MITSUBISHI HEAVY INDUSTRIES, LTD.
16-5, KONAN 2-CHOME, MINATO-KU
TOKYO, JAPAN

October 21, 2010

Document Control Desk
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

Attention: Mr. Jeffrey A. Ciocco

Docket No. 52-021
MHI Ref: UAP-HF-10279

Subject: **PRELIMINARY REPORT ON US-APWR DNB TEST RESULT (TYPICAL CELL TEST)**

Reference: 1) Topical Report "THERMAL DESIGN METHODOLOGY", MUAP-07009-P Revision 0, May 2007

With this letter, Mitsubishi Heavy Industries, Ltd. ("MHI") transmits to the U.S. Nuclear Regulatory Commission ("NRC") a document entitled "PRELIMINARY REPORT ON US-APWR DNB TEST RESULT (TYPICAL CELL TEST)".

Enclosed are preliminary DNB test results for US-APWR fuel related with Reference 1.

As indicated in the enclosed materials, this document contains information that MHI considers proprietary, and therefore should be withheld from public disclosure pursuant to 10 C.F.R. § 2.390 (a)(4) as trade secrets and commercial or financial information which is privileged or confidential. A non-proprietary version of the document is also being submitted with the information identified as proprietary redacted and replaced by the designation "[ ]".

This letter includes a copy of the proprietary version (Enclosure 2), a copy of the non-proprietary version (Enclosure 3), and the Affidavit of Yoshiki Ogata (Enclosure 1) which identifies the reasons MHI respectfully requests that all materials designated as "Proprietary" in Enclosure 2 be withheld from public disclosure pursuant to 10 C.F.R. § 2.390 (a)(4).

Please contact Dr. C. Keith Paulson, Senior Technical Manager, Mitsubishi Nuclear Energy Systems, Inc. if the NRC has questions concerning any aspects of the submittal. His contact information is below.

Sincerely,

Y. Ogata

Yoshiki Ogata,
General Manager- APWR Promoting Department
Mitsubishi Heavy Industries, LTD.

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NRO

Enclosures:

1. Affidavit of Yoshiki Ogata

2. PRELIMINARY REPORT ON US-APWR DNB TEST RESULT (TYPICAL CELL TEST) (proprietary version)

3. PRELIMINARY REPORT ON US-APWR DNB TEST RESULT (TYPICAL CELL TEST) (non-proprietary version)

CC: J. A. Ciocco
C. K. Paulson

Contact Information
C. Keith Paulson, Senior Technical Manager
Mitsubishi Nuclear Energy Systems, Inc.
300 Oxford Drive, Suite 301
Monroeville, PA 15146
E-mail: ck_paulson@mnes-us.com
Telephone: (412) 373 – 6466

ENCLOSURE 1

Docket No.52-021
MHI Ref: UAP-HF-10279

MITSUBISHI HEAVY INDUSTRIES, LTD.

AFFIDAVIT

I, Yoshiki Ogata, state as follows:

1. I am General Manager, APWR Promoting Department, of Mitsubishi Heavy Industries, LTD ("MHI"), and have been delegated the function of reviewing MHI's US-APWR documentation to determine whether it contains information that should be withheld from public disclosure pursuant to 10 C.F.R. § 2.390 (a)(4) as trade secrets and commercial or financial information which is privileged or confidential.

2. In accordance with my responsibilities, I have reviewed the enclosed document entitled "PRELIMINARY REPORT ON US-APWR DNB TEST RESULT (TYPICAL CELL TEST)" dated October, 2010, and have determined that portions of the document contain proprietary information that should be withheld from public disclosure. Those pages containing proprietary information are identified with the label "Proprietary" on the top of the page and the proprietary information has been bracketed with an open and closed bracket as shown here "[ ]". The first page of the document indicates that all information identified as "Proprietary" should be withheld from public disclosure pursuant to 10 C.F.R. § 2.390 (a)(4).

3. The information identified as proprietary in the enclosed document has in the past been, and will continue to be, held in confidence by MHI and its disclosure outside the company is limited to regulatory bodies, customers and potential customers, and their agents, suppliers, and licensees, and others with a legitimate need for the information, and is always subject to suitable measures to protect it from unauthorized use or disclosure.

4. The basis for holding the referenced information confidential is that it describes the proprietary technique of the DNB test and the unique thermal design, developed by MHI and not used in the exact form by any MHI's competitors. This information was developed at significant cost to MHI, since it required the performance of Research and Development and detailed design for its software and hardware extending over several years.

5. The referenced information is being furnished to the Nuclear Regulatory Commission ("NRC") in confidence and solely for the purpose of information to the NRC staff.

6. The referenced information is not available in public sources and could not be gathered readily from other publicly available information. Other than through the provisions in paragraph 3 above, MHI knows of no way the information could be lawfully acquired by organizations or individuals outside of MHI.

7. Public disclosure of the referenced information would assist competitors of MHI in their design of new nuclear power plants without incurring the costs or risks associated with the design of the subject systems. Therefore, disclosure of the information contained in the

referenced document would have the following negative impacts on the competitive position of MHI in the U.S. nuclear plant market:

A. Loss of competitive advantage due to the costs associated with development of the DNB test technique and thermal design. Providing public access to such information permits competitors to duplicate or mimic the methodology without incurring the associated costs.

B. Loss of competitive advantage of the US-APWR created by benefits of enhanced plant safety, and reduced operation and maintenance costs associated with the thermal design.

I declare under penalty of perjury that the foregoing affidavit and the matters stated therein are true and correct to the best of my knowledge, information and belief.

Executed on this 21st day of October 2010

Y. Ogata

Yoshiki Ogata,
General Manager- APWR Promoting Department
Mitsubishi Heavy Industries, LTD.

Docket No. 52-021
MHI Ref: UAP-HF-10279

Enclosure 3

UAP-HF-10279
Docket No. 52-021

PRELIMINARY REPORT ON US-APWR DNB TEST RESULT (TYPICAL CELL TEST)

October, 2010
(Non-Proprietary)

PRELIMINARY REPORT
ON US-APWR DNB TEST RESULT
(TYPICAL CELL TEST)

NON-PROPRIETARY VERSION

October, 2010

MITSUBISHI HEAVY INDUSTRIES, LTD

Table of Contents

1. INTRODUCTION

Mitsubishi Heavy Industries Ltd. (MHI) issued a topical report "MUAP-07009-P, THERMAL DESIGN METHODOLOGY" which describes VIPRE-01M code and DNB correlations for the US-APWR design application (Reference 1). In the review of the topical report, the applicability of the DNB correlations to the US-APWR fuel has been discussed between the United States Nuclear Regulatory Commission (NRC) and MHI (References 2 and 3). As a result, MHI has determined to supplement the topical report with additional DNB tests for the US-APWR fuel that utilizes 14ft heated length and Z3 grid spacers (References 4 and 5).

The objective of the DNB test program for the US-APWR fuel is to provide a confirmation of the applicability of WRB-1 and WRB-2 DNB correlations to the US-APWR fuel by obtaining test data with 14ft test bundle, which is representative of the US-APWR fuel. The DNB heat flux data are collected for flow conditions which bound limiting conditions for DNB analyses relevant to all the normal operation and anticipated operational occurrences of the US-APWR core.

MHI conducted previous DNB tests at the Heat Transfer Research Facility of Columbia University (HTRF) as other nuclear fuel vendors did. However, because of the closure of the HTRF, the DNB test program for the US-APWR fuel has been conducted at Karlstein Thermal-Hydraulic Facility in AREVA GmbH (KATHY) (References 6 and 7).
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The DNB test program consists of a series of DNB tests with two different bundle geometries: typical cell test and thimble cell test. This report briefly presents the result of the typical cell test in order to assist the NRC to understand the present status. All of the data has not been formally distributed from AREVA GmbH, and therefore the results included in this report are treated as preliminary results. The final test report for the NRC review will include the result of thimble cell test in addition to typical cell test and thorough description of the entire test program. The final test report will be submitted after the thimble cell test is completed. The outline of final test report is described in Section 7.

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2. QUALITY ASSURANCE PROGRAM

The DNB test program was conducted by MHI under the quality assurance program applicable to the US-APWR (Reference 9) in compliance with 10 CFR 50 Appendix B, ANSI/ASME NQA-1 1994 and 10 CFR 21. MHI purchased heater rod manufacturing, test bundle assembling, DNB measurements and test bundle inspections from AREVA GmbH. The activities in AREVA GmbH were performed under the quality assurance program of AREVA GmbH reviewed and accepted by MHI in compliance with 10 CFR 50 Appendix B, ANSI/ASME NQA-1 1994 and 10 CFR 21.

3. TEST SECTION

The typical cell test was conducted using a 5x5 array of the electrically heated rods as shown in Figure 1. [

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The axial geometry of the test bundles is shown in Figure 3. [

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The specifications of the test bundle geometries are compared to the actual US-APWR fuel in Table 1. The geometry of the present test is representative of the US-APWR fuel design utilizing the same grid spacer type and heated length. [

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4. TEST PROCEDURE

4.1 Pre-Experimental Checks

In order to confirm the integrity of the test section and measurement instrumentation, following items were checked prior to the DNB measurements. Electrical resistance distribution of the heater rods was measured before the bundle assembling. The dimensions of test bundle, such as rod-to-rod gaps and the axial position of grid spacers, were checked during the bundle assembling. Loop functionality including measurement devices for bundle power, pressure, flow rate and temperature was checked during commissioning. The axial pressure drop was measured across the test bundle and between adjacent pressure taps. The heat balance was checked by comparing the enthalpy rise across the test section with the heat input.

4.2 DNB Measurements

DNB heat flux was measured at steady-state flow conditions. After the flow conditions, such as pressure, mass velocity, and inlet temperature, reached specified conditions, the power of test bundle was gradually increased until the thermocouples inside the heater rods detect DNB as a result of the rapid increasing in the heater rod temperature. After DNB detection, the power was decreased automatically to protect the test bundle. DNB heat flux was determined from the bundle power when DNB occurs. Measured data were acquired from the beginning of the power increase until the end of power decrease [ ]. During the DNB test, repeatability tests were performed [ ].

4.3 Post-Experimental Checks

After the completion of the DNB measurements, heat balance check, pressure drop measurement and test bundle inspections were performed and compared with the pre-experimental checks to confirm the integrity of test bundle.

5. TEST PARAMETERS

Table 2 shows test parameter matrix based on pressure, mass velocity, and inlet temperature. [ ].

6. TEST RESULTS AND EVALUATIONS

6.1 Repeatability Tests

During the typical cell test, repeatability tests were performed [

]. The M/P was calculated based on the VIPRE-01M subchannel code and the WRB-2 correlation. As show in the figure, [

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6.2 Typical Cell Test Results

The data analysis was performed based on WRB-1/VIPRE-01M and WRB-2/VIPRE-01M, respectively. The analysis procedure is consistent with that in appendix B of MUAP-07009-P (Reference 1) in terms of geometry modeling and model options for void fraction, heat transfer and pressure drop calculation.

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7. ITEMS IN FINAL TEST REPORT

Table 5 shows the list of contents which will be described in the final test report. The information presented in the NRC's observation on August 2010 (Reference 8) will be incorporated in the report, and the following items will be added.

- ✓ [ ]
- ✓ [ ]
- ✓ [ ]
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8. REFERENCES

1. Topical Report "THERMAL DESIGN METHODOLOGY", MUAP-07009-P Revision 0, May 2007
2. Letter from MHI to NRC, "Response to NRC's Request for Additional Information on US-APWR Topical Report MUAP-07009-P, Thermal Design Methodology", UAP-HF-08067, dated on April 4, 2008
3. Letter from MHI to NRC, "MHI's Response to the NRC's Request for Additional Information on Topical Report MUAP-07009-P, Revision 0, THERMAL DESIGN METHODOLOGY", UAP-HF-09093, dated on March 13, 2009
4. Letter from MHI to NRC, "Supplemental Information on UAP-HF-09093, MHI's Response to the NRC's Request for Additional Information related with Topical Report MUAP-07009-P Revision 0, THERMAL DESIGN METHODOLOGY", UAP-HF-09182, dated on April 28, 2009
5. Letter from MHI to NRC, "US-APWR DNB TEST PLAN", UAP-HF-10060, dated on March 1, 2010
6. D. Kreuter, et al., "KATHY: FRAMATOME ANP's Thermal Hydraulic Test Loop", Proc. the 6th Int. Conf. on Nuclear Thermal Hydraulics, Operations and Safety (NUTHOS-6), N6P203, 2004
7. C. Herer, et al., "COMPARISON OF PWR FUEL ASSEMBLY CHF TESTS OBTAINED

AT THREE DIFFERENT TEST FACILITIES", Proc. the 11th Int. Topical Meeting on Nuclear Reactor Thermal-Hydraulics (NURETH-11), 117, 2005

8. Presentation materials in the NRC observation for KATHY loop on August 2010, "DNB TESTS FOR US-APWR FUEL" and "BENCHMARKING TESTS", 5BS-UAP-20100156-R0, 2010

9. "Quality Assurance Program (QAP) Description for Design Certification of the US-APWR", PQD-HD-19005-R3, 2009

Table 1 Comparison of the Test Bundle Specifications

Table 2 Test Parameter Matrix for Typical Cell Test

Table 3 Comparison of Parameter Ranges

Table 4 Comparison of the M/P Statistics between Typical Cell Tests of 12 ft and 14ft Heated Length

Table 5 Planned Contents in Final Test Report

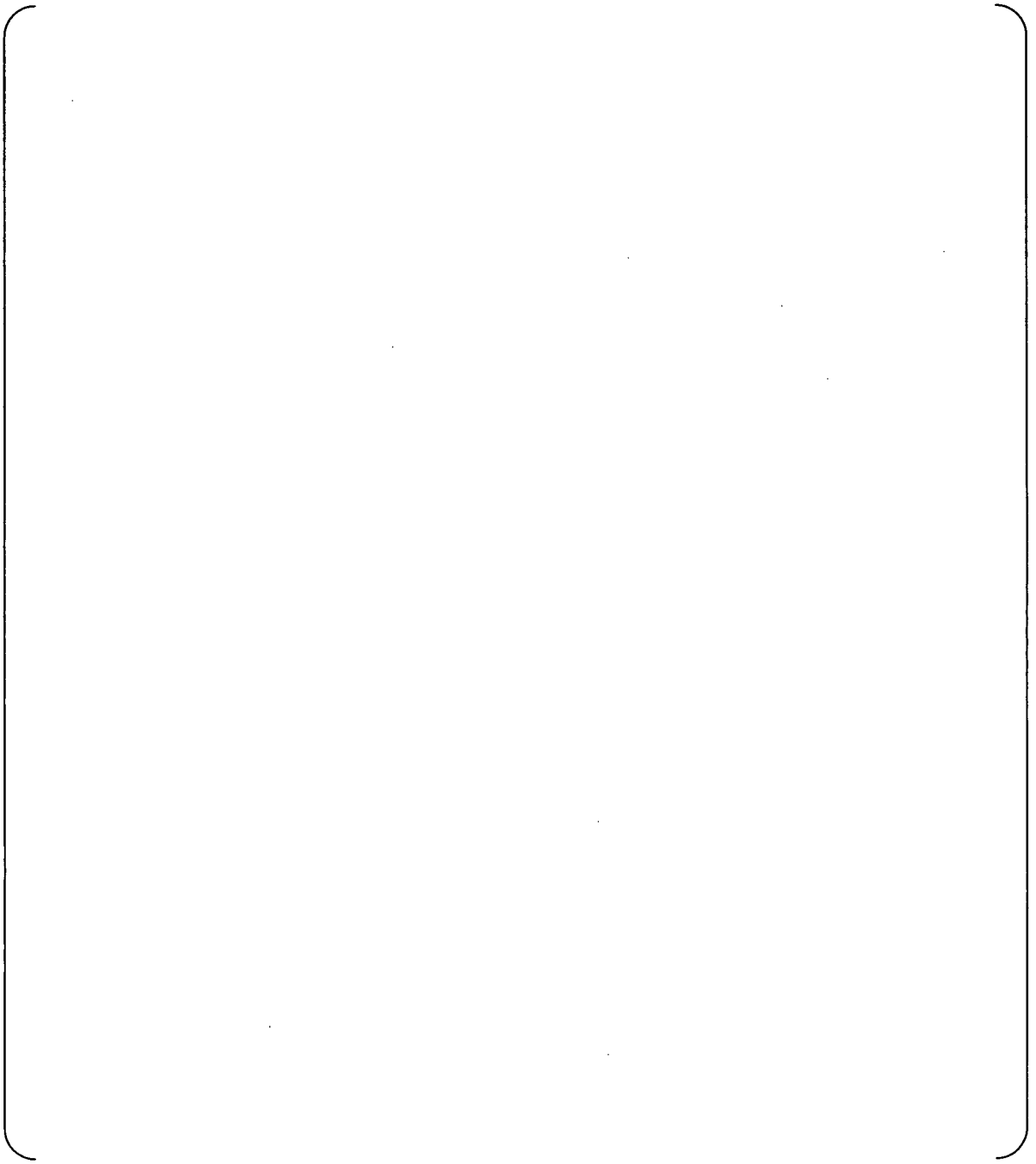

Figure 1 Radial Geometry for Typical Cell Test

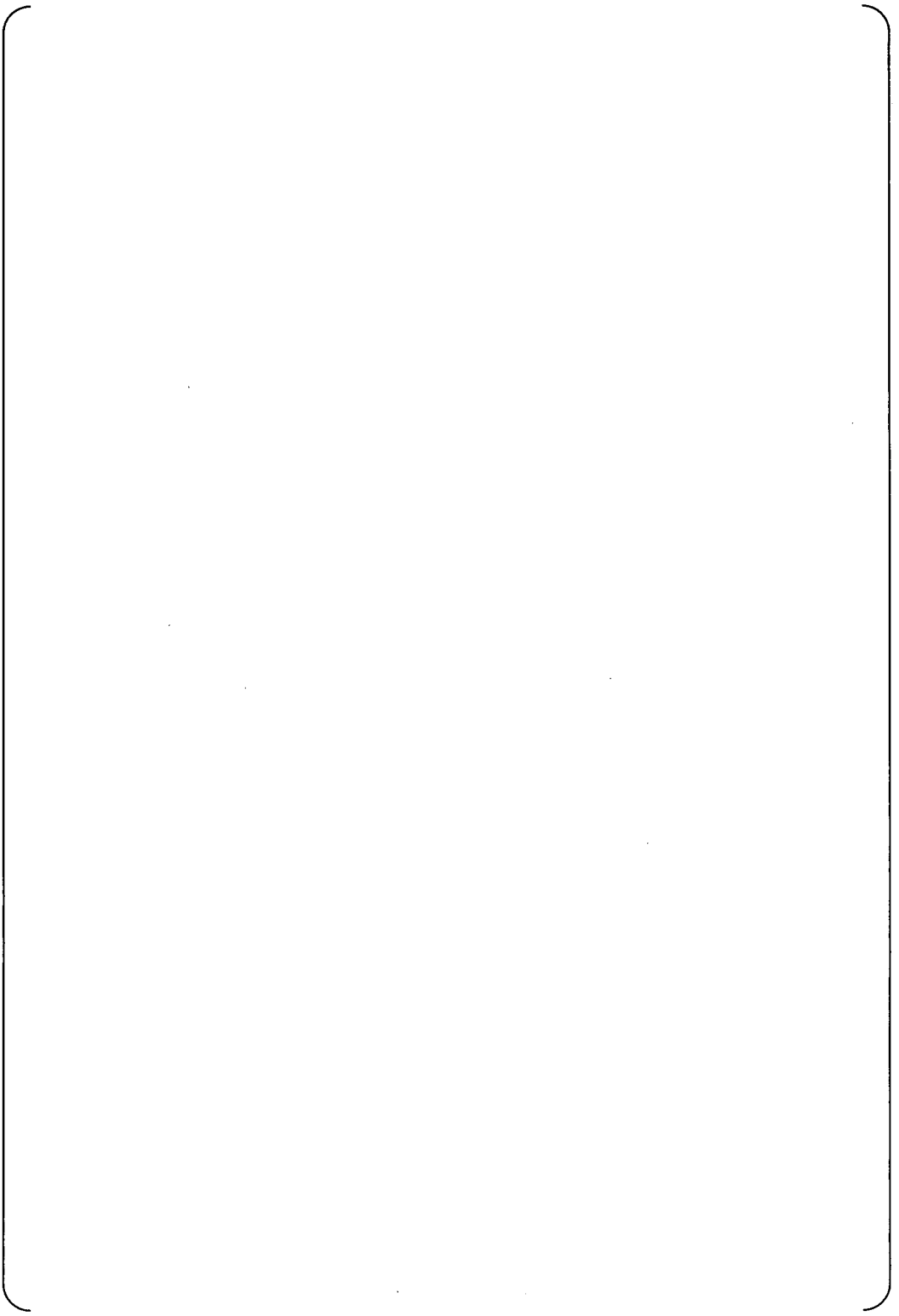

Figure 2 Axial Power Profile for US-APWR Fuel DNB Tests

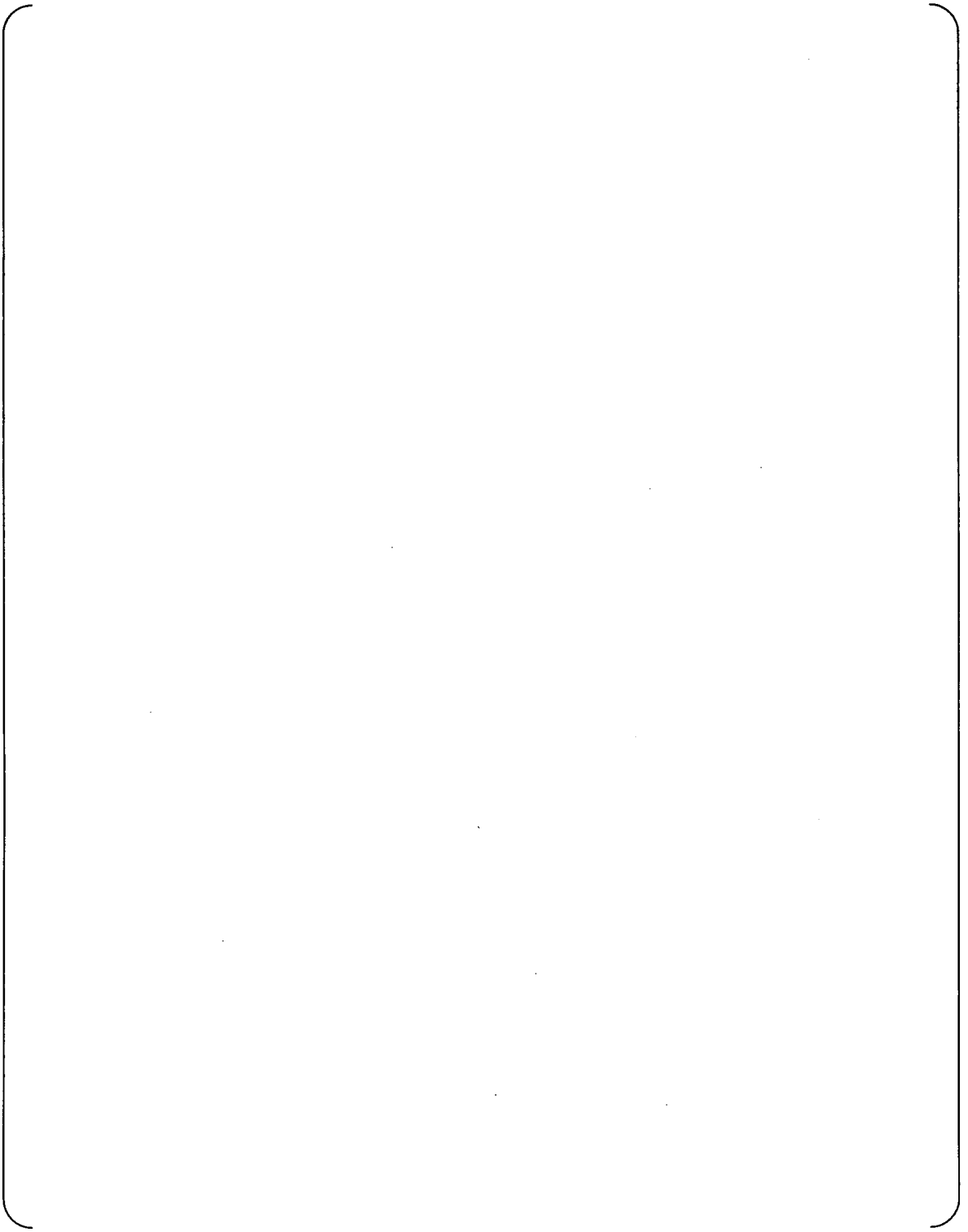

Figure 3 Axial Geometry for US-APWR Fuel DNB Tests

Figure 4 Repeatability Test Result for Typical Cell Test

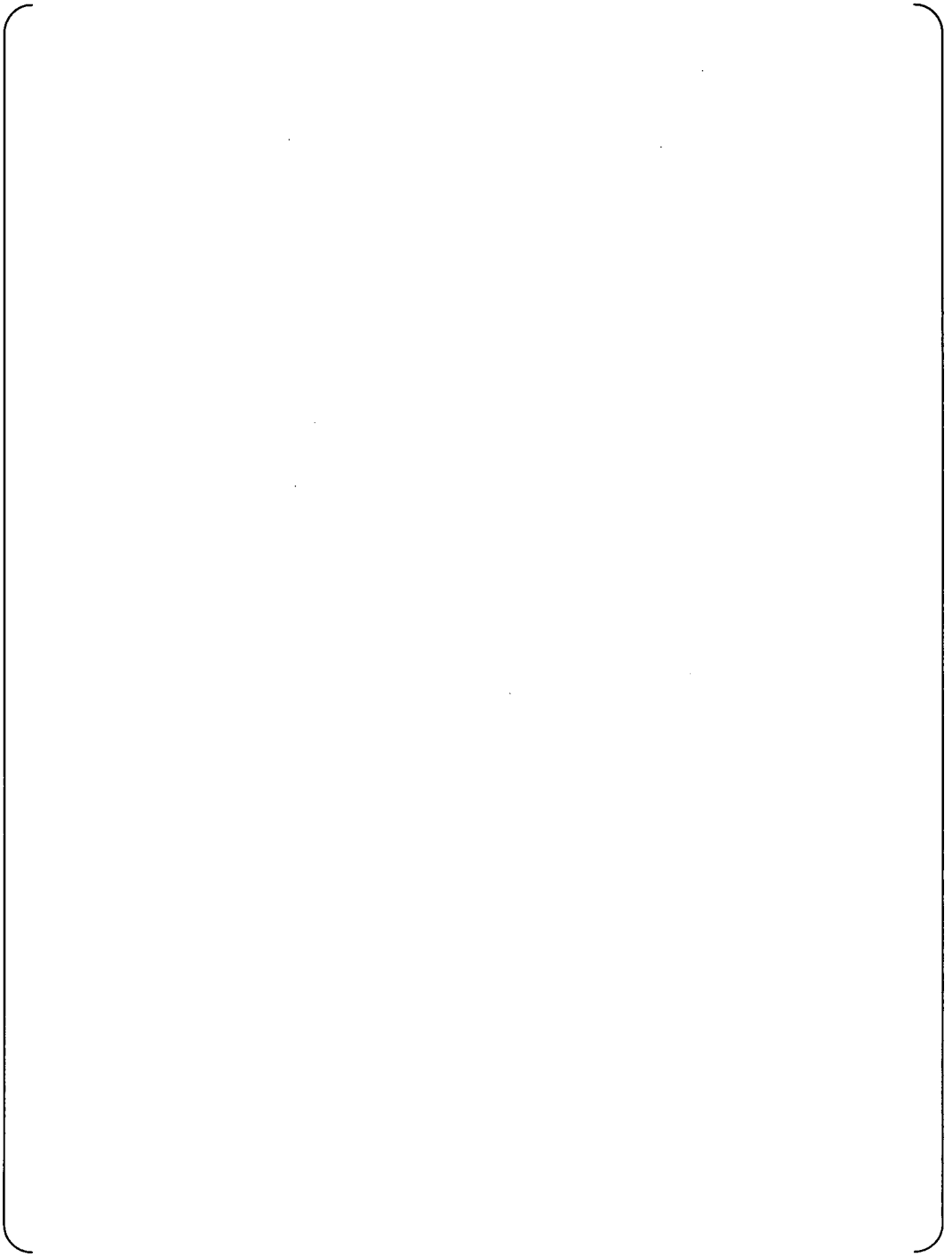

Figure 5 Excluded Data in Typical Cell Test

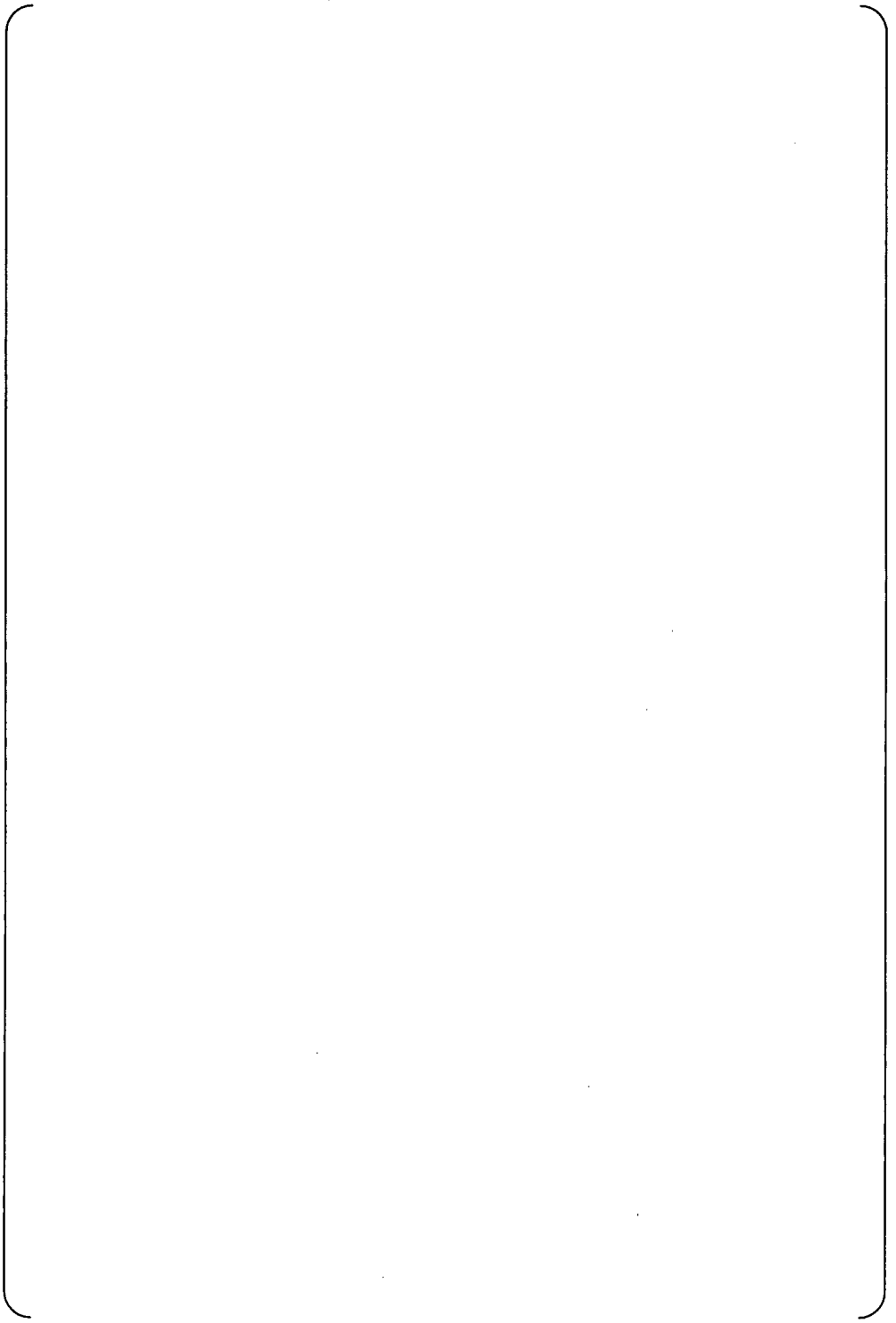

Figure 6 Measured vs. Predicted DNB Heat Flux for Typical Cell Test

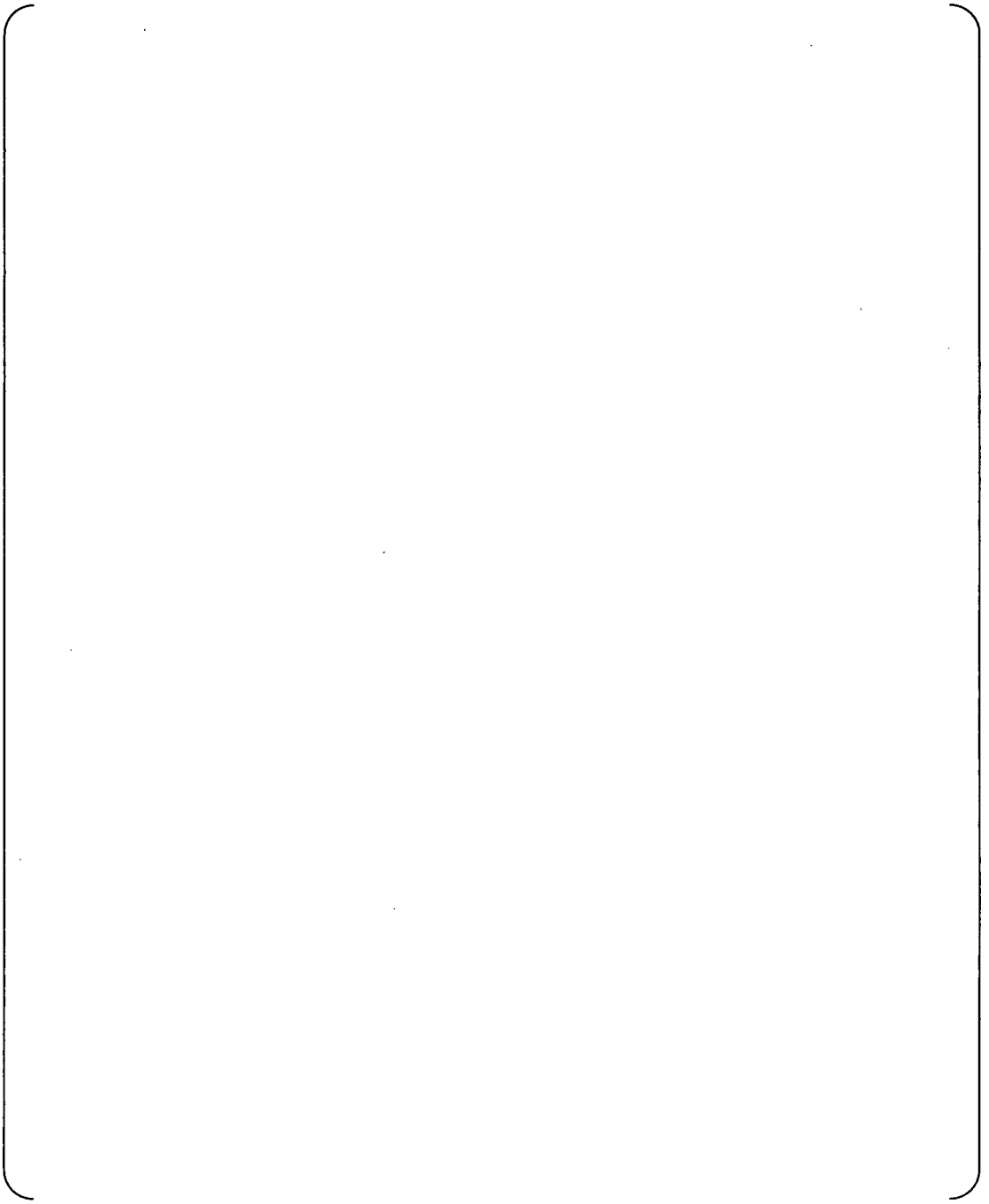

Figure 7 M/P vs. Local Mass Flux for Typical Cell Test

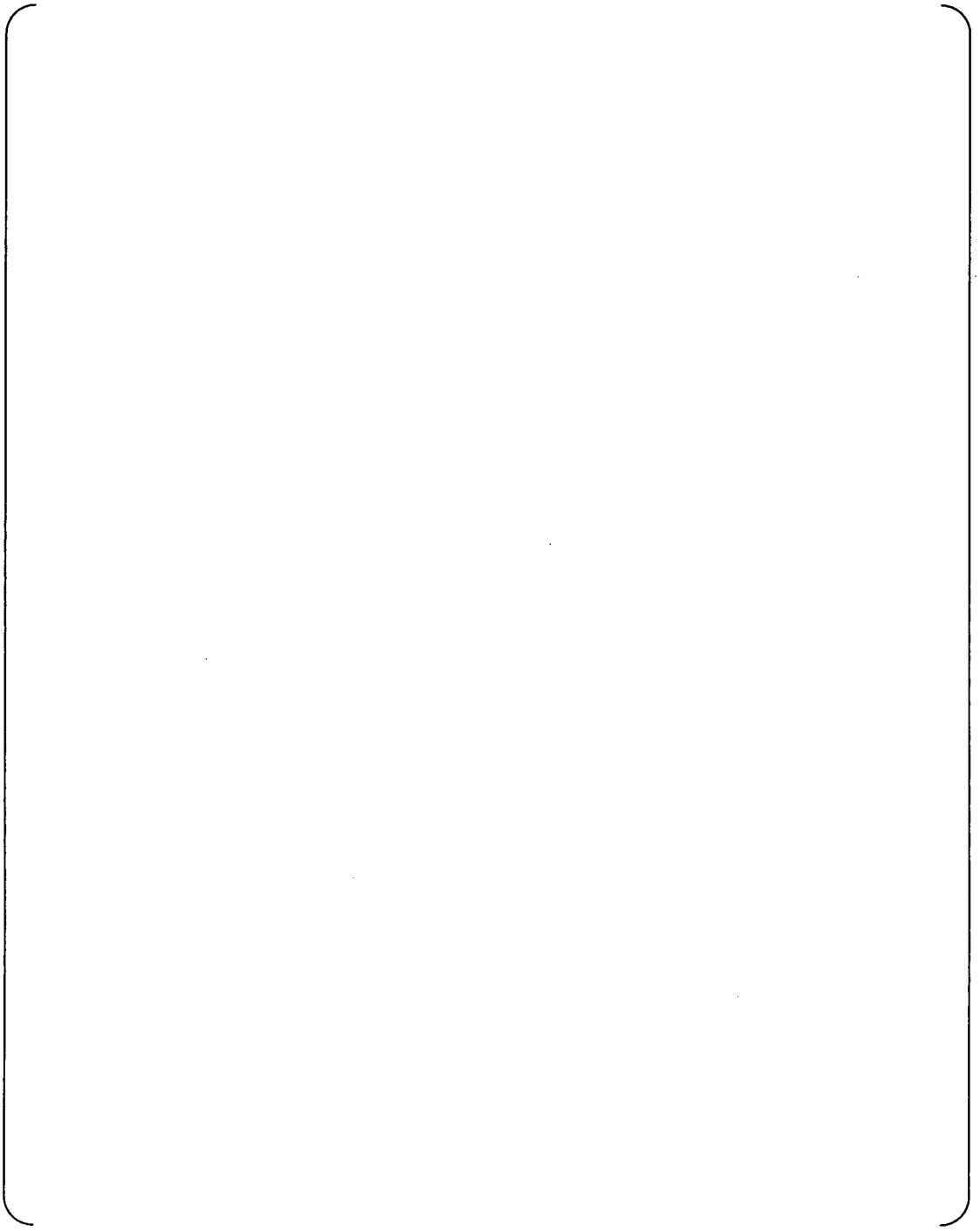

Figure 8 M/P vs. Pressure for Typical Cell Test

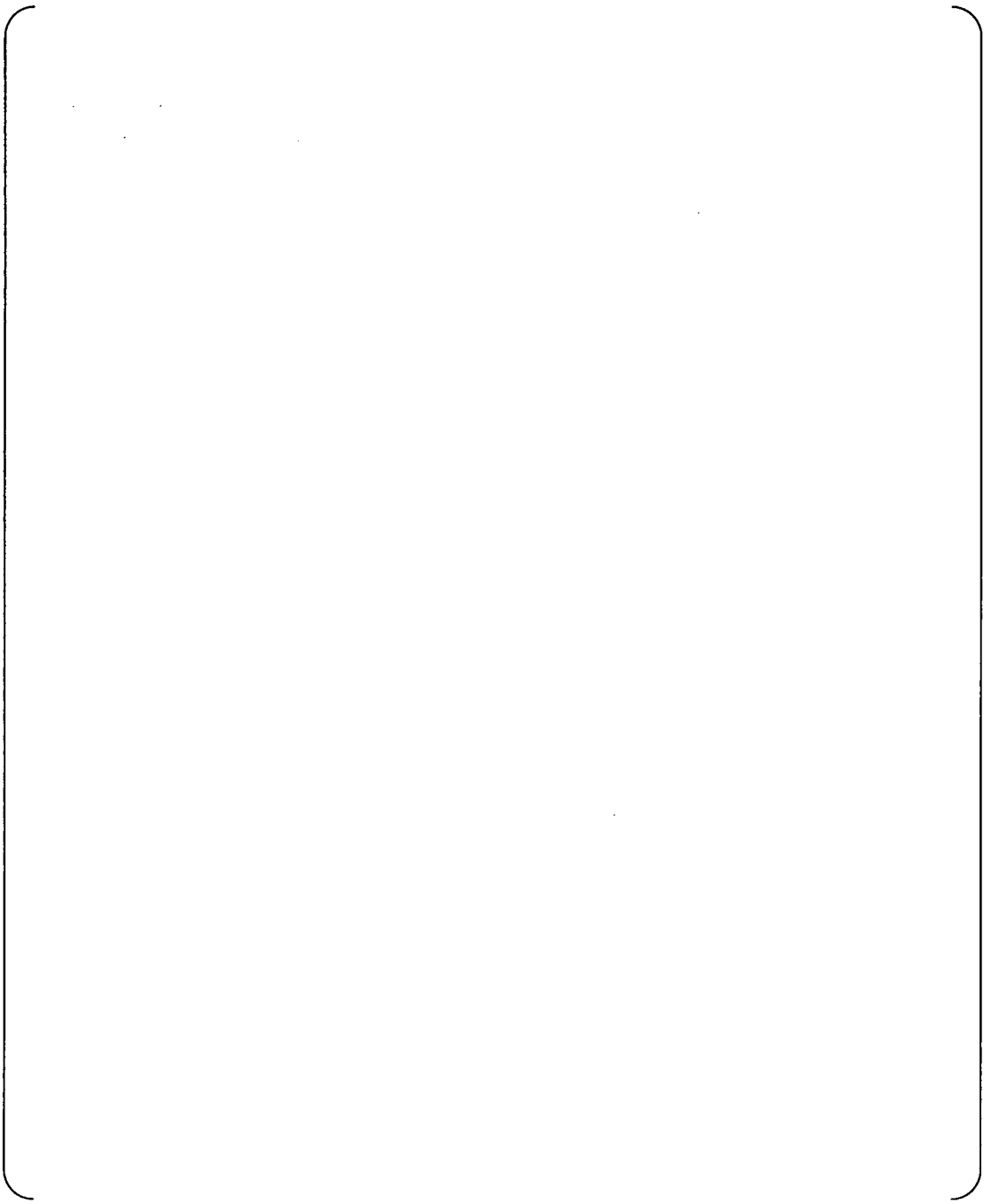

Figure 9 M/P vs. Local Equilibrium Quality for Typical Cell Test