Westinghouse Electric Corporation
Energy Systems
Box 355
Pittsburgh Pennsylvania 15230-0355

AW-96-978

June 24, 1996

Document Control Desk
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

ATTENTION: T. R. QUAY

APPLICATION FOR WITHHOLDING PROPRIETARY INFORMATION FROM PUBLIC DISCLOSURE

SUBJECT: EVALUATION OF LOW FLOW DNB DATA OF THE MODIFIED V5H/IFM FUEL FOR AP600

Dear Mr. Quay:

The application for withholding is submitted by Westinghouse Electric Corporation ("Westinghouse") pursuant to the provisions of paragraph (b)(1) of Section 2.790 of the Commission's regulations. It contains commercial strategic information proprietary to Westinghouse and customarily held in confidence.

The proprietary material for which withholding is being requested is identified in the proprietary version of the subject report. In conformance with 10CFR Section 2.790, Affidavit AW-96-978 accompanies this application for withholding setting forth the basis on which the identified proprietary information may be withheld from public disclosure.

Accordingly, it is respectfully requested that the subject information which is proprietary to Westinghouse be withheld from public disclosure in accordance with 10CFR Section 2.790 of the Commission's regulations.

Correspondence with respect to this application for withholding or the accompanying affidavit should reference AW-96-978 and should be addressed to the undersigned.

Very truly yours,

Brian A. McIntyre, Manager
Advanced Plant Safety and Licensing

/nja

cc: Kevin Bohrer NRC 12H5

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AW-96-978

AFFIDAVIT

COMMONWEALTH OF PENNSYLVANIA:

SS

COUNTY OF ALLEGHENY:

Before me, the undersigned authority, personally appeared Brian A. McIntyre, who, being by me duly sworn according to law, deposes and says that he is authorized to execute this Affidavit on behalf of Westinghouse Electric Corporation ("Westinghouse") and that the averments of fact set forth in this Affidavit are true and correct to the best of his knowledge, information, and belief:

Brian A. McIntyre, Manager
Advanced Plant Safety and Licensing

Sworn to and subscribed
before me this 24 day
of June, 1996

Notary Public

Notarial Seal
Rose Marie Payne, Notary Public
Monroeville Boro, Allegheny County
My Commission Expires Nov. 4, 1998
Member, Pennsylvania Association of Notaries

2811A

(1) I am Manager, Advanced Plant Safety And Licensing, in the Advanced Technology Business Area, of the Westinghouse Electric Corporation and as such, I have been specifically delegated the function of reviewing the proprietary information sought to be withheld from public disclosure in connection with nuclear power plant licensing and rulemaking proceedings, and am authorized to apply for its withholding on behalf of the Westinghouse Energy Systems Business Unit.

(2) I am making this Affidavit in conformance with the provisions of 10CFR Section 2.790 of the Commission's regulations and in conjunction with the Westinghouse application for withholding accompanying this Affidavit.

(3) I have personal knowledge of the criteria and procedures utilized by the Westinghouse Energy Systems Business Unit in designating information as a trade secret, privileged or as confidential commercial or financial information.

(4) Pursuant to the provisions of paragraph (b)(4) of Section 2.790 of the Commission's regulations, the following is furnished for consideration by the Commission in determining whether the information sought to be withheld from public disclosure should be withheld.

(i) The information sought to be withheld from public disclosure is owned and has been held in confidence by Westinghouse.

(ii) The information is of a type customarily held in confidence by Westinghouse and not customarily disclosed to the public. Westinghouse has a rational basis for determining the types of information customarily held in confidence by it and, in that connection, utilizes a system to determine when and whether to hold certain types of information in confidence. The application of that system and the substance of that system constitutes Westinghouse policy and provides the rational basis required.

Under that system, information is held in confidence if it falls in one or more of several types, the release of which might result in the loss of an existing or potential competitive advantage, as follows:

(a) The information reveals the distinguishing aspects of a process (or component, structure, tool, method, etc.) where prevention of its use by any of Westinghouse's competitors without license from Westinghouse constitutes a competitive economic advantage over other companies.

(b) It consists of supporting data, including test data, relative to a process (or component, structure, tool, method, etc.), the application of which data secures a competitive economic advantage, e.g., by optimization or improved marketability.

(c) Its use by a competitor would reduce his expenditure of resources or improve his competitive position in the design, manufacture, shipment, installation, assurance of quality, or licensing a similar product.

(d) It reveals cost or price information, production capacities, budget levels, or commercial strategies of Westinghouse, its customers or suppliers.

(e) It reveals aspects of past, present, or future Westinghouse or customer funded development plans and programs of potential commercial value to Westinghouse.

(f) It contains patentable ideas, for which patent protection may be desirable.

There are sound policy reasons behind the Westinghouse system which include the following:

(a) The use of such information by Westinghouse gives Westinghouse a competitive advantage over its competitors. It is, therefore, withheld from disclosure to protect the Westinghouse competitive position.

(b) It is information which is marketable in many ways. The extent to which such information is available to competitors diminishes the Westinghouse ability to sell products and services involving the use of the information.

(c) Use by our competitor would put Westinghouse at a competitive disadvantage by reducing his expenditure of resources at our expense.

(d) Each component of proprietary information pertinent to a particular competitive advantage is potentially as valuable as the total competitive advantage. If competitors acquire ponents of proprietary information, any one component may be the key to the entire puzzle, thereby depriving Westinghouse of a competitive advantage.

(e) Unrestricted disclosure would jeopardize the position of prominence of Westinghouse in the world market, and thereby give a market advantage to the competition of those countries.

(f) The Westinghouse capacity to invest corporate assets in research and development depends upon the success in obtaining and maintaining a competitive advantage.

(iii) The information is being transmitted to the Commission in confidence and, under the provisions of 10CFR Section 2.790, it is to be received in confidence by the Commission.

(iv) The information sought to be protected is not available in public sources or available information has not been previously employed in the same original manner or method to the best of our knowledge and belief.

(v) Enclosed is Letter NSD-NRC-96-4755, June 24, 1996 being transmitted by Westinghouse Electric Corporation (W) letter and Application for Withholding Proprietary Information from Public Disclosure, Brian A. McIntyre (W), to Mr. T. R. Quay, Office of NRR. The proprietary information as submitted for use by Westinghouse Electric Corporation is in response to questions concerning the AP600 plant and the associated design certification application and is expected to be applicable in other licensee submittals in response to certain NRC requirements for justification of licensing advanced nuclear power plant designs.

This information is part of that which will enable Westinghouse to:

(a) Demonstrate the design and safety of the AP600 Passive Safety Systems.

(b) Establish applicable verification testing methods.

(c) Design Advanced Nuclear Power Plants that meet NRC requirements.

(d) Establish technical and licensing approaches for the AP600 that will ultimately result in a certified design.

(e) Assist customers in obtaining NRC approval for future plants.

Further this information has substantial commercial value as follows:

(a) Westinghouse plans to sell the use of similar information to its customers for purposes of meeting NRC requirements for advanced plant licenses.

(b) Westinghouse can sell support and defense of the technology to its customers in the licensing process.

Public disclosure of this proprietary information is likely to cause substantial harm to the competitive position of Westinghouse because it would enhance the ability of competitors to provide similar advanced nuclear power designs and licensing defense services for commercial power reactors without commensurate expenses. Also, public disclosure of the information would enable others to use the information to meet NRC requirements for licensing documentation without purchasing the right to use the information.

The development of the technology described in part by the information is the result of applying the results of many years of experience in an intensive Westinghouse effort and the expenditure of a considerable sum of money.

In order for competitors of Westinghouse to duplicate this information, similar technical programs would have to be performed and a significant manpower effort, having the requisite talent and experience, would have to be expended for developing analytical metnods and receiving NRC approval for those methods.

Further the deponent sayeth not.

ATTACHMENT 2

to

NSD-NRC-96-4755

Westinghouse Non-Proprietary Class 3

EVALUATION OF LOW FLOW CHF DATA OF MODIFIED V5H/IFM FUEL

1. BACKGROUND

The report on the AP600 low flow Critical Heat Flux (CHF) test data analysis [Reference 1], was submitted in May 1995. "Low flow" pertains to mass flux levels below 1.1 Mlbm/hr-ft^2. Based on the test data of the original Vantage 5H (V5H) fuel design with Intermediate Flow Mixer (IFM) grids, an adjustment was made to the WRB-2 Departure from Nucleate Boiling (DNB) correlation for the AP600 low flow applications as described in Reference 1.

Subsequently, Westinghouse has modified the V5H grid design to improve Departure from Nucleate Boiling (DNB) and vibration performance. The Modified V5H fuel design, CHF testing, and evaluation with the (original) WRB-2 correlation on the test data within its applicable range are presented in Reference 2. Described below are the results of an evaluation of the low flow test data with the adjusted WRB-2 correlation for AP600.

2. LOW FLOW DATA EVALUATION

As shown in Reference 1, the data range for the adjusted WRB-2 DNB correlation is as follows:

$$1503 \leq \text{Pressure} \leq 2430 \text{ psia}$$
$$0.48 \leq \text{Local Mass Flux} \leq 1.04 \times 10^6 \text{ lbm/hr-ft}^2$$
$$0.0 \leq \text{Local Quality} \leq 0.81$$

There are 32 data points within the above range from the CHF test obtained from the typical cell bundle of the Modified V5H fuel design. The CHF data containing inlet pressure, inlet mass flux, inlet temperature, and average bundle heat flux are listed in Table 1. The table also identifies rods/thermocouples that indicated a CHF event. Figure 1 shows the test configuration and radial power distribution. Figure 2 shows the locations of grids and thermocouples along the heated length. Figure 3 shows the axial power profile used for the CHF test.

The methodology used to analyze the low-flow CHF data for the Modified V5H/IFM fuel design was consistent with that described in Reference 1 . As before, the WESTAR code [Reference 3] was used to calculate the subchannel fluid conditions for each data point in Table 1.

Figures 4 and 5 show the ratio of measured to predicted CHF (M/P) using the adjusted WRB-2 as plotted against local mass flux and local pressure, respectively. The statistics of the M/P's for CHF data in Table 1 are listed below:

No. of Data:	32
M/P Mean:	[ ](a,c)
M/P Std. Dev.	[ ]
95/95 Limit DNBR	[ ]

The adjusted WRB-2 predictions are conservative as compared to the test data, particularly at flow rates above 1.0 Mlbm/hr-ft^2. The conservative predictions result in a high M/P mean and a large standard deviation. The 95/95 DNBR limit of [ ](a,c) in Reference 1, which was derived from the test data of the original V5H fuel design, is bounding for the test data of the Modified V5H/IFM fuel design.

3. SUMMARY

The low flow CHF test data of the Modified V5H fuel were evaluated using the adjusted WRB-2 correlation and the WESTAR code. The evaluation shows that the adjusted WRB-2 correlation with a 95/95 limit of [ ](a,c) remains bounding for the AP600 loss of flow and locked rotor analyses with the Modified V5H fuel.

4. REFERENCES

1. Olson, C.A., Smith, L.D., and Sung, Y., *AP600 Low Flow Critical Heat Flux (CHF) Test Data Analysis*, WCAP-14371, May 1995.

2. Letter to R.C. Jones (USNRC) from N.J. Liparulo (Westinghouse), *Transmittal of Presentation Material from NRC/Westinghouse Fuel Design Change Meeting on April 15, 1996*, NSD-NRC-96-4964, April 22, 1996.

3. Ho, S.A., Olson, C.A., and Paik, I.K., *WESTAR: An Advanced Three-Dimensional Program for the Thermal-Hydraulic Analysis of Light Water Reactor Cores*, WCAP-10951-P-A, June 1988.

Table 1
AP600 Low Flow CHF Test Results
(Modified V5H/IFM Grid)
5x5 Typical Cell

WStar Run ID	CHF Test Run #96-xxx	Inlet Pressure (psia)	Inlet Mass Flux (lbm/hr-ft^2)* E6	Inlet Temp. (F)	Average Heat Flux (Btu/hr-ft^2) * E6	Thermocouples Indicating CHF [1]
1	113					
2	119					
3	125					
4	91					
5	97					
6	100					
7	114					
8	120					
9	126					
10	92					
11	98					
12	101					
13	115					
14	121					
15	127					
16	93					
17	99					
18	110					
19	116					
20	122					
21	128					
22	94					

(b,c)

Table 1
AP600 Low Flow CHF Test Results
(Modified V5H/IFM Grid)
5x5 Typical Cell

WStar Run ID	CHF Test Run #96-xxx	Inlet Pressure (psia)	Inlet Mass Flux (lbm/hr-ft^2)* E6	Inlet Temp. (F)	Average Heat Flux (Btu/hr-ft^2) * E6	Thermocouples Indicating CHF [1]
23	111					
24	117					
25	123					
26	129					
27	95					
28	112					
29	118					
30	124					
31	89					
32	96					

(b,c)

Note:
(1) Thermocouple identification example: 24.2 = rod # 24, axial position # 2.

Figure 1

Cross-Section Configuration and Radial Power Distribution

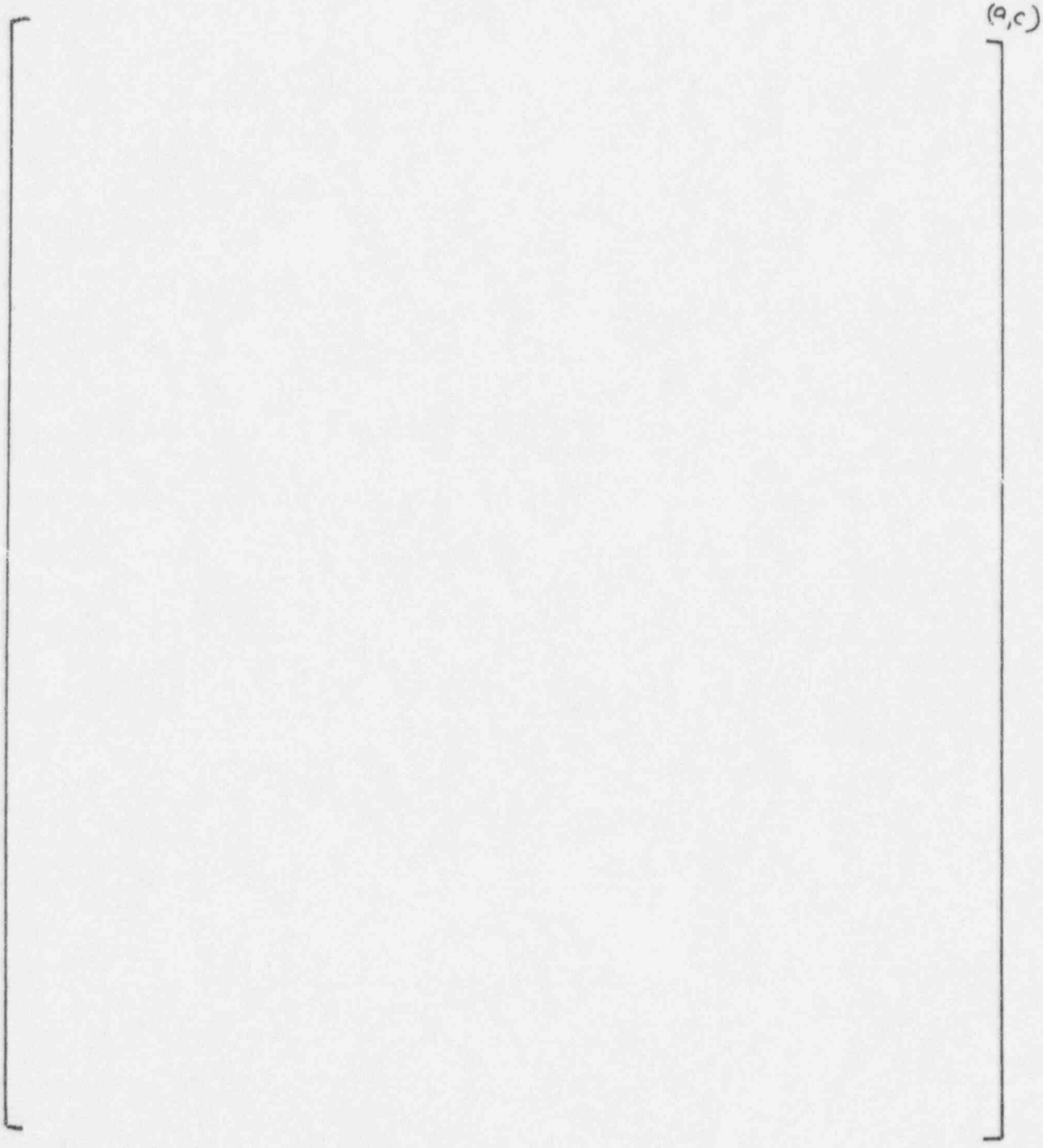
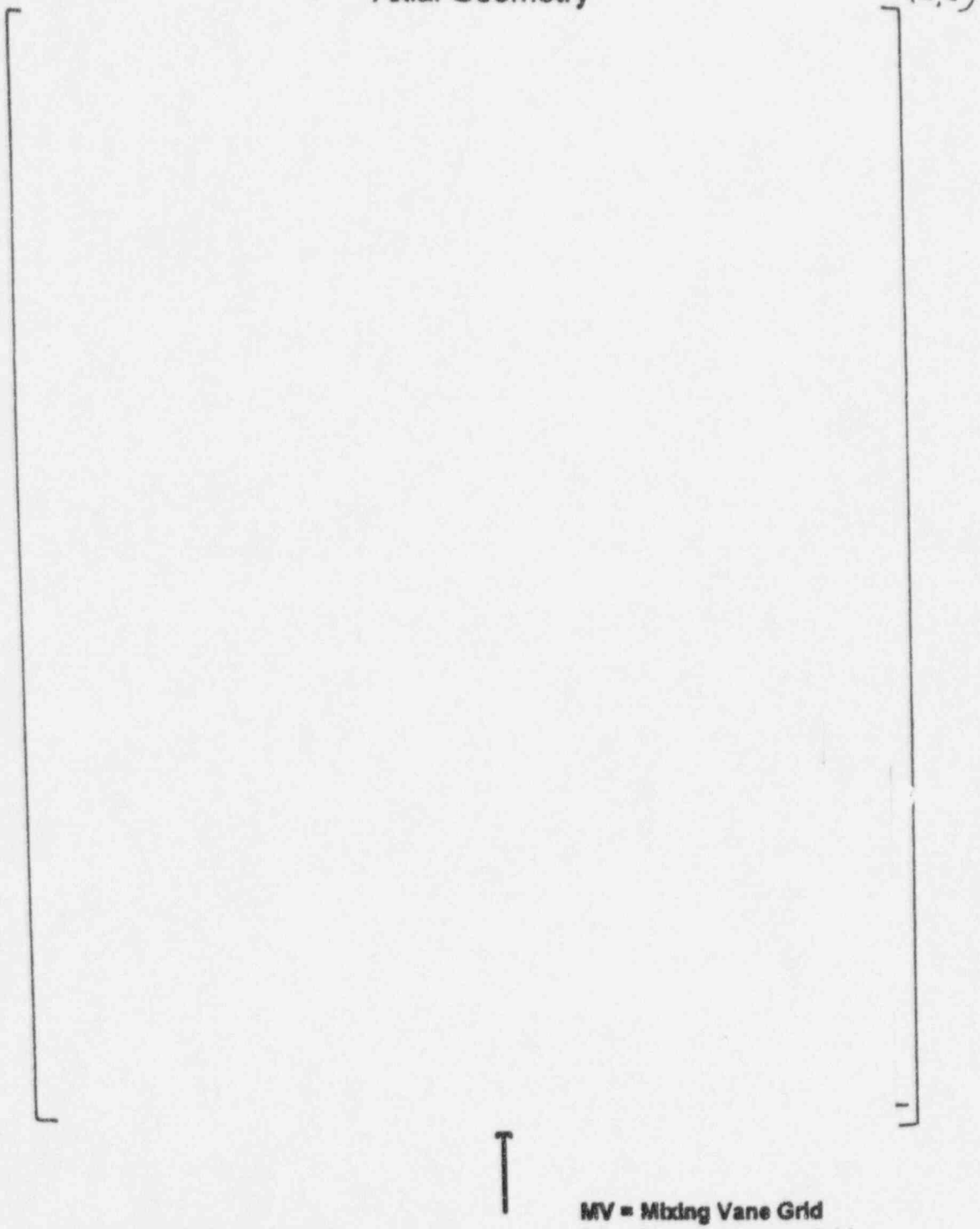


Figure 2

Axial Geometry

(a,c)

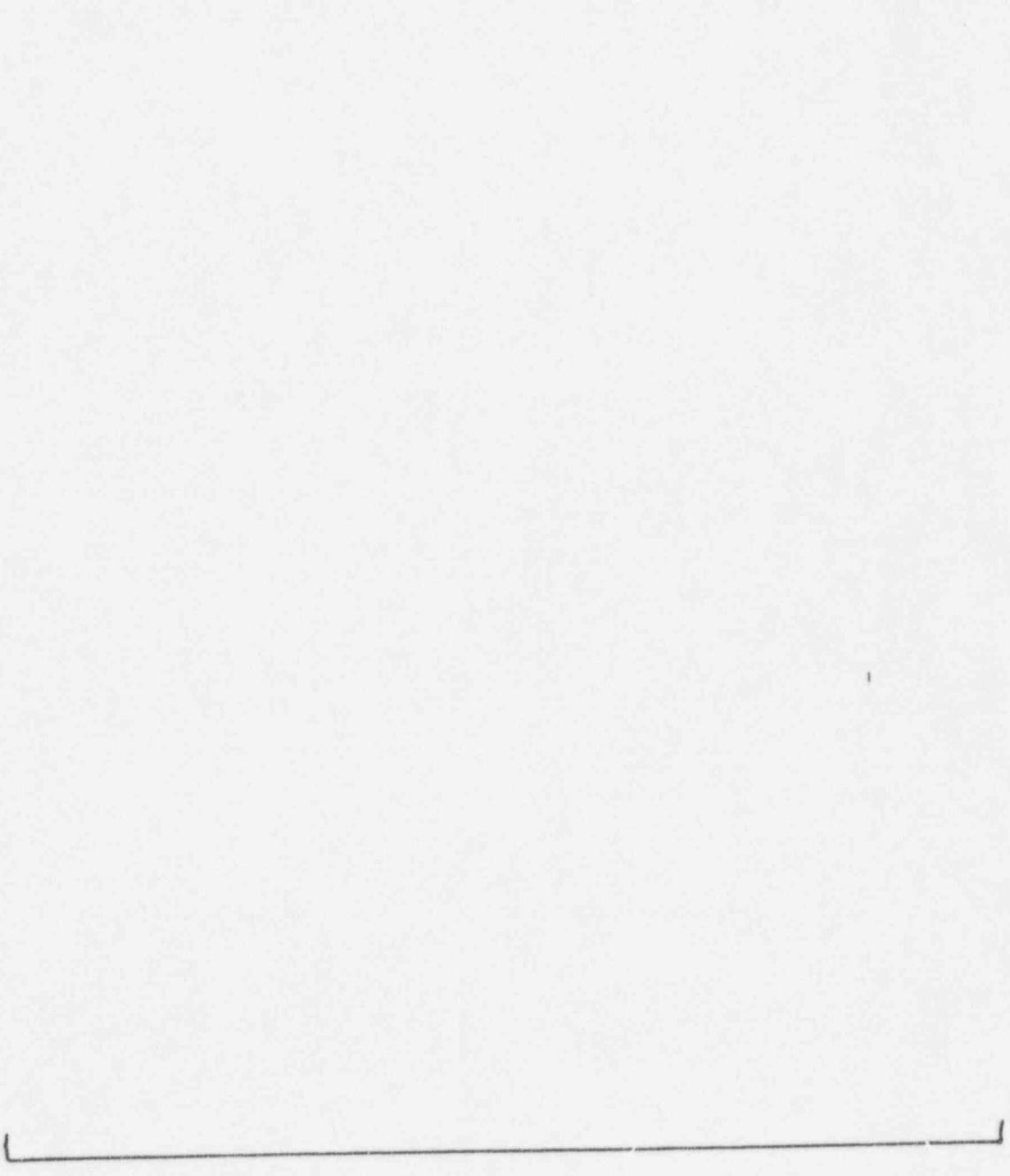


T/C = Thermocouple
BOHL = Beginning of Heated length
EOHL = End of Heated length

MV = Mixing Vane Grid
SS = Simple Support Grid
IFM = Intermediate Flow Mixer

Figure 3

(b,c)



Low Flow Data for Modified V5H/IFM

Adjusted WRB-2 Predictions

(a,b,c)

Figure 4

Low Flow Data for Modified V5H/IFM

Adjusted WRB-2 Predictions

(a,b,c)

Figure 5