DPC-NE-2000-A

DCHF-1

CORRELATION FOR PREDICTING CRITICAL HEAT FLUX IN MIXING VANE GRID FUEL ASSEMBLIES

Original Report: September 1987
Approved Report: August 1989

A. M. Mitry, Ph. D.

Duke Power Company
Design Engineering Department
Nuclear Engineering Section
Charlotte, North Carolina

ABSTRACT

A new critical heat flux (CHF) correlation has been derived for use with the EPRI VIPRE-01 computer code for predicting CHF in pressurized water reactor fuel assemblies with mixing vane spacer grids. This correlation, DCHF-1, is based on 1004 CHF data points from 22 Westinghouse test sections which include both 0.422 inch and 0.374 inch rod O.D., geometries. The correlation accounts for typical cell and thimble cell effects, uniform and nonuniform heat flux profiles, variations in rod heated length and in grid spacing. DCHF-1 predicted CHF for the 1004 points with an average CHF ratio (measured-to-predicted CHF) of 1.00 and a standard deviation of 0.0942. The design limiting value for departure from nucleate boiling ratio for DCHF-1 for application to 15x15 and 17x17 mixing vane grid designs is 1.194.

CONTENTS

LIST OF FIGURES

LIST OF TABLES

1. INTRODUCTION

Boiling crisis is characterized by a sudden drop in the heat transfer coefficient due to the change of heat transfer mechanisms and is indicated by a temperature excursion of the fuel rod surface temperature. The heat flux just before the boiling crisis is called the Critical Heat Flux (CHF) or the point of Departure from Nucleate Boiling (DNB). The occurrence of CHF marks the transition from nucleate boiling, a very effective heat transfer mode, to transition boiling, a relatively poor heat transfer mode. If transition boiling were to occur at typical reactor conditions, the fuel rod surface temperature would rise to levels which would cause rapid deterioration of the mechanical properties of the fuel cladding, and therefore it must be avoided.

In order to maintain the fuel cladding temperature at a safe condition the design heat flux should be within the nucleate boiling heat transfer region and sufficiently below CHF. Reactor power limits are generally set so that a prescribed safety margin below CHF is maintained. A Departure from Nucleate Boiling Ratio (DNBR), defined as the ratio of the predicted CHF to the actual heat flux at the same condition, is usually used in design. The greater the DNBR (above 1.0) the greater the thermal margin.

Since no satisfactory theory exists at this time for predicting CHF in rod bundles, the nuclear industry must rely on correlations based on experimental data for specific fuel designs. For design purposes, representative experiments are performed on large scale electrically heated models of specific types of fuel elements and empirical correlations are developed based on experimental data for those specific type of bundles. This report describes the development and verification of a new CHF correlation that is directly applicable to fuel assemblies with mixing vane grids. Included are Westinghouse 15x15 fuel assemblies (both L-grid and R-grid), Westinghouse 17x17 fuel assemblies (both standard, or 0.374 inch diameter, and OFA, or 0.360 inch diameter fuel assemblies) and the Babcock and Wilcox Mark-BW mixing vane grid assembly design*.

The development of the correlation encompasses the following tasks:

1. Compilation of experimental CHF data obtained from full scale electrically-heated rod bundle test sections.

2. Reduction of this data to the local conditions form, using a subchannel thermal hydraulic computer code.

3. Correlating CHF as a function of the local conditions as well as other system parameters. This task includes:

   - optimizing the coefficients of the CHF correlation with a nonlinear least squares regression program.

   - using all data points to verify the optimized coefficients and to obtain statistics for the verification process.

4. Calculation of a 95/95 design limit that is consistent with the specified acceptable fuel design limit of Standard Review Plan 4.4 (NUREG 0800).

*See Appendix C which confirms the applicability of DCHF-1 to CHF in fuel assemblies with Zircaloy mixing vane grids (or B&W Mark-BW fuel assemblies). The data contained in this appendix is proprietary to Babcock & Wilcox Company

2. SOURCES OF DATA

The Heat Transfer Research Facility (HTRF) of Columbia University has performed CHF tests and collected over 11,000 data points from 230 different types of rod bundles. These data were obtained for Combustion Engineering Inc., Westinghouse Electric Co., General Electric Co., Exxon Nuclear Co., Babcock and Wilcox Co., United Nuclear Corp., and Idaho National Laboratories (LOFT program). In 1982, Columbia published the results of 20 years of CHF testing in their HTRF[1]. Volume 1 of reference 1 describes the facilities that were used to obtain the CHF data, and volume 3 of the same reference provides a detailed description of the bundle geometries, power shapes, test sections, and CHF data.

The CHF correlation discussed in this report, which was developed for application to PWR fuel assemblies with mixing vane spacer grids, is based upon the applicable portion of that published data. The published data which supports the present work includes 70 tests performed in the HTFR for Westinghouse. Test sections that simulate Westinghouse 15x15 and 17x17 fuel assembly designs with mixing vane spacer grids were used as part of the data base. Test sections with non-mixing vane grids or high pressure drop grids, and tests performed specifically for determination of rod bow or flow blockage penalties were not used in the correlation data base. In addition, tests with fewer than 15 data points were not included. The final data set selected for the correlation included 22 test sections (1004 runs). A description of the 22 test sections geometries is given in Table 2.1. Reference 1, volume 3 contains a detailed description of these test sections, however a brief summary of their pertinent characteristics is given below.

All of the 22 test sections were either 96 or 168 inch in heated length. They simulated either a typical cell (all rods heated) or a thimble cell (i.e. one interior rod unheated, simulating a control rod thimble tube). The test sections were all in the form of rectangular array rod bundles; 5x5 for the 0.374 inch rod outside diameter test sections and 4x4 for the 0.422 inch rod outside diameter test sections. The test section configurations are shown in Figures 2-1 through 2-4. The axial heat flux profiles were either uniform or nonuniform. The four nonuniform axial heat flux shapes used in the testing are shown in Figures 2-5 and 2-6. 1004 CHF data points from 22 test sections were used to develop the present correlation. This data covers the following parameter ranges:

Pressure	1485	to	2445 psia	Rev.1
Local Mass Velocity	0.85	to	3.63 Mlbm/hr-ft^2	Rev.1
Local Quality (equilibrium)	-0.15	to	0.36	Rev.1
Heated Length	96	to	168 inches	
Grid Spacing	13	to	32 inches	
Equivalent Hydraulic Diameter	0.37	to	0.51 inches	
Equivalent Heated Hydraulic Diameter	0.46	to	0.58 inches	Rev.1
Rod Outside Diameter	0.374	to	0.422 inches	

Table 2-1 Test Section Geometries

Westinghouse Test Sec. No.	108	114	121	122	124	125	127	131	132	133	134
Test Sec. Configuration	4x4 Typ.*	4x4 Typ.	4x4 Typ.	4x4 Typ.	4x4 Typ.	4x4 Typ.	4x4 Typ.	4x4 Typ.	4x4 Typ.	4x4 Typ.	4x4 Typ.
Configuration Reference	Fig. 2-1	Fig. 2-1	Fig. 2-1	Fig. 2-1	Fig. 2-1	Fig. 2-1	Fig. 2-1	Fig. 2-1	Fig. 2-1	Fig. 2-1	Fig. 2-1
Heated Length (inches)	96.0	96.0	96.0	96.0	96.0	96.0	96.0	168.0	168.0	168.0	168.0
Heated Rod O.D. (inches)	0.422	0.422	0.422	0.422	0.422	0.422	0.422	0.422	0.422	0.422	0.422
Rod Pitch (inches)	0.555	0.555	0.555	0.555	0.555	0.555	0.555	0.555	0.555	0.555	0.555
Unheated Rod O.D. (inches)	None	None	None	None	None	None	None	None	None	None	None
Rod to Rod Gap (inches)	0.133	0.133	0.133	0.133	0.133	0.133	0.133	0.133	0.133	0.133	0.133
Rod to Wall Gap (inches)	0.153	0.153	0.153	0.153	0.153	0.153	0.153	0.102	0.102	0.106	0.105
Shroud Size (inches)	2.393	2.393	2.393	2.393	2.393	2.393	2.393	2.291	2.291	2.254	2.299
Radial Peak Factor (inner)	1.105	1.047	1.0585	1.0585	1.0525	1.1578	1.1625	1.1213	1.1213	1.1215	1.122
Radial Peak Factor (outer)	0.952	0.984	0.9772	0.9772	0.9825	0.9478	0.946	0.9597	0.9597	0.9593	0.9593
Axial Heat Flux Profile	p Sine p	Cosine p	Cosine p	Cosine p	Cosine p	p Sine p	p Sine p	p Sine p	p Sine p	p Sine p	p Sine p
Axial Heat Flux Profile Ref.	Fig. 2-5	Fig. 2-5	Fig. 2-5	Fig. 2-5	Fig. 2-5	Fig. 2-5	Fig. 2-5	Fig. 2-6	Fig. 2-6	Fig. 2-6	Fig. 2-6
No. of Mixing Vane Grids	5	4	5	4	5	5	4	6	8	13	5
First Mixing Vane Grid (inches)	10.75	6.75	4.75	6.75	4.75	10.75	0.75	19.0	13.0	6.0	27.0
Mixing Vane Grid Spacing (inches)	20.0	26.0	20.0	26.0	20.0	20.0	22.0	26.0	20.0	13.0	32.0
Mixing Vane Grid Loss Coeff.	1.20	1.20	1.20	1.20	1.20	0.680	0.680	1.40	1.40	1.40	1.40

* Typ. - Typical Cell

Table 2-1 Test Section Geometries (continued)

Westinghouse Test Sec. No.	138	139	153	157	158	160	161	162	163	164	166
Test Sec. Configuration	4x4 Th.*	4x4 Th.	4x4 Typ.	5x5 Typ.	5x5 Th.	5x5 Typ.	5x5 Typ.	5x5 Th.	5x5 Typ.	5x5 Typ.	4x4 Th.
Configuration Reference	Fig. 2-2	Fig. 2-2	Fig. 2-1	Fig. 2-3	Fig. 2-4	Fig. 2-3	Fig. 2-3	Fig. 2-4	Fig. 2-3	Fig. 2-3	Fig. 2-2
Heated Length (inches)	160.0	160.0	160.0	96.0	96.0	96.0	160.0	160.0	96.0	160.0	160.0
Heated Rod O.D. (inches)	0.422	0.422	0.422	0.374	0.374	0.374	0.374	0.374	0.374	0.374	0.422
Rod Pitch (inches)	0.555	0.555	0.555	0.496	0.496	0.496	0.496	0.496	0.496	0.496	0.555
Unheated Rod O.D. (inches)	0.545	0.545	None	None	0.482	None	None	0.485	None	None	0.544
Rod to Rod Gap (inches)	0.133	0.133	0.133	0.122	0.122	0.122	0.122	0.122	0.122	0.122	0.133
Rod to Wall Gap (inches)	0.106	0.106	0.102	0.098	0.098	0.100	0.100	0.100	0.100	0.100	0.102
Shroud Size (inches)	2.299	2.299	2.291	2.554	2.554	2.550	2.550	2.560	2.550	2.550	2.291
Radial Peak Factor (inner)	1.136	1.131	1.107	1.1057	1.1198	1.105	1.1059	1.099	1.105	1.095	1.1007
Radial Peak Factor (outer)	0.966	0.967	0.9643	0.9405	0.9446	0.941	0.9404	0.9505	0.941	0.9466	0.972
Axial Heat Flux Profile	μ Sine μ	μ Sine μ	Uniform	Uniform	Uniform	Uniform	Uniform	Cosine μ	Uniform	Cosine μ	μ Sine μ
Axial Heat Flux Profile Ref.	Fig. 2-6	Fig. 2-6	(None)	(None)	(None)	(None)	(None)	Fig. 2-6	(None)	Fig. 2-6	Fig. 2-6
No. of Mixing Vane Grids	6	5	6	4	4	4	8	8	4	8	6
First Mixing Vane Grid (inches)	19.0	27.37	25.0	5.0	5.0	20.0	4.0	3.0	20.0	3.0	19.0
Mixing Vane Grid Spacing (inches)	26.0	32.0	26.0	26.0	26.0	22.0	22.0	22.0	22.0	22.0	26.0
Mixing Vane Grid Loss Coeff.	1.40	1.40	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25

* Th. - Thimble Cell

Figure 2-1. 4 by 4 Typical Cell Test Section

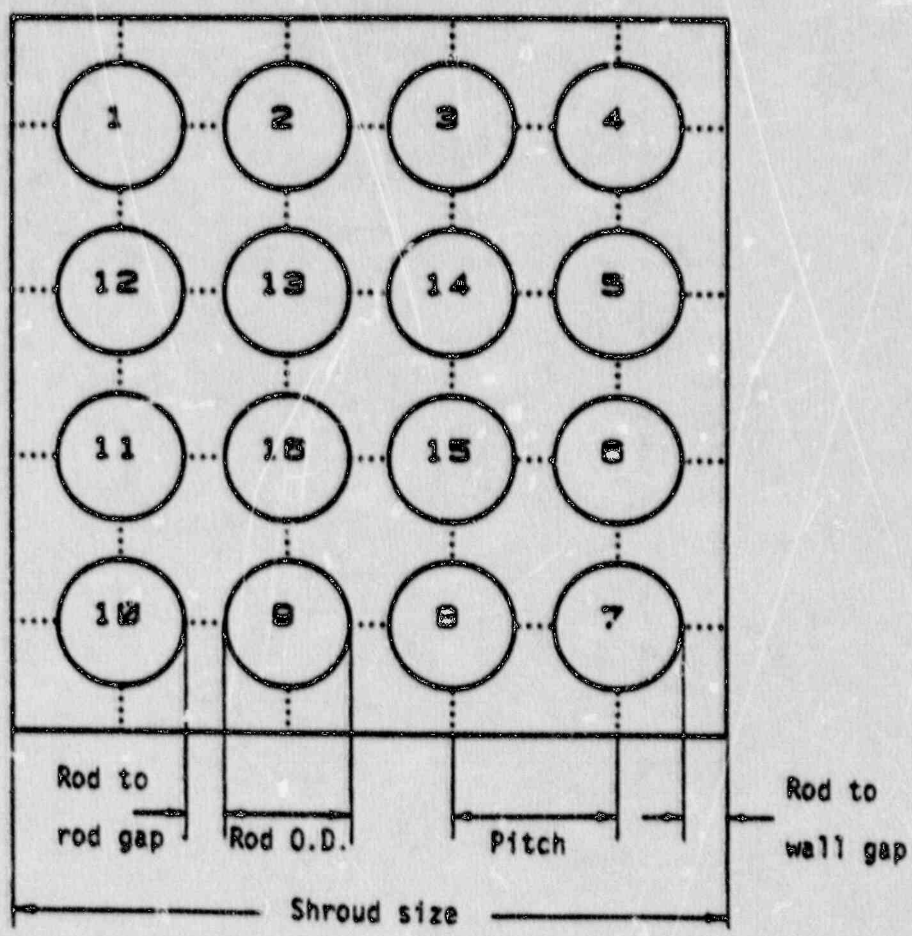


Figure 2-2. 4 by 4 Thimble Cell Test Section

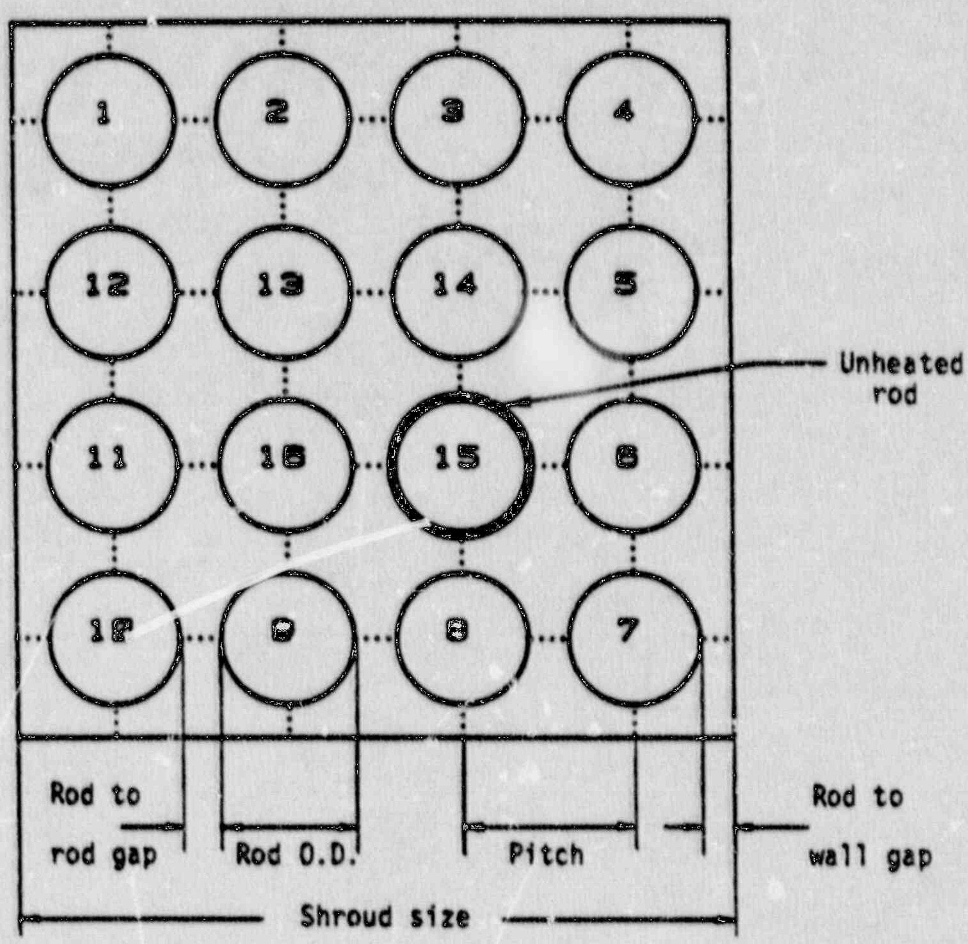


Figure 2-3. 5 by 5 Typical Cell Test Section

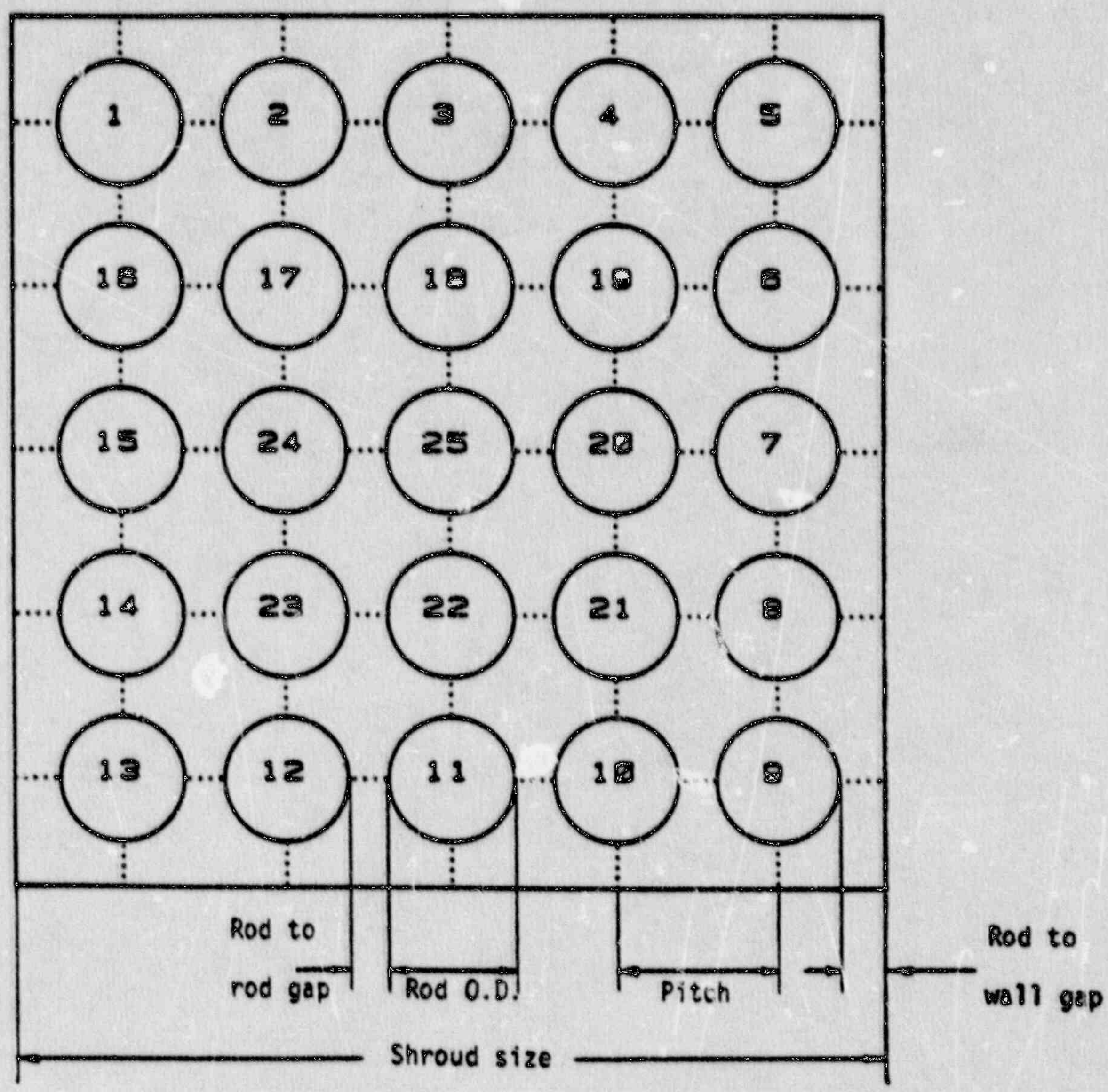


Figure 2-4. 5 by 5 Thimble Cell Test Section

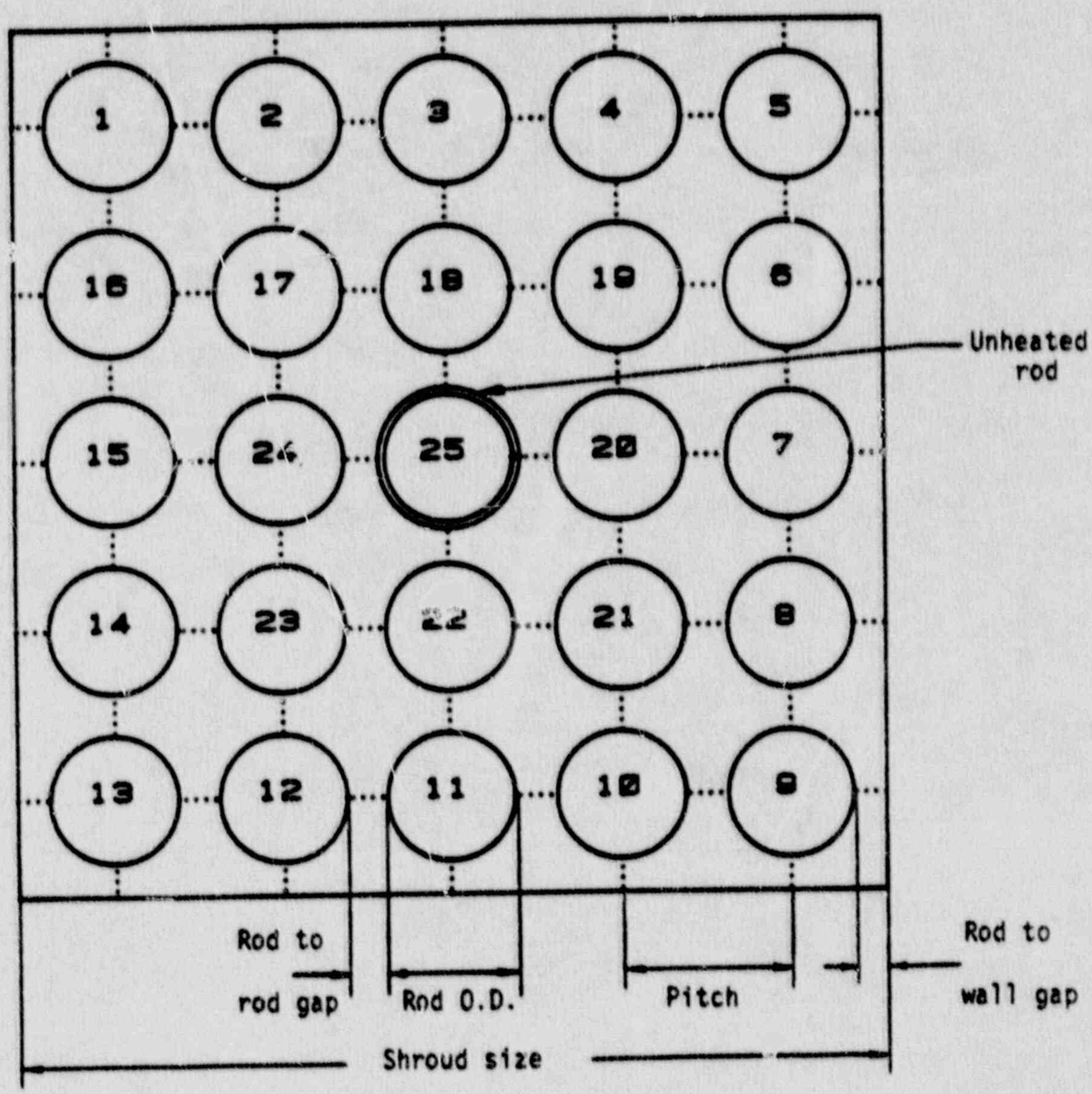


Figure 2-5. 96 Inch Heater Rods Nonuniform Axial Heat Flux Distributions

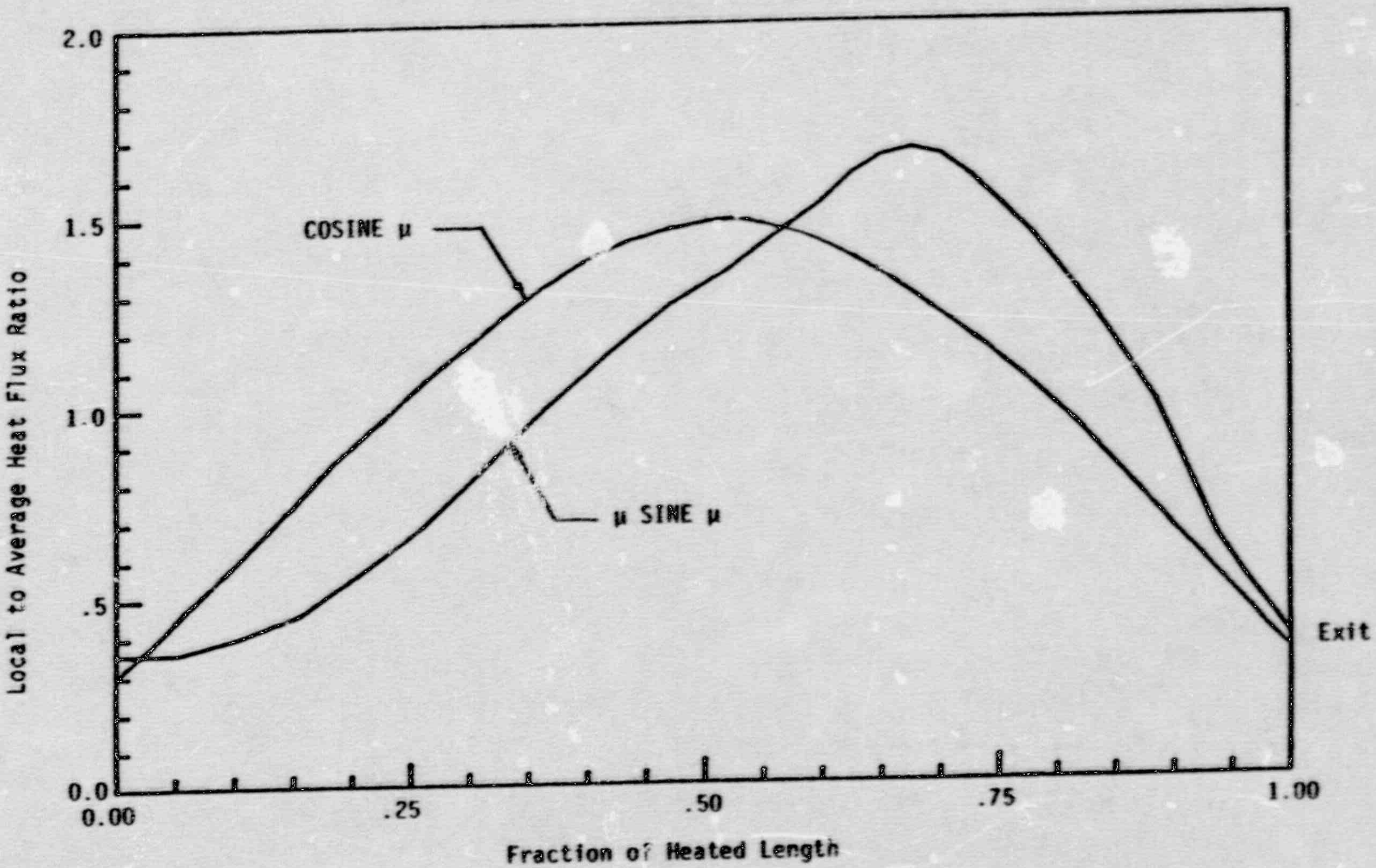
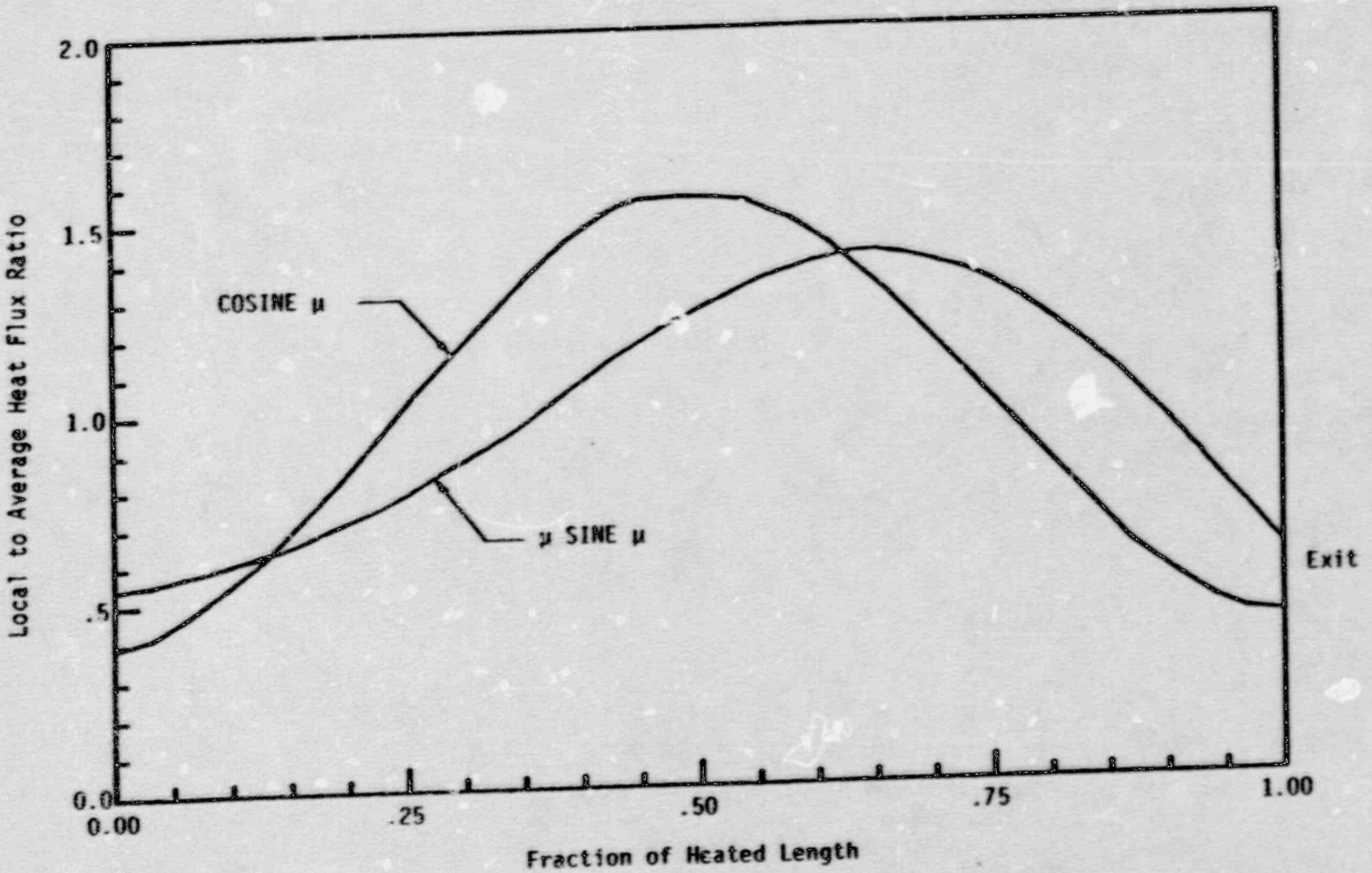


Figure 2-6. 168 Inch Heater Rods Nonuniform Axial Heat Flux Distributions



3. CHF CORRELATION

The DCHF-1 correlation was developed using local fluid conditions determined by the VIPRE-01 thermal hydraulic code [2] based on published Westinghouse mixing vane grid rod bundle CHF data. The basic form of the correlation is similar to the one adopted by Columbia University for the development of their generalized CHF correlation [1].

$$q''_{CHF,UN} = (A - X_{CHF,\ell})/C$$

Where $q''_{CHF,UN}$ is the uniform critical heat flux (with a uniform axial flux shape), $X_{CHF,\ell}$ is the local quality at the point of DNB and A and C are functions of pressure and mass velocity expressed as,

$$A = B_1 P_R^{B_2} G^{(B_5+B_7 P_R)}$$

$$C = B_3 P_R^{B_4} G^{(B_6+B_8 P_R)}$$

The basic A and C equations above were modified by adding bundle specific multipliers to account for the effects of grid spacing, test section heated length and test section geometry. The modified A and C forms are where B_1 through B_{12} are constants to be evaluated with the use of the CHF data.

The correlation was extended to the case of a nonuniform heat flux distribution by applying the standard Tong F-factor to the uniform CHF equation as follows

$$q''_{CHF,NU} = q''_{CHF,UN}/F$$

where $q''_{CHF,NU}$ is the nonuniform critical heat flux, F is the standard Tong factor for nonuniform axial heat flux given by [3],

$$F = [K/q''_{CHF,\ell}(1-e^{-KL_{CHF}})]\int_0^{L_{CHF}}[q''(z)]e^{-K(L_{CHF}-z)}dz$$

Here $q''_{CHF,\ell}$ is the local nonuniform CHF, L_{CHF} is the location of CHF measured from the inception of local boiling, and $q''(z)$ is the nonuniform heat flux at axial location z. The factor K is a function of the local quality at the point of DNB, $X_{CHF,\ell}$ and the bulk mass velocity G. The formulation of K is given in reference 3. The factor K must be evaluated utilizing the test data. Comparison with nonuniform data, performed by Westinghouse [4] indicated that no modification to either the constant or the form of the F-factor was necessary for the present application.

The final form of the DCHF-1 correlation, which accounts for typical cell and thimble cell effects, uniform and nonuniform heat flux profiles, variations in rod heated length, grid spacing and test section geometry, is

Rev.1

where

q''_{CHF} = Critical heat flux, MBtu/hr-ft²

G = Local mass velocity, Mlbm/hr-ft² for the coefficient C-equation
lbm/hr-ft² for the Tong factor F-equation Rev.1

P = Pressure, psia

X_ℓ = Local quality

P_c = Critical pressure, 3208.2 psia

z_{CHF} = Location of CHF measured from test section inlet, ft

q''_ℓ = Local heat flux, MBtu/hr-ft²

$q''(z)$ = Heat flux at axial location z, MBtu/hr-ft²

L_{CHF} = Location of CHF measured from the inception of local boiling, ft

S = Spacer grid spacing, inches

The coefficients B_1 through B_{12} were optimized using a nonlinear least squares regression program developed by Columbia University [5]. The program uses a stepwise regression algorithm developed by Jennrich and Sampson [6]. The optimized values of the coefficients are:

4. VERIFICATION

The experimental verification of the present CHF correlation was performed by comparing the measured CHF with the predicted CHF at the point of minimum predicted-to-measured critical heat flux ratio (CHFR), for each test point. A ratio of measured-to-predicted CHF (R_i) was calculated for each test point at the point of minimum CHFR. These ratios, R_i, were then plotted against each independent variable appearing in the correlation.

Figure 4-1 shows measured CHF plotted against predicted CHF for all of the 1004 data points. Figures 4-2, 4-3, and 4-4 show measured-to-predicted CHF ratio plotted against fluid parameters of local quality, mass velocity, and pressure, respectively. The low scatter ($\sigma = 0.0942$) in the data (1004 points) and the absence of any significant trend with the fluid parameters indicates that the DCHF-1 correlation accounts quite well for the behavior of these fluid parameters. Figures 4-5, 4-6, and 4-7 show measured-to-predicted CHF ratio plotted against the rod bundle variables of length, grid spacing, and equivalent hydraulic diameter. The figures show that there is no bias in the correlation relative to these bundle variables.

The accuracy of the DCHF-1 correlation in predicting the CHF data was determined by the following error statistics:

$$\bar{R} = \left(\sum_{i=1}^{n} R_i\right)/n$$

$$\sigma = \left[\left\{\sum_{i=1}^{n} (R_i - \bar{R})^2\right\}/n\right]^{1/2}$$

where

$\bar{R}$ = Average ratio of measured-to-predicted CHF.

R_i = Ratio of measured-to-predicted CHF for ith data point.

n = Number of data points.

σ = Standard deviation of the error from the mean.

The precision of the DCHF-1 correlation in predicting the source data set is indicated by the following statistics:

Number of test sections	N = 22
Number of data points	n = 1004
Average ratio of measured-to-predicted CHF	$\bar{R}$ = 1.000
Standard deviation	σ = 9.42%

Error statistics broken down by pressure, mass velocity, heated length, grid spacing, equivalent hydraulic diameter, wetted perimeter/heated perimeter, and test section are given in Tables 4-1 through 4-7. These tables clearly show that there is no bias with respect to any of these parameters. Figure 4-8 shows a histogram of the measured-to-predicted CHF ratios for the correlation and its data base. The figure demonstrates that the distribution for all data is normal. This justifies the treatment of the data as a normal distribution. The normality of the distribution was verified statistically with the D prime test.

Table 4-1. Error Statistics Broken Down By Pressure

P (psia)	n	$\bar{R}$	σ (%)
2400	283	1.003	9.55
2100	303	1.003	9.61
1800	186	0.983	9.94
1500	222	1.008	8.45
All Data	1004	1.000	9.42

Table 4-2. Error Statistics Broken Down By Mass Velocity

G (Mlbm/hr-ft2)	n	$\bar{R}$	σ (%)
1.0	52	1.036	9.13
1.5	124	1.013	9.11
2.0	252	0.971	9.91
2.5	218	0.994	9.01
3.0	168	1.002	8.82
3.5	177	1.024	8.99
All Data	1004	1.000	9.42

Nomenclature:

P = Pressure
G = Mass velocity
n = Number of data points
$\bar{R}$ = Average measured-to-predicted critical heat flux ratio
σ = Standard deviation

Table 4-3. Error Statistics Broken Down By Heated Length

L (inches)	n	$\bar{R}$	σ (%)
96.0	482	1.011	9.00
166.0	522	0.990	9.69
All Data	1004	1.000	9.42

| Rev.1

Table 4-4. Error Statistics Broken Down By Grid Spacing

S (inches)	n	$\bar{R}$	σ (%)
13.0	37	1.004	6.78
20.0	168	1.035	8.80
22.0	356	0.974	9.67
26.0	367	1.008	9.01
32.0	76	1.009	9.58
All Data	1004		9.42

Nomenclature:

L = Heated Length, inches
S = Grid spacing, inches
n = Number of data points
$\bar{R}$ = Average measured-to-predicted critical heat flux ratio
σ = Standard deviation

Table 4-5. Error Statistics Broken Down By Equivalent Hydraulic Diameter

D_e (inches)	n	$\bar{R}$	σ (%)
0.37	136	1.000	10.70
0.46	326	0.987	9.75
0.51	542	1.008	8.79
All Data	1004	1.000	9.42

Table 4-6. Error Statistics Broken Down By Wetted Perimeter/Heated Perimeter

P_W/P_H	n	$\bar{R}$	σ (%)
1.00	747	0.999	9.30
1.43	257	1.004	9.78
All Data	1004	1.000	9.42

Nomenclature:

D_e = Equivalent hydraulic diameter, inches
P_W/P_H = Wetted perimeter/Heated perimeter
n = Number of data points
$\bar{R}$ = Average measured-to-predicted critical heat flux ratio
σ = Standard deviation

Table 4-7. Error Statistics Broken Down By Test Section

	Test Section No.	Test Section Configuration	Heated Rod O.D. (inches)	Heated Length (inches)	Axial Heat Flux Profile	No. of Data Points	Av. Measured to Predicted CHF Ratio	Standard Deviation (%)
	108	4x4 Typ.	0.422	96.0	μ Sine μ	29	0.997	7.00
	114	4x4 Typ.	0.422	96.0	Cosine μ	33	0.900	4.72
	121	4x4 Typ.	0.422	96.0	Cosine μ	37	1.025	6.84
	122	4x4 Typ.	0.422	96.0	Cosine μ	29	1.011	5.10
	124	4x4 Typ.	0.422	96.0	Cosine μ	34	1.023	5.86
	125	4x4 Typ.	0.422	96.0	μ Sine μ	33	1.005	6.33
	127	4x4 Typ.	0.422	96.0	μ Sine μ	37	0.980	7.19
	131	4x4 Typ.	0.422	168.0	μ Sine μ	37	1.026	9.00
	132	4x4 Typ.	0.422	168.0	μ Sine μ	35	1.115	11.42
	133	4x4 Typ.	0.422	168.0	μ Sine μ	37	1.004	6.78
	134	4x4 Typ.	0.422	168.0	μ Sine μ	38	0.996	9.32
	138	4x4 Th.	0.422	168.0	μ Sine μ	37	0.965	7.80
	139	4x4 Th.	0.422	168.0	μ Sine μ	38	1.022	9.78
	166	4x4 Th.	0.422	168.0	μ Sine μ	46	1.033	7.04
	162	5x5 Th.	0.374	168.0	Cosine μ	70	0.936	7.02
Rev.1	164	5x5 Typ.	0.374	168.0	Cosine μ	73	0.930	7.70
Rev.1	153	4x4 Typ.	0.422	168.0	Uniform	42	1.009	8.97
	157	5x5 Typ.	0.374	96.0	Uniform	77	0.997	7.40
	158	5x5 Th.	0.374	96.0	Uniform	66	1.067	9.71
	160	5x5 Typ.	0.374	96.0	Uniform	66	1.029	11.24
	161	5x5 Typ.	0.374	168.0	Uniform	69	0.972	8.77
	163	5x5 Typ.	0.374	96.0	Uniform	41	1.030	10.54
					All Data	1004	1.000	9.42

Figure 4-1. Measured vs Predicted Critical Heat Flux

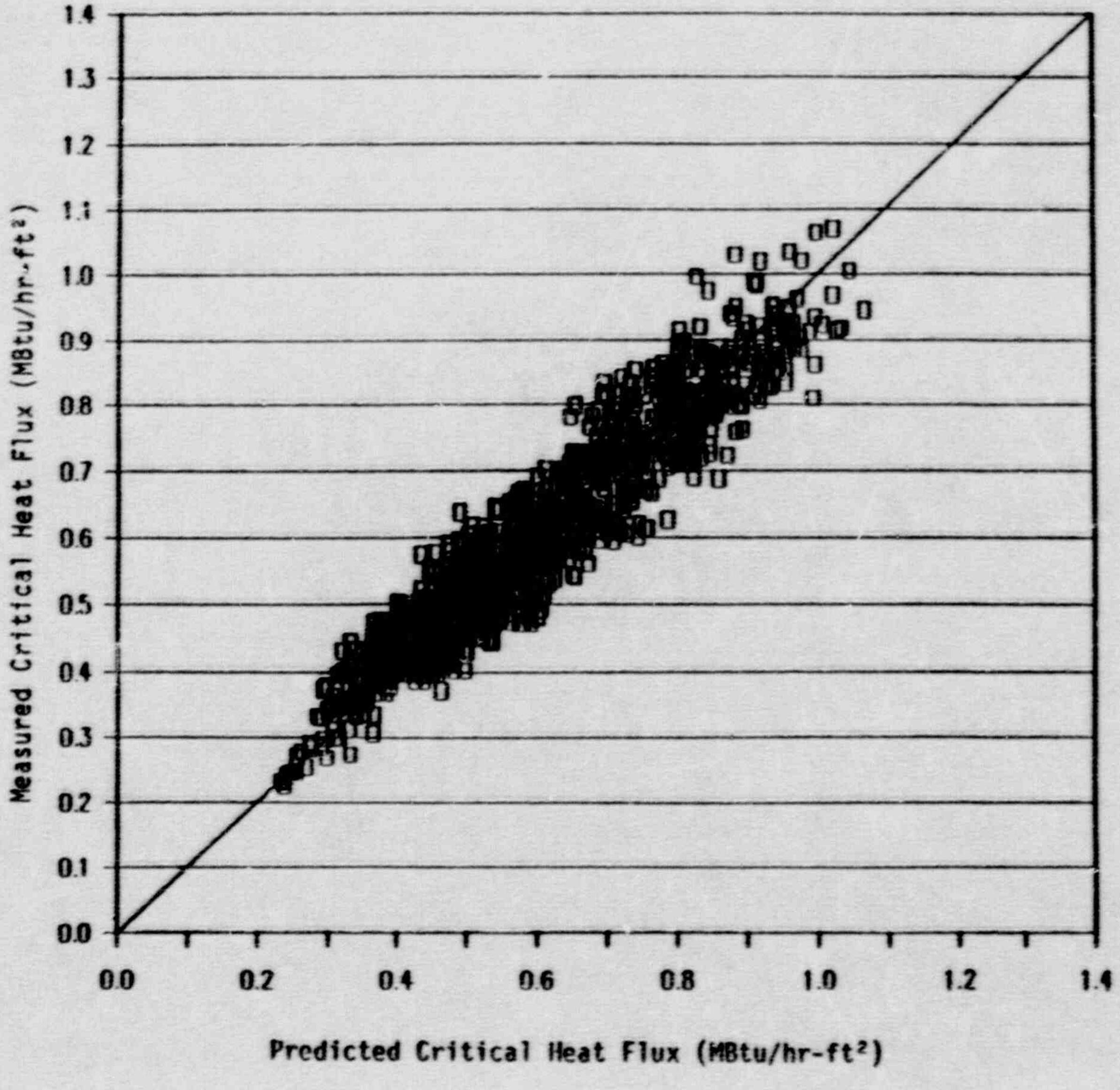


Figure 4-2. Measured-to-Predicted Critical Heat Flux vs Local Quality

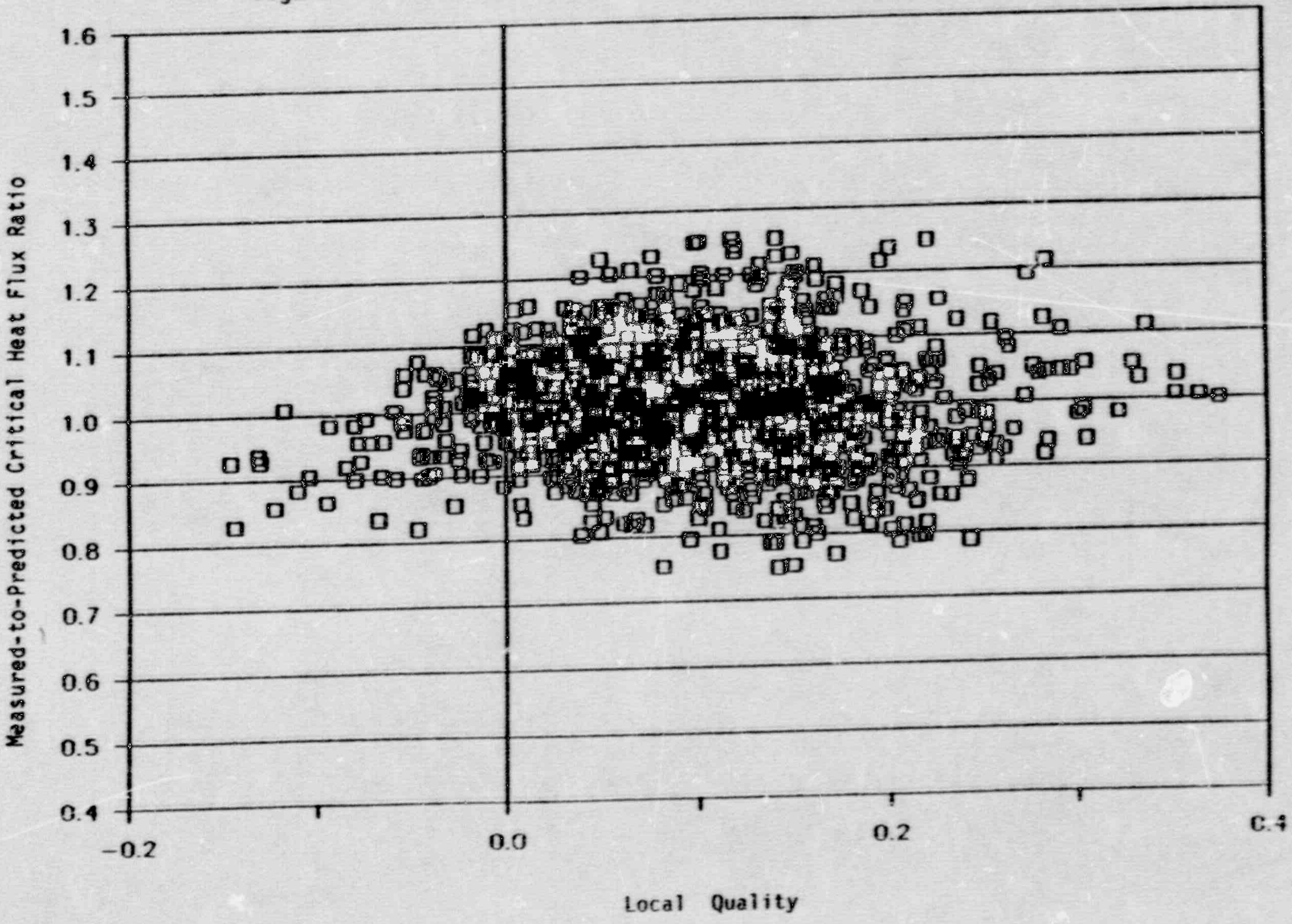


Figure 4-3. Measured-to-Predicted Critical Heat Flux vs Local Mass Velocity

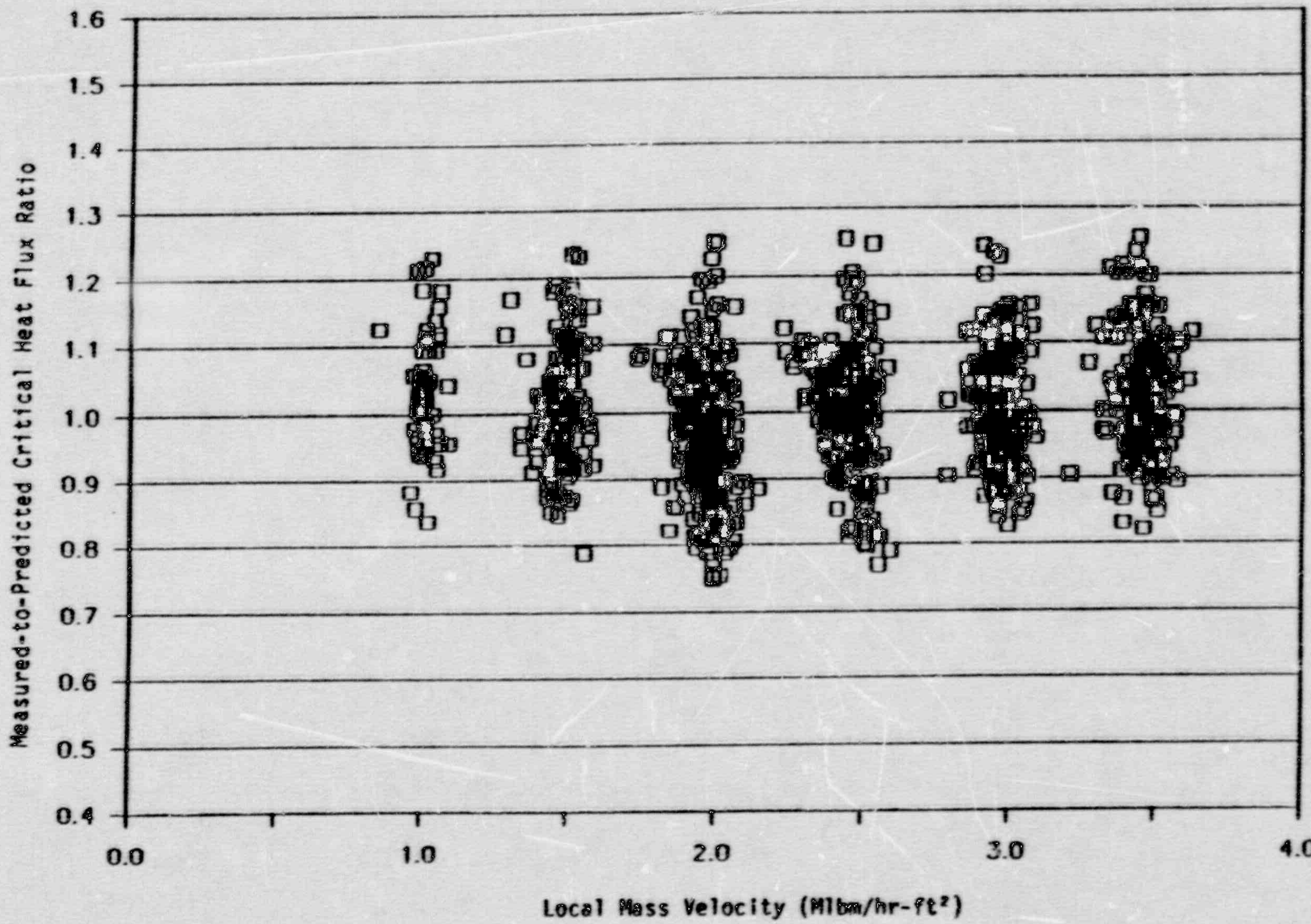
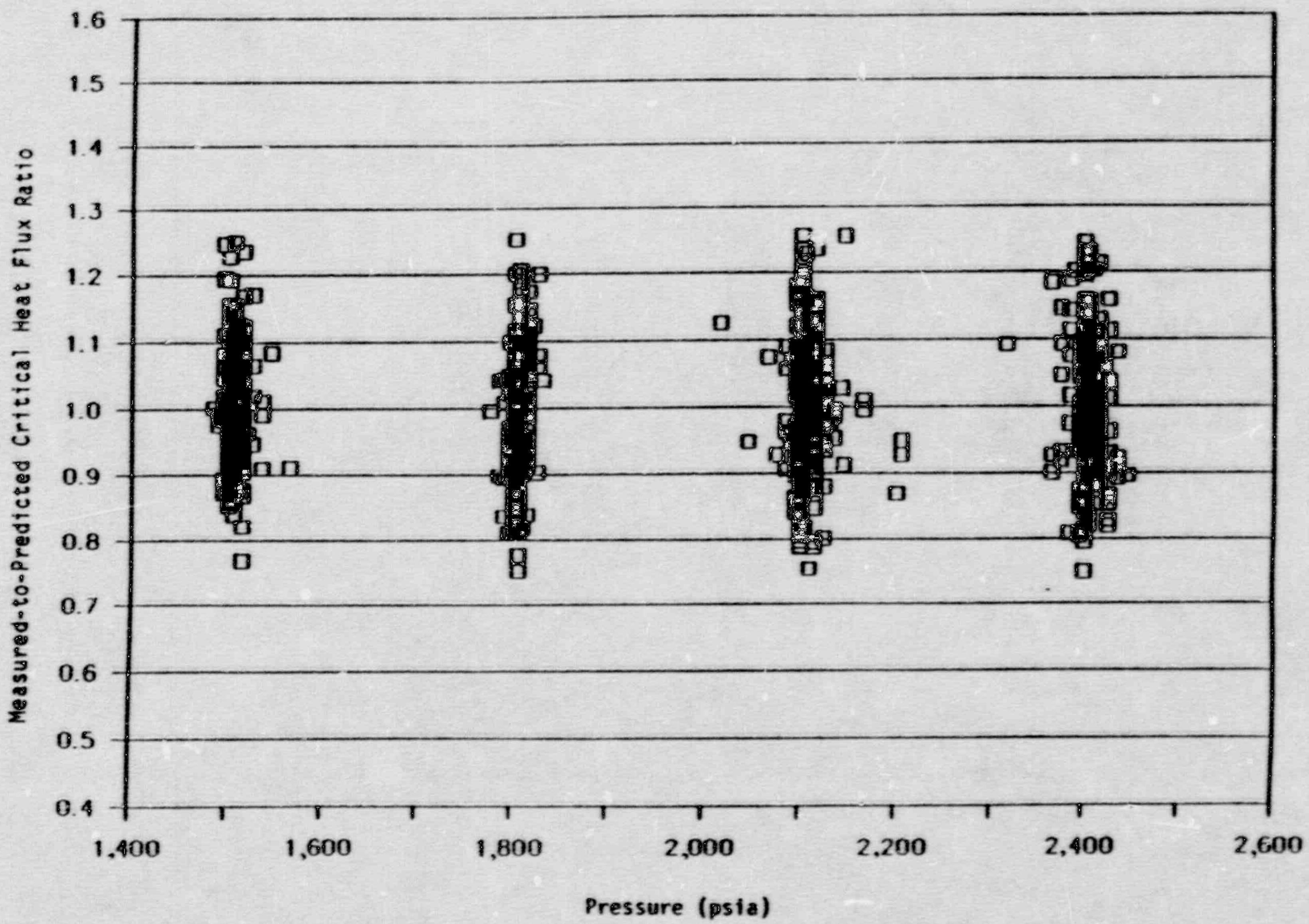


Figure 4-4. Measured-to-Predicted Critical Heat Flux vs Pressure



Rev. 1

Figure 4-5. Measured-to-Predicted Critical Heat Flux vs Heated Length

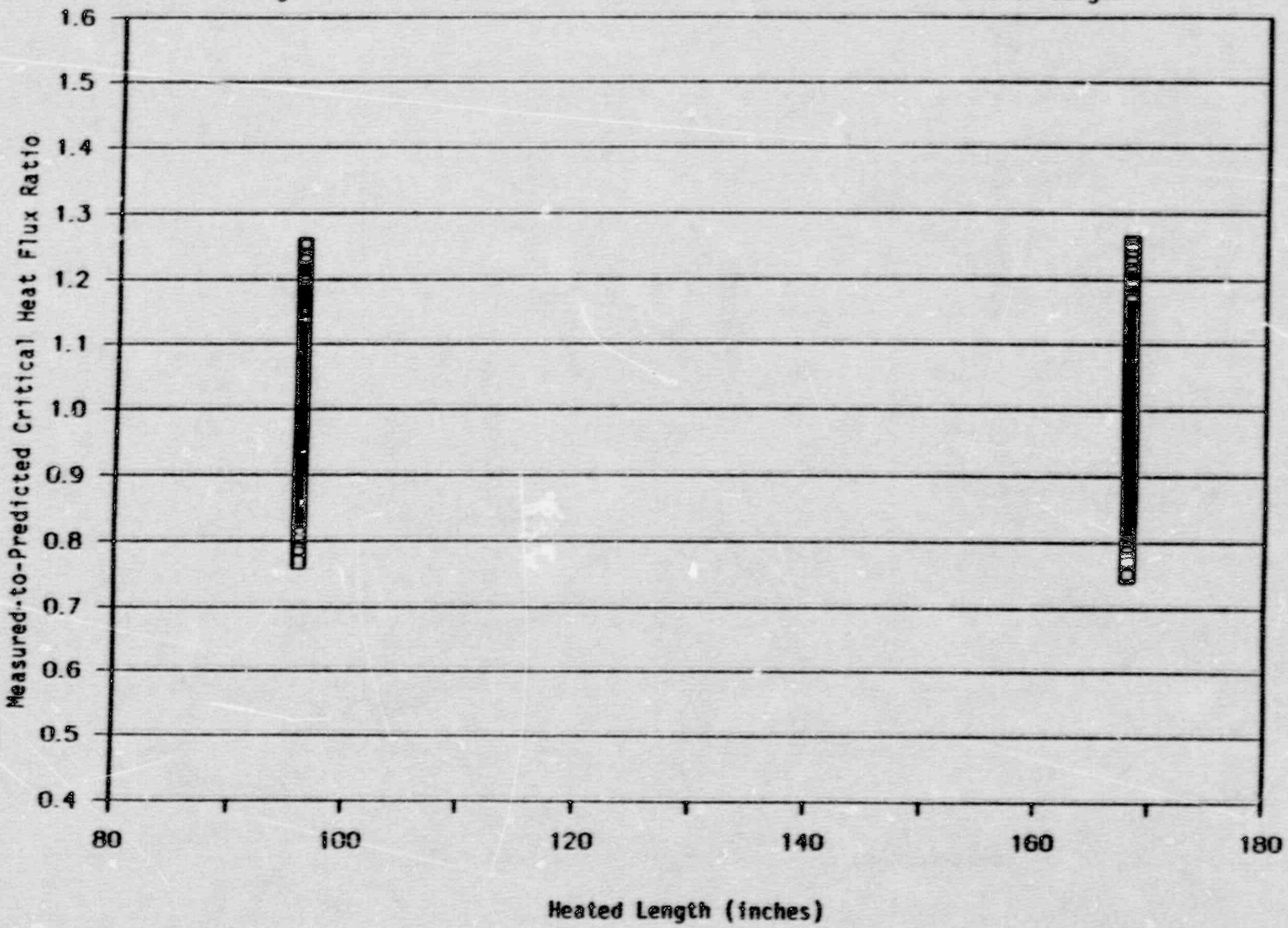


Figure 4-6. Measure-to-Predicted Critical Heat Flux vs Grid Spacing

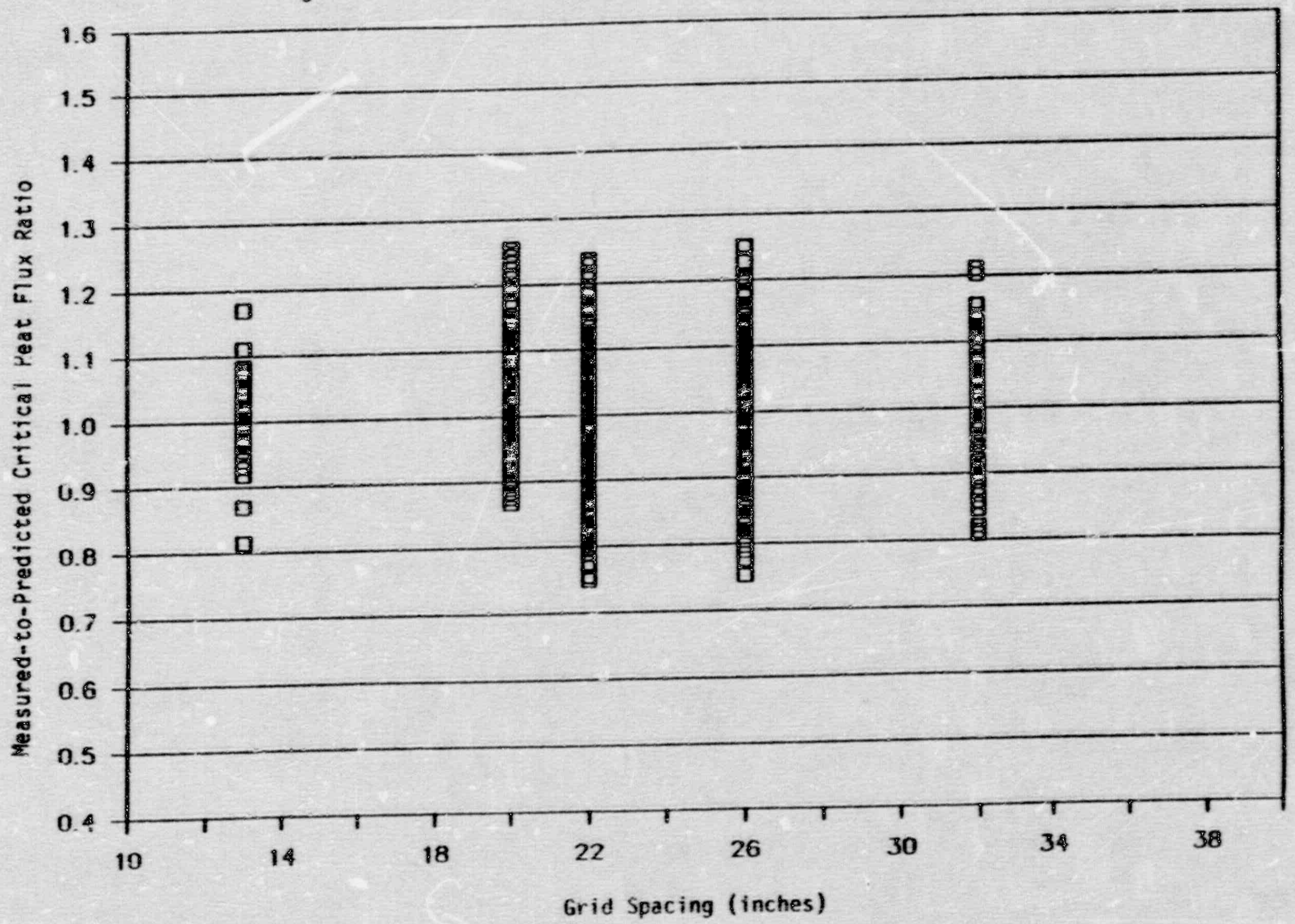


Figure 4-7. Measured-to-Predicted Critical Heat Flux vs Hydraulic Diameter

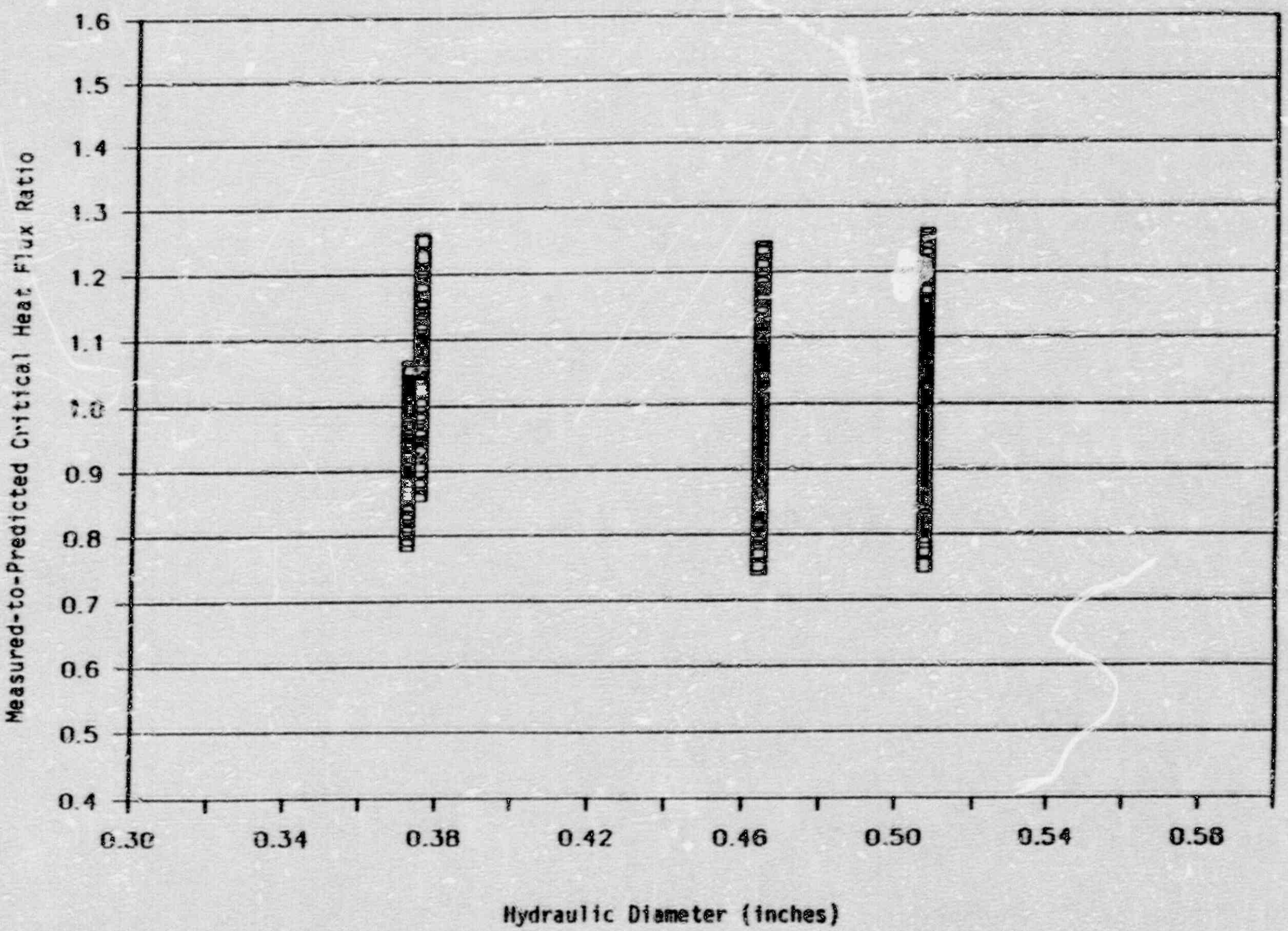
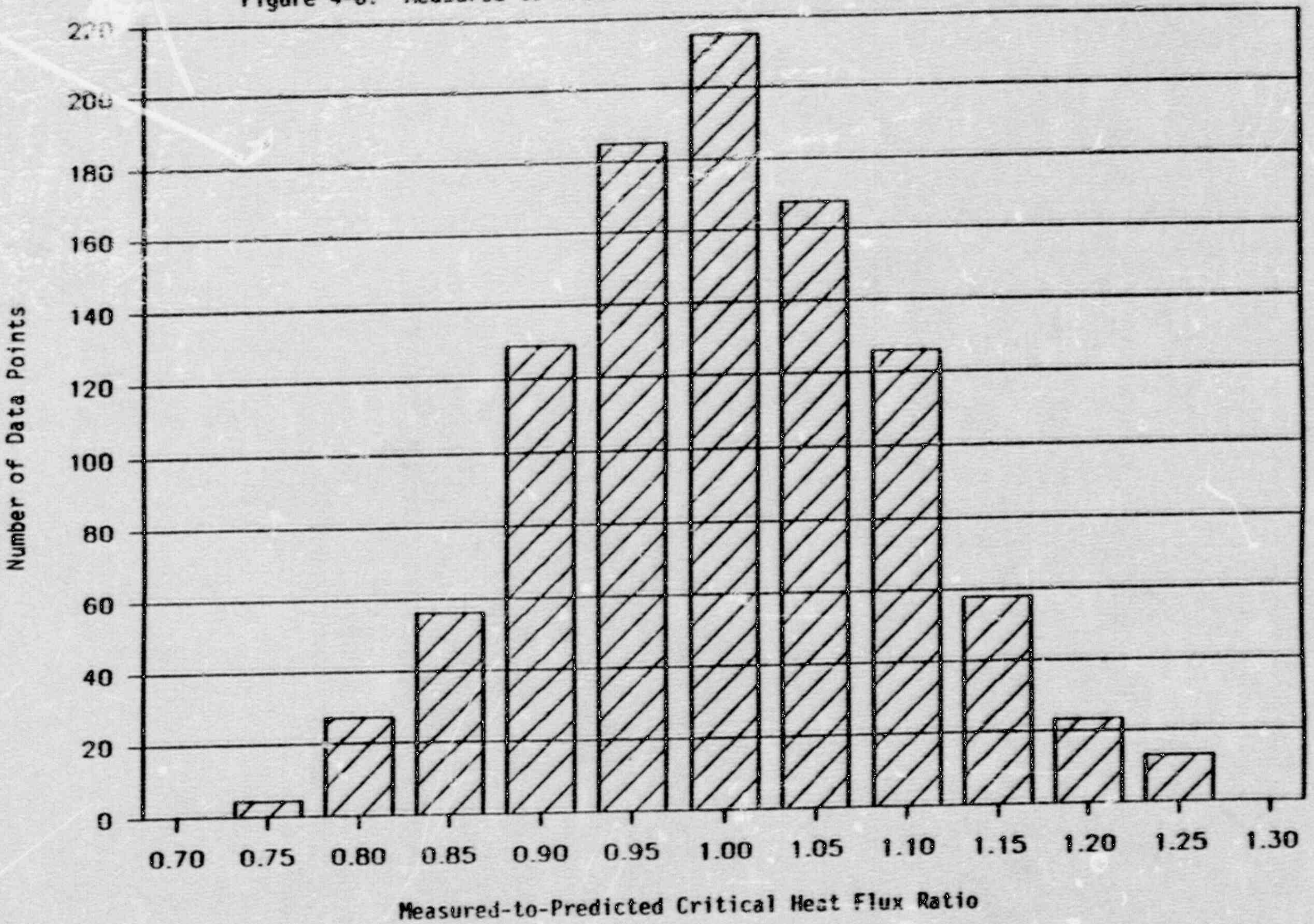


Figure 4-8. Measured-to-Predicted Critical Heat Flux vs Frequency Distribution



5. DESIGN CRITERION

In reactor core design analysis the design heat flux should be within the nucleate boiling region and sufficiently below the CHF to avoid fuel burnout. A Departure from Nucleate Boiling Ratio (DNBR), defined as the ratio of the calculated CHF at a given location to the actual heat flux at that location, is usually used in design. The chosen design criterion for the present analysis is that CHF will not occur with a 95 percent probability with a 95 percent confidence level. In order to meet this criterion, a design Limiting value for Departure from Nucleate Boiling Ratio (MDNBR) is determined by the method of Owen [7]. The MDNBR is the minimum DNBR that can be calculated (for any given core condition) on the limiting pins in the reactor while still maintaining a 95 percent confidence that 95 percent of these limiting pins are not in film boiling.

Using one-sided tolerance theory from Owen [7], we can write the following expression for MDNBR,

$$MDNBR = 1.0/(\bar{R} - K_{\gamma,p}\sigma)$$

where

$\bar{R}$ = Average measured-to-predicted CHF ratio for the correlation data base

σ = Standard deviation of the measured-to-predicted CHF ratios of the data base

$K_{\gamma,P}$ = One-sided tolerance factor based on number of data points (n), confidence level (γ) and portion of the population protected (P). (Reference 7 provides tables which give values for $K_{\gamma,P}$)

For the present correlation, $\bar{R}$ = 1.000, σ = 0.0942, and $K_{0.95,0.95}$ = 1.727.

Therefore, MDNBR = 1.194.

Based on this result a reactor core designed using the DCHF-1 correlation could operate with a minimum DNBR of 1.194 and satisfy the design criterion.

6. APPLICATION

The DCHF-1 correlation is limited to fuel assemblies with mixing spacer grids. Specific applicability of the correlation includes Westinghouse 15x15 fuel assemblies (both L-grid and R-grid), Westinghouse 17x17 fuel assemblies (both standard, or 0.374 inch diameter, and OFA, or 0.360 inch diameter fuel assemblies) and the Babcock and Wilcox Mark BW mixing vane grid fuel assemblies.*

The parameter ranges over which the DCHF-1 correlation is applicable are:

Pressure	1485	to	2445 psia
Local mass velocity	0.85	to	3.63 $Mlbm/hr\text{-}ft^2$
Local quality	-0.15	to	0.36
Heated length	96	to	168 inches
Axial spacing between spacing grids	13	to	32 inches
Equivalent hydraulic diameter	0.37	to	0.51 inches

Rev. 1

Since the development of the correlation was based on local conditions determined by the VIPRE-01 thermal hydraulic computer code, the use of the DCHF-1 correlation is limited to the VIPRE-01 code [2].

*Appendix C justifies the application of the DCHF-1 correlation to the B&W Mark BW fuel assemblies. This appendix contains data which is proprietary to Babcock & Wilcox Company.

7. REFERENCES

1. C. F. Fighetti and D. G. Reddy, "Parametric Study of CHF Data," EPRI-NP-2609, September 1982 (three volumes).

2. J. M. Cuta, et. al., "VIPRE-01: A Thermal-Hydraulic Code for Reactor Cores," EPRI-NP-2511-CCM, July 1985 (five volumes).

3. L. S. Tong, "Boiling Crisis and Critical Heat Flux," TID-25887, U.S. AEC, 1972.

4. F. E. Motley, et. al, "New Westinghouse Correlation WRB-1 for predicting Critical Heat Flux in Rod Bundles with Mixing Vane Grids," WCAP-8763-A, Westinghouse Electric Corporation, July 1984. (Nonproprietary)

Rev.1 | 5. D. G. Reddy, S. R. Sreepada, and A. N. Nahavandi, "Two-Phase Friction Multiplier Correlation for High-Pressure Steam-Water Flow," EPRI-NP-2522, July 1982.

6. R. I. Jennrich and P. F. Sampson, "Application of Step-Wise Regression to Nonlinear Estimation," Technometrics, Vol. 10, No. 1, Feb. 1968.

7. O. B. Owens, "Factors for One-Sided Tolerance Limits," Sandia Corporation Monograph, 1963.

APPENDIX A

SYSTEM THERMAL CONDITIONS FOR THE DCHF-1 DATA BASE

Table A-1. System Conditions - Test Section W108

Test Serial No.	Test ID No.	System Pressure (psia)	Inlet Temperature (°F)	Average Mass Velocity (Mlbm/hr-ft^2)	Average Heat Flux (MBtu/hr-ft^2)	Axial CHF Location (inches)
1	8	1515.0	520.0	2.500	.568	70.00
2	9	1515.0	499.0	2.500	.624	70.00
3	10	2165.0	584.0	2.587	.510	70.00
4	11	2115.0	567.0	2.540	.557	70.00
5	12	2415.0	577.0	2.535	.550	70.00
6	13	2415.0	559.0	2.064	.517	70.00
7	14	1515.0	560.0	3.429	.512	70.00
8	15	1815.0	579.0	3.552	.545	70.00
9	16	1825.0	500.0	1.907	.563	70.00
10	17	1515.0	545.0	3.604	.579	70.00
11	18	1515.0	482.0	2.480	.664	70.00
12	19	1545.0	466.0	1.970	.610	70.00
13	53	1515.0	558.0	3.571	.508	70.00
14	54	1815.0	560.0	3.612	.605	70.00
15	55	1795.0	481.5	2.029	.597	70.00
16	56	2115.0	502.5	2.021	.571	70.00
17	57	2115.0	517.5	2.035	.550	70.00
18	58	2115.0	541.5	2.026	.507	70.00
19	59	2115.0	545.0	2.526	.584	70.00
20	60	2090.0	567.5	3.057	.608	70.00
21	61	2125.0	581.0	3.068	.546	70.00
22	62	2095.0	601.5	3.040	.482	70.00
23	63	2115.0	566.0	3.574	.689	76.00
24	64	2115.0	594.0	3.456	.548	70.00
25	65	2095.0	577.5	3.568	.618	70.00
26	66	2405.0	580.0	3.091	.597	76.00
27	67	2410.0	602.0	3.069	.521	76.00
28	68	2415.0	623.0	3.047	.470	70.00
29	69	2415.0	627.0	3.557	.502	70.00

Table A-2. System Conditions - Test Section W114

Test Serial No.	Test ID No.	System Pressure (psia)	Inlet Temperature (°F)	Average Mass Velocity (Mlbm/hr-ft^2)	Average Heat Flux (MBtu/hr-ft^2)	Axial CHF Location (inches)
1	217	1500.0	517.1	2.545	.583	74.00
2	218	1505.0	496.9	2.558	.643	74.00
3	219	1505.0	481.3	2.544	.690	81.00
4	220	1515.0	559.9	3.592	.550	58.00
5	221	1515.0	539.5	3.587	.644	58.00
6	222	1805.0	580.8	3.540	.545	58.00
7	223	1805.0	560.3	3.674	.675	58.00
8	224	2095.0	583.1	2.558	.539	74.00
9	225	2100.0	565.5	2.550	.586	58.00
10	226	2115.0	546.3	2.570	.635	74.00
11	227	2115.0	599.0	3.095	.539	58.00
12	228	2125.0	583.7	3.055	.606	58.00
13	229	2135.0	559.6	3.101	.684	74.00
14	230	2115.0	600.3	3.572	.571	58.00
15	231	2135.0	585.3	3.582	.674	74.00
16	232	2125.0	566.4	3.563	.737	74.00
17	233	2435.0	626.4	3.537	.577	74.00
18	234	2435.0	602.6	3.609	.672	74.00
19	235	2425.0	583.7	3.587	.736	74.00
20	236	2445.0	624.5	3.026	.531	74.00
21	237	2435.0	602.3	3.063	.601	74.00
22	238	2425.0	580.4	3.086	.673	74.00
23	239	2425.0	579.5	2.574	.587	74.00
24	240	2425.0	553.8	2.564	.654	74.00
25	241	2400.0	537.2	2.560	.684	74.00
26	242	2425.0	558.7	2.089	.551	74.00
27	243	2405.0	541.1	2.058	.585	74.00
28	244	2425.0	514.8	2.067	.641	74.00
29	245	2125.0	537.8	2.035	.582	74.00
30	246	2115.0	515.7	2.064	.623	74.00
31	247	2115.0	500.2	2.051	.655	74.00
32	248	1805.0	500.2	2.108	.605	81.00
33	249	1825.0	478.1	2.018	.641	81.00

Table A-3. System Conditions - Test Section W121

Test Serial No.	Test ID No.	System Pressure (psia)	Inlet Temperature (°F)	Average Mass Velocity ($Mlbm/hr-ft^2$)	Average Heat Flux ($MBtu/hr-ft^2$)	Axial CHF Location (inches)
1	394	1535.0	560.6	3.589	.611	64.00
2	395	1505.0	539.5	3.648	.679	64.00
3	396	1795.0	585.0	3.643	.590	64.00
4	397	1775.0	559.3	3.584	.694	64.00
5	398	2085.0	603.9	3.511	.606	64.00
6	399	2065.0	578.2	3.578	.735	64.00
7	400	2115.0	568.1	3.577	.813	64.00
8	401	2115.0	607.2	3.037	.557	64.00
9	402	2115.0	580.4	3.090	.648	64.00
10	403	2115.0	562.2	3.116	.757	64.00
11	404	2400.0	624.8	3.583	.609	64.00
12	405	2405.0	605.2	3.631	.716	64.00
13	406	2405.0	582.1	3.615	.822	64.00
14	407	2415.0	628.7	3.045	.547	64.00
15	408	2395.0	606.8	3.091	.633	64.00
16	409	2385.0	584.4	3.077	.731	64.00
17	410	2415.0	587.6	2.552	.627	64.00
18	411	2405.0	562.9	2.579	.717	64.00
19	412	2415.0	537.2	2.607	.797	64.00
20	413	2095.0	582.7	2.590	.570	64.00
21	414	2125.0	560.9	2.576	.653	64.00
22	415	2105.0	542.1	2.594	.721	64.00
23	416	1495.0	521.3	2.617	.653	64.00
24	417	1505.0	503.1	2.590	.701	64.00
25	418	1505.0	480.0	2.620	.769	64.00
26	419	2405.0	559.3	2.083	.610	64.00
27	420	2405.0	543.7	2.114	.652	64.00
28	421	2405.0	530.7	2.045	.693	64.00
29	422	2100.0	540.1	2.077	.615	64.00
30	423	2115.0	524.2	2.049	.667	64.00
31	424	2095.0	500.8	2.075	.728	64.00
32	425	1805.0	503.1	2.141	.687	64.00
33	426	1815.0	482.3	2.057	.724	64.00
34	427	1505.0	479.7	1.527	.552	64.00
35	428	1515.0	462.5	1.553	.604	64.00
36	429	1515.0	440.5	1.526	.658	64.00
39	432	2015.0	301.7	0.962	.659	64.00

Table A-4. System Conditions - Test Section W122

Test Serial No.	Test ID No.	System Pressure (psia)	Inlet Temperature (°F)	Average Mass Velocity (Mlbm/hr-ft^2)	Average Heat Flux (MBtu/hr-ft^2)	Axial CHF Location (inches)
1	434	1525.0	557.7	3.639	.601	64.00
2	435	1515.0	535.9	3.633	.690	64.00
3	436	1815.0	584.4	3.586	.588	64.00
4	437	1815.0	560.9	3.673	.693	64.00
5	438	2115.0	602.0	3.624	.600	64.00
6	439	2105.0	582.1	3.685	.693	64.00
7	440	2115.0	561.2	3.637	.779	64.00
8	441	2130.0	602.3	3.111	.558	64.00
9	442	2115.0	582.1	3.163	.643	64.00
10	443	2115.0	561.6	3.148	.707	64.00
11	444	2395.0	627.4	3.614	.578	64.00
12	445	2425.0	605.2	3.662	.699	64.00
13	446	2375.0	578.5	3.667	.783	78.00
14	447	2415.0	623.8	2.978	.519	64.00
15	448	2010.0	601.3	2.982	.595	64.00
16	449	2395.0	582.1	2.985	.662	78.00
17	450	2375.0	583.1	2.502	.572	64.00
1	451	2415.0	565.2	2.515	.638	74.00
2	452	2115.0	587.9	2.489	.527	64.00
3	453	2115.0	570.7	2.532	.591	74.00
4	454	2115.0	550.8	2.491	.651	74.00
5	455	1515.0	519.3	2.535	.616	64.00
6	456	1515.0	492.1	2.546	.705	64.00
7	457	1515.0	478.4	2.525	.746	64.00
8	458	2125.0	536.0	2.034	.582	74.00
9	459	2125.0	522.2	1.996	.622	74.00
10	460	2095.0	500.2	2.056	.681	74.00
11	461	1815.0	500.5	1.998	.626	74.00
12	462	1815.0	479.7	2.031	.689	74.00

Table A-5. System Conditions - Test Section W124

Test Serial No.	Test ID No.	System Pressure (psia)	Inlet Temperature (°F)	Average Mass Velocity ($Mlbm/hr-ft^2$)	Average Heat Flux ($MBtu/hr-ft^2$)	Axial CHF Location (inches)
1	475	1565.0	565.2	3.493	.597	64.00
2	476	1515.0	537.8	3.516	.688	64.00
3	477	1790.0	572.5	3.712	.621	64.00
4	478	1790.0	559.9	3.764	.731	64.00
6	480	2115.0	580.8	3.723	.770	64.00
7	481	2115.0	599.2	3.149	.607	64.00
8	482	2115.0	580.1	3.180	.699	64.00
9	483	2115.0	565.2	3.148	.757	64.00
10	484	2415.0	623.1	3.643	.641	64.00
11	485	2415.0	601.3	3.654	.755	64.00
12	486	2415.0	619.9	3.015	.578	64.00
13	487	2415.0	598.4	2.983	.646	74.00
14	488	2415.0	584.7	2.910	.688	74.00
15	489	2415.0	577.5	2.501	.640	64.00
16	490	2415.0	562.2	2.483	.684	74.00
17	491	2415.0	547.6	2.472	.719	74.00
18	492	2115.0	585.7	2.438	.571	64.00
19	493	2165.0	574.6	2.454	.602	74.00
20	494	2115.0	543.1	2.508	.712	74.00
21	495	2115.0	525.5	2.479	.745	74.00
22	496	1515.0	516.7	2.491	.663	64.00
23	497	1515.0	502.4	2.511	.719	64.00
24	498	1515.0	481.3	2.505	.763	84.00
25	499	2415.0	561.9	1.997	.586	74.00
26	500	2415.0	539.2	1.991	.646	64.00
27	501	2415.0	516.1	2.022	.697	74.00
28	502	2115.0	544.3	2.004	.594	64.00
29	503	2115.0	526.8	1.996	.646	74.00
30	504	2115.0	494.0	1.980	.719	64.00
31	505	1815.0	496.3	2.025	.660	84.00
32	506	1815.0	488.2	1.947	.676	84.00
33	507	1515.0	475.2	1.536	.574	64.00
34	508	1515.0	455.7	1.488	.588	84.00
35	509	1515.0	440.8	1.491	.616	84.00

Table A-6. System Conditions - Test Section W125

Test Serial No.	Test ID No.	System Pressure (psia)	Inlet Temperature (°F)	Average Mass Velocity (Mlbm/hr-ft^2)	Average Heat Flux (MBtu/hr-ft^2)	Axial CHF Location (inches)
1	510	1515.0	554.7	3.537	.510	87.00
2	511	1515.0	541.7	3.511	.587	87.00
3	512	1815.0	579.8	3.470	.542	70.00
4	513	1815.0	558.0	3.568	.614	70.00
5	514	2115.0	600.0	3.541	.533	70.00
6	515	2115.0	584.4	3.499	.622	70.00
7	516	2115.0	571.7	3.482	.658	87.00
8	517	2145.0	605.9	2.954	.463	70.00
9	518	2115.0	576.5	3.043	.573	70.00
10	519	2115.0	560.9	3.019	.612	87.00
11	520	2415.0	619.9	3.537	.530	87.00
12	521	2415.0	599.7	3.536	.610	87.00
13	522	2415.0	583.1	3.520	.665	87.00
14	523	2415.0	620.5	3.053	.466	87.00
15	524	2415.0	594.1	3.052	.568	87.00
16	525	2415.0	582.1	3.004	.606	87.00
17	526	2390.0	579.8	2.517	.515	70.00
18	527	2375.0	560.6	2.522	.547	76.00
19	528	2395.0	539.2	2.521	.600	76.00
20	529	2135.0	581.1	2.515	.500	70.00
21	530	2100.0	561.9	2.514	.542	76.00
22	531	2100.0	544.3	2.506	.577	76.00
23	532	1535.0	518.7	2.528	.555	87.00
24	533	1525.0	498.5	2.507	.595	87.00
25	534	1525.0	483.9	2.482	.634	76.00
26	535	2400.0	556.4	1.994	.475	76.00
27	536	2395.0	544.7	2.037	.537	76.00
28	537	2415.0	523.2	2.040	.584	76.00
29	538	2115.0	544.0	1.997	.508	70.00
30	539	2100.0	519.3	2.025	.560	76.00
31	540	2095.0	505.0	1.994	.581	80.00
32	541	1825.0	503.1	1.987	.560	70.00
33	542	1815.0	484.3	2.016	.608	70.00

Table A-7. System Conditions - Test Section W127

Test Serial No.	Test ID No.	System Pressure (psia)	Inlet Temperature (°F)	Average Mass Velocity (Mlbm/hr-ft²)	Average Heat Flux (MBtu/hr-ft²)	Axial CHF Location (inches)
1	550	1515.0	558.0	3.548	.508	70.00
2	551	1515.0	532.3	3.543	.590	90.00
3	552	1815.0	572.6	3.549	.528	70.00
4	553	1815.0	558.0	3.530	.589	70.00
5	554	2115.0	600.7	3.526	.512	70.00
6	555	2115.0	587.6	3.489	.569	70.00
7	556	2115.0	562.6	3.533	.640	70.00
8	557	2115.0	594.8	3.046	.484	70.00
9	558	2115.0	581.4	3.021	.524	70.00
10	559	2115.0	563.8	3.017	.576	70.00
11	560	2415.0	624.5	3.518	.499	76.00
12	561	2415.0	604.9	3.521	.551	76.00
13	562	2415.0	585.7	3.506	.605	76.00
14	563	2415.0	616.3	3.050	.451	76.00
15	564	2415.0	605.2	3.006	.497	76.00
16	565	2415.0	582.4	3.034	.544	76.00
17	566	2365.0	583.1	2.502	.479	76.00
18	567	2365.0	564.5	2.484	.523	76.00
19	568	2415.0	546.3	2.493	.569	70.00
20	569	2115.0	584.4	2.503	.445	70.00
21	570	2045.0	563.2	2.511	.491	70.00
22	571	2115.0	547.6	2.493	.543	70.00
23	572	1535.0	520.3	2.486	.540	70.00
24	573	1515.0	510.5	2.459	.575	70.00
25	574	1515.0	487.5	2.506	.620	70.00
26	575	1815.0	503.4	1.978	.541	76.00
27	576	1815.0	485.2	1.976	.577	76.00
28	577	2115.0	543.7	2.015	.487	70.00
29	578	2115.0	521.3	1.983	.520	70.00
30	579	1815.0	503.1	1.979	.544	70.00
31	580	2115.0	499.8	2.006	.555	70.00
32	581	2415.0	564.2	2.001	.462	70.00
33	582	2415.0	545.7	1.997	.493	76.00
34	583	2415.0	521.6	1.998	.541	70.00
35	584	1515.0	475.8	1.747	.493	70.00
36	585	1515.0	464.5	1.467	.524	70.00
37	586	1515.0	444.0	1.480	.564	70.00

Table A-8. System Conditions - Test Section W131

Test Serial No.	Test ID No.	System Pressure (psia)	Inlet Temperature (°F)	Average Mass Velocity (Mlbm/hr-ft²)	Average Heat Flux (MBtu/hr-ft²)	Axial CHF Location (inches)	
1	617	1505.0	559.6	3.427	.423	122.00	
2	618	2095.0	603.9	3.448	.402	122.00	
3	619	2395.0	604.2	3.450	.455	122.00	
4	620	2395.0	601.3	3.007	.423	148.00	
5	621	2115.0	592.2	3.005	.359	122.00	
6	622	2125.0	567.4	2.949	.443	148.00	
7	623	2125.0	566.1	2.422	.387	122.00	
8	624	2395.0	563.2	2.442	.429	148.00	
9	625	2405.0	575.6	3.413	.543	148.00	
10	626	2375.0	569.4	2.941	.479	148.00	
11	627	2405.0	541.1	2.933	.546	148.00	
12	628	2415.0	532.0	2.463	.478	148.00	
13	629	2415.0	502.4	2.470	.538	148.00	
14	630	2415.0	561.9	1.960	.360	122.00	
15	631	2405.0	525.2	1.952	.407	122.00	
16	632	2100.0	561.2	1.969	.327	122.00	
17	633	2095.0	524.8	1.949	.382	122.00	
18	634	2405.0	492.1	1.964	.461	122.00	Rev.1
19	635	2115.0	474.5	1.997	.467	122.00	
20	636	2125.0	487.2	2.468	.520	122.00	
21	637	2095.0	503.4	2.495	.463	122.00	
22	638	2115.0	556.4	3.448	.522	148.00	
23	639	2085.0	528.7	2.972	.517	122.00	
24	640	1815.0	555.4	3.486	.458	122.00	
25	641	1795.0	532.7	3.463	.520	148.00	
26	642	1800.0	520.6	3.494	.536	148.00	
27	643	1515.0	515.1	3.528	.519	122.00	
28	644	1490.0	483.6	2.467	.456	122.00	
29	645	1490.0	449.2	2.483	.501	122.00	
30	646	1515.0	441.4	1.996	.447	122.00	
31	647	1805.0	561.9	1.942	.284	122.00	
32	648	1500.0	520.9	2.513	.426	122.00	
33	649	1505.0	527.1	1.937	.359	148.00	
34	650	1502.0	479.1	2.004	.409	122.00	
35	651	1805.0	514.1	1.952	.352	122.00	
36	652	1785.0	479.7	2.001	.408	122.00	
37	653	2105.0	605.2	3.464	.412	122.00	

Table A-9. System Conditions - Test Section W132

Test Serial No.	Test ID No.	System Pressure (psia)	Inlet Temperature (°F)	Average Mass Velocity (Mlbm/hr-ft²)	Average Heat Flux (MBtu/hr-ft²)	Axial CHF Location (inches)
1	654	1515.0	563.2	3.421	.475	152.00
2	655	2095.0	607.2	3.439	.427	142.00
3	656	2405.0	605.5	2.950	.428	142.00
4	657	2205.0	601.3	2.978	.390	142.00
5	658	2105.0	567.7	2.942	.461	142.00
6	659	1805.0	563.8	3.442	.470	142.00
7	660	2375.0	606.5	3.418	.476	142.00
8	661	2400.0	594.5	3.349	.514	142.00
9	662	2400.0	576.5	3.395	.561	142.00
10	663	2115.0	560.3	3.456	.566	142.00
11	664	2400.0	545.0	2.930	.575	142.00
12	665	2115.0	523.6	2.969	.580	142.00
14	667	1800.0	529.7	3.464	.573	142.00
15	668	2100.0	484.6	2.470	.576	142.00
16	669	2385.0	502.4	2.493	.572	142.00
17	670	2390.0	573.6	2.918	.508	142.00
18	671	2385.0	563.2	2.438	.457	142.00
19	672	2400.0	538.5	2.453	.510	142.00
20	673	2400.0	560.3	1.947	.358	142.00
21	674	2400.0	518.7	1.962	.461	142.00
22	675	2405.0	482.0	1.937	.497	142.00
23	676	2095.0	482.6	1.951	.480	142.00
24	677	2105.0	563.8	2.415	.413	142.00
25	678	2105.0	527.4	2.469	.492	142.00
26	679	2105.0	520.3	1.946	.410	142.00
27	680	2105.0	568.1	1.918	.329	142.00
28	681	1800.0	525.2	1.932	.367	142.00
29	682	1800.0	562.9	1.941	.331	142.00
30	683	1500.0	525.8	1.925	.403	152.00
31	684	1495.0	522.2	2.511	.476	122.00
32	685	1800.0	486.2	1.984	.423	142.00
33	686	1500.0	488.2	2.444	.501	142.00
34	687	1500.0	484.3	1.961	.444	142.00
35	688	1500.0	442.1	2.010	.486	142.00
36	689	1500.0	464.1	2.452	.512	142.00

Table A-10 System Conditions - Test Section W133

Test Serial No.	Test ID No.	System Pressure (psia)	Inlet Temperature (°F)	Average Mass Velocity (Mlbm/hr-ft²)	Average Heat Flux (MBtu/hr-ft²)	Axial CHF Location (inches)
1	690	1500.0	560.5	3.425	.501	122.00
2	691	2100.0	607.0	2.955	.402	148.00
3	692	2100.0	606.0	3.407	.459	136.00
4	693	2400.0	609.0	2.960	.445	136.00
5	694	2105.0	569.0	2.971	.491	136.00
6	695	2405.0	568.0	1.959	.387	136.00
7	696	2405.0	509.0	1.997	.463	142.00
8	697	2105.0	478.0	1.961	.494	136.00
9	698	2115.0	560.0	2.434	.449	148.00
10	699	2105.0	519.0	1.961	.437	148.00
11	700	2110.0	563.0	1.938	.370	148.00
12	701	2400.0	560.0	2.477	.471	142.00
14	703	1805.0	566.0	1.967	.337	136.00
15	704	1500.0	523.0	1.917	.399	136.00
16	705	1500.0	527.5	2.518	.470	136.00
17	706	1795.0	487.0	1.969	.458	148.00
18	707	1505.0	485.0	1.988	.454	136.00
19	708	1500.0	447.0	2.008	.510	136.00
20	709	1830.0	536.0	3.445	.566	148.00
21	710	1815.0	569.0	3.412	.497	148.00
22	711	2400.0	609.0	3.404	.488	148.00
23	712	2400.0	586.0	3.392	.532	136.00
24	713	2400.0	576.0	3.408	.551	136.00
25	714	2115.0	570.0	3.455	.540	136.00
26	715	2415.0	550.0	2.935	.548	136.00
27	716	2100.0	534.0	2.949	.558	136.00
28	717	1525.0	537.0	3.446	.563	136.00
29	718	2400.0	504.0	2.507	.562	136.00
30	719	2405.0	573.0	2.947	.509	136.00
31	720	2400.0	541.0	2.468	.497	136.00
32	721	2100.0	527.0	2.499	.515	136.00
33	722	2100.0	493.0	2.463	.561	136.00
34	723	2405.0	477.0	1.992	.505	142.00
35	724	1495.0	486.0	2.468	.533	136.00
36	725	1505.0	469.0	2.469	.554	136.00
37	726	1500.0	443.0	1.531	.415	148.00
38	727	1505.0	489.0	1.463	.376	148.00

Table A-11. System Conditions - Test Section W134

Test Serial No.	Test ID No.	System Pressure (psia)	Inlet Temperature (°F)	Average Mass Velocity ($Mlbm/hr-ft^2$)	Average Heat Flux ($MBtu/hr-ft^2$)	Axial CHF Location (inches)
1	728	1510.0	561.2	3.393	.399	122.00 Rev
2	729	1800.0	562.9	3.408	.423	152.00
3	730	2095.0	606.8	3.369	.384	152.00
4	731	2125.0	607.2	3.433	.393	152.00
5	732	2405.0	603.3	3.437	.444	152.00
6	733	2385.0	602.6	2.985	.410	152.00
7	734	2115.0	600.0	2.895	.346	152.00
8	735	2100.0	559.9	2.942	.444	152.00
9	736	2405.0	565.8	2.927	.486	152.00
10	737	2400.0	562.2	2.411	.418	152.00
11	738	2100.0	560.9	2.403	.378	152.00
12	739	2405.0	565.2	3.420	.557	152.00
13	740	1490.0	442.7	2.444	.489	152.00
14	741	2385.0	482.6	2.477	.530	152.00
15	742	2100.0	481.0	2.443	.506	152.00
16	743	1500.0	483.6	3.538	.567	152.00
17	744	1500.0	516.7	3.502	.496	152.00
18	745	1800.0	519.7	3.494	.518	152.00
19	746	2405.0	521.9	2.930	.542	152.00
20	747	2405.0	525.8	2.949	.507	152.00
21	748	2405.0	522.6	2.430	.470	152.00
22	749	2105.0	563.2	3.249	.465	152.00
23	750	2085.0	559.3	1.932	.318	152.00
24	751	2385.0	557.7	1.952	.327	152.00
25	752	2410.0	513.8	1.934	.401	152.00
26	753	2105.0	514.1	1.936	.378	152.00
27	754	2105.0	517.7	2.452	.447	152.00
28	755	2090.0	475.5	1.965	.428	152.00
29	756	2425.0	478.1	1.949	.443	152.00
30	757	1485.0	514.1	2.411	.399	152.00
31	758	1505.0	481.0	2.450	.452	152.00
32	759	1505.0	520.0	1.934	.340	152.00
33	760	1800.0	522.2	1.937	.335	152.00
34	761	1800.0	481.0	1.977	.393	152.00
35	762	1500.0	480.0	1.930	.377	152.00
36	763	1500.0	440.0	1.938	.421	136.00 Re
37	764	1800.0	561.9	1.890	.281	152.00
38	765	2105.0	562.6	3.398	.479	152.00

Table A-12. System Conditions - Test Section W138

Test Serial No.	Test ID No.	System Pressure (psia)	Inlet Temperature (°F)	Average Mass Velocity (Mlbm/hr-ft²)	Average Heat Flux (MBtu/hr-ft²)	Axial CHF Location (inches)
1	803	1495.0	434.6	2.004	.431	122.00
2	804	1500.0	445.3	2.473	.482	122.00
3	805	1500.0	483.9	2.173	.397	148.00
4	806	1500.0	483.0	2.481	.437	122.00
5	807	1795.0	482.3	1.995	.401	122.00
6	808	2100.0	481.7	2.015	.444	148.00
7	809	2095.0	488.5	2.474	.501	148.00
8	810	2395.0	482.0	1.965	.452	148.00
9	811	2405.0	502.4	2.435	.513	148.00
10	812	2405.0	519.3	1.946	.401	148.00
11	813	2395.0	521.9	2.456	.484	148.00
12	814	2115.0	518.7	1.964	.385	148.00
13	815	2120.0	521.9	2.479	.445	148.00
14	816	2115.0	525.5	2.941	.498	148.00
15	817	1810.0	516.4	1.974	.343	148.00
16	818	1805.0	520.0	3.465	.505	122.00
17	819	1505.0	521.6	1.922	.325	148.00
18	820	1500.0	520.9	2.511	.378	122.00
19	821	1515.0	516.4	3.498	.471	122.00
20	822	2415.0	536.6	2.893	.527	122.00
21	823	1510.0	557.7	3.435	.410	122.00
22	824	1805.0	559.0	3.494	.433	122.00
23	825	1805.0	553.1	1.991	.295	122.00
24	826	2115.0	557.3	2.006	.329	122.00
25	827	2105.0	558.7	2.451	.379	122.00
26	828	2105.0	561.2	2.939	.426	122.00
27	829	2095.0	562.2	3.441	.482	122.00
28	830	2405.0	563.5	1.954	.349	148.00
29	831	2395.0	558.7	2.434	.422	148.00
30	832	2405.0	563.2	2.932	.485	148.00
31	833	2415.0	576.9	3.359	.512	148.00
32	834	2420.0	601.3	2.980	.413	122.00
33	835	2415.0	605.5	3.406	.453	148.00
34	836	2095.0	599.7	3.006	.349	148.00
35	837	2100.0	594.8	3.424	.412	148.00
36	838	2105.0	556.4	2.476	.394	122.00
37	839	2100.0	520.0	2.522	.457	148.00

Table A-13. System Conditions - Test Section W139

Test Serial No.	Test ID No.	System Pressure (psia)	Inlet Temperature (°F)	Average Mass Velocity (Mlbm/hr-ft²)	Average Heat Flux (MBtu/hr-ft²)	Axial CHF Location (inches)
1	840	1495.0	478.9	1.924	.365	152.00
2	841	1505.0	439.8	2.403	.485	152.00
3	842	1500.0	440.5	1.863	.401	152.00
4	843	1495.0	485.0	2.403	.430	152.00
5	844	1500.0	494.9	3.466	.538	152.00
6	845	1805.0	481.7	1.924	.381	152.00
7	846	2095.0	482.4	1.929	.413	152.00
8	847	2095.0	485.8	2.380	.490	152.00
9	848	2395.0	476.2	1.913	.450	152.00
10	849	2410.0	494.1	2.422	.526	142.00 Rev.
11	850	1509.0	517.5	1.880	.333	152.00
12	851	1495.0	523.6	2.344	.376	152.00
13	852	1505.0	516.7	3.474	.491	148.00
14	853	1805.0	517.4	3.462	.531	152.00
15	854	1605.0	522.9	1.883	.325	152.00
16	855	2075.0	510.9	1.899	.370	152.00
17	856	2095.0	520.9	2.372	.436	152.00
18	857	2105.0	521.9	2.886	.508	152.00
19	858	2405.0	526.3	2.393	.470	152.00
20	859	2395.0	514.1	1.890	.399	152.00
21	860	1800.0	563.0	1.845	.271	152.00
22	861	1815.0	560.9	3.359	.423	152.00
23	862	1505.0	564.2	3.328	.388	148.00
24	863	2100.0	555.4	2.379	.373	152.00
25	864	2100.0	563.1	2.934	.429	152.00
26	865	2105.0	562.1	3.375	.484	152.00
27	866	2100.0	561.4	1.869	.297	152.00
28	867	2400.0	564.4	1.895	.334	152.00
29	868	2405.0	565.9	2.356	.399	152.00
30	869	2405.0	566.3	2.880	.472	152.00
31	870	2405.0	603.9	2.918	.400	152.00
32	871	2405.0	601.1	3.385	.449	136.00 Rev.
33	872	2105.0	605.1	3.375	.390	152.00
34	873	2085.0	602.8	2.844	.330	152.00
35	874	2410.0	563.1	3.372	.550	152.00
36	875	2405.0	525.2	2.885	.550	152.00
37	876	1500.0	482.1	2.382	.429	136.00
38	877	2095.0	525.5	2.361	.425	152.00

Table A-14. System Conditions - Test Section W153

Test Serial No.	Test ID No.	System Pressure (psia)	Inlet Temperature (°F)	Average Mass Velocity (Mlbm/hr-ft²)	Average Heat Flux (MBtu/hr-ft²)	Axial CHF Location (inches)
1	1391	1505.0	565.8	2.990	.416	154.00
2	1392	1800.0	572.6	2.981	.404	154.00
3	1393	1805.0	580.1	2.716	.356	154.00
4	1394	1810.0	575.9	2.989	.381	154.00
5	1395	2100.0	606.5	2.962	.369	154.00
6	1396	2100.0	582.7	2.531	.339	154.00
7	1397	2115.0	552.2	2.493	.429	154.00
8	1398	2100.0	587.6	2.006	.292	154.00
9	1399	2100.0	548.6	1.986	.368	154.00
10	1400	2400.0	607.2	2.960	.428	154.00
12	1402	2400.0	600.7	2.484	.377	154.00
13	1403	2395.0	557.7	2.491	.456	168.00
14	1404	2400.0	549.9	1.976	.395	168.00
15	1405	2105.0	559.3	2.972	.480	154.00
16	1406	1800.0	516.4	2.489	.446	154.00
17	1407	1805.0	525.5	2.968	.494	154.00
18	1408	2405.0	469.7	2.040	.455	168.00
19	1409	2105.0	486.5	1.981	.454	154.00
20	1410	1500.0	493.0	1.996	.416	154.00
21	1411	1500.0	494.3	2.495	.487	154.00
22	1412	2405.0	497.9	1.542	.385	154.00
23	1413	2100.0	486.9	1.530	.367	154.00
24	1414	2400.0	435.6	1.533	.426	168.00
25	1415	2100.0	430.4	1.478	.420	154.00
26	1416	2400.0	384.2	1.507	.451	168.00
27	1417	2100.0	382.6	1.483	.448	168.00
28	1418	1815.0	382.9	1.486	.444	154.00
29	1419	1500.0	373.8	1.501	.448	154.00
30	1420	1795.0	418.1	1.471	.401	154.00
31	1421	1500.0	440.8	1.426	.383	154.00
32	1422	1800.0	460.3	1.447	.354	154.00
33	1423	1495.0	496.9	1.453	.348	154.00
34	1424	2095.0	552.5	1.450	.285	154.00
35	1425	2400.0	546.6	1.473	.318	154.00
36	1426	2415.0	440.1	1.466	.404	168.00
37	1427	2405.0	548.6	2.980	.532	168.00
38	1428	2425.0	494.3	2.465	.554	168.00
39	1429	2405.0	496.6	2.979	.623	168.00
40	1430	2400.0	438.5	1.970	.526	168.00
41	1431	2400.0	448.2	2.458	.595	168.00
42	1432	2410.0	461.5	2.948	.657	168.00
43	1433	2410.0	413.3	1.962	.535	168.00

Table A-15. System Conditions - Test Section W157

Test Serial No.	Test ID No.	System Pressure (psia)	Inlet Temperature (°F)	Average Mass Velocity (Mlbm/hr-ft²)	Average Heat Flux (MBtu/hr-ft²)	Axial CHF Location (inches)
1	1559	2100.0	548.2	1.983	.507	96.00
2	1560	2125.0	545.0	2.500	.575	96.00
3	1561	2115.0	550.5	3.003	.627	96.00
4	1562	2115.0	554.4	3.439	.688	96.00
5	1563	2425.0	539.5	1.998	.523	96.00
6	1564	2400.0	549.2	2.485	.597	96.00
7	1565	2415.0	536.9	3.002	.740	96.00
8	1566	2405.0	563.8	3.443	.730	96.00
9	1567	2400.0	621.8	1.958	.375	82.00
10	1568	2400.0	627.7	2.410	.429	82.00
11	1569	2405.0	617.6	2.916	.515	82.00
12	1570	2415.0	615.7	3.441	.595	96.00
13	1571	2100.0	608.5	2.037	.370	82.00
14	1572	2100.0	606.5	2.464	.426	82.00
15	1573	2105.0	608.8	2.961	.468	82.00
16	1574	2105.0	616.0	3.418	.501	82.00
17	1575	2105.0	463.2	2.031	.662	96.00
18	1576	2115.0	481.0	2.485	.731	96.00
19	1577	2100.0	515.7	2.918	.736	96.00
20	1578	2395.0	468.0	2.020	.692	96.00
21	1579	2400.0	498.9	2.471	.734	96.00
22	1580	2405.0	534.3	2.893	.732	96.00
23	1581	2415.0	531.0	2.503	.636	96.00
24	1582	2405.0	622.2	2.901	.499	96.00
25	1583	2415.0	466.7	1.047	.413	96.00
26	1584	2405.0	465.4	1.550	.568	96.00
27	1585	2105.0	619.6	3.408	.486	96.00
28	1586	2105.0	548.9	3.480	.718	96.00
29	1587	2115.0	544.7	1.033	.328	96.00
30	1588	2105.0	533.3	1.561	.455	96.00
31	1589	2100.0	465.8	1.046	.413	96.00
32	1590	2105.0	467.1	1.512	.555	96.00
33	1591	2405.0	558.3	.974	.307	96.00
34	1592	2405.0	558.3	1.490	.478	96.00
35	1593	1505.0	455.7	2.032	.615	96.00
36	1594	1505.0	458.6	2.482	.696	96.00
37	1595	1815.0	467.7	1.998	.618	96.00
38	1596	1815.0	472.9	2.498	.662	96.00
39	1597	1815.0	517.7	1.988	.523	96.00
40	1598	1800.0	516.7	2.514	.625	96.00
41	1599	1805.0	517.1	2.992	.705	96.00
42	1600	1500.0	513.2	2.015	.546	96.00
43	1601	1515.0	516.7	2.501	.588	96.00
44	1602	1500.0	515.4	2.989	.628	82.00
45	1603	1515.0	514.8	3.492	.697	96.00
46	1604	1505.0	576.2	2.017	.434	82.00

Table A-15. System Conditions - Test Section W157 (Continued)

Test Serial No.	Test ID No.	System Pressure (psia)	Inlet Temperature (°F)	Average Mass Velocity (Mlbm/hr-ft²)	Average Heat Flux (MBtu/hr-ft²)	Axial CHF Location (inches)
47	1605	1505.0	566.8	2.481	.463	82.00
48	1606	1505.0	564.5	3.010	.523	82.00
50	1608	1800.0	539.5	3.446	.702	96.00
51	1609	1520.0	582.7	3.443	.506	82.00
53	1611	1795.0	570.0	1.531	.377	82.00
54	1612	1805.0	549.9	2.073	.471	96.00
55	1613	1805.0	563.8	2.515	.503	96.00
56	1614	1815.0	574.6	2.963	.542	96.00
57	1615	1805.0	561.9	3.514	.608	96.00
58	1616	1805.0	517.1	1.067	.382	96.00
59	1617	1800.0	516.1	1.517	.468	96.00
60	1618	1495.0	495.3	1.036	.416	82.00
61	1619	1505.0	513.0	1.462	.444	82.00
62	1620	1790.0	393.6	1.035	.445	96.00
63	1621	1495.0	453.8	1.989	.617	96.00
64	1622	1805.0	417.5	1.507	.605	96.00
65	1623	1800.0	427.9	1.957	.679	96.00
66	1624	1510.0	387.7	1.051	.518	96.00
67	1625	1505.0	402.9	1.526	.623	96.00
68	1626	1505.0	410.7	1.987	.719	96.00
69	1627	1495.0	575.9	2.468	.439	82.00
70	1628	1805.0	470.6	2.472	.722	96.00
71	1629	1510.0	453.1	1.004	.436	96.00
72	1630	1500.0	457.7	1.538	.551	96.00
73	1631	1805.0	455.7	1.518	.548	96.00
74	1632	1805.0	466.4	1.003	.404	96.00
75	1633	2105.0	396.8	1.057	.498	96.00
76	1634	2425.0	392.3	1.049	.518	96.00
77	1635	2405.0	398.4	1.505	.653	96.00
78	1636	2115.0	400.7	1.498	.635	96.00
79	1637	2110.0	486.9	2.016	.640	96.00

Table A-16. System Conditions - Test Section W158

Test Serial No.	Test ID No.	System Pressure (psia)	Inlet Temperature (°F)	Average Mass Velocity ($Mlbm/hr-ft^2$)	Average Heat Flux ($MBtu/hr-ft^2$)	Axial CHF Location (inches)	
1	1638	2100.0	555.1	2.035	.517	96.00	
2	1639	2105.0	554.7	2.503	.571	96.00	
3	1640	2100.0	556.4	3.007	.647	82.00	
4	1641	2105.0	556.4	3.496	.738	96.00	
5	1642	2395.0	552.2	2.048	.558	96.00	
6	1643	2425.0	547.6	2.524	.643	96.00	
7	1644	2395.0	558.0	2.996	.693	96.00	
8	1645	2435.0	562.9	3.446	.767	82.00	
9	1646	2415.0	610.4	2.033	.424	96.00	Rev.
10	1647	2400.0	611.7	2.498	.444	96.00	
11	1648	2405.0	613.7	2.971	.519	96.00	
12	1649	2410.0	606.5	3.507	.595	82.00	
13	1650	2115.0	618.9	1.973	.344	82.00	
14	1651	2110.0	616.0	2.475	.401	96.00	
15	1652	2105.0	617.3	2.944	.467	96.00	
16	1653	2100.0	617.6	3.466	.484	96.00	
17	1654	2115.0	521.6	2.994	.758	96.00	
18	1655	2400.0	533.0	2.979	.756	96.00	
19	1656	2100.0	483.9	2.022	.667	96.00	
20	1657	2100.0	490.1	2.500	.737	96.00	
21	1658	2400.0	490.4	2.032	.651	96.00	
22	1659	2400.0	490.1	2.518	.764	96.00	
23	1660	2415.0	484.9	1.508	.540	96.00	
24	1661	2400.0	484.9	1.051	.425	96.00	Rev.
25	1662	2095.0	484.3	1.010	.379	96.00	
26	1663	2100.0	433.4	1.010	.435	96.00	
27	1664	2105.0	419.1	1.515	.626	96.00	
28	1665	2100.0	432.4	2.039	.746	96.00	
29	1666	2100.0	484.9	1.523	.547	96.00	
30	1667	2115.0	544.0	1.514	.445	96.00	
31	1668	2395.0	552.2	1.523	.452	82.00	
32	1669	1800.0	572.3	1.504	.352	82.00	
33	1670	1815.0	576.5	2.002	.418	82.00	
34	1671	1800.0	572.6	2.506	.473	82.00	
35	1672	1800.0	572.3	3.010	.536	82.00	
36	1673	2100.0	556.4	2.998	.655	96.00	
37	1674	1825.0	570.0	3.486	.651	82.00	
38	1675	1500.0	563.5	1.558	.380	82.00	
39	1676	1515.0	567.7	2.040	.417	82.00	
40	1677	1500.0	573.3	2.513	.492	82.00	Rev.
41	1678	1515.0	569.4	3.014	.489	82.00	
42	1679	1505.0	573.6	3.469	.510	82.00	
43	1680	1800.0	514.4	1.556	.485	96.00	Rev.
44	1681	1800.0	517.1	1.989	.559	96.00	Rev.
45	1682	1815.0	514.1	2.505	.648	96.00	Rev.

2

IMAGE EVALUATION TEST TARGET (MT-3)

150mm

6″

2

IMAGE EVALUATION TEST TARGET (MT-3)

1.0 1.1 1.25 1.4 1.6 1.8 2.0 2.2 2.5 2.8 3.2 3.6 4.0

150mm

6"

2

IMAGE EVALUATION TEST TARGET (MT-3)

150mm

6"

PHOTOGRAPHIC SCIENCES CORPORATION
770 BASKET ROAD
P.O. BOX 338
WEBSTER, NEW YORK 14580
(716) 265-1600

Table A-16. System Conditions - Test Section W158 (Continued)

Test Serial No.	Test ID No.	System Pressure (psia)	Inlet Temperature (°F)	Average Mass Velocity (Mlbm/hr-ft^2)	Average Heat Flux (MBtu/hr-ft^2)	Axial CHF Location (inches)
46	1683	1815.0	513.2	3.017	.726	96.00
47	1684	1800.0	534.6	3.534	.738	96.00
48	1685	1500.0	510.5	1.513	.471	82.00
49	1686	1505.0	508.9	2.021	.544	82.00
50	1687	1505.0	508.0	2.520	.612	82.00
51	1688	1505.0	512.5	3.011	.682	82.00
52	1689	1510.0	509.6	3.515	.712	82.00
53	1690	1805.0	446.9	1.537	.579	96.00
54	1691	1800.0	454.1	2.023	.703	96.00
55	1692	1805.0	457.7	2.497	.780	96.00
57	1694	1500.0	453.4	2.002	.675	82.00
58	1695	1495.0	461.9	2.505	.737	82.00
60	1697	2405.0	427.2	1.547	.634	96.00
61	1698	1500.0	467.4	1.012	.422	96.00
62	1699	1810.0	453.8	1.023	.412	96.00
63	1700	1795.0	390.3	1.028	.481	96.00
64	1701	1805.9	399.4	1.511	.641	96.00
65	1702	1505.0	374.5	1.029	.519	96.00
66	1703	1505.0	394.5	1.523	.639	96.00
67	1704	1505.0	403.9	2.041	.769	96.00
68	1705	1815.0	397.4	2.009	.724	96.00

Table A-17. System Conditions - Test Section W160

Test Serial No.	Test ID No.	System Pressure (psia)	Inlet Temperature (°F)	Average Mass Velocity (Mlbm/hr-ft^2)	Average Heat Flux (MBtu/hr-ft^2)	Axial CHF Location (inches)
1	1720	1800.0	508.9	1.466	.468	85.00
2	1721	1800.0	512.6	2.011	.554	85.00
3	1722	1800.0	513.5	2.490	.637	85.00
4	1723	1800.0	510.9	2.995	.733	85.00
5	1724	2415.0	537.8	1.422	.456	96.00
6	1725	2400.0	539.8	2.511	.622	96.00
7	1726	2400.0	541.6	2.508	.675	96.00
8	1727	2415.0	542.9	2.984	.772	96.00
9	1728	2115.0	539.8	1.469	.436	96.00
10	1729	2115.0	548.3	2.005	.534	96.00
11	1730	2100.0	550.8	2.498	.603	96.00
12	1731	2105.0	552.2	2.982	.684	96.00
13	1732	2115.0	609.8	1.961	.378	85.00
14	1733	2105.0	482.2	1.495	.558	96.00
15	1734	2100.0	473.5	2.005	.683	96.00
16	1735	2100.0	475.8	2.505	.799	96.00
17	1736	2105.0	483.4	2.978	.899	96.00
18	1737	2415.0	469.3	1.502	.585	96.00
19	1738	2405.0	465.3	2.015	.720	96.00
20	1739	2415.0	470.3	2.526	.837	96.00
21	1740	1815.0	438.9	1.510	.595	96.00
22	1741	1815.0	449.3	2.003	.700	96.00
23	1742	1815.0	452.9	2.496	.808	85.00
24	1743	1815.0	466.5	3.003	.864	96.00
25	1744	1805.0	409.3	1.475	.641	96.00
26	1745	1800.0	424.4	1.971	.725	96.00
27	1746	2095.0	405.2	1.471	.651	96.00
28	1747	2400.0	410.4	1.489	.655	96.00
29	1748	1515.0	443.9	1.458	.563	96.00
30	1749	1515.0	450.3	1.985	.642	85.00
31	1750	1500.0	453.9	2.495	.746	85.00
32	1751	1505.0	453.2	2.991	.840	85.00
33	1752	1505.0	513.3	1.470	.465	85.00
34	1753	1505.0	515.9	1.996	.508	85.00
35	1754	1515.0	508.5	2.485	.615	85.00
36	1755	1525.0	511.9	2.983	.679	85.00
37	1756	1500.0	567.9	2.032	.429	85.00
38	1757	1515.0	567.3	2.530	.443	85.00
39	1758	1500.0	561.8	3.031	.519	85.00
40	1759	2125.0	605.5	2.479	.428	85.00
41	1760	2100.0	604.2	3.020	.492	85.00
42	1761	2415.0	599.9	2.009	.438	85.00
43	1762	2425.0	604.8	2.509	.525	85.00
44	1763	2415.0	604.9	3.011	.584	85.00
45	1764	2405.0	609.4	3.457	.653	96.00
46	1765	2115.0	608.6	3.454	.540	85.00

Table A-17. System Conditions - Test Section W160 (Continued)

Test Serial No.	Test ID No.	System Pressure (psia)	Inlet Temperature (°F)	Average Mass Velocity ($Mlbm/hr-ft^2$)	Average Heat Flux ($MBtu/hr-ft^2$)	Axial CHF Location (inches)
47	1766	1800.0	570.3	1.490	.341	85.00
48	1767	1800.0	567.2	2.002	.431	85.00
49	1768	1815.0	567.2	2.513	.489	85.00
50	1769	1815.0	560.5	3.027	.580	85.00
51	1770	1815.0	568.5	3.509	.609	85.00
52	1771	1515.0	563.2	3.053	.555	85.00
53	1771	2115.0	563.5	3.448	.737	85.00
54	1772	2410.0	547.2	3.504	.856	96.00
55	1773	2400.0	543.3	2.492	.683	96.00
56	1774	1515.0	512.6	3.461	.723	85.00
57	1775	1815.0	510.9	3.489	.830	85.00
58	1776	1515.0	411.5	1.499	.609	85.00
59	1777	1510.0	407.8	1.990	.745	96.00
60	1778	1505.0	385.4	1.025	.529	96.00
61	1779	1800.0	386.0	1.032	.506	96.00
62	1780	2100.0	390.3	1.016	.520	96.00
63	1781	2365.0	397.3	1.005	.508	96.00
64	1782	2415.0	463.4	1.002	.435	96.00
65	1783	2100.0	460.3	.998	.430	96.00
66	1784	1785.0	445.9	1.001	.445	85.00
67	1785	1501.0	443.2	1.086	.464	96.00

Table A-18. System Conditions - Test Section W161

Test Serial No.	Test ID No.	System Pressure (psia)	Inlet Temperature (°F)	Average Mass Velocity (Mlbm/hr-ft^2)	Average Heat Flux (MBtu/hr-ft^2)	Axial CHF Location (inches)
1	1796	2115.0	598.4	1.998	.269	157.00
2	1797	2400.0	600.3	2.019	.283	157.00
3	1798	2400.0	541.9	2.014	.367	157.00
4	1799	2100.0	543.9	1.983	.340	157.00
5	1800	2200.0	497.6	2.013	.398	157.00
6	1801	2415.0	493.5	1.982	.432	157.00
7	1802	2415.0	448.4	2.043	.506	168.00
8	1803	2100.0	491.2	2.008	.400	157.00
9	1804	2100.0	602.8	2.474	.300	157.00
10	1805	2400.0	601.8	2.511	.329	157.00
11	1806	2100.0	597.9	2.998	.353	157.00
12	1807	2400.0	604.2	2.998	.379	157.00
13	1808	2100.0	539.5	1.482	.291	157.00
14	1809	2400.0	548.9	1.478	.290	157.00
15	1810	2400.0	552.4	2.504	.416	157.00
16	1811	2100.0	555.3	2.484	.378	157.00
17	1812	2100.0	485.4	1.507	.342	157.00
18	1813	2400.0	499.9	1.449	.333	157.00
19	1814	2100.0	429.9	1.499	.392	157.00
20	1815	2400.0	425.2	1.514	.417	168.00
21	1816	1500.0	440.9	1.486	.386	157.00
22	1817	1500.0	445.2	2.018	.446	157.00
23	1818	1800.0	453.2	1.476	.361	157.00
24	1819	1800.0	466.2	2.037	.430	157.00
25	1820	2410.0	497.4	2.487	.519	157.00
26	1821	2410.0	554.0	2.980	.492	157.00
27	1822	2405.0	627.3	3.501	.376	157.00
28	1823	2400.0	603.9	3.524	.446	157.00
29	1824	2100.0	602.4	3.472	.387	157.00
30	1825	2100.0	572.8	2.922	.397	157.00
31	1826	2100.0	570.6	3.497	.466	157.00
32	1827	2100.0	543.3	2.941	.466	157.00
33	1828	2100.0	503.3	2.494	.463	157.00
34	1829	2105.0	476.9	.992	.265	157.00
35	1830	2415.0	484.8	.996	.269	157.00
36	1831	2100.0	459.8	2.010	.456	168.00
37	1832	2100.0	468.9	2.467	.517	157.00
38	1833	2085.0	437.3	.957	.286	157.00
39	1834	2415.0	433.9	.970	.300	157.00
40	1835	2100.0	436.8	2.038	.487	168.00
41	1836	2100.0	384.4	1.012	.331	168.00
43	1838	2100.0	404.9	1.589	.425	168.00
44	1839	2400.0	416.3	1.584	.452	168.00
45	1840	2405.0	526.8	2.505	.471	157.00
46	1841	1805.0	521.4	1.456	.303	168.00
47	1842	1805.0	536.4	1.997	.336	157.00

Table A-18. System Conditions - Test Section W161 (Continued)

Test Serial No.	Test ID No.	System Pressure (psia)	Inlet Temperature (°F)	Average Mass Velocity (Mlbm/hr-ft^2)	Average Heat Flux (MBtu/hr-ft^2)	Axial CHF Location (inches)
48	1843	1805.0	544.9	2.456	.380	157.00
49	1844	1805.0	523.9	2.997	.460	157.00
50	1845	1510.0	502.2	1.433	.322	157.00
51	1846	1505.0	502.6	2.002	.377	157.00
52	1847	1505.0	511.4	2.486	.420	157.00
53	1848	1505.0	502.2	2.992	.485	157.00
54	1849	1505.0	522.5	3.451	.500	157.00
55	1850	1805.0	524.8	4.458	.514	157.00
56	1851	1505.0	437.4	1.016	.306	157.00
57	1852	1805.0	458.8	.981	.282	157.00
58	1853	1505.0	458.2	2.506	.499	157.00
59	1854	1800.0	484.3	2.500	.477	157.00
60	1855	1800.0	553.8	3.002	.419	157.00
61	1856	1800.0	551.4	3.493	.466	157.00
62	1857	1500.0	552.9	3.540	.456	157.00
63	1858	1510.0	556.4	3.032	.422	157.00
64	1859	1500.0	397.5	.981	.322	157.00
65	1860	1800.0	389.4	.960	.310	157.00
66	1861	1805.0	394.5	1.468	.408	157.00
67	1862	1505.0	394.8	1.466	.423	157.00
68	1863	1805.0	420.2	1.989	.477	157.00
69	1864	1500.0	417.0	1.974	.470	157.00
70	1865	2095.0	543.8	1.991	.341	157.00
71	1866	2105.0	500.3	2.014	.408	157.00

Table A-19. System Conditions - Test Section W162

Test Serial No.	Test ID No.	System Pressure (psia)	Inlet Temperature (°F)	Average Mass Velocity (Mlbm/hr-ft²)	Average Heat Flux (MBtu/hr-ft²)	Axial CHF Location (inches)
1	1867	2100.0	504.3	1.962	.405	134.00
2	1868	2400.0	503.9	1.996	.443	101.50
3	1869	2405.0	508.5	2.480	.513	101.50
4	1870	2100.0	505.0	2.492	.481	134.00
5	1871	2100.0	548.9	2.508	.383	134.00
6	1872	2400.0	558.0	2.474	.419	134.00
7	1873	2400.0	558.0	2.982	.493	134.00
8	1874	2105.0	548.0	2.972	.451	134.00
9	1875	2395.0	549.3	1.985	.353	134.00
10	1876	2115.0	558.5	1.968	.316	134.00
11	1877	2090.0	566.9	3.471	.464	134.00
12	1878	2100.0	605.4	1.990	.271	134.00
13	1879	2410.0	600.9	1.992	.302	112.00
14	1880	2400.0	606.3	2.475	.319	134.00
15	1881	2100.0	600.7	2.481	.317	112.00
16	1882	2095.0	606.4	2.952	.338	112.00
17	1883	2400.0	608.9	2.996	.390	112.00 | Rev.
18	1884	2395.0	609.3	3.457	.440	112.00
19	1885	2110.0	605.9	3.428	.374	112.00
20	1886	1500.0	571.4	1.996	.305	112.00
21	1887	1805.0	585.9	1.986	.275	112.00
22	1888	1800.0	582.2	2.530	.313	112.00
23	1889	1500.0	573.4	2.466	.339	112.00
24	1890	1505.0	573.4	2.987	.356	112.00
25	1891	1805.0	583.5	2.981	.343	112.00
26	1892	1800.0	581.9	3.503	.383	112.00
27	1893	1505.0	574.3	3.483	.387	112.00
28	1894	1500.0	530.2	1.997	.344	112.00
29	1895	1800.0	532.9	2.003	.350	134.00
30	1896	1800.0	533.9	2.476	.391	112.00
31	1897	1500.0	534.8	2.462	.379	112.00
32	1898	1505.0	533.8	2.975	.416	112.00
33	1899	1805.0	532.5	3.007	.430	134.00
34	1900	2120.0	544.2	2.934	.479	134.00
35	1901	1795.0	534.9	3.499	.480	134.00
36	1902	2125.0	582.9	2.974	.382	134.00
37	1903	2405.0	586.3	2.495	.358	134.00
38	1904	2100.0	584.2	2.485	.346	112.00
39	1905	2425.0	589.9	2.977	.427	134.00
40	1906	2100.0	584.2	1.990	.284	134.00
41	1907	2400.0	584.3	2.008	.316	112.00
42	1908	2105.0	582.3	3.481	.420	134.00
43	1909	2410.0	585.4	3.502	.492	134.00
44	1910	1500.0	530.3	3.545	.438	112.00
45	1911	1500.0	488.4	2.008	.411	112.00
46	1912	1800.0	491.4	2.008	.409	134.00

Table A-19. System Conditions - Test Section W162 (Continued)

Test Serial No.	Test ID No.	System Pressure (psia)	Inlet Temperature (°F)	Average Mass Velocity (Mlbm/hr-ft^2)	Average Heat Flux (MBtu/hr-ft^2)	Axial CHF Location (inches)
47	1913	1805.0	492.2	2.490	.453	134.00
48	1914	1505.0	482.9	[illegible]54	.468	112.00
49	1915	1505.0	496.0	[illegible]69	.478	112.00
50	1916	1810.0	510.4	2.999	.482	134.00
51	1917	1510.0	524.2	1.475	.297	112.00
52	1918	1805.0	529.2	1.488	.293	134.00
53	1919	2100.0	546.8	1.495	.295	112.00
54	1920	2410.0	552.2	1.465	.309	134.00
55	1921	2400.0	509.4	1.474	.341	134.00
56	1922	2105.0	504.9	1.471	.350	112.00
57	1923	1805.0	479.4	1.488	.354	134.00
58	1924	1515.0	484.8	1.489	.346	112.00
59	1925	2105.0	462.4	.998	.292	134.00
60	1926	2385.0	452.6	1.015	.307	134.00
61	1927	2105.0	452.5	1.488	.382	134.00
62	1928	2405.0	458.6	1.483	.411	134.00
63	1929	2105.0	462.8	2.025	.470	134.00
64	1930	2405.0	478.2	2.008	.489	134.00
65	1931	1805.0	429.2	1.022	.311	134.00
66	1932	1505.0	436.9	1.009	.316	112.00
67	1933	1505.0	434.3	1.485	.396	112.00
68	1934	1800.0	433.2	1.448	.399	134.00
69	1935	1795.0	442.9	2.010	.468	134.00
70	1936	1500.0	438.4	2.002	.476	112.00

|Rev.

Table A-20. System Conditions - Test Section W163

Test Serial No.	Test ID No.	System Pressure (psia)	Inlet Temperature (°F)	Average Mass Velocity (Mlbm/hr-ft²)	Average Heat Flux (MBtu/hr-ft²)	Axial CHF Location (inches)
1	1937	1805.0	505.6	1.478	.490	96.00
2	1938	1800.0	513.3	2.062	.569	96.00
3	1939	1805.0	513.8	2.518	.632	85.00
4	1940	2405.0	528.4	1.433	.475	85.00
5	1941	2405.0	545.3	2.000	.576	85.00
6	1942	2410.0	542.4	2.505	.678	96.00
7	1943	2115.0	542.5	1.549	.411	96.00
8	1944	2100.0	548.6	2.056	.537	96.00
9	1945	2100.0	554.5	2.528	.581	85.00
10	1946	2115.0	553.2	2.993	.683	85.00
11	1947	2115.0	483.4	1.525	.564	96.00
12	1948	2100.0	478.1	2.065	.678	85.00
13	1949	2405.0	469.9	1.533	.597	85.00
14	1950	2405.0	472.4	2.063	.741	85.00
15	1951	1815.0	443.2	1.536	.592	96.00
16	1952	1810.0	444.0	2.064	.712	96.00
17	1953	1815.0	413.3	1.554	.640	96.00
18	1954	1820.0	433.8	2.008	.724	96.00
19	1955	2100.0	413.3	1.534	.672	85.00
20	1956	2405.0	418.4	1.532	.684	85.00
21	1957	1505.0	439.6	1.530	.589	85.00
22	1958	1505.0	452.9	2.033	.643	96.00
23	1959	1495.0	509.3	1.517	.483	85.00
24	1960	1505.0	515.3	2.040	.535	85.00
25	1961	1515.0	509.2	2.521	.622	85.00
26	1962	1505.0	512.4	3.009	.664	85.00
27	1963	2095.0	604.6	3.024	.510	85.00
28	1964	2395.0	598.3	2.084	.441	85.00
29	1965	2405.0	598.0	2.551	.525	85.00
30	1966	2405.0	602.6	3.043	.590	85.00
31	1967	1805.0	562.2	2.054	.463	85.00
32	1968	1805.0	563.2	2.542	.514	85.00
33	1969	1815.0	562.0	3.025	.574	85.00
34	1970	1505.0	558.0	3.068	.563	85.00
35	1971	1495.0	572.2	2.549	.516	85.00
36	1972	1815.0	519.7	2.513	.666	85.00
37	1973	2100.0	549.5	1.509	.455	96.00
38	1974	1505.0	509.4	3.021	.667	85.00
39	1975	1810.0	381.3	1.078	.506	96.00
40	1976	2100.0	390.2	1.076	.537	96.00
41	1977	2400.0	399.8	1.036	.525	85.00

Table A-21. System Conditions - Test Section W164

Test Serial No.	Test ID No.	System Pressure (psia)	Inlet Temperature (°F)	Average Mass Velocity (Mlbm/hr-ft^2)	Average Heat Flux (MBtu/hr-ft^2)	Axial CHF Location (inches)
1	1979	2100.0	492.6	1.454	.339	134.00
2	1980	2105.0	503.8	1.968	.402	134.00
3	1981	2100.0	502.1	2.500	.486	134.00
4	1982	2395.0	500.4	1.447	.342	134.00
5	1983	2415.0	507.2	1.928	.435	134.00
6	1984	2415.0	510.6	2.490	.518	134.00
7	1985	2400.0	553.1	1.446	.288	134.00
8	1986	2425.0	555.6	2.002	.363	134.00
9	1987	2400.0	554.6	2.495	.423	134.00
10	1988	2405.0	556.0	2.980	.504	134.00
11	1989	2115.0	562.3	1.406	.280	134.00
12	1990	2110.0	551.0	2.043	.328	134.00
13	1991	2105.0	549.0	2.499	.387	134.00
14	1992	2115.0	548.8	2.998	.461	134.00
15	1993	2100.0	557.3	3.457	.486	134.00
16	1994	2395.0	578.5	3.464	.494	134.00
17	1995	2400.0	598.0	1.994	.284	134.00
18	1996	2405.0	606.0	2.456	.326	134.00
19	1997	2400.0	605.0	2.962	.373	134.00
20	1998	2395.0	604.4	3.507	.416	134.00
21	1999	2100.0	607.2	1.972	.259	112.00
22	2000	2095.0	597.4	2.493	.320	134.00
23	2001	2110.0	605.3	2.973	.348	134.00
24	2002	2100.0	600.2	3.482	.385	134.00
25	2003	1795.0	581.3	1.983	.283	112.00
26	2004	1805.0	579.7	2.535	.322	112.00
27	2005	1800.0	582.2	2.970	.347	112.00
28	2006	1805.0	580.7	3.485	.394	112.00
29	2007	1505.0	571.7	3.415	.377	112.00
30	2008	1500.0	569.4	1.987	.307	112.00
31	2009	1500.0	570.6	2.491	.334	112.00
32	2010	1510.0	570.6	2.988	.363	112.00
33	2011	1505.0	533.5	1.427	.297	112.00
34	2012	1500.0	531.3	2.007	.353	112.00
35	2013	1500.0	525.7	2.502	.404	112.00
36	2014	1505.0	528.8	2.969	.438	112.00
37	2015	1510.0	531.8	3.534	.472	112.00
38	2016	1805.0	536.3	1.428	.288	134.00
39	2017	1800.0	528.1	1.995	.364	134.00
40	2018	1800.0	529.5	2.498	.413	134.00
41	2019	1815.0	534.9	2.941	.432	134.00
42	2020	1805.0	533.6	3.471	.485	134.00
43	2021	2105.0	540.0	2.949	.455	134.00
44	2022	1800.0	512.2	3.001	.477	134.00
45	2023	1500.0	481.8	1.429	.340	112.00
46	2024	1510.0	482.2	1.919	.412	112.00

Table A-21. System Conditions - Test Section W164 (Continued)

Test Serial No.	Test ID No.	System Pressure (psia)	Inlet Temperature (°F)	Average Mass Velocity (Mlbm/hr-ft²)	Average Heat Flux (MBtu/hr-ft²)	Axial CHF Location (inches)
47	2025	1500.0	482.9	2.486	.470	112.00
48	2025	1500.0	486.3	3.005	.520	112.00
49	2027	1802.0	483.2	1.445	.341	134.00
50	2028	1805.0	489.0	1.961	.422	134.00
51	2029	1810.0	484.3	2.505	.475	134.00
52	2030	1790.0	454.1	1.441	.379	134.00
53	2031	1815.0	461.6	1.954	.467	134.00
54	2032	2405.0	442.1	1.463	.416	134.00
55	2033	2405.0	463.0	1.929	.501	134.00
56	2034	2405.0	451.6	.980	.297	134.00
57	2035	2100.0	404.3	.991	.330	134.00
58	2036	2405.0	423.3	1.437	.431	134.00
59	2037	2205.0	419.5	1.436	.411	134.00
60	2038	2090.0	452.2	.992	.291	134.00
61	2039	1805.0	420.6	.993	.302	134.00
62	2040	1505.0	429.0	.972	.311	134.00
63	2041	1800.0	432.2	1.424	.389	134.00
64	2042	1505.0	422.6	1.420	.396	134.00
65	2043	1800.0	438.9	1.947	.465	134.00
66	2044	1505.0	436.0	1.913	.473	134.00
67	2045	1505.0	464.4	2.475	.501	112.00
68	2046	1800.0	386.8	.983	.323	134.00
69	2047	1505.0	384.4	.977	.341	134.00
71	2049	2110.0	530.0	2.956	.519	134.00
72	2050	2105.0	506.3	2.023	.402	134.00
73	2051	2100.0	499.3	1.424	.340	134.00
74	2052	2100.0	492.0	1.431	.347	134.00

Table A-22. System Conditions - Test Section W166

Test Serial No.	Test ID No.	System Pressure (psia)	Inlet Temperature (°F)	Average Mass Velocity (Mlbm/hr-ft^2)	Average Heat Flux (MBtu/hr-ft^2)	Axial CHF Location (inches)
1	14	1500.0	565.6	3.442	.416	122.00
2	15	1800.0	564.0	3.486	.440	148.00
3	16	2110.0	571.9	3.505	.476	136.00
4	17	2405.0	568.4	3.563	.553	136.00
6	19	2101.0	567.4	2.950	.445	122.00
7	20	2100.0	562.3	2.476	.380	136.00
8	21	2400.0	556.4	2.470	.437	136.00
9	22	2400.0	563.0	2.035	.371	136.00
10	23	2405.0	594.5	2.997	.410	136.00
11	24	2100.0	603.3	2.944	.349	148.00
12	25	2100.0	596.6	3.531	.424	136.00
13	26	2400.0	606.5	3.486	.421	136.00
14	27	2400.0	517.4	2.016	.429	136.00
15	28	2100.0	524.9	2.024	.406	148.00
16	29	2095.0	519.5	2.544	.496	136.00
17	30	2410.0	528.8	2.498	.479	148.00
18	31	1805.0	564.2	3.459	.446	148.00
19	32	1800.0	515.2	1.993	.370	148.00
20	33	1500.0	514.6	2.498	.418	148.00
21	34	1500.0	523.8	3.481	.493	148.00
22	35	1500.0	473.8	2.061	.417	148.00
23	36	1805.0	478.3	2.031	.434	148.00
24	37	2100.0	473.8	1.544	.385	148.00
25	38	2100.0	485.3	2.018	.462	148.00
26	39	2405.0	487.9	1.998	.477	148.00
27	40	2405.0	468.5	1.483	.405	136.00
28	41	2405.0	443.4	1.511	.428	122.00 Rev.
29	42	2105.0	436.9	1.482	.427	122.00
30	43	2115.0	432.5	2.014	.540	148.00
31	44	1800.0	439.9	1.991	.486	148.00
32	45	1505.0	431.0	1.996	.460	148.00
33	45	1505.0	432.0	1.995	.461	148.00
34	46	1500.0	401.7	1.505	.420	148.00
35	47	1505.0	433.1	1.500	.396	148.00
36	48	2110.0	403.1	1.494	.447	122.00
37	49	2395.0	404.7	1.492	.466	136.00
38	50	2405.0	552.1	3.007	.522	136.00
39	51	2400.0	517.9	3.006	.605	136.00
40	52	2100.0	522.5	2.997	.535	136.00
41	53	1805.0	515.8	3.498	.567	148.00
42	54	1505.0	487.3	2.489	.451	148.00 Rev.
43	55	2105.0	479.7	2.505	.525	122.00
44	56	2410.0	480.4	2.515	.531	122.00 Rev.
45	57	2100.0	486.9	2.492	.539	136.00
46	58	1500.0	401.8	2.024	.516	148.00
47	59	2100.0	410.1	2.016	.525	148.00

APPENDIX B

LOCAL THERMAL CONDITIONS AND DCHF-1 CORRELATION EVALUATIONS

Table B-1. Local Conditions - Test Section W108

Test Serial No.	Test ID No.	System Pressure (psia)	Local Mass Velocity (Mlbm/hr-ft^2)	Local Equilibrium Quality	Measured Critical Heat Flux (MBtu/hr-ft^2)	Predicted Critical Heat Flux (MBtu/hr-ft^2)	Predicted Critical Heat Flux Location (inches)	Measured-to-Predicted Critical Heat Flux Ratio
01	8	1515.	2.3074	.0580	.8792	.8602	78.	1.0222
02	9	1515.	2.2385	.0391	.9658	.8870	78.	1.0888
03	10	2165.	2.4755	.0377	.7894	.7938	78.	.9945
04	11	2115.	2.4116	.0285	.8621	.8067	78.	1.0686
05	12	2415.	2.4135	-.0330	.8513	.8659	78.	.9831
06	13	2415.	1.9570	-.0434	.8002	.8240	78.	.9712
07	14	1515.	3.2191	.0696	.7455	.8245	80.	.9042
08	15	1815.	3.4019	.0561	.7936	.8161	80.	.9724
09	16	1825.	1.7347	.0212	.8714	.8075	78.	1.0792
10	17	1515.	3.3967	.0421	.8962	.9258	78.	.9680
11	18	1515.	2.2314	.0219	1.0277	.9151	78.	1.1230
12	19	1545.	1.7475	.0282	.9442	.8707	78.	1.0843
13	53	1515.	3.3956	.0563	.7397	.8525	80.	.8676
14	54	1815.	3.4419	.0177	.9364	.9289	78.	1.0081
15	55	1795.	1.8488	-.0172	.9240	.8813	78.	1.0484
16	56	2115.	1.9197	-.0799	.9347	.9523	76.	.9815
17	57	2115.	1.9195	-.0552	.9004	.9152	76.	.9838
18	58	2115.	1.8864	-.0043	.7847	.8032	78.	.9769
19	59	2115.	2.3774	-.0202	.9039	.8770	78.	1.0307
20	60	2090.	2.8899	.0091	.9411	.8787	78.	1.0710
21	61	2125.	2.9298	.0126	.8451	.8728	78.	.9683
22	62	2095.	2.9310	.0643	.7018	.7558	80.	.9286
23	63	2115.	3.3867	-.0105	1.0664	.9469	78.	1.1262
24	64	2115.	3.3375	.0301	.8482	.8770	78.	.9672
25	65	2095.	3.3958	.0035	.9565	.9256	78.	1.0334
26	66	2405.	2.9861	-.0648	.9773	1.0220	76.	.9562
27	67	2410.	2.9606	-.0136	.8064	.8958	78.	.9002
28	68	2415.	2.9704	.0441	.7275	.8120	78.	.8959
29	69	2415.	3.4971	.0457	.7309	.8119	80.	.9003

Table B-3. Local Conditions - Test Section W114

Test Serial No.	Test ID No.	System Pressure (psia)	Local Mass Velocity ($Mlbm/hr-ft^2$)	Local Equilibrium Quality	Measured Critical Heat Flux ($MBtu/hr-ft^2$)	Predicted Critical Heat Flux ($MBtu/hr-ft^2$)	Predicted Critical Heat Flux Location (inches)	Measured-to-Predicted Critical Heat Flux Ratio
01	217	1500.	2.4189	.0448	.6928	.8127	72.	.8525
02	218	1505.	2.4224	.0234	.7641	.8539	72.	.8948
03	219	1505.	2.3896	.0111	.8200	.8775	72.	.9345
04	220	1515.	3.4629	.0612	.6536	.7956	72.	.8215
05	221	1515.	3.4438	.0408	.7653	.8398	72.	.9114
06	222	1805.	3.3948	.0518	.6477	.7794	72.	.8311
07	223	1805.	3.5697	.0299	.8021	.8300	72.	.9664
08	224	2095.	2.4856	.0632	.6125	.6705	74.	.9136
09	225	2100.	2.4760	.0275	.6964	.7506	72.	.9278
10	226	2115.	2.4665	-.0102	.7546	.8146	72.	.9264
11	227	2115.	3.0228	.0611	.6125	.6999	74.	.8751
12	228	2125.	2.9872	.0361	.7201	.7650	72.	.9414
13	229	2135.	3.0077	-.0115	.8128	.8538	72.	.9520
14	230	2115	3.5038	.0425	.6786	.7820	72.	.8677
15	231	2135.	3.5140	.0252	.8010	.8144	72.	.9836
16	232	2125.	3.4646	-.0060	.8758	.8733	72.	1.0029
17	233	2435.	3.4886	.0598	.6557	.7192	74.	.9117
18	234	2435.	3.5266	-.0068	.7986	.8662	72.	.9219
19	235	2425.	3.5177	-.0457	.8746	.9405	72.	.9299
20	236	2445.	2.9718	.0729	.5745	.6418	76.	.8953
21	237	2435.	2.9964	.0069	.7142	.8001	72.	.8926
22	238	2425.	3.0174	-.0383	.7998	.8838	72.	.9050
23	239	2425.	2.5071	-.0270	.6976	.8163	72.	.8545
24	240	2425.	2.5081	-.0945	.8425	.9760	68.	.8633
25	241	2400.	2.5157	-.1224	.8812	1.0300	68.	.8555
26	242	2425.	2.0329	-.0466	.6548	.7986	72.	.8200
27	243	2405.	2.0080	-.0675	.6952	.8321	72.	.8355
28	244	2425.	2.0439	-.1439	.8258	.9966	68.	.8286
29	245	2125.	1.9454	.0133	.6916	.7315	72.	.9455

Table B-3. Local Conditions - Test Section W114 (Continued)

Test Serial No.	Test ID No.	System Pressure (psia)	Local Mass Velocity (Mlbm/hr-ft^2)	Local Equilibrium Quality	Measured Critical Heat Flux (MBtu/hr-ft^2)	Predicted Critical Heat Flux (MBtu/hr-ft^2)	Predicted Critical Heat Flux Location (inches)	Measured-to-Predicted Critical Heat Flux Ratio
30	246	2115.	1.9706	-.0252	.7404	.7986	72.	.9271
31	247	2115.	1.9673	-.0448	.7784	.8314	72.	.9361
32	248	1805.	1.9911	-.0016	.7190	.8145	72.	.8827
33	249	1825.	1.9146	-.0234	.7617	.8436	72.	.9029

Table B-3. Local Conditions - Test Section W121

Test Serial No.	Test ID No.	System Pressure (psia)	Local Mass Velocity (Mlbm/hr-ft^2)	Local Equilibrium Quality	Measured Critical Heat Flux (MBtu/hr-ft^2)	Predicted Critical Heat Flux (MBtu/hr-ft^2)	Predicted Critical Heat Flux Location (inches)	Measured-to-Predicted Critical Heat Flux Ratio
01	394	1535.	3.4551	.0811	.7157	.7874	74.	.9090
02	395	1505.	3.4558	.0514	.8317	.8834	72.	.9415
03	396	1795.	3.5182	.0793	.6911	.7656	74.	.9026
04	397	1775.	3.4328	.0473	.8501	.8544	72.	.9951
05	398	2085.	3.4235	.0882	.6758	.7031	76.	.9612
06	399	2065.	3.4707	.0509	.8610	.8005	74.	1.0757
07	400	2115.	3.4484	.0308	.9958	.8616	72.	1.1558
08	401	2115.	2.9668	.1063	.6212	.6521	76.	.9527
09	402	2115.	2.9906	.0453	.7937	.8083	72.	.9820
10	403	2115.	2.9945	.0337	.9273	.8291	72.	1.1185
11	404	2400.	3.5142	.0806	.6791	.7165	76.	.9478
12	405	2405.	3.5432	.0322	.8770	.8564	72.	1.0241
13	406	2405.	3.4579	-.0081	1.0069	.9244	72.	1.0892
14	407	2415.	2.9785	.1076	.6100	.6421	76.	.9500
15	408	2395.	3.0233	.0589	.7415	.7471	74.	.9926
16	409	2385.	2.9670	.0217	.8954	.8314	72.	1.0771
17	410	2415.	2.4688	.0361	.7680	.7627	72.	1.0069
18	411	2405.	2.4341	.0010	.8783	.8178	72.	1.0740
19	412	2415.	2.4790	-.0469	.9762	.9037	72.	1.0802
20	413	2095.	2.4916	.0765	.6677	.7028	74.	.9501
21	414	2125.	2.4710	.0409	.7999	.7808	72.	1.0244
22	415	2105.	2.4655	.0236	.8832	.8122	72.	1.0874
23	416	1495.	2.4543	.0841	.7649	.7760	74.	.9856
24	417	1505.	2.3904	.0662	.8211	.8068	74.	1.0178
25	418	1505.	2.4041	.0354	.9420	.8925	72.	1.0555
26	419	2405.	1.9708	.0113	.7472	.7533	72.	.9920
27	420	2405.	1.9936	-.0178	.7986	.8015	72.	.9963
28	421	2405.	1.9220	-.0029	.8118	.7514	74.	1.0804
29	422	2100.	1.9733	.0427	.7533	.7434	72.	1.0132

Rev. 1

Table B-3. Local Conditions - Test Section W121 (Continued)

Rev.1

Test Serial No.	Test ID No.	System Pressure (psia)	Local Mass Velocity ($Mlbm/hr\text{-}ft^2$)	Local Equilibrium Quality	Measured Critical Heat Flux ($MBtu/hr\text{-}ft^2$)	Predicted Critical Heat Flux ($MBtu/hr\text{-}ft^2$)	Predicted Critical Heat Flux Location (inches)	Measured-to-Predicted Critical Heat Flux Ratio
30	423	2115.	1.9342	.0331	.8170	.7534	72.	1.0844
31	424	2095.	1.9226	.0083	.8917	.7953	72.	1.1211
32	425	1805.	1.9972	.0482	.8415	.7857	72.	1.0711
33	426	1815.	1.8865	.0440	.8481	.7631	74.	1.1113
34	427	1505.	1.3819	.1147	.6466	.7099	74.	.9108
35	428	1515.	1.3957	.1071	.7075	.7181	74.	.9853
36	429	1515.	1.3567	.1177	.7338	.6798	76.	1.0795
39	432	2015.	.8506	.0159	.7349	.6527	76.	1.1260

Table B-4. Local Conditions - Test Section W122

	Test Serial No.	Test ID No.	System Pressure (psia)	Local Mass Velocity (Mlbm/hr-ft^2)	Local Equilibrium Quality	Measured Critical Heat Flux (MBtu/hr-ft^2)	Predicted Critical Heat Flux (MBtu/hr-ft^2)	Predicted Critical Heat Flux Location (inches)	Measured-to-Predicted Critical Heat Flux Ratio
	01	434	1525.	3.4033	.0690	.7361	.7773	72.	.9469
	02	435	1515.	3.4485	.0454	.8451	.8295	72.	1.0188
	03	436	1815.	3.4719	.0749	.6864	.7101	74.	.9666
	04	437	1815.	3.5375	.0371	.8488	.8128	72.	1.0444
	05	438	2115.	3.5072	.0620	.7028	.7211	74.	.9746
	06	439	2105.	3.5733	.0257	.8488	.8179	72.	1.0377
	07	440	2115.	3.4985	-.0065	.9541	.8770	72.	1.0879
	08	441	2130.	3.0183	.0770	.6536	.6715	74.	.9733
	09	442	2115.	3.0640	.0483	.7531	.7249	74.	1.0388
	10	443	2115.	3.0103	.0087	.8659	.8175	72.	1.0592
	11	444	2395.	3.5248	.0732	.6770	.6989	74.	.9687
	12	445	2425.	3.5732	.0163	.8561	.8272	72.	1.0350
	13	446	2375.	3.5549	-.0313	.9590	.9171	72.	1.0457
	14	447	2415.	2.8969	.0795	.5787	.6280	76.	.9215
Rev.1 |	15	448	2410.	2.9143	.0228	.7288	.7677	72.	.9492
	16	449	2395.	2.8822	-.0133	.8108	.8284	72.	.9787
	17	450	2375.	2.3969	.0078	.7006	.7519	72.	.9318
	01	451	2415.	2.4184	-.0316	.7814	.8164	72.	.9572
	02	452	2115.	2.3907	.0777	.6173	.6397	74.	.9650
	03	453	2115.	2.4417	.0533	.6922	.6823	74.	1.0146
	04	454	2115.	2.3830	.0250	.7973	.7469	72.	1.0675
	05	455	1515.	2.3774	.0692	.7215	.7384	74.	.9771
	06	456	1515.	2.3301	.0424	.8635	.8118	72.	1.0638
	07	457	1515.	2.2959	.0334	.9137	.8280	72.	1.1035
	08	458	2125.	1.9210	.0144	.7128	.7279	72.	.9793
	09	459	2125.	1.8738	.0076	.7618	.7345	72.	1.0371
	10	460	2095.	1.9283	-.0186	.8341	.7868	72.	1.0602
	11	461	1815.	1.8781	.0311	.7667	.7491	72.	1.0235
	12	462	1815.	1.8704	.0141	.8439	.7775	72.	1.0854

Table B-5. Local Conditions - Test Section W124

Test Serial No.	Test ID No.	System Pressure (psia)	Local Mass Velocity (Mlbm/hr-ft²)	Local Equilibrium Quality	Measured Critical Heat Flux (MBtu/hr-ft²)	Predicted Critical Heat Flux (MBtu/hr-ft²)	Predicted Critical Heat Flux Location (inches)	Measured-to-Predicted Critical Heat Flux Ratio
01	475	1565.	3.3870	.0856	.7043	.7742	74.	.9097
02	476	1515.	3.3313	.0543	.8487	.8730	72.	.9722
03	477	1790.	3.5769	.0480	.7661	.8574	72.	.8935
04	478	1790.	3.6171	.0451	.9018	.8639	72.	1.0440
06	480	2115.	3.6310	.0469	.9084	.8137	74.	1.1163
07	481	2115.	3.0505	.0872	.7161	.7126	74.	1.0049
08	482	2115.	3.0784	.0619	.8246	.7580	74.	1.0879
09	483	2115.	3.0329	.0375	.9339	.8244	72.	1.1328
10	484	2415.	3.5746	.0775	.7199	.7253	76.	.9926
11	485	2415.	3.5613	.0266	.9314	.8678	72.	1.0732
12	486	2415.	2.9537	.0884	.6492	.6692	76.	.9700
13	487	2415.	2.9040	.0303	.7969	.8103	72.	.9835
14	488	2415.	2.7924	.0097	.8487	.8358	72.	1.0155
15	489	2415.	2.3934	.0133	.7895	.7928	72.	.9958
16	[illegible]	2415.	2.3547	-.0108	.8438	.8287	72.	1.0183
17	[illegible]	2415.	2.3556	-.0374	.8870	.8737	72.	1.0152
18	492	2115.	2.3481	.1040	.6413	.6270	76.	1.0229
19	493	2165.	2.3708	.0663	.7102	.7052	74.	1.0072
20	494	2115.	2.3928	.0295	.8784	.7954	72.	1.1043
21	495	2115.	2.3205	.0019	.9191	.8375	72.	1.0975
22	496	1515.	2.3346	.0862	.7822	.7663	74.	1.0208
23	497	1515.	2.3162	.0779	.8482	.7816	74.	1.0852
24	498	1515.	2.3008	.0460	.9413	.8666	72.	1.0862
25	499	2415.	1.8988	.0155	.7229	.7377	72.	.9799
26	500	2415.	1.8729	-.0144	.7969	.7806	72.	1.0209
27	501	2415.	1.9219	-.0587	.8598	.8571	72.	1.0032
28	502	2115.	1.9101	.0491	.7328	.7261	72.	1.0093
29	503	2115.	1.8933	.0355	.7969	.7461	72.	1.0680
30	504	2115.	1.8303	-.0017	.8870	.7997	72.	1.1092

Table B-5. Local Conditions - Test Section W124 (Continued)

Test Serial No.	Test ID No.	System Pressure (psia)	Local Mass Velocity (Mlbm/hr-ft²)	Local Equilibrium Quality	Measured Critical Heat Flux (MBtu/hr-ft²)	Predicted Critical Heat Flux (MBtu/hr-ft²)	Predicted Critical Heat Flux Location (inches)	Measured-to-Predicted Critical Heat Flux Ratio
31	505	1815.	1.8935	.0334	.8142	.8024	72.	1.0147
32	506	1815.	1.8084	.0487	.7975	.7509	74.	1.0620
33	507	1515.	1.3933	.1142	.6772	.7072	74.	.9575
34	508	1515.	1.3427	.0973	.6937	.7324	74.	.9472
35	509	1515.	1.3422	.0865	.7267	.7488	74.	.9705

Table B-6. Local Conditions - Test Section W125

Test Serial No.	Test ID No.	System Pressure (psia)	Local Mass Velocity (Mlbm/hr-ft^2)	Local Equilibrium Quality	Measured Critical Heat Flux (MBtu/hr-ft^2)	Predicted Critical Heat Flux (MBtu/hr-ft^2)	Predicted Critical Heat Flux Location (inches)	Measured-to-Predicted Critical Heat Flux Ratio
01	510	1515.	3.3600	.0474	.8014	.9158	78.	.8751
02	511	1515.	3.3301	.0468	.8677	.8680	80.	.9997
03	512	1815.	3.3292	.0624	.8012	.8019	80.	.9991
04	513	1815.	3.4090	.0186	.9646	.9254	78.	1.0425
05	514	2115.	3.4410	.0394	.8375	.8684	78.	.9643
06	515	2115.	3.3758	.0263	.9774	.8848	78.	1.1047
07	516	2115.	3.3029	.0025	1.0339	.9190	78.	1.1250
08	517	2145.	2.8888	.0644	.6844	.7505	80.	.9120
09	518	2115.	2.9138	.0163	.9004	.8664	78.	1.0392
10	519	2115.	2.8604	-.0112	.9617	.9064	78.	1.0610
11	520	2415.	3.4730	.0251	.8328	.8849	78.	.9411
12	521	2415.	3.4248	-.0188	.9585	.9483	78.	1.0107
13	522	2415.	3.4040	-.0544	1.0449	1.0056	78.	1.0391
14	523	2415.	2.9986	.0320	.7322	.8322	78.	.8798
15	524	2415.	2.9488	-.0185	.8925	.9020	78.	.9895
16	525	2415.	2.8993	-.0383	.9522	.9277	78.	1.0264
17	526	2390.	2.4115	-.0326	.8092	.8676	78.	.9327
18	527	2375.	2.4466	-.0843	.9091	.9894	76.	.9188
19	528	2395.	2.4630	-.1313	.9971	1.0642	76.	.9369
20	529	2135.	2.4153	.0392	.7857	.7897	78.	.9950
21	530	2100.	2.3811	.0133	.8517	.8287	78.	1.0278
22	531	2100.	2.3617	-.0180	.9067	.8741	78.	1.0373
23	532	1535.	2.3486	.0433	.8721	.8804	78.	.9906
24	533	1525.	2.3145	.0212	.9349	.9184	78.	1.0179
25	534	1525.	2.2652	.0099	.9962	.9349	78.	1.0656
26	535	2400.	1.8979	-.0409	.7894	.8467	76.	.9323
27	536	2395.	1.9420	-.0739	.8924	.9000	76.	.9916
28	537	2415.	1.9658	-.1172	.9706	.9638	76.	1.0071
29	538	2115.	1.8684	.0099	.7982	.7774	78.	1.0267

| Rev. 1

Table B-6. Local Conditions - Test Section W125 (Continued)

Test Serial No.	Test ID No.	System Pressure (psia)	Local Mass Velocity (Mlbm/hr-ft^2)	Local Equilibrium Quality	Measured Critical Heat Flux (MBtu/hr-ft^2)	Predicted Critical Heat Flux (MBtu/hr-ft^2)	Predicted Critical Heat Flux Location (inches)	Measured-to-Predicted Critical Heat Flux Ratio
30	539	2100.	1.8918	-.0252	.8799	.8366	78.	1.0518
31	540	2095.	1.8705	-.0536	.9656	9102	76.	1.0609
32	541	1825.	1.8268	.0123	.8799	.8282	78.	1.0624
33	542	1815.	1.8381	-.0058	.9554	.8586	78.	1.1128

Table B-7. Local Conditions - Test Section W127

Test Serial No.	Test ID No.	System Pressure (psia)	Local Mass Velocity (Mlbm/hr-ft²)	Local Equilibrium Quality	Measured Critical Heat Flux (MBtu/hr-ft²)	Predicted Critical Heat Flux (MBtu/hr-ft²)	Predicted Critical Heat Flux Location (inches)	Measured-to-Predicted Critical Heat Flux Ratio
01	550	1515.	3.4366	.0574	.7622	.8289	80.	.9195
02	551	1515.	3.3449	.0204	.9410	.9400	78.	1.0010
03	552	1815.	3.4135	.0298	.8421	.8827	78.	.9541
04	553	1815.	3.3692	.0126	.9394	.9110	78.	1.0312
05	554	2115.	3.4442	.0342	.8166	.8543	78.	.9559
06	555	2115.	3.3642	.0169	.9075	.8771	78.	1.0346
07	556	2115.	3.3958	-.0355	1.0207	.9688	78.	1.0536
08	557	2115.	2.9687	.0335	.7719	.8229	78.	.9380
09	558	2115.	2.9215	.0109	.8357	.8540	78.	.9786
10	559	2115.	2.8738	-.0183	.9186	.8976	78.	1.0234
11	560	2415.	3.4585	.0316	.7958	.8508	78.	.9354
12	561	2415.	3.4263	-.0237	.8788	.9341	78.	.9407
13	562	2415.	3.4191	-.0781	1.0205	1.0691	76.	.9545
14	563	2415.	2.9706	.0078	.7193	.8427	78.	.8536
15	564	2415.	2.9037	-.0085	.7926	.8606	78.	.9210
16	565	2415.	2.9587	-.0798	.9176	1.0204	76.	.8992
17	566	2365.	2.4023	-.0408	.8080	.8978	76.	.8999
18	567	2365.	2.4054	-.0766	.8822	.9524	76.	.9262
19	568	2415.	2.4376	-.1302	.9598	1.0353	76.	.9271
20	569	2115.	2.4101	.0264	.7097	.7896	78.	.8989
21	570	2045.	2.3767	.0051	.7831	.8267	78.	.9473
22	571	2115.	2.3784	-.0383	.9159	.9225	76.	.9928
23	572	1535.	2.3089	.0447	.8612	.8529	78.	1.0098
24	573	1515.	2.2696	.0462	.9170	.8539	78.	1.0739
25	574	1515.	2.2917	.0113	.9888	.9131	78.	1.0829
26	575	1815.	1.8122	.0059	.8628	.8180	78.	1.0547
27	576	1815.	1.8152	-.0151	.9202	.8496	78.	1.0831
28	577	2115.	1.8856	-.0080	.7767	.7889	78.	.9845
29	578	2115.	1.8759	-.0537	.8771	.8870	76.	.9889

Table B-7. Local Conditions - Test Section W127 (Continued)

Test Serial No.	Test ID No.	System Pressure (psia)	Local Mass Velocity (Mlbm/hr-ft^2)	Local Equilibrium Quality	Measured Critical Heat Flux (MBtu/hr-ft^2)	Predicted Critical Heat Flux (MBtu/hr-ft^2)	Predicted Critical Heat Flux Location (inches)	Measured-to-Predicted Critical Heat Flux Ratio
30	579	1815.	1.8178	.0065	.8676	.8176	78.	1.0612
31	580	2115.	1.9261	-.0933	.9362	.9530	76.	.9824
32	581	2415.	1.9254	-.0656	.7793	.8634	76.	.9026
33	582	2415.	1.9346	-.1041	.8316	.9199	76.	.9040
34	583	2415.	1.9480	-.1459	.9126	.9842	76.	.9272
35	584	1515.	1.5911	.0246	.7863	.8541	78.	.9206
36	585	1515.	1.2829	.0984	.7862	.7037	80.	1.1172
37	586	1515.	1.3001	.0828	.8462	.7241	80.	1.1687

Table B-8. Local Conditions - Test Section W131

Test Serial No.	Test ID No.	System Pressure (psia)	Local Mass Velocity (Mlbm/hr-ft²)	Local Equilibrium Quality	Measured Critical Heat Flux (MBtu/hr-ft²)	Predicted Critical Heat Flux (MBtu/hr-ft²)	Predicted Critical Heat Flux Location (inches)	Measured-to-Predicted Critical Heat Flux Ratio
01	617	1505.	3.5033	.1529	.4966	.4650	147.	1.0679
02	618	2095.	3.4620	.1522	.4482	.4323	150.	1.0368
03	619	2395.	3.4595	.1277	.5073	.4682	150.	1.0835
04	620	2395.	3.0159	.1423	.4716	.4338	150.	1.0869
05	621	2115.	3.0175	.1371	.4002	.4445	150.	.9004
06	622	2125.	2.9496	.1178	.4939	.4691	150.	1.0530
07	623	2125.	2.4221	.1381	.4315	.4282	150.	1.0079
08	624	2395.	2.4337	.1101	.4783	.4522	150.	1.0578
09	625	2405.	3.4013	.1013	.6054	.5031	150.	1.2033
10	626	2375.	2.9300	.0990	.5340	.4884	150.	1.0934
11	627	2405.	2.9131	.0657	.6087	.5332	150.	1.1417
12	628	2415.	2.4489	.0569	.5329	.5214	150.	1.0221
13	629	2415.	2.4560	.0353	.5998	.5509	150.	1.0889
14	630	2415.	1.9548	.1239	.4014	.4118	150.	.9748
15	631	2405.	1.9376	.0806	.4538	.4626	150.	.9808
16	632	2100.	1.9718	.1447	.3646	.4092	150.	.8910
17	633	2095.	1.9369	.1198	.4259	.4388	150.	.9706
18	634	2405.	1.9473	.0567	.5140	.4924	150.	1.0438
19	635	2115.	1.9681	.0803	.5206	.4879	150.	1.0671
20	636	2125.	2.4380	.0514	.5797	.5462	150.	1.0614
21	637	2095.	2.4739	.0862	.5162	.5008	150.	1.0308
22	638	2115.	3.4336	.1013	.5820	.5053	150.	1.1517
23	639	2085.	2.9461	.0775	.5764	.5288	150.	1.0901
24	640	1815.	3.5472	.1057	.5494	.5253	147.	1.0459
25	641	1795.	3.5143	.0880	.6105	.5549	147.	1.1002
26	642	1800.	3.5143	.0587	.6592	.6210	144.	1.0614
27	643	1515.	3.5761	.0982	.6093	.5576	147.	1.0927
28	644	1490.	2.5019	.1116	.5354	.5403	147.	.9909
29	645	1490.	2.4746	.0687	.6162	.6247	144.	.9864

Table B-6. Local Conditions - Test Section W131 (Continued)

Test Serial No.	Test ID No.	System Pressure (psia)	Local Mass Velocity (Mlbm/hr-ft^2)	Local Equilibrium Quality	Measured Critical Heat Flux (MBtu/hr-ft^2)	Predicted Critical Heat Flux (MBtu/hr-ft^2)	Predicted Critical Heat Flux Location (inches)	Measured-to-Predicted Critical Heat Flux Ratio
30	646	1515.	2.0086	.0999	.5248	.5543	147.	.9469
31	647	1805.	1.9953	.1503	.3334	.4436	147.	.7517
32	648	1500.	2.5151	.1638	.4749	.4437	150.	1.0703
33	649	1505.	1.9662	.2141	.3754	.3685	153.	1.0188
34	650	1502.	2.0391	.1379	.4802	.5015	147.	.9575
35	651	1805.	1.9818	.0999	.4329	.5226	144.	.8284
36	652	1785.	2.0093	.0757	.5018	.5592	144.	.8975
Rev.1 37	653	2105.	3.4781	.1604	.4593	.4212	150.	1.0903 Rev.1

Table B-9. Local Conditions - Test Section W132

Test Serial No.	Test ID No.	System Pressure (psia)	Local Mass Velocity (Mlbm/hr-ft^2)	Local Equilibrium Quality	Measured Critical Heat Flux (MBtu/hr-ft^2)	Predicted Critical Heat Flux (MBtu/hr-ft^2)	Predicted Critical Heat Flux Location (inches)	Measured-to-Predicted Critical Heat Flux Ratio
01	654	1515.	3.4351	.1998	.4967	.4019	153.	1.2359
02	655	2095.	3.4577	.1872	.4465	.4087	153.	1.0924
03	656	2405.	2.9606	.1759	.4475	.4125	153.	1.0850
04	657	2205.	3.0130	.1521	.4579	.4824	147.	.9491
05	658	2105.	2.9618	.1327	.5412	.5092	147.	1.0628
06	659	1805.	3.4709	.1348	.5518	.5267	147.	1.0477
07	660	2375.	3.4291	.1693	.4977	.4345	153.	1.1456
08	661	2400.	3.3529	.1609	.5374	.4433	153.	1.2124
09	662	2400.	3.3889	.1322	.5866	.4826	153.	1.2154
10	663	2115.	3.4498	.1405	.5918	.4715	153.	1.2550 Rev.1
11	664	2400.	2.9124	.1191	.6012	.4829	153.	1.2449
12	665	2115.	2.9469	.1192	.6064	.4908	153.	1.2355
14	667	1800.	3.4679	.1137	.6727	.5601	147.	1.2009
15	668	2100.	2.4404	.1177	.6023	.4799	153.	1.2550
16	669	2385.	2.4652	.0896	.5981	.5033	153.	1.1884
17	670	2390.	2.9184	.1507	.5312	.4421	153.	1.2016
18	671	2385.	2.4371	.1561	.4778	.4181	153.	1.1427
19	672	2400.	2.4388	.1328	.5333	.4461	153.	1.1955
20	673	2400.	1.9581	.1137	.4203	.4759	147.	.8832
21	674	2400.	1.9491	.1511	.4820	.4027	153.	1.1968
22	675	2405.	1.9134	.1043	.5197	.4551	153.	1.1419
23	676	2095.	1.9354	.1464	.5019	.4290	153.	1.1699
24	677	2105.	2.4192	.1712	.4318	.4103	153.	1.0524
25	678	2105.	2.4583	.1417	.5144	.4484	153.	1.1473
26	679	2105.	1.9405	.1515	.4287	.4223	153.	1.0151
27	680	2105.	1.9268	.1847	.3440	.3835	153.	.8971
28	681	1800.	1.9734	.1635	.4092	.4553	150.	.8988
29	682	1800.	1.9545	.2201	.3461	.3698	153.	.9360
30	683	1500.	1.9693	.2735	.3650	.3060	159.	1.1930

Table B-9. Local Conditions - Test Section W132 (Continued)

Test Serial No.	Test ID No.	System Pressure (psia)	Local Mass Velocity (Mlbm/hr-ft²)	Local Equilibrium Quality	Measured Critical Heat Flux (MBtu/hr-ft²)	Predicted Critical Heat Flux (MBtu/hr-ft²)	Predicted Critical Heat Flux Location (inches)	Measured-to-Predicted Critical Heat Flux Ratio
31	684	1495.	2.5332	.2200	.4644	.3720	156.	1.2482
32	685	1800.	1.9879	.1165	.4966	.5320	147.	.9336
33	686	1500.	2.4843	.1663	.5585	.4869	150.	1.1471
34	687	1500.	1.9627	.2085	.4642	.4189	153.	1.1083
35	688	1500.	2.0348	.1481	.5418	.5186	150.	1.0446
36	689	1500.	2.4439	.1182	.6011	.5775	147.	1.0408

Table B-10. Local Conditions - Test Section W133

Test Serial No.	Test ID No.	System Pressure (psia)	Local Mass Velocity (Mlbm/hr-ft^2)	Local Equilibrium Quality	Measured Critical Heat Flux (MBtu/hr-ft^2)	Predicted Critical Heat Flux (MBtu/hr-ft^2)	Predicted Critical Heat Flux Location (inches)	Measured-to-Predicted Critical Heat Flux Ratio
01	690	1500.	3.4545	.2086	.5248	.4722	153.	1.1115
02	691	2100.	2.9565	.2074	.4490	.4730	150.	.9494
03	692	2100.	3.4394	.2065	.4808	.4600	153.	1.0452
04	693	2400.	2.9546	.1949	.4970	.4842	150.	1.0265
05	694	2105.	2.9540	.1614	.5484	.5307	150.	1.0333
06	695	2405.	1.9464	.1832	.4322	.4494	150.	.9617
07	696	2405.	1.9648	.0942	.5171	.5551	150.	.9316
08	697	2105.	1.9223	.1323	.5517	.5327	150.	1.0356
09	698	2115.	2.4262	.1812	.5015	.4893	150.	1.0250
10	699	2105.	1.9375	.1654	.4881	.4928	150.	.9905
11	700	2110.	1.9309	.2068	.4132	.4446	150.	.9294
12	701	2400.	2.4539	.1362	.5260	.5327	150.	.9875
14	703	1805.	1.9680	.2198	.3764	.4622	150.	.8143
15	704	1500.	1.9525	.2553	.3900	.4178	156.	.9333
16	705	1500.	2.5392	.2157	.4923	.4766	153.	1.0328
17	706	1795.	1.9433	.1665	.5115	.5272	150.	.9703
18	707	1505.	1.9998	.2095	.4755	.4938	153.	.9629
19	708	1500.	1.9771	.1781	.5696	.5600	150.	1.0172
20	709	1830.	3.4634	.1176	.6657	.6389	147.	1.0419
21	710	1815.	3.4007	.1694	.5551	.5380	150.	1.0318
22	711	2400.	3.3958	.1748	.5450	.5264	150.	1.0353
23	712	2400.	3.3703	.1290	.5942	.5866	150.	1.0129
24	713	2400.	3.3795	.1080	.6154	.6168	150.	.9977
25	714	2115.	3.4340	.1400	.6031	.5738	150.	1.0511
26	715	2415.	2.9002	.0892	.6120	.6192	150.	.9884
27	716	2100.	2.9177	.1233	.6232	.5828	150.	1.0693
28	717	1525.	3.4686	.1855	.5897	.5039	153.	1.1703
29	718	2400.	2.4710	.0581	.6277	.6376	150.	.9844
30	719	2405.	2.9239	.1284	.5685	.5666	150.	1.0035

Table B-10. Local Conditions - Test Section W133 (Continued)

Test Serial No.	Test ID No.	System Pressure (psia)	Local Mass Velocity (Mlbm/hr-ft^2)	Local Equilibrium Quality	Measured Critical Heat Flux (MBtu/hr-ft^2)	Predicted Critical Heat Flux (MBtu/hr-ft^2)	Predicted Critical Heat Flux Location (inches)	Measured-to-Predicted Critical Heat Flux Ratio
31	720	2400.	2.4361	.1068	.5551	.5696	150.	.9745
32	721	2100.	2.4681	.1462	.5752	.5362	150.	1.0727
33	722	2100.	2.4148	.1111	.6266	.5818	150.	1.0771
34	723	2405.	1.9607	.0620	.5640	.5954	150.	.9472
35	724	1495.	2.4772	.1883	.5583	.5158	153.	1.0825
36	725	1505.	2.4330	.1620	.6187	.5771	150.	1.0721
37	726	1500.	1.5189	.2040	.4635	.5335	150.	.8689
38	727	1505.	1.4957	.2828	.3675	.4005	156.	.9176

Table B-11. Local Conditions - Test Section W134

Test Serial No.	Test ID No.	System Pressure (psia)	Local Mass Velocity (Mlbm/hr-ft^2)	Local Equilibrium Quality	Measured Critical Heat Flux (MBtu/hr-ft^2)	Predicted Critical Heat Flux (MBtu/hr-ft^2)	Predicted Critical Heat Flux Location (inches)	Measured-to-Predicted Critical Heat Flux Ratio
01	728	1510.	3.4727	.1463	.4455	.4227	150.	1.0539
02	729	1800.	3.4587	.1034	.4974	.4928	147.	1.0092
03	730	2095.	3.4467	.1528	.4288	.3979	150.	1.0776
04	731	2125.	3.5089	.1490	.4388	.4042	150.	1.0855
05	732	2405.	3.4889	.1036	.5221	.4851	147.	1.0762
06	733	2385.	3.0448	.1365	.4578	.4106	150.	1.1149
07	734	2115.	2.9524	.1348	.4068	.4281	147.	.9502
08	735	2100.	2.9754	.0933	.5221	.4872	147.	1.0716
09	736	2405.	2.9638	.0839	.5426	.4779	150.	1.1354
10	737	2400.	2.4428	.0944	.4667	.4422	150.	1.0554
11	738	2100.	2.4397	.1116	.4445	.4466	147.	.9952
12	739	2405.	3.4527	.0642	.6549	.5407	147.	1.2112
13	740	1490.	2.4113	.0494	.6023	.6174	144.	.9756
14	741	2385.	2.4849	-.0539	.6528	.6711	144.	.9728
15	742	2100.	2.4303	.0093	.6233	.6012	144.	1.0367
16	743	1500.	3.5080	.0527	.6984	.6207	144.	1.1252
17	744	1500.	3.5327	.0915	.5832	.5332	147.	1.0937
18	745	1800.	3.4949	.0425	.6380	.6110	144.	1.0441
19	746	2405.	2.9310	-.0231	.6676	.6574	144.	1.0156
20	747	2405.	2.9645	-.0579	.6512	.7248	141.	.8984
21	748	2405.	2.4216	.0029	.5789	.5865	144.	.9872
22	749	2105.	3.2802	.0826	.5468	.5114	147.	1.0692
23	750	2085.	1.9659	.1277	.3739	.4130	147.	.9053
24	751	2385.	1.9729	.0487	.4028	.4982	144.	.8085
25	752	2410.	1.9414	.0131	.4939	.5378	144.	.9183
26	753	2105.	1.9380	.0652	.4656	.4996	144.	.9320
27	754	2105.	2.4595	.0435	.5506	.5534	144.	.9950
28	755	2090.	1.9663	.0235	.5272	.5568	144.	.9469
29	756	2425.	1.9481	-.0439	.5457	.6082	144.	.8972

Table B-11. Local Conditions - Test Section W134 (Continued)

Test Serial No.	Test ID No.	System Pressure (psia)	Local Mass Velocity (Mlbm/hr-ft^2)	Local Equilibrium Quality	Measured Critical Heat Flux (MBtu/hr-ft^2)	Predicted Critical Heat Flux (MBtu/hr-ft^2)	Predicted Critical Heat Flux Location (inches)	Measured-to-Predicted Critical Heat Flux Ratio
30	757	1485.	2.4508	.1352	.4691	.4684	147.	1.0015
31	758	1505.	2.4633	.0998	.5315	.5200	147.	1.0221
32	759	1505.	1.9872	.1701	.3796	.4083	150.	.9296
33	760	1800.	1.9536	.1012	.4126	.4871	144.	.8471
34	761	1800.	1.9687	.0608	.4841	.5422	144.	.8929
35	762	1500.	1.9516	.1198	.4433	.4925	147.	.9000
36	763	1500.	1.9191	.0763	.5186	5687	144.	.9119
37	764	1800.	1.9333	.1538	.3304	.4067	147.	.8124
38	765	2105.	3.4169	.0687	.5900	.5517	144.	1.0694

Table B-12. Local Conditions - Test Section W138

Test Serial No.	Test ID No.	System Pressure (psia)	Local Mass Velocity (Mlbm/hr-ft^2)	Local Equilibrium Quality	Measured Critical Heat Flux (MBtu/hr-ft^2)	Predicted Critical Heat Flux (MBtu/hr-ft^2)	Predicted Critical Heat Flux Location (inches)	Measured-to-Predicted Critical Heat Flux Ratio
01	803	1495.	1.9534	.0374	.5600	.6411	141.	.8735
02	804	1500.	2.4200	.0205	.6263	.6772	141.	.9249
03	805	1500.	2.1512	.0833	.4947	.5595	144.	.8841
04	806	1500.	2.4497	.0691	.5445	.5837	144.	.9328
05	807	1795.	1.9678	.0534	.4996	.5528	144.	.9038
06	808	2100.	2.0010	.0277	.5532	.5585	144.	.9905
07	809	2095.	2.4321	.0000	.6242	.6149	144.	1.0152
08	810	2395.	1.9465	-.0386	.5632	.6039	144.	.9326
09	811	2405.	2.4121	-.0331	.6392	.6347	144.	1.0072
10	812	2405.	1.9283	.0063	.4996	.5453	144.	.9163
11	813	2395.	2.4253	-.0065	.6031	.5998	144.	1.0054
12	814	2115.	1.9484	.0590	.4797	.5068	144.	.9466
13	815	2120.	2.4731	.0279	.5545	.5751	144.	.9642
14	816	2115.	2.9139	.0070	.6471	.6411	141.	1.0094
15	817	1810.	1.9530	.0657	.4457	.5455	141.	.8172
16	818	1805.	3.4420	.0187	.6562	.6659	141.	.9854
17	819	1505.	1.9306	.1423	.3866	.4603	147.	.8398
18	820	1500.	2.5073	.1015	.4710	.5323	144.	.8848
19	821	1515.	3.4638	.0540	.6120	.6319	141.	.9685
20	822	2415.	2.8646	-.0072	.6566	.6290	144.	1.0439
21	823	1510.	3.4490	.1286	.4877	.4680	147.	1.0420
22	824	1805.	3.4984	.0769	.5395	.5519	144.	.9776
23	825	1805.	1.9955	.1115	.3676	.4735	144.	.7763
24	826	2115.	2.0026	.0919	.4099	.4675	144.	.8768
25	827	2105.	2.4435	.0763	.4722	.5067	144.	.9319
26	828	2105.	2.9296	.0613	.5308	.5463	144.	.9716
27	829	2095.	3.4310	.0553	.6006	.5731	144.	1.0480
28	830	2405.	1.9311	.0933	.3942	.4184	150.	.9421
29	831	2395.	2.4059	.0654	.4766	.4779	150.	.9972

| Rev.1

Table B-12. Local Conditions - Test Section W138 (Continued)

Test Serial No.	Test ID No.	System Pressure (psia)	Local Mass Velocity (Mlbm/hr-ft^2)	Local Equilibrium Quality	Measured Critical Heat Flux (MBtu/hr-ft^2)	Predicted Critical Heat Flux (MBtu/hr-ft^2)	Predicted Critical Heat Flux Location (inches)	Measured-to-Predicted Critical Heat Flux Ratio
30	832	2405.	2.9351	.0471	.5769	.5418	147.	1.0647
31	833	2415.	3.3279	.0630	.5783	.5219	150.	1.1080
32	834	2420.	2.9601	.1114	.4665	.4403	150.	1.0596
33	835	2415.	3.3840	.1131	.5117	.4527	150.	1.1301
34	836	2095.	3.0232	.1191	.4151	.4517	147.	.9190
35	837	2100.	3.4391	.1124	.4900	.4706	147.	1.0412
36	838	2105.	2.4690	.0802	.4909	.5022	144.	.9775
37	839	2100.	2.5117	.0317	.5694	.5727	144.	.9942

Table B-13. Local Conditions - Test Section W139

Test Serial No.	Test ID No.	System Pressure (psia)	Local Mass Velocity (Mlbm/hr-ft^2)	Local Equilibrium Quality	Measured Critical Heat Flux (MBtu/hr-ft^2)	Predicted Critical Heat Flux (MBtu/hr-ft^2)	Predicted Critical Heat Flux Location (inches)	Measured-to-Predicted Critical Heat Flux Ratio
01	840	1495.	1.9033	.0864	.4534	.5195	144.	.8727
02	841	1505.	2.3511	.0206	.6283	.6374	141.	.9858
03	842	1500.	1.8211	.0560	.4982	.5617	144.	.8870
04	843	1495.	2.3806	.0792	.5342	.5321	144.	1.0040
05	844	1500.	3.4209	.0548	.6683	.5785	144.	1.1554
06	845	1805.	1.8909	.0346	.4936	.5532	141.	.8923
07	846	2095.	1.8939	.0002	.5350	.5617	141.	.9525
08	847	2095.	2.3396	.0004	.6087	.5771	144.	1.0548
09	848	2395.	1.8944	-.0423	.5590	.5745	144.	.9732
10	849	2410.	2.4005	-.0431	.6534	.6158	144.	1.0610
11	850	1509.	1.8843	.1475	.3949	.4197	147.	.9410
12	851	1495.	2.3485	.1319	.4459	.4383	147.	1.0173
13	852	1505.	3.4532	.0741	.6100	.5427	144.	1.1238
14	853	1805.	3.4334	.0343	.6596	.5874	144.	1.1229
15	854	1805.	1.8734	.0868	.4037	.4714	144.	.8564
16	855	2075.	1.8847	.0446	.4596	.4957	144.	.9272
17	856	2095.	2.3569	.0410	.5416	.5209	144.	1.0397
18	857	2105.	2.8745	.0232	.6311	.5681	144.	1.1108
19	858	2405.	2.3640	.0016	.5839	.5531	144.	1.0557
20	859	2395.	1.8709	.0064	.4957	.5126	144.	.9670
21	860	1800.	1.8493	.1348	.3367	.4100	144.	.8213
22	861	1815.	3.3540	.0835	.5255	.5030	144.	1.0449
23	862	1505.	3.3536	.1434	.4369	.3946	150.	1.1071
24	863	2100.	2.3702	.0726	.4634	.4777	144.	.9700
25	864	2100.	2.9226	.0705	.5329	.4996	144.	1.0666
26	865	2105.	3.3677	.0665	.5740	.5051	147.	1.1365
27	866	2100.	1.8674	.0946	.3690	.4301	144.	.8580
28	867	2400.	1.8940	.0817	.3961	.4137	147.	.9574
29	868	2405.	2.3537	.0665	.4732	.4562	147.	1.0372

Table B-13. Local Conditions - Test Section W139 (Continued)

Test Serial No.	Test ID No.	System Pressure (psia)	Local Mass Velocity (Mlbm/hr-ft^2)	Local Equilibrium Quality	Measured Critical Heat Flux (MBtu/hr-ft^2)	Predicted Critical Heat Flux (MBtu/hr-ft^2)	Predicted Critical Heat Flux Location (inches)	Measured-to-Predicted Critical Heat Flux Ratio
30	869	2405.	2.8801	.0529	.5597	.4996	147.	1.1203
31	870	2405.	2.9403	.1205	.4504	.3977	150.	1.1324
32	871	2405.	3.3929	.0909	.5324	.4669	147.	1.1404
33	872	2105.	3.3990	.1381	.4392	.3858	150.	1.1383
34	873	2085.	2.8619	.1308	.3913	.4005	147.	.9769
35	874	2410.	3.3775	.0385	.6522	.5425	147.	1.2023
36	875	2405.	2.8551	-.0175	.6833	.6112	144.	1.1179
37	876	1500.	2.3507	.0743	.5329	.5389	144.	.9889
38	877	2095.	2.3448	.0445	.5280	.5155	144.	1.0241

Table B-14. Local Conditions - Test Section W153

Test Serial No.	Test ID No.	System Pressure (psia)	Local Mass Velocity (Mlbm/hr-ft^2)	Local Equilibrium Quality	Measured Critical Heat Flux (MBtu/hr-ft^2)	Predicted Critical Heat Flux (MBtu/hr-ft^2)	Predicted Critical Heat Flux Location (inches)	Measured-to-Predicted Critical Heat Flux Ratio
01	1391	1505.	3.0792	.2259	.4604	.3980	168.	1.1567
02	1392	1800.	3.0749	.1856	.4471	.4494	168.	.9949
03	1393	1805.	2.7932	.1942	.3940	.4360	168.	.9036
04	1394	1810.	3.0703	.1732	.4217	.4685	168.	.9001
05	1395	2100.	3.0434	.2049	.4084	.4140	168.	.9866
06	1396	2100.	2.5998	.1548	.3752	.4752	168.	.7896
07	1397	2115.	2.5515	.1656	.4748	.4586	168.	1.0353
08	1398	2100.	2.0681	.2012	.3232	.4014	168.	.8051
09	1399	2100.	2.0395	.1941	.4073	.4094	168.	.9950
10	1400	2400.	3.0344	.2085	.4737	.4110	168.	1.1524
12	1402	2400.	2.5496	.2064	.4172	.3979	168.	1.0485
13	1403	2395.	2.5434	.1559	.5047	.4613	168.	1.0940
14	1404	2400.	2.0235	.1820	.4371	.4050	168.	1.0793
15	1405	2105.	3.0380	.1594	.5312	.4801	168.	1.1065
16	1406	1800.	2.5451	.1502	.4936	.4999	168.	.9874
17	1407	1805.	3.0305	.1404	.5467	.5200	168.	1.0514
18	1408	2405.	2.0680	.0089	.5035	.6052	168.	.8320
19	1409	2105.	2.0206	.1470	.5024	.4653	168.	1.0798
20	1410	1500.	2.0539	.2159	.4604	.4442	168.	1.0364
21	1411	1500.	2.5633	.1901	.5390	.4706	168.	1.1454
22	1412	2405.	1.5800	.1760	.4261	.3865	168.	1.1024
23	1413	2100.	1.5677	.1774	.4062	.4130	168.	.9835
24	1414	2400.	1.5563	.0873	.4715	.4749	168.	.9928
25	1415	2100.	1.5070	.1586	.4648	.4303	168.	1.0801
26	1416	2400.	1.5197	.0133	.4991	.5456	168.	.9148
27	1417	2100.	1.4963	.0945	.4958	.4971	168.	.9974
28	1418	1815.	1.5115	.1428	.4914	.4869	168.	1.0092
29	1419	1500.	1.5360	.1785	.4958	.5043	168.	.9832
30	1420	1795.	1.5046	.1569	.4438	.4741	168.	.9361

Table B-14. Local Conditions - Test Section W153 (Continued)

Test Serial No.	Test ID No.	System Pressure (psia)	Local Mass Velocity (Mlbm/hr-ft^2)	Local Equilibrium Quality	Measured Critical Heat Flux (MBtu/hr-ft^2)	Predicted Critical Heat Flux (MBtu/hr-ft^2)	Predicted Critical Heat Flux Location (inches)	Measured-to-Predicted Critical Heat Flux Ratio
31	1421	1500.	1.4782	.2406	.4239	.4302	168.	.9853
32	1422	1800.	1.4900	.1792	.3918	.4480	168.	.8746
33	1423	1495.	1.5053	.2917	.3851	.3681	168.	1.0461
34	1424	2095.	1.4982	.2360	.3154	.3491	168.	.9036
35	1425	2400.	1.5153	.2215	.3519	.3375	168.	1.0428
36	1426	2415.	1.4904	.0884	.4471	.4664	168.	.9586
37	1427	2405.	3.0368	.1094	.5888	.5460	168.	1.0783
38	1428	2425.	2.5014	.0816	.6131	.5509	168.	1.1130
39	1429	2405.	3.0295	.0444	.6895	.6340	168.	1.0875
40	1430	2400.	2.0005	.0611	.5821	.5404	168.	1.0772
41	1431	2400.	2.4818	.0098	.6585	.6401	168.	1.0288
42	1432	2410.	2.9620	-.0165	.7271	.7114	168.	1.0221
43	1433	2410.	1.9691	.0060	.5921	.5987	168.	.9889

Table B-15. Local Conditions - Test Section W157

Test Serial No.	Test ID No.	System Pressure (psia)	Local Mass Velocity (Mlbm/hr-ft²)	Local Equilibrium Quality	Measured Critical Heat Flux (MBtu/hr-ft²)	Predicted Critical Heat Flux (MBtu/hr-ft²)	Predicted Critical Heat Flux Location (inches)	Measured-to-Predicted Critical Heat Flux Ratio
01	1559	2100.	1.9809	.1423	.5634	.5651	96.	.9969
02	1560	2125.	2.4842	.0818	.6389	.6840	96.	.9341
03	1561	2115.	2.9902	.0618	.6967	.7479	96.	.9315
04	1562	2115.	3.4268	.0575	.7645	.7792	96.	.9812
05	1563	2425.	1.9975	.0467	.5812	.6701	96.	.8673
06	1564	2400.	2.4868	.0417	.6634	.7262	96.	.9135
07	1565	2415.	2.9645	.0101	.8223	.8176	96.	1.0057
08	1566	2405.	3.4498	.0308	.8112	.8212	96.	.9878
09	1567	2400.	1.9895	.2018	.4167	.4565	96.	.9128
10	1568	2400.	2.4497	.1984	.4767	.4842	96.	.9844
11	1569	2405.	2.9493	.1536	.5723	.5795	96.	.9875
12	1570	2415.	3.4735	.1358	.6612	.6364	96.	1.0390
13	1571	2100.	2.0756	.1932	.4111	.4931	96.	.8336
14	1572	2100.	2.5025	.1715	.4734	.5402	96.	.8764
15	1573	2105.	3.0040	.1520	.5200	.5886	96.	.8835
16	1574	2105.	3.4702	.1559	.5567	.5943	96.	.9367
17	1575	2105.	1.9899	.0414	.7356	.7137	96.	1.0306
18	1576	2115.	2.4365	.0274	.8123	.7699	96.	1.0551
19	1577	2100.	2.8881	.0471	.8178	.7690	96.	1.0635
20	1578	2395.	1.9553	.0059	.7690	.7249	96.	1.0608
21	1579	2400.	2.4035	.0015	.8156	.7795	96.	1.0464
22	1580	2405.	2.8664	.0186	.8134	.7957	96.	1.0223
23	1581	2415.	2.4675	.0069	.7067	.7765	96.	.9101
24	1582	2405.	2.9400	.1624	.5545	.5645	96.	.9822
25	1583	2415.	1.0438	.1015	.4589	.4932	96.	.9304
26	1584	2405.	1.5514	.0452	.6312	.6242	96.	1.0112
27	1585	2105.	3.4501	.1615	.5400	.5832	96.	.9260
28	1586	2105.	3.4902	.0553	.7978	.7870	96.	1.0138
29	1587	2115.	1.0544	.2376	.3645	.3974	96.	.9173

Table B-15. Local Conditions - Test Section W157 (Continued)

Test Serial No.	Test ID No.	System Pressure (psia)	Local Mass Velocity (Mlbm/hr-ft^2)	Local Equilibrium Quality	Measured Critical Heat Flux (MBtu/hr-ft^2)	Predicted Critical Heat Flux (MBtu/hr-ft^2)	Predicted Critical Heat Flux Location (inches)	Measured-to-Predicted Critical Heat Flux Ratio
30	1588	2105.	1.5743	.1627	.5056	.5152	96.	.9814
31	1589	2100.	1.0503	.1706	.4589	.4733	96.	.9696
32	1590	2105.	1.5020	.1248	.6167	.5602	96.	1.1008
33	1591	2405.	.9906	.2239	.3411	.3633	96.	.9390
34	1592	2405	1.5040	.1673	.4756	.4691	96.	1.0139
35	1593	1505.	2.0297	.1156	.6834	.7046	96.	.9699
36	1594	1505.	2.4579	.0900	.7734	.7552	96.	1.0240
37	1595	1815.	1.9772	.0897	.6867	.6837	96.	1.0043
38	1596	1815.	2.4834	.0306	.7356	.8075	96.	.9109
39	1597	1815.	1.9990	.1316	.5812	.6186	96.	.9396
40	1598	1800.	2.5180	.1095	.6945	.6723	96.	1.0330
41	1599	1805.	2.9870	.0889	7834	.7230	96.	1.0836
42	1600	1500.	2.0367	.1892	.6067	.5783	96.	1.0490
43	1601	1515.	2.5225	.1436	.6534	.6514	96.	1.0031
44	1602	1500.	3.0041	.1083	.6978	.7234	96.	.9646
45	1603	1515.	3.5125	.0890	.7745	.7654	96.	1.0119
46	1604	1505.	2.0585	.2522	.4823	.4673	96.	1.0322
47	1605	1505.	2.5230	.1893	.5145	.5653	96.	.9101
48	1606	1505.	3.0549	.1659	.5812	.6013	96.	.9666
50	1608	1800.	3.4594	.0940	.7801	.7255	96.	1.0752
51	1609	1520.	3.4932	.1695	.5623	.5842	96.	.9626
53	1611	1795.	1.5563	.2384	.4189	.4570	96.	.9167
54	1612	1805.	2.0972	.1556	.5234	.5839	96.	.8963
55	1613	1805.	2.5460	.1486	.5589	.6031	96.	.9268
56	1614	1815.	3.0007	.1483	.6023	.6087	96.	.9895
57	1615	1805.	3.5493	.1013	.6756	.7121	96.	.9488
58	1616	1805.	1.0879	.2796	.4245	.4075	96.	1.0416
59	1617	1800.	1.5346	.2014	.5200	.5080	96.	1.0236
60	1618	1495.	1.0560	.3357	.4623	.4156	96.	1.1124

Table B-15. Local Conditions - Test Section W157 (Continued)

Test Serial No.	Test ID No.	System Pressure (psia)	Local Mass Velocity (Mlbm/hr-ft^2)	Local Equilibrium Quality	Measured Critical Heat Flux (MBtu/hr-ft^2)	Predicted Critical Heat Flux (MBtu/hr-ft^2)	Predicted Critical Heat Flux Location (inches)	Measured-to-Predicted Critical Heat Flux Ratio
61	1619	1505.	1.4851	.2339	.4934	.5232	96.	.9430
62	1620	1790.	1.0220	.1243	.4945	.5912	96.	.8365
63	1621	1495.	1.9849	.1245	.6856	.6915	96.	.9915
64	1622	1805.	1.4829	.1286	.6723	.6066	96.	1.1083
65	1623	1800.	1.9283	.0649	.7545	.7228	96.	1.0439
66	1624	1510.	1.0550	.2536	.5756	.5144	96.	1.1190
67	1625	1505.	1.5173	.1636	.6923	.6272	96.	1.1037
68	1626	1505.	1.9559	.1126	.7990	.7092	96.	1.1267
69	1627	1495.	2.5106	.2006	.4878	.5454	96.	.8944
70	1628	1805.	2.4469	.0709	.8023	.7369	96.	1.0888
71	1629	1510.	1.0162	.2967	.4845	.4632	96.	1.0459
72	1630	1500.	1.5487	.1989	.6123	.5748	96.	1.0652
73	1631	1805.	1.5148	.1464	.6089	.5833	96.	1.0440
74	1632	1805.	1.0122	.2349	.4489	.4600	96.	.9759
75	1633	2105.	1.0453	.1394	.5534	.5061	96.	1.0934
76	1634	2425.	1.0519	.0976	.5756	.4969	96.	1.1585
77	1635	2405.	1.4584	-.0032	.7256	.6710	96.	1.0814
78	1636	2115.	1.4824	.0623	.7056	.6375	96.	1.1067
79	1637	2110.	2.0035	.0856	.7112	.6489	96.	1.0959

Table B-16. Local Conditions - Test Section W158

Test Serial No.	Test ID No.	System Pressure (psia)	Local Mass Velocity (Mlbm/hr-ft^2)	Local Equilibrium Quality	Measured Critical Heat Flux (MBtu/hr-ft^2)	Predicted Critical Heat Flux (MBtu/hr-ft^2)	Predicted Critical Heat Flux Location (inches)	Measured-to-Predicted Critical Heat Flux Ratio
01	1638	2100.	2.0277	.1400	.5770	.5295	96.	1.0897
02	1639	2105.	2.4921	.0940	.6373	.6228	96.	1.0234
03	1640	2100.	2.9917	.0778	.7221	.6749	96.	1.0699
04	1641	2105.	3.4769	.0698	.8237	.7113	96.	1.1580
05	1642	2395.	2.0349	.0964	.6228	.5677	96.	1.0971
06	1643	2425.	2.5239	.0376	.7177	.6921	96.	1.0370
07	1644	2395.	3.0021	.0360	.7757	.7341	96.	1.0567
08	1645	2435.	3.4525	.0213	.8560	.7913	96.	1.0818
09	1646	2415.	2.0342	.1716	.4732	.4610	96.	1.0265
10	1647	2400.	2.4992	.1194	.4955	.5659	96.	.8756
11	1648	2405.	2.9732	.1198	.5793	.5925	96.	.9778
12	1649	2410.	3.5062	.0807	.6641	.6895	96.	.9632
13	1650	2115.	1.9792	.2007	.3839	.4368	96.	.8788
14	1651	2110.	2.4792	.1707	.4476	.4968	96.	.9010
15	1652	2105.	2.9503	.1704	.5212	.5090	96.	1.0240
16	1653	2100.	3.4723	.1404	.5402	.5766	96.	.9369
17	1654	2115.	2.9811	.0422	.8460	.7367	96.	1.1484
18	1655	2400.	2.9518	-.0036	.8438	.7957	96.	1.0604
19	1656	2100.	1.9981	.0781	.7444	.6197	96.	1.2013
20	1657	2100.	2.4882	.0341	.8226	.7209	96.	1.1410
21	1658	2400.	1.9977	-.0023	.7266	.7015	96.	1.0358
22	1659	2400.	2.4815	-.0371	.8527	.8045	96.	1.0599
23	1660	2315.	1.4939	.0789	.6027	.5513	96.	1.0931
24	1661	2400.	1.0443	.1468	.4743	.4162	96.	1.1395
25	1662	2095.	1.0024	.1562	.4230	.4515	96.	.9370
26	1663	2100.	.9976	.1236	.4855	.4850	96.	1.0011
27	1664	2105.	1.4974	.0589	.6987	.6068	96.	1.1515
28	1665	2100.	2.0029	.0116	.8326	.7184	96.	1.1590
29	1666	2100.	1.5041	.1304	.6105	.5155	96.	1.1843

Rev.1

Table B-16. Local Conditions - Test Section W158 (Continued)

Test Serial No.	Test ID No.	System Pressure (psia)	Local Mass Velocity (Mlbm/hr-ft^2)	Local Equilibrium Quality	Measured Critical Heat Flux (MBtu/hr-ft^2)	Predicted Critical Heat Flux (MBtu/hr-ft^2)	Predicted Critical Heat Flux Location (inches)	Measured-to-Predicted Critical Heat Flux Ratio
30	1667	2115.	1.5093	.1735	.4967	.4580	96.	1.0846
31	1668	2395.	1.5171	.1440	.5045	.4639	96.	1.0875
32	1669	1800.	1.5056	.2098	.3929	.4544	96.	.8647
33	1670	1815.	2.0034	.1807	.4665	.4972	96.	.9382
34	1671	1800.	2.5067	.1429	.5279	.5671	96.	.9308
35	1672	1800.	3.0090	.1260	.5982	.6052	96.	.9884
36	1673	2100.	2.9843	.0834	.7310	.6646	96.	1.0999
37	1674	1825.	3.4819	.1282	.7266	.6057	96.	1.1997
38	1675	1500.	1.5556	.2492	.4241	.4517	95.	.9389
39	1676	1515.	2.0434	.2034	.4654	.5028	96.	.9256
40	1677	1500.	2.5168	.2075	.5491	.4819	96.	1.1395
41	1678	1515.	3.0146	.1501	.5458	.5835	96.	.9354
42	1679	1505.	3.4761	.1414	.5692	.5975	96.	.9526
43	1680	1800.	1.5513	.1825	.5413	.4927	96.	1.0986
44	1681	1800.	1.9788	.1428	.6239	.5587	96	1.1167
45	1682	1815.	2.4875	.0992	.7232	.6419	96.	1.1267
46	1683	1815.	2.9893	.0696	.8103	.7116	96.	1.1387
47	1684	1800.	3.5120	.0765	.8237	.7140	96.	1.1536
48	1685	1500.	1.5100	.2224	.5257	.4943	96.	1.0636
49	1686	1505.	2.0144	.1612	.6072	.5781	96.	1.0503
50	1687	1505.	2.5096	.1234	.6831	.6426	96.	1.0630
51	1688	1505.	2.9976	.1110	.7612	.6666	96.	1.1419
52	1689	1510.	3.4924	.0711	.7947	.7549	96.	1.0528
53	1690	1805.	1.5179	.1273	.6462	.5681	96.	1.1374
54	1691	1800.	1.9923	.1000	.7846	.6267	96.	1.2520
55	1692	1805.	2.4615	.0536	.8706	.7220	96.	1.2058
57	1694	1500.	1.9827	.1411	.7534	.6139	96.	1.2271
58	1695	1495.	2.4776	.1005	.8226	.6882	96.	1.1953
60	1697	2405.	1.5073	-.0085	.7076	.6487	96.	1.0908

Table B-16. Local Conditions - Test Section W158 (Continued)

Test Serial No.	Test ID No.	System Pressure (psia)	Local Mass Velocity (Mlbm/hr-ft^2)	Local Equilibrium Quality	Measured Critical Heat Flux (MBtu/hr-ft^2)	Predicted Critical Heat Flux (MBtu/hr-ft^2)	Predicted Critical Heat Flux Location (inches)	Measured-to-Predicted Critical Heat Flux Ratio
61	1698	1500.	1.0057	.2765	.4710	.4477	96.	1.0521
62	1699	1810.	1.0149	.1800	.4598	.4831	96.	.9518
63	1700	1795.	1.0128	.1458	.5368	.5257	96.	1.0211
64	1701	1805.	1.4799	.0976	.7154	.6074	96.	1.1777
65	1702	1505.	1.0176	.2160	.5793	.5200	96.	1.1140
66	1703	1505.	1.5034	.1385	.7132	.6185	96.	1.1530
67	1704	1505.	2.0000	.0981	.8583	.6865	96.	1.2502
68	1705	1815.	1.9512	-.0064	.8081	.7888	96.	1.0244

Table B-17. Local Conditions - Test Section W160

Test Serial No.	Test ID No.	System Pressure (psia)	Local Mass Velocity (Mlbm/hr-ft²)	Local Equilibrium Quality	Measured Critical Heat Flux (MBtu/hr-ft²)	Predicted Critical Heat Flux (MBtu/hr-ft²)	Predicted Critical Heat Flux Location (inches)	Measured-to-Predicted Critical Heat Flux Ratio
01	1720	1800.	1.4764	.2001	.5172	.5441	96.	.9506
02	1721	1800.	2.0178	.1407	.6123	.6438	96.	.9510
03	1722	1800.	2.4856	.1122	.7040	.7050	96.	.9986
04	1723	1800.	2.9780	.0888	.8101	.7631	96.	1.0616
05	1724	2415.	1.4262	.1655	.5040	.4931	96.	1.0222
06	1725	2400.	2.5218	.0255	.6874	.7895	96.	.8706
07	1726	2400.	2.5121	.0756	.7460	.7114	96.	1.0486
08	1727	2415.	3.0018	.0539	.8532	.7852	96.	1.0866
09	1728	2115.	1.4802	.1867	.4819	.5096	96.	.9456
10	1729	2115.	2.0147	.1568	.5902	.5783	96.	1.0206
11	1730	2100.	2.5035	.1221	.6654	.6577	96.	1.0132
12	1731	2105.	2.9837	.1047	.7560	.7101	96.	1.0646
13	1732	2115.	1.9911	.2139	.4178	.4931	96.	.8472
14	1733	2105.	1.4904	.1723	.6167	.5301	96.	1.1633
15	1734	2100.	1.9843	.0937	.7549	.6713	96.	1.1245
16	1735	2100.	2.4914	.0610	.8831	.7571	96.	1.1664
17	1736	2105.	2.9681	.0487	.9936	.8086	96.	1.2288
18	1737	2415.	1.4999	.0995	.6465	.5802	96.	1.1143
19	1738	2405.	1.9943	.0245	.7957	.7352	96.	1.0823
20	1739	2415.	2.4771	-.0182	.9251	.8507	96.	1.0874
21	1740	1815.	1.4977	.1589	.6576	.5983	96.	1.0992
22	1741	1815.	1.9736	.1113	.7736	.6863	96.	1.1272
23	1742	1815.	2.4560	.0785	.8930	.7608	96.	1.1738
24	1743	1815.	2.9716	.0514	.9549	.8325	96.	1.1470
25	1744	1805.	1.4552	.1616	.7084	.5952	96.	1.1903
26	1745	1800.	1.9321	.0894	.8013	.7214	96.	1.1108
27	1746	2095.	1.4480	.1093	.7195	.6065	96.	1.1805
28	1747	2400.	1.4728	.0416	.7239	.6492	96.	1.1150
29	1748	1515.	1.4610	.2076	.6222	.5988	96.	1.0391

Table B-17. Local Conditions - Test Section W160 (Continued)

Test Serial No.	Test ID No.	System Pressure (psia)	Local Mass Velocity (Mlbm/hr-ft^2)	Local Equilibrium Quality	Measured Critical Heat Flux (MBtu/hr-ft^2)	Predicted Critical Heat Flux (MBtu/hr-ft^2)	Predicted Critical Heat Flux Location (inches)	Measured-to-Predicted Critical Heat Flux Ratio
30	1749	1515.	1.9766	.1315	.7095	.7147	96.	.9927
31	1750	1500.	2.4680	.1070	.8245	.7653	96.	1.0774
32	1751	1505.	2.9411	.0788	.9284	.8256	96.	1.1245
33	1752	1505.	1.4881	.2513	.5139	.5359	96.	.9589
34	1753	1505.	2.0133	.1700	.5614	.6510	96.	.8623
35	1754	1515.	2.4943	.1427	.6797	.6943	96.	.9789
36	1755	1525.	2.9879	.1200	.7504	.7371	96.	1.0180
37	1756	1500.	2.0643	.2265	.4741	.5529	96.	.8574
38	1757	1515.	2.5604	.1720	.4896	.6375	96.	.7680
39	1758	1500.	3.0669	.1562	.5736	.6645	96.	.8632
40	1759	2125.	2.5108	.1622	.4730	.5907	96.	.8008
41	1760	2100.	3.0540	.1458	.5438	.6397	96.	.8501
42	1761	2415.	2.0300	.1673	.4841	.5389	96.	.8984
43	1762	2425.	2.5326	.1655	.5802	.5734	96.	1.0119
44	1763	3415.	3.0358	.1367	.6454	.6787	96.	.9509
45	1764	2405.	3.4860	.1461	.7217	.6574	96.	1.0978
46	1765	2115.	3.4865	.1457	.5968	.6538	96.	.9128
48	1767	1800.	2.0271	.1812	.4763	.5795	96.	.8219
49	1768	1815.	2.5382	.1462	.5404	.6446	96.	.8384
50	1769	1815.	3.0443	.1241	.6410	.6956	96.	.9215
51	1770	1815.	3.5307	.1167	.6731	.7201	96.	.9347
52	1771	1515.	3.0883	.1718	.6134	.6293	96.	.9748
53	1771	2115.	3.4557	.1073	.8145	.7257	96.	1.1224
54	1772	2410.	3.5302	.0397	.9461	.8503	96.	1.1127
55	1773	2400.	2.4904	.0913	.7549	.6855	96.	1.1012
56	1774	1515.	3.4681	.0968	.7991	.7904	96.	1.0110
57	1775	1815.	3.4634	.0748	.9173	.8047	96.	1.1400
58	1776	1515.	1.4710	.1745	.6731	.6473	96.	1.0399
59	1777	1510.	1.9543	.1227	.8234	.7307	96.	1.1268

Table B-17. Local Conditions - Test Section W16G (Continued)

Test Serial No.	Test ID No.	System Pressure (psia)	Local Mass Velocity (Mlbm/hr-ft^2)	Local Equilibrium Quality	Measured Critical Heat Flux (MBtu/hr-ft^2)	Predicted Critical Heat Flux (MBtu/hr-ft^2)	Predicted Critical Heat Flux Location (inches)	Measured-to-Predicted Critical Heat Flux Ratio
60	1778	1505.	1.0130	.2820	.5847	.5199	96.	1.1246
61	1779	1800.	1.0253	.2003	.5592	.5337	96.	1.0479
62	1780	2100.	1.0047	.1952	.5747	.4723	96.	1.2168
63	1781	2365.	.997[illegible]	.1479	.5614	.4740	96.	1.1845
64	1782	2415.	.9999	.1739	.4808	.4397	96.	1.0934
65	1783	2100.	1.0019	.2192	.4752	.4463	96.	1.0647
66	1784	1785.	1.0060	.2568	.4918	.4720	96.	1.0419
67	1785	1501.	1.0939	.2658	.5128	.5368	96.	.9552

Table B-18. Local Conditions - Test Section W161

Test Serial No.	Test ID No.	System Pressure (psia)	Local Mass Velocity (Mlbm/hr-ft^2)	Local Equilibrium Quality	Measured Critical Heat Flux (MBtu/hr-ft^2)	Predicted Critical Heat Flux (MBtu/hr-ft^2)	Predicted Critical Heat Flux Location (inches)	Measured-to-Predicted Critical Heat Flux Ratio
01	1796	2115.	2.0368	.2422	.2984	.3787	168.	7879
02	1797	2400.	2.0529	.2157	.3139	.3952	168.	.7943
03	1798	2400.	2.0312	.1623	.4071	.4550	168.	.8948
04	1799	2100	2.0081	.1934	.3771	.4379	168.	.8612
05	1800	2200.	2.0184	.1282	.4415	.5079	168.	.8693
06	1801	2415.	1.9832	.1349	.4792	.4820	168.	.9943
07	1802	2415.	2.0303	.1084	.5613	.5152	168.	1.0896
08	1803	2100.	2.0145	.1368	.4437	.5063	168.	.8764
09	1804	2100.	2.5219	.2187	.3328	.4177	168.	.7967
10	1805	2400.	2.5482	.1895	.3649	.4483	168.	.8139
11	1806	2100.	3.0441	.1926	.3915	.4635	168.	.8446
12	1807	2400.	3.0386	.1825	.4204	.4775	168.	.8805
13	1808	2100.	1.5088	.2555	.3228	.3548	168.	.9098
14	1809	2400.	1.5011	.2332	.3217	.3498	168.	.9196
15	1810	2400.	2.5215	.1402	.4614	.5090	168.	.9066
16	1811	2100.	2.5120	.1678	.4193	.4854	168.	.8638
17	1812	2100.	1.5224	.2049	.3793	.4086	168.	.9282
18	1813	2400.	1.4617	.1984	.3694	.3819	168.	.9673
19	1814	2100.	1.5002	.1727	.4348	.4417	168.	.9845
20	1815	2400.	1.5076	.1443	.4625	.4386	168.	1.0544
21	1816	1500.	1.5084	.2829	.4282	.4098	168.	1.0450
22	1817	1500.	2.0349	.1988	.4947	.5020	168.	.9854
23	1818	1800.	1.4924	.2273	.4004	.4230	168.	.9466
24	1819	1800.	2.0468	.1671	.4770	.5012	168.	.9516
25	1820	2410.	2.4829	.1153	.5757	.5374	168.	1.0712
26	1821	2410.	2.9979	.1395	.5457	.5341	168.	1.0218
27	1822	2405.	3.5544	.2062	.4171	.4617	168.	.9034
28	1823	2400.	3.5666	.1820	.4947	.4973	168.	.9948
29	1824	2100.	3.5227	.1883	.4293	.4784	168.	.8973

Table B-18. Local Conditions - Test Section W161 (Continued)

Test Serial No.	Test ID No.	System Pressure (psia)	Local Mass Velocity (Mlbm/hr-ft²)	Local Equilibrium Quality	Measured Critical Heat Flux (MBtu/hr-ft²)	Predicted Critical Heat Flux (MBtu/hr-ft²)	Predicted Critical Heat Flux Location (inches)	Measured-to-Predicted Critical Heat Flux Ratio
30	1825	2100.	2.9574	.1697	.4404	.4948	168.	.8900
31	1826	2100.	3.5324	.1555	.5169	.5298	168.	.9756
32	1827	2100.	2.9632	.1530	.5169	.5190	168.	.9959
33	1828	2100.	2.5021	.1273	.5136	.5391	168.	.9527
34	1829	2105.	1.0100	.3027	.2939	.2985	168.	.9845
35	1830	2415.	1.0113	.2913	.2984	.2694	168.	1.1078
36	1831	2100.	2.0110	.1413	.5058	.5007	168.	1.0102
37	1832	2100.	2.4566	.1119	.5735	.5576	168.	1.0285
38	1833	2085.	.9713	.3033	.3172	.3002	168.	1.0568
39	1834	2415.	.9891	.2833	.3328	.2742	168.	1.2137
40	1835	2100.	2.0247	.12[illegible]7	.5402	.5250	168.	1.0290
41	1836	2100.	1.0191	.2617	.3671	.3355	168.	1.0943
43	1838	2100.	1.5775	.1313	.4714	.4899	168.	.9623
44	1839	2400.	1.5752	.1548	.5014	.4332	168.	1.1574
45	1840	2405.	2.5132	.1338	.5224	.5163	168.	1.0117
46	1841	1805.	1.4851	.2841	.3361	.3588	168.	.9367
47	1842	1805.	2.0301	.2145	.3727	.4390	168.	.8490
48	1843	1805.	2.4923	.1996	.4215	.4600	168.	.9163
49	1844	1805.	3.0253	.1451	.5102	.5454	168.	.9355
50	1845	1510.	1.4646	.3211	.3572	.3643	168.	.9804
51	1846	1505.	2.0349	.2355	.4182	.4496	168.	.9301
52	1847	1505.	2.5181	.2078	.4659	.4773	168.	.9760
53	1848	1505.	3.0191	.1720	.5380	.5264	168.	1.0219
54	1849	1505.	3.4862	.1740	.5546	.5162	168.	1.0745
56	1851	1505.	1.0376	.3744	.3394	.3397	168.	.9992
57	1852	1805.	1.0007	.3523	.3128	.3016	168.	1.0370
58	1853	1505.	2.5192	.1712	.5535	.5344	168.	1.0358
59	1854	1800.	2.5106	.1536	.5231	.5264	168.	1.0052
60	1855	1800.	3.0392	.1826	.4648	.4870	168.	.9544

Table B-18. Local Conditions - Test Section W161 (Continued)

Test Serial No.	Test ID No.	System Pressure (psia)	Local Mass Velocity ($Mlbm/hr-ft^2$)	Local Equilibrium Quality	Measured Critical Heat Flux ($MBtu/hr-ft^2$)	Predicted Critical Heat Flux ($MBtu/hr-ft^2$)	Predicted Critical Heat Flux Location (inches)	Measured-to-Predicted Critical Heat Flux Ratio
61	1856	1800.	3.5296	.1602	.5169	.5255	168.	.9835
62	1857	1500.	3.5889	.2041	.5058	.4591	168.	1.1017
63	1858	1510.	3.0835	.2354	.4681	.4161	168.	1.1249
64	1859	1500.	.9987	.3636	.3572	.3552	168.	1.0055
65	1860	1800.	.9724	.3000	.3439	.3514	168.	.9787
66	1861	1805.	1.4708	.1910	.4526	.4625	168.	.9787
67	1862	1505.	1.4799	.2633	.4692	.4338	168.	1.0817
68	1863	1805.	1.9815	.1436	.5291	.5297	168.	.9989
69	1864	1500.	1.9826	.1854	.5213	.5217	168.	.9992
70	1865	2095.	2.0162	.1935	.3782	.4384	168.	.8627
71	1866	2105.	2.0259	.1694	.4526	.4670	168.	.9692

Table B-19. Local Conditions - Test Section W162

Test Serial No.	Test ID No.	System Pressure (psia)	Local Mass Velocity (Mlbm/hr-ft^2)	Local Equilibrium Quality	Measured Critical Heat Flux (MBtu/hr-ft^2)	Predicted Critical Heat Flux (MBtu/hr-ft^2)	Predicted Critical Heat Flux Location (inches)	Measured-to-Predicted Critical Heat Flux Ratio
01	1867	2100.	1.9234	.0706	.4863	.5245	123.	.9271
02	1868	2400.	1.9656	.0441	.5042	.5244	126.	.9615
03	1869	2405.	2.4254	.0006	.6160	.6288	123.	.9797
04	1870	2100.	2.4546	.0294	.6078	.6241	120.	.9739
05	1871	2100.	2.4703	.0442	.5080	.6172	117.	.8231
06	1872	2400.	2.4487	.0537	.5031	.5526	123.	.9104
07	1873	2400.	2.9577	.0320	.6229	.6285	120.	.9910
08	1874	2105.	2.9299	.0470	.5699	.6172	120.	.9235
09	1875	2395.	1.9645	.0392	.4460	.5543	120.	.8047
10	1876	2115.	1.9411	.0957	.3993	.5024	120.	.7948
11	1877	2090.	3.4298	.0622	.5863	.6109	120.	.9597
12	1878	2100.	1.9889	.2054	.2914	.3297	129.	.8840
13	1879	2410.	1.9866	.1693	.3248	.3546	129.	.9160
14	1880	2400.	2.4601	.1108	.3831	.4736	123.	.8089
15	1881	2100.	2.4674	.1629	.3608	.4029	126.	.8953
16	1882	2095.	2.9415	.1440	.4059	.4534	123.	.8953
17	1883	2400.	2.9752	.1320	.4439	.4512	126.	.9839
18	1884	2395.	3.4340	.1266	.5008	.4742	126.	1.0562
19	1885	2110.	3.4149	.1262	.4491	.4897	123.	.9172
20	1886	1500.	1.9949	.2506	.3087	.3142	132.	.9825
21	1887	1805.	1.9761	.1974	.3130	.3745	126.	.8357
22	1888	1800.	2.5198	.1504	.3759	.4535	123.	.8289
23	1889	1500.	2.4645	.2241	.3431	.3331	132.	1.0300
24	1890	1505.	2.9721	.1771	.4052	.4196	126.	.9656
25	1891	1805.	2.9650	.1289	.4334	.5055	120.	.8573
26	1892	1800.	3.4805	.1136	.4839	.5361	120.	.9026
27	1893	1505.	3.4673	.1633	.4404	.4344	126.	1.0139
28	1894	1500.	1.9779	.1834	.3915	.4289	126.	.9129
29	1895	1800.	1.9807	.1335	.4203	.4721	123.	.8904

Table B-19. Local Conditions - Test Section W162 (Continued)

Test Serial No.	Test ID No.	System Pressure (psia)	Local Mass Velocity (Mlbm/hr-ft^2)	Local Equilibrium Quality	Measured Critical Heat Flux (MBtu/hr-ft^2)	Predicted Critical Heat Flux (MBtu/hr-ft^2)	Predicted Critical Heat Flux Location (inches)	Measured-to-Predicted Critical Heat Flux Ratio
30	1896	1800.	2.4399	.0923	.4940	.5551	120.	.8900
31	1897	1500.	2.4438	.1513	.4551	.4834	123.	.9415
32	1898	1505.	2.9447	.1149	.5256	.5555	120.	.9462
33	1899	1805.	2.9551	.0490	.5703	.6551	117.	.8705
34	1900	2120.	2.8925	.0690	.5752	.5642	123.	1.0195
35	1901	1795.	3.4406	.0452	.6366	.6758	117.	.9420
36	1902	2125.	2.9474	.0897	.4827	.5490	120.	.8791
37	1903	2405.	2.4718	.0677	.4523	.5475	120.	.8261
38	1904	2100.	2.4678	.1323	.4155	.4580	123.	.9073
39	1905	2425.	2.9517	.0841	.5127	.5331	123.	.9616
40	1906	2100.	1.9795	.1407	.3410	.4330	123.	.7877
41	1907	2400.	1.9873	.1195	.3596	.4270	126.	.8422
42	1908	2105.	3.4476	.0739	.5307	.5915	120.	.8972
43	1909	2410.	3.4733	.0638	.5908	.5879	123.	1.0048
44	1910	1500.	3.4874	.0716	.5809	.6556	117.	.8860
45	1911	1500.	1.9761	.1590	.4678	.4634	126.	1.0095
46	1912	1800.	1.9664	.0981	.4911	.5223	123.	.9402
47	1913	1805.	2.4312	.0336	.6008	.6645	117.	.9042
48	1914	1505.	2.4074	.1116	.5620	.5466	123.	1.0283
49	1915	1505.	2.9152	.0739	.6040	.6288	120.	.9605
50	1916	1810.	2.9423	.0311	.6393	.6856	117.	.9324
51	1917	1510.	1.4700	.2408	.3006	.3420	132.	.8790
52	1918	1805.	1.4709	.1798	.3335	.3948	126.	.8448
53	1919	2100.	1.4811	.1827	.3172	.3457	129.	.9175
54	1920	2410.	1.4484	.1945	.2930	.2862	135.	1.0237
55	1921	2400.	1.4488	.1006	.3667	.4099	129.	.8946
56	1922	2105.	1.4493	.1915	.3318	.3136	135.	1.0579
57	1923	1805.	1.4643	.1640	.3807	.4022	129.	.9466
58	1924	1515.	1.4796	.2206	.3502	.3645	132.	.9608

Table B-19. Local Conditions - Test Section W162 (Continued)

Test Serial No.	Test ID No.	System Pressure (psia)	Local Mass Velocity (Mlbm/hr-ft^2)	Local Equilibrium Quality	Measured Critical Heat Flux (MBtu/hr-ft^2)	Predicted Critical Heat Flux (MBtu/hr-ft^2)	Predicted Critical Heat Flux Location (inches)	Measured-to-Predicted Critical Heat Flux Ratio
59	1925	2105.	.9877	.2470	.2393	.2335	141.	1.0248
60	1926	2385.	1.0016	.2014	.2516	.2478	141.	1.0155
61	1927	2105.	1.4495	.0734	.4347	.4852	126.	.8959
62	1928	2405.	1.4497	.1120	.3897	.3773	135.	1.0328
63	1929	2105.	1.9774	.0131	.5939	.6208	120.	.9567
64	1930	2405.	1.9749	.0285	.5565	.5458	126.	1.0196
65	1931	1805.	1.0067	.2356	.2749	.2916	138.	.9429
66	1932	1505.	1.0045	.3286	.2381	.2256	144.	1.0553
67	1933	1505.	1.4670	.1922	.4008	.4021	132.	.9968
68	1934	1800.	1.4127	.1480	.4291	.4224	129.	1.0158
69	1935	1795.	1.9505	.0425	.5913	.6188	120.	.9555
70	1936	1500.	1.9475	.1247	.5417	.5152	126.	1.0514

Table B-20. Local Conditions - Test Section W163

Test Serial No.	Test ID No.	System Pressure (psia)	Local Mass Velocity (Mlbm/hr-ft^2)	Local Equilibrium Quality	Measured Critical Heat Flux (MBtu/hr-ft^2)	Predicted Critical Heat Flux (MBtu/hr-ft^2)	Predicted Critical Heat Flux Location (inches)	Measured-to-Predicted Critical Heat Flux Ratio
01	1937	1805.	1.4880	.2107	.5415	.5287	96.	1.0242
02	1938	1800.	2.0690	.1429	.6289	.6417	96.	.9801
03	1939	1805.	2.5116	.1041	.6985	.7194	96.	.9709
04	1940	2405.	1.4347	.1599	.5250	.5017	96.	1.0464
05	1941	2405.	1.9991	.1247	.6366	.5966	96.	1.0671
06	1942	2410.	2.5085	.0783	.7493	.7064	96.	1.0608
07	1943	2115.	1.5580	.1382	.4542	.5774	96.	.7866
08	1944	2100.	2.0657	.1513	.5935	.5905	96.	1.0051
09	1945	2100.	2.5345	.1128	.6421	.6746	96.	.9519
10	1946	2115.	2.9957	.1030	.7549	.7132	96.	1.0585
11	1947	2115.	1.5195	.1669	.6233	.5374	96.	1.1598
12	1948	2100.	2.0469	.0831	.7493	.6915	96.	1.0836
13	1949	2405.	1.5287	.1035	.6598	.5797	96.	1.1382
14	1950	2405.	2.0608	.0487	.8190	.7087	96.	1.1557
15	1951	1815.	1.5238	.1542	.6543	.6057	96.	1.0803
16	1952	1810.	2.0291	.0933	.7869	.7180	96.	1.0960
17	1953	1815.	1.5276	.1319	.7073	.6368	96.	1.1107
18	1954	1820.	1.9713	.0938	.8002	.7127	96.	1.1227
19	1955	2100.	1.5093	.1194	.7427	.6006	96.	1.2365
20	1956	2405.	1.5280	.0756	.7560	.6140	96.	1.2313
21	1957	1505.	1.5299	.1990	.6510	.6127	96.	1.0626
22	1958	1505.	2.0249	.1281	.7106	.7232	96.	.9826
23	1959	1495.	1.5245	.2471	.5338	.5430	96.	.9830
24	1960	1505.	2.0572	.1795	.5913	.6340	96.	.9327
25	1961	1515.	2.5304	.1430	.6874	.6936	96.	.9911
26	1962	1505.	3.0144	.1149	.7339	.7510	96.	.9772
27	1963	2095.	3.0540	.1582	.5637	.6176	96.	.9128
28	1964	2395.	2.1048	.1527	.4874	.5660	96.	.8611
29	1965	2405.	2.5717	.1374	.5802	.6200	96.	.9359

Table B-20. Local Conditions - Test Section W163 (Continued)

Test Serial No.	Test ID No.	System Pressure (psia)	Local Mass Velocity (Mlbm/hr-ft^2)	Local Equilibrium Quality	Measured Critical Heat Flux (MBtu/hr-ft^2)	Predicted Critical Heat Flux (MBtu/hr-ft^2)	Predicted Critical Heat Flux Location (inches)	Measured-to-Predicted Critical Heat Flux Ratio
30	1966	2405.	3.0668	.1302	.6521	.6623	96.	.9847
31	1967	1805.	2.0775	.1830	.5117	.5765	96.	.8876
32	1968	1805.	2.5632	.1495	.5681	.6402	96.	.8873
33	1969	1815.	3.0434	.1255	.6344	.6929	96.	.9156
34	1970	1505.	3.1016	.1637	.6222	.6474	96.	.9610
35	1971	1495.	2.5846	.2254	.5703	.5363	96.	1.0633
36	1972	1815.	2.5201	.1383	.7361	.6581	96.	1.1185
37	1973	2100.	1.5227	.2246	.5029	.4645	96.	1.0826
38	1974	1505.	3.0239	.1087	.7372	.7640	96.	.9649
39	1975	1810.	1.0622	.1554	.5592	.5849	96.	.9560
40	1976	2100.	1.0615	.1721	.5935	.5019	96.	1.1826
41	1977	2400.	1.0287	.1489	.5802	.4711	96.	1.2315

Table B-21. Local Conditions - Test Section W164

Test Serial No.	Test ID No.	System Pressure (psia)	Local Mass Velocity (Mlbm/hr-ft^2)	Local Equilibrium Quality	Measured Critical Heat Flux (MBtu/hr-ft^2)	Predicted Critical Heat Flux (MBtu/hr-ft^2)	Predicted Critical Heat Flux Location (inches)	Measured-to-Predicted Critical Heat Flux Ratio
01	1979	2100.	1.4331	.1398	.3844	.4343	126.	.8851
02	1980	2105.	1.9421	.0830	.4810	.5416	123.	.8881
03	1981	2100.	2.4667	.0442	.6119	.6388	120.	.9579
04	1982	2395.	1.4330	.1158	.3665	.4196	129.	.8735
05	1983	2415.	1.9067	.0988	.4661	.4671	129.	.9978
06	1984	2415.	2.4665	.0435	.5874	.5888	126.	.9976
07	1985	2400.	1.4481	.1661	.3086	.3632	129.	.8496
08	1986	2425.	1.9837	.1038	.4117	.4762	126.	.8646
09	1987	2400.	2.4878	.0514	.5326	.6075	120.	.8767
10	1988	2405.	2.9523	.0742	.5716	.5689	126.	1.0048
11	1989	2115.	1.4166	.2722	.2466	.2452	138.	1.0058
12	1990	2110.	2.0186	.0816	.4335	.5752	117.	.7536
13	1991	2105.	2.4776	.0723	.4873	.5959	120.	.8177
14	1992	2115.	2.9703	.0667	.5804	.6245	120.	.9294
15	1993	2100.	3.4311	.0619	.6119	.6505	120.	.9407
16	1994	2395.	3.4559	.0568	.6220	.6542	120.	.9508
17	1995	2400.	1.9955	.1419	.3221	.4304	126.	.7483
18	1996	2405.	2.4586	.1418	.3697	.4512	126.	.8195
19	1997	2400.	2.9669	.1038	.4696	.5581	120.	.8414
20	1998	2395.	3.5103	.0820	.5238	.6168	120.	.8492
21	1999	2100.	1.9862	.2052	.2937	.3735	126.	.7864
22	2000	2095.	2.5016	.1670	.3629	.4316	126.	.8409
23	2001	2110.	2.9841	.1607	.3946	.4498	126.	.8774
24	2002	2100.	3.4955	.1180	.4847	.5607	120.	.8646
25	2003	1795.	1.9952	.2078	.3209	.3957	126.	.8109
26	2004	1805.	2.5624	.1606	.3853	.4751	123.	.8109
27	2005	1800.	2.9996	.1456	.4152	.5012	123.	.8284
28	2006	1805.	3.4987	.1268	.4961	.5537	120.	.8960
29	2007	1505.	3.4530	.1596	.4511	.4979	123.	.9060

Table B-21. Local Conditions - Test Section W164 (Continued)

Test Serial No.	Test ID No.	System Pressure (psia)	Local Mass Velocity (Mlbm/hr-ft²)	Local Equilibrium Quality	Measured Critical Heat Flux (MBtu/hr-ft²)	Predicted Critical Heat Flux (MBtu/hr-ft²)	Predicted Critical Heat Flux Location (inches)	Measured-to-Predicted Critical Heat Flux Ratio
30	2008	1500.	2.0266	.2608	.3096	.3342	132.	.9263
31	2009	1500.	2.5275	.2158	.3579	.3930	129.	.9107
32	2010	1510.	3.0027	.1833	.4117	.4468	126.	.9214
33	2011	1505.	1.4425	.3043	.2616	.2786	138.	.9389
34	2012	1500.	2.0236	.2130	.3783	.4082	129.	.9268
35	2013	1500.	2.5135	.1585	.4834	.5098	123.	.9483
36	2014	1505.	2.9773	.1363	.5241	.5409	123.	.9690
37	2015	1510.	3.5203	.1081	.5943	.6075	120.	.9783
38	2016	1805.	1.4539	.2407	.2905	.3313	132.	.8769
39	2017	1800.	1.9836	.1623	.4128	.4534	126.	.9104
40	2018	1800.	2.4900	.1194	.4942	.5356	123.	.9227
41	2019	1815.	2.9218	.1036	.5439	.5832	120.	.9326
42	2020	1805.	3.4139	.0572	.6410	.6941	117.	.9235
43	2021	2105.	2.9194	.0366	.6013	.6897	117.	.8719
44	2022	1800.	2.9387	.0479	.6304	.6981	117.	.9029
45	2023	1500.	1.4501	.2462	.3429	.3700	132.	.9268
46	2024	1510.	1.9169	.1392	.4415	.4413	129.	1.0004
47	2025	1500.	2.4642	.1243	.5624	.5655	123.	.9946
48	2026	1500.	2.9522	.0916	.6547	.6392	120.	1.0243
49	2027	1802.	1.4418	.1891	.3654	.4033	129.	.9061
50	2028	1805.	1.9296	.1450	.4786	.4759	126.	1.0058
51	2029	1810.	2.4465	.0567	.5981	.6494	120.	.9211
52	2030	1790.	1.4470	.1996	.3823	.3798	132.	1.0067
53	2031	1815.	1.9230	.1463	.5004	.4591	129.	1.0898
54	2032	2405.	1.4263	.1188	.3930	.3946	135.	.9960
55	2033	2405.	1.9032	.0752	.5368	.4986	129.	1.0766
56	2034	2405.	.9832	.2288	.2425	.2412	141.	1.0054
57	2035	2100.	.9917	.2472	.2695	.2560	141.	1.0529
58	2036	2405.	1.3976	.1155	.4072	.3968	135.	1.0263

Table B-21. Local Conditions - Test Section W164 (Continued)

Test Serial No.	Test ID No.	System Pressure (psia)	Local Mass Velocity (Mlbm/hr-ft^2)	Local Equilibrium Quality	Measured Critical Heat Flux (MBtu/hr-ft^2)	Predicted Critical Heat Flux (MBtu/hr-ft^2)	Predicted Critical Heat Flux Location (inches)	Measured-to-Predicted Critical Heat Flux Ratio
59	2037	2205.	1.3990	.0714	.4661	.5023	126.	.9280
60	2038	2090.	.9893	.2435	.2563	.2708	138.	.9463
61	2039	1805.	.9781	.2322	.2853	.3330	135.	.8567
62	2040	1505.	.9934	.3510	.2335	.2319	144.	1.0069
63	2041	1800.	1.4024	.1644	.4168	.4336	129.	.9613
64	2042	1505.	1.4269	.2163	.3994	.4060	132.	.9837
65	2043	1800.	1.8879	.0783	.5564	.5855	123.	.9503
66	2044	1505.	1.8894	.1669	.5068	.4745	129.	1.0681
67	2045	1505.	2.4303	.1132	.5995	.5835	123.	1.0276
68	2046	1800.	.9630	.2209	.3051	.3457	135.	.8827
69	2047	1505.	.9938	.3318	.2560	.2480	144.	1.0325
70	2048	2395.	.9808	.2156	.2752	.2542	141.	1.0826
71	2049	2110.	2.9254	.0794	.6210	.5864	123.	1.0591
72	2050	2105.	1.9909	.0646	.5061	.5839	120.	.8668
74	2052	2100.	1.4140	.1940	.3278	.3373	135.	.9718

Rev.1

Table B-22. Local Conditions - Test Section W166

Test Serial No.	Test ID No.	System Pressure (psia)	Local Mass Velocity ($Mlbm/hr-ft^2$)	Local Equilibrium Quality	Measured Critical Heat Flux ($MBtu/hr-ft^2$)	Predicted Critical Heat Flux ($MBtu/hr-ft^2$)	Predicted Critical Heat Flux Location (inches)	Measured-to Predicted Critical Heat Flux Ratio
01	14	1500.	3.4460	.1572	.4585	.4056	150.	1.1305
02	15	1800.	3.5132	.1019	.5107	.4955	147.	1.0308
03	16	2110.	3.5251	.0780	.5525	.5247	147.	1.0530
04	17	2405.	3.5894	.0386	.6419	.5848	147	1.0975
06	19	2101.	2.9382	.1090	.4905	.4492	150.	1.0919
07	20	2100.	2.4910	.0939	.4411	.4716	147.	.9352
08	21	2400.	2.4560	.0687	.4817	.4758	150.	1.0124
09	22	2400.	2.0248	.1057	.4089	.4087	150.	1.0004
10	23	2405.	3.0185	.0799	.4759	.4996	147.	.9527
11	24	2100.	2.9463	.1420	.3847	.4040	150.	.9521
12	25	2100.	3.5300	.1242	.4674	.4396	150.	1.0631
13	26	2400.	3.5160	.0820	.4887	.5169	147.	.9454
14	27	2400.	2.0035	.0449	.4729	.4815	150.	.9821
15	28	2100.	2.0077	.1100	.4475	.4227	150.	1.0587
16	29	2095.	2.5188	.0831	.5467	.4744	150.	1.1523
17	30	2410.	2.4900	-.0021	.5824	.5973	144.	.9749
18	31	1805.	3.4822	.1071	.5177	.4865	147.	1.0641
19	32	1800.	2.0026	.1059	.4295	.4691	147.	.9157
20	33	1500.	2.5148	.1263	.4852	.4790	147.	1.0130
21	34	1500.	3.4987	.0976	.5722	.5221	147.	1.0960
22	35	1500.	2.0662	.1077	.4840	.5091	147.	.9506
23	36	1805.	2.0257	.0789	.5038	.5056	147.	.9965
24	37	2100.	1.5237	.0950	.4244	.4225	150.	1.0045
25	38	2100.	1.9920	.0749	.5092	.4666	150.	1.0912
26	39	2405.	1.9830	.0276	.5258	.5014	150.	1.0487
27	40	2405.	1.4667	.0674	.4464	.4192	150.	1.0649
28	41	2405.	1.4940	.0242	.4718	.4691	150.	1.0057
29	42	2105.	1.4575	.0969	.4707	.4168	150.	1.1294
30	43	2115.	1.9865	.0353	.5952	.5166	150.	1.1520

Table B-22. Local Conditions - Test Section W166 (Continued)

Test Serial No.	Test ID No.	System Pressure (psia)	Local Mass Velocity (Mlbm/hr-ft²)	Local Equilibrium Quality	Measured Critical Heat Flux (MBtu/hr-ft²)	Predicted Critical Heat Flux (MBtu/hr-ft²)	Predicted Critical Heat Flux Location (inches)	Measured-to-Predicted Critical Heat Flux Ratio	
31	44	1800.	1.9727	.0594	.5641	.5317	147.	1.0609	
32	45	1505.	1.9736	.0668	.5593	.5820	144.	.9611	
33	45	1505.	1.9731	.0699	.5606	.5773	144.	.9711	
34	46	1500.	1.4955	.1125	.4875	.5038	147.	.9677	
35	47	1505.	1.4831	.1522	.4355	.4394	150.	.9935	
36	48	2110.	1.4719	.0412	.4927	.4812	150.	1.0240	
37	49	2395.	1.4597	.0015	.5136	.4924	150.	1.0430	
38	50	2405.	2.9924	.0438	.5754	.5354	150.	1.0747	Rev. 1
39	51	2400.	2.9994	.0041	.7022	.6077	147.	1.1555	
40	52	2100.	3.0005	.0424	6210	.5636	147.	1.1019	
41	53	1805.	3.4911	.0502	.6895	.5969	144.	1.1552	
42	54	1505.	2.4864	.0876	.5484	.5534	144.	.9908	
43	55	2105.	2.4869	-.0068	.6384	.6269	144.	1.0184	
44	56	2410.	2.5275	-.1100	.6733	.7636	141.	.8817	
45	57	2100.	2.4625	.0484	.5941	.5209	150.	1.1404	
46	58	1500.	1.9963	.0668	.5989	.5697	147.	1.0512	
47	59	2100.	2.0115	-.0712	.6657	.6970	141.	.9551	

APPENDIX C

APPLICATION OF THE DCHF-1 CORRELATION TO CHF IN B&W MARK BW FUEL ASSEMBLIES

Introduction

| Rev. 1

Results

Rev.1

Proprietary to Babcock & Wilcox Company

Figure C-1. Radial Geometry and Power Distribution of Test Section

Figure C-2. 144 Inch Heater Rods Axial Heat Flux Distribution

Table C-1. Axial Heat Flux Distribution

Fraction of Heated Length	Local-to-Average Heat Flux

Table C-2. Spacer Grid and Thermocouple Locations

Spacer	Type [1]	Axial Position [2]	Thermocouple [3]

Table C-3. System Conditions For Each Data Point

Test Serial No.	Test ID No.	System Pressure (psia)	Inlet Temperature (°F)	Average Mass Velocity (Mlbm/hr-ft^2)	Average Heat Flux (MBtu/hr-ft^2)	Axial CHF Location (inches)

Table C-3. System Conditions For Each Data Point (Continued)

Test Serial No.	Test ID No.	System Pressure (psia)	Inlet Temperature (°F)	Average Mass Velocity (Mlbm/hr-ft²)	Average Heat Flux (MBtu/hr-ft²)	Axial CHF Location (inches)

| Rev.1

| Rev.1

| Rev.1

Table C-3. System Conditions For Each Data Point (Continued)

Test Serial No.	Test ID No.	System Pressure (psia)	Inlet Temperature (°F)	Average Mass Velocity (Mlbm/hr-ft^2)	Average Heat Flux (MBtu/hr-ft^2)	Axial CHF Location (inches)

Table C-4. VIPRE-01/DCHF-1 Analysis Results

Test Serial No.	Test ID No.	System Pressure (psia)	Local Mass Velocity (Mlbm/hr-ft^2)	Local Equilibrium Quality	Measured CHF_m (MBtu/hr-ft^2)	Predicted CHF_p (MBtu/hr-ft^2)	CHF_p Location (inches)	CHF_m/CHF_p Ratio

Table C-4. VIPRE-01/DCHF-1 Analysis Results (Continued)

Test Serial No.	Test ID No.	System Pressure (psia)	Local Mass Velocity (Mlbm/hr-ft^2)	Local Equilibrium Quality	Measured CHF_m (MBtu/hr-ft^2)	Predicted CHF_p (MBtu/hr-ft^2)	CHF_p Location (inches)	CHF_m/CHF_p Ratio

Table C-4. VIPRE-01/DCHF-1 Analysis Results (Continued)

Test Serial No.	Test ID No.	System Pressure (psia)	Local Mass Velocity (Mlbm/hr-ft^2)	Local Equilibrium Quality	Measured CHF_m (MBtu/hr-ft^2)	Predicted CHF_p (MBtu/hr-ft^2)	CHF_p Location (inches)	CHF_m/CHF_p Ratio

Figure C-3.
MEASURED vs. PREDICTED CHF

Figure C-4.
MEASURED-to-PREDICTED CHF RATIO vs. LOCAL QUALITY

Figure C-5.
MEASURED-to-PREDICTED CHF RATIO vs. LOCAL MASS VELOCITY

Figure C-6.
MEASURED-to-PREDICTED CHF RATIO vs. PRESSURE

APPENDIX D

SAFETY EVALUATION REPORT

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

August 8, 1989

Mr. H. B. Tucker
Duke Power Company
P.O. Box 33189
Charlotte, NC 28242

Dear Mr. Tucker:

SUBJECT: ACCEPTANCE FOR REFERENCING OF TOPICAL REPORT DPC-NE-2000 "DCHF-1 CORRELATION FOR PREDICTING CRITICAL HEAT FLUX IN MIXING VANE GRID FUEL ASSEMBLIES" SEPTEMBER 1987

The staff has completed its review of the topical report "DCHF-1 Correlation for Predicting Critical Heat Flux in Mixing Vane Grid Fuel Assemblies" submitted by the Duke Power Company by letters dated October 21, 1987 and May 9, 1989. Additional information was submitted on October 27, 1988. This report (DPC-NE-2000) provides information and justification for a new critical heat flux (CHF) correlation for pressurized-water-reactor fuel assemblies with mixing vane spacer grids. The data base for this correlation (designated DCHF-1) consists of 1004 data points derived from 22 separate test sections. The range of parameters in these test sections included: 96-inch or 168-inch heated lengths and 0.374-inch or 0.422-inch outside diameter rods. In addition to uniform, 4 nonuniform flux shapes were used, the pressure ranged from 1485 to 2445 psia, the grid spacing covered 13 to 32 inches and the equivalent hydraulic diameter varied from 0.37 to 0.51-inch. For applications to 15x15 and 17x17 mixing vane grid designs, the design limit for the departure from nucleate boiling ratio for DCHF-1 is 1.194.

We find the application of DPC-NE-2000 to be acceptable for referencing in license applications to the extent specified, and under the limitations delineated, in DPC-NE-2000 and the associated NRC technical evaluation. The evaluation defines the basis for acceptance of this topical report.

We do not intend to repeat our review of the matters found acceptable as described in DPC-NE-2000 when the report appears as a reference in license applications, except to assure that the material presented is applicable to the specific plant involved. Our acceptance applies only to the matters described in the application of DPC-NE-2000.

In accordance with procedures established in NUREG-0390, it is requested that the Duke Power Company publish accepted versions of this topical report, proprietary and non-proprietary, within three months of receipt of this letter. The accepted versions shall include an -A (designating accepted) following the report identification symbol.

Should our criteria or regulations change so that our conclusions as to the acceptability of the report are invalidated, Duke Power Company and/or the applicants referencing the topical report will be expected to revise and resubmit their respective documentation, or submit justification for the continued effective applicability of the topical report without revision of their respective documentation.

Sincerely,

Ashok C. Thadani, Assistant Director
for Systems
Division of Engineering & Systems Technology

Enclosure:
DPC-NE-2000 Evaluation

ENCLOSURE

SAFETY EVALUATION FOR THE TOPICAL REPORT DPC-NE-2000 "DCHF-1 CORRELATION FOR PREDICTING CRITICAL HEAT FLUX IN MIXING VANE GRID FUEL ASSEMBLIES"

1.0 INTRODUCTION

By letters dated October 21, 1987 and May 5, 1989, the Duke Power Company submitted topical report DPC-NE-2000 for NRC review (Ref. 1). Additional information was submitted on October 27, 1988 (Ref. 2). This topical report provides information and justification for a new critical heat flux (CHF) correlation for pressurized-water-reactor fuel assemblies with mixing vane spacer grids. The data base for this correlation (DCHF-1) consists of 1004 CHF data points derived from 22 Westinghouse test sections which include both 0.422-inch and 0.374-inch rod outside-diameter geometries. The correlation accounts for typical cell and thimble cell effects, uniform and non-uniform heat flux profiles, and variation in rod heated length and in grid spacing. The design limiting value for departure from nucleate boiling ratio for DCHF-1 for application to 15x15 and 17x17 mixing vane grid designs is 1.194.

The following evaluation incorporates our consultants' Pacific Northwest and Brookhaven National Laboratories contribution to this review. Restrictions to be observed in the application of this topical report are listed in Section 3.9.

2.0 SUMMARY OF TOPICAL REPORT

The subject topical report first outlines the methodology and then describes the origin, data sources, and ranges of the variables. The values of the local independent variables are computed using the VIPRE-01 code (Ref. 3) while the test bundle global conditions are measured. Next, the form of the correlation is described, which essentially is the same as that of the Columbia University generalized CHF correlation and published by EPRI (Ref. 4) with an additional explicit dependence on heated length grid spacing and grid type.

Next, the correlation's algebraic coefficients are determined and optimized. The form is then verified; the verification includes a statistical analysis of the correlation performance as a function of the independent variables individually and two at a time. By such verification, the applicant attempts to identify the existence of biases with respect to any of the independent variables. This is done (1) by visual inspection for possible trends in plots of the measured/predicted values and (2) numerically. The next section of the topical report includes a determination of the minimum departure from nucleate boiling ratio (MDNBR) using the measured-to-predicted standard deviation for the DCHF-1 correlation and a 95/95 upper tolerance factor determined using the method described by Owens (Ref. 5). In this manner, the estimated MDNBR for the DCHF-1 correlation is 1.194. In the derivation of this value, all the qualified values in the data base were used in a single grouping. Appendix C of the topical report includes a confirmatory application of this correlation to the Mark-BW mixing vane grid assembly design data.

3.0 EVALUATION

3.1 Data Base

The data base for this CHF correlation is taken from the results of the Columbia University Heat Transfer Laboratory experiments published by EPRI (Ref. 4). To obtain an accurate CHF predictor for the mixing vane grid designed for use in Westinghouse (W) reactors, 70 tests performed for W were considered. Tests performed for (1) non-mixing vane or high-pressure drop grids, (2) rod bowing, and (3) flow blockage, or tests which included fewer than 15 data points were not included. The 22 test sections selected for this correlation include a total of 1004 runs. The data cover the following parameter ranges:

Pressure	1485 to 2445 psia
Local Mass Velocity	0.85 to 3.63 Mlbm/hr-ft^2
Local Quality (Equilibrium)	-0.15 to 0.36
Heated Length	96 to 168 inches
Grid Spacing	13 to 32 inches
Equivalent Hydraulic Diameter	0.37 to 0.51 inches
Equivalent Heated Hydraulic Diameter	0.46 to 0.58 inches
Rod Outside Diameter	0.374 to 0.422 inches

Data from the Columbia University Heat Transfer Laboratory were used as the basis for other correlations in the past.

3.2 Data Analyses

While the global (bundle) variables have known measured values, the local conditions within the channel must be calculated. These determinations were made using the VIPRE-01 code which requires the geometric modeling and the measured experimental values for bundle pressure, flow, power, and inlet temperature for each data point (Ref. 3). Such determinations were made for all data points and were the basis for the rejection of 9 points for too high or too low measured/predicted ratio. (Another 6 points in this process were erroneously deleted.)

3.3 The CHF Correlation

The analytical form chosen for this correlation is similar to the one adopted by Columbia University for the development of the generalized CHF correlation (Ref. 4):

$$q''_{CHF,UN} = (A - X_{CHF,1})/C$$

where $q''_{CHF,UN}$ = the uniform critical heat flux

$A = B_1 \times P_R^{B_2} . G^{(B_5 + B_7 P_R)}$

$X_{CHF,1}$ = local quality at the DNB point

$C = B_3 \times P_R^{B_4} . G^{(B_6 + B_8 P_R)}$

P_R = reduced reactor pressure

G = local mass velocity

Bi = correlation constants

This basic equation was further modified by adding bundle-specific multipliers to account for the effects of grid spacing, test section heated length, and test section geometry.

The coefficients in the final expression for q" were determined as an optimized fit using a non-linear least-squares regression analysis method developed at Columbia University (Ref. 6) based on an algorithm by Jennrich and Sampson (Ref. 7).

3.4 Verification

Once the correlation has been established, the performance of the correlation is evaluated with respect to the independent variables to establish the possible existence of any bias. These comparisons included visual and numerical checks of correlation statistics for the following variables: bundle geometry, spacer grid spacing, heated rod length, pressure, mass velocity, equivalent hydraulic diameter, and the wetted-perimeter/heated-perimeter ratio. The visual verification consists of plotting the M/P (measured to predicted value) data on the ordinate of a two-dimensional graph with the independent variable as the abscissa. Any bias with respect to these variables would be observed as a deviation from M/P = 1.0. The spread of the individual M/P values about M/P = 1.0 gives a visual impression of the precision (or standard deviation) of the correlation. In addition, a general indication of the normality of the M/P distribution can be determined from the distribution of the M/P data about M/P = 1.0. Finally, a visual measure of any correlation bias with increasing CHF is obtained by plotting the measured and predicted CHF and observing any deviation from the 45-degree line. The same search for biases, deviations, and normality was also performed numerically for each of the variables individually and for the following pairs of variables: mass velocity and pressure, mass velocity and quality, pressure and quality, mass velocity and grid spacing, and heated length and rod diameter. The range of each of the independent variables was divided into high, medium, and low intervals, and the M/P data were tested statistically in each of the resulting one- and two-dimensional subregions for (1) normality, (2) mean M/P, and (3) standard deviation. The results indicated that an overwhelming majority of the subregions passed the statistical tests.

Consideration of these results showed that: (1) none of the parameter correlations shows any significant bias, (2) the overall average ratio of measured to predicted is 1.000, that is, there is no bias, (3) the distribution for all the points is normal as demonstrated in D', the statistical tests, and (4) the overall standard deviation is 9.42%.

3.5 Comments on the Correlation and Its Verification

The EPRI-NP-2609 data (Ref. 4) have been used as the bases of other DNBR correlations which have been approved by the staff. One noteworthy feature of these data is the use of the first DNB indication as the one experimentally noted. The staff has found this practice to be conservative and acceptable. In addition, the 1004 data points used are more than the number of points usually used in data bases for CHF correlations.

However, there are somewhat unusual features in this correlation and its data base:

(1) the a priori rejection of bundle test sets with less than 15 data point each (with no justification),

(2) the unusually small number of rejections, which is less than 1% of the total compared to 4% or 5% in similar correlations,

(3) the data point rejection performed before the determination of the correlation,

(4) the lack of a criterion on M/P ratio for the rejection process, and

(5) no data rejection on the basis of the flow regime.

On the other hand, the correlation has a larger than usual number of data points, the standard deviation is smaller than usual, the overall M/P ratio is 1.000, the number of rejections is very small, and the proposed DNBR value is very close to the usual value of 1.21.

There were 22 sets with an average number of about 46 data points per set. Usually sets with less than 15 points indicate an abbreviated experimental series which probably includes many outliers. Therefore, the preselection of sets with more than 15 points avoided questionable data points. The size of the data set, its normal distribution, the lack of bias, and the good standard deviation are indicative of a qualified and acceptable CHF correlation.

3.6 Design MDNBR Value

The acceptable minimum departure from nucleate boiling ratio (MDNBR) value on the limiting pins must maintain 95% confidence that 95% of the limiting pins will not experience film boiling. Using the one-sided tolerance theory by Owens (Ref. 5), the following expression is used:

$$MDNBR = 1.0/(R-K_pG)$$

where:

R = average M/P ratio = 1.000

K_p = factor given in Reference 5 depending on number of data points, confidence level, and portion of protected population = 1.727

G = standard deviation for M/P = 0.0942

Thus, MDNBR = 1.194.

3.7 Validation

Validation in this report is performed through an application of the correlation to a set of 250 data points which have not been used in the development of the correlation and are, therefore, "new data points." This data set was also measured at Columbia University for Westinghouse. Using the VIPRE-01 computer code, the results show that the DCHF-1 correlation results in an accurate prediction of the data. The average M/P was found to be 1.007 and the standard deviation of the M/P data was found to be 0.078. These results provide an independent demonstration of the validity of the DCHF-1 correlation.

3.8 Application to Mark-BW Assemblies

The applicability of the DCHF-1 correlation to the Mark-BW mixing vane grid assembly design was demonstrated using a set of 99 test points obtained from a confirmatory test performed by Columbia University for the Babcock and Wilcox Corporation. Using the VIPRE-01 computer code, the results show that the DCHF-1 correlation results in a conservative prediction of the data. Of the 99 test points, 96 have M/P values greater than 1.0 and 3 points have M/P values of 1.00 or less. The standard deviation of this data set about the average M/P is 0.0852. In addition, M/P values plotted against fluid mass velocity, pressure or local quality indicate that there is no bias. Therefore, the staff concludes that the DCHF-1 correlation is conservatively applicable to fuel assemblies with Zircaloy mixing vane spacer grids using the DNBR value of 1.194.

3.9 Restrictions

The following restrictions are imposed on the DCHF-1 correlation:

(1) The DNBR limit of 1.194 is applicable only to analyses using the VIPRE-01 code.

(2) The correlation is applicable only to the range of operation comparable to the data source ranges listed in Section 2 of DPC-NE-2000.

(3) The correlation is only applicable to the following types of fuel assemblies: Westinghouse 15x15, L-grid and R-grid, Westinghouse 17x17 standard (0.374 inch), and OFA (0.360 inch) and Babcock and Wilcox Mark-BW mixing vane grid assemblies.

4.0 SUMMARY AND CONCLUSIONS

The staff reviewed the DPC-NE-2000 topical report and found that:

- The data used to determine DCHF-1 are based on the Columbia University Heat Transfer Laboratory results specifically produced for CHF correlations.

- Outliers (6 out of 1010 data points) were rejected.

- The choice of the correlation form is similar to existing correlations and is acceptable.

- The coefficient optimization method is appropriate and acceptable.

- Verification of the correlation with "new data" provided adequate demonstration of the validity of the correlation.

The staff reviewed the information submitted by the Duke Power Company regarding the DCHF-1 correlation for predicting the critical heat flux in mixing vane grid fuel assemblies. The staff finds the correlation acceptable for referencing in future submittals, subject to the limitations of Section 3.9 of this evaluation. However, the licensee must make the corrections noted in the May 5, 1989 submittal (Ref. 1).

5.0 REFERENCES

1. Letters October 21, 1987 and May 5, 1989 from H. B. Tucker, Duke Power Company to USNRC, "DCHF-1, Correlation for Predicting Critical Heat Flux in Mixing Vane Grid Fuel Assemblies," DPC-NE-2000.

2. Letter from H. B. Tucker, Duke Power Company to USNRC, "Responses to NRC Question on Topical Report DPC-NE-2000," October 27, 1988.

3. EPRI-NP-2511-CCM, "VIPRE-01: A Thermal Hydraulic Code for Reactor Cores" (in five volumes), by J. M. Cuta et al., July 1985.

4. EPRI-NP-2609, "Parametric Study of CHF Data" (in three volumes), by C. F. Fighetti and D. G. Reddy, September 1982.

5. Owens, O. B., "Factors for One Sided Tolerance Limits" Sandia Corporation Monograph, 1963.

6. EPRI-NP-2522, "Two-Phase Friction Multiplier Correlation for High-Pressure Steam-Water Flow," by D. Reddy, S. Sreepada, and A. Nahavandi, July 1982.

7. Jennrich, R. I., and P. F. Sampson, "Application of Step-Wise Regression to Nonlinear Estimation," Technometrics, Vol. 10, No. 1, February 1968.

APPENDIX E

RESPONSES TO REQUESTS FOR ADDITIONAL INFORMATION

1. As a part of our review, we would like to independently estimate (via nonlinear least squares) the coefficients B1-B12 in DCHF-1. To ensure that our calculations use the same information as was used in the original derivation, please provide us with the values of the independent and dependent variables used for each of the 1004 data points in the DCHF-1 data base. This information should be provided on magnetic tape or floppy diskette, in some logical format that contains the following information for each data point:

bundle ID, run number, P, G, X_l, Z_{CHF}, L_{CHF}, S, F, F_G, q''_{CHF}, q''_l

where
P = pressure
G = local mass velocity
X_l = local quality
Z_{CHF} = location of CHF
q''_l = local heat flux
q''_{CHF} = predicted critical heat flux
S = axial grid spacing
F = axial heat flux factor at Z_{CHF}
F_G = ratio of wetted perimeter to heated perimeter
L_{CHF} = location of CHF, relative to the inception of local boiling

Note that the local conditions in the above data must refer to conditions at the location for which the correlation was optimized (which we assume was the location of measured DNB).

RESPONSE

The local conditions of the independent and dependent variables for all the data used in developing DCHF-1 correlation are provided on a floppy diskette and also attached in Appendix A. The following variables are provided for each data point:

1. Test section number
2. Serial number
3. Run Number
4. Pressure (psia)
5. Local Mass Velocity (M. lbs/hr/sqft)
6. Local Quality
7. Location of CHF measured from test section inlet (inches)
8. Spacer grid spacing (inches)
9. Non-uniform F-factor
10. Ratio of wetted to heated perimeter

11. Measured local heat flux (M. btu/hr/sqft)

12. Predicted local heat flux (M. btu/hr/sqft)

To facilitate the verification process non-uniform F-factor calculated by the VIPRE-01 thermal hydraulic computer code is included.

The DCHF-1 correlation was developed with the local conditions at the minimum M/P CHF ratio location. The local conditions at the location of measured DNB were initially used to optimize the correlation. This correlation was then used to predict M/P CHF ratio at all locations in the rod bundle for each data point. The local conditions at the minimum M/P CHF ratio were used to optimize the correlation during the second iteration. The procedure was continued till the process converged; that is till the coefficients in the correlation and the minimum M/P CHF ratio locations did not change from iteration to iteration. The advantage of such a procedure is that the correlation coefficients are compatible with the method used in applying the correlation for the calculation of design limits, where minimum M/P CHF ratio is computed for given operating conditions.

2. We will be performing audit calculations to independently check the fit of the DCHF-1 correlation over its range of applicability. It would greatly facilitate1 our verification effort if Duke Power provides us with the input decks for the CHF test bundles in the correlations data base, including the Mark-BW test section described in Appendix C. Providing us with this information will eliminate differences between our results and the Duke Power calculations that are due solely to differences in the code input models. If it is not possible to supply the input decks, we will need additional information on the test sections, which is not included in the report, such as local loss coefficients for the spacers, friction-factor correlations, and power profile tables. (The graphical representation of the axial power distributions in the report is not sufficient for the desired accuracy of the computation.)

Also, provide a diagram indicating the location of all experimental measurement locations for each of the configurations tested.

RESPONSE

The inputs to the VIPRE-01 code for all the tests used in developing and verifying DCHF-1 correlation are provided on a floppy diskette. A listing of these inputs are included in Appendix B.

These inputs include all the information (such as geometry parameters and physical models) for running the VIPRE-01 code to generate the local conditions of the independent and dependent variables for the DCHF-1 correlation data base.

For all the tests used in developing and verifying DCHF-01 correlation, the figures indicating the location of all experimental CHF locations are given in Reference 1 of the topical report DPC-NE-2000.

3. How is the inception of local boiling defined for the L term in the CHF nonuniform axial heat flux factor, F?

RESPONSE

L_{chf} term in the non-uniform F-factor is defined in the topical report on page 3-4 as the location of CHF measured from the inception of local boiling. Inception of local boiling location is determined by the VIPRE subchannel code based on the Jens Lottes heat transfer correlation for nucleate boiling. L_{chf} is internally calculated in the VIPRE code as the axial distance from the inlet to the first boiling node. The code uses this L_{chf} to calculate and print out the non-uniform F factor at each axial location.

4. Other evaluations of the data from the 22 test sections used to develop DCHF-1 have found "outlying" data representing annular flow. Were any investigations or tests performed to identify "outlying" or "bad" data? If so, please identify these data points. Were these data points used in estimating the B1-B12 coefficients of DCHF-1, or were they omitted?

RESPONSE

In the development of DCHF-1 correlation, no attempt was made to distinguish different flow regimes. There is no reliable quantitative method of identifying different flow regimes. Even if an attempt is made to some how qualitatively differentiate different flow regimes, there is the problem of flow regime transition regions which are more difficult to identify.

The initial data points for the 22 test sections were 1019 points. Fifteen (15) out of the 1019 were omitted from the correlation data base. The fifteen omitted data represent three high M/P outliers, six low M/P outliers, and six erroneous deletions, which were "good" points as seen in the accompanying table. It should be noted that only nine CHF data points were rejected as outliers (about 0.9% of the data base). The residuals of some of these rejected data were so far away from the data base residuals that they were rejected as obvious outliers. For the rest of the rejected data, a comparison between them and the other data at similar nominal conditions identified them as outliers. Although the effect of these nine outliers was not significant on the values of the optimized coefficients, they were not used in developing the correlation because they would significantly influence the precision of the correlation.

Data not included in the DCHF-1 Data base

No.	Test Section No.	Test Serial No.	Test ID No.	System Pressure (psia)	Mass Velocity M. lbm / hr-sqft	Local Quality	Measured CHF M. Btu / hr-sqft	Predicted CHF M. Btu / hr-sqft	M/P CHF Ratio
1	124	5	479	2114.7	3.5913	0.0213	0.6611	0.9175	0.7205
2	132	13	666	1489.7	3.4841	0.1714	0.5960	0.4453	1.3384
3	133	13	702	1804.7	1.9058	0.0041	0.3627	0.8446	0.4294
4	153	11	1401	2404.7	2.0966	0.1001	0.3575	0.5029	0.7109
5	158	56	1693	1504.7	1.4912	0.2200	0.6429	0.4978	1.2915
6	158	59	1696	2394.7	1.0089	0.2266	0.5926	0.3321	1.7844
7	160	47	1766	1799.7	1.5145	0.2102	0.3769	0.5309	0.7099
8	161	55	1850	1804.7	4.4613	0.0452	0.5701	0.7458	0.7644
9	166	5	18	2404.7	3.0551	-0.0774	0.5074	0.7693	0.6596
10	157	49	1607	1504.7	3.5230	0.1577	0.6023	0.6115	0.9850
11	157	52	1610	1504.7	2.6149	0.0929	0.7745	0.7517	1.0303
12	161	42	1837	2414.7	1.0253	0.2238	0.3771	0.3267	1.1543
13	164	73	2051	2099.7	1.4095	0.2026	0.3212	0.3279	0.9795
14	164	75	2053	1499.7	2.4578	0.1165	0.5612	0.5788	0.9696
15	164	76	2054	1499.7	1.9420	0.1578	0.4993	0.4881	1.0229

Note: Data points 1 through 9 were excluded from the data base as outliers.
Data points 10 through 15 were deleted erroneously.

5. One of the factors that determines uncertainty in a fitted correlation such as DCHF-1 is the experimental error (i.e., uncertainty) in the data. It is important relative to least squares estimation of the DCHF-1 coefficients and to DNBR limit determination to estimate the experimental error standard deviation throughout the independent variable space. Replicate or near-replicate data can be used for this purpose.

   a. Other than the 7 repeat points identified in Appendix C, are there other sets of replicate or near-replicate data points? If so, identify the data points in each replicate or near-replicate set, and tabulate the experimental error standard deviation for each set.

   b. Discuss the constancy, or lack thereof, of the experimental error standard deviation over the independent variable space. For example, the standard deviation of the measured CHF values for the 7 repeats in Appendix C is 0.0122. The standard deviation of the M/P CHF ratios is 0.0348. Are these values much different in other portions of the independent variable space? Explain the basis of your conclusions, especially if there are limited replicate or near-replicate data.

RESPONSE

a. Other than seven (7) repeat points identified in Appendix C, there are no other systematic group of (multiple) repeat points in the CHF data base. Usually a CHF point is repeated to check the integrity of the test bundle and the instrumentation. Fifteen (15) such pairs of repeat points are given here in the accompanying table. Since a CHF point was repeated either once or twice it is not possible to tabulate the experimental error standard deviation for each set.

b. As pointed out in the response to part (A) of this question there is not enough replicate data to evaluate constancy of the experimental error standard deviation over the independent variable space. However examination of these 30 repeat points shows that there is no significant variation in the repeatability of the CHF data at various pressure, quality, and flow rate conditions. Although it is not possible to calculate the experimental error standard deviation at different independent variable values using these 30 points, it is possible to calculate the overall experimental error standard deviation for the entire data base. The experimental error, that is the repeatability, was evaluated by comparing the data pairs for the best possible match in the inlet temperature for the same nominal values of the system pressure and mass velocity. In practice it is impossible to match the inlet temperature and other flow conditions exactly. Therefore to eliminate the effect of such mismatches in flow conditions as far as possible, M/P CHF ratios were compared. The repeatability parameter defined as the difference between the CHF ratios of the repeat points normalized by the average CHF ratio of the points was calculated for each pair of repeat points. The standard deviation of the repeatability parameters, that is the experimental error standard deviation, was 6%. Considering that the standard deviation of the correlation is 9.4% and experimental error standard deviation is 6%. It is clear that error due to regression is not significant and that the correlation form adequately represented all independent variables.

Repeat CHF data points									
No.	Test Section No.	Test Serial No.	Test ID No.	System Pressure (psia)	Mass Velocity M. lbm / hr-sqft	Local Quality	Measured CHF M. Btu / hr-sqft	Predicted CHF M. Btu / hr-sqft	M/P CHF Ratio
1	157	35	1593	1504.7	[illegible]	0.1156	0.6834	0.7050	0.9694
2	157	63	1621	1494.7	1.9849	0.1245	0.6856	0.6918	0.9910
3	157	38	1596	1814.7	2.4834	0.0306	0.7356	0.8078	0.9106
4	157	70	1628	1804.7	2.4469	0.0709	0.8023	0.7371	1.0885
5	157	4	1562	2114.7	3.4268	0.0575	0.7645	0.7792	0.9811
6	157	28	1586	2104.7	3.4902	0.0553	0.7978	0.7870	1.0137
7	157	7	1565	2414.7	2.9645	0.0101	0.8223	0.8177	1.0056
8	157	22	1580	2404.7	2.8664	0.0186	[illegible]	0.7958	[illegible]
9	158	3	1640	2099.7	2.9917	0.0778	0.7221	0.6750	1.0698
10	158	36	1673	2099.7	2.9843	0.0834	0.7310	0.6647	1.0997
11	162	8	1874	2104.7	2.9299	0.0470	0.5699	0.6171	0.9235
12	162	34	1900	2119.7	2.8925	0.0690	0.5752	0.5641	1.0197
13	164	1	1979	2099.7	1.4331	0.1398	0.3844	0.4345	0.8847
14	164	74	2052	2099.7	1.4140	0.1940	0.3278	0.3375	0.9713
15	164	2	1980	2104.7	1.9421	0.0830	0.4810	0.5417	0.8879
16	164	72	2050	2104.7	1.9909	0.0646	0.5061	0.5835	0.8674
17	148	3	1179	2399.7	2.9559	0.0185	0.6555	0.6326	1.0362
18	148	70	1246	2404.7	2.8790	0.0695	0.5942	0.5263	1.1290
19	148	14	1190	2394.7	2.4528	0.0512	0.5372	0.5303	1.0130
20	148	71	1247	2399.7	2.4386	0.0635	0.5428	0.5129	1.0583
21	148	34	1210	1789.7	3.4780	0.0586	0.6456	0.6212	1.0393
22	148	72	1248	1799.7	3.4486	0.0651	0.6542	0.6087	1.0747
23	152	2	1348	1500.0	1.5186	0.1421	0.4724	0.4868	0.9704
24	152	44	1390	1500.0	1.5456	0.1164	0.4790	0.5342	0.8967
25	152	32	1378	2405.0	3.3693	0.1092	0.5583	0.4908	1.1375
26	152	34	1380	2400.0	3.3913	0.1152	0.5693	0.4831	1.1784
27	152	21	1367	2400.0	1.5465	0.1311	0.3612	0.3830	0.9431
28	152	41	1387	2395.0	1.5994	0.1307	0.3667	0.3868	0.9480
29	152	29	1375	2100.0	2.4732	0.1191	0.4328	0.4559	0.9493
30	152	35	1381	2100.0	2.4525	0.1433	0.4460	0.4236	1.0529

6. In the definition of the A and C terms on the bottom of page 3-1, please explain why correction factors F_L, F_S, and F_G were applied to A but only F_L was applied to C.

RESPONSE

A stepwise regression analysis was performed in model building and selecting the correlation form of the DCHF-1 correlation. The two criteria of selecting the best regression were to make the correlation accurately predict DNBR and keep the equation as simple as possible. There is no standard statistical procedure available to do this; a trial and error procedure and personal judgement were used in selecting the final form of the correlation. The basic strategy of stepwise regression procedure is outlined below.

The stepwise procedure starts with the basic correlation equation [q" = (A-X)/C] and enters into the regression the variable most highly correlated with the dependent variable. The partial F-test value is calculated for every variable and the lowest partial F-test value is compared with a preselected significance level. The variable is dropped from consideration if its F-value is non significant. The stepwise method now selects the next variable to enter regression, the one that is most highly correlated with the dependent variable. Again partial F-tests are computed and variable with the least F-value is tested for significance and the process is continued till there are no variables left to enter the regression.

This methodical procedure resulted in the final form chosen for the DCHF-1 correlation. The WRB-1 correlation (Reference 4 in the topical report DPC-NE-2000), which is based on the same data base, adopting similar correlation form [q" = A-BX], came to same conclusion. The first term (A) is a function of length, grid spacing, and geometry factors in addition to pressure and flow rate, where as the second term (B) associated with quality is a function of length only, in addition to pressure and flow rate.

7. The last sentence on page 3-2 states that no modification in the K-constant or form of the F-factor was necessary. Although the form of their correlation is different than DCHF-1, Babcock and Wilcox reoptimized the three coefficients of the K-constant using largely the same data as that used to develop DCHF-1 and obtained noticeably different values for two of the three coefficients. This suggests that the coefficients in the K-constant of the F-factor may require reestimation for some correlations and data sets. Please explain your reasons for concluding that it was not necessary to reestimate the coefficients of the K-constant.

RESPONSE

The non-uniform F-factor to be applied to the non-uniform CHF data to bring them to uniform level depends on the CHF data base and on the form of the correlation and variables introduced in it. An examination of the non-uniform and uniform CHF data (See table D.2 in Appendix D) indicated that no modification to the F-factor was necessary for DCHF-1 correlation. Therefore non-uniform axial heat flux data were reduced using the non-uniform F-factor to the level of the uniform data and the coefficients in the data DCHF-1 correlation were optimized using the total data base.

It should be noted that the WRB-1 correlation (Reference 4 in the topical report DPC-NE-2000, which is based on the same data base, also utilizes the original F-factor. It was observed that no modification to either the constants or the form of the F-factor was necessary to predict the non-uniform data using the WRB-1 correlation.

8. The coefficients B1-B12 of DCHF-1 were estimated via a nonlinear least squares program developed at Columbia University (Ref. 5 in the submittal) based on an algorithm by Jennrich and Sampson (Ref. 6 in the submittal). We have reviewed these references, but some of the specifics of how the program was applied are not given in the submittal.

   a. Was weighted or unweighted nonlinear least squares performed? If weighted, how were the weights determined and what were their values? (Note: If weighted least squares was used, include these weights in the magnetic tape or diskette file requested in Question #1.) If unweighted, what was done to verify the "constant variance" assumption required for unweighted least squares?

   b. Was the usual "minimize the sum of squared errors" or "minimize the sum of weighted squared errors" least squares criterion used, or was a criterion based on the M/P CHF ratio used?

   c. Apparently the Columbia University nonlinear least squares program does not compute the approximate standard deviations of the estimated coefficients. Did you compute these to assess the significance of the estimated coefficients? If so, what were the results?

RESPONSE

a. An unweighted nonlinear least squares regression was used. There are two reasons to consider a weighted least squares technique; Either some data is known to be more reliable than other data, or some region of the independent variable space is grossly under represented. For this case, there was no reason to suspect that some data was superior to other data. Also, considering that CHF experiments are designed to blanket the independent variable space, it was judged that no significant under representation was present.

b. The M/P CHF ratio was used to minimize the residual sum of squares (RSS) and optimize the coefficients.

c. Since each coefficient in the correlation was evaluated based on the reduction in RSS error, standard deviations of the estimated coefficients were considered not important and were not calculated. See the response to question 6.

9. Least squares regression techniques assume that the independent variables are known without error (uncertainty), or at least that the errors are small relative to the error in the dependent variable. Some of the DCHF-1 independent variables are measured (and hence subject to measurement error), whereas others are computed via VIPRE-01 (and hence subject to error propagation and the possible introduction of other random errors or biases). Please provide justification for the assumption that the errors (uncertainty) in the independent variables were small.

RESPONSE

A detailed error analysis of the measured independent variables of the DCHF-1 correlation is presented in chapter 5 of Reference 1 of the topical report. Typical error in inlet temperature is about 2.2^0 F. Average error in flow rate is about 1.3% for a 4X4 bundle and about 0.88% for a 5X5 bundle. The total error in pressure measurement is +/- 6 psi and the error in heat flux is about 0.75%. Nominal inlet conditions were used to obtain local conditions using the VIPRE code and the DCHF-1 correlation was developed using these local conditions which admittedly contain measurement errors. However all these errors are built into the overall Residual Sum of Squares (RSS) and thus are reflected in the standard deviation of the correlation.

10. The graphical and tabular "verification" investigations of Section 4 of the submittal are all based on the same 1004 data points as used to fit (i.e., estimate the coefficients of) DCHF-1. It is widely recognized that a fitted regression model such as DCHF-1 will tend to perform better for the data used to develop it than for "fresh" data not used to develop it. A realistic assessment of how well DCHF-1 performs (referred to as "validation") should be based on data not used to estimate its coefficients. The best option for doing this is to use additional "fresh" data. Otherwise, data-splitting or cross-validation techniques are often used. Data-splitting involves dividing the data into two sets (referred to as the "estimation set" and the "validation set"), and then refitting the correlation with the estimation set and validating it with the validation set. Cross-validation involves splitting the data into several sets (e.g., by test sections), with each set used in turn as the validation set and the remaining sets used as the estimation set.

Although the results of a proper validation may show that the "optimism" in using the same data to assess performance of a fitted model (as was used to fit it) is small, it is still important to perform a proper validation (since the optimism may not be small). Did you perform a proper validation using fresh data, data-splitting, or cross-validation techniques? If so, please describe what you did and the results. If not, please do so and present the results. [In the latter case, certain data-splitting principles should be followed and objective statistical validation tests should be performed, in addition to subjective graphical and tabular investigations as in Section 4. Additional details concerning these comments can be provided on the phone or in writing.]

RESPONSE

Appendix C of the topical report DPC-NE-2000 confirms the applicability of DCHF-1 correlation to the fuel assemblies with Zircaloy mixing vane spacer grids, specifically the MARK-BW mixing vane grid assembly design. These data were obtained from a confirmatory test performed at Columbia University for Babcock and Wilcox. The DCHF-1 correlation conservatively predicted CHF in this test section with an average measured-to-predicted ratio of 1.203 and standard deviation of 8.52%.

In addition to the above data, 250 CHF data from seven tests performed by Westinghouse and published in Reference 1 of the topical report were used in validating the correlation. Two CHF points were deleted due to suspected input errors. The DCHF-1 correlation predicts these 248 points with a mean of 1.007 and a standard deviation of 7.8%.

Considering that the validation data came from a variety of test sections and covered a wide range of parameters, the DCHF-1 correlation predicted the data remarkably well.

The tables showing the test section geometry characteristics and one way groupings of means and standard deviations are given in Appendix C.

11. In Table 4-2, mass velocity has a clear (statistically significant) quadratic effect on R = M/P, yet this was not pointed out in the discussion of Section 4. The fact that DCHF-1 is conservative for G = 1.0 and 3.5 (the means are statistically significantly greater than 1.0) is of course no problem, but the statistically significant nonconservative behavior at G = 2.0 is bothersome. Because the significant differences from 1.0 show up as a quadratic trend and are not randomly distributed among the levels of G, the indication is that DCHF-1 does have both conservative and nonconservative biases with respect to G. It is possible, however, that the observed biases are due, at least in part, to the effects of other factors (see the following question). Please discuss the statistically significant differences and quadratic trend in Table 4-2, and present your position as to whether the results are indicative of real biases in DCHF-1.

RESPONSE

Deriving an empirical correlation whose mean M/P ratio equal to 1.0 will necessarily yield some test sections or data groups whose mean is higher or lower than 1.0. However the mean of each test section or data group should fall approximately within the experimental error of 6.0%. Additionally, deviations from a mean of 1.0 of a test section or a data group are accounted for in the correlation MDNBR limit of 1.194.

12. The tabular presentation of means and standard deviations in Tables 4-1 to 4-6 are all for one-variable groupings of the data, and do not provide for detecting interaction effects among the correlation's independent variables. It is well-known that the presence of interactions can lead to "false positive" or "false negative" determinations regarding the effects of single variables. Thus, the results of Tables 4-1 to 4-6 may be misleading if there are interactions among the variables. Did you produce two-variable tabular groupings of means and standard deviations (such as groupings by mass velocity at each pressure, or by pressure over the range of inlet subcooling, for example), or perform corresponding analyses of variance to investigate interactions? If so, please provide these tables and the results of the analyses of variance. If you did not perform such investigations, justify your position as to the adequacy of your investigations.

RESPONSE

Several one way groupings and two way groupings of means of M/P ratios and standard deviations were prepared and presented in Appendix D. The data were divided into several subgroups. In the case of one way analysis the data were divided into three groups based on low, medium, and high values of the parameter. In addition for two way analysis the data were divided into nine groups.

The following one way groupings of means and standard deviations and the corresponding normality tests, T tests and F tests were performed:

- Pressure
- Mass flux
- Local quality
- Grid spacing
- Length
- Diameter
- Axial heat flux profile
- Cell type.

The following two way groupings of means and standard deviations were performed:

- Pressure and Mass flux
- Pressure and Local quality
- Mass flux and Local quality
- Mass flux and grid spacing

Length and Diameter.

The following three statistical tests were performed on each subgroup:

The Kolmogorov - Smirnov test (K-S Z test) was used to determine how well M/P ratios fit normal distribution. It is based on comparison of the sample cumulative distribution function to the normal cumulative distribution function. The K-S test gives Z value and PROB > Z, the probability of obtaining a Z value greater under the assumption that the distribution is normal.

The usual T test statistic was used for testing the equality of means of the particular subgroup and the entire data base. The T test gives the T statistic, the degrees of freedom, and PROB > T, the probability of a greater absolute value of T under the null hypothesis that the two means are equal.

The statistic used to test the hypothesis that the variances of the subgroup and the entire data base are equal is the F value, which is the ratio of the larger sample variance to the smaller. The F test gives the F ratio and PROB > F, the probability of a greater F value under the hypothesis that the two variances are equal. If the observed PROB > F value was small, the hypothesis that the population variances are equal is rejected, and the separate variance T test for the means was used. On the other hand when the PROB > F value was high, pooled variance T test was used.

The tables given in Appendix D demonstrate that overwhelming majority of the subgroups passed all the three tests: normality K-S test, T test for equality of means, and F test for equality of variances.

13. The value of performing two- or three-variable groupings (as discussed in the previous question) is that it can lead to the discovery of subregions of the independent variable space where DCHF-1 may not perform as well as in other subregions. This is evidenced by the results in Table 4-7, which seem to indicate that DCHF-1 is nonconservative for 5x5 test data with heated rod O.D. = 0.374 and heated length = 168. The three test sections with these characteristics were #'s 161, 162, and 164, which had mean M/P values of 0.972, 0.936, and 0.930. Please discuss whether these results are indicative of a nonconservative bias in DCHF-1 for the stated conditions, or whether there were unusual circumstances in the testing of these sections.

RESPONSE

One way groupings of means and standard deviations by diameter of the rods and length of the rods are given in Appendix D. These results show that there is no bias with respect to either rod diameter (0.374" and 0.422") or length (96" and 168"). Two way groupings by length and diameter show that the means for tests with 0.374" diameter rods and 168" length are within the experimental error of 6.0%.

Refer to the response to question 11 for further discussions about deviations from the mean and the application of the engineering design limit.

14. Test sections with noticeably higher or lower mean M/P ratios in Table 4-7 should be investigated to determine their effect on fitting the correlation and their validity for use. Specifically, test section #114 has a noticeably low mean M/P value (0.900), while sections #132 and #158 have noticeably high values (1.115 and 1.067). [Other sections with noticeably low values were mentioned in the preceding question.] Please discuss whether the test results for the noted sections are considered to be valid, and if so, what their effects are on the fitted correlation (note that this is part of a cross-validation procedure by test section, and statistical techniques exist for deciding whether the fitted coefficients obtained without the data from a given test section are different than those obtained with it).

RESPONSE

A detailed examination of one way groupings by test section show that all the means of M/P ratios are within the repeatability of CHF testing, except two test sections. These are tests 114 and 132 with means of 0.900 and 1.115 respectively.

The inclusion of these two test sections in the development of the correlation has little effect on the fitted correlation coefficients for two reasons. First, test sections 114 and 132 have 33 and 35 points respectively, which are a small fraction of the total data base. Secondly, the mean of the test section 114 is 10% lower than the population mean and that of test section 132 is 11.5% higher. Thus their effects of over prediction and under prediction are negated and therefore the coefficients optimized without these data would not have been significantly different from the values obtained with them. Further these data have been included by the original investigators (Westinghouse) in the WRB-1 correlation report. See Reference 4 in the topical report.

15. Along the lines of the previous question, please discuss the results for S = 20 and 22 in Table 4-4. The DCHF-1 correlation seems to be biased (statistically significant) conservatively for S = 20 and nonconservatively for S = 22. The differences are not part of a trend, however, which raises questions as to whether they are indicative of a real effect of grid spacing, or if the results are due to some other reason. [The two-way tables recommended in Question #12 may help resolve this question.] Please discuss the matter and give your conclusions.

RESPONSE

One way groupings of means and standard deviations by grid spacing, given in Appendix D of DCHF-1 data base, do not show any significant bias with respect to grid spacing.

Refer to the response to question 11 for further discussions about deviations from the mean and the application of the engineering design limit.

16. Figure 4-2 seems to indicate that DCHF-1 is nonconservative for small values of local quality and conservative for large values. Please provide a table of means and standard deviations that would better illustrate this and explain the trend.

RESPONSE

One way groupings by local quality, two way groupings by local quality & mass flux, and two way groupings by pressure and local quality do not show any significant variation of mean M/P with respect to local quality. See Appendix D.

17. The MDNBR limit development in Section 5 is based on the assumption that DCHF-1 performs equally well over its whole range of applicability. Specifically, the development is based on the assumption that the M/P values are a random sample from a common, normally-distributed population. The three parts of the assumption (random sample, common population, and normally-distributed) are important, since they are the basis for the normal tolerance interval theory used to develop the limit.

a. Justify the validity of the "random sample" assumption. Are the data clustered in certain portions of the independent variable space or are they evenly distributed over the space?

b. Justify the validity of the "common population" assumption and discuss what you did to check this. Statistical least squares theory and practical experience suggest that it is extremely unlikely that a fitted model such as DCHF-1 will perform equally well over a large independent variable space. For example, a fitted model will tend to perform better in subregions where there are more data, and worse in regions where there are less data. Also, performance tends to degrade as the distance from the center of the space increases. Address these issues in your response.

An exploratory way to check the "common population" assumption and simultaneously look for subregions where the correlation does not perform as well, is to compute means and standard deviations for various one- and two-way groupings of the M/P values (grouped by the independent or other variables that may affect DCHF-1 performance) and see if the means and standard deviations are relatively constant. [Previous questions have pointed out at least a few potential subregions where performance differs.] Also, it is preferable to do this with "validation" data as well as with the data used to fit the correlation. If the "common population" assumption can not be justified, then the limiting set of the mean and standard deviation derived from the grouping analysis may have to be used for the MDNBR limit calculations.

c. It is important to realize that the normal distribution assumption required for applying normal tolerance interval theory to the DNBR situation is that the distribution of all possible values of DNBR for a given set of conditions be normally distributed. The assumption must be approximately true for every set of conditions, but the normal distributions at the different conditions need not have the same mean and standard deviation. The fact that the distribution of DNBR values over all conditions investigated has an approximate normal distribution (as you note on page 4-2 and display in Figure 4-8) may not be relevant if the individual DNBR values at different conditions don't come from a common population. Please discuss these issues relative to DCHF-1 and the data base used to fit it.

RESPONSE

a. The distribution of the CHF data with respect to variables effecting CHF such as pressure, mass flux, quality, length, axial profile, grid spacing etc., can be seen in the one way and two way groupings of means and standard deviations given in Appendix D. From these tables and also from the plots of M/P ratio versus these variables presented in the topical report DPC-NE-2000, it can be seen that the data are not clustered.

b. The common population assumption is verified by analysis of the data contained in Appendix D. Of the 60 sample groups in these tables, the group M/P mean values were tested to be not significantly different than the population mean for:

A. 35 groups at 5% level,

B. 9 groups at 1% level, and

C. 12 groups at 0.1% level.

Based upon above demonstrated agreement of the sample M/P mean values, it is concluded that the data come from a common population. Sample groups with significantly different means are addressed in engineering practice by usage of the design limit factor as discussed in the chapter 5 of the topical report.

c. The normal distribution assumption is verified by analysis of the data contained in Appendix D. Of the 60 sample groups in these tables, the normality hypothesis test was accepted for all the groups at 5% level. Therefore from the demonstrated normality of the sample group M/P data, it can be concluded that the DNBR data come from a common population.

18. Your approach to computing an MDNBR limit may not provide the stated 95/95 protection for subregions of the claimed region of applicability where DCHF-1 is nonconservative or where its predictions have larger standard deviations. Since the design limit criterion specifies that 95/95 protection is required for every set of conditions, it is important that the approach for obtaining the limit actually satisfy the criterion. The best way to do this is to compute an MDNBR limit for many possible subregions, with the goal of investigating subregions (sets of condition: that will yield larger MDNBR limits than the one obtained by assuming (possibly incorrectly) a common population. The largest value of MDNBR obtained will then provide 95/95 protection for all conditions within the region of applicability.

To illustrate the above comments, consider the subregion defined by all sets of conditions having G = 2.0 Mlbm/hr-ft2, for which DCHF-1 has M/P mean and standard deviation values of 0.971 and 0.0991 respectively, based on 252 data points (refer to Table 4.2). The 95/95 MDNBR limit for the subregion is

$$1/(0.971 - 1.815*0.0991) = 1.264,$$

which is somewhat larger than the value of 1.194 reported on page 5-2. For this subregion of the space, the 1.194 value only provides approximately 95/88 protection (i.e., 95% confidence that MDNBR will be less than 1.194 88% of the time for a given set of conditions within the subregion). In this subregion, 1.194 does not provide the desired 95/95 protection; the actual protection is somewhat less. In light of the above comments and illustration, please discuss and justify your claim that the MDNBR limit of 1.194 provides 95/95 protection for any given core condition. On the other hand, if you concur with our assessment that 1.194 does not provide 95/95 protection for every set of conditions in the region of applicability, please state and justify your revised position regarding a new value of the limit or a revised statement about the protection provided by the 1.194 limit.

RESPONSE

A detailed residual analysis and one way and two way groupings of means and standard deviations presented in Appendix D justified the assumptions of random sample, common population and normal distribution. See the response to question 17

This conclusion is supported by the validation data statistics given Appendix C. See the response to question to 10.

Since "common population" assumption is justified, population statistics are used to compute MDNBR limit rather than the limiting set of mean and standard deviation.

19. Please elaborate on the interpretation of the design limit criterion given in the last sentence of the first paragraph on page 5-1. Specifically, what do you mean by "limiting pins" and the phrase "... that 95 percent of these limiting pins are not in film boiling"? The 95% presumably refers to the proportion of limiting pins from some population, but it is not clear what the population is. Please explain what you mean by these two phrases.

RESPONSE

The phrase "limiting pins" is defined as the rod or rods where measured-to-predicted (M/P) CHF ratio is minimum when DCHF-1 correlation is applied. This correlation will be used in conjunction with a Duke core thermal hydraulic application methodology to be described in a topical report submitted in October 1988. This thermal hydraulic methodology will meet GDC 10 and specifically SRP 4.2 of NUREG 0800, Rev 1, July 1981.

20. There is no discussion in Section 5 as to how other uncertainties (e.g., in the DCHF-1 independent variables, design parameters, computer codes, etc.) are to be treated in applying the MDNBR limit. Please discuss this topic relative to application of DCHF-1.

RESPONSE

All types of uncertainties relative to the application of DCHF-1 correlation to establish MDNBR design limit will be discussed in a separate core thermal hydraulic methodology topical report which Duke will submit to NRC in October 1988.

Appendix A′

Local Conditions of the DCHF-1 Data Base

108	1	8	1514.7	2.3074	0.058	78	20	1.0904	1	0.8605	0.8792
108	2	9	1514.7	2.2385	0.0391	78	20	1.0964	1	0.8873	0.9658
108	3	10	2164.7	2.4755	0.0377	78	20	1.0927	1	0.7939	0.7894
108	4	11	2114.7	2.4116	0.0285	78	20	1.0955	1	0.8069	0.8621
108	5	12	2414.7	2.4135	-0.033	78	20	1.0983	1	0.8661	0.8513
108	6	13	2414.7	1.957	-0.0434	78	20	1.0978	1	0.8242	0.8002
108	7	14	1514.7	3.2191	0.0696	80	20	1.1251	1	0.8247	0.7455
108	8	15	1814.7	3.4019	0.0561	80	20	1.1268	1	0.8162	0.7936
108	9	16	1824.7	1.7347	0.0212	78	20	1.1	1	0.8078	0.8714
108	10	17	1514.7	3.3967	0.0421	78	20	1.085	1	0.9261	0.8862
108	11	18	1514.7	2.2314	0.0219	78	20	1.099	1	0.9155	1.0277
108	12	19	1544.7	1.7475	0.0282	78	20	1.0999	1	0.8712	0.9442
108	13	53	1514.7	3.3956	0.0563	80	20	1.1287	1	0.8528	0.7397
108	14	54	1814.7	3.4419	0.0177	78	20	1.0914	1	0.9201	0.9364
108	15	55	1794.7	1.8488	-0.0172	78	20	1.0986	1	0.8817	0.924
108	16	56	2114.7	1.9197	-0.0799	76	20	1.0654	1	0.9526	0.9347
108	17	57	2114.7	1.9195	-0.0552	76	20	1.066	1	0.9155	0.9004
108	18	58	2114.7	1.8864	-0.0043	78	20	1.0998	1	0.8035	0.7847
108	19	59	2114.7	2.3774	-0.0202	78	20	1.1	1	0.8772	0.9039
108	20	60	2089.7	2.8899	0.0091	78	20	1.0955	1	0.8789	0.9411
108	21	61	2124.7	2.9236	0.0126	78	20	1.0949	1	0.8729	0.8451
108	22	62	2094.7	2.931	0.0643	80	20	1.1284	1	0.7559	0.7018
108	23	63	2114.7	3.3867	-0.0105	78	20	1.0969	1	0.947	1.0664
108	24	64	2114.7	3.3375	0.0301	78	20	1.0865	1	0.8771	0.8482
108	25	65	2094.7	3.3958	0.0035	78	20	1.0939	1	0.9257	0.9565
108	26	66	2404.7	2.9861	-0.0648	76	20	1.0644	1	1.0222	0.9773
108	27	67	2409.7	2.9606	-0.0136	78	20	1.0975	1	0.8959	0.8064
108	28	68	2414.7	2.9704	0.0441	78	20	1.0845	1	0.812	0.7275
108	29	69	2414.7	3.4971	0.0457	80	20	1.1269	1	0.8119	0.7309
114	1	217	1499.7	2.4189	0.0448	72	26	1.1407	1	0.813	0.6928
114	2	218	1504.7	2.4224	0.0234	72	26	1.1367	1	0.8543	0.7641
114	3	219	1504.7	2.3896	0.0111	72	26	1.1338	1	0.8778	0.82
114	4	220	1514.7	3.4629	0.0612	72	26	1.1454	1	0.7958	0.6536
114	5	221	1514.7	3.4438	0.0408	72	26	1.145	1	0.84	0.7653
114	6	222	1804.7	3.3948	0.0518	72	26	1.1446	1	0.7795	0.6477
114	7	223	1804.7	3.5697	0.0299	72	26	1.1441	1	0.8302	0.8021
114	8	224	2094.7	2.4856	0.0632	74	26	1.1678	1	0.6706	0.6125
114	9	225	2099.7	2.476	0.0275	72	26	1.1376	1	0.7508	0.6964
114	10	226	2114.7	2.4665	-0.0102	72	26	1.1287	1	0.8148	0.7546
114	11	227	2114.7	3.0228	0.0611	74	26	1.1715	1	0.7	0.6125
114	12	228	2124.7	2.9872	0.0361	72	26	1.1423	1	0.7651	0.7201
114	13	229	2134.7	3.0077	-0.0115	72	26	1.1341	1	0.8539	0.8128
114	14	230	2114.7	3.5038	0.0425	72	26	1.1441	1	0.7821	0.6786
114	15	231	2134.7	3.514	0.0252	72	26	1.1433	1	0.8144	0.801
114	16	232	2124.7	3.4646	-0.006	72	26	1.1384	1	0.8734	0.8758
114	17	233	2434.7	3.4886	0.0598	74	26	1.1724	1	0.7192	0.6557
114	18	234	2434.7	3.5266	-0.0068	72	26	1.138	1	0.8663	0.7986
114	19	235	2424.7	3.5177	-0.0457	72	26	1.1296	1	0.9406	0.8746
114	20	236	2444.7	2.9718	0.0729	76	26	1.2027	1	0.6418	0.5745
114	21	237	2434.7	2.9964	0.0069	72	26	1.1371	1	0.8002	0.7142
114	22	238	2424.7	3.0174	-0.0383	72	26	1.127	1	0.8839	0.7998
114	23	239	2424.7	2.5071	-0.027	72	26	1.1243	1	0.8165	0.6976
114	24	240	2424.7	2.5081	-0.0945	68	26	1.0796	1	0.9762	0.8425
114	25	241	2399.7	2.5157	-0.1224	68	26	1.0744	1	1.0303	0.8812

114	26	242	2424.7	2.0329	-0.0466	72	26	1.1113	1	0.7988	0.6548
114	27	243	2404.7	2.008	-0.0675	72	26	1.1043	1	0.8323	0.6952
114	28	244	2424.7	2.0439	-0.1439	68	26	1.0649	1	0.9969	0.8258
114	29	245	2124.7	1.9454	0.0133	72	26	1.1279	1	0.7318	0.6916
114	30	246	2114.7	1.9706	-0.0252	72	26	1.117	1	0.7989	0.7404
114	31	247	2114.7	1.9673	-0.0448	72	26	1.1108	1	0.8317	0.7784
114	32	248	1804.7	1.9911	-0.0016	72	26	1.1246	1	0.8149	0.719
114	33	249	1824.7	1.9146	-0.0234	72	26	1.1167	1	0.844	0.7617
121	1	394	1534.7	3.4551	0.0811	74	20	1.1746	1	0.7875	0.7157
121	2	395	1504.7	3.4558	0.0514	72	20	1.1462	1	0.8836	0.8317
121	3	396	1794.7	3.5182	0.0793	74	20	1.1728	1	0.7657	0.6911
121	4	397	1774.7	3.4328	0.0473	72	20	1.1457	1	0.8545	0.8501
121	5	398	2094.7	3.4235	0.0882	76	20	1.207	1	0.7031	0.6758
121	6	399	2064.7	3.4707	0.0509	74	20	1.1723	1	0.8006	0.861
121	7	400	2114.7	3.4484	0.0308	72	20	1.1437	1	0.8617	0.9958
121	8	401	2114.7	2.9668	0.1063	76	20	1.2076	1	0.6522	0.6212
121	9	402	2114.7	2.9906	0.0453	72	20	1.1426	1	0.8084	0.7937
121	10	403	2114.7	2.9845	0.0337	72	20	1.1419	1	0.8292	0.9273
121	11	404	2399.7	3.5142	0.0806	76	20	1.2063	1	0.7165	0.6791
121	12	405	2404.7	3.5432	0.0322	72	20	1.1432	1	0.8564	0.877
121	13	406	2404.7	3.4579	-0.0081	72	20	1.1373	1	0.9245	1.0069
121	14	407	2414.7	2.9785	0.1076	76	20	1.206	1	0.6421	0.61
121	15	408	2394.7	3.0233	0.0589	74	20	1.1711	1	0.7472	0.7415
121	16	409	2384.7	2.967	0.0217	72	20	1.1397	1	0.8315	0.8954
121	17	410	2414.7	2.4688	0.0361	72	20	1.1387	1	0.7629	0.768
121	18	411	2404.7	2.4341	0.001	72	20	1.1309	1	0.818	0.8783
121	19	412	2414.7	2.479	-0.0469	72	20	1.1183	1	0.9039	0.9762
121	20	413	2094.7	2.4916	0.0765	74	20	1.1707	1	0.703	0.6677
121	21	414	2124.7	2.471	0.0409	72	20	1.1397	1	0.781	0.7999
121	22	415	2104.7	2.4655	0.0236	72	20	1.1367	1	0.8124	0.8832
121	23	416	1494.7	2.4543	0.0841	74	20	1.173	1	0.7763	0.7649
121	24	417	1504.7	2.3904	0.0662	74	20	1.1693	1	0.8071	0.8211
121	25	418	1504.7	2.4041	0.0354	72	20	1.1393	1	0.8928	0.942
121	26	419	2404.7	1.9708	0.0113	72	20	1.1275	1	0.7535	0.7472
121	27	420	2404.7	1.9936	-0.0178	72	20	1.1195	1	0.8018	0.7986
121	28	421	2404.7	1.922	-0.0029	74	20	1.1394	1	0.7517	0.8118
121	29	422	2099.7	1.9733	0.0427	72	20	1.1356	1	0.7437	0.7533
121	30	423	2114.7	1.9342	0.0331	72	20	1.1327	1	0.7536	0.817
121	31	424	2094.7	1.9226	0.0083	72	20	1.1261	1	0.7956	0.8917
121	32	425	1804.7	1.9972	0.0482	72	20	1.1371	1	0.786	0.8415
121	33	426	1814.7	1.8865	0.044	74	20	1.1557	1	0.7634	0.8481
121	34	427	1504.7	1.3819	0.1147	74	20	1.1667	1	0.7103	0.6466
121	35	428	1514.7	1.3957	0.1071	74	20	1.1656	1	0.7185	0.7075
121	36	429	1514.7	1.3567	0.1177	76	20	1.1945	1	0.6802	0.7338
121	39	432	2014.7	0.8506	0.0159	76	20	1.1231	1	0.6532	0.7349
122	1	434	1524.7	3.4033	0.069	72	26	1.144	1	0.7775	0.7361
122	2	435	1514.7	3.4485	0.0454	72	26	1.1455	1	0.8297	0.8451
122	3	436	1814.7	3.4719	0.0749	74	26	1.174	1	0.7102	0.6864
122	4	437	1814.7	3.5375	0.0371	72	26	1.1449	1	0.8129	0.8488
122	5	438	2114.7	3.5072	0.062	74	26	1.1727	1	0.7212	0.7028
122	6	439	2104.7	3.5733	0.0257	72	26	1.1436	1	0.818	0.8488
122	7	440	2114.7	3.4985	-0.0065	72	26	1.1385	1	0.8771	0.9541
122	8	441	2129.7	3.0183	0.077	74	26	1.1727	1	0.6716	0.6536
122	9	442	2114.7	3.064	0.0483	74	26	1.1693	1	0.725	0.7531

122	10	443	2114.7	3.0103	0.0087	72	26	1.1362	1	0.8177	0.8659
122	11	444	2394.7	3.5248	0.0732	74	26	1.1724	1	0.6989	0.677
122	12	445	2424.7	3.5732	0.0163	72	26	1.1413	1	0.8272	0.8561
122	13	446	2374.7	3.5549	-0.0313	72	26	1.1334	1	0.9171	0.959
122	14	447	2414.7	2.8969	0.0795	76	26	1.2024	1	0.628	0.5787
122	15	448	2409.7	2.9143	0.0228	72	26	1.1369	1	0.7676	0.7288
122	16	449	2394.7	2.8822	-0.0133	72	26	1.1321	1	0.8285	0.8108
122	17	450	2374.7	2.3969	0.0078	72	26	1.1318	1	0.752	0.7006
122	1	451	2414.7	2.4184	-0.0316	72	26	1.1218	1	0.8186	0.7814
122	2	452	2114.7	2.3907	0.0777	74	26	1.1701	1	0.6399	0.6173
122	3	453	2114.7	2.4417	0.0533	74	26	1.1658	1	0.6824	0.6922
122	4	454	2114.7	2.383	0.025	72	26	1.1362	1	0.7471	0.7973
122	5	455	1514.7	2.3774	0.0692	74	26	1.169	1	0.7386	0.7215
122	6	456	1514.7	2.3301	0.0424	72	26	1.1394	1	0.8121	0.8635
122	7	457	1514.7	2.2959	0.0334	72	26	1.1377	1	0.8283	0.9137
122	8	458	2124.7	1.921	0.0144	72	26	1.1275	1	0.7281	0.7128
122	9	459	2124.7	1.8738	0.0076	72	26	1.1251	1	0.7348	0.7618
122	10	460	2094.7	1.9283	-0.0186	72	26	1.1183	1	0.787	0.8341
122	11	461	1814.7	1.8781	0.0311	72	26	1.1318	1	0.7494	0.7667
122	12	462	1814.7	1.8704	0.0141	72	26	1.1269	1	0.7778	0.8439
124	1	475	1564.7	3.387	0.0856	74	20	1.1729	1	0.7744	0.7043
124	2	476	1514.7	3.3313	0.0543	72	20	1.1461	1	0.8732	0.8487
124	3	477	1789.7	3.5769	0.048	72	20	1.1448	1	0.8575	0.7661
124	4	478	1789.7	3.6171	0.0451	72	20	1.146	1	0.864	0.9018
124	6	480	2114.7	3.631	0.0469	74	20	1.1724	1	0.8138	0.9084
124	7	481	2114.7	3.0505	0.0872	74	20	1.174	1	0.7127	0.7161
124	8	482	2114.7	3.0784	0.0619	74	20	1.172	1	0.7581	0.8246
124	9	483	2114.7	3.0329	0.0375	72	20	1.1427	1	0.8246	0.9339
124	10	484	2414.7	3.5746	0.0775	76	20	1.2061	1	0.7253	0.7199
124	11	485	2414.7	3.5613	0.0266	72	20	1.1426	1	0.8679	0.9314
124	12	486	2414.7	2.9537	0.0884	76	20	1.206	1	0.6693	0.6492
124	13	487	2414.7	2.904	0.0303	72	20	1.1401	1	0.8104	0.7969
124	14	488	2414.7	2.7924	0.0097	72	20	1.1361	1	0.8359	0.8487
124	15	489	2414.7	2.3934	0.0133	72	20	1.1331	1	0.793	0.7895
124	16	490	2414.7	2.3547	-0.0108	72	20	1.1268	1	0.8289	0.8438
124	17	491	2414.7	2.3556	-0.0374	72	20	1.1194	1	0.8739	0.887
124	18	492	2114.7	2.3481	0.104	76	20	1.2044	1	0.6271	0.6413
124	19	493	2164.7	2.3708	0.0663	74	20	1.1682	1	0.7054	0.7102
124	20	494	2114.7	2.3928	0.0295	72	20	1.1373	1	0.7956	0.8784
124	21	495	2114.7	2.3205	0.0019	72	20	1.1301	1	0.8377	0.9191
124	22	496	1514.7	2.3346	0.0862	74	20	1.1724	1	0.7666	0.7822
124	23	497	1514.7	2.3162	0.0779	74	20	1.1704	1	0.7819	0.8482
124	24	498	1514.7	2.3008	0.046	72	20	1.1399	1	0.867	0.9413
124	25	499	2414.7	1.8988	0.0155	72	20	1.1275	1	0.738	0.7229
124	26	500	2414.7	1.8729	-0.0144	72	20	1.1184	1	0.7809	0.7969
124	27	501	2414.7	1.9219	-0.0587	72	20	1.1055	1	0.8573	0.8598
124	28	502	2114.7	1.9101	0.0491	72	20	1.1363	1	0.7264	0.7328
124	29	503	2114.7	1.8933	0.0355	72	20	1.1327	1	0.7464	0.7969
124	30	504	2114.7	1.8303	-0.0017	72	20	1.1215	1	0.8	0.887
124	31	505	1814.7	1.8935	0.0334	72	20	1.1326	1	0.8028	0.8142
124	32	506	1814.7	1.8084	0.0487	74	20	1.1558	1	0.7513	0.7975
124	33	507	1514.7	1.3933	0.1142	74	20	1.1676	1	0.7076	0.6772
124	34	508	1514.7	1.3427	0.0973	74	20	1.1613	1	0.7328	0.6937
124	35	509	1514.7	1.3422	0.0865	74	20	1.1582	1	0.7492	0.7267

125 1 510 1514.7 3.36 0.0474 78 20 1.082 1 0.9161 0.8014
125 2 511 1514.7 3.3301 0.0468 80 20 1.1327 1 0.8682 0.8677
125 3 512 1814.7 3.3292 0.0624 80 20 1.126 1 0.8021 0.8012
125 4 513 1814.7 3.409 0.0186 78 20 1.0915 1 0.9256 0.9648
125 5 514 2114.7 3.441 0.0394 78 20 1.0834 1 0.8825 0.8375
125 6 515 2114.7 3.3758 0.0263 78 20 1.0886 1 0.8849 0.9774
125 7 516 2114.7 3.3029 0.0025 78 20 1.0945 1 0.9191 1.0339
125 8 517 2144.7 2.8988 0.0644 80 20 1.1272 1 0.7506 0.6844
125 9 518 2114.7 2.9138 0.0163 78 20 1.0945 1 0.8886 0.9004
125 10 519 2114.7 2.8604 -0.0112 78 20 1.0984 1 0.9086 0.9617
125 11 520 2414.7 3.473 0.0251 78 20 1.0852 1 0.885 0.8328
125 12 521 2414.7 3.4248 -0.0188 78 20 1.0965 1 0.9484 0.9585
125 13 522 2414.7 3.404 -0.0544 78 20 1.0993 1 1.0057 1.0449
125 14 523 2414.7 2.9986 0.032 78 20 1.0874 1 0.8323 0.7322
125 15 524 2414.7 2.9488 -0.0185 78 20 1.0979 1 0.9021 0.8925
125 16 525 2414.7 2.8993 -0.0383 78 20 1.0994 1 0.9278 0.9522
125 17 526 2389.7 2.4115 -0.0326 78 20 1.0993 1 0.8678 0.8092
125 18 527 2374.7 2.4466 -0.0843 76 20 1.066 1 0.9696 0.9091
125 19 528 2394.7 2.463 -0.1313 76 20 1.0645 1 1.0645 0.9971
125 20 529 2134.7 2.4153 0.0392 78 20 1.0929 1 0.7899 0.7857
125 21 530 2099.7 2.3811 0.0133 78 20 1.0973 1 0.8269 0.8517
125 22 531 2099.7 2.3617 -0.018 78 20 1.1 1 0.8743 0.9067
125 23 532 1534.7 2.3486 0.0433 78 20 1.0939 1 0.8808 0.8721
125 24 533 1524.7 2.3145 0.0212 78 20 1.0978 1 0.9187 0.9349
125 25 534 1524.7 2.2652 0.0099 78 20 1.0995 1 0.9352 0.9962
125 26 535 2399.7 1.8979 -0.0409 76 20 1.0654 1 0.8469 0.7894
125 27 536 2394.7 1.942 -0.0739 76 20 1.0655 1 0.9003 0.8924
125 28 537 2414.7 1.9558 -0.1172 76 20 1.0633 1 0.9641 0.9706
125 29 538 2114.7 1.8684 0.0099 78 20 1.0994 1 0.7819 0.7982
125 30 539 2099.7 1.8918 -0.0252 78 20 1.0989 1 0.8369 0.8799
125 31 540 2094.7 1.8705 -0.0536 76 20 1.066 1 0.9105 0.9656
125 32 541 1824.7 1.8268 0.0123 78 20 1.1 1 0.8286 0.8799
125 33 542 1814.7 1.8381 -0.0058 78 20 1.0997 1 0.8589 0.9554
127 1 550 1514.7 3.4366 0.0574 80 22 1.1263 1 0.8292 0.7622
127 2 551 1514.7 3.3449 0.0204 78 22 1.0932 1 0.9403 0.941
127 3 552 1814.7 3.4135 0.0298 78 22 1.0876 1 0.8828 0.8421
127 4 553 1814.7 3.3692 0.0126 78 22 1.0927 1 0.9112 0.9394
127 5 554 2114.7 3.4442 0.0342 78 22 1.0847 1 0.8544 0.8166
127 6 555 2114.7 3.3642 0.0169 78 22 1.0905 1 0.8773 0.9075
127 7 556 2114.7 3.3958 -0.0355 78 22 1.0995 1 0.969 1.0207
127 8 557 2114.7 2.9687 0.0335 78 22 1.0885 1 0.8231 0.7719
127 9 558 2114.7 2.9215 0.0109 78 22 1.0951 1 0.8541 0.8357
127 10 559 2114.7 2.8738 -0.0183 78 22 1.0988 1 0.8978 0.9186
127 11 560 2414.7 3.4585 0.0316 78 22 1.0837 1 0.8508 0.7958
127 12 561 2414.7 3.4263 -0.0237 78 22 1.097 1 0.9342 0.8788
127 13 562 2414.7 3.4191 -0.0781 76 22 1.0643 1 1.0692 1.0205
127 14 563 2414.7 2.9706 0.0078 78 22 1.0942 1 0.8428 0.7193
127 15 564 2414.7 2.9037 -0.0085 78 22 1.0973 1 0.8607 0.7926
127 16 565 2414.7 2.9587 -0.0798 76 22 1.0653 1 1.0206 0.9176
127 17 566 2364.7 2.4023 -0.0408 76 22 1.064 1 0.898 0.808
127 18 567 2364.7 2.4054 -0.0766 76 22 1.0658 1 0.9527 0.8822
127 19 568 2414.7 2.4376 -0.1302 76 22 1.0644 1 1.0355 0.9598
127 20 569 2114.7 2.4101 0.0264 78 22 1.0948 1 0.7898 0.7097
127 21 570 2044.7 2.376[illegible] 0.005[illegible] 78 22 1.0987 1 0.8269 0.78[illegible]

127	22	571	2114.7	2.3784	-0.0383	76	22	1.0644	1	0.9228	0.9159
127	23	572	1534.7	2.3089	0.0447	78	22	1.094	1	0.8533	0.8612
127	24	573	1514.7	2.2696	0.0462	78	22	1.094	1	0.8542	0.917
127	25	574	1514.7	2.2917	0.0113	78	22	1.0994	1	0.9134	0.9888
127	26	575	1814.7	1.8122	0.0059	78	22	1.0999	1	0.8184	0.8628
127	27	576	1814.7	1.8152	-0.0151	78	22	1.0996	1	0.85	0.9202
127	28	577	2114.7	1.8856	-0.008	78	22	1.0997	1	0.7892	0.7767
127	29	578	2114.7	1.8759	-0.0537	76	22	1.066	1	0.8873	0.8771
127	30	579	1814.7	1.8178	0.0065	78	22	1.0999	1	0.8179	0.8676
127	31	580	2114.7	1.9261	-0.0933	76	22	1.0649	1	0.8534	0.9362
127	32	581	2414.7	1.9254	-0.0656	76	22	1.0657	1	0.8637	0.7793
127	33	582	2414.7	1.9346	-0.1041	76	22	1.0642	1	0.9202	0.8316
127	34	583	2414.7	1.946	-0.1459	76	22	1.0605	1	0.9845	0.9126
127	35	584	1514.7	1.5911	0.0246	78	22	1.1	1	0.8546	0.7863
127	36	585	1514.7	1.2829	0.0984	80	22	1.138	1	0.7041	0.7862
127	37	586	1514.7	1.3001	0.0826	80	22	1.1386	1	0.7245	0.8462
131	1	617	1504.7	3.5033	0.1529	147	26	1.1658	1	0.4651	0.4966
131	2	618	2094.7	3.462	0.1522	150	26	1.2016	1	0.4323	0.4482
131	3	619	2394.7	3.4595	0.1277	150	26	1.1969	1	0.4682	0.5073
131	4	620	2394.7	3.0159	0.1423	150	26	1.1973	1	0.4338	0.4716
131	5	621	2114.7	3.0175	0.1371	150	26	1.195	1	0.4445	0.4002
131	6	622	2124.7	2.9496	0.1178	150	26	1.1885	1	0.4691	0.4939
131	7	623	2124.7	2.4221	0.1381	150	26	1.1988	1	0.4282	0.4315
131	8	624	2394.7	2.4337	0.1101	150	26	1.1774	1	0.4523	0.4783
131	9	625	2404.7	3.4013	0.1013	150	26	1.1875	1	0.5031	0.6054
131	10	626	2374.7	2.93	0.099	150	26	1.1805	1	0.4884	0.534
131	11	627	2404.7	2.9131	0.0657	150	26	1.1654	1	0.5332	0.6087
131	12	628	2414.7	2.4489	0.0569	150	26	1.1525	1	0.5215	0.5329
131	13	629	2414.7	2.456	0.0353	150	26	1.1423	1	0.551	0.5998
131	14	630	2414.7	1.9548	0.1239	150	26	1.1738	1	0.4119	0.4014
131	15	631	2404.7	1.9376	0.0806	150	26	1.1523	1	0.4628	0.4538
131	16	632	2099.7	1.9718	0.1447	150	26	1.1835	1	0.4093	0.3646
131	17	633	2094.7	1.9369	0.1198	150	26	1.1715	1	0.4389	0.4259
131	18	634	2404.7	1.9473	0.0567	150	26	1.1407	1	0.4925	0.514
131	19	635	2114.7	1.9681	0.0803	150	26	1.153	1	0.4881	0.5206
131	20	636	2124.7	2.438	0.0514	150	26	1.1497	1	0.5463	0.5797
131	21	637	2094.7	2.4739	0.0862	150	26	1.1672	1	0.5009	0.5162
131	22	638	2114.7	3.4336	0.1013	150	26	1.1882	1	0.5053	0.582
131	23	639	2084.7	2.9461	0.0775	150	26	1.1715	1	0.5289	0.5764
131	24	640	1814.7	3.5472	0.1057	147	26	1.1605	1	0.5254	0.5494
131	25	641	1794.7	3.5143	0.088	147	26	1.1559	1	0.555	0.6105
131	26	642	1799.7	3.5143	0.0587	144	26	1.1235	1	0.6211	0.6592
131	27	643	1514.7	3.5761	0.0982	147	26	1.1593	1	0.5578	0.6093
131	28	644	1489.7	2.5019	0.1116	147	26	1.1525	1	0.5405	0.5354
131	29	645	1489.7	2.4746	0.0687	144	26	1.1164	1	0.6249	0.6162
131	30	646	1514.7	2.0086	0.0999	147	26	1.1406	1	0.5545	0.5248
131	31	647	1804.7	1.9953	0.1503	147	26	1.1368	1	0.4437	0.3334
131	32	648	1499.7	2.5151	0.1638	150	26	1.1988	1	0.4438	0.4749
131	33	649	1504.7	1.9662	0.2141	153	26	1.2539	1	0.3687	0.3754
131	34	650	1501.7	2.0391	0.1379	147	26	1.1547	1	0.5018	0.4802
131	35	651	1804.7	1.9818	0.0999	144	26	1.1187	1	0.5228	0.4329
131	36	652	1784.7	2.0093	0.0757	144	26	1.1119	1	0.5594	0.5018
131	37	653	2104.7	3.4781	0.1604	150	26	1.2028	1	0.4212	0.4593
132	1	654	1514.7	3.4351	0.1998	153	20	1.2571	1	0.402	0.4967

132	2	655	2094.7	3.4577	0.1872	153	20	1.2567	1	0.4087	0.4465
132	3	656	2404.7	2.9606	0.1759	153	20	1.2533	1	0.4125	0.4475
132	4	657	2204.7	3.013	0.1521	147	20	1.1652	1	0.4824	0.4579
132	5	658	2104.7	2.9618	0.1327	147	20	1.1629	1	0.5093	0.5412
132	6	659	1804.7	3.4709	0.1348	147	20	1.1654	1	0.5268	0.5518
132	7	660	2374.7	3.4291	0.1693	153	20	1.2557	1	0.4344	0.4977
132	8	661	2399.7	3.3529	0.1609	153	20	1.2532	1	0.4432	0.5374
132	9	662	2399.7	3.3889	0.1322	153	20	1.2422	1	0.4826	0.5866
132	10	663	2114.7	3.4498	0.1405	153	20	1.2469	1	0.4717	0.5918
132	11	664	2399.7	2.9124	0.1191	153	20	1.2289	1	0.4829	0.6012
132	12	665	2114.7	2.9469	0.1192	153	20	1.2296	1	0.4909	0.6064
132	14	667	1799.7	3.4679	0.1137	147	20	1.1624	1	0.5602	0.6727
132	15	668	2099.7	2.4404	0.1177	153	20	1.2186	1	0.48	0.6023
132	16	669	2384.7	2.4652	0.0896	153	20	1.2024	1	0.5034	0.5981
132	17	670	2399.7	2.9184	0.1507	153	20	1.2443	1	0.4421	0.5312
132	18	671	2384.7	2.4371	0.1561	153	20	1.2389	1	0.4182	0.4778
132	19	672	2399.7	2.4388	0.1328	153	20	1.2269	1	0.4461	0.5333
132	20	673	2399.7	1.9581	0.1137	147	20	1.1445	1	0.476	0.4203
132	21	674	2399.7	1.9491	0.1511	153	20	1.2254	1	0.4028	0.482
132	22	675	2404.7	1.9134	0.1043	153	20	1.1959	1	0.4552	0.5197
132	23	676	2094.7	1.9354	0.1464	153	20	1.2224	1	0.4291	0.5019
132	24	677	2104.7	2.4192	0.1712	153	20	1.2453	1	0.4104	0.4318
132	25	678	2104.7	2.4583	0.1417	153	20	1.2323	1	0.4485	0.5144
132	26	679	2104.7	1.9405	0.1515	153	20	1.2252	1	0.4224	0.4287
132	27	680	2104.7	1.9268	0.1847	153	20	1.2418	1	0.3836	0.344
132	28	681	1799.7	1.9734	0.1635	150	20	1.1915	1	0.4555	0.4092
132	29	682	1799.7	1.9545	0.2201	153	20	1.2547	1	0.37	0.3461
132	30	683	1499.7	1.9693	0.2735	159	20	1.395	1	0.3061	0.365
132	31	684	1494.7	2.5332	0.22	156	20	1.3192	1	0.3722	0.4644
132	32	685	1799.7	1.9879	0.1165	147	20	1.1463	1	0.5322	0.4966
132	33	686	1499.7	2.4843	0.1663	150	20	1.2006	1	0.487	0.5585
132	34	687	1499.7	1.9627	0.2085	153	20	1.2541	1	0.4191	0.4642
132	35	688	1499.7	2.0348	0.1481	150	20	1.187	1	0.5189	0.5418
132	36	689	1499.7	2.4439	0.1182	147	20	1.1542	1	0.5778	0.6011
133	1	690	1499.7	3.4545	0.2086	153	13	1.2578	1	0.4723	0.5248
133	2	691	2099.7	2.9565	0.2074	150	13	1.2042	1	0.473	0.449
133	3	692	2099.7	3.4394	0.2065	153	13	1.2584	1	0.4599	0.4808
133	4	693	2399.7	2.9546	0.1949	150	13	1.2069	1	0.4842	0.497
133	5	694	2104.7	2.954	0.1614	150	13	1.2026	1	0.5308	0.5484
133	6	695	2404.7	1.9464	0.1832	150	13	1.1982	1	0.4496	0.4322
133	7	696	2404.7	1.9648	0.0942	150	13	1.1597	1	0.5553	0.5171
133	8	697	2104.7	1.9223	0.1323	150	13	1.1773	1	0.5329	0.5517
133	9	698	2114.7	2.4262	0.1812	150	13	1.2036	1	0.4894	0.5015
133	10	699	2104.7	1.9375	0.1654	150	13	1.1919	1	0.493	0.4881
133	11	700	2109.7	1.9309	0.2068	150	13	1.2045	1	0.4448	0.4132
133	12	701	2399.7	2.4539	0.1362	150	13	1.1887	1	0.5328	0.526
133	14	703	1804.7	1.968	0.2198	150	13	1.2047	1	0.4624	0.3764
133	15	704	1499.7	1.9525	0.2553	156	13	1.3232	1	0.418	0.39
133	16	705	1499.7	2.5392	0.2157	153	13	1.2605	1	0.4763	0.4923
133	17	706	1794.7	1.9433	0.1665	150	13	1.1925	1	0.5274	0.5115
133	18	707	1504.7	1.9998	0.2095	153	13	1.2552	1	0.494	0.4755
133	19	708	1499.7	1.9771	0.1781	150	13	1.1978	1	0.5602	0.5696
133	20	709	1829.7	3.4634	0.1176	147	13	1.1629	1	0.639	0.6657
133	21	710	1814.7	3.4007	0.1694	150	13	1.2051	1	0.5381	0.5551

133	22	711	2399.7	3.3958	0.1748	150	13	1.2066	1	0.5264	0.545
133	23	712	2399.7	3.3703	0.129	150	13	1.1969	1	0.5866	0.5942
133	24	713	2399.7	3.3795	0.108	150	13	1.1899	1	0.6168	0.6154
133	25	714	2114.7	3.434	0.14	150	13	1.201	1	0.5738	0.5031
133	26	715	2414.7	2.9002	0.0892	150	13	1.1759	1	0.6193	0.612
133	27	716	2099.7	2.9177	0.1233	150	13	1.1906	1	0.5829	0.6232
133	28	717	1524.7	3.4686	0.1855	153	13	1.2599	1	0.504	0.5897
133	29	718	2399.7	2.471	0.0581	150	13	1.1536	1	0.6378	0.6277
133	30	719	2404.7	2.9239	0.1284	150	13	1.1924	1	0.5666	[illegible]
133	31	720	2399.7	2.4361	0.1068	150	13	1.1759	1	0.5697	0.5551
133	32	721	2099.7	2.4681	0.1462	150	13	1.1933	1	0.5363	0.5752
133	33	722	2099.7	2.4148	0.1111	150	13	1.1779	1	0.5819	0.6266
133	34	723	2404.7	1.9607	0.062	150	13	1.1437	1	0.5955	0.564
133	35	724	1494.7	2.4772	0.1883	153	13	1.2543	1	0.516	0.5583
133	36	725	1504.7	2.433	0.162	150	13	1.1989	1	0.5774	0.6187
133	37	726	1499.7	1.5189	0.204	150	13	1.1986	1	0.5338	0.4635
133	38	727	1504.7	1.4957	0.2828	156	13	1.3289	1	0.4008	0.3675
134	1	728	1509.7	3.4727	0.1463	150	32	1.2004	1	0.4228	0.4455
134	2	729	1799.7	3.4587	0.1034	147	32	1.1589	1	0.4929	0.4974
134	3	730	2094.7	3.4467	0.1528	150	32	1.2012	1	0.3979	0.4288
134	4	731	2124.7	3.5089	0.149	150	32	1.2012	1	0.4042	0.4388
134	5	732	2404.7	3.4889	0.1036	147	32	1.1592	1	0.4851	0.5221
134	6	733	2384.7	3.0448	0.1365	150	32	1.1957	1	0.4106	0.4578
134	7	734	2114.7	2.9524	0.1348	147	32	1.1616	1	0.4281	0.4068
134	8	735	2099.7	2.9754	0.0933	147	32	1.1519	1	0.4873	0.5221
134	9	736	2404.7	2.9638	0.0839	150	32	1.1745	1	0.4779	0.5426
134	10	737	2399.7	2.4428	0.0944	150	32	1.1703	1	0.4423	0.4667
134	11	738	2099.7	2.4397	0.1116	147	32	1.1512	1	0.4467	0.4445
134	12	739	2404.7	3.4527	0.0642	147	32	1.1474	1	0.5407	0.6549
134	13	740	1489.7	2.4113	0.0494	144	32	1.1097	1	0.6176	0.6023
134	14	741	2384.7	2.4849	-0.0539	144	32	1.0787	1	0.6713	0.6528
134	15	742	2099.7	2.4303	0.0093	144	32	1.0972	1	0.6014	0.6233
134	16	743	1499.7	3.508	0.0527	144	32	1.1221	1	0.6209	0.6984
134	17	744	1499.7	3.5327	0.0915	147	32	1.1569	1	0.5334	0.5832
134	18	745	1799.7	3.4949	0.0425	144	32	1.1191	1	0.6112	0.638
134	19	746	2404.7	2.931	-0.0231	144	32	1.0937	1	0.6575	0.6676
134	20	747	2404.7	2.9645	-0.0579	141	32	1.0717	1	0.725	0.6512
134	21	748	2404.7	2.4216	0.0029	144	32	1.0951	1	0.5866	0.5789
134	22	749	2104.7	3.2802	0.0826	147	32	1.1516	1	0.5115	0.5468
134	23	750	2084.7	1.9659	0.1277	147	32	1.1495	1	0.4132	0.3739
134	24	751	2384.7	1.9729	0.0487	144	32	1.1026	1	0.4983	0.4028
134	25	752	2409.7	1.9414	0.0131	144	32	1.0906	1	0.5379	0.4939
134	26	753	2104.7	1.938	0.0652	144	32	1.1073	1	0.4998	0.4656
134	27	754	2104.7	2.4595	0.0435	144	32	1.1084	1	0.5535	0.5506
134	28	755	2089.7	1.9663	0.0235	144	32	1.0944	1	0.557	0.5272
134	29	756	2424.7	1.9481	-0.0439	144	32	1.0733	1	0.6084	0.5457
134	30	757	1484.7	2.4508	0.1352	147	32	1.1586	1	0.4686	0.4691
134	31	758	1504.7	2.4633	0.0998	147	32	1.1479	1	0.5202	0.5315
134	32	759	1504.7	1.9872	0.1701	150	32	1.1937	1	0.4085	0.3796
134	33	760	1799.7	1.9536	0.1012	144	32	1.1185	1	0.4873	0.4126
134	34	761	1799.7	1.9687	0.0608	144	32	1.1065	1	0.5424	0.4841
134	35	762	1499.7	1.9516	0.1198	147	32	1.1469	1	0.4927	0.4433
134	36	763	1499.7	1.9191	0.0763	144	32	1.1106	1	0.569	0.5186
134	37	764	1799.7	1.9333	0.1538	147	32	1.1568	1	0.4068	0.3304

134	38	765	2104.7	3.4169	0.0687	144	32	1.1249	1	0.5518	0.59
138	1	803	1494.7	1.9534	0.0374	141	26	1.0838	1.430454	0.6413	0.56
138	2	804	1499.7	2.42	0.0205	141	26	1.0854	1.430454	0.6774	0.6263
138	3	805	1499.7	2.1512	0.0833	144	26	1.1163	1.430454	0.5597	0.4947
138	4	806	1499.7	2.4497	0.0691	144	26	1.1161	1.430454	0.5839	0.5445
138	5	807	1794.7	1.9676	0.0534	144	26	1.1041	1.430454	0.553	0.4996
138	6	808	2099.7	2.001	0.0227	144	26	1.0947	1.430454	0.5586	0.5532
138	7	809	2094.7	2.4321	0	144	26	1.0943	1.430454	0.615	0.6242
138	8	810	2394.7	1.9465	-0.0386	144	26	1.0749	1.430454	0.6041	0.5632
138	9	811	2404.7	2.4121	-0.0331	144	26	1.0838	1.430454	0.6346	0.6392
138	10	812	2404.7	1.9283	0.0063	144	26	1.0682	1.430454	0.5454	0.4996
138	11	813	2394.7	2.4253	-0.0065	144	26	1.0922	1.430454	0.5999	0.6031
138	12	814	2114.7	1.9484	0.059	144	26	1.1055	1.430454	0.5069	0.4797
138	13	815	2119.7	2.4731	0.0279	144	26	1.1037	1.430454	0.5748	0.5545
138	14	816	2114.7	2.9139	0.007	141	26	1.087	1.430454	0.6411	0.6471
138	15	817	1809.7	1.953	0.0657	141	26	1.0908	1.430454	0.5456	0.4457
138	16	818	1804.7	3.442	0.0187	141	26	1.094	1.430454	0.686	0.6562
138	17	819	1504.7	1.9306	0.1423	147	26	1.1537	1.430454	0.4605	0.3866
138	18	820	1499.7	2.5073	0.1015	144	26	1.1251	1.430454	0.5325	0.471
138	19	821	1514.7	3.4638	0.054	141	26	1.1012	1.430454	0.632	0.612
138	20	822	2414.7	2.8646	-0.0072	144	26	1.0978	1.430454	0.629	0.6566
138	21	823	1509.7	3.449	0.1286	147	26	1.1631	1.430454	0.4681	0.4877
138	22	824	1804.7	3.4984	0.0769	144	26	1.1272	1.430454	0.5519	0.5395
138	23	825	1804.7	1.9955	0.1115	144	26	1.1217	1.430454	0.4736	0.3676
138	24	826	2114.7	2.0026	0.0919	144	26	1.1165	1.430454	0.4676	0.4099
138	25	827	2104.7	2.4435	0.0763	144	26	1.1178	1.430454	0.5088	0.4722
138	26	828	2104.7	2.9296	0.0613	144	26	1.1189	1.430454	0.5464	0.5308
138	27	829	2094.7	3.431	0.0553	144	26	1.1218	1.430454	0.5732	0.6006
138	28	830	2404.7	1.9311	0.0933	150	26	1.1584	1.430454	0.4185	0.3942
138	29	831	2394.7	2.4059	0.0654	150	26	1.1557	1.430454	0.478	0.4766
138	30	832	2404.7	2.9351	0.0471	147	26	1.135	1.430454	0.5419	0.5769
138	31	833	2414.7	3.3279	0.063	150	26	1.1704	1.430454	0.5219	0.5783
138	32	834	2419.7	2.9601	0.1114	150	26	1.1856	1.430454	0.4403	0.4665
138	33	835	2414.7	3.384	0.1131	150	26	1.1914	1.430454	0.4527	0.5117
138	34	836	2094.7	3.0232	0.1191	147	26	1.1587	1.430454	0.4517	0.4151
138	35	837	2099.7	3.4391	0.1124	147	26	1.1605	1.430454	0.4706	0.49
138	36	838	2104.7	2.469	0.0802	144	26	1.1193	1.430454	0.5023	0.4909
138	37	839	2099.7	2.5117	0.0317	144	26	1.1054	1.430454	0.5728	0.5694
139	1	840	1494.7	1.9033	0.0864	144	32	1.1134	1.430454	0.5197	0.4534
139	2	841	1504.7	2.3511	0.0206	141	32	1.0847	1.430454	0.6376	0.6283
139	3	842	1499.7	1.8211	0.056	144	32	1.1023	1.430454	0.5619	0.4962
139	4	843	1494.7	2.3806	0.0792	144	32	1.1182	1.430454	0.5322	0.5342
139	5	844	1499.7	3.4209	0.0548	144	32	1.1219	1.430454	0.5786	0.6683
139	6	845	1804.7	1.8909	0.0346	141	32	1.0822	1.430454	0.5534	0.4936
139	7	846	2094.7	1.8939	0.0002	141	32	1.0734	1.430454	0.5619	0.535
139	8	847	2094.7	2.3396	0.0004	144	32	1.0931	1.430454	0.5772	0.6087
139	9	848	2394.7	1.8944	-0.0423	144	32	1.0729	1.430454	0.5746	0.559
139	10	849	2409.7	2.4005	-0.0431	144	32	1.0807	1.430454	0.6159	0.6534
139	11	850	1508.7	1.8843	0.1475	147	32	1.1547	1.430454	0.4199	0.3949
139	12	851	1494.7	2.3485	0.1319	147	32	1.1564	1.430454	0.4384	0.4459
139	13	852	1504.7	3.4532	0.0741	144	32	1.1268	1.430454	0.5428	0.61
139	14	853	1804.7	3.4334	0.0343	144	32	1.1164	1.430454	0.5875	0.6596
139	15	854	1804.7	1.8724	0.0868	144	32	1.113	1.430454	0.4716	0.4037
139	16	855	2074.7	1.8847	0.0446	144	32	1.0998	1.430454	0.4959	0.4596

139 17 856 2094.7 2.3569 0.041 144 32 1.1062 1.430454 0.521 0.5416
139 18 857 2104.7 2.8745 0.0232 144 32 1.1073 1.430454 0.5682 0.6311
139 19 858 2404.7 2.364 0.0016 144 32 1.0938 1.430454 0.5532 0.5839
139 20 859 2394.7 1.8709 0.0064 144 32 1.0872 1.430454 0.5127 0.4857
139 21 860 1799.7 1.8493 0.1348 144 32 1.1255 1.430454 0.4102 0.3367
139 22 861 1814.7 3.354 0.0835 144 32 1.1276 1.430454 0.503 0.5255
139 23 862 1504.7 3.3536 0.1434 150 32 1.1986 1.430454 0.3947 0.4369
139 24 863 2099.7 2.3702 0.0726 144 32 1.1159 1.430454 0.4778 0.4634
139 25 864 2099.7 2.9226 0.0705 144 32 1.1214 1.430454 0.4997 0.5329
139 26 865 2104.7 3.3677 0.0865 147 32 1.1473 1.430454 0.5051 0.574
139 27 866 2099.7 1.8674 0.0946 144 32 1.1151 1.430454 0.4302 0.369
139 28 867 2399.7 1.894 0.0817 147 32 1.1308 1.430454 0.4138 0.3961
139 29 868 2404.7 2.3537 0.0865 147 32 1.1336 1.430454 0.4563 0.4732
139 30 869 2404.7 2.8801 0.0529 147 32 1.1365 1.430454 0.4996 0.5597
139 31 870 2404.7 2.9403 0.1205 150 32 1.1889 1.430454 0.3977 0.4504
139 32 871 2404.7 3.3929 0.0509 147 32 1.1549 1.430454 0.4668 0.5324
139 33 872 2104.7 3.399 0.1381 150 32 1.1981 1.430454 0.3858 0.4392
139 34 873 2064.7 2.8619 0.1308 147 32 1.1601 1.430454 0.4005 0.3913
139 35 874 2409.7 3.3775 0.0385 147 32 1.1374 1.430454 0.5425 0.6522
139 36 875 2404.7 2.8551 -0.0175 144 32 1.0944 1.430454 0.6113 0.6833
139 37 876 1499.7 2.3507 0.0743 144 32 1.1163 1.430454 0.5391 0.5329
139 38 877 2094.7 2.3448 0.0445 144 32 1.1071 1.430454 0.5156 0.528
153 1 1391 1504.7 3.0792 0.2259 168 26 1 1 0.3981 0.4604
153 2 1392 1799.7 3.0749 0.1856 168 26 1 1 0.4494 0.4471
153 3 1393 1804.7 2.7932 0.1942 168 26 1 1 0.4361 0.394
153 4 1394 1809.7 3.0703 0.1732 168 26 1 1 0.4686 0.4217
153 5 1395 2099.7 3.0434 0.2049 168 26 1 1 0.414 0.4084
153 6 1396 2099.7 2.5998 0.1548 168 26 1 1 0.4753 0.3752
153 7 1396 2114.7 2.5515 0.1656 168 26 1 1 0.4587 0.4748
153 8 1398 2099.7 2.0681 0.2012 168 26 1 1 0.4016 0.3232
153 9 1399 2099.7 2.0395 0.1941 168 26 1 1 0.4095 0.4073
153 10 1400 2399.7 3.0344 0.2085 168 26 1 1 0.411 0.4737
153 12 1402 2399.7 2.5496 0.2064 168 26 1 1 0.3979 0.4172
153 13 1403 2394.7 2.5434 0.1559 168 26 1 1 0.4614 0.5047
153 14 1404 2399.7 2.0235 0.182 168 26 1 1 0.4051 0.4371
153 15 1405 2104.7 3.038 0.1594 168 26 1 1 0.4801 0.5312
153 16 1406 1799.7 2.5451 0.1502 168 26 1 1 0.5 0.4936
153 17 1407 1804.7 3.0305 0.1404 168 26 1 1 0.5201 0.5467
153 18 1408 2404.7 2.068 0.0089 168 26 1 1 0.6053 0.5035
153 19 1409 2104.7 2.0206 0.147 168 26 1 1 0.4654 0.5024
153 20 1410 1499.7 2.0539 0.2159 168 26 1 1 0.4444 0.4604
153 21 1411 1499.7 2.5633 0.1901 168 26 1 1 0.4707 0.539
153 22 1412 2404.7 1.58 0.176 168 26 1 1 0.3867 0.4261
153 23 1413 2099.7 1.5677 0.1774 168 26 1 1 0.4132 0.4062
153 24 1414 2399.7 1.5563 0.0873 168 26 1 1 0.4751 0.4715
153 25 1415 2099.7 1.507 0.1586 168 26 1 1 0.4305 0.4648
153 26 1416 2399.7 1.5197 0.0133 168 26 1 1 0.5458 0.4991
153 27 1417 2099.7 1.4963 0.0945 168 26 1 1 0.4973 0.4958
153 28 1418 1814.7 1.5115 0.1428 168 26 1 1 0.4872 0.4914
153 29 1419 1499.7 1.536 0.1785 168 26 1 1 0.5046 0.4958
153 30 1420 1794.7 1.5046 0.1569 168 26 1 1 0.4744 0.4438
153 31 1421 1499.7 1.4782 0.2406 168 26 1 1 0.4305 0.4239
153 32 1422 1799.7 1.49 0.1792 168 26 1 1 0.4482 0.3918
153 33 1423 1494.7 1.5053 0.2917 168 26 1 1 0.3684 0.3851

153	34	1424	2094.7	1.4982	0.236	168	26	1	1	0.3492	0.3154
153	35	1425	2399.7	1.5153	0.2215	168	26	1	1	0.3376	0.3519
153	36	1426	2414.7	1.4904	0.0884	168	26	1	1	0.4666	0.4471
153	37	1427	2404.7	3.0368	0.1094	168	26	1	1	0.5461	0.5888
153	38	1428	2424.7	2.5014	0.0816	168	26	1	1	0.5509	0.6131
153	39	1429	2404.7	3.0295	0.0444	168	26	1	1	0.6341	0.6896
153	40	1430	2399.7	2.0005	0.0611	168	26	1	1	0.5405	0.5821
153	41	1431	2399.7	2.4818	0.0098	168	26	1	1	0.6402	0.6585
153	42	1432	2409.7	2.962	-0.0165	168	26	1	1	0.7115	0.7271
153	43	1433	2409.7	1.9691	0.006	168	26	1	1	0.5989	0.5921
157	1	1559	2099.7	1.9809	0.1423	96	26	1	1	0.5653	0.5634
157	2	1560	2124.7	2.4842	0.0818	96	26	1	1	0.6842	0.6389
157	3	1561	2114.7	2.9902	0.0618	96	26	1	1	0.748	0.6957
157	4	1562	2114.7	3.4268	0.0575	96	26	1	1	0.7792	0.7645
157	5	1563	2424.7	1.9975	0.0467	96	26	1	1	0.6703	0.5812
157	6	1564	2399.7	2.4868	0.0417	96	26	1	1	0.7263	0.6634
157	7	1565	2414.7	2.9645	0.0101	96	26	1	1	0.8177	0.8223
157	8	1566	2404.7	3.4498	0.0308	96	26	1	1	0.8213	0.8112
157	9	1567	2399.7	1.9895	0.2018	96	26	1	1	0.4566	0.4167
157	10	1568	2399.7	2.4497	0.1984	96	26	1	1	0.4843	0.4767
157	11	1569	2404.7	2.9493	0.1536	96	26	1	1	0.5795	0.5723
157	12	1570	2414.7	3.4735	0.1358	96	26	1	1	0.6363	0.6612
157	13	1571	2099.7	2.0756	0.1932	96	26	1	1	0.4933	0.4111
157	14	1572	2099.7	2.5025	0.1715	96	26	1	1	0.5403	0.4734
157	15	1573	2104.7	3.004	0.152	96	26	1	1	0.5886	0.52
157	16	1574	2104.7	3.4702	0.1559	96	26	1	1	0.5943	0.5567
157	17	1575	2104.7	1.9899	0.0414	96	26	1	1	0.714	0.7356
157	18	1576	2114.7	2.4365	0.0274	96	26	1	1	0.7701	0.8123
157	19	1577	2099.7	2.8881	0.0471	96	26	1	1	0.7691	0.8178
157	20	1578	2394.7	1.9553	0.0059	96	26	1	1	0.7251	0.769
157	21	1579	2399.7	2.4035	0.0015	96	26	1	1	0.7796	0.8156
157	22	1580	2404.7	2.8664	0.0186	96	26	1	1	0.7958	0.8134
157	23	1581	2414.7	2.4675	0.0069	96	26	1	1	0.7766	0.7067
157	24	1582	2404.7	2.94	0.1624	96	26	1	1	0.5645	0.5545
157	25	1583	2414.7	1.0438	0.1015	96	26	1	1	0.4935	0.4589
157	26	1584	2404.7	1.5514	0.0452	96	26	1	1	0.6245	0.6312
157	27	1585	2104.7	3.4501	0.1615	96	26	1	1	0.5832	0.54
157	28	1586	2104.7	3.4902	0.0553	96	26	1	1	0.787	0.7978
157	29	1587	2114.7	1.0544	0.2376	96	26	1	1	0.3976	0.3645
157	30	1588	2104.7	1.5743	0.1627	96	26	1	1	0.5154	0.5056
157	31	1589	2099.7	1.0503	0.1706	96	26	1	1	0.4736	0.4589
157	32	1590	2104.7	1.502	0.1248	96	26	1	1	0.5605	0.6167
157	33	1591	2404.7	0.9906	0.2239	96	26	1	1	0.3635	0.3411
157	34	1592	2404.7	1.504	0.1673	96	26	1	1	0.4693	0.4756
157	35	1593	1504.7	2.0297	0.1156	96	26	1	1	0.705	0.6834
157	36	1594	1504.7	2.4579	0.09	96	26	1	1	0.7555	0.7734
157	37	1595	1814.7	1.9772	0.0897	96	26	1	1	0.684	0.6867
157	38	1596	1814.7	2.4634	0.0306	96	26	1	1	0.8078	0.7356
157	39	1597	1814.7	1.999	0.1316	96	26	1	1	0.6188	0.5812
157	40	1598	1799.7	2.518	0.1095	96	26	1	1	0.6725	0.6945
157	41	1599	1804.7	2.987	0.0889	96	26	1	1	0.7231	0.7834
157	42	1600	1499.7	2.0367	0.1892	96	26	1	1	0.5786	0.6067
157	43	1601	1514.7	2.5225	0.1436	96	26	1	1	0.6516	0.6534
157	44	1602	1499.7	3.0041	0.1083	96	26	1	1	0.7236	0.6978

157	45	1603	1514.7	3.5125	0.089	96	26	1	1	0.7655	0.7745
157	46	1604	1504.7	2.0585	0.2522	96	26	1	1	0.4675	0.4823
157	47	1605	1504.7	2.523	0.1893	96	26	1	1	0.5655	0.5145
157	48	1606	1504.7	3.0549	0.1659	96	26	1	1	0.6014	0.5812
157	50	1608	1799.7	3.4594	0.094	96	26	1	1	0.7256	0.7801
157	51	1609	1519.7	3.4932	0.1695	96	26	1	1	0.5843	0.5623
157	53	1611	1794.7	1.5563	0.2384	96	26	1	1	0.4572	0.4189
157	54	1612	1804.7	2.0972	0.1556	96	26	1	1	0.5842	0.5234
157	55	1613	1804.7	2.546	0.1486	96	26	1	1	0.6032	0.5589
157	56	1614	1814.7	3.0007	0.1483	96	26	1	1	0.6088	0.6023
157	57	1615	1804	3.5493	0.1013	96	26	1	1	0.7122	0.6756
157	58	1616	1804.7	1.0879	0.2796	96	26	1	1	0.4079	0.4245
157	59	1617	1799.7	1.5346	0.2014	96	26	1	1	0.5083	0.52
157	60	1618	1494.7	1.056	0.3357	96	26	1	1	0.4159	0.4623
157	61	1619	1504.7	1.4851	0.2339	96	26	1	1	0.5236	0.4934
157	62	1620	1789.7	1.022	0.1243	96	26	1	1	0.5916	0.4945
157	63	1621	1494.7	1.9849	0.1245	96	26	1	1	0.6918	0.6856
157	64	1622	1804.7	1.4829	0.1286	96	26	1	1	0.6069	0.6723
157	65	1623	1799.7	1.9283	0.0649	96	26	1	1	0.723	0.7545
157	66	1624	1509.7	1.055	0.2536	96	26	1	1	0.5148	0.5756
157	67	1625	1504.7	1.5173	0.1636	96	26	1	1	0.6276	0.6923
157	68	1626	1504.7	1.9559	0.1126	96	26	1	1	0.7095	0.799
157	69	1627	1494.7	2.5106	0.2006	96	26	1	1	0.5456	0.4878
157	70	1628	1804.7	2.4469	0.0709	96	26	1	1	0.7371	0.8023
157	71	1629	1509.7	1.0162	0.2967	96	26	1	1	0.4636	0.4845
157	72	1630	1499.7	1.5487	0.1989	96	26	1	1	0.5752	0.6123
157	73	1631	1804.7	1.5148	0.1464	96	26	1	1	0.5836	0.6089
157	74	1632	1804.7	1.0122	0.2349	96	26	1	1	0.4603	0.4489
157	75	1633	2104.7	1.0453	0.1394	96	26	1	1	0.5065	0.5534
157	76	1634	2424.7	1.0519	0.0976	96	26	1	1	0.4972	0.5756
[illegible]	77	1635	2404.7	1.4584	-0.0032	96	26	1	1	0.6713	0.7256
157	78	1636	2114.7	1.4824	0.0623	96	26	1	1	0.6378	0.7056
157	79	1637	2109.7	2.0035	0.0856	96	26	1	1	0.6492	0.7112
158	1	1638	2099.7	2.0277	0.14	96	26	1	1.429643	0.5297	0.577
158	2	1639	2104.7	2.4921	0.094	96	26	1	1.429643	0.6229	0.6373
158	3	1640	2099.7	2.9917	0.0778	96	26	1	1.429643	0.675	0.7221
158	4	1641	2104.7	3.4769	0.0698	96	26	1	1.429643	0.7114	0.8237
158	5	1642	2394.7	2.0349	0.0964	96	26	1	1.429643	0.5678	0.6228
158	6	1643	2424.7	2.5239	0.0376	96	26	1	1.429643	0.6923	0.7177
158	7	1644	2394.7	3.0021	0.036	96	26	1	1.429643	0.7342	0.7757
158	8	1645	2434.7	3.4525	0.0213	96	26	1	1.429643	0.7913	0.856
158	9	1646	2414.7	2.0342	0.1716	96	26	1	1.429643	0.4611	0.4732
158	10	1647	2399.7	2.4992	0.1194	96	26	1	1.429643	0.566	0.4955
158	11	1648	2404.7	2.9732	0.1198	96	26	1	1.429643	0.5925	0.5793
158	12	1649	2409.7	3.5062	0.0807	96	26	1	1.429643	0.6895	0.6641
158	13	1650	2114.7	1.9792	0.2007	96	26	1	1.429643	0.437	0.3839
158	14	1651	2109.7	2.4792	0.1707	96	26	1	1.429643	0.4969	0.4476
158	15	1652	2104.7	2.9503	0.1704	96	26	1	1.429643	0.5091	0.5212
158	16	1653	2099.7	3.4723	0.1404	96	26	1	1.429643	0.5766	0.5402
158	17	1654	2114.7	2.9811	0.0422	96	26	1	1.429643	0.7368	0.846
158	18	1655	2399.7	2.9518	-0.0036	96	26	1	1.429643	0.7958	0.8438
158	19	1656	2099.7	1.9981	0.0781	96	26	1	1.429643	0.6199	0.7444
158	20	1657	2099.7	2.4882	0.0341	96	26	1	1.429643	0.7211	0.8226
158	21	1658	2399.7	1.9977	-0.0023	96	26	1	1.429643	0.7017	0.7266

158	22	1659	2399.7	2.4815	-0.0371	96	26	1	1.429643	0.8047	0.8527
158	23	1660	2314.7	1.4939	0.0789	96	26	1	1.429643	0.5516	0.6027
158	24	1661	2399.7	1.0443	0.1468	96	26	1	1.429643	0.417	0.4743
158	25	1662	2094.7	1.0024	0.1562	96	26	1	1.429643	0.4516	0.423
158	26	1663	2099.7	0.9976	0.1236	96	26	1	1.429643	0.4853	0.4855
158	27	1664	2104.7	1.4974	0.0589	96	26	1	1.429643	0.6071	0.6987
158	28	1665	2099.7	2.0029	0.0116	96	26	1	1.429643	0.7186	0.8326
158	29	1666	2099.7	1.5041	0.1304	96	26	1	1.429643	0.5158	0.6105
158	30	1667	2114.7	1.5093	0.1735	96	26	1	1.429643	0.4582	0.4957
158	31	1668	2394.7	1.5171	0.144	96	26	1	1.429643	0.4641	0.5045
158	32	1669	1799.7	1.5056	0.2098	96	26	1	1.429643	0.4547	0.3929
158	33	1670	1814.7	2.0034	0.1807	96	26	1	1.429643	0.4974	0.4665
158	34	1671	1799.7	2.5067	0.14[illegible]	96	26	1	1.429643	0.5673	0.5279
158	35	1672	1799.7	3.009	0.126	96	26	1	1.429643	0.6053	0.5982
158	36	1673	2099.7	2.9843	0.0834	96	26	1	1.429643	0.6647	0.731
158	37	1674	1824.7	3.4819	0.1282	96	26	1	1.429643	0.6057	0.7266
158	38	1675	1499.7	1.5556	0.2492	96	26	1	1.429643	0.452	0.4241
158	39	1676	1514.7	2.0434	0.2034	96	26	1	1.429643	0.5031	0.4654
158	40	1677	1499.7	2.5168	0.2075	96	26	1	1.429643	0.4821	0.5491
158	41	1678	1514.7	3.0146	0.1501	96	25	1	1.429643	0.5837	0.5458
158	42	1679	1504.7	3.4761	0.1414	96	26	1	1.429643	0.5977	0.5692
158	43	1680	1799.7	1.5513	0.1825	96	26	1	1.429643	0.493	0.5413
158	44	1681	1799.7	1.9788	0.1428	96	26	1	1.429643	0.559	0.6239
158	45	1682	1814.7	2.4875	0.0392	96	26	1	1.429643	0.6421	0.7232
158	46	1683	1814.7	2.9893	0.0696	96	26	1	1.429643	0.7118	0.8103
158	47	1684	1799.7	3.512	0.0765	96	26	1	1.429643	0.7142	0.8237
158	48	1685	1499.7	1.51	0.2224	96	26	1	1.429643	0.4946	[illegible]
158	49	1686	1504.7	2.0144	0.1612	96	26	1	1.429643	0.5784	0.6072
158	50	1687	1504.7	2.5096	0.1234	96	26	1	1.429643	0.6429	0.6231
158	51	1688	1504.7	2.9976	0.111	96	26	1	1.429643	0.6668	0.7612
158	52	1689	1509.7	3.4924	0.0711	96	26	1	1.429643	0.7551	0.7947
158	53	1690	1804.7	1.5179	0.1273	96	26	1	1.429643	0.5684	0.6462
158	54	1691	1799.7	1.9923	0.1	96	26	1	1.429643	0.627	0.7846
158	55	1692	1804.7	2.4615	0.0536	96	26	1	1.429643	0.7223	0.8706
158	57	1694	1499.7	1.9827	0.1411	96	26	1	1.429643	0.6143	0.7534
158	58	1695	1494.7	2.4776	0.1005	96	26	1	1.429643	0.6885	0.8226
158	60	1697	2404.7	1.5073	-0.0085	96	26	1	1.429643	0.649	0.7076
158	61	1698	1499.7	1.0057	0.2765	96	26	1	1.429643	0.4481	0.471
158	62	1699	1809.7	1.0149	0.18	96	26	1	1.429643	0.4835	0.4598
158	63	1700	1794.7	1.0128	0.1458	96	26	1	1.429643	0.5261	0.5368
158	64	1701	1804.7	1.4799	0.0976	96	26	1	1.429643	0.6078	0.7154
158	65	1702	1504.7	1.0176	0.215	96	26	1	1.429643	0.5205	0.5793
158	66	1703	1504.7	1.5034	0.1385	96	26	1	1.429643	0.6189	0.7132
158	67	1704	1504.7	2	0.0981	96	26	1	1.429643	0.6869	0.8583
158	68	1705	1814.7	1.9512	-0.0064	96	26	1	1.429643	0.7892	0.8081
160	1	1720	1799.7	1.4764	0.2001	96	22	1	1	0.5444	0.5172
160	2	1721	1799.7	2.0178	0.1407	96	22	1	1	0.6441	0.6123
160	3	1722	1799.7	2.4856	0.1122	96	22	1	1	0.7052	0.704
160	4	1723	1799.7	2.978	0.0888	96	22	1	1	0.7633	0.8101
160	5	1724	2414.7	1.4262	0.1655	96	22	1	1	0.4933	0.504
160	6	1725	2399.7	2.5218	0.0255	96	22	1	1	0.7897	0.6874
160	7	1726	2399.7	2.5121	0.0756	96	22	1	1	0.7115	0.746
160	8	1727	2414.7	3.0018	0.0539	96	22	1	1	0.7853	0.8532
160	9	1728	2114.7	1.4802	0.1867	96	22	1	1	0.5098	0.4819

160	10	1729	2114.7	2.0147	0.1568	96	22	1	1	0.5785	0.5902
160	11	1730	2099.7	2.5035	0.1221	96	22	1	1	0.6578	0.6664
160	12	1731	2104.7	2.9837	0.1047	96	22	1	1	0.7102	0.756
160	13	1732	2114.7	1.9911	0.2139	96	22	1	1	0.4933	0.4178
160	14	1733	2104.7	1.4904	0.1723	96	22	1	1	0.5304	0.6167
160	15	1734	2099.7	1.9643	0.0937	96	22	1	1	0.6716	0.7549
160	16	1735	2099.7	2.4914	0.061	96	22	1	1	0.7573	0.8831
160	17	1736	2104.7	2.9681	0.0487	96	22	1	1	0.8088	0.9836
160	18	1737	2414.7	1.4999	0.0995	96	22	1	1	0.5804	0.6465
160	19	1738	2404.7	1.9943	0.0245	96	22	1	1	0.7354	0.7957
160	20	1739	2414.7	2.4771	-0.0182	96	22	1	1	0.8509	0.9251
160	21	1740	1814.7	1.4977	0.1589	96	22	1	1	0.5986	0.6576
160	22	1741	1814.7	1.9736	0.1113	96	22	1	1	0.6865	0.7736
160	23	1742	1814.7	2.456	0.0785	96	22	1	1	0.761	0.893
160	24	1743	1814.7	2.9716	0.0514	96	22	1	1	0.8327	0.9549
160	25	1744	1804.7	1.4552	0.1616	96	22	1	1	0.5955	0.7084
160	26	1745	1799.7	1.9321	0.0894	96	22	1	1	0.7217	0.8013
160	27	1746	2094.7	1.448	0.1093	96	22	1	1	0.6098	0.7195
160	28	1747	2399.7	1.4728	0.0416	96	22	1	1	0.6495	0.7239
160	29	1748	1514.7	1.461	0.2076	96	22	1	1	0.5991	0.6222
160	30	1749	1514.7	1.9766	0.1315	96	22	1	1	0.715	0.7095
160	31	1750	1499.7	2.468	0.107	96	22	1	1	0.7656	0.8245
160	32	1751	1504.7	2.9411	0.0788	96	22	1	1	0.8258	0.9284
160	33	1752	1504.7	1.4881	0.2513	96	22	1	1	0.5362	0.5139
160	34	1753	1504.7	2.0133	0.17	96	22	1	1	0.6513	0.5614
160	35	1754	1514.7	2.4943	0.1427	96	22	1	1	0.6946	0.6797
160	36	1755	1524.7	2.9879	0.12	96	22	1	1	0.7373	0.7504
160	37	1756	1499.7	2.0643	0.2265	96	22	1	1	0.5532	0.4741
160	38	1757	1514.7	2.5604	0.172	96	22	1	1	0.6377	0.4896
160	39	1758	1499.7	3.0669	0.1562	96	22	1	1	0.6646	0.5736
160	40	1759	2124.7	2.5108	0.1622	96	22	1	1	0.5908	0.473
160	41	1760	2099.7	3.054	0.1458	96	22	1	1	0.6398	0.5438
160	42	1761	2414.7	2.03	0.1673	96	22	1	1	0.539	0.4841
160	43	1762	2424.7	2.5326	0.1655	96	22	1	1	0.5735	0.5802
160	44	1763	3414.7	3.0358	0.1367	96	22	1	1	0.6786	0.6454
160	45	1764	2404.7	3.486	0.1431	96	22	1	1	0.6573	0.7217
160	46	1765	2114.7	3.4865	0.1457	96	22	1	1	0.6538	0.5968
160	48	1767	1799.7	2.0271	0.1812	96	22	1	1	0.5797	0.4763
160	49	1768	1814.7	2.5382	0.1462	96	22	1	1	0.6447	0.5404
160	50	1769	1814.7	3.0443	0.1241	96	22	1	1	0.6957	0.641
160	51	1770	1814.7	3.5307	0.1167	96	22	1	1	0.7202	0.6731
160	52	1771	1514.7	3.0881	0.1718	96	22	1	1	0.6294	0.6134
160	53	1771	2114.7	3.4557	0.1073	96	22	1	1	0.7257	0.8145
160	54	1772	2409.7	3.5302	0.0397	96	22	1	1	0.8503	0.9461
160	55	1773	2399.7	2.4904	0.0913	96	22	1	1	0.6856	0.7549
160	56	1774	1514.7	3.4681	0.0968	96	22	1	1	0.7906	0.7991
160	57	1775	1814.7	3.4634	0.0748	96	22	1	1	0.8048	0.9173
160	58	1776	1514.7	1.471	0.1745	96	22	1	1	0.6476	0.6731
160	59	1777	1509.7	1.9543	0.1227	96	22	1	1	0.7311	0.8234
160	60	1778	1504.7	1.013	0.282	96	22	1	1	0.5203	0.5847
160	61	1779	1799.7	1.0253	0.2003	96	22	1	1	0.534	0.5592
160	62	1780	2099.7	1.0047	0.1952	96	22	1	1	0.4726	0.5747
160	63	1781	2364.7	0.9976	0.1479	96	22	1	1	0.4743	0.5614
160	64	1782	2414.7	0.9999	0.1739	96	22	1	1	0.44	0.4808

160	65	1733	2099.7	1.0019	0.2192	96	22	1	1	0.4486	0.4752
160	66	1784	1784.7	1.006	0.2568	96	22	1	1	0.4724	0.4918
160	67	1785	1500.7	1.0939	0.2658	96	22	1	1	0.5372	0.5128
161	1	1796	2114.7	2.0368	0.2422	168	22	1	1	0.3788	0.2984
161	2	1797	2399.7	2.0529	0.2157	168	22	1	1	0.3953	0.3139
161	3	1798	2399.7	2.0312	0.1623	168	22	1	1	0.4551	0.4071
161	4	1799	2099.7	2.0081	0.1934	168	22	1	1	0.438	0.3771
161	5	1800	2199.7	2.0184	0.1282	168	22	1	1	0.508	0.4415
161	6	1801	2414.7	1.9832	0.1349	168	22	1	1	0.4821	0.4792
161	7	1802	2414.7	2.0303	0.1084	168	22	1	1	0.5153	0.5613
161	8	1803	2099.7	2.0145	0.1368	168	22	1	1	0.5064	0.4437
161	9	1804	2099.7	2.5219	0.2187	168	22	1	1	0.4178	0.3328
161	10	1805	2399.7	2.5482	0.1896	168	22	1	1	0.4484	0.3649
161	11	1806	2099.7	3.0441	0.1926	168	22	1	1	0.4636	0.3915
161	12	1807	2399.7	3.0386	0.1825	168	22	1	1	0.4774	0.4204
161	13	1808	2099.7	1.5088	0.2555	168	22	1	1	0.355	0.3228
161	14	1809	2399.7	1.5011	0.2332	168	22	1	1	0.35	0.3217
161	15	1810	2399.7	2.5215	0.1402	168	22	1	1	0.509	0.4614
161	16	1811	2099.7	2.512	0.1678	168	22	1	1	0.4855	0.4193
161	17	1812	2099.7	1.5224	0.2049	168	22	1	1	0.4088	0.3793
161	18	1813	2399.7	1.4617	0.1984	168	22	1	1	0.382	0.3694
161	19	1814	2099.7	1.5002	0.1727	168	22	1	1	0.4419	0.4348
161	20	1815	2399.7	1.5076	0.1443	168	22	1	1	0.4388	0.4625
161	21	1816	1499.7	1.5084	0.2829	168	22	1	1	0.41	0.4282
161	22	1817	1499.7	2.0349	0.1988	168	22	1	1	0.5023	0.4947
161	23	1818	1799.7	1.4924	0.2273	168	22	1	1	0.4232	0.4004
161	24	1819	1799.7	2.0468	0.1671	168	22	1	1	0.5014	0.477
161	25	1820	2409.7	2.4829	0.1153	168	22	1	1	0.5375	0.5757
161	26	1821	2409.7	2.9979	0.1395	168	22	1	1	0.5341	0.5457
161	27	1822	2404.7	3.5544	0.2062	168	22	1	1	0.4616	0.4171
161	28	1823	2399.7	3.5666	0.182	168	22	1	1	0.4972	0.4947
161	29	1824	2099.7	3.5227	0.1883	168	22	1	1	0.4784	0.4293
161	30	1825	2099.7	2.9574	0.1697	168	22	1	1	0.4949	0.4404
161	31	1826	2099.7	3.5324	0.1555	168	22	1	1	0.5298	0.5169
161	32	1827	2099.7	2.9632	0.153	168	22	1	1	0.5191	0.5169
161	33	1828	2099.7	2.5021	0.1273	168	22	1	1	0.5392	0.5136
161	34	1829	2104.7	1.01	0.3027	168	22	1	1	0.2988	0.2939
161	35	1830	2414.7	1.0113	0.2913	168	22	1	1	0.2696	0.2984
161	36	1831	2099.7	2.011	0.1413	168	22	1	1	0.5009	0.5058
161	37	1832	2099.7	2.4566	0.1119	168	22	1	1	0.5577	0.5735
161	38	1833	2084.7	0.9713	0.3033	168	22	1	1	0.3004	0.3172
161	39	1834	2414.7	0.9801	0.2833	168	22	1	1	0.2744	0.3328
161	40	1835	2099.7	2.0247	0.1217	168	22	1	1	0.5251	0.5402
161	41	1836	2099.7	1.0191	0.2617	168	22	1	1	0.3357	0.3671
161	43	1838	2099.7	1.5775	0.1313	168	22	1	1	0.4901	0.4714
161	44	1839	2399.7	1.5752	0.1548	168	22	1	1	0.4334	0.5014
161	45	1840	2404.7	2.5132	0.1338	168	22	1	1	0.5164	0.5224
161	46	1841	1804.7	1.4851	0.2841	168	22	1	1	0.359	0.3361
161	47	1842	1804.7	2.0301	0.2145	168	22	1	1	0.4392	0.3727
161	48	1843	1804.7	2.4923	0.1996	168	22	1	1	0.4601	0.4215
161	49	1844	1804.7	3.0253	0.1451	168	22	1	1	0.5455	0.5102
161	50	1845	1509.7	1.4646	0.3211	168	22	1	1	0.3646	0.3572
161	51	1846	1504.7	2.0349	0.2355	168	22	1	1	0.4498	0.4182
161	52	1847	1504.7	2.5181	0.2078	168	22	1	1	0.4775	0.4659

161	53	1848	1504.7	3.0191	0.172	168	22	1	1	0.5266	0.538
161	54	1849	1504.7	3.4862	0.174	168	22	1	1	0.5163	0.5546
161	56	1851	1504.7	1.0376	0.3744	168	22	1	1	0.34	0.3394
161	57	1852	1804.7	1.0007	0.3523	168	22	1	1	0.3019	0.3128
161	58	1853	1504.7	2.5192	0.1712	168	22	1	1	0.5346	0.5535
161	59	1854	1799.7	2.5106	0.1536	168	22	1	1	0.5265	0.5291
161	60	1855	1799.7	3.0392	0.1826	168	22	1	1	0.4871	0.4648
161	61	1856	1799.7	3.5296	0.1602	168	22	1	1	0.5256	0.5169
161	62	1857	1499.7	3.5889	0.2041	168	22	1	1	0.4592	0.5058
161	63	1858	1509.7	3.0835	0.2354	168	22	1	1	0.4162	0.4681
161	64	1859	1499.7	0.9987	0.3636	168	22	1	1	0.3556	0.3572
161	65	1860	1799.7	0.9724	0.3	168	22	1	1	0.3517	0.3439
161	66	1861	1804.7	1.4708	0.191	168	22	1	1	0.4627	0.4526
161	67	1862	1504.7	1.4799	0.2633	168	22	1	1	0.434	0.4692
161	68	1863	1804.7	1.9815	0.1436	168	22	1	1	0.5299	0.5291
161	69	1864	1499.7	1.9826	0.1854	168	22	1	1	0.5219	0.5213
161	70	1865	2094.7	2.0162	0.1935	168	22	1	1	0.4385	0.3782
161	71	1866	2104.7	2.0259	0.1694	168	22	1	1	0.4671	0.4526
162	1	1867	2099.7	1.9234	0.0706	123	22	1.1539	1.432246	0.5245	0.4863
162	2	1868	2399.7	1.9656	0.0441	126	22	1.1561	1.432246	0.5244	0.5042
162	3	1869	2404.7	2.4254	0.0006	123	22	1.131	1.432246	0.6288	0.616
162	4	1870	2099.7	2.4546	0.0294	120	22	1.1298	1.432246	0.6241	0.6078
162	5	1871	2099.7	2.4703	0.0442	117	22	1.1178	1.432246	0.6172	0.508
162	6	1872	2399.7	2.4487	0.0537	123	22	1.158	1.432246	0.5526	0.5031
162	7	1873	2399.7	2.9577	0.032	120	22	1.1391	1.432246	0.6284	0.6229
162	8	1874	2104.7	2.9299	0.047	120	22	1.1447	1.432246	0.6171	0.5699
162	9	1875	2394.7	1.9645	0.0392	120	22	1.1239	1.432246	0.5543	0.446
162	10	1876	2114.7	1.9411	0.0957	120	22	1.1468	1.432246	0.5024	0.3993
162	11	1877	2089.7	3.4298	0.0622	120	22	1.1564	1.432246	0.6108	0.5863
162	12	1878	2099.7	1.9869	0.2054	129	22	1.2796	1.432246	0.3296	0.2914
162	13	1879	2409.7	1.9866	0.1693	129	22	1.2614	1.432246	0.3545	0.3248
162	14	1880	2399.7	2.4601	0.1108	123	22	1.1854	1.432246	0.4735	0.3831
162	15	1881	2099.7	2.4674	0.1629	126	22	1.2354	1.432246	0.4029	0.3608
162	16	1882	2094.7	2.9415	0.144	123	22	1.203	1.432246	0.4533	0.4059
162	17	1883	2399.7	2.9752	0.132	126	22	1.2307	1.432246	0.451	0.4439
162	18	1884	2394.7	3.434	0.1266	126	22	1.2348	1.432246	0.474	0.5008
162	19	1885	2109.7	3.4149	0.1262	123	22	1.2028	1.432246	0.4895	0.4491
162	20	1886	1499.7	1.9949	0.2506	132	22	1.3366	1.432246	0.3142	0.3087
162	21	1887	1804.7	1.9761	0.1974	126	22	1.2393	1.432246	0.3745	0.313
162	22	1888	1799.7	2.5198	0.1504	123	22	1.2003	1.432246	0.4535	0.3759
162	23	1889	1499.7	2.4645	0.2241	132	22	1.3333	1.432246	0.3331	0.3431
162	24	1890	1504.7	2.9721	0.1771	126	22	1.2421	1.432246	0.4196	0.4052
162	25	1891	1804.7	2.965	0.1289	120	22	1.1691	1.432246	0.5055	0.4334
162	26	1892	1799.7	3.4805	0.1136	120	22	1.1701	1.432246	0.536	0.4839
162	27	1893	1504.7	3.4673	0.1633	126	22	1.2422	1.432246	0.4343	0.4404
162	28	1894	1499.7	1.9779	0.1834	126	22	1.2372	1.432246	0.4289	0.3915
162	29	1895	1799.7	1.9807	0.1335	123	22	1.1869	1.432246	0.4721	0.4203
162	30	1896	1799.7	2.4399	0.0923	120	22	1.1546	1.432246	0.5551	0.494
162	31	1897	1499.7	2.4438	0.1513	123	22	1.2013	1.432246	0.4834	0.4551
162	32	1898	1504.7	2.9447	0.1149	120	22	1.1677	1.432246	0.5554	0.5256
162	33	1899	1804.7	2.9551	0.049	117	22	1.1254	1.432246	0.6551	0.5703
162	34	1900	2119.7	2.8925	0.069	123	22	1.1742	1.432246	0.5641	0.5752
162	35	1901	1794.7	3.4406	0.0452	117	22	1.1287	1.432246	0.6757	0.6366
162	36	1902	2124.7	2.9474	0.0897	120	22	1.1602	1.432246	0.549	0.4827

162 37 1903 2404.7 2.4718 0.0677 120 22 1.1455 1.432246 0.5474 0.4523
162 38 1904 2099.7 2.4678 0.1323 123 22 1.1949 1.432246 0.4579 0.4155
162 39 1905 2424.7 2.9517 0.0841 123 22 1.1822 1.432246 0.533 0.5127
162 40 1906 2099.7 1.9795 0.1407 123 22 1.1883 1.432246 0.433 0.341
162 41 1907 2399.7 1.9873 0.1195 126 22 1.2032 1.432246 0.427 0.3595
162 42 1908 2104.7 3.4476 0.0739 120 22 1.1602 1.432246 0.5914 0.5307
162 43 1909 2409.7 3.4733 0.0638 123 22 1.1805 1.432246 0.5878 0.5808
162 44 1910 1499.7 3.4874 0.0716 117 22 1.1359 1.432246 0.6556 0.5809
162 45 1911 1499.7 1.9761 0.159 126 22 1.2263 1.432246 0.4635 0.4578
162 46 1912 1799.7 1.9864 0.0981 123 22 1.1693 1.432246 0.5223 0.4911
162 47 1913 1804.7 2.4312 0.0336 117 22 1.1139 1.432246 0.5645 0.6008
162 48 1914 1504.7 2.4074 0.1116 123 22 1.1859 1.432246 0.5466 0.562
162 49 1915 1504.7 2.9152 0.0739 120 22 1.1551 1.432246 0.6269 0.604
162 50 1916 1809.7 2.9423 0.0311 117 22 1.1198 1.432246 0.6856 0.6393
162 51 1917 1509.7 1.47 0.2408 132 22 1.328 1.432246 0.3421 0.3006
162 52 1918 1804.7 1.4709 0.1798 126 22 1.2222 1.432246 0.3948 0.3335
162 53 1919 2099.7 1.4811 0.1827 129 22 1.2528 1.432246 0.3458 0.3172
162 54 1920 2409.7 1.4484 0.1945 135 22 1.3259 1.432246 0.2863 0.293
162 55 1921 2399.7 1.4488 0.1006 129 22 1.189 1.432246 0.4099 0.3667
162 56 1922 2104.7 1.4493 0.1915 135 22 1.3229 1.432246 0.3137 0.3318
162 57 1923 1804.7 1.4643 0.164 129 22 1.2383 1.432246 0.4022 0.3807
162 58 1924 1514.7 1.4796 0.2206 132 22 1.3147 1.432246 0.3646 0.3502
162 59 1925 2104.7 0.9877 0.247 141 22 1.4343 1.432246 0.2336 0.2393
162 60 1926 2384.7 1.0016 0.2014 141 22 1.3656 1.432246 0.2479 0.2516
162 61 1927 2104.7 1.4495 0.0734 126 22 1.1546 1.432246 0.4853 0.4347
162 62 1928 2404.7 1.4497 0.112 135 22 1.2388 1.432246 0.3774 0.3897
162 63 1929 2104.7 1.9774 0.0131 120 22 1.1133 1.432246 0.6209 0.5939
162 64 1930 2404.7 1.9749 0.0285 126 22 1.1472 1.432246 0.5458 0.5565
162 65 1931 1804.7 1.0067 0.2356 138 22 1.3756 1.432246 0.2917 0.2749
162 66 1932 1504.7 1.0045 0.3206 144 22 1.6297 1.432246 0.2257 0.2381
162 67 1933 1504.7 1.467 0.1922 132 22 1.2906 1.432246 0.4022 0.4008
162 68 1934 1799.7 1.4127 0.148 129 22 1.2235 1.432246 0.4225 0.4291
162 69 1935 1794.7 1.9505 0.0425 120 22 1.125 1.432246 0.6169 0.5913
162 70 1936 1499.7 1.9475 0.1247 126 22 1.2056 1.432246 0.5153 0.5417
163 1 1937 1804.7 1.488 0.2107 96 22 1 1 0.529 0.5415
163 2 1938 1799.7 2.069 0.1429 96 22 1 1 0.6419 0.6289
163 3 1939 1804.7 2.5116 0.1041 96 22 1 1 0.7196 0.6985
163 4 1940 2404.7 1.4347 0.1599 96 22 1 1 0.5019 0.525
163 5 1941 2404.7 1.9991 0.1247 96 22 1 1 0.5967 0.6366
163 6 1942 2409.7 2.5085 0.0783 96 22 1 1 0.7065 0.7493
163 7 1943 2114.7 1.558 0.1382 96 22 1 1 0.5777 0.4542
163 8 1944 2099.7 2.0657 0.1513 96 22 1 1 0.5907 0.5935
163 9 1945 2099.7 2.5345 0.1128 96 22 1 1 0.6747 0.6421
163 10 1946 2114.7 2.9957 0.103 96 22 1 1 0.7133 0.7549
163 11 1947 2114.7 1.5195 0.1669 96 22 1 1 0.5377 0.6233
163 12 1948 2099.7 2.0469 0.0831 96 22 1 1 0.6917 0.7493
163 13 1949 2404.7 1.5287 0.1035 96 22 1 1 0.5799 0.6598
163 14 1950 2404.7 2.0608 0.0487 96 22 1 1 0.7089 0.819
163 15 1951 1814.7 1.5238 0.1542 96 22 1 1 0.606 0.6543
163 16 1952 1809.7 2.0291 0.0933 96 22 1 1 0.7183 0.7869
163 17 1953 1814.7 1.5276 0.1319 96 22 1 1 0.6371 0.7073
163 18 1954 1819.7 1.9713 0.0938 96 22 1 1 0.713 0.8002
163 19 1955 2099.7 1.5093 0.1194 96 22 1 1 0.6009 0.7427
163 20 1956 2404.7 1.528 0.0756 96 22 1 1 0.6142 0.756

163	21	1957	1504.7	1.5299	0.199	96	22	1	1	0.613	0.651
163	22	1958	1504.7	2.0249	0.1281	96	22	1	1	0.7235	0.7106
163	23	1959	1494.7	1.5245	0.2471	96	22	1	1	0.5434	0.5338
163	24	1960	1504.7	2.0572	0.1795	96	22	1	1	0.6342	0.5913
163	25	1961	1514.7	2.5304	0.143	96	22	1	1	0.6936	0.6874
163	26	1962	1504.7	3.0144	0.1149	96	22	1	1	0.7512	0.7339
163	27	1963	2094.7	3.0[illegible]	0.1[illegible]	96	22	1	1	0.6176	0.5637
163	28	1964	2394.7	2.1048	0.1527	96	22	1	1	0.5632	0.4874
163	29	1965	2404.7	2.5717	0.1374	96	22	1	1	0.62	0.5802
163	30	1966	2404.7	3.0868	0.1302	96	22	1	1	0.6623	0.6521
163	31	1967	1804.7	2.0775	0.183	96	22	1	1	0.5767	0.5117
163	32	1968	1804.7	2.5632	0.1495	96	22	1	1	0.6404	0.5681
163	33	1969	1814.7	3.0434	0.1255	96	22	1	1	0.693	0.6344
163	34	1970	1504.7	3.1016	0.1637	96	22	1	1	0.6476	0.6222
163	35	1971	1494.7	2.5846	0.2254	96	22	1	1	0.5365	0.5703
163	36	1972	1814.7	2.5201	0.1383	96	22	1	1	0.6583	0.7361
163	37	1973	2099.7	1.5227	0.2246	96	22	1	1	0.4648	0.5029
163	38	1974	1504.7	3.0239	0.1087	96	22	1	1	0.7642	0.7372
163	39	1975	1809.7	1.0622	0.1554	96	22	1	1	0.5853	0.5592
163	40	1976	2099.7	1.0615	0.1721	96	22	1	1	0.5022	0.5935
163	41	1977	2399.7	1.0287	0.1489	96	22	1	1	0.4715	0.5802
164	1	1979	2099.7	1.4331	0.1398	126	22	1.1964	1	0.4345	0.3844
164	2	1980	2104.7	1.9421	0.083	123	22	1.1608	1	0.5417	0.481
164	3	1981	2099.7	2.4667	0.0442	120	22	1.1362	1	0.63[illegible]9	0.6119
164	4	1982	2394.7	1.433	0.1158	129	22	1.1997	1	0.4198	0.3665
164	5	1983	2414.7	1.9067	0.0988	129	22	1.2082	1	0.4672	0.4661
164	6	1984	2414.7	2.4665	0.0435	126	22	1.1702	1	0.5889	0.5874
164	7	1985	2399.7	1.4481	0.1661	129	22	1.2391	1	0.3634	0.3086
164	8	1986	2424.7	1.9837	0.1038	126	22	1.1935	1	0.4763	0.4117
164	9	1987	2399.7	2.4878	0.0514	120	22	1.1395	1	0.6076	0.5326
164	10	1988	2404.7	2.9523	0.0742	126	22	1.2	1	0.5689	0.5716
164	11	1989	2114.7	1.4166	0.2722	138	22	1.4498	1	0.2453	0.2466
164	12	1990	2109.7	2.0186	0.0816	117	22	1.123	1	0.5754	0.4335
164	13	1991	2104.7	2.4776	0.0723	120	22	1.1476	1	0.596	0.4873
164	14	1992	2114.7	2.9703	0.0667	120	22	1.1528	1	0.6246	0.5804
164	15	1993	2099.7	3.4311	0.0619	120	22	1.1566	1	0.6505	0.6119
164	16	1994	2394.7	3.4559	0.0568	120	22	1.1547	1	0.6542	0.622
164	17	1995	2399.7	1.9955	0.1419	126	22	1.2162	1	0.4305	0.3221
164	18	1996	2404.7	2.4586	0.1418	126	22	1.2271	1	0.4512	0.3697
164	19	1997	2399.7	2.9669	0.1038	120	22	1.1645	1	0.5581	0.4696
164	20	1998	2394.7	3.5103	0.082	120	22	1.163	1	0.6168	0.5238
164	21	1999	2099.7	1.9862	0.2052	126	22	1.2434	1	0.3736	0.2937
164	22	2000	2094.7	2.5016	0.167	126	22	1.2386	1	0.4316	0.3629
164	23	2001	2109.7	2.9841	0.1607	126	22	1.2417	1	0.4[illegible]8	0.3946
164	24	2002	2099.7	3.4955	0.118	120	22	1.1712	1	0.56[illegible]7	0.4847
164	25	2003	1794.7	1.9952	0.2078	126	22	1.2444	1	0.[illegible]959	0.3209
164	26	2004	1804.7	2.5624	0.1606	123	22	1.204	1	0.4753	0.3853
164	27	2005	1799.7	2.9996	0.1456	123	22	1.204	1	0.5013	0.4152
164	28	2006	1804.7	3.4987	0.1268	120	22	1.1731	1	0.5538	0.4961
164	29	2007	1504.7	3.453	0.1596	123	22	1.2066	1	0.498	0.4511
164	30	2008	1499.7	2.0266	0.2608	132	22	1.3402	1	0.3344	0.3096
164	31	2009	1499.7	2.5275	0.2158	129	22	1.2881	1	0.3931	0.3579
164	32	2010	1509.7	3.0027	0.1833	126	22	1.2451	1	0.4469	0.4117
164	33	2011	1504.7	1.4425	0.3043	138	22	1.4759	1	0.2788	0.2616

164	34	2012	1499.7	2.0236	0.213	129	22	1.2867	1	0.4084	0.3783
164	35	2013	1499.7	2.5135	0.1585	123	22	1.2058	1	0.51	0.4834
164	36	2014	1504.7	2.9773	0.1363	123	22	1.2036	1	0.541	0.5241
164	37	2015	1509.7	3.5203	0.1081	120	22	1.1708	1	0.6075	0.5943
164	38	2016	1804.7	1.4539	0.2407	132	22	1.3283	1	0.3315	0.2905
164	39	2017	1799.7	1.9836	0.1623	126	22	1.2278	1	0.4536	0.4128
164	40	2018	1799.7	2.49	0.1194	123	22	1.1807	1	0.5357	0.4942
164	41	2019	1814.7	2.9218	0.1036	120	22	1.1646	1	0.5433	0.5439
164	42	2020	1804.7	3.4139	0.0572	117	22	1.1319	1	0.6942	0.641
164	43	2021	2104.7	2.9194	0.0365	117	22	1.1211	1	0.6628	0.6013
164	44	2022	1799.7	2.9387	0.0479	117	22	1.1249	1	0.6963	0.6304
164	45	2023	1499.7	1.4501	0.2462	132	22	1.3333	1	0.3702	0.3429
164	46	2024	1509.7	1.9169	0.1892	129	22	1.2737	1	0.4415	0.4415
164	47	2025	1499.7	2.4642	0.1243	123	22	1.1929	1	0.5657	0.5624
164	48	2026	1499.7	2.9522	0.0916	120	22	1.1618	1	0.6394	0.6547
164	49	2027	1801.7	1.4418	0.1891	129	22	1.2561	1	0.4035	0.3654
164	50	2028	1804.7	1.9296	0.145	126	22	1.2172	1	0.4761	0.4786
164	51	2029	1809.7	2.4465	0.0567	120	22	1.1411	1	0.6496	0.5981
164	52	2030	1789.7	1.447	0.1996	132	22	1.2963	1	0.38	0.3823
164	53	2031	1814.7	1.923	0.1463	129	22	1.2443	1	0.4593	0.5004
164	54	2032	2404.7	1.4263	0.1168	135	22	1.244	1	0.3947	0.393
164	55	2033	2404.7	1.9032	0.0752	129	22	1.1906	1	0.4987	0.5368
164	56	2034	2404.7	0.9832	0.2288	141	22	1.4054	1	0 2414	0.2425
164	57	2035	2099.7	0.9917	0.2472	141	22	1.4348	1	0.2562	0.2695
164	58	2036	2404.7	1.3976	0.1155	135	22	1.2387	1	0.3969	0.4072
164	59	2037	2204.7	1.399	0.0714	126	22	1.151	1	0.5025	0.4631
164	60	2038	2089.7	0.9693	0.2435	138	22	1.3839	1	0.271	0.2563
164	61	2039	1804.7	0.9781	0.2322	135	22	1.3299	1	0.3332	0.2853
164	62	2040	1504.7	0.9934	0.351	144	22	1.6605	1	0.2321	0.2335
164	63	2041	1799.7	1.4024	0.1644	129	22	1.2356	1	0.4338	0.4168
164	64	2042	1504.7	1.4269	0.2163	132	22	1.3095	1	0.4062	0.3994
164	65	2043	1799.7	1.8879	0.0783	123	22	1.1569	1	0.5857	0.5564
164	66	2044	1504.7	1.8894	0.1669	129	22	1.2579	1	0.4747	0.5068
164	67	2045	1504.7	2.4303	0.1132	123	22	1.1871	1	0.5837	0.5995
164	68	2046	1799.7	0.963	0.2209	135	22	1.3158	1	0.3459	0.3051
164	69	2047	1504.7	0.9938	0.3318	144	22	1.6339	1	0.2482	0.256
164	70	2048	2394.7	0.9808	0.2156	141	22	1.3844	1	0.2542	0.2752
164	71	2049	2109.7	2.9254	0.0794	123	22	1.1798	1	0.5862	0.621
164	72	2050	2104.7	1.9909	0.0646	120	22	1.1353	1	0.5835	0.5061
164	74	2052	2099.7	1.414	0.194	135	22	1.3233	1	0.3375	0.3278
166	1	14	1499.7	3.446	0.1572	150	26	1.2017	1.42975	0.4057	0.4585
166	2	15	1799.7	3.5132	0.1019	147	26	1.1589	1.42975	0.4956	0.5107
166	3	16	2109.7	3.5251	0.078	147	26	1.1525	1.42975	0.5248	0.5525
166	4	17	2404.7	3.5894	0.0386	147	26	1.1398	1.42975	0.5849	0.6419
166	6	19	2100.7	2.9382	0.109	150	26	1.1847	1.42975	0.4493	0.4905
166	7	20	2099.7	2.491	0.0339	147	26	1.1461	1.42975	0.4718	0.4411
166	8	21	2399.7	2.456	0.0687	150	26	1.1584	1.42975	0.4759	0.4817
166	9	22	2399.7	2.0248	0.1037	150	26	1.1668	1.42975	0.4089	0.4089
166	10	23	2404.7	3.0185	0.0799	147	26	1.1479	1.42975	0.4996	0.4759
166	11	24	2099.7	2.9463	0.142	150	26	1.1956	1.42975	0.4041	0.3847
166	12	25	2099.7	3.53	0.1242	150	26	1.196	1.42975	0.4397	0.4674
166	13	26	2399.7	3.516	0.082	147	26	1.1533	1.42975	0.5169	0.4887
166	14	27	2399.7	2.0035	0.0449	150	26	1.1364	1.42975	0.4817	0.4729
166	15	28	2099.7	2.0077	0.11	150	26	1.1685	1.42975	0.4228	0.4475

166	16	29	2094.7	2.5188	0.0831	150	26	1.1666	1.42975	0.4746	0.5467
166	17	30	2409.7	2.49	-0.0021	144	26	1.0945	1.42975	0.5975	0.5824
166	18	31	1804.7	3.4822	0.1071	147	26	1.16	1.42975	0.4866	0.5177
166	19	32	1799.7	2.0026	0.1059	147	26	1.1425	1.42975	0.4693	0.4295
166	20	33	1499.7	2.5148	0.1263	147	26	1.157	1.42975	0.4782	0.4852
166	21	34	1489.7	3.4987	0.0976	147	26	1.1581	1.42975	0.5222	0.5722
166	22	35	1499.7	2.0362	0.1077	147	26	1.1446	1.42975	0.5094	0.484
166	23	36	1804.7	2.0257	0.0789	147	26	1.1325	1.42975	0.5058	0.5038
166	24	37	2099.7	1.5237	0.095	150	26	1.1473	1.42975	0.4227	0.4244
166	25	38	2099.7	1.992	0.0749	150	26	1.1509	1.42975	0.4888	0.5092
166	26	39	2404.7	1.983	0.0276	150	26	1.1276	1.42975	0.5015	0.5258
166	27	40	2404.7	1.4867	0.0674	150	26	1.1314	1.42975	0.4194	0.4464
166	28	41	2404.7	1.494	0.0242	150	26	1.1117	1.42975	0.4693	0.4718
166	29	42	2104.7	1.4575	0.0989	150	26	1.146	1.42975	0.417	0.4707
166	30	43	2114.7	1.9865	0.0353	150	26	1.1313	1.42975	0.5168	0.5952
166	31	44	1799.7	1.9727	0.0594	147	26	1.1237	1.42975	0.5319	0.5641
166	32	45	1504.7	1.9736	0.0688	144	26	1.1065	1.42975	0.5822	0.5593
166	33	45	1504.7	1.9731	0.0689	144	26	1.1095	1.42975	0.5776	0.5606
166	34	46	1499.7	1.4955	0.1125	147	26	1.1339	1.42975	0.504[illegible]	0.4875
166	35	47	1504.7	1.4831	0.1522	150	26	1.175	1.42975	0.4396	0.4365
166	36	48	2109.7	1.4719	0.0412	150	26	1.1189	1.42975	0.4814	0.4927
166	37	49	2394.7	1.4597	0.0015	150	26	1.1006	1.42975	0.4928	0.5136
166	38	50	2404.7	2.9924	0.0438	150	26	1.1563	1.42975	0.5354	0.5754
166	39	51	2399.7	2.9994	0.0041	147	26	1.1195	1.42975	0.6078	0.7022
166	40	52	2099.7	3.0005	0.0421	147	26	1.1343	1.42975	0.5637	0.621
166	41	53	1804.7	3.4911	0.0502	144	26	1.1212	1.42975	0.597	0.6695
166	42	54	1504.7	2.4864	0.0876	144	26	1.1217	1.42975	0.5537	0.5484
166	43	55	2104.7	2.4869	-0.0068	144	26	1.093	1.42975	0.6271	0.6384
166	44	56	2409.7	2.5275	-0.11	141	26	1.0553	1.42975	0.7638	0.6733
166	45	57	2099.7	2.4625	0.0484	150	26	1.1487	1.42975	0.5211	0.5941
166	46	58	1499.7	1.9963	0.0668	147	26	1.1272	1.42975	0.57	0.5969
166	47	59	2099.7	2.0115	-0.0712	141	26	1.0577	1.42975	0.6972	0.6657

Appendix B'

Inputs to the VIPRE-01 Code

```
** CDC FILE NAME: WM108
**
** VIPRE.1:
   1, 0, 0
** VIPRE.2:
   WM108
** GOEM.1:
   GEOM, 25, 25, 48, 0, 0, 0
** GEOM.2:
   96.00,    0.0,    0.5
** GEOM.4:
    1, .0975, 1.0594,  .3314, 2,  2, .1530, .4595,  6, .1530, .4595
    2, .1321, 1.2179,  .6629, 2,  3, .1530, .5550,  7, .1330, .4595
    3, .1321, 1.2179,  .6629, 2,  4, .1530, .5550,  8, .1330, .4595
    4, .1321, 1.2179,  .6629, 2,  5, .1530, .4595,  9, .1330, .4595
    5, .0975, 1.0594,  .3314, 1, 10, .1530, .4595,  0, .0000, .0000
    6, .1321, 1.2179,  .6629, 2,  7, .1330, .4595, 11, .1530, .5550
    7, .1682, 1.3258, 1.3258, 2,  8, .1330, .5550, 12, .1330, .5550
    8, .1682, 1.3258, 1.3258, 2,  9, .1330, .5550, 13, .1330, .5550
    9, .1682, 1.3258, 1.3258, 2, 10, .1330, .4595, 14, .1330, .5550
   10, .1321, 1.2179,  .6629, 1, 15, .1530, .5550,  0, .0000, .0000
   11, .1321, 1.2179,  .6629, 2, 12, .1330, .4595, 16, .1530, .5550
   12, .1682, 1.3258, 1.3258, 2, 13, .1330, .5550, 17, .1330, .5550
   13, .1682, 1.3258, 1.3258, 2, 14, .1330, .5550, 18, .1330, .5550
   14, .1682, 1.3258, 1.3258, 2, 15, .1330, .4595, 19, .1330, .5550
   15, .1321, 1.2179,  .6629, 1, 20, .1530, .5550,  0, .0000, .0000
   16, .1321, 1.2179,  .6629, 2, 17, .1330, .4595, 21, .1530, .4595
   17, .1682, 1.3258, 1.3258, 2, 18, .1330, .5550, 22, .1330, .4595
   18, .1682, 1.3258, 1.3258, 2, 19, .1330, .5550, 23, .1330, .4595
   19, .1682, 1.3258, 1.3258, 2, 20, .1330, .4595, 24, .1330, .4595
5
   20, .1321, 1.2179,  .6629, 1, 25, .1530, .4595,  0, .0000, .0000
   21, .0975, 1.0594,  .3314, 1, 22, .1530, .4595,  0, .0000, .0000
   22, .1321, 1.2179,  .6629, 1, 23, .1530, .5550,  0, .0000, .0000
   23, .1321, 1.2179,  .6629, 1, 24, .1530, .5550,  0, .0000, .0000
   24, .1321, 1.2179,  .6629, 1, 25, .1530, .4595,  0, .0000, .0000
   25, .0975, 1.0594,  .3314, 0,  0, .0000, .0000,  0, .0000, .0000
** RODS.1:
   RODS,    1,   16,   0,   1,   0,   0,   0,   0,   0,   0,   0
** RODS.2:
   96.00,    0.0,    0,    0
** RODS.3:
   28
** RODS.4:
     .000,    .358,  4.992,   .359,  9.984,    .400, 14.976,    .458
   19.968,    .567, 24.960,   .683, 30.084,    .833, 35.040,    .992
   40.032,   1.133, 45.024,  1.258, 47.520,   1.305, 50.016,   1.350
   52.512,   1.410, 55.008,  1.467, 57.504,   1.522, 60.000,   1.592
   62.496,   1.640, 64.992,  1.658, 67.488,   1.640, 69.984,   1.583
   72.480,   1.510, 74.976,  1.433, 79.968,   1.233, 84.960,    .993
   87.456,    .815, 90.048,   .633, 92.448,    .520, 96.000,    .367
** RODS.9:
    1,  1,  .9517,  1,  1   .250,  2,  .250,  6,  .250,  7,  .250
    2,  1,  .9517,  1,  2,  .250,  3,  .250,  7,  .250,  8,  .250
    3,  1,  .9517,  1,  3,  .250,  4,  .250,  8,  .250,  9,  .250
    4,  1,  .9517,  1,  4,  .250,  5,  .250,  9,  .250, 10,  .250
    5,  1,  .9517,  1,  9,  .250, 10,  .250, 14,  .250, 15,  .250
    6,  1,  .9517,  1, 14,  .250, 15,  .250, 19,  .250, 20,  .250
    7,  1,  .9517,  1, 19,  .250, 20,  .250, 24,  .250, 25,  .250
    8,  1,  .9517,  1, 18,  .250, 19,  .250, 23,  .250, 24,  .250
    9,  1,  .9517,  1, 17,  .250, 18,  .250, 22,  .250, 23,  .250
   10,  1,  .9517,  1, 16,  .250, 17,  .250, 21,  .250, 22,  .250
   11,  1,  .9517,  1, 11,  .250, 12,  .250, 16,  .250, 17,  .250
   12,  1,  .9517,  1,  6,  .250,  7,  .250, 11,  .250, 12,  .250
   13,  1, 1.1449,  1,  7,  .250,  8,  .250, 12,  .250, 13,  .250
   14,  1, 1.1449,  1,  8,  .250,  9,  .250, 13,  .250, 14,  .250
   15,  1, 1.1449,  1, 13,  .250, 14,  .250, 18,  .250, 19,  .250
   16,  1, 1.1449,  1, 12,  .250, 13,  .250, 17,  .250, 18,  .250
   0
** RODS.68:
   1, DUMY, .4220, 0.0, 0
** OPER.1:
   OPER, 1, 2, 0, 2, 0, 29, 0, 0, 0
** OPER.2:
   -1.0, 0.0, 0.0, 0.0
** OPER.3:
   0
** OPER.5:
   1514.700,   520.000,   2.500,   .568,   0.0   *   1   8
   1514.700,   499.000,   2.500,   .624,   0.0   *   2   9
   2164.700,   584.000,   2.587,   .510,   0.0   *   3  10
   2114.700,   567.000,   2.540,   .557,   0.0   *   4  11
   2414.700,   577.000,   2.535,   .550,   0.0   *   5  12
   2414.700,   559.000,   2.064,   .517,   0.0   *   6  13
   1514.700,   560.000,   3.429,   .512,   0.0   *   7  14
   1814.700,   579.000,   3.552,   .545,   0.0   *   8  15
   1824.700,   500.000,   1.907,   .563,   0.0   *   9  16
   1514.700,   545.000,   3.604,   .579,   0.0   *  10  17
   1514.700,   482.000,   2.480,   .664,   0.0   *  11  18
   1544.700,   466.000,   1.970,   .610,   0.0   *  12  19
   1514.700,   558.000,   3.571,   .508,   0.0   *  13  53
   1814.700,   560.000,   3.612,   .605,   0.0   *  14  54
   1794.700,   481.500,   2.029,   .597,   0.0   *  15  55
   2114.700,   502.500,   2.021,   .571,   0.0   *  16  56
   2114.700,   517.500,   2.035,   .550,   0.0   *  17  57
   2114.700,   541.500,   2.026,   .507,   0.0   *  18  58
   2114.700,   545.000,   2.526,   .584,   0.0   *  19  59
   2089.700,   567.500,   3.057,   .608,   0.0   *  20  60
   2124.700,   581.000,   3.068,   .546,   0.0   *  21  61
```

```
      2094.700,    601.500,    3.040,    .482,    0.0    *    22    62
      2114.700,    566.000,    3.574,    .689,    0.0    *    23    63
      2114.700,    594.000,    3.456,    .548,    0.0    *    24    64
      2094.700,    577.500,    3.568,    .618,    0.0    *    25    65
      2404.700,    580.000,    3.091,    .597,    0.0    *    26    66
      2409.700,    602.000,    3.069,    .521,    0.0    *    27    67
      2414.700,    623.000,    3.047,    .470,    0.0    *    28    68
      2414.700,    627.000,    3.557,    .502,    0.0    *    29    69
  ** OPER.12:
      0,  0,  0,  0,  0,  0
  ** MIXX.1:
      MIXX,  0,  0,  0
  ** MIXX.2:
      0.6,  0.038
  ** DRAG.1:
      DRAG,  1,  0,  1
  ** DRAG.2:
      0.186, -0.20, 0.0, 64.0, -1.0, 0.0
  ** DRAG.5:
      0.5,    .555
  ** DRID.1:
      GRID,  0,     2
  ** GRID.2:
      1.200,     .570
  ** GRID.4:
      -1,     9
  ** GRID.6:
      10.75, 1,20.75, 2,30.75, 1,40.75, 2,50.75, 1,60.75, 2,70.75, 1,80.75, 2
      90.75, 1,  .00, 0,  .00, 0,  .00, 0,  .00, 0,  .00, 0,  .00, 0,  .00, 0
      0
  ** CORR.1:
      CORR, 1, 1, 0
  ** CORR.2:
      EPRI, EPRI, EPRI, NONE
  ** CORR.3:
      0.2
  ** CORR.6:
      EPRI, THOM, THOM, CE-1, COND, G5.7
  ** CORR.7:
      0.0
  ** CORR.9:
      CE-1
  ** CORR.12:
      0.5074, 1
  ** CONT.1:
      CONT
  ** CONT.2:
      0.0, 0, 20, 20, 2, 2, 0, 0
  ** CONT.3:
      0.1, 0.0001, 0.001, 0, 0, 0, 0, 0.9
  ** CONT.6:
      1, 1, 0, 0, 1, 0, 1, 1, 0, 0, 1, 1, 0, 0
  ** CONT.7:
      4000.0, 0, 0, 0, 0, 0
  ** CONT.8:
      13
  ** CONT.11:
      13
  ** CONT.15:
      0,  0,  0,  0,  0
  ** END OF INPUT DATA:
      ENDD
      0
```

```
** CDC FILE NAME: HH114
**
** VIPRE.1:
   1, 0, 0
** VIPRE.2:
   HH114
** GEOM.1:
   GEOM,  25,  25,  48,  0,  0,  0
** GEOM.2:
   96.00,    0.0,    0.5
** GEOM.4:
    1,  .0975,  1.0594,   .3314,  2,   2,  .1530,  .4595,   6,  .1530,  .4595
    2,  .1321,  1.2179,   .6629,  2,   3,  .1530,  .5550,   7,  .1330,  .4595
    3,  .1321,  1.2179,   .6629,  2,   4,  .1530,  .5550,   8,  .1330,  .4595
    4,  .1321,  1.2179,   .6629,  2,   5,  .1530,  .4595,   9,  .1330,  .4595
    5,  .0975,  1.0594,   .3314,  1,  10,  .1530,  .4595,   0,  .0000,  .0000
    6,  .1321,  1.2179,   .6629,  2,   7,  .1330,  .4595,  11,  .1530,  .5550
    7,  .1682,  1.3258,  1.3258,  2,   8,  .1330,  .5550,  12,  .1330,  .5550
    8,  .1682,  1.3258,  1.3258,  2,   9,  .1330,  .5550,  13,  .1330,  .5550
    9,  .1682,  1.3258,  1.3258,  2,  10,  .1330,  .4595,  14,  .1330,  .5550
   10,  .1321,  1.2179,   .6629,  1,  15,  .1530,  .5550,   0,  .0000,  .0000
   11,  .1321,  1.2179,   .6629,  2,  12,  .1330,  .4595,  16,  .1530,  .5550
   12,  .1682,  1.3258,  1.3258,  2,  13,  .1330,  .5550,  17,  .1330,  .5550
   13,  .1682,  1.3258,  1.3258,  2,  14,  .1330,  .5550,  18,  .1330,  .5550
   14,  .1682,  1.3258,  1.3258,  2,  15,  .1330,  .4595,  19,  .1330,  .5550
   15,  .1321,  1.2179,   .6629,  1,  20,  .1530,  .5550,   0,  .0000,  .0000
   16,  .1321,  1.2179,   .6629,  2,  17,  .1330,  .4595,  21,  .1530,  .4595
   17,  .1682,  1.3258,  1.3258,  2,  18,  .1330,  .5550,  22,  .1330,  .4595
   18,  .1682,  1.3258,  1.3258,  2,  19,  .1330,  .5550,  23,  .1330,  .4595
   19,  .1682,  1.3258,  1.3258,  2,  20,  .1330,  .4595,  24,  .1330,  .4595
   20,  .1321,  1.2179,   .6629,  1,  25,  .1530,  .4595,   0,  .0000,  .0000
   21,  .0975,  1.0594,   .3314,  1,  22,  .1530,  .4595,   0,  .0000,  .0000
   22,  .1321,  1.2179,   .6629,  1,  23,  .1530,  .5550,   0,  .0000,  .0000
   23,  .1321,  1.2179,   .6629,  1,  24,  .1530,  .5550,   0,  .0000,  .0000
   24,  .1321,  1.2179,   .6629,  1,  25,  .1530,  .4595,   0,  .0000,  .0000
   25,  .0975,  1.0594,   .3314,  0,   0,  .0000,  .0000,   0,  .0000,  .0000
** RODS.1:
   RODS,    1,    16,    0,    1,    0,    0,    0,    0,    0,    0,   ,0
** RODS.2:
   96.00,    0.0,   0,   0
** RODS.3:
   24
** RODS.4:
      .000,    .310,   4.992,    .450,   9.984,    .610,  14.976,    .780
    19.968,    .920,  24.960,   1.080,  30.048,   1.200,  35.040,   1.320
    40.032,   1.400,  45.024,   1.460,  48.960,   1.480,  50.016,   1.480
    55.008,   1.450,  57.984,   1.410,  60.000,   1.380,  64.032,   1.300
    69.984,   1.160,  74.016,   1.060,  78.048,    .950,  79.968,    .875
    81.024,    .840,  84.000,    .740,  90.048,    .530,  96.000,    .310
** RODS.9:
    1,  1,   .9843,  1,   1,  .250,   2,  .250,   6,  .250,   7,  .250
    2,  1,   .9843,  1,   2,  .250,   3,  .250,   7,  .250,   8,  .250
    3,  1,   .9843,  1,   3,  .250,   4,  .250,   8,  .250,   9,  .250
    4,  1,   .9843,  1,   4,  .250,   5,  .250,   9,  .250,  10,  .250
    5,  1,   .9843,  1,   9,  .250,  10,  .250,  14,  .250,  15,  .250
    6,  1,   .9843,  1,  14,  .250,  15,  .250,  19,  .250,  20,  .250
    7,  1,   .9843,  1,  19,  .250,  20,  .250,  24,  .250,  25,  .250
    8,  1,   .9843,  1,  18,  .250,  19,  .250,  23,  .250,  24,  .250
    9,  1,   .9843,  1,  17,  .250,  18,  .250,  22,  .250,  23,  .250
   10,  1,   .9843,  1,  16,  .250,  17,  .250,  21,  .250,  22,  .250
   11,  1,   .9843,  1,  11,  .250,  12,  .250,  16,  .250,  17,  .250
   12,  1,   .9843,  1,   6,  .250,   7,  .250,  11,  .250,  12,  .250
   13,  1,  1.0472,  1,   7,  .250,   8,  .250,  12,  .250,  13,  .250
   14,  1,  1.0472,  1,   8,  .250,   9,  .250,  13,  .250,  14,  .250
   15,  1,  1.0472,  1,  13,  .250,  14,  .250,  18,  .250,  19,  .250
   16,  1,  1.0472,  1,  12,  .250,  13,  .250,  17,  .250,  18,  .250
** RODS.68:
   0
   1, DUMY, .4220, 0.0, 0
** OPER.1:
   OPER, 1, 2, 0, 2, 0, 33, 0, 0, 0
** OPER.2:
   -1.0, 0.0, 0.0, 0.0
** OPER.3:
   0
** OPER.5:
   1499.700,    517.050,    2.545,    .583,    0.0    *     1    217
   1504.700,    496.920,    2.558,    .643,    0.0    *     2    218
   1504.700,    481.344,    2.544,    .690,    0.0    *     3    219
   1514.700,    559.950,    3.592,    .550,    0.0    *     4    220
   1514.700,    539.475,    3.587,    .644,    0.0    *     5    221
   1804.700,    580.768,    3.540,    .545,    0.0    *     6    222
   1804.700,    560.275,    3.674,    .675,    0.0    *     7    223
   2094.700,    583.050,    2.558,    .539,    0.0    *     8    224
   2099.700,    565.475,    2.550,    .586,    0.0    *     9    225
   2114.700,    546.300,    2.570,    .635,    0.0    *    10    226
   2114.700,    599.024,    3.095,    .539,    0.0    *    11    227
   2124.700,    583.702,    3.055,    .606,    0.0    *    12    228
   2134.700,    559.625,    3.101,    .684,    0.0    *    13    229
   2114.700,    600.328,    3.572,    .571,    0.0    *    14    230
   2134.700,    585.332,    3.582,    .674,    0.0    *    15    231
   2124.700,    566.450,    3.563,    .737,    0.0    *    16    232
   2434.700,    626.408,    3.537,    .577,    0.0    *    17    233
   2434.700,    602.610,    3.609,    .672,    0.0    *    18    234
   2424.700,    583.702,    3.587,    .736,    0.0    *    19    235
   2444.700,    624.452,    3.026,    .531,    0.0    *    20    236
   2434.700,    602.284,    3.063,    .601,    0.0    *    21    237
   2424.700,    580.442,    3.086,    .673,    0.0    *    22    238
   2424.700,    579.464,    2.574,    .587,    0.0    *    23    239
```

```
  2424.7?0,   555.775,   2.566,   .654,   0.0   *   24   240
  2344.700,   537.200,   2.560,   .684,   0.0   *   25   241
  2424.700,   558.650,   2.084,   .551,   0.0   *   26   242
  2404.700,   541.100,   2.058,   .585,   0.0   *   27   243
  2424.700,   514.775,   2.067,   .641,   0.0   *   28   244
  2124.700,   537.850,   2.035,   .582,   0.0   *   29   245
  2114.700,   515.750,   2.064,   .623,   0.0   *   30   246
  2114.700,   500.165,   2.051,   .655,   0.0   *   31   247
  1804.700,   500.165,   2.108,   .605,   0.0   *   32   248
  1824.700,   478.099,   2.018,   .641,   0.0   *   33   249
** OPER.12:
  0,  0,  0,  0,  0,  0
** MIXX.1:
  MIXX,  0,  0,  0
** MIXX.2:
  0.8,  0.038
** DRAG.1:
  DRAG,  1,  0,  1
** DRAG.2:
  0.186, -0.20, 0.0, 64.0, -1.0, 0.0
** DRAG.5:
  0.5,     .555
** GRID.1:
  GRID,  0,    2
** GRID.2:
  1.200,     .570
** GRID.4:
  -1,      7
** GRID.6:
  6.75, 1, 19.75, 2, 32.75, 1, 45.75, 2, 58.75, 1, 71.75, 2, 84.75, 1, .00, 0
  0
** CORR.1:
  CORR, 1, 1, 0
** CORR.2:
  EPRI, EPRI, EPRI, NONE
** CORR.3:
  0.2
** CORR.6:
  EPRI, THOM, THOM, CE-1, COND, G5.7
** CORR.7:
  0.0
** CORR.9:
  CE-1
** CORR.12:
  0.50747, 1
** CONT.1:
  CONT
** CONT.2:
  0.0, 0, 20, 20, 2, 2, 0, 0
** CONT.3:
  0.1, 0.0001, 0.001, 0, 0, 0, 0, 0.*
** CONT.6:
  1, 1, 0, 0, 1, 0, 1, 1, 0, 0, 1, 1, 0, 0
** CONT.7:
  4000.0, 0, 0, 0, 0, 0
** CONT.:8
  13
** CONT.:11
  13
** CONT.15:
  0,  0,  0,  0,  0
** END OF INPUT:
  ENDD
  0
```

```
** CDC FILE NAME: HH121
**
** VIPRE.1:
   1,  ,  0
** VIPRE.2:
   HH121
** GEOM.1:
   GEOM,  25,  25,  48,  0,  0,  0
** GEOM.2:
   96.00,    0.0,    0.5
** GEOM.4:
    1,  .0975, 1.0594,  .3314,  2,   2,  .1530,  .4595,  6,  .1530,  .4595
    2,  .1321, 1.2179,  .6629,  2,   3,  .1530,  .5550,  7,  .1330,  .4595
    3,  .1321, 1.2179,  .6629,  2,   4,  .1530,  .5550,  8,  .1330,  .4595
    4,  .1321, 1.2179,  .6629,  2,   5,  .1530,  .4595,  9,  .1330,  .4595
    5,  .0975, 1.0594,  .3314,  1,  10,  .1530,  .4595,  0,  .0000,  .0000
    6,  .1321, 1.2179,  .6629,  2,   7,  .1330,  .4595, 11,  .1530,  .5550
    7,  .1682, 1.3258, 1.3258,  2,   8,  .1330,  .5550, 12,  .1330,  .5550
    8,  .1682, 1.3258, 1.3258,  2,   9,  .1330,  .5550, 13,  .1330,  .5550
    9,  .1682, 1.3258, 1.3258,  2,  10,  .1330,  .4595, 14,  .1330,  .5550
   10,  .1321, 1.2179,  .6629,  1,  15,  .1530,  .5550,  0,  .0000,  .0000
   11,  .1321, 1.2179,  .6629,  2,  12,  .1330,  .4595, 16,  .1530,  .5550
   12,  .1682, 1.3258, 1.3258,  2,  13,  .1330,  .5550, 17,  .1330,  .5550
   13,  .1682, 1.3258, 1.3258,  2,  14,  .1330,  .5550, 18,  .1330,  .5550
   14,  .1682, 1.3258, 1.3258,  2,  15,  .1330,  .4595, 19,  .1330,  .5550
   15,  .1321, 1.2179,  .6629,  1,  20,  .1530,  .5550,  0,  .0000,  .0000
   16,  .1321, 1.2179,  .6629,  2,  17,  .1330,  .4595, 21,  .1530,  .4595
   17,  .1682, 1.3258, 1.3258,  2,  18,  .1330,  .5550, 22,  .1330,  .4595
   18,  .1682, 1.3258, 1.3258,  2,  19,  .1330,  .5550, 23,  .1330,  .4595
   19,  .1682, 1.3258, 1.3258,  2,  20,  .1330,  .4595, 24,  .1330,  .4595
   20,  .1321, 1.2179,  .6629,  1,  25,  .1530,  .4595,  0,  .0000,  .0000
   21,  .0975, 1.0594,  .3314,  1,  22,  .1530,  .4595,  0,  .0000,  .0000
   22,  .1321, 1.2179,  .6629,  1,  23,  .1530,  .5550,  0,  .0000,  .0000
   23,  .1321, 1.2179,  .6629,  1,  24,  .1530,  .5550,  0,  .0000,  .0000
   24,  .1321, 1.2179,  .6629,  1,  25,  .1530,  .4595,  0,  .0000,  .0000
   25,  .0975, 1.0594,  .3314,  0,   0,  .0000,  .0000,  0,  .0000,  .0000
** RODS.1:
   RODS,   1,   16,   0,   1,   0,   0,   0,   0,   0,   0,   0
** RODS.2:
   96.00,    0.0,    0,    0
** RODS.3:
   24
** RODS.4:
     .000,     .310,    4.992,     .450,    9.984,     .610,   14.976,     .700
   19.968,     .920,   24.960,    1.080,   30.048,    1.200,   35.040,    1.320
   40.032,    1.400,   45.024,    1.460,   48.960,    1.480,   50.016,    1.480
   55.008,    1.450,   57.984,    1.410,   60.000,    1.380,   64.032,    1.300
   69.984,    1.160,   74.016,    1.060,   78.048,     .950,   79.968,     .875
   81.024,     .840,   84.000,     .740,   90.048,     .530,   96.000,     .310
** RODS.9:
    1,  1,   .9637,  1,   1,  .250,   2,  .250,   6,  .250,   7,  .250
    2,  1,   .9707,  1,   2,  .250,   3,  .250,   7,  .250,   8,  .250
    3,  1,   .9860,  1,   3,  .250,   4,  .250,   8,  .250,   9,  .250
    4,  1,   .9667,  1,   4,  .250,   5,  .250,   9,  .250,  10,  .250
    5,  1,   .9717,  1,   9,  .250,  10,  .250,  14,  .250,  15,  .250
    6,  1,   .9902,  1,  14,  .250,  15,  .250,  19,  .250,  20,  .250
    7,  1,   .9667,  1,  19,  .250,  20,  .250,  24,  .250,  25,  .250
    8,  1,   .9707,  1,  18,  .250,  19,  .250,  23,  .250,  24,  .250
    9,  1,   .9902,  1,  17,  .250,  18,  .250,  22,  .250,  23,  .250
   10,  1,   .9707,  1,  16,  .250,  17,  .250,  21,  .250,  22,  .250
   11,  1,   .9892,  1,  11,  .250,  12,  .250,  16,  .250,  17,  .250
   12,  1,   .9892,  1,   6,  .250,   7,  .250,  11,  .250,  12,  .250
   13,  1,  1.0794,  1,   7,  .250,   8,  .250,  12,  .250,  13,  .250
   14,  1,  1.0622,  1,   8,  .250,   9,  .250,  13,  .250,  14,  .250
   15,  1,  1.0683,  1,  13,  .250,  14,  .250,  18,  .250,  19,  .250
   16,  1,  1.0646,  1,  12,  .250,  13,  .250,  17,  .250,  18,  .250
    0
** RODS.68:
   1, DUMY, .4220, 0.0, 0
** OPER.1:
   OPER, 1, 2, 0, 2, 0, 37, 0, 0, 0
** OPER.2:
   -1.0, 0.0, 0.0, 0.0
** OPER.3:
   0
** OPER.5:
   1534.700,    560.600,    3.589,    .611,    0.0    *    1   394
   1504.700,    539.475,    3.648,    .679,    0.0    *    2   395
   1794.700,    585.006,    3.643,    .590,    0.0    *    3   396
   1774.700,    559.300,    3.584,    .694,    0.0    *    4   397
   2084.700,    603.914,    3.511,    .606,    0.0    *    5   398
   2064.700,    578.160,    3.578,    .735,    0.0    *    6   399
   2114.700,    568.075,    3.577,    .813,    0.0    *    7   400
   2114.700,    607.174,    3.037,    .557,    0.0    *    8   401
   2114.700,    580.442,    3.090,    .646,    0.0    *    9   402
   2114.700,    562.225,    3.116,    .757,    0.0    *   10   403
   2349.700,    624.778,    3.583,    .609,    0.0    *   11   404
   2404.700,    605.218,    3.631,    .716,    0.0    *   12   405
   2404.700,    582.072,    3.615,    .822,    0.0    *   13   406
   2414.700,    628.690,    3.045,    .547,    0.0    *   14   407
   2394.700,    606.848,    3.091,    .633,    0.0    *   15   408
   2384.700,    584.354,    3.077,    .731,    0.0    *   16   409
   2414.700,    587.614,    2.552,    .627,    0.0    *   17   410
   2404.700,    562.875,    2.579,    .717,    0.0    *   18   411
   2414.700,    537.200,    2.607,    .797,    0.0    *   19   412
   2094.700,    582.724,    2.590,    .570,    0.0    *   20   413
   2124.700,    560.925,    2.576,    .653,    0.0    *   21   414
   2104.700,    542.075,    2.594,    .721,    0.0    *   22   415
   1494.700,    521.275,    2.617,    .653,    0.0    *   23   416
```

```
    1504.700,   503.086,   2.590,   .701,   0.0   *   24   417
    1504.700,   480.046,   2.620,   .769,   0.0   *   25   418
    2404.700,   559.300,   2.083,   .610,   0.0   *   26   419
    2404.700,   543.700,   2.114,   .652,   0.0   *   27   420
    2404.700,   530.700,   2.045,   .693,   0.0   *   28   421
    2099.700,   540.125,   2.077,   .615,   0.0   *   29   422
    2114.700,   524.200,   2.049,   .667,   0.0   *   30   423
    2094.700,   500.814,   2.075,   .728,   0.0   *   31   424
    1804.700,   503.086,   2.141,   .687,   0.0   *   32   425
    1814.700,   482.318,   2.057,   .724,   0.0   *   33   426
    1504.700,   479.721,   1.527,   .552,   0.0   *   34   427
    1514.700,   462.523,   1.553,   .604,   0.0   *   35   428
    1514.700,   440.471,   1.526,   .658,   0.0   *   36   429
    2014.700,   301.666,   0.962,   .659,   0.0   *   39   432
 ** OPER.12:
    0,  0,  0,  0,  0,  0
 ** MIXX.1:
    MIXX,  0,  0,  0
 ** MIXX.2:
    0.8,  0.038
 ** DRAG.1:
    DRAG,  1,  0,  1
 ** DRAG.2:
    0.186, -0.20, 0.0, 64.0, -1.0, 0.0
 ** DRAG.5:
    0.5,    .555
 ** GRID.1:
    GRID,  0,    2
 ** GRID.2:
    1.200,    .570
 ** GRID.4:
    -1,    9
 ** GRID.6:
    4.75, 1, 14.75, 2, 24.75, 1, 34.75, 2, 44.75, 1, 54.75, 2, 64.75, 1, 74.75, 2
    84.75, 1,  .00, 0,  .00, 0,  .00, 0,  .00, 0,  .00, 0,  .00, 0,  .00, 0
    0
 ** CORR.1:
    CORR, 1, 1, 0
 ** CORR.2:
    EPRI, EPRI, EPRI, NONE
 ** CORR.3:
    0.2
 ** CORR.6:
    EPRI, THOM, THOM, CE-1, COND, G5.7
 ** CORR.7:
    0.0
 ** CORR.9:
    CE-1
 ** CORR.12:
    0.50747, 1
 ** CONT.1:
    CONT
 ** CONT.2:
    0.0, 0, 20, 20, 2, 2, 0, 0
 ** CONT.3:
    0.1, 0.0001, 0.001, 0, 0, 0, 0, 0.9
 ** CONT.6:
    1, 1, 0, 0, 1, 0, 1, 1, 0, 0, 1, 1, 0, 0
 ** CONT.7:
    4000.0, 0, 0, 0, 0, 0
 ** CONT.8:
    13
 ** CONT.11:
    13
 ** CONT.15:
    0, 0, 0, 0, 0
 ** END OF INPUT DATA:
    ENDD
    0
```

```
** CDL FILE NAME: WH122
**
** VIPRE.1:
   1, 0, 0
** VIPRE.2:
   WH122
** GEOM.1:
   GEOM,  25,  25,  48,  0, 0, 0
** GEOM.2:
   96.0D,    0.0,    0.5
** GEOM.4:
    1,  .0975, 1.0594,  .3314,  2,   2,  .1530,  .4595,   6,  .1530,  .4595
    2,  .1321, 1.2179,  .6629,  2,   3,  .1530,  .5550,   7,  .1330,  .6595
    3,  .1321, 1.2179,  .6629,  2,   4,  .1530,  .5550,   8,  .1330,  .4595
    4,  .1321, 1.2179,  .6629,  2,   5,  .1530,  .4595,   9,  .1330,  .4595
    5,  .0975, 1.0594,  .3314,  1,  10,  .1530,  .4595,   0,  .0000,  .0000
    6,  .1321, 1.2179,  .6629,  2,   7,  .1330,  .4595,  11,  .1530,  .5550
    7,  .1682, 1.3258, 1.3258,  2,   8,  .1330,  .5550,  12,  .1330,  .5550
    8,  .1682, 1.3258, 1.3258,  2,   9,  .1330,  .5550,  13,  .1330,  .5550
    9,  .1682, 1.3258, 1.3258,  2,  10,  .1330,  .4595,  14,  .1330,  .5550
   10,  .1321, 1.2179,  .6629,  1,  15,  .1530,  .5550,   0,  .0000,  .0000
   11,  .1321, 1.2179,  .6629,  2,  12,  .1330,  .4595,  16,  .1530,  .5550
   12,  .1682, 1.3258, 1.3258,  2,  13,  .1330,  .5550,  17,  .1330,  .5550
   13,  .1682, 1.3258, 1.3258,  2,  14,  .1330,  .5550,  18,  .1330,  .5550
   14,  .1682, 1.3258, 1.3258,  2,  15,  .1330,  .4595,  19,  .1330,  .5550
   15,  .1321, 1.2179,  .6629,  1,  20,  .1530,  .5550,   0,  .0000,  .0000
   16,  .1321, 1.2179,  .6629,  2,  17,  .1330,  .4595,  21,  .1530,  .4595
   17,  .1682, 1.3258, 1.3258,  2,  18,  .1330,  .5550,  22,  .1330,  .4595
   18,  .1682, 1.3258, 1.3258,  2,  19,  .1330,  .5550,  23,  .1330,  .4595
   19,  .1682, 1.3258, 1.3258,  2,  20,  .1330,  .4595,  24,  .1330,  .4595
   20,  .1321, 1.2179,  .6629,  1,  25,  .1530,  .4595,   0,  .0000,  .0000
   21,  .0975, 1.0594,  .3314,  1,  22,  .1530,  .4595,   0,  .0000,  .0000
   22,  .1321, 1.2179,  .6629,  1,  23,  .1530,  .5550,   0,  .0000,  .0000
   23,  .1321, 1.2179,  .6629,  1,  24,  .1530,  .5550,   0,  .0000,  .0000
   24,  .1321, 1.2179,  .6629,  1,  25,  .1530,  .4595,   0,  .0000,  .0000
   25,  .0975, 1.0594,  .3314,  0,   0,  .0000,  .0000,   0,  .0000,  .0000
** RODS.1:
   RODS,    1,    16,    0,    1,    0,    0,    0,    0,    0,    0,    0
** RODS.2:
   96.00,    0.0,    0,    0
** RODS.3:
   24
** RODS.4:
     .000,     .310,    4.992,     .450,    9.984,     .610,   14.976,     .780
   19.968,     .920,   24.960,    1.080,   30.048,    1.200,   35.040,    1.320
   40.032,    1.400,   45.024,    1.460,   48.960,    1.480,   50.016,    1.480
   55.008,    1.450,   57.984,    1.410,   60.000,    1.380,   64.032,    1.300
   69.984,    1.160,   74.016,    1.060,   78.048,     .950,   79.968,     .875
   81.024,     .840,   84.000,     .760,   90.048,     .530,   96.000,     .310
** RODS.9:
    1,  1,   .9635,  1,   1,  .250,   2,  .250,   6,  .250,   7,  .250
    2,  1,   .9705,  1,   2,  .250,   3,  .250,   7,  .250,   8,  .250
    3,  1,   .9890,  1,   3,  .250,   4,  .250,   8,  .250,   9,  .250
    4,  1,   .9665,  1,   4,  .250,   5,  .250,   9,  .250,  10,  .250
    5,  1,   .9645,  1,   9,  .250,  10,  .250,  14,  .250,  15,  .250
    6,  1,   .9901,  1,  14,  .250,  15,  .250,  19,  .250,  20,  .250
    7,  1,   .9705,  1,  19,  .250,  20,  .250,  24,  .250,  25,  .250
    8,  1,   .9665,  1,  18,  .250,  19,  .250,  23,  .250,  24,  .250
    9,  1,   .9890,  1,  17,  .250,  18,  .250,  22,  .250,  23,  .250
   10,  1,   .9880,  1,  16,  .250,  17,  .250,  21,  .250,  22,  .250
   11,  1,   .9787,  1,  11,  .250,  12,  .250,  16,  .250,  17,  .250
   12,  1,   .9890,  1,   6,  .250,   7,  .250,  11,  .250,  12,  .250
   13,  1,  1.0793,  1,   7,  .250,   8,  .250,  12,  .250,  13,  .250
   14,  1,  1.0621,  1,   8,  .250,   9,  .250,  13,  .250,  14,  .250
   15,  1,  1.0681,  1,  13,  .250,  14,  .250,  18,  .250,  19,  .250
   16,  1,  1.0645,  1,  12,  .250,  13,  .250,  17,  .250,  18,  .250
   0
** RODS.68:
   1, DUMY, .4220, 0.0, 0
** OPER.1:
   OPER, 1, 2, 0, 2, 0, 29, 0, 0, 0
** OPER.2:
   -1.0, 0.0, 0.0, 0.0
** OPER.3:
   0
** OPER.5:
   1524.700,    557.675,    3.639,    .601,    0.0   *    1   434
   1514.700,    535.900,    3.633,    .690,    0.0   *    2   435
   1814.700,    584.354,    3.586,    .586,    0.0   *    3   436
   1814.700,    560.925,    3.673,    .693,    0.0   *    4   437
   2114.700,    601.958,    3.624,    .600,    0.0   *    5   438
   2104.700,    582.072,    3.685,    .693,    0.0   *    6   439
   2114.700,    561.250,    3.637,    .779,    0.0   *    7   440
   2129.700,    602.284,    3.111,    .558,    0.0   *    8   441
   2114.700,    582.072,    3.163,    .643,    0.0   *    9   442
   2114.700,    561.575,    3.148,    .707,    0.0   *   10   443
   2394.700,    627.386,    3.614,    .578,    0.0   *   11   444
   2424.700,    605.218,    3.662,    .699,    0.0   *   12   445
   2374.700,    578.486,    3.667,    .783,    0.0   *   13   446
   2414.700,    623.800,    2.978,    .519,    0.0   *   14   447
   2409.700,    602.284,    2.982,    .595,    0.0   *   15   448
   2394.700,    582.072,    2.985,    .662,    0.0   *   16   449
   2374.700,    583.050,    2.502,    .572,    0.0   *   17   450
   2414.700,    565.150,    2.515,    .638,    0.0   *    1   451
   2114.700,    587.940,    2.489,    .527,    0.0   *    2   452
   2114.700,    570.675,    2.532,    .591,    0.0   *    3   453
   2114.700,    550.850,    2.491,    .651,    0.0   *    4   454
   1514.700,    519.325,    2.535,    .616,    0.0   *    5   455
   1514.700,    492.053,    2.546,    .705,    0.0   *    6   456
```

```
       1514.700,   478.424,    2.525,    .746,   0.0   *    7   457
       2124.700,   536.550,    2.034,    .582,   0.0   *    8   458
       2124.700,   522.250,    1.996,    .622,   0.0   *    9   459
       2094.700,   500.165,    2.056,    .681,   0.0   *   10   460
       1814.700,   500.490,    1.998,    .626,   0.0   *   11   461
       1814.700,   479.721,    2.031,    .689,   0.0   *   12   462
    ** OPER.12:
       0,  0,  0,  0,  0,  0
    ** MIXX.1:
       MIXX,  0,  0,  0
    ** MIXX.2:
       0.8,  0.038
    ** DRAG.1:
       DRAG,  1,  0,  1
    ** DRAG.2:
       0.186, -1.20, 0.0, 64.0, -1.0, 0.0
    ** DRAG.5:
       0.5,    .555
    ** GRID.1:
       GRID,  0,    2
    ** GRID.2:
       .200,     .570
    ** GRID.4:
       -1,    7
    ** GRID.6:
       6.75, 1, 19.75, 2, 32.75, 1, 45.75, 2, 58.75, 1, 71.75, 2, 84.75, 1, .00, 0
       0
    ** CORR.1:
       CORR, 1, 1, 0
    ** CORR.2:
       EPRI, EPRI, EPRI, NONE
    ** CORR.3:
       0.2
    ** CORR.6:
       EPRI, THOM, THOM, CE-1, COND, G5.7
    ** CORR.7:
       0.0
    ** CORR.9:
       CE-1
    ** CORR.12:
       0.50747, 1
    ** CONT.1:
       CONT
    ** CONT.2:
       0.0, 0, 20, 20, 2, 2, 0, 0
    ** CONT.3:
       0.1, 0.0001, 0.001, 0, 0, 0, 0, 0.9
    ** CONT.6:
       1, 1, 0, 0, 1, 0, 1, 1, 0, 0, 1, 1, 0, 0
    ** CONT.7:
       4000.0, 0, 0, 0, 0, 0
    ** CONT.8:
       13
    ** CONT.11:
       13
    ** CONT.15:
       0,  0,  0,  0,  0
    ** END OF INPUT DATA:
       ENDD
       0
```

```
** CDC FILE NAME: HH124
**
** VIPRE.1:
   1,  0,  0,
** VIPRE.2:
   HH124
** GEOM.1:
   GEOM,  25,  25,  48,  0,  0,  0
** GEOM.2:
   96.00,    0.0,    0.5
** GEOM.4:
    1,  .0975, 1.0594,   .3314,   2,   2,  .1530,  .4595,   6,  .1530,  .4595
    2,  .1321, 1.2179,   .6629,   2,   3,  .1530,  .5550,   7,  .1330,  .4595
    3,  .1321, 1.2179,   .6629,   2,   4,  .1530,  .5550,   8,  .1330,  .4595
    4,  .1321, 1.2179,   .6629,   2,   5,  .1530,  .4595,   9,  .1330,  .4595
    5,  .0975, 1.0594,   .3314,   1,  10,  .1530,  .4595,   0,  .0000,  .0000
    6,  .1321, 1.2179,   .6629,   2,   7,  .1330,  .4595,  11,  .1530,  .5550
    7,  .1682, 1.3258,  1.3258,   2,   8,  .1330,  .5550,  12,  .1330,  .5550
    8,  .1682, 1.3258,  1.3258,   2,   9,  .1330,  .5550,  13,  .1330,  .5550
    9,  .1682, 1.3258,  1.3258,   2,  10,  .1330,  .4595,  14,  .1330,  .5550
   10,  .1321, 1.2179,   .6629,   1,  15,  .1530,  .5550,   0,  .0000,  .0000
   11,  .1321, 1.2179,   .6629,   2,  12,  .1330,  .4595,  16,  .1330,  .5550
   12,  .1682, 1.3258,  1.3258,   2,  13,  .1330,  .5550,  17,  .1330,  .5550
   13,  .1682, 1.3258,  1.3258,   2,  14,  .1330,  .5550,  18,  .1330,  .5550
   14,  .1682, 1.3258,  1.3258,   2,  15,  .1330,  .4595,  19,  .1330,  .5550
   15,  .1321, 1.2179,   .6629,   1,  [illegible],  .1530,  .5550,   0,  .0000,  .0000
   16,  .1321, 1.2179,   .6629,   2,  [illegible],  .1330,  .4595,  21,  .1530,  .4595
   17,  .1682, 1.3258,  1.3258,   2,  [illegible],  .1330,  .5550,  22,  .1330,  .4595
   18,  .1682, 1.3258,  1.3258,   2,  [illegible],  .1330,  .5550,  23,  .1330,  .4595
   19,  .1682, 1.3258,  1.3258,   2,  [illegible],  .1330,  .4595,  24,  .1330,  .4595
   20,  .1321, 1.2179,   .6629,   1,  25,  .1530,  .4595,   0,  .0000,  .0000
   21,  .0975, 1.0594,   .3314,   1,  22,  .1530,  .4595,   0,  .0000,  .0000
   22,  .1321, 1.2179,   .6629,   1,  23,  .1530,  .5550,   0,  .0000,  .0000
   23,  .1321, 1.2179,   .6629,   1,  24,  .1530,  .5550,   0,  .0000,  .0000
   24,  .1321, 1.2179,   .6629,   1,  25,  .1530,  .4595,   0,  .0000,  .0000
   25,  .0975, 1.0594,   .3314,   0,   0,  .0000,  .0000,   0,  .0000,  .0000
** RODS.1:
   RODS,    1,  16,   0,    1,    0,    0,    0,    0,    0,    0,    0
** RODS.2:
   96.00,    0.0,    0,    0
** RODS.3:
   24
** RODS.4:
     .000,     .310,   4.992,    .450,   9.984,    .610,  14.976,     .780
   19.968,     .920,  24.960,   1.080,  30.048,   1.200,  35.040,    1.320
   40.032,    1.400,  45.024,   1.460,  48.960,   1.480,  50.016,    1.480
   55.008,    1.450,  57.984,   1.410,  60.000,   1.380,  64.032,    1.300
   69.984,    1.160,  74.016,   1.060,  78.048,    .950,  79.968,     .875
   81.024,     .840,  84.000,    .740,  90.048,    .530,  96.000,     .310
** RODS.9:
    1,   1,  .9811,   1,   1,   .250,   2,   .250,   6,   .250,   7,   .250
    2,   1,  .9801,   1,   2,   .250,   3,   .250,   7,   .250,   8,   .250
    3,   1,  .9885,   1,   3,   .250,   4,   .250,   8,   .250,   9,   .250
    4,   1,  .9832,   1,   4,   .250,   5,   .250,   9,   .250,  10,   .250
    5,   1,  .9780,   1,   9,   .250,  10,   .250,  14,   .250,  15,   .250
    6,   1,  .9822,   1,  14,   .250,  15,   .250,  19,   .250,  20,   .250
    7,   1,  .9822,   1,  19,   .250,  20,   .250,  24,   .250,  25,   .250
    8,   1,  .9832,   1,  18,   .250,  19,   .250,  23,   .250,  24,   .250
    9,   1,  .9822,   1,  17,   .250,  18,   .250,  22,   .250,  23,   .250
   10,   1,  .9832,   1,  16,   .250,  17,   .250,  21,   .250,  22,   .250
   11,   1,  .9832,   1,  11,   .250,  12,   .250,  16,   .250,  17,   .250
   12,   1,  .9832,   1,   6,   .250,   7,   .250,  11,   .250,  12,   .250
   13,   1, 1.0871,   1,   7,   .250,   8,   .250,  12,   .250,  13,   .250
   14,   1, 1.0302,   1,   8,   .250,   9,   .250,  13,   .250,  14,   .250
   15,   1, 1.0634,   1,  13,   .250,  14,   .250,  18,   .250,  19,   .250
   16,   1, 1.0291,   1,  12,   .250,  13,   .250,  17,   .250,  18,   .250
   0
** RODS.68:
   1, DUMY, .4220, 0.0, 0
** OPER.1:
   OPER, 1, 2, 0, 2, 0, 34, 0, 0, 0
** OPER.2:
   -1.0, 0.0, 0.0, 0.0
** OPER.3:
   0
** OPER.5:
   1564.700, 565.150,   3.493,    .597,   0.0   *    1   475
   1514.700, 537.850,   3.516,    .688,   0.0   *    2   476
   1789.700, 572.625,   3.712,    .621,   0.0   *    3   477
   1789.700, 559.950,   3.764,    .731,   0.0   *    4   478
   2114.700, 580.768,   3.723,    .770,   0.0   *    6   480
   2114.700, 599.350,   3.149,    .607,   0.0   *    7   481
   2114.700, 580.116,   3.180,    .699,   0.0   *    8   482
   2114.700, 565.150,   3.148,    .757,   0.0   *    9   483
   2414.700, 623.148,   3.643,    .641,   0.0   *   10   484
   2414.700, 601.306,   3.654,    .755,   0.0   *   11   485
   2414.700, 619.888,   3.015,    .578,   0.0   *   12   486
   2414.700, 598.372,   2.983,    .646,   0.0   *   13   487
   2414.700, 584.680,   2.910,    .688,   0.0   *   14   488
   2414.700, 577.508,   2.501,    .640,   0.0   *   15   489
   2414.700, 562.225,   2.483,    .684,   0.0   *   16   490
   2414.700, 547.600,   2.472,    .719,   0.0   *   17   491
   2114.700, 585.658,   2.438,    .571,   0.0   *   18   492
   2164.700, 574.575,   2.454,    .602,   0.0   *   19   493
   2114.700, 543.050,   2.508,    .712,   0.0   *   20   494
   2114.700, 525.500,   2.479,    .745,   0.0   *   21   495
   1514.700, 516.725,   2.491,    .663,   0.0   *   22   496
   1514.700, 502.437,   2.511,    .719,   0.0   *   23   497
   1514.700, 481.344,   2.505,    .763,   0.0   *   24   498
```

```
2414.700, 561.900,   1.997,    .586,    0.0   *   25   499
2414.700, 539.150,   1.991,    .646,    0.0   *   26   500
2414.700, 516.075,   2.022,    .697,    0.0   *   27   501
2114.700, 544.350,   2.004,    .594,    0.0   *   28   502
2114.700, 526.800,   1.996,    .646,    0.0   *   29   503
2114.700, 494.000,   1.980,    .719,    0.0   *   30   504
1814.700, 496.271,   2.025,    .660,    0.0   *   31   505
1814.700, 480.159,   1.947,    .676,    0.0   *   32   506
1514.700, 475.179,   1.536,    .574,    0.0   *   33   507
1514.700, 455.708,   1.488,    .588,    0.0   *   34   508
1514.700, 440.795,   1.491,    .616,    0.0   *   35   509
** OPER.12:
   0,  0,  0,  0,  0,  0
** MIXX.1:
   MIXX,  0,  0,  0
** MIXX.2:
   0.8,  0.038
** DRAG.1:
   DRAG,  1,  0,  1
** DRAG.2:
   0.186, -0.20, 0.0, 64.0, -1.0, 0.0
** DRAG.5:
   0.5,    .555
** GRID.1:
   GRID,  0,    2
** GRID.2:
   1.200,     .570
** GRID.4:
   -1,    9
** GRID.6:
    4.75, 1,14.75, 2,24.75, 1,34.75, 2,44.75, 1,54.75, 2,64.75, 1,74.75, 2,
   84.75, 1,  .00, 0,  .00, 0,  .00, 0,  .00, 0,  .00, 0,  .00, 0,  .00, 0
   0
** CORR.1:
   CORR, 1, 1, 0
** CORR.2:
   EPRI, EPRI, EPRI, NONE
** CORR.3:
   0.2
** CORR.6:
   EPRI, THOM, THOM, CE-1, COND, G5.7
** CORR.7:
   0.0
** CORR.9:
   CE-1
** CORR.12:
   0.50747, 1
** CONT.1:
   CONT
** CONT.2:
   0.0, 0, 20, 20, 2, 2, 0, 0
** CONT.3:
   0.1, 0.0001, 0.001, 0, 0, 0, 0, 0.9
** CONT.6:
   1, 1, 0, 0, 1, 0, 1, 1, 0, 0, 1, 1, 0, 0
** CONT.7:
   4000.0, 0, 0, 0, 0, 0
** CONT.8:
   13
** CONT.11:
   13
** CONT.15:
   0, 0, 0, 0, 0
** END OF INPUT DATA:
   ENDD
   0
```

```
** CDC FILE NAME HH125
**
** VIPRE.1:
   1,  0,  0,
** VIPRE.2:
   HH125
** GEOM.1:
   GEOM,  25,  25,  48,  0,  0,  0
** GEOM.2:
   96.00,    0.0,    0.5
** GEOM.4:
    1,  .0975, 1.0594,  .3314,  2,  2,  .1530,  .4595,  6,  .1530,  .4595
    2,  .1321, 1.2179,  .6629,  2,  3,  .1530,  .5550,  7,  .1330,  .4595
    3,  .1321, 1.2179,  .6629,  2,  4,  .1530,  .5550,  8,  .1330,  .4595
    4,  .1321, 1.2179,  .6629,  2,  5,  .1530,  .4595,  9,  .1330,  .4595
    5,  .0975, 1.0594,  .3314,  1, 10,  .1530,  .4595,  0,  .0000,  .0000
    6,  .1321, 1.2179,  .6629,  2,  7,  .1330,  .4595, 11,  .1530,  .5550
    7,  .1682, 1.3258, 1.3258,  2,  8,  .1330,  .5550, 12,  .1330,  .5550
    8,  .1682, 1.3258, 1.3258,  2,  9,  .1330,  .5550, 13,  .1330,  .5550
    9,  .1682, 1.3258, 1.3258,  2, 10,  .1330,  .4595, 14,  .1330,  .5550
   10,  .1321, 1.2179,  .6629,  1, 15,  .1530,  .5550,  0,  .0000,  .0000
   11,  .1321, 1.2179,  .6629,  2, 12,  .1330,  .4595, 16,  .1530,  .5550
   12,  .1682, 1.3258, 1.3258,  2, 13,  .1330,  .5550, 17,  .1330,  .5550
   13,  .1682, 1.3258, 1.3258,  2, 14,  .1330,  .5550, 18,  .1330,  .5550
   14,  .1682, 1.3258, 1.3258,  2, 15,  .1330,  .4595, 19,  .1330,  .5550
   15,  .1321, 1.2179,  .6629,  1, 20,  .1530,  .5550,  0,  .0000,  .0000
   16,  .1321, 1.2179,  .6629,  2, 17,  .1330,  .4595, 21,  .1530,  .4595
   17,  .1682, 1.3258, 1.3258,  2, 18,  .1330,  .5550, 22,  .1330,  .4595
   18,  .1682, 1.3258, 1.3258,  2, 19,  .1330,  .5550, 23,  .1330,  .4595
   19,  .1682, 1.3258, 1.3258,  2, 20,  .1330,  .4595, 24,  .1330,  .4595
   20,  .1321, 1.2179,  .6629,  1, 25,  .1530,  .4595,  0,  .0000,  .0000
   21,  .0975, 1.0594,  .3314,  1, 22,  .1530,  .4595,  0,  .0000,  .0000
   22,  .1321, 1.2179,  .6629,  1, 23,  .1530,  .5550,  0,  .0000,  .0000
   23,  .1321, 1.2179,  .6629,  1, 24,  .1530,  .5550,  0,  .0000,  .0000
   24,  .1321, 1.2179,  .6629,  1, 25,  .1530,  .4595,  0,  .0000,  .0000
   25,  .0975, 1.0594,  .3314,  0,  0,  .0000,  .0000,  0,  .0000,  .0000
** RODS.1:
   RODS,   1,  16,  0,  1,  0,  0,  0,  0,  0,  0,  0
** RODS.2:
   96.00,   0.0,   0,   0
** RODS.3:
   28
** RODS.4:
     .000,    .358,   4.992,    .359,   9.984,    .400,  14.976,    .458
   19.968,    .567,  24.960,    .683,  30.048,    .833,  35.040,    .992
   40.032,   1.133,  45.024,   1.258,  47.520,   1.305,  50.016,   1.350
   52.512,   1.410,  55.008,   1.467,  57.504,   1.522,  60.000,   1.592
   62.496,   1.640,  64.992,   1.658,  67.488,   1.640,  69.984,   1.583
   72.480,   1.510,  74.976,   1.433,  79.968,   1.233,  84.960,    .993
   87.456,    .815,  90.048,    .633,  92.448,    .520,  96.000,    .367
** RODS.9:
    1,  1,  .9502,  1,  1,  .250,  2,  .250,  6,  .250,  7,  .250
    2,  1,  .9502,  1,  2,  .250,  3,  .250,  7,  .250,  8,  .250
    3,  1,  .9429,  1,  3,  .250,  4,  .250,  8,  .250,  9,  .250
    4,  1,  .9481,  1,  4,  .250,  5,  .250,  9,  .250, 10,  .250
    5,  1,  .9492,  1,  9,  .250, 10,  .250, 14,  .250, 15,  .250
    6,  1,  .9460,  1, 14,  .250, 15,  .250, 19,  .250, 20,  .250
    7,  1,  .9429,  1, 19,  .250, 20,  .250, 24,  .250, 25,  .250
    8,  1,  .9492,  1, 18,  .250, 19,  .250, 23,  .250, 24,  .250
    9,  1,  .9492,  1, 17,  .250, 18,  .250, 22,  .250, 23,  .250
   10,  1,  .9481,  1, 16,  .250, 17,  .250, 21,  .250, 22,  .250
   11,  1,  .9492,  1, 11,  .250, 12,  .250, 16,  .250, 17,  .250
   12,  1,  .9429,  1,  6,  .250,  7,  .250, 11,  .250, 12,  .250
   13,  1, 1.1623,  1,  7,  .250,  8,  .250, 12,  .250, 13,  .250
   14,  1, 1.1591,  1,  8,  .250,  9,  .250, 13,  .250, 14,  .250
   15,  1, 1.1560,  1, 13,  .250, 14,  .250, 18,  .250, 19,  .250
   16,  1, 1.1544,  1, 12,  .250, 13,  .250, 17,  .250, 18,  .250
   0
** RODS.68:
   1, DUMY, .4220, 0.0, 0
** OPER.1:
   OPER, 1, 2, 0, 2, 0, 33, 0, 0, 0
** OPER.2:
   -1.0, 0.0, 0.0, 0.0
** OPER.3:
   0
** OPER.5:
   1514.700,   554.750,   3.537,   .510,   0.0   *   1   510
   1514.700,   541.750,   3.511,   .587,   0.0   *   2   511
   1814.700,   579.790,   3.470,   .542,   0.0   *   3   512
   1814.700,   558.000,   3.568,   .614,   0.0   *   4   513
   2114.700,   600.002,   3.541,   .533,   0.0   *   5   514
   2114.700,   584.354,   3.499,   .622,   0.0   *   6   515
   2114.700,   571.650,   3.482,   .658,   0.0   *   7   516
   2144.700,   605.870,   2.954,   .463,   0.0   *   8   517
   2114.700,   576.530,   3.043,   .573,   0.0   *   9   518
   2114.700,   560.925,   3.019,   .612,   0.0   *  10   519
   2414.700,   619.888,   3.537,   .530,   0.0   *  11   520
   2414.700,   599.676,   3.536,   .610,   0.0   *  12   521
   2414.700,   583.050,   3.520,   .665,   0.0   *  13   522
   2414.700,   620.540,   3.053,   .466,   0.0   *  14   523
   2414.700,   594 134,   3.052,   .568,   0.0   *  15   524
   2414.700,   582.072,   3.004,   .606,   0.0   *  16   525
   2389.700,   579.790,   2.517,   .515,   0.0   *  17   526
   2374.700,   560.600,   2.522,   .547,   0.0   *  18   527
   2394.700,   539.150,   2.521,   .600,   0.0   *  19   528
   2134.700,   581.094,   2.515,   .500,   0.0   *  20   529
   2099.700,   561.900,   2.514,   .542,   0.0   *  21   530
   2099.700,   544.350,   2.506,   .577,   0.0   *  22   531
```

```
   2534.700,   518.675,   2.520,    .555,    0.0   *   23    532
   2524.700,   498.543,   2.507,    .595,    0.0   *   24    533
   2524.700,   483.940,   2.482,    .634,    0.0   *   25    534
   2399.700,   566.450,   1.994,    .475,    0.0   *   26    535
   2394.700,   544.675,   2.037,    .537,    0.0   *   27    536
   2414.700,   523.225,   2.040,    .584,    0.0   *   28    537
   2114.700,   544.025,   1.997,    .508,    0.0   *   29    538
   2099.700,   519.325,   2.025,    .560,    0.0   *   30    539
   2094.700,   505.033,   1.994,    .581,    0.0   *   31    540
   1824.700,   503.086,   1.987,    .560,    0.0   *   32    541
   1814.700,   484.264,   2.016,    .608,    0.0   *   33    542
** OPER.12:
   0,  0,  0,  0,  0,  0
** MIXX.1:
   MIXX,  0,  0,  0
** MIXX.2:
   0.8,  0.038
** DRAG.1:
   DRAG,  1,  0,  1
** DRAG.2:
   0.186, -0.20, 0.0, 64.0, -1.0, 0.0
** DRAG.5:
   0.5,    .555
** GRID.1:
   GRID,  0,    2
** GRID.2:
   0.680,   0.570
** GRID.4:
   -1,    9
** GRID.6:
   10.75, 1,20.75, 2,30.75, 1,40.75, 2,50.75, 1,60.75, 2,70.75, 1,80.75, 2,
   90.75, 1,  .00, 0,  .00, 0,  .00, 0,  .00, 0,  .00, 0,  .00, 0,  .00, 0
   0
** CORR.1:
   CORR, 1, 1, 0
** CORR.2:
   EPRI, EPRI, EPRI, NONE
** CORR.3:
   0.2
** CORR.6:
   EPRI, THOM, THOM, CE-1, COND, G5.7
** CORR.7:
   0.0
** CORR.9
   CE-1
** CORR.12:
   0.50747, 1
** CONT.1:
   CONT
** CONT.2:
   0.0, 0, 20, 20, 2, 2, 0, 0
** CONT.3:
   0.1, 0.0001, 0.001, 0, 0, 0, 0, 0.9
** CONT.6:
   1, 1, 0, 0, 1, 0, 1, 1, 0, 0, 1, 1, 0, 0
** CONT.7:
   4000.0, 0, 0, 0, 0, 0
** CONT.8:
   13
** CONT.11:
   13
** CONT.15:
   0, 0, 0, 0, 0
** END OF INPUT DATA:
   ENDD
   0
```

```
** CDC FILE NAME: HH127
**
** VIPRE.1:
   1,  0,  0,
** VIPRE.2:
   HH127
** GEOM.1:
   GEOM,  25,  25,  48,  0,  0,  0
** GEOM.2:
   96.00,    0.0,    0.5
** GEOM.4:
    1,  .0975, 1.0594,  .3314,   2,   2,  .1530,  .4595,   6,  .1530,  .4595
    2,  .1321, 1.2179,  .6629,   2,   3,  .1530,  .5550,   7,  .1330,  .4595
    3,  .1321, 1.2179,  .6629,   2,   4,  .1530,  .5560,   8,  .1330,  .4595
    4,  .1321, 1.2179,  .6629,   2,   5,  .1530,  .4595,   9,  .1330,  .4595
    5,  .0975, 1.0594,  .3314,   1,  10,  .1530,  .4595,   0,  .0000,  .0000
    6,  .1321, 1.2179,  .6629,   2,   7,  .1330,  .4595,  11,  .1530,  .5550
    7,  .1682, 1.3258, 1.3258,   2,   8,  .1330,  .5550,  12,  .1330,  .5550
    8,  .1682, 1.3258, 1.3258,   2,   9,  .1330,  .5550,  13,  .1330,  .5550
    9,  .1682, 1.3258, 1.3258,   2,  10,  .1330,  .4595,  14,  .1330,  .5550
   10,  .1321, 1.2179,  .6629,   1,  15,  .1530,  .5550,   0,  .0000,  .0000
   11,  .1321, 1.2179,  .6629,   2,  12,  .1330,  .4595,  16,  .1530,  .5550
   12,  .1682, 1.3258, 1.3258,   2,  13,  .1330,  .5550,  17,  .1330,  .5550
   13,  .1682, 1.3258, 1.3258,   2,  14,  .1330,  .5550,  18,  .1330,  .5550
   14,  .1682, 1.3258, 1.3258,   2,  15,  .1330,  .4595,  19,  .1330,  .5550
   15,  .1321, 1.2179,  .6629,   1,  20,  .1530,  .5550,   0,  .0000,  .0000
   16,  .1321, 1.2179,  .6629,   2,  17,  .1330,  .4595,  21,  .1530,  .4595
   17,  .1682, 1.3258, 1.3258,   2,  18,  .1330,  .5550,  22,  .1330,  .4595
   18,  .1682, 1.3258, 1.3258,   2,  19,  .1330,  .5550,  23,  .1310,  .4595
   19,  .1682, 1.3258, 1.3258,   2,  20,  .1330,  .4595,  24,  .1330,  .4595
   20,  .1321, 1.2179,  .6629,   1,  25,  .1530,  .4595,   0,  .0000,  .0000
   21,  .0975, 1.0594,  .3314,   1,  22,  .1530,  .4595,   0,  .0000,  .0000
   22,  .1321, 1.2179,  .6629,   1,  23,  .1530,  .5550,   0,  .0000,  .0000
   23,  .1321, 1.2179,  .6629,   1,  24,  .1530,  .5550,   0,  .0000,  .0000
   24,  .1321, 1.2179,  .6629,   1,  25,  .1530,  .4595,   0,  .0000,  .0000
   25,  .0975, 1.0594,  .3314,   0,   0,  .0000,  .0000,   0,  .0000,  .0000
** RODS.1:
   RODS,    1,  16,   0,   1,   0,    0,    0,    0,    0,    0,    0
** RODS.2:
   96.00,     0.0,    0,    0
** RODS.3:
   28
** RODS.4:
     .000,     .358,   4.992,     .359,   9.984,     .400,  14.976,     .458
   19.968,     .567,  24.960,     .683,  30.048,     .833,  35.040,     .99[illegible]
   40.032,    1.133,  45.024,    1.258,  47.520,    1.305,  50.016,    1.350
   52.512,    1.410,  55.008,    1.467,  57.504,    1.522,  60.000,    1.592
   62.496,    1.640,  64.992,    1.658,  67.488,    1.640,  69.984,    1.583
   72.480,    1.510,  74.976,    1.433,  79.968,    1.233,  84.960,     .993
   87.456,     .815,  90.048,     .633,  92.448,     .520,  96.000,     .367
** RODS.9:
    1,   1,  .9487,   1,   1,   .250,   2,    .250,   6,    .250,   7,   .250
    2,   1,  .9487,   1,   2,   .250,   3,    .250,   7,    .250,   8,   .250
    3,   1,  .9414,   1,   3,   .250,   4,    .250,   8,    .250,   9,   .250
    4,   1,  .9466,   1,   4,   .250,   5,    .250,   9,    .250,  10,   .250
    5,   1,  .9477,   1,   9,   .250,  10,    .250,  14,    .250,  15,   .250
    6,   1,  .9445,   1,  14,   .250,  15,    .250,  19,    .250,  20,   .250
    7,   1,  .9414,   1,  19,   .250,  20,    .250,  24,    .250,  25,   .250
    8,   1,  .9477,   1,  18,   .250,  19,    .250,  23,    .250,  24,   .250
    9,   1,  .9477,   1,  17,   .250,  18,    .250,  22,    .250,  23,   .250
   10,   1,  .9466,   1,  16,   .250,  17,    .250,  21,    .250,  22,   .250
   11,   1,  .9477,   1,  11,   .250,  12,    .250,  16,    .250,  17,   .250
   12,   1,  .9414,   1,   6,   .250,   7,    .250,  11,    .250,  12,   .250
   13,   1, 1.1604,   1,   7,   .250,   8,    .250,  12,    .250,  13,   .250
   14,   1, 1.1573,   1,   8,   .250,   9,    .250,  13,    .250,  14,   .250
   15,   1, 1.1797,   1,  13,   .250,  14,    .250,  18,    .250,  19,   .250
   16,   1, 1.1526,   1,  12,   .250,  13,    .250,  17,    .250,  18,   .250
   0
** RODS.68:
   1, DUMY, .4220, 0.0, 0
** OPER.1:
   OPER, 1, 2, 0, 2, 0, 37, 0, 0, 0
** OPER.2:
   -1.0, 0.0, 0.0, 0.0
** OPER.3:
   0
** OPER.5:
   1514.700,   558.000,   3.548,   .508,   0.0   *    1    550
   1514.700,   532.325,   3.543,   .590,   0.0   *    2    551
   1814.700,   572.625,   3.549,   .528,   0.0   *    3    552
   1814.700,   558.000,   3.530,   .589,   0.0   *    4    553
   2114.700,   600.654,   3.526,   .512,   0.0   *    5    554
   2114.700,   587.614,   3.489,   .569,   0.0   *    6    555
   2114.700,   562.550,   3.533,   .640,   0.0   *    7    556
   2114.700,   594.786,   3.046,   .484,   0.0   *    8    557
   2114.700,   581.420,   3.021,   .524,   0.0   *    9    558
   2114.700,   563.850,   3.017,   .576,   0.0   *   10    559
   2414.700,   624.452,   3.518,   .499,   0.0   *   11    560
   2414.700,   604.892,   3.521,   .551,   0.0   *   12    561
   2414.700,   585.658,   3.306,   .605,   0.0   *   13    562
   2414.700,   616.302,   3.050,   .451,   0.0   *   14    563
   2414.700,   605.218,   3.006,   .497,   0.0   *   15    564
   2414.700,   582.398,   3.034,   .544,   0.0   *   16    565
   2364.700,   583.050,   2.502,   .479,   0.0   *   17    566
   2364 700,   564.500,   2.484,   .523,   0.0   *   18    567
   2414.700,   546.300,   2.493,   .569,   0.0   *   19    568
   2114.700,   584.354,   2.503,   .445,   0.0   *   20    569
   2044.700,   563.200,   2.511,   .491,   0.0   *   21    570
   2114.700,   547.600,   2.493,   .543,   0.0   *   22    571
```

```
    1534.700,   520.300,   2.486,    .540,    0.0   *   23     572
    1514.700,   510.550,   2.459,    .575,    0.0   *   24     573
    1514.700,   487.510,   2.506,    .620,    0.0   *   25     574
    1814.700,   503.410,   1.978,    .541,    0.0   *   26     575
    1814.700,   485.238,   1.976,    .577,    0.0   *   27     576
    2114.700,   543.700,   2.015,    .487,    0.0   *   28     577
    2114.700,   521.275,   1.983,    .520,    0.0   *   29     578
    1814.700,   503.086,   1.979,    .544,    0.0   *   30     579
    2114.700,   499.841,   2.006,    .555,    0.0   *   31     580
    2414.700,   564.175,   2.001,    .462,    0.0   *   32     581
    2414.700,   545.650,   1.987,    .493,    0.0   *   33     582
    2414.700,   521.600,   1.998,    .541,    0.0   *   34     583
    1514.700,   475.828,   1.747,    .493,    0.0   *   35     584
    1514.700,   464.470,   1.467,    .524,    0.0   *   36     585
    1514.700,   444.029,   1.480,    .564,    0.0   *   37     586
** OPER.12:
    0,  0,  0,  0,  0,  0
** MIXX.1:
    MIXX,  0,  0,  0
** MIXX.2:
    0.8,  0.038
** DRAG.1:
    DRAG,  1,  0,  1
** DRAG.2:
    0.186, -0.20, 0.0, 64.0, -1.0, 0.0
** DRAG.5:
    0.5,     .555
** GRID.1:
    GRID,  0,   2
** GRID.2:
    0.680,    0.570
** GRID.4:
    -1,     8
** GRID.6:
    0.75, 1,11.75, 2,22.75, 1,33.75, 2,44.75, 1,57.75, 2,70.75, 1,84.75, 2
    0
** CORR.1:
    CORR, 1, 1, 0
** CORR.2:
    EPRI, EPRI, EPRI, NONE
** CORR.3:
    0.2
** CORR.6:
    EPRI, THOM, THOM, CE-1, COND, G5.7
** CORR.7:
    0.0
** CORR.9:
    CE-1
** CORR.12:
    0.50747, 1
** CONT.1:
    CONT
** CONT.2:
    0.0, 0, 20, 20, 2, 2, 0, 0
** CONT.3:
    0.1, 0.0001, 0.001, 0, 0, 0, 0, 0.9
** CONT.6:
    1, 1, 0, 0, 1, 0, 1, 1, 0, 0, 1, 1, 0, 0
** CONT.7:
    4000.0, 0, 0, 0, 0, 0
** CONT.8:
    13
** CONT.11:
    13
** CONT.15:
    0, 0, 0, 0, 0
** END OF INPUT DATA:
    ENDD
    0
```

```
** CDC FILE NAME: WH131
**
** VIPRE.1:
   1,  0,  0
** VIPRE.2:
   WH131
** GEOM.1:
   GEOM,  25,  25,  56,  0,  0,  0
** GEOM.2:
   168.00,    0.0,    0.5
** GEOM.4:
    1,  .0630,   .9574,   .3314,  2,   2,  .1020,  .4340,   6,  .1020,  .4340
    2,  .1038, 1.2179,   .6629,  2,   3,  .1020,  .5550,   7,  .1330,  .4340
    3,  .1038, 1.2179,   .6629,  2,   4,  .1020,  .5550,   8,  .1330,  .4340
    4,  .1038, 1.2179,   .6629,  2,   5,  .1020,  .4340,   9,  .1330,  .4340
    5,  .0630,   .9574,   .3314,  1,  10,  .1020,  .4340,   0,  .0000,  .0000
    6,  .1038, 1.2179,   .6629,  2,   7,  .1330,  .4340,  11,  .1020,  .5550
    7,  .1682, 1.3258, 1.3258,  2,   8,  .1330,  .5550,  12,  .1330,  .5550
    8,  .1682, 1.3258, 1.3258,  2,   9,  .1330,  .5550,  13,  .1330,  .5550
    9,  .1682, 1.3258, 1.3258,  2,  10,  .1330,  .4340,  14,  .1330,  .5550
   10,  .1038, 1.2179,   .6629,  1,  15,  .1020,  .5550,   0,  .0000,  .0000
   11,  .1038, 1.2179,   .6629,  2,  12,  .1330,  .4340,  16,  .1020,  .5550
   12,  .1682, 1.3258, 1.3258,  2,  13,  .1330,  .5550,  17,  .1330,  .5550
   13,  .1682, 1.3258, 1.3258,  2,  14,  .1330,  .5550,  18,  .1330,  .5550
   14,  .1682, 1.3258, 1.3258,  2,  15,  .1330,  .4340,  19,  .1330,  .5550
   15,  .1038, 1.2179,   .6629,  1,  20,  .1020,  .5550,   0,  .0000,  .0000
   16,  .1038, 1.2179,   .6629,  2,  17,  .1330,  .4340,  21,  .1020,  .4340
   17,  .1682, 1.3258, 1.3258,  2,  18,  .1330,  .5550,  22,  .1330,  .4340
   18,  .1682, 1.3258, 1.3258,  2,  19,  .1330,  .5550,  23,  .1330,  .4340
   19,  .1682, 1.3258, 1.3258,  2,  20,  .1330,  .4340,  24,  .1330,  .4340
   20,  .1038, 1.2179,   .6629,  1,  25,  .1020,  .4340,   0,  .0000,  .0000
   21,  .0630,   .9574,   .3314,  1,  22,  .1020,  .4340,   0,  .0000,  .0000
   22,  .1038, 1.2179,   .6629,  1,  23,  .1020,  .5550,   0,  .0000,  .0000
   23,  .1038, 1.2179,   .6629,  1,  24,  .1020,  .5550,   0,  .0000,  .0000
   24,  .1038, 1.2179,   .6629,  1,  25,  .1020,  .4340,   0,  .0000,  .0000
   25,  .0630,   .9574,   .3314,  0,   0,  .0000,  .0000,   0,  .0000,  .0000
** RODS.1:
   RODS,    1,  16,  0,   1,   0,   0,   0,   0,   0,   0,   0
** RODS.2:
   168.00,    0.0,    0,    0
** RODS.3:
   22
** RODS.4:
      .000,    .540,   12.328,    .577,   23.419,    .638,   35.759,    .724
    43.149,    .798,   53.012,    .896,   61.034,    .994,   69.040,   1.092
    73.970,   1.153,   80.136,   1.221,   88.771,   1.300,   96.163,   1.350
   101.091,   1.374,  107.260,   1.393,  110.961,   1.386,  117.120,   1.374
   123.278,   1.337,  128.218,   1.288,  134.366,   1.215,  140.539,   1.129
   147.949,   1.006,  168.000,    .589,     .000,    .000,     .000,    .000
** RODS.9:
    1,  1,   .9592,  1,   1,   .250,   2,   .250,   6,   .250,   7,   .250
    2,  1,   .9592,  1,   2,   .250,   3,   .250,   7,   .250,   8,   .250
    3,  1,   .9583,  1,   3,   .250,   4,   .250,   8,   .250,   9,   .250
    4,  1,   .9616,  1,   4,   .250,   5,   .250,   9,   .250,  10,   .250
    5,  1,   .9600,  1,   9,   .250,  10,   .250,  14,   .250,  15,   .250
    6,  1,   .9608,  1,  14,   .250,  15,   .250,  19,   .250,  20,   .250
    7,  1,   .9583,  1,  19,   .250,  20,   .250,  24,   .250,  25,   .250
    8,  1,   .9592,  1,  18,   .250,  19,   .250,  23,   .250,  24,   .250
    9,  1,   .9600,  1,  17,   .250,  18,   .250,  22,   .250,  23,   .250
   10,  1,   .9600,  1,  16,   .250,  17,   .250,  21,   .250,  22,   .250
   11,  1,   .9600,  1,  11,   .250,  12,   .250,  16,   .250,  17,   .250
   12,  1,   .9600,  1,   6,   .250,   7,   .250,  11,   .250,  12,   .250
   13,  1,  1.1206,  1,   7,   .250,   8,   .250,  12,   .250,  13,   .250
   14,  1,  1.1217,  1,   8,   .250,   9,   .250,  13,   .250,  14,   .250
   15,  1,  1.1206,  1,  13,   .250,  14,   .250,  18,   .250,  19,   .250
   16,  1,  1.1206,  1,  12,   .250,  13,   .250,  17,   .250,  18,   .250
   0
** RODS.68:
   1, DUMY,    .4220,  0.0,  0
** OPER.1:
   OPER, 1, 2, 0, 2, 0, 37, 0, 0, 0
** OPER.2:
   -1.0, 0.0, 0.0, 0.0
** OPER.3:
   0
** OPER.5:
   1504.700,    559.625,    3.427,     .423,     0.0    *    1    617
   2094.700,    603.914,    3.448,     .40[illegible],     0.0    *    2    618
   2394.700,    604.240,    3.450,     .455,     0.0    *    3    619
   2394.700,    601.306,    3.007,     .423,     0.0    *    4    620
   2114.700,    598.300,    3.005,     .359,     0.0    *    5    621
   2124.700,    567.425,    2.949,     .443,     0.0    *    6    622
   2124.700,    566.125,    2.422,     .387,     0.0    *    7    623
   2394.700,    563.200,    2.447,     .429,     0.0    *    8    624
   2404.700,    575.552,    3.413,     .543,     0.0    *    9    625
   2374.700,    569.375,    2.941,     .479,     0.0    *   10    626
   2404.700,    541.100,    2.933,     .546,     0.0    *   11    627
   2414.700,    532.000,    2.463,     .478,     0.0    *   12    628
   2414.700,    502.437,    2.470,     .538,     0.0    *   13    629
   2414.700,    561.900,    1.96[illegible],     .360,     0.0    *   14    630
   2404.700,    525.175,    1.952,     .407,     0.0    *   15    631
   2099.700,    561.250,    1.969,     .327,     0.0    *   16    632
   2094.700,    524.850,    1.949,     .382,     0.0    *   17    633
   2404.700,    492.053,    1.964,     .461,     0.0    *   18    634
   2114.700,    474.529,    1.997,     .467,     0.0    *   19    635
   2124.700,    487.185,    2.468,     .520,     0.0    *   20    636
   2094.700,    522.000,    2.495,     .463,     0.0    *   21    637
   2114.700,    560.000,    3.448,     .522,     0.0    *   22    638
   2084.700,    528.750,    2.972,     .517,     0.0    *   23    639
```

```
   1814.700,   555.400,   3.486,    .468,    0.0   *   24   640
   1794.700,   532.650,   3.463,    .520,    0.0   *   25   641
   1799.700,   520.625,   3.494,    .536,    0.0   *   26   642
   1514.700,   515.100,   3.528,    .519,    0.0   *   27   643
   1489.700,   483.626,   2.467,    .456,    0.0   *   28   644
   1489.700,   449.218,   2.483,    .501,    0.0   *   29   645
   1514.700,   441.441,   1.996,    .447,    0.0   *   30   646
   1804.700,   561.900,   1.942,    .284,    0.0   *   31   647
   1499.700,   520.950,   2.513,    .426,    0.0   *   32   648
   1504.700,   527.125,   1.937,    .359,    0.0   *   33   649
   1501.700,   479.073,   2.004,    .409,    0.0   *   34   650
   1804.700,   514.125,   1.952,    .352,    0.0   *   35   651
   1784.700,   479.721,   2.001,    .408,    0.0   *   36   652
   2104.700,   605.218,   3.464,    .412,    0.0   *   37   653
** OPER.12:
   0,  0,  0,  0,  0,  0
** MIXX.1:
   MIXX,  0,  0,  0
** MIXX.2:
   0.8,  0.038
** DRAG.1:
   DRAG,  1,  0,  1
** DRAG.2:
   0.186, -0.20, 0.0, 64.0, -1.0, 0.0
** DRAG.5:
   0.5,    .555
** GRID.1:
   GRID,  0,    2
** GRID.2:
   1.400,    .570
** GPID.4:
   -1,   13
** GRID.6:
     6.00, 2,19.00, 1,32.00, 2,45.00, 1,53.00, 2,71.00, 1,84.00, 2,97.00, 1,
   110.00, 2,123.0, 1,136.0, 2,149.0, 1,162.0, 2,  .00, 0,  .00, 0,  .00, 0
   0
** CORR.1:
   CORR, 1, 1, 0
** CORR.2:
   EPRI, EPRI, EPRI, NONE
** CORR.3:
   0.2
** CORR.6:
   EPRI, THOM, THOM, CE-1, COND, G5.7
** CORR.7:
   0
** CORR.9:
   CE-1
** CORR.12:
   0.50747, 1
** CONT.1:
   CONT
** CONT.2:
   0.0, 0, 20, 20, 2, 2, 0, 0
** CONT.3:
   0.1, 0.0001, 0.001, 0, 0, 0, 0, 0.9
** CONT.6:
   1, 1, 0, 0, 1, 0, 1, 1, 0, 0, 1, 1, 0, 0
** CONT.7:
   4000.0, 0, 0, 0, 0, 0
** CONT.8:
   13
** CONT.11:
   13
** CONT.15:
   0,  0,  0,  0,  0
** END OF INPUT DATA:
   ENDD
   0
```

```
** CDC FILE NAME: HH132
**
**  IPRE.1:
    1,  0,  0
** VIPRE.2:
    HH132
** GEOM.1:
    GEOM,  25,  25,  56,  0,  0,  0
** GEOM.2:
    168.00,    0.0,    0.5
** GEOM.4:
     1,  .0630,   .9574,  .3314,  2,  2,  .1020,  .4340,  6,  .1020,  .4340
     2,  .1038, 1.2179,  .6629,  2,  3,  .1020,  .5550,  7,  .1330,  .4340
     3,  .1038, 1.2179,  .6629,  2,  4,  .1020,  .5550,  8,  .1330,  .4340
     4,  .1038, 1.2179,  .6629,  2,  5,  .1020,  .4340,  9,  .1330,  .4340
     5,  .0630,   .9574,  .3314,  1, 10,  .1020,  .4340,  0,  .0000,  .0000
     6,  .1038, 1.2179,  .6629,  2,  7,  .1330,  .4340, 11,  .1020,  .5550
     7,  .1682, 1.3258, 1.3258,  2,  8,  .1330,  .5550, 12,  .1330,  .5550
     8,  .1682, 1.3258, 1.3258,  2,  9,  .1330,  .5550, 13,  .1330,  .5550
     9,  .1682, 1.3258, 1.3258,  2, 10,  .1330,  .4340, 14,  .1330,  .5550
    10,  .1038, 1.2179,  .6629,  1, 15,  .1020,  .5550,  0,  .0000,  .0000
    11,  .1038, 1.2179,  .6629,  2, 12,  .1330,  .4340, 16,  .1020,  .5550
    12,  .1682, 1.3258, 1.3258,  2, 13,  .1330,  .5550, 17,  .1330,  .5550
    13,  .1682, 1.3258, 1.3258,  2, 14,  .1330,  .5550, 18,  .1330,  .5550
    14,  .1682, 1.3258, 1.3258,  2, 15,  .1330,  .4340, 19,  .1330,  .5550
    15,  .1038, 1.2179,  .6629,  1, 20,  .1020,  .5550,  0,  .0000,  .0000
    16,  .1038, 1.2179,  .6629,  2, 17,  .1330,  .4340, 21,  .1020,  .4340
    17,  .1682, 1.3258, 1.3258,  2, 18,  .1330,  .5550, 22,  .1330,  .4340
    18,  .1682, 1.3258, 1.3258,  [illegible] 19,  .1330,  .5550, 23,  .1330,  .4340
    19,  .1682, 1.3258, 1.3258,  [illegible] 20,  .1330,  .4340, 24,  .1330,  .4340
    20,  .1038, 1.2179,  .6629,  1, 25,  .1020,  .4340,  0,  .0000,  .0000
    21,  .0630,   .9574,  .3314,  1, 22,  .1020,  .4340,  0,  .0000,  .0000
    22,  .1038, 1.2179,  .6629,  1, 23,  .1020,  .5550,  0,  .0000,  .0000
    23,  .1038, 1.2179,  .6629,  1, 24,  .1020,  .5550,  0,  .0000,  .0000
    24,  .1038, 1.2179,  .6629,  1, 25,  .1020,  .4340,  0,  .0000,  .0000
    25,  .0630,   .9574,  .3314,  0,  0,  .0000,  .0000,  0,  .0000,  .0000
** RODS.1:
    RODS,   1,  16,   0,   1,   0,   0,   0,   0,   0,   0,   0
** RODS.2:
    168.00,    0.0,    0,    0
** RODS.3:
    22
** RODS.4:
       .000,    .540,   12.328,    .577,  23.419,    .638,   35.759,    .724
     43.149,    .798,   53.012,    .896,  61.034,    .994,   69.040,   1.092
     73.970,   1.153,   80.136,   1.221,  88.771,   1.300,   96.163,   1.350
    101.091,   1.374,  107.260,   1.393, 110.961,   1.386,  117.120,   1.374
    123.278,   1.337,  128.218,   1.288, 134.366,   1.215,  140.539,   1.129
    147.949,   1.006,  168.000,    .589,    .000,    .000,     .000,    .000
** RODS.9:
     1,   1,  .9592,   1,   1,   .250,   2,   .250,   6,   .250,   7,   .250
     2,   1,  .9592,   1,   2,   .250,   3,   .250,   7,   .250,   8,   .250
     3,   1,  .9583,   1,   3,   .250,   4,   .250,   8,   .250,   9,   .250
     4,   1,  .9616,   1,   4,   .250,   5,   .250,   9,   .250,  10,   .250
     5,   1,  .9600,   1,   9,   .250,  10,   .250,  14,   .250,  15,   .250
     6,   1,  .9608,   1,  14,   .250,  15,   .250,  19,   .250,  20,   .250
     7,   1,  .9583,   1,  19,   .250,  20,   .250,  24,   .250,  25,   .250
     8,   1,  .9592,   1,  18,   .250,  19,   .250,  23,   .250,  24,   .250
     9,   1,  .9600,   1,  17,   .250,  18,   .250,  22,   .250,  23,   .250
    10,   1,  .9600,   1,  16,   .250,  17,   .250,  21,   .250,  22,   .250
    11,   1,  .9600,   1,  11,   .250,  12,   .250,  16,   .250,  17,   .250
    12,   1,  .9600,   1,   6,   .250,   7,   .250,  11,   .250,  12,   .250
    13,   1, 1.1206,   1,   7,   .250,   8,   .250,  12,   .250,  13,   .250
    14,   1, 1.1217,   1,   8,   .250,   9,   .250,  13,   .250,  14,   .250
    15,   1, 1.1206,   1,  13,   .250,  14,   .250,  18,   .250,  19,   .250
    16,   1, 1.1206,   1,  12,   .250,  13,   .250,  17,   .250,  18,   .250
    0
** RODS.68:
    1, DUMY, 0.4220, 0.0, 0
** OPER.1:
    CPER, 1, 2, 0, 2, 0, 35, 0, 0, 0
** OPER.2:
    -1.0, 0.0, 0.0, 0.0
** OPER 3:
    0
** OPER.5:
    1514.700,    563.200,    3.421,    .475,    0.0    *    1    654
    2094.700,    607.174,    3.439,    .427,    0.0    *    2    655
    2404.700,    605.544,    2.950,    .428,    0.0    *    3    656
    2204.700,    601.306,    2.978,    .390,    0.0    *    4    657
    2104.700,    567.750,    2.942,    .461,    0.0    *    5    658
    1804.700,    563.850,    3.442,    .470,    0.0    *    6    659
    2374.700,    606.522,    3.418,    .476,    0.0    *    7    660
    2399.700,    594.660,    3.349,    .514,    0.0    *    8    661
    2399.700,    576.530,    3.395,    .561,    0.0    *    9    662
    2114.700,    560.275,    3.456,    .566,    0.0    *   10    663
    2399.700,    545.000,    2.930,    .575,    0.0    *   11    664
    2114.700,    523.550,    2.969,    .580,    0.0    *   12    665
    1799.700,    529.725,    3.464,    .573,    0.0    *   14    667
    2099.700,    484.589,    2.470,    .576,    0.0    *   15    668
    2384.700,    502.437,    2.493,    .572,    0.0    *   16    669
    2389.700,    573.600,    2.918,    .508,    0.0    *   17    670
    2384.700,    563.200,    2.438,    .457,    0.0    *   18    671
    2399.700,    538.500,    2.453,    .510,    0.0    *   19    672
    2399.700,    560.275,    1.947,    .358,    0.0    *   20    673
    2399.700,    518.675,    1.962,    .461,    0.0    *   21    674
    2404.700,    481.993,    1.937,    .497,    0.0    *   22    675
    2094.700,    482.642,    1.951,    .480,    0.0    *   23    676
    2104.700,    563.850,    2.415,    .413,    0.0    *   24    677
```

```
   2104.700,   527.450,   2.469,    .492,   0.0    *    25     678
   2104.700,   520.300,   1.946,    .410,   0.0    *    26     679
   2104.700,   568.075,   1.918,    .329,   0.0    *    27     680
   1799.700,   525.175,   1.932,    .367,   0.0    *    28     681
   1799.700,   562.875,   1.941,    .331,   0.0    *    29     682
   1499.700,   525.825,   1.923,    .403,   0.0    *    30     683
   1499.700,   522.250,   2.511,    .476,   0.0    *    31     684
   1799.700,   486.212,   1.984,    .423,   0.0    *    32     685
   1499.700,   488.159,   2.444,    .501,   0.0    *    33     686
   1499.700,   484.264,   1.961,    .444,   0.0    *    34     687
   1499.700,   442.089,   2.010,    .486,   0.0    *    35     688
   1499.700,   404.146,   2.452,    .512,   0.0    *    36     689
** OPER.12:
   0,  0,  0,  0,  0,  0
** MIXX.1:
   MIXX,  0,  0,  0
** MIXX.2:
   0.8,  0.038
** DRAG.1:
   DRAG,  1,  0,  1
** DRAG.2:
   0.186, -0.20, 0.0, 64.0, -1.0, 0.0
** DRAG.5:
   0.5,    .555
** GRID.1:
   GRID,  0,    2
** GRID.2:
   1.400,    .570
** GRID.4:
   -1,  17
** GRID.6:
     3.0,2, 13.0,1,  23.0,2,  33.0,1,  43.0,2,  53.0,1,  63.0,2,  73.0,1,
    83.0,2, 93.0,1, 103.0,2, 113.0,1, 123.0,2, 133.0,1, 143.0,2, 153.0,1,
   163.0,2,    .0,0,     .0,0,     .0,0,     .0,0,     .0,0,     .0,0,     .0,0
   0
** CORR.1:
   CORR, 1, 1, 0
** CORR.2:
   EPRI, EPRI, EPRI, NONE
** CORR.3:
   0.2
** CORR.6:
   EPRI, THOM, THOM, CE-1, COND, G5.7
** CORR.7:
   0.0
** CORR.9:
   CE-1
** CORR.12:
   0.50747, 1
** CONT.1:
   CONT
** CONT.2:
   0.0, 0, 20, 20, 2, 2, 0, 0
** CONT.3:
   0.1, 0.0001, 0.001, 0, 0, 0, 0, 0.9
** CONT.6:
   1, 1, 0, 0, 1, 0, 1, 1, 0, 0, 1, 1, 0, 0
** CONT.7:
   4000.0, 0, 0, 0, 0, 0
** CONT.8:
   13
** CONT.11:
   13
** CONT.15:
   0, 0, 0, 0, 0
** END OF INPUT DATA:
   ENDD
   0
```

```
** CDC FILE NAME: HH133
**
** VIPRE.1:
   1,  0,  0
** VIPRE.2:
   HH133
** GEOM.1:
   GEOM,  25,  25,  56,  0,  0,  0
** GEOM.2:
   168.00,     0.0,     0.5
** GEOM.4:
    1,  .0655,   .9654,  .3314,   2,   2,  .1060,  .4360,   6,  .1060,  .4360
    2,  .1060, 1.2179,   .6629,   2,   3,  .1060,  .5550,   7,  .1330,  .4360
    3,  .1060, 1.2179,   .6629,   2,   4,  .1060,  .5550,   8,  .1330,  .4360
    4,  .1060, 1.2179,   .6629,   2,   5,  .1060,  .4360,   9,  .1330,  .4360
    5,  .0655,   .9654,  .3314,   1,  10,  .1060,  .4360,   0,  .0000,  .0000
    6,  .1060, 1.2179,   .6629,   2,   7,  .1330,  .4360,  11,  .1060,  .5550
    7,  .1682, 1.3258, 1.3258,   2,   8,  .1330,  .5550,  12,  .1330,  .5550
    8,  .1682, 1.3258, 1.3258,   2,   9,  .1330,  .5550,  13,  .1330,  .5550
    9,  .1682, 1.3258, 1.3258,   2,  10,  .1330,  .4360,  14,  .1330,  .5550
   10,  .1060, 1.2179,   .6629,   1,  15,  .1060,  .5550,   0,  .0000,  .0000
   11,  .1060, 1.2179,   .6629,   2,  12,  .1330,  .4360,  16,  .1060,  .5550
   12,  .1682, 1.3258, 1.3258,   2,  13,  .1330,  .5550,  17,  .1330,  .5550
   13,  .1682, 1.3258, 1.3258,   2,  14,  .1330,  .5550,  18,  .1330,  .5550
   14,  .1682, 1.3258, 1.3258,   2,  15,  .1330,  .4360,  19,  .1330,  .5550
   15,  .1060, 1.2179,   .6629,   1,  20,  .1060,  .5550,   0,  .0000,  .0000
   16,  .1060, 1.2179,   .6629,   2,  17,  .1330,  .4360,  21,  .1060,  .4360
   17,  .1682, 1.3258, 1.3258,   2,  18,  .1330,  .5550,  22,  .1330,  .4360
   18,  .1682, 1.3258, 1.3258,   2,  19,  .1330,  .5550,  23,  .1330,  .4360
   19,  .1682, 1.3258, 1.3258,   2,  20,  .1330,  .4360,  24,  .1330,  .4360
   20,  .1060, 1.2179,   .6629,   1,  25,  .1060,  .4360,   0,  .0000,  .0000
   21,  .0655,   .9654,  .3314,   1,  22,  .1060,  .4360,   0,  .0000,  .0000
   22,  .1060, 1.2179,   .6629,   1,  23,  .1060,  .5550,   0,  .0000,  .0000
   23,  .1060, 1.2179,   .6629,   1,  24,  .1060,  .5550,   0,  .0000,  .0000
   24,  .1060, 1.2179,   .6629,   1,  25,  .1060,  .4360,   0,  .0000,  .0000
   25,  .0655,   .9654,  .3314,   0,   0,  .0000,  .0000,   0,  .0000,  .0000
** RODS.1:
   RODS,    1,   16,    ,    1,    0,    0,    0,    0,    0,    0,    0
** RODS.2:
   168.00,     0.0,     0,     0
** RODS.3:
   22
** RODS.4:
       .000,     .540,   12.328,    .577,   23.419,    .638,   35.759,    .724
     43.149,     .798,   53.012,    .896,   61.034,    .994,   69.040,   1.092
     73.970,    1.153,   80.136,   1.221,   88.771,   1.300,   96.163,   1.350
    101.091,    1.374,  107.260,   1.393,  110.961,   1.386,  117.120,   1.374
    123.278,    1.337,  128.216,   1.288,  134.366,   1.215,  140.539,   1.129
    147.949,    1.006,  168.000,    .589,     .000,    .000,     .000,    .000
** RODS.9:
    1,   1,   .9589,   1,   1,   .250,   2,   .250,   6,   .250,   7,   .250
    2,   1,   .9589,   1,   2,   .250,   3,   .250,   7,   .250,   8,   .250
    3,   1,   .9581,   1,   3,   .250,   4,   .250,   8,   .250,   9,   .250
    4,   1,   .9614,   1,   4,   .250,   5,   .250,   9,   .250,  10,   .250
    5,   1,   .9597,   1,   9,   .250,  10,   .250,  14,   .250,  15,   .250
    6,   1,   .9605,   1,  14,   .250,  15,   .250,  19,   .250,  20,   .250
    7,   1,   .9581,   1,  19,   .250,  20,   .250,  24,   .250,  25,   .250
    8,   1,   .9589,   1,  18,   .250,  19,   .250,  23,   .250,  24,   .250
    9,   1,   .9597,   1,  17,   .250,  18,   .250,  22,   .250,  23,   .250
   10,   1,   .9597,   1,  16,   .250,  17,   .250,  21,   .250,  22,   .250
   11,   1,   .9597,   1,  11,   .250,  12,   .250,  16,   .250,  17,   .250
   12,   1,   .9597,   1,   6,   .250,   7,   .250,  11,   .250,  12,   .250
   13,   1,  1.1203,   1,   7,   .250,   8,   .250,  12,   .250,  13,   .250
   14,   1,  1.1214,   1,   8,   .250,   9,   .250,  13,   .250,  14,   .250
   15,   1,  1.1237,   1,  13,   .250,  14,   .250,  18,   .250,  19,   .250
   16,   1,  1.1214,   1,  12,   .250,  13,   .250,  17,   .250,  18,   .250
   0
** RODS.68:
   1, DUMY, 0.4220, 0.0, 0
** OPER.1:
   OPER, 1, 2, 0, 2, 0, 38 , 0, 0, 0
** OPER.2:
   -1.0, 0.0, 0.0, 0.0
** OPER.3:
   0
** OPER.5:
   1499.700,    560.500,    3.425,    .501,   0.0   *    1    690
   2099.700,    607.000,    2.955,    .402,   0.0   *    2    691
   2099.700,    606.000,    3.407,    .459,   0.0   *    3    692
   2399.700,    609.000,    2.960,    .445,   0.0   *    4    693
   2104.700,    569.000,    2.971,    .491,   0.0   *    5    694
   2404.700,    568.000,    1.959,    .387,   0.0   *    6    695
   2404.700,    509.000,    1.997,    .463,   0.0   *    7    696
   2104.700,    478.000,    1.961,    .494,   0.0   *    8    697
   2114.700,    560.000,    2.434,    .449,   0.0   *    9    698
   2104.700,    519.000,    1.961,    .437,   0.0   *   10    699
   2109.700,    563.000,    1.938,    .370,   0.0   *   11    700
   2399.700,    560.000,    2.477,    .471,   0.0   *   12    701
   1804.700,    566.000,    1.967,    .337,   0.0   *   14    703
   1499.700,    523.000,    1.917,    .399,   0.0   *   15    704
   1499.700,    527.500,    2.518,    .470,   0.0   *   16    705
   1794.700,    487.000,    1.969,    .458,   0.0   *   17    706
   1504.700,    485.000,    1.988,    .454,   0.0   *   18    707
   1499.700,    447.000,    2.008,    .510,   0.0   *   19    708
   1829.700,    536.000,    3.445,    .566,   0.0   *   20    709
   1814.700,    569.000,    3.412,    .497,   0.0   *   21    710
   2399.700,    609.000,    3.404,    .488,   0.0   *   22    711
   2399.700,    586.000,    3.392,    .532,   0.0   *   23    712
   2399.700,    576.000,    3.408,    .551,   0.0   *   24    713
```

```
   2114.700,   570.000,   3.455,    .540,   0.0   *   25   714
   2414.700,   550.000,   2.935,    .548,   0.0   *   26   715
   2099.700,   534.000,   2.949,    .558,   0.0   *   27   716
   2524.700,   537.000,   3.446,    .563,   0.0   *   28   717
   2399.700,   504.000,   2.507,    .562,   0.0   *   29   718
   2404.700,   573.000,   2.947,    .509,   0.0   *   30   719
   2299.700,   541.000,   2.468,    .497,   0.0   *   31   720
   2099.700,   527.000,   2.499,    .515,   0.0   *   32   721
   2099.700,   493.000,   2.463,    .561,   0.0   *   33   722
   2404.700,   477.000,   1.992,    .505,   0.0   *   34   723
   1494.700,   486.000,   2.468,    .533,   0.0   *   35   724
   1504.700,   469.000,   2.469,    .554,   0.0   *   36   725
   1499.700,   443.000,   1.531,    .419,   0.0   *   37   726
   1504.700,   489.000,   1.463,    .376,   0.0   *   38   727
** OPER.12:
   0,  0,  0,  0,  0,  0
** MIXX.1:
   MIXX,  0,  0,  0
** MIXX.2:
   0.8,  0.038
** DRAG.1:
   DRAG,  1,  0,  1
** DRAG.2:
   0.186, -0.20, 0.0, 64.0, -1.0, 0.0
** DRAG.5:
   0.5,    .555
** GRID.1:
   GRID,  0,    1
** GRID.2:
   1.400,    .000
** GRID.4:
   -1,   13
** GRID.6:
     6.0, 1, 19.0, 1, 32.0, 1, 45.0, 1, 58.0, 1,71.00, 1,84.00, 1,97.00, 1,
   110.0, 1,123.0, 1,137.0, 1,149.0, 1,162.0, 1,  .00, 0,  .00, 0,  .00, 0
   0
** CORR.1:
   CORR, 1, 1, 0
** CORR.2:
   EPRI, EPRI, EPRI, NONE
** CORR.3:
   0.2
** CORR.6:
   EPRI, THOM, THOM, CE-1, COND, G5.7
** CORR.7:
   0.0
** CORR.9:
   CE-1
** CORR.12:
   0.50747, 1
** CONT.1:
   CONT
** CONT.2:
   0.0, 0, 20, 20, 2, 2, 0, 0
** CONT.3:
   0.1, 0.0001, 0.001, 0, 0, 0, 0, 0.9
** CONT.6:
   1, 1, 0, 0, 1, 0, 1, 1, 0, 0, 1, 1, 0, 0
** CONT.7:
   4000.0, 0, 0, 0, 0, 0
** CONT.8:
   13
** CONT.11:
   13
** CONT.15:
   0, 0, 0, 0, 0
** END OF INPUT DATA:
   ENDD
   0
```

```
** CDC FILE NAME: HH134
**
** VIPRE.1:
   1,  0,  0
** VIPRE.2:
   HH134
** GEOM.1:
   GEOM,  25,  25,  56,  0,  0,  0
** GEOM.2:
   168.00,    0.0,    0.5
** GEOM.4:
    1,  .0655,  .9654,  .3314,  2,  2,  .1060,  .4360,  6,  .1060,  .4360
    2,  .1060, 1.2179,  .6629,  2,  3,  .1060,  .5550,  7,  .1330,  .4360
    3,  .1060, 1.2179,  .6629,  2,  4,  .1060,  .5550,  8,  .1330,  .4360
    4,  .1060, 1.2179,  .6629,  2,  5,  .1060,  .4360,  9,  .1330,  .4360
    5,  .0655,  .9654,  .3314,  1, 10,  .1060,  .4360,  0,  .0000,  .0000
    6,  .1060, 1.2179,  .6629,  2,  7,  .1330,  .4360, 11,  .1060,  .5550
    7,  .1682, 1.3258, 1.3258,  2,  8,  .1330,  .5550, 12,  .1330,  .5550
    8,  .1682, 1.3258, 1.3258,  2,  9,  .1330,  .5550, 13,  .1330,  .5550
    9,  .1682, 1.3258, 1.3258,  2, 10,  .1330,  .4360, 14,  .1330,  .5550
   10,  .1060, 1.2179,  .6629,  1, 15,  .1060,  .5550,  0,  .0000,  .0000
   11,  .1060, 1.2179,  .6629,  2, 12,  .1330,  .4360, 16,  .1060,  .5550
   12,  .1682, 1.3258, 1.3258,  2, 13,  .1330,  .5550, 17,  .1330,  .5550
   13,  .1682, 1.3258, 1.3258,  2, 14,  .1330,  .5550, 18,  .1330,  .5550
   14,  .1682, 1.3258, 1.3258,  2, 15,  .1330,  .4360, 19,  .1330,  .5550
   15,  .1060, 1.2179,  .6629,  1, 20,  .1060,  .5550,  0,  .0000,  .0000
   16,  .1060, 1.2179,  .6629,  2, 17,  .1330,  .4360, 21,  .1060,  .4360
   17,  .1682, 1.3258, 1.3258,  2, 18,  .1330,  .5550, 22,  .1330,  .4360
   18,  .1682, 1.3258, 1.3258,  2, 19,  .1330,  .5550, 23,  .1330,  .4360
   19,  .1682, 1.3258, 1.3258,  2, 20,  .1330,  .4360, 24,  .1330,  .4360
   20,  .1060, 1.2179,  .6629,  1, 25,  .1060,  .4360,  0,  .0000,  .0000
   21,  .0655,  .9654,  .3314,  1, 22,  .1060,  .4360,  0,  .0000,  .0000
   22,  .1060, 1.2179,  .6629,  1, 23,  .1060,  .5550,  0,  .0000,  .0000
   23,  .1060, 1.2179,  .6629,  1, 24,  .1060,  .5550,  0,  .0000,  .0000
   24,  .1060, 1.2179,  .6629,  1, 25,  .1060,  .4360,  0,  .0000,  .0000
   25,  .0655,  .9654,  .3314,  0,  0,  .0000,  .0000,  0,  .0000,  .0000
** RODS.1:
   RODS,   1,  16,   0,   1,   0,   0,   0,   0,   0,   0,   0
** RODS.2:
   168.00,    0.0,    0,    0
** RODS.3:
   22
** RODS.4:
      .000,    .540,   12.328,    .577,   23.419,    .638,   35.759,    .724
    43.149,    .798,   53.012,    .896,   61.034,    .994,   69.040,   1.092
    73.970,   1.153,   80.136,   1.221,   88.771,   1.300,   96.163,   1.350
   101.091,   1.374,  107.260,   1.393,  110.961,   1.386,  117.120,   1.374
   123.278,   1.337,  128.218,   1.288,  134.366,   1.215,  140.539,   1.129
   147.949,   1.006,  168.000,    .589,     .000,    .000,     .000,    .000
** RODS.9:
    1,   1,  .9587,  1,  1,  .250,  2,  .250,  6,  .250,  7,  .250
    2,   1,  .9595,  1,  2,  .250,  3,  .250,  7,  .250,  8,  .250
    3,   1,  .9579,  1,  3,  .250,  4,  .250,  8,  .250,  9,  .250
    4,   1,  .9603,  1,  4,  .250,  5,  .250,  9,  .250, 10,  .250
    5,   1,  .9603,  1,  9,  .250, 10,  .250, 14,  .250, 15,  .250
    6,   1,  .9603,  1, 14,  .250, 15,  .250, 19,  .250, 20,  .250
    7,   1,  .9595,  1, 19,  .250, 20,  .250, 24,  .250, 25,  .250
    8,   1,  .9587,  1, 18,  .250, 19,  .250, 23,  .250, 24,  .250
    9,   1,  .9579,  1, 17,  .250, 18,  .250, 22,  .250, 23,  .250
   10,   1,  .9587,  1, 16,  .250, 17,  .250, 21,  .250, 22,  .250
   11,   1,  .9595,  1, 11,  .250, 12,  .250, 16,  .250, 17,  .250
   12,   1,  .9595,  1,  6,  .250,  7,  .250, 11,  .250, 12,  .250
   13,   1, 1.1212,  1,  7,  .250,  8,  .250, 12,  .250, 13,  .250
   14,   1, 1.1212,  1,  8,  .250,  9,  .250, 13,  .250, 14,  .250
   15,   1, 1.1234,  1, 13,  .250, 14,  .250, 18,  .250, 19,  .250
   16,   1, 1.1234,  1, 12,  .250, 13,  .250, 17,  .250, 18,  .250
   0
** RODS.68:
   1, DUMY, 0.4220, 0.0, 0
** OPER.1:
   OPER, 1, 2, 0, 2, 0, 38, 0, 0, 0
** OPER.2:
   -1.0, 0.0, 0.0, 0.0
** OPER.3:
   0
** OPER.5:
   1509.700,   561.250,   3.393,    .399,   0.0   *    1   728
   1799.700,   562.875,   3.408,    .423,   0.0   *    2   729
   2094.700,   606.848,   3.369,    .384,   0.0   *    3   730
   2124.700,   607.174,   3.433,    .393,   0.0   *    4   731
   2404.700,   603.262,   3.437,    .444,   0.0   *    5   732
   2384.700,   602.610,   2.985,    .410,   0.0   *    6   733
   2114.700,   600.002,   2.895,    .346,   0.0   *    7   734
   2099.700,   559.950,   2.942,    .444,   0.0   *    8   735
   2404.700,   565.800,   2.927,    .486,   0.0   *    9   736
   2399.700,   562.225,   2.411,    .418,   0.0   *   10   737
   2099.700,   560.925,   2.403,    .378,   0.0   *   11   738
   2404.700,   565.150,   3.420,    .557,   0.0   *   12   739
   1489.700,   442.736,   2.444,    .489,   0.0   *   13   740
   2384.700,   482.642,   2.477,    .530,   0.0   *   14   741
   2099.700,   481.020,   2.443,    .506,   0.0   *   15   742
   1499.700,   483.616,   3.538,    .567,   0.0   *   16   743
   1499.700,   516.725,   3.502,    .496,   0.0   *   17   744
   1799.700,   519.650,   3.494,    .518,   0.0   *   18   745
   2404.700,   521.925,   2.930,    .542,   0.0   *   19   746
   2404.700,   525.825,   2.949,    .507,   0.0   *   20   747
   2404.700,   522.575,   2.430,    .470,   0.0   *   21   748
   2104.700,   563.200,   3.249,    .465,   0.0   *   22   749
   2084.700,   559.300,   1.932,    .318,   0.0   *   23   750
```

```
2384.700,   557.675,   1.952,    .327,   0.0   *   24   751
2409.700,   513.800,   1.934,    .401,   0.0   *   25   752
2104.700,   514.125,   1.936,    .378,   0.0   *   26   753
2104.700,   517.700,   2.452,    .447,   0.0   *   27   754
2089.700,   475.503,   1.965,    .428,   0.0   *   28   755
2424.700,   478.099,   1.949,    .443,   0.0   *   29   756
1484.700,   514.125,   2.411,    .399,   0.0   *   30   757
1504.700,   481.020,   2.450,    .452,   0.0   *   31   758
1504.700,   519.975,   1.934,    .340,   0.0   *   32   759
1799.700,   522.250,   1.937,    .335,   0.0   *   33   760
1799.700,   481.020,   1.977,    .393,   0.0   *   34   761
1499.700,   480.046,   1.930,    .377,   0.0   *   35   762
1499.700,   440.633,   1.938,    .421,   0.0   *   36   763
1799.700,   561.900,   1.890,    .281,   0.0   *   37   764
2104.700,   562.550,   3.398,    .479,   0.0   *   38   765
** OPER.12:
   0,  0,  0,  0,  0,  0
** MIXX.1:
   MIXX,  0,  0,  0
** MIXX.2:
   0.8,  0.038
** DRAG.1:
   DRAG,  1,  0,  1
** DRAG.2:
   0.186, -0.20, 0.0, 64.0, -1.0, 0.0
** DRAG.5:
   0.5,    .555
** GRID.1:
   GRID,  0,    2
** GRID.2:
   1.400,     .570
** GRID.4:
   -1,   10
** GRID.6:
    11.0,2,  27.0,1, 43.0,2, 59.0,1, 75.0,2, 91.0,1, 107.0,2, 123.0,1,
   139.0,2, 155.0,1, 00.0,0, 00.0,0, 00.0,0, 00.0,0, 000.0,0, 000.0,0
   0
** CORR.1:
   CORR, 1, 1, 0
** CORR.2:
   EPRI, EPRI, EPRI, NONE
** CORR.3:
   0.2
** CORR.6:
   EPRI, THOM, THOM, CE-1, COND, G5.7
** CORR.7:
 0.0
** CORR.9:
   CE-1
** CORR.12:
   0.50747, 1
** CONT.1:
   CONT
** CONT.2:
   0.0, 0, 20, 20, 2, 2, 0, 0
** CONT.3:
   0.1, 0.0001, 0.001, 0, 0, 0, 0, 0.9
** CONT.6:
   1, 1, 0, 0, 1, 0, 1, 1, 0, 0, 1, 1, 0, 0
** CONT.7:
   4000.0, 0, 0, 0, 0, 0
** CONT.8:
   13
** CONT.11:
   13
** CONT.15:
   0,  0,  0,  0,  0
** END OF INPUT DATA:
   ENDD
   0
```

```
** CDC FILE NAME: HH138
**
** VIPRE.1:
   1, 0, 0
** VIPRE.2:
   HH138
** GEOM.1:
   GEOM,  25,  25,  56,  0,  0,  0
** GEOM.2:
   168.00,    0.0,    0.5
** GEOM.4:
    1,  .0655,  .9654,  .3314,  2,  2,  .1060,  .4360,  6,  .1060,  .4360
    2,  .1060, 1.2179,  .6629,  2,  3,  .1060,  .5550,  7,  .1330,  .4360
    3,  .1060, 1.2179,  .6629,  2,  4,  .1060,  .5550,  8,  .1330,  .4360
    4,  .1060, 1.2179,  .6629,  2,  5,  .1060,  .4360,  9,  .1330,  .4360
    5,  .0655,  .9654,  .3314,  1, 10,  .1060,  .4360,  0,  .0000,  .0000
    6,  .1060, 1.2179,  .6629,  2,  7,  .1330,  .4360, 11,  .1060,  .5550
    7,  .1682, 1.3258, 1.3258,  2,  8,  .1330,  .5550, 12,  .1330,  .5550
    8,  .1682, 1.3258, 1.3258,  2,  9,  .1330,  .5550, 13,  .1330,  .5550
    9,  .1682, 1.3258, 1.3258,  2, 10,  .1330,  .4360, 14,  .1330,  .5550
   10,  .1060, 1.2179,  .6629,  1, 15,  .1060,  .5550,  0,  .0000,  .0000
   11,  .1060, 1.2179,  .6629,  2, 12,  .1330,  .4360, 16,  .1060,  .5550
   12,  .1682, 1.3258, 1.3258,  2, 13,  .1330,  .5550, 17,  .1330,  .5550
   13,  .1448, 1.4223, 0.9943,  2, 14,  .0715,  .5550, 18,  .0715,  .5550
   14,  .1448, 1.4223, 0.9943,  2, 15,  .1330,  .4360, 19,  .0715,  .5550
   15,  .1060, 1.2179,  .6629,  1, 20,  .1060,  .5550,  0,  .0000,  .0000
   16,  .1060, 1.2179,  .6629,  2, 17,  .1330,  .4360, 21,  .1060,  .4360
   17,  .1682, 1.3258, 1.3258,  2, 18,  .1330,  .5550, 22,  .1330,  .4360
   18,  .1448, 1.4223, 0.9943,  2, 19,  .0715,  .5550, 23,  .1330,  .4360
   19,  .1448, 1.4223, 0.9943,  2, 20,  .1330,  .4360, 24,  .1330,  .4360
   20,  .1060, 1.2179,  .6629,  1, 25,  .1060,  .4360,  0,  .0000,  .0000
   21,  .0655,  .9654,  .3314,  1, 22,  .1060,  .4360,  0,  .0000,  .0000
   22,  .1060, 1.2179,  .6629,  1, 23,  .1060,  .5550,  0,  .0000,  .0000
   23,  .1060, 1.2179,  .6629,  1, 24,  .1060,  .5550,  0,  .0000,  .0000
   24,  .1060, 1.2179,  .6629,  1, 25,  .1060,  .4360,  0,  .0000,  .0000
   25,  .0655,  .9654,  .3314,  0,  0,  .0000,  .0000,  0,  .0000,  .0000
** RODS.1:
   RODS,   1,  15,   0,   1,   0,   0,   0,   0,   0,   0,   0
** RODS.2:
   168.00,    0.0,    0,    0
** RODS.3:
   22
** RODS.4:
       .000,   .540,  12.328,   .577,  23.419,   .638,  35.759,   .724
     43.149,   .798,  53.012,   .896,  61.034,   .994,  69.040,  1.092
     73.970,  1.153,  80.136,  1.221,  88.771,  1.300,  96.163,  1.350
    101.091,  1.374, 107.260,  1.393, 110.961,  1.386, 117.120,  1.374
    123.278,  1.337, 128.218,  1.288, 134.366,  1.215, 140.539,  1.129
    147.949,  1.006, 168.000,   .589,    .000,   .000,    .000,   .000
** RODS.9:
    1,  1,  .9659,  1,  1,  .250,  2,  .250,  6,  .250,  7,  .250
    2,  1,  .9659,  1,  2,  .250,  3,  .250,  7,  .250,  8,  .250
    3,  1,  .9659,  1,  3,  .250,  4,  .250,  8,  .250,  9,  .250
    4,  1,  .9659,  1,  4,  .250,  5,  .250,  9,  .250, 10,  .250
    5,  1,  .9659,  1,  9,  .250, 10,  .250, 14,  .250, 15,  .250
    6,  1,  .9659,  1, 14,  .250, 15,  .250, 19,  .250, 20,  .250
    7,  1,  .9659,  1, 19,  .250, 20,  .250, 24,  .250, 25,  .250
    8,  1,  .9659,  1, 18,  .250, 19,  .250, 23,  .250, 24,  .250
    9,  1,  .9659,  1, 17,  .250, 18,  .250, 22,  .250, 23,  .250
   10,  1,  .9659,  1, 16,  .250, 17,  .250, 21,  .250, 22,  .250
   11,  1,  .9659,  1, 11,  .250, 12,  .250, 16,  .250, 17,  .250
   12,  1,  .9659,  1,  6,  .250,  7,  .250, 11,  .250, 12,  .250
   13,  1, 1.1364,  1,  7,  .250,  8,  .250, 12,  .250, 13,  .250
   14,  1, 1.1364,  1,  8,  .250,  9,  .250, 13,  .250, 14,  .250
   15,  1, 1.1364,  1, 12,  .250, 13,  .250, 17,  .250, 18,  .250
   0
** RODS.68:
   1,  DUMY,  0.4220,  0.0,  0
** OPER.1:
   OPER,  1,  2,  0,  2,  0,  37,  0,  0,  0
** OPER.2:
   -1.0,  0.0,  0.0,  0.0
** OPER.3:
   0
** OPER.5:
   1494.700,   434.648,   2.004,   .431,   0.0   *    1    803
   1499.700,   445.325,   2.473,   .482,   0.0   *    2    804
   1499.700,   483.940,   2.173,   .397,   0.0   *    3    805
   1499.700,   482.966,   2.481,   .437,   0.0   *    4    806
   1794.700,   482.318,   1.995,   .401,   0.0   *    5    807
   2099.700,   481.669,   2.015,   .444,   0.0   *    6    808
   2094.700,   488.483,   2.474,   .501,   0.0   *    7    809
   2394.700,   481.993,   1.965,   .452,   0.0   *    8    810
   2404.700,   502.437,   2.435,   .513,   0.0   *    9    811
   2404.700,   519.325,   1.946,   .401,   0.0   *   10    812
   2394.700,   521.925,   2.456,   .484,   0.0   *   11    813
   2114.700,   518.675,   1.964,   .385,   0.0   *   12    814
   2119.700,   521.925,   2.479,   .445,   0.0   *   13    815
   2114.700,   525.500,   2.941,   .498,   0.0   *   14    816
   1809.700,   516.400,   1.974,   .343,   0.0   *   15    817
   1804.700,   519.975,   3.465,   .505,   0.0   *   16    818
   1504.700,   521.600,   1.922,   .325,   0.0   *   17    819
   1499.700,   520.950,   2.511,   .378,   0.0   *   18    820
   1514.700,   516.400,   3.498,   .471,   0.0   *   19    821
   2414.700,   536.550,   2.893,   .527,   0.0   *   20    822
   1509.700,   557.675,   3.435,   .410,   0.0   *   21    823
   1804.700,   558.975,   3.494,   .433,   0.0   *   22    824
   1804.700,   553.125,   1.991,   .295,   0.0   *   23    825
   2114.700,   557.350,   2.006,   .329,   0.0   *   24    826
```

```
 2104.700,   558.650,   2.451,    .379,   0.0     *     25     827
 2104.700,   561.250,   2.939,    .426,   0.0     *     26     828
 2094.700,   562.225,   3.441,    .482,   0.0     *     27     829
 2404.700,   563.525,   1.954,    .349,   0.0     *     28     830
 2394.700,   558.650,   2.434,    .422,   0.0     *     29     831
 2404.700,   563.200,   2.932,    .485,   0.0     *     30     832
 2414.700,   576.856,   3.359,    .512,   0.0     *     31     833
 2419.700,   601.306,   2.980,    .413,   0.0     *     32     834
 2414.700,   605.544,   3.406,    .453,   0.0     *     33     835
 2094.700,   599.676,   3.006,    .349,   0.0     *     34     836
 2099.700,   594.786,   3.424,    .412,   0.0     *     35     837
 2104.700,   556.375,   2.476,    .394,   0.0     *     36     838
 2099.700,   519.975,   2.522,    .457,   0.0     *     37     839
** OPER.12:
  0,  0,  0,  0,  0,  0
** MIXX.1:
  MIXX,  0,  0,  0
** MIXX.2:
  0.8,  0.038
** DRAG.1:
  DRAG,  1,  0,  1
** DRAG.2:
  0.186, -0.20, 0.0, 64.0, -1.0, 0.0
** DRAG.5:
  0.5,    .555
** GRID.1:
  GRID,  0,    2
** GRID.2:
  1.400,    .570,
** GRID.4:
  -1,   13
** GRID.6:
    6.0,2,  19.0,1,  32.0,2,  45.0,1,  58.0,2, 71.00,1, 84.00,2, 97.00, 1,
  110.0,2, 123.0,1, 136.0,2, 149.0,1, 162.0,2,    .00,0,    .00,0,    .00, 0
  0
** CORR.1:
  CORR, 1, 1, 0
** CORR.2:
  EPRI, EPRI, EPRI, NONE
** CORR.3:
  0.2
** CORR.6:
  EPRI, THOM, THOM, CE-1, COND, G5.7
** CORR.7:
  0.0
** CORR.9:
  CE-1
** CORR.12:
  0.40723, 1
** CONT.1:
  CONT
** CONT.2:
  0.0, 0, 20, 20, 2, 2, 0, 0
** CONT.3:
  0.1, 0.0001, 0.001, 0, 0, 0, 0, 0.9
** CONT.6:
  1, 1, 0, 0, 1, 0, 1, 1, 0, 0, 1, 1, 0, 0
** CONT.7:
  4000.0, 0, 0, 0, 0, 0
** CONT.8:
  13
** CONT.11:
  13
** CONT.15:
  0,  0,  0,  0,  0
** END OF INPUT:
  ENDD
  0
```

```
** CDC FILE NAME: WH139
**
** VIPRE.1:
   1,  0,  0
** VIPRE.2:
   WH139
** GEOM.1:
   GEOM,  25,  25,  56,  0,  0,  0
** GEOM.2:
   168.00,    0.0,    0.5
** GEOM.4:
    1,  .0655,   .9654,   .3314,   2,   2,  .1060,  .4360,   6,  .1060,  .4360
    2,  .1060,  1.2179,   .6629,   2,   3,  .1060,  .5550,   7,  .1330,  .4360
    3,  .1060,  1.2179,   .6629,   2,   4,  .1060,  .5550,   8,  .1330,  .4360
    4,  .1060,  1.2179,   .6629,   2,   5,  .1060,  .4360,   9,  .1330,  .4360
    5,  .0655,   .9654,   .3314,   1,  10,  .1060,  .4360,   0,  .0000,  .0000
    6,  .1060,  1.2179,   .6629,   2,   7,  .1330,  .4360,  11,  .1060,  .5550
    7,  .1682,  1.3258,  1.3258,   2,   8,  .1330,  .5550,  12,  .1330,  .5550
    8,  .1682,  1.3258,  1.3258,   2,   9,  .1330,  .5550,  13,  .1330,  .5550
    9,  .1682,  1.3258,  1.3258,   2,  10,  .1330,  .4360,  14,  .1330,  .5550
   10,  .1060,  1.2179,   .6629,   1,  15,  .1060,  .5550,   0,  .0000,  .0000
   11,  .1060,  1.2179,   .6629,   2,  12,  .1330,  .4360,  16,  .1060,  .5550
   12,  .1682,  1.3258,  1.3258,   2,  13,  .1330,  .5550,  17,  .1330,  .5550
   13,  .1448,  1.4223,  0.9943,   2,  14,  .0715,  .5550,  18,  .0715,  .5550
   14,  .1448,  1.4223,  0.9943,   2,  15,  .1330,  .4360,  19,  .0715,  .5550
   15,  .1060,  1.2179,   .6629,   1,  20,  .1060,  .5550,   0,  .0000,  .0000
   16,  .1060,  1.2179,   .6629,   2,  17,  .1330,  .4360,  21,  .1060,  .4360
   17,  .1682,  1.3258,  1.3258,   2,  18,  .1330,  .5550,  22,  .1330,  .4360
   18,  .1448,  1.4223,  0.9943,   2,  19,  .0715,  .5550,  23,  .1330,  .4360
   19,  .1448,  1.4223,  0.9943,   2,  20,  .1330,  .4360,  24,  .1330,  .4360
   20,  .1060,  1.2179,   .6629,   1,  25,  .1060,  .4360,   0,  .0000,  .0000
   21,  .0655,   .9654,   .3314,   1,  22,  .1060,  .4360,   0,  .0000,  .0000
   22,  .1060,  1.2179,   .6629,   1,  23,  .1060,  .5550,   0,  .0000,  .0000
   23,  .1060,  1.2179,   .6629,   1,  24,  .1060,  .5550,   0,  .0000,  .0000
   24,  .1060,  1.2179,   .6629,   1,  25,  .1060,  .4360,   0,  .0000,  .0000
   25,  .0655,   .9654,   .3314,   0,   0,  .0000,  .0000,   0,  .0000,  .0000
** RODS.1:
   RODS,   1,  15,   0,   1,   0,   0,   0,   0,   0,   0,   0
** RODS.2:
   168.00,    0.0,    0,    0
** RODS.3:
   22
** RODS.4:
       .000,    .540,   12.328,    .577,   23.419,    .638,   35.759,    .724
     43.149,    .798,   53.012,    .896,   61.034,    .994,   69.040,   1.092
     73.970,   1.153,   80.136,   1.221,   88.771,   1.300,   96.163,   1.350
    101.091,   1.374,  107.260,   1.393,  110.961,   1.386,  117.120,   1.374
    123.278,   1.337,  128.218,   1.288,  134.366,   1.215,  140.539,   1.129
    147.949,   1.006,  168.000,    .589,     .000,    .000,     .000,    .000
** RODS.9:
    1,  1,  .9670,  1,   1,  .250,   2,  .250,   6,  .250,   7,  .250
    2,  1,  .9670,  1,   2,  .250,   3,  .250,   7,  .250,   8,  .250
    3,  1,  .9660,  1,   3,  .250,   4,  .250,   8,  .250,   9,  .250
    4,  1,  .9680,  1,   4,  .250,   5,  .250,   9,  .250,  10,  .250
    5,  1,  .9680,  1,   9,  .250,  10,  .250,  14,  .250,  15,  .250
    6,  1,  .9680,  1,  14,  .250,  15,  .250,  19,  .250,  20,  .250
    7,  1,  .9670,  1,  19,  .250,  20,  .250,  24,  .250,  25,  .250
    8,  1,  .9670,  1,  18,  .250,  19,  .250,  23,  .250,  24,  .250
    9,  1,  .9660,  1,  17,  .250,  18,  .250,  22,  .250,  23,  .250
   10,  1,  .9670,  1,  16,  .250,  17,  .250,  21,  .250,  22,  .250
   11,  1,  .9670,  1,  11,  .250,  12,  .250,  16,  .250,  17,  .250
   12,  1,  .9670,  1,   6,  .250,   7,  .250,  11,  .250,  12,  .250
   13,  1, 1.1300,  1,   7,  .250,   8,  .250,  12,  .250,  13,  .250
   14,  1, 1.1300,  1,   8,  .250,   9,  .250,  13,  .250,  14,  .250
   15,  1, 1.1330,  1,  12,  .250,  13,  .250,  17,  .250,  18,  .250
   0
** RODS.68:
   1,  DUMY,  0.4220,  0.0,  0
** OPER.1:
   OPER,  1,  2,  0,  2,  0,  38 ,  0,  0,  0
** OPER.2:
   -1.0,  0.0,  0.0,  0.0
** OPER.3:
   0
** OPER.5:
   1494.700,   478.900,   1.924,   .366,   0.0   *    1   840
   1504.700,   439.800,   2.403,   .485,   0.0   *    2   841
   1499.700,   440.500,   1.863,   .401,   0.0   *    3   842
   1494.700,   485.000,   2.403,   .430,   0.0   *    4   843
   1499.700,   494.900,   3.466,   .538,   0.0   *    5   844
   1804.700,   481.700,   1.924,   .381,   0.0   *    6   845
   2094.700,   482.400,   1.929,   .413,   0.0   *    7   846
   2094.700,   485.800,   2.380,   .490,   0.0   *    8   847
   2394.700,   476.200,   1.913,   .450,   0.0   *    9   848
   2409.700,   494.100,   2.422,   .526,   0.0   *   10   849
   1508.700,   517.500,   1.880,   .333,   0.0   *   11   850
   1494.700,   523.600,   2.344,   .376,   0.0   *   12   851
   1504.700,   516.700,   3.474,   .491,   0.0   *   13   852
   1804.700,   517.400,   3.462,   .531,   0.0   *   14   853
   1804.700,   522.900,   1.883,   .325,   0.0   *   15   854
   2074.700,   510.900,   1.899,   .373,   0.0   *   16   855
   2094.700,   520.900,   2.372,   .436,   0.0   *   17   856
   2104.700,   521.900,   2.886,   .508,   0.0   *   18   857
   2404.700,   526.300,   2.393,   .470,   0.0   *   19   858
   2394.700,   514.100,   1.890,   .399,   0.0   *   20   859
   1799.700,   563.000,   1.845,   .271,   0.0   *   21   860
   1814.700,   560.900,   3.359,   .423,   0.0   *   22   861
   1504.700,   564.200,   3.328,   .388,   0.0   *   23   862
   2099.700,   555.400,   2.379,   .373,   0.0   *   24   863
```

```
     2099.700,   563.100,   2.934,    .429,    0.0     *     25    864
     2104.700,   562.100,   3.375,    .484,    0.0     *     26    865
     2099.700,   561.400,   1.869,    .297,    0.0     *     27    866
     2399.700,   564.400,   1.895,    .334,    0.0     *     28    867
     2404.700,   565.900,   2.356,    .369,    0.0     *     29    868
     2404.700,   566.300,   2.880,    .472,    0.0     *     30    869
     2404.700,   603.900,   2.918,    .400,    0.0     *     31    870
     2404.700,   601.100,   3.385,    .449,    0.0     *     32    871
     2104.700,   605.100,   3.375,    .390,    0.0     *     33    872
     2084.700,   602.800,   2.844,    .330,    0.0     *     34    873
     2409.700,   563.100,   3.372,    .550,    0.0     *     35    874
     2404.700,   525.200,   2.885,    .530,    0.0     *     36    875
     1499.700,   482.100,   2.382,    .429,    0.0     *     37    876
     2094.700,   525.500,   2.361,    .425,    0.0     *     38    877
** OPER.12:
   0,  0,  0,  0,  0,  0
** MIXX.1:
   MIXX,  0,  0,  0
** MIXX.2:
   0.8,  0.038
** DRAG.1:
   DRAG,  1,  0,  1
** DRAG.2:
   0.186, -0.20, 0.0, 64.0, -1.0, 0.0
** DRAG.5:
   0.5,  0.555
** GRID.1:
   GRID,  0,   2
** GRID.2:
   1.400,   0.570
** GRID.4:
   -1,   10
** GRID.6:
    11.5,2,  27.37,1, 43.37,2, 59.37,1, 75.37,2, 91.37,1, 107.4,2, 123.4,1,
   139.4,2, 155.40,1,   .00,0,   .00,0,   .00,0,   .00,0,    .0,0,    .0,0
   0
** CORR.1:
   CORR, 1, 1, 0
** CORR.2:
   EPRI, EPRI, EPRI, NONE
** CORR.3:
   0.2
** CORR.6:
   EPRI, THOM, THOM, CE-1, COND, G5.7
** CORR.7:
   0.0
** CORR.9:
   CE-1
** CORR.12:
   0.40723, 1
** CONT.1:
   CONT
** CONT.2:
   0.0, 0, 20, 20, 2, 2, 0, 0
** CONT.3:
   0.1, 0.0001, 0.001, 0, 0, 0, 0, 0.9
** CONT.6:
   1, 1, 0, 0, 1, 0, 1, 1, 0, 0, 1, 1, 0, 0
** CONT.7:
   4000.0, 0, 0, 0, 0, 0
** CONT.8:
   13
** CONT.11:
   13
** CONT.15:
   0,  0,  0,  0,  0
** END OF INPUT DATA:
   ENDD
   0
```

```
** CDC FILE NAME: WH153
**
** VIPRE.1:
   1,    0,    0
** VIPRE.2:
   WH153
** GEOM.1:
   GEOM,    25,   25,   56,   0,   0,   0
** GEOM.2:
   168.00,    0.0,    0.5
** GEOM.4:
    1,  .0630,   .9574,   .3314,  2,   2,  .1020,  .4340,   6,  .1020,  .4340
    2,  .1038,  1.2179,   .6629,  2,   3,  .1020,  .5550,   7,  .1330,  .4340
    3,  .1038,  1.2179,   .6629,  2,   4,  .1020,  .5550,   8,  .1330,  .4340
    4,  .1038,  1.2179,   .6629,  2,   5,  .1020,  .4340,   9,  .1330,  .4340
    5,  .0630,   .9574,   .3314,  1,  10,  .1020,  .4340,   0,  .0000,  .0000
    6,  .1038,  1.2179,   .6629,  2,   7,  .1330,  .4340,  11,  .1020,  .5550
    7,  .1682,  1.3258,  1.3258,  2,   8,  .1330,  .5550,  12,  .1330,  .5550
    8,  .1682,  1.3258,  1.3258,  2,   9,  .1330,  .5550,  13,  .1330,  .5550
    9,  .1682,  1.3258,  1.3258,  2,  10,  .1330,  .4340,  14,  .1330,  .5550
   10,  .1038,  1.2179,   .6629,  1,  15,  .1020,  .5550,   0,  .0000,  .0000
   11,  .1038,  1.2179,   .6629,  2,  12,  .1330,  .4340,  16,  .1020,  .5550
   12,  .1682,  1.3258,  1.3258,  2,  13,  .1330,  .5550,  17,  .1330,  .5550
   13,  .1682,  1.3258,  1.3258,  2,  14,  .1330,  .5550,  18,  .1330,  .5550
   14,  .1682,  1.3258,  1.3258,  2,  15,  .1330,  .4340,  19,  .1330,  .5550
   15,  .1038,  1.2179,   .6629,  1,  20,  .1020,  .5550,   0,  .0000,  .0000
   16,  .1038,  1.2179,   .6629,  2,  17,  .1330,  .4340,  21,  .1020,  .4340
   17,  .1682,  1.3258,  1.3258,  2,  18,  .1330,  .5550,  22,  .1330,  .4340
   18,  .1682,  1.3258,  1.3258,  2,  19,  .1330,  .5550,  23,  .1330,  .4340
   19,  .1682,  1.3258,  1.3258,  2,  20,  .1330,  .4340,  24,  .1330,  .4340
   20,  .1038,  1.2179,   .6629,  1,  25,  .1020,  .4340,   0,  .0000,  .0000
   21,  .0630,   .9574,   .3314,  1,  22,  .1020,  .4340,   0,  .0000,  .0000
   22,  .1038,  1.2179,   .6629,  1,  23,  .1020,  .5550,   0,  .0000,  .0000
   23,  .1038,  1.2179,   .6629,  1,  24,  .1020,  .5550,   0,  .0000,  .0000
   24,  .1038,  1.2179,   .6629,  1,  25,  .1020,  .4340,   0,  .0000,  .0000
   25,  .0630,   .9574,   .3314,  0,   0,  .0000,  .0000,   0,  .0000,  .0000
** RODS.1:
   RODS,    0,    16,    0,    1,    0,    0,    0,    0,    0,    0,    0
** RODS.2:
   168.00,    0.0,    0,    0
** RODS.9:
    1,  1,   .9620,  1,   1,  .250,   2,  .250,   6,  .250,   7,  .250
    2,  1,   .9657,  1,   2,  .250,   3,  .250,   7,  .250,   8,  .250
    3,  1,   .9657,  1,   3,  .250,   4,  .250,   8,  .250,   9,  .250
    4,  1,   .9657,  1,   4,  .250,   5,  .250,   9,  .250,  10,  .250
    5,  1,   .9620,  1,   9,  .250,  10,  .250,  14,  .250,  15,  .250
    6,  1,   .9657,  1,  14,  .250,  15,  .250,  19,  .250,  20,  .250
    7,  1,   .9657,  1,  19,  .250,  20,  .250,  24,  .250,  25,  .250
    8,  1,   .9657,  1,  18,  .250,  19,  .250,  23,  .250,  24,  .250
    9,  1,   .9620,  1,  17,  .250,  18,  .250,  22,  .250,  23,  .250
   10,  1,   .9620,  1,  16,  .250,  17,  .250,  21,  .250,  22,  .250
   11,  1,   .9657,  1,  11,  .250,  12,  .250,  16,  .250,  17,  .250
   12,  1,   .9657,  1,   6,  .250,   7,  .250,  11,  .250,  12,  .250
   13,  1,  1.1067,  1,   7,  .250,   8,  .250,  12,  .250,  13,  .250
   14,  1,  1.1067,  1,   8,  .250 ,  9,  .250,  13,  .250,  14,  .250
   15,  1,  1.1067,  1,  13,  .250,  14,  .250,  18,  .250,  19,  .250
   16,  1,  1.1067,  1,  12,  .250,  13,  .250,  17,  .250,  18,  .250
   0
** RODS.68:
   1, DUMY, .4220, 0.0, 0
** OPER.1:
   OPER, 1, 2, 0, 2, 0, 42, 0, 0, 0
** OPER.2:
   -1.0, 0.0, 0.0, 0.0, 0
** OPER.3:
   0
** OPER.5
   1504.700,   565.800,   2.990,   .416,   0.0   *  1    1391
   1799.700,   572.625,   2.981,   .404,   0.0   *  2    1392
   1804.700,   580.116,   2.716,   .356,   0.0   *  3    1393
   1809.700,   575.878,   2.989,   .381,   0.0   *  4    1394
   2099.700,   606.522,   2.962,   .369,   0.0   *  5    1395
   2099.700,   582.724,   2.531,   .339,   0.0   *  6    1396
   2114.700,   552.150,   2.493,   .429,   0.0   *  7    1397
   2099.700,   587.614,   2.006,   .292,   0.0   *  8    1398
   2099.700,   548.575,   1.986,   .368,   0.0   *  9    1399
   2399.700,   607.174,   2.960,   .428,   0.0   * 10    1400
   2399.700,   600.654,   2.484,   .377,   0.0   * 12    1402
   2394.700,   557.675,   2.491,   .456,   0.0   * 13    1403
   2399.700,   549.875,   1.976,   .395,   0.0   * 14    1404
   2104.700,   559.300,   2.972,   .480,   0.0   * 15    1405
   1799.700,   516.400,   2.489,   .446,   0.0   * 16    1406
   1804.700,   525.500,   2.968,   .494,   0.0   * 17    1407
   2404.700,   469.662,   2.040,   .455,   0.0   * 18    1408
   2104.700,   486.536,   1.981,   .454,   0.0   * 19    1409
   1499.700,   493.026,   1.996,   .416,   0.0   * 20    1410
   1499.700,   494.324,   2.495,   .487,   0.0   * 21    1411
   2404.700,   497.893,   1.542,   .385,   0.0   * 22    1412
   2099.700,   486.861,   1.530,   .367,   0.0   * 23    1413
   2399.700,   435.618,   1.533,   .426,   0.0   * 24    1414
   2099.700,   430.442,   1.478,   .420,   0.0   * 25    1415
   2399.700,   384.182,   1.507,   .451,   0.0   * 26    1416
   2099.700,   382.564,   1.483,   .448,   0.0   * 27    1417
   1814.700,   382.888,   1.486,   .444,   0.0   * 28    1418
   1499.700,   373.810,   1.501,   .448,   0.0   * 29    1419
   1794.700,   418.149,   1.471,   .401,   0.0   * 30    1420
   1499.700,   440.795,   1.426,   .383,   0.0   * 31    1421
   1799.700,   460.251,   1.447,   .354,   0.0   * 32    1422
   1494.700,   496.920,   1.453,   .348,   0.0   * 33    1423
```

```
   2394.700,   552.475,   1.450,   .285,   0.0   * 34    1424
   2399.700,   546.625,   1.473,   .318,   0.0   * 35    1425
   2414.700,   440.148,   1.466,   .404,   0.0   * 36    1426
   2404.700,   548.575,   2.980,   .532,   0.0   * 37    1427
   2424.700,   494.324,   2.465,   .554,   0.0   * 38    1428
   2404.700,   496.596,   2.979,   .623,   0.0   * 39    1429
   2399.700,   438.530,   1.970,   .526,   0.0   * 40    1430
   2399.700,   448.245,   2.458,   .595,   0.0   * 41    1431
   2409.700,   461.549,   2.948,   .657,   0.0   * 42    1432
   2409.700,   413.297,   1.962,   .535,   0.0   * 43    1433
** OPER.12:
   0,  0,  0,  0,  0,  0
** MIXX.1:
   MIXX,  0,  0,  0
** MIXX.2:
   0.8,  0.038
** DRAG.1:
   DRAG,  1,  0,  1
** DRAG.2:
   0.186, -0.20, 0.0, 64.0, -1.0, 0.0
** DRAG.5:
   0.5,     .555
** GRID.1:
   GRID,  0,  2
** GRID.2:
   1.250,     .570,
** GRID.4:
   -1,   12
** GRID.6:
    12.0, 2, 25.0, 1, 38.0, 2, 51.0, 1, 64.0, 2, 77.0, 1, 90.0, 2,103.0, 1,
   116.0, 2,129.0, 1,142.0, 2,155.0, 1
   0
** CORR.1:
   CORR, 1, 1, 0
** CORR.2:
   EPRI, EPRI, EPRI, NONE
** CORR.3:
   0.2
** CORR.6:
   EPRI, THOM, THOM, CE-1, COND, G5.7
** CORR.7:
   0.0
** CORR.9:
   CE-1
** CORR.12:
   0.50747, 0
** CONT.1:
   CONT
** CONT.2:
   0.0, 0, 20, 20, 2, 2, 0, 0
** CONT.3:
   0.1, 0.0001, 0.001, 0, 0, 0, 0, 0.9
** CONT.6:
   1, 1, 0, 0, 1, 0, 1, 1, 0, 0, 1, 1, 0, 0
** CONT.7:
   4000.0, 0, 0, 0, 0, 0
** CONT.8:
   13
** CONT.11:
   13
** CONT.15:
   0, 0, 0, 0, 0
** END OF INPUT DATA:
   ENDD
   0
```

```
** CDC FILE NAME: HH157A
**
** VIPRE.1:
   1,    0,    0
** VIPRE.2:
   HH157
** GEOM.1:
   GEOM,     36,    36,    25,    0,    0,    0
** GEOM.2:
   96.00,     0.0,    0.5
** GEOM.4:
    1,  .0538,   .8637,   .2937,  2,   2,  .0980,  .3905,   7,  .0980,  .3905
    2,  .0864,  1.0835,   .5875,  2,   3,  .0980,  .4960,   8,  .1220,  .3905
    3,  .0864,  1.0835,   .5875,  2,   4,  .0980,  .4960,   9,  .1220,  .3905
    4,  .0864,  1.0835,   .5875,  2,   5,  .0980,  .4960,  10,  .1220,  .3905
    5,  .0864,  1.0835,   .5875,  2,   6,  .0980,  .3905,  11,  .1220,  .3905
    6,  .0538,   .8637,   .2937,  1,  12,  .0980,  .3905,   0,  .0000,  .0000
    7,  .0864,  1.0835,   .5875,  2,   8,  .1220,  .3905,  13,  .0980,  .4960
    8,  .1362,  1.1750,  1.1750,  2,   9,  .1220,  .4960,  14,  .1220,  .4960
    9,  .1362,  1.1750,  1.1750,  2,  10,  .1220,  .4960,  15,  .1220,  .4960
   10,  .1362,  1.1750,  1.1750,  2,  11,  .1220,  .4960,  16,  .1220,  .4960
   11,  .1362,  1.1750,  1.1750,  2,  12,  .1220,  .3905,  17,  .1220,  .4960
   12,  .0864,  1.0835,   .5875,  1,  18,  .0980,  .4960,   0,  .0000,  .0000
   13,  .0864,  1.0835,   .5875,  2,  14,  .1220,  .3905,  19,  .0980,  .4960
   14,  .1362,  1.1750,  1.1750,  2,  15,  .1220,  .4960,  20,  .1220,  .4960
   15,  .1362,  1.1750,  1.1750,  2,  16,  .1220,  .4960,  21,  .1220,  .4960
   16,  .1362,  1.1750,  1.1750,  2,  17,  .1220,  .4960,  22,  .1220,  .4960
   17,  .1362,  1.1750,  1.1750,  2,  18,  .1220,  .3905,  23,  .1220,  .4960
   18,  .0864,  1.0835,   .5875,  1,  24,  .0980,  .4960,   0,  .0000,  .0000
   19,  .0864,  1.0835,   .5875,  2,  20,  .1220,  .3905,  25,  .0980,  .4960
   20,  .1362,  1.1750,  1.1750,  2,  21,  .1220,  .4960,  26,  .1220,  .4960
   21,  .1362,  1.1750,  1.1750,  2,  22,  .1220,  .4960,  27,  .1220,  .4960
   22,  .1362,  1.1750,  1.1750,  2,  23,  .1220,  .4960,  28,  .1220,  .4960
   23,  .1362,  1.1750,  1.1750,  2,  24,  .1220,  .3905,  29,  .1220,  .4960
   24,  .0864,  1.0835,   .5875,  1,  30,  .0980,  .4960,   0,  .0000,  .0000
   25,  .0864,  1.0835,   .5875,  2,  26,  .1220,  .3905,  31,  .0980,  .3905
   26,  .1362,  1.1750,  1.1750,  2,  27,  .1220,  .4960,  32,  .1220,  .3905
   27,  .1362,  1.1750,  1.1750,  2,  28,  .1220,  .4960,  33,  .1220,  .3905
   28,  .1362,  1.1750,  1.1750,  2,  29,  .1220,  .4960,  34,  .1220,  .3905
   29,  .1362,  1.1750,  1.1750,  2,  30,  .1220,  .3905,  35,  .1220,  .3905
   30,  .0864,  1.0835,   .5875,  1,  36,  .0980,  .3905,   0,  .0000,  .0000
   31,  .0503,   .8637,   .2937,  1,  32,  .0980,  .3905,   0,  .0000,  .0000
   32,  .0864,  1.0835,   .5875,  1,  33,  .0980,  .4960,   0,  .0000,  .0000
   33,  .0864,  1.0835,   .5875,  1,  34,  .0980,  .4960,   0,  .0000,  .0000
   34,  .0864,  1.0835,   .5875,  1,  35,  .0980,  .4960,   0,  .0000,  .0000
   35,  .0864,  1.0835,   .5875,  1,  36,  .0980,  .3905,   0,  .0000,  .0000
   36,  .0538,   .8637,   .2937,  0,   0,  .0000,  .0000,   0,  .0000,  .0000
** RODS.1:
   RODS,    0,   25,   0,   1,   0,   0,   0,   0,   0,   0,
** RODS.2:
   96.00,    0.0,    0,   0
** RODS.9:
    1,  1,   .9407,  1,   1,  .250,   2,  .250,   7,  .250,   8,  .250
    2,  1,   .9407,  1,   2,  .250,   3,  .250,   8,  .250,   9,  .250
    3,  1,   .9407,  1,   3,  .250,   4,  .250,   9,  .250,  10,  .250
    4,  1,   .9407,  1,   4,  .250,   5,  .250,  10,  .250,  11,  .250
    5,  1,   .9407,  1,   5,  .250,   6,  .250,  11,  .250,  12,  .250
    6,  1,   .9407,  1,  11,  .250,  12,  .250,  17,  .250,  18,  .250
    7,  1,   .9407,  1,  17,  .250,  18,  .250,  23,  .250,  24,  .250
    8,  1,   .9407,  1,  23,  .250,  24,  .250,  29,  .250,  30,  .250
    9,  1,   .9407,  1,  29,  .250,  30,  .250,  35,  .250,  36,  .250
   10,  1,   .9407,  1,  28,  .250,  29,  .250,  34,  .250,  35,  .250
   11,  1,   .9407,  1,  27,  .250,  28,  .250,  33,  .250,  34,  .250
   12,  1,   .9454,  1,  26,  .250,  27,  .250,  32,  .250,  33,  .250
   13,  1,   .9407,  1,  25,  .250,  26,  .250,  31,  .250,  32,  .250
   14,  1,   .9407,  1,  19,  .250,  20,  .250,  25,  .250,  26,  .250
   15,  1,   .9360,  1,  13,  .250,  14,  .250,  19,  .250,  20,  .250
   16,  1,   .9407,  1,   7,  .250,   8,  .250,  13,  .250,  14,  .250
   17,  1,  1.1047,  1,   8,  .250,   9,  .250,  14,  .250,  15,  .250
   18,  1,  1.1112,  1,   9,  .250,  10,  .250,  15,  .250,  16,  .250
   19,  1,  1.1047,  1,  10,  .250,  11,  .250,  16,  .250,  17,  .250
   20,  1,  1.1047,  1,  16,  .250,  17,  .250,  22,  .250,  23,  .250
   21,  1,  1.1047,  1,  22,  .250,  23,  .250,  28,  .250,  29,  .250
   22,  1,  1.1047,  1,  21,  .250,  22,  .250,  27,  .250,  28,  .250
   23,  1,  1.1047,  1,  20,  .250,  21,  .250,  26,  .250,  27,  .250
   24,  1,  1.1047,  1,  14,  .250,  15,  .250,  20,  .250,  21,  .250
   25,  1,  1.1047,  1,  15,  .250,  16,  .250,  21,  .250,  22,  .250
   0
** RODS.68:
   1, DUMY,    .3740,    0.0,    0
** OPER.1:
   OPER, 1, 2, 0, 2, 0, 25, 0, 0, 0
** OPER.2:
   -1.0, 0.0, 0.0, 0.0
** OPER.3:
   0
** OPER.5:
   2099.700,    548.250,    1.983,    .507,    0.0    *  1    1559
   2124.700,    545.000,    2.500,    .575,    0.0    *  2    1560
   2114.700,    550.525,    3.003,    .627,    0.0    *  3    1561
   2114.700,    554.425,    3.439,    .688,    0.0    *  4    1562
   2424.700,    539.475,    1.998,    .523,    0.0    *  5    1563
   2399.700,    549.225,    2.485,    .597,    0.0    *  6    1564
   2414.700,    536.875,    3.002,    .740,    0.0    *  7    1565
   2404.700,    563.850,    3.443,    .730,    0.0    *  8    1566
   2399.700,    621.822,    1.958,    .375,    0.0    *  9    1567
   2399.700,    627.712,    2.410,    .429,    0.0    * 10    1568
   2404.700,    617.606,    2.916,    .515,    0.0    * 11    1569
   2414.700,    615.650,    3.441,    .595,    0.0    * 12    1570
```

```
  2099.700,   608.478,   2.037,   .370,   0.0   * 13   1571
  2099.700,   606.522,   2.464,   .426,   0.0   * 14   1572
  2104.700,   608.804,   2.961,   .468,   0.0   * 15   1573
  2104.700,   615.976,   3.418,   501,    0.0   * 16   1574
  2104.700,   463.172,   2.031,   .662,   0.0   * 17   1575
  2114.700,   481.020,   2.485,   .731,   0.0   * 18   1576
  2099.700,   515.750,   2.918,   .736,   0.0   * 19   1577
  2394.700,   468.039,   2.020,   .692,   0.0   * 20   1578
  2399.700,   498.867,   2.471,   .734,   0.0   * 21   1579
  2404.700,   534.275,   2.893,   .732,   0.0   * 22   1580
  2414.700,   531.025,   2.503,   .636,   0.0   * 23   1581
  2404.700,   622.170,   2.901,   .499,   0.0   * 24   1582
  2414.700,   466.742,   1.047,   .413,   0.0   * 25   1583
** OPER.12:
  0,  0,  0,  0,  0,  0
** MIXX.1:
  MIXX,  0,  0,  0
** MIXX.2:
  0.8,  0.038
** DRAG.1:
  DRAG,  1,  0,  1
** DRAG.2:
  0.186, -0.20, 0.0, 64.0, -1.0, 0.0
** DRAG.5:
  0.5,    .496
** GRID.1:
  GRID,  0,    2
** GRID.2:
  1.250,     .570
** GRID.4:
  -1,     7
** GRID.6:
  5.00, 1, 18.00, 2, 31.00, 1, 44.00, 2, 57.00, 1, 70.00, 2, 83.00, 1
  0
** CORR.1:
  CORR, 1, 1, 0
** CORR.2:
  EPRI, EPRI, EPRI, NONE
** CORR.3:
  0.2
** CORR.6:
  EPRI,THOM, THOM, CE-1, COND, G5.7
** CORR.7:
  0.0
** CORR.9:
  CE-1
** CORR.12:
  0.46366, 0
** CONT.1:
  CONT
** CONT.2:
  0.0, 0, 20, 20, 2, 2, 0, 0
** CONT.3:
  0.1, 0.0001, 0.001, 0, 0, 0, 0, 0.9
** CONT.6:
  1, 1, 0, 0, 1, 0, 1, 1, 0, 0, 1, 1, 0, 0
** CONT.7:
  4000.0, 0, 0, 0, 0, 0
** CONT.8:
  16
** CONT.11:
  16
** CONT.15:
  0, 0, 0, 0, 0
** END OF INPUT DATA:
  ENDD
  0
```

```
** CDC FILE NAME: HH157B
**
** VIPRE.1:
   1,    0,    0
** VIPRE.2:
   HH157
** GEOM.1:
   GEOM,    36,    36,    48,    0,    0,    0
** GEOM.2:
   96.00,    0.0,    0.5
** GEOM.4:
    1,  .0538,   .8637,   .2937,  2,   2,  .0980,  .3905,   7,  .0980,  .3905
    2,  .0864,  1.0835,   .5875,  2,   3,  .0980,  .4960,   8,  .1220,  .3905
    3,  .0864,  1.0835,   .5875,  2,   4,  .0980,  .4960,   9,  .1220,  .3905
    4,  .0864,  1.0835,   .5875,  2,   5,  .0960,  .4960,  10,  .1220,  .3905
    5,  .0864,  1.0835,   .5875,  2,   6,  .0980,  .3905,  11,  .1220,  .3905
    6,  .0538,   .8637,   .2937,  1,  12,  .0980,  .3905,   0,  .0000,  .0000
    7,  .0864,  1.0835,   .5875,  2,   8,  .1220,  .3905,  13,  .0980,  .4960
    8,  .1362,  1.1750,  1.1750,  2,   9,  .1220,  .4960,  14,  .1220,  .4960
    9,  .1362,  1.1750,  1.1750,  2,  10,  .1220,  .4960,  15,  .1220,  .4960
   10,  .1362,  1.1750,  1.1750,  2,  11,  .1220,  .4960,  16,  .1220,  .4960
   11,  .1362,  1.1750,  1.1750,  2,  12,  .1220,  .3905,  17,  .1220,  .4960
   12,  .0864,  1.0835,   .5875,  1,  18,  .0980,  .4960,   0,  .0000,  .0000
   13,  .0864,  1.0835,   .5875,  2,  14,  .1220,  .3905,  19,  .0980,  .4960
   14,  .1362,  1.1750,  1.1750,  2,  15,  .1220,  .4960,  20,  .1220,  .4960
   15,  .1362,  1.1750,  1.1750,  2,  16,  .1220,  .4960,  21,  .1220,  .4960
   16,  .1362,  1.1750,  1.1750,  2,  17,  .1220,  .4960,  22,  .1220,  .4960
   17,  .1362,  1.1750,  1.1750,  2,  18,  .1220,  .3905,  23,  .1220,  .4960
   18,  .0864,  1.0835,   .5875,  1,  24,  .0980,  .4960,   0,  .0000,  .0000
   19,  .0864,  1.0835,   .5875,  2,  20,  .1220,  .3905,  25,  .0980,  .4960
   20,  .1362,  1.1750,  1.1750,  2,  21,  .1220,  .4960,  26,  .1220,  .4960
   21,  .1362,  1.1750,  1.1750,  2,  22,  .1220,  .4960,  27,  .1220,  .4960
   22,  .1362,  1.1750,  1.1750,  2,  23,  .1220,  .4960,  28,  .1220,  .4960
   23,  .1362,  1.1750,  1.1750,  2,  24,  .1220,  .3905,  29,  .1220,  .4960
   24,  .0864,  1.0835,   .5875,  1,  30,  .0980,  .4960,   0,  .0000,  .0000
   25,  .0864,  1.0835,   .5875,  2,  26,  .1220,  .3905,  31,  .0980,  .3905
   26,  .1362,  1.1750,  1.1750,  2,  27,  .1220,  .4960,  32,  .1220,  .3905
   27,  .1362,  1.1750,  1.1750,  2,  28,  .1220,  .4960,  33,  .1220,  .3905
   28,  .1362,  1.1750,  1.1750,  2,  29,  .1220,  .4960,  34,  .1220,  .3905
   29,  .1362,  1.1750,  1.1750,  2,  30,  .1220,  .3905,  35,  .1220,  .3905
   30,  .0864,  1.0835,   .5875,  1,  36,  .0980,  .3905,   0,  .0000,  .0000
   31,  .0583,   .8637,   .2937,  1,  32,  .0980,  .3905,   0,  .0000,  .0000
   32,  .0864,  1.0835,   .5875,  1,  33,  .0980,  .4960,   0,  .0000,  .0000
   33,  .0864,  1.0835,   .5875,  1,  34,  .0980,  .4960,   0,  .0000,  .0000
   34,  .0864,  1.0835,   .5875,  1,  35,  .0980,  .4960,   0,  .0000,  .0000
   35,  .0864,  1.0835,   .5875,  1,  36,  .0980,  .3905,   0,  .0000,  .0000
   36,  .0538,   .8637,   .2937,  0,   0,  .0000,  .0000,   0,  .0000,  .0000
** RODS.1:
   RODS,    0,   25,   0,   1,   0,   0,   0,   0,   0,   0,
** RODS.2:
   96.00,    0.0,    0,    0
** RODS.9:
    1,  1,   .9407,  1,   1,  .250,   2,  .250,   7,  .250,   8,  .250
    2,  1,   .9407,  1,   2,  .250,   3,  .250,   8,  .250,   9,  .250
    3,  1,   .9407,  1,   3,  .250,   4,  .250,   9,  .250,  10,  .250
    4,  1,   .9407,  1,   4,  .250,   5,  .250,  10,  .250,  11,  .250
    5,  1,   .9407,  1,   5,  .250,   6,  .250,  11,  .250,  12,  .250
    6,  1,   .9407,  1,  11,  .250,  12,  .250,  17,  .250,  18,  .250
    7,  1,   .9407,  1,  17,  .250,  18,  .250,  23,  .250,  24,  .250
    8,  1,   .9407,  1,  23,  .250,  24,  .250,  29,  .250,  30,  .250
    9,  1,   .9407,  1,  29,  .250,  30,  .250,  35,  .250,  36,  .250
   10,  1,   .9407,  1,  28,  .250,  29,  .250,  34,  .250,  35,  .250
   11,  1,   .9407,  1,  27,  .250,  28,  .250,  33,  .250,  34,  .250
   12,  1,   .9454,  1,  26,  .250,  27,  .250,  32,  .250,  33,  .250
   13,  1,   .9407,  1,  25,  .250,  26,  .250,  31,  .250,  32,  .250
   14,  1,   .9407,  1,  19,  .250,  20,  .250,  25,  .250,  26,  .250
   15,  1,   .9360,  1,  13,  .250,  14,  .250,  19,  .250,  20,  .250
   16,  1,   .9407,  1,   7,  .250,   8,  .250,  13,  .250,  14,  .250
   17,  1,  1.1047,  1,   8,  .250,   9,  .250,  14,  .250,  15,  .250
   18,  1,  1.1112,  1,   9,  .250,  10,  .250,  15,  .250,  16,  .250
   19,  1,  1.1047,  1,  10,  .250,  11,  .250,  16,  .250,  17,  .250
   20,  1,  1.1047,  1,  16,  .250,  17,  .250,  22,  .250,  23,  .250
   21,  1,  1.1047,  1,  22,  .250,  23,  .250,  28,  .250,  29,  .250
   22,  1,  1.1047,  1,  21,  .250,  22,  .250,  27,  .250,  28,  .250
   23,  1,  1.1047,  1,  20,  .250,  21,  .250,  26,  .250,  27,  .250
   24,  1,  1.1047,  1,  14,  .250,  15,  .250,  20,  .250,  21,  .250
   25,  1,  1.1047,  1,  15,  .250,  16,  .250,  21,  .250,  22,  .250
   0
** RODS.68:
   1, DUMY,    .3740,    0.0,    0
** OPER.1:
   OPER, 1, 2, 0, 2, 0, 52, 0, 0, 0
** OPER.2:
   -1.0, 0.0, 0.0, 0.0
** OPER.3:
   0
** OPER.5:
   2404.700,   465.443,   1.550,   .568,   0.0    * 26    1584
   2104.700,   619.562,   3.408,   .486,   0.0    * 27    1585
   2104.700,   548.900,   3.480,   .718,   0.0    * 28    1586
   2114.700,   544.675,   1.033,   .328,   0.0    * 29    1587
   2104.700,   533.300,   1.561,   .45[illegible],   0.0    * 30    1588
   2099.700,   465.768,   1.046,   .413,   0.0    * 31    1589
   2104.700,   467.066,   1.512,   .555,   0.0    * 32    1590
   2404.700,   558.325,    .974,   .307,   0.0    * 33    1591
   2404.700,   558.325,   1.490,   .428,   0.0    * 34    1592
   1504.700,   455.709,   2.032,   .615,   0.0    * 35    1593
   1504.700,   458.629,   2.482,   [illegible],   0.0    * 36    1594
   1814.700,   467.715,   1.998,   [illegible]18,   0.0    * 37    1595
```

```
    1814.700,    472.907,    2.498,    .662,    0.0    * 38    1596
    1814.700,    517.700,    1.988,    .523,    0.0    * 39    1597
    1799.700,    516.725,    2.514,    .625,    0.0    * 40    1598
    1804.700,    517.050,    2.992,    .705,    0.0    * 41    1599
    1499.700,    513.150,    2.015,    .546,    0.0    * 42    1600
    1514.700,    516.725,    2.501,    .588,    0.0    * 43    1601
    1499.700,    515.425,    2.989,    .628,    0.0    * 44    1602
    1514.700,    514.775,    3.492,    .697,    0.0    * 45    1603
    1504.700,    576.204,    2.017,    .434,    0.0    * 46    1604
    1504.700,    566.775,    2.481,    .463,    0.0    * 47    1605
    1504.700,    564.500,    3.010,    .523,    0.0    * 48    1606
    1799.700,    539.475,    3.446,    .702,    0.0    * 50    1608
    1519.700,    582.724,    3.443,    .506,    0.0    * 51    1609
    1794.700,    570.025,    1.531,    .377,    0.0    * 53    1611
    1804.700,    549.875,    2.073,    .471,    0.0    * 54    1612
    1806.700,    563.850,    2.515,    .503,    0.0    * 55    1613
    1814.700,    574.575,    2.963,    .562,    0.0    * 56    1614
    1804.700,    561.900,    3.514,    .608,    0.0    * 57    1615
    1804.700,    517.050,    1.067,    .382,    0.0    * 58    1616
    1799.700,    516.075,    1.517,    .468,    0.0    * 59    1617
    1494.700,    495.297,    1.036,    .416,    0.0    * 60    1618
    1504.700,    513.000,    1.462,    .4[illegible],    0.0    * 61    1619
    1789.700,    393.563,    1.035,    .445,    0.0    * 62    1620
    1494.700,    453.762,    1.989,    .617,    0.0    * 63    1621
    1804.700,    417.503,    1.507,    .605,    0.0    * 64    1622
    1799.700,    427.854,    1.957,    .679,    0.0    * 65    1623
    1509.700,    387.7[illegible],    1.051,    .518,    0.0    * 66    1624
    1[illegible].700,    402.[illegible],    1.526,    .623,    0.0    * 67    1625
    1[illegible].700,    410.[illegible],    1.987,    .719,    0.0    * 68    1626
    1494.700,    575.[illegible],    2.468,    .439,    0.0    * 69    1627
    1804.700,    470.[illegible],    2.472,    .72[illegible],    [illegible]    * 70    1628
    1509.700,    453.112,    1.002,    .43[illegible],    [illegible]    * 71    1629
    1499.700,    457.655,    1.538,    .55[illegible],    [illegible]    * 72    1630
    1804.700,    455.708,    1.518,    .548,    [illegible].0    * 73    1631
    1804.700,    466.417,    1.003,    .404,    [illegible].0    * 74    1632
    2104.700,    396.799,    1.057,    .498,    0.0    * 75    1633
    2424.700,    392.269,    1.049,    .518,    0.0    * 76    1634
    2404.700,    398.416,    1.505,    .653,    0.0    * 77    1635
    2[illegible]4.700,    400.680,    1.498,    .635,    0.0    * 78    1636
    2[illegible]9.700,    486.861,    2.016,    .[illegible],    0.0    * 79    1637
** OPER.12:
    0,  0,  0,  0,  0,  0
** MIXX.1:
    MIXX,  0,  0,  0
** MIXX.2:
    0.8,  0.038
** DRAG.1:
    DRAG,  1,  0,  1
** DRAG.2:
    0.186, -0.20, 0.0, 64.0, -1.0, 0.0
** DRAG.5:
    0.5,     .496
** GRID.1:
    GRID,  0,    2
** GRID.2:
    1.250,     .570
** GRID.4:
    -1,     7
** GRID.6:
    5.00, 1, 18.00, 2, 31.00, 1, 44.00, 2, 57.00, 1, 70.00, 2, 83.00, 1
    0
** CORR.1:
    CORR, 1, 1, 0
** CORR.2:
    EPRI, EPRI, EPRI, NONE
** CORR.3:
    0.2
** CORR.6:
    EPRI,THOM, THOM, CE-1, COND, G5.7
** CORR.7:
    0.0
** CORR.9:
    CE-1
** CORR.12:
    0.46366, 0
** CONT.1:
    CONT
** CONT.2:
    0.0, 0, 20, 20, 2, 2, 0, 0
** CONT.3:
    0.1, 0.0001, 0.001, 0, 0, 0, 0, 0.9
** CONT.6:
    1, 1, 0, 0, 1, 0, 1, 1, 0, 0, 1, 1, 0, 0
** CONT.7:
    4000.0, 0, 0, 0, 0, 0
** CONT.8:
    16
** CONT.11:
    16
** CONT.15:
    0, 0, 0, 0, 0
** END OF INPUT DATA:
    ENDD
    0
```

```
** CDC FILE NAME: HH158
**
** VIPRE.1:
   1,    0,    0
** VIPRE.2:
   HH158
** GEOM.1:
   GEOM,   36,   36,   48,   0,   0,   0
** GEOM.2:
   96.00,   0.0,   0.5
** GEOM.4:
    1,  .0538,   .8637,   .2937, 2,  2, .0980, .3905,  7, .0980, .3905
    2,  .0864,  1.0835,   .5875, 2,  3, .0980, .4960,  8, .1220, .3905
    3,  .0864,  1.0835,   .5875, 2,  4, .0980, .4960,  9, .1220, .3905
    4,  .0864,  1.0835,   .5875, 2,  5, .0980, .4960, 10, .1220, .3905
    5,  .0864,  1.0835,   .5875, 2,  6, .0980, .3905, 11, .1220, .3905
    6,  .0538,   .8637,   .2937, 1, 12, .0980, .3905,  0, .0000, .0000
    7,  .0864,  1.0835,   .5875, 2,  8, .1220, .3905, 13,  0980, .4960
    8,  .1362,  1.1750,  1.1750, 2,  9, .1220, .4960, 14, .1220, .4960
    9,  .1362,  1.1750,  1.1750, 2, 10, .1220, .4960, 15, .1220, .4960
   10,  .1362,  1.1750,  1.1750, 2, 11, .1220, .4960, 16, .1220, .4960
   11,  .1362,  1.1750,  1.1750, 2, 12, .1220, .3905, 17, .1220, .4960
   12,  .0864,  1.0835,   .5875, 1, 18, .0980, .4960,  0, .0000, .0000
   13,  .0864,  1.0835,   .5875, 2, 14, .1220, .3905, 19, .0980, .4960
   14,  .1362,  1.1750,  1.1750, 2, 15, .1220, .4960, 20, .1220, .4960
   15,  .1180,  1.2598,   .8812, 2, 16, .0680, .4960, 21, .0680, .4960
   16,  .1180,  1.2598,   .8812, 2, 17, .1220, .4960, 22, .0680, .4960
   17,  .1362,  1.1750,  1.1750, 2, 18, .1220, .3905, 23, .1220, .4960
   18,  .0864,  1.0835,   .5875, 1, 24, .0980, .4960,  0, .0000, .0000
   19,  .0864,  1.0835,   .5875, 2, 20, .1220, .3905, 25, .0980, .4960
   20,  .1362,  1.1750,  1.1750, 2, 21, .1220, .4960, 26, .1220, .4960
   21,  .1180,  1.2598,   .8812, 2, 22, .0680, .4960, 27, .1220, .4960
   22,  .1180,  1.2598,   .8812, 2, 23, .1220, .4960, 28, .1220, .4960
   23,  .1362,  1.1750,  1.1750, 2, 24, .1220, .3905, 29, .1220, .4960
   24,  .0864,  1.0835,   .5875, 1, 30, .0980, .4960,  0, .0000, .0000
   25,  .0864,  1.0835,   .5875, 2, 26, .1220, .3905, 31, .0980, .3905
   26,  .1362,  1.1750,  1.1750, 2, 27, .1220, .4960, 32, .1220, .3905
   27,  .1362,  1.1750,  1.1750, 2, 28, .1220, .4968, 33, .1220, .3905
   28,  .1362,  1.1750,  1.1750, 2, 29, .1220, .4960, 34, .1220, .3905
   29,  .1362,  1.1750,  1.1750, 2, 30, .1220, .3905, 35, .1220, .3905
   30,  .0864,  1.0835,   .5875, 1, 36, .0980, .3905,  0, .0000, .0000
   31,  .0538,   .8637,   .2937, 1, 32, .0980, .3905,  0, .0000, .0000
   32,  .0864,  1.0835,   .5875, 1, 33, .0980, .4960,  0, .0000, .0000
   33,  .0864,  1.0835,   .5875, 1, 34, .0980, .4960,  0, .0000, .0000
   34,  .0864,  1.0835,   .5875, 1, 35, .0980, .4960,  0, .0000, .0000
   35,  .0864,  1.0835,   .5875, 1, 36, .0980, .3905,  0, .0000, .0000
   36,  .0538,   .8637,   .2937, 0,  0, .0000, .0000,  0, .0000, .0000
** RODS.1:
   RODS,    0,   24,   0,   1,   0,   0,   0,   0,   0,   0,   0
** RODS.2:
   96.00,    0.0,    0,    0
** RODS.9:
    1, 1,  .9448, 1,  1, .250,  2, .250,  7, .250,  8, .250
    2, 1,  .9448, 1,  2, .250,  3, .250,  8, .250,  9, .250
    3, 1,  .9448, 1,  3, .250,  4, .250,  9, .250, 10, .250
    4, 1,  .9448, 1,  4, .250,  5, .250, 10, .250, 11, .250
    5, 1,  .9448, 1,  5, .250,  6, .250, 11, .250, 12, .250
    6, 1,  .9448, 1, 11, .250, 12, .250, 17, .250, 18, .250
    7, 1,  .9448, 1, 17, .250, 18, .250, 23, .250, 24, .250
    8, 1,  .9448, 1, 23, .250, 24, .250, 29, .250, 30, .250
    9, 1,  .9448, 1, 29, .250, 30, .250, 35, .250, 36, .250
   10, 1,  .9448, 1, 28, .250, 29, .250, 34, .250, 35, .250
   11, 1,  .9448, 1, 27, .250, 28, .250, 33, .250, 34, .250
   12, 1,  .9448, 1, 26, .250, 27, .250, 32, .250, 33, .250
   13, 1,  .9448, 1, 25, .250, 26, .250, 31, .250, 32, .250
   14, 1,  .9448, 1, 19, .250, 20, .250, 25, .250, 26, .250
   15, 1,  .9448, 1, 13, .250, 14, .250, 19, .250, 20, .250
   16, 1,  .9448, 1,  7, .250,  8, .250, 13, .250, 14, .250
   17, 1, 1.1096, 1,  8, .250,  9, .250, 14, .250, 15, .250
   18, 1, 1.1161, 1,  9, .250, 10, .250, 15, .250, 16, .250
   19, 1, 1.1096, 1, 10, .250, 11, .250, 16, .250, 17, .250
   20, 1, 1.1096, 1, 16, .250, 17, .250, 22, .250, 23, .250
   21, 1, 1.1096, 1, 22, .250, 23, .250, 28, .250, 29, .250
   22, 1, 1.1096, 1, 21, .250, 22, .250, 27, .250, 28, .250
   23, 1, 1.1096, 1, 20, .250, 21, .250, 26, .250, 27, .250
   24, 1, 1.1096, 1, 14, .250, 15, .250, 20, .250, 21, .250
   0
** RODS.68:
    1, DUMY,    .3740,    0.0,    0
** OPER.1:
   OPER, 1, 2, 0, 2, 0, 66, 0, 0, 0
** OPER.2:
   -1.0, 0.0, 0.0, 0.0
** OPER.3:
   0
** OPER.5:
   2099.700,   555.075,   2.035,   .517,   0.0   *  1    1638
   2104.700,   554.750,   2.503,   .571,   0.0   *  2    1639
   2099.700,   556.375,   3.007,   .647,   0.0   *  3    1640
   2104.700,   556.375,   3.496,   .738,   0.0   *  4    1641
   2394.700,   552.150,   2.048,   .558,   0.0   *  5    1642
   2424.700,   547.600,   2.524,   .643,   0.0   *  6    1643
   2394.700,   558.000,   2.996,   .695,   0.0   *  7    1644
   2434.700,   562.875,   3.446,   .767,   0.0   *  8    1645
   2414.700,   610.434,   2.033,   .424,   0.0   *  9    1646
   2399.700,   611.738,   2.498,   .444,   0.0   * 10    1647
   2404.700,   613.694,   2.971,   .519,   0.0   * 11    1648
   2409.700,   606.522,   3.507,   .595,   0.0   * 12    1649
   2114.700,   618.910,   1.973,   .344,   0.0   * 13    1650
```

```
 2109.700,   615.976,   2.475,   .401,   0.0   * 14    1651
 2104.700,   617.280,   2.944,   .467,   0.0   * 15    1652
 2099.700,   617.606,   3.466,   .484,   0.0   * 16    1653
 2114.700,   521.600,   2.994,   .758,   0.0   * 17    1654
 2399.700,   532.975,   2.979,   .756,   0.0   * 18    1655
 2099.700,   483.960,   2.022,   .667,   0.0   * 19    1656
 2099.700,   490.106,   2.500,   .737,   0.0   * 20    1657
 2399.700,   490.430,   2.032,   .651,   0.0   * 21    1658
 2399.700,   490.106,   2.518,   .764,   0.0   * 22    1659
 2314.700,   484.914,   1.508,   .540,   0.0   * 23    1660
 2399.700,   484.914,   1.051,   .425,   0.0   * 24    1661
 2094.700,   484.264,   1.010,   .379,   0.0   * 25    1662
 2099.700,   433.354,   1.010,   .435,   0.0   * 26    1663
 2104.700,   419.120,   1.515,   .626,   0.0   * 27    1664
 2099.700,   432.384,   2.039,   .745,   0.0   * 28    1665
 2099.700,   484.914,   1.523,   .547,   0.0   * 29    1666
 2114.700,   544.025,   1.514,   .445,   0.0   * 30    1667
 2394.700,   552.150,   1.523,   .452,   0.0   * 31    1668
 1799.700,   572.300,   1.504,   .352,   0.0   * 32    1669
 1814.700,   576.530,   2.002,   .418,   0.0   * 33    1670
 1799.700,   572.625,   2.506,   .473,   0.0   * 34    1671
 1799.700,   572.300,   3.010,   .536,   0.0   * 35    1672
 2099.700,   556.375,   2.998,   .655,   0.0   * 36    1673
 1824.700,   570.025,   3.486,   .651,   0.0   * 37    1674
 1499.700,   563.525,   1.558,   .380,   0.0   * 38    1675
 1514.700,   567.750,   2.040,   .417,   0.0   * 39    1676
 1499.700,   573.275,   2.513,   .492,   0.0   * 40    1677
 1514.700,   569.375,   3.014,   .489,   0.0   * 41    1673
 1504.700,   573.600,   3.469,   .510,   0.0   * 42    1679
 1799.700,   514.450,   1.556,   .485,   0.0   * 43    1680
 1799.700,   517.050,   1.989,   .559,   0.0   * 44    1681
 1814.700,   514.125,   2.505,   .648,   0.0   * 45    1682
 1814.700,   513.150,   3.017,   .726,   0.0   * 46    1683
 1799.700,   534.600,   3.534,   .738,   0.0   * 47    1684
 1499.700,   510.550,   1.513,   .471,   0.0   * 48    1685
 1504.700,   508.927,   2.021,   .544,   0.0   * 49    1686
 1504.700,   507.953,   2.520,   .612,   0.0   * 50    1687
 1504.700,   512.500,   3.011,   .682,   0.0   * 51    1688
 1509.700,   509.576,   3.515,   .712,   0.0   * 52    1689
 1804.700,   446.947,   1.537,   .579,   0.0   * 53    1690
 1799.700,   454.086,   2.023,   .703,   0.0   * 54    1691
 1804.700,   457.655,   2.497,   .780,   0.0   * 55    1692
 1499.700,   453.437,   2.002,   .675,   0.0   * 57    1694
 1494.700,   461.874,   2.505,   .737,   0.0   * 58    1695
 2404.700,   427.208,   1.547,   .634,   0.0   * 60    1697
 1499.700,   467.391,   1.012,   .422,   0.0   * 61    1698
 1809.700,   453.762,   1.023,   .412,   0.0   * 62    1699
 1794.700,   390.328,   1.028,   .481,   0.0   * 63    1700
 1804.700,   399.386,   1.511,   .641,   0.0   * 64    1701
 1504.700,   374.459,   1.029,   .519,   0.0   * 65    1702
 1504.700,   394.534,   1.523,   .639,   0.0   * 66    1703
 1504.700,   403.915,   2.041,   .769,   0.0   * 67    1704
 1814.700,   397.445,   2.009,   .724,   0.0   * 68    1705
** OPER.12:
   0,  0,  0,  0,  0,  0
** MIXX.1:
   MIXX,  0,  0,  0
** MIXX.2:
   0.8,  0.038
** DRAG.1:
   DRAG,  1,  0,  1
** DRAG.2:
   0.186, -0.20, 0.0, 64.0, -1.0, 0.0
** DRAG.5:
   0.5,    .496
** GRID.1:
   GRID,  0,  2
** GRID.2:
   1.250,    .570
** GRID.4:
   -1,    7
** GRID.6:
   5.00, 1, 18.00, 2, 31.00, 1, 44.00, 2, 57.00, 1, 70.00, 2, 83.00, 1
   0
** CORR.1:
   CORR, 1, 1, 0
** CORR.2:
   EPRI, EPRI, EPRI, NONE
** CORR.3:
   0.2
** CORR.6:
   EPRI, THOM, THOM, CE-1, COND, G5.7
** CORR.7:
   0.0
** CORR.9:
   CE-1
** CORR.12:
   0.37466, 0
** CONT.1:
   CONT
** CONT.2:
   0.0, 0, 20, 20, 2, 2, 0, 0
** CONT.3:
   0.1, 0.0001, 0.001, 0, 0, 0, 0, 0.9
** CONT.6:
   1, 1, 0, 0, 1, 0, 1, 1, 0, 0, 1, 1, 0, 0
** CONT.7:
   4000.0, 0, 0, 0, 0, 0
** CONT.8:
```

```
   16
** CONT.11:
   16
** CONT.15:
   C, D, D, U, 0
** END OF INPUT DATA:
   ENDD
   0
```

```
   2114.700,    609.800,    1.961,    .378,    0.0    * 13     1732
   2104.700,    482.200,    1.495,    .558,    0.0    * 14     1733
   2099.700,    473.500,    2.005,    .683,    0.0    * 15     1734
   2099.700,    475.800,    2.505,    .799,    0.0    * 16     1735
   2104.700,    483.400,    2.978,    .899,    0.0    * 17     1736
   2414.700,    469.300,    1.502,    .585,    0.0    * 18     1737
   2404.700,    465.300,    2.015,    .720,    0.0    * 19     1738
   2414.700,    470.300,    2.526,    .837,    0.0    * 20     1739
   1814.700,    438.900,    1.510,    .595,    0.0    * 21     1740
   1814.700,    449.300,    2.003,    .700,    0.0    * 22     1741
   1814.700,    452.900,    2.496,    .808,    0.0    * 23     1742
   1814.700,    466.470,    3.003,    .864,    0.0    * 24     1743
   1804.700,    409.300,    1.475,    .641,    0.0    * 25     1744
   1799.700,    424.400,    1.971,    .725,    0.0    * 26     1745
   2094.700,    405.200,    1.471,    .651,    0.0    * 27     1746
   2399.700,    410.400,    1.489,    .655,    0.0    * 28     1747
   1514.700,    443.900,    1.458,    .563,    0.0    * 29     1748
   1514.700,    450.300,    1.985,    .642,    0.0    * 30     1749
   1499.700,    453.900,    2.495,    .746,    0.0    * 31     1750
   1504.700,    453.200,    2.991,    .840,    0.0    * 32     1751
   1504.700,    513.300,    1.470,    .465,    0.0    * 33     1752
   1504.700,    515.900,    1.996,    .508,    0.0    * 34     1753
   1514.700,    508.500,    2.485,    .615,    0.0    * 35     1754
   1524.700,    511.900,    2.983,    .679,    0.0    * 36     1755
   1499.700,    567.900,    2.032,    .429,    0.0    * 37     1756
   1514.700,    567.300,    2.530,    .443,    0.0    * 38     1757
   1499.700,    561.800,    3.031,    .519,    0.0    * 39     1758
   2124.700,    605.500,    2.479,    .428,    0.0    * 40     1759
   2099.700,    604.200,    3.020,    .492,    0.0    * 41     1760
   2414.700,    599.900,    2.009,    .438,    0.0    * 42     1761
   2424.700,    604.800,    2.509,    .525,    0.0    * 43     1762
   2414.700,    604.900,    3.011,    .584,    0.0    * 44     1763
   2404.700,    609.400,    3.457,    .653,    0.0    * 45     1764
   2114.700,    608.600,    3.454,    .540,    0.0    * 46     1765
   1799.700,    567.200,    2.002,    .431,    0.0    * 48     1767
   1814.700,    567.200,    2.513,    .489,    0.0    * 49     1768
   1814.700,    560.500,    3.027,    .580,    0.0    * 50     1769
   1814.700,    568.500,    3.509,    .609,    0.0    * 51     1770
   1514.700,    563.200,    3.053,    .555,    0.0    * 52     1771
   2114.700,    563.500,    3.448,    .737,    0.0    * 53     1771
   2409.700,    547.200,    3.504,    .856,    0.0    * 54     1772
   2399.700,    543.300,    2.492,    .683,    0.0    * 55     1773
   1514.700,    512.600,    3.461,    .723,    0.0    * 56     1774
   1814.700,    510.900,    3.489,    .830,    0.0    * 57     1775
   1514.700,    411.500,    1.499,    .609,    0.0    * 58     1776
   1509.700,    407.800,    1.990,    .745,    0.0    * 59     1777
   1504.700,    385.400,    1.025,    .529,    0.0    * 60     1778
   1799.700,    386.000,    1.032,    .506,    0.0    * 61     1779
   2099.700,    390.300,    1.016,    .520,    0.0    * 62     1780
   2364.700,    397.300,    1.005,    .508,    0.0    * 63     1781
   2414.700,    463.400,    1.002,    .435,    0.0    * 64     1782
   2099.700,    460.300,     .998,    .430,    0.0    * 65     1783
   1784.700,    445.900,    1.001,    .445,    0.0    * 66     1784
   1500.700,    443.200,    1.086,    .464,    0.0    * 67     1785
** OPER.12:
   0,  0,  0,  0,  0,  0
** MIXX.1:
   MIXX,  0,  0,  0
** MIXX.2:
   0.8,  0.038
** DRAG.1:
   DRAG,  1,  0,  1
** DRAG.2:
   0.186, -0.20, 0.0, 64.0, -1.0, 0.0
** DRAG.5:
   0.5,   .496
** GRID.1:
   GRID,  0,  2
** GRID.2:
   1.250,     .570
** GRID.4:
   -1,     8
** GRID.6:
   9.0, 2, 20.0, 1, 31.0, 2, 42.0, 1, 53.0, 2, 64.0, 1, 75.0, 2, 86.0, 1
   0
** CORR.1:
   CORR, 1, 1, 0
** CORR.2:
   EPRI, EPRI, EPRI, NONE
** CORR.3:
   0.2
** CORR.6:
   EPRI, THOM, THOM, CE-1, COND, G5.7
** CORR.7:
   0.0
** CORR.9:
   CE-1
** CORR.12A:
   0.46366, 0
** CONT.1:
   CONT
** CONT.2:
   0.0, 0, 20, 20, 2, 2, 0, 0
** CONT.3:
   0.1, 0.0001, 0.001, 0, 0, 0, 0, 0.9
** CONT.6:
   1, 1, 0, 0, 1, 0, 1, 1, 0, 0, 1, 1, 0, 0
** CONT.7:
   4000.0, 0, 0, 0, 0, 0
```

```
** CDC FILE NAME: WH160
**
** VIPRE.1:
   1,    0,    0
** VIPRE.2:
   WH160
** GEOM.1:
   GEOM,   36,   36,   48,   0,   0,   0
** GEOM.2:
   96.00,    0.0,    0.5
** GEOM.4:
    1,  .0549,  0.8677,   .2937,  2,   2,  .1000,  .3915,   7,  .1000,  .3915
    2,  .0874,  1.0835,   .5875,  2,   3,  .1000,  .4960,   8,  .1220,  .3915
    3,  .0874,  1.0835,   .5875,  2,   4,  .1000,  .4960,   9,  .1220,  .3915
    4,  .0874,  1.0835,   .5875,  2,   5,  .1000,  .4960,  10,  .1220,  .3915
    5,  .0874,  1.0835,   .5875,  2,   6,  .1000,  .3915,  11,  .1220,  .3915
    6,  .0549,   .8677,   .2937,  1,  12,  .1000,  .3915,   0,  .0000,  .0000
    7,  .0874,  1.0835,   .5875,  2,   8,  .1220,  .3915,  13,  .1000,  .4960
    8,  .1362,  1.1750,  1.1750,  2,   9,  .1220,  .4960,  14,  .1220,  .4960
    9,  .1362,  1.1750,  1.1750,  2,  10,  .1220,  .4960,  15,  .1220,  .4960
   10,  .1362,  1.1750,  1.1750,  2,  11,  .1220,  .4960,  16,  .1220,  .4960
   11,  .1362,  1.1750,  1.1750,  2,  12,  .1220,  .3915,  17,  .1220,  .4960
   12,  .0874,  1.0835,   .5875,  1,  18,  .1000,  .4960,   0,  .0000,  .0000
   13,  .0874,  1.0835,   .5875,  2,  14,  .1220,  .3915,  19,  .1000,  .4960
   14,  .1362,  1.1750,  1.1750,  2,  15,  .1220,  .4960,  20,  .1220,  .4960
   15,  .1362,  1.1750,  1.1750,  2,  16,  .1220,  .4960,  21,  .1220,  .4960
   16,  .1362,  1.1750,  1.1750,  2,  17,  .1220,  .4960,  22,  .1220,  .4960
   17,  .1362,  1.1750,  1.1750,  2,  18,  .1220,  .3915,  23,  .1220,  .4960
   18,  .0874,  1.0835,   .5875,  1,  24,  .1000,  .4960,   0,  .0000,  .0000
   19,  .0874,  1.0835,   .5875,  2,  20,  .1220,  .3915,  25,  .1000,  .4960
   20,  .1362,  1.1750,  1.1750,  2,  21,  .1220,  .4960,  26,  .1220,  .4960
   21,  .1362,  1.1750,  1.1750,  2,  22,  .1220,  .4960,  27,  .1220,  .4960
   22,  .1362,  1.1750,  1.1750,  2,  23,  .1220,  .4960,  28,  .1220,  .4960
   23,  .1362,  1.1750,  1.1750,  2,  24,  .1220,  .3915,  29,  .1220,  .4960
   24,  .0874,  1.0835,   .5875,  1,  30,  .1000,  .4960,   0,  .0000,  .0000
   25,  .0874,  1.0835,   .5875,  2,  26,  .1220,  .3915,  31,  .1000,  .3915
   26,  .1362,  1.1750,  1.1750,  2,  27,  .1220,  .4960,  32,  .1220,  .3915
   27,  .1362,  1.1750,  1.1750,  2,  28,  .1220,  .4960,  33,  .1220,  .3915
   28,  .1362,  1.1750,  1.1750,  2,  29,  .1220,  .4960,  34,  .1220,  .3915
   29,  .1362,  1.1750,  1.1750,  2,  30,  .1220,  .3915,  35,  .1220,  .3915
   30,  .0874,  1.0835,   .5875,  1,  36,  .1000,  .3915,   0,  .0000,  .0000
   31,  .0549,   .8677,   .2937,  1,  32,  .1000,  .3915,   0,  .0000,  .0000
   32,  .0874,  1.0835,   .5875,  1,  33,  .1000,  .4960,   0,  .0000,  .0000
   33,  .0874,  1.0835,   .5875,  1,  34,  .1000,  .4960,   0,  .0000,  .0000
   34,  .0874,  1.0835,   .5875,  1,  35,  .1000,  .4960,   0,  .0000,  .0000
   35,  .0874,  1.0835,   .5875,  1,  36,  .1000,  .3915,   0,  .0000,  .0000
   36,  .0549,   .8677,   .2937,  0,   0,  .0000,  .0000,   0,  .0000,  .0000
** RODS.1:
   RODS,    0,    25,    0,    1,    0,    0,    0,    0,    0,    0,    0
** RODS.2:
   96.00,    0.0,    0,    0
** RODS.9:
    1,  1,   .9411,  1,   1,  .250,   2,  .250,   7,  .250,   8,  .250
    2,  1,   .9411,  1,   2,  .250,   3,  .250,   8,  .250,   9,  .250
    3,  1,   .9411,  1,   3,  .250,   4,  .250,   9,  .250,  10,  .250
    4,  1,   .9411,  1,   4,  .250,   5,  .250,  10,  .250,  11,  .250
    5,  1,   .9411,  1,   5,  .250,   6,  .250,  11,  .250,  12,  .250
    6,  1,   .9411,  1,  11,  .250,  12,  .250,  17,  .250,  18,  .250
    7,  1,   .9411,  1,  17,  .250,  18,  .250,  23,  .250,  24,  .250
    8,  1,   .9411,  1,  23,  .250,  24,  .250,  29,  .250,  30,  .250
    9,  1,   .9411,  1,  29,  .250,  30,  .250,  35,  .250,  36,  .250
   10,  1,   .9411,  1,  28,  .250,  29,  .250,  34,  .250,  35,  .250
   11,  1,   .9411,  1,  27,  .250,  28,  .250,  33,  .250,  34,  .250
   12,  1,   .9411,  1,  26,  .250,  27,  .250,  32,  .250,  33,  .250
   13,  1,   .9411,  1,  25,  .250,  26,  .250,  31,  .250,  32,  .250
   14,  1,   .9411,  1,  19,  .250,  20,  .250,  25,  .250,  26,  .250
   15,  1,   .9365,  1,  13,  .250,  14,  .250,  19,  .250,  20,  .250
   16,  1,   .9411,  1,   7,  .250,   8,  .250,  13,  .250,  14,  .250
   17,  1,  1.1052,  1,   8,  .250,   9,  .250,  14,  .250,  15,  .250
   18,  1,  1.1052,  1,   9,  .250,  10,  .250,  15,  .250,  16,  .250
   19,  1,  1.1052,  1,  10,  .250,  11,  .250,  16,  .250,  17,  .250
   20,  1,  1.1052,  1,  16,  .250,  17,  .250,  22,  .250,  23,  .250
   21,  1,  1.1052,  1,  22,  .250,  23,  .250,  28,  .250,  29,  .250
   22,  1,  1.1052,  1,  21,  .250,  22,  .250,  27,  .250,  28,  .250
   23,  1,  1.1052,  1,  20,  .250,  21,  .250,  26,  .250,  27,  .250
   24,  1,  1.1052,  1,  14,  .250,  15,  .250,  20,  .250,  21,  .250
   25,  1,  1.1052,  1,  15,  .250,  16,  .250,  21,  .250,  22,  .250
   0
** RODS.68:
   1,  DUMY,    .3740,    0.0,    0
** OPER.1:
   OPER, 1, 2, 0, 2, 0, 66, 0, 0, 0
** OPER.2:
   -1.0, 0.0, 0.0, 0.0
** OPER.3:
   0
** OPER.5:
   1799.700,    508.900,    1.466,    .468,    0.0    *  1     1720
   1799.700,    512.600,    2.011,    .554,    0.0    *  2     1721
   1799.700,    513.500,    2.490,    .637,    0.0    *  3     1722
   1799.700,    510.900,    2.995,    .733,    0.0    *  4     1723
   2414.700,    537.800,    1.422,    .456,    0.0    *  5     1724
   2399.700,    539.800,    2.511,    .622,    0.0    *  6     1725
   2399.700,    541.600,    2.508,    .675,    0.0    *  7     1726
   2414.700,    542.900,    2.984,    .772,    0.0    *  8     1727
   2114.700,    539.800,    1.469,    .436,    0.0    *  9     1728
   2114.700,    548.300,    2.005,    .534,    0.0    * 10     1729
   2099.700,    550.498,    2.498,    .603,    0.0    * 11     1730
   2104.700,    552.200,    2.982,    .684,    0.0    * 12     1731
```

```
*® CONT.8:
   ::
*® CONT.11:
   ::
*® CONT.15:
   0, 0, 0, 0, 0
*® END OF INPUT DATA:
   ENDD
   0
```

```
** CDC FILE NAME: HH161
**
** VIPRE.1:
   1,    0,    0
** VIPRE.2:
   HH161
** GEOM.1:
   GEOM,   36,   36,   56,   0,   0,   0
** GEOM.2:
   168.00,    0.0,    0.5
** GEOM.4:
    1, .0549,   .8677,   .2937, 2,  2, .1000, .3915,  7, .1000, .3915
    2, .0874, 1.0835,   .5875, 2,  3, .1000, .4960,  8, .1220, .3915
    3, .0874, 1.0835,   .5875, 2,  4, .1000, .4960,  9, .1220, .3915
    4, .0874, 1.0835,   .5875, 2,  5, .1000, .4960, 10, .1220, .3915
    5, .0874, 1.0835,   .5875, 2,  6, .1000, .3915, 11, .1220, .3915
    6, .0549,   .8677,   .2937, 1, 12, .1000, .3915,  0, .0000, .0000
    7, .0874, 1.0835,   .5875, 2,  8, .1220, .3915, 13, .1000, .4960
    8, .1362, 1.1750, 1.1750, 2,  9, .1220, .4960, 14, .1220, .4960
    9, .1362, 1.1750, 1.1750, 2, 10, .1220, .4960, 15, .1200, .4960
   10, .1362, 1.1750, 1.1750, 2, 11, .1220, .4960, 16, .1220, .4960
   11, .1362, 1.1750, 1.1750, 2, 12, .1220, .3915, 17, .1220, .4960
   12, .0874, 1.0835,   .5875, 1, 18, .1000, .4690,  0, .0000, .0000
   13, .0874, 1.0835,   .5875, 2, 14, .1220, .3915, 19, .1000, .4960
   14, .1362, 1.1750, 1.1750, 2, 15, .1220, .4960, 20, .1220, .4960
   15, .1362, 1.1750, 1.1750, 2, 16, .1220, .4960, 21, .1220, .4960
   16, .1362, 1.1750, 1.1750, 2, 17, .1220, .4960, 22, .1220, .4960
   17, .1362, 1.1750, 1.1750, 2, 18, .1220, .3915, 23, .1220, .4960
   18, .0874, 1.0835,   .5875, 1, 24, .1000, .4960,  0, .0000, .0000
   19, .0874, 1.0835,   .5875, 2, 20, .1220, .3915, 25, .1000, .4960
   20, .1362, 1.1750, 1.1750, 2, 21, .1220, .4960, 26, .1220, .4960
   21, .1362, 1.1750, 1.1750, 2, 22, .1220, .4960, 27, .1220, .4960
   22, .1362, 1.1750, 1.1750, 2, 23, .1220, .4960, 28, .1220, .4960
   23, .1362, 1.1750, 1.1750, 2, 24, .1220, .3915, 29, .1220, .4960
   24, .0874, 1.0835,   .5875, 1, 30, .1000, .4960,  0, .0000, .0000
   25, .0874, 1.0835,   .5875, 2, 26, .1220, .3915, 31, .1000, .3915
   26, .1362, 1.1750, 1.1750, 2, 27, .1220, .4960, 32, .1220, .3915
   27, .1362, 1.1750, 1.1750, 2, 28, .1220, .4960, 33, .1220, .3915
   28, .1362, 1.1750, 1.1750, 2, 29, .1220, .4960, 34, .1220, .3915
   29, .1362, 1.1750, 1.1750, 2, 30, .1220, .3915, 35, .1220, .3915
   30, .0874, 1.0835,   .5875, 1, 36, .1000, .3915,  0, .0000, .0000
   31, .0549,   .8677,   .2937, 1, 32, .1000, .3915,  0, .0000, .0000
   32, .0874, 1.0835,   .5875, 1, 33, .1000, .4960,  0, .0000, .0000
   33, .0874, 1.0835,   .5875, 1, 34, .1000, .4960,  0, .0000, .0000
   34, .0874, 1.0835,   .5875, 1, 35, .1000, .4960,  0, .0000, .0000
   35, .0874, 1.0835,   .5875, 1, 36, .1000, .3915,  0, .0000, .0000
   36, .0549,   .8677,   .2937, 0,  0, .0000, .0000,  0, .0000, .0000
** RODS.1:
   RODS,   0,   25,   0,   1,   0,   0,   0,   0,   0,   0,   0
** RODS.2:
   168.00,    0.0,    0,    0
** RODS.9:
    1, 1,   .9437, 0,  1, .250,  2, .250,  7, .250,  8, .250
    2, 1,   .9290, 0,  2, .250,  3, .250,  8, .250,  9, .250
    3, 1,   .9407, 0,  3, .250,  4, .250,  9, .250, 10, .250
    4, 1,   .9407, 0,  4, .250,  5, .250, 10, .250, 11, .250
    5, 1,   .9407, 0,  5, .250,  6, .250, 11, .250, 12, .250
    6, 1,   .9407, 0, 11, .250, 12, .250, 17, .250, 18, .250
    7, 1,   .9467, 0, 17, .250, 18, .250, 23, .250, 24, .250
    8, 1,   .9467, 0, 23, .250, 24, .250, 29, .250, 30, .250
    9, 1,   .9407, 0, 29, .250, 30, .250, 35, .250, 36, .250
   10, 1,   .9407, 0, 28, .250, 29, .250, 34, .250, 35, .250
   11, 1,   .9407, 0, 27, .250, 28, .250, 33, .250, 34, .250
   12, 1,   .9407, 0, 26, .250, 27, .250, 32, .250, 33, .250
   13, 1,   .9348, 0, 25, .250, 26, .250, 31, .250, 32, .250
   14, 1,   .9378, 0, 19, .250, 20, .250, 25, .250, 26, .250
   15, 1,   .9407, 0, 13, .250, 14, .250, 19, .250, 20, .250
   16, 1,   .9407, 0,  7, .250,  8, .250, 13, .250, 14, .250
   17, 1, 1.1092, 0,  8, .250,  9, .250, 14, .250, 15, .250
   18, 1, 1.1051, 0,  9, .250, 10, .250, 15, .250, 16, .250
   19, 1, 1.1010, 0, 10, .250, 11, .250, 16, .250, 17, .250
   20, 1, 1.1092, 0, 16, .250, 17, .250, 22, .250, 23, .250
   21, 1, 1.1051, 0, 22, .250, 23, .250, 28, .250, 29, .250
   22, 1, 1.1051, 0, 21, .250, 22, .250, 27, .250, 28, .250
   23, 1, 1.1051, 0, 20, .250, 21, .250, 26, .250, 27, .250
   24, 1, 1.1051, 0, 14, .250, 15, .250, 20, .250, 21, .250
   25, 1, 1.1092, 0, 15, .250, 16, .250, 21, .250, 22, .250
   0
** RODS.68:
   1, DUMY,   .3740,   0.0,   0
```

```
** OPER.1:
   OPER, 1, 2, 0, 2, 0, 69, 0, 0, 0
** OPER.2:
   -1.0, 0.0, 0.0, 0.0
** OPER.3:
   0
** OPER.5:
   2114.700,   598.400,   1.998,   .269,   0.0   *  1    1796
   2399.700,   600.300,   2.019,   .283,   0.0   *  2    1797
   2399.700,   541.900,   2.014,   .367,   0.0   *  3    1798
   2099.700,   543.900,   1.983,   .340,   0.0   *  4    1799
   2199.700,   497.600,   2.013,   .398,   0.0   *  5    1800
   2414.700,   493.500,   1.982,   .432,   0.0   *  6    1801
   2414.700,   448.400,   2.043,   .506,   0.0   *  7    1802
   2099.700,   491.200,   2.008,   .400,   0.0   *  8    1803
   2099.700,   602.800,   2.474,   .300,   0.0   *  9    1804
   2399.700,   601.800,   2.511,   .329,   0.0   * 10    1805
   2099.700,   597.900,   2.998,   .353,   0.0   * 11    1806
   2399.700,   604.200,   2.998,   .379,   0.0   * 12    1807
   2099.700,   539.500,   1.482,   .291,   0.0   * 13    1808
   2399.700,   548.900,   1.478,   .290,   0.0   * 14    1809
   2399.700,   552.400,   2.504,   .416,   0.0   * 15    1810
   2099.700,   555.300,   2.484,   .378,   0.0   * 16    1811
   2099.700,   485.400,   1.507,   .342,   0.0   * 17    1812
   2399.700,   499.900,   1.449,   .333,   0.0   * 18    1813
   2099.700,   429.900,   1.499,   .392,   0.0   * 19    1814
   2399.700,   425.200,   1.514,   .417,   0.0   * 20    1815
   1499.700,   440.900,   1.486,   .386,   0.0   * 21    1816
   1499.700,   445.200,   2.018,   .446,   0.0   * 22    1817
   1799.700,   453.200,   1.476,   .361,   0.0   * 23    1818
   1799.700,   466.200,   2.037,   .430,   0.0   * 24    1819
   2409.700,   497.400,   2.487,   .519,   0.0   * 25    1820
   2409.700,   554.000,   2.980,   .492,   0.0   * 26    1821
   2404.700,   627.300,   3.501,   .376,   0.0   * 27    1822
   2399.700,   603.900,   3.524,   .446,   0.0   * 28    1823
   2099.700,   602.400,   3.472,   .387,   0.0   * 29    1824
   2099.700,   572.800,   2.922,   .397,   0.0   * 30    1825
   2099.700,   570.600,   3.497,   .466,   0.0   * 31    1826
   2099.700,   543.300,   2.941,   .466,   0.0   * 32    1827
   2099.700,   503.300,   2.494,   .463,   0.0   * 33    1828
   2104.700,   476.900,    .992,   .265,   0.0   * 34    1829
   2414.700,   484.800,    .996,   .269,   0.0   * 35    1830
   2099.700,   459.800,   2.010,   .456,   0.0   * 36    1831
   2099.700,   468.900,   2.467,   .517,   0.0   * 37    1832
   2084.700,   437.300,    .957,   .286,   0.0   * 38    1833
   2414.700,   433.900,    .970,   .300,   0.0   * 39    1834
   2099.700,   436.800,   2.038,   .447,   0.0   * 40    1835
   2099.700,   384.400,   1.012,   .331,   0.0   * 41    1836
   2099.700,   404.900,   1.589,   .425,   0.0   * 43    1838
   2399.700,   416.300,   1.584,   .452,   0.0   * 44    1839
   2404.700,   526.800,   2.505,   .471,   0.0   * 45    1840
   1804.700,   521.400,   1.456,   .303,   0.0   * 46    1841
   1804.700,   536.400,   1.997,   .336,   0.0   * 47    1842
   1804.700,   544.900,   2.456,   .380,   0.0   * 48    1843
   1804.700,   523.900,   2.997,   .460,   0.0   * 49    1844
   1509.700,   502.200,   1.433,   .322,   0.0   * 50    1845
   1504.700,   502.600,   2.002,   .377,   0.0   * 51    1846
   1504.700,   511.400,   2.486,   .420,   0.0   * 52    1847
   1504.700,   502.200,   2.992,   .485,   0.0   * 53    1848
   1504.700,   522.500,   3.451,   .500,   0.0   * 54    1849
   1504.700,   437.400,   1.016,   .306,   0.0   * 56    1851
   1804.700,   458.800,    .981,   .282,   0.0   * 57    1852
   1504.700,   458.200,   2.506,   .499,   0.0   * 58    1853
   1799.700,   484.300,   2.500,   .477,   0.0   * 59    1854
   1799.700,   553.800,   1.002,   .419,   0.0   * 60    1855
   1799.700,   551.400,   3.493,   .466,   0.0   * 61    1856
   1499.700,   552.900,   3.540,   .456,   0.0   * 62    1857
   1509.700,   556.400,   3.032,   .422,   0.0   * 63    1858
   1499.700,   397.500,    .981,   .322,   0.0   * 64    1859
   1799.700,   389.400,    .960,   .310,   0.0   * 65    1860
   1804.700,   394.500,   1.468,   .408,   0.0   * 66    1861
   1504.700,   394.800,   1.466,   .423,   0.0   * 67    1862
   1804.700,   420.200,   1.989,   .477,   0.0   * 68    1863
   1499.700,   417.000,   1.974,   .470,   0.0   * 69    1864
   2094.700,   543.800,   1.991,   .341,   0.0   * 70    1865
   2104.700,   500.300,   2.014,   .408,   0.0   * 71    1866
** OPER.12:
   0, 0, 0, 0, 0, 0
** MIXX.1:
   MIXX, 0, 0, 0
```

```
** MIXX.2:
   0.8,  0.038
** DRAG.1:
   DRAG,  1,  0,  1
** DRAG.2:
   0.186, -0.20, 0.0, 64.0, -1.0, 0.0
** DRAG.5:
   0.5,      .496
** GRID.1:
   GRID,  0,  2
** GRID.2:
   1.250,      .570
** GRID.4:
   -1,   15
** GRID.6:
    4.0, 1, 15.0, 2, 26.0, 1, 37.0, 2, 48.0, 1, 59.0, 2, 70.0, 1, 81.0, 2
   92.0, 1,103.0, 2,114.0, 1,125.0, 2,136.0, 1,147.0, 2,158.0, 1
   0
** CORR.1:
   CORR, 1, 1, 0
** CORR.2:
   EPRI, EPRI, EPRI, NONE
** CORR.3:
   0.2
** CORR.6:
   EPRI, THOM, THOM, CE-1, COND, G5.7
** CORR.7:
   0.0
** CORR.9:
   CE-1
** CORR.12:
   0.46366, 0
** CONT.1:
   CONT
** CONT.2:
   0.0, 0, 20, 20, 2, 2, 0, 0
** CONT.3:
   0.1, 0.0001, 0.001, 0, 0, 0, 0, 0.9
** CONT.6:
   1, 1, 0, 0, 1, 0, 1, 1, 0, 0, 1, 1, 0, 0
** CONT.7:
   4000.0, 0, 0, 0, 0, 0
** CONT.8:
   22
** CONT.11:
   22
** CONT.15:
   0, 0, 0, 0, 0
** END OF INPUT DATA:
   ENDD
   0
```

```
** CDC FILE NAME: HH162
**
** VIPRE.1:
   1,  0,  0
** VIPRE.2:
   HH162
** GEOM.1:
   GEOM,  36,  34,  56,  0,  0,  0
** GEOM.2:
   168.00,    0.0,    0.5
** GEOM.4:
    1,  .0549,  .8677,  .2937,   2,   2,  .1000,  .3915,   7,  .1000,  .3915
    2,  .0874, 1.0835,  .5875,   2,   3,  .1000,  .4960,   8,  .1220,  .3915
    3,  .0874, 1.0835,  .5875,   2,   4,  .1000,  .4960,   9,  .1220,  .3915
    4,  .0874, 1.0835,  .5875,   2,   5,  .1000,  .4960,  10,  .1220,  .3915
    5,  .0874, 1.0835,  .5875,   2,   6,  .1000,  .3915,  11,  .1220,  .3915
    6,  .0549,  .8677,  .2937,   1,  12,  .1000,  .3915,   0,  .0000,  .0000
    7,  .0874, 1.0835,  .5875,   2,   8,  .1220,  .3915,  13,  .1000,  .4960
    8,  .1362, 1.1750, 1.1750,   2,   9,  .1220,  .4960,  14,  .1220,  .4960
    9,  .1362, 1.1750, 1.1750,   2,  10,  .1220,  .4960,  15,  .1220,  .4960
   10,  .1362, 1.1750, 1.1750,   2,  11,  .1220,  .4960,  16,  .1220,  .4960
   11,  .1362, 1.1750, 1.1750,   2,  12,  .1220,  .3915,  17,  .1220,  .4960
   12,  .0874, 1.0835,  .5875,   1,  18,  .1000,  .4960,   0,  .0000,  .0000
   13,  .0874, 1.0835,  .5875,   2,  14,  .1220,  .3915,  19,  .1000,  .4960
   14,  .1362, 1.1750, 1.1750,   2,  15,  .1220,  .4960,  20,  .1220,  .4960
   15,  .1174, 1.2621, 0.8812,   2,  16,  .0665,  .4960,  21,  .0665,  .4960
   16,  .1174, 1.2621, 0.8812,   2,  17,  .1220,  .4960,  22,  .0665,  .4960
   17,  .1362, 1.1750, 1.1750,   2,  18,  .1220,  .3915,  23,  .1220,  .4960
   18,  .0874, 1.0835,  .5875,   1,  24,  .1000,  .4960,   0,  .0000,  .0000
   19,  .0874, 1.0835,  .5875,   2,  20,  .1220,  .3915,  25,  .1000,  .4960
   20,  .1362, 1.1750, 1.1750,   2,  21,  .1220,  .4960,  26,  .1220,  .4960
   21,  .1174, 1.2621, 0.8812,   2,  22,  .0665,  .4960,  27,  .1220,  .4960
   22,  .1174, 1.2621, 0.8812,   2,  23,  .1220,  .4960,  28,  .1220,  .4960
   23,  .1362, 1.1750, 1.1750,   2,  24,  .1220,  .3915,  29,  .1220,  .4960
   24,  .0874, 1.0835,  .5875,   1,  30,  .1000,  .4960,   0,  .0000,  .0000
   25,  .0874, 1.0835,  .5875,   2,  26,  .1220,  .3915,  31,  .1000,  .3915
   26,  .1362, 1.1750, 1.1750,   2,  27,  .1220,  .4960,  32,  .1220,  .3915
   27,  .1362, 1.1750, 1.1750,   2,  28,  .1220,  .4960,  33,  .1220,  .3915
   28,  .1362, 1.1750, 1.1750,   2,  29,  .1220,  .4960,  34,  .1220,  .3915
   29,  .1362, 1.1750, 1.1750,   2,  30,  .1220,  .3915,  35,  .1220,  .3915
   30,  .0874, 1.0835,  .5875,   1,  36,  .1000,  .3915,   0,  .0000,  .0000
   31,  .0549,  .8677,  .2937,   1,  32,  .1000,  .3915,   0,  .0000,  .0000
   32,  .0874, 1.0835,  .5875,   1,  33,  .1000,  .3915,   0,  .0000,  .0000
   33,  .0874, 1.0835,  .5875,   1,  34,  .1000,  .4960,   0,  .0000,  .0000
   34,  .0874, 1.0835,  .5875,   1,  35,  .1000,  .4960,   0,  .0000,  .0000
   35,  .0874, 1.0835,  .5875,   1,  36,  .1000,  .4960,   0,  .0000,  .0000
   36,  .0549,  .8677,  .2937,   0,   0,  .0000,  .0000,   0,  .0000,  .0000
** RODS.1:
   RODS,    1,    24,    0,    1,    0,    0,    0,    0,    0,    0,    0
** RODS.2:
   168.00,    0.0,    0,    0
** RODS.3:
   27
** RODS.4:
      .000,    .390,    5.413,    .416,   10.824,    .475,   16.237,    .543
    21.650,    .619,   32.474,    .819,   43.294,   1.048,   54.125,   1.250
    59.536,   1.353,   64.949,   1.440,   70.358,   1.505,   72.526,   1.527
    75.768,   1.544,   81.186,   1.548,   86.597,   1.544,   90.928,   1.535
    94.392,   1.505,   97.423,   1.483,  102.833,   1.418,  111.266,   1.287
   129.562,    .939,  139.642,    .743,  146.135,    .612,  152.628,    .525
   158.038,    .460,  162.372,    .427,  168.000,    .416,     .000,    .000
** RODS.9:
    1,   1,  .9505,   1,   1,   .250,   2,   .250,   7,   .250,   8,   .250
    2,   1,  .9500,   1,   2,   .250,   3,   .250,   8,   .250,   9,   .250
    3,   1,  .9505,   1,   3,   .250,   4,   .250,   9,   .250,  10,   .250
    4,   1,  .9505,   1,   4,   .250,   5,   .250,  10,   .250,  11,   .250
    5,   1,  .9505,   1,   5,   .250,   6,   .250,  11,   .250,  12,   .250
    6,   1,  .9505,   1,  11,   .250,  12,   .250,  17,   .250,  18,   .250
    7,   1,  .9505,   1,  17,   .250,  18,   .250,  23,   .250,  24,   .250
    8,   1,  .9505,   1,  23,   .250,  24,   .250,  29,   .250,  30,   .250
    9,   1,  .9505,   1,  29,   .250,  30,   .250,  35,   .250,  36,   .250
   10,   1,  .9500,   1,  28,   .250,  29,   .250,  34,   .250,  35,   .250
   11,   1,  .9505,   1,  27,   .250,  28,   .250,  33,   .250,  34,   .250
   12,   1,  .9500,   1,  26,   .250,  27,   .250,  32,   .250,  33,   .250
   13,   1,  .9505,   1,  25,   .250,  26,   .250,  31,   .250,  32,   .250
   14,   1,  .9500,   1,  19,   .250,  20,   .250,  25,   .250,  26,   .250
   15,   1,  .9500,   1,  13,   .250,  14,   .250,  19,   .250,  20,   .250
   16,   1,  .9500,   1,   7,   .250,   8,   .250,  13,   .250,  14,   .250
   17,   1, 1.0993,   1,   8,   .250,   9,   .250,  14,   .250,  15,   .250
   18,   1, 1.0993,   1,   9,   .250,  10,   .250,  15,   .250,  16,   .250
```

```
  19,   1, 1.0993,   1,  10,   .250,  11,   .250,  16,   .250,  17,   .250
  20,   1, 1.0993,   1,  16,   .250,  17,   .250,  22,   .250,  23,   .250
  21,   1, 1.0993,   1,  22,   .250,  23,   .250,  28,   .250,  29,   .250
  22,   1, 1.0993,   1,  21,   .250,  22,   .250,  27,   .250,  28,   .250
  23,   1, 1.0993,   1,  20,   .250,  21,   .250,  26,   .250,  27,   .250
  24,   1, 1.0993,   1,  14,   .250,  15,   .250,  20,   .250,  21,   .250
  0
** RODS.68:
  1,  DUMY,  0.3740,  0.0,  0
** OPER.1:
  OPER,  1,  2,  0,  2,  0,  70,  0,  0,  0
** OPER.2:
  -1.0,  0.0,  0.0,  0.0
** OPER.3:
  0
** OPER.5:
  2099.700,   504.300,   1.962,    .405,   0.0   *    1    1867
  2399.700,   503.900,   1.996,    .443,   0.0   *    2    1868
  2404.700,   508.500,   2.480,    .513,   0.0   *    3    1869
  2099.700,   505.000,   2.492,    .481,   0.0   *    4    1870
  2099.700,   548.900,   2.508,    .383,   0.0   *    5    1871
  2399.700,   558.000,   2.474,    .419,   0.0   *    6    1872
  2399.700,   558.000,   2.982,    .493,   0.0   *    7    1873
  2104.700,   548.000,   2.972,    .451,   0.0   *    8    1874
  2394.700,   549.350,   1.985,    .353,   0.0   *    9    1875
  2114.700,   558.500,   1.968,    .316,   0.0   *   10    1876
  2089.700,   566.900,   3.471,    .464,   0.0   *   11    1877
  2099.700,   605.400,   1.990,    .271,   0.0   *   12    1878
  2409.700,   600.900,   1.992,    .302,   0.0   *   13    1879
  2399.700,   606.300,   2.475,    .319,   0.0   *   14    1880
  2099.700,   600.700,   2.481,    .317,   0.0   *   15    1881
  2094.700,   606.400,   2.952,    .338,   0.0   *   16    1882
  2399.700,   608.870,   2.996,    .390,   0.0   *   17    1883
  2394.700,   609.300,   3.457,    .440,   0.0   *   18    1884
  2109.700,   605.900,   3.428,    .374,   0.0   *   19    1885
  1499.700,   571.400,   1.996,    .305,   0.0   *   20    1886
  1804.700,   585.900,   1.986,    .275,   0.0   *   21    1887
  1799.700,   582.200,   2.530,    .313,   0.0   *   22    1888
  1499.700,   573.400,   2.466,    .339,   0.0   *   23    1889
  1504.700,   573.400,   2.987,    .356,   0.0   *   24    1890
  1804.700,   583.500,   2.981,    .343,   0.0   *   25    1891
  1799.700,   581.900,   3.503,    .383,   0.0   *   26    1892
  1504.700,   574.300,   3.483,    .387,   0.0   *   27    1893
  1499.700,   530.200,   1.997,    .344,   0.0   *   28    1894
  1799.700,   532.900,   2.003,    .350,   0.0   *   29    1895
  1799.700,   533.900,   2.476,    .391,   0.0   *   30    1896
  1499.700,   534.800,   2.462,    .379,   0.0   *   31    1897
  1504.700,   533.800,   2.975,    .416,   0.0   *   32    1898
  1804.700,   532.500,   3.007,    .430,   0.0   *   33    1899
  2119.700,   544.200,   2.934,    .479,   0.0   *   34    1900
  1794.700,   534.900,   3.499,    .480,   0.0   *   35    1901
  2124.700,   582.900,   2.974,    .382,   0.0   *   36    1902
  2404.700,   586.300,   2.495,    .358,   0.0   *   37    1903
  2099.700,   584.200,   2.485,    .346,   0.0   *   38    1904
  2424.700,   589.900,   2.977,    .427,   0.0   *   39    1905
  2099.700,   584.200,   1.990,    .284,   0.0   *   40    1906
  2399.700,   584.300,   2.008,    .316,   0.0   *   41    1907
  2104.700,   582.300,   3.481,    .420,   0.0   *   42    1908
  2409.700,   585.400,   3.502,    .492,   0.0   *   43    1909
  1499.700,   530.300,   3.545,    .438,   0.0   *   44    1910
  1499.700,   488.400,   2.008,    .411,   0.0   *   45    1911
  1799.700,   491.400,   2.008,    .409,   0.0   *   46    1912
  1804.700,   492.200,   2.490,    .453,   0.0   *   47    1913
  1504.700,   482.900,   2.454,    .468,   0.0   *   48    1914
  1504.700,   496.000,   2.969,    .478,   0.0   *   49    1915
  1809.700,   510.400,   2.999,    .482,   0.0   *   50    1916
  1509.700,   524.200,   1.475,    .297,   0.0   *   51    1917
  1804.700,   529.200,   1.488,    .293,   0.0   *   52    1918
  2099.700,   546.800,   1.495,    .295,   0.0   *   53    1919
  2409.700,   552.200,   1.465,    .309,   0.0   *   54    1920
  2399.700,   509.400,   1.474,    .341,   0.0   *   55    1921
  2104.700,   504.900,   1.471,    .350,   0.0   *   56    1922
  1804.700,   479.400,   1.489,    .354,   0.0   *   57    1923
  1514.700,   484.800,   1.489,    .346,   0.0   *   58    1924
  2104.700,   462.400,    .998,    .292,   0.0   *   59    1925
  2384.700,   452.600,   1.015,    .307,   0.0   *   60    1926
  2104.700,   452.500,   1.488,    .382,   0.0   *   61    1927
  2404.700,   458.600,   1.483,    .411,   0.0   *   62    1928
  2104.700,   462.800,   2.025,    .470,   0.0   *   63    1929
  2404.700,   478.200,   2.008,    .489,   0.0   *   64    1930
```

```
   1804.700,   429.200,   1.022,    .311,    0.0     *    65     1931
   1504.700,   436.870,   1.009,    .316,    0.0     *    66     1932
   1504.700,   434.300,   1.485,    .396,    0.0     *    67     1933
   1799.700,   433.200,   1.448,    .399,    0.0     *    68     1934
   1794.700,   442.900,   2.010,    .468,    0.0     *    69     1935
   1499.700,   438.400,   2.002,    .476,    0.0     *    70     1936
** OPER.12:
   0,  0,  0,  0,  0,  0
** MIXX.1:
   MIXX,  0,  0,  0
** MIXX.2:
   0.8,  0.038
** DRAG.1:
   DRAG,  1,  0,  1
** DRAG.2:
   0.186, -0.20, 0.0, 64.0, -1.0, 0.0
** DRAG.5:
   0.5,    .496
** GRID.1:
   GRID,  0,    2
** GRID.2:
   1.250,     .570
** GRID.4:
   -1,   15
** GRID.6:
    3.0,1,  14.0,2,  25.0,1,  36.0,2,  47.0,1,  58.0,2,  69.0,1, 80.0,2,
   91.0,1, 102.0,2, 113.0,1, 124.0,2, 135.0,1, 146.0,2, 157.0,1,    .0,0
   0
** CORR.1:
   CORR, 1, 1, 0
** CORR.2:
   EPRI, EPRI, EPRI, NONE
** CORR.3:
   0.2
** CORR.6:
   EPRI, THOM, THOM, CE-1, COND, G5.7
** CORR.7:
   0.0
** CORR.9:
   CE-1
** CORR.12:
   0.37208, 1
** CONT.1:
   CONT
** CONT.2:
   0.0, 0, 20, 20, 2, 2, 0, 0,
** CONT.3:
   0.1, 0.0001, 0.001, 0, 0, 0, 0, 0.9
** CONT.6:
   1, 1, 0, 0, 1, 0, 1, 1, 0, 0, 1, 1, 0, 0
** CONT.7:
   4000.0, 0, 0, 0, 0, 0
** CONT.8:
   16
** CONT.11:
   16
** CONT.15:
   0, 0, 0, 0, 0,
** END OF INPUT DATA:
   ENDD
   0
```

```
** CDC FILE NAME: HH163
**
** VIPRE.1:
  1,    0,     0
** VIPRE.2:
  HH163
** GEOM.1:
  GEOM,   36,   36,   48,    0,    0,    0
** GEOM.2:
  96.00,     0.0,     0.5
** GEOM.4:
    1,  .0549,    .8677,    .2937,  2,   2,  .1000,  .3915,   7,  .1000,  .3915
    2,  .0874,  1.0835,    .5875,  2,   3,  .1000,  .4960,   8,  .1220,  .3915
    3,  .0874,  1.0835,    .5875,  2,   4,  .1000,  .4960,   9,  .1220,  .3915
    4,  .0874,  1.0835,    .5875,  2,   5,  .1000,  .4960,  10,  .1220,  .3915
    5,  .0874,  1.0835,    .5875,  2,   6,  .1000,  .3915,  11,  .1220,  .3915
    6,  .0549,    .8677,    .2937,  1,  12,  .1000,  .3915,   0,  .0000,  .0000
    7,  .0874,  1.0835,    .5875,  2,   8,  .1220,  .3915,  13,  .1000,  .4960
    8,  .1362,  1.1750,  1.1750,  2,   9,  .1220,  .4960,  14,  .1220,  .4960
    9,  .1362,  1.1750,  1.1750,  2,  10,  .1220,  .4960,  15,  .1220,  .4960
   10,  .1362,  1.1750,  1.1750,  2,  11,  .1220,  .4960,  16,  .1220,  .4960
   11,  .1362,  1.1750,  1.1750,  2,  12,  .1220,  .3915,  17,  .1220,  .4960
   12,  .0874,  1.0835,    .5875,  1,  18,  .1000,  .4960,   0,  .0000,  .0000
   13,  .0874,  1.0835,    .5875,  2,  14,  .1220,  .3915,  19,  .1000,  .4960
   14,  .1362,  1.1750,  1.1750,  2,  15,  .1220,  .4960,  20,  .1220,  .4960
   15,  .1362,  1.1750,  1.1750,  2,  16,  .1220,  .4960,  21,  .1220,  .4960
   16,  .1362,  1.1750,  1.1750,  2,  17,  .1220,  .4960,  22,  .1220,  .4960
   17,  .1362,  1.1750,  1.1750,  2,  18,  .1220,  .3915,  23,  .1220,  .4960
   18,  .0874,  1.0835,    .5875,  1,  24,  .1000,  .4960,   0,  .0000,  .0000
   19,  .0874,  1.0835,    .5875,  2,  20,  .1220,  .3915,  25,  .1000,  .4960
   20,  .1362,  1.1750,  1.1750,  2,  21,  .1220,  .4960,  26,  .1220,  .4960
   21,  .1362,  1.1750,  1.1750,  2,  22,  .1220,  .4960,  27,  .1220,  .4960
   22,  .1362,  1.1750,  1.1750,  2,  23,  .1220,  .4960,  28,  .1220,  .4960
   23,  .1362,  1.1750,  1.1750,  2,  24,  .1220,  .3915,  29,  .1220,  .4960
   24,  .0874,  1.0835,    .5875,  1,  30,  .1000,  .4960,   0,  .0000,  .0000
   25,  .0874,  1.0835,    .5875,  2,  26,  .1220,  .3915,  31,  .1000,  .3915
   26,  .1362,  1.1750,  1.1750,  2,  27,  .1220,  .4960,  32,  .1220,  .3915
   27,  .1362,  1.1750,  1.1750,  2,  28,  .1220,  .4960,  33,  .1220,  .3915
   28,  .1362,  1.1750,  1.1750,  2,  29,  .1220,  .4960,  34,  .1220,  .3915
   29,  .1362,  1.1750,  1.1750,  2,  30,  .1220,  .3915,  35,  .1220,  .3915
   30,  .0874,  1.0835,    .5875,  1,  36,  .1000,  .3915,   0,  .0000,  .0000
   31,  .0549,    .8677,    .2937,  1,  32,  .1000,  .3915,   0,  .0000,  .0000
   32,  .0874,  1.0835,    .5875,  1,  33,  .1000,  .4960,   0,  .0000,  .0000
   33,  .0874,  1.0835,    .5875,  1,  34,  .1000,  .4960,   0,  .0000,  .0000
   34,  .0874,  1.0835,    .5875,  1,  35,  .1000,  .4960,   0,  .0000,  .0000
   35,  .0874,  1.0835,    .5875,  1,  36,  .1000,  .3915,   0,  .0000,  .0000
   36,  .0549,    .8677,    .2937,  0,   0,  .0000,  .0000,   0,  .0000,  .0000
** RODS.1:
  RODS,    0,    25,    0,    1,    0,    0,    0,    0,    0,    0,    0
** RODS.2:
  96.00,     0.0,    0,    0
** RODS.9:
    1,  1,    .9411,  1,   1,  .250,   2,  .250,   7,  .250,   8,  .250
    2,  1,    .9411,  1,   2,  .250,   3,  .250,   8,  .250,   9,  .250
    3,  1,    .9411,  1,   3,  .250,   4,  .250,   9,  .250,  10,  .250
    4,  1,    .9411,  1,   4,  .250,   5,  .250,  10,  .250,  11,  .250
    5,  1,    .9411,  1,   5,  .250,   6,  .250,  11,  .250,  12,  .250
    6,  1,    .9411,  1,  11,  .250,  12,  .250,  17,  .250,  18,  .250
    7,  1,    .9411,  1,  17,  .250,  18,  .250,  23,  .250,  24,  .250
    8,  1,    .9411,  1,  23,  .250,  24,  .250,  29,  .250,  30,  .250
    9,  1,    .9411,  1,  29,  .250,  30,  .250,  35,  .250,  36,  .250
   10,  1,    .9411,  1,  28,  .250,  29,  .250,  34,  .250,  35,  .250
   11,  1,    .9411,  1,  27,  .250,  28,  .250,  33,  .250,  34,  .250
   12,  1,    .9411,  1,  26,  .250,  27,  .250,  32,  .250,  33,  .250
   13,  1,    .9411,  1,  25,  .250,  26,  .250,  31,  .250,  32,  .250
   14,  1,    .9411,  1,  19,  .250,  20,  .250,  25,  .250,  26,  .250
   15,  1,    .9365,  1,  13,  .250,  14,  .250,  19,  .250,  20,  .250
   16,  1,    .9411,  1,   7,  .250,   8,  .250,  13,  .250,  14,  .250
   17,  1,  1.1052,  1,   8,  .250,   9,  .250,  14,  .250,  15,  .250
   18,  1,  1.1052,  1,   9,  .250,  10,  .250,  15,  .250,  16,  .250
   19,  1,  1.1052,  1,  10,  .250,  11,  .250,  16,  .250,  17,  .250
   20,  1,  1.1052,  1,  16,  .250,  17,  .250,  22,  .250,  23,  .250
   21,  1,  1.1052,  1,  22,  .250,  23,  .250,  28,  .250,  29,  .250
   22,  1,  1.1052,  1,  21,  .250,  22,  .250,  27,  .250,  28,  .250
   23,  1,  1.1052,  1,  20,  .250,  21,  .250,  26,  .250,  27,  .250
   24,  1,  1.1052,  1,  14,  .250,  15,  .250,  20,  .250,  21,  .250
   25,  1,  1.1052,  1,  15,  .250,  16,  .250,  21,  .250,  22,  .250
    0
** RODS.68:
  1,  DUMY,    .3740,    0.0,    0
```

```
** OPER.1:
   OPER, 1, 2, 0, 2, 0, 41, 0, 0, 0
** OPER.2:
   -1.0, 0.0, 0.0, 0.0
** OPER.3:
   0
** OPER.5:
   1804.700,   505.600,   1.478,   .490,   0.0   *  1    1937
   1799.700,   513.300,   2.062,   .569,   0.0   *  2    1938
   1804.700,   513.800,   2.518,   .632,   0.0   *  3    1939
   2406.700,   528.400,   1.433,   .475,   0.0   *  4    1940
   2404.700,   545.300,   2.000,   .576,   0.0   *  5    1941
   2409.700,   542.400,   2.505,   .678,   0.0   *  6    1942
   2114.700,   542.500,   1.549,   .411,   0.0   *  7    1943
   2099.700,   548.600,   2.056,   .537,   0.0   *  8    1944
   2099.700,   554.500,   2.528,   .581,   0.0   *  9    1945
   2114.700,   553.200,   2.993,   .683,   0.0   * 10    1946
   2114.700,   483.400,   1.525,   .564,   0.0   * 11    1947
   2099.700,   478.100,   2.065,   .678,   0.0   * 12    1948
   2406.700,   469.900,   1.533,   .597,   0.0   * 13    1949
   2404.700,   472.400,   2.063,   .741,   0.0   * 14    1950
   1814.700,   443.200,   1.556,   .592,   0.0   * 15    1951
   1809.700,   444.000,   2.064,   .712,   0.0   * 16    1952
   1814.700,   413.300,   1.554,   .640,   0.0   * 17    1953
   1819.700,   433.800,   2.008,   .724,   0.0   * 18    1954
   2099.700,   413.300,   1.534,   .672,   0.0   * 19    1955
   2404.700,   418.400,   1.532,   .684,   0.0   * 20    1956
   1504.700,   439.600,   1.530,   .589,   0.0   * 21    1957
   1504.700,   452.900,   2.033,   .643,   0.0   * 22    1958
   1494.700,   509.300,   1.517,   .483,   0.0   * 23    1959
   1504.700,   515.300,   2.040,   .535,   0.0   * 24    1960
   1514.700,   509.200,   2.521,   .622,   0.0   * 25    1961
   1504.700,   512.400,   3.009,   .664,   0.0   * 26    1962
   2094.700,   604.600,   3.024,   .510,   0.0   * 27    1963
   2394.700,   598.300,   2.084,   .441,   0.0   * 28    1964
   2404.700,   598.000,   2.551,   .525,   0.0   * 29    1965
   2404.700,   602.600,   3.043,   .590,   0.0   * 30    1966
   1804.700,   562.200,   2.054,   .463,   0.0   * 31    1967
   1804.700,   563.200,   2.542,   .514,   0.0   * 32    1968
   1814.700,   562.200,   3.025,   .574,   0.0   * 33    1969
   1504.700,   558.000,   3.068,   .563,   0.0   * 34    1970
   1494.700,   572.200,   2.549,   .516,   0.0   * 35    1971
   1814.700,   519.700,   2.513,   .666,   0.0   * 36    1972
   2099.700,   549.500,   1.509,   .455,   0.0   * 37    1973
   1504.700,   509.400,   3.021,   .667,   0.0   * 38    1974
   1809.700,   381.280,   1.078,   .506,   0.0   * 39    1975
   2099.700,   390.200,   1.076,   .537,   0.0   * 40    1976
   2399.700,   399.800,   1.036,   .525,   0.0   * 41    1977
** OPER.12:
   0,  0,  0,  0,  0,  0
** MIXX.1:
   MIXX,  0,  0,  0
** MIXX.2:
   0.8,  0.038
** DRAG.1:
   DRAG,  1,  0,  1
** DRAG.2:
   0.186, -0.20, 0.0, 64.0, -1.0, 0.0
** DRAG.5:
   0.5,    .496
** GRID.1:
   GRID,  0,  1
** GRID.2:
   1.250,    .000
** GRID.4:
   -1,    4
** GRID.6:
   20.00, 1, 42.00, 1, 64.00, 1, 86.00, 1
   0
** CORR.1:
   CORR, 1, 1, 0
** CORR.2:
   EPRI, EPRI, EPRI, NONE
** CORR.3:
   0.2
** CORR.6:
   EPRI, THOM, THOM, CE-1, COND, G5.7
** CORR.7:
   0.0
** CORR.9:
```

```
   CE-1
** CORR.12:
   0.46366, 0
** CONT.1:
   CONT
** CONT.2:
   0.0, 0, 20, 20, 2, 2, 0, 0
** CONT.3:
   0.1, 0.0001, 0.001, 0, 0, 0, 0, 0.9
** CONT.6:
   1, 1, 0, 0, 1, 0, 1, 1, 0, 0, 1, 1, 0, 0
** CONT.7:
   4000.0,  0,  0,  0,  0,  0
** CONT.8:
   22
** CONT.11:
   22
** CONT.15:
   0,  0,  0,  0,  0
** END OF INPUT DATA:
   ENDD
   0
```

```
** CDC FILE NAME: HH164
**
** VIPRE.1:
   1,  0,  0
** VIPRE.2:
   HH164
** GEOM.1:
   GEOM,  36,  36,  56,  0,  0,  0
** GEOM.2:
   168.00,    0.0,    0.5
** GEOM.4:
     1,  .0549,  .8677,  .2937,   2,   2,  .1000,  .3915,   7,  .1000,  .3915
     2,  .0874, 1.0835,  .5875,   2,   3,  .1000,  .4960,   8,  .1220,  .3915
     3,  .0874, 1.0835,  .5875,   2,   4,  .1000,  .4960,   9,  .1220,  .3915
     4,  .0874, 1.0835,  .5875,   2,   5,  .1000,  .4960,  10,  .1220,  .3915
     5,  .0874, 1.0835,  .5875,   2,   6,  .1000,  .3915,  11,  .1220,  .3915
     6,  .0549,  .8677,  .2937,   1,  12,  .1000,  .3915,   0,  .0000,  .0000
     7,  .0874, 1.0835,  .5875,   2,   8,  .1220,  .3915,  13,  .1000,  .4960
     8,  .1362, 1.1750, 1.1750,   2,   9,  .1220,  .4960,  14,  .1220,  .4960
     9,  .1362, 1.1750, 1.1750,   2,  10,  .1220,  .4960,  15,  .1220,  .4960
    10,  .1362, 1.1750, 1.1750,   2,  11,  .1220,  .4960,  16,  .1220,  .4960
    11,  .1362, 1.1750, 1.1750,   2,  12,  .1220,  .3915,  17,  .1220,  .4960
    12,  .0874, 1.0835,  .5875,   1,  18,  .1000,  .4960,   0,  .0000,  .0000
    13,  .0874, 1.0835,  .5875,   2,  14,  .1220,  .3915,  19,  .1000,  .4960
    14,  .1362, 1.1750, 1.1750,   2,  15,  .1220,  .4960,  20,  .1220,  .4960
    15,  .1362, 1.1750, 1.1750,   2,  16,  .1220,  .4960,  21,  .1220,  .4960
    16,  .1362, 1.1750, 1.1750,   2,  17,  .1220,  .4960,  22,  .1220,  .4960
    17,  .1362, 1.1750, 1.1750,   2,  18,  .1220,  .3915,  23,  .1220,  .4960
    18,  .0874, 1.0835,  .5875,   1,  24,  .1000,  .4960,   0,  .0000,  .0000
    19,  .0874, 1.0835,  .5875,   2,  20,  .1220,  .3915,  25,  .1000,  .4960
    20,  .1362, 1.1750, 1.1750,   2,  21,  .1220,  .4960,  26,  .1220,  .4960
    21,  .1362, 1.1750, 1.1750,   2,  22,  .1220,  .4960,  27,  .1220,  .4960
    22,  .1362, 1.1750, 1.1750,   2,  23,  .1220,  .4960,  28,  .1220,  .4960
    23,  .1362, 1.1750, 1.1750,   2,  24,  .1220,  .3915,  29,  .1220,  .4960
    24,  .0874, 1.0835,  .5875,   1,  30,  .1000,  .4960,   0,  .0000,  .0000
    25,  .0874, 1.0835,  .5875,   2,  26,  .1220,  .3915,  31,  .1000,  .3915
    26,  .1362, 1.1750, 1.1750,   2,  27,  .1220,  .4960,  32,  .1220,  .3915
    27,  .1362, 1.1750, 1.1750,   2,  28,  .1220,  .4960,  33,  .1220,  .3915
    28,  .1362, 1.1750, 1.1750,   2,  29,  .1220,  .4960,  34,  .1220,  .3915
    29,  .1362, 1.1750, 1.1750,   2,  30,  .1220,  .3915,  35,  .1220,  .3915
    30,  .0874, 1.0835,  .5875,   1,  36,  .1000,  .3915,   0,  .0000,  .0000
    31,  .0549,  .8677,  .2937,   1,  32,  .1000,  .3915,   0,  .0000,  .0000
    32,  .0874, 1.0835,  .5875,   1,  33,  .1000,  .4960,   0,  .0000,  .0000
    33,  .0874, 1.0835,  .5875,   1,  34,  .1000,  .4960,   0,  .0000,  .0000
    34,  .0874, 1.0835,  .5875,   1,  35,  .1000,  .4960,   0,  .0000,  .0000
    35,  .0874, 1.0835,  .5875,   1,  36,  .1000,  .3915,   0,  .0000,  .0000
    36,  .0549,  .8677,  .2937,   0,   0,  .0000,  .0000,   0,  .0000,  .0000
** RODS.1:
   RODS,    1,   25,    0,    1,    0,    0,    0,    0,    0,    0,    0
** RODS.2:
   168.00,    0.0,    0,    0
** RODS.3:
   27
** RODS.4:
       .000,   .390,    5.413,   .416,   10.824,   .475,   16.237,   .543
     21.650,   .619,   32.474,   .819,   43.294,  1.048,   54.125,  1.[illegible]50
     59.536,  1.353,   64.949,  1.440,   70.358,  1.505,   72.526,  1.527
     75.768,  1.544,   81.186,  1.548,   86.597,  1.544,   90.928,  1.535
     94.392,  1.505,   97.423,  1.483,  102.833,  1.418,  111.266,  1.287
    129.562,   .939,  139.642,   .743,  146.135,   .612,  152.628,   .525
    158.038,   .460,  162.372,   .427,  168.000,   .416,     .000,   .000
** RODS.9:
     1,   1,  .9456,   1,   1,   .250,   2,   .250,   7,   .250,   8,   .250
     2,   1,  .9476,   1,   2,   .250,   3,   .250,   8,   .250,   9,   .250
     3,   1,  .9466,   1,   3,   .250,   4,   .250,   9,   .250,  10,   .250
     4,   1,  .9456,   1,   4,   .250,   5,   .250,  10,   .250,  11,   .250
     5,   1,  .9461,   1,   5,   .250,   6,   .250,  11,   .250,  12,   .250
     6,   1,  .9461,   1,  11,   .250,  12,   .250,  17,   .250,  18,   .250
     7,   1,  .9487,   1,  17,   .250,  18,   .250,  23,   .250,  24,   .250
     8,   1,  .9461,   1,  23,   .250,  24,   .250,  29,   .250,  30,   .250
     9,   1,  .9461,   1,  29,   .250,  30,   .250,  35,   .250,  36,   .250
    10,   1,  .9461,   1,  28,   .250,  29,   .250,  34,   .250,  35,   .250
    11,   1,  .9461,   1,  27,   .250,  28,   .250,  33,   .250,  34,   .250
    12,   1,  .9466,   1,  26,   .250,  27,   .250,  32,   .250,  33,   .250
    13,   1,  .9461,   1,  25,   .250,  26,   .250,  31,   .250,  32,   .250
    14,   1,  .9461,   1,  19,   .250,  20,   .250,  25,   .250,  26,   .250
    15,   1,  .9456,   1,  13,   .250,  14,   .250,  19,   .250,  20,   .250
    16,   1,  .9481,   1,   7,   .250,   8,   .250,  13,   .250,  14,   .250
    17,   1, 1.0947,   1,   8,   .250,   9,   .250,  14,   .250,  15,   .250
    18,   1, 1.0947,   1,   9,   .250,  10,   .250,  15,   .250,  16,   .250
```

```
 19,   1, 1.0947,   1,  10,   .250,  11,   .250,  16,   .250,  17,   .250
 20,   1, 1.0954,   1,  16,   .250,  17,   .250,  22,   .250,  23,   .250
 21,   1, 1.0954,   1,  22,   .250,  23,   .250,  28,   .250,  29,   .250
 22,   1, 1.0947,   1,  21,   .250,  22,   .250,  27,   .250,  28,   .250
 23,   1, 1.0954,   1,  20,   .250,  21,   .250,  26,   .250,  27,   .250
 24,   1, 1.0954,   1,  14,   .250,  15,   .250,  20,   .250,  21,   .250
 25,   1, 1.0954,   1,  15,   .250,  16,   .250,  21,   .250,  22,   .250
 0
** RODS.68:
 1,  DUMY,  0.3740,  0.0,  0
** OPER.1:
 OPER,  1,  2,  0,  2,  0,  73,  0,  0,  0
** OPER.2:
 -1.0,  0.0,  0.0,  0.0
** OPER.3:
 0
** OPER.5:
 2099.700,   492.600,   1.454,    .339,    0.0    *    1    1979
 2104.700,   503.800,   1.968,    .402,    0.0    *    2    1980
 2099.700,   502.100,   2.500,    .486,    0.0    *    3    1981
 2394.700,   500.400,   1.447,    .342,    0.0    *    4    1982
 2414.700,   507.200,   1.928,    .435,    0.0    *    5    1983
 2414.700,   510.600,   2.490,    .518,    0.0    *    6    1984
 2399.700,   553.100,   1.446,    .288,    0.0    *    7    1985
 2424.700,   555.600,   2.002,    .363,    0.0    *    8    1986
 2399.700,   554.600,   2.495,    .423,    0.0    *    9    1987
 2404.700,   556.000,   2.980,    .504,    0.0    *   10    1988
 2114.700,   562.340,   1.406,    .280,    0.0    *   11    1989
 2109.700,   551.000,   2.043,    .328,    0.0    *   12    1990
 2104.700,   549.000,   2.499,    .387,    0.0    *   13    1991
 2114.700,   548.800,   2.998,    .461,    0.0    *   14    1992
 2099.700,   557.300,   3.457,    .486,    0.0    *   15    1993
 2394.700,   578.500,   3.464,    .494,    0.0    *   16    1994
 2399.700,   598.000,   1.994,    .284,    0.0    *   17    1995
 2404.700,   606.000,   2.456,    .326,    0.0    *   18    1996
 2399.700,   605.000,   2.962,    .373,    0.0    *   19    1997
 2394.700,   604.400,   3.507,    .416,    0.0    *   20    1998
 2099.700,   607.200,   1.972,    .259,    0.0    *   21    1999
 2094.700,   597.600,   2.493,    .320,    0.0    *   22    2000
 2109.700,   605.300,   2.973,    .348,    0.0    *   23    2001
 2099.700,   600.200,   3.482,    .385,    0.0    *   24    2002
 1794.700,   581.300,   1.983,    .283,    0.0    *   25    2003
 1804.700,   579.700,   2.535,    .322,    0.0    *   26    2004
 1799.700,   582.200,   2.970,    .347,    0.0    *   27    2005
 1804.700,   580.700,   3.485,    .394,    0.0    *   28    2006
 1504.700,   571.700,   3.415,    .377,    0.0    *   29    2007
 1499.700,   569.400,   1.987,    .307,    0.0    *   30    2008
 1499.700,   570.600,   2.491,    .334,    0.0    *   31    2009
 1509.700,   570.600,   2.908,    .363,    0.0    *   32    2010
 1504.700,   533.500,   1.427,    .297,    0.0    *   33    2011
 1499.700,   531.300,   2.007,    .353,    0.0    *   34    2012
 1499.700,   525.700,   2.502,    .404,    0.0    *   35    2013
 1504.700,   528.800,   2.969,    .438,    0.0    *   36    2014
 1509.700,   531.800,   3.534,    .472,    0.0    *   37    2015
 1804.700,   536.300,   1.428,    .288,    0.0    *   38    2016
 1799.700,   528.100,   1.995,    .364,    0.0    *   39    2017
 1799.700,   529.500,   2.498,    .413,    0.0    *   40    2018
 1814.700,   543.930,   2.941,    .432,    0.0    *   41    2019
 1804.700,   533.600,   3.471,    .485,    0.0    *   42    2020
 2104.700,   540.000,   2.949,    .455,    0.0    *   43    2021
 1799.700,   512.200,   3.001,    .477,    0.0    *   44    2022
 1499.700,   481.800,   1.429,    .340,    0.0    *   45    2023
 1509.700,   482.200,   1.919,    .412,    0.0    *   46    2024
 1499.700,   482.900,   2.486,    .470,    0.0    *   47    2025
 1499.700,   486.300,   3.005,    .520,    0.0    *   48    2026
 1801.700,   483.200,   1.445,    .341,    0.0    *   49    2027
 1804.700,   489.000,   1.961,    .422,    0.0    *   50    2028
 1809.700,   484.300,   2.505,    .475,    0.0    *   51    2029
 1789.700,   454.100,   1.441,    .379,    0.0    *   52    2030
 1814.700,   461.600,   1.954,    .467,    0.0    *   53    2031
 2404.700,   442.100,   1.463,    .416,    0.0    *   54    2032
 2404.700,   463.000,   1.929,    .501,    0.0    *   55    2033
 2404.700,   451.600,    .980,    .297,    0.0    *   56    2034
 2099.700,   404.300,    .991,    .330,    0.0    *   57    2035
 2404.700,   423.300,   1.437,    .431,    0.0    *   58    2036
 2204.700,   419.500,   1.436,    .411,    0.0    *   59    2037
 2089.700,   452.200,    .992,    .291,    0.0    *   60    2038
 1804.700,   420.600,    .993,    .302,    0.0    *   61    2039
 1504.700,   429.000,    .972,    .311,    0.0    *   62    2040
 1799.700,   432.200,   1.424,    .389,    0.0    *   63    2041
```

```
    1504.700,   422.600,   1.420,    .396,    0.0    *    64    2042
    1799.700,   438.900,   1.947,    .465,    0.0    *    65    2043
    1504.700,   436.000,   1.913,    .473,    0.0    *    66    2044
    1504.700,   464.400,   2.475,    .501,    0.0    *    67    2045
    1799.700,   386.800,    .983,    .323,    0.0    *    68    2046
    1504.700,   384.400,    .977,    .341,    0.0    *    69    2047
    2394.700,   400.600,    .985,    .337,    0.0    *    70    2048
    2109.700,   530.000,   2.956,    .519,    0.0    *    71    2049
    2104.700,   506.300,   2.023,    .402,    0.0    *    72    2050
    2099.700,   492.000,   1.431,    .347,    0.0    *    74    2052
** OPER.12:
    0,  0,  0,  0,  0,  0
** MIXX.1:
    MIXX,  0,  0,  0
** MIXX.2:
    0.8,  0.038
** DRAG.1:
    DRAG,  1,  0,  1
** DRAG.2:
    0.186,  -0.20,  0.0,  64.0,  -1.0,  0.0
** DRAG.5:
    0.5,   0.496
** GRID.1:
    GRID,  0,   2
** GRID.2:
    1.250,   0.570
** GRID.4:
    -1,   15
** GRID.6:
     3.0,1,  14.0,2,  25.0,1,  36.0,2,  47.0,1,  58.0,2,  69.0,1, 80.00,2,
    91.0,1, 102.0,2, 113.0,1, 124.0,2, 135.0,1, 146.0,2, 157.0,1,    .00,0
    0
** CORR.1:
    CORR,  1,  1,  0
** CORR.2:
    EPRI, EPRI, EPRI, NONE
** CORR.3:
    0.2
** CORR.6:
    EPRI, THOM, THOM, CE-1, COND, G5.7
** CORR.7:
    0.0
** CORR.9:
    CE-1
** CORR.12:
    0.46366, 1
** CONT.1:
    CONT
** CONT.2:
    0.0, 0, 20, 20, 2, 2, 0, 0
** CONT.3:
    0.1, 0.0001, 0.001, 0, 0, 0, 0, 0.9
** CONT.6:
    1, 1, 0, 0, 1, 0, 1, 1, 0, 0, 1, 1, 0, 0
** CONT.7:
    4000.0, 0, 0, 0, 0, 0
** CONT.8:
    16
** CONT.11:
    16
** CONT.15:
    0, 0, 0, 0, 0
** END OF INPUT DATA:
    ENDD
    0
```

```
** CDC FILE NAME: WH166
**
** VIPRE.1:
   1,  0,  0
** VIPRE.2:
   WH166
** GEOM.1:
   GEOM,  25,  25,  56,  0,  0,  0
** GEOM.2:
   168.00,    0.0,    0.5
** GEOM.4:
    1,  .0630,   .9574,  .3314,   2,   2,  .1020,  .4340,   6,  .1020,  .4340
    2,  .1038, 1.2179,   .6629,   2,   3,  .1020,  .5550,   7,  .1330,  .4340
    3,  .1038, 1.2179,   .6629,   2,   4,  .1020,  .5550,   8,  .1330,  .4340
    4,  .1038, 1.2179,   .6629,   2,   5,  .1020,  .4340,   9,  .1330,  .4340
    5,  .0630,   .9574,  .3314,   1,  10,  .1020,  .4340,   0,  .0000,  .0000
    6,  .1038, 1.2179,   .6629,   2,   7,  .1330,  .4340,  11,  .1020,  .5550
    7,  .1682, 1.3258, 1.3258,   2,   8,  .1330,  .5550,  12,  .1330,  .5550
    8,  .1450, 1.4216, 0.9943,   2,   9,  .0720,  .5550,  13,  .0720,  .5550
    9,  .1450, 1.4216, 0.9943,   2,  10,  .1330,  .4340,  14,  .0720,  .5550
   10,  .1038, 1.2179,   .6629,   1,  15,  .1020,  .5550,   0,  .0000,  .0000
   11,  .1038, 1.2179,   .6629,   2,  12,  .1330,  .4340,  16,  .1020,  .5550
   12,  .1682, 1.3258, 1.3258,   2,  13,  .1330,  .5550,  17,  .1330,  .5550
   13,  .1450, 1.4216, 0.9943,   2,  14,  .0720,  .5550,  18,  .1330,  .5550
   14,  .1450, 1.4216, 0.9943,   2,  15,  .1330,  .4340,  19,  .1330,  .5550
   15,  .1038, 1.2179,   .6629,   1,  20,  .1020,  .5550,   0,  .0000,  .0000
   16,  .1038, 1.2179,   .6629,   2,  17,  .1330,  .4340,  21,  .1020,  .4340
   17,  .1682, 1.3258, 1.3258,   2,  18,  .1330,  .5550,  22,  .1330,  .4340
   18,  .1682, 1.3258, 1.3258,   2,  19,  .1330,  .5550,  23,  .1330,  .4340
   19,  .1682, 1.3258, 1.3258,   2,  20,  .1330,  .4340,  24,  .1330,  .4340
   20,  .1038, 1.2179,   .6629,   1,  25,  .1020,  .4340,   0,  .0000,  .0000
   21,  .0630,   .9574,  .3314,   1,  22,  .1020,  .4340,   0,  .0000,  .0000
   22,  .1038, 1.2179,   .6629,   1,  23,  .1020,  .5550,   0,  .0000,  .0000
   23,  .1038, 1.2179,   .6629,   1,  24,  .1020,  .5550,   0,  .0000,  .0000
   24,  .1038, 1.2179,   .6629,   1,  25,  .1020,  .4340,   0,  .0000,  .0000
   25,  .0630,   .9574,  .3314,   0,   0,  .0000,  .0000,   0,  .0000,  .0000
** RODS.1:
   RODS,    1,   15,    0,    1,    0,    0,    0,    0,    0,    0,    0
** RODS.2:
   168.00,    0.0,    0,    0
** RODS.3:
   22
** RODS.4:
      .000,    .540,   12.328,    .577,   23.419,    .638,   35.759,    .724
    43.149,    .798,   53.012,    .896,   61.034,    .994,   69.040,   1.092
    73.970,   1.153,   80.136,   1.221,   88.771,   1.300,   96.163,   1.350
   101.091,   1.374,  107.260,   1.393,  110.961,   1.386,  117.120,   1.374
   123.278,   1.337,  128.218,   1.288,  134.366,   1.215,  140.539,   1.129
   147.949,   1.006,  168.000,    .589,     .000,    .000,     .000,    .000
** RODS.9:
    1,   1,  .9723,   1,   1,   .250,   2,   .250,   6,   .250,   7,   .250
    2,   1,  .9732,   1,   2,   .250,   3,   .250,   7,   .250,   8,   .250
    3,   1,  .9723,   1,   3,   .250,   4,   .250,   8,   .250,   9,   .250
    4,   1,  .9732,   1,   4,   .250,   5,   .250,   9,   .250,  10,   .250
    5,   1,  .9723,   1,   9,   .250,  10,   .250,  14,   .250,  15,   .250
    6,   1,  .9732,   1,  14,   .250,  15,   .250,  19,   .250,  20,   .250
    7,   1,  .9732,   1,  19,   .250,  20,   .250,  24,   .250,  25,   .250
    8,   1,  .9723,   1,  18,   .250,  19,   .250,  23,   .250,  24,   .250
    9,   1,  .9732,   1,  17,   .250,  18,   .250,  22,   .250,  23,   .250
   10,   1,  .9732,   1,  16,   .250,  17,   .250,  21,   .250,  22,   .250
   11,   1,  .9723,   1,  11,   .250,  12,   .250,  16,   .250,  17,   .250
   12,   1,  .9732,   1,   6,   .250,   7,   .250,  11,   .250,  12,   .250
   13,   1, 1.1079,   1,   7,   .250,   8,   .250,  12,   .250,  13,   .250
   14,   1, 1.1090,   1,  13,   .250,  14,   .250,  18,   .250,  19,   .250
   15,   1, 1.1090,   1,  12,   .250,  13,   .250,  17,   .250,  18,   .250
   0
** RODS.68:
   1,  DUMY,  0.4220,  0.0,  0
** OPER.1:
   OPER,  1,  2,  0,  2,  0,  46,  0,  0,  0
** OPER.2:
   -1.0,  0.0,  0.0,  0.0
** OPER.3:
   0
** OPER.5:
   1499.700,    565.600,    3.442,     .416,    0.0     *      1    14
   1799.700,    564.000,    3.486,     .440,    0.0     *      2    15
   2109.700,    571.900,    3.505,     .476,    0.0     *      3    16
   2404.700,    568.400,    3.563,     .553,    0.0     *      4    17
   2100.700,    567.400,    2.950,     .445,    0.0     *      6    19
   2099.700,    562.300,    2.476,     .380,    0.0     *      7    20
   2399.700,    556.400,    2.470,     .437,    0.0     *      8    21
   2399.700,    563.000,    2.035,     .371,    0.0     *      9    22
   2404.700,    594.500,    2.997,     .410,    0.0     *     10    23
   2099.700,    603.300,    2.944,     .349,    0.0     *     11    24
   2099.700,    596.600,    3.531,     .424,    0.0     *     12    25
   2399.700,    606.500,    3.486,     .421,    0.0     *     13    26
   2399.700,    517.400,    2.016,     .429,    0.0     *     14    27
   2099.700,    524.900,    2.024,     .406,    0.0     *     15    28
   2094.700,    519.500,    2.544,     .496,    0.0     *     16    29
   2409.700,    528.800,    2.498,     .479,    0.0     *     17    30
   1804.700,    564.200,    3.459,     .446,    0.0     *     18    31
   1799.700,    515.200,    1.993,     .370,    0.0     *     19    32
   1499.700,    514.600,    2.498,     .418,    0.0     *     20    33
   1499.700,    523.800,    3.481,     .493,    0.0     *     21    34
   1499.700,    473.800,    2.061,     .417,    0.0     *     22    35
   1804.700,    478.300,    2.031,     .434,    0.0     *     23    36
   2099.700,    473.800,    1.544,     .385,    0.0     *     24    37
   2099.700,    485.300,    2.018,     .462,    0.0     *     25    38
```

```
2404.700,   487.900,   1.998,   .477,   0.0   *   26   39
2404.700,   468.500,   1.483,   .405,   0.0   *   27   40
2404.700,   443.400,   1.511,   .428,   0.0   *   28   41
2104.700,   436.900,   1.482,   .427,   0.0   *   29   42
2114.700,   432.500,   2.014,   .540,   0.0   *   30   43
1799.700,   439.900,   1.991,   .486,   0.0   *   31   44
1504.700,   431.000,   1.996,   .460,   0.0   *   32   45
1504.700,   432.000,   1.995,   .461,   0.0   *   33   45
1499.700,   401.700,   1.505,   .420,   0.0   *   34   46
1504.700,   433.100,   1.500,   .396,   0.0   *   35   47
2109.700,   403.100,   1.494,   .447,   0.0   *   36   48
2394.700,   404.700,   1.492,   .466,   0.0   *   37   49
2404.700    552.100,   3.007,   .522,   0.0   *   38   50
2399.700,   517.900,   3.006,   .605,   0.0   *   39   51
2099.700,   522.500,   2.997,   .535,   0.0   *   40   52
1804.700,   515.800,   3.498,   .567,   0.0   *   41   53
1504.700,   487.300,   2.489,   .451,   0.0   *   42   54
2104.700,   479.700,   2.505,   .525,   0.0   *   43   55
2409.700,   480.400,   2.515,   .531,   0.0   *   44   56
2099.700,   486.900,   2.492,   .539,   0.0   *   45   57
1499.700,   401.800,   2.024,   .516,   0.0   *   46   58
2099.700,   410.100,   2.016,   .525,   0.0   *   47   59
** OPER.12:
   0,  0   0,  0,  0,  0
** MIXX.1:
   MIXX,  0,  0,  0
** MIXX.2:
   0.8,  0.038
** DRAG.1:
   DRAG,  1,  0,  1
** DRAG.2:
   0.186,  -0.20,  0.0,  66.0,  -1.0,  0.0
** DRAG.5:
   0.5,  0.555
** GRID.1:
   GRID,  0,    2
** GRID.2:
   1.250,   0.570
** GRID.4:
   -1,   13
** GRID.6:
     6.0,2,  19.0,1,  32.0,2,  45.0,1,  58.0,2, 71.00,1, 84.00,2, 97.00,1,
   110.0,2, 123.0,1, 136.5,2, 149.0,1, 162.0,2,    .00,0,    .00,0,    .00,0
   0
** CORR.1:0
   CORR,  1,  1,  0
** CORR.2:
   EPRI,  EPRI,  EPRI,  NONE
** CORR.3:
   0.2
** CORR.6:
   EPRI, THOM, THOM, CE-1, COND, G5.7
** CORR.7:
   0.0
** CORR.9
   CE-1
** CORR.12:
   0.40799, 1
** CONT.1:
   CONT
** CONT.2:
   0.0, 0, 20, 20, 2, 2, 0, 0
** CONT.3:
   0.1, 0.0001, 0.001, 0, 0, 0, 0, 0.9
** CONT.6:
   1, 1, 0, 0, 1, 0, 1, 1, 0, 0, 1, 1, 0, 0
** CONT.7:
   4000.0, 0, 0, 0, 0, 0
** CONT.8:
   13
** CONT.11:
   13
** CONT.15:
   0, 0, 0, 0, 0
** END OF INPUT DATA:
   ENDD
   0
```

```
** CDC FILE NAME: [ ]
**
** VIPRE.1:
   1, 0, 0
** VIPRE.2:
   B AND W CONFIRMATORY TEST [ ]
** GEOM.1:
   [ ]
** GEOM.2:
   [ ]
** GEOM.4:
   [ ]
** RODS.1:
   [ ]
** RODS.2:
   [ ]
** RODS.3:
   [ ]
** RODS.4:
   [ ]
** RODS.9:
   [ ]
** RODS.68:
   [ ]
** OPER.1:
   [ ]
** OPER.2:
   [ ]
** OPER.3:
   [ ]
** OPER.5:
   [ ]
```

** OPER.12:

** MIXX.1:

```
** MIXX.2: [ ]
** DRAG.1: [ ]
** DRAG.2: [ ]
** DRAG.5: [ ]
** GRID.1: [ ]
** GRID.2: [ ]
** GRID.4: [ ]
** GRID.6: [ ]
[ ]
** CORR.1: [ ]
** CORR.2: [ ]
** CORR.3: [ ]
** CORR.6: [ ]
** CORR.7: [ ]
** CORR.9: [ ]
** CORR.12: [ ]
** CONT.1: [ ]
** CONT.2: [ ]
** CONT.3: [ ]
** CONT.6: [ ]
** CONT.7: [ ]
** CONT.8: [ ]
** CONT.11: [ ]
** CONT.15: [ ]
** END OF INPUT DATA: [ ]
ENDD
0
```

Appendix C

Validation Data Statistics

Table C.1 Test Section Geometry Parameters of the Validation Data

Test Section No.	No. of Data Points	No. of Heated Rods	Pitch (in)	Heated Rod OD (in)	Guide Tube OD (in)	Heated Length (in)	Grid Spacing (in)	Axial Flux Profile
113	11	16	0.555	0.422	0	96	20	CosineU
123	12	16	0.555	0.422	0	96	20	CosineU
140	32	16	0.555	0.422	0	96	32	USinU
144	38	16	0.555	0.422	0.545	168	26	USinU
145	41	16	0.555	0.422	0	168	26	USinU
148	72	16	0.555	0.422	0	168	26	USinU
152	44	16	0.555	0.422	0	168	26	USinU

Table C.2	ANALYSIS OF VARIANCE VALIDATION (FRESH) DATA ONE-WAY GROUPINGS BY	DCHF-1 CORRELATION TEST SECTION								
GR. NO.	Test Section	No. of CASES	M/P MEAN	STD DEV	NORMAL K-S Z	2-Tailed Prob>Z	MEAN T-VALUE	2-Tailed Prob>T	STD F-RATIO	2-Tailed Prob>F
1.	W113	11	0.977	0.068	0.438	0.991	1.25	0.213	1.32	0.665
2.	W123	12	0.986	0.062	0.514	0.954	1.14	0.274	1.60	0.383
3.	W140	32	0.997	0.057	0.459	0.985	0.93	0.358	1.88	0.037
4.	W144	38	1.017	0.070	0.544	0.929	-0.79	0.435	1.26	0.407
5.	W145	41	1.025	0.074	0.555	0.918	-1.38	0.167	1.12	0.688
6.	W148	70	1.002	0 095	0.420	0.995	0.42	0.672	1.48	0.032
7.	W152	44	1.011	0.077	0.797	0.549	-0.31	0.758	1.01	0.994
	ALL DATA	248	1.007	0.078	0.563	0.930				

Appendix D´

DCHF-1 Data Base Statistics

Ranges of the independent variables

Pressure		(psia)
	Low	Less than 1900
	Medium	Between 1900 and 2300
	High	Greater than 2300
Mass Flux		(Mlb/hr/sqft)
	Low	Less than 1.80
	Medium	Between 1.8 and 2.8
	High	Greater than 2.80
Local Quality		(%)
	Low	Less than 2.5
	Medium	Between 2.5 and 12.5
	High	Greater than 12.5
Grid spacing		(in)
	Low	Less than 15
	Medium	Between 15 and 25
	High	Greater than 25

Table D.1 ANALYSIS OF VARIANCE DCHF-1 CORRELATION

DCHF-1 DATA BASE

ONE-WAY GROUPINGS BY PRESSURE, MASS FLUX, & LOCAL QUALITY

GR. NO.	VARIABLE	No. of CASES	M/P MEAN	STD DEV	NORMAL K-S Z	2-Tailed Prob>Z	MEAN T-VALUE	2-Tailed Prob>T	STD F-RATIO	2-Tailed Prob>F
	PRESSURE									
1.	Low Pressure	409	0.996	0.092	0.545	0.928	0.78	0.436	1.04	0.621
2.	Med. Pressure	309	1.003	0.096	0.589	0.879	-0.39	0.697	1.04	0.690
3.	High Pressure	286	1.004	0.095	0.472	0.979	-0.56	0.577	1.02	0.802
	FLOW RATE									
4.	Low Flow rate	179	1.021	0.091	0.686	0.734	-2.74	0.006	1.07	0.592
5.	Med. Flow rate	478	0.983	0.096	0.710	0.694	3.30	0.001	1.03	0.628
6.	High Flow rate	347	1.013	0.090	1.021	0.248	-2.27	0.023	1.10	0.268
	LOCAL QUALITY									
7.	Low Quality	174	0.998	0.072	0.646	0.799	0.39	0.694	1.71	0.000
8.	Med. Quality	440	1.010	0.095	0.669	0.762	-1.76	0.078	1.03	0.747
9.	High Quality	390	0.991	0.101	0.525	0.946	1.64	0.102	1.14	0.117
	ALL DATA	1004	1.000	0.094	0.600	0.864				

Table D.2 ANALYSIS OF VARIANCE DCHF-1 CORRELATION

DCHF-1 DATA BASE

ONE-WAY GROUPINGS BY GRID SPACING, AXIAL FLUX, LENGTH, ROD DIAMETER AND CELL TYPE

GR. NO.	VARIABLE	No. of CASES	M/P MEAN	STD DEV	NORMAL K-S Z	2-Tailed Prob>Z	MEAN T-VALUE	2-Tailed Prob>T	STD F-RATIO	2-Tailed Prob>F
	GRID SPACING									
1.	Low Spacing	37	1.004	0.068	0.483	0.974	-0.330	0.740	1.930	0.016
2.	Med. Spacing	524	0.994	0.098	0.802	0.541	1.260	0.209	1.080	0.287
3.	High Spacing	443	1.008	0.091	0.803	0.540	-1.420	0.157	1.070	0.396
	LENGTH									
1.	Length (8 ft)	482	1.011	0.090	0.706	0.702	-2.150	0.032	1.100	0.240
2.	Length (14 ft)	522	0.990	0.097	0.390	0.953	1.940	0.053	1.060	0.436
	ROD DIAMETER									
1.	Small OD (0.374")	462	0.991	0.100	0.688	0.732	1.670	0.095	1.140	0.106
2.	Large OD (0.422")	542	1.008	0.088	0.530	0.941	-1.640	0.101	1.150	0.071
	AXIAL HEAT FLUX									
1.	Uniform AHF	361	1.016	0.099	0.651	0.790	-2.620	0.009	1.100	0.282
2.	Non-Uniform AHF	643	0.991	0.091	0.505	0.961	1.890	0.058	1.080	0.269
	CELL TYPE									
1.	Typical Cell	747	0.999	0.093	0.545	0.928	0.270	0.788	1.030	0.707
2.	Thimble Cell	257	1.004	0.098	0.587	0.881	-0.520	0.602	1.080	0.441
	ALL DATA	1004	1.000	0.094	0.600	0.864				

Table D.3 ANALYSIS OF VARIANCE DCHF-1 CORRELATION

DCHF-1 DATA BASE

TWO-WAY GROUPINGS BY PRESSURE & MASS FLUX

GR. NO.	PRES -SURE	FLOW RATE	No. of CASES	M/P MEAN	STD DEV	NORMAL K-S Z	2-Tailed Prob>Z	MEAN T-VALUE	2-Tailed Prob>T	STD F-RATIO	2-Tailed Prob>F
1.	Low P	Low G	90	[illegible]	0.081	0.663	0.771	-0.390	0.697	1.340	0.083
2.	Low P	Med. G	[illegible]	0.987	0.098	0.593	0.873	1.750	0.081	1.080	0.456
3.	Low P	High G	121	1.005	0.089	0.880	0.421	-0.530	0.596	1.110	0.466
4.	Med. P	Low G	46	1.030	0.102	0.648	0.795	-1.950	0.057	1.170	0.422
5.	Med. P	Med. G	146	0.984	0.097	0.569	0.902	1.960	0.050	1.050	0.656
6.	Med. P	High G	117	1.015	0.088	0.825	0.504	-1.740	0.085	1.140	0.380
7.	High P	Low G	43	1.048	0.093	0.438	0.991	-3.230	0.001	1.030	0.945
8.	High P	Med. G	134	0.976	0.091	0.704	0.705	2.830	0.005	1.070	0.636
9.	High P	High G	109	1.021	0.091	0.640	0.808	-2.170	0.030	1.060	0.699
	ALL DATA		1004	1.000	0.094	0.600	0.864				

Table D.4 ANALYSIS OF VARIANCE DCHF-1 CORRELATION

DCHF-1 DATA BASE

TWO-WAY GROUPINGS BY PRESSURE & LOCAL QUALITY

GR. NO.	PRES -SURE	LOCAL QUALIT	No. of CASES	M/P MEAN	STD DEV	NORMAL K-S Z	2-Tailed Prob>Z	MEAN T-VALUE	2-Tailed Prob>T	STD F-RATIO	2-Tailed Prob>F
1.	Low P	Low X	25	1.016	0.071	0.620	0.837	-1.110	0.275	1.770	0.090
2.	Low P	Med. X	177	1.002	0.094	0.698	0.714	-0.240	0.811	1.010	0.945
3.	Low P	High X	207	0.988	0.093	0.466	0.982	1.670	0.096	1.030	0.813
4.	Med. P	Low X	54	1.024	0.059	0.677	0.750	-2.790	0.007	2.550	0.000
5.	Med. P	Med. X	143	1.018	0.095	0.510	0.957	-2.090	0.037	1.020	0.835
6.	Med. P	High X	112	0.973	0.104	0.726	0.667	2.660	0.009	1.220	0.140
7.	High P	Low X	95	0.978	0.073	0.770	0.593	2.775	0.007	1.640	0.003
8.	High P	Med. X	120	1.011	0.098	0.519	0.951	-1.240	0.216	1.080	0.539
9.	High P	High X	71	1.025	0.109	0.673	0.756	-1.880	0.064	1.340	0.072
	ALL DATA		1004	1.000	0.094	0.600	0.864				

Table D.5 ANALYSIS OF VARIANCE DCHF-1 CORRELATION

DCHF-1 DATA BASE

TWO-WAY GROUPINGS BY MASS FLUX & LOCAL QUALITY

GR. NO.	FLOW RATE	LOCAL QUALIT	No. of CASES	M/P MEAN	STD DEV	NORMAL K-S Z	2-Tailed Prob>Z	MEAN T-VALUE	2-Tailed Prob>T	STD F-RATIO	2-Tailed Prob>F
1.	Low G	Low X	8	1.032	0.079	0.628	0.825	-0.96	0.338	1.42	0.665
2.	Low G	Med. X	40	1.039	0.102	0.541	0.932	-2.39	0.021	1.17	0.450
3.	Low G	High X	131	1.015	0.088	0.694	0.148	-1.76	0.080	1.14	0.348
4.	Med. G	Low X	113	0.989	0.072	0.582	0.888	1.45	0.150	1.71	0.000
5.	Med. G	Med. X	206	0.998	0.096	0.491	0.969	0.26	0.799	1.05	0.647
6.	Med. G	High X	159	0.958	0.104	0.597	0.868	4.79	0.000	1.23	0.079
7.	High G	Low X	53	1.010	0.068	0.633	0.817	-1.01	0.315	1.89	0.005
8.	High G	Med. X	194	1.016	0.092	1.140	0.148	-2.11	0.035	1.06	0.622
9.	High G	High X	100	1.010	0.096	0.802	0.541	-1.03	0.303	1.04	0.746
	ALL DATA		1004	1.000	0.094	0.600	0.864				

Table D́.6 ANALYSIS OF VARIANCE DCHF-1 CORRELATION

DCHF-1 DATA BASE

TWO-WAY GROUPINGS BY MASS FLUX & GRID SPACING

GR. NO.	FLOW RATE	GRID SPACE	No. of CASES	M/P MEAN	STD DEV	NORMAL K-S Z	2-Tailed Prob>Z	MEAN T-VALUE	2-Tailed Prob>T	STD F-RATIO	2-Tailed Prob>F
1.	Low G	Low S	2	0.893	0.034	0.368	0.999	1.610	0.107	7.510	0.570
2.	Low G	Med. S	109	1.018	0.096	0.703	0.706	-1.900	0.058	1.040	0.735
3.	Low G	High S	68	1.029	0.081	0.713	0.690	-2.830	0.006	1.350	0.118
4.	Med. G	Low S	20	0.990	0.065	0.561	0.912	0.690	0.495	2.090	0.058
5.	Med. G	Med. S	242	0.984	0.100	0.950	0.327	2.270	0.024	1.140	0.196
6.	Med. G	High S	216	0.981	0.093	0.569	0.903	2.740	0.006	1.030	0.783
7.	High G	Low S	15	1.038	0.052	0.772	0.590	-2.730	0.015	3.270	0.013
8.	High G	Med. S	173	0.992	0.094	1.185	0.121	1.110	0.266	1.010	0.950
9.	High G	High S	159	1.035	0.082	0.884	0.416	-4.820	0.000	1.310	0.031
	ALL DATA		1004	1.000	0.094	0.600	0.864				

Table D.7 ANALYSIS OF VARIANCE DCHF-1 CORRELATION

DCHF-1 DATA BASE

TWO-WAY GROUPINGS BY LENGTH & ROD DIAMETER

GR. NO.	Length	ROD OD	No. of CASES	M/P MEAN	STD DEV	NORMAL K-S Z	2-Tailed Prob>Z	MEAN T-VALUE	2-Tailed Prob>T	STD F-RATIO	2-Tailed Prob>F
1.	Short	Small	250	1.029	0.100	0.669	0.763	-4.170	0.000	1.120	0.257
2.	Short	Large	232	0.991	0.074	0.751	0.626	1.540	0.125	1.640	0.000
3.	Long	Small	212	0.946	0.081	0.594	0.872	8.640	0.000	1.360	0.006
4.	Long	Large	310	1.020	0.096	0.449	0.988	-3.310	0.001	1.030	0.742
	ALL DATA		1004	1.000	0.094	0.600	0.864				

Short Rods 96"

Long Rods 168"

Small OD 0.374"

Large OD 0.422"