Westinghouse Proprietary Class 3

RESPONSE TO NUCLEAR REGULATORY STAFF REQUEST FOR ADDITIONAL INFORMATION ON VIPRE/WRB-2 DNBR THERMAL LIMIT FOR WESTINGHOUSE 17X17 OFA AND VANTAGE 5 FUEL

Document Number NFSR-0090 RAI Response #1

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Proprietary Statement

Table of Contents

List of Tables

List of Figures

Question on VANTAGE 5H DNBR Penalty

On June 27, 1994, Westinghouse informed the NRC that design corrective measures to resolve flow induced vibration problems for 17x17 VANTAGE 5H fuel with intermediate flow mixing grids resulted in reduced DNBR margin. Do you intend that your methodology be applicable for this design? If so, please address how the appropriate penalty is to be determined and the magnitude of the penalty to be imposed.

Response:

The Byron and Braidwood plants do not use 17x17 VANTAGE 5H fuel, nor does ComEd plan to use this fuel type. Therefore, the penalty associated with these design corrective measures does not apply to ComEd.

Question 1

(Page 4) A range of validity for the DNB correlation is given on this page. Please explain how your methodology assures that the correlation will not be used outside of the acceptable range.

Response

ComEd's procedures that govern generation and review of controlled work require verification that any assumptions, applicable correlation limits, etc. are applied correctly. This includes verification that the parameters used by correlations are within the ranges of applicability for the correlations.

Question 2

(Page 19) Please provide copies of the sections of Reference 1 ("Factors for One-Sided Tolerance Limits and for Variables Sampling Plans," SCR 607, D. B. Owen) which describe the basis for your statistical approach.

Response

Provided as **Appendix A** is Section 1.1 "One-sided tolerance limits for a normal distribution" and Table 2.4, Values of k for f=n-1 and γ=.95 from Reference 1. Section 1.1 provides a brief description of Owen's method used to calculate the VIPRE/WRB-2 thermal limit. Table 2.4 was used to determine K_p based on a 95/95 confidence level and the calculated degrees of freedom. Pages 9 and 10 of Reference **2**, provide equations for calculating the mean, standard deviation, degrees of freedom, and thermal limit. The following provides more details on the VIPRE/WRB-2 thermal limit calculation:

$$TL = \frac{1}{\left(\frac{M}{P}\right)_{avg} - K_p S}$$

where,

$$\left(\frac{M}{P}\right)_{avg} = \frac{1}{J}\left[\sum_{j=1}^{J}\left(\frac{M}{P}\right)_{avg,j}\right]$$

$$\left(\frac{M}{P}\right)_{avg,j} = \frac{1}{N_j}\left[\sum_{i=1}^{N_j}\left(\frac{M}{P}\right)_{i,j}\right]$$

J = The total number of Test Series (11)
N_j = The number of tests in Test Series j

From Table 2 on Page 11 of Reference **2**

$$\left(\frac{M}{P}\right)_{avg} = \frac{1}{11}[0.9791 + ... + 0.9974] = 1.0040$$

$$S = \sqrt{SW^2 + SA^2}$$

where SW^2 = Variance within a group
SA^2 = Variance between groups

The NRC recommended formulas for SA^2 and SW^2 are (Reference 3 and Westinghouse's Follow up Response to additional information Request #1 of Reference 4);

$$SA^2 = \frac{SSA}{FA}$$

$$SW^2 = \frac{SSW}{FW}$$

where

$$SSA = \sum_{j=1}^{J}\left[\left(\frac{M}{P}\right)_{avg,j} - \left(\frac{M}{P}\right)_{avg}\right]^2$$

$$SSW = \sum_{j=1}^{J}\sum_{i=1}^{N_j}\left[\left(\frac{M}{P}\right)_{i,j} - \left(\frac{M}{P}\right)_{avg,j}\right]^2 = \sum (N_j - 1)\, S_j^{\,2}$$

S_j = Standard Deviation of Test j
FA = J - 1
FW = N - J
N = Total number of tests (684)

From Table 2 on Page 11 of our Topical Report (Reference 4)

$$SSA = (0.9791 - 1.0040)^2 + \ldots\ldots\ldots\ldots + (0.9974 - 1.0040)^2 = 0.00425 \quad \text{and,}$$

$$SSW = (51-1)\,0.0713^2 + \ldots\ldots\ldots\ldots\ldots + (73-1)\,0.0812^2 = 4.39$$

Therefore

$$SA^2 = \frac{0.00425}{(11-1)} = 0.000425 \quad \text{and,}$$

$$SW^2 = \frac{4.39}{(684-11)} = 0.00653$$

$$S = \sqrt{0.000425 + 0.00653} = 0.0834$$

The Degrees of Freedom (F) is defined as:

$$F = \frac{\left(SW^2 + SA^2\right)^2}{\left(\frac{SW^4}{FW} + \frac{SA^4}{FA}\right)} = 594$$

From Table 2.4[1] of Reference **1**

$$K_p = 1.753$$

Therefore the WRB-2 Thermal Limit is

$$TL = \frac{1}{1.0040 - 1.753(0.0834)} = 1.1658 \quad \therefore \text{ Thermal Limit of 1.17 is used}$$

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[1] Note this table is also included in **Appendix A** of this document.

Question 3

(Page 3) It is stated that the standard Tong F-factor is applied to account for non-uniform axial power profiles. Please give the exact form of this equation used defining each of the terms. Also, explain how each input parameter is obtained for both analysis of test data and in the application of your methodology for licensing analysis.

Response

The exact form of the Tong F-factor equation is (Reference **5**);

$$F_c = \frac{C}{q''_{crit,NU}\left(1 - e^{-C l_{crit}}\right)} \int_0^{l_{crit}} q''(z) e^{-C(l_{crit} - z)} dz$$

where F_c is used in the relation:

$$q''_{crit,NU} = \frac{q''_{crit,EU}}{F_c}$$

and C is empirically determined as

$$C = 0.15 \frac{(1 - \chi_{crit})^{4.31}}{(G/10^6)^{0.478}} \quad (in^{-1})$$

Variable Definitions

χ_{crit} = Quality at critical heat flux location
l_{crit} = Axial location of critical heat flux (in)
$q''(z)$ = Heat flux at axial location z (BTU/hr-ft^2)
$q''_{crit,EU}$ = Equivalent uniform critical heat flux (BTU/hr-ft^2)
$q''_{crit,NU}$ = Non uniform critical heat flux (BTU/hr-ft^2)
G = Mass Velocity (lb/hr-ft^2)

ComEd's implementation of the standard Tong F-factor equation for the WRB-2 correlation is identical to its implementation in the W-3 critical heat flux correlation function already written into VIPRE (Reference 6). Below is the standard Tong F-factor equations as used in VIPRE.

$$F_{axial} = \frac{C_j}{q_j^{\cdot}\left(1-e^{-C_j(X_j-X_b)}\right)}\int_{X_b}^{X_j} q^{\cdot}(z)e^{-C_j(X_j-z)}dz$$

where F_{axial} is used in the relation:

$$q^{\cdot}_{CHF_{nonuniform}} = \frac{q^{\cdot}_{CHF_{uniform}}}{F_{axial}}$$

and

$C_j \quad = \; 0.15\dfrac{(1-x_j)^{4.31}}{(G_j/10^6)^{0.478}}\,in^{-1}$
X_j = axial distance from the inlet (inches) at node j
X_b = axial distance from inlet to first boiling node (determined using the Jen-Lottes correlation
$q''(z)$ = heat flux at axial location z
$q_j^{\cdot}$ = local heat flux at node j
x_j = local quality at node j
G_j = local mass flux at node j

The only difference between the VIPRE implementation of the Tong F-factor and the original Tong paper is the integration limits. In a subsequent publication (Reference 7) Tong clarified the definition of the l_{crit} or l_{dnb} term as "the location of DNB measured from the inception of local boiling."

It is our understanding that the Technical Reviewer is planning to use a spread sheet to check the accuracy of ComEd's calculations. In order to help expedite the reviewer's check of our calculations, we have provided the VIPRE calculated Tong F-factors for all the Test Cases with non-uniform axial heat flux distributions in **Appendix B**. Please note that Test Bundles A-6, A-7, A-10, A-11, and A-12 have uniform axial heat flux distributions, therefore, the Tong F-factor is 1.0 for these cases.

Question 4

(Page 15) The figure on this page appears to show a consistent trend of the predicted CHF being conservative at low values of the local mass flux and non-conservative at high values of the mass flux. Please describe any analysis you have performed to quantify biases in the correlation. If no such analyses have been performed, justify that the apparent bias is acceptable by providing an upper bound on the bias.

Response

As addressed in the response to Question 5, ComEd also recognizes that there is a residual trend in the scatter plots. However, by comparing to Westinghouse's original submittal to the NRC (Reference 4), it is concluded that this residual trend is not a result of the implementation of the WRB-2 correlation in VIPRE. Any bias in the correlation will be bounded statistically by the 1.17 thermal limit; where the intent is that a calculated value of DNBR or 1.17 corresponds to 95% probability at a 95% confidence level of not experiencing DNB. Since DNBR is actually defined as the Predicted CHF/Measured CHF, the DNBR limit can be represented in terms of the Measured CHF/Predicted CHF value as 1/1.17 or 0.855. The expected percentage of data points with a Measured CHF/Predicted CHF below 0.855 would therefore be approximately 5%. The 11 test series for the WRB-2 correlation contain a total of 684 data point. We would therefore expect fewer than 35 data points would have Measured CHF/Predicted CHF values less than 0.855. The actual data indicated 27 data points were below 0.855, which is less than the correlation infers, and is therefore conservative.

Question 5

Please provide the best linear fit of the data shown on page 15 as a linear function of mass flux. To determine whether there are other potential biases, please fit the data as a linear function of pressure and as a linear function of quality.

Response

Figure 1: Measured-to-Predicted Critical Heat Flux vs. Local Mass Flux, Figure 2: Measured-to-Predicted Critical Heat Flux vs. Local Quality, and Figure 3: Measured-to-Predicted Critical Heat Flux vs. Pressure, which follow, include the equation of the best linear fit as requested. Also note the Measured CHF/Predicted CHF value of 0.855 corresponding to the thermal limit of 1.17 is indicated with a dotted line on these figures.

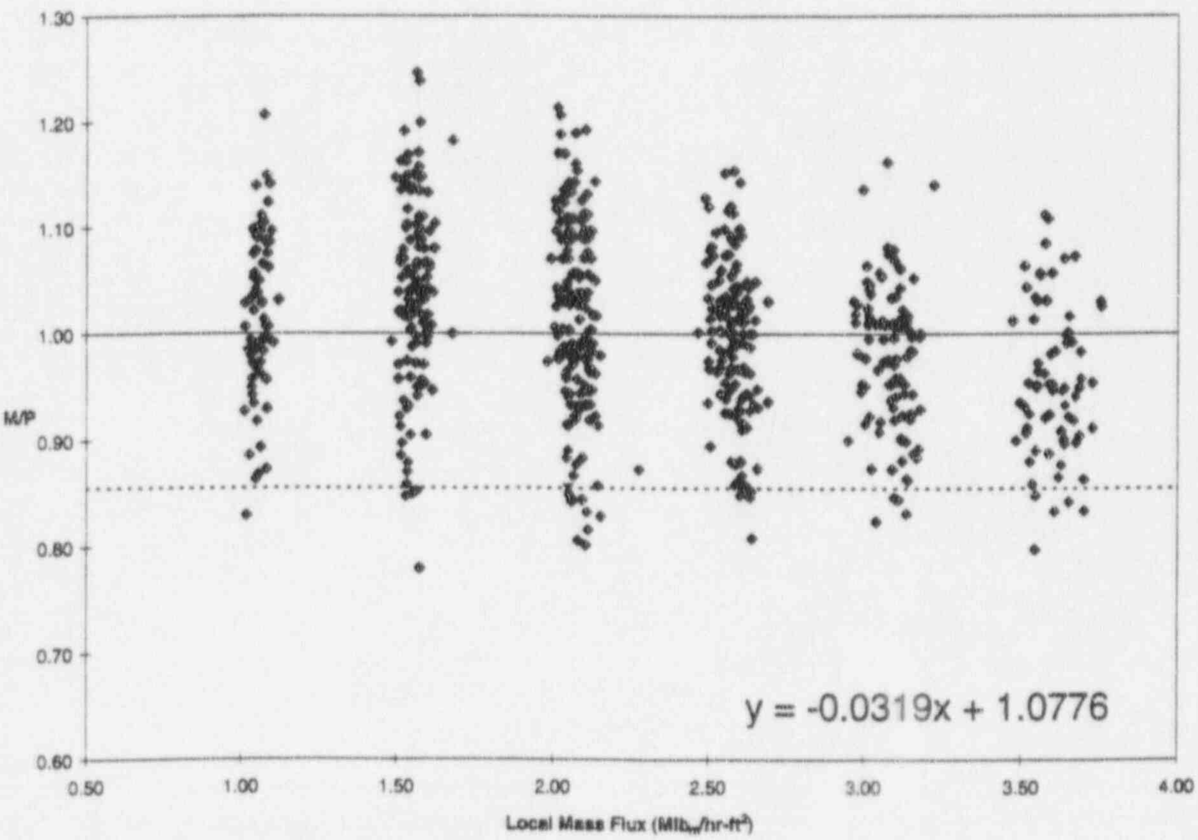

Figure 1: Measured-to-Predicted Critical Heat Flux vs. Local Mass Flux

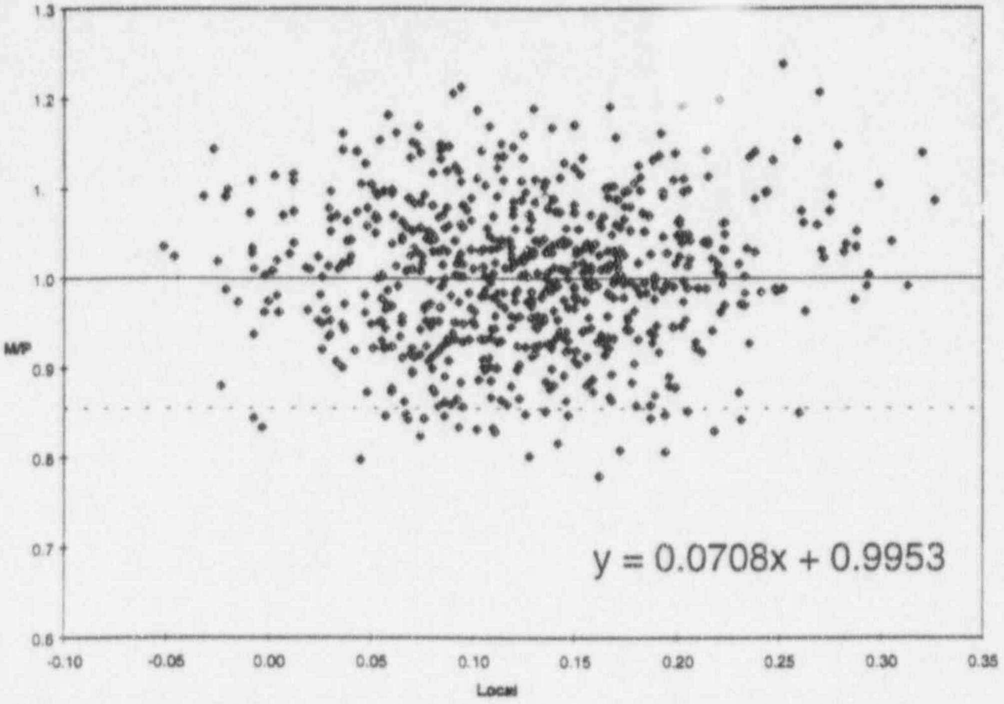

Figure 2: Measured-to-Predicted Critical Heat Flux vs. Local Quality

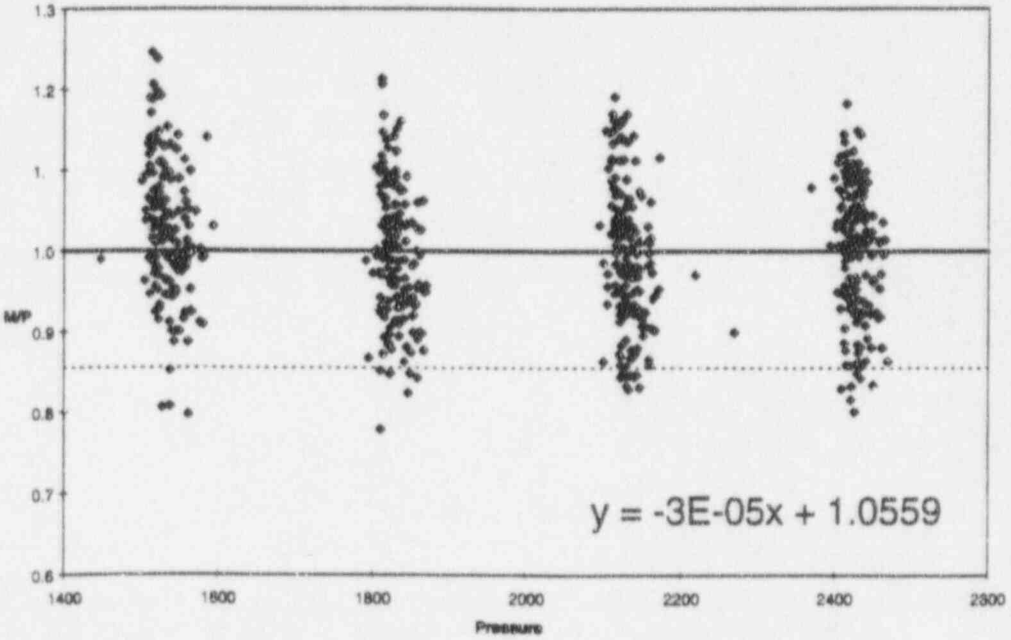

Figure 3: Measured-to-Predicted Critical Heat Flux vs. Pressure

Question 6

Many of the parameters in the WRB-2 CHF correlation involve geometrical features of the Westinghouse test apparatus (e.g. hydraulic diameter, heated diameter, distance from the most recent upstream mixing vane). No mention is given in the report as to the values used for these parameters. Please provide the values used for each test section and channel type.

Response

The following information is required as input to the WRB-2 correlation

1. Pressure, P
2. Local Mass Flux, G_{loc}
3. Local Quality, X_{loc}
4. Hydraulic Diameter, D_h
5. Heated Diameter, D_e
6. Heated Length, Inlet to CHF Location, L_h
7. Grid Spacing, g_{sp}
8. Distance from the Last Vaned Grid to CHF Location, d_g

The first three items, pressure, local mass flux, and local quality can be found in **Appendix C** in the CHF Summary output listings from VIPRE. Table 1, Test Bundle Geometrical Data References, is a list of figures containing geometrical data for each test bundle. The figures referenced in this table contain the grid locations, grid spacing and the geometrical data required to calculate hydraulic and heated diameters. It should be noted that the test section numbering used in Reference **8** refers to the test numbering for the WRB-1 calculations. Cross references are included for clarity. Nine of the eleven WRB-2 test bundles were also used in calculating the WRB-1 thermal limit. ComEd used the Westinghouse logic to maximize the value of d_g, the distance from the last vaned grid to CHF location. An excellent description of Westinghouse's logic for determining d_g can be found in the response to question 12 of Westinghouse's Response to additional information Request #1 in Reference 4.

WRB-2 Test Number	WRB-1 Test Number	Test Bundle Cross Section	Test Bundle Axial Grid Location
A-2	N/A	Figure A-6, Reference 4	Figure A-8, Reference 4
A-3	N/A	Figure A-6, Reference 4	Figure A-8, Reference 4
A-4	A-20	Figure 7, Reference 8	Figure 17, Reference 8
A-5	A-21	Figure 8, Reference 8	Figure 17, Reference 8
A-6	A-3	Figure 1, Reference 8	Figure 10, Reference 8
A-7	A-1	Figure 1, Reference 8	Figure 10, Reference 8
A-8	A-5	Figure 1, Reference 8	Figure 13, Reference 8
A-9	A-18	Figure 6, Reference 8	Figure 13, Reference 8
A-10	A-4	Figure 2, Reference 8	Figure 12, Reference 8
A-11	A-19	Figure 2, Reference 8	Figure 12, Reference 8
A-12	A-2	Figure 2, Reference 8	Figure 11, Reference 8

Table 1: Test Bundle Geometrical Data References

Question 7

The report does not address the nodalization utilized in the VIPRE simulation. Please provide information regarding the mesh spacing. The nodalization is important for determination of geometrical parameters for input to the WRB-2 correlation, in particular, the resolution that can be achieved for such parameters as heated length, LH, and distance from the most recent mixing vane grid, dg.?

Response

The axial noding used was 50 uniform nodes (3.36 in.) for the 14 foot tests (A-2 to A-5, A-7 to A-9, A-12) and 48 uniform nodes (2 in.) for the 8 foot tests (A-6, A-10, A-11). All of the models noding began at the bottom of the heated length. Westinghouse (Reference 4) used these same axial noding schemes in their THINC/WRB-2 calculations.

Question 8

Tables A-1 through A-12 of the report provide only the predicted local heat flux and quality. Other parameters from the code simulations, such as local mass flux and heated length to the CHF position are necessary to make a prediction using the WRB-2 correlation. Please provide all applicable data that were used as input to the correlation.

Response

Please note that there is no Table A-1 in Reference 2. The data included as Appendix A in our topical is listed by Westinghouse Test Section Number (Reference 4).

Appendix C contains the output listings of the VIPRE CHF summary files for tests A-2 through A-12. These output listings contain the following information:

1) Case ID Number
2) Operating Conditions
    - System Pressure (psia)
    - Inlet Enthalpy (BTU/lb$_m$)
    - Inlet Mass Flux (Mlb$_m$/hr-ft^2)
    - Average Heat Rate (BTU/sec-ft)
3) MDNBR
4) Critical Location
    - Hot Channel Index (see Figure 4 on page 15)
    - Hot Rod Index (see Figure 4 on page 15)
    - Axial Level (in)
5) Hot Channel Conditions
    - Mass Flux (Mlb$_m$/hr-ft^2)
    - Equilibrium Quality
    - Heat Flux (MBTU/hr-ft^2)
6) Predicted Critical Heat Flux (MBTU/hr-ft^2)
7) Correlation Flag (WRB-2 in all Cases)
8) Time (sec) (0.00 in all cases)

Question 9

Please provide the radial layout of the VIPRE model of the test section tube bundle. For the data of Tables A-1 to A-12 identify which bundle subchannel is predicted to have the CHF and confirm that the local quality and mass flux values are for that channel? Do these "predicted" subchannels and rods match the experimental test data?

Response

Figure 4 shows the radial nodalization of the VIPRE model used for the eleven (11) Westinghouse tests (A-2 through A-12). Again, please note that Reference **2** does not include a Table A-1.

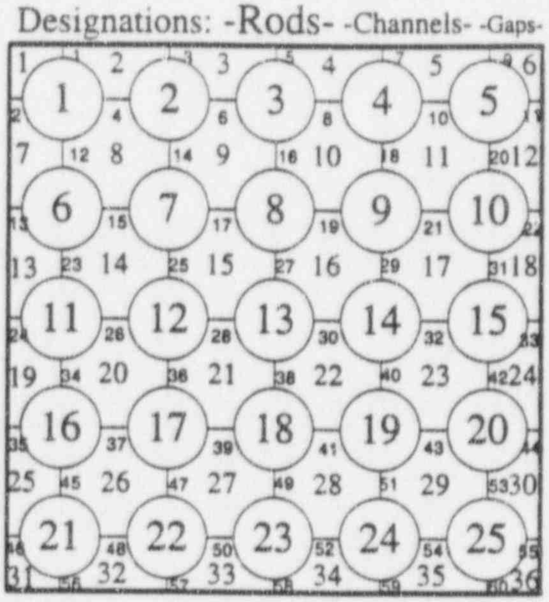

Figure 4: VIPRE Radial Nodalization

Appendix C contains the VIPRE CHF Summary output file listings for each test series. These output listings include the location of CHF for each test along with fluid conditions at that location. ComEd does not have access to the measured subchannel and rod locations where CHF was observed. This information was not included in Reference **4**. However, the VIPRE/WRB-2 predicted location of the subchannels and rods where CHF occurred were consistent with expectations. For the thimble channel tests, A-5, A-9, and A-11, the hot rod was always one of the 8 high powered rods (7, 8, 9, 12, 14, 17, 18, or 19) and the hot channel was one of the four channels associated with that rod. For the remaining cases, representative of a typical channel, the hot channel was always one of the four center channels (15, 16, 21, or 22) and the hot rod was one of the four rods associated with this channel.

Question 10

(Page 13) For the purposes of establishing the accuracy of the correlation, please show the least square linear fit to the measured versus predicted data.

Response

The dashed line on Figure 5: Measured-to-Predicted Critical Heat Flux Data, indicates that ComEd's VIPRE/WRB-2 95/95 thermal limit of 1.17. Also shown on the Figure is the equation for the linear fit as indicated on the plot.

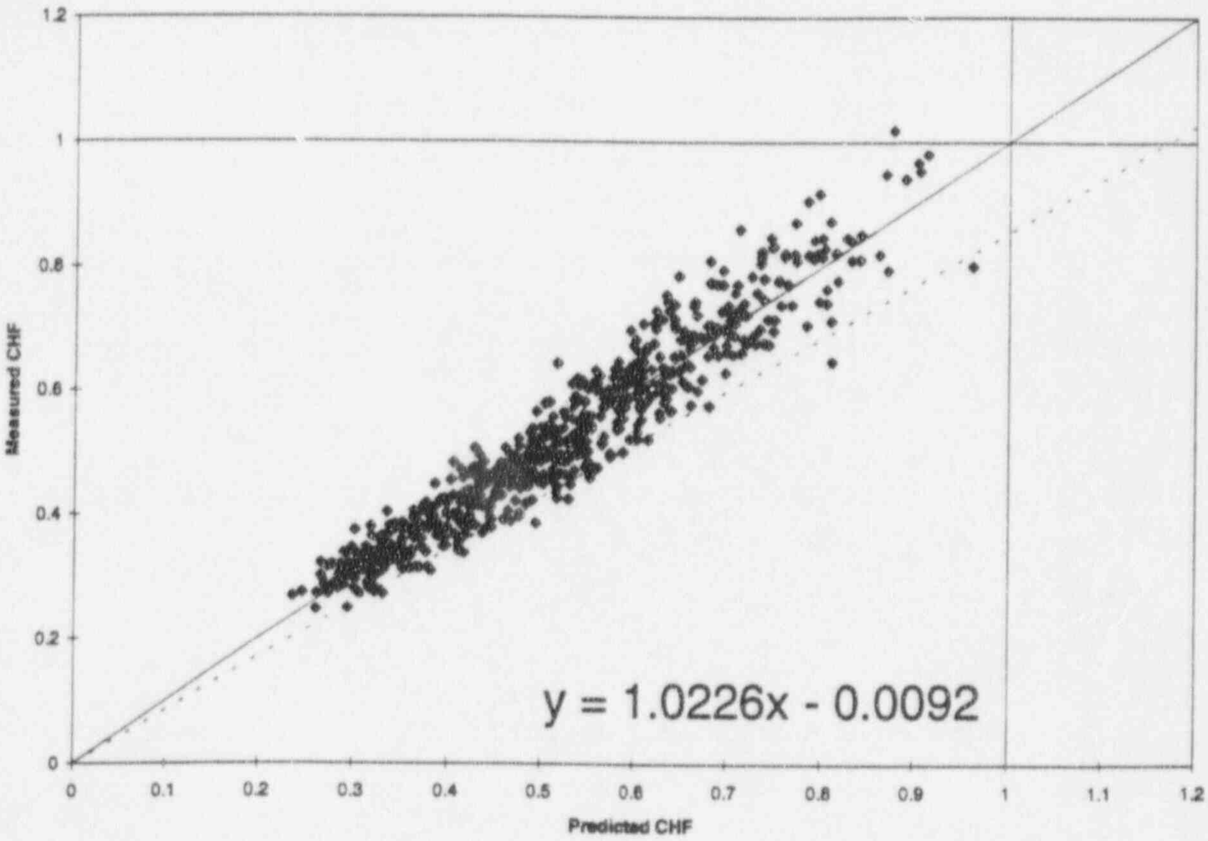

Figure 5: Measured-to-Predicted Critical Heat Flux Data

References

1) "Factors for One-Sided Tolerance Limits and for Variables Sampling Plans," SCR-607, Sandia National Laboratories, D. B. Owen, March 1963.

2) "VIPRE/WRB-2 DNBR Thermal Limit for Westinghouse 17x17 OFA and VANTAGE 5 Fuel," Commonwealth Edison Company, Document Number NFSR-0090, L. Klasmier and H. Kim, dated September 8, 1992.

3) "New Westinghouse Correlation WRB-1 for Predicting Critical Heat Flux in Rod Bundles with Mixing Vane Grids," WCAP-8762-P-A, F. E. Motley, et al., July 1984.

4) "Reference Core Report Vantage 5 Fuel Assembly," WCAP-10444-P-A, edited by S. L. Davidson and W. R. Kramer, September 1985.

5) Tong, L. S., "Boiling Crisis and Critical Heat Flux," TID-25887, 1972.

6) "VIPRE-01: A Thermal-Hydraulic Code for Reactor Cores," Volume 1: Mathematical Modeling (Revision 3), EPRI NP-2511-CCM-A, August 1989.

7) "Boiling Heat Transfer and Two-Phase Flow," L. S. Tong, Westinghouse Electric Corporation, 1975.

8) "Commonwealth Edison Project, Byron/Braidwood Nuclear Power Plant, Zion Nuclear Power Plant, Thermal-Hydraulic Technology Transfer," Letter from J. W. Swogger (West.) to M. F. Finn (CECo), 88CW*-G-0024, April 29, 1988.

Appendix A - Owen's Method Reference

FACTORS FOR ONE-SIDED TOLERANCE LIMITS AND FOR VARIABLES SAMPLING PLANS

1. INTRODUCTION.

1.1 One-sided tolerance limits for a normal distribution.

For a normal random variable X with known mean μ and known standard deviation σ, it is possible to say that exactly a proportion P of the normal population is below $\mu + K_p\sigma$, where K_p is read from a table of the inverse normal probability distribution (e.g., see Reference [52], p. 12). For example, one can say that exactly 95% of the population is below $\mu + 1.64485\sigma$. The quantity $\mu + K_p\sigma$ is an upper tolerance limit.

In most cases, however, μ and σ are unknown and it is necessary to estimate both of them from a sample. Then a tolerance limit of the form $\bar{x} + ks$ may be used where $\bar{x}$ is an estimate of μ and s is an estimate of σ. Since $\bar{x}$ and s will be random variables, however, the tolerance limit statement can only be made with a given probability attached.

The problem then reduces to finding k such that the probability is γ that at least a proportion P of the population is below $\bar{x} + ks$. Tables of factors for one-sided tolerance limits for a normal distribution have been given in References [29], [37], [50], and [52] for the case where a sample $x_1, x_2, \ldots, x_n$ is taken and the sample mean,

$$\bar{x} = \frac{1}{n}\sum_{i=1}^{n} x_i,$$

and the sample standard deviation,

$$s = \sqrt{\frac{1}{n-1}\sum_{i=1}^{n}(x_i - \bar{x})^2},$$

are computed.

A value of k is given in the tables of Section 2 such that "at least a proportion P of the normal population is less than $\bar{x} + ks$ with probability equal to γ." The value $\bar{x} + ks$ is called an upper tolerance limit. For a lower tolerance limit $\bar{x} - ks$ is used and the statement is "at least a proportion P of the population is greater than $\bar{x} - ks$ with confidence γ." If a two-sided limit is desired the reader is referred to References [12], [35], [52], and [76].

If the normal distribution has mean μ and standard deviation σ and either of these are known, there are entries in the tables of Sections 3 and 4 which will give the required tolerance limit. When the mean is known, k may be read from the tables of Section 4 with $n = \infty$, i.e., the tables of Sections 4.1.15, 4.2.15, and 4.3.15. Similarly, if the standard deviation is known, k may be read from the tables of Section 4 with $f = \infty$, i.e., as the last entry for each table. The tables of Sections 3.1, 3.2 and 3.3 may be useful if $n = 1$ or ∞ or if $f = 1$ or ∞.

It is convenient to define the term degrees of freedom for $\bar{x}$ as that value of n which occurs in the statement $\bar{x}$ has mean μ and standard deviation $\sigma/\sqrt{n}$. Similarly, the degrees of freedom for s is that value of f which occurs in the statement fs^2/σ^2 has a chi-square distribution with f degrees of freedom.

In addition to giving more extensive tables of k than [29], [37], and [50], this report extends the tables of k to the cases where the degrees of freedom for s are not necessarily one less than the degrees of freedom for $\bar{x}$. The degrees of freedom for s will be designated by f, and the degrees of freedom for $\bar{x}$ will be designated by n. Values for $n = 1, 2, 3$ and 4 only are given in [53] for this case where $f \neq n - 1$. The present report can also be considered an extension of the work in References [35] and [75] which cover the two sided tolerance limit problem with $\bar{x}$ based on n degrees of freedom and s based on f degrees of freedom, where again f is not necessarily equal to $n - 1$. The extension given here, of course, is from the two-sided case to the one-sided case.

The values of k given in Sections 2, 3.1, 3.2, 3.3, and 4 correspond to percentage points (divided by the square root of n) of the noncentral t-distribution. Specifically,

$$\Pr\left\{\text{noncentral } t \le k\sqrt{n} \mid \delta = K_p\sqrt{n}\right\} = \gamma.$$

where the noncentral t has f degrees of freedom and K_p is such that $\Pr\left\{\text{a standardized normal variable} \le K_p\right\} = P$.

1.2 Johnson and Welch type tables for computing k.

A discussion of the tables of Section 5 follows. Among other things these tables may be used whenever there is a combination of values of f, n, and P for which there is not an entry in the tables of Sections 2, 3 or 4 and for which interpolation in Sections 2, 3 or 4 would not be satisfactory. Note also that the values of γ which are available in Section 5 include $(1 - \gamma)$ for each γ listed since $\Pr\left\{\text{noncentral } t \le t_e \mid \delta\right\} = 1 - \Pr\left\{\text{noncentral } t \le -t_e \mid -\delta\right\}$ and both positive and negative values of t and δ appear in the tables.

Section 5 follows a procedure used by Johnson and Welch [32] and contains values of γ such that if

$$\eta = \frac{\delta}{\sqrt{2f}}\left(1 + \frac{\delta^2}{2f}\right)^{-\frac{1}{2}},$$

id

$$t_e = \frac{\delta + \lambda\left(1 + \frac{\delta^2}{2f} - \frac{\lambda^2}{2f}\right)^{\frac{1}{2}}}{\left(1 - \frac{\lambda^2}{2f}\right)},$$

2.4 Values of k for $f = n - 1$ and $\gamma = .95$

$$\Pr\left\{T_f \leq k\sqrt{n} \,\middle|\, K_p\sqrt{n}\right\} = \gamma$$

	P							
n	.75000	.90000	.95000	.97500	.99000	.99900	.99990	.99999
2	11.763	20.581	26.260	31.257	37.094	49.276	59.304	68.010
3	3.806	6.155	7.656	8.986	10.553	13.857	16.598	18.986
4	2.618	4.162	5.144	6.015	7.042	9.214	11.019	12.593
5	2.150	3.407	4.203	4.909	5.741	7.502	8.966	10.243
6	1.895	3.006	3.708	4.329	5.062	6.612	7.901	9.025
7	1.732	2.755	3.399	3.970	4.642	6.063	7.244	8.275
8	1.618	2.582	3.187	3.723	4.354	5.688	6.796	7.763
9	1.532	2.454	3.031	3.542	4.143	5.413	6.469	7.390
10	1.465	2.355	2.911	3.402	3.981	5.203	6.219	7.105
11	1.411	2.275	2.815	3.292	3.852	5.036	6.020	6.878
12	1.366	2.210	2.736	3.201	3.747	4.900	5.858	6.694
13	1.328	2.155	2.671	3.125	3.659	4.787	5.723	6.540
14	1.296	2.109	2.614	3.060	3.585	4.690	5.609	6.409
15	1.268	2.068	2.566	3.005	3.520	4.607	5.510	6.297
16	1.243	2.033	2.524	2.956	3.464	4.535	5.424	6.199
17	1.220	2.002	2.486	2.913	3.414	4.471	5.348	6.113
18	1.201	1.974	2.453	2.875	3.370	4.415	5.281	6.037
19	1.185	1.949	2.423	2.841	3.331	4.364	5.221	5.968
20	1.166	1.926	2.396	2.810	3.295	4.318	5.167	5.906
21	1.152	1.905	2.371	2.781	3.265	4.277	5.118	5.850
22	1.138	1.886	2.349	2.756	3.233	4.239	5.073	5.795
23	1.125	1.869	2.328	2.732	3.206	4.204	5.031	5.752
24	1.114	1.853	2.309	2.710	3.181	4.172	4.994	5.709
25	1.103	1.838	2.292	2.690	3.158	4.142	4.959	5.670
26	1.093	1.824	2.275	2.672	3.136	4.115	4.926	5.633
27	1.083	1.811	2.260	2.654	3.116	4.089	4.896	5.598
28	1.075	1.799	2.246	2.638	3.098	4.066	4.868	5.566
29	1.066	1.788	2.232	2.623	3.080	4.045	4.841	5.536
30	1.058	1.777	2.220	2.608	3.064	4.022	4.816	5.508
31	1.051	1.767	2.208	2.595	3.048	4.002	4.793	5.481
32	1.044	1.758	2.197	2.582	3.034	3.984	4.771	5.456
33	1.037	1.749	2.186	2.570	3.020	3.966	4.750	5.433
34	1.031	1.740	2.176	2.559	3.007	3.950	4.730	5.410
35	1.025	1.732	2.167	2.548	2.995	3.934	4.712	5.389
36	1.019	1.725	2.158	2.538	2.983	3.919	4.694	5.369
37	1.014	1.717	2.149	2.528	2.972	3.904	4.677	5.350
38	1.009	1.710	2.141	2.518	2.961	3.891	4.661	5.332
39	1.004	1.704	2.133	2.510	2.951	3.878	4.646	5.314
40	.999	1.697	2.125	2.501	2.941	3.865	4.631	5.298
41	.994	1.691	2.118	2.493	2.932	3.854	4.617	5.282
42	.990	1.685	2.111	2.485	2.923	3.842	4.603	5.266
43	.986	1.680	2.105	2.478	2.914	3.831	4.591	5.252
44	.982	1.674	2.098	2.470	2.906	3.821	4.578	5.238
45	.978	1.669	2.092	2.463	2.898	3.811	4.566	5.226

2.4 Values of k for $f = n - 1$ and $\gamma = .95$ (Continued)

$$\Pr\left\{T_f \le k\sqrt{n} \,\middle|\, K_p\sqrt{n}\right\} = \gamma$$

	P							
n	.75000	.90000	.95000	.97500	.99000	.99900	.99990	.99999
46	.974	1.664	2.086	2.457	2.890	3.801	4.555	5.211
47	.971	1.659	2.081	2.450	2.883	3.792	4.544	5.199
48	.967	1.654	2.075	2.444	2.876	3.783	4.533	5.187
49	.964	1.650	2.070	2.438	2.869	3.774	4.523	5.175
50	.960	1.646	2.065	2.432	2.862	3.766	4.513	5.164
51	.957	1.641	2.060	2.427	2.856	3.758	4.504	5.153
52	.954	1.637	2.055	2.421	2.850	3.750	4.494	5.142
53	.951	1.633	2.051	2.416	2.844	3.742	4.485	5.132
54	.948	1.630	2.046	2.411	2.838	3.735	4.477	5.123
55	.945	1.626	2.042	2.406	2.833	3.728	4.468	5.113
56	.943	1.622	2.038	2.401	2.827	3.721	4.460	5.104
57	.940	1.619	2.034	2.397	2.822	3.714	4.452	5.095
58	.938	1.615	2.030	2.392	2.817	3.708	4.445	5.086
59	.935	1.612	2.026	2.388	2.812	3.701	4.437	5.078
60	.933	1.609	2.022	2.384	2.807	3.695	4.430	5.070
61	.930	1.606	2.019	2.380	2.802	3.689	4.423	5.062
62	.928	1.603	2.015	2.376	2.798	3.684	4.416	5.054
63	.926	1.600	2.012	2.372	2.793	3.678	4.410	5.047
64	.924	1.597	2.008	2.368	2.789	3.673	4.403	5.039
65	.921	1.594	2.005	2.364	2.785	3.667	4.397	5.032
66	.919	1.591	2.002	2.361	2.781	3.662	4.391	5.025
67	.917	1.589	1.999	2.357	2.777	3.657	4.385	5.018
68	.915	1.586	1.996	2.354	2.773	3.652	4.379	5.012
69	.913	1.584	1.993	2.351	2.769	3.647	4.373	5.005
70	.911	1.581	1.990	2.347	2.765	3.643	4.368	4.999
71	.910	1.579	1.987	2.344	2.762	3.638	4.362	4.993
72	.908	1.576	1.984	2.341	2.758	3.633	4.357	4.987
73	.906	1.574	1.982	2.338	2.755	3.629	4.352	4.981
74	.904	1.572	1.979	2.335	2.751	3.625	4.347	4.975
75	.903	1.570	1.976	2.332	2.748	3.621	4.342	4.970
76	.901	1.568	1.974	2.329	2.745	3.617	4.337	4.964
77	.899	1.565	1.971	2.327	2.742	3.613	4.333	4.959
78	.898	1.563	1.969	2.324	2.739	3.609	4.328	4.954
79	.896	1.561	1.967	2.321	2.736	3.605	4.323	4.949
80	.895	1.559	1.964	2.319	2.733	3.601	4.319	4.944
81	.893	1.557	1.962	2.316	2.730	3.597	4.315	4.939
82	[illegible]	1.556	1.960	2.314	2.727	3.594	4.310	4.934
83	.890	1.554	1.958	2.311	2.724	3.590	4.306	4.929
84	.889	1.552	1.956	2.309	2.721	3.587	4.302	4.925
85	.888	1.550	1.954	2.306	2.719	3.583	4.298	4.920
86	.886	1.548	1.952	2.304	2.716	3.580	4.294	4.916
87	.885	1.547	1.950	2.302	2.714	3.577	4.291	4.911
88	.884	1.545	1.948	2.300	2.711	3.574	4.287	4.907
89	.882	1.543	1.946	2.297	2.709	3.571	4.283	4.903
90	.881	1.542	1.944	2.295	2.706	3.567	4.279	4.899

2.4 Values of k for $f = n - 1$ and $\gamma = .95$ (Continued)

$$Pr\left\{T_f \le k\sqrt{n} \mid K_p\sqrt{n}\right\} = \gamma$$

	P							
n	.75000	.90000	.95000	.97500	.99000	.99900	.99990	.99999
91	.880	1.540	1.942	2.293	2.704	3.564	4.276	4.895
92	.879	1.538	1.940	2.291	2.701	3.561	4.272	4.891
93	.877	1.537	1.938	2.289	2.699	3.559	4.269	4.887
94	.876	1.535	1.937	2.287	2.697	3.556	4.266	4.883
95	.875	1.534	1.935	2.285	2.695	3.553	4.262	4.879
96	.874	1.532	1.933	2.283	2.692	3.550	4.259	4.876
97	.873	1.531	1.931	2.281	2.690	3.547	4.256	4.872
98	.872	1.530	1.930	2.279	2.688	3.545	4.253	4.869
99	.871	1.528	1.928	2.278	2.686	3.542	4.250	4.865
100	.870	1.527	1.927	2.276	2.684	3.539	4.247	4.862
101	.869	1.525	1.925	2.274	2.682	3.537	4.244	4.858
102	.868	1.524	1.923	2.272	2.680	3.534	4.241	4.855
103	.867	1.523	1.922	2.271	2.678	3.532	4.238	4.852
104	.866	1.521	1.920	2.269	2.676	3.530	4.235	4.848
105	.865	1.520	1.919	2.267	2.674	3.527	4.232	4.845
106	.864	1.519	1.917	2.266	2.672	3.525	4.229	4.842
107	.863	1.518	1.916	2.264	2.671	3.523	4.227	4.839
108	.862	1.517	1.915	2.262	2.669	3.520	4.224	4.836
109	.861	1.515	1.913	2.261	2.667	3.518	4.271	4.833
110	.860	1.514	1.912	2.259	2.665	3.516	4.219	4.830
111	.859	1.513	1.911	2.258	2.663	3.514	4.216	4.827
112	.858	1.512	1.909	2.256	2.662	3.511	4.214	4.824
113	.857	1.511	1.908	2.255	2.660	3.509	4.211	4.821
114	.856	1.510	1.907	2.253	2.658	3.507	4.209	4.819
115	.855	1.508	1.905	2.252	2.657	3.505	4.206	4.816
116	.855	1.507	1.904	2.251	2.655	3.503	4.204	4.813
117	.854	1.506	1.903	2.249	2.654	3.501	4.201	4.811
118	.853	1.505	1.902	2.248	2.652	3.499	4.199	4.808
119	.852	1.504	1.900	2.246	2.651	3.497	4.197	4.805
120	.851	1.503	1.899	2.245	2.649	3.495	4.195	4.803
121	.851	1.502	1.898	2.244	2.648	3.493	4.192	4.800
122	.850	1.501	1.897	2.242	2.646	3.492	4.190	4.798
123	.849	1.500	1.896	2.241	2.645	3.490	4.188	4.795
124	.848	1.499	1.895	2.240	2.643	3.488	4.186	4.793
125	.848	1.498	1.894	2.239	2.642	3.486	4.184	4.790
126	.847	1.497	1.893	2.237	2.640	3.484	4.182	4.788
127	.846	1.496	1.891	2.236	2.639	3.483	4.180	4.786
128	.845	1.496	1.890	2.235	2.638	3.481	4.178	4.784
129	.845	1.495	1.889	2.234	2.636	3.479	4.176	4.781
130	.844	1.494	1.888	2.233	2.635	3.478	4.174	4.779
131	.843	1.493	1.887	2.232	2.634	3.476	4.172	4.777
132	.843	1.492	1.886	2.230	2.632	3.474	4.170	4.775
133	.842	1.491	1.885	2.229	2.631	3.473	4.168	4.772
134	.841	1.490	1.884	2.228	2.630	3.471	4.166	4.770
135	.841	1.489	1.883	2.227	2.628	3.469	4.164	4.768

2.4 Values of k for $f = n - 1$ and $\gamma = .95$ (Continued)

$$\Pr\left\{T_f \le k\sqrt{n} \mid K_p\sqrt{n}\right\} = \gamma$$

	P							
n	.75000	.90000	.95000	.97500	.99000	.99900	.99990	.99999
136	.840	1.489	1.882	2.226	2.627	3.468	4.162	4.766
137	.839	1.488	1.881	2.225	2.626	3.466	4.160	4.754
138	.839	1.487	1.880	2.224	2.625	3.465	4.159	4.762
139	.838	1.486	1.879	2.223	2.624	3.463	4.157	4.760
140	.837	1.485	1.879	2.222	2.622	3.462	4.155	4.758
141	.837	1.485	1.878	2.221	2.621	3.460	4.153	4.756
142	.836	1.484	1.877	2.220	2.620	3.459	4.152	4.754
143	.836	1.483	1.876	2.219	2.619	3.457	4.150	4.752
144	.835	1.482	1.875	2.218	2.618	3.456	4.148	4.750
145	.834	1.481	1.874	2.217	2.617	3.455	4.147	4.748
146	.834	1.481	1.873	2.216	2.616	3.453	4.145	4.747
147	.833	1.480	[illegible]	2.215	2.615	3.452	4.143	4.745
148	.833	1.479	1.872	2.214	2.613	3.451	4.142	4.743
149	.832	1.479	1.871	2.213	2.612	3.449	4.140	4.741
150	.832	1.478	1.870	2.212	2.611	3.448	4.139	4.739
151	.831	1.477	1.869	2.211	2.610	3.447	4.137	4.738
152	.830	1.476	1.868	2.210	2.609	3.445	4.136	4.736
153	.830	1.476	1.867	2.209	2.608	3.444	4.134	4.734
154	.829	1.475	1.867	2.208	2.607	3.443	4.133	4.733
155	.829	1.474	1.866	2.207	2.606	3.441	4.131	4.731
156	.828	1.474	1.865	2.207	2.605	3.440	4.130	4.729
157	.828	1.473	1.864	2.206	2.604	3.439	4.128	4.728
158	.827	1.472	1.864	2.205	2.603	3.438	4.127	4.726
159	.827	1.472	1.863	2.204	2.602	3.436	4.125	4.724
160	.826	1.471	1.862	2.203	2.601	3.435	4.124	4.723
161	.826	1.470	1.861	2.202	2.600	3.434	4.122	4.721
162	.825	1.470	1.861	2.201	2.600	3.433	4.121	4.720
163	.825	1.469	1.860	2.201	2.599	3.432	4.120	4.718
164	.824	1.469	1.859	2.200	2.598	3.431	4.118	4.716
165	.824	1.468	1.858	2.199	2.597	3.429	4.117	4.715
166	.823	1.467	1.858	2.198	2.596	3.428	4.116	4.713
167	.823	1.467	1.857	2.198	2.595	3.427	4.114	4.712
168	.822	1.466	1.856	2.197	2.594	3.426	4.113	4.710
169	.822	1.466	1.856	2.196	2.593	3.425	4.112	4.709
170	.822	1.465	1.855	2.195	2.592	3.424	4.111	4.708
171	.821	1.464	1.854	2.194	2.592	3.423	4.109	4.706
172	.821	1.464	1.854	2.194	2.591	3.422	4.108	4.705
173	.820	1.463	1.853	2.193	2.590	3.421	4.107	4.703
174	.820	1.463	1.852	2.192	2.589	3.420	4.106	4.702
175	.819	1.462	1.852	2.192	2.588	3.419	4.104	4.701
176	.819	1.462	1.851	2.191	2.587	3.418	4.103	4.699
177	.818	1.461	1.850	2.190	2.587	3.417	4.102	4.698
178	.818	1.460	1.850	2.189	2.586	3.416	4.101	4.696
179	.818	1.460	1.849	2.189	2.585	3.415	4.100	4.695
180	.817	1.459	1.849	2.188	2.584	3.414	4.098	4.694

7.4 Values of k for $f = n - 1$ and $\gamma = .95$ (Continued)

$$\Pr\left\{T_f \le k\sqrt{n} \,\middle|\, K_p\sqrt{n}\right\} = \gamma$$

	P							
n	.75000	.90000	.95000	.97500	.99000	.99900	.99990	.99999
181	.817	1.459	1.848	2.187	2.583	3.413	4.097	4.692
182	.816	1.458	1.847	2.187	2.583	3.412	4.096	4.691
183	.816	1.458	1.847	2.186	2.582	3.411	4.095	4.690
184	.815	1.457	1.846	2.185	2.581	3.410	4.094	4.689
185	.815	1.457	1.846	2.185	2.580	3.409	4.093	4.687
186	.815	1.456	1.845	2.184	2.580	3.408	4.092	4.686
187	.814	1.456	1.844	2.183	2.579	3.407	4.090	4.685
188	.814	1.455	1.844	2.183	2.578	3.406	4.089	4.684
189	.814	1.455	1.843	2.182	2.577	3.405	4.088	4.682
190	.813	1.454	1.843	2.181	2.577	3.404	4.087	4.681
191	.813	1.454	1.842	2.181	2.576	3.403	4.086	4.680
192	.812	1.453	1.842	2.180	2.575	3.402	4.085	4.679
193	.812	1.453	1.841	2.179	2.575	3.401	4.084	4.678
194	.812	1.452	1.840	2.179	2.574	3.401	4.083	4.676
195	.811	1.452	1.840	2.178	2.573	3.400	4.082	4.675
196	.811	1.451	1.839	2.178	2.572	3.399	4.081	4.674
197	.811	1.451	1.839	2.177	2.572	3.398	4.080	4.673
198	.810	1.450	1.838	2.176	2.571	3.397	4.079	4.672
199	.810	1.450	1.838	2.176	2.570	3.396	4.078	4.671
200	.809	1.450	1.837	2.175	2.570	3.395	4.077	4.670
205	.808	1.447	1.835	2.172	2.566	3.391	4.072	4.664
210	.806	1.445	1.832	2.170	2.563	3.387	4.068	4.659
215	.804	1.443	1.830	2.167	2.560	3.384	4.063	4.654
220	.803	1.441	1.828	2.164	2.557	3.380	4.059	4.649
225	.801	1.439	1.825	2.162	2.555	3.376	4.055	4.644
230	.800	1.437	1.823	2.160	2.552	3.373	4.051	4.640
235	.798	1.436	1.821	2.157	2.549	3.370	4.047	4.635
240	.797	1.434	1.819	2.155	2.547	3.367	4.043	4.631
245	.796	1.432	1.817	2.153	2.544	3.363	4.040	4.627
250	.795	1.431	1.815	2.151	2.542	3.361	4.036	4.623
255	.793	1.429	1.814	2.149	2.540	3.358	4.033	4.619
260	.792	1.428	1.812	2.147	2.537	3.355	4.029	4.616
265	.791	1.426	1.810	2.145	2.535	3.352	4.026	4.612
270	.790	1.425	1.809	2.143	2.533	3.349	4.023	4.609
275	.789	1.423	1.807	2.141	2.531	3.347	4.020	4.605
280	.788	1.422	1.805	2.140	2.529	3.344	4.017	4.602
285	.787	1.421	1.804	2.138	2.527	3.342	4.014	4.599
290	.786	1.419	1.802	2.136	2.525	3.340	4.012	4.596
295	.785	1.418	1.801	2.135	2.524	3.337	4.009	4.593
300	.784	1.417	1.800	2.133	2.522	3.335	4.006	4.590
305	.783	1.416	1.798	2.132	2.520	3.333	4.004	4.587
310	.782	1.415	1.797	2.130	2.518	3.331	4.001	4.584
315	.781	1.413	1.796	2.129	2.517	3.329	3.999	4.581
320	.780	1.412	1.794	2.127	2.515	3.327	3.996	4.579
325	.779	1.411	1.793	2.126	2.514	3.325	3.994	4.576

2.4 Values of k for f = n - 1 and γ = .95 (Continued)

$$\Pr\{T_f \le k\sqrt{n} \mid K_p\sqrt{n}\} = \gamma$$

	P							
n	.75000	.90000	.95000	.97500	.99000	.99900	.99990	.99999
330	.778	1.410	1.792	2.124	2.512	3.323	3.992	4.573
335	.778	1.409	1.791	2.123	2.511	3.321	3.990	4.571
340	.777	1.408	1.790	2.122	2.509	3.319	3.988	4.568
345	.776	1.407	1.789	2.121	2.508	3.318	3.986	4.566
350	.775	1.406	1.787	2.119	2.506	3.316	3.983	4.564
355	.775	1.405	1.786	2.118	2.505	3.314	3.981	4.562
360	.774	1.404	1.785	2.117	2.504	3.312	3.980	.559
365	.773	1.404	1.784	2.116	2.502	3.311	3.978	4.557
370	.772	1.403	1.783	2.115	2.501	3.309	3.976	4.555
375	.772	1.402	1.782	2.114	2.500	3.308	3.974	4.553
380	.771	1.401	1.781	2.113	2.499	3.306	3.972	4.551
385	.770	1.400	1.780	2.112	2.498	3.305	3.970	4.549
390	.770	1.399	1.780	2.111	2.496	3.303	3.969	4.547
395	.769	1.399	1.779	2.109	2.495	3.302	3.967	4.545
400	.769	1.398	1.778	2.109	2.494	3.300	3.965	4.543
425	.766	1.394	1.774	2.104	2.489	3.294	3.957	4.534
450	.763	1.391	1.770	2.100	2.486	3.288	3.950	4.526
475	.761	1.388	1.765	2.096	2.480	3.282	3.944	4.519
500	.758	1.385	1.763	2.092	2.475	3.277	3.938	4.512
525	.756	1.382	1.760	2.089	2.472	3.272	3.932	4.506
550	.754	1.380	1.757	2.086	2.468	3.268	3.927	4.500
575	.752	1.378	1.755	2.083	2.465	3.264	3.922	4.495
600	.751	1.376	1.752	2.080	2.462	3.260	3.918	4.489
625	.749	1.374	1.750	2.077	2.459	3.256	3.913	4.485
650	.748	1.372	1.748	2.075	2.456	3.253	3.910	4.480
675	.746	1.370	1.746	2.073	2.454	3.250	3.906	4.476
700	.745	1.368	1.744	2.071	2.451	3.247	3.902	4.472
725	.744	1.367	1.742	2.069	2.449	3.244	3.899	4.468
750	.743	1.365	1.741	2.067	2.447	3.241	3.896	4.465
775	.741	1.364	1.739	2.065	2.445	3.238	3.893	4.461
800	.740	1.363	1.737	2.063	2.443	3.236	3.890	4.458
825	.739	1.361	1.736	2.062	2.441	3.234	3.887	4.455
850	.738	1.360	1.734	2.060	2.439	3.232	3.885	4.452
875	.737	1.359	1.733	2.059	2.438	3.229	3.882	4.449
900	.736	1.358	1.732	2.057	2.436	3.227	3.880	4.446
925	.736	1.357	1.731	2.056	2.434	3.225	3.877	4.444
950	.735	1.356	1.729	2.054	2.433	3.224	3.875	4.441
975	.734	1.355	1.728	2.053	2.432	3.222	3.873	4.439
1000	.733	1.354	1.727	2.052	2.430	3.220	3.871	4.437
1500	.722	1.340	1.712	2.035	2.411	3.196	3.842	4.404
2000	.716	1.332	1.703	2.024	2.399	3.181	3.825	4.385
3000	.708	1.323	1.692	2.012	2.385	3.164	3.806	4.363
5000	.701	1.313	1.681	2.000	2.372	3.14-	3.786	4.340
10000	.693	1.304	1.670	1.988	2.358	3.120	3.766	4.318
∞	.674	1.282	1.645	1.960	2.326	3.090	3.719	4.265

Appendix B - Tong F-Factor Values for Non-Uniform Test Cases

Test Section A-2

Case ID	CHF Axial Location	Predicted CHF	Tong F-Factor
902			1.2104
2			1.1984
3			1.2038
4			1.1851
5			1.1895
6			1.1563
7			1.1915
8			1.2159
9			1.2052
10			1.2184
11			1.2091
12			1.1775
13			1.1770
14			1.2070
15			1.2190
16			1.2023
17			1.2026
18			1.1757
19			1.1924
20			1.1869
21			1.1530
22			1.1455
23			1.1631
24			1.1775
25			1.2154
26			1.2062

Case ID	CHF Axial Location	Predicted CHF	Tong F-Factor
27			1.2009
28			1.2119
29			1.2147
30			1.1967
31			1.2112
32			1.2194
33			1.1794
34			1.1915
35			1.1988
36			1.1853
37			1.1939
38			1.1990
39			1.2185
40			1.2024
41			1.2017
42			1.2061
43			1.1825
44			1.1765
45			1.1604
46			1.2108
47			1.2160
48			1.2140
49			1.1971
50			1.2089
51			1.2141

+(b, c)

Test Section A-3

Case ID	CHF Axial Location	Predicted CHF	Tong F-Factor
903			1.2147
2			1.2101
3			1.2168
4			1.2188
5			1.2023
6			1.2066
7			1.1934
8			1.1772
9			1.2166
10			1.2119
11			1.1986
12			1.2039
13			1.1909
14			1.4004
15			1.1769
16			1.2037
17			1.2112
18			1.1849
19			1.2219
20			1.2117
21			1.2274
22			1.1771
23			1.1971
24			1.2130
25			1.2095
26			1.2133
27			1.2068
28			1.3369
29			1.3491
30			1.1415
31			1.2139

+(b,c)

Test Section A-4

Case ID	CHF Axial Location	Predicted CHF	Tong F-Factor
502	[	]+	1.0921
2			1.0878
3			1.0935
4			1.0861
5			1.0947
6			1.0836
7			1.0955
8			1.0881
9			1.3447
10			1.0976
11			1.0971
12			1.0994
13			1.0992
14			1.0987
15			1.0994
16			1.3453
17			1.2815
18			1.3063
19			1.0737
20			1.2920
21			1.0747
22			1.2794
23			1.3934
24			1.3611
25			1.1005
26			1.0860
27			1.0893
28			1.2606
29			1.0609
30			1.0686
31			1.0749
32			1.0782
33	[	]+	1.0616
34			1.3044
35			1.3810
36			1.3400
37			1.0965
38			1.0959
39			1.4094
40			1.3553
41			1.0949
42			1.3719
43			1.2866
44			1.0767
45			1.3265
46			1.3125
47			1.0857
48			1.0865
49			1.3477
50			1.3116
51			1.0929
52			1.0960
53			1.1010
54			1.1009
55			1.0942
56			1.3485
57			1.3810
58			1.3369
59			1.3680
60			1.0996
61			1.0955
62			1.0999
63			1.0952

+(b,c)

Test Section A-5

Case ID	CHF Axial Location	Predicted CHF	Tong F-Factor
503	[	]+	1.3094
2			1.0839
3			1.0910
4			1.3184
5			1.0954
6			1.0896
7			1.3334
8			1.3183
9			1.0943
10			1.0832
11			1.3676
12			1.0868
13			1.0931
14			1.0936
15			1.1001
16			1.0943
17			1.0941
18			1.0834
19			1.0854
20			1.0980
21			1.0967
22			1.3214
23			1.0918
24			1.0923
25			1.3534
26			1.3464
27			1.3449
28			1.0992
29			1.0988
30			1.0992
31			1.3261
32			1.2795
33			1.0834
34			1.0758
35			1.0678
36			1.0796
37			1.3184
38			1.0949

+(b,c)

Test Section A-8

Case ID	CHF Axial Location	Predicted CHF	Tong F-Factor
164	[	]+	1.2524
2			1.2370
3			1.2340
4			1.2160
5			1.2262
6			1.2158
7			1.2714
8			1.2547
9			1.2441
10			1.2602
11			1.3479
12			1.2634
13			1.2583
14			1.2674
15			1.2737
16			1.2741
17			1.2907
18			1.3072
19			1.3001
20			1.2962
21			1.3414
22			1.3317
23			1.3350
24			1.3217
25			1.3438
26			1.3284
27			1.3272
28			1.3287
29			1.3395
30			1.3649
31			1.3551
32			1.3470
33			1.3701
34			1.3440
35			1.3246
36			1.3180
37			1.3100

Case ID	CHF Axial Location	Predicted CHF	Tong F-Factor
38	[	]+	1.3359
39			1.3074
40			1.2922
41			1.2962
42			1.2727
43			1.2472
44			1.2569
45			1.3391
46			1.3158
47			1.2948
48			1.2859
49			1.2907
50			1.2837
51			1.2421
52			1.2881
53			1.2724
54			1.1859
55			1.1981
56			1.2329
57			1.2542
58			1.1787
59			1.1821
60			1.2769
61			1.2576
62			1.3686
63			1.2596
64			1.3038
65			1.2250
66			1.2902
67			1.2829
68			1.2595
69			1.3446
70			1.2022
71			1.2706
72			1.2350
73			1.2819
74			1.2763

+(b,c)

Test Section A-9

Case ID	CHF Axial Location	Predicted CHF	Tong F-Factor
162			1.2434
2			1.2142
3			1.2033
4			1.2329
5			1.2550
6			1.2516
7			1.2541
8			1.2596
9			1.2303
10			1.2707
11			1.2781
12			1.3505
13			1.3197
14			1.2945
15			1.3298
16			1.3294
17			1.3266
18			1.3246
19			1.3254
20			1.3658
21			1.3490
22			1.3265
23			1.3580
24			1.3457
25			1.3207
26			1.3200
27			1.3433
28			1.3329
29			1.2980
30			1.2834
31			1.3247
32			1.3107
33			1.2613
34			1.2706
35			1.2685

Case ID	CHF Axial Location	Predicted CHF	Tong F-Factor
36			1.2941
37			1.2658
38			1.3167
39			1.2923
40			1.3033
41			1.2892
42			1.2881
43			1.2802
44			1.0834
45			1.3131
46			1.2406
47			1.2388
48			1.2953
49			1.0805
50			1.2480
51			1.3484
52			1.3010
53			1.3032
54			1.2947
55			1.2180
56			1.2906
57			1.2802
58			1.3272
59			1.2805
60			1.2232
61			1.2043
62			1.2005
63			1.2064
64			1.2012
65			1.2832
66			1.3604
67			1.2991
68			1.2584
69			1.2268
70			1.2798

+(b,c)

Appendix C - CHF Summary Output File Listings

Test Section A-2

```
     *********** OPERATING CONDITIONS ***********      *CRITICAL LOCATION*** HOT CHANNEL CONDITIONS **** PREDICTED **
     * SYSTEM    INLET      INLET       AVERAGE   *      *                AXIAL*MASS FLUX          HEAT FLUX*   CRITICAL  *
     *PRESSURE ENTHALPY  MASS FLUX    HEAT RATE   *      *   HOT     HOT LEVEL*(MLBM/HR-   EQUIL.  (MBTU/HR-*  HEAT FLUX  *CORR* TIME  *
CASE* (PSIA)  (BTU/LBM)(MLBM/HR-FT2)(BTU/SEC-FT)*MDNBR*CHANNEL  ROD (IN.)*   FT2)    QUALITY     FT2)   *(MBTU/HR-FT2)*FLAG* (SEC) *
*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*
 902                                          +1.064    22      19                                                  +  WRB2   0.000  +(b,c
   2                                            0.931    22      19                                                     WRB2   0.000
   3                                            1.018    22      19                                                     WRB2   0.000
   4                                            0.912    22      19                                                     WRB2   0.000
   5                                            0.962    22      19                                                     WRB2   0.000
   6                                            0.919    22      19                                                     WRB2   0.000
   7                                            0.963    22      19                                                     WRB2   0.000
   8                                            1.010    22      19                                                     WRB2   0.000
   9                                            0.970    22      19                                                     WRB2   0.000
  10                                            1.012    22      19                                                     WRB2   0.000
  11                                            1.017    22      19                                                     WRB2   0.000
  12                                            1.022    22      19                                                     WRB2   0.000
  13                                            0.995    22      19                                                     WRB2   0.000
  14                                            1.132    22      19                                                     WRB2   0.000
  15                                            1.176    22      19                                                     WRB2   0.000
  16                                            1.067    22      19                                                     WRB2   0.000
  17                                            1.150    22      19                                                     WRB2   0.000
  18                                            1.045    22      19                                                     WRB2   0.000
  19                                            1.084    22      19                                                     WRB2   0.000
  20                                            1.096    22      19                                                     WRB2   0.000
  21                                            0.980    22      19                                                     WRB2   0.000
  22                                            0.950    22      19                                                     WRB2   0.000
  23                                            0.981    22      19                                                     WRB2   0.000
  24                                            0.933    22      19                                                     WRB2   0.000
  25                                            1.137    22      19                                                     WRB2   0.000
  26                                            1.015    22      19                                                     WRB2   0.000
  27                                            1.006    22      19                                                     WRB2   0.000
  28                                            0.987    22      19                                                     WRB2   0.000
  29                                            1.049    22      19                                                     WRB2   0.000
  30                                            1.034    22      19                                                     WRB2   0.000
  31                                            0.944    22      19                                                     WRB2   0.000
  32                                            0.908    22      19                                                     WRB2   0.000
  33                                            0.995    22      19                                                     WRB2   0.000
  34                                            1.016    22      19                                                     WRB2   0.000
  35                                            1.091    22      19                                                     WRB2   0.000
  36                                            0.968    22      19                                                     WRB2   0.000
  37                                            1.026    22      19                                                     WRB2   0.000
  38                                            1.080    22      19                                                     WRB2   0.000
  39                                            0.944    22      19                                                     WRB2   0.000
  40                                            0.931    22      19                                                     WRB2   0.000
  41                                            1.166    22      19                                                     WRB2   0.000
  42                                            1.139    22      19                                                     WRB2   0.000
  43                                            1.181    22      19                                                     WRB2   0.000
  44                                            1.131    22      19                                                     WRB2   0.000
```

```
45 [                                  ]+ 1.115   22    19 [                                  ]+   WRB2   0.000  +(b,c
46 |                                  |  0.978   22    19 |                                  |    WRB2   0.000
47 |                                  |  1.188   22    19 |                                  |    WRB2   0.000
48 |                                  |  0.990   22    19 |                                  |    WRB2   0.000
49 |                                  |  0.966   22    19 |                                  |    WRB2   0.000
50 |                                  |  0.990   22    19 |                                  |    WRB2   0.000
51 [                                  ]  1.004   22    19 [                                  ]    WRB2   0.000
```

Test Section A-3

```
    *********** OPERATING CONDITIONS ***********      *CRITICAL LOCATION*** HOT CHANNEL CONDITIONS **** PREDICTED **
    * SYSTEM    INLET        INLET        AVERAGE   *       *                  AXIAL*MASS FLUX           HEAT FLUX*   CRITICAL   *
    *PRESSURE ENTHALPY  MASS FLUX    HEAT RATE   *       *   HOT     HOT LEVEL*(MLBM/HR-   EQUIL.  (MBTU/HR-*  HEAT FLUX   *CORR* TIME   *
CASE* (PSIA)  (BTU/LBM)(MLBM/HR-FT2)(BTU/SEC-FT)*MDNBR*CHANNEL RCD (IN.)*   FT2)    QUALITY    FT2)   *(MBTU/HR-FT2)*FLAG* (SEC)  *
*-*-* *-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*
 903 [                                          ]+ 1.090   16     14 [                                             ]+  WRB2   0.000  +(b,c,
   2 |                                          |  1.076   16     14 |                                             |   WRB2   0.000
   3 |                                          |  0.898   16     14 |                                             |   WRB2   0.000
   4 |                                          |  0.962   16     14 |                                             |   WRB2   0.000
   5 |                                          |  1.012   16     14 |                                             |   WRB2   0.000
   6 |                                          |  0.993   16     14 |                                             |   WRB2   0.000
   7 |                                          |  1.024   16     14 |                                             |   WRB2   0.000
   8 |                                          |  0.955   16     14 |                                             |   WRB2   0.009
   9 |                                          |  0.950   16     14 |                                             |   WRB2   0.000
  10 |                                          |  1.027   16     14 |                                             |   WRB2   0.000
  11 |                                          |  1.012   16     14 |                                             |   WRB2   0.000
  12 |                                          |  0.997   16     14 |                                             |   WRB2   0.000
  13 |                                          |  0.997   16     14 |                                             |   WRB2   0.000
  14 |                                          |  0.967   16     14 |                                             |   WRB2   0.000
  15 |                                          |  0.946   16     14 |                                             |   WRB2   0.000
  16 |                                          |  0.941   16     14 |                                             |   WRB2   0.000
  17 |                                          |  0.973   16     14 |                                             |   WRB2   0.000
  18 |                                          |  0.919   16     14 |                                             |   WRB2   0.000
  19 |                                          |  0.918   16     14 |                                             |   WRB2   0.000
  20 |                                          |  1.024   16     14 |                                             |   WRB2   0.000
  21 |                                          |  0.942   16     14 |                                             |   WRB2   0.000
  22 |                                          |  0.854   16     14 |                                             |   WRB2   0.000
  23 |                                          |  0.890   16     14 |                                             |   WRB2   0.000
  24 |                                          |  1.088   16     14 |                                             |   WRB2   0.000
  25 |                                          |  0.984   16     14 |                                             |   WRB2   0.000
  26 |                                          |  0.974   16     14 |                                             |   WRB2   0.000
  27 |                                          |  1.060   16     14 |                                             |   WRB2   0.000
  28 |                                          |  0.972   16     14 |                                             |   WRB2   0.000
  29 |                                          |  1.013   16     14 |                                             |   WRB2   0.000
  30 |                                          |  0.881   16     14 |                                             |   WRB2   0.000
  31 [                                          ]  1.062   16     14 [.                                            ]   WRB2   0.000
```

Test Section A-4

	OPERATING CONDITIONS					CRITICAL LOCATION		HOT CHANNEL CONDITIONS				PREDICTED		
CASE	SYSTEM PRESSURE (PSIA)	INLET ENTHALPY (BTU/LBM)	INLET MASS FLUX (MLBM/HR-FT2)	AVERAGE HEAT RATE (BTU/SEC-FT)	MDNBR	HOT CHANNEL	HOT ROD	AXIAL LEVEL (IN.)	MASS FLUX (MLBM/HR-FT2)	EQUIL. QUALITY	HEAT FLUX (MBTU/HR-FT2)	CRITICAL HEAT FLUX (MBTU/HR-FT2)	CORR FLAG	TIME (SEC)
502				+	1.185	22	19					+	WRB2	0.000 +(b,c
2					1.085	22	19						WRB2	0.000
3					1.140	22	19						WRB2	0.000
4					1.050	22	19						WRB2	0.000
5					1.145	22	19						WRB2	0.000
6					1.067	22	19						WRB2	0.000
7					1.103	22	19						WRB2	0.000
8					1.039	22	19						WRB2	0.000
9					1.182	22	19						WRB2	0.000
10					1.201	22	19						WRB2	0.000
11					1.160	22	19						WRB2	0.000
12					1.102	22	19						WRB2	0.000
13					1.202	22	19						WRB2	0.000
14					1.082	22	19						WRB2	0.000
15					1.155	22	19						WRB2	0.000
16					1.154	22	19						WRB2	0.000
17					0.962	22	19						WRB2	0.000
18					0.980	22	19						WRB2	0.000
19					0.997	22	19						WRB2	0.000
20					0.975	22	19						WRB2	0.000
21					0.981	22	19						WRB2	0.000
22					0.973	22	19						WRB2	0.000
23					0.869	22	19						WRB2	0.000
24					0.912	22	19						WRB2	0.000
25					0.989	22	19						WRB2	0.000
26					1.020	22	19						WRB2	0.000
27					0.991	22	19						WRB2	0.000
28					0.982	22	19						WRB2	0.000
29					1.014	22	19						WRB2	0.000
30					0.917	22	19						WRB2	0.000
31					1.019	22	19						WRB2	0.000
32					0.973	22	19						WRB2	0.000
33					1.055	22	19						WRB2	0.000
34					0.901	22	19						WRB2	0.000
35					0.807	22	19						WRB2	0.000
36					0.904	22	19						WRB2	0.000
37					0.977	22	19						WRB2	0.000
38					1.051	22	19						WRB2	0.000
39					0.878	22	19						WRB2	0.000
40					0.834	22	19						WRB2	0.000
41					0.889	22	19						WRB2	0.000
42					0.831	22	19						WRB2	0.000
43					0.925	22	19						WRB2	0.000
44					0.962	22	19						WRB2	0.000

+(b,c)

45		0.878	22	19		WRB2	0.000
46		0.948	22	19		WRB2	0.000
47		1.040	22	19		WRB2	0.000
48		1.037	22	19		WRB2	0.000
49		0.960	22	19		WRB2	0.000
50		1.033	22	19		WRB2	0.000
51		1.060	22	19		WRB2	0.000
52		1.036	22	19		WRB2	0.000
53		1.027	22	19		WRB2	0.000
54		1.050	22	19		WRB2	0.000
55		1.086	22	19		WRB2	0.000
56		0.998	22	19		WRB2	0.000
57		0.868	22	19		WRB2	0.000
58		1.062	22	19		WRB2	0.000
59		0.953	22	19		WRB2	0.000
60		1.132	22	19		WRB2	0.000
61		0.988	22	19		WRB2	0.000
62		1.122	22	19		WRB2	0.000
63		0.998	22	19		WRB2	0.000

est Section A-5

```
     *********** OPERATING CONDITIONS ***********       *CRITICAL LOCATION*** HOT CHANNEL CONDITIONS **** PREDICTED **
     * SYSTEM    INLET        INLET        AVERAGE    *       *                AXIAL*MASS FLUX            HEAT FLUX*   CRITICAL   *
     *PRESSURE ENTHALPY  MASS FLUX    HEAT RATE    *       *  HOT      HOT  LEVEL*(MLBM/HR-    EQUIL.  (MBTU/HR-*  HEAT FLUX   *CORR* TIME   *
CASE* (PSIA)  (BTU/LBM) (MLBM/HR-FT2) (BTU/SEC-FT) *MDNBR*CHANNEL  ROD  (IN.)*    FT2)     QUALITY      FT2)   *(MBTU/HR-FT2)*FLAG* (SEC)  *
*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-
  503 [                                              ]+ 1.074    28      19  [                                                      ]+  WRB2   0.000 +(b,c)
    2                                                   1.059    28      19                                                             WRB2   0.000
    3                                                   0.937    22      19                                                             WRB2   0.000
    4                                                   0.973    28      19                                                             WRB2   0.000
    5                                                   1.025    22      19                                                             WRB2   0.000
    6                                                   0.976    22      19                                                             WRB2   0.000
    7                                                   0.896    28      19                                                             WRB2   0.000
    8                                                   0.986    28      19                                                             WRB2   0.000
    9                                                   1.049    22      19                                                             WRB2   0.000
   10                                                   1.136    22      19                                                             WRB2   0.000
   11                                                   1.039    28      19                                                             WRB2   0.000
   12                                                   1.011    28      19                                                             WRB2   0.000
   13                                                   1.054    28      19                                                             WRB2   0.000
   14                                                   1.070    22      19                                                             WRB2   0.000
   15                                                   1.055    28      19                                                             WRB2   0.000
   16                                                   1.020    22      19                                                             WRB2   0.000
   17                                                   1.070    22      19                                                             WRB2   0.000
   18                                                   1.013    28      19                                                             WRB2   0.000
   19                                                   0.998    22      19                                                             WRB2   0.000
   20                                                   1.066    28      19                                                             WRB2   0.000
   21                                                   1.051    22      19                                                             WRB2   0.000
   22                                                   1.014    28      19                                                             WRB2   0.000
   23                                                   0.952    28      19                                                             WRB2   0.000
   24                                                   0.981    22      19                                                             WRB2   0.000
   25                                                   0.911    28      19                                                             WRB2   0.000
   26                                                   1.023    28      19                                                             WRB2   0.000
   27                                                   1.087    28      19                                                             WRB2   0.000
   28                                                   1.029    28      19                                                             WRB2   0.000
   29                                                   0.987    22      19                                                             WRB2   0.000
   30                                                   1.112    22      19                                                             WRB2   0.000
   31                                                   0.861    23      19                                                             WRB2   0.000
   32                                                   0.949    23      19                                                             WRB2   0.000
   33                                                   1.031    28      19                                                             WRB2   0.000
   34                                                   0.934    28      19                                                             WRB2   0.000
   35                                                   0.966    22      19                                                             WRB2   0.000
   36                                                   1.025    22      19                                                             WRB2   0.000
   37                                                   1.003    28      19                                                             WRB2   0.000
   38 [                                              ]  1.085    22      19  [                                                      ]   WRB2   0.000
```

Test Section A-6

```
     *********** OPERATING CONDITIONS ***********      *CRITICAL LOCATION*** HOT CHANNEL CONDITIONS **** PREDICTED **
     * SYSTEM    INLET        INLET       AVERAGE    *      *                AXIAL*MASS FLUX            HEAT FLUX*   CRITICAL   *
     *PRESSURE ENTHALPY  MASS FLUX   HEAT RATE    *      *   HOT    HOT LEVEL*(MLBM/HR-   EQUIL.  (MBTU/HR-*  HEAT FLUX   *CORR* TIME    *
CASE* (PSIA)  (BTU/LBM)(MLBM/HR-FT2)(BTU/SEC-FT)*MDNBR*CHANNEL ROD (IN.)*    FT2)    QUALITY     FT2)   *(MBTU/HR-FT2)*FLAG* (SEC)  *
*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-
 160 [                                           ]+ 1.026   22     19  [                                              ]+  WRB2   0.000  +(b,c
   2                                                1.009   22     19                                                    WRB2   0.000
   3                                                0.998   22     19                                                    WRB2   0.000
   4                                                0.967   22     19                                                    WRB2   0.000
   5                                                1.008   22     19                                                    WRB2   0.000
   6                                                0.933   22     19                                                    WRB2   0.000
   7                                                0.923   22     19                                                    WRB2   0.000
   8                                                0.927   22     19                                                    WRB2   0.000
   9                                                1.074   22     19                                                    WRB2   0.000
  10                                                0.964   22     19                                                    WRB2   0.000
  11                                                0.959   22     19                                                    WRB2   0.000
  12                                                0.880   22     19                                                    WRB2   0.000
  13                                                1.046   22     19                                                    WRB2   0.000
  14                                                0.881   22     19                                                    WRB2   0.000
  15                                                0.882   22     19                                                    WRB2   0.000
  16                                                0.866   22     19                                                    WRB2   0.000
  17                                                0.860   22     19                                                    WRB2   0.000
  18                                                0.923   22     19                                                    WRB2   0.000
  19                                                0.902   22     19                                                    WRB2   0.000
  20                                                0.916   22     19                                                    WRB2   0.000
  21                                                0.919   22     19                                                    WRB2   0.000
  22                                                0.875   22     19                                                    WRB2   0.000
  23                                                0.868   22     19                                                    WRB2   0.000
  24                                                0.930   22     19                                                    WRB2   0.000
  25                                                0.855   22     19                                                    WRB2   0.000
  26                                                0.894   22     19                                                    WRB2   0.000
  27                                                0.870   22     19                                                    WRB2   0.000
  28                                                0.895   22     19                                                    WRB2   0.000
  29                                                0.932   22     19                                                    WRB2   0.000
  30                                                0.976   22     19                                                    WRB2   0.000
  31                                                0.944   22     19                                                    WRB2   0.000
  32                                                0.948   22     19                                                    WRB2   0.000
  33                                                0.975   22     19                                                    WRB2   0.000
  34                                                1.024   22     19                                                    WRB2   0.000
  35                                                0.984   22     19                                                    WRB2   0.000
  36                                                0.993   22     19                                                    WRB2   0.000
  37                                                1.016   22     19                                                    WRB2   0.000
  38                                                1.173   22     19                                                    WRB2   0.000
  39                                                1.082   22     19                                                    WRB2   0.000
  40                                                1.136   22     19                                                    WRB2   0.000
  41                                                1.060   22     19                                                    WRB2   0.000
  42                                                1.077   22     19                                                    WRB2   0.000
  43                                                0.957   22     19                                                    WRB2   0.000
  44 [                                           ]  0.985   22     19  [                                              ]   WRB2   0.000
```

```
45      +  0.902   22   19      +  WRB2   0.000 +(b,c
46         1.019   22   19         WRB2   0.000
47         1.283   22   19         WRB2   0.000
48         1.084   22   19         WRB2   0.000
49         1.098   22   19         WRB2   0.000
50         1.051   22   19         WRB2   0.000
51         1.057   22   19         WRB2   0.000
52         1.110   22   19         WRB2   0.000
53         0.899   22   19         WRB2   0.000
54         0.934   22   19         WRB2   0.000
55         0.893   22   19         WRB2   0.000
56         1.052   22   19         WRB2   0.000
57         0.946   22   19         WRB2   0.000
58         0.944   22   19         WRB2   0.000
59         0.881   22   19         WRB2   0.000
60         0.911   22   19         WRB2   0.000
61         1.004   22   19         WRB2   0.000
62         0.906   22   19         WRB2   0.000
63         0.928   22   19         WRB2   0.000
64         1.035   22   19         WRB2   0.000
65         1.029   22   19         WRB2   0.000
66         1.011   22   19         WRB2   0.000
67         0.953   22   19         WRB2   0.000
```

Test Section A-7

```
     *********** OPERATING CONDITIONS ***********      *CRITICAL LOCATION*** HOT CHANNEL CONDITIONS **** PREDICTED **
     * SYSTEM    INLET        INLET        AVERAGE   *      *                AXIAL*MASS FLUX            HEAT FLUX*   CRITICAL   *
     *PRESSURE ENTHALPY  MASS FLUX    HEAT RATE   *      *   HOT      HOT LEVEL*(MLBM/HR-   EQUIL.  (MBTU/HR-*  HEAT FLUX  *CORR* TIME   *
CASE* (PSIA) (BTU/LBM)(MLBM/HR-FT2)(BTU/SEC-FT)*MDNBR*CHANNEL ROD (IN.)*    FT2)    QUALITY     FT2)   *(MBTU/HR-FT2)*FLAG* (SEC) *
*-*-* *-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*
 161                                              +1.083   22     19                                                 +  WRB2   0.000 +(b,c
   2                                               1.164   22     19                                                    WRB2   0.000
   3                                               1.032   22     19                                                    WRB2   0.000
   4                                               0.970   22     19                                                    WRB2   0.000
   5                                               1.020   22     19                                                    WRB2   0.000
   6                                               0.945   22     19                                                    WRB2   0.000
   7                                               0.874   22     19                                                    WRB2   0.000
   8                                               1.051   22     19                                                    WRB2   0.000
   9                                               1.076   22     19                                                    WRB2   0.000
  10                                               1.144   22     19                                                    WRB2   0.000
  11                                               1.076   22     19                                                    WRB2   0.000
  12                                               1.121   22     19                                                    WRB2   0.000
  13                                               1.003   22     19                                                    WRB2   0.000
  14                                               1.049   22     19                                                    WRB2   0.000
  15                                               1.039   22     19                                                    WRB2   0.000
  16                                               1.059   22     19                                                    WRB2   0.000
  17                                               0.992   22     19                                                    WRB2   0.000
  18                                               0.995   22     19                                                    WRB2   0.000
  19                                               0.966   22     19                                                    WRB2   0.000
  20                                               0.911   22     19                                                    WRB2   0.000
  21                                               0.943   22     19                                                    WRB2   0.000
  22                                               0.981   22     19                                                    WRB2   0.000
  23                                               0.989   22     19                                                    WRB2   0.000
  24                                               0.983   22     19                                                    WRB2   0.000
  25                                               0.916   22     19                                                    WRB2   0.000
  26                                               0.984   22     19                                                    WRB2   0.000
  27                                               1.157   22     19                                                    WRB2   0.000
  28                                               1.048   22     19                                                    WRB2   0.000
  29                                               1.063   22     19                                                    WRB2   0.000
  30                                               1.050   22     19                                                    WRB2   0.000
  31                                               1.018   22     19                                                    WRB2   0.000
  32                                               1.003   22     19                                                    WRB2   0.000
  33                                               0.998   22     19                                                    WRB2   0.000
  34                                               1.015   22     19                                                    WRB2   0.000
  35                                               0.987   22     19                                                    WRB2   0.000
  36                                               0.934   22     19                                                    WRB2   0.000
  37                                               0.919   22     19                                                    WRB2   0.000
  38                                               0.969   22     19                                                    WRB2   0.000
  39                                               0.909   22     19                                                    WRB2   0.000
  40                                               0.933   22     19                                                    WRB2   0.000
  41                                               0.922   22     19                                                    WRB2   0.000
  42                                               0.890   22     19                                                    WRB2   0.000
  43                                               1.000   22     19                                                    WRB2   0.000
  44                                               0.846   22     19                                                    WRB2   0.000
```

45	+	0.957	22	19	+	WRB2	0.000 +(b,c
46		0.966	22	19		WRB2	0.000
47		1.039	22	19		WRB2	0.000
48		0.988	22	19		WRB2	0.000
49		1.061	22	19		WRB2	0.000
50		0.977	22	19		WRB2	0.000
51		1.011	22	19		WRB2	0.000
52		1.000	22	19		WRB2	0.000
53		1.018	22	19		WRB2	0.000
54		1.009	22	19		WRB2	0.000
55		1.054	22	19		WRB2	0.000
56		1.007	22	19		WRB2	0.000
57		0.972	22	19		WRB2	0.000
58		0.975	22	19		WRB2	0.000
59		0.968	22	19		WRB2	0.000
60		0.999	22	19		WRB2	0.000
61		1.043	22	19		WRB2	0.000
62		0.970	22	19		WRB2	0.000
63		0.877	22	19		WRB2	0.000
64		1.008	22	19		WRB2	0.000
65		1.006	22	19		WRB2	0.000
66		0.975	22	19		WRB2	0.000
67		0.903	22	19		WRB2	0.000
68		0.944	22	19		WRB2	0.000
69		0.968	22	19		WRB2	0.000
70		1.026	22	19		WRB2	0.000
71		0.949	22	19		WRB2	0.000

Test Section A-8

```
    *********** OPERATING CONDITIONS ***********      *CRITICAL LOCATION*** HOT CHANNEL CONDITIONS **** PREDICTED **
    * SYSTEM    INLET        INLET       AVERAGE     *      *                AXIAL*MASS FLUX           HEAT FLUX*   CRITICAL    *
    *PRESSURE ENTHALPY  MASS FLUX    HEAT RATE    *      *   HOT      HOT LEVEL*(MLBM/HR-   EQUIL.  (MBTU/HR-*  HEAT FLUX   *CORR* TIME   *
CASE* (PSIA)  (BTU/LBM)(MLBM/HR-FT2)(BTU/SEC-FT)*MDNBR*CHANNEL ROD  (IN.)*    FT2)    QUALITY     FT2)   *(MBTU/HR-FT2)*FLAG* (SEC)  *
*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-
 164 [                                          ]+ 1.040   22     19  [                                              ]+  WRB2   0.000  +(b,c
   2                                               1.072   22     19                                                      WRB2   0.000
   3                                               1.034   22     19                                                      WRB2   0.000
   4                                               1.078   22     19                                                      WRB2   0.000
   5                                               0.956   22     19                                                      WRB2   0.000
   6                                               0.974   22     19                                                      WRB2   0.000
   7                                               1.105   22     19                                                      WRB2   0.000
   8                                               1.073   22     19                                                      WRB2   0.000
   9                                               1.096   22     19                                                      WRB2   0.000
  10                                               0.989   22     19                                                      WRB2   0.000
  11                                               0.880   22     19                                                      WRB2   0.000
  12                                               1.207   22     19                                                      WRB2   0.000
  13                                               1.181   22     19                                                      WRB2   0.000
  14                                               1.083   22     19                                                      WRB2   0.000
  15                                               1.118   22     19                                                      WRB2   0.000
  16                                               1.085   22     19                                                      WRB2   0.000
  17                                               1.226   22     19                                                      WRB2   0.000
  18                                               1.136   22     19                                                      WRB2   0.000
  19                                               1.157   22     19                                                      WRB2   0.000
  20                                               1.200   22     19                                                      WRB2   0.000
  21                                               1.055   22     19                                                      WRB2   0.000
  22                                               1.001   22     19                                                      WRB2   0.000
  23                                               1.001   22     19                                                      WRB2   0.000
  24                                               1.108   22     19                                                      WRB2   0.000
  25                                               1.011   22     19                                                      WRB2   0.000
  26                                               1.070   22     19                                                      WRB2   0.000
  27                                               1.087   22     19                                                      WRB2   0.000
  28                                               1.054   22     19                                                      WRB2   0.000
  29                                               1.102   22     19                                                      WRB2   0.000
  30                                               0.912   22     19                                                      WRB2   0.000
  31                                               0.954   22     19                                                      WRB2   0.000
  32                                               1.003   22     19                                                      WRB2   0.000
  33                                               0.945   22     19                                                      WRB2   0.000
  34                                               0.953   22     19                                                      WRB2   0.000
  35                                               0.987   22     19                                                      WRB2   0.000
  36                                               1.020   22     19                                                      WRB2   0.000
  37                                               1.098   22     19                                                      WRB2   0.000
  38                                               0.985   22     19                                                      WRB2   0.000
  39                                               0.962   22     19                                                      WRB2   0.000
  40                                               1.012   22     19                                                      WRB2   0.000
  41                                               1.043   22     19                                                      WRB2   0.000
  42                                               1.186   22     19                                                      WRB2   0.000
  43                                               1.183   22     19                                                      WRB2   0.000
  44 [                                          ]  1.160   22     19  [                                              ]    WRB2   0.000
```

45	+	0.968	22	19	+	WRB2	0.000	+(b,
46		0.921	22	19		WRB2	0.000	
47		0.974	22	19		WRB2	0.000	
48		1.016	22	19		WRB2	0.000	
49		0.995	22	19		WRB2	0.000	
50		0.915	22	19		WRB2	0.000	
51		1.093	22	19		WRB2	0.000	
52		0.906	22	19		WRB2	0.000	
53		0.861	22	19		WRB2	0.000	
54		0.963	22	19		WRB2	0.000	
55		0.904	22	19		WRB2	0.000	
56		1.020	22	19		WRB2	0.000	
57		0.945	22	19		WRB2	0.000	
58		0.938	22	19		WRB2	0.000	
59		1.030	22	19		WRB2	0.000	
60		1.014	22	19		WRB2	0.000	
61		1.090	22	19		WRB2	0.000	
62		0.952	22	19		WRB2	0.000	
63		0.963	22	19		WRB2	0.000	
64		0.932	22	19		WRB2	0.000	
65		1.037	22	19		WRB2	0.000	
66		0.887	22	19		WRB2	0.000	
67		0.957	22	19		WRB2	0.000	
68		1.060	22	19		WRB2	0.000	
69		0.930	22	19		WRB2	0.000	
70		0.966	22	19		WRB2	0.000	
71		0.936	22	19		WRB2	0.000	
72		1.088	22	19		WRB2	0.000	
73		0.936	22	19		WRB2	0.000	
74		0.934	22	19		WRB2	0.000	

Test Section A-9

```
      *********** OPERATING CONDITIONS ***********        *CRITICAL LOCATION*** HOT CHANNEL CONDITIONS **** PREDICTED **
      * SYSTEM    INLET        INLET        AVERAGE   *         *                      AXIAL*MASS FLUX           HEAT FLUX*   CRITICAL   *
      *PRESSURE ENTHALPY   MASS FLUX    HEAT RATE   *         *   HOT     HOT  LEVEL*(MLBM/HR-   EQUIL.  (MBTU/HR-*  HEAT FLUX   *CORR* TIME   *
CASE*  (PSIA)  (BTU/LBM) (MLBM/HR-FT2) (BTU/SEC-FT) *MDNBR*CHANNEL  ROD  (IN.)*    FT2)    QUALITY     FT2)   *(MBTU/HR-FT2)*FLAG* (SEC)  *
*-*-* *-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-
 162 [                                          ]+ 0.996    28     19  [                                                    ]+  WRB2   0.000  +(b,
   2                                              0.959    22     19                                                          WRB2   0.000
   3                                              0.986    22     19                                                          WRB2   0.000
   4                                              1.008    22     19                                                          WRB2   0.000
   5                                              1.168    28     19                                                          WRB2   0.000
   6                                              1.034    22     19                                                          WRB2   0.000
   7                                              0.992    22     19                                                          WRB2   0.000
   8                                              1.091    22     19                                                          WRB2   0.000
   9                                              1.143    28     19                                                          WRB2   0.000
  10                                              1.154    28     19                                                          WRB2   0.000
  11                                              1.102    22     19                                                          WRB2   0.000
  12                                              0.900    28     19                                                          WRB2   0.000
  13                                              1.007    28     19                                                          WRB2   0.000
  14                                              1.178    28     19                                                          WRB2   0.000
  15                                              0.986    28     19                                                          WRB2   0.000
  16                                              1.022    28     19                                                          WRB2   0.000
  17                                              0.957    28     19                                                          WRB2   0.000
  18                                              0.958    22     19                                                          WRB2   0.000
  19                                              1.056    28     19                                                          WRB2   0.000
  20                                              0.881    28     19                                                          WRB2   0.000
  21                                              0.962    28     19                                                          WRB2   0.000
  22                                              1.073    28     19                                                          WRB2   0.000
  23                                              0.875    28     19                                                          WRB2   0.000
  24                                              0.996    28     19                                                          WRB2   0.000
  25                                              1.112    28     19                                                          WRB2   0.000
  26                                              1.115    28     19                                                          WRB2   0.000
  27                                              1.006    28     19                                                          WRB2   0.000
  28                                              1.001    28     19                                                          WRB2   0.000
  29                                              1.011    28     19                                                          WRB2   0.000
  30                                              1.073    28     19                                                          WRB2   0.000
  31                                              1.009    28     19                                                          WRB2   0.000
  32                                              1.082    28     19                                                          WRB2   0.000
  33                                              1.214    22     19                                                          WRB2   0.000
  34                                              0.970    22     19                                                          WRB2   0.000
  35                                              1.179    22     19                                                          WRB2   0.000
  36                                              1.109    28     19                                                          WRB2   0.000
  37                                              1.166    28     19                                                          WRB2   0.000
  38                                              0.973    28     19                                                          WRB2   0.000
  39                                              1.006    22     19                                                          WRB2   0.000
  40                                              1.131    28     19                                                          WRB2   0.000
  41                                              1.070    28     19                                                          WRB2   0.000
  42                                              1.164    22     19                                                          WRB2   0.000
  43                                              1.029    22     19                                                          WRB2   0.000
  44 [                                          ]  1.254    22     19  [                                                    ]   WRB2   0.000
```

45		+	0.917	28	19		+	WRB2	0.000	+(b,
46			1.148	28	19			WRB2	0.000	
47			1.118	22	19			WRB2	0.000	
48			0.947	28	19			WRB2	0.000	
49			1.112	22	19			WRB2	0.000	
50			1.145	22	19			WRB2	0.000	
51			1.030	23	19			WRB2	0.000	
52			1.103	23	19			WRB2	0.000	
53			0.986	23	19			WRB2	0.000	
54			0.938	23	19			WRB2	0.000	
55			1.054	23	19			WRB2	0.000	
56			0.863	23	19			WRB2	0.000	
57			0.970	23	19			WRB2	0.000	
58			0.961	23	19			WRB2	0.000	
59			0.970	23	19			WRB2	0.000	
60			0.996	23	19			WRB2	0.000	
61			1.053	23	19			WRB2	0.000	
62			0.914	23	19			WRB2	0.000	
63			0.995	22	19			WRB2	0.000	
64			0.905	22	19			WRB2	0.000	
65			1.008	23	19			WRB2	0.000	
66			0.930	23	19			WRB2	0.000	
67			0.927	23	19			WRB2	0.000	
68			0.920	23	19			WRB2	0.000	
69			1.004	22	19			WRB2	0.000	
70			0.900	28	19			WRB2	0.000	

Test Section A-10

```
     *********** OPERATING CONDITIONS ***********      *CRITICAL LOCATION*** HOT CHANNEL CONDITIONS **** PREDICTED **
     * SYSTEM    INLET        INLET      AVERAGE    *          *                 AXIAL*MASS FLUX               HEAT FLUX*   CRITICAL   *
     *PRESSURE ENTHALPY  MASS FLUX   HEAT RATE   *          *   HOT      HOT LEVEL*(MLBM/HR-  EQUIL.  (MBTU/HR-*  HEAT FLUX   *CORR* TIME   *
CASE* (PSIA) (BTU/LBM)(MLBM/HR-FT2)(BTU/SEC-FT)*MDNBR*CHANNEL ROD (IN.)*   FT2)    QUALITY     FT2)   *(MBTU/HR-FT2)*FLAG* (SEC)  *
*-*-* *-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*
 157  [                                          ]+ 0.928    22     19  [                                             ]+  WRB2   0.000  +(b,
   2                                                1.033    22     19                                                   WRB2   0.000
   3                                                1.075    22     19                                                   WRB2   0.000
   4                                                1.053    22     19                                                   WRB2   0.000
   5                                                1.087    22     19                                                   WRB2   0.000
   6                                                1.055    22     19                                                   WRB2   0.000
   7                                                0.992    22     19                                                   WRB2   0.000
   8                                                1.038    22     19                                                   WRB2   0.000
   9                                                1.057    22     19                                                   WRB2   0.000
  10                                                0.958    22     19                                                   WRB2   0.000
  11                                                0.992    22     19                                                   WRB2   0.000
  12                                                0.922    22     19                                                   WRB2   0.000
  13                                                1.056    22     19                                                   WRB2   0.000
  14                                                1.016    22     19                                                   WRB2   0.000
  15                                                1.026    22     19                                                   WRB2   0.000
  16                                                0.947    22     19                                                   WRB2   0.000
  17                                                0.949    22     19                                                   WRB2   0.000
  18                                                0.980    22     19                                                   WRB2   0.000
  19                                                0.960    22     19                                                   WRB2   0.000
  20                                                0.901    22     19                                                   WRB2   0.000
  21                                                0.931    22     19                                                   WRB2   0.000
  22                                                0.973    22     19                                                   WRB2   0.000
  23                                                1.038    22     19                                                   WRB2   0.000
  24                                                0.963    22     19                                                   WRB2   0.000
  25                                                1.075    22     19                                                   WRB2   0.000
  26                                                0.937    22     19                                                   WRB2   0.000
  27                                                0.970    22     19                                                   WRB2   0.000
  28                                                1.200    22     19                                                   WRB2   0.000
  29                                                1.145    22     19                                                   WRB2   0.000
  30                                                0.963    22     19                                                   WRB2   0.000
  31                                                1.046    22     19                                                   WRB2   0.000
  32                                                0.870    22     19                                                   WRB2   0.000
  33                                                1.206    22     19                                                   WRB2   0.000
  34                                                0.976    22     19                                                   WRB2   0.000
  35                                                0.987    22     19                                                   WRB2   0.000
  36                                                0.970    22     19                                                   WRB2   0.000
  37                                                0.958    22     19                                                   WRB2   0.000
  38                                                0.910    22     19                                                   WRB2   0.000
  39                                                0.996    22     19                                                   WRB2   0.000
  40                                                0.938    22     19                                                   WRB2   0.000
  41                                                0.924    22     19                                                   WRB2   0.000
  42                                                0.888    22     19                                                   WRB2   0.000
  43                                                0.958    22     19                                                   WRB2   0.000
  44  [                                          ]  1.049    22     19  [                                             ]   WRB2   0.000
```

45	+	1.051	22	19	+	WRB2	0.000	+(b,c
46		0.839	22	19		WRB2	0.000	
47		0.969	22	19		WRB2	0.000	
48		0.978	22	19		WRB2	0.000	
49		1.015	22	19		WRB2	0.000	
50		0.947	22	19		WRB2	0.000	
51		0.970	22	19		WRB2	0.000	
52		0.971	22	19		WRB2	0.000	
53		1.000	22	19		WRB2	0.000	
54		1.021	22	19		WRB2	0.000	
55		0.988	22	19		WRB2	0.000	
56		0.930	22	19		WRB2	0.000	
57		1.073	22	19		WRB2	0.000	
58		0.970	22	19		WRB2	0.000	
59		0.911	22	19		WRB2	0.000	
60		0.921	22	19		WRB2	0.000	
61		0.985	22	19		WRB2	0.000	
62		1.153	22	19		WRB2	0.000	
63		0.963	22	19		WRB2	0.000	
64		0.933	22	19		WRB2	0.000	
65		0.877	22	19		WRB2	0.000	
66		0.855	22	19		WRB2	0.000	
67		0.841	22	19		WRB2	0.000	
68		0.991	22	19		WRB2	0.000	
69		0.913	22	19		WRB2	0.000	
70		0.963	22	19		WRB2	0.000	
71		0.882	22	19		WRB2	0.000	
72		0.907	22	19		WRB2	0.000	
73		1.033	22	19		WRB2	0.000	
74		0.921	22	19		WRB2	0.000	
75		0.871	22	19		WRB2	0.000	
76		0.874	22	19		WRB2	0.000	
77		0.876	22	19		WRB2	0.000	
78		0.877	22	19		WRB2	0.000	

Test Section A-11

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    *********** OPERATING CONDITIONS ***********      *CRITICAL LOCATION*** HOT CHANNEL CONDITIONS **** PREDICTED **
    * SYSTEM    INLET        INLET       AVERAGE   *      *                                                                                          
    *PRESSURE ENTHALPY   MASS FLUX    HEAT RATE  *      *    HOT    HOT        AXIAL*MASS FLUX               HEAT FLUX*   CRITICAL   *
CASE* (PSIA) (BTU/LBM)(MLBM/HR-FT2)(BTU/SEC-FT)*MDNBR*CHANNEL ROD (IN.)*  (MLBM/HR      EQUIL.  (MBTU/HR-*  HEAT FLUX   *CORR* TIME  *
*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-  LEVEL*   FT2)      QUALITY     FT2)  *(MBTU/HR-FT2)*FLAG* (SEC) *
 158 [                                          ]+ 0.918   28    19  [                                               ]+
   2                                              0.998   22    19                                                        WRB2   0.000  +(b,c
   3                                              0.984   22    19                                                        WRB2   0.000
   4                                              0.941   22    19                                                        WRB2   0.000
   5                                              0.928   28    19                                                        WRB2   0.000
   6                                              0.983   22    19                                                        WRB2   0.000
   7                                              0.990   22    19                                                        WRB2   0.000
   8                                              0.989   22    19                                                        WRB2   0.000
   9                                              1.248   28    19                                                        WRB2   0.000
  10                                              1.165   28    19                                                        WRB2   0.000
  11                                              1.057   22    19                                                        WRB2   0.000
  12                                              1.082   22    19                                                        WRB2   0.000
  13                                              1.123   28    19                                                        WRB2   0.000
  14                                              1.080   28    19                                                        WRB2   0.000
  15                                              0.946   28    19                                                        WRB2   0.000
  16                                              1.082   28    19                                                        WRB2   0.000
  17                                              0.940   22    19                                                        WRB2   0.000
  18                                              0.990   22    19                                                        WRB2   0.000
  19                                              0.854   22    19                                                        WRB2   0.000
  20                                              0.927   22    19                                                        WRB2   0.000
  21                                              0.968   22    19                                                        WRB2   0.000
  22                                              0.977   22    19                                                        WRB2   0.000
  23                                              0.959   28    19                                                        WRB2   0.000
  24                                              0.993   28    19                                                        WRB2   0.000
  25                                              1.160   28    19                                                        WRB2   0.000
  26                                              1.071   28    19                                                        WRB2   0.000
  27                                              0.861   22    19                                                        WRB2   0.000
  28                                              0.897   22    19                                                        WRB2   0.000
  29                                              0.873   28    19                                                        WRB2   0.000
  30                                              0.953   23    19                                                        WRB2   0.000
  31                                              0.971   28    19                                                        WRB2   0.000
  32                                              1.173   28    19                                                        WRB2   0.000
  33                                              1.043   28    19                                                        WRB2   0.000
  34                                              1.077   28    19                                                        WRB2   0.000
  35                                              1.043   23    19                                                        WRB2   0.000
  36                                              0.954   22    19                                                        WRB2   0.000
  37                                              1.072   22    19                                                        WRB2   0.000
  38                                              1.057   28    19                                                        WRB2   0.000
  39                                              1.057   28    19                                                        WRB2   0.000
  40                                              1.077   28    19                                                        WRB2   0.000
  41                                              1.110   28    19                                                        WRB2   0.000
  42                                              1.126   28    19                                                        WRB2   0.000
  43                                              0.926   28    19                                                        WRB2   0.000
  44 [                                          ]  0.901   23    19  [                                               ]     WRB2   0.000
```

45		0.924	22	19		WRB2	0.000	+(b,c
46		0.955	22	19		WRB2	0.000	
47		0.968	22	19		WRB2	0.000	
48		0.961	28	19		WRB2	0.000	
49		0.969	23	19		WRB2	0.000	
50		0.989	28	19		WRB2	0.000	
51		0.990	22	19		WRB2	0.000	
52		1.097	22	19		WRB2	0.000	
53		0.901	28	19		WRB2	0.000	
54		0.824	22	19		WRB2	0.000	
55		0.887	22	19		WRB2	0.000	
56		0.802	28	19		WRB2	0.000	
57		0.842	28	19		WRB2	0.000	
58		0.893	22	19		WRB2	0.000	
59		0.918	28	19		WRB2	0.000	
60		0.909	22	19		WRB2	0.000	
61		1.040	28	19		WRB2	0.000	
62		1.121	28	19		WRB2	0.000	
63		1.028	28	19		WRB2	0.000	
64		0.873	22	19		WRB2	0.000	
65		0.939	28	19		WRB2	0.000	
66		0.881	28	19		WRB2	0.000	
67		0.828	22	19		WRB2	0.000	
68		1.027	22	19		WRB2	0.000	

Test Section A-12

	OPERATING CONDITIONS					CRITICAL LOCATION		HOT CHANNEL CONDITIONS				PREDICTED		
CASE	SYSTEM PRESSURE (PSIA)	INLET ENTHALPY (BTU/LBM)	INLET MASS FLUX (MLBM/HR-FT2)	AVERAGE HEAT RATE (BTU/SEC-FT)	MDNBR	HOT CHANNEL	HOT ROD	AXIAL LEVEL (IN.)	MASS FLUX (MLBM/HR-FT2)	EQUIL. QUALITY	HEAT FLUX (MBTU/HR-FT2)	CRITICAL HEAT FLUX (MBTU/HR-FT2)	CORR FLAG	TIME (SEC)
156					0.876	22	19						WRB2	0.000
2					0.898	22	19						WRB2	0.000
3					1.034	22	19						WRB2	0.000
4					0.974	22	19						WRB2	0.000
5					1.072	22	19						WRB2	0.000
6					0.986	22	19						WRB2	0.000
7					0.912	22	19						WRB2	0.000
8					0.903	22	19						WRB2	0.000
9					0.959	22	19						WRB2	0.000
10					1.071	22	19						WRB2	0.000
11					1.063	22	19						WRB2	0.000
12					1.062	22	19						WRB2	0.000
13					1.001	22	19						WRB2	0.000
14					0.949	22	19						WRB2	0.000
15					1.046	22	19						WRB2	0.000
16					1.130	22	19						WRB2	0.000
17					0.973	22	19						WRB2	0.000
18					0.997	22	19						WRB2	0.000
19					1.083	22	19						WRB2	0.000
20					1.184	22	19						WRB2	0.000
21					0.942	22	19						WRB2	0.000
22					0.915	22	19						WRB2	0.000
23					0.840	22	19						WRB2	0.000
24					0.980	22	19						WRB2	0.000
25					0.992	22	19						WRB2	0.000
26					0.928	22	19						WRB2	0.000
27					0.911	22	19						WRB2	0.000
28					0.930	22	19						WRB2	0.000
29					1.016	22	19						WRB2	0.000
30					1.022	22	19						WRB2	0.000
31					1.036	22	19						WRB2	0.000
32					1.238	22	19						WRB2	0.000
33					0.907	22	19						WRB2	0.000
34					0.940	22	19						WRB2	0.000
35					0.914	22	19						WRB2	0.000
36					0.961	22	19						WRB2	0.000
37					0.916	22	19						WRB2	0.000
38					1.075	22	19						WRB2	0.000
39					0.969	22	19						WRB2	0.000
40					1.177	22	19						WRB2	0.000
41					1.133	22	19						WRB2	0.000
42					1.127	22	19						WRB2	0.000
43					1.010	22	19						WRB2	0.000
44					1.028	22	19						WRB2	0.000

+(b,c

+(b,c)

45		1.080	22	19		WRB2	0.000
46		0.984	22	19		WRB2	0.000
47		1.019	22	19		WRB2	0.000
48		0.977	22	19		WRB2	0.000
49		1.095	22	19		WRB2	0.000
50		1.046	22	19		WRB2	0.000
51		1.008	22	19		WRB2	0.000
52		0.960	22	19		WRB2	0.000
53		1.009	22	19		WRB2	0.000
54		1.012	22	19		WRB2	0.000
55		1.060	22	19		WRB2	0.000
56		1.067	22	19		WRB2	0.000
57		1.070	22	19		WRB2	0.000
58		0.909	22	19		WRB2	0.000
59		0.907	22	19		WRB2	0.000
60		1.240	22	19		WRB2	0.000
61		1.093	22	19		WRB2	0.000
62		0.942	22	19		WRB2	0.000
63		0.910	22	19		WRB2	0.000
64		0.938	22	19		WRB2	0.000
65		0.969	22	19		WRB2	0.000
66		1.010	22	19		WRB2	0.000
67		0.978	22	19		WRB2	0.000
68		1.081	22	19		WRB2	0.000
69		1.046	22	19		WRB2	0.000
70		1.001	22	19		WRB2	0.000
71		1.111	22	19		WRB2	0.000
72		0.931	22	19		WRB2	0.000
7[illegible]		1.140	22	19		WRB2	0.000