PRIMARY PIPE RUPTURE ACCIDENT ANALYSIS
FOR THE CLINCH RIVER BREEDER REACTOR

D. C. ALBRIGHT AND R. A. BARI
FAST REACTOR SAFETY DIVISION

APRIL 1976

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TABLE OF CONTENTS

	<u>Page</u>
List of Diagrams and Figures	iii
List of Tables	iv
I. <u>Introduction</u>	1
I.A. LOCA Concerns for the LMFBR	1
I.B. LMFBR Piping Integrity	2
I.C. Scope of Report	3
I.D. Major Conclusions	6
II. <u>Clinch River Breeder Reactor Plant Configuration</u>	9
III. <u>Analytical Methods</u>	12
III.A. Model Assumptions of the DEMO Code	13
III.B. Modifications of DEMO made by BNL	18
III.C. Input Data Set for DEMO	21
III.D. NALAP (MOD62)	23
IV. <u>Accident Analyses</u>	29
IV.A. The Worst-Case Accident	29
IV.B. Axial Nodalization Studies of the Core and Radial Blanket	37
IV.C. Fuel Rod Gap Conductance	43
IV.D. If the First Scram Fails	45
IV.E. The No-Scram Case	50
IV.F. Effect of Break Location	53
IV.G. Orifice Rupture Studies	58
IV.H. Calculations for BOEC Cases	60
IV.I. Calculations with NALAP	65
IV.J. Calculations with the Parallel Design	70
V. <u>Summary</u>	77
Acknowledgements	79
References	80
<u>Appendices</u>	82
A. DEMO3 User's Manual	82
B1. DEMO3 Output	98
B2. DEMO2 Output	119
C1. DEMO3 Input Data Set	139
C2. DEMO2 Input Data Set	146
C3. NALAP (MOD62) Input and Output	154

List of Diagrams and Figures

<u>Diagram</u>	<u>Page</u>
1 CRBR NALAP Model	28

<u>Figure</u>	
1 Case 2: Boiling Time Determination	30
2 Lower Plenum Pressure as a Function of Time	32
3 Illustration of Power to Flow Mismatch in Case 2	33
4 Radial Node Temperatures at the 5th Axial Node	34
5 The Axial Maximum of the Blanket Average Channel Sodium Temperature	36
6 Nodalization Studies	42
7 Comparison of Sodium Hot Channel Temperatures	51
8 Comparison of Sodium Hot Channel Temperatures for Two Cases	52
9 Effect of Break Location on the Severity of the Thermal Transient	56
10 Case 7: Near Boiling in the Hot Channel	57
11 Effect of Break Location on Lower Plenum Pressure at $t = 1.75$ sec After the Break	59
12 Comparison of T_{sat}^m and T_{HC}^m as a Function of Leak Area, A_L	62
13 Comparison of Results from DEMO2, DEMO3, NALAP (MOD62)	64
14 Comparison of NALAP and DEMO3 Results	67
15 Comparison of Normalized Through-Core Flow for Identical Cases with NALAP (MOD62) and DEMO3	69
16 Comparison of Designs	72
17 Comparison of Normalized Through-Core Flow for Different Designs	73
18 Peak Channel Temperatures for Reference and Parallel Designs	76

List of Tables

<u>Table</u>		<u>Page</u>
III-1	Initial Conditions for the CRBR	22
III-2	Sources of DEMO3 Input Data Set	24
III-3	Glossary of Symbols (Sec. III)	25
IV-1	Glossary of Symbols (Sec. IV)	38
IV-2	Nodalization Studies	41
IV-3	Sensitivity Study: Fuel Rod Gap Conductance	44
IV-4a	Effect of Delaying the Scram on the Thermal Transient Produced by a DEPR at RVI	46
IV-4b	Effect of Delaying the Scram on the Thermal Transient Produced by a DEPR at RVI	47
IV-4c	Effect of Delaying the Scram on the Thermal Transient Produced by a DEPR at RVI	48
IV-5	Scram Functions and Their Order of Initiation of Scram	49
IV-6	Times of Phase Transitions for Various Thermal Transients	54
IV-7	Effect of Break Location	55
IV-8	Orifice Rupture Studies	61
IV-9	Calculations Using DEMO2	63
IV-10	CRBR NALAP (MOD62) Results	66
IV-11	Effect of Parallel Design on the Thermal Transient Produced by the Worst-Case Accident	71
IV-12	Effect of Parallel Design on the Thermal Transient Produced by the Worst-Case Accident (Average and Peak Channel Responses)	75

I. Introduction

I.A. LOCA concerns for the LMFBR

In the Reactor Safety Study⁽¹⁾ for U. S. Commercial light-water nuclear reactors it was found that a significant contributor to the risk associated with radioactive releases to the public was the loss-of-coolant accident (LOCA). The loss of reactor core coolant can be initiated by a failure of the primary heat transport system boundary integrity. In the Reactor Safety Study⁽¹⁾ it was found that a rupture or leak of the piping (rather than a reactor vessel rupture) was the most likely initiator of a LOCA.

Due to the fact that core coolant, in a light-water reactor, also plays the essential role of a moderator, the LOCA leads to a shutdown of the reactor. The accident analysis is then primarily concerned with the possibility of a gradual meltdown of the reactor core (as a result of the failure of the emergency cooling systems), without the possibility of nuclear recriticality.

In the (loop-type) liquid metal fast breeder reactor (LMFBR), the accident that is, perhaps, most analogous to the LOCA of the light-water reactor is the primary system piping rupture followed by a scram that is initiated by the plant protection system. For the LMFBR accident scenarios, successful operation of the plant protection system is a crucial postulate. Unlike the light water reactor, the LMFBR does not have an automatic negative feedback associated with the loss of the primary coolant. On the contrary, an undercooling accident in the LMFBR can lead to a positive reactivity feedback as a result of the well-known positive sodium-void effect.

In the event that the control rods that are actuated by the plant protection system insert properly and bring the reactor into a subcritical condition, the LMFBR must receive sufficient cooling to prevent sodium boiling or a core melt as a result of the decay heat. This is also analogous to the concerns for the light-water reactor. However, in addition to the long term heat removal concerns of the LMFBR under the conditions of a pipe rupture, the short term thermal transient response must also be given careful consideration. The response time of the plant protection system to the accident condition and the details of the transient flow of the coolant through the core during

the first few seconds after the pipe rupture are significant factors in determining the severity of the transient response. Transient coolant temperatures in the core that are in excess of the sodium saturation temperature could, if encountered, pose a serious threat (due to the melting of cladding) to the intact geometry of the core, the upper axial breeding blanket and the radial breeding blanket. A partial meltdown of the core, on this time scale, would further aggravate the long-term decay heat removal capability.

Two distinct questions arise in connection with the accident situation described above. Firstly, the likelihood or probability of the initiating events may be addressed from the perspective of an entire spectrum of accident scenarios and also, perhaps, from a risk-benefit point of view. Secondly, there is a basic question of the adequacy of a given reactor design with respect to the severity of the consequences. For example, the sensitivity of the thermal transient in the reactor core to the location of the rupture along the primary piping can be addressed and studied in order to gain insight into the safety of the design. This report primarily addresses questions of the second type.

The unprotected pipe rupture accident for the LMFBR⁽²⁾ can lead to accident conditions that are not expected for the light water reactor LOCA. Namely, to the extent that the initial transient core-flow conditions that result from a pipe rupture accident are comparable (or more severe) than those that are occasioned in a loss-of-flow (due to tripping of the primary pumps) accident, it may be expected that the unprotected pipe rupture accident would involve core disassembly and recriticality energetics. This accident scenario is not described, in a significant detail, in this report and would require methods of analysis that go beyond the scope of this present work.

I.B. LMFBR Piping Integrity

In this subsection, a brief discussion of the first question that was raised in the preceding subsection is presented. This question deserves attention here, especially in view of the increasing emphasis on reliability methods in connection with reactor safety analysis.

Of central concern to the pipe rupture accident analysis is the likelihood of a major failure of the primary piping. The analysis of LMFBR primary piping integrity has been the subject of two major reports^(3,4) recently (it is also the subject of a special session of a forthcoming meeting⁽⁵⁾ of the American Nuclear Society).

Due to the lack of extensive LMFBR primary piping experience, the current analysis must rely heavily on the present understanding of stainless steel material properties and stress behavior at approximately 1000°F. The efficacy of a stress-strength analysis for primary piping in the LMFBR operating plant environment depends upon an understanding of the realizable stress loadings and histories during the lifetime of the plant.

In a recent probabilistic analysis⁽⁴⁾ for the CRBR primary piping it was concluded that the probability of failure of the cold-leg inlet downcomer section is on the order of 10^{-13} per year. This assessment is based on the stress-strength overlap reliability method⁽⁶⁾ and has utilized subjective analysis in obtaining a quantitative estimate of the reliability of the primary system piping. In a review of this work, it was shown⁽⁷⁾ that this assessment is extremely sensitive to the assumed values for the probabilistic parameters. Thus it appears that the quantification of the likelihood of a rupture of the primary system piping requires further analysis.

I.C. Scope of Report

In this report, the thermal transient response of the CRBR to a severe primary coolant flow perturbation, initiated by a rupture of the primary heat transport system piping, is analysed. This hypothetical accident is studied under the further assumption that the plant protection system does function according to current design descriptions⁽⁸⁾ for the CRBR. Although a brief discussion of an unprotected (no scram) pipe rupture accident is presented, the major emphasis of the present report is on the protected accident.

If the probability of concurrent failure of the primary system piping and the plant protection system is dominated by random, independent failure probabilities for each, then it can be expected that the protected accident

would be more likely than the unprotected accident. However, if the concurrent failures are related to some common initiating event or environment that can disable both systems (e.g., a severe earthquake), then relative emphasis that is placed on the unprotected accident must depend on the vulnerability of the plant to such common mode failure events. In any case, the potential consequences of the protected accident in the CRBR warrant investigation.

In Appendix E of the CRBR PSAR⁽⁹⁾, some results of the analysis of the protected, double-ended pipe rupture accidents are presented. The principal conclusion of this analysis is that, if there is a double-ended rupture of the piping on the segment that runs from the reactor vessel inlet nozzle to the top of the cold-leg inlet downcomer, then the coolant at the core exit elevation will exceed the sodium saturation temperature in the hot channels of both the core and the radial blanket. Furthermore, it was also reported that the radial blanket hot channel coolant temperature stays above the saturation temperature for double-ended ruptures up to the location of the cold-leg check valve (88 ft. from the vessel inlet nozzle). No analysis was presented of the temperature - time histories of these transients[†] or of potential for the meltdown (or loss of structural integrity) of parts of the subassemblies. Analysis of the latter would certainly be relevant to the question of the long term (decay heat) coolability of the reactor, especially since two primary heat transport loops (at most) would be available for heat removal. Furthermore, due to the loss of sodium inventory from the vessel, the overflow heat removal service (OHRS) may not be capable of providing a redundant heat removal path.

This report focuses on the former subject. Namely, a detailed analysis of the temperature-time transient histories for the primary system pipe rupture accident is presented. The report is aimed at the following objectives:

- 1) an assessment of the technical validity of the conclusions put forth in Appendix E of the CRBR PSAR.
- 2) an analysis of a spectrum of accidents related to, but not limited to, the particular accident conditions assumed in Appendix E of the CRBR PSAR.

[†] Recently, Amendment 17 (April, 1976) of the CRBR PSAR was issued and this contained certain temperature-time histories related to the double-ended pipe rupture accident.

The report includes simulations of the thermal transient response of the CRBR by two LMFBR systems analysis computer codes. These codes are the DEMO⁽¹⁵⁾ code and the NALAP⁽¹²⁾ code. Descriptions of the codes are given later in the report. The analysis with these codes includes studies of the implications of variations in the pipe break sizes, pipe break locations, degree of operability of the plant protection system, reactor burn-up, fuel-clad gap conductance and heat transfer nodalization scheme for the core.

In addition, a brief study of the parallel design feature⁽⁹⁾ is also presented in this report. In Appendix E of the CRBR PSAR⁽⁹⁾, it was stated that if a concentric pipe sleeve were installed around those segments of the primary system piping for which the saturation temperature was exceeded, the sodium temperature would be maintained below its saturation point following a double-ended pipe rupture. In this report, the thermal transient response of the core to a protected double-ended pipe rupture at the reactor vessel inlet, with the pipe sleeve modeled into the DEMO code, is presented.

This work also includes a discussion of the model assumptions of the DEMO code, modifications (mostly user-oriented) made by BNL to the DEMO code and a discussion of the implementation of the NALAP code in connection with CRBR pipe rupture studies. A user's manual for the modified version of the DEMO code is presented as an appendix to this report.

In the following subsection (I.D.), a discussion of the major conclusions of this work is presented. Section II contains a description of the CRBR plant configuration as it relates to the primary system pipe rupture accident. Section III contains discussions of the DEMO and NALAP codes as analytical tools for this study. Input data requirements are also presented and discussed. A discussion of the modifications to DEMO is also presented here. Section IV contains the results of the accident analysis performed with the codes. A detailed description is given of a (base case) protected double-ended pipe rupture at the reactor vessel inlet nozzle. This is followed by analysis of related accidents under conditions that vary somewhat from the base case accident. Section V contains a summary of this work.

I.D. Major Conclusions

In this subsection, the major conclusions of this report, in relation to the primary system pipe rupture accident in the CRBR, are presented. The conclusions are based, primarily, on analyses with the DEMO and NALAP computer codes. It should be noted at the outset that both DEMO and NALAP do not model sodium boiling at all. This is one of the most severe limitations of these codes for many of the accident scenarios described in this report. The extent of core damage, as a result of the sodium temperature exceeding the saturation temperature, could not be quantitatively assessed with these codes.

This report partially concurs with the results presented in Appendix E of the CRBR PSAR⁽⁹⁾ in connection with the protected double-ended rupture of the primary heat transport system piping. In particular, this report is in agreement that the core exit sodium temperature in the hot channel of the core exceeds the saturation temperature as a result of pipe ruptures along the segment of piping that extends from the reactor vessel inlet nozzle to the top of the cold-leg inlet downcomer. However this report has found that sodium boiling also occurs for a spectrum of accident conditions beyond those specified in Appendix E of the CRBR PSAR⁽⁹⁾. This report has found that sodium boiling also occurs for breaks of the primary piping on the segment that extends approximately 35 feet beyond the top of the cold-leg inlet downcomer. On this point we are in disagreement with the results presented in Ref. 9. It was also found that sodium boiling occurs as a result of orifice pipe ruptures (at the reactor vessel inlet nozzle) with leak area cross sections as small as 2.20 ft². Similar conclusions were reported recently in Amendment 17 (April, 1976) of the CRBR PSAR.

In addition, it was found that the maximum core hot channel coolant transient temperature was rather sensitive to the time of insertion of the control rods of the plant protection system. A failure of the rods to insert within 1.5 seconds after the pipe rupture leads to sodium boiling in the peak channel as well as the hot channel. Further delays in the rod insertion time leads to clad melting in the peak and hot channels as well as sodium boiling in the average channel of the core. The severity of the thermal transient response was found to be sensitive to the assumed value for the fuel-clad gap conductance.

On the other hand, the thermal transient response was found to not be very sensitive to the burn-up history (during the first few seconds of the transient). As a result of the axial nodalization study performed with the DEMO code (in order to determine the number of finite axial segments to be used in the numerical computations of heat transfer in the core), it was found that there was a one percent variation in the core temperature as the number of nodes varied from five to twenty.

Analysis of the hot channel of the radial blanket has also been performed. Equations of the type used in the hot channel of the core in DEMO have been programmed into the revised version of the code. Unfortunately, the relevant hot channel factors that were received from the applicant⁽¹⁰⁾, could not be reconciled with the present BNL model of the hot channel. This situation requires further investigation and no comparison with the radial blanket hot channel results of Appendix E is made at this time. It can be said, however, that, in the average channel of the radial blanket, there is a rather broad peak (in comparison to the core response) in the temperature as a function of time. Details are given in Section IV.

The transient response for the parallel design concept⁽⁹⁾ (pipe sleeve) was analyzed. It was found that boiling occurred for a double-ended rupture at the reactor vessel inlet nozzle if the pipe sleeve alone (and not the flow restrictor) was taken into account. As a result of the presence of the pipe sleeve, the maximum hot channel temperature was reduced by $\sim 100^{\circ}\text{F}$ and the corresponding saturation temperature was increased by $\sim 30^{\circ}\text{F}$. This, in turn, led to a shorter estimated duration for sodium boiling (1.3 seconds instead of 5.5 seconds). The present analysis does not confirm the results given in Appendix E for the parallel design on the basis of considering of the pipe sleeve alone. It appears that the flow restrictor plays an essential role in the applicant's predictions for the thermal transient with the parallel design.

Pipe rupture accident analysis was also carried out with the computer code NALAP. For comparable accidents, NALAP consistently predicted milder thermal transients than DEMO. This can partially be understood in terms of

certain ostensible differences between the codes, particularly in terms of the differences in the approaches to simulation of basic model equations. On the other hand, the level of modeling in the codes is basically the same and thus, in the absence of any substantial experimental validation of either code, the difference in predictions of the code may be a reflection of the state of the art.

II. Clinch River Breeder Reactor Plant Configuration

In this section, a summary is given of the overall physical characteristics of the plant, including the safety features as they relate to the primary piping rupture accident. This information is primarily derived from the CRBR PSAR (8).

The CRBR heat transport system must, at rated conditions, dissipate 975 MWt among three parallel heat transport circuits. Each heat transport circuit is comprised of a primary sodium loop, a secondary sodium loop and a tertiary water/steam generator system. Because of the scope of this report, rather more emphasis is placed on the description of the primary heat transport system.

In the primary heat transport loops, the sodium flows up through the reactor core (and breeding blankets), then into the outlet plenum and then through the reactor vessel outlet nozzle and into the stainless steel piping. The sodium then flows to the suction side of a free surface centrifugal pump. The sodium flows from the discharge side of the pump, through further piping segments, and then into the shell side of the intermediate heat exchanger (IHX). The sodium then flows into the cold-leg piping (which contains a flow meter and a check valve) and then back into the reactor vessel through the nozzle to the lower inlet plenum.

The hot-leg piping has an outside diameter of three feet for those segments between the reactor vessel outlet and the pump. It has an outside diameter of two feet for those segments of piping between the pump and the IHX. The wall thickness is 0.5 inches and is welded pipe of Type 316 stainless steel.

The cold-leg piping has an outside diameter of two feet, a wall thickness of 0.5 inches and is welded pipe of Type 304 stainless steel.

In the intermediate heat transport loops, sodium flows upward through the tube side of the IHX, into the piping segment between the IHX and the steam generator, through the steam generator (superheater and evaporators) and into the cold-leg piping. The sodium then flows into a centrifugal pump and then into the cold-leg piping that leads back to the IHX.

The steam generator system converts feedwater to superheated steam at the turbine. A detailed description of the steam generator system components

and configuration is given in Section 5.5 of the CRBR PSAR.

In the event of a leak or rupture of the reactor vessel or portions of the primary system piping, sodium would flow into the reactor guard vessel. The purpose of the guard vessel is to prevent the uncovering of the reactor vessel outlet plenum by the sodium inventory (4600 ft.³) in the outlet plenum. The guard vessel extends to approximately six feet above the minimum safe level for sodium in the reactor vessel. In addition to the reactor guard vessel and for the same purpose, there will also be separate guard vessels for the IHX's and primary pumps. Although the guard vessel provides a means of obtaining a reverse pressure head against outflowing sodium from a break in the reactor vessel or portions of the primary system pipe, the time required to fill the guard vessel to the location of the break is much too long to significantly mitigate the accidents studied in this report. Indeed, it is the position of the applicant, in Appendix E of the CRBR PSAR⁽⁹⁾, that (guillotine) double-ended pipe ruptures on the segment of the cold-leg primary system piping between the reactor vessel inlet nozzle and the top of the inlet downcomer would cause sodium to exceed its saturation temperature in the hot channels of the core and radial blanket at the elevation of the core flow-exit. For this reason, the applicant has put forth, in Appendix E, a parallel design feature associated with the primary system piping for the purpose of mitigating (preventing sodium from exceeding the saturation temperature) the severity of the above mentioned pipe rupture accident. The rationale is that if the original, reference design is not acceptable from a safety point of view, then the parallel design would be submitted for consideration of its safety features. The parallel design is basically a pipe sleeve that is concentric to the primary piping along the above mentioned piping segment. There is a seven inch annulus between the primary pipe and the (0.5 inch thick stainless steel) pipe sleeve. The narrow channel would allow for a rapid filling and covering of the pipe break by the outflowing sodium.

In addition to the pipe sleeve itself, the parallel design includes a flow restrictor in the annular channel between the primary pipe and pipe

sleeve at a height of approximately twenty feet above the reactor vessel inlet nozzle height. It is shown in Section IV of this report, that the flow restrictor must apparently play an important role in the parallel design safety concept for the purpose of mitigating the core thermal transient that results from a double-ended pipe rupture at the reactor vessel inlet nozzle.

This report does not address efficacy of the parallel design as an overall safety concept in terms of the extra welds introduced or the inspectability of the primary pipe for flaws or cracks. Nor does this report address the question of the structural integrity of the parallel design or its survivability in the event of a primary piping rupture.

The plant protection (or scram) system consists of two sets of control rods. These are fifteen primary rods and four secondary rods. Each set of rods is actuated by its own separate mechanical actuation system, which is, in turn, triggered by its own separate electronics. The electronics, which consists of logic modules, comparators and signal conditioners, contains several sensors that sense certain plant parameters for the purpose of detecting off-normal behavior. These sensors are designed to detect changes in flux, flow, pressure, pump speed, reactor sodium level as well as variations in other parameters associated with the steam generator system.

There are flux sensors associated with both the primary and secondary protection systems, but the other sensors of relevance to the primary system pipe rupture are associated with either the primary protection system (pressure, pump speed, reactor sodium level) or the secondary protection system (flow). This separation is a limitation to the redundancy and diversity of the plant protection system. The consequences of the failure (upon demand) of either the primary or secondary protection system (but not both), in connection with a pipe rupture accident, are presented in Section IV of this report.

III. Analytical Methods

Due to the complexity of the CRBR on the plant systems level, the analysis of the thermal transient response of the reactor core to off-normal initiating perturbations that originate outside of the reactor vessel inevitably involves the simulation of the plant behavior by a computer program. For the liquid metal fast breeder reactor (LMFBR) concept, there have been three notable developments in recent years.

The IANUS code⁽¹¹⁾ simulates the transient neutronic and thermal-hydraulic behavior of a loop-type LMFBR, with specific application to the Fast Flux Test Facility (FFTF). The code calculates the average fuel pin and coolant channel response to pump failures, pipe ruptures, and certain other system transients.

The NALAP code⁽¹²⁾ is a modification of the RELAP3B code⁽¹³⁾. The latter is used in light water reactor transient analysis. The essential modification that was made to RELAP3B was the replacement of water by (liquid phase only) sodium in the primary system of the reactor. The basic approach to the modeling of a reactor for transient analysis is the same as that of the RELAP series. An analysis, with NALAP, of the primary pipe rupture accident, with scram, for the FFTF has recently been reported.⁽¹⁴⁾

The third code that has received some attention in system transient analysis for the LMFBR is the DEMO code⁽¹⁵⁾. The DEMO code is based on the framework of the IANUS code but was written for application to the Clinch River Breeder Reactor. The dump heat exchanger model of the IANUS code is replaced by a water/steam generator system in the DEMO code.

The IANUS code is proprietary to the Westinghouse Electric Company and consequently no accident analysis has been performed with this code at BNL. In addition, the simulations employed in the IANUS code have not, to our knowledge, been subject to an evaluation or an experimental test. The NALAP and DEMO codes have been used at BNL primarily for the studies of pipe rupture accidents. Although the basic physical modeling in the codes are rather similar, the detailed numerics, nodal approximations and the actual coding are somewhat different. As a result of the structure of NALAP, the user

specifies the nodal configuration within the reactor vessel, along the piping segments and in the pumps and heat exchanger as well. This allows for a flexibility in simulation that is not as easily obtained from DEMO. On the other hand, NALAP is limited by the fact that its numerics and/or coding structures requires rather long computer running times for certain transients. For example, for a similarly modeled pipe rupture accident NALAP requires an order of magnitude greater running time than DEMO. NALAP is also limited by the fact that it does not describe the behavior of the reactor under natural convection conditions. It is difficult to take into account the reactor guard vessel with the NALAP code. A modeling of the water/steam generator system is not easily obtained from NALAP and would require a reasonable amount of modeling effort.

The DEMO code takes into account many of the essential features of the CRBR plant in its fundamental modeling. The reactor guard vessel is included in the DEMO modeling as is a detailed model of the water/steam generator system (for the purpose of studying blowdown accidents). In contrast to NALAP, DEMO has been constructed with a fixed nodalization and a fixed plant configuration. DEMO does not include models of the CRBR safety system related to the overflow heat removal service (OHRS) or the protected air-cooled condensers (PACC).

In the following subsection, discussions of the modeling assumption employed in the DEMO code are presented. Preliminary evaluations of parts of the code are presented.

III.A. Model Assumptions of the DEMO Code

In this section, a review of model assumptions employed in the DEMO code for its simulation of the thermal-hydraulic transients of the CRBR is presented.

DEMO simulates the thermal-hydraulic behavior of the in-vessel systems and components, the primary heat transport system, the intermediate heat transport system and the steam generator system. Since the primary area of interest in this report is the consequences of a pipe rupture of the primary piping (in the proximity of the reactor vessel inlet nozzles), the discussion

places rather more emphasis on the modeling assumptions used in the simulation of the in-vessel system and the primary heat transport system. Comparisons with the modeling in the NALAP code are made where appropriate.

(1) In-Vessel Systems and Components

A. Reactivity

The core and breeding blankets are each modeled as single average channels and the point kinetics description is used. The reactivity equations are solved in the prompt jump approximation and, as a result of the approximation, the reactivity insertions are limited ($\leq \$1$). Inasmuch as large, negative ($> \$6$) reactivity insertions from the plant protection system are assumed to follow the accident initiation, the prompt jump approximation is not believed to be an essential limitations. However, if the scram is sufficiently delayed after the initiating transient, the representation of the neutronics by the prompt jump approximation may be questionable.

B. Heat Transfer

i) The average channel of the active core is modeled by five axial nodes and five radial nodes. This average channel modeling represents all 42,966 (= 217 x 198) fuel pins of the active core. Hot and peak channel temperatures are computed with the aid of engineering factors as described below. It is shown in a later section that the approximations of five axial nodes, gives a reasonable description of the axial temperature distribution during the pipe rupture transient.

ii) For each node, the heat equation is solved by a finite difference technique; explicit time stepping is used throughout. (NALAP used an implicit time stepping approximation.)

iii) The radial nodalization of the core consist of two equal mass fuel nodes, a clad node, a coolant node and a duct node. NALAP has the capability of modeling 31 radial core nodes, and in recent analysis five radial fuel nodes have been used. During the pipe rupture transient, the fuel centerline temperature is significantly below the fuel melting temperature.

iv) The heat equations are integrated to give equations for volume-averaged temperatures in each node; the coolant nodes are staggered with respect to the fuel, clad and duct nodes. Lumped parameter heat transfer coefficients are utilized. NALAP does not stagger the heat generation nodes with respect to the coolant nodes. As a result of this difference between the codes, the core exit coolant node for NALAP has a lower average temperature than the DEMO counterpart.

v) The lower and upper axial blankets are modeled by one "metal" node and one sodium coolant node each. The "metal" node apparently denotes the depleted UO_2 blanket material and stainless steel structure, although this is not clear from the description given in WARD-D-0005.

iv) The radial blanket, which generates approximately 8% of the total power, is represented by an average channel of five axial nodes and four radial nodes (two fuel nodes, and one clad node and one coolant node). The radial power distribution for the blanket assumes that 50% of the heat generation is in each of the radial blanket pin nodes and that no power is generated in the clad, coolant or structure.

vii) A phenomenological model is presented for simulating the possible stratification of coolant flow in the upper or outlet plenum as a result of a thermal transient. This mixing of hotter sodium with a jet of cool sodium in the outlet plenum is under active study at this time. (16,17)

viii) The hot and peak channel temperatures are computed from the heat equation as follows:

- Appropriate hot or peak channel "factors" are introduced into the heat generation terms and flow terms for the average channel.
- The relevant thermal conductivities depend on the hot or peak channel temperature.
- However, the net power generation is determined by the average channel behavior and the core is modeled by a single channel only.

ix) Perfect mixing of temperature is assumed for the inlet plenum.

- x) There is no heating of the coolant that comprises the bypass
- xi) The fractions of flow through the core, blanket and bypass are assumed fixed for all flow rates. This may not be true for the CRBR.
- xii) The heat conductance of the gap between the fuel and cladding is taken to be a fixed constant in each axial node of the core. In the radial blanket, it is further assumed that the gap conductance is independent of the axial position of the node. NALAP utilizes a variable, temperature dependent, gap conductance.

(2) Primary Heat Transport System

A. Coolant Flow

i) The coolant is assumed to be a single-phase, mechanically incompressible fluid which can undergo thermal expansion. The three piping loops are modeled by one single-loop and one double-loop. The latter accounts for twice the heat removal capacity of the former. The fact that DEMO does not model vapor phase sodium is one of the most severe limitations of this code from the point of view of an accident such as a major pipe rupture.

ii) For each vessel-piping loop, the momentum-flow equation is resolved into three spatial nodes. One node specifies the flow in the segment of piping from the vessel outlet to the pump inlet in terms of the pressure difference between the outlet plenum region and the pump inlet, a friction term and a gravitational head term. A similar flow equation is given for the total length of piping (including the IHX and check valves) between the pump outlet and the vessel inlet.

iii) A homologous pump model is used for the primary pumps. The angular momentum of the pump impeller is determined in terms of the net torque according to Newton's Law. The possible cavitation of the pumps is modeled in the code.

iv) Coolant heat transfer in the IHX is modeled in terms of a lumped parameter description with forty-six axial heat transfer nodes for the primary coolant. The radial nodalization of the IHX specifies one node for the primary coolant, one node for the secondary coolant, one node for the metal wall between the coolants and one node for the shell-side of the IHX.

v) Check valves are modeled in terms of prescribed pressure drops.

vi) In order to simulate a rupture (or leak) of the primary piping, DEMO solves the flow equations for vessel-to-break flow and pump-to-break flow. For an orifice pipe rupture, a discharge coefficient or frictional resistance at the break location is introduced in the expression for the pressure against the vessel-to-break flow. Unlike the present leak model utilized in NALAP, DEMO does not model a double-ended pipe rupture as an orifice rupture with area equivalent to the pipe cross section.

vii) The filling of the guard vessel as a result of a pipe rupture is also modeled by DEMO. When the coolant fills the guard vessel to the elevation of the break in the piping, impedance to further flow from the break is described by the resultant static pressure head.

(3) Intermediate Heat Transport System

The modeling of the intermediate sodium loop is similar to that of the primary system. Pumps are modeled similarly and the flowing sodium is modeled as an incompressible, one-dimensional fluid.

(4) Steam Generator System

Heat transfer and fluid flow through evaporators, superheaters, the steam drum and turbine are modeled in varying degrees of sophistication. Two options exist for the modeling of the steam generator system. One of these, which is selected on input to the code, allows for a more detailed description of a blowdown accident in the water/steam system.

A simulation of the auxiliary feedwater system of the steam generator auxiliary heat removal system is contained in the code.

III.B. Modification of DEMO

In this study, it was found that the input data set required to perform calculations with DEMO was cumbersome and inflexible. A further inconvenience of DEMO was that the output was not as easily readable as was desirable. This lack of readability could retard the analysis of the resulting code calculations.

The input data set for DEMO is cumbersome and inflexible for five reasons. The first reason is that some of the input variables are poorly named because they are not mnemonic variables. Secondly, the order of inputting, although not haphazard, does not facilitate small modifications of the input data set. The third reason is that DEMO is quite inflexible with respect to nodalization. Fourthly, DEMO requires a fixed number, usually larger than necessary, of data points needed to specify a given input parameter curve. The fifth (and most important) reason for the inflexibility of the DEMO input data set is the required inputting of initial condition data. This initial condition data is in some cases quite voluminous and difficult to compute by hand. This initial condition data must also be changed every time there is a modification of the reactor geometry or operating conditions.

For the reasons outlined above, modifications to the DEMO code, as obtained from WARD, were made at BNL. The modified version is denoted as DEMO3 in this report. The version obtained from WARD is denoted as DEMO2. DEMO2 has been used in conjunction with Revision 3 of WARD-D-0005.⁽¹⁵⁾ These versions of DEMO refer to those versions that are operational at BNL (an earlier "DEMO1" version is not presently operational at BNL).

(1) Difference in the Required Input Data Set

A detailed description of the differences between the input data set required by DEMO3 and that required by DEMO2 is illustrated in Appendix A. This appendix consists of pages that are inserted into a DEMO2 user's manual to convert it into a DEMO3 user's manual.

Some important features of these modifications to the DEMO2 data set should be mentioned. In the input to the REACTOR subroutine the names of certain of the parameters have been changed to facilitate the

recognition of their function in DEMO3. Also, it can be seen that the order of data inputting is improved. Parameters that are closely related to each other are inputted on nearly sequential data cards. This is shown in the REACTOR subroutine. The reactor vessel geometry is described in one large set of cards while the neutronics are described by another intermediate heat exchangers is now variable and nodalization studies are now possible. The option exists for up to 25 axial nodes in the core and blanket and 46 nodes in the intermediate heat exchangers. The number of data points required to specify the decay heat curve and the insertion of failure of control rods is now variable as well.

The major change in the input data set required by DEMO3 is that one does not specify the initial temperature distribution required by the REACTOR and SIHX1 subroutines. These temperature distributions are calculated by the new subroutines RODIC and SIHXIC. This will be discussed in some detail in the following subsections.

(2) Difference in the Output Format

The output of DEMO3 is more easily readable than the output of DEMO2. Certain control variables are now available to allow the suppression of undesired output. Also the output from the REACTOR and SIHX1 subroutines is more clearly labeled and is presented in a more orderly fashion. In order to illustrate these modifications, the listing of a DEMO3 output is included in Appendix B1. This listing can be compared to Appendix B2 wherein a listing of DEMO2 output is included. Both listings include the input data verification and the results for one time step.

(3) Initialization of the Subroutine REACTOR

The modification of DEMO such that steady state initial conditions for the specified configuration and operating conditions are computed by the code is necessary in order to make DEMO into a useful, flexible system transient code. Although DEMO2 receives steady state initial conditions from the input data set, this method is far too cumbersome and

inflexible to be useful except for a limited range of calculations. This portion of the data set is too cumbersome because it requires, for a case using five axial nodes, the inputting of 125 values of the steady state temperatures (for a case using 20 axial nodes 470 values of the steady state temperatures are required). This method is inconvenient because any change in configuration or operating conditions (e.g. a change in geometry, burn-up, power level or flow rate) necessitates the changing of this entire data set.

The REACTOR subroutine in DEMO is responsible for the calculation of temperatures of the reactor core, blankets and plena. It also computes the reactivity from these temperatures and calculates the power level.

The time-dependent heat transfer equations associated with heat transfer processes in the core, blankets and plena are given in the REACTOR subroutine as well as the equation set of WARD-D-0005. In order to obtain the steady state, the time derivatives of the temperatures were set equal to zero and the (coupled) equations were solved for the appropriate temperatures. These calculations were done with a new subroutine, RODIC, which has been interfaced with the DEMO code.

(4) Initialization of the Subroutine SIHX1

Another subroutine in DEMO2 that requires a voluminous amount of initial condition data is SIHX1. This subroutine requires the specification of 274 initial temperatures for a heat exchanger represented by 46 axial nodes. The calculation of this temperature distribution for every computer calculation for which there is a change in the operating condition of the reactor involving the primary or secondary loop flow-rate or power level is extremely tedious to do by hand.

The calculation of the initial temperatures required by SIHX1 is performed by the new subroutine SIHXIC. This subroutine uses a functional relationship, derived from first principles considerations, between the axial position in the heat exchanger and the required tempera-

tures. The exact parameters in this functional relationship are computed using the operating conditions of the reactor and geometric configuration of the intermediate heat exchanger.

(5) Further Modifications of DEMO

Another improvement of DEMO3 over DEMO2 is the modeling of a hot channel in the radial blanket. This modeling is similar to that of the modeling of the hot channel in the core and requires the inputting of three blanket hot channel factors.

Another modification of the code was the modification of the flux-pressure scram function to a form specified in Appendix E of the PSAR.⁽⁹⁾ This is explained in the PROTSYS part of the DEMO3 manual presented in Appendix A. This modification was also implemented in the DEMO2 calculations, discussed in this report.

III.C. Input Data Set for DEMO

All the calculations in this report were made with the CRBR initially operating with three intact coolant loops and at full power. These operating conditions are compared with other operating conditions of interest in Table III-1. From this table, it is easily seen that the present operating conditions are very similar to plant thermal and hydraulic design values except that the inlet and outlet sodium temperatures have been increased by 20.5°F.

The input data set for the calculations using DEMO2 was obtained from basic design information obtained directly from Westinghouse⁽¹⁹⁾. The given initial condition data was apparently obtained by estimating the initial conditions and then allowing the code to run until an approximate steady state was obtained. This initial condition data is applicable only to the configuration and operating conditions associated with the plant configurational data. The DEMO2 input data set uses a BOEC core to describe the neutronics and power distribution. Only two parts of this

Table III-1 Initial Conditions for the CRBR

	<u>Plant T & H Design Values</u>	<u>Plant Expected Operating Values</u>	<u>Present Calculations</u>
Reactor Power, MW _t	975	975	975
Inlet Temperature, °F	730	716	750.5
Outlet Temperature	995	965	1015.5
Primary Coolant Flow lbm/sec	11512.8	12234.4	11526.0

data are different (modified at BNL) from the data originally provided by WARD. A different decay heat curve has been substituted and the flux-pressure scram function data has been made compatible with the new form of the scram function given in Appendix E of the PSAR.⁽⁹⁾ This input data set is listed in Appendix C2 of this report and can be interpreted with the aid of a DEMO2 manual.

The input data set for DEMO3 is derived as much as possible from information obtained in the PSAR. This was checked against the data provided in the DEMO2 data set. The PSAR data was also used to obtain the proper power distributions, control rod worths, and nucleonics for an EOE core, which was used in the DEMO3 calculations. However, the PSAR data was, at times, incomplete or ambiguous and therefore data was also obtained from the DEMO2 input set. The source of the input data set is broken down in Table III-2. The input data set for DEMO3 is listed in Appendix C1 and can be interpreted with the aid of a DEMO3 manual. The characters in columns 70 through 80 are not read by the computer but are provided to help the user.

III.D. NALAP (MOD62)

In order to obtain a perspective for the results of the DEMO code, independent calculations with another systems transient code would be useful. The system transient code available at BNL is NALAP (MOD62),⁽¹²⁾ which is a modification of RELAP3B⁽¹³⁾ made by replacing water properties and its associated heat transfer correlations with those for sodium and including an option to allow for two dissimilar fluids.

Since the primary use of DEMO and NALAP (MOD62) in this report

(1) Differences Between NALAP and DEMO

is a modification of code written for water-cooled reactors, there exists a number of differences between them.

Since the primary use of DEMO and NALAP (MOD62) in this report will be to analyze the thermal transient produced by various pipe ruptures,

Table III-2 Sources of DEMO3 Input Data Set

<u>Subroutine</u>	<u>Source of Data</u>
Run Control	H. C.
CONTROL	DEMO2
REACTOR	PSAR
POLATE1	PSAR
POLATE2	PSAR
RODFAIL	PSAR
SIHX1	DEMO2
STGEN	DEMO2
NATURL	DEMO2
VOLEX	PSAR & H. C.
FLOCD3	PSAR & DEMO2
RUPTURE	DEMO2
PROTSYS	DEMO2 (Verified in PSAR)

Initial Condition Data

CONTROL	DEMO2
STGEN	DEMO2
VOLEX	H. C.
FLOCD3	DEMO2
PROTSYS	DEMO2

H. C. = data calculated from diagrams or blueprints by hand.

Table III-3

Glossary of Symbols

A_L = leak area (ft^2)

C_D = discharge coefficient

g = acceleration of gravity (ft/sec^2)

h = height of sodium in the guard vessel above the rupture (ft)
 $h \geq 0$ at all times

K_{CBR} = friction coefficient for the pressure drop from a reference point depending on break location to the break. ($\text{lbs}/(\text{lbs}/\text{sec})^2$)

K_{CDA} = friction coefficient for the pressure drop across the break ($\text{lbs}/(\text{lbs}/\text{sec})^2$)

$\left. \frac{\ell}{A} \right|_r$ = flow inertance to the break (ft^{-1})

P_v = vault pressure in the guard vessel (lbs/in^2)

P_p = pressure in plenum or pipe where break occurs (lbs/in^2)

W_ℓ = coolant flow through the break to the guard vessel (lbs/in^2)

ρ = density of sodium (lb/ft^3)

the leak modeling used in both codes are compared. The leak model used by DEMO is:

$$\frac{L}{A} \left|_r \frac{dW_L}{dt} = P_p - P_v - (K_{CBR} + K_{CDA}) \right| W_L \left| W_L + h \rho g \right. \quad (D1)$$

where the notation is explained in Table III-3. The leak model in NALAP (MOD62) neglects the time derivative of the through-leak flow. Thus,

$$W_L = C_D A_L \sqrt{2 \rho g (P_p - P_v)} \quad (D2)$$

where the notation is explained in Table III-3. It can be seen from Equations (D1) and (D2) that the leak model in DEMO more general than the steady state model used in NALAP (MOD62). The treatment of the through-leak flow is important because the transient response of the lower plenum pressure, and the through-core coolant flow are dependent on it.

As was noted in a previous subsection, one of the differences between NALAP (MOD62) and DEMO is the difference in time-stepping schemes. In DEMO, an explicit time-stepping scheme is used. This explicit time-stepping scheme uses a time step of .001 seconds in the RUPTURE subroutine. In NALAP, the time-stepping scheme requires very small time steps ($\Delta t_{N1} = .0001$ sec, normally) and even smaller time steps immediately after the rupture ($\Delta t_{N2} = .00001$ sec). These smaller time steps substantially increase the computer running time required by NALAP (MOD62) to perform the calculations.

A further difference between the two codes is the different methods used to calculate sodium properties. Sodium properties are calculated from functions in most cases in DEMO. In NALAP (MOD62) the method results from the fact that NALAP is really a modified water-reactor code. This method involves the searching of a sodium properties table and the interpolation of these properties to the proper values. This method is far more computer time consuming than the simple evaluation of functions done in DEMO and also leads to difficulties in getting NALAP (MOD62) to run. The difficulties arise from the fact that sodium thermodynamic

properties are computed at thermodynamic equilibrium. After the opening of a leak at large leak area, the sodium in the volumes near the leak is not going to be near thermodynamic equilibrium. Therefore the sodium in these volumes may be out of the range of convergence of the sodium properties table and NALAP (MOD62) will fail to find the proper sodium properties and the code will abort. This effect helps to substantially reduce the maximum allowable time step at times soon after the break and to create difficulties in running the code.

(2) The NALAP (MOD62) Input Data Set

The input data set for NALAP (MOD62), presented in Appendix C3, models the CRBR as 23 control volumes connected by 28 junctions (see Diagram 1). The pipe rupture is modeled by 2 leaks that open simultaneously when the rupture is initiated. Also in this calculation a MOD0 or dump heat exchanger was used to model the intermediate heat exchanger.

The main source of the input data set for NALAP (MOD62) was the PSAR.⁽⁸⁾ A secondary source of data was the input data set of DEMO2.⁽⁷⁾ There were several deficiencies in the available data. Pressure drops for the primary piping often yielded very small friction coefficients and were in conflict with those predicted in DEMO2. Accurate pump parameters were not given and the units used for some input parameters were ambiguously defined. However, the input data set used for the NALAP (MOD62) calculations, although not perfect, is quite adequate in view of the level of modeling of the code.

CRBR NALAP MODEL

Diagram 1

IV. Accident Analysis

IV.A. The Worst-Case Accident

Among the spectrum of accidents postulated to occur in a sodium-cooled fast reactor, the double-ended pipe rupture at the reactor vessel inlet, with or without scram, can result in severe consequences and warrants investigation. This accident will be analyzed in detail in order to illustrate important features of the transient response of the CRBR as it is simulated by the DEMO code. Comparisons with the simulation by the NALAP code are made in a following subsection of this report.

The severity of the thermal transient produced by a double-ended pipe rupture is shown by examination of Figure 1, which is a graph of the hot channel sodium temperature and saturation temperature versus time for Case 2. (See Section III.C for a description of this case). In this case, even though the reactor is scrammed by the first protective function (under the assumption that the plant protection system operates according to design), it is found that a maximum hot channel sodium temperature of 1994.6°F results. This temperature is well above the saturation temperature of sodium at the reactor core exit.

As was noted earlier, DEMO does not take into account the phase change of liquid sodium when its temperature exceeds saturation. It should be noted that the results presented in this report for the sodium temperature above its saturation point are not quantitatively correct. Nevertheless the code was allowed to run beyond the time at which the saturation temperature was exceeded. Thus, although the maximum temperature above saturation and the estimated duration of boiling should not be taken literally, the data does give (for the transients studied in this report) a measure of the heat flux from the fuel pins during the transient.

The long boiling period (5.5 seconds) indicated for Case 2 suggests that cladding dryout, melting and relocation are distinct possibilities. Furthermore, it should be noted that the effects of fission product gases on fuel pin failure, particularly for this EOEC case, are not modeled in DEMO at all.

FIGURE 1: Case 2 Boiling Time Determination

The cause for the severity of this transient is illustrated by Fig. 2, which shows the lower plenum sodium pressure, P_L , for two cases. Case 1 is the normal scram (upper curve) and Case 2 is the double-ended pipe rupture (lower curve). From this graph, it is seen that, immediately after the pipe rupture occurs, the lower plenum pressure falls over 110 lbs/in^2 , from 147 lbs/in^2 to approximately 36 lbs/in^2 . Since it is the pressure difference between the lower plenum and the upper plenum that determines the sodium flow-rate through the core, this large decrease in P_L causes a substantial decrease in sodium flow-rate through the core, W_c ; this is shown in Figure 3. Immediately after the pipe rupture occurs, the sodium flow-rate through the core, W_c , decreases rapidly from its normal operating value of W_{co} to $.26 W_{co}$. One then can observe from Figure 3 that W_c then recovers slightly to $.30 W_{co}$ due to the fact that pumps of the intact primary loops speed up. During this short time period, the reactor has not yet tripped and the power is, in fact, increasing from its rated value, P_o , to 115% of the rated power due to the effects of the sodium density expansion reactivity. In this calculation, the sodium density expansion reactivity coefficient for each axial core node was scaled up by a factor of ~ 3.7 from the values presented in Ref. 15. This scaling, which is conservative for this accident, is based on the sodium density reactivity coefficients presented in Table 4.3-11 of Ref. 8 but it is, in essence, an ad hoc sensitivity study. The calculation was also carried out with the reactivity coefficients given in Ref. 15. In this case, the overpower was 2% and the maximum core hot channel temperature difference was less than 3°F for the two cases.

From Figure 3, one can see that before the reactor scrams and the control rods start shutting down the reactor there is a gross power-to-flow mismatch which manifests itself in increasing sodium temperatures. After the reactor has been scrammed and the normalized power becomes lower than the normalized flow, the inner and outer fuel nodes start to cool by transferring heat to the cladding and coolant thereby causing the temperatures of these nodes to rise (see Figure 4). Figure 4 also shows that there is a large heat flux, radially outward, from the fuel nodes to the clad and coolant during the first few seconds of the transient. Figure 4 shows that even without the sodium boiling dynamics (that should be included in more realistic analysis),

FIGURE 2: Lower Plenum Pressure as a Function of Time

FIGURE 3: Illustration of Power to Flow Mismatch in Case 2

FIGURE 4: Radial Node Temperatures at the 5th Axial Node

the clad experiences a significant thermal transient as a result of the heat flux from the fuel nodes. Although the clad remains below the steel melting temperature of 2500°F in this calculation, the possibility of clad failure as a result of this transient is difficult to rule out.

The sodium hot channel temperature continues to rise until there is a favorable ratio of heat flux to sodium flow-rate, causing a maximum in the sodium hot channel temperature to occur at 1.75 seconds, well after the primary control rods had been completely inserted. In this case, the sensor of the flux to pressure trip function is activated at 0.329 seconds after the rupture occurs.

For times greater than that corresponding to the maximum in hot channel sodium temperature, the fuel nodes and cladding nodes continue to cool at roughly the same rate as before the maximum was reached. The sodium temperature also decreases monotonically with time over the short term. There is a shoulder in the hot channel temperature curve (Figure 1) starting at around $t = 4.0$ seconds. This shoulder may be significant since it lengthens the estimated boiling time by approximately 1.2 seconds. Cladding dryout would therefore be more likely than in the case of a "shoulderless" curve. The shoulder in Figure 1 is directly related to the change in slope of the flow versus time history shown in Figure 3.

Earlier in this report it was noted that DEMO3 models both an average and a hot channel in the radial blanket. Although analysis of the thermal transient in the radial blanket hot channel is important, analysis will be restricted to the average channel in the radial blanket due to the lack of a suitable set of hot channel factors for the radial blanket at this time. A careful analysis of the radial blanket must take into account the great skew in power from the inner edge to the outer edge ⁽⁸⁾.

The temperature of the hottest sodium node in the average channel of the radial blanket, $T_{AV}^B(t)$, is plotted as a function of time, t , in Fig. 5. From this figure, it can be seen that the thermal response of the radial blanket is very different from that of the core. There is a much broader peak in $T_{AV}^B(t)$ than in the plot of the core hot channel temperature in Fig. 1. This is due

FIGURE 5: The Axial Maximum of the Blanket Average Channel Sodium Temperature

to the fact that the heat capacities (and therefore the thermal response times) of the radial blanket fuel rods are much larger than those of the core fuel rods. The larger heat capacities of the radial blanket rods will allow the radial blanket fuel rods to maintain a relatively constant heat flux to the coolant for a longer time than is possible with smaller (and therefore faster cooling) core fuel rods. It is this heat flux which causes the broad peak in Fig. 5.

The maximum average channel sodium in the radial blanket T_{AV}^{Bm} is 1134°F and is reached at 11.15 seconds after the break occurs. At this time, the saturation temperature at the pressure of the core exit is 1620°F . In order for sodium boiling to be initiated in the hot channel of the radial blanket an effective temperature-rise hot channel factor, f_{HC}^B , of 2.27 is needed. This value of f_{HC}^B is substantially larger than the effective temperature rise hot channel factor for the core $f_{HC} = 1.81$. However, from the information on hot channel factors given on p. 4.4-5 of the CRBR PSAR, it is reasonable to expect more pronounced hot channel effects in the radial blanket than in the core. For example, the nuclear radial factor is 1.430 for the core whereas it is 3.529 for the radial blanket.

IV.B. Axial Nodalization Studies of the Core and Radial Blanket

Among the modifications made to DEMO that were mentioned earlier in this report, was the fact that one could use from one to twenty-five axial nodes to represent the core and radial blanket. In DEMO2 the number of axial nodes was fixed at five. In the previous subsection, the analysis presented utilized five axial nodes. In this subsection, the effects of varying the number of axial nodes, n_c , is examined.

If one examines Table IV-2 (see Table IV-1 for a definition of the symbols), one can see that the first five cases listed in this table are identical to Case 2 except for the nodalization of the core and blanket. These results are also given in Fig. 6. From the information given in this graph and Table IV-2, it is seen that both T_{HC}^{max} and T_{AV}^{Bm} are rapidly changing for $n_c < 5$ nodes and are slowly changing for $n_c > 5$ nodes. In a recent study⁽¹⁸⁾, it was found that, for a normal scram, the equations in the REACTOR subroutine of DEMO

Table IV-1

Glossary of Symbols

A_L	= leak area (ft^2); the cross-sectional area of the cold leg piping is 2.89 ft^2 ; this value will be used to denote a double-ended pipe rupture in this report
C_{DA}	= break pressure drop coefficient ($\text{lbs/in}^2/(\text{lbs}^2/\text{sec}^2)$)
f_{HC}	= coolant enthalpy-rise scaling factor for the core
f_{HC}^B	= coolant enthalpy-rise scaling factor for the blanket
$h_g, (h_{gi})$	= fuel rod gap conductance (for the i^{th} axial node) ($\text{BTU/sec } ^\circ\text{F}$)
n_c	= number of axial nodes in the core
$P(t)/P_o$	= normalized power as a function of time
$P_L(t)$	= lower plenum sodium pressure as a function of time (lbs/in^2 , actual)
P_L	= lower plenum pressure at $t = 1.75 \text{ sec}$, the time of the maximum hot channel temperature in Case 2 (lbs/in^2 , actual)
s	= location of leak, i.e. the distance from the reactor vessel inlet along the pipe (ft.)
t_b	= time at which boiling is initiated in the hot channel of the core (sec)
Δt_b	= sodium boiling period, the minimum amount of time sodium boiling occurs under the given accident conditions (sec)

Table IV-1 (continued)

t_{sen}	= time after break when the sensor of the relevant scram function is activated (sec)
$T_{\text{AV}}(t)$	= average channel sodium temperature at the core exit as function of time ($^{\circ}\text{F}$)
$T_{\text{AV}}^{\text{Bm}}$	= maximum average channel sodium temperature in the radial blanket
$T_{\text{AV}}^{\text{B4}}, T_{\text{AV}}^{\text{B5}}$	= average channel sodium temperature at the exit of 4th, 5th axial nodes in the radial blanket
$T_{\text{HC}}(t)$	= the hot channel sodium temperature at the core exit as a function of time ($^{\circ}\text{F}$)
$T_{\text{HC}}^{\text{max}}$	= the maximum hot channel sodium temperature at core exit ($^{\circ}\text{F}$)
T_{In}	= inlet plenum sodium temperature ($^{\circ}\text{F}$)
$\bar{T}_{\text{Na5}}(t)$	= the average of the sodium hot channel temperatures of the 4th and 5th axial nodes ($n_c = 5$). Required due to the staggered nodalization used by DEMO. ($^{\circ}\text{F}$)
$T_{\text{Cl5}}(t)$	= the cladding temperature of the 5th (and exit) axial node of the hot channel ($^{\circ}\text{F}$)
$T_{\text{F1}}(t)$	= temperature of the inner fuel node of the 5th (and exit) axial node of the hot channel ($^{\circ}\text{F}$)
$T_{\text{F2}}(t)$	= temperature of the outer fuel node of the 5th (and exit) axial node of the hot channel ($^{\circ}\text{F}$)
$T_{\text{sat}}^{\text{m}}$	= saturation temperature of sodium at the pressure of the core exit of the time of the maximum in the hot channel temperature ($^{\circ}\text{F}$)

Table IV-1 (continued)

- $T_{\text{sat}}(t)$ = saturation temperature of sodium at the pressure of the core exit as a function of time ($^{\circ}\text{F}$)
- $T_{\text{F23}}^{\text{OHC}}$ = the steady state temperature of the outer fuel node of the 3rd (middle) axial node of the hot channel ($^{\circ}\text{F}$)
- W_B = sodium flow through the break to the guard vessel vault (lbs/sec)
- $W_c(t)/W_{c0}$ = normalized through-core coolant flow as a function of time
- W_c/W_{c0} = normalized through-core coolant flow at $t = 1.75$ sec

Table IV - 2 : Nodalization Studies

<u>Case</u>	<u>n_T</u>	<u>n_c</u>	<u>$A_L (ft^2)$</u>	<u>$s (ft)$</u>	<u>$T_{HC}^{max} (^{\circ}F)$</u>	<u>$\tau_b (sec)$</u>	<u>$\Delta \tau_b (sec)$</u>	<u>$T_{sat}^m (^{\circ}F)$</u>	<u>$T_{AV}^{Bm} (^{\circ}F)$</u>
2	1	5	2.89	0	1994.6 [†]	.80	5.30 [†]	1713.6	1134.33
20	1	2	2.89	0	1962.3 [†]	.80	5.40 [†]	1713.9	1102.4
21	1	7	2.89	0	2002.5 [†]	.80	5.50 [†]	1713.5	*
25	1	10	2.89	0	2008.0 [†]	.80	5.50 [†]	1713.4	1138.2
27	1	20	2.89	0	2017.9 [†]	.80	5.50 [†]	1713.1	1137.4
21	1	5	0	0	1279.9	-	-	1940.4	980.1
23	1	7	0	0	1279.9	-	-	1940.4	980.1
26	1	10	0	0	1279.9	-	-	1940.4	980.1

* not calculated due to short time specified in the computer run.

[†] these parameters have, at best, a qualitative significance since DEMO does not model vapor phase sodium.

FIGURE 6: Nodalization Studies

were insensitive to the number of axial nodes between five and twenty-five (the temperature varied by less than 1°F). This result is verified by the last three cases in Table IV-2.

Since, an increase of the number of nodes to twenty leads to only a one percent increase in the hot channel coolant temperature, the remaining calculations in this report have been done with $n_c = 5$.

IV.C. Fuel Rod Gap Conductance

One of the input parameters of DEMO that is most ambiguous in its value is h_{gi} , the fuel rod gap conductance for the i^{th} axial node. The reason for this ambiguity is that the value of the fuel rod gap conductance depends upon a wide variety of factors. Temperature, burn-up, power and cycling come into play in determining the gap conductance during steady-state operation. Furthermore there is an experimental and theoretical uncertainty in the value of h_g even if all the factors needed to determine it were accurately known. The behavior of the gap conductance during a transient is even more complicated than the steady state. As is noted on p. 4.4-16 of the CRBR PSAR, this is particularly true for an undercooling transient.

For the reasons given above, a sensitivity study was done to determine the effect that a wide variation in the value of gap conductance, h_g , has on the severity of the thermal transient produced by a double-ended pipe rupture at the reactor vessel inlet. This effect is illustrated in Table IV-3. There is a variation of 124.7°F in $T_{\text{HC}}^{\text{max}}$ as a result of a variation of a factor four in h_g . This is related to the higher steady state temperature of the fuel nodes, illustrated by $T_{\text{F23}}^{\text{OHC}}$ in the Table IV-3. This higher temperature of the fuel nodes leads to more heat transfer from the fuel rod to the coolant after the reactor is scrammed and this leads to a higher maximum hot channel sodium temperature.

The values of h_{gi} used in Case 55, were those obtained from Westinghouse⁽¹⁹⁾ in their DEMO input deck. Each value of h_{gi} was larger than .30 BTU/sec ft^2 $^{\circ}\text{F}$ and therefore $T_{\text{HC}}^{\text{max}}$ for Case 55 was smaller than $T_{\text{HC}}^{\text{max}}$ for Case 2.

Table IV - 3 Sensitivity Study: Fuel Rod Gap Conductance

For all cases in this table:

$$n_T = 1$$

$$n_c = 5 \text{ nodes}$$

$$A_L = 2.89 \text{ ft}^2$$

$$s = 0 \text{ ft}$$

$$h_{gi} = h_g = \text{Fuel rod gap conductance}$$

Double-ended pipe rupture at
reactor vessel inlet (DEPR at RVI).

Case	h_g (BTU/sec ft ² °F)	T_{HC}^{max} (°F)	t_b (sec)	Δt_b (sec)	T_{F23}^{OHC} (°F)
51	.15	2063.7 [†]	.75	8.55 [†]	3927.9
2	.30	1994.6 [†]	.80	5.50 [†]	2979.6
52	.60	1939.0 [†]	.85	3.05 [†]	2438.1
55	WARD *	1968.4 [†]	.80	4.20 [†]	2660.6

T_{F23}^{OHC} = The steady state temperature of the second radial fuel
node of the third axial node in the hot channel.

* The WARD⁽¹⁹⁾ values are:

i	h_{gi}
1	.4016
2	.4293
3	.4292
4	.4109
5	.3738

[†] these parameters have, at best, a qualitative significance since
DEMO does not model vapor phase sodium.

Thus, in this sense, Case 2, with $h_{gi} = .30 \text{ BTU/sec}^\circ\text{F}$ for all axial nodes, is more conservative in its prediction of the hot channel transient temperature.

IV.D. If The First Scram Fails

In the first part of this section, the thermal transient produced by a double-ended pipe rupture at the reactor vessel inlet, Case 2, was analyzed in detail. This accident postulates that the first scram function to be activated succeeds in initiating reactor scram and pump coastdown and that both sets of control rods, primary and secondary are inserted properly. However, as one can see from Table IV-4, more severe thermal transients can be produced if there is a failure in the plant protection system. This can occur in several ways; (e.g. reactor scram is not initiated by the earliest possible scram function; or there is a failure such that one set of control rods, primary or secondary does not insert).

In Case 12, a failure of the secondary rods to insert was postulated. The failure of the secondary control rods to insert causes a smaller negative reactivity to be inserted in Case 12 than in Case 2. The smaller negative reactivity causes a slower decrease in reactor power in Case 12 than in Case 2. This slower decrease in reactor power lengthens the estimated boiling time but does not affect the maximum hot channel sodium temperature. This is due to the fact that in Case 2, the secondary rods were inserted too late in the transient to affect the maximum hot channel sodium temperature.

A tabulation of the order in which the various scram functions initiate reactor scram and pump coastdown for a double-ended pipe rupture at the reactor vessel inlet is given by Table IV-5. This table is derived from the results of Case 17, the catastrophic case where a double-ended pipe rupture occurs at the reactor vessel inlet and no scram or pump coastdown is initiated. The results listed in Table IV-5 were obtained because DEMO lists the scram function and the times at which its setpoint was reached even though the reactor did not trip. These scram functions are described in detail in the CRBR PSAR, especially Section 7.2.

Table IV - 4a Effect of Delaying the Scram on the Thermal Transient Produced by a DEPR at RVI.

For all cases in this table:

$n_c = 5$ nodes

$A_L = 2.89 \text{ ft}^2$

$s = 0 \text{ ft}$

<u>Case</u>	<u>n_T</u>	<u>$t_{\text{gen}}(\text{sec})$</u>	<u>$T_{\text{HC}}^{\text{max}} (^{\circ}\text{F})$</u>	<u>$t_b(\text{sec})$</u>	<u>$\Delta t_b(\text{sec})$</u>	<u>$T_{\text{AV}}^{\text{Bm}} (^{\circ}\text{F})$</u>
2	1	.329	1994.6 [†]	.80	5.50 [†]	1134.3
12	1P	.329	1994.6 [†]	.80	6.70 [†]	1140.6
13	2	.561	2062.8 [†]	.80	6.90 [†]	1143.9
14	3	1.575	2314.6 [†]	.80	9.95 [†]	1184.9
15	6S	4.10	3106.8 [†]	.80	15.00 [†]	1298.8

P = primary rods only

S = secondary rods only

[†] these parameters have, at best, a qualitative significance since DEMO does not model vapor phase sodium.

Table IV - 4b Effect of Delaying the Scram on the Thermal Transient Produced by a DEPR at RVI. (Average and Peak Channel responses)

<u>Case</u>	<u>n_T</u>	<u>$T_P^{\max}$ ($^{\circ}\text{F}$)</u>	<u>$T_{AV}^{\max}$ ($^{\circ}\text{F}$)</u>	<u>t_b^P (sec)</u>	<u>Δt_b^P (sec)</u>
2	1	1718.4 [†]	1380.0	1.50	.30 [†]
12	1P	1718.4 [†]	1380.0	1.50	.30 [†]
13	2	1777.5 [†]	1416.2	1.20	1.10 [†]
14	3	1988.2 [†]	1550.3	1.20	5.70 [†]
15	6S	2643.9 [†]	1961.5 [†]	1.20	12.50 [†]

$T_P^{\max}$ ($^{\circ}\text{F}$) = the maximum peak channel sodium temperature at the core exit

$T_{AV}^{\max}$ ($^{\circ}\text{F}$) = the maximum average channel sodium temperature at the core exit

t_b^P (sec) = time at which boiling is initiated in the peak channel

Δt_b^P (sec) = duration of sodium boiling in the peak channel

[†] these parameters have, at best, a qualitative significance since DEMO does not model vapor phase sodium.

Table IV - 4c Effect of Delaying the Scram on the Thermal Transient Produced by a DEPR at RVI. (Nodal Temperature distribution)

t = .80 sec

<u>Case</u>	<u>n_T</u>	<u>T_{F1} (°F)</u>	<u>T_{F2} (°F)</u>	<u>T_{C15} (°F)</u>	<u>T_{Na5} (°F)</u>
2	1	4397.1	3118.6	1588.7	1507.8
12	1P	4397.1	3118.6	1588.7	1507.8
13	2	4505.2	3221.2	1598.5	1515.2
14	3	4509.1	3225.1	1598.7	1515.3
15	6S	4509.1	3225.1	1598.7	1515.3

t = 2.0 sec (Same as above except at two seconds after pipe rupture occurs)

2	1	3635.9	2589.3	1503.6	1424.7
12	1P	3635.9	2589.3	1503.6	1424.7
13	2	3843.1	2750.5	1566.4	1480.9
14	3	4831.9	3594.7	1802.7	1689.3
15	6S	4913.4	3672.8	1809.7	1694.0

Table IV - 5

Scram Functions and Their Order of Initiation of Scram.

Case 17 $A_L = 2.89 \text{ ft}^2$
 $s = 0 \text{ ft}$
 $n_c = 5 \text{ nodes}$

<u>n_T</u>	<u>$t_{sen} \text{ (sec)}$</u>	<u>Function</u>	<u>Control Rod Set</u>
1	.329	Flux to Pressure	P
2	.561	Total Flux Trip	P
3	1.575	Pump Speed Ratio L - Loop	P
4	1.968	Pump Speed Ratio S - Loop	P
5	2.874	Reactor Level Trip	P
6	4.10	Flux to Total Flow	S
7	5.64	Flow Ratio Trip S- Loop	S
8	5.70	Flow ratio Trip L- Loop	S

One can easily see from Table IV-4 and Figure 7, that as a number of trip functions bypassed increases, so does the severity of the thermal transient predicted. This trend is illustrated by comparing the transients resulting from Case 2 ($n_T = 1$) and Case 14 ($n_T = 3$). From these two cases, one can see that by delaying the initiation of reactor scram by approximately 1.20 sec, the severity of thermal transient is increased greatly, with an increase in T_{HC}^{max} of 320°F and an increase in Δt_b of 4.45 sec.

In Case 15, it was postulated that the primary plant protection system had failed and the reactor would remain unscrammed until a trip function associated with the secondary plant protection system was activated. Unfortunately, the first five scram functions (simulated by DEMO) activated were associated with the primary plant protection system. The sixth scram function activated, the flux-to-total flow function, was the first function able to initiate reactor scram and pump coastdown. The bypassing of 5 scram functions delays the initiation of scram greatly and the resulting thermal transient is very severe with $T_{HC}^{max} = 3106.8^\circ\text{F}$, a boiling time, Δt_b , of 15 sec., and $T_{AV}^{Bm} = 1293.8^\circ\text{F}$. The severity of this thermal transient can be further illustrated by the fact that sodium boiling occurs in the peak channel and the average channel as well as the hot channel. An accident of the type postulated in Case 15 would certainly lead to effects that are beyond the scope of DEMO to calculate.

IV.E. The No-Scram Case

Earlier in this section we examined the thermal transient produced by a double-ended pipe rupture at the reactor vessel inlet when the primary plant protection system fails, Case 15. We shall now examine what happens in such an accident with both the primary and secondary plant protection systems fail. Clearly, it is beyond the capability of DEMO to model the consequences of this transient with much accuracy. Nevertheless, it is interesting to record the predictions of the code itself in this case. In Figure 8, $T_{HC}(t)$, calculated in Case 2, is compared with $T_{HC}(t)$ for Case 17. DEMO does not model the positive sodium void reactivity but does take into account the sodium density expansion reactivity in the liquid phase.

FIGURE 7: Comparison of Sodium Hot Channel Temperatures

FIGURE 8: Comparison of Sodium Hot Channel Temperatures for 2 Cases

In Table IV-6, times of phase transitions, sodium boiling, clad melting and fuel melting are tabulated for each of the four channels. For the purpose of this table, initiation of clad melting occurs when the temperature of one of the cladding nodes exceeds 2500°F . Similarly, the initiation of fuel melting occurs when one of the fuel nodes exceeds 5012.6°F .

One can see from Table IV-6 that each phase transition occurs for all 3 core channels for Case 17. However, due to positive reactivity insertions resulting from cladding melting, the results of Case 15 and Case 17 could be considered to have little validity after 4.70 sec, the time of initiation of clad melting in the peak channel. In Case 2, sodium boiling occurs in the hot channel and it also occurs very briefly in the peak channel. However, clad melting, per se, and fuel melting are not predicted by DEMO3. In summary, from Table IV-6, it is seen that if a double-ended pipe rupture at the reactor vessel inlet occurs and the reactor fails to scram using the primary plant protection system, the resulting thermal transient is significantly more severe than the worst case accident, Case 2.

IV.F. Effect of Break Location

The change in the severity of the thermal transient with s , the distance of the location of the break in the pipe from the reactor vessel inlet is studied. In this study, the check valve was assumed to be failed in the open position.

In order to explore the effect of the break location on the severity of the thermal transient, DEMO calculations were made at various values of s . The results of these calculations are shown in Table IV-7 and Figure 9. The saturation temperature at the core exit pressure at the time of the maximum in $T_{\text{HC}}(t)$ is also shown. In Figure 9, it is seen that sodium boiling occurs for any break location within 76 ft. of the reactor vessel inlet.

In Figure 10, the thermal transient produced by a double-ended pipe rupture at $s = 80$ ft. is examined. From this figure one can see that the difference between $T_{\text{sat}}(t)$ and $T_{\text{HC}}(t)$ is less than 10°F near the maximum of the hot channel sodium temperature curve. If one considers the effects

Table IV - 6 Times of Phase Transitions for Various Thermal Transients

For all cases listed in this table:

$$A_L = 2.89 \text{ ft}^2$$

$$s = 0 \text{ ft}$$

$$n_c = 5 \text{ nodes}$$

<u>P P S</u>	<u>Channel</u>	<u>t_b(sec)</u>	<u>Δt_b(sec)</u>	<u>t_{cm}(sec)</u>	<u>Δt_{cm}(sec)</u>	<u>t_{fm}(sec)</u>	<u>Δt_{fm}(sec)</u>
P (Case 2)	Hot	.80	5.50	-	-	-	-
	Peak	1.50	.10	-	-	-	-
	Average	-	-	-	-	-	-
	Radial Blanket	-	-	-	-	-	-
S (Case 15)	Hot	.80	15.00	3.20	5.80	2.40	2.80
	Peak	1.20	11.90	4.70	1.70	-	-
	Average	3.30	7.90	-	-	-	-
	Radial Blanket	-	-	-	-	-	-
none (Case 17)	Hot	.80	=	3.20	=	2.40	=
	Peak	1.20	=	4.70	=	5.70	=
	Average	3.30	=	7.10	=	7.80	=
	Radial Blanket	9.70	=	-	-	-	-

t_x = time of initiation of process x

Δt_x = duration while process x occurs

b = sodium boiling cm = clad melting

fm = fuel melting

Table IV - 7 : Effect of Break Location

For all cases in this table:

$$A_L = 2.89 \text{ ft}^2$$

$$n_T = 1$$

$$n_c = 5 \text{ nodes}$$

Case	s (ft)	$T_{HC}^{max} (^{\circ}F)$	$t_b(\text{sec})$	$\Delta t_b(\text{sec})$	$T_{AV}^{Em} (^{\circ}F)$	W_c/W_{co}	$P_L(\text{lbs/in}^2)$
2	0	1994.6 [†]	.80	5.50 [†]	1134.3	.297	35.57
3	20	1865.2 [†]	1.00	2.00 [†]	1104.4	.352	40.17
4	30	1812.6 [†]	1.20	1.40 [†]	1091.1	.378	42.60
5	50	1767.7 [†]	1.60	1.20 [†]	1086.0	.379	42.73
6	60	1754.4 [†]	1.70	1.00 [†]	1086.1	.384	43.25
7	80	1728.6	-	0	1085.9	.400	44.67
8	100	1665.4	-	0	1073.0	.430	49.81
9	130	1642.9	-	0	1072.7	.470	52.13
10	160	1622.1	-	0	1072.1	.494	54.95

[†] these parameters have, at best, a qualitative significance since DEMO does not model vapor phase sodium.

FIGURE 9: Effect of Break Location on the Severity of the Thermal Transient

FIGURE 10: Case 7 Near Boiling in the Hot Channel

of nodalization and possibly small errors or uncertainties in the input data set or the code itself, 10°F is not a significant temperature difference between the saturation temperature and the sodium temperature. It can also be seen from the two curves in Figure 10 that the minimum temperature difference does not occur when the hot channel sodium temperature is at its maximum value.

Fig. 9 should be compared with Fig. E.3-1 of Appendix E of the CRBR PSAR. In the latter figure, the crossing of the transient temperature and the saturation temperature occurs at approximately 40 ft. from the reactor vessel inlet.

The reason for the discontinuity in both the curves in Fig. 9 is the presence of a check valve at $s = 88$ ft. The transient temperature slopes downward with increasing s because as the break moves farther from the reactor vessel inlet, the pressure drop from the lower plenum to the break location increases. This increases the lower plenum pressure after the break (see Fig. 11) and therefore implies greater coolant flow through the core and a milder thermal transient. The check valve at 88 ft. increases the lower plenum-to-break location pressure drop further and therefore decreases the severity of the thermal transient even further.

From these results it can be concluded that the pipe break location producing the most severe thermal transient is at the reactor vessel inlet. One further concludes from these results that sodium boiling is initiated in the hot channel for a double-ended pipe rupture at any location between the reactor inlet and a distance of 76 ft. from it.

IV.G. Orifice Rupture Studies

In this subsection, the results of analysis of the thermal transient produced by an orifice rupture (less than double-ended) in the CRBR is presented. In this analysis, it is assumed that the orifice rupture occurs at the reactor vessel inlet and that the first trip function applicable (under designed operating conditions) will scram the reactor.

FIGURE 11: Effect of Break Location on Lower Plenum Pressure at $t = 1.75$ sec After the Break

The results from this series of calculations are shown in Table IV-8 and Figure 12. From these results it can be seen that an orifice rupture with $A_L \geq 2.20 \text{ ft}^2$ leads to sodium boiling in the hot channel. It is noted, however, that for $A_L = 2.80 \text{ ft}^2$, the resulting thermal transient is significantly milder than that resulting from a double-ended pipe break. Similarly, the orifice rupture for $A_L = 2.89 \text{ ft}^2$ leads to a less severe transient than the double-ended rupture.

The reason for this difference is that modeling of the pressure drop across the rupture in the case of an orifice rupture is different than that of a double-ended pipe rupture. In an orifice rupture the pressure drop across the rupture includes a term of the form

$$C_{DA} w_B^2,$$

where w_B is the flow-rate through the rupture to the guard vessel and C_{DA} is a coefficient related to the flow discharge and is dependent upon A_L . In a double-ended pipe break this pressure drop term is not included because the model of this (essentially guillotine) rupture treats the flow as that arising from two independent pipes. Therefore the lower plenum pressure is decreased for this case relative to that for a single orifice rupture at $A_L = 2.89$. This decrease in lower plenum pressure leads to a corresponding decrease in sodium flow through the core. This, in turn, increases the severity of the thermal transient. This effect is illustrated in Table IV-8.

IV.H. Calculations for BOEC Cases

The results of a series of initial calculations with DEMO2 are shown in Table IV-9 and in Figure 13. A comparison of the results from calculations using DEMO2, DEMO3 and NALAP (MOD62) for the CRBR are shown in Figure 13. The NALAP (MOD62) results will be discussed in the next subsection while the results from DEMO2 and DEMO3 will be compared in this subsection.

It can be seen from Figure 13 that the thermal transients predicted by DEMO2 are somewhat different than those predicted by DEMO3. This disagreement is caused in part by the differences in axial power distribution in the core described in the input data set of DEMO2 (BOEC) and

Table IV - 8: Orifice Rupture Studies

For all cases in this table:

$$n_T = 1$$

$$n_c = 5$$

$$s = 0$$

Case	A_L (ft ²)	T_{HC}^{max} (°F)	t_b (sec)	Δt_b (sec)	T_{sat}^m (°F)	P_L (lbs/in ²)
2	2.89	1994.6 [†]	.80	5.50 [†]	1713.6	-
30	2.80	1818.5 [†]	.90	1.20 [†]	1746.8	44.12
31	2.60	1800.7 [†]	1.00	.90 [†]	1750.1	45.32
32	2.40	1780.3 [†]	1.00	.60 [†]	1754.0	46.78
32A	2.00	1731.8	-	-	1766.6	50.93
33	1.80	1702.1	-	-	1773.9	53.82
34	1.40	1631.8	-	-	1796.0	62.57
35	1.20	1585.5	-	-	1810.5	69.12
36	1.00	1526.9	-	-	1829.3	78.10
38	.75	1482.5	-	-	1834.4	76.42
37	.50	1444.9	-	-	1845.3	87.07

[†] these parameters have, at best, a qualitative significance since DEMO does not model vapor phase sodium.

FIGURE 12: Comparison of T_{sac}^m and T_{HC}^m as a Function of Leak Area, A_L

Table IV-9 Calculations Using DEMO2

For all cases in this table:

$$A_L = 2.89 \text{ ft}^2$$

$$n_T = 1$$

$$n_c = 5$$

Case	s (ft)	T_{HC}^{max} (°F)	t_b (sec)	Δt_b (sec)	T_{AV}^{Bm} (°F)	W_c / W_{co}	P_L (lbs/in ²)
11B	0	1972.0 †	.80	7.30 †	1050.6	.303	34.20
12B	20	1885.2 †	1.00	3.60 †	1027.3	.310	35.02
13B	30	1825.0 †	1.20	2.30 †	1014.6	.336	36.92
14B	50	1737.3 †	1.80	.40 †	1001.5	.379	39.66
15B	60	1720.1	--	--	1001.3	.387	40.95
16B	80	1686.7	--	--	1000.7	.401	42.58
17B	100	1632.8	--	--	991.6	.455	47.05
18B	130	1604.0	--	--	990.9	.480	49.42
19B	160	1579.6	--	--	990.1	.507	52.19

† these parameters have, at best, a qualitative significance since DEMO does not model vapor phase sodium.

FIGURE 13: Comparison of Results from DEMO2, DEMO3, NALAP (MOD62)

DEMO3 (EOEC). The major cause of this difference is the difference in flow rates predicted by the two codes. This results from a difference in the input data sets as the coolant flow is modeled identically in both codes. The differences in the DEMO2 and DEMO3 input data sets are discussed in Section III.

Despite these differences in the input data sets, the curves shown in Figure 13 for the results from DEMO2 and DEMO3 display a qualitative similarity. Both T_{HC}^{max} curves are monotonically decreasing with increasing s and both T_{HC}^{max} curves are discontinuous at the position of the check valve. However, the thermal transients predicted for $s > 30$ ft. by DEMO2 are less severe than those predicted by DEMO3. In fact, the DEMO2 results predict that sodium boiling is not initiated for thermal transients initiated by a double-ended pipe-rupture if the break occurs farther than 60 feet from the reactor vessel inlet if the first scram function is used to scram the reactor. In comparison, the DEMO3 results show that only if the break occurs more than 76 feet away from the reactor vessel inlet, then sodium boiling in the core hot channel will not occur.

IV.I. Calculations with NALAP (MOD62)

In addition to the pipe rupture accident analysis carried out with the DEMO code, system transient calculations were performed with the computer code NALAP (MOD62). The differences in code simulation modeling between DEMO and any version of NALAP are many and some of these differences were discussed in Section III.

Due to the differences in modeling, the input data set required by NALAP (MOD62) is significantly different from that used by either version of DEMO. This input data set for NALAP (MOD62) has been analyzed in Section III of this report.

The results of the NALAP calculations are shown in Table IV-10. The results associated with the variation of leak area are shown in Figure 14. The hot channel sodium temperatures at the core exit are calculated by

Table IV-10 CRBR NALAP (MOD62) Results

For all calculations in this table: $n_c = 5$

Case	n_T	A_L (ft ²)	s (ft)	T_{HC}^{max} (°F)	t_b (sec)	Δt_b (sec)	T_{sat}^m (°F)	w_c/w_{co}	P_L (lbs/in ²)
N2	1	2.89	0	1786.4 [†]	.90	*	1697.	.275	32.40
N3	1	2.39	0	1709.6	-	-	1724.	.311	36.09
N4	1	1.89	0	1630.0	-	-	1752.	.367	41.45
N5	1	1.39	0	1545.0	-	-	1784.	.438	49.43
N6	1	.89	0	1452.8	-	-	1820.	.530	61.89
N11	1	2.89	20	1623.5	-	-	1754.	.377	42.48
N12	1	2.89	40	1586.4	-	-	1764.	.406	45.68
N21	2	2.89	0	1850.6 [†]	.90	*	1688.0	.286	33.65

* Not determined due to difficulties in running the code for long times after the initiation of the break. This is due to limitations in the selection of data points in the sodium properties table in connection with the simulation of these transients by NALAP.

[†] these parameters have, at best, a qualitative significance since DEMO does not model vapor phase sodium.

FIGURE 14: Comparison of NALAP and DEMO3 Results

scaling the average channel sodium temperature-rise across the core with an effective hot channel factor, f_{HC} . The hot channel sodium temperature at the core exit is given by:

$$T_{HC}(t) = f_{HC} (T_{AV}(t) - T_{In}) + T_{In}$$

where T_{In} is the inlet plenum sodium temperature and $T_{AV}(t)$ is the average channel core exit temperature.

These results (Figure 14) show that the maximum hot channel sodium temperatures predicted by the NALAP calculations (lower, positive sloping curve) are somewhat below those predicted by the DEMO3 calculations. It is also seen that, in order to initiate sodium boiling in the hot channel, a pipe rupture with $A_L > 2.46 \text{ ft.}^2$ must occur. The DEMO3 calculations, however, predict (upper, positive sloping curve) that a break with $A_L > 2.20 \text{ ft.}^2$ will initiate sodium boiling in the hot channel. The saturation curve shown in Figure 14 is that associated with the NALAP calculation. The DEMO saturation curve (not shown) is somewhat above its NALAP counterpart.

A comparison between the results of the NALAP calculations and those from both DEMO2 and DEMO3 is shown in Figure 13. It can be seen from this figure that the transient temperatures predicted by NALAP are lower than those computed in both DEMO2 and DEMO3.

The comparative mildness of the thermal transients predicted by NALAP (MOD62) relative to those predicted by DEMO3 partially results from the larger through-core coolant flow predicted by NALAP (MOD62). This prediction of NALAP (MOD62) is illustrated in Figure 15, where, although identical accidents are modeled, the through-core coolant flow predicted by NALAP (MOD62) and DEMO3 are in gross disagreement. The arrows indicate times when the maximum hot channel sodium temperature is reached for each code.

This difference in through-core flow is the result of the difference in the leak modeling used in NALAP (MOD62) and DEMO3. This modeling is discussed in Section III* of this report.

FIGURE 13: Comparison of Normalized Through-Core Flow for Identical Cases with NALAP (MOD62) and DEMO3

It is also worth noting that, as a result of the nodalization scheme used for the NALAP core, at least thirteen axial nodes are required to obtain an asymptotic value for the core hot channel sodium temperature⁽²⁰⁾. If the simulation with NALAP had utilized thirteen axial nodes (which consequently implies much greater computer running time) instead of five nodes, the temperatures predicted by NALAP would be approximately 40° F higher. As is shown in Table IV-2, the analogous temperature change with DEMO is approximately 20°F.

IV.J. Calculations with the Parallel Design

It was mentioned in Section II of this report that a parallel design for the CRBR has been put forth by the applicant. This parallel design would consist of the addition of a pipe sleeve and a flow restrictor to the cold-leg of the primary piping. The addition of the flow restrictor to the DEMO3 input data set described earlier was not possible. Certain changes in the code itself would be required, but this has not yet been satisfactorily carried out at the time of the writing of this report. The implementation of the pipe sleeve was done by changing the data that described the reactor guard vessel in the input to the RUPTURE subroutine.

The results of these calculations are shown in Table IV-11 and Figure 16. The thermal transients, with and without the pipe sleeve present, initiated by a double-ended pipe break at the reactor vessel inlet, with scram initiated by the first scram function, are compared. The pipe sleeve helps to reduce the maximum hot channel sodium temperature, T_{HC}^{max} , the estimated sodium boiling time, Δt_b , and the maximum radial blanket average channel sodium temperature, T_{AV}^{Bm} , while raising the saturation temperature at the time of the maximum in the hot channel sodium temperature in the core. Another feature illustrated by Figure 16 is that the maximum occurs earlier in Case 50, with the pipe sleeve than in Case 2, without the pipe sleeve.

The reason for the mitigation of the thermal transient is illustrated in Figure 17. It can be seen from Figure 17 that the through-core sodium flow-rate is substantially greater for Case 50 than for Case 2 for times greater than .40 sec, when the sodium level in the pipe sleeve of

Table IV-11 Effect of Parallel Design on the Thermal
Transient Produced by the Worst-Case Accident

For all calculations in this table:

$$n_c = 5$$

$$A_L = 2.89 \text{ ft}^2$$

$$s = 0 \text{ ft}$$

Case	n_T	Rupture Input	$T_{HC}^{max} (^{\circ}F)$	t_b (sec)	Δt_b (sec)	$T_{sat}^m (^{\circ}F)$	$T_{AV}^{Bm} (^{\circ}F)$	W_c/W_{co}	P_L (lbs/in ²)
2	1	G.V.	1994.6 [†]	.80	5.50 [†]	1713.6	1134.3	.297	35.57
50	1	P.S.	1894.7 [†]	.80	1.30 [†]	1744.6	1072.2	.405	44.63

G.V. = Guard vessel

P.S. = Pipe sleeve

[†] these parameters have, at best, a qualitative significance since DEMO does not model vapor phase sodium.

FIGURE 16: Comparison of Designs

FIGURE 17: Comparison of Normalized Through-Core Flow for Different Designs

Case 50 rises to the level of the rupture. Once the sodium in the pipe sleeve immerses the rupture, resistance to flow from the break to the vessel increases. This effect increases the lower plenum pressure which increases the through-core flow.

The effect of the flow restrictor on the severity of the thermal transient can be crudely evaluated, although, as of this writing, the flow restrictor was not modeled in the code. The sodium level in the pipe sleeve reaches the flow restrictor roughly .7 sec after the pipe rupture occurs. At this time $T_{HC}(t)$ equals 1696°F, roughly 40°F below the saturation temperature and is rapidly increasing. Unless the flow restrictor can prevent a further increase in $T_{HC}(t)$ or cause $T_{sat}(t)$ to increase significantly, a possibility of the initiation of sodium boiling in the hot channel exists.

The peak and average channel responses for the two designs are also interesting to compare. Table IV-12 shows that while the peak channel temperature just exceeds the saturation temperature for the reference design, the peak channel temperature for the parallel design is approximately 100°F below saturation at its maximum in time (see Figure 18). It is also seen that the maximum average channel temperature is approximately 35°F less for the parallel design than for the reference design.

Table IV-12 Effect of Parallel Design on the Thermal Transient Produced
by the Worst-Case Accident (Average and Peak Channel Responses)

$$n_c = 5$$

$$A_L = 2.89 \text{ ft}^2$$

$$S = 0 \text{ ft}$$

<u>Case</u>	<u>n_T</u>	<u>Rupture Input</u>	<u>$T_P^{\max}$ ($^{\circ}\text{F}$)</u>	<u>$T_{AV}^{\max}$ ($^{\circ}\text{F}$)</u>	<u>t_b^P (sec)</u>	<u>Δt_b^P (sec)</u>
2	1	G.V.	1718.4 [†]	1380.0	1.50	.30 [†]
50	1	P.S.	1648.0	1344.5	--	--

[†] these parameters have, at best, a qualitative significance since DEMO does not model vapor phase sodium.

See Table IV-4b for definitions of symbols used here.

FIGURE 13: Peak Channel Temperatures for Reference and Parallel Designs

V. Summary

In this report, the thermal transient response of the Clinch River Breeder Reactor to a rupture of the primary system piping was studied. Two LMFBR system transient computer codes, DEMO and NALAP, were used extensively in this study. The CRBR core was modeled as a single, average channel. Hot (and peak) channel temperatures were computed by scaling with the engineering hot channel factors. Neither code is capable of simulating vapor phase sodium in the core. Thus, the accident analysis could not be carried beyond the initiation of sodium boiling with the codes.

The principal conclusions of this study are given in Section I.D. of this report. The highlights of those conclusions are as follows:

- (i) A protected double-ended pipe rupture leads to sodium boiling in the hot channel of the core for piping breaks along the segment from the reactor vessel inlet nozzle to a distance of seventy-six feet.
- (ii) A scram delay of more than a few seconds (after the ruptures at the vessel inlet nozzle) may lead to clad melting in the peak and hot channels as well as sodium boiling in the average channel of the core.
- (iii) The thermal transient response is dependent upon the uncertainty in the fuel-clad gap conductance.
- (iv) Under the assumption that the scram system is perfectly operative per design, sodium boiling does not occur for orifice ruptures (at the vessel inlet nozzle) with cross sections less than 2.20 ft^2 .
- (v) The thermal transient response during the first few seconds, to the protected pipe rupture accident is not sensitive to the burn-up history.
- (vi) A rather broad maximum is found in the radial blanket average channel temperature versus time history. Radial blanket hot channel analysis could not be carried out at this writing.
- (vii) If the pipe sleeve (parallel design) is present, but not the flow restrictor, then sodium boiling still occurs in

the hot channel of the core. However, the accident is noticeably less severe.

- (viii) The NALAP code systematically predicts milder transients than the DEMO code. Nevertheless, it also predicts that sodium boiling will occur in the core hot channel as a result of a protected double-ended pipe rupture at the reactor vessel inlet nozzle.

ACKNOWLEDGEMENTS

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We also thank H. H. Hummel of Argonne National Laboratory for a careful reading of the manuscript and for providing useful comments.

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APPENDIX A

DEMO3 User's Manual

In general, all formats that were originally (E15.7) have now been changed to (F12.5) or (F12.1). Other changes can be incorporated in the DEMO⁽¹⁵⁾ User's Manual by inserting the following set of addition or replacement pages. Otherwise the input data format for DEMO2 and DEMO3 are identical.

III - 4 Changes in LOGIC Array
(Addition)

LOGIC (51) = 1	Surpress printout of derivatives of temperatures calculated in REACTOR and SIHX1
LOGIC (52) = 1	Surpress printout of all variables except for columnar output
LOGIC (55) = 1	Print temperatures calculated in REACTOR
LOGIC (56) = 1	Print temperatures calculated in SIHX1
LOGIC (57) = 1	Surpress printout of variables other than those outputed from REACTOR and SIHX1

III - 13 REACTOR Input
(Replacement)

<u>Card #</u>	<u>DEMO</u> <u>Variable Name</u>	<u>Description</u>	<u>FORMAT</u>
0	ITITLE	Title Card	8A10
1 - 4	MMT(I)	region metal mass (lb)	(5F12.5,10X,A10)
	MNA(I)	region sodium mass (lb)	
	AHT(I)	heat transfer Area (ft ²)	
	HF(I)	heat transfer coefficient(BTU/Sec ft ² °F)	
	CPM(I)	metal specific heat (BTU/lb °F)	
	ANAME(I)	region description	
	I = 1	lower plenum	
	2	lower blanket	
	3	upper blanket	
	4	upper plenum	
5	MFRB	radial blanket fuel & metal mass (lb)	(5F12.5)
	MNARB	radial blanket Na mass (lb)	
	BLHO	radial blanket film heat transfer coefficient (BTU/sec ft ² °F)	
6	BLL	radial blanket length (ft)	
	BLNPIN	number of rods in radial blanket	
	NRB	number of rods in radial blanket subassembly	
7	BLR2	blanket rod inner radius (ft)	(5F12.5)
	BLR3	blanket rod outer radius (ft)	
	BLHG	blanket rod gap heat transfer coefficient (BTU/sec ft ² °F)	
	BLKCL	blanket rod cladding Thermal conductivity (BTU/Sec °F ft)	
8	V	Volume of sodium in Active core (ft ³)	(5F12.5)
9	L	length of core (ft)	(5F12.5)
	NRODS	number of rods in core	

<u>Card #</u>	<u>DEMO Variable Name</u>	<u>Description</u>	<u>FORMAT</u>
10	NCANS	number of ducts in core	(5F12.5)
	ACAN	heat transfer area of duct (ft ²)	
	XTCAN	thickness of ducts (ft)	
	NRC	number of rods/assembly	
11	R1	radius of fuel pellet (ft)	(5F12.5)
	R2	clad inner radius (ft)	
	R3	clad outer radius (ft)	
	DEQC	hydraulic diameter (ft)	
	PIDIRC	pitch to diameter ratio	
12	RW	radius of wire wrap (ft)	(5F12.5)
	PITW	pitch of wire wrap (ft rise/rev)	
13	VTOT	mixing volume in upper plenum(ft ³)	(5F12.5)
	VNOZ	mixing volume above outlet nozzle(ft ³)	
	RHONoz	sodium density at outlet nozzle(lb/ft ³)	
14	CPF	fuel specific heat (BTU/lb °F)	(5F12.5)
	RHOF	fuel density (lb/ft ³)	
15	CPL	clad specific heat (BTU/lb °F)	(5F12.5)
	RHOCL	clad density (lb/ft ³)	
	KCLAD	clad Thermal conductivity(BTU/sec °F ft)	
16	CPNA	sodium specific heat (BTU/lb °F)	(5F12.5)
	RHOS	sodium density (lb/ft ³)	
17	POW	Power (BTU/sec)	(5F12.5)
18	WREF	reference flow (lbs/sec)	(5F12.5)
19	FFCORE	flow fraction core	(5F12.5)
	FFRB	flow fraction radial blanket	
	FFBP	flow fraction bypass	

<u>Card #</u>	<u>DEMO Variable Name</u>	<u>Description</u>	<u>FORMAT</u>
20	ITITLE 1	core state description	(8A10)
21 - 26	BETA(I) POT1(I)	delayed neutron fraction group I delayed neutron decay const (sec^{-1})	(5F12.5)
27	NDECPT	number of points in decay data curve ($2 \leq \text{NDECPT} \leq 54$)	(I5)
next NECPT	TDEC(J) QDEC(J)	time of J^{th} data point fractional power at TDEC(J)	(5F12.15)
next card	FPLB FPUB FPRB FCOR	power fraction in lower blanket power fraction in upper blanket power fraction in radial blanket power fraction in core	(5F12.5)
next card	NC	number of nodes in core ($1 \leq \text{NC} \leq 25$)	(I5)
next card	BLDOP1 BLDOP2 BLDOP3	Doppler coeff. lower blanket ($\$/^{\circ}\text{F}$) Doppler coeff. upper blanket ($\$/^{\circ}\text{F}$) Doppler coeff. radial blanket ($\$/^{\circ}\text{F}$)	(5F12.5)
next NC Cards	FABL(I) (I = 1, NC)	radial blanket axial power distribution	(5F12.5)
next card	FRBL(J) (J = 1, 5)	radial blanket radial power distribution J denotes the node number	(5F12.5)
next card	FWBL FQBL FBH	blanket flow distribution hot channel factor blanket power hot channel factor blanket clad hotspot factor	(5F12.5)
next NC Cards	FA(J) DOP(J,1) DOP(J,2) DNA(J) HG(J) (J = 1, NC)	core axial power distribution inner fuel Doppler coeff. ($\$/^{\circ}\text{F}$) outer fuel Doppler coeff. ($\$/^{\circ}\text{F}$) sodium density coeff. ($\$/^{\circ}\text{F}$) gap heat transfer coeff. ($\text{BTU}/\text{Sec}^{\circ}\text{F}$)	(5F12.5)

<u>Card #</u>	<u>DEMO Variable Name</u>	<u>Description</u>	<u>FORMAT</u>
next card	FR(K)(K = 1,5)	core radial power distribution	
next card	FNRA	radial nuclear factor (assembly)	(5F12.5)
	FNRP	radial nuclear factor (Pin)	
	FMD	flow maldistribution factor	
	FOR	flow orificing factor	
	FQ	heat flux factor	
next card	FFUEL	fuel conductivity factor	(5F12.5)
	FGAP	gap conductivity factor	
	FCLAD	clad conductivity factor	
	FFILM	film conductivity factor	
	FDH	channel enthalpy rise factor	
next card	FTHETA	clad hotspot factor	(5F12.5)
next card	TIN	initial temperature at vessel inlet(^o F)	(5F12.5)
next card	DELAY	delay time for PPS (Sec)	(5F12.5)
next card	NS	initial fraction of total power	(5F12.5)
	DK	initial core reactivity (\$)	
	PVOLH	cumulative core flow (lbs/sec)	

Note: due to the inclusion of the subroutine RODIC, the data cards describing the initial conditions for the subroutine REACTOR are omitted in this version of the code. That is the data input for REACTOR described on pages III-105 - III-112 is prohibited.

III - 22 POLATE1 input data
(Replacement)

<u>Card #</u>	<u>DEMO</u> <u>Variable Name</u>	<u>Description</u>	<u>FORMAT</u>
1	ITITLE	title card	(8A10)
2	NPOL1 ($1 \leq NPOL1 \leq 20$)	number of input data points	(I5)
3 - (NPOL1 + 2)	DK(I) TT(I)	I th reactivity insertion (S) time of I th reactivity (Sec) insertion	(2F12.5)

note: if NPOL1 is negative $\rho_1^{\text{con}}(\infty) = \text{DK} (NPOL1)$

III -23 POLATE2 input data
(Replacement)

<u>Card #</u>	DEMO <u>Variable Name</u>	<u>Description</u>	<u>FORMAT</u>
1	ITITLE	title card	(8A10)
2	NPOL1 (1 ≤ NPOL1 ≤ 20)	number of input data points	(I5)
3 - (NPOL1 + 2)	DK(I)	I th reactivity insertion S	(2F12.5)
	TT(I)	time of I th reactivity (Sec) insertion	

note: if NPOL1 is negative $\rho_2^{\text{con}}(\infty) = \text{DK}(\text{NPOL1})$

III - 24 RODFAIL Input Data
(Replacement)

DEMO

<u>Card #</u>	<u>Variable Name</u>	<u>Description</u>	<u>FORMAT</u>
1	ITITLE	title card	(8A10)
2	NPOL1 ($1 \leq NPOL1 \leq 20$)	number of input data points	(I5)
3	DK(I) TT(I)	I th reactivity loss time of I th reactivity loss	(2F12.5)

note: if NPOL1 is negative then $\rho_{\text{rodfail}}^{(\infty)} = -DK(NPOL1)$

<u>Card #</u>	<u>DEMO</u> <u>Variable Name</u>	<u>Description</u>	<u>FORMAT</u>
1	ITITLE	title card	(8A10)
2	ATUBE	number of tubes	(5F12.5)
	VOL	volume of active sodium(ft ³)	
	AREAP	flow area of primary Na(ft ²)	
	ALEN	Active length (ft)	
3	ASH	area of shell(ft ²)	(5F12.5)
	XMCPSH	heat capacity of shell and stagnant sodium (BTU/°F)	
4	RIN	tube inside radius (ft)	(5F12.5)
	ROUT	tube outside radius (ft)	
	DEQP	primary side equivalent diameter(ft)	
	DEQS	secondary side equivalent diameter (ft)	
	PD	pitch to diameter ratio	
5	CPW	specific heat of wall (BTU/lb°F)	(5F12.5)
	RHOW	density of wall (lb/ft ³)	
6	FRIGI	heat transfer adjustment factor	(5F12.5)
7	NODE	number nodes in tube wall	(5I5
	NS	number of loops represented by S-Loop	
	NL	number of loops represented by L-Loop	
8	TSO	cold leg temperature secondary side (°F)	(5F12.5)
	TPO	cold leg temperature primary side (°F)	
9	WIS	initial secondary sodium flow/loop(lbs/sec)	(5F12.5)
	WIP	initial primary sodium flow/loop (lbs/sec)	

note: due to the addition of the subroutine SIHXIC the inputing of
 intial temperatures as described on pages III - 112 thru III -
 113 is unnecessary and prohibited.

III - 28
(Addition)

STGEN input data

The new input format except for the title card and those cards using integer formats originally is 5F12.1.

III - 39
(Addition)

NATURL input format

In this subroutine all E15.7 formats have been changed to F12.5 .

III - 76 PROTSYS input data
(Replacement)

Flux to Pressure trip (Card # 15 - Card # 17)

<u>Card#</u>	<u>Variable Name</u>	<u>Description</u>	<u>FORMAT</u>
15	DEM0		
	PRES $\left[\Delta P_o \right]$	pressure normalization (lbs/in ²)	(5F12.5)
	TAUF	flux sensor time constant (sec)	
	TAUPR	pressure sensor time constant (sec)	
	GAIN1 $\left[\beta_1 \right]$	flux sensor gain	
	GAINK $\left[\beta_k \right]$	pressure gain	
16	ALFA $\left[\alpha_1 \right]$	set point	
	WKP	design flow pressure drop pump exit to flowmeter (lbs/in ²)	
17	DPRSO $\left[\delta p \right]$	pressure difference used for correction	
Reactor sodium level trip			
18	TAUHL	level sensor time constant (sec)	
	GAINL	level sensor gain	
	STPTL	level set point (ft)	

The reason for changing the input format for the flux to pressure trip is that in Appendix E of the CRBR PSAR's. this scram function is

$$.213 + 3.652 \sqrt{\Delta P} - .092 - 2.857 \varphi \leq 0$$

which is represented by:

$$\alpha_1 + \beta_k \sqrt{\frac{\Delta P(t)}{\Delta P_o} - \delta p} - \beta_1 \varphi \leq 0$$

by setting $\delta p = 0$ and changing the values α_1 , β_k , ΔP_o , β , one can get the scram function given in the original version of DEMO.

III - 105
(Replacement)

REACTOR initial conditions

Due to the inclusion of the RODIC subroutine in the code, the inputting of initial condition data for the REACTOR subroutine is prohibited as these initial conditions are computed by RODIC.

III - 112

SIHX1 initial condition data

(Replacement)

Due to the inclusion of the SIHXIC subroutine in the code, the inputting of initial condition data for the SIHX1 subroutine is prohibited as these initial conditions are calculated by SIHXIC.

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BNL INPUT VERSION OF DEMO
 ALSO INPUT DATA TAKEN FROM PSARS EXCEPT WHERE NOTED
 APPENDIX 2 ASSUMPTIONS AS MUCH AS POSSIBLE

I DT
 20.0000 .1000
 5.0000 .2000
 10.0000 .5000
 20.0000 2.0000

LOGIC AFFAY 123456789012345678901234567890123456789012345678901234567890
 1*11***111*****

CONTROL DIMENSIONAL DATA

1.00000 1.00000 1.00000 1.00000
 1.00000 1.00000
 2.00000 1.00000
 5.00000 1.00000
 10.00000 1.00000
 10.00000 .02000
 5.00000 1.00000 1.00000

CORE PARAMETERS & GEOMETRY PSAR DATA

METAL	NNA	AHT	HE	CPM	
LBS	LBS	FT2	BTU/SEC FT2 F	BTU/LB F	
33575.1000	169468.8000	4801.7000	.0690	.1350	L PLENUM
6802.3000	589.4400	3013.0000	.0750	.0740	L AX BLN
6802.3000	589.4400	3013.0000	.0750	.0740	U AX BLN
19970.3000	323724.0000	1341.2400	.0690	.1350	U PLENUM
40903.9000	1262.6000		4.32000		RADIAL BLANKET

LR	NRODS	R2	R3	HG
5.3300	9150.0000	.6204	.0217	.3500

CORE GEOMETRY

VNA= 27.6620 L= 3.0000 NRODS=42966.0000
 FP= .005100 KIN= .008330 KOUT= .009580
 DE= .010070 P/D= 1.24390
 FWIPE= .002330 PITCH= .991670
 HEX CANS NO. = 190.00000 AFPA= 3.75000 DX= .010000
 NO. OF RODS/ASS. CORE= 217.0000 BLANKET= 57.0000

VTGT	VNOZ	PHCNA	UPPER PLENUM
4970.0000	873.0000	51.3000	

MATL PROP.

C2	EHD	K
.0700	609.2500	
.1300	486.3000	.1133
.3100	51.3000	

REACTOR POWER BTU/SEC

.92455E+10

REFERENCE FLOW INTO REACTOR VESS LBS/SEC

11521.0000

FLOW DIST. CORE RADIAL BLANKET BYPASS
 .0000 .1200 .0800

EOEC CORE DATA FROM PSARS

DELAYED NEUTRON GROUPS

BETA	LAMBDA (SEC-1)
.0006745	.0129000
.0037550	.0363000
.00164300	.1720000
.00130600	.3350000
.00359500	1.3400000
.00319500	3.2700000

DECAY HALF DATA

T (SEC)	P/P1
1.0000	.0869
1.0000	.0774
1.5000	.0734
2.0000	.0710
3.0000	.0675
4.0000	.0648
5.0000	.0628
6.0000	.0611
8.0000	.0584
10.0000	.0564
12.0000	.0546
14.0000	.0534
16.0000	.0522
20.0000	.0502
25.0000	.0486
30.0000	.0468
35.0000	.0456
40.0000	.0443
45.0000	.0434
50.0000	.0413
70.0000	.0400
83.0000	.0386
100.0000	.0374
143.0000	.0348
242.0000	.0313
346.0000	.0291
492.0000	.0271
701.0000	.0252
817.0000	.0243
1000.0000	.0234

POWER FRAC LE	UB	EB	CORE
.0350	.0130	.1040	.8480

BLANKET DOPPLER COEFF

LOWER	5700E-03	UPPER	17000E-03	RADIAL	12100E-02
1	.1581				
2	.2536				
3	.1784				
4	.2492				
5	.0610				

FUEL	1	2	CLAD	NA	DUCT
	.9000	.9000	0.0000	0.0000	0.0000

FHRL=	1.1103	FQOL=	1.0900	FQHS=	1.3200
-------	--------	-------	--------	-------	--------

CORE NEUTRONICS DATA

I	PIZPC	LOE COEF IN	OUT	ANA	HG
1	.1590300	.0022760	.0022760	-.0022180	.3000000
2	.2253000	.0033630	.0033630	.0022080	.3000000
3	.2434000	.0034960	.0034960	.0004330	.3000000
4	.2123000	.0026170	.0026170	.0004330	.3000000
5	.14900	.001249	.001249	-.0025300	.3000000

FUEL 1 2 CLAG HA DUCT
 .4883 .828 .111C .3060 .011C

HOT CHANNEL FACTORS

FNFA=1.3501 FNFP=1.0030 FND=1.1500 FOR=1.1000

FQ=1.1600 FEUEL=1.1000 FGAP=1.3745

FCL=1.5243 FFILH=1.5750 FOM=1.3300

FG=1.7113

REACTOR VESSEL INLET TEMPERATURE= 750.5000

P/POH= 1.0000 INIT. OK= .03004000NCUM= 0.0000

DELAY TIME = .2000

PRIMARY ROD INSERTION DATA

TIME REACTIVITY

0.0000 0.0000

.1000 .0000

.2000 .4000

.3000 2.3000

.4000 4.0700

.5000 5.2900

.6000 6.0700

.7000 6.2200

.8000 6.5000

SECONDARY ROD INSERTION DATA

TIME REACTIVITY

0.0000 0.0000

.1000 .1000

.2000 .3000

.3000 .5000

.4000 1.1000

.5000 2.7500

.6000 3.7500

.7000 4.7500

.8000 5.8000

.9000 6.2000

1.0000 6.3000

FAILURE ROD INSERTION DATA

TIME REACTIVITY

0.0000 0.0000

.1000 .1000

.2000 .2000

.3000 .3000

.4000 .4000

.5000 .5000

.6000 .6000

.7000 .7000

.8000 .8000

.9000 1.0000

INX GEOM DATA USING WAFD D=00005 DATA AND DA S.FOENAT

INX GEOM DATA

RTUBE	INX VOL	AP	INX LENGTH
2630.0000	1130.0000	20.15000	25.08000
ASHELL	HEAT CAP SHELL		
001.00000	14550.00000		

FIN	FOUT	DEOP	DEOS	P/D
.03230	.03646	.12870	.06470	1.50000
CPH = .1400	WALL DENSITY = 501.0000			

WE FUDGE WITH .8100

MS= 395.0000 WP= 3942.0000

STGEN INPUT DATA FROM HARD D=0.000

1 3 3
0 0 0 0 2
CARDS 3 THRU 6, EVAP & SUP MODUL DIMENSIONS
2.0 757.0 1.0 757.0
.0 .1 .0 .1
-1.0 -1.0 7.0 7.0
2.0 5.7 2.0 5.7
CARD 7, DRUM A-HOE VOLUMES
837.3 617.0 1360.0
CARDS 8-9, PIPING LENGTHS & ELEVATIONS
120.0 336.0 2616.0 2208.0
49.0 5.0 0.0 -13.0
SOD NODE MASSES
2.3 2.3
SOD & TURE PPOPS
.3 .1 429.0
RECIRC LOOP A TO L RATIOS
487.0 487.8
CARDS 13 THRU 16, REF VALS FOR COEF CALCS
.5 .6 .0 124.3
365.7 1.4 616.7
1766.0 1549.0 1465.0 308.3 925.0
1151.6 1470.6 904.7
CARDS 17, STGEN TIME CONSTANTS & DELAYS
.5
CARDS 18/19, DRUM LEVEL MODEL
301.0 193.0 535.0
.1 .1 .1 -0.0 17.3
CARD 20, FIT COEFS FOR FEEDWATER ENTHALPY
214.3 517.4 181.2 -481.0 309.0
CARD 21, SGHRS SYSTEM MODEL
35.0 43.0 323.5 462.0
0.0 4.0 0.0

NATURAL INPUT DATA FROM HARD D=0005

-12.93000 -5.50000 8.10000 16.40000 -5.99000
5.00000 35.00000 70.00000 87.00000 108.00000
16.00000 51.00000 86.00000 106.00000 114.00000
116.00000 6.00000 5
18.32000 -31.25000 6.58000 -9.50000
1.00000 26.00000 120.00000 130.00000
19.00000 57.00000 127.00000 222.00000
223.00000 2.83000 4
7.50000 4.00000 -39.92000 6.00000 38.50000
1.00000 57.00000 48.00000 137.00000 160.00000
37.00000 41.00000 88.00000 100.00000 199.00000
203.00000 2.00000 5
-9.75000 4.07000 19.50000 10.50000 1.00000
-4.10000
1.00000 102.00000 202.00000 266.00000 325.00000
458.00000
50.00000 106.00000 221.00000 277.00000 337.00000
499.00000
569.00000 2.00000 0
-27.00000 22.00000 -24.48000 5.38000 40.10000
58.00000 98.00000 155.00000 193.00000 280.00000
85.00000 114.00000 182.00000 272.00000 320.00000
363.00000 2.00000 5
-9.75000 4.07000 27.50000 3.54000 -41.00000
1.00000 112.00000 224.00000 251.00000 625.00000

675.0000	2.8900	3		
-2.7000	2.2000	-3.5000	-21.1300	-5.3000
40.1000				
55.0000	99.0000	1.8.0000	371.0000	414.0000
495.0000				
85.0000	114.0000	371.0000	392.0000	495.0000
535.0000				
619.0000	2.8900	6		
-35.4200	53.0000	98.0000		
-35.4200	53.0000	98.0000		
115.0000	1.9700	1		
115.0000	1.9700	1		
25.1000	-25.1000	35.5000	35.5000	
9.8290	1.1000	3.0000	1.1000	10.2500

VOLEX INPUT DATA FROM PSARS + HAND CALC.

21230.0000	221.0000	499.0000	1361.0000	3153.0000
10.9400	27.6000	10.9400	24.3800	6360.0000
870.0000	645.0000			
0.0000	0.0000	381.1000		

FLCCG3 DATA FROM PSARS + HAND D-0005

117.0000	855.0000	25471.0000	43225.0000	
676.0000	22523.0000	24730.0000	1847.0000	
10.1000	10.1000	10.1000	109.8000	109.8000
109.8000				
54.3000	54.3000	54.3000	3842.0000	3550.0000
.0004	.0004	.0004	.0004	.0004
.0004				
2.2700	2.2700	2.2700		
27.5000	27.5000	27.5000		
53.6000	51.3000	25.0000		
1.4010	-.3400	.1020	-.1630	-250.0000
.0200	.0120	.0117	8.9200	.1170
.5430	.4000	.3640	-.3680	.0610
-250.0000	.0200	.0150	.0147	9.0000
.1470				
10.0000	19.1400			
139.4200	207.1300	100.0000	.00023	
1.0000	1.0000	1.0000	1.0000	1.0000
1.0000				
14.7000	15.0570	.1760	.1760	
.5000				

RUPTURE DATA FROM WARD D-0005

426.0000	2700.0000	775.0000	.01721	
1.0000	44.5000	14.7000	0.0000	41.5000
33.0000	4.6000	8.2000	8.0000	27.0000

PROTSYS INPUT DATA FROM WARD D-0005 VERIFIED IN PSARS
NUMBER OF PPS TRIPS TO TRIP PLANT

FLOW RATIO TRIP				
.5000	.5000	1.0000	1.0000	.14920
.0500	.0125	.9850	1.0150	
SPEED RATIO TRIP				
.0200	.0200	1.0000	1.0000	.14920
.0595	.0125	.9850	1.0150	
FLUX-DELAYED FLUX TRIP				
.0500	1.0000	28.0000	1.0200	28.0000

1.18750 3.25000 1.35000 .10250 1.05000

1.05000

FLUX-TOTAL FLOW

.05000 .99000 .50000 1.00000 1.00000

.01000

.00300 .00400 .00500 1.20000 .00600

TOTAL FLUX TRIP

.99000 .05000 1.14400

MANUAL TRIP

4.00000

FLUX TO PRESSURE TRIP

131.70000 .05000 .15000 1.00000 1.27000

.07400 33.70000

.09200

REACTOR LEVEL TRIP

.50000 1.00000 14.79000

CONTROL IC DATA

1.03500 1.03500 1.03500 1.03200 1.03200

1.03500

AVL. CHANNEL TEMPERATURES

FUEL 1 2 CLAD NA DUCT

1497.1063 1366.3591 815.1352 809.3894 802.1406

2458.2835 1649.2288 880.0389 872.5509 862.7971

2705.6388 1803.1732 949.0223 941.0787 930.1953

2513.2367 1743.8415 1007.8764 1001.0452 991.6294

2035.1110 1541.7707 1048.0300 1043.2700 1036.6120

PEAK CHANNEL TEMPERATURES

FUEL 1 2 CLAD NA DUCT

2438.9886 1616.1557 835.7816 828.9401

3193.4627 2028.3627 927.1034 918.2806

3496.9767 2245.1004 1024.5757 1015.2898

3266.2442 2163.0038 1108.1352 1100.1677

2624.2128 1880.0996 1165.4520 1159.6871

HOT CHANNEL TEMPERATURES

FUEL 1 2 CLAD NA H.S.

3215.3794 2395.0523 877.8616 849.0933 928.4850

4069.7204 2696.5236 1003.2384 965.4696 1070.4083

4378.1732 2979.5548 1132.3333 1091.8651 1204.8994

4124.5344 2842.7825 1237.5202 1202.3350 1300.8144

3385.6816 2485.4837 1306.6742 1279.9225 1349.1560

RADIAL BLANKET TEMPERATURES

FUEL 1 2 CLAD NA DUCT

817.0792 787.1496 758.9125 763.7272

1086.7726 933.5557 800.5060 821.5928

1351.0702 1081.6292 876.7473 908.4691

1243.3570 1075.7559 944.9148 965.9266

1043.8751 1007.0439 974.8619 980.0178

RADIAL BLANKET TEMPERATURES

HOT CHANNEL TEMPERATURES

FUEL 1 2 CLAD NA H.S.

836.1732 799.7786 761.5451 766.5055 762.5187

1191.6236 992.6362 814.8054 836.5671 819.0516

1544.3691 1191.2063 909.1175 941.8385 915.3582

1391.6468 1174.6493 969.7111 1011.4853 993.8869

1112.4332 1067.0401 1023.2176 1026.5619 1024.2400

I

TIME

TNA

1

750.5000 750.5000

2

899.6149 761.9916

3

1098.6179 1047.6116

4

1216.3497 981.0178

5

1015.5634 1015.5634

INX INIT CONDITIONS

TSO = 671.5000 TSL = 956.9479

PECLEY NO. PRIMARY 678.4658 SECONDARY 720.9830
 NUSSELY NO. PRIMARY 15.5213 SECONDARY 10.8337

TPL = 750.5100 TPL = 1015.5634
 TSG = 871.6000 TSL = 956.9479

PECLEY NO. PRIMARY 678.4658 SECONDARY 720.9830
 NUSSELY NO. PRIMARY 15.5213 SECONDARY 10.8337

NODE	S-LOOP				L-LOOP			
	Z (FT)	TP (F)	TH (F)	TS (F)	TP (F)	TH (F)	TS (F)	
1	25.6603 24.8013	1015.5634	982.4937	956.9429	1015.5634	982.4937	956.9429	
2	24.5227 24.2440	1010.4917	977.2019	951.4861	1010.4917	977.2019	951.4861	
3	23.9653 23.6867	1005.3861	971.8748	945.9879	1005.3861	971.8748	945.9879	
4	23.4082 23.1293	1000.2466	966.5123	940.4531	1000.2466	966.5123	940.4531	
5	22.8517 22.5720	995.0729	961.1141	934.8816	995.0729	961.1141	934.8816	
6	22.2933 22.0147	989.8648	955.6800	929.2729	989.8648	955.6800	929.2729	
7	21.7360 21.4573	984.6220	950.2098	923.6269	984.6220	950.2098	923.6269	
8	21.1787 20.9000	979.3443	944.7031	917.9434	979.3443	944.7031	917.9434	
9	20.6213 20.3427	974.0315	939.1598	912.2220	974.0315	939.1598	912.2220	
10	20.0640 19.7853	968.6834	933.5796	906.4626	968.6834	933.5796	906.4626	
11	19.5067 19.2280	963.2997	927.9623	900.6648	963.2997	927.9623	900.6648	
12	18.9493 18.6707	957.9861	922.3076	894.8285	957.9861	922.3076	894.8285	
13	18.3920 18.1133	952.4245	916.6153	888.9533	952.4245	916.6153	888.9533	
14	17.8347 17.5560	946.9326	910.8851	883.0390	946.9326	910.8851	883.0390	
15	17.2773 16.9987	941.4041	905.1168	877.0854	941.4041	905.1168	877.0854	
16	16.7203 16.4413	935.8388	899.3100	871.0921	935.8388	899.3100	871.0921	
17	16.1627 15.8843	930.2366	893.4647	865.0590	930.2366	893.4647	865.0590	
18	15.6253 15.3467	924.5970	887.5804	858.9857	924.5970	887.5804	858.9857	
19	15.0684 14.7693	918.9199	881.6570	852.8721	918.9199	881.6570	852.8721	
20	14.6907 14.2120	913.2050	875.6942	846.7177	913.2050	875.6942	846.7177	
21	13.9333 13.6547	907.4521	869.6917	840.5224	907.4521	869.6917	840.5224	
22	13.3763 13.0973	901.6610	863.6492	834.2858	901.6610	863.6492	834.2858	
23	12.8187 12.5400	895.8312	857.5666	828.0078	895.8312	857.5666	828.0078	
24	12.2813 11.9827	889.9627	851.4435	821.6880	889.9627	851.4435	821.6880	
25	11.7142 11.4253	884.0552	845.2796	815.3261	884.0552	845.2796	815.3261	
26	11.1567 10.8677	878.1167	839.0216	808.9216	878.1167	839.0216	808.9216	

27	12.8655	872.1219	839.0747	882.4751	872.1219	839.0747	882.4751
	10.5393		832.8285			832.8285	
	10.3117						
28	10.0329	866.0956	795.9854	795.9854	866.0956	795.9854	795.9854
	9.7533		826.5408			826.5408	
29	9.4747	860.8292	769.4525	769.4525	860.8292	769.4525	769.4525
	9.1968		821.2112			821.2112	
30	8.9173	853.9225	762.6761	762.6761	853.9225	762.6761	762.6761
	8.6387		813.8395			813.8395	
31	8.3610	847.7751	776.2560	776.2560	847.7751	776.2560	776.2560
	8.0813		807.4254			807.4254	
32	7.8027	841.5866	769.5918	769.5918	841.5866	769.5918	769.5918
	7.5240		800.9686			800.9686	
33	7.2453	835.3574	762.8833	762.8833	835.3574	762.8833	762.8833
	6.9667		794.4689			794.4689	
34	6.6881	829.0865	756.1301	756.1301	829.0865	756.1301	756.1301
	6.4093		787.9259			787.9259	
35	6.1307	822.7738	749.3320	749.3320	822.7738	749.3320	749.3320
	5.8520		781.3394			781.3394	
36	5.5733	816.4192	742.4886	742.4886	816.4192	742.4886	742.4886
	5.2947		774.7090			774.7090	
37	5.0160	810.0223	735.5998	735.5998	810.0223	735.5998	735.5998
	4.7373		768.0345			768.0345	
38	4.4587	803.5828	728.6650	728.6650	803.5828	728.6650	728.6650
	4.1800		761.3157			761.3157	
39	3.9013	797.1004	721.6842	721.6842	797.1004	721.6842	721.6842
	3.6227		754.5521			754.5521	
40	3.3441	790.5749	714.6569	714.6569	790.5749	714.6569	714.6569
	3.0653		747.7435			747.7435	
41	2.7867	784.0060	707.5828	707.5828	784.0060	707.5828	707.5828
	2.5080		740.8895			740.8895	
42	2.2293	777.3934	700.4616	700.4616	777.3934	700.4616	700.4616
	1.9507		733.9900			733.9900	
43	1.6720	770.7368	693.2931	693.2931	770.7368	693.2931	693.2931
	1.3933		727.0446			727.0446	
44	1.1147	764.0359	686.0768	686.0768	764.0359	686.0768	686.0768
	.8361		720.0529			720.0529	
45	.5573	757.2904	678.8126	678.8126	757.2904	678.8126	678.8126
	.2787		713.0148			713.0148	
46	0.0000	750.5000	671.5000	671.5000	750.5000	671.5000	671.5000

STGEN I C DATA FROM HARD D-30015

CARD 1, S-LOOP EVAP PRESSURES				
1860.6	1855.9	1851.4	1846.8	1842.2
1837.6	1833.4	1829.6		
CARD 2, S-EVAP STM ENTHALPIES				
533.4	522.1	618.0	609.7	737.7
827.2	865.0	938.5		
CARD 3, S-EVAP SOD TEMP				
671.2	695.0	717.2	745.4	782.7
831.8	852.6	876.6		
CARD 4, S-LOOP SUPERHEATER STM PRESSURES				
1766.5	1734.2	1701.9	1669.6	1637.3
1605.0	1572.7	1540.4		
CARD 5, S-SUP STM ENTHALPIES				
1151.6	1226.8	1281.2	1330.3	1365.2
1391.8	1422.1	1427.5		
CARD 6, S-SUP SOD TEMP				
878.6	896.3	914.1	929.2	938.2
945.9	951.7	956.2		
CARD 7-12, L-LOOP INIT VALUES				
1860.6	1855.9	1851.4	1846.8	1842.2
1837.6	1833.4	1829.6		
533.4	527.1	618.0	609.7	737.7

671.2	699.1	717.2	745.4	752.7
631.8	652.6	676.6		
1766.9	1734.2	1711.9	1669.6	1637.3
1605.0	1572.7	1540.4		
1151.5	1226.8	1285.2	1330.3	1365.2
1391.8	1412.1	1427.5		
876.6	898.3	915.1	926.2	938.2
945.9	951.7	956.2		
CARDS 13-14, RECIRC LOOP PRESSURES				
1768.3	1924.1	1899.4	1766.5	
1786.3	1934.1	1899.4	1766.5	
CARDS 15-17, DRUM AND HOE VALS				
14643.9	14643.9	10377530.0	10377570.0	
2864.1	370079.0			
CARDS 16-19, FLOWS				
.4	.4	369.3	309.3	
309.3	369.3	927.9		
CARDS 20-22, HALL TEMPS				
637.3	663.0	676.5	691.5	711.1
801.3	816.9			
637.3	663.0	676.5	691.5	711.1
801.3	816.9			
620.6	654.5	681.0	901.7	917.9
930.4	934.0			
620.6	654.5	681.0	901.7	917.9
930.4	934.0			

VOLEX I C
16.26000

FLOCOS I C DATA FROM WARD 6005

0.00000	0.00000	0.00000	0.00000	0.00000
0.00000				
1460.00000	1460.00000	1460.00000	1460.00000	1460.00000
1460.00000				
151.10000	151.10000	151.10000	823.79000	2400.00000
10.00000				
15.10000	15.10000	15.10000	15.10000	15.10000
14.70000				
1.00000	1.00000	1.00000	1.00000	1.00000
1.00000				
9.93000	9.93000	9.93000		
113.10000	113.10000	113.10000		

PRIMARY PUMP INSTANCE= .2120276E+00 HEAD= .4344092E+03
INTERMEDIATE PUMP INSTANCE= .4177586E+00 HEAD= .3040615E+03

LENGTHS OF DELAY TABLES

194 104 87 87 79 79 215 265 33 33 153 262

BREAK BETWEEN INX AND VESSEL

BREAK IN GV

GUILLOTINE RUPTURE

426.00000	2700.00000	775.00000	.01721	
1.00000	44.50000	14.70000	0.00000	
32.55826	1675.04400	33.00000	4.60000	3.28000
0.00000	0.00000	0.00000	2.89000	2.89000

PROT SYS IC DATA TAKEN FROM WAFD C-C-0005

FLOW RATIO TRIP

1.00000 1.00000 1.00000 1.00000

SPEED RATIO TRIP

1.00000 1.00000 1.00000 1.00000

FLUX-DELAYED FLUX TRIP

1.00000 1.00000 1.00000

FLUX-TOTAL FLOW

1.00000 .99000

TOTAL FLUX TRIP

.99000

REACTOR LEVEL TRIP

16.30000

T= 0.000

DERIVATIVES

FLOCD3

4.48598	4.48598	4.48598	13.83878	13.83878
4013.49803	291.62509	63.56826	1.01060	0.00011
.00001	.00001	-.00124	-.00124	0.00030

REACTOR

AVE. CHANNEL TEMPS.

FUEL	1	2	CLAD	NA	DUCT
	.3010	.3424	.1310	-.4924	.0305
	.0019	.4315	.1926	-.6536	.0307
	.0007	.4566	.2173	-.7061	.0007
	.0010	.4611	.1867	-.6158	.0006
	.0006	.2913	.1234	-.4328	.0004

HOT CHANNEL TEMPS.

FUEL	1	2	CLAD	NA	H S
	-.0000	1.1689	-.3081	-.8051	
	-.0037	1.4601	-.3481	-1.0686	
	-.0094	1.5921	-.3629	-1.1545	
	-.0006	1.3662	-.3209	-1.0070	
	-.0000	.9979	-.2460	-.7077	

PEAK CHANNEL TEMPS.

FUEL	1	2	CLAD	NA	DUCT
	.3024	.8869	-.1759	-.6755	
	-.0000	1.1164	-.1745	-.6966	
	-.0012	1.1693	-.1627	-.9686	
	-.0000	1.0288	-.1495	-.8449	
	.0004	.7494	-.1277	-.5938	

PLENUM TEMPERATURES

DERIVATIVES

I	THET	TNA
1	0.0000	0.0000
2	-.0005	.0258
3	-.0002	.0111
4	0.0000	1.0000
5	0.0000	.0001

PLANKET TEMPERATURES

FUEL	1	2	CLAD	NA	DUCT
	-.0000	-.0215	-.9120	1.4071	
	-.0012	-.0086	-3.9923	6.1370	
	-.0013	-.1246	-5.9819	9.1644	
	-.0001	-.0827	-3.9594	6.0353	
	-.0000	-.0000	-.0000	1.0000	

BLANKET TEMPERATURES

HOT CHANNEL TEMPS.

FUEL	1	2	CLAC	NA	DUCT
	-0.000	-0.0288	-0.9593	1.5062	
	-0.0004	-0.1173	-4.2008	6.5693	
	-0.0010	-0.1643	-6.3123	4.6099	
	-0.0032	-0.1592	-4.1556	6.4604	
	-0.0036	-0.0277	-1.0146	1.5814	

INX

MODE	S-LOOP Z (FT)	TP (F)	TH (F)	TS (F)	TSH (F)	L-LOOP TP (F)	TH (F)	TS (F)	TSH (F)
1	25.0800	0.0000		-2.0266	0.0000	0.0000		-2.0266	0.0000
2	24.8013		2.6745	-2.0599	0.0000	-0.1881	2.6745	-2.0599	0.0000
3	24.9227	-0.1881	2.6923	-2.0943	0.0000	-0.1867	2.6923	-2.0943	0.0000
4	23.9653	-0.1867	2.7102	-2.1296	0.0000	-0.1853	2.7102	-2.1296	0.0000
5	23.6867	-0.1853	2.7282	-2.1660	0.0000	-0.1837	2.7282	-2.1660	0.0000
6	23.4080	-0.1837	2.7464	-2.2036	0.0000	-0.1819	2.7464	-2.2036	0.0000
7	23.1293	-0.1819	2.7647	-2.2422	0.0000	-0.1800	2.7647	-2.2422	0.0000
8	22.8507	-0.1800	2.7831	-2.2820	0.0000	-0.1780	2.7831	-2.2820	0.0000
9	22.5720	-0.1780	2.8016	-2.3230	0.0000	-0.1758	2.8016	-2.3230	0.0000
10	22.2933	-0.1758	2.8202	-2.3652	0.0000	-0.1734	2.8202	-2.3652	0.0000
11	22.0147	-0.1734	2.8390	-2.4087	0.0000	-0.1709	2.8390	-2.4087	0.0000
12	21.7360	-0.1709	2.8579	-2.4535	0.0000	-0.1682	2.8579	-2.4535	0.0000
13	21.4573	-0.1682	2.8769	-2.4995	0.0000	-0.1654	2.8769	-2.4995	0.0000
14	21.1787	-0.1654	2.8960	-2.5470	0.0000	-0.1623	2.8960	-2.5470	0.0000
15	20.9000	-0.1623	2.9153	-2.5958	0.0000	-0.1591	2.9153	-2.5958	0.0000
16	20.6213	-0.1591	2.9347	-2.6461	0.0000	-0.1557	2.9347	-2.6461	0.0000
17	20.3427	-0.1557	2.9542	-2.6978	0.0000	-0.1521	2.9542	-2.6978	0.0000
18	20.0640	-0.1521	2.9739	-2.7510	0.0000	-0.1483	2.9739	-2.7510	0.0000
19	19.7853	-0.1483	2.9937	-2.8058	0.0000	-0.1442	2.9937	-2.8058	0.0000
20	19.5067	-0.1442	3.0136	-2.8622	0.0000	-0.1400	3.0136	-2.8622	0.0000
21	19.2280	-0.1400	3.0337	-2.9201	0.0000	-0.1355	3.0337	-2.9201	0.0000
22	18.9493	-0.1355	3.0538	-2.9798	0.0000	-0.1309	3.0538	-2.9798	0.0000
23	18.6707	-0.1309	3.0742	-3.0412	0.0000	-0.1259	3.0742	-3.0412	0.0000
24	18.3920	-0.1259	3.0946	-3.1043	0.0000	-0.1208	3.0946	-3.1043	0.0000
25	18.1133	-0.1208	3.1152	-3.1693	0.0000	-0.1153	3.1152	-3.1693	0.0000
26	17.8347	-0.1153							
27	17.5560								
28	17.2773								
29	16.9987								
30	16.7200								
31	16.4413								
32	16.1627								
33	15.8840								
34	15.6053								
35	15.3267								
36	15.0480								
37	14.7693								
38	14.4907								
39	14.2120								
40	13.9333								
41	13.6547								
42	13.3760								
43	13.0973								
44	12.8187								
45	12.5400								
46	12.2613								
47	11.9827								
48	11.7040								
49	11.4253								
50	11.1467								

26	11.1457	-1.197	3.1566	-3.2361	0.0000	-1.1097	3.1566	-3.2361	0.0000
27	12.5893	-1.137	3.1778	-3.3048	0.0000	-1.1037	3.1778	-3.3048	0.0000
28	10.3107	-0.975	3.1778	-3.3754	0.0000	-0.975	3.1778	-3.3754	0.0000
29	9.2537	-0.911	3.1990	-3.4486	0.0000	-0.911	3.1990	-3.4486	0.0000
30	8.1966	-0.843	3.2202	-3.5227	0.0000	-0.843	3.2202	-3.5227	0.0000
31	7.1387	-0.772	3.2417	-3.5995	0.0000	-0.772	3.2417	-3.5995	0.0000
32	6.0813	-0.699	3.2632	-3.6785	0.0000	-0.699	3.2632	-3.6785	0.0000
33	5.0243	-0.622	3.2850	-3.7597	0.0000	-0.622	3.2850	-3.7597	0.0000
34	3.9667	-0.542	3.3069	-3.8431	0.0000	-0.542	3.3069	-3.8431	0.0000
35	2.9091	-0.459	3.3288	-3.9289	0.0000	-0.459	3.3288	-3.9289	0.0000
36	1.8520	-0.372	3.3510	-4.0170	0.0000	-0.372	3.3510	-4.0170	0.0000
37	0.7947	-0.282	3.3733	-4.1076	0.0000	-0.282	3.3733	-4.1076	0.0000
38	-0.2627	-0.188	3.3957	-4.2007	0.0000	-0.188	3.3957	-4.2007	0.0000
39	-1.3105	-0.091	3.4183	-4.2964	0.0000	-0.091	3.4183	-4.2964	0.0000
40	-2.3583	0.010	3.4411	-4.3947	0.0000	0.010	3.4411	-4.3947	0.0000
41	-3.4061	0.115	3.4640	-4.4957	0.0000	0.115	3.4640	-4.4957	0.0000
42	-4.4539	0.224	3.4870	-4.5995	0.0000	0.224	3.4870	-4.5995	0.0000
43	-5.5017	0.337	3.5102	-4.7061	0.0000	0.337	3.5102	-4.7061	0.0000
44	-6.5495	0.455	3.5336	-4.8156	0.0000	0.455	3.5336	-4.8156	0.0000
45	-7.5973	0.576	3.5571	-4.9281	0.0000	0.576	3.5571	-4.9281	0.0000
	-8.6451		3.5808		0.0000		3.5808		0.0000

REACTOR

AVG. CHANNEL TEMPERATURES

FUEL	1	2	CLAD	NA	DUCT
1897.1063	1366.3591	815.1352	809.3894	802.1406	
2458.2835	1649.2268	880.0389	872.5509	862.7971	
2755.6388	1800.1732	949.0223	941.0787	935.3953	
2513.2367	1743.8415	1007.8764	1001.0452	991.6294	
2035.1110	1548.7707	1046.0300	1043.2700	1036.6120	

PEAK CHANNEL TEMPERATURES

FUEL	1	2	CLAD	NA	DUCT
2435.9816	1616.1557	835.7816	828.9411		
3193.4627	2028.3627	927.1034	919.2806		
4090.9767	2248.1116	1024.5757	1015.2898		
3266.2442	2163.0838	1108.1352	1103.1677		
2624.2128	1881.0996	1165.4520	1159.8871		

HOT CHANNEL TEMPERATURES

FUEL	1	2	CLAD	NA	H S
3215.1734	2095.4523	877.8616	849.0933	928.4850	
4069.7234	2096.1236	1003.2324	965.4696	1070.4083	
4378.1732	2079.5548	1132.3333	1091.8651	1204.8994	
4124.5344	2842.7825	1237.9202	1202.3353	1300.8146	
3385.0016	2405.4837	1304.6742	1279.9225	1349.1560	

RADIAL BLANKET TEMPERATURES

FUEL	1	2	CLAD	NA	DUCT

1288.7708	939.5557	900.5000	821.5928
1351.5732	1181.6292	678.7473	855.4691
1248.1179	1079.7559	947.9148	905.9266
1043.8791	1007.0439	974.8619	900.0175

RAJIAL BLANKET TEMPERATURES

HOT CHANNEL TEMPERATURES

FUEL	1	2	CLAD	HA	H S
836.1732	799.7236	761.5451	766.5055	762.5187	
1191.8294	992.0362	814.3054	832.5671	819.0516	
1544.3691	1191.2362	909.0175	941.8365	915.3532	
1391.6468	1174.6490	929.7111	1011.4853	993.8669	
1112.3332	1062.0411	823.2178	1028.5619	1024.2480	

I	THEI	TNA
1	750.5000	750.5000
2	899.4149	761.9916
3	1098.6179	1047.6116
4	1216.3497	980.0178
5	1015.5034	1015.5634

INX

NONE	S-LOOP				L-LOOP				
	Z (FT)	TPI (F)	TNI (F)	TSI (F)	TSH (F)	TPI (F)	TNI (F)	TSI (F)	TSH (F)
1	25.2800	1015.5634		956.9478		1015.5634		956.9478	
2	24.8013		982.4937		1011.0276		962.4937		1013.0276
3	24.5227	1010.4917		951.4861		1010.4917		951.4861	
4	24.2440		977.2019		1007.9389		977.2019		1007.9389
5	23.9653	1005.3861		945.9879		1005.3861		945.9879	
6	23.6867		971.8748		1002.8164		971.8748		1002.8164
7	23.4080	1000.2466		940.4531		1000.2466		940.4531	
8	23.1293		966.5123		997.6598		966.5123		997.6598
9	22.8507	995.0729		934.8816		995.0729		934.8816	
10	22.5720		961.1141		992.4689		961.1141		992.4689
11	22.2933	989.8648		929.2729		989.8648		929.2729	
12	22.0147		955.6800		987.2434		955.6800		987.2434
13	21.7360	984.6220		923.6269		984.6220		923.6269	
14	21.4573		950.2098		981.9832		950.2098		981.9832
15	21.1787	979.3443		917.9434		979.3443		917.9434	
16	20.9000		944.7031		976.6879		944.7031		976.6879
17	20.6213	974.0315		912.2220		974.0315		912.2220	
18	20.3427		939.1598		971.3575		939.1598		971.3575
19	20.0640	968.6834		906.4626		968.6834		906.4626	
20	19.7853		933.5796		965.9915		933.5796		965.9915
21	19.5067	963.2997		900.6648		963.2997		900.6648	
22	19.2280		927.9623		960.5899		927.9623		960.5899
23	18.9493	957.8801		894.8285		957.8801		894.8285	
24	18.6707		922.3076		955.1523		922.3076		955.1523
25	18.3920	952.4245		888.9533		952.4245		888.9533	
26	18.1133		916.6153		949.6785		916.6153		949.6785
27	17.8347	946.5326		883.0390		946.5326		883.0390	
28	17.5560		910.8851		944.1683		910.8851		944.1683
29	17.2773	941.4041		877.0854		941.4041		877.0854	
30	16.9987		905.1168		938.6215		905.1168		938.6215
31	16.7200	935.8368		871.0921		935.8368		871.0921	
32	16.4413		899.3100		933.0377		899.3100		933.0377
33	16.1627	930.2366		865.0590		930.2366		865.0590	
34	15.8840		893.4647		927.4168		893.4647		927.4168
35	15.6053	924.5970		858.9857		924.5970		858.9857	
36	15.3267		887.5804		921.7584		887.5804		921.7584
37	15.0480	918.9199		852.8721		918.9199		852.8721	
38	14.7693		881.6570		916.0625		881.6570		916.0625
39	14.4907	913.2050		846.7177		913.2050		846.7177	
40	14.2120		875.6942		910.3286		875.6942		910.3286
41	13.9333	907.4521		840.5224		907.4521		840.5224	
42	13.6547		869.6917		904.5005		869.6917		904.5005

23	13.8973	863.6492	898.7461	863.6492	898.7461
24	12.8187	857.5666	892.8970	857.5666	892.8970
25	12.2613	849.9627	889.9627	849.9627	889.9627
26	11.9827	851.4435	887.0090	851.4435	887.0090
27	11.7446	844.6552	884.6552	844.6552	884.6552
28	11.4253	845.2796	881.0818	845.2796	881.0818
29	11.1467	838.1043	878.1043	838.1043	878.1043
30	10.8683	839.0747	875.1151	839.0747	875.1151
31	10.5893	832.1219	872.1219	832.1219	872.1219
32	10.3107	832.8285	869.1087	832.8285	869.1087
33	10.0321	826.5406	863.0624	826.5406	863.0624
34	9.7533	821.2112	856.9759	821.2112	856.9759
35	9.4747	813.6395	850.9488	813.6395	850.9488
36	9.1960	807.4254	844.6810	807.4254	844.6810
37	8.9173	800.9686	838.4721	800.9686	838.4721
38	8.6387	794.4689	832.2219	794.4689	832.2219
39	8.3601	787.9259	825.9301	787.9259	825.9301
40	8.0813	781.3394	819.5965	781.3394	819.5965
41	7.8027	774.7090	813.2207	774.7090	813.2207
42	7.5240	768.0345	806.8025	768.0345	806.8025
43	7.2453	761.3157	800.3416	761.3157	800.3416
44	6.9667	754.5521	793.8377	754.5521	793.8377
45	6.6880	747.7435	787.2905	747.7435	787.2905
46	6.4091	740.8895	780.6997	740.8895	780.6997
47	6.1307	733.9900	774.0651	733.9900	774.0651
48	5.8520	727.0446	767.3863	727.0446	767.3863
49	5.5733	720.0529	760.6631	720.0529	760.6631
50	5.2947	713.0148	753.8952	713.0148	753.8952
51	5.0160	706.0768	747.1064	706.0768	747.1064
52	4.7373	700.4616	740.0060	700.4616	740.0060
53	4.4587	693.2931	733.9900	693.2931	733.9900
54	4.1800	686.0768	727.0446	686.0768	727.0446
55	3.9013	678.8126	720.0529	678.8126	720.0529
56	3.6227	671.5000	713.0148	671.5000	713.0148
57	3.3440	664.2359	706.0768	664.2359	706.0768
58	3.0653	656.9686	700.4616	656.9686	700.4616
59	2.7867	649.6965	693.2931	649.6965	693.2931
60	2.5080	642.4254	686.0768	642.4254	686.0768
61	2.2293	635.1574	678.8126	635.1574	678.8126
62	1.9507	627.8895	671.5000	627.8895	671.5000
63	1.6720	620.6166	664.2359	620.6166	664.2359
64	1.3933	613.3416	656.9686	613.3416	656.9686
65	1.1147	606.0625	649.6965	606.0625	649.6965
66	.8360	600.3416	642.4254	600.3416	642.4254
67	.5573	593.8377	635.1574	593.8377	635.1574
68	.2787	587.2905	627.8895	587.2905	627.8895
69	.0000	580.6997	620.6166	580.6997	620.6166

PUMP NO. - I = 3CAVITATING

T = .05000 31.77533 32.11509 3869.14887 4045.97217

DERIVATIVES

FLOCD3

691.49911 691.49911 1720.36282 2595.91093 2595.91093
1727.77794 275.96116 60.93306 0.00000 -0.03516
-0.03516 -0.03516 -0.03516 -0.03516 0.00000

REACTOR

AVE. CHANNEL TEMPS.

FUEL 1 2 CLAD HA DUCT
.2636 .9216 4.6083 5.5114 .1018

.1739	1.5938	12.1124	13.1823	.2652
.3295	1.4164	12.7095	13.0990	.2796
.2356	1.1673	11.7736	12.7666	.2260

HOT CHANNEL TEMPS.

FUEL	1	2	CLAD	NA	H S
	.4174	1.6331	6.6482	8.9929	
	.5556	2.5351	14.3218	17.6690	
	.5964	2.8236	14.7335	22.5619	
	.5263	2.5653	19.2161	22.5849	
	.3734	1.9328	16.1678	18.6278	

PEAK CHANNEL TEMPS.

FUEL	1	2	CLAD	NA	DUCT
	.3661	1.5621	5.9311	7.4106	
	.4820	2.3172	12.7648	14.4568	
	.5286	2.5892	16.8545	18.1777	
	.4566	2.3956	17.3796	18.1614	
	.3266	1.8901	14.6668	14.7785	

PLENUM TEMPERATURES

DERIVATIVES

I	THET	TNA
1	0.0000	0.0000
2	.0540	1.4965
3	.2036	6.7881
4	0.0000	0.0000
5	.0000	.0000

BLANKET TEMPERATURES

FUEL	1	2	CLAD	NA	DUCT
	.3037	-.0197	.2325	.7392	
	.0162	-.0722	1.3638	3.0991	
	.0237	-.0778	2.9821	4.3087	
	.0164	-.0254	3.6225	2.5049	
	.0041	.0158	1.3866	.4260	

BLANKET TEMPERATURES

HOT CHANNEL TEMPS.

FUEL	1	2	CLAD	NA	DUCT
	.3044	-.1299	.1138	1.0215	
	.0176	-.1150	.8978	4.2915	
	.0262	-.1423	2.4601	5.9752	
	.0178	-.0727	2.9367	3.4533	
	.0044	-.0032	1.5713	.5485	

INX

NODE	S-LOOP					L-LOOP				
	Z (FT)	TP (F)	TH (F)	TS (F)	TSH (F)	TP (F)	TH (F)	TS (F)	TSH (F)	
1	25.6860	0.0000		-2.0316		0.0000		-2.0277		
2	24.6713		2.6736		0.0000		2.6743		0.0000	
	24.6227	-.1090		-2.0650		-.1880		-2.0610		
	24.2440		2.6913		0.0000		2.6921		0.0000	
3	23.9253	-.1807		-2.0994		-.1867		-2.0954		
	23.6867		2.7393		0.0000		2.7100		0.0000	
4	23.4384	-.1852		-2.1348		-.1852		-2.1307		
	23.1293		2.7273		0.0000		2.7281		0.0000	
5	22.8877	-.1846		-2.1712		-.1876		-2.1672		

	22.5720		2.7454		0.0000		2.7462		0.0000
6	22.2933	-0.1819		-2.2086		-0.1819	-2.2047		0.0000
	22.0147		2.7637		0.0000		2.7645		0.0000
7	21.7380	-0.1800		-2.2475		-0.1800	-2.2434		0.0000
	21.4573		2.7821		0.0000		2.7829		0.0000
8	21.1787	-0.1779		-2.2873		-0.1779	-2.2832		0.0000
	20.9000		2.8066		0.0000		2.8014		0.0000
9	20.6213	-0.1757		-2.3283		-0.1757	-2.3242		0.0000
	20.3427		2.8192		0.0000		2.8200		0.0000
10	20.0640	-0.1734		-2.3706		-0.1734	-2.3664		0.0000
	19.7853		2.8380		0.0000		2.8388		0.0000
11	19.5067	-0.1709		-2.4141		-0.1709	-2.4099		0.0000
	19.2280		2.8569		0.0000		2.8577		0.0000
12	18.9493	-0.1682		-2.4589		-0.1682	-2.4547		0.0000
	18.6707		2.8759		0.0000		2.8767		0.0000
13	18.3920	-0.1653		-2.5050		-0.1653	-2.5007		0.0000
	18.1133		2.8950		0.0000		2.8959		0.0000
14	17.8347	-0.1623		-2.5525		-0.1623	-2.5482		0.0000
	17.5560		2.9143		0.0000		2.9151		0.0000
15	17.2773	-0.1591		-2.6014		-0.1591	-2.5970		0.0000
	16.9987		2.9337		0.0000		2.9345		0.0000
16	16.7200	-0.1556		-2.6517		-0.1556	-2.6473		0.0000
	16.4413		2.9532		0.0000		2.9540		0.0000
17	16.1627	-0.1520		-2.7034		-0.1520	-2.6990		0.0000
	15.8840		2.9729		0.0000		2.9737		0.0000
18	15.6053	-0.1482		-2.7567		-0.1482	-2.7523		0.0000
	15.3267		2.9926		0.0000		2.9935		0.0000
19	15.0480	-0.1442		-2.8115		-0.1442	-2.8070		0.0000
	14.7693		3.0126		0.0000		3.0134		0.0000
20	14.4907	-0.1400		-2.8679		-0.1400	-2.8634		0.0000
	14.2120		3.0326		0.0000		3.0335		0.0000
21	13.9333	-0.1355		-2.9259		-0.1355	-2.9214		0.0000
	13.6547		3.0528		0.0000		3.0536		0.0000
22	13.3760	-0.1308		-2.9856		-0.1308	-2.9811		0.0000
	13.0973		3.0731		0.0000		3.0740		0.0000
23	12.8187	-0.1259		-3.0471		-0.1259	-3.0426		0.0000
	12.5400		3.0935		0.0000		3.0944		0.0000
24	12.2613	-0.1207		-3.1162		-0.1207	-3.1056		0.0000
	11.9827		3.1141		0.0000		3.1150		0.0000
25	11.7040	-0.1153		-3.1752		-0.1153	-3.1706		0.0000
	11.4253		3.1348		0.0000		3.1357		0.0000
26	11.1467	-0.1096		-3.2421		-0.1096	-3.2374		0.0000
	10.8680		3.1557		0.0000		3.1566		0.0000
27	10.5893	-0.1037		-3.3108		-0.1037	-3.3061		0.0000
	10.3107		3.1767		0.0000		3.1776		0.0000
28	10.0320	-0.0975		-3.3815		-0.0975	-3.3767		0.0000
	9.7533		3.1978		0.0000		3.1988		0.0000
29	9.4747	-0.0910		-3.4542		-0.0910	-3.4494		0.0000
	9.1960		3.2191		0.0000		3.2200		0.0000
30	8.9173	-0.0842		-3.5289		-0.0842	-3.5241		0.0000
	8.6387		3.2405		0.0000		3.2415		0.0000
31	8.3600	-0.0772		-3.6058		-0.0772	-3.6009		0.0000
	8.0813		3.2621		0.0000		3.2630		0.0000
32	7.8027	-0.0696		-3.6848		-0.0696	-3.6799		0.0000
	7.5240		3.2838		0.0000		3.2847		0.0000
33	7.2453	-0.0621		-3.7661		-0.0621	-3.7610		0.0000
	6.9667		3.3057		0.0000		3.3066		0.0000
34	6.6880	-0.0541		-3.8495		-0.0541	-3.8445		0.0000
	6.4093		3.3277		0.0000		3.3286		0.0000
35	6.1307	-0.0458		-3.9353		-0.0458	-3.9303		0.0000
	5.8520		3.3498		0.0000		3.3508		0.0000
36	5.5733	-0.0371		-4.0235		-0.0371	-4.0184		0.0000
	5.2947		3.3721		0.0000		3.3731		0.0000
37	5.0160	-0.0281		-4.1141		-0.0281	-4.1090		0.0000
	4.7373		3.3945		0.0000		3.3955		0.0000

38	4.1380		3.4171	0.0000		3.4181	0.0000
39	3.9813	-0.0090	-4.3030	-0.0090		-4.2978	0.0000
40	3.6227		3.4399	0.0000		3.4408	0.0000
41	3.3440	.0011	-4.4013	.0011		-4.3961	0.0000
42	3.0653		3.4626	0.0000		3.4637	0.0000
43	2.7867	.0116	-4.5024	.0116		-4.4972	0.0000
44	2.5080		3.4858	0.0000		3.4868	0.0000
45	2.2293	.0225	-4.6162	.0225		-4.6010	0.0000
46	1.9507		3.5090	0.0000		3.5100	0.0000
47	1.6720	.0338	-4.7129	.0338		-4.7076	0.0000
48	1.3933		3.5323	0.0000		3.5333	0.0000
49	1.1147	.0455	-4.8225	.0455		-4.8171	0.0000
50	.8360		3.5558	0.0000		3.5569	0.0000
51	.5573	.0577	-4.9351	.0577		-4.9296	0.0000
52	.2787		3.5795	0.0000		3.5805	0.0000

REACTOR
AVE. CHANNEL TEMPERATURES

FUEL	1	2	CLAD	NA	DUCT
1897.1163	1366.3917	815.1651	829.9289	812.1438	
2456.2939	1649.2751	880.4747	873.3693	862.8035	
2705.8501	1800.2249	945.5563	942.0112	930.4032	
2513.2465	1743.6882	1006.4055	1001.9040	991.6373	
2035.1130	1548.6061	1048.4579	1043.9146	1036.6164	

PEAK CHANNEL TEMPERATURES

FUEL	1	2	CLAD	NA	DUCT
2438.9936	1616.2187	836.0759	829.6735		
3193.4772	2326.6490	927.6881	919.4022		
3490.9923	2245.1942	1025.2974	1016.5659		
3266.2578	2163.1685	1106.8475	1101.3395		
2624.2224	1889.1631	1166.0274	1160.7636		

HOT CHANNEL TEMPERATURES

FUEL	1	2	CLAD	NA	H S
3215.1920	2195.1203	878.1636	850.0156	928.6359	
4065.7371	2696.6247	1003.8362	966.9038	1070.5997	
4378.1909	2974.6653	1123.0706	1093.5101	1205.0748	
4124.5502	2942.6887	1238.2467	1203.0561	1300.9413	
3365.6127	2405.5559	1105.2606	1281.0708	1349.2186	

RADIAL BLANKET TEMPERATURES

FUEL	1	2	CLAD	NA	DUCT
817.0793	787.1465	756.9074	763.7956		
1096.7771	933.5511	800.4588	821.8803		
1351.0739	1081.6234	876.7790	908.8689		
1248.1575	1279.7526	944.9856	966.1585		
1043.6752	1107.6435	974.9106	980.0530		

RADIAL BLANKET TEMPERATURES

FUEL	1	2	CLAD	NA	H S
836.1704	799.7770	761.5317	766.5925	762.5009	
1191.6310	992.6301	814.7616	836.9366	818.9934	
1544.3699	1191.1978	908.9937	942.3638	915.3268	
1391.6474	1174.6442	965.7418	1011.7999	993.9340	
1112.8334	1067.6392	1023.2612	1028.6186	1024.2972	

INLET

1	2	3	4	5
750.5300	750.5000			
899.4165	762.1004			
1096.6232	1047.8534			
1216.3472	980.0536			
1015.5634	1015.5636			

INX					L-LOOP				
DE	S-LOOP								
	Z (FT)	TPI (F)	THI (F)	TSI (F)	TSHI (F)	TPI (F)	THI (F)	TSI (F)	TSHI (F)
1	25.1800	1015.5634	612.6276	956.8463	1013.0276	1015.5634	612.6276	956.8465	1013.0276

2	24.5227	1010.4823	951.3828	1010.4823	951.3830	1007.9389
3	24.2444	1009.3768	977.3364	1007.9389	977.3365	945.8831
4	23.9853	1008.2374	972.0103	1007.9389	972.0103	945.8831
5	23.6867	1007.0980	966.6487	1006.8164	966.6487	940.3466
6	23.4390	1005.9537	961.2514	1005.9537	961.2514	934.7732
7	23.1393	1004.8557	955.8182	1004.8557	955.8183	929.1627
8	22.8507	1003.7367	950.3489	1003.7367	950.3489	923.5148
9	22.5720	1002.6130	944.8432	1002.6130	944.8432	917.8292
10	22.2933	1001.4823	939.3408	1001.4823	939.3408	912.1058
11	22.0147	1000.3466	933.7216	1000.3466	933.7216	906.3443
12	21.7360	999.2091	928.1052	999.2091	928.1052	900.5443
13	21.4573	998.0716	922.4814	998.0716	922.4814	894.7055
14	21.1787	996.9341	916.8576	996.9341	916.8576	888.8283
15	20.9000	995.7966	911.2338	995.7966	911.2338	882.9114
16	20.6213	994.6591	905.6100	994.6591	905.6100	876.9553
17	20.3427	993.5216	900.0000	993.5216	900.0000	870.9596
18	20.0640	992.3841	894.3841	992.3841	894.3841	864.9238
19	19.7853	991.2466	888.7682	991.2466	888.7682	858.8479
20	19.5067	990.1091	883.1523	990.1091	883.1523	852.7315
21	19.2280	988.9716	877.5364	988.9716	877.5364	846.5743
22	18.9493	987.8341	871.9205	987.8341	871.9205	840.3761
23	18.6707	986.6966	866.3046	986.6966	866.3046	834.1366
24	18.3920	985.5591	860.6887	985.5591	860.6887	828.0000
25	18.1133	984.4216	855.0728	984.4216	855.0728	821.8625
26	17.8347	983.2841	849.4569	983.2841	849.4569	815.7250
27	17.5560	982.1466	843.8410	982.1466	843.8410	809.5875
28	17.2773	981.0091	838.2251	981.0091	838.2251	803.4500
29	16.9987	979.8716	832.6092	979.8716	832.6092	797.3125
30	16.7200	978.7341	826.9933	978.7341	826.9933	791.1750
31	16.4413	977.5966	821.3774	977.5966	821.3774	785.0375
32	16.1627	976.4591	815.7615	976.4591	815.7615	778.9000
33	15.8840	975.3216	810.1456	975.3216	810.1456	772.7625
34	15.6053	974.1841	804.5297	974.1841	804.5297	766.6250
35	15.3267	973.0466	798.9138	973.0466	798.9138	760.4875
36	15.0480	971.9091	793.2979	971.9091	793.2979	754.3500
37	14.7693	970.7716	787.6820	970.7716	787.6820	748.2125
38	14.4907	969.6341	782.0661	969.6341	782.0661	742.0750
39	14.2120	968.4966	776.4502	968.4966	776.4502	735.9375
40	13.9333	967.3591	770.8343	967.3591	770.8343	729.8000
41	13.6547	966.2216	765.2184	966.2216	765.2184	723.6625
42	13.3760	965.0841	759.6025	965.0841	759.6025	717.5250
43	13.0973	963.9466	753.9866	963.9466	753.9866	711.3875
44	12.8187	962.8091	748.3707	962.8091	748.3707	705.2500
45	12.5400	961.6716	742.7548	961.6716	742.7548	699.1125
46	12.2613	960.5341	737.1389	960.5341	737.1389	692.9750
47	11.9827	959.3966	731.5230	959.3966	731.5230	686.8375
48	11.7040	958.2591	725.9071	958.2591	725.9071	680.7000
49	11.4253	957.1216	720.2912	957.1216	720.2912	674.5625
50	11.1467	955.9841	714.6753	955.9841	714.6753	668.4250
51	10.8680	954.8466	709.0594	954.8466	709.0594	662.2875
52	10.5893	953.7091	703.4435	953.7091	703.4435	656.1500
53	10.3107	952.5716	697.8276	952.5716	697.8276	650.0125
54	10.0320	951.4341	692.2117	951.4341	692.2117	643.8750
55	9.7533	950.2966	686.5958	950.2966	686.5958	637.7375
56	9.4747	949.1591	680.9799	949.1591	680.9799	631.6000
57	9.1960	948.0216	675.3640	948.0216	675.3640	625.4625
58	8.9173	946.8841	669.7481	946.8841	669.7481	619.3250
59	8.6387	945.7466	664.1322	945.7466	664.1322	613.1875
60	8.3600	944.6091	658.5163	944.6091	658.5163	607.0500
61	8.0813	943.4716	652.9004	943.4716	652.9004	600.9125
62	7.8027	942.3341	647.2845	942.3341	647.2845	594.7750
63	7.5240	941.1966	641.6686	941.1966	641.6686	588.6375
64	7.2453	940.0591	636.0527	940.0591	636.0527	582.5000
65	6.9667	938.9216	630.4368	938.9216	630.4368	576.3625
66	6.6880	937.7841	624.8209	937.7841	624.8209	570.2250
67	6.4093	936.6466	619.2050	936.6466	619.2050	564.0875
68	6.1307	935.5091	613.5891	935.5091	613.5891	557.9500
69	5.8520	934.3716	607.9732	934.3716	607.9732	551.8125
70	5.5733	933.2341	602.3573	933.2341	602.3573	545.6750
71	5.2947	932.0966	596.7414	932.0966	596.7414	539.5375
72	5.0160	930.9591	591.1255	930.9591	591.1255	533.4000
73	4.7373	929.8216	585.5096	929.8216	585.5096	527.2625
74	4.4587	928.6841	579.8937	928.6841	579.8937	521.1250
75	4.1800	927.5466	574.2778	927.5466	574.2778	514.9875
76	3.9013	926.4091	568.6619	926.4091	568.6619	508.8500
77	3.6227	925.2716	563.0460	925.2716	563.0460	502.7125
78	3.3440	924.1341	557.4301	924.1341	557.4301	496.5750
79	3.0653	922.9966	551.8142	922.9966	551.8142	490.4375
80	2.7867	921.8591	546.1983	921.8591	546.1983	484.3000
81	2.5080	920.7216	540.5824	920.7216	540.5824	478.1625
82	2.2293	919.5841	534.9665	919.5841	534.9665	472.0250
83	1.9507	918.4466	529.3506	918.4466	529.3506	465.8875
84	1.6720	917.3091	523.7347	917.3091	523.7347	459.7500
85	1.3933	916.1716	518.1188	916.1716	518.1188	453.6125
86	1.1147	915.0341	512.5029	915.0341	512.5029	447.4750
87	0.8360	913.8966	506.8870	913.8966	506.8870	441.3375
88	0.5573	912.7591	501.2711	912.7591	501.2711	435.2000
89	0.2787	911.6216	495.6552	911.6216	495.6552	429.0625
90	0.0000	910.4841	490.0393	910.4841	490.0393	422.9250

35	8.1357	822.7715	731.5069	749.1352	819.5965	822.7715	761.5069	749.1355	819.5965
36	5.2523	616.4173	774.6776	742.2875	813.2207	816.4173	774.6777	742.2877	813.2207
37	5.2947	616.4173	774.6776	735.3940	813.2207	810.0208	768.2643	735.3943	806.8025
38	4.7373	803.5816	769.2043	728.4547	806.8025	833.5818	768.2643	728.4549	806.8025
39	4.4587	803.5816	769.2043	728.4547	806.8025	800.3416	761.4866	728.4549	800.3416
40	4.1800	797.1031	761.4866	721.4690	800.3416	797.1030	754.7241	721.4693	793.8377
41	3.9013	797.1031	754.7241	721.4690	793.8377	797.1030	754.7241	721.4693	793.8377
42	3.6227	793.5750	754.7241	714.4368	793.8377	790.5750	747.9166	714.4370	787.2906
43	3.3440	793.5750	747.9166	707.3577	787.2906	784.0066	741.6639	707.3579	780.6997
44	3.0653	784.0066	741.6639	700.2313	780.6997	777.3945	734.1655	700.2316	774.0651
45	2.7867	777.3945	734.1655	693.0574	774.0651	770.7385	727.2213	693.0577	767.3863
46	2.5080	777.3945	727.2213	685.8357	767.3863	764.0382	720.2308	685.8360	760.6631
47	2.2293	764.0382	720.2308	678.5658	760.6631	757.2933	713.1938	678.5661	753.8952
48	1.9507	757.2933	713.1937	671.5000	753.8952	750.5035	706.0000	671.5000	750.5035
49	1.6720	750.5035	706.0000	664.3167	750.5035	747.2167	698.8167	664.3167	747.2167
50	1.3933	747.2167	698.8167	657.1333	747.2167	738.0333	691.6333	657.1333	738.0333
51	1.1147	740.0382	691.6333	650.0000	740.0382	730.8500	684.4500	650.0000	730.8500
52	.8360	733.8500	684.4500	642.8667	733.8500	721.6667	677.2667	642.8667	721.6667
53	.5573	727.2213	677.2213	635.6833	727.2213	710.0833	670.6833	635.6833	710.0833
54	.2787	720.2308	670.6833	628.5000	720.2308	702.8833	663.5000	628.5000	702.8833
55	.0000	713.1938	664.3167	621.3167	713.1938	695.6967	656.3167	621.3167	695.6967

PUMP NO. - I = 1 CAVITATING

PUMP NO. - I = 2 CAVITATING

I = .150

DERIVATIVES

FLOCCS

1628.28409	1628.28409	1640.04604	1627.38900	1627.38900
1635.35352	241.30096	55.24869	0.60000	-0.09306
-0.09356	-0.10520	-0.02459	-0.06635	0.00000

REACTOR

AVE. CHANNEL TEMPS.

FUEL	1	2	CLAD	NA	DUCT
	11.9464	32.4906	144.6575	202.0306	6.8445
	18.6712	53.3248	265.9280	329.8552	9.5543
	20.2113	61.6987	359.6337	381.4342	11.8014
	17.8438	58.8248	366.6595	357.3760	11.7257
	12.8730	46.4691	296.2341	272.8433	9.5391

HOT CHANNEL TEMPS.

FUEL	1	2	CLAD	NA	H S
	21.0991	41.6270	221.6767	345.4783	
	26.2039	17.4618	465.7698	570.1214	
	30.6099	77.7477	583.2625	660.2982	
	26.8788	73.2368	582.6618	617.6675	
	19.0915	57.1616	475.7892	472.2057	

PEAK CHANNEL TEMPS.

FUEL	1	2	CLAD	NA	DUCT
	12.5636	42.8088	191.5946	282.6155	
	29.0272	71.4865	400.8032	470.3551	
	27.1293	62.4419	505.7344	542.9008	
	23.9125	78.5258	506.6258	507.4188	
	17.1645	62.1923	414.5663	386.5034	

APPENDIX B2

DEMO2 Output

ORIGINAL INPUT DATA PLUS MAX. DELAY HEAT
HARD DATA

2 - E. BREAK AT VESSEL INLET

LOGIC ARRAY 123456789 123456789 123456789 123456789 123456789 123456789 123456789 123456789 123456789

CONTROL DIMENSIONAL DATA

1.000000E+01 1.000000E+01 1.000000E+01 1.000000E+01
1.000000E+01 1.000000E+01 1.000000E+01 1.000000E+01
1.000000E+01 1.000000E+01 1.000000E+01 1.000000E+01
1.000000E+01 1.000000E+01 1.000000E+01 1.000000E+01
1.000000E+01 1.000000E+01 1.000000E+01 1.000000E+01
1.000000E+01 1.000000E+01 1.000000E+01 1.000000E+01

REACTOR DIMENSIONAL DATA

CARD1 AND CARD2---PLENUM & BLANKET NODE MASSES

3.95500E+06 1.638000E+06 3.982180E+04 5.678420E+03 8.982180E+04
5.678420E+03 3.853200E+05 1.216000E+04 1.997500E+06 2.852000E+06

CARD3---PLENUM AND BLANKET HEAT TRANSFER COEFFICIENT

6.91000E-01 7.499999E-01 7.499999E-01 6.91000E-01

CARD4---PLENUM AND BLANKET HEAT TRANSFER AREA

2.240000E+04 3.018340E+04 3.018340E+04 1.978000E+05

CARD5---HEAT CAPACITIES

7.400000E-01 3.100000E+00 1.250000E+00

HCARD6---REFERENCE POWER

9.24750E+06

CARD7---REACTOR POWER FRACTIONS, LBLANK, ABLANK, RBLANK

2.520000E-01 1.110000E-01 7.860000E-01

CARD8---FUEL ASSY POWER FRACTION-FUEL, FUEL, CLAD, NA, DUCT

4.460000E+00 4.460000E+00 1.000000E-01 6.269999E-02 1.071000E-01

CARD9---FUEL ASSY AXIAL POWER DISTRIBUTION

1.848970E+00 2.447881E+00 2.245410E+00 2.489860E+00 1.367900E+00

CARD10---RADIAL BLANKET AXIAL POWER DISTRIBUTION

2.200000E-01 2.200000E-01 4.000000E+00 2.250000E+00 4.000000E-01

CARD11---REFERENCE TOTAL REACTOR FLOW

1.152034E+05

CARD12---FLOW FRACTIONS

8.000000E+00 1.200000E+00 8.000000E-01

CARD13 AND CARD14- DELAYED NEUTRON GP FRACTIONS

8.723000E-04 7.499000E-03 6.647949E-03 1.306000E-02 5.950001E-03

1.949000E-03

CARD15 AND CARD16- DELAYED NEUTRON DECAY CONST.

1.290000E-01 3.080000E-01 1.320000E+00 3.350000E+00 1.340000E+01

1.320000E+01

CARD17 AND CARD18- ACTIVE CORE DOPPLER COEFF.

5.675000E-03 7.499999E-03 7.795000E-03 5.834999E-03 2.784999E-03

5.075000E-03 7.499999E-03 7.795000E-03 5.834999E-03 2.784999E-03

CARD19---BLANKET DOPPLER COEFFICIENTS

4.370001E-03 1.180000E-03 9.270001E-03

CARD20 -SODIUM DENSITY REACTIVITY COEFFICIENTS

0.280000E-04 5.960000E-04 1.252000E-03 6.019999E-04 -7.300000E-04

CARD21 -PPS AND ROD DYNAMICS DELAY

2.000000E+00

CARD22 AND CARD23 -COFF PARAMETERS

2.766200E+02 4.246600E+05 3.060000E+01 2.971500E+01 1.000000E+01

1.960000E+03

CARD24 ACTIVE CORE FUEL PIN GEOMETRY

8.194172E-02 8.133329E-12 9.583332E-02 1.666660E-02 1.000000E+01

ROD25 ACTIVE CORE HYDRAULIC DIA., FITCH/DIA.

9.67910E-01 1.24350E+01

CARD26 FUEL PIN GAP HEAT XFER COEFFICIENTS

.441600E+00 .429240E+00 .429160E+00 .415600E+00 .373820E+01

CARD27 AND CARD28 - MATERIAL PROPERTIES

.699999E+01 .150000E+00 .609250E+03 .501100E+03 .538780E+02

.330600E+02

CARD29, 30 AND 31 - HOT CHANNEL FACTORS

.135100E+01 .100300E+01 .115600E+01 .110000E+01 .116130E+01

.110000E+01 .137500E+01 .151400E+01 .157500E+01 .129792E+01

.170000E+01

CARD32 AND CARD33 - RADIAL BLANKET DATA

.533333E+01 .500000E+01 .204166E-01 .216667E-01 .915000E+04

.350000E+00 .344000E-02 .420000E+01

CARD34 - UPPER PLFNUM MIXING MODEL DATA

.497000E+00 .037000E+03 .513000E+02

DECAY HEAT TABLE

TIME (SEC) POWER (GT)

0. .8694249E-01

.1000000E+01 .7737922E-01

.1194000E+01 .7562160E-01

.1425000E+01 .7447128E-01

.1701000E+01 .7255011E-01

.2031000E+01 .7101027E-01

.2424000E+01 .6943101E-01

.2894000E+01 .6781762E-01

.3455000E+01 .6617594E-01

.4125000E+01 .6425272E-01

.4924000E+01 .6293178E-01

.5870000E+01 .6130972E-01

.7017000E+01 .5969141E-01

.8377000E+01 .5807310E-01

.1000000E+02 .5645175E-01

.1194000E+02 .5482930E-01

.1425000E+02 .5322857E-01

.1700999E+02 .5164946E-01

.2031000E+02 .5006946E-01

.2424000E+02 .4848178E-01

.2894000E+02 .4700318E-01

.3455000E+02 .4552968E-01

.4125000E+02 .4409450E-01

.4924000E+02 .4269792E-01

.5870000E+02 .4132761E-01

.7017000E+02 .3998123E-01

.8377000E+02 .3865743E-01

.1000000E+03 .3735632E-01

.1194000E+03 .3608167E-01

.1425000E+03 .3484415E-01

.1701000E+03 .3363896E-01

.2031000E+03 .3246388E-01

.2424000E+03 .3132439E-01

.2893999E+03 .3022056E-01

.3455000E+03 .2915391E-01

.4125000E+03 .2812250E-01

.4923999E+03 .2712602E-01

.5873000E+03 .2615514E-01

.7017000E+03 .2520724E-01

.8377000E+03 .2428170E-01

.1000000E+04 .2337847E-01

.1194000E+04 .2249039E-01

.1425000E+04 .2163556E-01

.1701000E+04 .2075067E-01

.2031000E+04 .1989523E-01

.2424000E+04 .1905880E-01

.2894000E+04 .1824223E-01

.3455000E+04 .1744679E-01

.4125000E+04 .1667126E-01

.4924000E+04 .1591641E-01

.587800E+04 .1318481E-01
 .701700E+04 .1348128E-01
 .837700E+04 .138476E-01
 .100000E+04 .1315495E-01

PRIMARY ROD INSERTION DATA

TIME

.100000E+00 .200000E+00 .300000E+00 .400000E+00
 .500000E+00 .600000E+00 .700000E+00 .800000E+00 .900000E+00
 .100000E+01 .120000E+01 .140000E+01 .160000E+01 .180000E+01
 .200000E+01 .100000E+02 .130000E+02 .200000E+02 .100000E+07

REACTIVITY

.900000E-01 .440000E+01 .130000E+01 .234000E+01
 .330000E+01 .437000E+01 .460000E+01 .529000E+01 .572000E+01
 .637000E+01 .632000E+01 .633000E+01 .650000E+01 .650000E+01
 .652000E+01 .650000E+01 .650000E+01 .650000E+01 .650000E+01

SECONDARY ROD INSERTION DATA

TIME

.100000E+00 .200000E+00 .300000E+00 .400000E+00
 .500000E+00 .600000E+00 .700000E+00 .800000E+00 .900000E+00
 .100000E+01 .120000E+01 .140000E+01 .160000E+01 .180000E+01
 .200000E+01 .100000E+02 .130000E+02 .200000E+02 .100000E+07

REACTIVITY

.150000E+00 .300000E+00 .500000E+00 .110000E+01
 .190000E+01 .275000E+01 .370000E+01 .475000E+01 .510000E+01
 .580000E+01 .620000E+01 .630000E+01 .630000E+01 .630000E+01
 .630000E+01 .630000E+01 .630000E+01 .630000E+01 .630000E+01

FAILURE ROD INSERTION DATA

TIME

.100000E+00 .200000E+00 .300000E+00 .400000E+00
 .500000E+00 .600000E+00 .700000E+00 .800000E+00 .900000E+00
 .100000E+01 .120000E+01 .140000E+01 .160000E+01 .180000E+01
 .200000E+01 .100000E+02 .130000E+02 .200000E+02 .100000E+07

REACTIVITY

.100000E+00 .200000E+00 .300000E+00 .400000E+00
 .500000E+00 .600000E+00 .700000E+00 .800000E+00 .900000E+00
 .999990E+00 .999990E+00 .999990E+00 .999990E+00 .999990E+00
 .999990E+00 .999990E+00 .999990E+00 .999990E+00 .999990E+00

SIHX1 DIMENSIONAL DATA

.263000E+04 .113000E+04 .251500E+02 .250900E+02 .841000E+03
 .145507E+05 .323330E-01 .364500E-01 .128700E+00 .646700E-01
 .150000E+01 .150000E+00 .501000E+03
 .810000E+00

STGEN DIMENSIONAL DATA

1 3 3
 0 0 0
 CARDS 3 THRU 6, EVAP & SUP MODULE DIMENSIONS
 .200000E+01 .757000E+03 .100000E+01 .757000E+03
 .339200E-01 .520000E-01 .339200E-01 .520000E-01
 .410000E+02 .410000E+12 .700000E+01 .700000E+01
 .195200E+01 .573300E+01 .195200E+01 .573300E+01

CARD 7, DRUM & HDR VOLUMES

.837000E+03 .837000E+03 .136000E+04

CARDS 8-9, PIPING LENGTHS & ELEVATIONS

.120000E+03 .336000E+03 .216000E+04 .226800E+04
 .900000E+02 .502000E+01 .130000E+02

SOD NODE MASSES

.229400E+01 .229400E+01

A TUNE PROPS

.110000E+00 .449020E+03

RECIRC LOOP A TO L RATIOS

.4879000E+03 .4879000E+03

CARDS 13 THRU 16, PEF VALS FOR COEF CALCS

.5250200E+00 .6000000E+00 .2580000E+02 .1242750E+03

.3656730E+03 .1400000E+01 .6106700E+03

.1766000E+04 .1240000E+04 .1500000E+04 .3083330E+03 .9250000E+03

.1154000E+04 .1430000E+04 .9000000E+03

CARDS 17, STGEN TIME CONSTANTS & DELAYS

.5000000E+00

CARDS 18/19, DRUM LEVEL MODEL

.3010000E+03 .1930000E+03 .5350000E+03

.7407400E+01 .9264000E+01 .9214000E+01 -.8000000E+01 .1733300E+02

CARD 20, FIT COEFS FOR FEEDWATER ENTHALPY

.2144650E+03 .5174400E+03 .1852300E+03 -.4481000E+03 .3090000E+03

CARD 21, SGARHS SYSTEM MODEL

.3501000E+02 .4330000E+03 .3210000E+03 .4620000E+03

0. .4000000E+01 0.

NATURAL DIMENSIONAL DATA

-.1293000E+02 -.5583000E+01 .8090000E+01 .1640300E+02 -.5987000E+01

.5000000E+01 .3500000E+02 .7000000E+02 .8700000E+02 .1080000E+03

.1800000E+02 .5100000E+02 .8600000E+02 .1060000E+03 .1140000E+03

.1160000E+03 .6690000E+01 5

.1832000E+02 -.3125000E+02 .6580000E+01 -.9500000E+01

.1400000E+01 .2600000E+02 .1200000E+03 .1300000E+03

.1900000E+02 .5700000E+02 .1270000E+03 .2220000E+03

.2230000E+03 .2890000E+01 4

.7500000E+01 .4000000E+01 -.3952000E+02 .6080000E+01 .3850000E+02

.1000000E+01 .3700000E+02 .4800000E+02 .1370000E+03 .1600000E+03

.3700000E+02 .4100000E+02 .8800000E+02 .1600000E+03 .1990000E+03

.2030000E+03 .2890000E+01 5

-.9750000E+01 .4670000E+01 .1950000E+02 .1050000E+02 .1000000E+01

-.4100000E+02 .1020000E+03 .2020000E+03 .2660000E+03 .3250000E+03

.1000000E+01 .1020000E+03 .2020000E+03 .2660000E+03 .3250000E+03

.4580000E+03

.9000000E+02 .1080000E+03 .2210000E+03 .2770000E+03 .3370000E+03

.4990000E+03

.5070000E+03 .2890000E+01 6

-.2700000E+02 .2230000E+02 -.2440000E+02 -.5380000E+01 .5010000E+02

.5800000E+02 .9800000E+02 .1550000E+03 .1930000E+03 .2800000E+03

.8500000E+02 .1140000E+03 .1820000E+03 .2720000E+03 .3200000E+03

.3030000E+03 .2890000E+01 5

-.9750000E+01 .4670000E+01 .2750000E+02 .3540000E+01 -.4100000E+02

.1000000E+01 .1020000E+03 .2240000E+03 .2510000E+03 .6250000E+03

.9000000E+02 .1080000E+03 .2510000E+03 .5050000E+03 .6660000E+03

.6750000E+03 .2890000E+01 5

-.2700000E+02 .2200000E+02 -.3540000E+01 -.2113000E+02 -.5380000E+01

.4010000E+02

.5800000E+02 .9900000E+02 .1400000E+03 .3710000E+03 .4140000E+03

.4950000E+03

.8500000E+02 .1140000E+03 .1710000E+03 .3920000E+03 .4950000E+03

.5350000E+03

.6190000E+03 .2890000E+01 6

-.3542000E+02 .6300000E+02 .9800000E+02

-.3542000E+02 .6300000E+02 .9800000E+02

.1150000E+03 .1970000E+01 1

.1150000E+03 .1970000E+01 1

.2510000E+02 -.2510000E+02 .3550000E+02 .3550000E+02

.9829000E+01 .1160000E+01 .1000000E+01 .1160000E+01 .1025000E+02

VOLEX DIMENSIONAL DATA

.2893400E+03 .7750000E+03 .5860000E+03 .8940000E+03 .2960000E+04

.1100000E+02 .2700000E+02 .1100000E+02 .2900000E+02 .6146000E+04

.1000000E+04 .6450000E+02

0. .640000E+02 .290000E+03

FLOCC3 DIMENSIONAL DATA

.100000E+01	.855000E+01	.254710E+05	.350000E+05	
.278000E+03	.225230E+05	.200000E+05	.184700E+04	
.101000E+02	.101000E+02	.101000E+02	.105000E+03	.105000E+03
.105000E+03				
.520000E+02	.520000E+02	.520000E+02	.384200E+04	.355500E+04
.441600E+03	.441600E+03	.441600E+03	.441600E+03	.441600E+03
.441600E+03				
.227000E+01	.227000E+01	.227000E+01		
.275000E+02	.275000E+02	.275000E+02		
.520000E+02	.513000E+02	.251000E+02		
.140100E+01	.340000E+00	.102000E+00	.163000E+00	.250000E+03
.230000E+01	.120000E+01	.117000E+01	.897000E+01	.117000E+01
.543000E+03	.400000E+00	.364000E+00	.368000E+00	.610000E+01
.250000E+03	.200000E+01	.150000E+01	.147000E+01	.900000E+01
.147000E+00				
.100000E+02	.191000E+02			
.139420E+03	.207130E+03	.100000E+03	.230000E+03	
.100000E+01	.100000E+01	.100000E+01	.100000E+01	.100000E+01
.100000E+01				
.147000E+02	.120570E+02	.176600E+00	.176600E+00	
.500000E+00				

RUPTURE DIMENSIONAL DATA

.426000E+03	.270000E+03	.775000E+03	.172100E+01	
.100000E+01	.445000E+02	.147000E+02	0.	.415000E+02
.330000E+02	.460000E+01	.820000E+01	.800000E+01	.270000E+02

PROTSYS DIMENSIONAL DATA

NUMBER OF FPS TRIPS TO TRIP PLANT

1

FLOW RATIO TRIP

.510000E+03	.500000E+00	.100000E+01	.100000E+01	.149205E+00
.999000E+01	.125000E+01	.985000E+01	.101500E+01	

SPEED RATIO TRIP

.200000E+01	.200000E+01	.100000E+01	.160000E+01	.149205E+00
.095000E+01	.125000E+01	.985000E+01	.101500E+01	

FLUX-DELAYED FLUX TRIP

.500000E+01	.100000E+01	.280000E+02	.102000E+01	.280000E+02
.109900E+01	.990000E+00	.101000E+01		
.187500E+01	.325000E+01	.101000E+01	.162500E+00	.275000E+01
.195000E+01				

FLUX-TOTAL FLOW

.500000E+01	.990000E+00	.500000E+00	.100000E+01	.103000E+01
.100000E+01				

TOTAL FLUX TRIP

.312500E+02	.437500E+02	.999999E+02	.119340E+01	.662999E+01
.990000E+00	.500000E+01	.114370E+01		

MANUAL TRIP

.400000E+01				
.143660E+01	.500000E+01	.150000E+03	.100000E+01	.127800E+01
.746000E+01	.337000E+02			
.920000E+01				

REACTOR LEVEL TRIP

.500000E+03	.100000E+01	.147800E+02		
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CONTROL INITIAL CONDITION DATA

1035131E+01	.1035131E+01	.1035136E+01	.1032241E+01	.1032549E+01
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REACTOR INITIAL CONDITION DATA

AVERAGE CHANNEL TEMPERATURES DEG. F

.1970915E+04	.2541622E+04	.2466541E+04	.2435693E+04	.1929231E+04
.1332830E+04	.1616429E+04	.1622777E+04	.1654546E+04	.1477838E+04
.6191398E+03	.8927013E+03	.9581332E+03	.1019115E+04	.1057153E+04
.8127074E+03	.8844387E+03	.9585238E+03	.1012221E+04	.1052677E+04
.8087520E+03	.8791154E+03	.9454957E+03	.1007362E+04	.1049460E+04

PEAK CHANNEL TEMPERATURES DEG. F

.2561336E+04	.3317629E+04	.3217577E+04	.3176768E+04	.2482216E+04
.1605394E+04	.1996445E+04	.2003355E+04	.2046514E+04	.1783784E+04
.8426426E+03	.9461512E+03	.1038938E+04	.1125597E+04	.1180052E+04
.8350129E+03	.9365727E+03	.1036203E+04	.1117588E+04	.1174836E+04

HOT CHANNEL TEMPERATURES DEG. F

.3349870E+04	.4173299E+04	.4058725E+04	.4009918E+04	.3196014E+04
.2076365E+04	.2639253E+04	.2623207E+04	.2631155E+04	.2250989E+04
.8901439E+03	.1032215E+04	.1150196E+04	.1260961E+04	.1322869E+04
.8574092E+03	.9899065E+03	.111696E+04	.1225209E+04	.1299428E+04
.9474358E+03	.1108063E+04	.1219772E+04	.1325717E+04	.1365254E+04

TPL AND TOL TEMPERATURES DEG. F

.7504185E+03	.7505164E+03	.8575509E+03	.7587876E+03	.1095605E+04
.1056050E+04	.1111546E+04	.9236220E+03	.1015545E+04	.1015585E+04
.7950561E+03	.1025533E+04	.1211576E+04	.1096697E+04	.9537035E+03
.7751332E+03	.8986184E+03	.1011516E+04	.9911057E+03	.9365775E+03
.7561895E+03	.7903957E+03	.9521405E+03	.9022992E+03	.9210645E+03
.7594631E+03	.8082565E+03	.8775452E+03	.9166590E+03	.9236220E+03

NS,OK,PVOLH

.1700094E+01 -.7884113E+00 0.

1HX PRIMARY SODIUM TEMPERATURES IN S-LOOP

.1015475E+04	.1010355E+04	.1005204E+04	.1000022E+04	.9948091E+03
.9895637E+03	.9842856E+03	.9789740E+03	.9736282E+03	.9682477E+03
.9628320E+03	.9573805E+03	.9518930E+03	.9463693E+03	.9408093E+03
.9352131E+03	.9295807E+03	.9239122E+03	.9182077E+03	.9124673E+03
.9066914E+03	.9008792E+03	.8950311E+03	.8891674E+03	.8832278E+03
.8772723E+03	.8712808E+03	.8652531E+03	.8591894E+03	.8530894E+03
.8489532E+03	.8427806E+03	.8365716E+03	.8303262E+03	.8240442E+03
.8157257E+03	.8093707E+03	.8029790E+03	.7965506E+03	.7900856E+03
.7835838E+03	.7770454E+03	.7705732E+03	.7639583E+03	.7572096E+03
.7505242E+03				

1HX HALL TEMPERATURES IN S-LOOP

.9826403E+03	.9773447E+03	.9719358E+03	.9665331E+03	.9610963E+03
.9556249E+03	.9501184E+03	.9445763E+03	.9389982E+03	.9333846E+03
.9277313E+03	.9220459E+03	.9163219E+03	.9105610E+03	.9047634E+03
.8989290E+03	.8930579E+03	.8871501E+03	.8812056E+03	.8752245E+03
.8642067E+03	.8581522E+03	.8520609E+03	.8459328E+03	.8447677E+03
.8385638E+03	.8323268E+03	.8261507E+03	.8197375E+03	.8133871E+03
.8069995E+03	.8005745E+03	.7941122E+03	.7876125E+03	.7810753E+03
.7745047E+03	.7678887E+03	.7612391E+03	.7545520E+03	.7478274E+03
.7410653E+03	.7342656E+03	.7274284E+03	.7205536E+03	.7136414E+03

1HX INTERMEDIATE SODIUM TEMPERATURES IN S-LOOP

.9561822E+03	.9506695E+03	.9451212E+03	.9395373E+03	.9339172E+03
.9242677E+03	.9185676E+03	.9128377E+03	.9071088E+03	.9012667E+03

.8994256E+03	.8935471E+03	.8876314E+03	.8816785E+03	.8756882E+03
.8696606E+03	.8635957E+03	.8576934E+03	.8513532E+03	.8451704E+03
.8389617E+03	.8327093E+03	.8264193E+03	.8200915E+03	.8137259E+03
.8073225E+03	.8008811E+03	.7944017E+03	.7878842E+03	.7813287E+03
.7747351E+03	.7681031E+03	.7614330E+03	.7547246E+03	.7479780E+03
.7411930E+03	.7343694E+03	.7275082E+03	.7205083E+03	.7136700E+03
.7066916E+03	.6996785E+03	.6926252E+03	.6855337E+03	.6784039E+03
.6712040E+03				

INX PRIMARY SODIUM TEMPERATURES IN L-LOOP

.1015475E+04	.1010355E+04	.1005294E+04	.1000222E+04	.9948091E+03
.9895637E+03	.9842856E+03	.9789740E+03	.9736282E+03	.9682477E+03
.9626320E+03	.9573805E+03	.9518930E+03	.9463693E+03	.9408093E+03
.9352131E+03	.9295807E+03	.9239122E+03	.9182077E+03	.9124673E+03
.9066910E+03	.9008790E+03	.8950311E+03	.8891476E+03	.8832278E+03
.8772723E+03	.8712608E+03	.8652531E+03	.8591694E+03	.8530894E+03
.8409532E+03	.8347806E+03	.8285716E+03	.8223262E+03	.8223442E+03
.8157257E+03	.8093747E+03	.8029790E+03	.7965506E+03	.7900856E+03
.7835818E+03	.7770454E+03	.7704702E+03	.7638583E+03	.7572090E+03
.7505242E+03				

INX WALL TEMPERATURES IN L-LOOP

.9826403E+03	.9773047E+03	.9719358E+03	.9665311E+03	.9610963E+03
.9536244E+03	.9481184E+03	.9425763E+03	.9369982E+03	.9313840E+03
.9277313E+03	.9220454E+03	.9163219E+03	.9105610E+03	.9047634E+03
.8989290E+03	.8930570E+03	.8871501E+03	.8812056E+03	.8752245E+03
.8692467E+03	.8631522E+03	.8570609E+03	.8509328E+03	.8447677E+03
.8305688E+03	.8243268E+03	.8180507E+03	.8117375E+03	.8133871E+03
.8069995E+03	.8005745E+03	.7941122E+03	.7876125E+03	.7810753E+03
.7745007E+03	.7678887E+03	.7612391E+03	.7545520E+03	.7478274E+03
.7410653E+03	.7342656E+03	.7274284E+03	.7205536E+03	.7136414E+03

INX INTERMEDIATE SODIUM TEMPERATURES IN L-LOOP

.9561622E+03	.9506695E+03	.9451212E+03	.9395373E+03	.9339172E+03
.9282607E+03	.9225676E+03	.9168377E+03	.9110708E+03	.9052667E+03
.8994256E+03	.8935471E+03	.8876314E+03	.8816785E+03	.8756882E+03
.8696606E+03	.8635957E+03	.8576934E+03	.8513532E+03	.8451704E+03
.8389617E+03	.8327093E+03	.8264193E+03	.8200915E+03	.8137259E+03
.8073225E+03	.8008811E+03	.7944017E+03	.7878842E+03	.7813287E+03
.7747351E+03	.7681031E+03	.7614330E+03	.7547246E+03	.7479780E+03
.7411930E+03	.7343694E+03	.7275082E+03	.7205083E+03	.7136700E+03
.7066916E+03	.6996785E+03	.6926252E+03	.6855337E+03	.6784039E+03
.6712040E+03				

STEAM INITIAL CONDITION DATA

CARD 1, S-LOOP EVAP. PRESSURES

.1800616E+04	.1855941E+04	.1811366E+04	.1845824E+04	.1842150E+04
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CARD 2, S-LOOP STEAM ENTHALPIES

.1837592E+04	.1833419E+04	.1829602E+04		
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CARD 3, S-LOOP SOD. TEMP.

.5333785E+03	.5271246E+03	.5179583E+03	.5096584E+03	.7777227E+03
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CARD 4, S-LOOP SUPERHEATER STEAM PRESSURES

.6712220E+03	.6943694E+03	.7171985E+03	.7454135E+03	.7826709E+03
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.4318217E+03	.8526433E+03	.8761247E+03		
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.766467E+04	.1724165E+04	.1711803E+04	.1669561E+04	.1637258E+04
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.1644956E+04	.1572654E+04	.1541352E+04		
CARD 9, S-SUP STM. LNTHALPIES				
.1151479E+04	.1226763E+04	.1285155E+04	.1333344E+04	.1365186E+04
.1791827E+04	.1412022E+04	.1427451E+04		
CARD 6, S-SUP SOO TEMP				
.9766348E+03	.8963022E+03	.9151272E+03	.9281585E+03	.9382127E+03
.9459038E+03	.9517546E+03	.9561942E+03		
CARDS 7-12, L-LOOP INIL VALUES				
.1860692E+04	.1856017E+04	.1851441E+04	.1846899E+04	.1842225E+04
.1837666E+04	.1833494E+04	.1829677E+04		
.5333638E+03	.5771155E+03	.6179576E+03	.6696532E+03	.7377139E+03
.8271729E+03	.8649533E+03	.9324216E+03		
.6712285E+03	.6949756E+03	.7172027E+03	.7454129E+03	.7826634E+03
.8318053E+03	.8526271E+03	.8765960E+03		
.1706544E+04	.1734242E+04	.1701940E+04	.1669638E+04	.1637335E+04
.1615933E+04	.1572731E+04	.1540429E+04		
.1151474E+04	.1226742E+04	.1285127E+04	.1330312E+04	.1365154E+04
.1391796E+04	.1412054E+04	.1427426E+04		
.8766006E+03	.8982675E+03	.9151936E+03	.9281268E+03	.9381836E+03
.9458776E+03	.9517306E+03	.9561736E+03		
CARDS 13-14, RECIRC LOOP PRESSURES				
.1780256E+04	.1904116E+04	.1899320E+04	.1766467E+04	
.1780333E+04	.1904193E+04	.1899197E+04	.1766544E+04	
CARDS 15-17, DRUM AND HOP VALS				
.1464390E+05	.1464390E+05	.1037753E+08	.1037757E+08	
.2664073E+04	.3700679E+07			
CARDS 18-19, FLOWS				
.3921311E+06	.3921416E+06	.3892488E+03	.3893744E+03	
.3093082E+03	.3093704E+03	.9279185E+03		
CARDS 20-27, WALL TEMPS				
.6372567E+03	.6630087E+03	.6764951E+03	.6914473E+03	.7110768E+03
.8049525E+03	.8169399E+03			
.6372582E+03	.6630110E+03	.6764994E+03	.6914490E+03	.7110748E+03
.6049384E+03	.8169201E+03			
.8206138E+03	.8545072E+03	.8810263E+03	.9017379E+03	.9179359E+03
.9304424E+03	.9399961E+03			
.8245086E+03	.8544731E+03	.8849687E+03	.9017014E+03	.9179015E+03
.9384105E+03	.9399677E+03			

VOLEX INITIAL CONDITION DATA

.1630090E+02

FLOCUS INITIAL CONDITION DATA

.1000000E+00	0.	.1000000E+00	.1000000E+00	.1000000E+00
.1000000E+00				
.1460000E+04	.1460000E+04	.1460000E+04	.1460000E+04	.1460000E+04
.1460000E+04				
.1511035E+03	.1511035E+03	.1508845E+03	.8237912E+03	.2409000E+04
.1009000E+02				
.1506215E+02	.1506212E+02	.1506478E+02	.1505701E+02	.1479077E+02
.1467068E+02				
.1002075E+01	.1000075E+01	.1000055E+01	.9984476E+00	.9586004E+00
.1000000E+01				
.9999196E+00	.9999996E+00	.9999948E+00	.1000000E+01	.1000000E+01
.1000000E+01				
.1000007E+02	.1000007E+02	.1000075E+02		
.1131000E+03	.1130000E+03	.1073000E+03		

PRIMARY PUMP INERTANCE= .2018541E+00

HEAD= .3873323E+03

INTERMEDIATE PUMP INERTANCE= .5139919E+00

HEAD= .2907692E+03

LENGTHS OF DELAY TABLES

104 104 87 47 79 79 214 285 33 33 153 261

PEAK BETWEEN INX AND VESSEL

BREAK IN GV

COILLOTINE RUPTURE

.4260000E+03	.2700000E+04	.7700000E+03	.1721000E+01
.1000000E+01	.4500000E+02	.1470000E+12	0.
.3250000E+02	.1625000E+04	.3300000E+02	.4600000E+01
0.	.8000000E+01	.8200000E+01	.8200000E+01
.2490000E+01	.2690000E+01		

PROTSYS INITIAL CONDITION DATA

FLOW RATIO TRIP	
.1000000E+01	.1000000E+01
SPEED RATIO TRIP	
.9999999E+01	.9999999E+01
FLUX-DELAYED FLUX TRIP	
.1000000E+01	.1000000E+01
FLUX-TOTAL FLOW	
.9999999E+01	.9999999E+01
TOTAL FLUX TRIP	
.9999999E+01	.9999999E+01
REACTOR LEVEL TRIP	
.1629999E+02	.1629999E+02

J = 0.0000

DEFINITIONS

FLOCO3

-1.154888E+00	-1.154888E+00	-1.168827E+01	.133164E+02	.133064E+02
.347997E+04	.776109E+03	.627619E+03	0.	.136107E+06
-1.136107E-06	.112251E-04	-.291801E-07	.203508E-06	0.

THE ACTOR

AVE. CHANNEL TEMPS.

-308446E-03	-328797E-03	-418110E-03	-471488E-03	-212592E-03
-504543E-04	-129268E-02	882967E-03	-580146E-03	915457E-03
121364E-02	108124E-02	178419E-02	686960E-02	635787E-02
-101864E-02	-394737E-02	-475839E-02	-216925E-01	786446E-02
-721653E-04	-533889E-04	649330E-05	118302E-03	156632E-01

H01 CHANNEL TEMPS.

-168465E-04	-928912E-04	-223315E-03	.961112E-03	.664777E-03
-560737E-03	.131762E-02	-303271E-04	-789838E-03	-.296049E-03
.329298E-03	-.114791E-01	.767007E-02	.185609E-02	.399934E-02
-.612373E-03	-.139741E-01	-.572450E-02	-.216079E-01	.177974E-02

PEAK CHANNEL TEMPS.

-438406E-03	153583E-03	184130E-03	-182657E-03	250751E-03
-654190E-03	62217E-03	267175E-03	119028E-02	-129161E-02
-181576E-02	288632E-03	-668030E-02	679013E-02	299413E-01
300015E-02	-549466E-02	127936E-01	-285974E-01	-423663E-01

PLENUM TEMPERATURES

320700E-01	242971E-03	-993425E-04	-911944E-03	-133204E-03
320800E-02	0	0	202669E-02	-286330E-02

BLANKET TEMPERATURES

- .840926E-04	.764694E-06	.547216E-04	-.376793E-04	-.342806E-04
-.102574E-03	-.122273E-03	-.191292E-03	.721254E-05	-.388346E-04
-.435214E-03	.828919E-04	-.213020E-03	-.672145E-03	.547010E-03
.735166E-03	-.715690E-03	.745070E-03	.104226E-02	-.462474E-03

INX

SHALL TEMPS.

[illegible]

PRIMARY SICE TEMPS.

0. .1797805E-01 .1251242E-01 .6061096E-02 .1931477E-02 .6317209E-02 .1094953E-01
 -.1408501E-01 -.1588571E-01 -.1682645E-01 -.1670718E-01 -.1515821E-01 -.1323598E-01 -.1078845E-01
 -.8173302E-02 -.5669755E-02 -.3654497E-02 -.1837919E-02 -.3174617E-03 .7161125E-03 .1631917E-02

.175569E-02	.225592E-02	.221126E-02	.229924E-02	.2.71218E-02	.1976569E-02	.2239792E-02
.170487E-02	.184841E-02	.152211E-02	.162831E-02	.15409E-02	.1315287E-02	.1542688E-02
.132845E-02	.995844E-03	.118630E-02	.127275E-02	.9932961E-03	.1258921E-02	.9037224E-03
.105957E-02	.926683E-03	.10509E-02	.949820E-02			
6.	.179783E-01	.125122E-01	.606139E-02	.1931477E-02	.6317289E-02	.109+953E-01
.140851E-01	.158851E-01	.1532E-01	.167071E-01	.1515821E-01	.132359E-01	.1078845E-01
.8173802E-02	.586975E-02	.3654487E-02	.1637919E-02	.317481E-03	.7161125E-03	.1631917E-02
.1755609E-02	.225592E-02	.224126E-02	.229924E-02	.2.71218E-02	.1976569E-02	.2239792E-02
.170487E-02	.184841E-02	.152211E-02	.162831E-02	.15409E-02	.1315287E-02	.1542688E-02
.132845E-02	.995844E-03	.118630E-02	.127275E-02	.9932961E-03	.1258921E-02	.9037224E-03
.105957E-02	.926683E-03	.10509E-02	.949820E-02			

HALL TEMPS.

.8061646E-02	.4128465E-02	.2133363E-04	.2654238E-02	.5072566E-02	.7424322E-02	.9048175E-02
.981466E-02	.970841E-02	.9359973E-02	.842713E-02	.7114959E-02	.6361694E-02	.4507328E-02
.542847E-02	.2175330E-02	.7517535E-03	.3547940E-03	.3074358E-03	.4749240E-03	.6833922E-03
.712396E-03	.7785349E-03	.6617627E-03	.1120892E-02	.9639180E-03	.9504520E-03	.9702725E-03
.917044E-03	.908699E-03	.595050E-03	.6531819E-03	.5318503E-03	.4514987E-03	.6287238E-03
.736707E-03	.5626990E-03	.6501143E-03	.6721346E-03	.5223850E-03	.3110872E-03	.3612128E-03
.643415E-03	.5011099E-03	.3930169E-01				
.8061646E-02	.4128465E-02	.2133363E-04	.2654238E-02	.5072566E-02	.7424322E-02	.9048175E-02
.981466E-02	.970841E-02	.9359973E-02	.842713E-02	.7114959E-02	.6361694E-02	.4507328E-02
.542847E-02	.2175330E-02	.7517535E-03	.3547940E-03	.3074358E-03	.4749240E-03	.6833922E-03
.712396E-03	.7785349E-03	.6617627E-03	.1120892E-02	.9639180E-03	.9504520E-03	.9702725E-03
.917044E-03	.908699E-03	.595050E-03	.6531819E-03	.5318503E-03	.4514987E-03	.6287238E-03
.736707E-03	.5626990E-03	.6501143E-03	.6721346E-03	.5223850E-03	.3110872E-03	.3612128E-03
.643415E-03	.5011099E-03	.3930169E-01				

INTERMEDIATE SIDE TEMPS.

.1099289E-02	.5128881E-02	.4103144E-02	.6847528E-02	.7612340E-02	.7205914E-02	.6437185E-02
.6115707E-02	.6791454E-02	.3223054E-02	.4514760E-02	.2658362E-02	.4465070E-03	.1197654E-02
.1375531E-03	.9306001E-03	.7209041E-03	.1499223E-02	.6078961E-04	.2079566E-02	.8185042E-03
.193599E-02	.1101174E-02	.1318517E-02	.2034524E-02	.1211213E-02	.1074887E-02	.3270297E-03
.1719136E-02	.9019060E-03	.8859738E-03	.1114352E-02	.5422420E-03	.1666376E-02	.1226508E-03
.1728556E-02	.8457585E-03	.1244857E-02	.3427411E-03	.9041617E-03	.1356483E-02	.1216658E-03
.150665E-02	.8611612E-03	.4579279E-04				
.1199289E-02	.5128881E-02	.4103144E-02	.6847528E-02	.7612340E-02	.7205914E-02	.6437185E-02
.6115707E-02	.6791454E-02	.3223054E-02	.4514760E-02	.2658362E-02	.4465070E-03	.1197654E-02
.1375531E-03	.9306001E-03	.7209041E-03	.1499223E-02	.6078961E-04	.2079566E-02	.8185042E-03
.193599E-02	.1101174E-02	.1318517E-02	.2034524E-02	.1211213E-02	.1074887E-02	.3270297E-03
.1719136E-02	.9019060E-03	.8859738E-03	.1114352E-02	.5422420E-03	.1666376E-02	.1226508E-03
.1728556E-02	.8457585E-03	.1244857E-02	.3427411E-03	.9041617E-03	.1356483E-02	.1216658E-03
.150665E-02	.8611612E-03	.4579279E-04				

REACTOR

AVE. CHANNEL TEMPS.

.197092E+04	.254863E+04	.246664E+04	.243569E+04	.192923E+04
.135284E+04	.161633E+04	.162278E+04	.165455E+04	.147781E+04
.819140E+03	.922781E+03	.958033E+03	.101912E+04	.105715E+04
.812707E+03	.944439E+03	.950524E+03	.101222E+04	.105268E+04
.808742E+03	.879015E+03	.945406E+03	.100736E+04	.104946E+04

HOT CHANNEL TEMPS.

.334937E+04	.417330E+04	.405873E+04	.400992E+04	.319601E+04
.207637E+04	.283955E+04	.262321E+04	.266316E+04	.225099E+04
.898144E+03	.103222E+04	.115020E+04	.126096E+04	.132287E+04
.857819E+03	.989302E+03	.111170E+04	.122521E+04	.129943E+04
.947436E+03	.118066E+04	.121977E+04	.132572E+04	.136525E+04

PEAK CHANNEL TEMPS.

.256134E+04	.331768E+04	.321759E+04	.317677E+04	.248224E+04
.168539E+04	.199645E+04	.200336E+04	.204651E+04	.178378E+04
.842643E+03	.946351E+03	.103894E+04	.112560E+04	.118005E+04
.835013E+03	.976572E+03	.103020E+04	.111759E+04	.117484E+04

PLENUM TEMPERATURES

.750419E+03	.750516E+03	.857512E+03	.750788E+03	.109561E+04
.105605E+04	.111155E+04	.923622E+03	.101555E+04	.101559E+04

BLANKET TEMPERATURES

.295056E+03	.102253E+04	.121158E+04	.109673E+04	.953703E+03
.775133E+03	.890518E+03	.101152E+04	.991706E+03	.936578E+03
.756190E+03	.731396E+03	.852141E+03	.902299E+03	.921664E+03
.759460E+03	.808257E+03	.877544E+03	.916659E+03	.923622E+03

INX

SHELL TEMPS.

.1012915E+04	.1037780E+04	.1002613E+04	.9974156E+03	.9921864E+03	.9869247E+03	.9816298E+03
.9763011E+03	.9709380E+03	.9655399E+03	.9601063E+03	.9546368E+03	.9491311E+03	.9435893E+03
.9380112E+03	.9323969E+03	.9267465E+03	.9210599E+03	.9153375E+03	.9095792E+03	.9037850E+03
.8973521E+03	.8920493E+03	.8861876E+03	.8802501E+03	.8742766E+03	.8682670E+03	.8622213E+03
.8561394E+03	.8500213E+03	.8438669E+03	.8376761E+03	.8314489E+03	.8251852E+03	.8188850E+03
.8125442E+03	.8061244E+03	.7997648E+03	.7933181E+03	.7868347E+03	.7803146E+03	.7737578E+03
.7671643E+03	.7605340E+03	.7538669E+03				
.912915E+04	.1007780E+04	.1102613E+04	.9974156E+03	.9921864E+03	.9869247E+03	.9816298E+03
.9763011E+03	.9709380E+03	.9655399E+03	.9601063E+03	.9546368E+03	.9491311E+03	.9435893E+03
.9380112E+03	.9323969E+03	.9267465E+03	.9210599E+03	.9153375E+03	.9095792E+03	.9037850E+03
.8973521E+03	.8920493E+03	.8861876E+03	.8802501E+03	.8742766E+03	.8682670E+03	.8622213E+03
.8561394E+03	.8500213E+03	.8438669E+03	.8376761E+03	.8314489E+03	.8251852E+03	.8188850E+03
.8125442E+03	.8061244E+03	.7997648E+03	.7933181E+03	.7868347E+03	.7803146E+03	.7737578E+03
.7671643E+03	.7605340E+03	.7538669E+03				

PRIMARY SIDE TEMPS.

.1015475E+04	.1010355E+04	.1005204E+04	.1000022E+04	.9948091E+03	.9895637E+03	.9842856E+03
.9769743E+03	.9710282E+03	.9658277E+03	.9602832E+03	.9543805E+03	.9489301E+03	.9435693E+03
.9408093E+03	.9352131E+03	.9295807E+03	.9239122E+03	.9182077E+03	.9124673E+03	.9066910E+03
.9008790E+03	.8950311E+03	.8891674E+03	.8832270E+03	.8772723E+03	.8712808E+03	.8652531E+03
.8591894E+03	.8530894E+03	.8469532E+03	.8407806E+03	.8345716E+03	.8283262E+03	.8220442E+03
.8157257E+03	.8093707E+03	.8029790E+03	.7965506E+03	.7900856E+03	.7835838E+03	.7770454E+03
.7734702E+03	.7668583E+03	.7602096E+03	.7505242E+03			
.1015475E+04	.1010355E+04	.1005204E+04	.1000022E+04	.9948091E+03	.9895637E+03	.9842856E+03
.9769743E+03	.9710282E+03	.9658277E+03	.9602832E+03	.9543805E+03	.9489301E+03	.9435693E+03
.9408093E+03	.9352131E+03	.9295807E+03	.9239122E+03	.9182077E+03	.9124673E+03	.9066910E+03
.9008790E+03	.8950311E+03	.8891674E+03	.8832270E+03	.8772723E+03	.8712808E+03	.8652531E+03
.8591894E+03	.8530894E+03	.8469532E+03	.8407806E+03	.8345716E+03	.8283262E+03	.8220442E+03
.8157257E+03	.8093707E+03	.8029790E+03	.7965506E+03	.7900856E+03	.7835838E+03	.7770454E+03
.7734702E+03	.7668583E+03	.7602096E+03	.7505242E+03			

HALL TEMPS.

.9826403E+03	.9773047E+03	.9719358E+03	.9665331E+03	.9610963E+03	.9556249E+03	.9501184E+03
.9445763E+03	.9389982E+03	.9333840E+03	.9277333E+03	.9220459E+03	.9163219E+03	.9105610E+03
.9047634E+03	.8989290E+03	.8930578E+03	.8871501E+03	.8812056E+03	.8752245E+03	.8692067E+03
.8631522E+03	.8570609E+03	.8509328E+03	.8447677E+03	.8385658E+03	.8323268E+03	.8260507E+03
.8197375E+03	.8133871E+03	.8069955E+03	.8005745E+03	.7941122E+03	.7876125E+03	.7810753E+03
.7745007E+03	.7678887E+03	.7612391E+03	.7545520E+03	.7478274E+03	.7410653E+03	.7342656E+03
.7274284E+03	.7205536E+03	.7136414E+03				
.9826403E+03	.9773047E+03	.9719358E+03	.9665331E+03	.9610963E+03	.9556249E+03	.9501184E+03
.9445763E+03	.9389982E+03	.9333840E+03	.9277333E+03	.9220459E+03	.9163219E+03	.9105610E+03
.9047634E+03	.8989290E+03	.8930578E+03	.8871501E+03	.8812056E+03	.8752245E+03	.8692067E+03
.8631522E+03	.8570609E+03	.8509328E+03	.8447677E+03	.8385658E+03	.8323268E+03	.8260507E+03
.8197375E+03	.8133871E+03	.8069955E+03	.8005745E+03	.7941122E+03	.7876125E+03	.7810753E+03
.7745007E+03	.7678887E+03	.7612391E+03	.7545520E+03	.7478274E+03	.7410653E+03	.7342656E+03
.7274284E+03	.7205536E+03	.7136414E+03				

INTERMEDIATE SIDE TEMPS.

.9561822E+03	.9506695E+03	.9451212E+03	.9395373E+03	.9339172E+03	.9282607E+03	.9225676E+03
.9165377E+03	.9107080E+03	.9048675E+03	.8989256E+03	.8929541E+03	.8869314E+03	.8808585E+03
.8756882E+03	.8696606E+03	.8635970E+03	.8574934E+03	.8513537E+03	.8451764E+03	.8389617E+03
.8327393E+03	.8264193E+03	.8200915E+03	.8137299E+03	.8073225E+03	.8008811E+03	.7944017E+03

.7878842E+03	.7813247E+03	.7747350E+03	.7681031E+03	.7614330E+03	.7547246E+03	.7479780E+03
.7411930E+03	.7345698E+03	.7275082E+03	.7206303E+03	.7138700E+03	.7066934E+03	.6996785E+03
.6926252E+03	.6855337E+03	.6784039E+03	.6712900E+03			
.9561822E+03	.9506695E+03	.9451212E+03	.9395373E+03	.9339172E+03	.9282607E+03	.9225676E+03
.9168377E+03	.9111708E+03	.9052667E+03	.8994256E+03	.8935471E+03	.8876314E+03	.8816785E+03
.8750882E+03	.8696606E+03	.8635952E+03	.8574934E+03	.8513532E+03	.8451764E+03	.8389617E+03
.8327093E+03	.8264193E+03	.8200915E+03	.8137259E+03	.8073225E+03	.8008811E+03	.7944017E+03
.7874884E+03	.7813287E+03	.7747350E+03	.7681031E+03	.7614330E+03	.7547246E+03	.7479780E+03
.7411930E+03	.7345698E+03	.7275082E+03	.7206303E+03	.7138700E+03	.7066934E+03	.6996785E+03
.6926252E+03	.6855337E+03	.6784039E+03	.6712900E+03			

POWER, KINETICS, P.C.

.1000000E+01	.1000000E+01	0.	0.	.1015585E+04
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CIRCULATION

.3574686E+03	.3574686E+03	.3574686E+03	.4966165E+00	.4966165E+00	.4966165E+00	.9148254E+01
.9148254E+01	.9148254E+01	.924974E+01	.4276272E+00	.3855787E+00	0.	

NA FLOWS

.100000E+01	.100000E+01	.100000E+01	.100000E+01	.100000E+01	.984288E+00
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PRESSURES

PRIMARY

.186733E+02	.186733E+02	.186791E+02	.158571E+03	.158571E+03	.158570E+03
.130143E+01	.249431E+02				

INTERMEDIATE

.104572E+03	.104614E+03	0.	.220072E+03	.224314E+03	0.
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PUMP

.100000E+01	.100000E+01	.999995E+00	.100000E+01	.100000E+01	.100000E+01
.100007E+01	.100007E+01	.100006E+01	.998448E+00	.998600E+00	.100000E+01
.103513E+01	.103513E+01	.103516E+01	.103228E+01	.103255E+01	.102320E+01
.100013E+01	.100013E+01	.100009E+01	.997312E+00	.997577E+00	0.
.387409E+03	.387409E+03	.387369E+03	.289585E+03	.289702E+03	0.

LEVELS

.163000E+02	.100001E+02	.100001E+02	.100087E+02
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COVER GAS

.151102E+03	.151102E+03	.150666E+03	.823600E+03	.240000E+04	.100000E+02
.150622E+02	.150622E+02	.150648E+02	.150570E+02	.147908E+02	.146781E+02

PIPE RUPTURE DATA

.952857E+00	.984288E+00	.999994E+00	.100090E+01	.480000E-05	.184416E-04
0.	0.	.133378E+02	.354646E-06	.266633E+02	.130193E+03
.150622E+02	.150622E+02	.150648E+02	.150570E+02	.147908E+02	.146781E+02
0.	0.	0.	.121758E+00	.672819E-01	.189040E+00
.141122E+06					
.517106E+02	.517106E+02	.517266E+02	.323014E+02	.323014E+02	.323000E+02
.193853E+04	.599377E+02				

PROTECTION SYSTEM

.100000E+01	.100000E+01	.999999E+00	.999999E+00	.998448E+00
.958000E+00	.100000E+01	.100000E+01	.100000E+01	.102000E+01
.100000E+01	.999999E+00	.999999E+00	.999999E+00	.162993E+02

STEAM GENERATOR VARIABLES

.671222E+03	.694809E+03	.717199E+03	.745414E+03	.792671E+03	.831822E+03	.852643E+03	.876625E+03
.70835E+03	.693702E+03	.915127E+03	.928159E+03	.938213E+03	.944904E+03	.951754E+03	.956194E+03

S-LOOP NA-TEMP IN EVAP AND SUPERH

S-LOOP WATERPRESS IN EVAP AND SUPERH

.186462E+04	.162594E+04	.195137E+04	.164672E+04	.184215E+04	.163759E+04	.183342E+04	.182960E+04
.176644E+04	.173417E+04	.178187E+04	.166957E+04	.163727E+04	.160497E+04	.157268E+04	.154035E+04

S-LOOP WATERENTH IN EVAP AND SUPERH

.533379E+03	.272125E+03	.617952E+03	.669658E+03	.237723E+03	.822190E+03	.864964E+03	.908445E+03
.115148E+04	.122676E+04	.128516E+04	.133334E+04	.136519E+04	.139183E+04	.141208E+04	.142745E+04

L-LOOP NA-TEMP IN EVAP AND SUPERH

.671229E+03	.494976E+03	.717233E+03	.745413E+03	.782663E+03	.831805E+03	.852620E+03	.876596E+03
.876601E+03	.896288E+03	.915894E+03	.928127E+03	.938184E+03	.945878E+03	.951731E+03	.956174E+03

L-LOOP WATERPRESS IN EVAP AND SUPERH

.186462E+04	.185012E+04	.145145E+04	.184690E+04	.184222E+04	.183767E+04	.183349E+04	.182968E+04
.176646E+04	.173424E+04	.170194E+04	.166964E+04	.163734E+04	.160504E+04	.157274E+04	.154035E+04

L-LOOP WATERENTH IN EVAP AND SUPERH

.533389E+03	.577116E+03	.617954E+03	.669653E+03	.237714E+03	.822173E+03	.864964E+03	.908422E+03
.115148E+04	.122674E+04	.128513E+04	.133031E+04	.136515E+04	.139180E+04	.141205E+04	.142743E+04

WATER/STEAM TEMPS IN VECTOR 1STEAM(13)

.618392E+03	.534071E+03	.538395E+03	.623268E+03	.623273E+03	.899576E+03
.453496E+03	.618390E+03	.618391E+03	.899629E+03	.899593E+03	.894849E+03

MASS ENERGY IN S-AND L-LOOP DRUMS AND HEADER

.146479E+02	.103775E+02	.146439E+02	.103775E+02	.286407E+04	.370067E+07
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BLUING, STEAM AND FEEDELOW FOR S-AND L-LOOP PLUS TURBINE STEAM FLOW

.392131E+00	.392141E+00	.309290E+03	.309305E+03	.309290E+03	.309309E+03	.927918E+03
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PRESSURES IN S-AND L-LOOP RECIRC LINES

.178925E+04	.190411E+04	.189932E+04	.176643E+04
.178033E+04	.190413E+04	.189939E+04	.176646E+04

WALL TEMPS IN S-AND L-LOOP EVAP AND SUPERH

.637256E+03	.663008E+03	.676495E+03	.691447E+03	.711076E+03	.804952E+03	.816439E+03
.637258E+03	.663011E+03	.676494E+03	.691449E+03	.711074E+03	.804938E+03	.816420E+03
.820613E+03	.854507E+03	.881023E+03	.901737E+03	.917935E+03	.930442E+03	.939996E+03
.820580E+03	.854470E+03	.880987E+03	.901701E+03	.917901E+03	.930410E+03	.939967E+03

Y= .050

DERIVATIVES

FLOCD3

.581430E+03	.591430E+03	.146894E+04	.222798E+04	.222798E+04
.342647E+04	.715361E+03	.620424E+03	0.	.371453E-01
.371453E-01	.639141E-01	.550736E-07	.171957E-06	0.

REACTOR

AVE. CHANNEL TEMPS.

.620909E-01	.865104E-01	.823051E-01	.771633E-01	.542987E-01
.520246E+00	.938687E+00	.110828E+01	.102611E+01	.604180E+00
.15333E+01	.311447E+01	.112971E+02	.111422E+02	.933248E+01
.526988E+01	.103361E+02	.119774E+02	.115671E+02	.931169E+01
.626468E-01	.187995E+00	.226011E+00	.218790E+00	.181339E+00

HOT CHANNEL TEMPS.

.885655E-01	.122635E+00	.115638E+00	.107894E+00	.721072E-01
.562822E+00	.103196E+01	.116192E+01	.108053E+01	.838807E+00
.644767E+01	.143518E+02	.174685E+02	.171295E+02	.141912E+02
.904716E+01	.179532E+02	.207912E+02	.201714E+02	.161834E+02

PEAK CHANNEL TEMPS.

.622504E-01	.114138E+00	.108768E+00	.108584E+00	.702549E-01
.669619E+00	.128224E+01	.143116E+01	.132626E+01	.104449E+01

•128366E+02
•128459E+02

•122046E+05

$$= .6552592 \pm 0.0$$

446025E-03

446025E-03

..146728E=01

.576158F+00

100253-100

[illegible]

1802045E-01	1255526E-01	6104018E-02	1888295E-02	6273832E-02	1090580E-01
1404099E-01	1584100E-01	1678184E-01	1666227E-01	1511299E-01	1319044E-01
8127641E-02	5823279E-02	3607696E-02	1790813E-02	2700610E-03	7638473E-03
1803972E-02	2304603E-02	2290259E-02	2348556E-02	2120846E-02	2026516E-02
1751463E-02	1899327E-02	1573349E-02	1679875E-02	1592853E-02	1367505E-02
1381333E-02	1049058E-02	1239846E-02	1326632E-02	1047513E-02	1313476E-02
1114406E-02	9822558E-03	1106884E-02	1006078E-02		9586143E-03
1802045E-01	1255526E-01	6104018E-02	1888295E-02	6273832E-02	1090580E-01
1404099E-01	1584100E-01	1678184E-01	1666227E-01	1511299E-01	1319044E-01
8127641E-02	5823279E-02	3607696E-02	1790813E-02	2700610E-03	7638473E-03
1803972E-02	2304603E-02	2290259E-02	2348556E-02	2120846E-02	2026516E-02
1751463E-02	1899327E-02	1573349E-02	1679875E-02	1592853E-02	1367505E-02
1381333E-02	1049058E-02	1239846E-02	1326632E-02	1047513E-02	1313476E-02
1114406E-02	9822558E-03	1106884E-02	1006078E-02		9586143E-03

8199473E-02	4168049E-02	5967624E-04	2E15632E-02	5032694E-02	7384181E-02	9007762E-02
9773932E-02	9667454E-02	9718734E-02	8385618E-02	7073163E-02	6019617E-02	4464970E-02
3385831E-02	2132408E-02	7085488E-03	3113056E-03	3512089E-03	5189628E-03	7277378E-03
7570305E-03	8234577E-03	7065764E-03	1166397E-02	1009716E-02	9965442E-03	1016660E-02
9636890E-03	9478522E-03	6423314E-03	7007636E-03	5797335E-03	4996846E-03	6772136E-03
7855021E-03	6117999E-03	6995224E-03	7218510E-03	5724107E-03	3614232E-03	4118604E-03
2943754E-03	5223835E-03	3925011E-01				
8099473E-02	4168049E-02	5967676E-04	2E14631E-02	5032694E-02	7384181E-02	9007762E-02
9773932E-02	9667454E-02	9718734E-02	8385618E-02	7073162E-02	6019617E-02	4464970E-02
3385830E-02	2132407E-02	7085483E-03	3113050E-03	3512095E-03	5189834E-03	7277364E-03
7570311E-03	8234583E-03	7065766E-03	1166390E-02	1009717E-02	9965448E-03	1016661E-02
9636896E-03	9478528E-03	6423320E-03	7007642E-03	5797341E-03	4996852E-03	6772142E-03
7855027E-03	6118050E-03	6995230E-03	7218516E-03	5724114E-03	3614239E-03	4118611E-03
2943761E-03	5223842E-03	3925011E-01				

993120 -02 -.5128805E-02 -.4103158E-02 -.6847541E-02 -.7612354E-02 -.7205927E-02 -.6437199E-02

-6115721E-02	-6791428E-02	-1223368E-02	-4514775E-02	-265837E-02	-4465215E-03	-1197668E-02
-1775678E-03	-934543E-03	-7248492E-03	-1499208E-02	-6481491E-04	-2179551E-02	-8184889E-03
-1935982E-02	-1101159E-02	-1318541E-02	-2134518E-02	-1211197E-02	-1074871E-02	-3270137E-03
-1719120E-02	-9018698E-03	-8959575E-03	-1114336E-02	-5422255E-03	-1666360E-02	-1226341E-03
-1728539E-02	-8457415E-03	-1244840E-02	-1427239E-03	-901445E-03	-1156465E-02	-1216484E-03
-1506637E-02	-8611535E-03	-572279E+00				
-1099299E-02	-5128827E-02	-113155E-02	-6847539E-02	-7612351E-02	-7205425E-02	-6437197E-02
-6115719E-02	-6791466E-02	-3223666E-02	-514772E-02	-265837E-02	-4465187E-03	-1197666E-02
-1375650E-03	-9305851E-03	-7208926E-03	-1499211E-02	-6680203E-04	-2079554E-02	-8184918E-03
-1935985E-02	-1101162E-02	-1318645E-02	-2134511E-02	-1211200E-02	-1174874E-02	-3270168E-03
-1719123E-02	-9018929E-03	-8959606E-03	-1114319E-02	-5422286E-03	-1666363E-02	-1226373E-03
-1728543E-02	-8457440E-03	-1244844E-02	-1427272E-03	-9014478E-03	-1156468E-02	-1216517E-03
-1506641E-02	-8611469E-03	-572279E+00				

REACTOR

AVE. CHANNEL TEMPS.

-197632E+04	-254467E+04	-466664E+04	-243570E+04	-192923E+04
-135285E+04	-161645E+04	-162280E+04	-165457E+04	-147781E+04
-819383E+03	-891286E+03	-958515E+03	-101957E+04	-105752E+04
-813227E+03	-885235E+03	-951321E+03	-101297E+04	-105321E+04
-808745E+03	-879021E+03	-945412E+03	-100737E+04	-104947E+04

HOT CHANNEL TEMPS.

-334967E+04	-17330E+04	-405873E+04	-400992E+04	-319602E+04
-207638E+04	-263958E+04	-262321E+04	-266318E+04	-225101E+04
-690447E+03	-103282E+04	-115088E+04	-126161E+04	-132339E+04
-859707E+03	-991377E+03	-111310E+04	-122653E+04	-130038E+04
-947612E+03	-110829E+04	-121995E+04	-132587E+04	-136533E+04

PEAK CHANNEL TEMPS.

-256134E+04	-331768E+04	-321758E+04	-317677E+04	-248224E+04
-166541E+04	-199640E+04	-260339E+04	-204654E+04	-178381E+04
-842928E+03	-946935E+03	-103960E+04	-112623E+04	-118055E+04
-635726E+03	-937671E+03	-103130E+04	-111861E+04	-117557E+04

PLENUM TEMPERATURES

-750419E+03	-750516E+03	-857551E+03	-758059E+03	-109561E+04
-105624E+04	-111155E+04	-923629E+03	-101555E+04	-101555E+04

PLANKET TEMPERATURES

-792056E+03	-102554E+04	-121158E+04	-109670E+04	-953704E+03
-775153E+03	-898619E+03	-101152E+04	-991337E+03	-936578E+03
-756196E+03	-792435E+03	-852210E+03	-902364E+03	-921088E+03
-759486E+03	-808392E+03	-877721E+03	-916743E+03	-923629E+03

JHX

SHELL TEMPS.

-1012915E+04	-1007780E+04	-1002613E+04	-9974156E+03	-9921864E+03	-9869247E+03	-9816298E+03
-9763011E+03	-9709380E+03	-9635399E+03	-9601763E+03	-9546368E+03	-9491311E+03	-9435893E+03
-9586112E+03	-9323969E+03	-9267455E+03	-9213599E+03	-9153375E+03	-9095792E+03	-9037850E+03
-8979551E+03	-8920693E+03	-8851876E+03	-8802501E+03	-8742766E+03	-8682670E+03	-8622213E+03
-8561394E+03	-8500213E+03	-8438669E+03	-8376761E+03	-8314489E+03	-8251852E+03	-8188850E+03
-8125482E+03	-8061749E+03	-7997650E+03	-7933181E+03	-7868347E+03	-7803146E+03	-7737578E+03
-7671643E+03	-7605340E+03	-7538669E+03				
-1012915E+04	-1007780E+04	-1002613E+04	-9974156E+03	-9921864E+03	-9869247E+03	-9816298E+03
-9763011E+03	-9709380E+03	-9635399E+03	-9601763E+03	-9546368E+03	-9491311E+03	-9435893E+03
-9586112E+03	-9323969E+03	-9267455E+03	-9213599E+03	-9153375E+03	-9095792E+03	-9037850E+03
-8979551E+03	-8920693E+03	-8851876E+03	-8802501E+03	-8742766E+03	-8682670E+03	-8622213E+03
-8561394E+03	-8500213E+03	-8438669E+03	-8376761E+03	-8314489E+03	-8251852E+03	-8188850E+03
-8125482E+03	-8061749E+03	-7997650E+03	-7933181E+03	-7868347E+03	-7803146E+03	-7737578E+03
-7671643E+03	-7605340E+03	-7538669E+03				

PRIMARY SIDE TEMPS.

.1015475E+04	.1010356E+04	.1005205E+04	.1000022E+04	.9948090E+03	.9895634E+03	.9842851E+03
.9789733E+03	.9736274E+03	.9682449E+03	.9628312E+03	.9573797E+03	.9518923E+03	.9463688E+03
.9403089E+03	.9352120E+03	.9295815E+03	.9239121E+03	.9182077E+03	.9124677E+03	.9066911E+03
.9004291E+03	.8950312E+03	.8891475E+03	.8832279E+03	.8772724E+03	.8712809E+03	.8652532E+03
.8591895E+03	.8530895E+03	.8469533E+03	.8407807E+03	.8345717E+03	.8283263E+03	.8220443E+03
.8157208E+03	.8093708E+03	.8029701E+03	.7965507E+03	.7900857E+03	.7835839E+03	.7770454E+03
.7704703E+03	.7638563E+03	.7572097E+03	.7505243E+03	.7438000E+03	.7369634E+03	.7300851E+03
.7135475E+03	.7068356E+03	.7001475E+03	.6934121E+03	.6866077E+03	.6797209E+03	.6727809E+03
.9789733E+03	.9736274E+03	.9682449E+03	.9628312E+03	.9573797E+03	.9518923E+03	.9463688E+03
.9403089E+03	.9352120E+03	.9295815E+03	.9239121E+03	.9182077E+03	.9124677E+03	.9066911E+03
.9004291E+03	.8950312E+03	.8891475E+03	.8832279E+03	.8772724E+03	.8712809E+03	.8652532E+03
.8591895E+03	.8530895E+03	.8469533E+03	.8407807E+03	.8345717E+03	.8283263E+03	.8220443E+03
.8157208E+03	.8093708E+03	.8029701E+03	.7965507E+03	.7900857E+03	.7835839E+03	.7770454E+03
.7704703E+03	.7638563E+03	.7572097E+03	.7505243E+03	.7438000E+03	.7369634E+03	.7300851E+03

HALL TEMPS.

.9826407E+03	.9773049E+03	.9719358E+03	.9665370E+03	.9610966E+03	.9556245E+03	.9501179E+03
.9445758E+03	.9389977E+03	.9333835E+03	.9277324E+03	.9220455E+03	.9163216E+03	.9105608E+03
.9047632E+03	.899289E+03	.8930577E+03	.8871501E+03	.8812056E+03	.8752245E+03	.8692067E+03
.8631522E+03	.8570609E+03	.8509328E+03	.8447678E+03	.8385659E+03	.8323268E+03	.8260508E+03
.8197375E+03	.8133871E+03	.8069955E+03	.8005745E+03	.7941122E+03	.7876125E+03	.7810753E+03
.7745007E+03	.7678887E+03	.7612391E+03	.7545520E+03	.7478274E+03	.7410653E+03	.7342656E+03
.7274284E+03	.7205536E+03	.7136394E+03	.7066533E+03	.6996077E+03	.6925245E+03	.6854008E+03
.9826407E+03	.9773049E+03	.9719358E+03	.9665370E+03	.9610966E+03	.9556245E+03	.9501179E+03
.9445758E+03	.9389977E+03	.9333835E+03	.9277324E+03	.9220455E+03	.9163216E+03	.9105608E+03
.9047632E+03	.899289E+03	.8930577E+03	.8871501E+03	.8812056E+03	.8752245E+03	.8692067E+03
.8631522E+03	.8570609E+03	.8509328E+03	.8447678E+03	.8385659E+03	.8323268E+03	.8260508E+03
.8197375E+03	.8133871E+03	.8069955E+03	.8005745E+03	.7941122E+03	.7876125E+03	.7810753E+03
.7745007E+03	.7678887E+03	.7612391E+03	.7545520E+03	.7478274E+03	.7410653E+03	.7342656E+03
.7274284E+03	.7205536E+03	.7136394E+03	.7066533E+03	.6996077E+03	.6925245E+03	.6854008E+03

INTERMEDIATE SIDE TEMPS.

.9561821E+03	.9506692E+03	.9451210E+03	.9395370E+03	.9339168E+03	.9282603E+03	.9225673E+03
.9168374E+03	.9110705E+03	.9052615E+03	.8994254E+03	.8935470E+03	.8876314E+03	.8816784E+03
.8756882E+03	.8696606E+03	.8635957E+03	.8574935E+03	.8513537E+03	.8451765E+03	.8389617E+03
.8327094E+03	.8264194E+03	.8200916E+03	.8137260E+03	.8073226E+03	.8008812E+03	.7944017E+03
.7878843E+03	.7813287E+03	.7747350E+03	.7681032E+03	.7614330E+03	.7547247E+03	.7479780E+03
.7411431E+03	.7343698E+03	.7275003E+03	.7206083E+03	.7136700E+03	.7066935E+03	.6996765E+03
.6926253E+03	.6855377E+03	.6783810E+03	.6712000E+03	.6640000E+03	.6567800E+03	.6495400E+03
.9561821E+03	.9506692E+03	.9451210E+03	.9395370E+03	.9339168E+03	.9282603E+03	.9225673E+03
.9168374E+03	.9110705E+03	.9052615E+03	.8994254E+03	.8935470E+03	.8876314E+03	.8816784E+03
.8756882E+03	.8696606E+03	.8635957E+03	.8574935E+03	.8513537E+03	.8451765E+03	.8389617E+03
.8327094E+03	.8264194E+03	.8200916E+03	.8137260E+03	.8073226E+03	.8008812E+03	.7944017E+03
.7878843E+03	.7813287E+03	.7747350E+03	.7681032E+03	.7614330E+03	.7547247E+03	.7479780E+03
.7411431E+03	.7343698E+03	.7275003E+03	.7206083E+03	.7136700E+03	.7066935E+03	.6996765E+03
.6926253E+03	.6855377E+03	.6783810E+03	.6712000E+03	.6640000E+03	.6567800E+03	.6495400E+03

POWER, KINETICS, ETC.

.1000079E+01	.1000087E+01	.8511391E-04	.8848414E-05	.1185719E-03	.1015552E+04
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CIRCULATION

.3574086E-03	.3574086E-03	.3574086E-03	.4966165E+00	.4966165E+00	.4966165E+00	.9148254E+01
.9148254E+01	.9148254E+01	.9249644E+01	.4276259E+00	.3855777E+00	0.	

NA FLOWS

.1000079E+01	.1000087E+01	.1000000E+01	.1000000E+01	.1000000E+01	.677367E+00
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PRESSURES

PRIMARY

.164839E+02	.164839E+02	.131380E+02	.153601E+03	.153601E+03	.148159E+03
.227005E+02	.229429E+02				

INTERMEDIATE

.104572E+03	.104614E+03	0.	.220072E+03	.224314E+03	0.
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PRESSURE IN S-AND L-LOOP RECIRC LINES

.1783232E+04	.1904092E+04	.189929E+04	.176643E+04
.1780251E+04	.1904109E+04	.1899315E+04	.1766462E+04

WALL TEMPS IN S-AND L-LOOP EVAP AND SUPERH

.6322562E+03	.6638083E+03	.6764951E+03	.6913474E+03	.7110769E+03	.8909526E+03	.8169400E+03
.8372581E+03	.6638119E+03	.6764964E+03	.6913496E+03	.7110748E+03	.8069384E+03	.8169201E+03
.8206133E+03	.8545067E+03	.8910259E+03	.9017375E+03	.9179356E+03	.9304418E+03	.9399960E+03
.8205894E+03	.8544699E+03	.8909885E+03	.9017912E+03	.9179014E+03	.9304405E+03	.9399677E+03

PUMP NO. -1 = 3CAVITATING

.10000E+00	.32912E+02	.32080E+02	.38698E+04	.40656E+04
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PUMP NO. -1 = 1CAVITATING

.15600E+00	.31896E+02	.31988E+02	.39449E+04	.41207E+04
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PUMP NO. -1 = 2CAVITATING

.15000E+00	.31896E+02	.31988E+02	.39449E+04	.41207E+04
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T = .150

DERIVATIVES

FLOCC3

.181534E+04	.181544E+04	.179718E+04	.181680E+04	.181680E+04
.179299E+04	.649631E-03	.636152E-03	0.	.113928E+00
-.113928E+00	-.133202E+00	-.109363E-06	.11054E-06	0.

REACTOR

AVE. CHANNEL TEMPS.

.313866E+01	.459262E+01	.462071E+01	.427658E+01	.327102E+01
.272462E+02	.528799E+02	.589206E+02	.542467E+02	.424042E+02
.339100E+03	.297104E+03	.352543E+03	.338842E+03	.278653E+03
.205457E+03	.348265E+03	.363697E+03	.340785E+03	.256285E+03
.31401E+01	.318552E+01	.106536E+02	.101116E+02	.824911E+01

HOT CHANNEL TEMPS.

.398049E+01	.596894E+01	.581964E+01	.538698E+01	.370618E+01
.306589E+02	.591412E+02	.656477E+02	.607627E+02	.475622E+02
.221082E+03	.485231E+03	.568481E+03	.544745E+03	.444528E+03
.325007E+03	.599758E+03	.624037E+03	.586499E+03	.438441E+03

PEAK CHANNEL TEMPS.

.397394E+01	.594037E+01	.592140E+01	.546889E+01	.404753E+01
.352908E+02	.691253E+02	.769708E+02	.708034E+02	.558793E+02
.187148E+03	.415549E+03	.493237E+03	.473098E+03	.388202E+03
.288043E+03	.493169E+03	.512576E+03	.479317E+03	.358954E+03

FLENUM TEMPERATURES

.320549E-03	-.259372E-04	.724876E+00	.333797E+02	.551444E+01
.129398E+03	0.	0.	-.876873E-01	-.215378E+02

BLANKET TEMPERATURES

.227931E-01	.123563E+00	.179031E+00	.109857E+00	.245060E-01
.294285E+00	.163710E+01	.304886E+01	.240565E+01	.781137E+00
.566271E+01	.351972E+02	.661192E+02	.521662E+02	.161479E+02
.118585E+02	.617688E+02	.765466E+02	.331340E+02	.148874E+01

INX

SHELL TEMPS.

.713293E-03	.1416210E-02	.178614E-02	.1341254E-02	.1303116E-02	.1277316E-02	.1256843E-02
.1246705E-02	.1245077E-02	.1250800E-02	.1265767E-02	.1287728E-02	.1313308E-02	.1341563E-02
.1369519E-02	.1396155E-02	.1420736E-02	.1443057E-02	.1462368E-02	.1479398E-02	.1493119E-02
.1505194E-02	.1516715E-02	.1520695E-02	.1535081E-02	.1544522E-02	.1554853E-02	.1563812E-02
.1272296E-02	.1581530E-02	.1590702E-02	.1600700E-02	.1609733E-02	.1619769E-02	.1629979E-02
.8290E-02	.1647886E-02	.1659087E-02	.1668796E-02	.1679038E-02	.1689085E-02	.1698776E-02
.9457E-02	.1719721E-02	.1728449E-02				

APPENDIX C1

DEMO3 Input Data Set

-140-

10					
20.0	.1				
5.0	.2				
10.0	.5				
20.0	2.0				
1 11			111		
CONTROL DIMENSIONAL DATA					
0.0	1.0	1.0	1.0	T0A0APAI	
1.0	1.0			T1A1	
2.0	1.0			T2A2	
5.0	1.0			T3A3	
10.0	1.0			T4A4	
10.0	.02			K0B1RMAX	
5.0	1.0	1.0		APATAC	
CORE PARAMETERS & GEOMETRY PSAR DATA					
33575.1	169464.80	4800.70	.069	.135	I PLENUM
6802.0	588.44	3013.00	.075	.074	L AX BLN
6802.0	588.44	3013.00	.075	.074	D AX BLN
199750.0	323724.00	1361.24	.069	.135	H PLENUM
40963.9	1262.6	4.32			R BLN 1
5.33	9150.0	57.0			R BLN 2
.02042	.0217	.350	.00344		R BLN 3
27.662					CORE 1
3.0	42966.0				CORE 2
198.0	3.75	.01	217.0		CORE 3
.0081	.00833	.00958	.01067	1.2439	CORE 4
.00233	.99167				CORE 5
4970.0	873.0	51.3			HIX DATA
.078	609.25				MATL F
.136	486.0	.0033			MATL CL
.31	51.3				MATL NA
924354.0					POWER
11526.0					WREF
.80	.12	.08			FLOW FRC
EOEC CORE DATA FROM PSARS					
.00008745	.0129				DN GRP 1
.00075540	.0308				DN GRP 2
.00064380	.1320				DN GRP 3
.001306	.335				DN GRP 4
.000595	1.340				DN GRP 5
.000195	3.27				DN GRP 6
30					NOECP
0.0	.0869				DECAY 1
1.0	.0774				DECAY 2
1.5	.0734				DECAY 3
2.0	.0710				DECAY 4
3.0	.0675				DECAY 5
4.0	.0648				DECAY 6
5.0	.0628				DECAY 7
6.0	.0611				DECAY 8
8.0	.0584				DECAY 9
10.0	.0564				DECAY 10
12.0	.0546				DECAY 11
14.0	.0534				DECAY 12
16.0	.0522				DECAY 13
20.0	.0502				DECAY 14
25.0	.0486				DECAY 15
30.0	.0468				DECAY 16
35.0	.0454				DECAY 17
40.0	.0443				DECAY 18

45.0	.0434
58.8	.0413
70.2	.0400
83.8	.0386
100.0	.0374
143.0	.0348
242.4	.0313
346.0	.0291
492.4	.0271
701.7	.0252
837.7	.0243
1000.0	.0234

5	.035	.013	.104	.848
.00057	.00017	.00121		

.0581
.2534
.3784
.2492
.0610

.50	.50	.0	.0	.0
1.11	1.09	1.32		
.1698	.0002276	.0002276	-.000218	.30
.2253	.0003363	.0003363	.000208	.30
.2434	.0003496	.0003496	.000433	.30
.2123	.0002617	.0002617	.000433	.30
.1492	.0001249	.0001249	-.000253	.30
.486	.486	.011	.006	.011

1.35	1.003	1.15	1.10	1.16
1.10	1.3745	1.524	1.575	1.30
1.70				

750.5
.20

1.0 0.00004 0.0

POLATE1 EOEC CORE ROD WORTHS

-9

.0	.0
.09	.10
.44	.20
2.34	.44
4.07	.60
5.29	.80
6.07	1.00
6.22	1.20
6.50	1.60

POLATE2 EOEC CORE ROD WORTHS

-11

.0	.0
.15	.10
.30	.20
.50	.30
1.10	.40
2.75	.60
3.75	.70
4.75	.80
5.80	1.00
6.20	1.20
6.30	1.60

RODFAIL EOEC CORE FAILED CONTROL ROD WORTH

-9

.0	.0
.10	.10
.20	.20

DECAY 19
DECAY 20
DECAY 21
DECAY 22
DECAY 23
DECAY 24
DECAY 25
DECAY 26
DECAY 27
DECAY 28
DECAY 29
DECAY 30
PWR FRAC

NC
ALHOP
EABL 1
EABL 2
EABL 3
EABL 4
EABL 5
FROU
FHC BL
CREPHYS1
CREPHYS2
CREPHYS3
CREPHYS4
CREPHYS5

FHC 1
FHC 2
FHC 3
TIN
DELAY
NS DK WGN

DK1
DK2
DK3
DK4
DK5
DK6
DK7
DK8
DK9

NPOL2
DK1 SEC
DK2 SEC
DK3 SEC
DK4 SEC
DK5 SEC
DK6 SEC
DK7 SEC
DK8 SEC
DK9 SEC
DK10 SEC
DK11 SEC
DK12 SEC

NPOL1
DK1 FAIL
DK2 FAIL
DK3 FAIL

.30 .30
 .40 .40
 .50 .50
 .60 .60
 .80 .80
 1.00 1.00
 INX GEOM DATA USING WARD D-00005 DATA AND DA S FORMAT
 2630.0 1130.0 29.15 25.08
 801.0 14550.0
 .0323 .03646 .1287 .0647 1.5
 .140 501.0
 .01
 45 1 2
 671.5 750.5
 3550.0 3842.0
 STGEN INPUT DATA FROM WARD D-00005
 1 3 3
 0 0 0 2
 2.0 757.0 1.0 757.0
 .034 .052 .034 .052
 41.0 41.0 7.0 7.0
 1.95 5.7 1.95 5.7
 837.0 837.0 1360.0
 120.0 336.0 2016.0 2208.0
 49.0 5.025 0.0 -13.0
 2.294 2.294
 .301 .110 489.02
 487.8 487.8
 .525 .60 .0000026 124.275
 365.7 1.40 616.7
 1766.0 1540.0 1465.0 308.3 925.0
 1151.6 1430.6 904.7
 .50
 301.0 193.0 535.0
 .074 .093 .093 -8.0 17.33
 214.3 517.4 180.2 -481.0 309.0
 35.0 433.0 323.5 462.0
 0.0 4.0 0.0
 NATURAL INPUT DATA FROM WARD D-00005
 -12.93 -5.58 8.1 16.4 -5.99
 5.0 35.0 70.0 87.0 108.0
 18.0 51.0 86.0 106.0 114.0
 116.0 6.68 5
 18.32 -31.25 6.58 -9.50
 1.0 26.0 120.0 130.0
 19.0 57.0 127.0 222.0
 223.0 2.89 4
 7.5 4.0 -39.52 6.08 34.5
 1.0 37.0 48.0 137.0 160.0
 37.0 41.0 88.0 160.0 199.0
 203.0 2.89 5
 -9.75 4.67 19.5 10.5 1.0
 -4.1
 1.0 102.0 202.0 266.0 325.0
 458.0
 90.0 108.0 221.0 277.0 337.0
 499.0
 509.0 2.89 6
 -27.0 22.0 -24.48 5.38 40.1
 58.0 98.0 155.0 193.0 280.0
 85.0 114.0 182.0 272.0 320.0
 363.0 2.89 5
 4.67 27.5 3.54 -41.0

DRY FALL
 DRY FALL
 DRY FALL
 DRY FALL
 DRY FALL
 DRY FALL
 MACRO GEOM
 SHELL SIZE
 CELL GEOM
 WALL PROP
 FUDGE
 NODES NLEUP
 TSP IPO
 US - WP
 SIGN CONTRI
 BYPASSCHIM
 STGEN CONEG
 TUBE CONEG
 L NNODE
 NA FLOW PAR
 VDRUM VSTD
 LPIPIES
 RPIPIES
 MNA/NODE
 METALNAPROP
 LZA
 FUDGES
 PUMPPANAM
 PDES WDES
 HREF TRFF
 TW
 DRUM VOL
 DRUM GEOM
 FW H FIT
 SGARRS MODL
 TGOOF
 HURP
 SRP
 SRP
 VESSTOPMP
 HPI
 SPI
 SPI
 PUMPTO INX
 HPIR
 SIR
 SIR
 THA TO VFSS
 HGIS 1
 HGIS 2
 SIS 1
 SIS 2
 SIS 1
 SIS 2
 THA SUPER
 HPI
 SEI
 SII
 EVAP TO THA
 HGIS2

1.0	102.0	224.0	251.0	625.0
90.0	108.0	251.0	505.0	666.0
675.0	2.89	5		
-2.7	2.2	-3.5	-21.13	-2.38
40.1				
50.0	99.0	148.0	371.0	414.0
495.0				
85.0	114.0	371.0	392.0	495.0
535.0				
619.0	2.89	6		
-35.42	63.0	98.0		
-35.42	63.0	98.0		
115.0	1.97	1		
115.0	1.97	1		
25.1	-25.1	35.5	35.5	
9.029	1.16	3.0	1.16	10.25

VOLEX INPUT DATA FROM PSARS + HAND CALC.

21230.0	821.0	499.0	1381.0	3153.0
10.94	27.66	10.94	24.38	6360.0
870.0	645.0			
0.0	0.0	301.1		

FLOCDS DATA FROM PSARS + HAND D-0005

117.00	855.0	25471.0	43225.0	
678.0	22523.0	24700.0	1847.0	
10.1	10.1	10.1	109.8	109.8
109.8				
54.3	54.3	54.3	3042.6	3550.0
.00044	.00044	.00044	.00044	.00044

.00044				
2.27	2.27	2.27		
27.5	27.5	27.5		
53.6	51.3	25.0		
1.401	-.34	.102	-.163	-250.0
.023	.012	.0117	8.97	.117
.543	.400	.364	-.368	.061
-250.0	.02	.015	.0147	9.0
.147				
10.0	19.14			
139.426	207.13	100.0	.00023	
1.0	1.0	1.0	1.0	1.0
1.0				
14.7	15.057	.1766	.1766	
.50				
3				

RUPTURE DATA FROM WARD D-0005

426.00	2700.0	775.0	.01721	
1.0	44.5	14.7	0.0	41.5
33.00	4.60	8.28	0.0	27.0

PROSYS INPUT DATA FROM WARD D-0005 VERIFIED IN PSARS

.50	.50	1.0	1.0	.1492
.05	.0125	.985	1.015	
.02	.02	1.0	1.0	.1492
.0595	.0125	.985	1.015	
.05	1.00	20.0	1.02	28.0
1.0	.99	1.01		
.1875	3.25	1.05	.1625	1.05
1.05				
.05	.99	.50	1.0	1.03
.01				
.003	.0044	.005	1.20	.066
.99	.05	1.144		
4.0				

S1S2 1
S1S2 1
TAX-SPO 1
H0E12 1
H0E12 2
SE12 1
SE12 2
STE12 1
STE12 2
EVAP-TMX 1
SUP-EVAP S
SUP-EVAP 1
SUP-EVAP1/A
SUP-EVAPS/A
ELEVHXSUP
ACTV L VESS

V1 - V5
V6 - V10
V11 V12
W 00 0 AUP

DPCORE PMP
INF PUMP
DPCV DPLP
DPLP
R00LP WSR

WLI - WLS
WLG
DPFH
DPFC

HHUC H AMP
PUMPH COEF
PUMPERIC
PUMPT COEF
INTPMP F 1

SPDIT
HLO HVO
ZU - Z3 ZET
C1 - C5

CB
PVCGR WCVMP
TDELAY
NLUP

GRD VESS
BRKSTZ
PRK PRFS

WZWD TRP 1
WZWD TRP 2
PMP SPD 1
PMP SPD 2
DLYD FLX 1
DLYD FLX 2
DLYD FLX 3
DLYD FLX 4
FLX/W 1
FLX/W 2
FLX/W 3
TOT FLX TRP
ANALOG TRIP

131.7	.05	.15	1.0	1.278	FLX2/P 1
.0746	33.7				FLX2/P 2
.092					FLX2/P 3
.50	1.0	14.79			HNA TRP
CONTROL IC DATA					CON IC 1
1.035	1.035	1.035	1.032	1.032	CON IC 2
1.035					
STGEN I C DATA FROM WARD 0-00005					SEVP P1
1860.62	1855.94	1851.37	1846.82	1842.15	SEVP P2
1837.59	1833.42	1829.60			SEVP H1
533.38	577.125	617.96	669.66	737.72	SEVP H2
827.19	864.98	908.45			SEVP TN1
671.22	694.97	717.20	745.41	782.67	SEVP TN2
831.82	852.64	876.62			S SH P1
1766.47	1734.17	1701.86	1669.56	1637.26	S SH P2
1604.96	1572.65	1540.35			S SH H1
1151.48	1226.76	1285.16	1330.34	1365.19	S SH H2
1391.83	1412.08	1427.45			S SH TN1
876.63	898.30	915.13	928.16	938.21	S SH TN2
945.90	951.75	956.19			LEV P1
1860.62	1855.94	1851.37	1846.82	1842.15	LEV P2
1837.59	1833.42	1829.60			LEV H1
533.38	577.125	617.96	669.66	737.72	LEV H2
827.19	864.98	908.45			LEV TN1
671.22	694.97	717.20	745.41	782.67	LEV TN2
831.82	852.64	876.62			L SH P1
1766.47	1734.17	1701.86	1669.56	1637.26	L SH P2
1604.96	1572.65	1540.35			L SH H1
1151.48	1226.76	1285.16	1330.34	1365.19	L SH H2
1391.83	1412.08	1427.45			L SH TN1
876.63	898.30	915.13	928.16	938.21	L SH TN2
945.90	951.75	956.19			S PL
1780.30	1904.10	1899.4	1766.5		L PL
1780.30	1904.10	1899.4	1766.5		
14643.90	14643.90	10377530.0	10377570.0		SH M F
2864.10	3700679.0				W FEED
.392	.392	309.3	309.3		W STEAP
309.3	309.3	927.9			SEVP TW1
637.26	663.01	676.50	691.45	711.08	SEVP TW2
800.95	816.94				LEV TW1
637.26	663.01	676.50	691.45	711.08	LEV TW2
800.95	816.94				S SH TW1
820.61	854.51	881.03	901.74	917.94	S SH TW2
930.44	934.00				L SH TN1
820.61	854.51	881.03	901.74	917.94	L SH TN2
930.44	934.00				
VOLEX I C					VOLEXIC
16.26					PONY 1
FLOC03 I C DATA FROM WARD 0005					PONY 2
.00	.00	.00	.00	.00	TGAS 1
.00					TGAS 2
1460.0	1460.0	1460.0	1460.0	1460.0	VGAS 1
1460.0					VGAS 2
151.1	151.1	151.1	823.79	2400.0	PGAS 1
10.0					PGAS 2
15.1	15.1	15.1	15.1	15.1	SPMP 1
14.7					SPMP 2
1.0	1.0	1.0	1.0	1.0	HL
1.0					PGAS PMP
9.93	9.93	9.93			
113.1	113.1	113.1			
PROT SY: DATA TAKEN FROM WARD 0-0-0005					S/SO TRP
1.0	1.0	1.0	1.0	1.0	

1.0	1.0	1.0	1.0	1.0
1.0	1.02	1.0		
1.0	.99			
.99				
16.30				

WZRO TTP
 FLX TTP
 FLX/ETTP
 FLX TTP
 MRA TTP

THIS PAGE
WAS INTENTIONALLY
LEFT BLANK

ORIGINAL INPUT DATA PLUS MAX DECAY HEAT

WARD DATA

2 - F BREAK AT VESSEL INLET

20.0 .10

5. .20

20.0 2.0

1000. 1.

1 11

CONTROL DIMENSIONAL DATA

0.0 1.0 1.0 1.0

1.0 1.0

1.0 1.0

1.0 1.0

1.0 1.0

10.0 0.02

.5000000E+01 .1000000E+01 1.0

REACTOR DIMENSIONAL DATA

.3495000E+06 .1630000E+06 .8982180E+04 .5678420E+03 .8982180E+04

.5678420E+03 .3893200E+05 .1216000E+04 .1997500E+06 .2052000E+06

.6900001E-01 .7499999E-01 .7499999E-01 .6900000E-01

.2240000E+04 .3018340E+04 .3018340E+04 .1978000E+05

.7400000E-01 .3100000E+00 .1350000E+00

.9243540E+06

.2520000E-01 .1010000E-01 .7860000E-01

.4860500E+00 .4860500E+00 .1090000E-01 .6269999E-02 .1073000E-01

.1848970E+00 .2447860E+00 .2245410E+00 .2087860E+00 .1367900E+00

.5200000E-01 .2830000E+00 .4000000E+00 .2250000E+00 .4000000E-01

.1152834E+05

0.8 0.12 0.08

.8723000E-04 .7499000E-03 .6647999E-03 .1306000E-02 .5950001E-03

.1949000E-03

.0129 .0308 .132 .335 1.34

.3270000E+01

.5075000E-03 .7499999E-03 .7795000E-03 .5834999E-03 .2784999E-03

.5075000E-03 .7499999E-03 .7795000E-03 .5834999E-03 .2784999E-03

.4370001E-03 .1080000E-03 .9270001E-03

.6280000E-04 .5960000E-04 .1252000E-03 .6019999E-04 -.7300000E-04

.2000000E+00

.2766200E+02 .4296600E+05 .3000000E+01 .2971500E+01 .1000000E-01

.1980000E+03

.8104172E-02 .8333329E-02 .9583302E-02 .1666660E-02 .1000000E+01

.1067000E-01 .1243500E+01

.4016000E+00 .4292900E+00 .4291600E+00 .4108600E+00 .3738200E+00

.6999999E-01 .1400000E+00 .6092500E+03 .5011001E+03 .5387801E+02

.3306000E-02

.1351000E+01 .1003000E+01 .1150000E+01 .1100000E+01 .1161300E+01

.1100000E+01 .1374500E+01 .1514000E+01 .1575000E+01 .1297920E+01

.1700000E+01

.5333333E+01 .5000000E+01 .2041667E-01 .2166667E-01 9150.0

.3500000E+00 .3440000E-02 .4200000E+01

.4970000E+04 837.0 .5130000E+02

.0000000E 00 .8694249E-01

.1000000E 01 .7737952E-01

.1194000E 01 .7562160E-01

.1425000E 01 .7407128E-01

.1701000E 01 .7255101E-01

.2031000E 01 .7101077E-01

.2424000E 01 .6943101E-01

.2894000E 01 .6780767E-01

.3455000E 01 .6617594E-01

.4125000E 01 .6455272E-01

.4924000E 01 .6293178E-01

.5878000E 01	.6130972E-01
.7017000E 01	.5969141E-01
.8377000E 01	.5807310E-01
.1000000E 02	.5645175E-01
.1194000E 02	.5482930E-01
.1425000E 02	.5322853E-01
.1700999E 02	.5164946E-01
.2031000E 02	.5006946E-01
.2424001E 02	.4881787E-01
.2894000E 02	.4700318E-01
.3455000E 02	.4552968E-01
.4125001E 02	.4409450E-01
.4924001E 02	.4269752E-01
.5878000E 02	.4132761E-01
.7017000E 02	.3998120E-01
.8377000E 02	.3865743E-01
.1000000E 03	.3735632E-01
.1194000E 03	.3608167E-01
.1425000E 03	.3484441E-01
.1701000E 03	.3363896E-01
.2031000E 03	.3246386E-01
.2424000E 01	.3132439E-01
.2893999E 03	.3022056E-01
.3455000E 03	.2915390E-01
.4125000E 03	.2812250E-01
.4923999E 03	.2712602E-01
.5873000E 03	.2615514E-01
.7017000E 03	.2520724E-01
.8377000E 03	.2428170E-01
.1000000E 04	.2337842E-01
.1194000E 04	.2249039E-01
.1425000E 04	.2161556E-01
.1701000E 04	.2075067E-01
.2031000E 04	.1989523E-01
.2424000E 04	.1905880E-01
.2894000E 04	.1824223E-01
.3455000E 04	.1744670E-01
.4125000E 04	.1667126E-01
.4924000E 04	.1591644E-01
.5878000E 04	.1518481E-01
.7017000E 04	.1448128E-01
.8377000E 04	.1380476E-01
.1000000E 04	.1315455E-01

POLATE1 DIMENSIONAL DATA

0.	.1000000E+00	.2000000E+00	.3000000E+00	.4000000E+00
.5000000E+00	.6000000E+00	.7000000E+00	.8000000E+00	.9000000E+00
.1000000E+01	.1200000E+01	.1400000E+01	.1600000E+01	.1800000E+01
.2000000E+01	.1000000E+02	.1000000E+03	.2000000E+03	.1000000E+07
.0000000E 00	.9000000E-01	.4400000E 00	.1300000E 01	.2340000E 01
.3300000E 01	.4070000E 01	.4600000E 01	.5290000E 01	.5720000E 01
.6070000E 01	.6320000E 01	.6330000E 01	.6500000E 01	.6500000E 01
.6500000E 01	.6500000E 01	.6500000E 01	.6500000E 01	.6500000E 01

POLATE2 DIMENSIONAL DATA

0.	.1000000E+00	.2000000E+00	.3000000E+00	.4000000E+00
.5000000E+00	.6000000E+00	.7000000E+00	.8000000E+00	.9000000E+00
.1000000E+01	.1200000E+01	.1400000E+01	.1600000E+01	.1800000E+01
.2000000E+01	.1000000E+02	.1000000E+03	.2000000E+03	.1000000E+07

0.0	0.15	0.3	0.5	1.1
1.9	2.75	3.75	4.75	5.4
5.8	6.2	6.3	6.3	6.3
6.3	6.3	6.3	6.3	6.3

RODEAIL DIMENSIONAL DATA

0.	.1	.2	.3	.4
----	----	----	----	----

.5	.6	.7	.8	.9
1.0	1.2	1.4	1.6	1.8
2.0	10.0	1.2	2.2	1.6
0.	.1	.2	.3	.4
.5	.6	.7	.8	.9
.99999	.99999	.99999	.99999	.99999
.99999	.99999	.99999	.99999	.99999

SIHX1 DIMENSIONAL DATA

.2630000E+04	.1130000E+04	.2015000E+02	.2508000E+02	.8010000E+03
.1455070E+05	.3233300E-01	.3645800E-01	.1207000E+00	.6467000E-01
.1500000E+010.14	501.0			

0.81 STGEN DIMENSIONAL DATA

1	3	3	0	2
0	0	0	0	2
.2000000E+01	.7570000E+03	.1000000E+01	.7570000E+03	
.3392000E-01	.5208000E-01	.3392000E-01	.5208000E-01	
.4100000E+02	.4100000E+02	.7000000E+01	.7000000E+01	
.1952000E+01	.5703300E+01	.1952000E+01	.5703300E+01	
.8370000E+03	.8370000E+03	.1360000E+04		
.1200000E+03	.3360000E+03	.2016000E+04	.2208000E+04	
.4900000E+02	.5025000E+01	0.	.1300000E+02	
.2294000E+01	.2294000E+01			
.301	.11	489.02		
.4878000E+03	.4878000E+03			
0.525	0.6	.2580000E-05	124.275	
365.673	1.4	616.67		
.1766000E+04	.1540000E+04	.1465000E+04	.3083330E+03	.9250000E+03
1154.	1430.	900.		

.5				
.3010000E+03	.1930000E+03	.5350000E+03		
.7407400E-01	.9264000E-01	.9264000E-01	.4000000E+01	.1733300E+02
.2144650E+03	.5174400E+03	.1802300E+03	.4810000E+03	.3090000E+03
35.0	433.	323.5	462.0	
0.	.4000000E+01	0.		

NATURL DIMENSIONAL DATA

.1293000E+02	.5583000E+01	.8096000E+01	.1640300E+02	.5987000E+01
.5000000E+01	.3500000E+02	.7000000E+02	.8700000E+02	.1080000E+03
.1800000E+02	.5100000E+02	.8600000E+02	.1060000E+03	.1140000E+03
.1160000E+03	.6680000E+01	5.		
.1832000E+02	.3125000E+02	.6580000E+01	.9500000E+01	
.1000000E+01	.2600000E+02	.1200000E+03	.1300000E+03	
.1900000E+02	.5700000E+02	.1270000E+03	.2220000E+03	
.2230000E+03	.2890000E+01	4.		
.7500000E+01	.4000000E+01	.3952000E+02	.6080000E+01	.3050000E+02
.1000000E+01	.3700000E+02	.4800000E+02	.1320000E+03	.1500000E+03
.3700000E+02	.4100000E+02	.8800000E+02	.1600000E+03	.1990000E+03
.2030000E+03	.2890000E+01	5.		
.9750000E+01	.4670000E+01	.1950000E+02	.1050000E+02	.1000000E+01
.4100000E+02				
.1000000E+01	.1020000E+03	.2020000E+03	.2660000E+03	.3250000E+03
.4580000E+03				
.9000000E+02	.1080000E+03	.2210000E+03	.2770000E+03	.3370000E+03
.4990000E+03	.2890000E+01	6.		
.5070000E+03	.2200000E+02	.2448000E+02	.5380000E+01	.4010000E+02
.2700000E+02	.9800000E+02	.1550000E+03	.1930000E+03	.2800000E+03
.5800000E+02	.1140000E+03	.1020000E+03	.2720000E+03	.3200000E+03
.8500000E+02	.2890000E+01	5.		
.3630000E+03	.4670000E+01	.2750000E+02	.3540000E+01	.4100000E+02
.9750000E+01	.1020000E+03	.2240000E+03	.2510000E+03	.6250000E+03
.1000000E+01	.1080000E+03	.2510000E+03	.5050000E+03	.6660000E+03
.9000000E+02	.2890000E+01	5.		
.6750000E+03				

-.2700000E+02	.2200000E+02	-.3500000E+01	-.2113000E+02	-.5380000E+01
.4010001E+02	.5800000E+02	.9900000E+02	.1400000E+03	.1710000E+03
.4950000E+03	.8500000E+02	.1140000E+03	.3710000E+03	.1020000E+03
.5350000E+03	.6190000E+03	.2890000E+01	6	
-.3542000E+02	.6300000E+02	.9800000E+02		
-.3542000E+02	.6300000E+02	.9800000E+02		
.1150000E+03	.1970000E+01	1		
.1150000E+03	.1970000E+01	1		
.2510001E+02	-.2510001E+02	.3550000E+02	.3550000E+02	
.9829000E+01	.1160000E+01	.3000000E+01	.1160000E+01	.1025000E+02
VOLEX DIMENSIONAL DATA				
.2093400E+05	.7750000E+03	.5880000E+03	.8940000E+03	.2960000E+04
.1100000E+02	.2700000E+02	.1100000E+02	.2900000E+02	.6146000E+04
.1000000E+04	.6450000E+03			

0.0	64.	290.		
FLOCD3 DIMENSIONAL DATA				
100.0	.8550000E+03	.2547100E+05	.3500000E+05	
678.0	22523.0	20000.0	1847.0	
.1010000E+02	.1010000E+02	.1010000E+02	.1050000E+03	.1050000E+03
.1050000E+03	.5200000E+02	.5200000E+02	.3842000E+04	.3555000E+04
.4416001E-03	.4416001E-03	.4416001E-03	.4416001E-03	.4416001E-03
.4416001E-03	.2270000E+01	.2270000E+01		

27.5	27.5	27.5		
.5200000E+02	.5130000E+02	.2500000E+02		
.1401000E+01	-.3400000E+00	.1020000E+00	-.1630000E+00	-.2500000E+03
0.023	0.012	0.0117	8.97	0.117
.5430000E+00	.4000000E+00	.3640000E+00	-.3600000E+00	.6100000E-01
-250.0	0.02	0.015	0.0147	9.0

0.147				
.1000000E+02	.1914000E+02			
.1394260E+03	.2071300E+03	.1000000E+03	.2300000E-03	
.1000000E+01	.1000000E+01	.1000000E+01	.1000000E+01	.1000000E+01
.1000000E+01	.1470000E+02	.1766000E+00	.1766000E+00	
.5000000E+00				

3				
RIPTURE DIMENSIONAL DATA				
426.0	2700.0	775.0	0.01721	
1.00	44.5	14.7	.00000	41.5
33.0	4.60	8.28	8.0	27.0

PROTSYS DIMENSIONAL DATA				
1				
.5000000E+00	.5000000E+00	.1000000E+01	.1000000E+01	.1492050E+00
.6950003E-01	.1250000E-01	.9850000E+00	.1015000E+01	
.2000000E-01	.2000000E-01	.1000000E+01	.1000000E+01	.1492050E+00
.6950003E-01	.1250000E-01	.9850000E+00	.1015000E+01	
.5000000E-01	.1000000E+01	.2800000E+02	.1020000E+01	.2800000E+02
.1000000E+01	.9900000E+00	.1010000E+01		
.1875000E+00	.3250000E-01	.1050000E+01	.1625000E+00	.2750000E-01
.1050000E+01				
.5000000E-01	.9900000E+00	.5000000E+00	.1000000E+01	.1030000E+01
.1000000E-01				
.3125000E-02	.4375000E-02	.4999999E-02	.1193400E+01	.6629997E-01
.9900000E+00	.5000000E-01	.1143700E+01		
4.0				
.143	+03	.5000000E-01	.1500000E+00	.1000000E+01
.746	-01	.3370000E+02		
.9260000E-01				

.5000000E+00	.1000000E+01	.1478000E+02		
CONTROL INITIAL	CONDITION DATA			
.1035131E+01	.1035131E+01	.1035130E+01	.1032201E+01	.1032547E+01
.1023200E+01				

REACTOR INITIAL	CONDITION DATA			
.1970915E+04	.2548625E+04	.2466641E+04	.2435693E+04	.1929231E+04
.1352838E+04	.1616429E+04	.1622777E+04	.1654546E+04	.1477800E+04
.8191398E+03	.8927813E+03	.9580332E+03	.1019115E+04	.1057153E+04
.8127074E+03	.8444387E+03	.9565234E+03	.1012221E+04	.1052677E+04
.8027420E+03	.8790154E+03	.9454057E+03	.1007362E+04	.1049460E+04
.2561336E+04	.3317679E+04	.3217577E+04	.3176780E+04	.2492230E+04
.1605394E+04	.1996445E+04	.2003355E+04	.2046514E+04	.1783704E+04
.8426426E+03	.9463512E+03	.1038930E+04	.1125597E+04	.1180052E+04
.8350129E+03	.9365727E+03	.1039203E+04	.1117540E+04	.1174830E+04
.3349870E+04	.4173299E+04	.4058725E+04	.4009918E+04	.3196019E+04
.2076365E+04	.2639553E+04	.2623207E+04	.2663155E+04	.2250989E+04
.8901479E+03	.1032215E+04	.1150196E+04	.1260961E+04	.1322067E+04
.8578092E+03	.9089085E+03	.1111696E+04	.1225209E+04	.1299420E+04
.9474358E+03	.1108063E+04	.1219772E+04	.1325717E+04	.1365254E+04
.7504185E+03	.7505164E+03	.8575509E+03	.7587076E+03	.1095502E+04
.1056050E+04	.1111546E+04	.9236220E+03	.1015545E+04	.1015585E+04
.7950561E+03	.1025533E+04	.1211576E+04	.1096697E+04	.9537035E+03
.7751533E+03	.8986184E+03	.1011516E+04	.9913057E+03	.9365775E+03
.7561995E+03	.7903957E+03	.8521405E+03	.9022992E+03	.9210645E+03
.7594601E+03	.8082565E+03	.8775442E+03	.9166590E+03	.9236220E+03

1.0
SIHX1 INITIAL CONDITION DATA

.1015475E+04	.1010355E+04	.1005204E+04	.1000022E+04	.9948091E+03
.9895637E+03	.9842856E+03	.9789740E+03	.9736202E+03	.9682477E+03
.9628320E+03	.9573805E+03	.9518930E+03	.9463693E+03	.9409093E+03
.9352131E+03	.9295807E+03	.9239122E+03	.9182077E+03	.9124673E+03
.9066910E+03	.9008790E+03	.8950311E+03	.8891474E+03	.8832278E+03
.8772723E+03	.8712808E+03	.8652531E+03	.8591894E+03	.8530894E+03
.8469532E+03	.8407806E+03	.8345716E+03	.8283262E+03	.8220442E+03
.8157257E+03	.8093707E+03	.8029790E+03	.7965506E+03	.7900856E+03
.7835830E+03	.7770454E+03	.7704702E+03	.7638583E+03	.7572096E+03
.7505242E+03				
.9826403E+03	.9773047E+03	.9719358E+03	.9665331E+03	.9610963E+03
.9556249E+03	.9501184E+03	.9445763E+03	.9389902E+03	.9333840E+03
.9277333E+03	.9220459E+03	.9163219E+03	.9105610E+03	.9047634E+03
.8989290E+03	.8930578E+03	.8871501E+03	.8812056E+03	.8752245E+03
.8692067E+03	.8631522E+03	.8570609E+03	.8509320E+03	.8447677E+03
.8305658E+03	.8232268E+03	.8160507E+03	.8097375E+03	.8033871E+03
.8069995E+03	.8005745E+03	.7941122E+03	.7876125E+03	.7810753E+03
.7745007E+03	.7678887E+03	.7612391E+03	.7545520E+03	.7478274E+03
.7410653E+03	.7342656E+03	.7274284E+03	.7205536E+03	.7135414E+03
.9561822E+03	.9506695E+03	.9451212E+03	.9395373E+03	.9339172E+03
.9282607E+03	.9225676E+03	.9168377E+03	.9110708E+03	.9052667E+03
.8994256E+03	.8935471E+03	.8876314E+03	.8816785E+03	.8756882E+03
.8696606E+03	.8635957E+03	.8574934E+03	.8513537E+03	.8451764E+03
.8389617E+03	.8327093E+03	.8264193E+03	.8200915E+03	.8137259E+03
.8073225E+03	.8008811E+03	.7944017E+03	.7878842E+03	.7813207E+03
.7747350E+03	.7681031E+03	.7614330E+03	.7547246E+03	.7479700E+03
.7411930E+03	.7343698E+03	.7275082E+03	.7206083E+03	.7136700E+03
.7066934E+03	.6996785E+03	.6926252E+03	.6855337E+03	.6784039E+03
.6712000E+03				
.1015475E+04	.1010355E+04	.1005204E+04	.1000022E+04	.9948091E+03
.9895637E+03	.9842856E+03	.9789740E+03	.9736202E+03	.9682477E+03
.9628320E+03	.9573805E+03	.9518930E+03	.9463693E+03	.9409093E+03
.9352131E+03	.9295807E+03	.9239122E+03	.9182077E+03	.9124673E+03
.9066910E+03	.9008790E+03	.8950311E+03	.8891474E+03	.8832278E+03
.8772723E+03	.8712808E+03	.8652531E+03	.8591894E+03	.8530894E+03
.8469532E+03	.8407806E+03	.8345716E+03	.8283262E+03	.8220442E+03

.8157257E+03	.8093707E+03	.8029790E+03	.7965506E+03	.7900050E+03
.7835038E+03	.7770454E+03	.7704702E+03	.7640583E+03	.7572090E+03
.7505242E+03				
.9826403E+03	.9773047E+03	.9719358E+03	.9665331E+03	.9610963E+03
.9556249E+03	.9501184E+03	.9445763E+03	.9389982E+03	.9333940E+03
.9277333E+03	.9220459E+03	.9163219E+03	.9105610E+03	.9047619E+03
.8989290E+03	.8930578E+03	.8871501E+03	.8812056E+03	.8752245E+03
.8692067E+03	.8631522E+03	.8570609E+03	.8509320E+03	.8447671E+03
.8385658E+03	.8323268E+03	.8260507E+03	.8197375E+03	.8133871E+03
.8069995E+03	.8005745E+03	.7941122E+03	.7876125E+03	.7810753E+03
.7745007E+03	.7678887E+03	.7612391E+03	.7545520E+03	.7478279E+03
.7410653E+03	.7342656E+03	.7274204E+03	.7205536E+03	.7136419E+03
.9561822E+03	.9506695E+03	.9451212E+03	.9395373E+03	.9339172E+03
.9282607E+03	.9225676E+03	.9168377E+03	.9110708E+03	.9052667E+03
.8994256E+03	.8935471E+03	.8876314E+03	.8816785E+03	.8756882E+03
.8696606E+03	.8635957E+03	.8574934E+03	.8513537E+03	.8451763E+03
.8389617E+03	.8327093E+03	.8264193E+03	.8200915E+03	.8137259E+03
.8073225E+03	.8008811E+03	.7944017E+03	.7878842E+03	.7813287E+03
.7747350E+03	.7681031E+03	.7614330E+03	.7547246E+03	.7479780E+03
.7411930E+03	.7343698E+03	.7275082E+03	.7206083E+03	.7136709E+03
.7066934E+03	.6996785E+03	.6926252E+03	.6855337E+03	.6784039E+03
.6712000E+03				

STGEN INITIAL CONDITION DATA

.1860616E+04	.1855941E+04	.1851366E+04	.1846824E+04	.1842150E+04
.1837592E+04	.1833419E+04	.1829602E+04		
.5333785E+03	.5771246E+03	.6179583E+03	.6696584E+03	.7377227E+03
.8271903E+03	.8649837E+03	.9084452E+03		
.6712220E+03	.6949694E+03	.7171985E+03	.7454135E+03	.7826709E+03
.8318217E+03	.8526430E+03	.8766247E+03		
.1766467E+04	.1734165E+04	.1701863E+04	.1669560E+04	.1637258E+04
.1604956E+04	.1572654E+04	.1540352E+04		
.1151479E+04	.1226763E+04	.1285155E+04	.1330344E+04	.1365180E+04
.1391427E+04	.1412082E+04	.1427451E+04		
.8766348E+03	.8983022E+03	.9151272E+03	.9281585E+03	.9382127E+03
.9459038E+03	.9517540E+03	.9561943E+03		
.1860692E+04	.1856017E+04	.1851441E+04	.1846899E+04	.1842225E+04
.1837666E+04	.1833494E+04	.1829677E+04		
.5333638E+03	.5771155E+03	.6179536E+03	.6696532E+03	.7377139E+03
.8271729E+03	.8649638E+03	.9084216E+03		
.6712285E+03	.6949756E+03	.7172027E+03	.7454129E+03	.7826639E+03
.8318053E+03	.8526201E+03	.8765960E+03		
.1766544E+04	.1734231E+04	.1701918E+04	.1669605E+04	.1637291E+04
.1604978E+04	.1572665E+04	.1540352E+04		
.1151474E+04	.1226742E+04	.1285127E+04	.1330312E+04	.1365154E+04
.1391796E+04	.1412054E+04	.1427426E+04		
.8766006E+03	.8982675E+03	.9150936E+03	.9281268E+03	.9381830E+03
.9458776E+03	.9517306E+03	.9561736E+03		
.1780256E+04	.1804116E+04	.1899320E+04	.1766467E+04	
.1780333E+04	.1904193E+04	.1899397E+04	.1766544E+04	
.1464390E+05	.1464390E+05	.1037753E+08	.1037757E+08	
.2864073E+04	.3700679E+07			
.3921311E+00	.3921416E+00	.3093088E+03	.3093704E+03	
.3093088E+03	.3093704E+03	.9279185E+03		
.6372567E+03	.6630083E+03	.6764951E+03	.6914473E+03	.7110760E+03
.8009525E+03	.8169399E+03			
.6372582E+03	.6630110E+03	.6764994E+03	.6914490E+03	.7110740E+03
.8009384E+03	.8169201E+03			
.8206138E+03	.8545072E+03	.8810263E+03	.9017379E+03	.9179359E+03
.9304420E+03	.9399961E+03			
.8205806E+03	.8544701E+03	.8809887E+03	.9017014E+03	.9179015E+03
.9301103E+03	.9399677E+03			

VOLEX II CONDITION DATA

FLOCD3 INITIAL CONDITION DATA

.1	0.0	.1	.1	.1
.1460000E+04	.1460000E+04	.1460000E+04	.1460000E+04	.1460000E+04
.1511033E+03	.1511033E+03	.1508845E+03	.4237912E+03	.2400000E+04
.1000000E+02	.1506215E+02	.1506478E+02	.1505701E+02	.1479077E+02
.1467060E+02	.1000075E+01	.1000055E+01	.9984476E+00	.9986004E+00
.1000000E+01	.9999996E+00	.9999948E+00	.1000000E+01	.1000000E+01
.1000000E+01	.1000007E+02	.1000075E+02		
.1131000E+03	.1173000E+03	.1073000E+03		

PROTSYS INITIAL CONDITION DATA

.1000000E+01	.1000000E+01	.9999988E+00	.9999988E+00
.9984476E+00	.9986004E+00	.1000075E+01	.1000075E+01
.1000000E+01	.1020000E+01	.1000000E+01	
.9999988E+00	.9900000E+00		
.9900000E+00			
.1629925E+02			

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PAGE 1
036 SEC

NALAP (HNL 750627 VERSION),
HNL FAST REACTOR SAFETY DIV,

CRBR CALCULATION USING BNL DATA

04/05/76
13,44,53

PAGE 2
046 SEC

GENERALIZED TRIP PARAMETERS FOR 4 SIGNALS,

TRIP NO.	TRIP ID	SIG ID	INX 1	INDX 2	ACTION	TRIP SIGNAL	SET POINT	DELAY TIME	VOLUME NO.	
1	1	1	-0	-0	END	ELAPSED TIME	,200000E+02	-0,		ENDTRIP
2	2	1	-0	-0	LEAK	ELAPSED TIME	,100000E+00	-0,		LEAKTRIP
3	3	-4	1	-0	SCRAM	LOW PRESSURE	,973300E+02	,450000E+00		SCRAMTRIP
4	4	-4	1	-0	PUMP	LOW PRESSURE	,973300E+02	,700000E+00		PUMPTRIP

INPUT DATA FOR 24 VOLUMES,

VOL NUM	BUBL INDX	HEAT INDX	PRESSURE (PSI)	TEMPERATURE (OR QUALITY)	VOLUME (FT**3)	HEIGHT (FT)	MIXTURE LEVEL (FT)	ELEVATION (FT)			
1	0	0	,140600E+03	,750500E+03	,310890E+04	,151600E+02	0,	,269000E+02	VOL 1	SODIUM	2
2	0	0	,109150E+03	,750500E+03	,446000E+02	,740000E+01	0,	,417700E+02	VOL 2	SODIUM	2
3	0	1	,773200E+02	,761990E+03	,109400E+02	,117000E+01	0,	,491600E+02	VOL 3	SODIUM	2
4	0	2	,725900E+02	,809390E+03	,540000E+01	,610000E+00	0,	,503200E+02	VOL 4	SODIUM	2
5	0	3	,693800E+02	,872550E+03	,540000E+01	,610000E+00	0,	,509200E+02	VOL 5	SODIUM	2
6	0	4	,658700E+02	,941080E+03	,540000E+01	,610000E+00	0,	,515200E+02	VOL 6	SODIUM	2
7	0	5	,629600E+02	,100105E+04	,540000E+01	,610000E+00	0,	,521200E+02	VOL 7	SODIUM	2
8	0	6	,597500E+02	,104327E+04	,540000E+01	,610000E+00	0,	,527200E+02	VOL 8	SODIUM	2
9	0	7	,550200E+02	,104761E+04	,109400E+02	,117000E+01	0,	,533200E+02	VOL 9	SODIUM	2
10	0	0	,391800E+02	,103879E+04	,756200E+02	,543000E+01	0,	,544800E+02	VOL 10	SODIUM	2
11	0	8	,544600E+02	,980020E+03	,243800E+02	,533000E+01	0,	,491600E+02	VOL 11	SODIUM	2
12	0	0	,812100E+02	,750500E+03	,284390E+04	,169500E+02	0,	,380400E+02	VOL 12	SODIUM	2
13	0	0	,207800E+02	,101556E+04	,636000E+04	,226700E+02	,210900E+02	,549800E+02	VOL 13	SODIUM	2
14	0	0	,187400E+02	,101556E+04	,821000E+03	,255000E+02	,245000E+02	,533300E+02	VOL 14	SODIUM	2
15	0	0	,100100E+03	,101556E+04	,870000E+03	,224000E+02	,214000E+02	,455000E+02	VOL 15	SODIUM	2
16	0	0	,172040E+03	,101556E+04	,310000E+03	,334700E+02	0,	,422000E+02	VOL 16	SODIUM	2
17	0	-1	,164440E+03	,750500E+03	,138100E+04	,483500E+02	0,	,433300E+02	VOL 17	SODIUM	2
18	0	0	,144930E+03	,750500E+03	,436400E+03	,280000E+02	0,	,508100E+02	VOL 18	SODIUM	2
19	0	0	,187400E+02	,101556E+04	,164200E+04	,255000E+02	,245000E+02	,533300E+02	VOL 19	SODIUM	2
20	0	0	,100100E+03	,101556E+04	,174000E+04	,224000E+02	,214000E+02	,455000E+02	VOL 20	SODIUM	2
21	0	0	,172040E+03	,101556E+04	,620000E+03	,334700E+02	0,	,422000E+02	VOL 21	SODIUM	2
22	0	-2	,164440E+03	,750500E+03	,276200E+04	,483500E+02	0,	,433000E+02	VOL 22	SODIUM	2
23	0	0	,151030E+03	,750500E+03	,110400E+04	,420000E+02	0,	,344100E+02	VOL 23	SODIUM	2
24	0	0	,146290E+03	,750500E+03	,115600E+03	,340000E+02	0,	,344100E+02	VOL 24	SODIUM	2

INPUT FOR 0 SETS OF BUBBLE CONSTANTS

SET NO.	SLOPE PARAMETER	BUBBLE VELOCITY	
0	0,	0,	(BUILT-IN DATA)

DESCRIPTIONS OF 29 JUNCTIONS,

FROM VOL	TO PUMP VOL	CHK LEAK	VALV FILL	CHCK VALV INDX	INITIAL FLOW (LBS/SEC)	MINIMUM FLOW AREA (FT**2)	JUNCTION HEIGHT (FT)	JUNCTION INERTIA (1/F)	FRICTION COEFFICIENT (DP=F*V**2)	
1	2	0	0	0	,106039E+05	0,	,417600E+02	,650000E+00	-0,	JCT 1
2	3	0	0	0	,922080E+04	0,	,491600E+02	,676000E+00	-0,	JCT 2
3	4	0	0	0	,922080E+04	0,	,503200E+02	,970000E-01	-0,	JCT 3
4	5	0	0	0	,922080E+04	0,	,509200E+02	,670000E-01	-0,	JCT 4
5	6	0	0	0	,922080E+04	0,	,515200E+02	,670000E-01	-0,	JCT 5
6	7	0	0	0	,922080E+04	0,	,521200E+02	,670000E-01	-0,	JCT 6
7	8	0	0	0	,922080E+04	0,	,527200E+02	,670000E-01	-0,	JCT 7
8	9	0	0	0	,922080E+04	0,	,533200E+02	,970000E-01	-0,	JCT 8
9	10	0	0	0	,922080E+04	0,	,544800E+02	,258000E+00	-0,	JCT 9
10	13	0	0	0	,106039E+05	0,	,599000E+02	,232000E+00	-0,	JCT 10
2	11	0	0	0	,138312E+04	0,	,491600E+02	,120000E+01	-0,	JCT 11
11	10	0	0	0	,138312E+04	0,	,544800E+02	,778000E+00	-0,	JCT 12
1	12	0	0	0	,922080E+03	0,	,380500E+02	,800000E-01	-0,	JCT 13
12	13	0	0	0	,922080E+03	0,	,549800E+02	,820000E-01	-0,	JCT 14
13	14	0	0	0	,384200E+04	0,	,598200E+02	,920000E+01	-0,	JCT 15
14	15	-1	0	0	,384200E+04	0,	,591300E+02	,944000E+01	-0,	JCT 16
15	16	1	0	0	,384200E+04	0,	,635000E+02	,188400E+02	-0,	JCT 17
16	17	0	0	0	,384200E+04	0,	,756600E+02	,194000E+02	-0,	JCT 18
17	18	0	0	0	,384200E+04	0,	,508100E+02	,241000E+02	-0,	JCT 19
18	24	0	0	0	,384200E+04	0,	,684100E+02	,300500E+02	-0,	JCT 19B
24	1	0	0	0	,384200E+04	0,	,344100E+02	,696000E+01	-0,	JCT 20
13	19	0	0	0	,768400E+04	0,	,598200E+02	,460000E+01	-0,	JCT 21
19	20	-2	0	0	,768400E+04	0,	,591300E+02	,472000E+01	-0,	JCT 22
20	21	2	0	0	,768400E+04	0,	,635000E+02	,942000E+01	-0,	JCT 23
21	22	0	0	0	,768400E+04	0,	,756600E+02	,970000E+01	-0,	JCT 24
22	23	0	0	0	,768400E+04	0,	,508100E+02	,153700E+02	-0,	JCT 25
23	1	0	0	0	,768400E+04	0,	,344100E+02	,149500E+02	-0,	JCT 26
24	0	1	-0	0,	0,	0,	,684100E+02	0,	-0,	JCT 27
18	0	1	-0	0,	0,	0,	,684100E+02	0,	-0,	JCT 28

NALAP (BRL 750627 VERSION),
 BNL FAST REACTOR SAFETY DIV.

CRBR CALCULATION USING BNL DATA

24 VOLUMES SODIUM

04/05/76
 13,44,53

PAGE 5
 ,102 SEC

DATA FOR 2 PUMPS

TOTAL NUMBER OF PLMP CURVES TO BE READ FOR THE RESPECTIVE CURVE SETS

0 0 4 0

PMPCNTRL

INDICATORS FOR WRITING RESPECTIVE CURVE SETS

0 0 1 0

OUTPUT

PUMP NO.	CURVE SET	REVERSE SWITCH	RATED SPEED REV/MIN	SPEED RATIO	RATED FLOW GAL/MIN	RATED HEAD FT	RATED TORQUE LBF-FT	MOM OF INERTIA LBM-FT**2	
1	2	0	,855000E+03	,100000E+01	,344194E+05	,460000E+03	,254710E+05	,350000E+05	PUMP1 A
						,510000E+02	,505000E+04		PUMP1 B
2	2	0	,855000E+03	,100000E+01	,688389E+05	,460000E+03	,509420E+05	,700000E+05	PUMP4 A
						,510000E+02	,101000E+05		PUMP2 B

HOMOLOGOUS PUMP CURVES

A = SPEED/RATED SPEED
H = HEAD/RATED HEAD

V = FLOW/RATED FLOW
B = TORQUE/RATED TORQUE

THERE IS AN H CURVE AND A B CURVE FOR EACH CURVE TYPE,

FOR ODD TYPES, H/A^{**2} (OR B/A^{**2}) = $F(V/A)$
FOR EVEN TYPES, H/V^{**2} (OR B/V^{**2}) = $F(A/V)$

TYPE

TYPE

1 A>0, V>0, V/A< 1

2 A>0, V>0, V/A> 1

3 A>0, V<0, V/A>-1

4 A>0, V<0, V/A<-1

5 A<0, V<0, V/A< 1

6 A<0, V<0, V/A> 1

7 A<0, V>0, V/A>-1

8 A<0, V>0, V/A<-1

SET	H,T	TYPE	PTS	X	Y	X	Y	X	Y	
3	1	1	9	0,	,140000E+01	,250000E+00	,132000E+01	,500000E+00	,123600E+01	PUMPH 1
				,750000E+00	,113500E+01	,100000E+01	,100000E+01	,110000E+01	,934000E+00	PUMPH 2
				,120000E+01	,858000E+00	,140000E+01	,678000E+00	,160000E+01	,450000E+00	PUMPH 3

SET	H,T	TYPE	PTS	X	Y	X	Y	X	Y	
3	1	2	4	,200000E+01	,494000E+01	,100000E+01	,100000E+01	,800000E+00	,520000E+00	PUMPH 4
				,670000E+00	,254000E+00					PUMPH 5

SET	H,T	TYPE	PTS	X	Y	X	Y	X	Y	
3	2	1	8	0,	,543000E+00	,400000E+00	,739000E+00	,800000E+00	,933000E+00	PUMPT 1
				,100000E+01	,100000E+01	,130000E+01	,104400E+01	,160000E+01	,100700E+01	PUMPT 2
				,180000E+01	,958000E+00	,200000E+01	,831000E+00			PUMPT 3

SET	H,T	TYPE	PTS	X	Y	X	Y	X	Y	
3	2	2	4	,200000E+01	,317000E+01	,100000E+01	,100000E+01	,800000E+00	,670000E+00	PUMPT 4
				,670000E+00	,460000E+01					PUMPT 5

PUMP CURVES FOR SET 3, THE FIRST OF EACH PAIR IS THE HEAD CURVE, THE SECOND IS THE TORQUE CURVE,

CURVE TYPE	DATA POINTS	V/A, A/V	H/A**2, H/V**2 B/A**2, B/V**2	V/A, A/V	H/A**2, H/V**2 B/A**2, B/V**2	V/A, A/V	H/A**2, H/V**2 B/A**2, B/V**2
1	9	0,	,140000E+01	,250000E+00	,132000E+01	,500000E+00	,123600E+01
		,750000E+00	,113500E+01	,100000E+01	,100000E+01	,110000E+01	,934000E+00
		,120000E+01	,858000E+00	,140000E+01	,678000E+00	,160000E+01	,450000E+00
1	8	0,	,543000E+00	,400000E+00	,739000E+00	,800000E+00	,933000E+00
		,100000E+01	,100000E+01	,130000E+01	,104400E+01	,160000E+01	,100700E+01
		,180000E+01	,958000E+00	,200000E+01	,831000E+00		
2	4	,200000E+01	,494000E+01	,100000E+01	,100000E+01	,800000E+00	,520000E+00
		,670000E+00	,254000E+00				
2		,200000E+01	,317000E+01	,100000E+01	,100000E+01	,800000E+00	,670000E+00
		,670000E+00	,460000E+01				

3	0	0,	0,	0,	0,	0,	0,
3	0	0,	0,	0,	0,	0,	0,
4	0	0,	0,	0,	0,	0,	0,
4	0	0,	0,	0,	0,	0,	0,
5	0	0,	0,	0,	0,	0,	0,
5	0	0,	0,	0,	0,	0,	0,
6	0	0,	0,	0,	0,	0,	0,
6	0	0,	0,	0,	0,	0,	0,
7	0	0,	0,	0,	0,	0,	0,
7	0	0,	0,	0,	0,	0,	0,
8	0	0,	0,	0,	0,	0,	0,
8	0	0,	0,	0,	0,	0,	0,

HALAP (BNL 750627 VERSION),
BNL FAST REACTOR SAFETY DIV.

CRHR CALCULATION USING BNL DATA

24 VOLUMES SODIUM

04/05/76
13,44,53

PAGE 7
135 SEC

PARAMETERS FOR 1 LEAKS,

LEAK DATA NO, PTS, TYPE	LEAK	SINK PRESSURE	CONTRACTION COEFFICIENT	TIME	AREA	TIME	AREA	
1 -6 -4		,147000E+02	,600000E+00	0,	,890000E+00	,200000E+01	,139000E+01	LEAK 1
		,400000E+01	,199000E+01	,600000E+01	,239000E+01	,800000E+01	,289000E+01	LEAK 2
		,100000E+00	,289000E+01					LEAK 3

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BNL FAST REACTOR SAFETY DIV,

CRBR CALCULATION USING BNL DATA

24 VOLUMES SODIUM

04/05/76
13,44,53

PAGE 8
138 SEC

REACTOR KINETICS PARAMETERS,

NO. GRPS	DETA OVER LIFETIME	INITIAL REACTIVITY
0	,185600E+05	0,

KINETICS

SCRAM CURVE,

DATA PTS.	TIME	NORM. POWER	TIME	NORM. POWER	TIME	NORM. POWER	
-16	0.	,100000E+01	,100000E+00	,100000E+01	,200000E+00	,938000E+00	SCRAM 1
	,300000E+00	,738000E+00	,400000E+00	,512000E+00	,500000E+00	,356000E+00	SCRAM 2
	,600000E+00	,254000E+00	,700000E+00	,205000E+00	,800000E+00	,175000E+00	SCRAM 3
	,900000E+00	,155000E+00	,110000E+01	,135000E+00	,130000E+01	,125000E+00	SCRAM 4
	,210000E+01	,111000E+00	,310000E+01	,101000E+00	,410000E+01	,970000E-01	SCRAM 5
	,560000E+01	,890000E-01					SCRAM 6

HEAT TRANSFER DATA FOR 8 CORE REGIONS,

CORE REG	ROD GEOM	PRINT AT	1 NODES	POWER FRACTION	HEAT TRANS, AREA	CHAN LENGTH	HYD DIAM	HID EQ DIAM
1	1	6	7 8	.350000E-01	.301995E+04	.117000E+01	.106800E-01	.191700E-01
2	1	6	7 8	.144000E+00	.155309E+04	.600000E+00	.106800E-01	.191700E-01
3	1	6	7 8	.191100E+00	.155309E+04	.600000E+00	.106800E-01	.191700E-01
4	1	6	7 8	.206400E+00	.155309E+04	.600000E+00	.106800E-01	.191700E-01
5	1	6	7 8	.180000E+00	.155309E+04	.600000E+00	.106800E-01	.191700E-01
6	1	6	7 8	.126500E+00	.155309E+04	.600000E+00	.106800E-01	.191700E-01
7	1	6	7 8	.130000E-01	.301995E+04	.117000E+01	.106800E-01	.191700E-01
8	1	6	7 8	.104000E+00	.663927E+04	.533000E+01	.119700E-01	.433300E-01

LOWER AB
 CORE 1
 CORE 2
 CORE 3
 CORE 4
 CORE 5
 UPPER AB
 BLANKET

ROD GEOM	REG ION	K,C SET	SPACES (FT)	SIZE (FT)	DENSITY (LB/FT**3)	POWER FRAC
1	1	1	5	.162500E+02	.654700E+03	.100000E+01
	2	2	1	.208000E+03	.300000E+00	0,
	3	3	1	.125000E-02	.496500E+03	0,

FUEL TEMPERATURE AVERAGED FROM NODE 1 TO 6 IN REGION 1

RODFUEL
 RODGAP
 RODCLAD

K AND C TABLES, SET NUMBER 1

THERMAL CONDUCTIVITY (BTU/FT-FH-F) VS TEMPERATURE (T(1),K(1),---)

11 POINTS	,500000E+03	,352000E+01	,100000E+04	,235000E+01	,150000E+04	,181900E+01	KFUEL 1
	,200000E+04	,151200E+01	,250000E+04	,135000E+01	,300000E+04	,120100E+01	KFUEL 2
	,350000E+04	,129200E+01	,400000E+04	,136600E+01	,450000E+04	,150400E+01	KFUEL 3
	,500000E+04	,170700E+01	,100000E+05	,170700E+01			KFUEL 4

HEAT CAPACITY (BTU/LB-F) VS TEMPERATURE (T(1),C(1),---)

16 POINTS	,764000E+02	,573100E-01	,260000E+03	,648300E-01	,620000E+03	,715100E-01	CFUEL 1
	,980000E+03	,748700E-01	,134000E+04	,771600E-01	,170000E+04	,790800E-01	CFUEL 2
	,206000E+04	,808900E-01	,242000E+04	,828800E-01	,278000E+04	,856800E-01	CFUEL 3
	,314000E+04	,899300E-01	,350000E+04	,963500E-01	,386000E+04	,105500E+00	CFUEL 4
	,422000E+04	,117790E+00	,458000E+04	,133320E+00	,494000E+04	,152000E+00	CFUEL 5
	,100000E+05	,152000E+00					CFUEL 6

NALAP (BNL 750627 VERSION),
BNL FAST REACTOR SAFETY DIV,

CRBR CALCULATION USING BNL DATA

24 VOLUMES SODIUM

04/05/76
13,44,53

PAGE 11
162 SEC

K AND C TABLES, SET NUMBER 2

THERMAL CONDUCTIVITY (BTU/FT-FR-F) VS TEMPERATURE (T(1),K(1),---)

2 POINTS ,100000E+03 ,300000E+00 ,100000E+05 ,300000E+00 -0, -0, KGAP 1

HEAT CAPACITY (BTU/LB-F) VS TEMPERATURE (T(1),C(1),---)

2 POINTS ,100000E+03 0, ,100000E+05 0, -0, -0, CGAP 1

K AND C TABLES, SET NUMBER 3

THERMAL CONDUCTIVITY (BTU/FT-FR-F) VS TEMPERATURE (T(1),K(1),---)

11 POINTS	,680000E+02	,767000E+01	,200000E+03	,826000E+01	,400000E+03	,917000E+01	KCLAD 1
	,600000E+03	,101200E+02	,800000E+03	,109600E+02	,100000E+04	,114500E+02	KCLAD 2
	,120000E+04	,126400E+02	,140000E+04	,133900E+02	,160000E+04	,142400E+02	KCLAD 3
	,180000E+04	,151400E+02	,250000E+04	,188000E+02			KCLAD 4

HEAT CAPACITY (BTU/LB-F) VS TEMPERATURE (T(1),C(1),---)

11 POINTS	,680000E+02	,108000E+00	,200000E+03	,116000E+00	,400000E+03	,126000E+00	CCLAD 1
	,600000E+03 <td>,131000E+00 <td>,800000E+03 <td>,135000E+00 <td>,100000E+04 <td>,137000E+00 <td>CCLAD 2</td> </td></td></td></td></td>	,131000E+00 <td>,800000E+03 <td>,135000E+00 <td>,100000E+04 <td>,137000E+00 <td>CCLAD 2</td> </td></td></td></td>	,800000E+03 <td>,135000E+00 <td>,100000E+04 <td>,137000E+00 <td>CCLAD 2</td> </td></td></td>	,135000E+00 <td>,100000E+04 <td>,137000E+00 <td>CCLAD 2</td> </td></td>	,100000E+04 <td>,137000E+00 <td>CCLAD 2</td> </td>	,137000E+00 <td>CCLAD 2</td>	CCLAD 2
	,120000E+04 <td>,140000E+00 <td>,140000E+04 <td>,147000E+00 <td>,160000E+04 <td>,155000E+00 <td>CCLAD 3</td> </td></td></td></td></td>	,140000E+00 <td>,140000E+04 <td>,147000E+00 <td>,160000E+04 <td>,155000E+00 <td>CCLAD 3</td> </td></td></td></td>	,140000E+04 <td>,147000E+00 <td>,160000E+04 <td>,155000E+00 <td>CCLAD 3</td> </td></td></td>	,147000E+00 <td>,160000E+04 <td>,155000E+00 <td>CCLAD 3</td> </td></td>	,160000E+04 <td>,155000E+00 <td>CCLAD 3</td> </td>	,155000E+00 <td>CCLAD 3</td>	CCLAD 3
	,180000E+04 <td>,165000E+00 <td>,250000E+04 <td>,228000E+00 <td></td> <td></td> <td>CCLAD 4</td> </td></td></td>	,165000E+00 <td>,250000E+04 <td>,228000E+00 <td></td> <td></td> <td>CCLAD 4</td> </td></td>	,250000E+04 <td>,228000E+00 <td></td> <td></td> <td>CCLAD 4</td> </td>	,228000E+00 <td></td> <td></td> <td>CCLAD 4</td>			CCLAD 4

NALAP (BHL 750627 VERSION),
 BNL FAST REACTOR SAFETY DIV,
 TIME STEP NUM 0, TIME = 0,

CRDR CALCULATION USING BNL DATA
 SEC,

24 VOLUMES SODIUM

04/05/76
 13,44,53

PAGE 14
 1204 SEC

TOTAL SYSTEM QUANTITIES	NCRH POWR	POWR (MW)	HEAT REM (BTU/HR)	ENGY LEAK (BTU)	MASS LEAK (LB)	ENGY BAL, (BTU)	MASS BAL, (LB)	TOT, REAC (S)	REAC T SEC,
	1.00000E+00	9.75000E+02	3.32768E+09	0.	0.	5.25579E+08	1.23858E+06	0.	0.
VOLUME NUMBER	AVG. PRES PSIA	TOT, MASS (LB)	AVG, ENTH (BTU/LB)	AVG. DENS (LB/FT3)	AVG, TEMP (F)	AVG, QUAL	BUOB MASS (LB)	MIXT LEVL (FT)	FLU, MASS (LB)
1	1.40600E+02	1.66247E+05	3.61832E+02	5.34744E+01	7.50500E+02	0.	0.	1.51600E+01	1.66247E+05
2	1.09150E+02	2.38484E+03	3.81723E+02	5.34718E+01	7.50500E+02	0.	0.	7.40000E+00	2.38484E+03
3	7.73200E+01	5.83913E+02	3.85125E+02	5.33741E+01	7.61900E+02	0.	0.	1.17000E+00	5.83913E+02
4	7.25900E+01	2.86097E+02	3.99543E+02	5.29809E+01	8.09390E+02	0.	0.	6.10000E+01	2.86097E+02
5	6.93800E+01	2.83263E+02	4.19688E+02	5.24562E+01	8.72550E+02	0.	0.	6.10000E+01	2.83263E+02
6	6.58700E+01	2.80182E+02	4.39370E+02	5.18856E+01	9.41080E+02	0.	0.	6.10000E+01	2.80182E+02
7	6.29600E+01	2.77482E+02	4.57414E+02	5.13855E+01	1.00107E+03	0.	0.	6.10000E+01	2.77482E+02
8	5.97500E+01	2.75577E+02	4.70085E+02	5.10328E+01	1.04327E+03	0.	0.	6.10000E+01	2.75577E+02
9	5.50200E+01	5.57898E+02	4.71371E+02	5.09962E+01	1.04761E+03	0.	0.	1.17000E+00	5.57898E+02
10	3.91800E+01	3.86179E+03	4.68664E+02	5.10684E+01	1.03879E+03	0.	0.	5.43000E+00	3.86179E+03
11	5.44600E+01	1.25704E+03	4.51056E+02	5.15601E+01	9.80020E+02	0.	0.	5.33000E+00	1.25704E+03
12	8.12100E+01	1.52062E+05	3.81626E+02	5.34695E+01	7.50500E+02	0.	0.	1.69500E+01	1.52062E+05
13	2.07800E+01	3.03296E+05	4.61620E+02	5.12607E+01	1.01556E+03	0.	0.	2.10900E+01	3.03296E+05
14	1.87400E+01	4.04345E+04	4.61613E+02	5.12605E+01	1.01556E+03	0.	0.	2.45000E+01	4.04345E+04
15	1.00100E+02	4.26117E+04	4.61906E+02	5.12677E+01	1.01556E+03	0.	0.	2.14000E+01	4.26117E+04
16	1.72040E+02	1.58950E+04	4.62166E+02	5.12741E+01	1.01556E+03	0.	0.	3.34700E+01	1.58950E+04
17	1.64440E+02	7.38508E+04	3.81914E+02	5.34763E+01	7.50500E+02	0.	0.	4.83500E+01	7.38508E+04
18	1.44930E+02	2.33364E+04	3.81847E+02	5.34747E+01	7.50500E+02	0.	0.	2.80000E+01	2.33364E+04
19	1.87400E+01	8.08689E+04	4.61613E+02	5.12605E+01	1.01556E+03	0.	0.	2.45000E+01	8.08689E+04
20	1.00100E+02	8.52234E+04	4.61906E+02	5.12677E+01	1.01556E+03	0.	0.	2.14000E+01	8.52234E+04
21	1.72040E+02	3.17899E+04	4.62166E+02	5.12741E+01	1.01556E+03	0.	0.	3.34700E+01	3.17899E+04
22	1.64440E+02	1.47702E+05	3.81914E+02	5.34763E+01	7.50500E+02	0.	0.	4.83500E+01	1.47702E+05
23	1.51030E+02	5.90367E+04	3.81868E+02	5.34752E+01	7.50500E+02	0.	0.	4.20000E+01	5.90367E+04
24	1.46290E+02	6.18169E+03	3.81851E+02	5.34749E+01	7.50500E+02	0.	0.	3.40000E+01	6.18169E+03
VOLUME NUMBER	HEAT TRANS, MCDE	SURF FLUX (BTU/HR/FT2)	DNB FLUX (BTU/HR/FT2)	H,T, COEF (BTU/H/F2/F)	SURF TEMP (F)	FUEL TEMP (F)	CENT TEMP (F)	POWR FLU, (BTU/HR)	FUEL POWR (MW)
3	9	3.85664E+04	1.00000E+10	5.14225E+04	7.62740E+02	8.32181E+02	8.66033E+02	1.16469E+08	3.41250E+01
4	9	3.08537E+05	1.00000E+10	5.10258E+04	8.15437E+02	1.48041E+03	1.89311E+03	4.79185E+08	1.40400E+02
5	9	4.09454E+05	1.00000E+10	4.99604E+04	8.80746E+02	1.82783E+03	2.45482E+03	6.35919E+08	1.86323E+02
6	9	4.42236E+05	1.00000E+10	4.88312E+04	9.50136E+02	2.00693E+03	2.71671E+03	6.86832E+08	2.01240E+02
7	9	3.85671E+05	1.00000E+10	4.78656E+04	1.00911E+03	1.91990E+03	2.52584E+03	5.98981E+08	1.75500E+02
8	9	2.71041E+05	1.00000E+10	4.72002E+04	1.04901E+03	1.66086E+03	2.05033E+03	4.20951E+08	1.23338E+02
9	9	1.43247E+04	1.00000E+10	4.67202E+04	1.07625E+03	1.07625E+03	1.09136E+03	4.32598E+07	1.26750E+01
11	9	5.21259E+04	1.00000E+10	3.76809E+04	9.81403E+02	1.08465E+03	1.14012E+03	3.46078E+08	1.01400E+02
17								-1.10922E+09	
22								-2.21845E+09	
VOLUME NUMBER	NODE	TEMP	NODE	TEMP	NODE	TEMP			
3	6	7.98648E+02	7	7.67500E+02	8	7.62740E+02			
4	6	1.10191E+03	7	8.52796E+02	8	8.15437E+02			
5	6	1.26015E+03	7	9.29555E+02	8	8.80746E+02			
6	6	1.35910E+03	7	1.00203E+03	8	9.50136E+02			
7	6	1.36482E+03	7	1.05343E+03	8	1.00911E+03			
8	6	1.29648E+03	7	1.07964E+03	8	1.04901E+03			
9	6	1.06111E+03	7	1.04955E+03	8	1.04792E+03			
11	6	1.02960E+03	7	9.87511E+02	8	9.81403E+02			

JUNCTION NUMBER	CONNECTING VOLUMES	CHOKE	JCT. FLOW (LB/SEC)	JCT. ENTH (BTU/LB)	JCT. QUAL	F R E S TOT, PSI	S U R E ELEV PSI	D I F F FRICTION PSI	E R E N T ACCL PSI	I A L S PUMP PSI
1	1 TO 2	NO	1,06039E+04	3,81032E+02	0.	3,14500E+01	4,08107E+00	2,73689E+01	1,13687E+13	0.
2	2 TO 3	NO	9,22080E+03	3,81723E+02	0.	3,18300E+01	1,58705E+00	3,02430E+01	0.	0.
3	3 TO 4	NO	9,22080E+03	3,85125E+02	0.	4,73000E+00	3,25342E-01	4,40466E+00	0.	0.
4	4 TO 5	NO	9,22080E+03	3,99543E+02	0.	3,21000E+00	2,19642E-01	2,99036E+00	1,42109E+14	0.
5	5 TO 6	NO	9,22080E+03	4,18688E+02	0.	3,51000E+00	2,17359E-01	3,29264E+00	0.	0.
6	6 TO 7	NO	9,22080E+03	4,39370E+02	0.	2,91000E+00	2,15131E-01	2,69487E+00	1,42109E-14	0.
7	7 TO 8	NO	9,22080E+03	4,57414E+02	0.	3,21000E+00	2,13359E-01	2,99664E+00	1,42109E-14	0.
8	8 TO 9	NO	9,22080E+03	4,70085E+02	0.	4,73000E+00	3,11718E-01	4,41828E+00	2,84217E+14	0.
9	9 TO 10	NO	9,22080E+03	4,71371E+02	0.	1,58400E+01	1,16648E+00	1,46735E+01	0.	0.
10	10 TO 13	NO	1,06039E+04	4,68664E+02	0.	1,84000E+01	2,96167E+00	1,54383E+01	5,68434E+14	0.
11	2 TO 11	NO	1,30312E+03	3,81723E+02	0.	5,46900E+01	2,32444E+00	5,23656E+01	4,54747E+13	0.
12	11 TO 10	NO	1,30312E+03	4,51056E+02	0.	1,52800E+01	1,91349E+00	1,33665E+01	1,70530E+13	0.
13	1 TO 12	NO	9,22080E+02	3,81032E+02	0.	5,93900E+01	4,46691E+00	5,49211E+01	0.	0.
14	12 TO 13	NO	9,22080E+02	3,81626E+02	0.	6,04300E+01	6,89697E+00	5,35330E+01	2,27374E+13	0.
15	13 TO 14	NO	3,84200E+03	4,61620E+02	0.	2,04000E+00	1,95715E-02	2,02043E+00	2,84217E+14	0.
16	14 TO 15	NO	3,84200E+03	4,61613E+02	0.	-8,13600E+01	-3,33920E+00	5,73034E+00	5,68434E+14	8,37511E+01
17	15 TO 16	NO	3,84200E+03	4,61906E+02	0.	-7,19400E+01	9,73528E-01	1,08376E+01	1,13687E+13	8,37511E+01
18	16 TO 17	NO	3,84200E+03	4,62166E+02	0.	7,60000E+00	2,92600E+00	4,67320E+00	8,52651E+14	0.
19	17 TO 18	NO	3,84200E+03	3,81914E+02	0.	1,95100E+01	-1,00098E+00	2,05110E+01	3,41061E+13	0.
20	18 TO 24	NO	3,84200E+03	3,81847E+02	0.	-1,36000E+00	-4,97614E+00	3,61614E+00	1,42109E+14	0.
21	24 TO 1	NO	3,84200E+03	3,81851E+02	0.	5,69000E+00	-6,28701E+00	1,19770E+01	1,70530E+13	0.
22	13 TO 19	NO	7,68400E+03	4,61620E+02	0.	2,04000E+00	1,95715E-02	2,02043E+00	2,84217E+14	0.
23	19 TO 20	NO	7,68400E+03	4,61613E+02	0.	-8,13600E+01	-3,33920E+00	5,73034E+00	5,68434E+14	8,37511E+01
24	20 TO 21	NO	7,68400E+03	4,61906E+02	0.	-7,19400E+01	9,73528E-01	1,08376E+01	1,13687E+13	8,37511E+01
25	21 TO 22	NO	7,68400E+03	4,62166E+02	0.	7,60000E+00	2,91566E+00	4,68434E+00	2,84217E+14	0.
26	22 TO 23	NO	7,68400E+03	3,81914E+02	0.	1,34100E+01	-4,48053E+00	1,78905E+01	1,13687E+13	0.
27	23 TO 1	NO	7,68400E+03	3,81868E+02	0.	1,04300E+01	-7,77246E+00	1,82025E+01	1,13687E+13	0.
28	24 TO 0	NO	0.	3,81851E+02	0.	0.	0.	0.	0.	0.
29	18 TO 0	NO	0.	3,81847E+02	0.	0.	0.	0.	0.	0.
16	14 TO 15		PUMP SPEED =			8,55000E+02 RPM				
17	15 TO 16		PUMP SPEED =			1,00983E+00 RPM				
23	19 TO 20		PUMP SPEED =			8,55000E+02 RPM				
24	20 TO 21		PUMP SPEED =			1,00983E+00 RPM				

HALAP (BNL 750627 VERSION), CHUR CALCULATION USING BNL DATA
 BNL FAST REACTOR SAFETY DIV,
 TIME STEP NUM 500, TIME = .500000E-01 SEC.

24 VOLUMES SODIUM

04/05/76 PAGE 16
 13,44,53 13,090 SEC

TOTAL SYSTEM QUANTITIES	NCRP POWER (MW)	POWER (MW)	HEAT REM (BTU/HR)	ENGY LEAK (RTU)	PASS LEAK (LB)	ENGY BAL. (BTU)	MASS BAL. (LB)	TOT. REAC (\$)	HEAC T SEC.
	1.00000E+00	9.75000E+02	3.32759E+09	0.	0.	5.25580E+08	1.23858E+06	0.	0.
VOLUME NUMBER	AVG. PRES PSIA	TOT. MASS (LB)	AVG. ENTH (BTU/LB)	AVG. DENS (LB/FT3)	AVG. TEMP (F)	AVG. QUAL	HUBB MASS (LB)	MIXT LEVL (FT)	FLU. MASS (LB)
1	1.40611E+02	1.66247E+05	3.81832E+02	5.34744E+01	7.50500E+02	0.	0.	1.51600E+01	1.66247E+05
2	1.09162E+02	2.38402E+03	3.81745E+02	5.34712E+01	7.50571E+02	0.	0.	7.40000E+00	2.38482E+03
3	7.73301E+01	5.83902E+02	3.85162E+02	5.33731E+01	7.62114E+02	0.	0.	1.17000E+00	5.83902E+02
4	7.25995E+01	2.86094E+02	3.99564E+02	5.29803E+01	8.09459E+02	0.	0.	6.10000E+01	2.86094E+02
5	6.93890E+01	2.83261E+02	4.16700E+02	5.24558E+01	8.72590E+02	0.	0.	6.10000E+01	2.83261E+02
6	6.50785E+01	2.80181E+02	4.39377E+02	5.18854E+01	9.41104E+02	0.	0.	6.10000E+01	2.80181E+02
7	6.29681E+01	2.77482E+02	4.57415E+02	5.13855E+01	1.00106E+03	0.	0.	6.10000E+01	2.77482E+02
8	5.97577E+01	2.75576E+02	4.70090E+02	5.10327E+01	1.04329E+03	0.	0.	6.10000E+01	2.75576E+02
9	5.50269E+01	5.57896E+02	4.71378E+02	5.09960E+01	1.04763E+03	0.	0.	1.17000E+00	5.57896E+02
10	3.91842E+01	3.86177E+03	4.68672E+02	5.10602E+01	1.03862E+03	0.	0.	5.43000E+00	3.86177E+03
11	5.44666E+01	1.25703E+03	4.51061E+02	5.15600E+01	9.60036E+02	0.	0.	5.33000E+00	1.25703E+03
12	8.12243E+01	1.52062E+05	3.81626E+02	5.34695E+01	7.50500E+02	0.	0.	1.69500E+01	1.52062E+05
13	2.07801E+01	3.03296E+05	4.61620E+02	5.12607E+01	1.01556E+03	0.	0.	2.10900E+01	3.03296E+05
14	1.87400E+01	4.04345E+04	4.61613E+02	5.12605E+01	1.01556E+03	0.	0.	2.45000E+01	4.04345E+04
15	1.00102E+02	4.26117E+04	4.61909E+02	5.12676E+01	1.01557E+03	0.	0.	2.14000E+01	4.26117E+04
16	1.71979E+02	1.58950E+04	4.62163E+02	5.12741E+01	1.01555E+03	0.	0.	3.34700E+01	1.58950E+04
17	1.64452E+02	7.38508E+04	3.81914E+02	5.34763E+01	7.50500E+02	0.	0.	4.83500E+01	7.38508E+04
18	1.44879E+02	2.33364E+04	3.81847E+02	5.34747E+01	7.50502E+02	0.	0.	2.80000E+01	2.33364E+04
19	1.87400E+01	8.08689E+04	4.61613E+02	5.12605E+01	1.01556E+03	0.	0.	2.45000E+01	8.08689E+04
20	1.00102E+02	8.52233E+04	4.61909E+02	5.12676E+01	1.01557E+03	0.	0.	2.14000E+01	8.52233E+04
21	1.71979E+02	3.17900E+04	4.62163E+02	5.12741E+01	1.01555E+03	0.	0.	3.34700E+01	3.17900E+04
22	1.64442E+02	1.47702E+05	3.81914E+02	5.34763E+01	7.50500E+02	0.	0.	4.83500E+01	1.47702E+05
23	1.51001E+02	5.90367E+04	3.81868E+02	5.34752E+01	7.50501E+02	0.	0.	4.20000E+01	5.90367E+04
24	1.46281E+02	6.18169E+03	3.81851E+02	5.34749E+01	7.50500E+02	0.	0.	3.40000E+01	6.18169E+03

-170-

VOLUME NUMBER	HEAT TRANS. NODE	SURF FLUX (BTU/HR/FT2)	DNB FLUX (BTU/HR/FT2)	H.T. COEF (BTU/H/F2/F)	SURF TEMP (F)	FUEL TEMP (F)	CENT TEMP (F)	POWER FLU. (BTU/HR)	FUEL POWER (MW)
3	9	3.75871E+04	1.00000E+10	5.14210E+04	7.62853E+02	8.32184E+02	8.66033E+02	1.14719E+08	3.41250E+01
4	9	3.08144E+05	1.00000E+10	5.10253E+04	8.15498E+02	1.48041E+03	1.89311E+03	4.78576E+08	1.40400E+02
5	9	4.09220E+05	1.00000E+10	4.99605E+04	8.80781E+02	1.82783E+03	2.45482E+03	6.35555E+08	1.86323E+02
6	9	4.42098E+05	1.00000E+10	4.88315E+04	9.50158E+02	2.00693E+03	2.71671E+03	6.86617E+08	2.01240E+02
7	9	3.85622E+05	1.00000E+10	4.78663E+04	1.00911E+03	1.91990E+03	2.52584E+03	5.98906E+08	1.75500E+02
8	9	2.70969E+05	1.00000E+10	4.72007E+04	1.04903E+03	1.66086E+03	2.05033E+03	4.20840E+08	1.23338E+02
9	9	1.42241E+04	1.00000E+10	4.67286E+04	1.04794E+03	1.07625E+03	1.09136E+03	4.29560E+07	1.26750E+01
11	9	5.20467E+04	1.00000E+10	3.76810E+04	9.81417E+02	1.08465E+03	1.14012E+03	3.45552E+08	1.01400E+02
17								-1.10920E+09	
22								-2.21840E+09	

VOLUME NUMBER	NODE	TEMP	NODE	TEMP	NODE	TEMP
3	6	7.98663E+02	7	7.67580E+02	8	7.62853E+02
4	6	1.10192E+03	7	8.52835E+02	8	8.15498E+02
5	6	1.26016E+03	7	9.29578E+02	8	8.80781E+02
6	6	1.35910E+03	7	1.00205E+03	8	9.50158E+02
7	6	1.36483E+03	7	1.05343E+03	8	1.00911E+03
8	6	1.29849E+03	7	1.07905E+03	8	1.04903E+03
9	6	1.06112E+03	7	1.04956E+03	8	1.04794E+03
	6	1.02960E+03	7	9.87520E+02	8	9.81417E+02

JUNCTION NUMBER	CONNECTING VOLUMES	CHOKE	JCT, FLOW (LH/SEC)	JCT, ENTH (BTU/LB)	JCT, QUAL	P R E S S U R E TOT, PSI	S U R F ELEV PSI	D I F F E R E N T FRIC PSI	I A L S ACCL PSI	PUMP PSI
1	1 TO 2	NO	1,06042E+04	3,81832E+02	0,	3,14484E+01	4,08106E+00	2,73702E+01	-2,92246E-03	0,
2	2 TO 3	NO	9,22143E+03	3,81745E+02	0,	2,18324E+01	1,58703E+00	3,02474E+01	-2,07248E-03	0,
3	3 TO 4	NO	9,22161E+03	3,05162E+02	0,	4,73060E+00	3,25337E-01	4,40552E+00	-2,54487E-04	0,
4	4 TO 5	NO	9,22168E+03	3,99564E+02	0,	3,21045E+00	2,19640E-01	2,99096E+00	-1,53632E-04	0,
5	5 TO 6	NO	9,22172E+03	4,18700E+02	0,	3,51050E+00	2,17358E-01	3,29332E+00	-1,79239E-04	0,
6	6 TO 7	NO	9,22175E+03	4,39377E+02	0,	2,91041E+00	2,15130E-01	2,69543E+00	-1,59047E-04	0,
7	7 TO 8	NO	9,22176E+03	4,57415E+02	0,	3,21049E+00	2,13359E-01	2,99727E+00	-1,38166E-04	0,
8	8 TO 9	NO	9,22177E+03	4,70090E+02	0,	4,73075E+00	3,11717E-01	4,41922E+00	-1,93005E-04	0,
9	9 TO 10	NO	9,22180E+03	4,71378E+02	0,	1,58426E+01	1,16648E+00	1,46768E+01	-4,63274E-04	0,
10	10 TO 13	NO	1,06054E+04	4,68672E+02	0,	1,84041E+01	2,96167E+00	1,54427E+01	-2,73479E-04	0,
11	2 TO 11	NO	1,38321E+03	3,81745E+02	0,	5,46959E+01	2,32442E+00	5,23728E+01	-1,36564E-03	0,
12	11 TO 10	NO	1,38327E+03	4,51061E+02	0,	1,52825E+01	1,91348E+00	1,33694E+01	-3,77456E-04	0,
13	1 TO 12	NO	9,22052E+02	3,81832E+02	0,	5,93866E+01	4,46891E+00	5,49178E+01	-8,79415E-05	0,
14	12 TO 13	NO	9,22202E+02	3,81626E+02	0,	6,04442E+01	6,89697E+00	5,35472E+01	-3,57977E-05	0,
15	13 TO 14	NO	3,84200E+03	4,61620E+02	0,	2,04008E+00	1,95707E-02	2,02043E+00	8,09448E-05	0,
16	14 TO 15	NO	3,84191E+03	4,61613E+02	0,	-8,13623E+01	-3,33919E+00	5,73007E+00	-2,80664E-03	8,37504E+01
17	15 TO 16	NO	3,84214E+03	4,61909E+02	0,	-7,18784E+01	9,73520E-01	1,08384E+01	6,00598E+02	8,37504E+01
18	16 TO 17	NO	3,84198E+03	4,62163E+02	0,	7,52852E+00	2,92681E+00	4,67314E+00	-7,14296E-02	0,
19	17 TO 18	NO	3,84179E+03	3,81914E+02	0,	1,95731E+01	-1,00098E+00	2,05087E+01	6,53094E+02	0,
20	18 TO 24	NO	3,84195E+03	3,81847E+02	0,	-1,40198E+00	-4,97614E+00	3,61604E+00	-4,18812E-02	0,
21	24 TO 1	NO	3,84192E+03	3,81851E+02	0,	5,67020E+00	-6,28701E+00	1,19765E+01	-1,93193E-02	0,
22	13 TO 19	NO	7,68410E+03	4,61620E+02	0,	2,04008E+00	1,95707E-02	2,02043E+00	8,07290E-05	0,
23	19 TO 20	NO	7,68382E+03	4,61613E+02	0,	-8,13623E+01	-3,33919E+00	5,73007E+00	-3,13636E-03	8,37500E+01
24	20 TO 21	NO	7,68436E+03	4,61909E+02	0,	-7,18689E+01	9,73520E-01	1,08386E+01	6,89830E+02	8,37500E+01
25	21 TO 22	NO	7,68412E+03	4,62163E+02	0,	7,52934E+00	2,91567E+00	4,68437E+00	-7,06943E-02	0,
26	22 TO 23	NO	7,68352E+03	3,81914E+02	0,	1,34402E+01	-4,48053E+00	1,78883E+01	3,24013E-02	0,
27	23 TO 1	NO	7,68391E+03	3,81868E+02	0,	1,03908E+01	-7,77248E+00	1,82021E+01	-3,88089E-02	0,
28	24 TO 0	NO	0,	3,81851E+02	0,	0,	0,	0,	0,	0,
29	18 TO 0	NO	0,	3,81847E+02	0,	0,	0,	0,	0,	0,
16	14 TO 15		PUMP SPEED = 8,55000E+02 RPM							
17	15 TO 16		PUMP SPEED = 1,00983E+00 RPM							
23	19 TO 20		PUMP SPEED = 8,55000E+02 RPM							
24	20 TO 21		PUMP SPEED = 1,00982E+00 RPM							

NALAP (MIL 750627 VERSION),
 HNL FAST REACTOR SAFETY DIV.

CRBR CALCULATION USING HNL DATA

24 VOLUMES SODIUM

04/05/76
 13,44,53

PAGE 18
 25,974 SEC

TIME SEC	AVG PRESS VOL 1 PSIA	AVG PRESS VOL 2 PSIA	FLUID TEMP VOL 17 F	AVG PRESS VOL 17 PSIA	FLOW JUN 18 SEC	LB/ SEC	FLOW JUN 19 SEC	LB/ SEC	FLUID TEMP VOL 8 F	FLOW JUN 1 SEC	LB/ SEC
.00500	1.40615E+02	1.09132E+02	7.50500E+02	1.64443E+02	3.84194E+03	3.84199E+03	1.04327E+03	1.06037E+04			
.01000	1.40623E+02	1.09142E+02	7.50500E+02	1.64443E+02	3.84179E+03	3.84197E+03	1.04328E+03	1.06037E+04			
.01500	1.40628E+02	1.09150E+02	7.50500E+02	1.64436E+02	3.84162E+03	3.84194E+03	1.04328E+03	1.06038E+04			
.02000	1.40629E+02	1.09159E+02	7.50500E+02	1.64425E+02	3.84151E+03	3.84189E+03	1.04328E+03	1.06040E+04			
.02500	1.40628E+02	1.09166E+02	7.50500E+02	1.64413E+02	3.84151E+03	3.84183E+03	1.04328E+03	1.06041E+04			
.03000	1.40625E+02	1.09169E+02	7.50500E+02	1.64407E+02	3.84162E+03	3.84177E+03	1.04328E+03	1.06042E+04			
.03500	1.40621E+02	1.09169E+02	7.50500E+02	1.64410E+02	3.84179E+03	3.84173E+03	1.04328E+03	1.06043E+04			
.04000	1.40618E+02	1.09167E+02	7.50500E+02	1.64421E+02	3.84194E+03	3.84171E+03	1.04328E+03	1.06043E+04			
.04500	1.40615E+02	1.09165E+02	7.50500E+02	1.64437E+02	3.84201E+03	3.84174E+03	1.04329E+03	1.06042E+04			
.05000	1.40611E+02	1.09162E+02	7.50500E+02	1.64452E+02	3.84198E+03	3.84179E+03	1.04329E+03	1.06042E+04			
.05500	1.40607E+02	1.09159E+02	7.50500E+02	1.64461E+02	3.84185E+03	3.84186E+03	1.04329E+03	1.06041E+04			
.06000	1.40603E+02	1.09156E+02	7.50501E+02	1.64460E+02	3.84170E+03	3.84192E+03	1.04329E+03	1.06040E+04			
.06500	1.40601E+02	1.09155E+02	7.50501E+02	1.64451E+02	3.84158E+03	3.84195E+03	1.04329E+03	1.06039E+04			
.07000	1.40600E+02	1.09153E+02	7.50501E+02	1.64437E+02	3.84156E+03	3.84194E+03	1.04329E+03	1.06038E+04			
.07500	1.40600E+02	1.09153E+02	7.50501E+02	1.64427E+02	3.84164E+03	3.84190E+03	1.04329E+03	1.06037E+04			
.08000	1.40602E+02	1.09154E+02	7.50501E+02	1.64424E+02	3.84178E+03	3.84183E+03	1.04329E+03	1.06036E+04			
.08500	1.40606E+02	1.09157E+02	7.50501E+02	1.64431E+02	3.84191E+03	3.84176E+03	1.04330E+03	1.06036E+04			
.09000	1.40610E+02	1.09160E+02	7.50501E+02	1.64445E+02	3.84198E+03	3.84172E+03	1.04330E+03	1.06037E+04			
.09500	1.40613E+02	1.09162E+02	7.50501E+02	1.64460E+02	3.84194E+03	3.84171E+03	1.04330E+03	1.06037E+04			
.10000	1.40615E+02	1.09164E+02	7.50501E+02	1.64472E+02	3.84183E+03	3.84195E+03	1.04330E+03	1.06038E+04			