40-8502
50-327

January 22, 1997

MEMORANDUM TO: David B. Matthews, Chief
Generic Issues and Environmental
Projects Branch
Division of Reactor Program Management
Office of Nuclear Reactor Regulation

FROM: Joseph L. Birmingham, Project Manager Original Signed By:
Generic Issues and Environmental
Projects Branch
Division of Reactor Program Management
Office of Nuclear Reactor Regulation

SUBJECT: SUMMARY OF DECEMBER 18, 1996, MEETING WITH FRAMATOME COGEMA FUELS ON TRANSITION TO MARK-BW FUEL AT SEQUOYAH

On January 16, 1997, representatives of Framatome Cogema Fuels (Framatome) met with U.S. Nuclear Regulatory Commission staff to discuss information on the transition from Vantage 5H fuel to Mark-BW fuel at the Sequoyah Nuclear Plant. Framatome presented information on the computer code used for modeling the performance of the Mark-BW fuel at Sequoyah and on the performance history of the fuel at three other domestic reactors. Framatome provided information on the mixed core thermal-hydraulic analyses in support of the transition of Sequoyah, identified the thermal margins preserved by the core safety limits, and established the magnitude and the basis for the transition core penalty. The NRC staff asked questions on the applicability of the code to Sequoyah and the manner in which the transition to Mark-BW fuel would be made at Sequoyah.

Meeting attendees are listed in Attachment 1 and the nonproprietary slides presented at the meeting are in Attachment 2.

Attachments: As stated

cc w/atts:

Mr. J. H. Taylor, Manager
Licensing Services
Framatome Technologies, Inc.
P.O. Box 10935
Lynchburg, VA 24506-0935

Mr. R. B. Borsum, Manager
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UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

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1700 Rockville Pike, Suite 525
Rockville, MD 20852-1631

FRAMATOME COGEMA FUELS MEETING ATTENDEES
JANUARY 16, 1997

NAME	ORGANIZATION
GEORGE MEYER	FRAMATOME COGEMA FUELS
JEFFREY GRIFFITH	FRAMATOME COGEMA FUELS
JOHN JONES	FRAMATOME COGEMA FUELS
RICHARD HARNE	FRAMATOME COGEMA FUELS
FRANK MCPHATTER	FRAMATOME COGEMA FUELS
FRANK BURROW	TVA\NUCLEAR FUELS
FRANK ORR	NRC\NRR\SRXB
TONY ATTARD	NRC\NRR\SRXB
TAI HUANG	NRC\NRR\SRXB
LARRY PHILLIPS	NRC\NRR\SRXB
RON HERNAN	NRC\NRR\DRPE\PDII-3
J. BIRMINGHAM	NRC\NRR\PGEB

ATTACHMENT 1

Framatome Cogema Fuels
Presentation to the NRC on
Thermal-Hydraulic Analysis Methods For
Evaluating The Transition From Vantage 5H Fuel to Mark-BW Fuel
At
TVA's Sequoyah Plant

January 16, 1997

Transition to Mark-BW Fuel at Sequoyah

AGENDA

- Introduction — Frank McPhatter
  - Review of Licensing History
- Mark-BW Experience Base — George Meyer
  - BWCMV Applicability
- LYNXT Code Application to Mixed Cores — John Jones
  - Applicabie code benchmarking
- Sequoyah Mixed Core Analyses — Jeff Griffith
  - Thermal margins
  - Transition core penalty basis

Meeting Objectives

- Discuss mixed core thermal-hydraulic analyses supporting the transition of Sequoyah to Mark-BW17 fuel
- Identify thermal margins preserved in core safety limits for transition cores
- Provide the magnitude and basis for the transition core penalty

Mark-BW Transition Experience

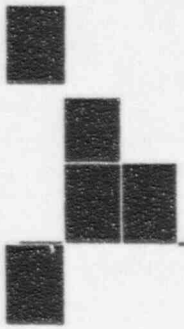
- McGuire LTAs
- Trojan LTAs
- One batch at Trojan - transition from W STD
- Full core transitions at Catawba (2 units), McGuire (2 units) - transition from W OFA
- First batch at Sequoyah (1997) - transition from W V5H

Mark-BW Operating Experience

- Designed for compatibility with Westinghouse 17x17 fuel
- 1244 fuel assemblies have been delivered and loaded in core
- 772 fuel assemblies are currently operating
- All fuel is operating failure-free

BWCMV CHF Correlation

- Developed from W, NFI data
  - BWC form with added mixing factor
  - 1418 data points (950 W)
- Licensed for W 15x15 and 17x17 STD and OFA, plus VANTAGE 5H and Mk-BW17 (BAW-10159)
- Extended to BW17 thru extensive testing, producing 20% improvement in DNBR (BAW-10189)



LYNXT

What is it?

Where did it come from?

What is it used for?

How do we justify its application?

LYNXT History

- Based on COBRAIV-I (developed by ERDA and NRC)
- Modified by Framatome Cogema Fuels (FCF)
- Benchmarked to experiments, FCF codes (LYNX1, LYNX2) and industry codes (COBRA3C)
- Submitted/approved topicals
  BAW 10156A, March 1986
  BAW 10156A, Rev. 1, August 1993
- Used to successfully license ~30 15-by-15 (FCF) and 17-by-17 (Westinghouse) reload cores, since 1984

Benchmarks

- Comparison to LYNX1 (BAW 10129A, July 1985) and LYNX2 (BAW 10130A, July 1985)
- Comparison to COBRA3C
- Comparison to isothermal and heated tests
- Comparison to VIPRE (EPRI) and FLICA III-F (Framatome) codes

Isothermal Tests

- Interbundle Diversion Crossflow (IBDCF) tests (results in BAW 10156A and BAW 10156A, Rev. 1)
- Marignan tests from CEA's Hermes facility

Figure 6-1. Two-Bundle Isothermal Crossflow Test Apparatus

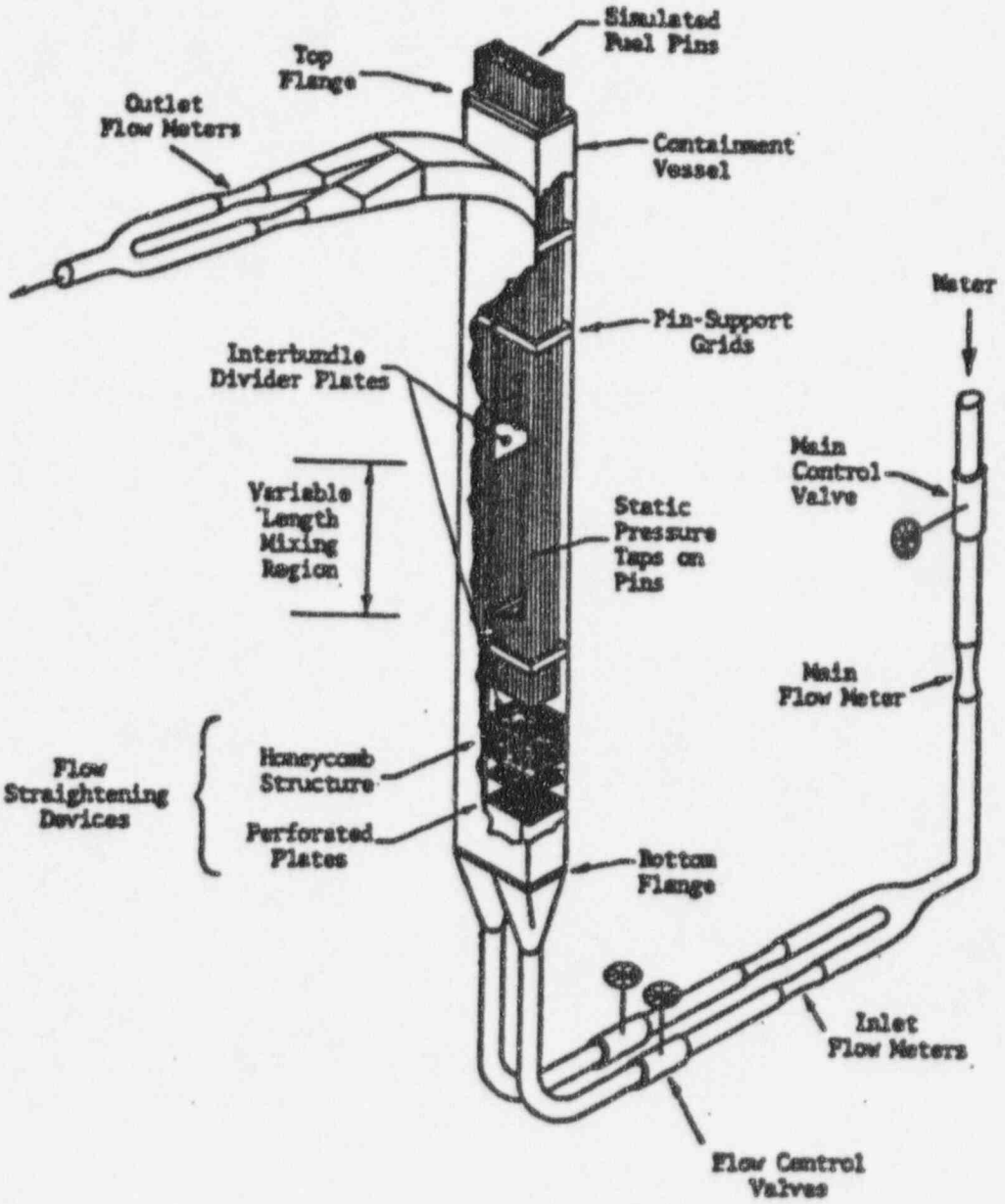
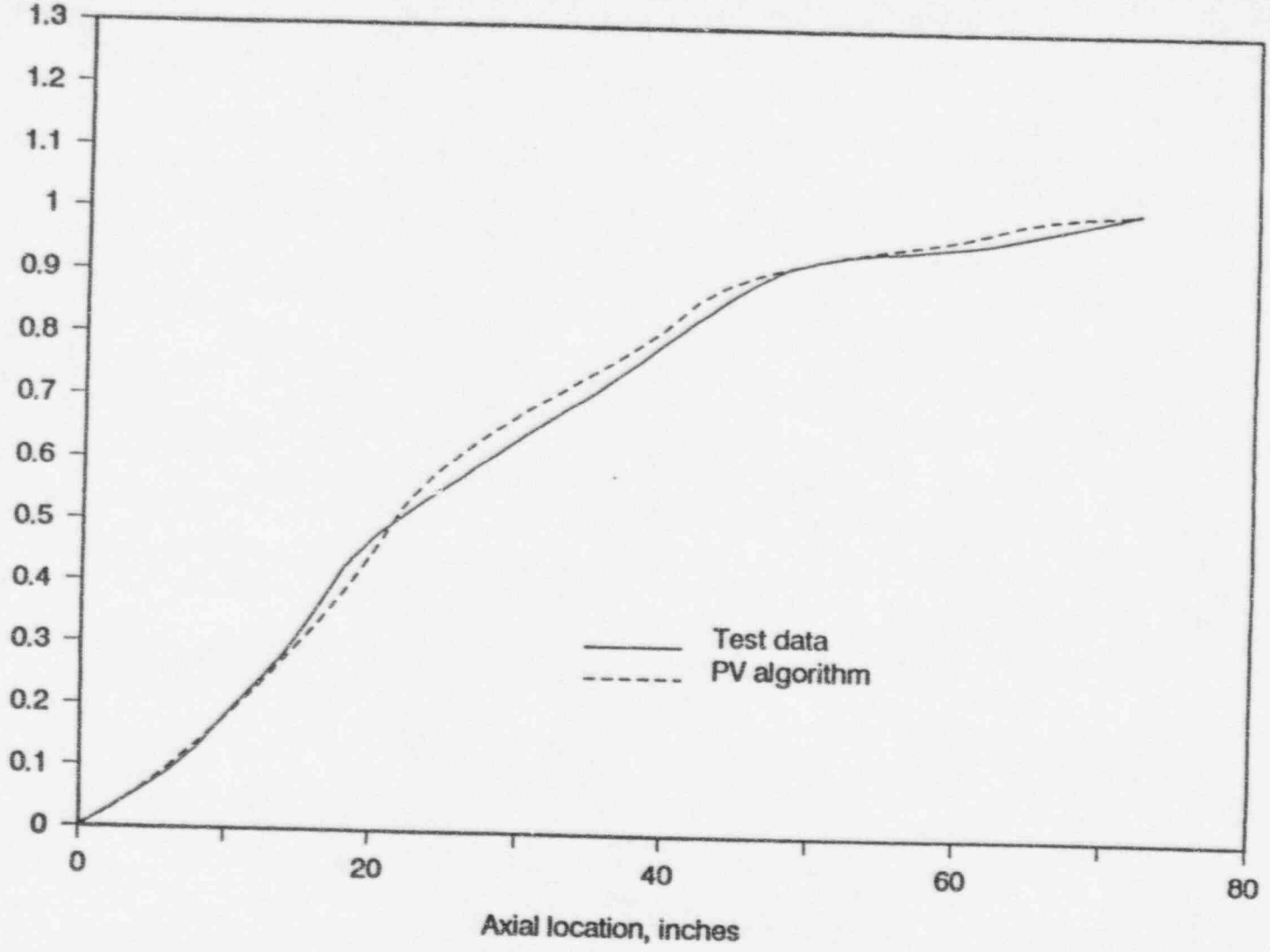


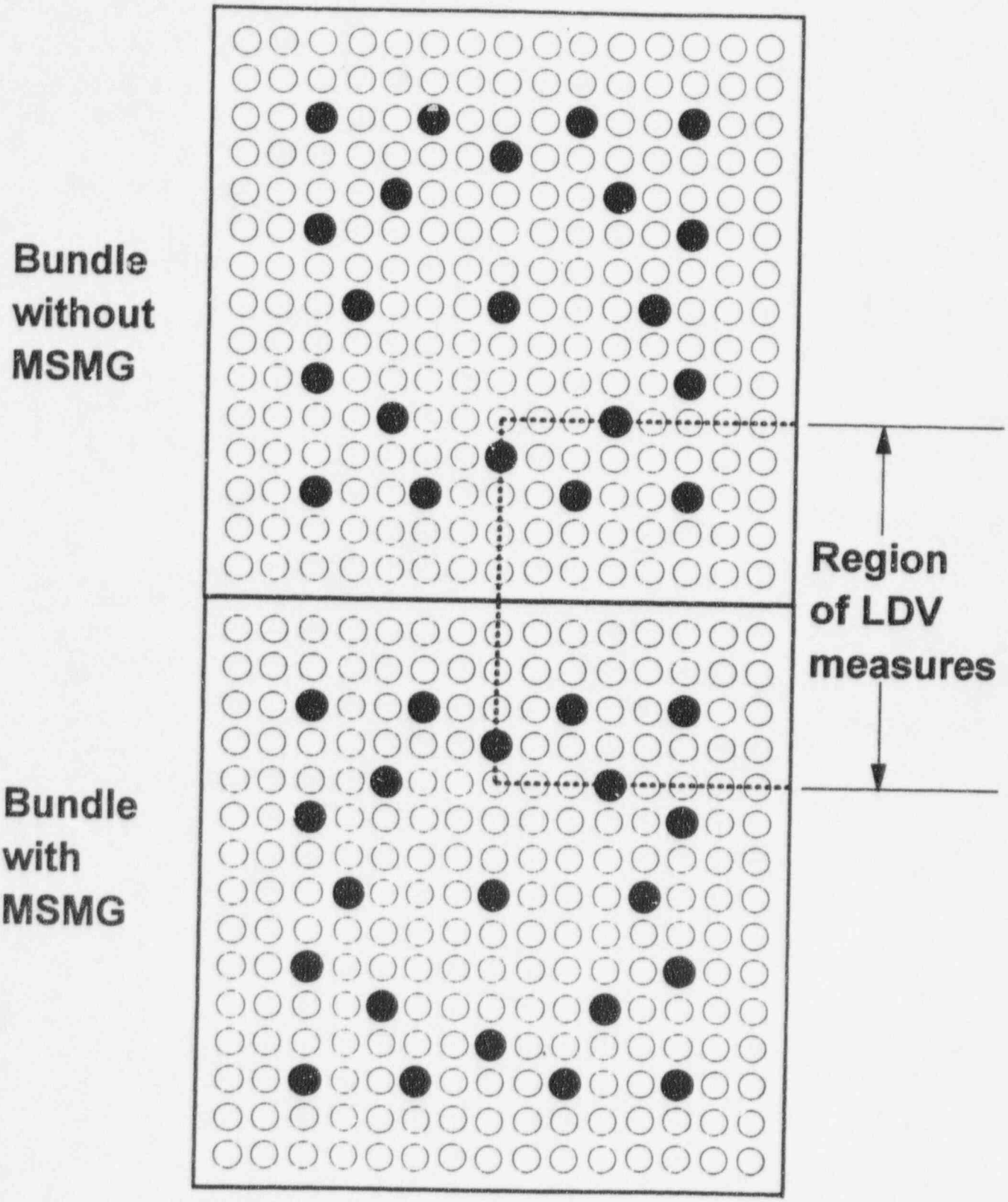
Figure 4-4. Bundle axial velocity ratio profiles for the IBDCF experimental data and the PV algorithm predictions.



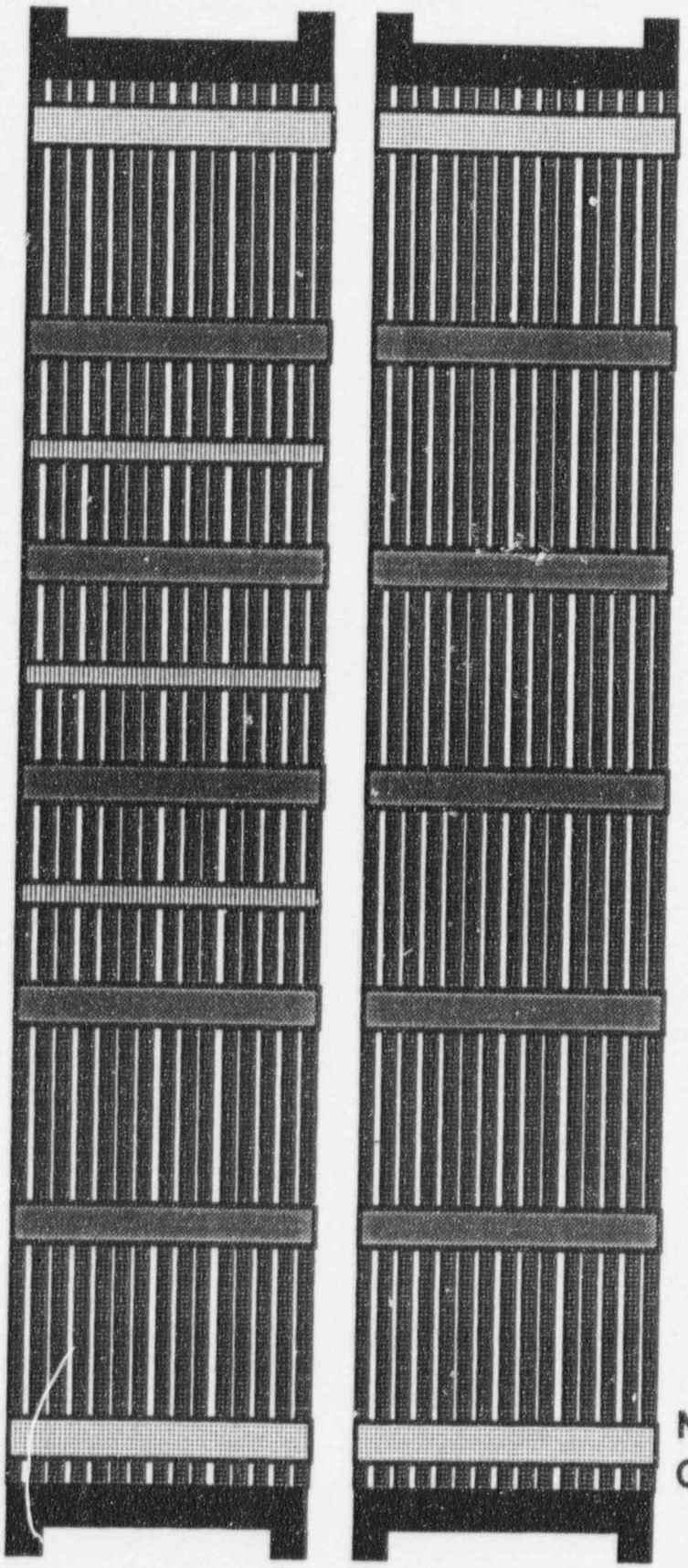
Marignan Tests

- 15-by-15 AFA-2G fuel assembly (FA)
  - 2 Nonmixing grids
  - 5 Mixing vane grids
  - 3 Midspan mixing grids (one FA)
- Fuel rod OD = 0.422 in
- Fuel rod pin pitch = 0.563 in
- Fuel pin length = 157.2 in

Marignan Test Configuration

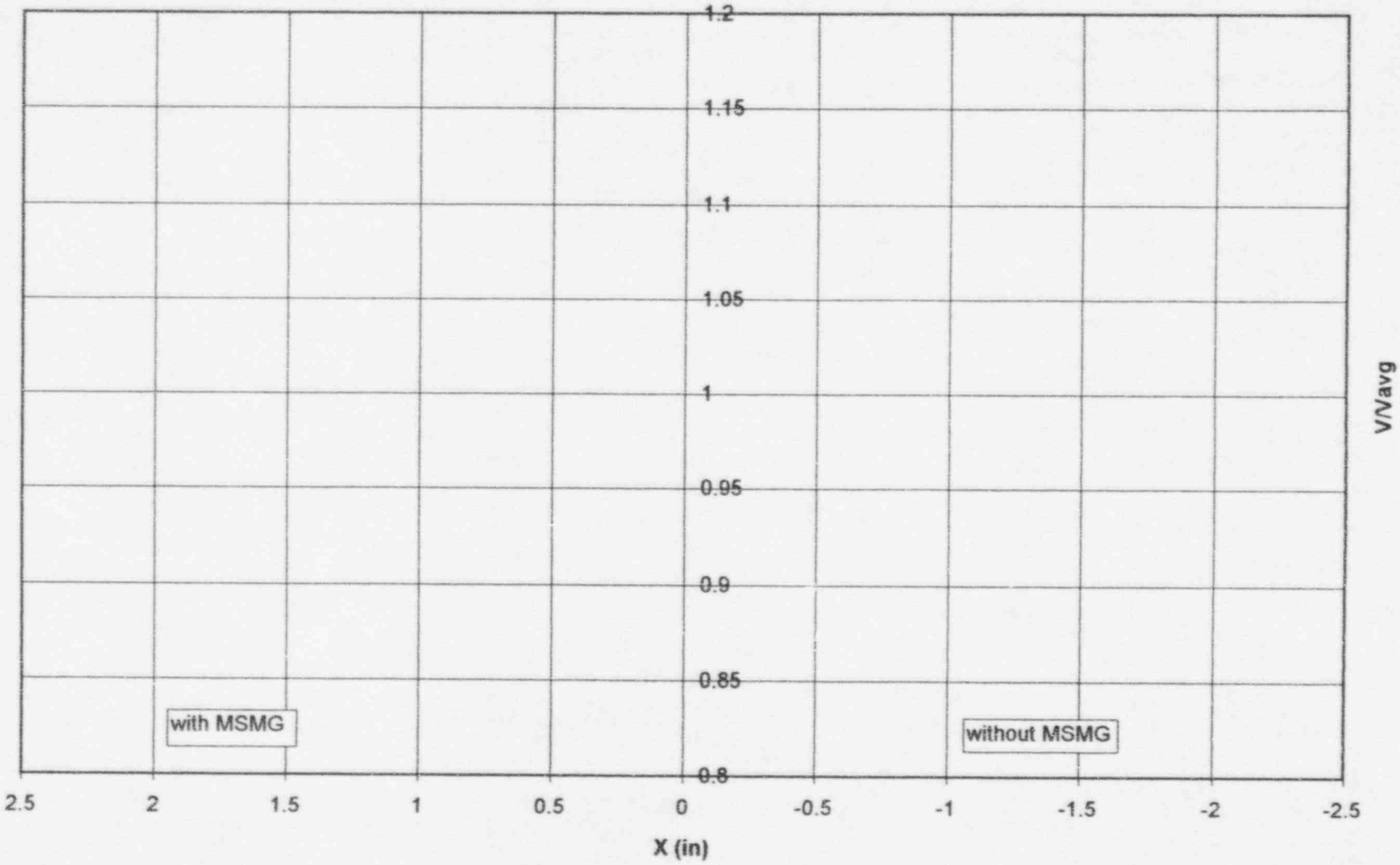


Marignan Test Schematic

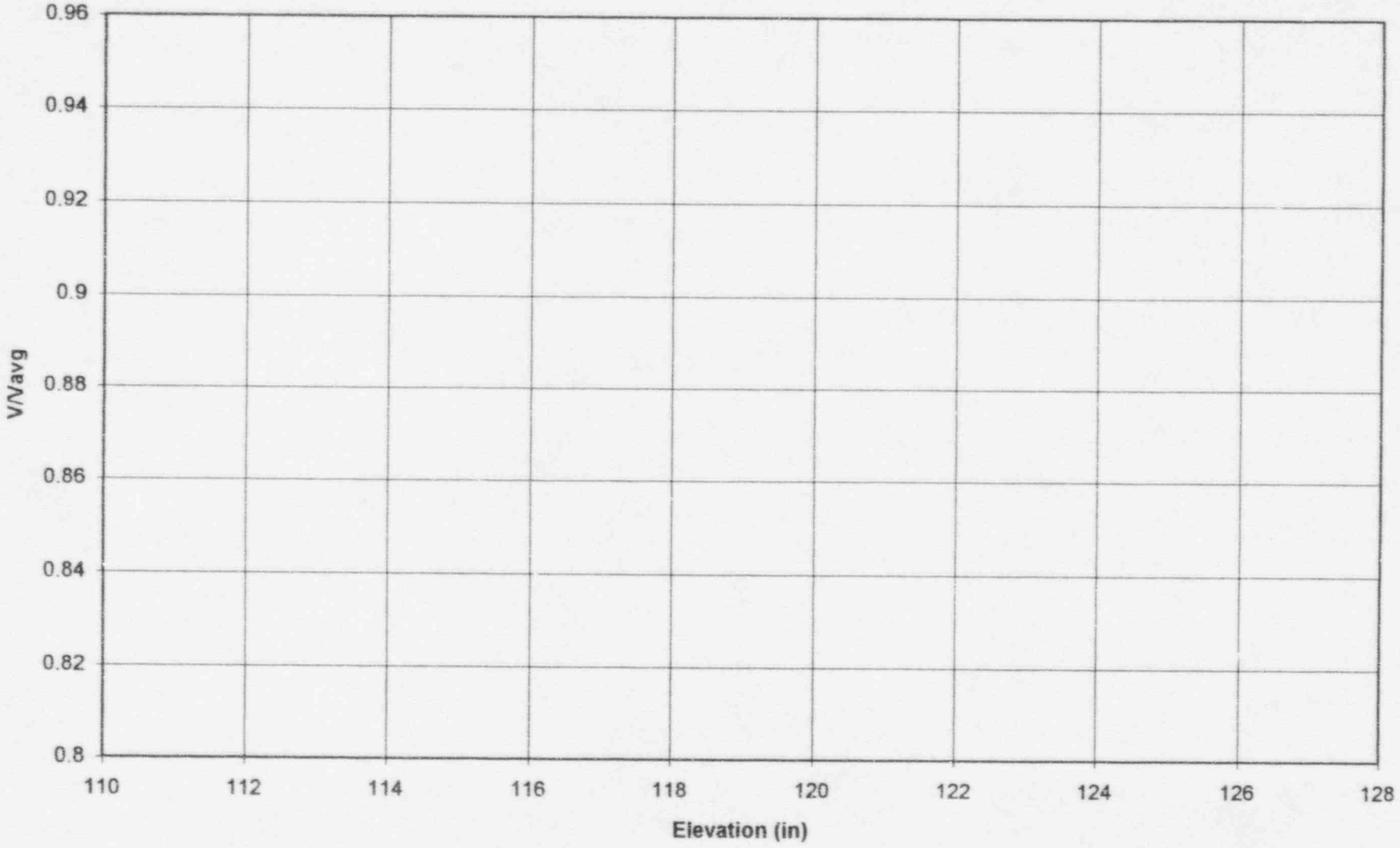


Schematic is not to scale.

Comparison of Measured and Predicted Axial Velocity
Axial Position: 7.5 mm Below 3rd MSMG



Comparison of Measured and Predicted Average Axial Velocity



Summary / Conclusions

- LYNXT approved by NRC.
- LYNXT extensively benchmarked to industry and NRC-approved codes.
- LYNXT compared to IBDCF and Marignan crossflow tests.
- LYNXT properly predicts the axial flow distribution when there are large hydraulic mismatches.
- LYNXT can be applied with confidence to mixed core situations.

Outline

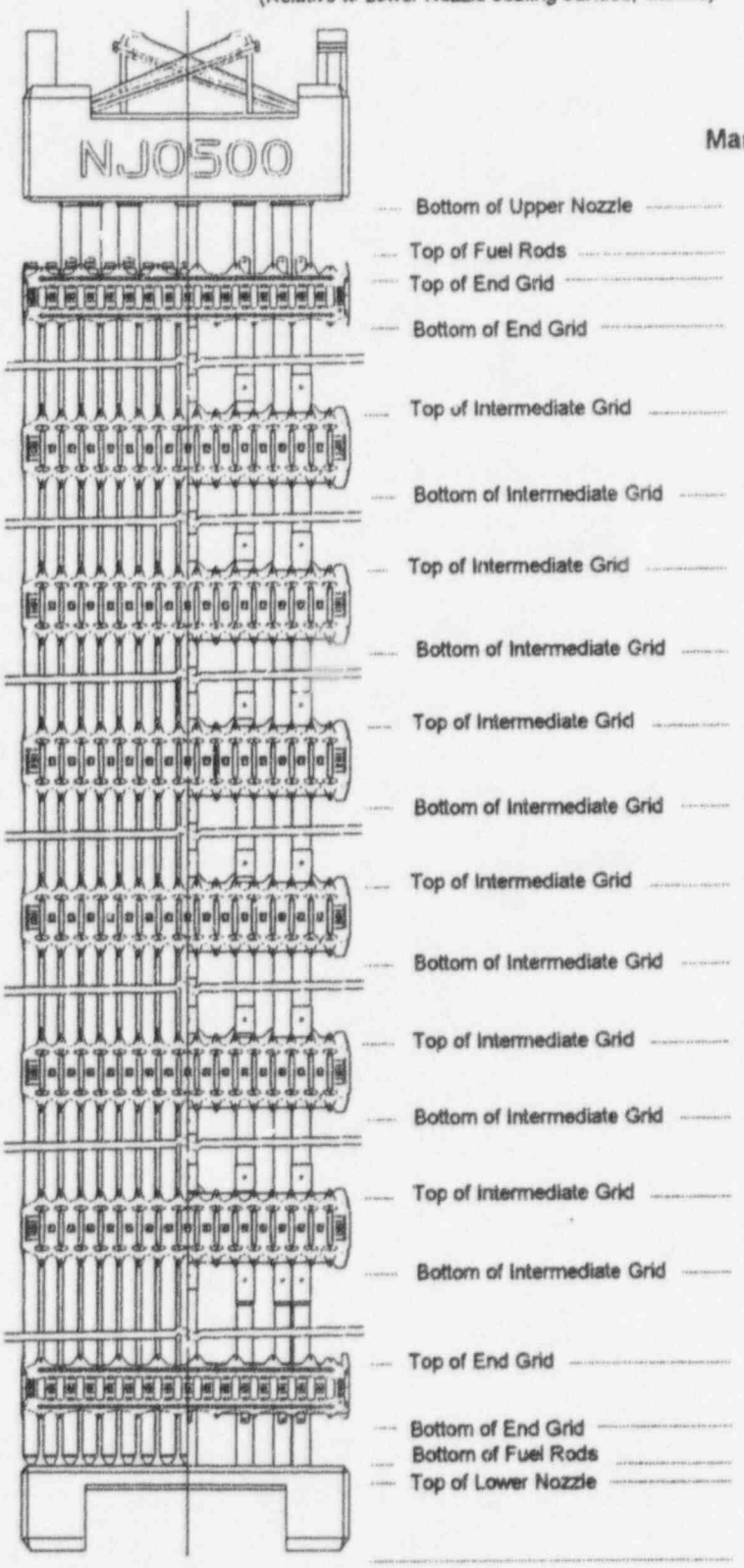
- Resident Fuel Characterization Program and Past Transition Core Experience
- Review of Sequoyah Specific Hydraulic Analyses
- Review of Sequoyah Specific DNB Analyses
- Transition Core Penalty
- Conclusions

Vantage 5H Characterization Program

- March 1994 Received two fresh V5H assemblies at FCF's LMF
- Performed Extensive Dimensional Characterization
- Performed Hydraulic Testing Using FCF's Transportable Flow Test Rig (TFTR)

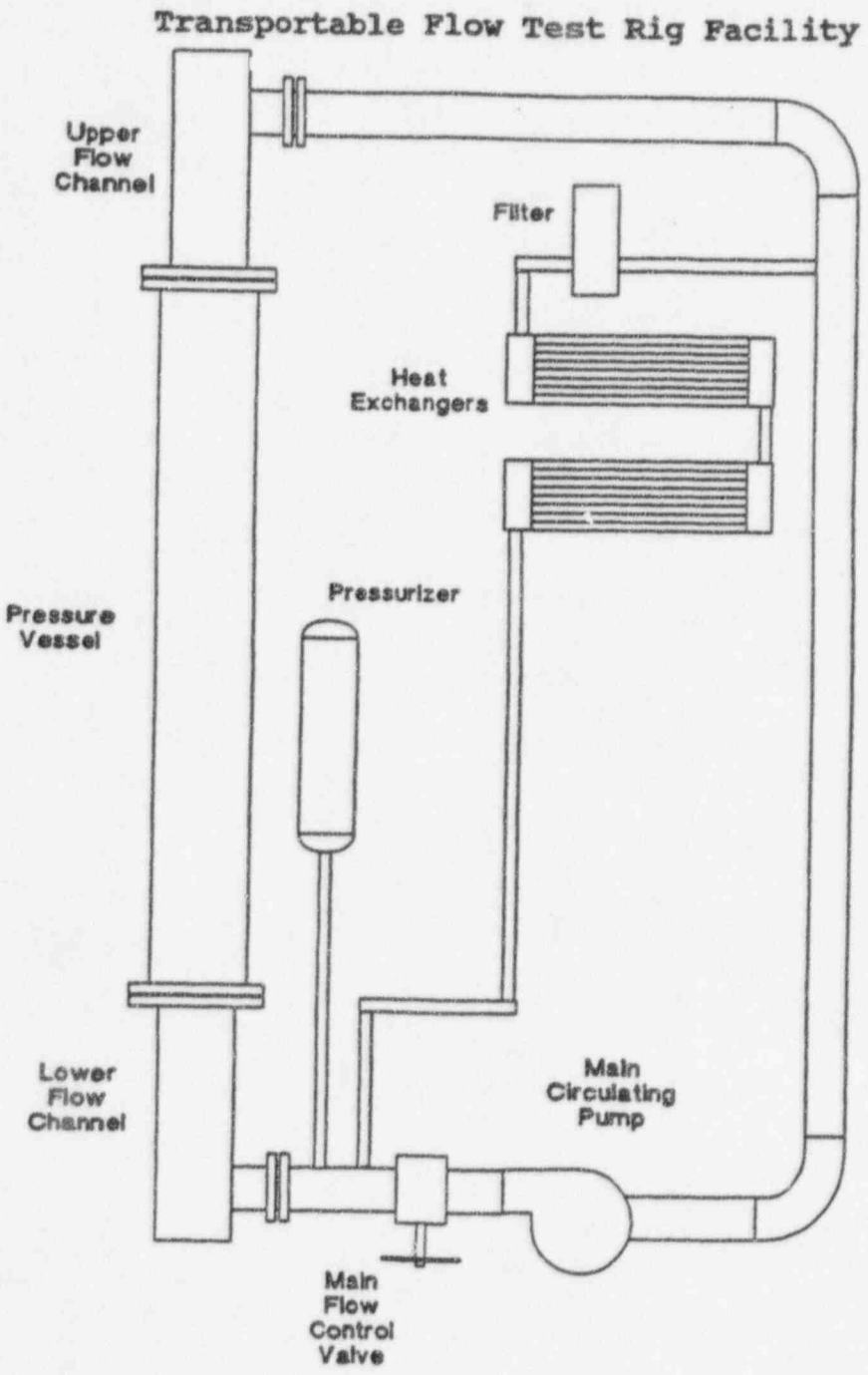
Figure 1
Axial Position Comparison of Primary Components

(Relative to Lower Nozzle seating surface, inches)

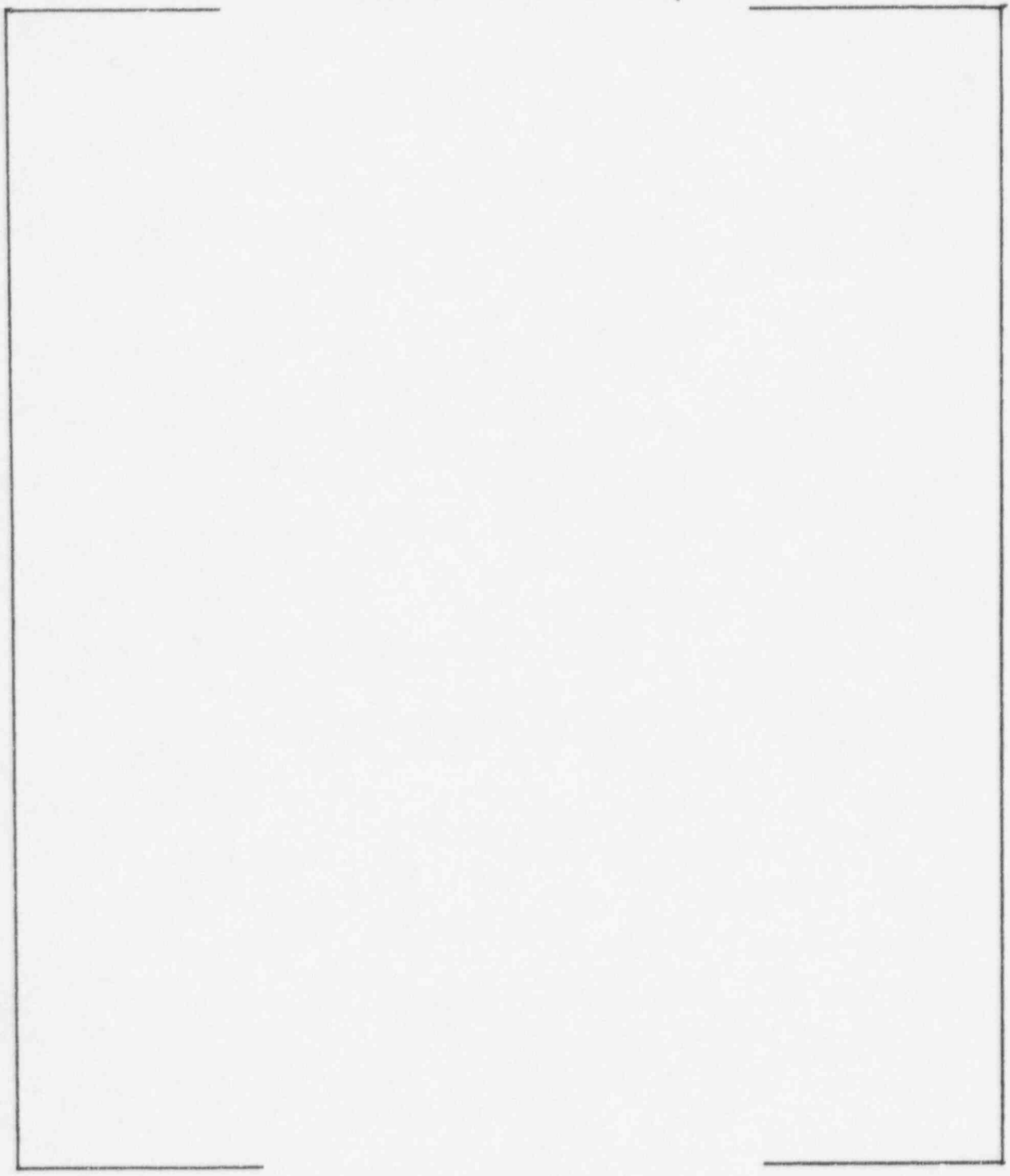


Mark-BW V-5H

Non-Proprietary


Transportable Flow Test Rig Facility
Upper Flow Channel
Filter
Heat Exchangers
Pressurizer
Pressure Vessel
Lower Flow Channel
Main Circulating Pump
Main Flow Control Valve

TFTR Test Section Instrumented Spans

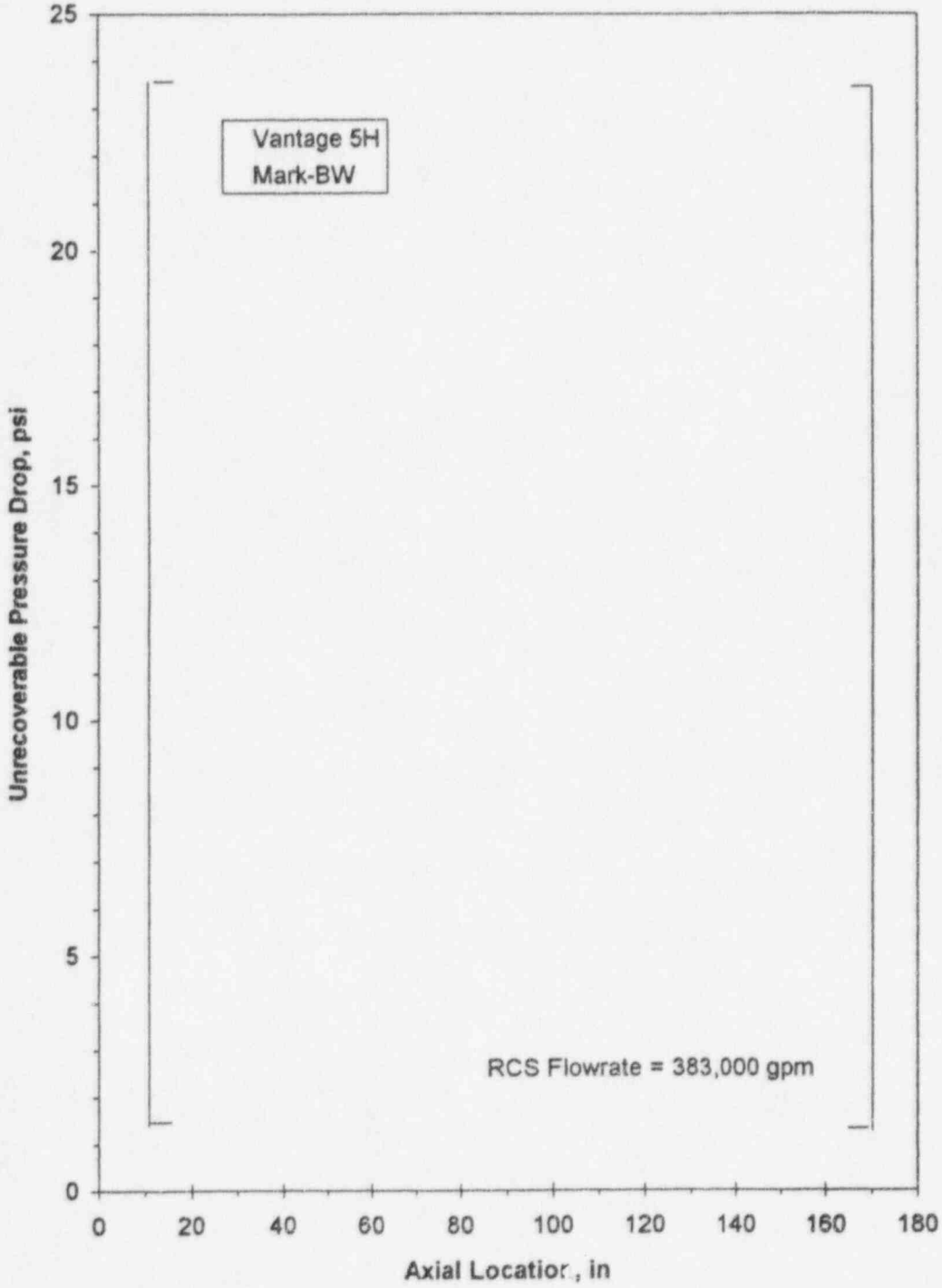


Non-Proprietary

TFTR Test Program

- Cold Flow Loop
  [ ]
- Tested [
  ]
- Acquired Assembly and Component Pressure Drop Data

Figure 2
Mark-BW Versus Vantage 5H
Unrecoverable Pressure Drop Comparison
Full Core Analysis



Fuel Assembly Total Pressure Drop Comparison	
Assembly Type	Total Pressure Drop Difference (w.r.t. MK-BW)
Westinghouse Vantage 5H	[ ]
Westinghouse OFA	[ ]
FCF Mark-BW	--
Westinghouse Standard	[ ]

Mixing Grid Pressure Drop Across the Grid Comparison	
Assembly Type	Grid Pressure Drop Difference (w.r.t. MK-BW)
Westinghouse OFA	[ ]
FCF Mark-BW	--
Westinghouse Vantage 5H	[ ]
Westinghouse Standard	[ ]

Sequoyah Specific Hydraulic Analyses

- [ ]
- [ ]
- [ ]

Figure 3
LYNXT 31-Channel Bundle-By-Bundle Model

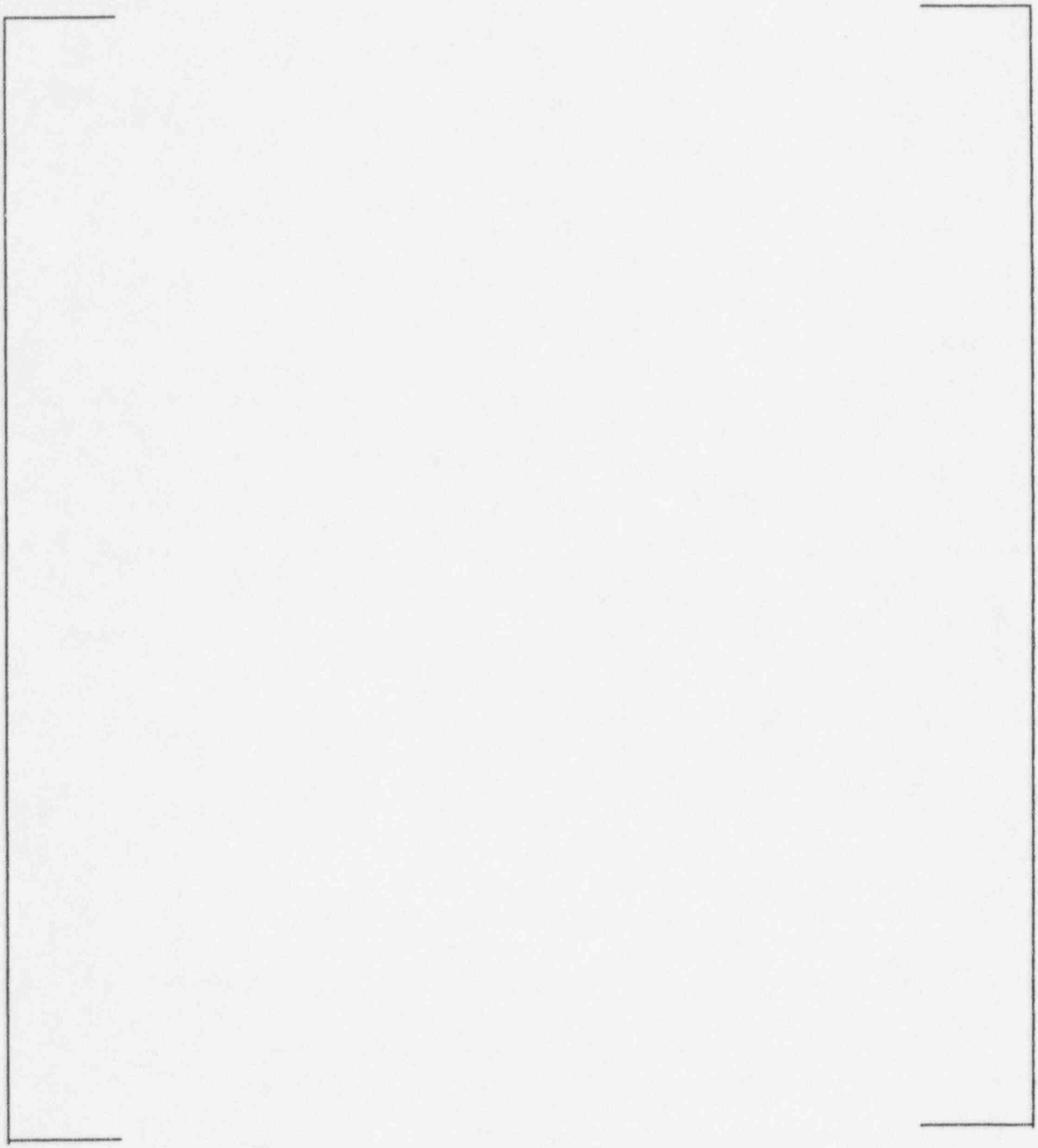


Figure 9
Mass Velocity Comparison - Mark-BW
Channel 1 (MK-BW) Mass Velocity

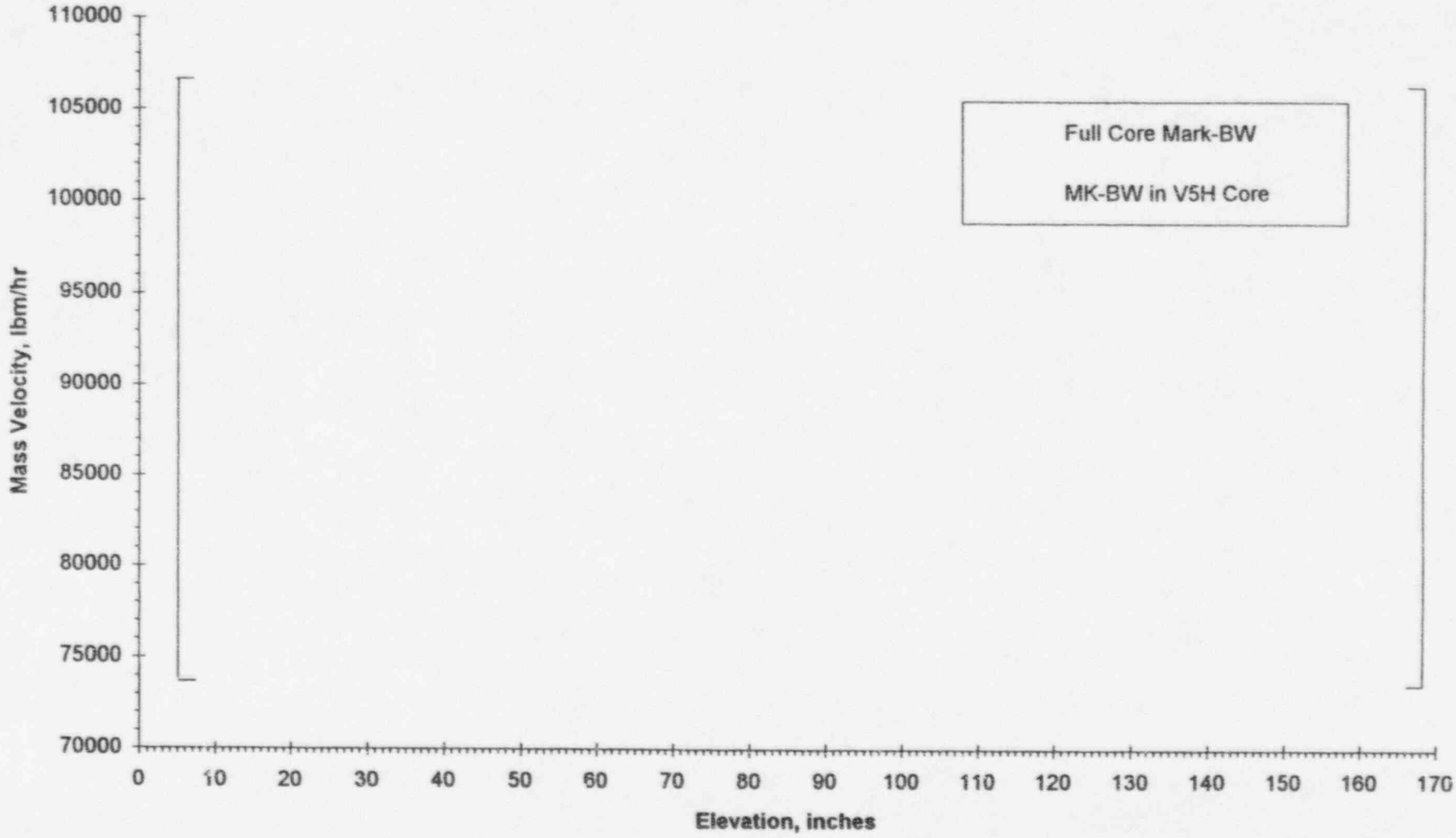
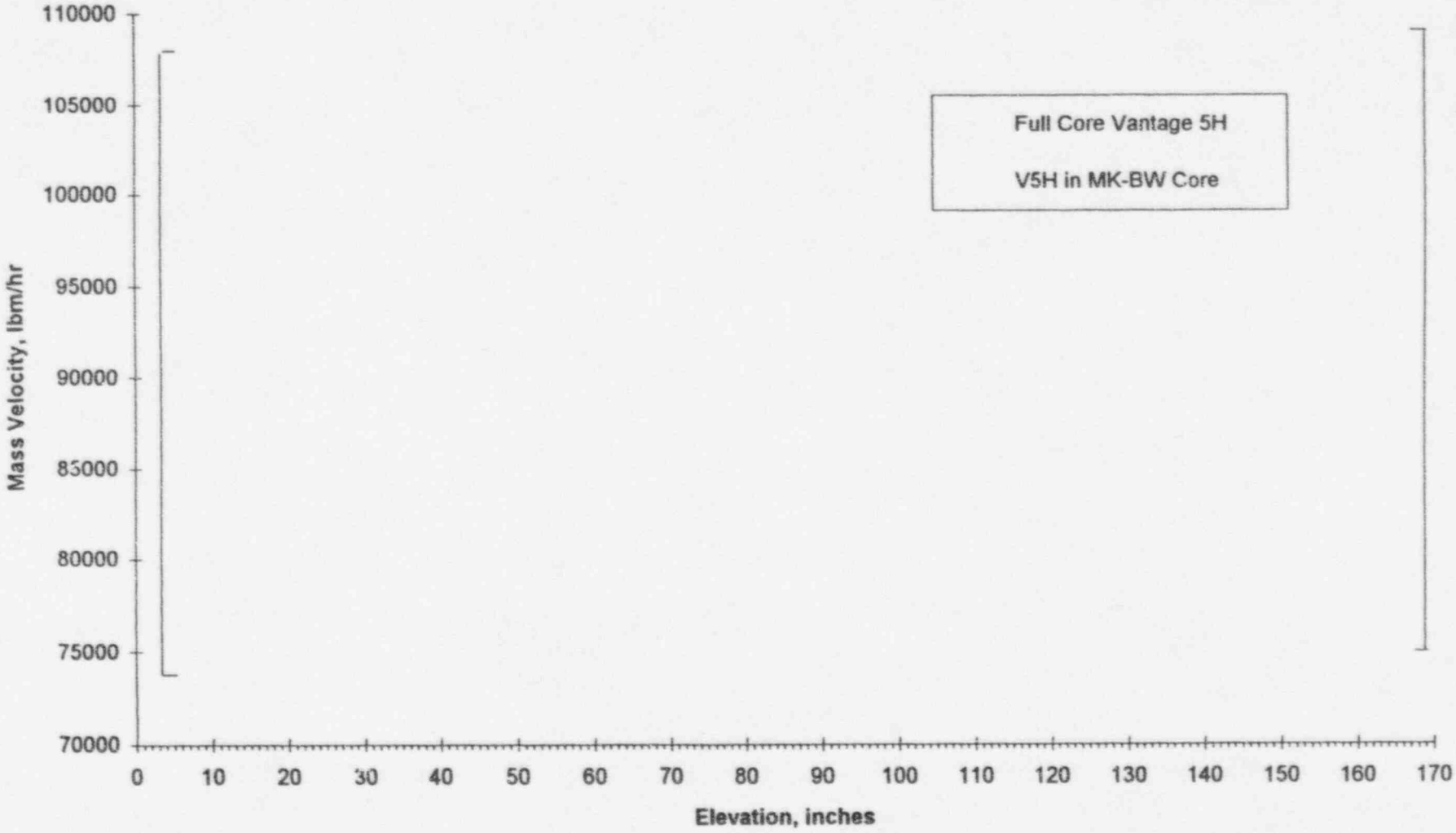


Figure 10
Mass Velocity Comparison - Vantage 5H
Channel 1 (V5H) Mass Velocity



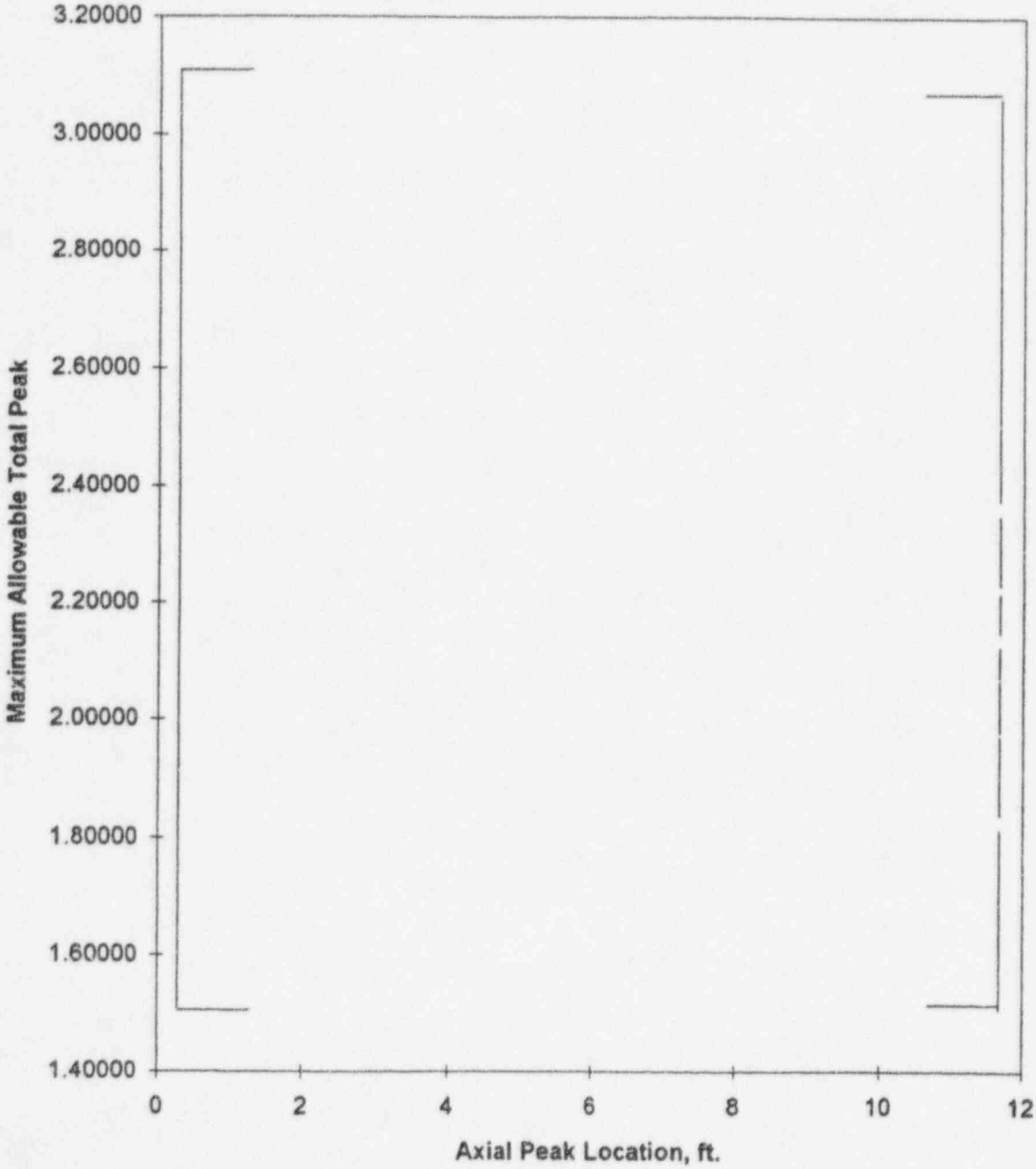
Sequoyah Specific DNB Analysis Ground Rules

- [ ]
- [ ]
  [ ]
- [ ]
  [ ]
  [ ]
  [ ]

What Constitutes FCF's DNB Analysis Package?

- [ ]
  - [ ]
  - [ ]
    [ ]

Typical 118% Power Safety Limit MAP Curves
Allowable Total Peak Versus Axial Peak Location
Mark-BW



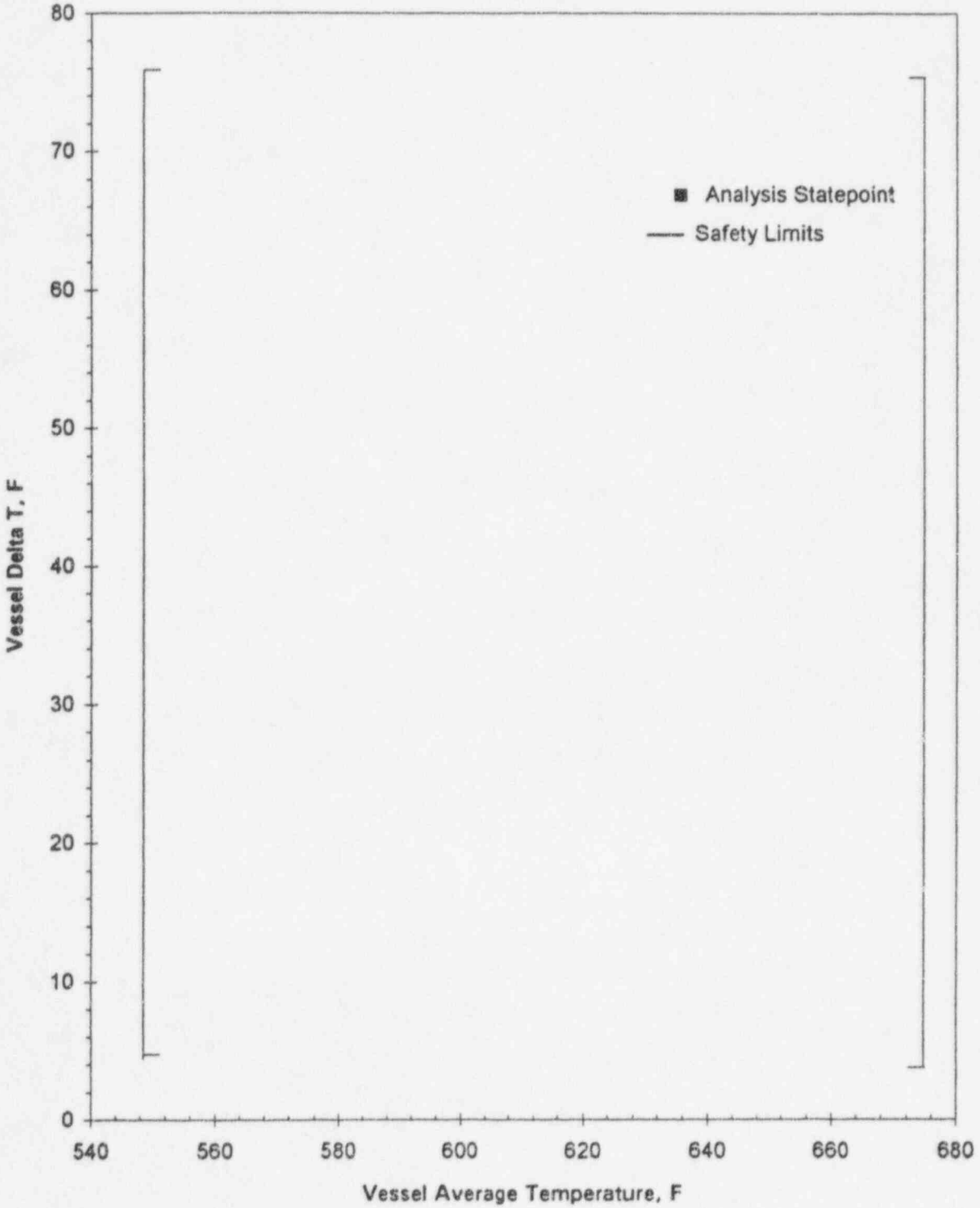
Non-Proprietary

How Are MAP's Generated?

- For Vantage 5H
  - [ ]
    [ ]
  - [ ]
- For Mark-BW
  - [ ]
  - [ ]
    [ ]

Figure 4
LYNXT [ ] Model

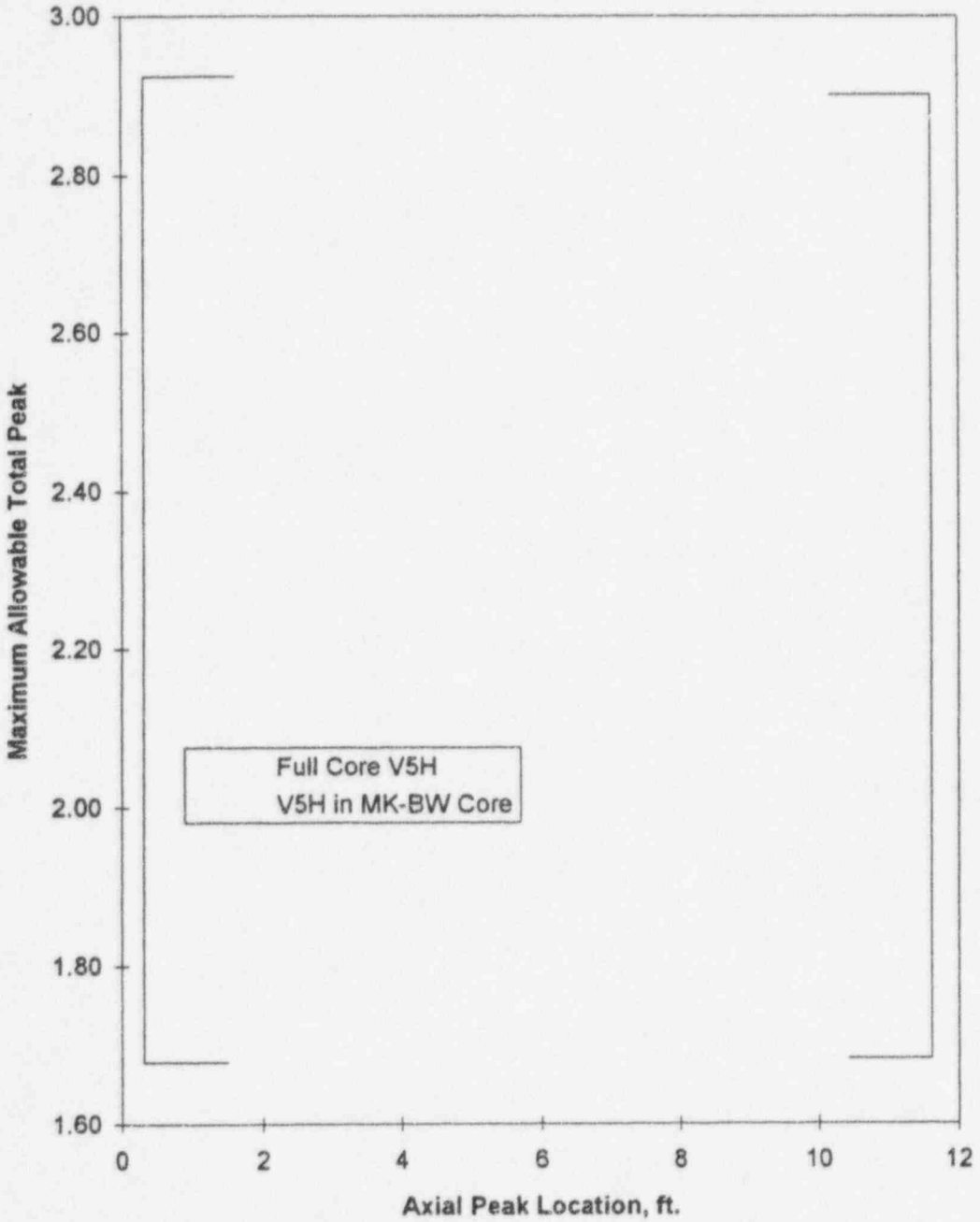
Figure 11
Sequoyah Reactor Core Safety Limits and
Statepoints for MAP Limit Analysis



Existing Safety Limit Evaluations

	Pressure (psia)	Power (%)	BWCMV MDNBR	Margin to TDL (1.50)	Margin to SDL (1.345)
Statepoint "A" 1775 psia, 118% Power					
Full V5H	1775 psia	118	[		]
V5H in BW	1775 psia	118	[		]
Full BW	1775 psia	118	[		]
BW in V5H	1775 psia	118	[		]
Statepoint "D" 1775 psia, 100% Power					
Full V5H	1775 psia	100	[		]
V5H in BW	1775 psia	100	[		]
Full BW	1775 psia	100	[		]
BW in V5H	1775 psia	100	[		]
Statepoint "B" 2400 psia, 118% Power					
Full V5H	2400 psia	118	[		]
V5H in BW	2400 psia	118	[		]
Full BW	2400 psia	118	[		]
BW in V5H	2400 psia	118	[		]
Statepoint "C" 2400 psia, 100% Power					
Full V5H	2400 psia	100	[		]
V5H in BW	2400 psia	100	[		]
Full BW	2400 psia	100	[		]
BW in V5H	2400 psia	100	[		]

Vantage 5H
MAP Limit Development Method



Summary and Conclusions

- Through Inspection and Testing, FCF has extensive data on resident Westinghouse Fuel.
- The transition at Sequoyah is similar to previous successful transitions at McGuire, Catawba and Trojan.
- FCF has demonstrated that the LYNXT code accurately predicts mixed core conditions.
- FCF has performed extensive Mixed Core Hydraulic and DNB analysis, demonstrating that Sequoyah's current safety limits are valid for the fuel transition.
- [ ]
  [ ]