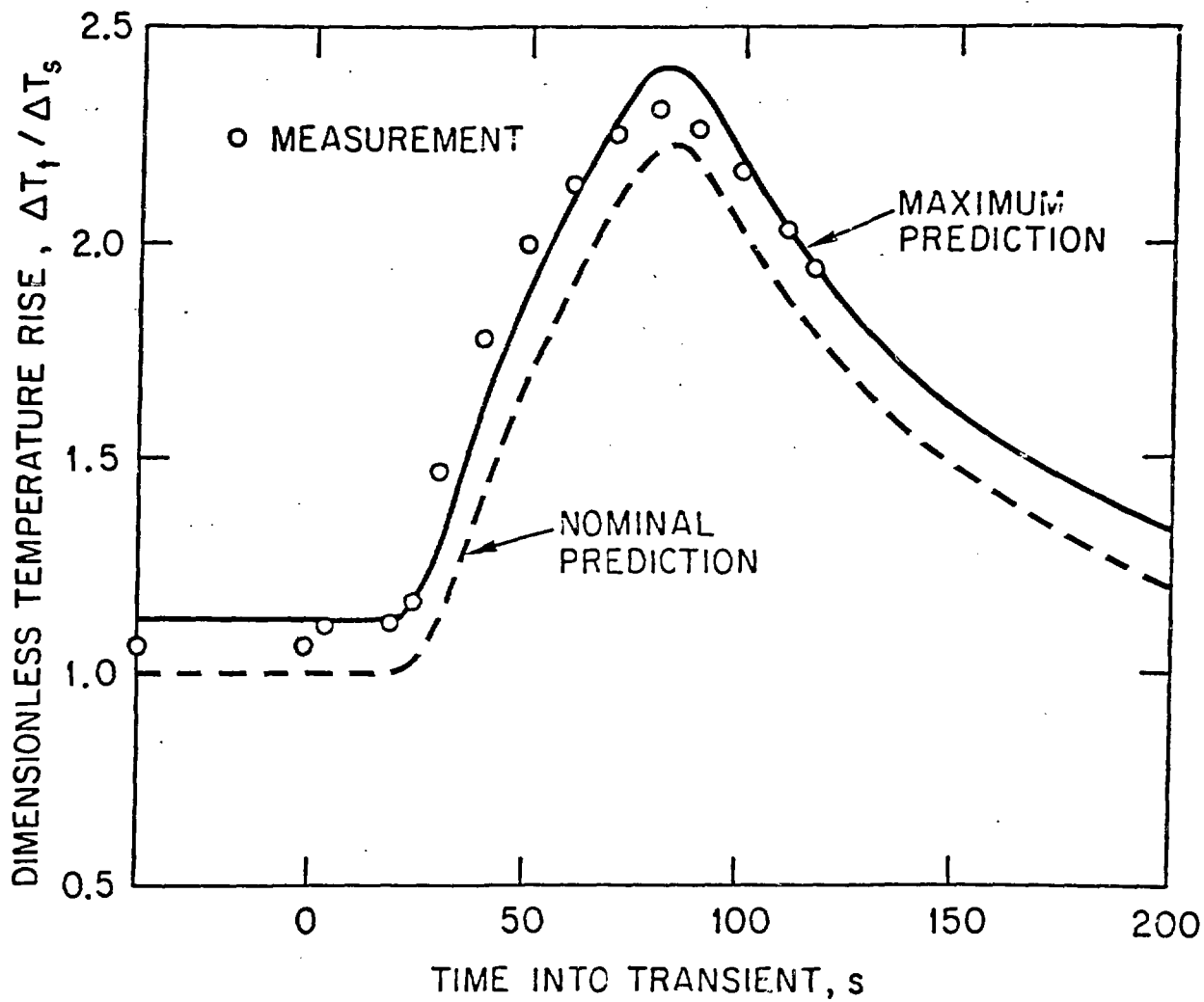


Fig. 1. Measured and Predicted Temperatures of INSAT XX09
Located Near Top of the Core

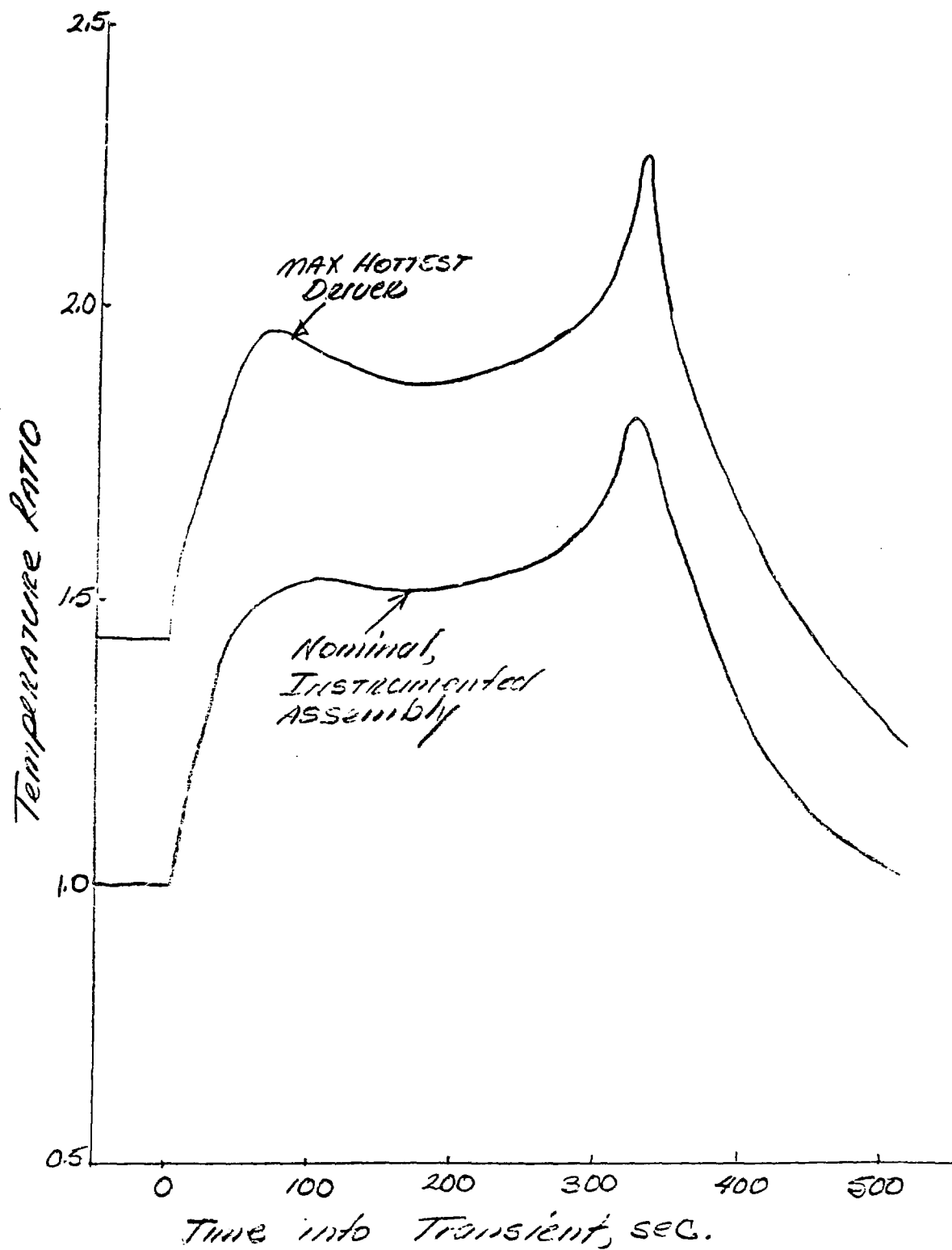
PLANS FOR NEXT GROUP OF LOSS-OF-FLOW
WITHOUT SCRAM TESTS

- GROUP VI-A - COMPLETE LOSS-OF-FLOW WITHOUT SCRAM

- CONDUCT TEST FROM UP TO 100% POWER BY
 - 1) SHUTTING OFF AUXILIARY PUMP
 - 2) BYPASSING LOF SCRAMS
 - 3) CONTROLLING FLOW TO ZERO FORCED FLOW
- CONDUCTED WITHIN TECH SPEC TEMPERATURE LIMITS FOR ANTICIPATED EVENT
- VARIABLES FROM TEST TO TEST ARE POWER/FLOW/SECONDARY FLOW/COASTDOWN RATE (300-400 SEC RANGE)

- GROUP VI-B - STATION BLACKOUT WITHOUT SCRAM

- CONDUCT TEST FROM TBD POWER BY
 - 1) PLACING AUXILIARY PUMP ON BATTERY POWER SUPPLY
 - 2) BYPASSING LOF SCRAMS
 - 3) SHUTTING OFF 2400 V POWER TO PUMP DRIVE SYSTEM
- TO BE CONDUCTED WITHIN TEMPERATURE LIMITS TO BE SHOWN SAFE BY SPECIAL FUELS TEST (HOT LEAD DRIVER TEST)
- VARIABLES FROM TEST TO TEST ARE POWER/COASTDOWN RATE (100-200 SEC RANGE)



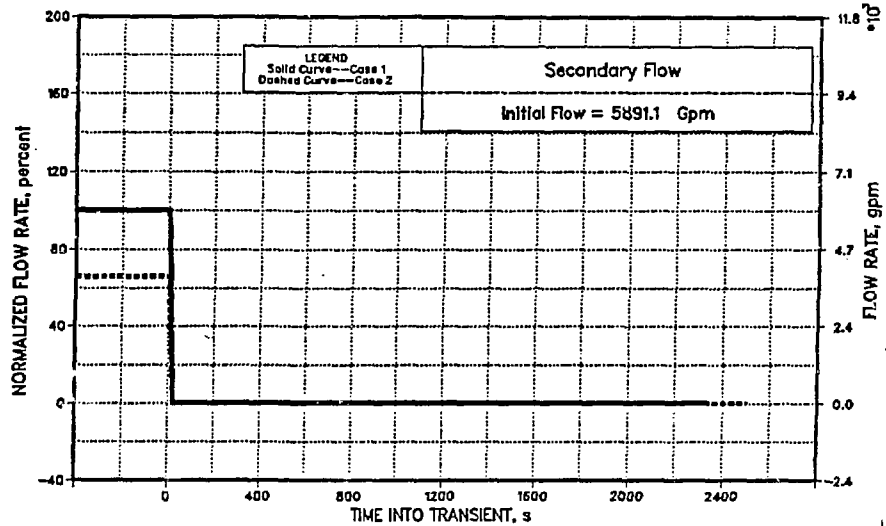
LOSS OF HEAT SINK WITHOUT SCRAM TESTS

- OBJECTIVES - DEMONSTRATE INHERENT SHUTDOWN CAPABILITIES FOR LOSS OF HEAT SINK
- PRELIMINARY TESTING COMPLETED
 - REACTOR INLET TEMPERATURE PERTURBATIONS JUNE 1984 (GROUP IV)
 - SECONDARY FLOW MULTIFREQUENCY PERTURBATIONS MAY 1985 (GROUP VII)
 - STEAM PRESSURE REDUCTION TESTS MAY 1985 (GROUP VII)
 - DATA SHOWS SIGNIFICANT POWER REDUCTION FOR INLET TEMPERATURE INCREASES
 - DATA USED TO VALIDATE FEEDBACK MODELS
- FULL LOSS OF HEAT SINK TESTS BEING PLANNED FOR SPRING 1986 (GROUP VII)

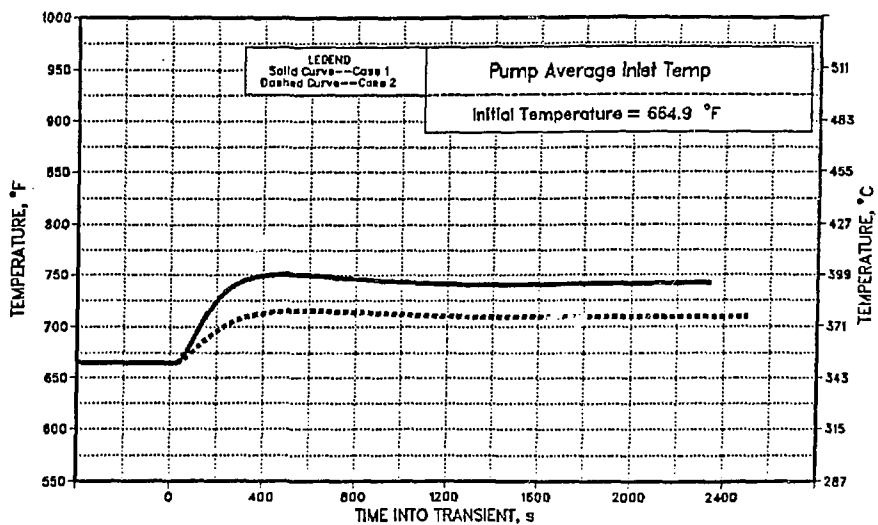
LOSS OF HEAT SINK TEST PREDICTIONS

- 100% POWER
- 50% POWER

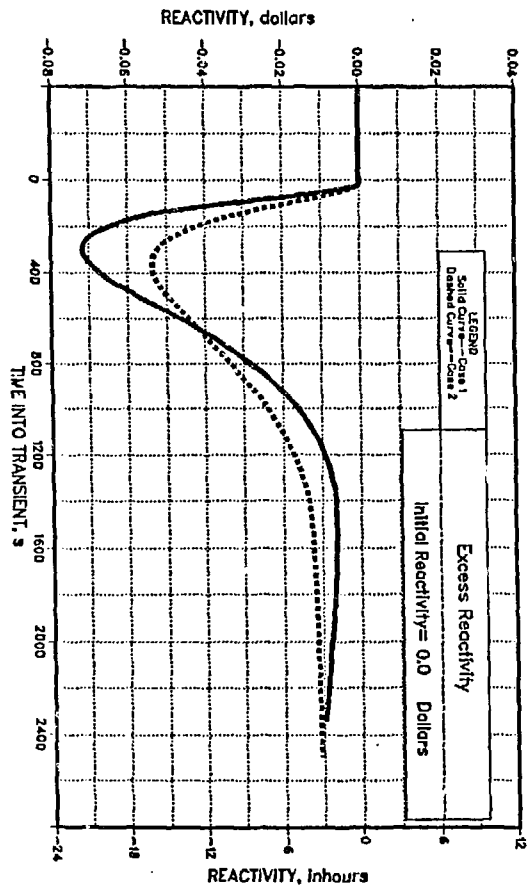
6 B30202
B30102



18 B30202
B30102



21 B30202
B30102



26 B30202
B30102

