Exelon Nuclear

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November 29, 2001

10 CFR 50.4

United States Nuclear Regulatory Commission
Attention: Document Control Desk
Washington, D.C. 20555

LaSalle County Station, Unit 1
Facility Operating License No. NPF-11
NRC Docket No. 50-373

Subject: Unit 1 Cycle 9 Core Operating Limits Report

Exelon Generation Company (EGC), LLC, in a letter dated, September 21, 2001, notified the NRC that the refueling outage for Unit 1 had been changed to January 10, 2002. The change in the refueling outage has resulted in a need to revise the Core Operating Limits Report (COLR). The COLR revision incorporates new operating limits for operation beyond the current analyzed exposure and an update to a name change in the fuel manufacturer. Other administrative changes have also been incorporated. Refer to Section 1, page i, for a summary of changes.

In accordance with Technical Specification Section 5.6.5, "Core Operating Limits Report," and 10 CFR 50.4, "Written Communications," LaSalle County Station is submitting this revision to the COLR to the NRC.

Should you have any questions concerning this letter, please contact Mr. William Riffer, Regulatory Assurance Manager, at (815) 415-2800.

Respectfully,

Charles G. Pardee

Charles G. Pardee
Site Vice President
LaSalle County Station

Attachment

cc: Regional Administrator - NRC Region III
NRC Senior Resident Inspector - LaSalle County Station

A001

Technical Requirements Manual - Appendix I

Section 1

LaSalle Unit 1 Cycle 9

Core Operating Limits Report

November 2001

Technical Requirements Manual - Appendix I
L1C9 Core Operating Limits Report

Issuance of Changes Summary

Affected Section	Affected Pages	Summary of Changes	Date
All	All	Original Issue (Cycle 9)	10/99
All	All	Incorporated administrative changes (including updating the date to be November 1999)	11/99
All	All	Incorporated changes to thermal limits due to uprate and MELLLA operation, revised LHGR and MAPLHGR limits, CBH penalties, and necessary administrative changes.	5/00
All	All	Incorporated ITS changes, RBM trip setpoint and allowable value equation change for DLO and SLO, TIP symmetry Chi-Squared testing, added information on the use of SUBTIP that allows operation with reduced number of TIPs, incorporated the results of revised thermal limits with correct thermal conductivity and ITS scram times, and other necessary administrative changes.	5/01
All	All	Incorporates coastdown thermal limits on tables 2-1, 2-2, and 3-1. Define the coastdown core average exposure limit. Add applicable references for coastdown analysis and evaluations. Changed SPC/Siemens to Framatome-ANP or FANP where applicable. Updated the Neutronic Licensing Report.	11/01

Technical Requirements Manual - Appendix I
L1C9 Core Operating Limits Report

Table of Contents

References

1. Commonwealth Edison Company Docket No. 50-373, LaSalle County Station, Unit 1 Facility Operating License, License No. NPF-11.
2. Letter from D. M. Crutchfield to All Power Reactor Licensees and Applicants, Generic Letter 88-16; Concerning the Removal of Cycle-Specific Parameter Limits from Tech Specs, dated October 4, 1988.
3. LaSalle Unit 1 Cycle 9 Neutronics Licensing Report (NLR), TODI NFM9900149, Sequence No. 01, November 2001.
4. LaSalle Unit 1 Cycle 9 Reload Analysis, EMF-2276, Revision 1, October, 1999.
5. LaSalle Unit 1 Cycle 9 Plant Transient Analysis, EMF-2277, Revision 1, October, 1999.
6. LOCA Break Spectrum Analysis for LaSalle Units 1 and 2, EMF-2174(P), March 1999.
7. LaSalle LOCA-ECCS Analysis MAPLHGR Limits for ATRIUM-9B fuel, EMF-2175(P), March 1999.
8. LaSalle Extended Operating Domain (EOD) and Equipment Out of Service (EOOS) Safety Analysis for ATRIUM-9B Fuel, EMF-95-205(P), Rev. 2, June 1996.
9. ARTS Improvement Program analysis for LaSalle County Station Units 1 and 2, NEDC-31531P, December 1993 and Supplement 1, June 1998 (Removal of Direct Scram Bypassed Limit).
10. Lattice-Dependent MAPLHGR Report for LaSalle County Station Unit 1 Reload 7 Cycle 8, 24A5180AA Revision 0, December 1995.
11. Lattice-Dependent MAPLHGR Report for LaSalle County Station Unit 1 Reload 6 Cycle 7, 23A7231AA, Rev.0, December 1993.
12. LaSalle Unit 1 Cycle 9 Principal Transient Analysis Parameters, EMF-96-189, May 1999.
13. General Electric Standard Application for Reactor Fuel (GESTAR), NEDE-24011-P-A-14, June 2000.
14. "Project Task Report, LaSalle County Station, Power Uprate Evaluation, Task 407: ECCS Performance," GE report number GE-NE-A1300384-39-01, Revision 0, Class 3, dated September 1999.
15. Evaluation of a Postulated Slow Turbine Control Valve Closure Event for LaSalle County Station, Units 1 and 2, GE-NE-187-13-0792, Revision 2, July 1998.
16. Transient Analysis Evaluation for LaSalle 3 TCV Operation at Power Uprate and MELLLA Conditions, NFM:BSA:00-025, R.W. Tsai to D. Bost, April 13, 2000.
17. Updated Transient Analysis: Abnormal Start-up of an Idle Recirculation Loop for LaSalle County Nuclear Station, Units 1 and 2, B33-00296-03P, March 1998.
18. "TIP Symmetry Testing", JHR:97:021, J.H. Riddle to R. Chin, January 20, 1997 and "TIP Symmetry Testing", DEG:99:085, D.Garber to R. Chin, March 23, 1999
19. "Use of SUBTIP Methodology with TIP Symmetry Testing Above 50 Percent Power", DEG:99:087, D. Garber to R.Chin, March 24, 1999
20. "On-Site and Off-Site Reviews of the GE Turbine Control Valve Slow Closure Analysis", T.Rieck to G.Spedl, NFS:BSS:93-117, May 19, 1993.
21. "LaSalle Units 1 and 2 Operating Limits with Multiple Equipment Out of Service (EOOS)", NFS:BSA:95-024, April 6, 1995.
22. NFM Calculation No. BSA-L-99-07, MAPFACf Thermal Limit Multiplier for 105% Maximum Core Flow
23. "Evaluation of CBH Effects on Fresh Fuel for LaSalle Unit 1 Cycle 9", DEG:00:025, D. Garber to R. Chin, February 25, 2000.
24. "ComEd GE9/GE10 LHGR Improvement Program" J11-03692-LHGR, Revision 1, February 2000.
25. "LaSalle County Station Power Uprate Project", Task 201: Reactor Power/Flow Map, GE-NE-A1300384-07-01, Revision 1, September 1999
26. "Reactor Stability Detect and Suppress Solutions Licensing Basis Methodology for Reload Applications", NEDO-32465-P-A, August 1996.

27. "ANFB Critical Power Correlation", ANF-1125(P)(A) and Supplements 1 and 2, Advanced Nuclear Fuels Corporation, April 1990.

28. Letter, Ashok C. Thadani (NRC) to R. A. Copeland (SPC), "Acceptance for Referencing of ULTRAFLOW^{TM} Spacer on 9X9-IX/X BWR Fuel Design," July 28, 1993.

29. Advanced Nuclear Fuels Corporation Critical Power Methodology for Boiling Water Reactors/Advanced Nuclear Fuels Corporation Critical Power Methodology for Boiling Water Reactors: Methodology for Analysis of Assembly Channel Bowing Effects/NRC Correspondence, XN-NF-524(P)(A) Revision 2 and Supplement 1 Revision 2 , Supplement 2, Advanced Nuclear Fuels Corporation November 1990.

30. COTRANSA 2: A Computer Program for Boiling Water Reactor Transient Analysis, ANF-913(P)(A), Volume 1, Revision 1 and Volume 1 Supplements 2, 3, and 4, Advanced Nuclear Fuels Corporation, August 1990.

31. HUXY: A Generalized Multirod Heatup Code with 10CFR50, Appendix K Heatup Option, ANF-CC-33(P)(A), Supplement 1 Revision 1; and Supplement 2, Advanced Nuclear Fuels Corporation, August 1986 and January 1991, respectively.

32. Advanced Nuclear Fuels Methodology for Boiling Water Reactors, XN-NF-80-19(P)(A), Volume 1, Supplement 3, Supplement 3 Appendix F, and Supplement 4, Advanced Nuclear Fuels Corporation, November 1990.

33. Exxon Nuclear Methodology for Boiling Water Reactors: Application of the ENC Methodology to BWR Reloads, XN-NF-80-19(P)(A), Volume 4, Revision 1, Exxon Nuclear Company, June 1986.

34. Exxon Nuclear Methodology for Boiling Water Reactors THERMEX: Thermal Limits Methodology Summary Description, XN-NF-80-19(P)(A), Volume 3, Revision 2, Exxon Nuclear Company, January 1987.

35. Generic Mechanical Design for Exxon Nuclear Jet Pump BWR Reload Fuel, XN-NF-85-67(P)(A) Revision 1, Exxon Nuclear Company, September 1986.

36. Advanced Nuclear Fuels Corporation Generic Mechanical Design for Advanced Nuclear Fuels Corporation 9X9-IX and 9X9-9X BWR Reload Fuel, ANF-89-014(P)(A), Revision 1 and Supplements 1 and 2, October 1991.

37. Volume 1 – STAIF – A Computer Program for BWR Stability Analysis in the Frequency Domain, Volume 2 – STAIF – A Computer Program for BWR Stability Analysis in the Frequency Domain, Code Qualification Report, EMF-CC-074(P)(A), Siemens Power Corporation, July 1994.

38. RODEX2 Fuel Rod Thermal-Mechanical Response Evaluation Model, XN-NF-81-58(P)(A), Revision 2 Supplements 1 and 2, Exxon Nuclear Company, March 1984.

39. XCOBRA-T: A Computer Code for BWR Transient Thermal-Hydraulic Core Analysis, XN-NF-84-105(P)(A), Volume 1 and Volume 1 Supplements 1 and 2; Volume 1 Supplement 4, Advanced Nuclear Fuels Corporation, February 1987 and June 1988, respectively.

40. Advanced Nuclear Fuels Corporation Methodology for Boiling Water Reactors EXEM BWR Evaluation Model, ANF-91-048(P)(A), Advanced Nuclear Fuels Corporation, January 1993.

41. Exxon Nuclear Methodology for Boiling Water Reactors – Neutronic Methods for Design and Analysis, XN-NF-80-19(P)(A) Volume 1 and Supplements 1 and 2, Exxon Nuclear Company, Richland, WA 99352, March 1983.

42. Exxon Nuclear Plant Transient Methodology for Boiling Water Reactors, XN-NF-79-71(P)(A), Revision 2 Supplements 1, 2, and 3, Exxon Nuclear Company, March 1986.

43. Generic Mechanical Design Criteria for BWR Fuel Designs, ANF-89-98(P)(A), Revision 1 and Revision 1 Supplement 1, Advanced Nuclear Fuels Corporation, May 1995.

44. Reference Deleted.

45. Commonwealth Edison Topical Report NFSR-0085, "Benchmark of BWR Nuclear Design Methods," November 1990, Revision 0.

46. Commonwealth Edison Topical Report NFSR-0085, Supplement 1, "Benchmark of BWR Nuclear Design Methods – Quad Cities Gamma Scan Comparisons," April 1991, Revision 0.

47. Commonwealth Edison Topical Report NFSR-0085, Supplement 2, "Benchmark of BWR Nuclear Design Methods – Neutronic Licensing Analyses," April 1991, Revision 0.

48. Commonwealth Edison Topical Report NFSR-0091, "Benchmark of CASMO/MICROBURN BWR Nuclear Design Methods," Revision 0, Supplements 1 and 2, December 1991, March 1992, and May 1992, respectively; SER letter dated March 22, 1993.

49. BWR Jet Pump Model Revision for RELAX, ANF-91-048(P)(A), Supplement 1 and Supplement 2, Siemens Power Corporation, October 1997.

50. ANFB Critical Power Correlation Application for Coresident Fuel, EMF-1125(P)(A), Supplement 1, Appendix C, Siemens Power Corporation, August 1997.

51. ANFB Critical Power Correlation Determination of ATRIUM-9B Additive Constant Uncertainties, ANF-1125(P)(A), Supplement 1, Appendix E, Siemens Power Corporation, September 1998.

52. "POWERPLEX-II CMSS Startup Testing", DEG:00:254, D. Garber to R. Chin, December 5, 2000.

53. "POWERPLEX-II CMSS Startup Testing", DEG:00:256, D. Garber to R. Chin, December 6, 2000.

54. "LaSalle Unit 1 Cycle 9 Operating Limits for Proposed ITS Scram Times and corrected Fuel Thermal Conductivity", DEG: 01:045, D. Garber to R. Chin, March 22, 2001.

55. "LaSalle Unit 1 and Unit 2 Rod Block Monitor COLR Setpoint Change", NFM:MW:01-0106, A. Giancatarino to J. Nugent, April 3, 2001.

56. "LaSalle Unit 1 Cycle 9 Operating Limits for Proposed Cycle Extension", DEG:01:148, D. Garber to F. Trikur, September 21, 2001.

57. "LaSalle Unit 1 Cycle 9 GE9 Mechanical Limits for Proposed Cycle Extension", DEG:01:143, D. Garber to F. Trikur, September 18, 2001.

58. "Evaluation of L1C9 Cycle Extension Transient Analysis Results for Compliance with GE Fuel Mechanical Limits", NFM-MW:01-0335, C. de la Hoz to J. Nugent, October 25, 2001.

59. "LaSalle Unit 1 Cycle 9 Coastdown Evaluation", NFM-MW:01-0349 Revision 1, F. W. Trikur to J. Nugent , November 7, 2001.

1. Average Planar Linear Heat Generation Rate (3.2.1)

1.1 Tech Spec Reference:
Tech Spec 3.2.1

1.2 Description:

1.2.1 GE Fuel

The MAPLHGR Limit is determined using the applicable Lattice-Type MAPLHGR limits from Tables 1.2-1, 1.2-2, 1.2-3, and 1.2-4. For Single Reactor Recirculation Loop Operation, the MAPLHGR limits in Tables 1.2-1, 1.2-2, 1.2-3, and 1.2-4 are multiplied by the MAPFAC multipliers provided in Figures 1.2-1 and 1.2-2.

Table for Fuel-Type MAPLHGR Limits	**Fuel Type** (Reference 3)	**Cycle First Inserted**
1.2-1	GE9B-P8CWB322-11GZ-100M-150-T	7
1.2-2	GE9B-P8CWB320-9GZ-100M-150-T	7
1.2-3	GE9B-P8CWB343-12GZ-80M-150-T	8
1.2-4	GE9B-P8CWB342-10GZ-80M-150-T	8

1.2.2 Framatome-ANP (FANP is formerly known as SPC) Fuel

The MAPLHGR Limit is the Lattice-Type MAPLHGR Limit. The Lattice-Type Maximum Average Planar Linear Heat Generation Rate (MAPLHGR) limits are determined from the table given below:

Fuel Type (References 3 and 4)	**Cycle First Inserted**
SPCA9-393B-16GZ-100M	9
SPCA9-396B-12GZB-100M	9
SPCA9-384B-11GZ6-80M	9
SPCA9-396B-12GZC-100M	9

Planar Average Exposure **(GWd/MTU)** (References 4 and 7)	**MAPLHGR (kW/ft)** (all FANP fuel types)
0.0	13.5
20.0	13.5
61.1	9.39

For single loop operation (or Abnormal Idle Loop Startup, UFSAR 15.4.4), the MAPLHGR multiplier for Framatome-ANP (FANP is formerly known as SPC) fuel is 0.90. (References 4, 6 and 7)

Table 1.2-1

Maximum Average Planar Linear Heat Generation Rate (MAPLHGR) vs. Average Planar Exposure for Fuel Type GE9B-P8CWB322-11GZ-100M-150-T

(References 11 and 24)

Exposure (MWD/ST)	Lattice Specific MAPLHGR limit (KW/ft)					
0	12.74	12.09	11.65	11.25	12.11	12.74
200	12.67	12.13	11.70	11.32	12.15	12.67
1000	12.48	12.22	11.83	11.46	12.25	12.48
2000	12.42	12.35	12.00	11.61	12.39	12.42
3000	12.41	12.48	12.14	11.77	12.54	12.41
4000	12.44	12.62	12.28	11.94	12.70	12.44
5000	12.46	12.77	12.43	12.11	12.86	12.46
6000	12.49	12.90	12.58	12.29	13.02	12.49
7000	12.51	13.03	12.73	12.46	13.19	12.51
8000	12.54	13.16	12.88	12.64	13.33	12.54
9000	12.55	13.30	13.01	12.82	13.43	12.55
10000	12.57	13.42	13.12	12.98	13.44	12.57
12500	12.41	13.41	13.08	13.04	13.40	12.41
15000	12.04	13.05	12.78	12.77	13.06	12.04
20000	11.27	12.38	12.16	12.16	12.40	11.27
25000	10.49	11.74	11.51	11.51	11.76	10.49
27215.6	12.314	12.314	12.314	12.314	12.314	12.314
48080.8	10.800	10.800	10.800	10.800	10.800	10.800
58967.1	6.000	6.000	6.000	6.000	6.000	6.000
Lattice No.	733	1817	1818	1819	1820	1821

Table 1.2-2

Maximum Average Planar Linear Heat Generation Rate (MAPLHGR) vs. Average Planar Exposure for Fuel Type GE9B-P8CWB320-9GZ-100M-150-T

(References 11 and 24)

Exposure (MWD/ST)	Lattice Specific MAPLHGR limit (kw/ft)					
0	12.74	12.05	11.62	11.10	12.09	12.74
200	12.67	12.09	11.64	11.15	12.14	12.67
1000	12.48	12.19	11.73	11.27	12.25	12.48
2000	12.42	12.32	11.86	11.44	12.39	12.42
3000	12.41	12.44	11.99	11.62	12.53	12.41
4000	12.44	12.57	12.13	11.80	12.67	12.44
5000	12.46	12.70	12.27	11.96	12.81	12.46
6000	12.49	12.83	12.42	12.09	12.89	12.49
7000	12.51	12.97	12.54	12.23	12.98	12.51
8000	12.54	13.07	12.62	12.37	13.07	12.54
9000	12.55	13.15	12.70	12.51	13.15	12.55
10000	12.57	13.20	12.77	12.66	13.22	12.57
12500	12.41	13.19	12.70	12.67	13.20	12.41
15000	12.04	12.89	12.40	12.40	12.90	12.04
20000	11.27	12.29	11.82	11.82	12.30	11.27
25000	10.49	11.69	11.25	11.25	11.70	10.49
27215.6	12.314	12.314	12.314	12.314	12.314	12.314
48080.8	10.800	10.800	10.800	10.800	10.800	10.800
58967.1	6.000	6.000	6.000	6.000	6.000	6.000
Lattice No.	733	1812	1813	1814	1815	1816

Table 1.2-3

Maximum Average Planar Linear Heat Generation Rate (MAPLHGR) vs. Average Planar Exposure for Fuel Type GE9B-P8CWB343-12GZ-80M-150-T

(References 10 and 24)

Exposure (MWD/ST)	Lattice Specific MAPLHGR limit (kw/ft)				
0	12.66	11.69	11.37	10.92	12.66
200	12.59	11.71	11.43	10.99	12.59
1000	12.40	11.78	11.55	11.13	12.40
2000	12.34	11.95	11.72	11.33	12.34
3000	12.34	12.16	11.91	11.54	12.34
4000	12.37	12.40	12.11	11.76	12.37
5000	12.40	12.67	12.32	12.00	12.40
6000	12.43	12.90	12.53	12.24	12.43
7000	12.46	13.05	12.76	12.49	12.46
8000	12.48	13.21	12.98	12.75	12.48
9000	12.50	13.37	13.13	13.01	12.50
10000	12.51	13.54	13.30	13.22	12.51
12500	12.35	13.75	13.60	13.57	12.35
15000	11.98	13.48	13.23	13.21	11.98
20000	11.20	12.71	12.40	12.37	11.20
25000	10.42	11.92	11.60	11.57	10.42
27215.6	12.314	12.314	12.314	12.314	12.314
48080.8	10.800	10.800	10.800	10.800	10.800
58967.1	6.000	6.000	6.000	6.000	6.000
Lattice No.	732	2083	2084	2085	2086

Table 1.2-4

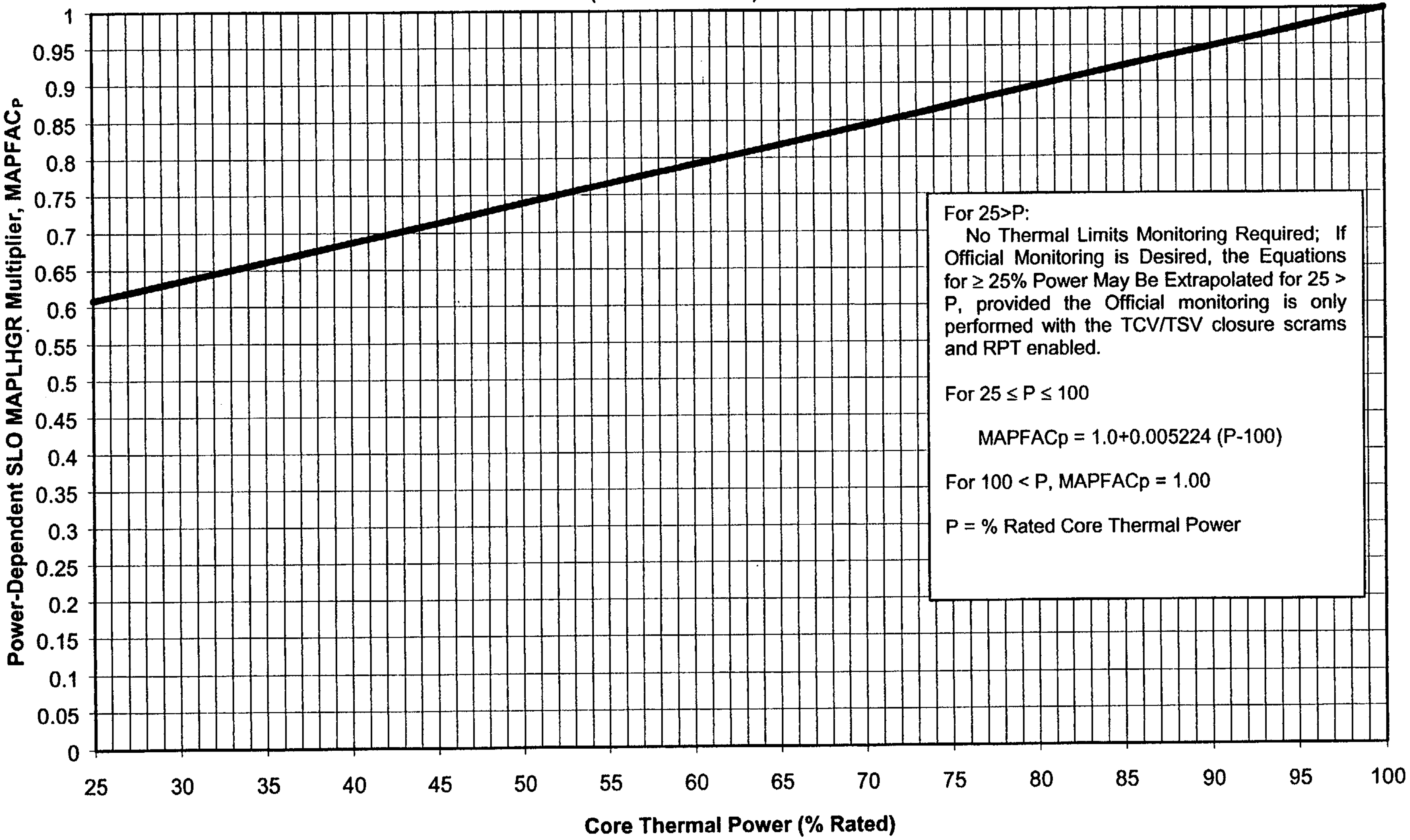
Maximum Average Planar Linear Heat Generation Rate (MAPLHGR) vs. Average Planar Exposure for Fuel Type GE9B-P8CWB342-10GZ-80M-150-T

(References 10 and 24)

Exposure (MWD/ST)	Lattice Specific MAPLHGR limit (kw/ft)					
0	12.66	12.04	12.25	11.72	12.09	12.66
200	12.59	12.08	12.28	11.77	12.12	12.59
1000	12.40	12.16	12.35	11.87	12.22	12.40
2000	12.34	12.28	12.45	12.00	12.37	12.34
3000	12.34	12.42	12.55	12.13	12.53	12.34
4000	12.37	12.57	12.65	12.27	12.70	12.37
5000	12.40	12.73	12.76	12.41	12.88	12.40
6000	12.43	12.89	12.87	12.56	13.07	12.43
7000	12.46	13.06	12.98	12.72	13.27	12.46
8000	12.48	13.24	13.10	12.88	13.47	12.48
9000	12.50	13.42	13.21	13.05	13.65	12.50
10000	12.51	13.61	13.31	13.21	13.76	12.51
12500	12.35	13.79	13.35	13.31	13.82	12.35
15000	11.98	13.50	13.06	13.05	13.51	11.98
20000	11.20	12.79	12.47	12.45	12.79	11.20
25000	10.42	11.95	11.67	11.63	11.95	10.42
27215.6	12.314	12.314	12.314	12.314	12.314	12.314
48080.8	10.800	10.800	10.800	10.800	10.800	10.800
58967.1	6.000	6.000	6.000	6.000	6.000	6.000
Lattice No.	732	2087	2088	2089	2090	2091

Figure 1.2-1 Power-Dependent SLO and Abnormal Idle Loop Startup MAPLHGR Multipliers for GE Fuel, MAPFAC$_P$

(Reference 9 and 24)



For 25>P:
No Thermal Limits Monitoring Required; If Official Monitoring is Desired, the Equations for ≥ 25% Power May Be Extrapolated for 25 > P, provided the Official monitoring is only performed with the TCV/TSV closure scrams and RPT enabled.

For $25 \le P \le 100$

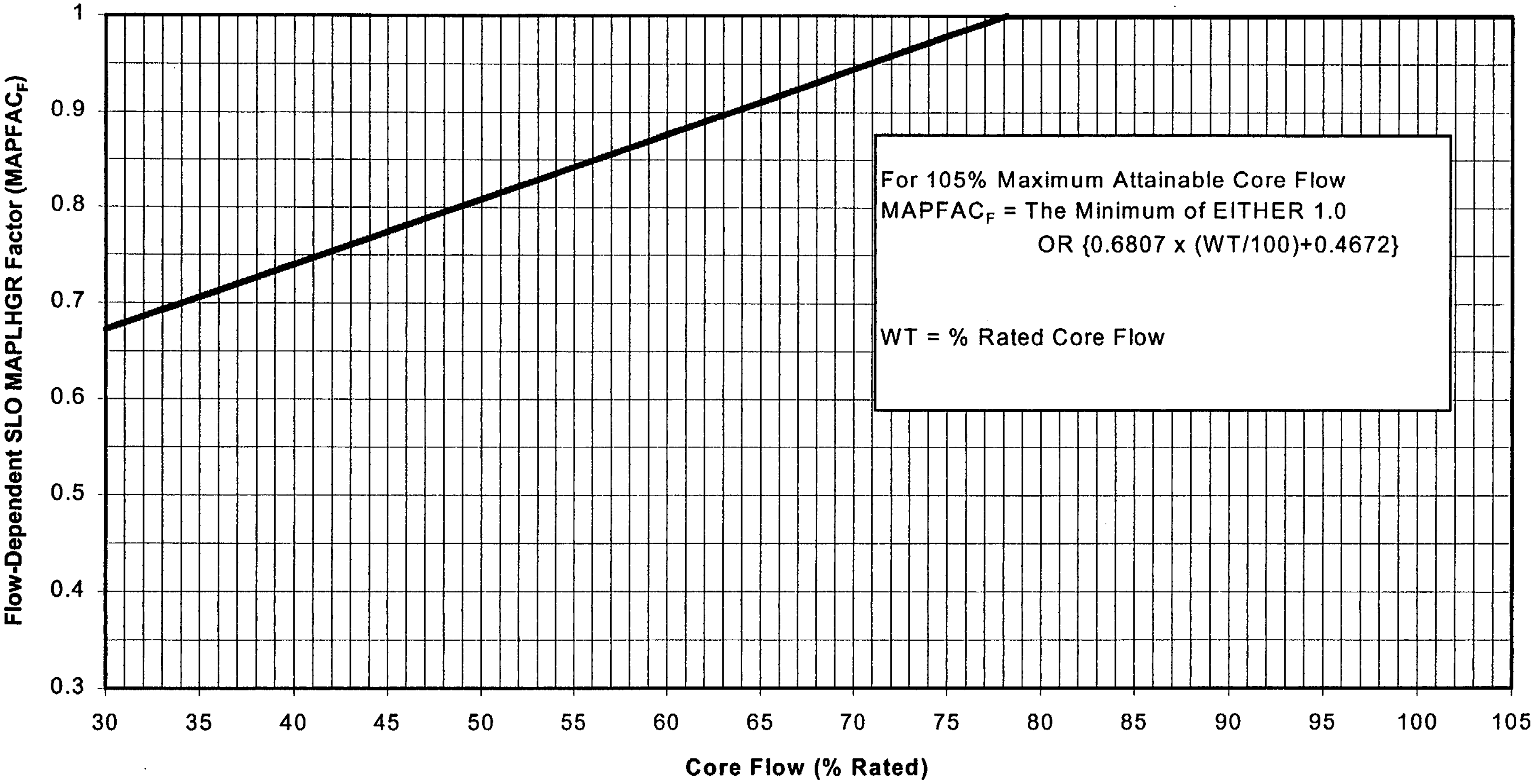
MAPFACp = 1.0+0.005224 (P-100)

For 100 < P, MAPFACp = 1.00

P = % Rated Core Thermal Power

Figure 1.2-2 Flow-Dependent SLO and Abnormal Idle Loop Startup MAPLHGR Multiplier for GE Fuel, $MAPFAC_F$

(References 9, 17, 22, and 24)



For 105% Maximum Attainable Core Flow
$MAPFAC_F$ = The Minimum of EITHER 1.0
OR {0.6807 x (WT/100)+0.4672}

WT = % Rated Core Flow

2. Minimum Critical Power Ratio (3.2.2)

2.1 Tech Spec Reference:

Tech Spec 3.2.2.

2.2 Description:

Prior to initial scram time testing for an operating cycle, the MCPR operating limit is to be based on the Technical Specification Scram Times. For Technical Specification requirements refer to Technical Specification table 3.1.4-1.

TIP symmetry Chi-squared testing shall be performed prior to reaching 500 MWd/MTU to validate the MCPR calculation.

MCPR limits from BOC to Coastdown are applicable up to a core average exposure of 29,439 MWd/MTU (which is the licensing basis exposure used by Framatome-ANP). (Reference 4)

MCPR limits from Coastdown to EOL are applicable from a core average exposure of 29,439 MWd/MTU to a core average exposure of 31,062 MWd/MTU. (Reference 56)

2.2.1 Manual Flow Control MCPR Limits

The Governing MCPR Operating Limit while in Manual Flow Control is either determined from 2.2.1.1 or 2.2.1.2, whichever is greater at any given power, flow condition.

2.2.1.1 Power-Dependent MCPR ($MCPR_P$)* (Reference 3, 4, 23, and 56)

2.2.1.1.1 GE Fuel
Table 2-1 gives the $MCPR_P$ limit as a function of core thermal power for Tech Spec Scram Speeds.

2.2.1.1.2 Framatome-ANP (formerly known as Siemens or SPC) Fuel
Table 2-2 gives the $MCPR_P$ limit as a function of core thermal power for Tech Spec Scram Speeds.

Note that the 10B rods are defined by the control cell locations 14-39, 22-15, 46-23, 38-47, 14-23, 38-15, 46-39, and 22-47.

2.2.1.2 Flow-Dependent MCPR ($MCPR_F$) (Reference 4)
Table 2-3 gives the $MCPR_F$ limit as a function of flow.

2.2.2 Automatic Flow Control MCPR Limits
Automatic Flow Control MCPR Limits are not provided for L1C9.

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* For thermal limit monitoring cases at greater than 100%P, the 100% power MCPRp limits should be applied.

Table 2-1

$MCPR_P$ for GE Fuel

(References 3, 4, 5 54, and 56)

Operation from BOC to Coastdown

Percent Core Thermal Power*

EOOS Combination	0	25	25 (25.1)	60	80	80 (80.1)	100
No EOOS	2.70	2.20	2.10	1.57	1.53		1.50
Single RR Loop Only	2.71	2.21	2.11	1.58	1.54		1.51
EOOS**	2.85	2.35	2.35		1.71	1.69	1.58
EOOS/Single RR Loop**	2.86	2.36	2.36		1.72	1.70	1.59

Coastdown Operation

Percent Core Thermal Power*

EOOS Combination	0	25	25 (25.1)	60	80	80 (80.1)	100
No EOOS†	2.85	2.35	2.35	1.62			1.50
Single RR Loop Only	2.86	2.36	2.36	1.63			1.51
EOOS**	2.85	2.35	2.35		1.71	1.69	1.61
EOOS/Single RR Loop**	2.86	2.36	2.36		1.72	1.70	1.62

* Values are interpolated between relevant power levels. For operation at exactly 25% or 80% CTP, the more limiting value is used. 3489 MWt is rated power.

** Allowable EOOS conditions are listed in Section 5. Other EOOS conditions are not covered.

† For coastdown operation the NO EOOS option includes final feedwater temperature reduction (FFTR) and /or feedwater heaters out of service up to 100 °F.

Table 2-2

MCPR_P for Framatome-ANP Fuel

(References 3, 4, 5, 23, 54 and 56)

For Operation at exposures from 11000 MWD/MTU to Coastdown

All Framatome-ANP (formerly known as SPC) fuel <u>except</u> fuel type 36 in 10B cell locations and fuel type 46 and 47 in A1 cell locations

Percent Core Thermal Power*

EOOS Combination	0	25	25 (25.1)	60	80	80 (80.1)	100
No EOOS	2.70	2.20	2.05	1.56	1.51		1.46
Single RR Loop only	2.71	2.21	2.06	1.57	1.52		1.47
EOOS**	2.85	2.35	2.35		1.67	1.64	1.54
EOOS**/Single RR Loop	2.86	2.36	2.36		1.68	1.65	1.55

Framatome-ANP fuel that is fuel type 36 in 10B cell locations and fuel type 46 and 47 in A1 cell locations

Percent Core Thermal Power*

EOOS Combination	0	25	25 (25.1)	60	80	80 (80.1)	100
No EOOS	2.74	2.24	2.09	1.60	1.55		1.48
Single RR Loop only	2.75	2.25	2.10	1.61	1.56		1.49
EOOS**	2.89	2.39	2.39		1.71	1.66	1.56
EOOS**/Single RR Loop	2.90	2.40	2.40		1.72	1.67	1.57

Coastdown Operation

All Framatome-ANP (formerly known as SPC) fuel <u>except</u> fuel type 36 in 10B cell locations

Percent Core Thermal Power*

EOOS Combination	0	25	25 (25.1)	60	80	80 (80.1)	100
No EOOS[†]	2.85	2.35	2.35	1.62			1.46
Single RR Loop Only	2.86	2.36	2.36	1.63			1.47
EOOS**	2.85	2.35	2.35		1.69	1.64	1.57
EOOS/Single RR Loop**	2.86	2.36	2.36		1.70	1.65	1.58

Framatome-ANP fuel that is fuel type 36 in 10B cell locations

Percent Core Thermal Power*

EOOS Combination	0	25	25 (25.1)	60	80	80 (80.1)	100
No EOOS[†]	2.87	2.37	2.37	1.64			1.48
Single RR Loop only	2.88	2.38	2.38	1.65			1.49
EOOS**	2.87	2.37	2.37		1.71	1.66	1.59
EOOS**/Single RR Loop	2.88	2.38	2.38		1.72	1.67	1.60

* Values are interpolated between relevant power levels. For operation at exactly 25% and 80% CTP, the more limiting value is used. 3489 MWt is rated power.

** Allowable EOOS conditions are listed in Section 5. Other EOOS conditions are not covered.

† For coastdown operation the NO EOOS option includes final feedwater temperature reduction (FFTR) and /or feedwater heaters out of service up to 100 °F.

Table 2-3

$MCPR_F$ for GE and Framatome-ANP Fuel

(References 4 & 5)

MCPRf limits for 105% Maximum Attainable Core Flow

Flow (% rated)	MCPRf ATRIUM-9B	MCPRf GE9
0	1.93	1.93
30	1.93	1.93
102.5	1.14	1.14
105	1.11	1.11

The MCPRf limits are applicable from BOC through coastdown and in all EOOS scenarios.

3. Linear Heat Generation Rate (3.2.3)

3.1 Tech Spec Reference:

Tech Spec 3.2.3.

3.2 Description:

3.2.1 GE Fuel

a. The LHGR Limit is the product of the LHGR Limit in the following tables and the minimum of either the power dependent LHGR Factor*, $LHGRFAC_P$ or the flow dependent LHGR Factor, $LHGRFAC_F$. The LHGR Factors ($LHGRFAC_P$ and $LHGRFAC_F$) for the GE fuel is determined from Figures 3.2-1 through 3.2-3. The following LHGR limits apply for the entire cycle exposure range: (References 9, 14 and 24)

1. GE9B-P8CWB322-11GZ-100M-150-T (bundle 3861 in Reference 24)

Nodal Exposure (GWd/MT)	LHGR Limit (KW/ft)
0.00	14.40
12.34	14.40
26.80	12.31
33.07	11.82
38.58	11.35
44.09	10.94
49.11	10.80
60.89	6.00

2. GE9B-P8CWB320-9GZ-100M-150-T (bundle 3860 in Reference 24)

Nodal Exposure (GWd/MT)	LHGR Limit (KW/ft)
0.00	14.40
12.14	14.40
26.19	12.31
48.16	10.80
59.93	6.00

3. GE9B-P8CWB343-12GZ-80M-150-T (bundle 3866 in Reference 24)

Nodal Exposure (GWd/MT)	LHGR Limit (KW/ft)
0.00	14.40
12.33	14.40
27.86	12.31
49.76	10.80
61.18	6.00

4. GE9B-P8CWB342-10GZ-80M-150-T (bundle 3867 in Reference 24)

Nodal Exposure (GWd/MT)	LHGR Limit (KW/ft)
0.00	14.40
12.71	14.40
27.52	12.31
49.54	10.80
60.95	6.00

3.2.2 Framatome-ANP (formerly known as SPC or Siemens) Fuel

The LHGR Limit is the product of the Steady-State LHGR Limit and the minimum of either the power dependent LHGR Factor*, $LHGRFAC_P$ or the flow dependent LHGR Factor, $LHGRFAC_F$. The Steady-State LHGR limits are given below (Reference 4). $LHGRFAC_P$ is determined from Table 3-1. $LHGRFAC_F$ is determined from Table 3-2. FANP $LHGRFAC_p$ multipliers in this COLR for BOC to coastdown are applicable up to a core average exposure of 29,439 MWd/MTU (Reference 4). FANP $LHGRFAC_p$ multipliers in this COLR for coastdown operation are applicable up to a core average exposure of 31,062 MWd/MTU (Reference 56).

Framatome-ANP Fuel Steady-State LHGR Limits for the following fuel types:

1. SPCA9-393B-16GZ-100M
2. SPCA9-396B-12GZB-100M
3. SPCA9-384B-11GZ6-80M
4. SPCA9-396B-12GZC-100M

LHGR limits for all Framatome-ANP fuel from BOC through Coastdown

(excluding fuel type 36 in 10B locations from rod pattern targeted for approximately 9000 MWD/MTU to rod pattern targeted approximately for 12,000MWD/MTU)

Planar Average Exposure (GWd/MTU) (Reference 4)	**LHGR limit (kW/ft)**
0.0	14.4
15.0	14.4
61.1	8.32

LHGR limits for Framatome-ANP fuel type 36 in 10B locations

(from rod pattern targeted at approximately 9000 MWD/MTU to rod pattern targeted at approximately 12,000 MWD/MT)

Planar Average Exposure (GWd/MTU) (References 4 and 23)	**LHGR limit (kW/ft)**
0.0	14.05
15.0	14.05
61.1	7.97

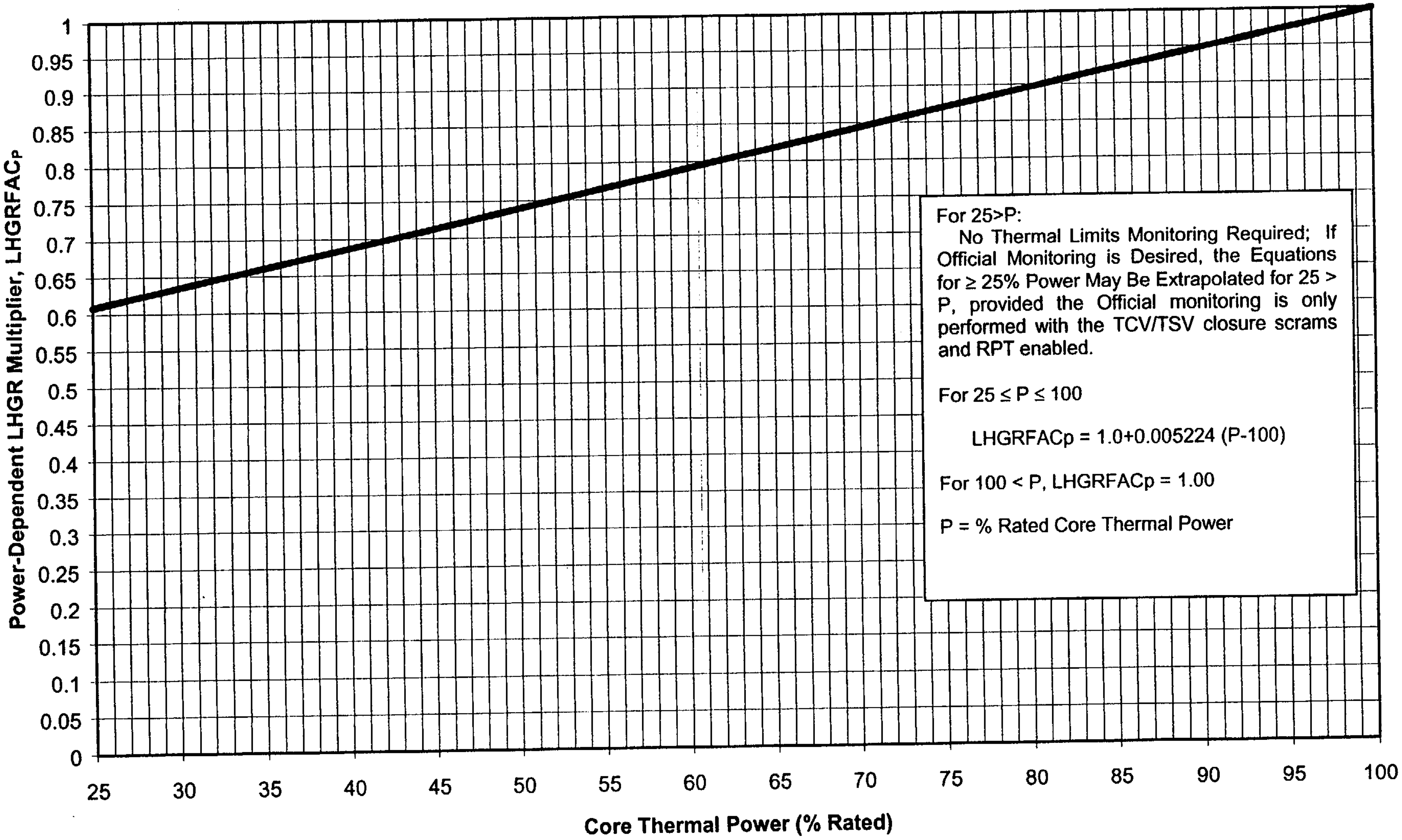
Note that the 10B rods are defined by the control cell locations 14-39, 22-15, 46-23, 38-47, 14-23, 38-15, 46-39, and 22-47.

---

* For thermal limit monitoring cases at greater than 100%P, the 100% power LHGRFACp limits should be applied.

Figure 3.2-1 Power-Dependent LHGR Multipliers for GE fuel (formerly $MAPFAC_P$)

(Reference 9 and 24)



For 25>P:
No Thermal Limits Monitoring Required; If Official Monitoring is Desired, the Equations for ≥ 25% Power May Be Extrapolated for 25 > P, provided the Official monitoring is only performed with the TCV/TSV closure scrams and RPT enabled.

For $25 \leq P \leq 100$

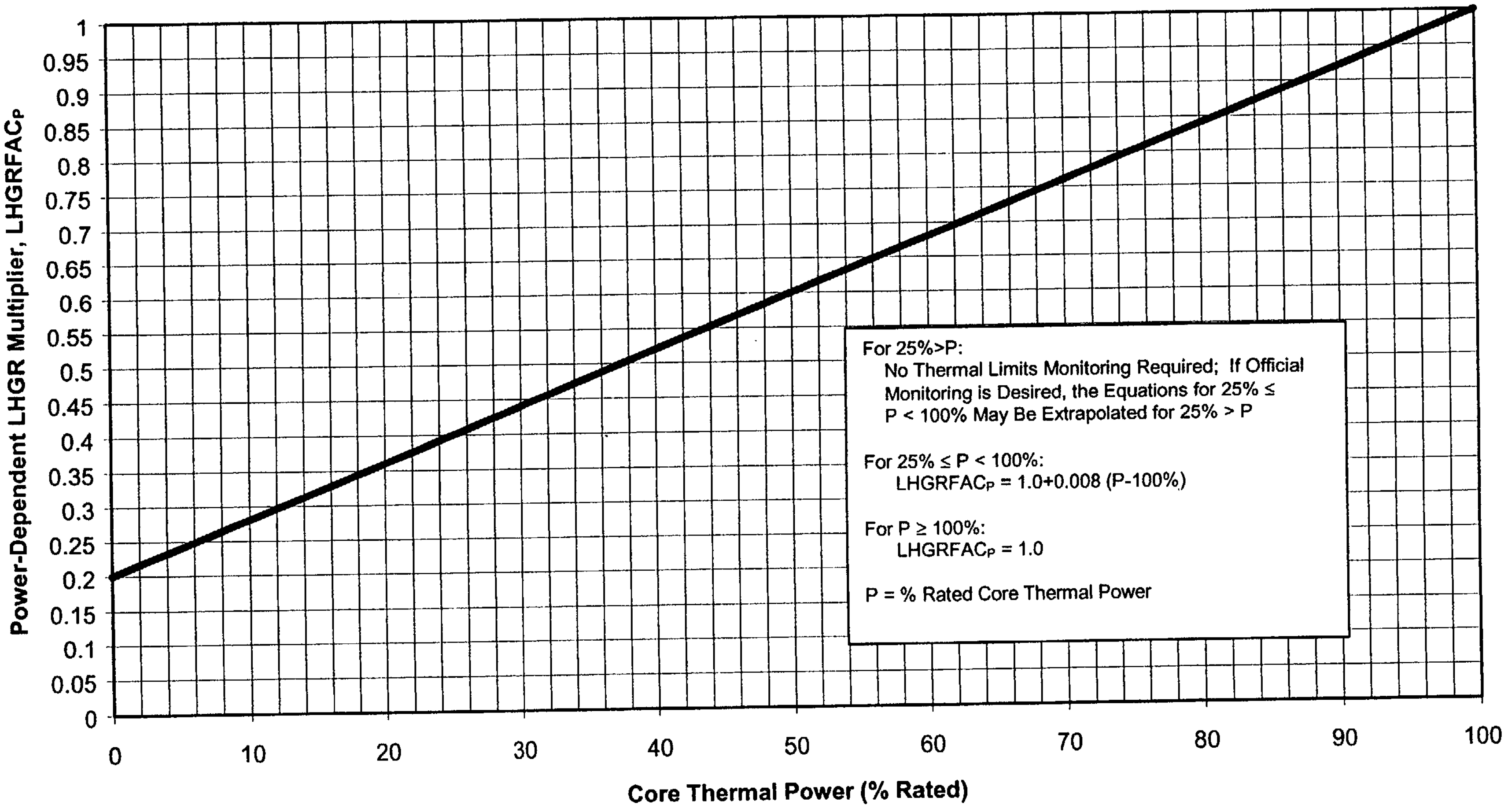
$LHGRFAC_p = 1.0+0.005224\ (P-100)$

For $100 < P$, $LHGRFAC_p = 1.00$

P = % Rated Core Thermal Power

Figure 3.2-2 Power-Dependent LHGR Multiplier for GE Fuel (TCV(s) Slow Closure) (formerly MAPFAC$_P$)

(Reference 15 and 24)



For 25%>P:
No Thermal Limits Monitoring Required; If Official Monitoring is Desired, the Equations for 25% ≤ P < 100% May Be Extrapolated for 25% > P

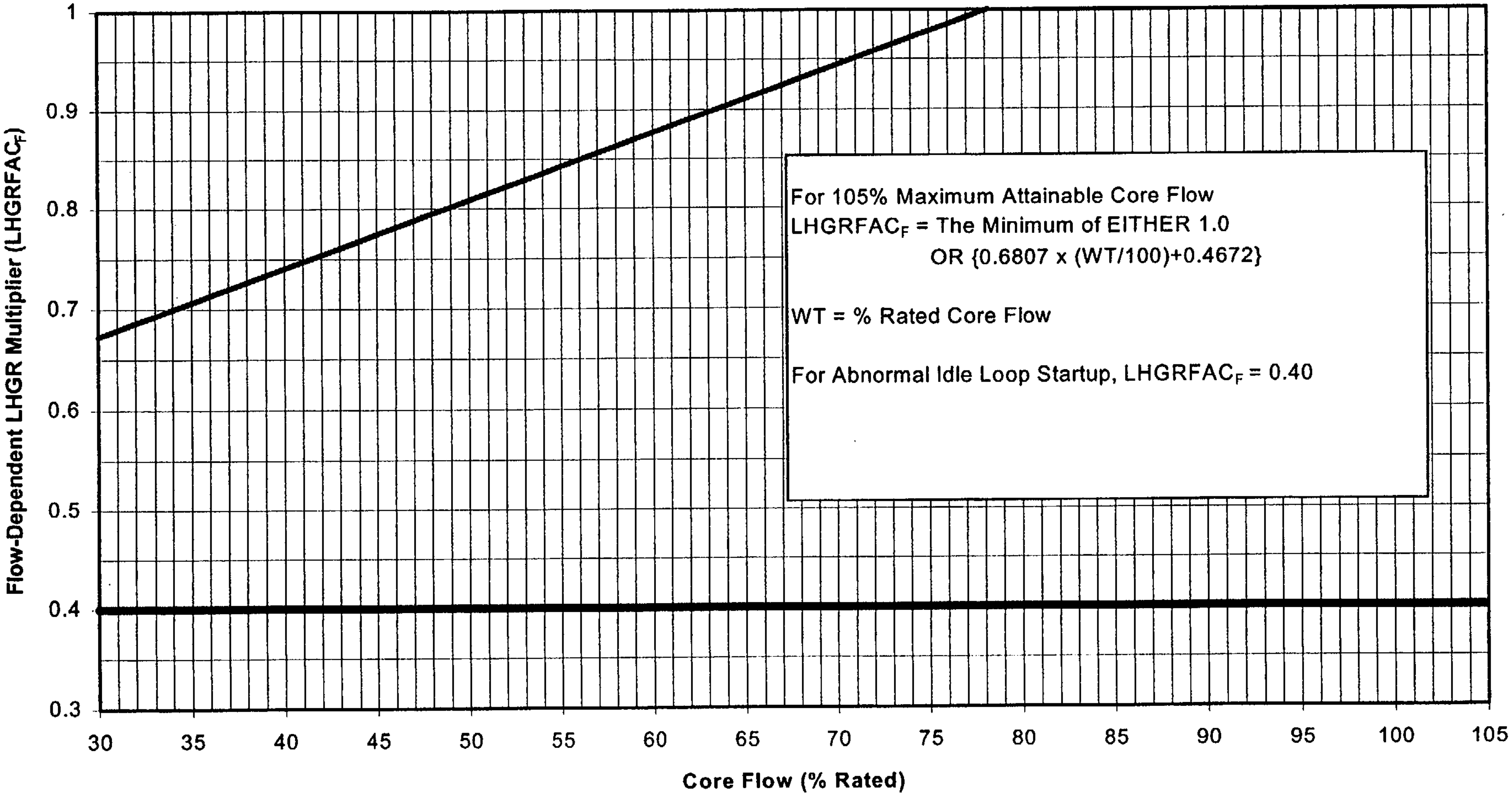
For 25% ≤ P < 100%:
$LHGRFAC_P = 1.0+0.008 (P-100\%)$

For P ≥ 100%:
$LHGRFAC_P = 1.0$

P = % Rated Core Thermal Power

Figure 3.2-3 Flow-Dependent LHGR Multiplier for GE Fuel (formerly $MAPFAC_F$)

(Reference 9 and 17, 22, and 24)



For 105% Maximum Attainable Core Flow
$LHGRFAC_F$ = The Minimum of EITHER 1.0
OR {0.6807 x (WT/100)+0.4672}

WT = % Rated Core Flow

For Abnormal Idle Loop Startup, $LHGRFAC_F$ = 0.40

Table 3-1

LHGRFAC$_P$ for Framatome-ANP Fuel

(References 4, 5, 54 and 56)

Operation from BOC to Coastdown

Percent Core Thermal Power*

EOOS Combination	0	25	25	60	80	80	100
No EOOS	0.67	0.67	0.67	0.94	0.98		1.00
Single RR Loop only	0.67	0.67	0.67	0.94	0.98		1.00
EOOS**	0.64	0.64	0.64		0.86	0.86	0.86
EOOS/Single RR Loop**	0.64	0.64	0.64		0.86	0.86	0.86

Coastdown Operation

Percent Core Thermal Power*

EOOS Combination	0	25	25	60	80	80	100
No EOOS†	0.64	0.64	0.64	0.91			0.93
Single RR Loop Only	0.64	0.64	0.64	0.91			0.93
EOOS**	0.64	0.64	0.64		0.83	0.83	0.83
EOOS/Single RR Loop**	0.64	0.64	0.64		0.83	0.83	0.83

* Values are interpolated between relevant power levels. For operation at exactly 25% or 80% CTP, the more limiting value is used.

** Allowable EOOS conditions are listed in Section 5.

† For coastdown operation the NO EOOS option includes final feedwater temperature reduction (FFTR) and /or feedwater heaters out of service up to 100 °F.

Table 3-2

LHGRFAC_F for Framatome-ANP Fuel

(References 4 & 5)

Values Applicable for up to 105% Maximum Attainable Core Flow

Flow (% rated)	LHGRFACf ATRIUM-9B
0	0.69
30	0.69
76	1.00
105	1.00

These LHGRFAC_f multipliers apply from BOC through coastdown and in all EOOS scenarios.

4. Control Rod Withdrawal Block Instrumentation (3.3.2.1)

4.1 Tech Spec Reference:

Tech Spec Table 3.3.2.1-1.

4.2 Description:

The Rod Block Monitor Upscale Instrumentation Setpoints are determined from the relationships shown below:

ROD BLOCK MONITOR UPSCALE TRIP FUNCTION	TRIP SETPOINT	ALLOWABLE VALUE
Two Recirculation Loop Operation*	0.66 W + 51%**	0.66 W + 54%**
Single Recirculation Loop Operation*	0.66 W + 45.7%**	0.66 W + 48.7%**

---

* This setpoint may be lower/higher and will still comply with the RWE Analysis, because RWE is analyzed unblocked.

** Clamped, with an allowable value not to exceed the allowable value for recirculation loop flow (W) of 100%.

5. Allowed Modes of Operation (B 3.2.2, B 3.2.3)

The Allowed Modes of Operation with combinations of Equipment Out-of-Service are as described below:

	----------OPERATING REGION---------			
Equipment Out of Service Options[1]	Standard	MELLLA	ICF[7]	Coastdown[9]
None	Yes	Yes	Yes	Yes
Feedwater Heaters[2] (Reference 9 and 56)	Yes	No[3]	Yes	Yes
Single RR Loop[10] (Reference 9 and 56)	Yes	No[8]	N/A	Yes
Turbine Bypass Valves (Reference 9)	Yes	Yes	Yes	No
EOC Recirculation Pump Trip (Reference 9 and 56)	Yes	Yes	Yes	Yes
TCV Slow Closure/EOC Recirculation Pump Trip (Reference 15 and 56)	Yes	Yes	Yes	Yes
TCV Slow Closure/EOC Recirculation Pump Trip / Feedwater Heaters [2] (Reference 15, 20,21, and 56)	Yes	No[3]	Yes	Yes
Turbine Bypass Valves / Feedwater Heaters [2] (Reference 9)	No	No	No[5]	No
EOC Recirculation Pump Trip / Feedwater Heaters [2] (Reference 9 and 56)	Yes[4]	No[3]	Yes[4]	Yes
TCV Stuck Closed[6] (Reference 16)	Yes	Yes	Yes	No

1. Each EOOS condition may be combined with one SRV OOS, up to two TIP Machines OOS or the equivalent number of TIP channels (100% available at startup from a refuel outage), a 20°F reduction in feedwater temperature (without Feedwater Heaters considered OOS), cycle startup with uncalibrated LPRMs (BOC to 500 MWd/MTU), and/or up to 50% of the LPRMs out of service.
2. Up to 100°F Reduction in Feedwater Temperature Allowed with Feedwater Heaters Out-of-Service or in combination with FFTR during coastdown. Feedwater Heaters OOS may be an actual OOS condition, or an intentionally entered mode of operation to extend the cycle energy. As long as this condition is met, this is not an EOOS for coastdown.
3. If operating with Feedwater Heaters Out-of-Service, operation in MELLLA is supported by current transient analyses, but administratively prohibited due to core stability concerns.
4. EOC Recirculation Pump Trip OOS/Feedwater Heaters OOS is allowed during coastdown/non-coastdown operation using the TCV Slow Closure/EOC Recirculation Pump Trip OOS/Feedwater Heaters OOS operating limits.
5. Only when operating in coastdown, otherwise this combination is not allowed. **This is not applicable.**
6. Operation is only allowed when less than 10.5 million lbm/hr steam flow and when average position of 3 open TCVs is less than 50% open, with FCL <103%, and the MCFL setpoint ≥ 120%. TCV Stuck Closed may be in combination with any EOOS except TBVOOS or TCV Slow Closure. If in combination with other EOOS(s), thermal limits may require adjustment for the other EOOS(s) as designated in Sections 1, 2, and 3.
7. Increased Core Flow (ICF) is analyzed for up to 105% core flow.
8. The SLO boundary was not moved up with the incorporation of MELLLA. The flow boundary for SLO at uprated conditions remains the ELLLA boundary for pre-uprate conditions. (Reference 25)
9. Coastdown is defined to begin at a core average exposure of 29,439 MWd/MTU (which is the licensing basis exposure used by Framatome-ANP) (Reference 4) and applicable to a core average exposure of 31,062 MWd/MTU (Reference 56).
10. Single Loop Operation is allowed with any of the EOOS options listed in this table.

6. Traversing In-Core Probe System (3.2.1, 3.2.2, 3.2.3)

6.1 Tech Spec Reference:

Tech Spec Sections 3.2.1, 3.2.2, 3.2.3 for thermal limits require the TIP system for recalibration of the LPRM detectors and monitoring thermal limits.

6.2 Description:

When the traversing in-core probe (TIP) system (for the required measurement locations) is used for recalibration of the LPRM detectors and monitoring thermal limits, the TIP system shall be operable with the following:

1. movable detectors, drives and readout equipment to map the core in the required measurement locations, and
2. indexing equipment to allow all required detectors to be calibrated in a common location.

For BOC to BOC + 500 MWD/MT, cycle analyses support thermal limit monitoring without the use of the TIPs.

Following the first TIP set (required prior to BOC + 500 MWD/MT), the following applies for use of the SUBTIP methodology:

With one or more TIP measurement locations inoperable, the TIP data for an inoperable measurement location may be replaced by data obtained from a 3-dimensional BWR core monitoring software system adjusted using the previously calculated uncertainties, provided the following conditions are met:

1. All TIP traces have previously been obtained at least once in the current operating cycle when the reactor core was operating above 20% power, (References 18, 52 and 53) and
2. The total number of simulated channels (measurement locations) does not exceed 42% (18 channels).

Otherwise, with the TIP system inoperable, suspend use of the system for the above applicable monitoring or calibration functions.

6.3 Bases:

The operability of the TIP system with the above specified minimum complement of equipment ensures that the measurements obtained from use of this equipment accurately represent the spatial neutron flux distribution of the reactor core. The normalization of the required detectors is performed internal to the core monitoring software system.

Substitute TIP data, if needed, is 3-dimensional BWR core monitoring software calculated data which is adjusted based on axial and radial factors calculated from previous TIP sets. Since uncertainty could be introduced by the simulation and adjustment process, a maximum of 18 channels may be simulated to ensure that the uncertainties assumed in the substitution process methodology remain valid.

Technical Requirements Manual - Appendix I

Section 2

LaSalle Unit 1 Cycle 9

Reload Transient Analysis Results

November 2001

Technical Requirements Manual - Appendix I
L1C9 Reload Transient Analysis Results

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Attachment 1

LaSalle Unit 1 Cycle 9

Neutronics Licensing Report

NUCLEAR FUEL MANAGEMENT
TRANSMITTAL OF DESIGN INFORMATION

☒ SAFETY RELATED ☐ NON-SAFETY RELATED ☐ REGULATORY RELATED	Originating Organization ☒ Nuclear Fuel Management ☐ Other (specify) ____	NFM ID# NFM9900149 Seq. No. 01 Page 1 of 27

Station: LaSalle Unit: 1 Cycle: 9 Generic: ____

To: Kirk Peterman (LaSalle)

Subject:

LaSalle 1 Cycle 9 Neutronics Licensing Report (NLR)

Frank W. Trikur
Preparer
Preparer's Signature
11·1·01
Date

Ming Y. Hsiao
Reviewer
Ming-Yuan Hsiao
Reviewer's Signature
11-01-01
Date

Anthony D. Giancatarino
NFM Department Head
Approver's Signature
11/01/01
Date

Status of Information:
☒ Verified
☐ Unverified
☐ Engineering Judgement

Action Tracking # for Method and Schedule of Verification for Unverified DESIGN INFORMATION : ____

Description of Information: LaSalle Unit 1 Cycle 9 Neutronics Licensing Report. Results and bases of neutronics licensings calculations for LaSalle 1 Cycle 9. These calculations cover operation with a rated core power up to 3489 MWt.

Purpose of Information: LaSalle Unit 1 Cycle 9 Neutronics Licensing Report
Seq. 0: Original issue
Seq. 1: Revised L1C9 peak fuel pellet burnup limit for the GE9B fuel design in the Maximum Exposure Limit Compliance Table.

Source of Information: NFM Calculation Note BNDL:99-050, Revision 0. Maximum peak pellet burnup limit for GE9B fuel is taken from the GE9/GE10 LHGR Improvement Program, J11-03692-LHGR, Revision 1, Class 3, February 2000 report transmitted by NDIT No. NFM0000067, Seq. No. 0.

Supplemental Distribution: Jeff Nugent (LaSalle), Norha Plumey (LaSalle), Adelmo S. Pallotta, Robert W. Tsai, Pedro L. Kong, LaSalle Central File, Cantara Central File

Licensing Basis

This document, in conjunction with References 1, 3 and 4 in Section VIII, provides the licensing basis for LaSalle County Station Unit 1 Reload 8, Cycle 9.

Table of Contents

JKW 10/7/99 10/7/99

I. Nuclear Design

I.1 New Reload Fuel Assembly Nuclear Design

I.1.1 Assembly Average Enrichment

Assembly Name	Batch Identifier	Enrichment (w/o U-235)
SPCA9-393B-16GZ-100M	19A	3.93
SPCA9-396B-12GZB-100M	19B	3.96
SPCA9-396B-12GZC-100M	19C	3.96
SPCA9-384B-11GZ6-80M	28B	3.84

I.1.2 Axial Enrichment and Burnable Poison Distribution

Assembly Name	Batch Identifier	Figure
SPCA9-393B-16GZ-100M	19A	1
SPCA9-396B-12GZB-100M	19B	1
SPCA9-396B-12GZC-100M	19C	1
SPCA9-384B-11GZ6-80M	28B	2

I.1.3 Radial Enrichment and Burnable Poison Distribution

Lattice Name	Batch Found In	Figure
SPCA9-4.56L-12G8.0/4G3.0-100M	19A	3
SPCA9-4.56L-12G8.0-100M	19A	4
SPCA9-3.91L-12G8.0-100M	19A	5
SPCA9-3.90L-8G5.0-100M	19A	6
SPCA9-4.59L-12G8.0-100M	19B	7
SPCA9-4.59L-12G7.0-100M	19B	8
SPCA9-3.96L-8G7.0/4G8.0-100M	19B	9
SPCA9-3.96L-8G5.0-100M	19B and 19C	10
SPCA9-4.58L-8G6.0/4G3.0-100M	19C	11
SPCA9-4.58L-8G6.0-100M	19C	12
SPCA9-4.06L-11G6.0-80M	28B	13
SPCA9-4.34L-10G6.0-80M	28B	14

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I.2 Core Nuclear Design

I.2.1 Core Configuration and Licensing Exposure Limits

Assembly Name	Cycle Loaded	Number in Core
GE9B-P8CWB322-11GZ-100M-150-CECO	7	56
GE9B-P8CWB320-9GZ-100M-150-CECO	7	89
GE9B-P8CWB343-12GZ-80M-150-CECO	8	104
GE9B-P8CWB342-10GZ-80M-150-CECO	8	143
SPCA9-384B-11GZ6-80M	9	36
SPCA9-393B-16GZ-100M	9	208
SPCA9-396B-12GZB-100M	9	88
SPCA9-396B-12GZC-100M	9	40

	Core Average Exposure	Core Incremental Exposure
Exposure at EOC 8 (Cycle N-1)		
Nominal EOC 8 (MWD/MT)	27966.9	12511.0
Short EOC 8 (MWD/MT) [for shutdown consideration]	27455.9	12000.0

Cycle 9 (Cycle N) neutronics analyses are valid for EOC 8 (Cycle N-1) exposures greater than 12000 MWD/MT. The exposure window that validates the pressurization transients can be found in the L1C9 reload analysis document (Reference 3).

	Core Average Exposure
Exposure at BOC 9 (Cycle N)	
With Nominal EOC 8 (MWD/MT)	10961.0
With Short EOC 8 (MWD/MT)	10634.9

The Cycle 9 incremental exposure to LFPC is 18000.0 MWD/MT (incremental energy to LFPC of 2418.0 GWD) based on a nominal EOC 8.

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I.2.2 Core Reactivity Characteristics

All values reported below are with zero xenon and are for 68°F moderator temperature. The MICROBURN-B cold BOC K-effective bias is 1.0050 (Reference 11). The shutdown margin calculations are based on the short cycle 8 exposure given in Section I.2.1.

BOC Cold K-Effective, All Rods Out	1.11710
BOC Cold K-Effective, All Rods In	0.96354
BOC Cold K-Effective, Strongest Rod Out	0.99407
BOC Shutdown Margin, % ΔK	1.09
Minimum Shutdown Margin, % ΔK	1.01
Cycle Exposure(s) of Minimum Shutdown Margin, MWD/MT	250.0 & 15000.0
Reactivity Defect (R-value) Total, % ΔK	0.08
Standby Liquid Control System (SLCS) Shutdown Margin, Cold Condition, 660 ppm enriched Boron, % ΔK	17.81

Note that the SLCS analysis results credit a B-10 enrichment of 45% at LaSalle.

II. Control Rod Withdrawal Error

Analysis was performed at a core power of 3489 MWt, 100% core flow (108.5 Mlbm/hr), unblocked (RBM not credited) conditions only. Figure 15 is the initial rod pattern for the case that set the limit for the ATRIUM-9B fuel in the core. Figure 16 is initial rod pattern for the case that set the limit for the GE9B fuel in the core. These results bound operation with 3323 MWt as the rated power for the core.

Distance Withdrawn (ft)	ATRIUM-9B ΔCPR	GE9B ΔCPR
12	0.29	0.31

The design complies with the SPC 1% plastic strain criteria via conformance to the PAPT (Protection Against Power Transient) LHGR limits. The design complies with the GE centerline melt criteria via conformance to the GE thermal overpower protection (TOP) criteria. The design complies with the GE 1% plastic strain criteria via conformance to updated GE mechanical overpower protection (MOP) criteria during a control rod withdrawal error event.

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III. Fuel Loading Error

The fuel loading error, including fuel mislocation and misorientation, is classified as an accident. By demonstrating that the fuel loading error meets the more stringent Anticipated Operational Occurrence (AOO) requirements, the offsite dose requirement is assured to be met. Because the events listed below result in a ΔCPR value that is less than that of the limiting transient, the AOO requirements and hence the off-site dose requirements are met for the fuel loading error.

The values reported below bound all fuel types found in the core.

Event	ΔCPR
Mislocated Bundle	0.31
Misoriented Bundle	0.17

The design complies with the SPC 1% plastic strain and centerline melt criteria via conformance to the PAPT (Protection Against Power Transient) LHGR limits.

IV. Control Rod Drop Accident

LaSalle is a Banked Position Withdrawal Sequence (BPWS) plant. In order to allow the site the option of shutting down the reactor by inserting control rods using the simplified control rod sequences shown in Table 1, the control rod drop accident analysis was performed for the simplified sequence. The results from this simplified sequence analysis bound those where BPWS guidelines are followed. The results demonstrate that the 280 cal/g Technical Specification limit for a control rod drop accident is not exceeded. Note that the 0.32%Δk adder mentioned below is included in this analysis to account for possible rod mispositioning errors as well as clumping effects.

Dropped Control Rod Worth without 0.32 %Δk adder, %Δk	0.722
Dropped Control Rod Worth with 0.32 %Δk adder, %Δk	1.042
Doppler Coefficient used, (Δk/k)/°F	-9.50E-06
Effective Delayed Neutron Fraction used	0.0052
Four-Bundle Local Peaking Factor	1.358
Maximum Deposited Fuel Rod Enthalpy with 0.32 %Δk adder, (cal/gm)	184.1
Number of Rods Greater than 170 cal/gm with 0.32%Δk adder	134

Note that the limit on maximum deposited fuel rod enthalpy is 280 cal/gm and the (conservative) limit on the number of rods greater that 170 cal/gm (failed rods) is 770 .

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V. Loss of Feedwater Heating

The loss of feedwater heating event is analyzed at a core power of 3489 MWt for 81%, 100% and 105% rated flow with an assumed inlet temperature decrease of 145°F. These results bound operation with 3323 MWt as the rated power for the core.

Event	ATRIUM-9B ΔCPR	GE9B ΔCPR
Loss of Feedwater Heating	0.19	0.18

The design complies with the SPC 1% plastic strain and centerline melt criteria via conformance to the PAPT (Protection Against Power Transient) LHGR limits. The design complies with the GE 1% plastic strain criteria via conformance to the mechanical overpower protection (MOP) limit. The design complies with the GE centerline melt criteria via conformance to the thermal overpower protection (TOP) limits. The analyses did not take credit for the thermal power scram function at the site.

VI. Maximum Exposure Limit Compliance

Note that the exposures listed below are based on the nominal Cycle 8 (Cycle N-1) exposure, 12511 MWD/MT, and the licensing basis (Reference 3) Cycle 9 (Cycle N) core average exposure of 29439 MWD/MT.

Exposure Criteria	GE9B Projected Exposure (GWD/MT)	GE9B Exposure Limit (GWD/MT)	ATRIUM-9B Projected Exposure (GWD/MT)	ATRIUM-9B Exposure Limit* (GWD/MT)
Peak Fuel Assembly	44.9	48.0**	23.8	48.0
Peak Fuel Batch	40.4	42.0	N/A	N/A
Peak Fuel Rod	N/A	N/A	26.4	55.0
Peak Fuel Pellet	58.4	65.0	35.6	66.0

* The ATRIUM-9B exposure limits identified are not applicable until document EMF-85-74 is added to the Technical Specifications (Tech Specs). Until this document is added to the Tech Specs, the ATRIUM-9B exposure limits are 48.0 GWD/MT for Peak Fuel Assembly (no change), 50.0 GWD/MT for Peak Fuel Rod and 60.0 GWD/MT for Peak Fuel Pellet.

** There is no peak fuel assembly exposure limit for GE9B fuel. The limit reported above is based on the maximum channel exposure assumption used in developing the safety limit MCPR for LaSalle 1 Cycle 9.

11-1-01
MYH, 11-1-01

VII. Spent Fuel Pool and Fresh Fuel Vault Criticality Compliance

For the L1C9 reload, there are three new SPC ATRIUM-9B assembly types consisting of 10 unique enriched lattices as well as one SPC ATRIUM-9B assembly type with 2 unique enriched lattices which was initially manufactured for use in L2C8. These four (total) assembly and twelve (total) enriched lattice types are identified in **I.1 New Reload Fuel Assembly Nuclear Design.** For the purpose of the following sections all four assembly types will be referred to as "new (ATRIUM-9B) assemblies".

VII.1 Fresh Fuel Vault Criticality Compliance

The fuel storage vault criticality analysis that is detailed in Reference 6 remains valid for the above lattices. All the new (ATRIUM-9B) assemblies comply with the fresh fuel vault criticality limits, i.e., all lattices have an enrichment of less than 5.00 wt % U-235 and a gadolinia content that is greater than 6 rods at 3.0 wt% Gd_2O_3.

VII.2 L1 Spent Fuel Pool Criticality Compliance

The LaSalle Unit 1 spent fuel pool criticality analysis that is detailed in Reference 7 remains valid for the above lattices. All the new (ATRIUM-9B) assemblies comply with the spent fuel pool criticality limits, i.e., all lattices have an enrichment of less than 4.60 wt % U-235 and a gadolinia content that is greater than 8 rods at 3.0 wt% Gd_2O_3.

VII.3 L2 Spent Fuel Pool Criticality Compliance

The LaSalle Unit 2 spent fuel pool criticality analysis that is detailed in Reference 8 remains valid for the above lattices. As shown below, all the new (ATRIUM-9B) assemblies comply with the LaSalle Unit 2 spent fuel pool criticality limit of k-eff < 0.95.

Lattice Type	Maximum k-inf*	Maximum in-Rack k-eff**	Spent Fuel Pool k-eff Limit
SPCA9-4.56L-12G8.0/4G3.0-100M	1.182	< 0.85	0.95
SPCA9-4.56L-12G8.0-100M	1.187	< 0.85	0.95
SPCA9-3.91L-12G8.0-100M	1.168	< 0.85	0.95
SPCA9-3.90L-8G5.0-100M	1.233	< 0.86	0.95
SPCA9-4.59L-12G8.0-100M	1.191	< 0.85	0.95
SPCA9-4.59L-12G7.0-100M	1.210	< 0.85	0.95
SPCA9-3.96L-8G7.0/4G8.0-100M	1.186	< 0.85	0.95
SPCA9-3.96L-8G5.0-100M	1.231	< 0.86	0.95
SPCA9-4.58L-8G6.0/4G3.0-100M	1.233	< 0.86	0.95
SPCA9-4.58L-8G6.0-100M	1.236	< 0.86	0.95
SPCA9-4.06L-11G6.0-80M	1.213	< 0.85	0.95
SPCA9-4.34L-10G6.0-80M	1.227	< 0.86	0.95

* From 68 °F, uncontrolled CASMO-3G results.

** From Figure 6.1 of Reference 8.

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VIII. References

1. Commonwealth Edison Topical Report NFSR-0091, "Benchmark of CASMO/MICROBURN BWR Nuclear Design Methods", Revision 0, Supplements 1 and 2, December 1991, March 1992, and May 1992, respectively; SER letter dated March 22, 1993.

2. "LaSalle 1 Cycle 9 Core Design", NDIT NFM9900038, Sequence 02, September 23, 1999.

3. "LaSalle Unit 1 Cycle 9 Reload Analysis", Siemens Power Corporation, EMF-2276.

4. "LaSalle Unit 1 Cycle 9 Plant Transient Analysis", Siemens Power Corporation, EMF-2277.

5. "Fuel Design Report for LaSalle Unit 1 Cycle 9 ATRIUM™-9B Fuel Assemblies", Siemens Power Corporation, EMF-2249(P), Revision 1, September 1999.

6. "Criticality Safety Analysis for ATRIUM-9B Fuel, LaSalle Units 1 and 2 New Fuel Storage Vault", Siemens Power Corporation, EMF-95-134(P), December 1995. [NDIT 960089, Revision 0 (sic).]

7. "Criticality Safety Analysis for ATRIUM-9B Fuel, LaSalle Unit 1 Spent Fuel Storage Pool (BORAL Rack)", Siemens Power Corporation, EMF-96-117(P), April 1996. [NDIT 960087, Revision 0 (sic).]

8. "Criticality Safety Analysis for ATRIUM-9B Fuel, LaSalle Unit 2 Spent Fuel Storage Pool (Boraflex Rack)", Siemens Power Corporation, EMF-95-088(P), February 1996. [NDIT 960088, Revision 0 (sic).]

9. "LS1 C9 Preliminary Bundle Design", NFM Calculation Note, BNDL:99-009, Revision 0, March 3, 1999.

10. "LS1 Projection to EOC N-1 for Cycle 9 FLLP", NFM Calculation Note, BNDL:99-027, Revision 0, April 22, 1999.

11. "LaSalle 1 Cycle 9 Design Basis for FLLP", NFM Calculation Note, BNDL:99-028, Revision 0, June 2, 1999.

12. "LaSalle 1 Cycle 9 Final Licensing Loading Pattern (FLLP)", NFM Calculation Note, BNDL:99-029, Revision 0, April 29, 1999.

13. "LaSalle 1 Cycle 9 LFWH", NFM Calculation Note, BNDL:99-035, Revision 0, June 25, 1999.

14. "LaSalle 1 Cycle 9 Standard RWE", NFM Calculation Note, BNDL:99-036, Revision 0, July 2, 1999.

15. "LaSalle 1 Cycle 9 MOPs/TOPs RWE", NFM Calculation Note, BNDL:BNDL:99-037, Revision 0, July 7, 1999.

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VIII. References

16. "LaSalle 1 Cycle 9 SLCS, CARO and CARI", NFM Calculation Note, BNDL:99-039, Revision 0, June 23, 1999.

17. "LaSalle 1 Cycle 9 Control Rod Drop Accident Analysis", NFM Calculation Note, BNDL:99-040, Revision 0, July 27, 1999.

18. "LaSalle Unit 1 Cycle 9 Bundle Misorientation Analysis", NFM Calculation Note, BNDL:99-054, Revision 0, August 20, 1999.

19. "LaSalle 1 Cycle 9 Fuel Assembly Mislocation Calculations", NFM Calculation Note, BNDL:99-055, Revision 0, July 29, 1999.

20. "LaSalle 1 Cycle 9 – L1C8 Data for GE Plastic Strain Analysis", NFM Calculation Note, BNDL:99-057, Revision 0, August 20, 1999.

21. "LaSalle 1 Cycle 9 – L1C9 Data for GE Plastic Strain Analysis", NFM Calculation Note, BNDL:99-058, Revision 0, August 18, 1999.

22. "LaSalle Unit 1 Cycle 9 New Fuel Storage", NDIT NFM9900119, Sequence 00, May 26,1999.

23. "LaSalle Unit 2 Cycle 8 Neutronics Licensing Report, Revision 2", NDIT NFM960103, Revision (sic) 2, March 22, 1999.

24. "LaSalle 1 Cycle 9 RWE Clad Strain Compliance", GE Proprietary Letter WHC:99-031 from William H. Hetzel to Dr. R.J. Chin, dated September 27, 1999.

25. "LaSalle 1 Cycle 9 NLR", NFM Calculation Note, BNDL:99-050, Revision 0, October 1999.

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Table 1

LaSalle 1 Cycle 9 Simplified Shutdown Sequences

Shutdown From an A1 Sequence

Rod Group	Insertion (Bank)	Comments*
7 or 8	48-00	Either Group 7 or 8 may be inserted first.
10	48-10	Groups 7 and 8 must be fully inserted prior to inserting any Group 10 rod.
10	10-00	Group 10 must be at 10 prior to inserting any Group 10 rod to 00.
9	48-10	Group 10 must be fully inserted prior to inserting any Group 9 rod.
9	10-00	Group 9 must be at 10 prior to inserting any Group 9 rod to 00.
5 or 6	48-00	Groups 5 and 6 may be inserted without banking anytime after Groups 7 and 8 have been inserted and before Group 4 is inserted.
4	48-00	Groups 5 through 10 must be fully inserted prior to inserting any Group 4 rod.
3	48-10	Group 4 must be fully inserted prior to inserting any Group 3 rod.
3	10-00	Group 3 must be at 10 prior to inserting any Group 3 rod to 00.
2	48-00	Group 3 must be fully inserted prior to inserting any Group 2 rod.
1	48-00	Group 2 must be fully inserted prior to inserting any Group 1 rod.

Shutdown from an A2 Sequence

Rod Group	Insertion (Bank)	Comments*
9 or 10	48-00	Either Group 9 or 10 may be inserted first.
8	48-00	Groups 9 and 10 must be fully inserted prior to inserting any Group 8 rod.
7	48-10	Group 8 must be fully inserted prior to inserting any Group 7 rod.
7	10-00	Group 7 must be at 10 prior to inserting any Group 7 rod to 00.
5 or 6	48-00	Groups 5 and 6 may be inserted without banking anytime after Groups 9 and 10 have been inserted and before Group 4 is inserted.
4	48-00	Groups 5 through 10 must be fully inserted prior to inserting any Group 4 rod.
3	48-10	Group 4 must be fully inserted prior to inserting any Group 3 rod.
3	10-00	Group 3 must be at 10 prior to inserting any Group 3 rod to 00..
2	48-00	Group 3 must be fully inserted prior to inserting any Group 2 rod.
1	48-00	Group 2 must be fully inserted prior to inserting any Group 1 rod.

* The standard BPWS rules concerning out-of-service rods apply to the shutdown sequences.

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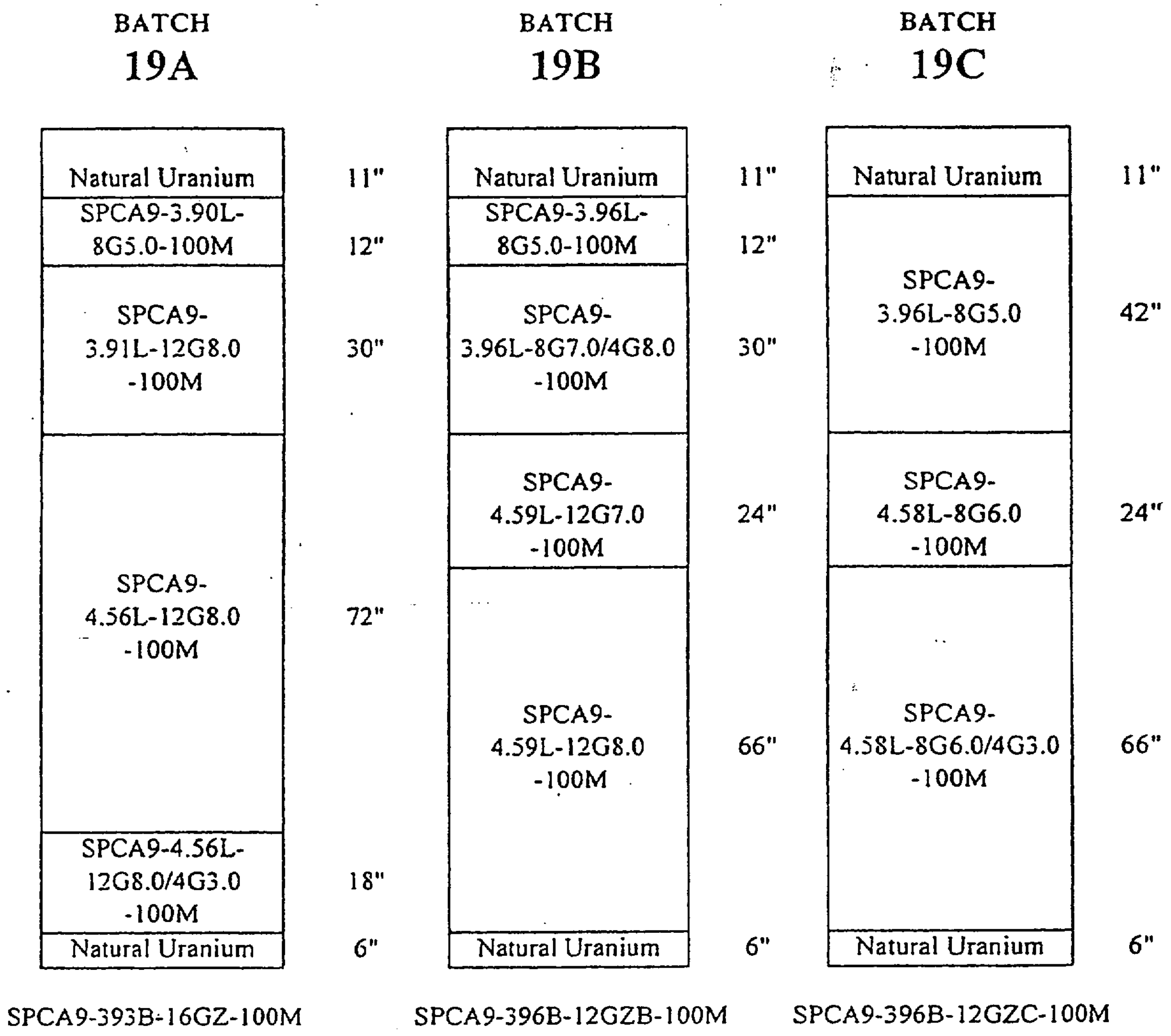

Figure 1

L1C9 ATRIUM-9B Assembly Axial Designs (100M Channels)

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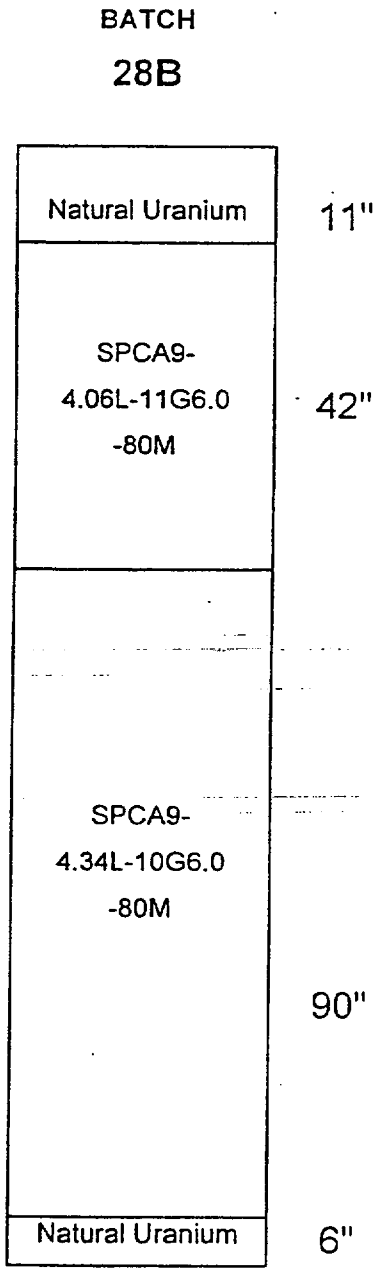

SPCA9-384B-11GZ6-80M

Figure 2

L1C9 ATRIUM-9B Assembly Axial Designs (80M Channels)

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1 3.00	2 4.00	3 4.70	4 4.95	4 4.95	4 4.95	3 4.70	2 4.00	1 3.00
2 4.00	G3 4.00	G2 4.20	4 4.95	G1 4.70	4 4.95	G2 4.20	G3 4.00	2 4.00
3 4.70	G2 4.20	4 4.95	4 4.95	4 4.95	4 4.95	4 4.95	G2 4.20	3 4.70
4 4.95	4 4.95	4 4.95	Internal Water Channel			4 4.95	4 4.95	4 4.95
4 4.95	G1 4.70	4 4.95				4 4.95	G1 4.70	4 4.95
4 4.95	4 4.95	4 4.95				4 4.95	4 4.95	4 4.95
3 4.70	G2 4.20	4 4.95	4 4.95	4 4.95	4 4.95	4 4.95	G2 4.20	3 4.70
2 4.00	G3 4.00	G2 4.20	4 4.95	G1 4.70	4 4.95	G2 4.20	G3 4.00	2 4.00
1 3.00	2 4.00	3 4.70	4 4.95	4 4.95	4 4.95	3 4.70	2 4.00	1 3.00

1	Rods (4)	3.00 w/o U-235
2	Rods (8)	4.00 w/o U-235
3	Rods (8)	4.70 w/o U-235
4	Rods (36)	4.95 w/o U-235
G1	Rods (4)	4.70 w/o U-235+8.0 w/o Gd2O3
G2	Rods (8)	4.20 w/o U-235+8.0 w/o Gd2O3
G3	Rods (4)	4.00 w/o U-235+3.0 w/o Gd2O3

Figure 3
SPCA9-4.56L-12G8.0/4G3.0-100M (19A)
Enrichment Distribution

8/20/99

1 3.00	2 4.00	3 4.70	4 4.95	4 4.95	4 4.95	3 4.70	2 4.00	1 3.00
2 4.00	2 4.00	G2 4.20	4 4.95	G1 4.70	4 4.95	G2 4.20	2 4.00	2 4.00
3 4.70	G2 4.20	4 4.95	4 4.95	4 4.95	4 4.95	4 4.95	G2 4.20	3 4.70
4 4.95	4 4.95	4 4.95	Internal Water Channel			4 4.95	4 4.95	4 4.95
4 4.95	G1 4.70	4 4.95				4 4.95	G1 4.70	4 4.95
4 4.95	4 4.95	4 4.95				4 4.95	4 4.95	4 4.95
3 4.70	G2 4.20	4 4.95	4 4.95	4 4.95	4 4.95	4 4.95	G2 4.20	3 4.70
2 4.00	2 4.00	G2 4.20	4 4.95	G1 4.70	4 4.95	G2 4.20	2 4.00	2 4.00
1 3.00	2 4.00	3 4.70	4 4.95	4 4.95	4 4.95	3 4.70	2 4.00	1 3.00

1	Rods (4)	3.00 w/o U-235
2	Rods (12)	4.00 w/o U-235
3	Rods (8)	4.70 w/o U-235
4	Rods (36)	4.95 w/o U-235
G1	Rods (4)	4.70 w/o U-235+8.0 w/o Gd2O3
G2	Rods (8)	4.20 w/o U-235+8.0 w/o Gd2O3

Figure 4
SPCA9-4.56L-12G8.0-100M (19A)
Enrichment Distribution

8/20/99

1 2.60	2 3.40	3 3.80	4 4.40	4 4.40	4 4.40	3 3.80	2 3.40	1 2.60
2 3.40	2 3.40	G1 3.40	4 4.40	G1 3.40	4 4.40	G1 3.40	2 3.40	2 3.40
3 3.80	G1 3.40	4 4.40	4 4.40	4 4.40	4 4.40	4 4.40	G1 3.40	3 3.80
4 4.40	4 4.40	4 4.40	Internal Water Channel			4 4.40	4 4.40	4 4.40
4 4.40	G1 3.40	4 4.40				4 4.40	G1 3.40	4 4.40
4 4.40	4 4.40	4 4.40				4 4.40	4 4.40	4 4.40
3 3.80	G1 3.40	4 4.40	4 4.40	4 4.40	4 4.40	4 4.40	G1 3.40	3 3.80
2 3.40	2 3.40	G1 3.40	4 4.40	G1 3.40	4 4.40	G1 3.40	2 3.40	2 3.40
1 2.60	2 3.40	3 3.80	4 4.40	4 4.40	4 4.40	3 3.80	2 3.40	1 2.60

1	Rods (4)	2.60 w/o U-235
2	Rods (12)	3.40 w/o U-235
3	Rods (8)	3.80 w/o U-235
4	Rods (36)	4.40 w/o U-235
G1	Rods (12)	3.40 w/o U-235+8.0 w/o Gd2O3

Figure 5
SPCA9-3.91L-12G8.0-100M (19A)
Enrichment Distribution

8/20/99

1 2.60	2 3.40	3 3.80	4 4.40	4 4.40	4 4.40	3 3.80	2 3.40	1 2.60
2 3.40	2 3.40	G1 3.40	4 4.40	2 3.40	4 4.40	G1 3.40	2 3.40	2 3.40
3 3.80	G1 3.40	4 4.40	4 4.40	4 4.40	4 4.40	4 4.40	G1 3.40	3 3.80
4 4.40	4 4.40	4 4.40	Internal Water Channel			4 4.40	4 4.40	4 4.40
4 4.40	2 3.40	4 4.40				4 4.40	2 3.40	4 4.40
4 4.40	4 4.40	4 4.40				4 4.40	4 4.40	4 4.40
3 3.80	G1 3.40	4 4.40	4 4.40	4 4.40	4 4.40	4 4.40	G1 3.40	3 3.80
2 3.40	2 3.40	G1 3.40	4 4.40	2 3.40	4 4.40	G1 3.40	2 3.40	2 3.40
1 2.60	2 3.40	3 3.80	4 4.40	4 4.40	4 4.40	3 3.80	2 3.40	1 2.60

1	Rods (4)	2.60 w/o U-235
2	Rods (16)	3.40 w/o U-235
3	Rods (8)	3.80 w/o U-235
4	Rods (36)	4.40 w/o U-235
G1	Rods (8)	3.40 w/o U-235+5.0 w/o Gd2O3

Figure 6
SPCA9-3.90L-8G5.0-100M (19A)
Enrichment Distribution

8/20/99

1 3.00	2 4.00	3 4.70	4 4.95	4 4.95	4 4.95	3 4.70	2 4.00	1 3.00
2 4.00	G1 4.20	4 4.95	G1 4.20	4 4.95	G1 4.20	4 4.95	G1 4.20	2 4.00
3 4.70	4 4.95	4 4.95	4 4.95	4 4.95	4 4.95	4 4.95	4 4.95	3 4.70
4 4.95	G1 4.20	4 4.95	Internal Water Channel			4 4.95	G1 4.20	4 4.95
4 4.95	4 4.95	4 4.95				4 4.95	4 4.95	4 4.95
4 4.95	G1 4.20	4 4.95				4 4.95	G1 4.20	4 4.95
3 4.70	4 4.95	4 4.95	4 4.95	4 4.95	4 4.95	4 4.95	4 4.95	3 4.70
2 4.00	G1 4.20	4 4.95	G1 4.20	4 4.95	G1 4.20	4 4.95	G1 4.20	2 4.00
1 3.00	2 4.00	3 4.70	4 4.95	4 4.95	4 4.95	3 4.70	2 4.00	1 3.00

1	Rods (4)	3.00 w/o U-235
2	Rods (8)	4.00 w/o U-235
3	Rods (8)	4.70 w/o U-235
4	Rods (40)	4.95 w/o U-235
G1	Rods (12)	4.20 w/o U-235+8.0 w/o Gd2O3

Figure 7
SPCA9-4.59L-12G8.0-100M (19B)
Enrichment Distribution

8/20/99

1 3.00	2 4.00	3 4.70	4 4.95	4 4.95	4 4.95	3 4.70	2 4.00	1 3.00
2 4.00	G1 4.20	4 4.95	G1 4.20	4 4.95	G1 4.20	4 4.95	G1 4.20	2 4.00
3 4.70	4 4.95	4 4.95	4 4.95	4 4.95	4 4.95	4 4.95	4 4.95	3 4.70
4 4.95	G1 4.20	4 4.95	Internal Water Channel			4 4.95	G1 4.20	4 4.95
4 4.95	4 4.95	4 4.95				4 4.95	4 4.95	4 4.95
4 4.95	G1 4.20	4 4.95				4 4.95	G1 4.20	4 4.95
3 4.70	4 4.95	4 4.95	4 4.95	4 4.95	4 4.95	4 4.95	4 4.95	3 4.70
2 4.00	G1 4.20	4 4.95	G1 4.20	4 4.95	G1 4.20	4 4.95	G1 4.20	2 4.00
1 3.00	2 4.00	3 4.70	4 4.95	4 4.95	4 4.95	3 4.70	2 4.00	1 3.00

1	Rods (4)	3.00 w/o U-235
2	Rods (8)	4.00 w/o U-235
3	Rods (8)	4.70 w/o U-235
4	Rods (40)	4.95 w/o U-235
G1	Rods (12)	4.20 w/o U-235+7.0 w/o Gd2O3

Figure 8
SPCA9-4.59L-12G7.0-100M (19B)
Enrichment Distribution

8/20/99
10/6/99

1 2.60	2 3.40	3 3.80	4 4.40	4 4.40	4 4.40	3 3.80	2 3.40	1 2.60
2 3.40	G2 3.40	4 4.40	G1 3.40	4 4.40	G1 3.40	4 4.40	G2 3.40	2 3.40
3 3.80	4 4.40	4 4.40	4 4.40	4 4.40	4 4.40	4 4.40	4 4.40	3 3.80
4 4.40	G1 3.40	4 4.40	Internal Water Channel			4 4.40	G1 3.40	4 4.40
4 4.40	4 4.40	4 4.40				4 4.40	4 4.40	4 4.40
4 4.40	G1 3.40	4 4.40				4 4.40	G1 3.40	4 4.40
3 3.80	4 4.40	4 4.40	4 4.40	4 4.40	4 4.40	4 4.40	4 4.40	3 3.80
2 3.40	G2 3.40	4 4.40	G1 3.40	4 4.40	G1 3.40	4 4.40	G2 3.40	2 3.40
1 2.60	2 3.40	3 3.80	4 4.40	4 4.40	4 4.40	3 3.80	2 3.40	1 2.60

1	Rods (4)	2.60 w/o U-235
2	Rods (8)	3.40 w/o U-235
3	Rods (8)	3.80 w/o U-235
4	Rods (40)	4.40 w/o U-235
G1	Rods (8)	3.40 w/o U-235+7.0 w/o Gd2O3
G2	Rods (4)	3.40 w/o U-235+8.0 w/o Gd2O3

Figure 9
SPCA9-3.96L-8G7.0/4G8.0-100M (19B)
Enrichment Distribution

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1 2.60	2 3.40	3 3.80	4 4.40	4 4.40	4 4.40	3 3.80	2 3.40	1 2.60
2 3.40	2 3.40	4 4.40	G1 3.40	4 4.40	G1 3.40	4 4.40	2 3.40	2 3.40
3 3.80	4 4.40	4 4.40	4 4.40	4 4.40	4 4.40	4 4.40	4 4.40	3 3.80
4 4.40	G1 3.40	4 4.40	Internal Water Channel			4 4.40	G1 3.40	4 4.40
4 4.40	4 4.40	4 4.40				4 4.40	4 4.40	4 4.40
4 4.40	G1 3.40	4 4.40				4 4.40	G1 3.40	4 4.40
3 3.80	4 4.40	4 4.40	4 4.40	4 4.40	4 4.40	4 4.40	4 4.40	3 3.80
2 3.40	2 3.40	4 4.40	G1 3.40	4 4.40	G1 3.40	4 4.40	2 3.40	2 3.40
1 2.60	2 3.40	3 3.80	4 4.40	4 4.40	4 4.40	3 3.80	2 3.40	1 2.60

1	Rods (4)	2.60 w/o U-235
2	Rods (12)	3.40 w/o U-235
3	Rods (8)	3.80 w/o U-235
4	Rods (40)	4.40 w/o U-235
G1	Rods (8)	3.40 w/o U-235+5.0 w/o Gd2O3

Figure 10
SPCA9-3.96L-8G5.0-100M (19B and 19C)
Enrichment Distribution

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1 3.00	2 4.00	3 4.70	4 4.95	4 4.95	4 4.95	3 4.70	2 4.00	1 3.00
2 4.00	G2 4.00	4 4.95	G1 4.20	4 4.95	G1 4.20	4 4.95	G2 4.00	2 4.00
3 4.70	4 4.95	4 4.95	4 4.95	4 4.95	4 4.95	4 4.95	4 4.95	3 4.70
4 4.95	G1 4.20	4 4.95	Internal Water Channel			4 4.95	G1 4.20	4 4.95
4 4.95	4 4.95	4 4.95				4 4.95	4 4.95	4 4.95
4 4.95	G1 4.20	4 4.95				4 4.95	G1 4.20	4 4.95
3 4.70	4 4.95	4 4.95	4 4.95	4 4.95	4 4.95	4 4.95	4 4.95	3 4.70
2 4.00	G2 4.00	4 4.95	G1 4.20	4 4.95	G1 4.20	4 4.95	G2 4.00	2 4.00
1 3.00	2 4.00	3 4.70	4 4.95	4 4.95	4 4.95	3 4.70	2 4.00	1 3.00

1	Rods (4)	3.00 w/o U-235
2	Rods (8)	4.00 w/o U-235
3	Rods (8)	4.70 w/o U-235
4	Rods (40)	4.95 w/o U-235
G1	Rods (8)	4.20 w/o U-235+6.0 w/o Gd2O3
G2	Rods (4)	4.00 w/o U-235+3.0 w/o Gd2O3

Figure 11
SPCA9-4.58L-8G6.0/4G3.0-100M (19C)
Enrichment Distribution

8/20/99

10/6/99

1 3.00	2 4.00	3 4.70	4 4.95	4 4.95	4 4.95	3 4.70	2 4.00	1 3.00
2 4.00	2 4.00	4 4.95	G1 4.20	4 4.95	G1 4.20	4 4.95	2 4.00	2 4.00
3 4.70	4 4.95	4 4.95	4 4.95	4 4.95	4 4.95	4 4.95	4 4.95	3 4.70
4 4.95	G1 4.20	4 4.95	Internal Water Channel			4 4.95	G1 4.20	4 4.95
4 4.95	4 4.95	4 4.95				4 4.95	4 4.95	4 4.95
4 4.95	G1 4.20	4 4.95				4 4.95	G1 4.20	4 4.95
3 4.70	4 4.95	4 4.95	4 4.95	4 4.95	4 4.95	4 4.95	4 4.95	3 4.70
2 4.00	2 4.00	4 4.95	G1 4.20	4 4.95	G1 4.20	4 4.95	2 4.00	2 4.00
1 3.00	2 4.00	3 4.70	4 4.95	4 4.95	4 4.95	3 4.70	2 4.00	1 3.00

1	Rods (4)	3.00 w/o U-235
2	Rods (12)	4.00 w/o U-235
3	Rods (8)	4.70 w/o U-235
4	Rods (40)	4.95 w/o U-235
G1	Rods (8)	4.20 w/o U-235+6.0 w/o Gd_2O_3

Figure 12
SPCA9-4.58L-8G6.0-100M(19C)
Enrichment Distribution

8/20/99
JKW 10/6/99

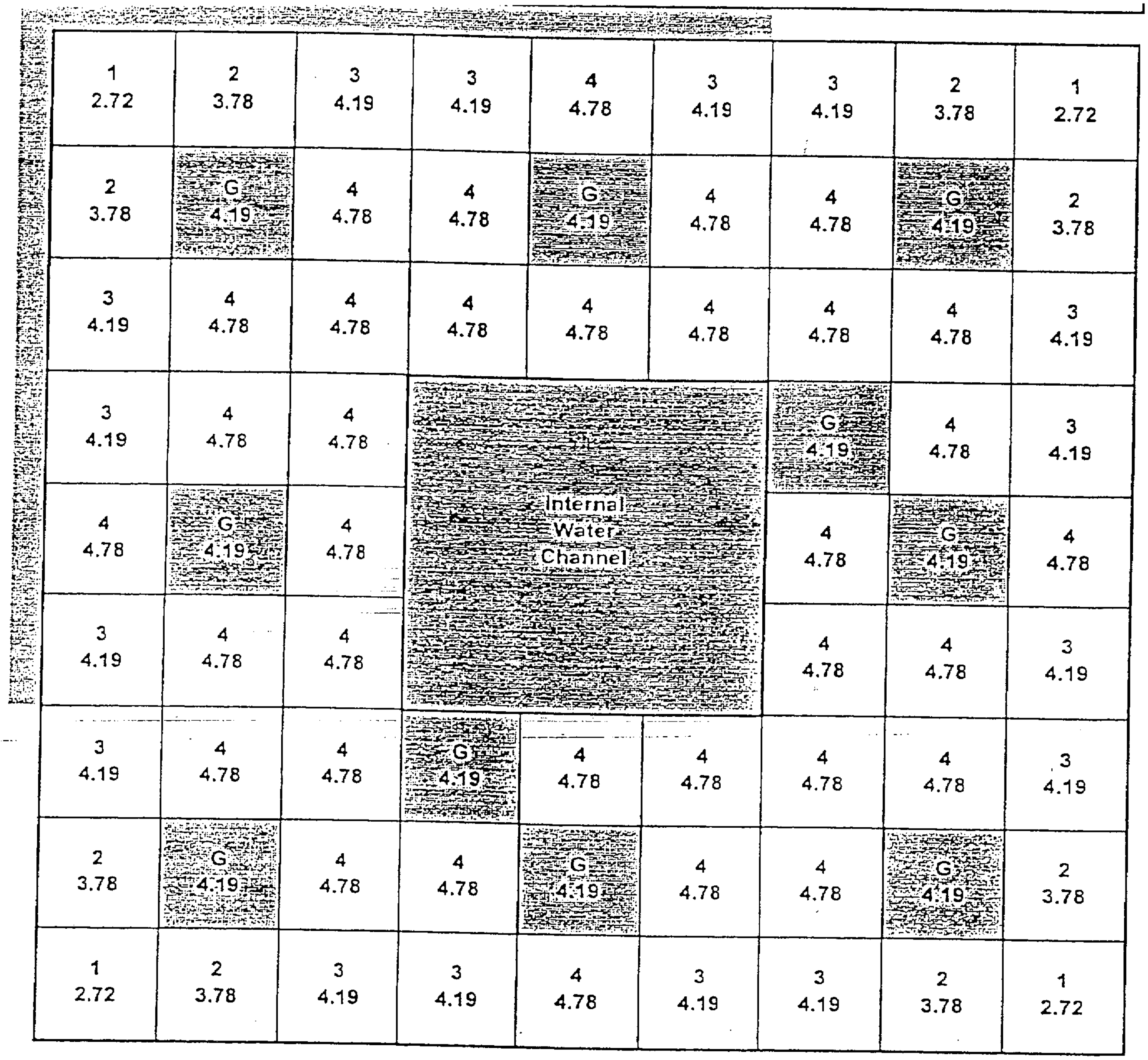
NUCLEAR FUEL MANAGEMENT TRANSMITTAL OF DESIGN INFORMATION	NFM ID#	NFM9900149
	Seq. No.	1
	Page 24 of 27	

1 2.72	2 3.53	3 3.94	3 3.94	4 4.53	3 3.94	3 3.94	2 3.53	1 2.72
2 3.53	G 3.69	4 4.53	4 4.53	G 3.69	4 4.53	4 4.53	G 3.69	2 3.53
3 3.94	4 4.53	4 4.53	4 4.53	4 4.53	4 4.53	4 4.53	4 4.53	3 3.94
3 3.94	4 4.53	4 4.53	Internal Water Channel			G 3.69	4 4.53	3 3.94
4 4.53	G 3.69	4 4.53				4 4.53	G 3.69	4 4.53
3 3.94	4 4.53	4 4.53				4 4.53	4 4.53	3 3.94
3 3.94	4 4.53	4 4.53	G 3.69	4 4.53	4 4.53	G 3.69	4 4.53	3 3.94
2 3.53	G 3.69	4 4.53	4 4.53	G 3.69	4 4.53	4 4.53	G 3.69	2 3.53
1 2.72	2 3.53	3 3.94	3 3.94	4 4.53	3 3.94	3 3.94	2 3.53	1 2.72

1	Rods (4)	2.72 w/o U-235
2	Rods (8)	3.53 w/o U-235
3	Rods (16)	3.94 w/o U-235
4	Rods (33)	4.53 w/o U-235
G	Rods (11)	3.69 w/o U-235+6.0 w/o Gd2O3

Figure 13
SPCA9-4.06L-11G6.0-80M (28B)
Enrichment Distribution

8/22/99
JKW 10/6/99



1 2.72	2 3.78	3 4.19	3 4.19	4 4.78	3 4.19	3 4.19	2 3.78	1 2.72
2 3.78	G 4.19	4 4.78	4 4.78	G 4.19	4 4.78	4 4.78	G 4.19	2 3.78
3 4.19	4 4.78	4 4.78	4 4.78	4 4.78	4 4.78	4 4.78	4 4.78	3 4.19
3 4.19	4 4.78	4 4.78				G 4.19	4 4.78	3 4.19
4 4.78	G 4.19	4 4.78		Internal Water Channel		4 4.78	G 4.19	4 4.78
3 4.19	4 4.78	4 4.78				4 4.78	4 4.78	3 4.19
3 4.19	4 4.78	4 4.78	G 4.19	4 4.78	4 4.78	4 4.78	4 4.78	3 4.19
2 3.78	G 4.19	4 4.78	4 4.78	G 4.19	4 4.78	4 4.78	G 4.19	2 3.78
1 2.72	2 3.78	3 4.19	3 4.19	4 4.78	3 4.19	3 4.19	2 3.78	1 2.72

1	Rods (4)	2.72 w/o U-235
2	Rods (8)	3.78 w/o U-235
3	Rods (16)	4.19 w/o U-235
4	Rods (34)	4.78 w/o U-235
G	Rods (10)	4.19 w/o U-235+6.0 w/o Gd2O3

Figure 14
SPCA9-4.34L-10G6.0-80M (28B)
Enrichment Distribution

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JKW 10/6/99

```
                         Cycle   9 Exposure 13000.0 MWd/MTU
                                             1746.3 GWd
                     Core Average Exposure 23961.4 MWd/MTU


Delta E: MWd/MTU, (GWd)                      .0   (     .00 )                         Axial Profile
Power: MWt                              3489.0 (100.00 %)                          N   Power    Exposure
Core Pressure: psia                     1020.1                              Top    25      .153      3.961
Inlet Subcooling: Btu/lbm               -18.28                                     24      .284      6.830
Flow: Mlb/hr                            108.50 (100.00 %)                          23      .663     16.284
                                                                                   22      .806     19.848
     2   6  10  14  18  22  26  30  34  38  42  46  50  54  58                     21      .874     21.821
59                  --  --  --  --  --  --  --                  59                 20      .935     23.364
55              --  --  16  --  --  --  16  --  --              55                 19      .978     24.366
51          --  --   0  --   0  --   0  --   0  --  --          51                 18     1.006     25.256
47      --  --  16  --  --  --  --  --  --  --  16  --  --      47                 17     1.010     26.344
43  --  --   0  --   8  --   0  --   0  --   8  --   0  --  --  43                 16     1.011     27.653
39  --  16  --  --  --  --  --  --  --  --  --  --  --  16  --  39                 15     1.013     28.409
35  --  --   0  --   0  --  16  --  16  --   0  --   0  --  --  35                 14     1.030     28.934
31  --  --  --  --  --  --  --  --  --  --  --  --  --  --  --  31                 13     1.056     29.323
27  --  --   0  --   0  --  16  --  16  --   0  --   0  --  --  27                 12     1.087     29.530
23  --  16  --  --  --  --  --  --  --  --  --  --  --  16  --  23                 11     1.128     29.908
19  --  --   0  --   8  --   0  --   0  --   8  --   0  --  --  19                 10     1.177     30.365
15      --  --  16  --  --  --  --  --  --  --  16  --  --      15                  9     1.231     30.778*
11          --  --   0  --   0  --   0  --   0  --  --          11                  8     1.279     30.556
 7              --  --  16  --  --  --  16  --  --               7                  7     1.347     30.740
 3                  --  --  --  --  --  --  --                   3                  6     1.421     30.648
     2   6  10  14  18  22  26  30  34  38  42  46  50  54  58                      5     1.485*    29.817
                                                                                    4     1.477     27.607
Control Rod Density: %                   20.54                                      3     1.308     23.608
                                                                                    2      .962     17.267
k-effective:                           1.00388                          Bottom      1      .279      4.864
Void Fraction:                            .448

Core Delta-P: psia                      21.675                    % AXIAL TILT -18.447 -10.750
Core Plate Delta-P: psia                17.213               AVG BOT 8ft/12ft  1.1042  1.0860
Coolant Temp: Deg-F                      545.8
In Channel Flow: Mlb/hr                  93.26     Active Channel Flow: Mlb/hr                  93.26
Source Convergence                      .00008
```

Figure 15
Initial RWE Rod Pattern for Limiting ATRIUM-9B Case
Error Rod is 34-43

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```
                              Cycle   9 Exposure       .0 MWd/MTU
                                                       .0 GWd
                            Core Average Exposure 10961.0 MWd/MTU

Delta E: MWd/MTU, (GWd)           .0 (    .00 )           Axial Profile
Power: MWt                    3489.0 (100.00 %)              N   Power Exposure
Core Pressure: psia           1020.1                    Top 25    .134   1.558
Inlet Subcooling: Btu/lbm     -18.28                        24    .242   2.748
Flow: Mlb/hr                  108.50 (100.00 %)             23    .614   6.567
                                                            22    .753   8.305
    2  6 10 14 18 22 26 30 34 38 42 46 50 54 58             21    .813   9.766
59             -- -- -- -- -- -- --             59          20    .885  10.769
55          -- -- 20 --  0 -- 20 -- --          55          19    .947  11.473
51       -- -- -- -- -- -- -- -- -- -- --       51          18   1.008  12.074
47    -- -- 12 --  0 -- 24 --  0 -- 12 -- --    47          17   1.084  12.760
43 -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- 43          16   1.209  13.155
39 -- 20 --  0 -- 24 --  0 -- 24 --  0 -- 20 -- 39          15   1.271  13.418
35 -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- 35          14   1.290  13.606
31 --  0 -- 24 --  0 -- 24 --  0 -- 24 --  0 -- 31          13   1.288  13.747
27 -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- 27          12   1.256  13.859
23 -- 20 --  0 -- 24 --  0 -- 24 --  0 -- 20 -- 23          11   1.254  13.965
19 -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- 19          10   1.273  14.034*
15    -- -- 12 --  0 -- 24 --  0 -- 12 -- --    15           9   1.304  14.008
11       -- -- -- -- -- -- -- -- -- -- --       11           8   1.326  13.527
 7          -- -- 20 --  0 -- 20 -- --           7           7   1.357  13.424
 3             -- -- -- -- -- -- --              3           6   1.365* 13.358
    2  6 10 14 18 22 26 30 34 38 42 46 50 54 58              5   1.316  13.185
                                                             4   1.164  12.622
Control Rod Density: %         15.23                         3    .968  11.120
                                                             2    .693   8.223
k-effective:                 1.00250                 Bottom  1    .187   2.308
Void Fraction:                  .430
Core Delta-P: psia            21.559             % AXIAL TILT -13.547 -10.296
Core Plate Delta-P: psia      17.096        AVG BOT 8ft/12ft  1.1172  1.0898
Coolant Temp: Deg-F            545.5
In Channel Flow: Mlb/hr        93.36  Active Channel Flow: Mlb/hr        93.36
Source Convergence            .00007
```

Figure 16

Initial RWE Rod Pattern for Limiting GE9B Case

Error Rod is 30-39

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JKW 10/6/99

Attachment 2

LaSalle Unit 1 Cycle 9

Reload Analysis

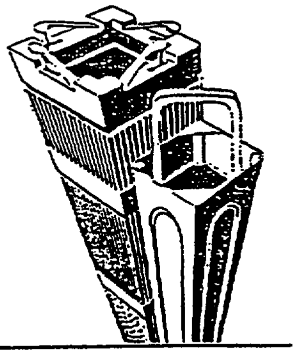
NDIT # NFM9900205

SIEMENS

EMF-2276
Revision 1

LaSalle Unit 1 Cycle 9 Reload Analysis

October 1999



Siemens Power Corporation
Nuclear Division

Siemens Power Corporation

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DATE: 10/7/99

EMF-2276
Revision 1

LaSalle Unit 1 Cycle 9
Reload Analysis

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Date

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D. G. Carr, Team Leader
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H. D. Curet, Manager
Product Licensing
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Approved: PDWimpy/for OCB 10/7/99
O. C. Brown, Manager
BWR Neutronics
Date

Approved: ME Garrett 10-6-99
M. E. Garrett, Manager
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Date

Approved: JHW for TM Howe 10/7/99
T. M. Howe, Manager
Product Mechanical Engineering
Date

Approved: Gail R Hartman for 7 Oct 1999
D. J. Denver, Manager
Commercial Operations
Date

gdh

Nature of Changes

Item	Page	Description and Justification
1.	5-1	Discussion added to indicate $MCPR_f$ limits and $LHGRFAC_f$ multipliers are provided for maximum core flows of 102.5% and 105% of rated.
2.	5-10	Revised Figure 5.1 to include $MCPR_f$ limits for both 102.5% and 105% maximum core flows.
3.	9-1	Updated references to revised plant transient analysis and fuel design reports.

The changed items are further identified by a vertical line (|) in the right-hand margin.

Contents

Tables

Figures

Nomenclature

AOO	abnormal operational occurrence
BOC	beginning of cycle
CPR	critical power ratio
EFPH	effective full power hour
EOC	end of cycle
EOD	extended operating domain
EOOS	equipment out of service
FHOOS	feedwater heater out of service
FWCF	feedwater controller failure
ICF	increased core flow
LFWH	loss of feedwater heater
LHGR	linear heat generation rate
LHGRFAC	LHGR multiplier
LPRM	local power range monitor
LRNB	load rejection no bypass
MAPLHGR	maximum average planar linear heat generation rate
MCPR	minimum critical power ratio
MELLLA	maximum extended load line limit area
MSIV	main steam isolation valve
NSS	nominal scram speed
PAPT	protection against power transient
PCT	peak clad temperature
RPT	recirculation pump trip
SLMCPR	safety limit minimum critical power ratio
SLO	single-loop operation
SPC	Siemens Power Corporation
SRVOOS	safety/relief valve out of service
TBVOOS	turbine bypass valves out of service
TCV	turbine control valve
TIP	traversing in-core probe
TIPOOS	traversing in-core probe out of service
TSSS	technical specification scram speed
UFSAR	updated final safety analysis report
ΔCPR	change in critical power ratio

1.0 Introduction

This report provides the results of the analysis performed by Siemens Power Corporation (SPC) as part of the reload analysis in support of the Cycle 9 reload for LaSalle Unit 1. This report is intended to be used in conjunction with the SPC topical Report XN-NF-80-19(P)(A), Volume 4, Revision 1, *Application of the ENC Methodology to BWR Reloads*, which describes the analyses performed in support of this reload, identifies the methodology used for those analyses, and provides a generic reference list. Section numbers in this report are the same as corresponding section numbers in XN-NF-80-19(P)(A), Volume 4, Revision 1. Methodology used in this report which supersedes XN-NF-80-19(P)(A), Volume 4, Revision 1, is referenced in Section 8.0. The NRC Technical Limitations presented in the methodology documents, including the documents referenced in Section 8.0, have been satisfied by these analyses.

Analyses performed by Commonwealth Edison Company (ComEd) are described elsewhere. This document alone does not necessarily identify the limiting events or the appropriate operating limits for Cycle 9. The limiting events and operating limits must be determined in conjunction with results from ComEd analyses.

The Cycle 9 core consists of a total of 764 fuel assemblies, including 372 unirradiated ATRIUM™-9B* assemblies and 392 irradiated GE9 assemblies. The reference core configuration is described in Section 4.2.

The design and safety analyses reported in this document were based on the design and operational assumptions in effect for LaSalle Unit 1 during the previous operating cycle. The effects of channel bow are explicitly accounted for in the safety limit analysis. The extended operating domain (EOD) and equipment out of service (EOOS) conditions presented in Table 1.1 are supported.

Analyses were performed to support end-of-cycle (EOC) operating limits. This report provides limits for both pre-power uprate (3323 MWt) and power uprate (3489 MWt) conditions. The analyses upon which the operating limits are based were performed such that both the pre-power uprate and power uprate limits are applicable for all of Cycle 9.

---

* ATRIUM is a trademark of Siemens.

Table 1.1 EOD and EOOS Operating Conditions

Extended Operating Domain (EOD) Conditions

- Increased Core Flow
- Maximum Extended Load Line Limit Analysis (MELLLA)

Equipment Out of Service (EOOS) Conditions*

- Feedwater Heaters Out of Service (FHOOS)
- Single-Loop Operation (SLO) - Recirculation Loop Out of Service
- Turbine Bypass Valves Out of Service (TBVOOS)
- Recirculation Pump Trip Out of Service (No RPT)
- Turbine Control Valve (TCV) Slow Closure and/or No RPT
- Safety-Relief Valve Out of Service (SRVOOS)
- Up to 2 TIP Machine(s) Out of Service (or the equivalent number of TIP channels)
- Up to 50% of the LPRMs Out of Service
- TCV Slow Closure, FHOOS and/or No RPT

---

* EOOS conditions are supported for EOD conditions as well as the standard operating domain. Each EOOS condition combined with 1 SRVOOS, up to 2 TIPOOS (or the equivalent number of TIP channels) and/or up to 50% of the LPRMs out of service is supported.

2.0 Fuel Mechanical Design Analysis

Applicable SPC Fuel Design Reports References 9.1 & 9.2

To assure that the power history for the ATRIUM-9B fuel to be irradiated during Cycle 9 of LaSalle Unit 1 is bounded by the assumed power history in the fuel mechanical design analysis, LHGR operating limits have been specified in Section 7.2.3. In addition, LHGR limits for Anticipated Operational Occurrences have been specified in Reference 9.1 and are presented in Section 7.2.3 as Figure 7.1.

3.0 Thermal-Hydraulic Design Analysis

3.2 *Hydraulic Characterization*

3.2.1 Hydraulic Compatibility

Component hydraulic resistances for the fuel types in the LaSalle Unit 1 Cycle 9 core have been determined in single-phase flow tests of full-scale assemblies. The hydraulic demand curves for SPC ATRIUM-9B and GE9 fuel in the LaSalle Unit 1 core are provided in Reference 9.1, Figure 4.2.

3.2.3 Fuel Centerline Temperature

Applicable Report ATRIUM-9B	Reference 9.1, Figure 3.3

3.2.5 Bypass Flow

Calculated Bypass Flow at 100%P/100%F (includes water channel flow)	14.7 Mlb/hr	Reference 9.3

3.3 *MCPR Fuel Cladding Integrity Safety Limit (SLMCPR)*

Two-Loop Operation[*]	1.11	Reference 9.3
Single-Loop Operation[*]	1.12	

3.3.1 Coolant Thermodynamic Condition

Thermal Power (at SLMCPR)	5232.35 MWt
Feedwater Flow Rate (at SLMCPR)	22.7 Mlbm/hr
Core Exit Pressure (at Rated Conditions)	1031.35 psia
Feedwater Temperature	426.5°F

---

[*] Includes the effects of channel bow, up to 2 TIPOOS (or the equivalent number of TIP channels), a 2000 EFPH LPRM calibration interval, and up to 50% of the LPRMs out of service.

3.3.2 Design Basis Radial Power Distribution

Figure 3.1 shows the radial power distribution used in the MCPR Fuel Cladding Integrity Safety Limit analysis.

3.3.3 Design Basis Local Power Distribution

Figures 3.2, 3.3 and 3.4 show the local power peaking factors used in the MCPR Fuel Cladding Integrity Safety Limit analysis.

SPCA9-393B-16GZ-100M	Figure 3.2
SPCA9-396B-12GZB-100M and SPCA9-396B-12GZC-100M	Figure 3.3
SPCA9-384B-11GZ-80M	Figure 3.4

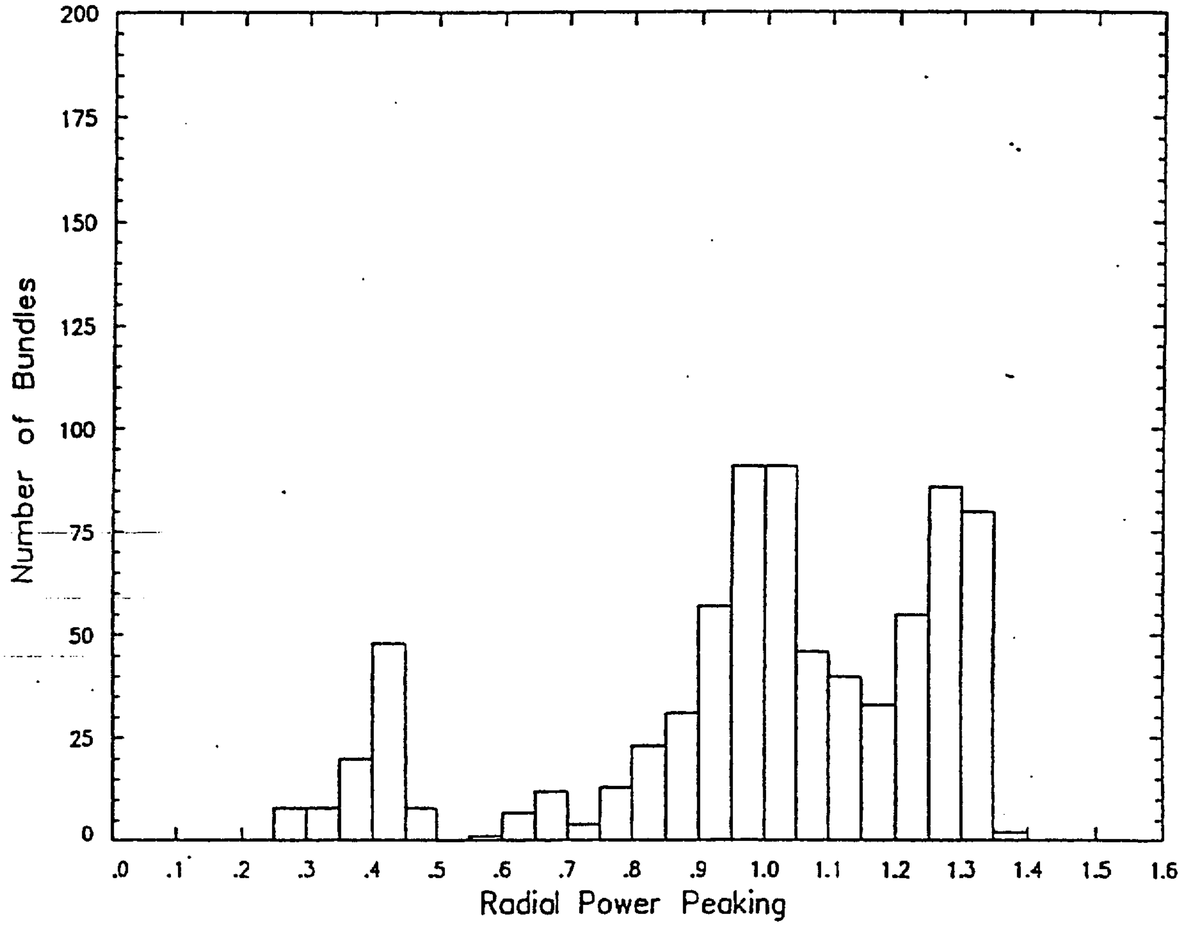

Figure 3.1 Radial Power Distribution
for SLMCPR Determination

Control Rod Corner

Control Rod Corner

1.023	1.055	1.068	1.112	1.099	1.102	1.049	1.023	.977
1.055	.958	.894	1.016	.894	1.007	.877	.927	1.002
1.068	.894	1.031	1.065	1.084	1.056	1.010	.863	1.011
1.112	1.016	1.065		Internal		1.044	.980	1.051
1.099	.894	1.084		Water		1.063	.863	1.038
1.102	1.007	1.056		Channel		1.035	.971	1.041
1.049	.877	1.010	1.044	1.063	1.035	.990	.846	.992
1.023	.927	.863	.980	.863	.971	.846	.895	.970
.977	1.002	1.011	1.051	1.038	1.041	.992	.970	.931

Figure 3.2 LaSalle Unit 1 Cycle 9 Safety Limit Local Peaking Factors
SPCA9-393B-16GZ-100M With Channel Bow

Control Rod Corner

Control Rod Corner

1.013	1.042	1.056	1.110	1.098	1.100	1.037	1.010	.967
1.042	.944	1.025	.879	1.014	.871	1.005	.912	.989
1.056	1.025	1.018	1.064	1.081	1.055	.997	.989	.999
1.110	.879	1.064		Internal		1.043	.848	1.047
1.098	1.014	1.081		Water		1.059	.978	1.035
1.100	.871	1.055		Channel		1.034	.840	1.037
1.037	1.005	.997	1.043	1.059	1.034	.977	.968	.979
1.010	.912	.989	.848	.978	.840	.968	.881	.956
.967	.989	.999	1.047	1.035	1.037	.979	.956	.921

Figure 3.3 LaSalle Unit 1 Cycle 9 Safety Limit Local Peaking Factors SPCA9-396B-12GZB-100M and SPCA9-396B-12GZC-100M With Channel Bow

Control Rod Corner

Control Rod Corner

1.022	1.056	1.061	1.035	1.102	1.028	1.045	1.029	.982
1.056	.947	1.018	1.003	.879	.997	1.004	.919	1.011
1.061	1.018	1.001	1.050	1.081	1.048	.996	.992	1.012
1.035	1.003	1.050		Internal		.926	.983	.987
1.102	.879	1.081		Water		1.077	.853	1.049
1.028	.997	1.048		Channel		1.040	.970	.979
1.045	1.004	.996	.926	1.077	1.040	.859	.980	.996
1.029	.919	.992	.983	.853	.970	.980	.891	.983
.982	1.011	1.012	.987	1.049	.979	.996	.983	.941

Figure 3.4 LaSalle Unit 1 Cycle 9 Safety Limit Local Peaking Factors
SPCA9-384B-11GZ-80M With Channel Bow

4.0 Nuclear Design Analysis

4.1 *Fuel Bundle Nuclear Design Analysis*

Assembly Average Enrichment (ATRIUM-9B fuel)

SPCA9-393B-16GZ-100M	3.93 wt%
SPCA9-396B-12GZB-100M	3.96 wt%
SPCA9-384B-11GZ-80M	3.84 wt%
SPCA9-396B-12GZC-100M	3.96 wt%

Radial Enrichment Distribution

SPCA9-4.56L-12G8.0/4G3.0-100M	Figure 4.1
SPCA9-4.56L-12G8.0-100M	Figure 4.2
SPCA9-3.91L-12G8.0-100M	Figure 4.3
SPCA9-3.90L-8G5.0-100M	Figure 4.4
SPCA9-4.59L-12G8.0-100M	Figure 4.5
SPCA9-4.59L-12G7.0-100M	Figure 4.6
SPCA9-3.96L-8G7.0/4G8.0-100M	Figure 4.7
SPCA9-3.96L-8G5.0-100M	Figure 4.8
SPCA9-4.58L-8G6.0/4G3.0-100M	Figure 4.9
SPCA9-4.58L-8G6.0-100M	Figure 4.10
SPCA9-4.06L-11G6.0-80M	Figures 4.11
SPCA9-4.34L-10G6.0-80M	Figures 4.12

Axial Enrichment Distribution	Figures 4.13–4.16
Burnable Absorber Distribution	Figures 4.13–4.16
Non-Fueled Rods	Figures 4.1–4.12
Neutronic Design Parameters	Table 4.1

Fuel Storage

LaSalle New Fuel Storage Vault	Reference 9.4

The LSA-1 Reload Batch fuel designs meet the fuel design limitations defined in Table 2.1 of Reference 9.4 and therefore can be safely stored in the vault.

LaSalle Unit 1 Spent Fuel Storage Pool (BORAL Racks)	Reference 9.5

The LSA-1 Reload Batch fuel designs meet the fuel design limitations defined in Table 2.1 of Reference 9.5 and therefore can be safely stored in the pool.

LaSalle Unit 2 Spent Fuel Storage Pool	Reference 9.6

The LSA-1 Reload Batch fuel designs can be safely stored as long as the fuel assembly reactivity limitations defined in Reference 9.6 are met.

< ComEd has responsibility to confirm that fuel meets reactivity limitations. >

4.2 *Core Nuclear Design Analysis*

4.2.1 Core Configuration

	Figure 4.17
Core Exposure at EOC8, MWd/MTU (nominal value)	27,957
Core Exposure at BOC9, MWd/MTU (from nominal EOC8)	10,962
Core Exposure at EOC9, MWd/MTU (licensing basis)	29,439

NOTE: Analyses in this report are applicable to a core exposure of 29,439 MWd/MTU.

< Cycle 9 short window exposure to be determined by ComEd. >

4.2.2 Core Reactivity Characteristics

< This data is to be furnished by ComEd. >

4.2.4 Core Hydrodynamic Stability

Reference 8.7

LaSalle Unit 1 utilizes the BWROG Interim Corrective Actions (ICAs) to address thermal hydraulic instability issues. This is in response to Generic Letter 94-02. When the long term solution OPRM is fully implemented, the ICAs will remain as a backup to the OPRM system.

In order to support the ICAs and remain cognizant of the relative stability of one cycle compared with previous cycles, decay ratios are calculated at various points on the power to flow map and at various points in the cycle. This satisfies the following functions.

1. Provides trending information to qualitatively compare the stability from cycle to cycle.
2. Provides decay ratio sensitivities to rod line and flow changes near the ICA regions.

3. Allows ComEd to review this information to determine if any administrative conservatisms are appropriate beyond the existing requirements.

The NRC approved STAIF computer code was used in the core hydrodynamic stability analysis performed in support of LaSalle Unit 1 Cycle 9. The power/flow state points used for this analysis were chosen to assist ComEd in performing the three functions described above. The Cycle 9 licensing basis control rod step-through projection was used to establish expected core depletion conditions. For each power/flow point, decay ratios were calculated at multiple cycle exposures to determine the highest expected decay ratio throughout the cycle. The results from this analysis are shown below.

Power/Flow (%)*	Maximum Global†	Maximum Regional†
29.6/26.6	0.73	0.61
30.3/29.2	0.48	0.53
51.9/26.6	>1.1	>1.1
54.4/29.2	>1.1	>1.1
61.9/50.0	0.46	0.69
73.6/50.0	0.67	1.04
78.1/55.0	0.57	0.90
82.4/60.0	0.49	0.79
70.0/55.0	0.44	0.69

For reactor operation under conditions of power coastdown, single-loop operation, final feedwater temperature reduction (FFTR) and/or operation with feedwater heaters out of service, it is possible that higher decay ratios could be achieved than are shown for normal operation.

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* NOTE: % power is based on 3489 MWt as rated. % flow is based on 108.5 Mlb/hr as rated.

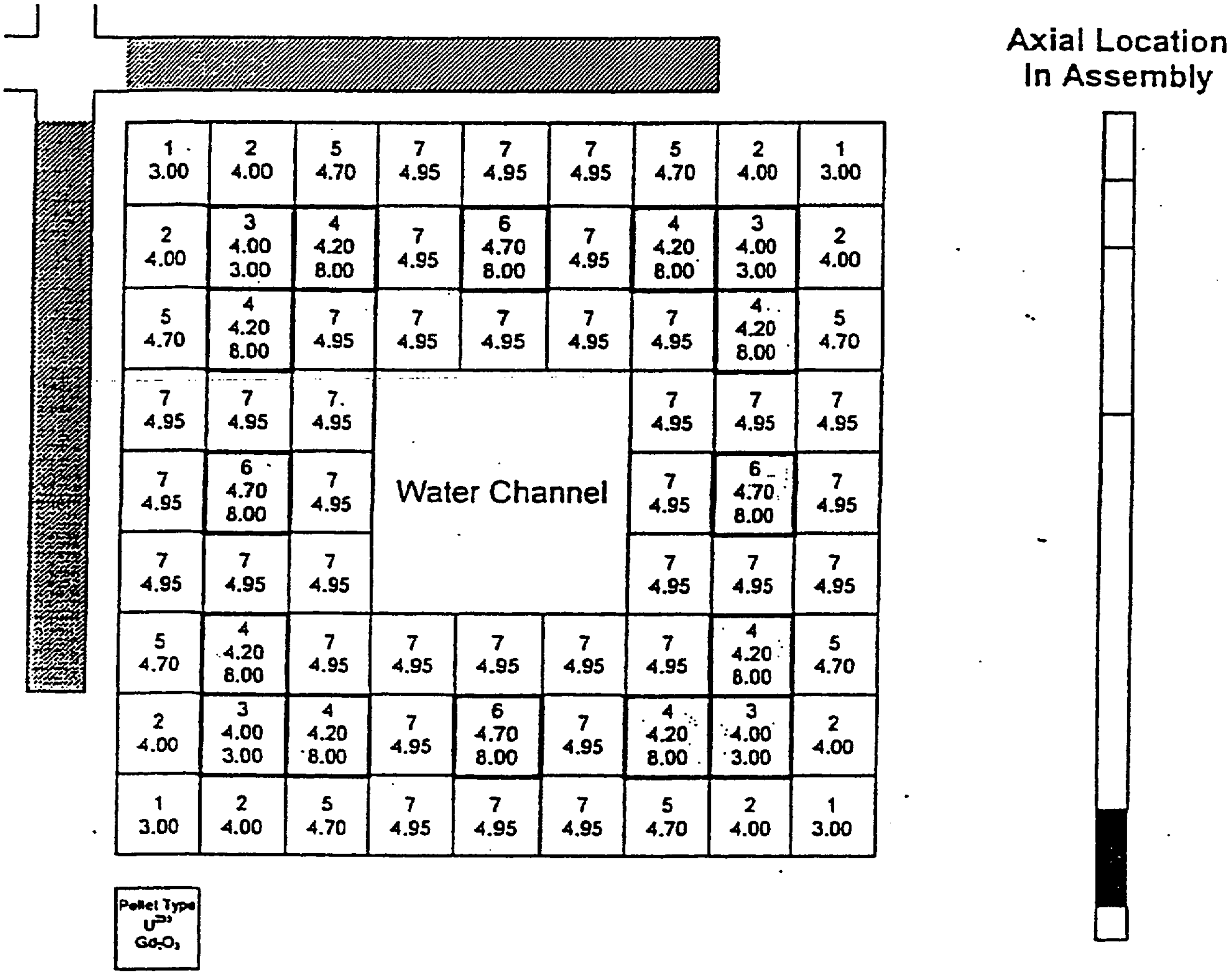
† NOTE: Decay ratios greater than 1.1 are outside the range of the STAIF methodology applicability. These points should be considered unstable without quantitative comparison.

Table 4.1 Neutronic Design Values

Number of Fuel Assemblies	764
Rated Thermal Power, MWt	3489
Rated Core Flow, Mlbm/hr	108.5
Core Inlet Subcooling, Btu/lbm	18.1
Moderator Temperature, °F	548.8
Channel Thickness, inch	0.080 & 0.100
Fuel Assembly Pitch, inch	6.0
Wide Water Gap Thickness, inch[•]	0.281/0.261
Narrow Water Gap Thickness, inch[•]	0.281/02.61
Control Rod Data[†]	
Absorber Material	B_4C
Total Blade Support Span, inch	1.580
Blade Thickness, inch	0.260
Blade Face-to-Face Internal Dimension, inch	0.200
Absorber Rod OD, inch	0.188
Absorber Rod ID, inch	0.138
Percentage B_4C, %TD	70

[•] The water gap thicknesses presented are based on 80/100-mil channels for ATRIUM-9B fuel.

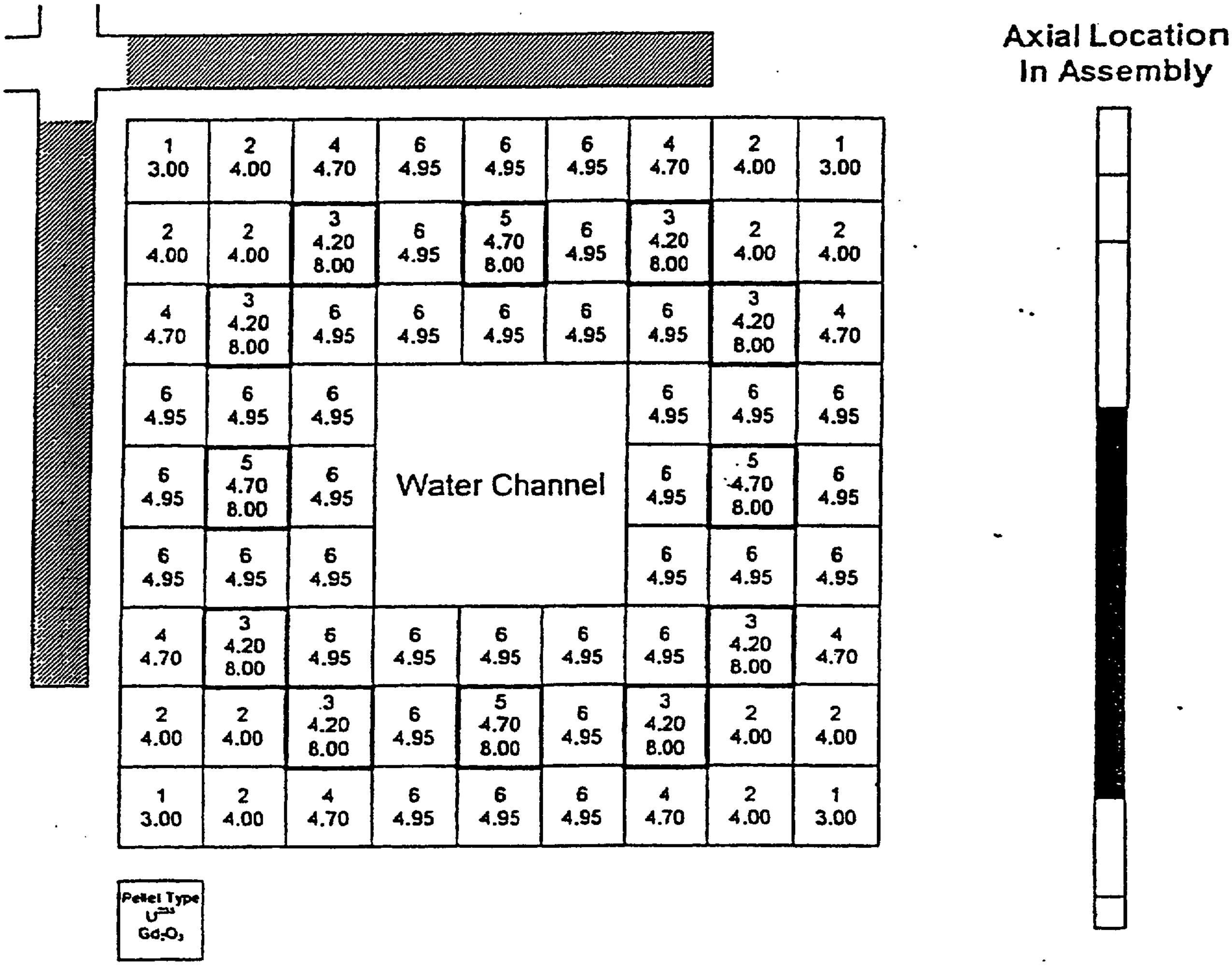
[†] The control rod data represents original equipment control blades at LaSalle and were used in the neutronic calculations.



1 3.00	2 4.00	5 4.70	7 4.95	7 4.95	7 4.95	5 4.70	2 4.00	1 3.00
2 4.00	3 4.00 3.00	4 4.20 8.00	7 4.95	6 4.70 8.00	7 4.95	4 4.20 8.00	3 4.00 3.00	2 4.00
5 4.70	4 4.20 8.00	7 4.95	7 4.95	7 4.95	7 4.95	7 4.95	4 4.20 8.00	5 4.70
7 4.95	7 4.95	7 4.95	Water Channel			7 4.95	7 4.95	7 4.95
7 4.95	6 4.70 8.00	7 4.95				7 4.95	6 4.70 8.00	7 4.95
7 4.95	7 4.95	7 4.95				7 4.95	7 4.95	7 4.95
5 4.70	4 4.20 8.00	7 4.95	7 4.95	7 4.95	7 4.95	7 4.95	4 4.20 8.00	5 4.70
2 4.00	3 4.00 3.00	4 4.20 8.00	7 4.95	6 4.70 8.00	7 4.95	4 4.20 8.00	3 4.00 3.00	2 4.00
1 3.00	2 4.00	5 4.70	7 4.95	7 4.95	7 4.95	5 4.70	2 4.00	1 3.00

Pellet Type	Quantity	U^{235} + Gd_2O_3 Concentration (wt%)
1	4	3.00
2	8	4.00
3	4	4.00 + 3.00
4	8	4.20 + 8.00
5	8	4.70
6	4	4.70 + 8.00
7	36	4.95

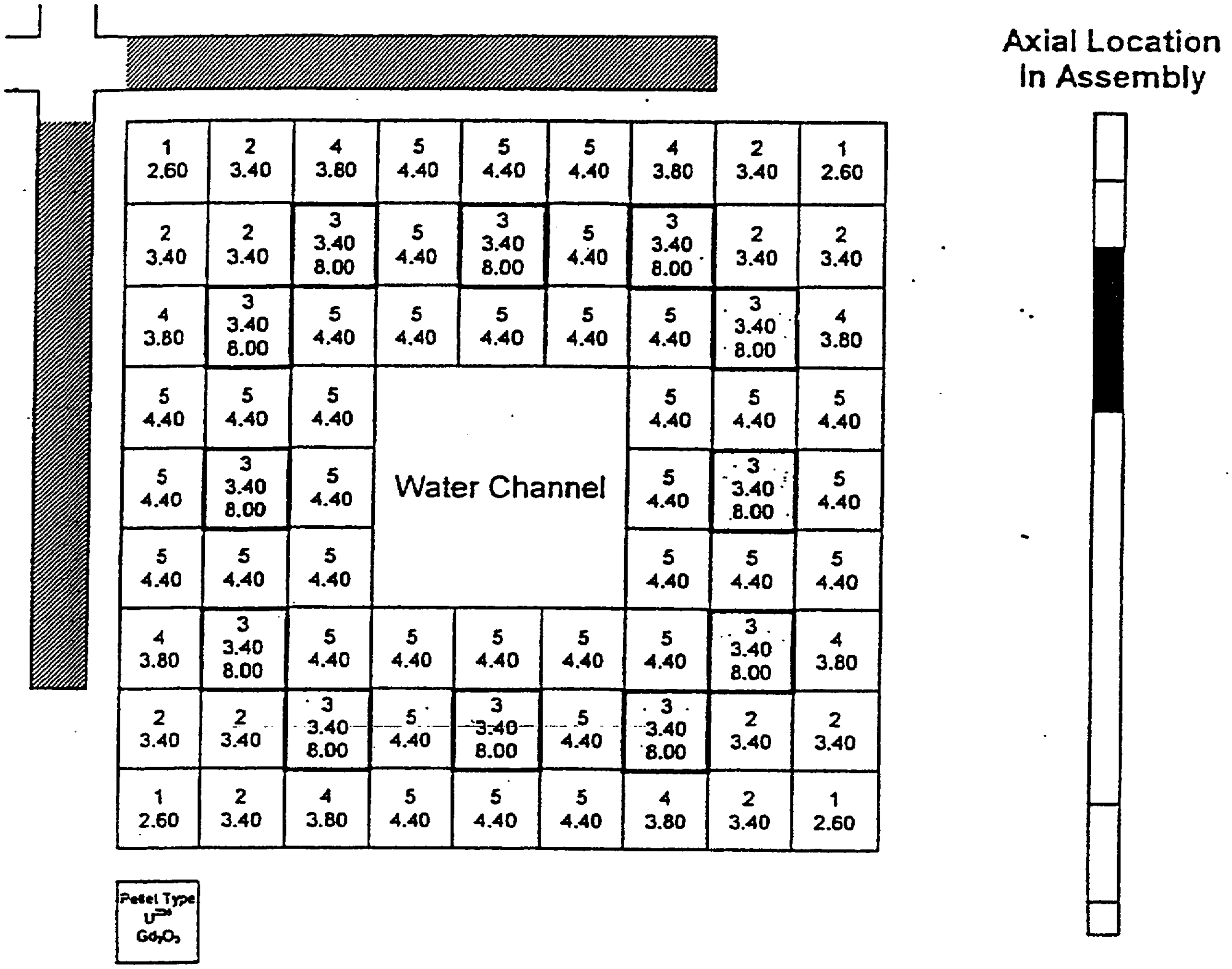
Figure 4.1 SPCA9-4.56L-12G8.0/4G3.0-100M
Enrichment Distribution



1 3.00	2 4.00	4 4.70	6 4.95	6 4.95	6 4.95	4 4.70	2 4.00	1 3.00
2 4.00	2 4.00	3 4.20 8.00	6 4.95	5 4.70 8.00	6 4.95	3 4.20 8.00	2 4.00	2 4.00
4 4.70	3 4.20 8.00	6 4.95	6 4.95	6 4.95	6 4.95	6 4.95	3 4.20 8.00	4 4.70
6 4.95	6 4.95	6 4.95				6 4.95	6 4.95	6 4.95
6 4.95	5 4.70 8.00	6 4.95		Water Channel		6 4.95	5 4.70 8.00	6 4.95
6 4.95	6 4.95	6 4.95				6 4.95	6 4.95	6 4.95
4 4.70	3 4.20 8.00	6 4.95	6 4.95	6 4.95	6 4.95	6 4.95	3 4.20 8.00	4 4.70
2 4.00	2 4.00	3 4.20 8.00	6 4.95	5 4.70 8.00	6 4.95	3 4.20 8.00	2 4.00	2 4.00
1 3.00	2 4.00	4 4.70	6 4.95	6 4.95	6 4.95	4 4.70	2 4.00	1 3.00

Pellet Type	Quantity	U^{235} + Gd_2O_3 Concentration (wt%)
1	4	3.00
2	12	4.00
3	8	4.20 + 8.00
4	8	4.70
5	4	4.70 + 8.00
6	36	4.95

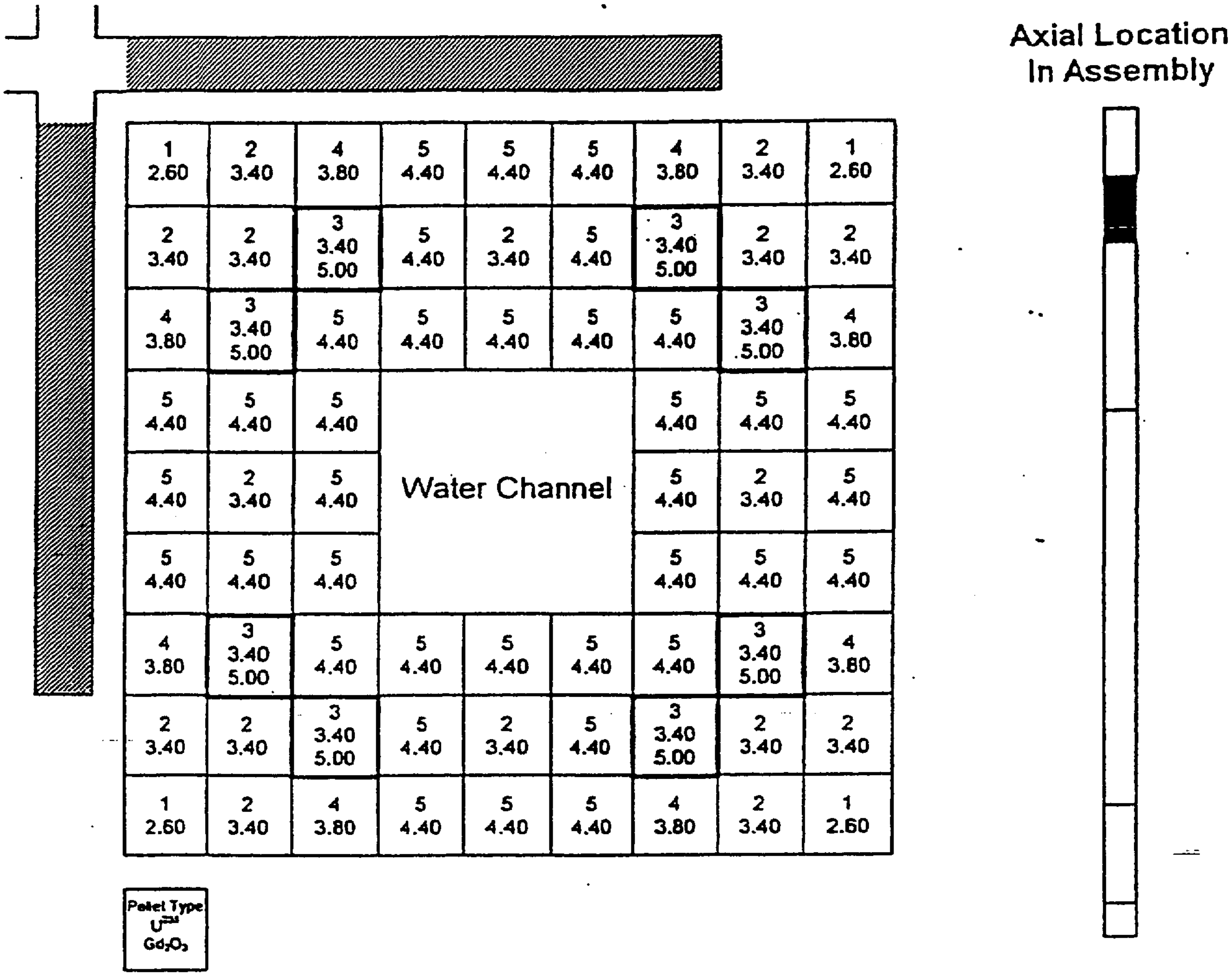
Figure 4.2 SPCA9-4.56L-12G8.0-100M
Enrichment Distribution



1 2.60	2 3.40	4 3.80	5 4.40	5 4.40	5 4.40	4 3.80	2 3.40	1 2.60
2 3.40	2 3.40	3 3.40 8.00	5 4.40	3 3.40 8.00	5 4.40	3 3.40 8.00	2 3.40	2 3.40
4 3.80	3 3.40 8.00	5 4.40	5 4.40	5 4.40	5 4.40	5 4.40	3 3.40 8.00	4 3.80
5 4.40	5 4.40	5 4.40				5 4.40	5 4.40	5 4.40
5 4.40	3 3.40 8.00	5 4.40		Water Channel		5 4.40	3 3.40 8.00	5 4.40
5 4.40	5 4.40	5 4.40				5 4.40	5 4.40	5 4.40
4 3.80	3 3.40 8.00	5 4.40	5 4.40	5 4.40	5 4.40	5 4.40	3 3.40 8.00	4 3.80
2 3.40	2 3.40	3 3.40 8.00	5 4.40	3 3.40 8.00	5 4.40	3 3.40 8.00	2 3.40	2 3.40
1 2.60	2 3.40	4 3.80	5 4.40	5 4.40	5 4.40	4 3.80	2 3.40	1 2.60

Pellet Type	Quantity	U^{235} + Gd_2O_3 Concentration (wt%)
1	4	2.60
2	12	3.40
3	12	3.40 + 8.00
4	8	3.80
5	36	4.40

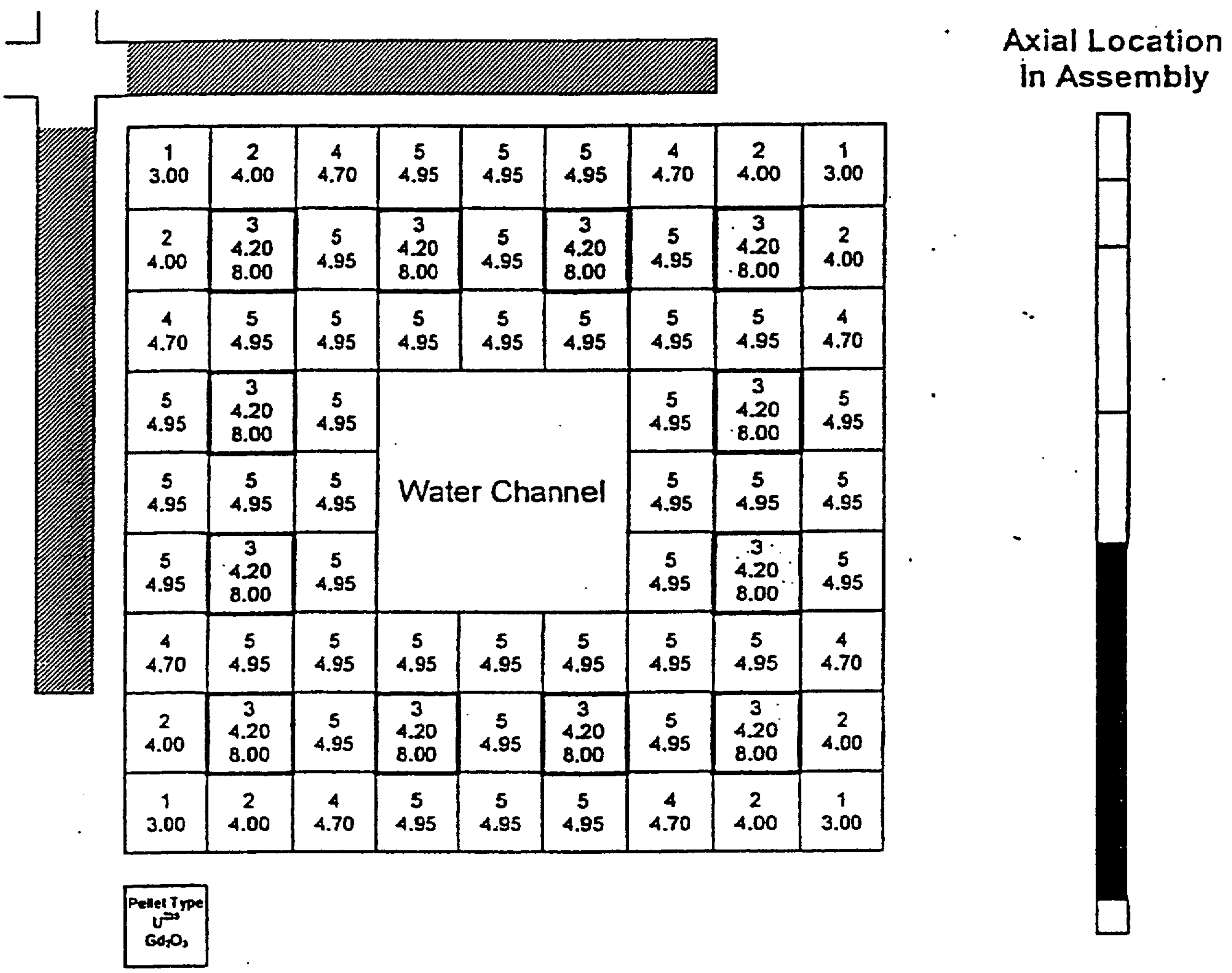
Figure 4.3 SPCA9-3.91L-12G8.0-100M
Enrichment Distribution



1 2.60	2 3.40	4 3.80	5 4.40	5 4.40	5 4.40	4 3.80	2 3.40	1 2.60
2 3.40	2 3.40	3 3.40 5.00	5 4.40	2 3.40	5 4.40	3 3.40 5.00	2 3.40	2 3.40
4 3.80	3 3.40 5.00	5 4.40	5 4.40	5 4.40	5 4.40	5 4.40	3 3.40 5.00	4 3.80
5 4.40	5 4.40	5 4.40	Water Channel			5 4.40	5 4.40	5 4.40
5 4.40	2 3.40	5 4.40				5 4.40	2 3.40	5 4.40
5 4.40	5 4.40	5 4.40				5 4.40	5 4.40	5 4.40
4 3.80	3 3.40 5.00	5 4.40	5 4.40	5 4.40	5 4.40	5 4.40	3 3.40 5.00	4 3.80
2 3.40	2 3.40	3 3.40 5.00	5 4.40	2 3.40	5 4.40	3 3.40 5.00	2 3.40	2 3.40
1 2.60	2 3.40	4 3.80	5 4.40	5 4.40	5 4.40	4 3.80	2 3.40	1 2.60

Pellet Type	Quantity	U^{235} + Gd_2O_3 Concentration (wt%)
1	4	2.60
2	16	3.40
3	8	3.40 + 5.00
4	8	3.80
5	36	4.40

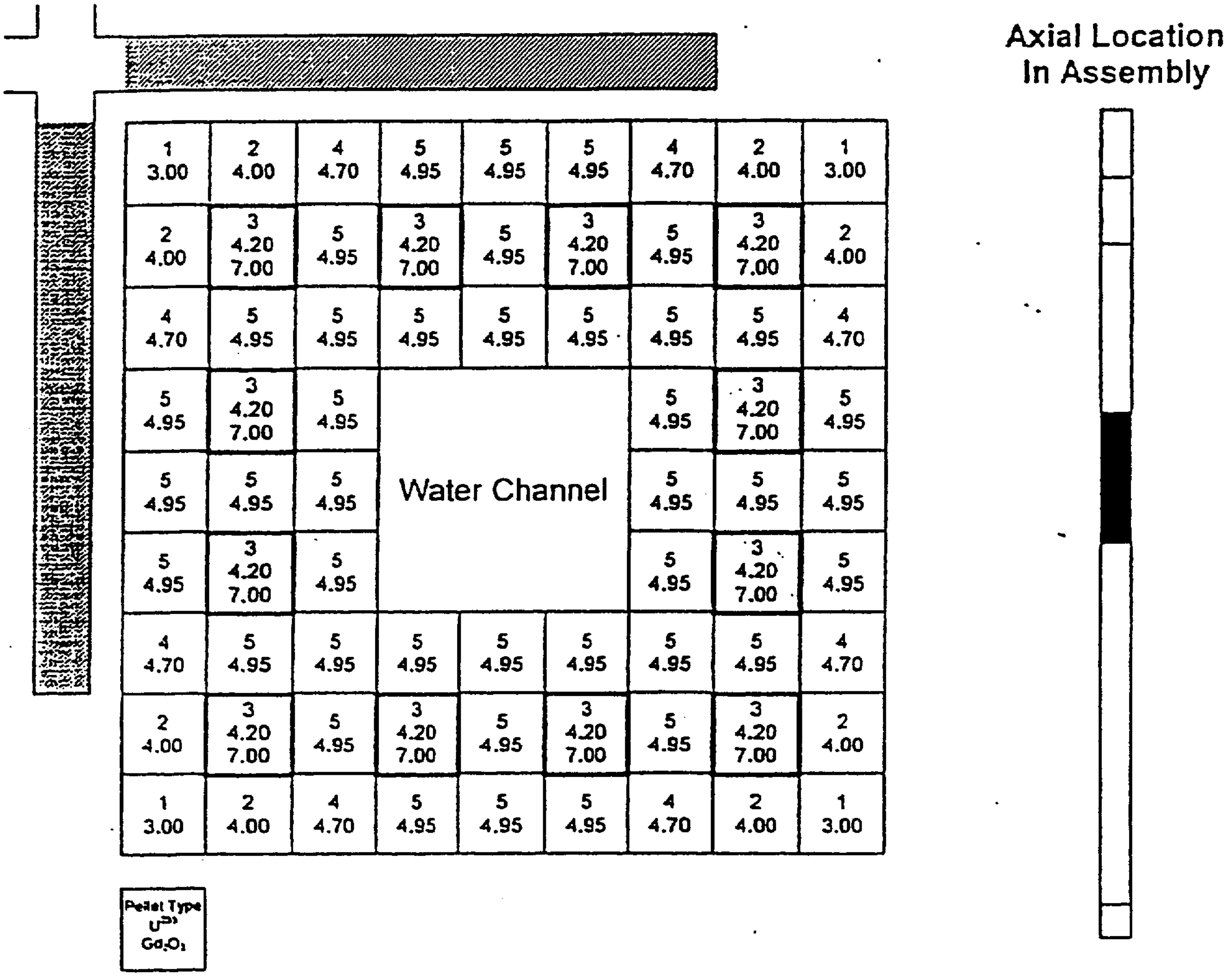
Figure 4.4 SPCA9-3.90L-8G5.0-100M
Enrichment Distribution



1 3.00	2 4.00	4 4.70	5 4.95	5 4.95	5 4.95	4 4.70	2 4.00	1 3.00
2 4.00	3 4.20 8.00	5 4.95	3 4.20 8.00	5 4.95	3 4.20 8.00	5 4.95	3 4.20 8.00	2 4.00
4 4.70	5 4.95	5 4.95	5 4.95	5 4.95	5 4.95	5 4.95	5 4.95	4 4.70
5 4.95	3 4.20 8.00	5 4.95				5 4.95	3 4.20 8.00	5 4.95
5 4.95	5 4.95	5 4.95		Water Channel		5 4.95	5 4.95	5 4.95
5 4.95	3 4.20 8.00	5 4.95				5 4.95	3 4.20 8.00	5 4.95
4 4.70	5 4.95	5 4.95	5 4.95	5 4.95	5 4.95	5 4.95	5 4.95	4 4.70
2 4.00	3 4.20 8.00	5 4.95	3 4.20 8.00	5 4.95	3 4.20 8.00	5 4.95	3 4.20 8.00	2 4.00
1 3.00	2 4.00	4 4.70	5 4.95	5 4.95	5 4.95	4 4.70	2 4.00	1 3.00

Pellet Type	Quantity	U^{235} + Gd_2O_3 Concentration (wt%)
1	4	3.00
2	8	4.00
3	12	4.20 + 8.00
4	8	4.70
5	40	4.95

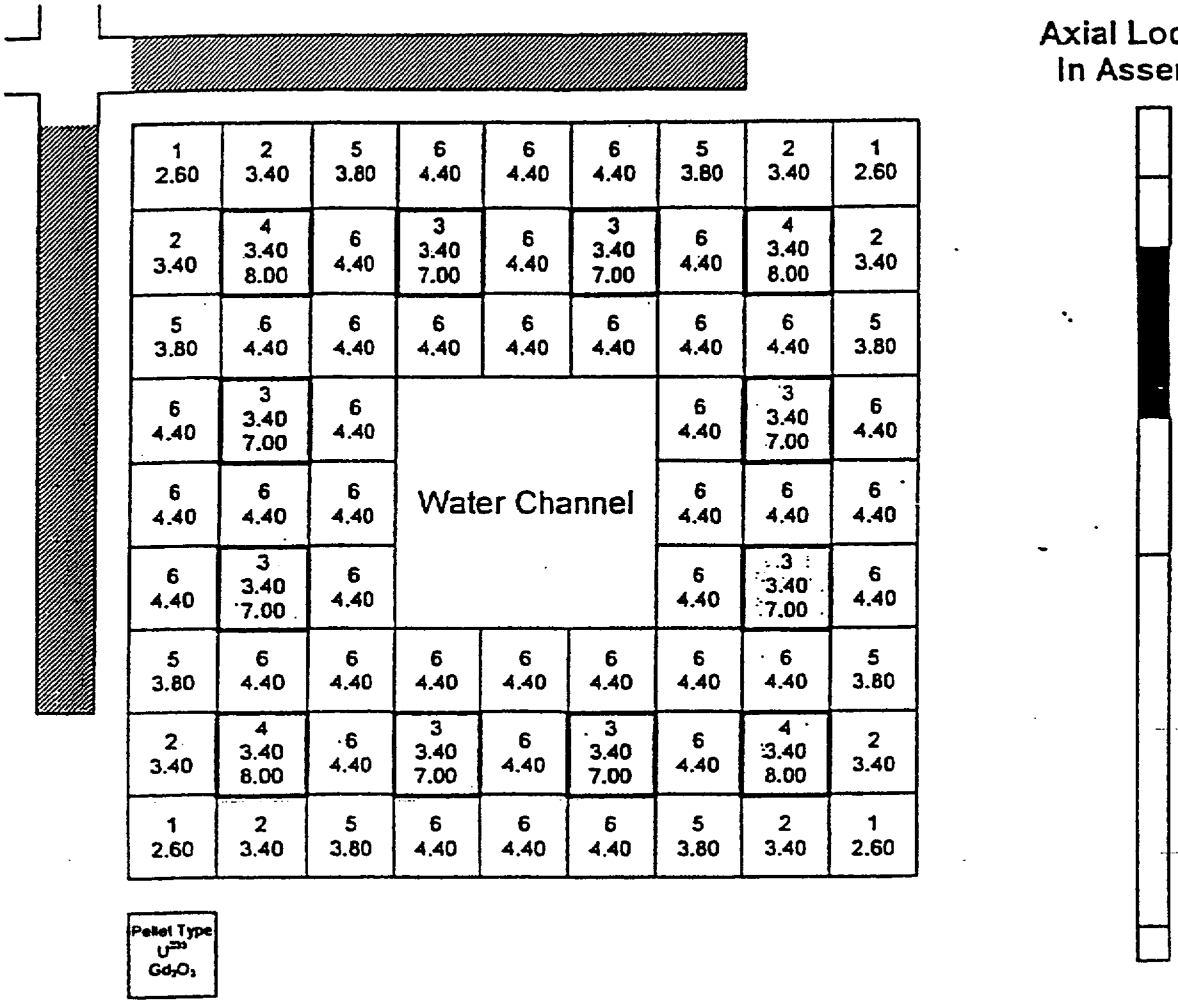
Figure 4.5 SPCA9-4.59L-12G8.0-100M
Enrichment Distribution



1 3.00	2 4.00	4 4.70	5 4.95	5 4.95	5 4.95	4 4.70	2 4.00	1 3.00
2 4.00	3 4.20 7.00	5 4.95	3 4.20 7.00	5 4.95	3 4.20 7.00	5 4.95	3 4.20 7.00	2 4.00
4 4.70	5 4.95	5 4.95	5 4.95	5 4.95	5 4.95	5 4.95	5 4.95	4 4.70
5 4.95	3 4.20 7.00	5 4.95	Water Channel			5 4.95	3 4.20 7.00	5 4.95
5 4.95	5 4.95	5 4.95				5 4.95	5 4.95	5 4.95
5 4.95	3 4.20 7.00	5 4.95				5 4.95	3 4.20 7.00	5 4.95
4 4.70	5 4.95	5 4.95	5 4.95	5 4.95	5 4.95	5 4.95	5 4.95	4 4.70
2 4.00	3 4.20 7.00	5 4.95	3 4.20 7.00	5 4.95	3 4.20 7.00	5 4.95	3 4.20 7.00	2 4.00
1 3.00	2 4.00	4 4.70	5 4.95	5 4.95	5 4.95	4 4.70	2 4.00	1 3.00

Pellet Type	Quantity	U^{235} + Gd_2O_3 Concentration (wt%)
1	4	3.00
2	8	4.00
3	12	4.20 + 7.00
4	8	4.70
5	40	4.95

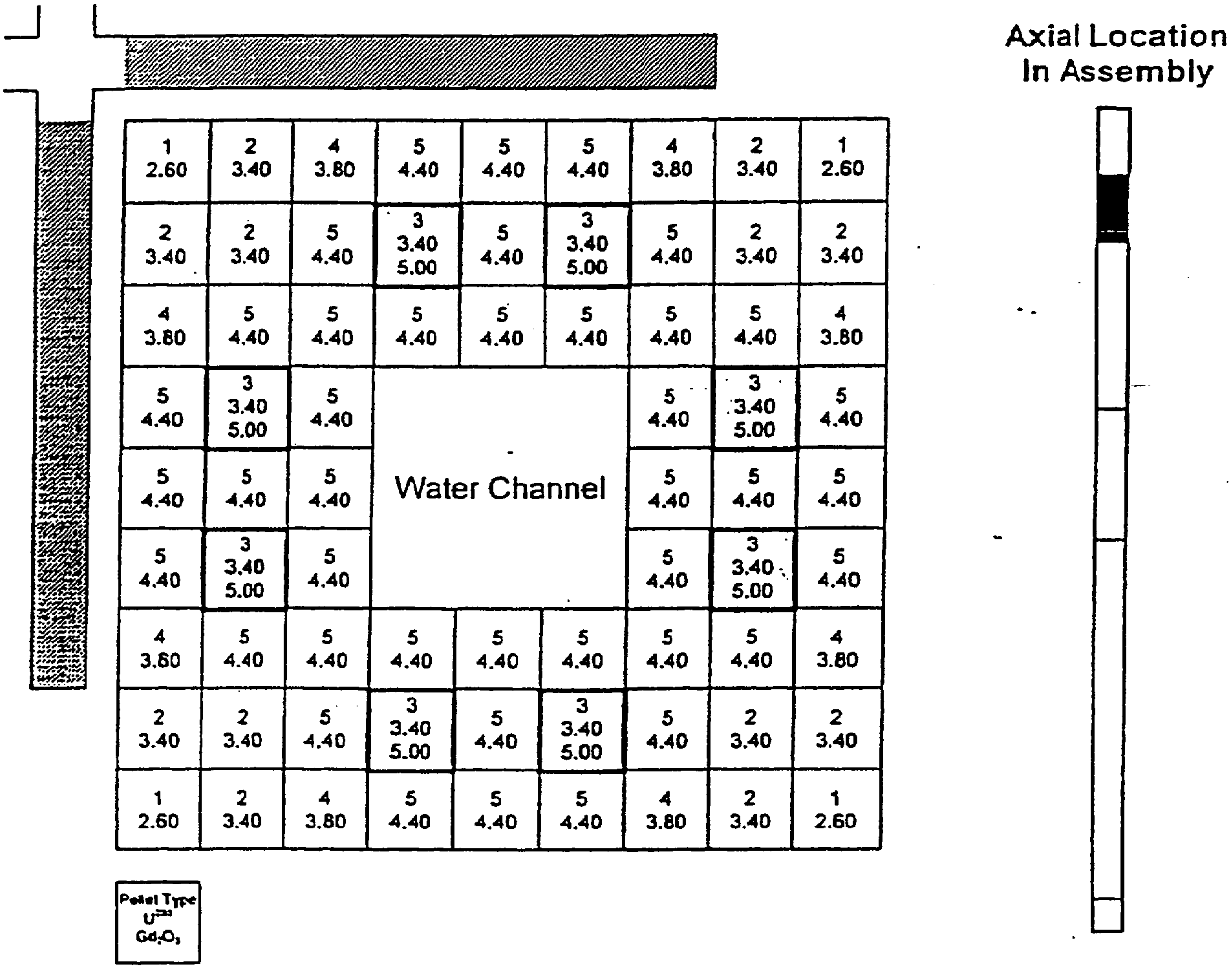
Figure 4.6 SPCA9-4.59L-12G7.0-100M
Enrichment Distribution



1 2.60	2 3.40	5 3.80	6 4.40	6 4.40	6 4.40	5 3.80	2 3.40	1 2.60
2 3.40	4 3.40 8.00	6 4.40	3 3.40 7.00	6 4.40	3 3.40 7.00	6 4.40	4 3.40 8.00	2 3.40
5 3.80	6 4.40	6 4.40	6 4.40	6 4.40	6 4.40	6 4.40	6 4.40	5 3.80
6 4.40	3 3.40 7.00	6 4.40	Water Channel			6 4.40	3 3.40 7.00	6 4.40
6 4.40	6 4.40	6 4.40				6 4.40	6 4.40	6 4.40
6 4.40	3 3.40 7.00	6 4.40				6 4.40	3 3.40 7.00	6 4.40
5 3.80	6 4.40	6 4.40	6 4.40	6 4.40	6 4.40	6 4.40	6 4.40	5 3.80
2 3.40	4 3.40 8.00	6 4.40	3 3.40 7.00	6 4.40	3 3.40 7.00	6 4.40	4 3.40 8.00	2 3.40
1 2.60	2 3.40	5 3.80	6 4.40	6 4.40	6 4.40	5 3.80	2 3.40	1 2.60

Pellet Type	Quantity	U^{235} + Gd_2O_3 Concentration (wt%)
1	4	2.60
2	8	3.40
3	8	3.40 + 7.00
4	4	3.40 + 8.00
5	8	3.80
6	40	4.40

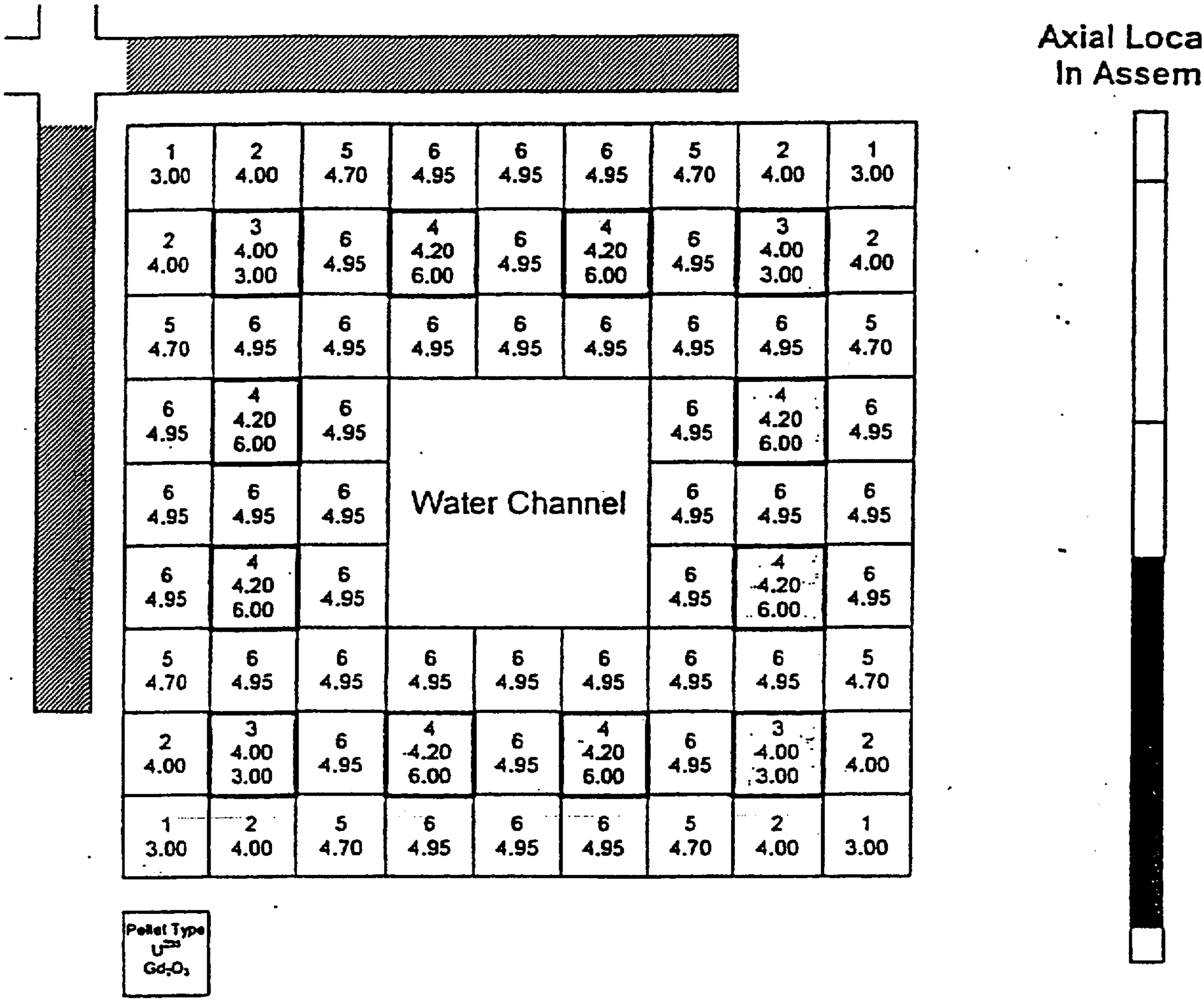
Figure 4.7 SPCA9-3.96L-8G7.0/4G8.0-100M
Enrichment Distribution



1 2.60	2 3.40	4 3.80	5 4.40	5 4.40	5 4.40	4 3.80	2 3.40	1 2.60
2 3.40	2 3.40	5 4.40	3 3.40 5.00	5 4.40	3 3.40 5.00	5 4.40	2 3.40	2 3.40
4 3.80	5 4.40	5 4.40	5 4.40	5 4.40	5 4.40	5 4.40	5 4.40	4 3.80
5 4.40	3 3.40 5.00	5 4.40				5 4.40	3 3.40 5.00	5 4.40
5 4.40	5 4.40	5 4.40		Water Channel		5 4.40	5 4.40	5 4.40
5 4.40	3 3.40 5.00	5 4.40				5 4.40	3 3.40 5.00	5 4.40
4 3.60	5 4.40	5 4.40	5 4.40	5 4.40	5 4.40	5 4.40	5 4.40	4 3.80
2 3.40	2 3.40	5 4.40	3 3.40 5.00	5 4.40	3 3.40 5.00	5 4.40	2 3.40	2 3.40
1 2.60	2 3.40	4 3.80	5 4.40	5 4.40	5 4.40	4 3.80	2 3.40	1 2.60

Pellet Type	Quantity	U^{235} + Gd_2O_3 Concentration (wt%)
1	4	2.60
2	12	3.40
3	8	3.40 + 5.00
4	8	3.80
5	40	4.40

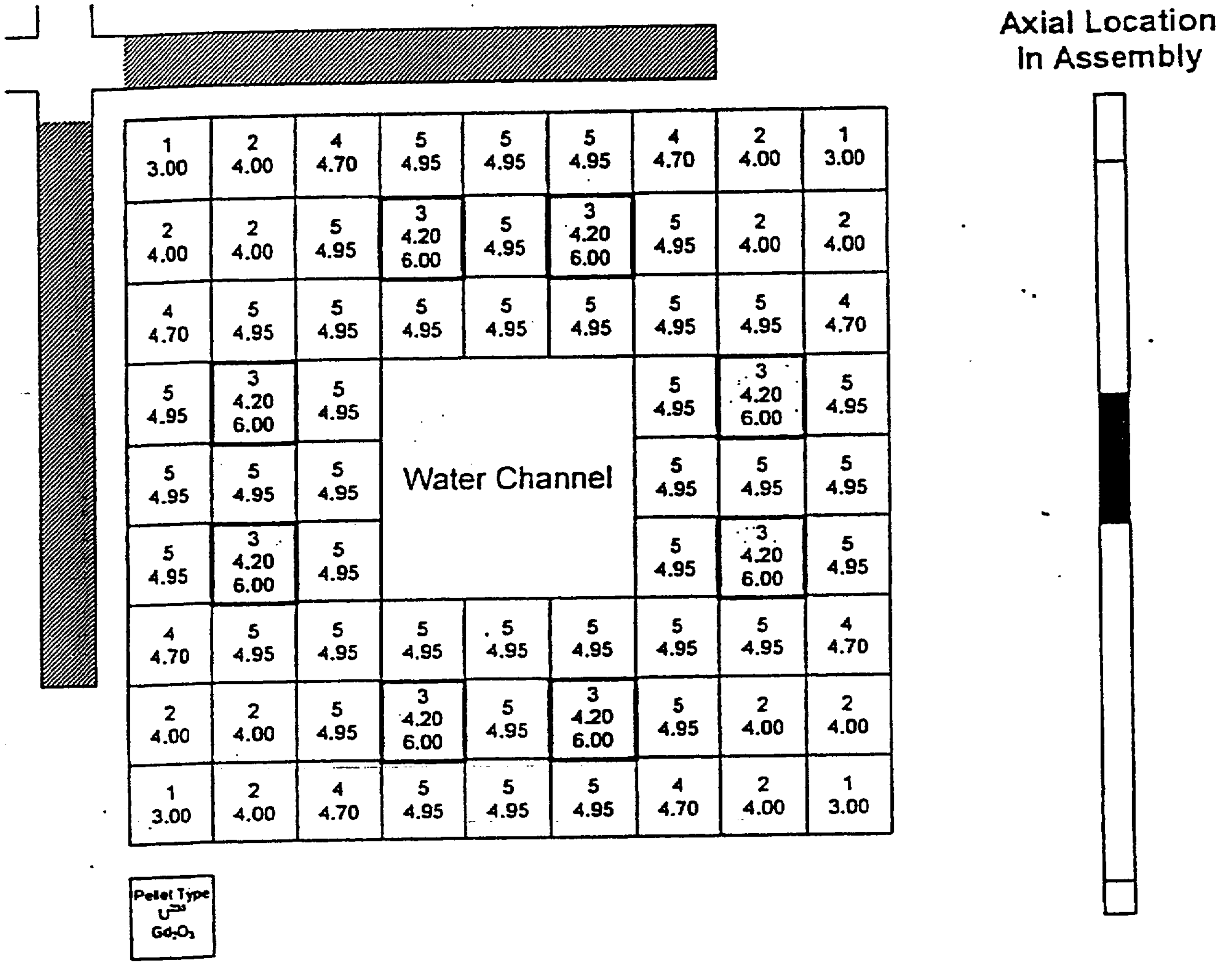
Figure 4.8 SPCA9-3.96L-8G5.0-100M
Enrichment Distribution



1 3.00	2 4.00	5 4.70	6 4.95	6 4.95	6 4.95	5 4.70	2 4.00	1 3.00
2 4.00	3 4.00 3.00	6 4.95	4 4.20 6.00	6 4.95	4 4.20 6.00	6 4.95	3 4.00 3.00	2 4.00
5 4.70	6 4.95	6 4.95	6 4.95	6 4.95	6 4.95	6 4.95	6 4.95	5 4.70
6 4.95	4 4.20 6.00	6 4.95	Water Channel			6 4.95	4 4.20 6.00	6 4.95
6 4.95	6 4.95	6 4.95				6 4.95	6 4.95	6 4.95
6 4.95	4 4.20 6.00	6 4.95				6 4.95	4 4.20 6.00	6 4.95
5 4.70	6 4.95	6 4.95	6 4.95	6 4.95	6 4.95	6 4.95	6 4.95	5 4.70
2 4.00	3 4.00 3.00	6 4.95	4 4.20 6.00	6 4.95	4 4.20 6.00	6 4.95	3 4.00 3.00	2 4.00
1 3.00	2 4.00	5 4.70	6 4.95	6 4.95	6 4.95	5 4.70	2 4.00	1 3.00

Pellet Type	Quantity	U^{235} + Gd_2O_3 Concentration (wt%)
1	4	3.00
2	8	4.00
3	4	4.00 + 3.00
4	8	4.20 + 6.00
5	8	4.70
6	40	4.95

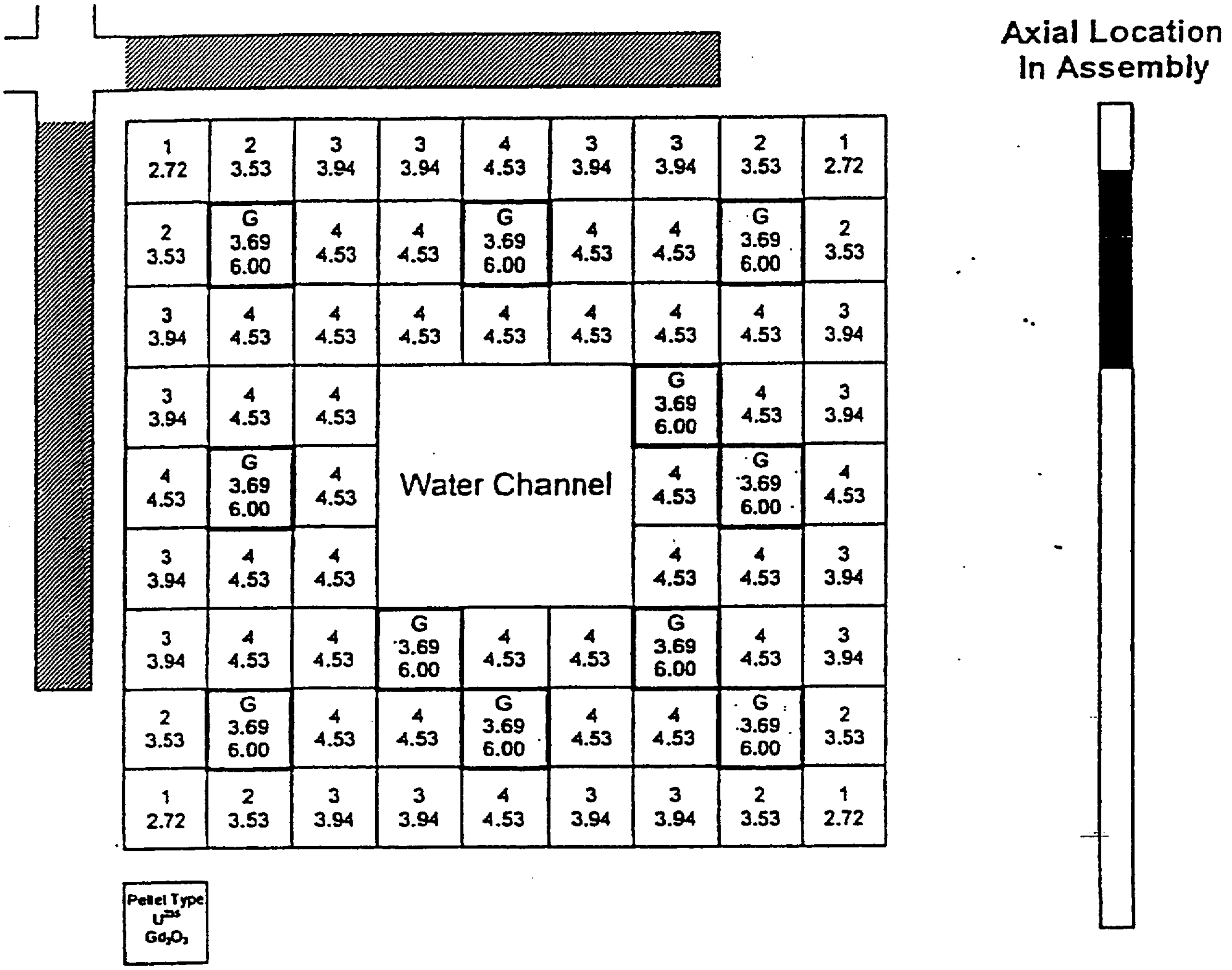
Figure 4.9 SPCA9-4.58L-8G6.0/4G3.0-100M
Enrichment Distribution



1 3.00	2 4.00	4 4.70	5 4.95	5 4.95	5 4.95	4 4.70	2 4.00	1 3.00
2 4.00	2 4.00	5 4.95	3 4.20 6.00	5 4.95	3 4.20 6.00	5 4.95	2 4.00	2 4.00
4 4.70	5 4.95	5 4.95	5 4.95	5 4.95	5 4.95	5 4.95	5 4.95	4 4.70
5 4.95	3 4.20 6.00	5 4.95	Water Channel			5 4.95	3 4.20 6.00	5 4.95
5 4.95	5 4.95	5 4.95				5 4.95	5 4.95	5 4.95
5 4.95	3 4.20 6.00	5 4.95				5 4.95	3 4.20 6.00	5 4.95
4 4.70	5 4.95	5 4.95	5 4.95	5 4.95	5 4.95	5 4.95	5 4.95	4 4.70
2 4.00	2 4.00	5 4.95	3 4.20 6.00	5 4.95	3 4.20 6.00	5 4.95	2 4.00	2 4.00
1 3.00	2 4.00	4 4.70	5 4.95	5 4.95	5 4.95	4 4.70	2 4.00	1 3.00

Pellet Type	Quantity	U^{235} + Gd_2O_3 Concentration (wt%)
1	4	3.00
2	12	4.00
3	8	4.20 + 6.00
4	8	4.70
5	40	4.95

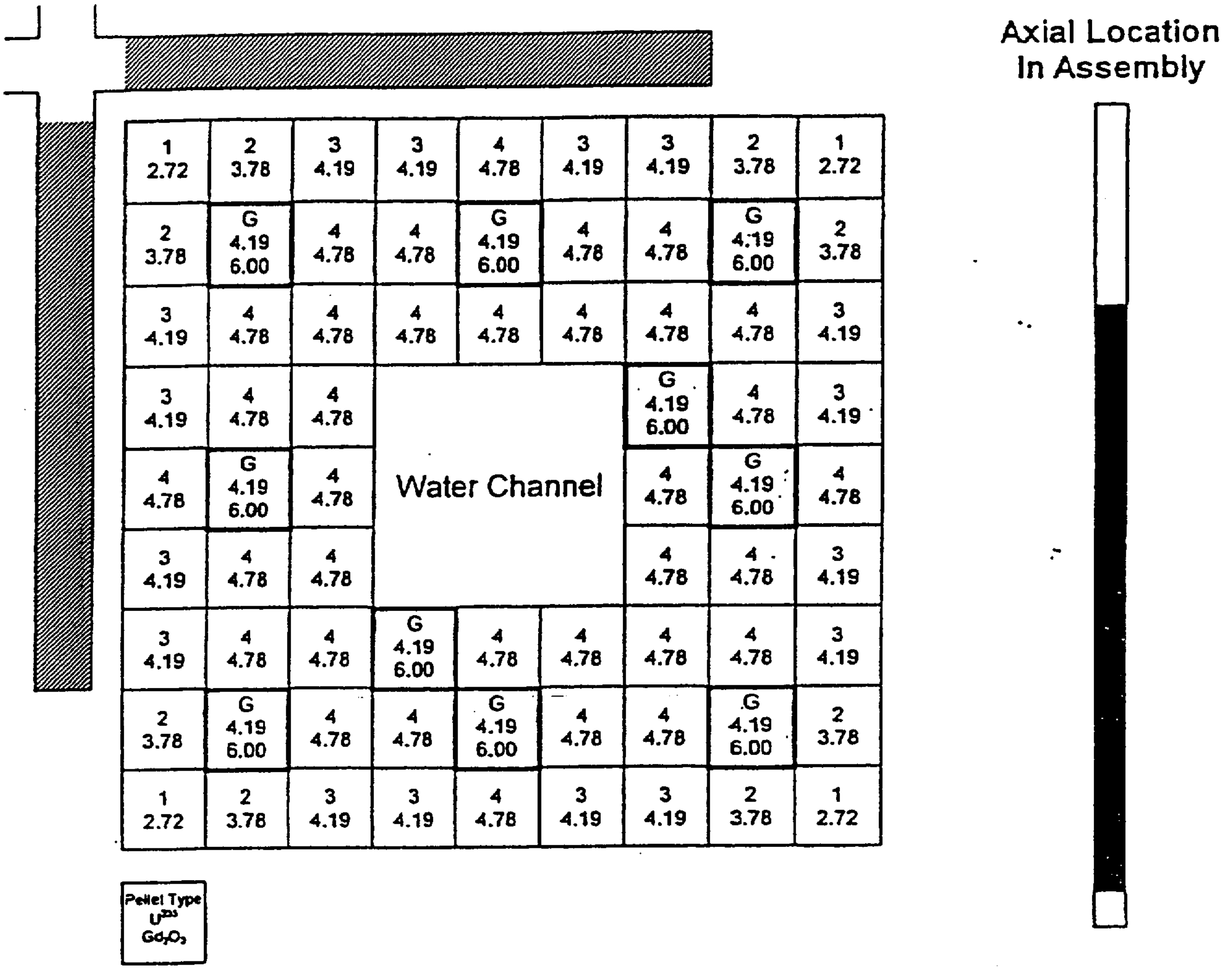
Figure 4.10 SPCA9-4.58L-8G6.0-100M
Enrichment Distribution



1 2.72	2 3.53	3 3.94	3 3.94	4 4.53	3 3.94	3 3.94	2 3.53	1 2.72
2 3.53	G 3.69 6.00	4 4.53	4 4.53	G 3.69 6.00	4 4.53	4 4.53	G 3.69 6.00	2 3.53
3 3.94	4 4.53	4 4.53	4 4.53	4 4.53	4 4.53	4 4.53	4 4.53	3 3.94
3 3.94	4 4.53	4 4.53				G 3.69 6.00	4 4.53	3 3.94
4 4.53	G 3.69 6.00	4 4.53		Water Channel		4 4.53	G 3.69 6.00	4 4.53
3 3.94	4 4.53	4 4.53				4 4.53	4 4.53	3 3.94
3 3.94	4 4.53	4 4.53	G 3.69 6.00	4 4.53	4 4.53	G 3.69 6.00	4 4.53	3 3.94
2 3.53	G 3.69 6.00	4 4.53	4 4.53	G 3.69 6.00	4 4.53	4 4.53	G 3.69 6.00	2 3.53
1 2.72	2 3.53	3 3.94	3 3.94	4 4.53	3 3.94	3 3.94	2 3.53	1 2.72

Pellet Type	Quantity	U^{235} + Gd$_2$O$_3$ Concentration (wt%)
1	4	2.72
2	8	3.53
3	16	3.94
4	33	4.53
G	11	3.69 + 6.00

Figure 4.11 SPCA9-4.06L-11G6.0-80M
Enrichment Distribution



1 2.72	2 3.78	3 4.19	3 4.19	4 4.78	3 4.19	3 4.19	2 3.78	1 2.72
2 3.78	G 4.19 6.00	4 4.78	4 4.78	G 4.19 6.00	4 4.78	4 4.78	G 4.19 6.00	2 3.78
3 4.19	4 4.78	4 4.78	4 4.78	4 4.78	4 4.78	4 4.78	4 4.78	3 4.19
3 4.19	4 4.78	4 4.78	Water Channel			G 4.19 6.00	4 4.78	3 4.19
4 4.78	G 4.19 6.00	4 4.78				4 4.78	G 4.19 6.00	4 4.78
3 4.19	4 4.78	4 4.78				4 4.78	4 4.78	3 4.19
3 4.19	4 4.78	4 4.78	G 4.19 6.00	4 4.78	4 4.78	4 4.78	4 4.78	3 4.19
2 3.78	G 4.19 6.00	4 4.78	4 4.78	G 4.19 6.00	4 4.78	4 4.78	G 4.19 6.00	2 3.78
1 2.72	2 3.78	3 4.19	3 4.19	4 4.78	3 4.19	3 4.19	2 3.78	1 2.72

Pellet Type	Quantity	U^{235} + Gd_2O_3 Concentration (wt%)
1	4	2.72
2	8	3.78
3	16	4.19
4	34	4.78
G	10	4.19 + 6.00

Figure 4.12 SPCA9-4.34L-10G6.0-80M
Enrichment Distribution

SPCA9-393B-16GZ-100M

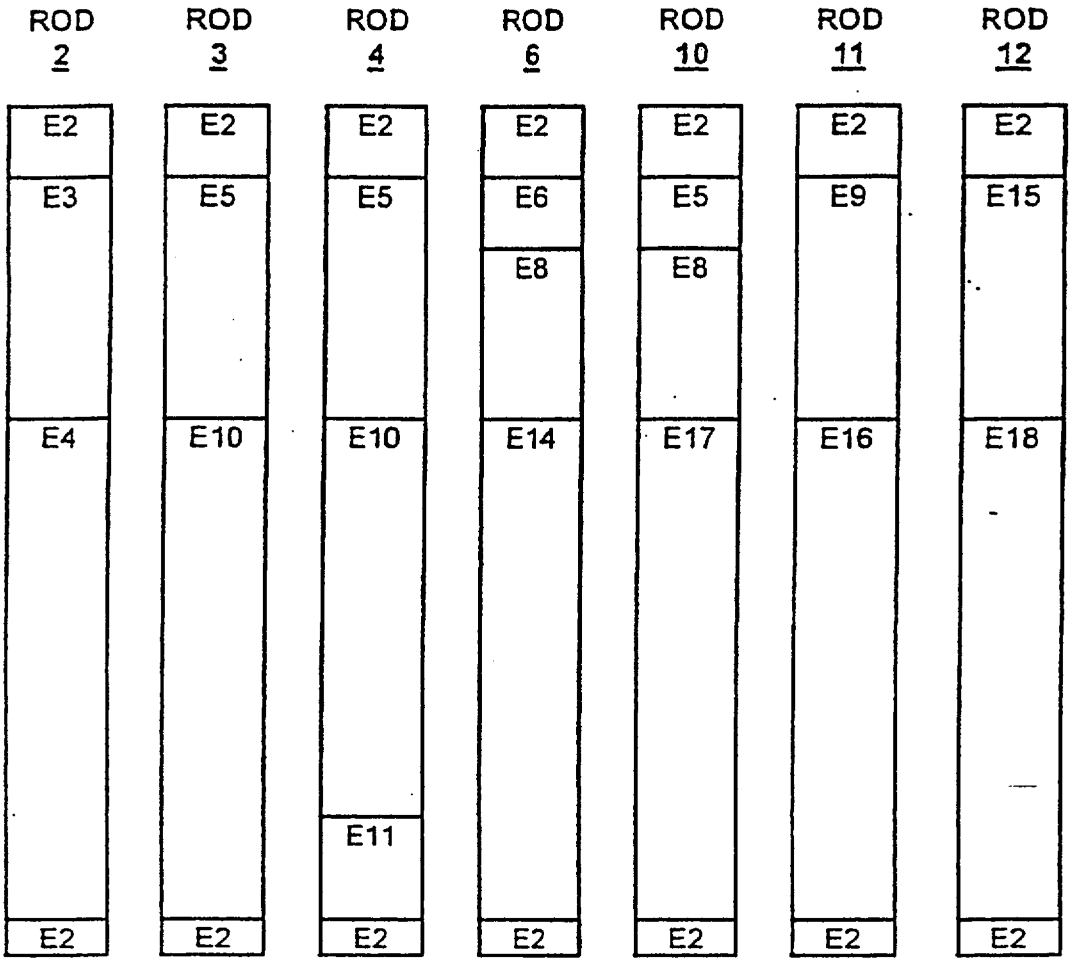
	Lattice
Natural Uranium	SPCA9-0.72L-0.G0.0-100M
3.90-8G5.0	SPCA9-3.90L-8G5.0-100M
3.91-12G8.0	SPCA9-3.91L-12G8.0-100M
4.56-12G8.0	SPCA9-4.56L-12G8.0-100M
4.56-12G8.0/4G3.0	SPCA9-4.56L-12G8.0/4G3.0-100M
Natural Uranium	SPCA9-0.72L-0.G0.0-100M

2	3	11	12	12	12	11	3	2
3	4	6	12	10	12	6	4	3
11	6	12	12	12	12	12	6	11
12	12	12	W	W	W	12	12	12
12	10	12	W	W	W	12	10	12
12	12	12	W	W	W	12	12	12
11	6	12	12	12	12	12	6	11
3	4	6	12	10	12	6	4	3
2	3	11	12	12	12	11	3	2

Fuel Rod Type	No. Rods
2	4
3	8
4	4
6	8
10	4
11	8
12	36

Figure 4.13 ATRIUM-9B LSA-1 19A Assembly Design

SPCA9-393B-16GZ-100M

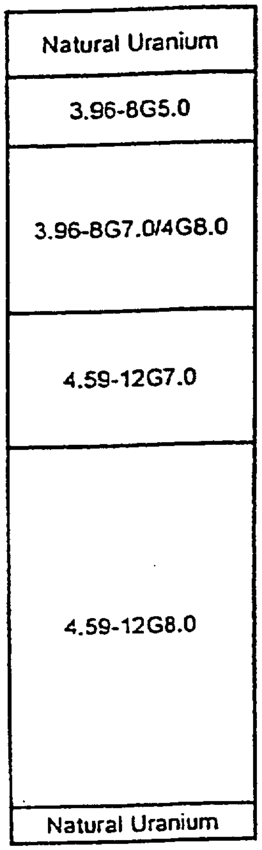


Lattice Index	Enrichment + Gd
E2	0.72 wt% U-235
E3	2.60 wt% U-235
E4	3.00 wt% U-235
E5	3.40 wt% U-235
E6	3.40 wt% U-235 + 5.0 wt% Gd_20_3
E7	3.40 wt% U-235 + 7.0 wt% Gd_20_3
E8	3.40 wt% U-235 + 8.0 wt% Gd_20_3
E9	3.80 wt% U-235
E10	4.00 wt% U-235

Lattice Index	Enrichment + Gd
E11	4.00 wt% U-235 + 3.0 wt% Gd_20_3
E12	4.20 wt% U-235 + 6.0 wt% Gd_20_3
E13	4.20 wt% U-235 + 7.0 wt% Gd_20_3
E14	4.20 wt% U-235 + 8.0 wt% Gd_20_3
E15	4.40 wt% U-235
E16	4.70 wt% U-235
E17	4.70 wt% U-235 + 8.0 wt% Gd_20_3
E18	4.95 wt% U-235

Figure 4.13 ATRIUM-9B LSA-1 19A Assembly Design (continued)

SPCA9-396B-12GZB-100M



Lattice

SPCA9-0.72L-0.G0.0-100M

SPCA9-3.96L-8G5.0-100M

SPCA9-3.96L-8G7.0/4G8.0-100M

SPCA9-4.59L-12G7.0-100M

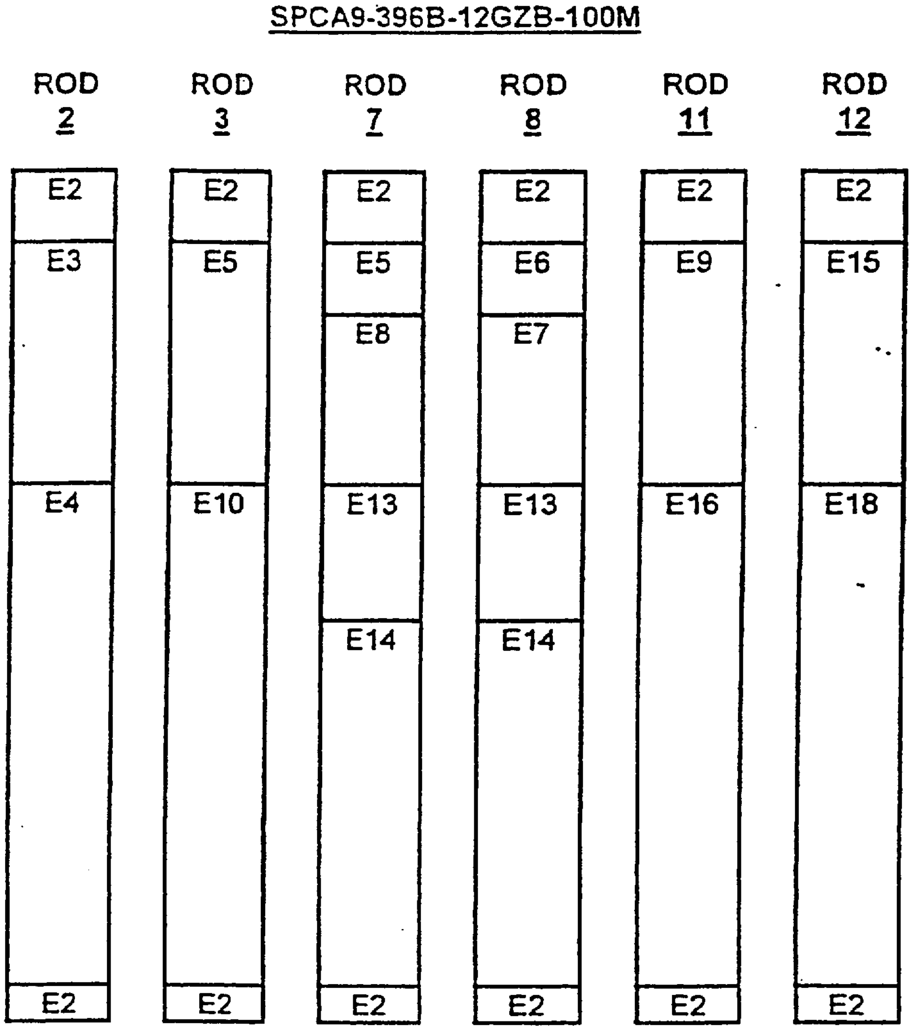
SPCA9-4.59L-12G8.0-100M

SPCA9-0.72L-0.G0.0-100M

2	3	11	12	12	12	11	3	2
3	7	12	8	12	8	12	7	3
11	12	12	12	12	12	12	12	11
12	8	12	W	W	W	12	8	12
12	12	12	W	W	W	12	12	12
12	8	12	W	W	W	12	8	12
11	12	12	12	12	12	12	12	11
3	7	12	8	12	8	12	7	3
2	3	11	12	12	12	11	3	2

Fuel Rod Type	No. Rods
2	4
3	8
7	4
8	8
11	8
12	40

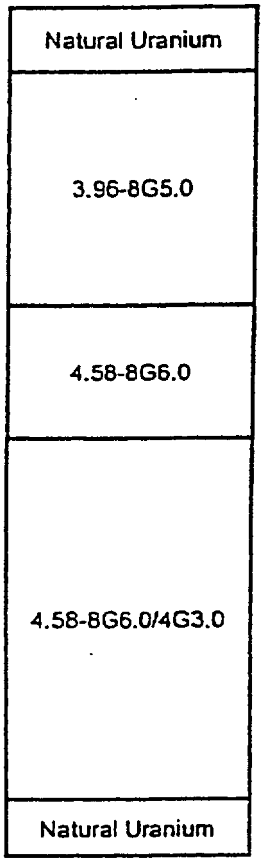
Figure 4.14 ATRIUM-9B LSA-1 19B Assembly Design



Lattice Index	Enrichment + Gd	Lattice Index	Enrichment + Gd
E2	0.72 wt% U-235	E11	4.00 wt% U-235 + 3.0 wt% Gd_2O_3
E3	2.60 wt% U-235	E12	4.20 wt% U-235 + 6.0 wt% Gd_2O_3
E4	3.00 wt% U-235	E13	4.20 wt% U-235 + 7.0 wt% Gd_2O_3
E5	3.40 wt% U-235	E14	4.20 wt% U-235 + 8.0 wt% Gd_2O_3
E6	3.40 wt% U-235 + 5.0 wt% Gd_2O_3	E15	4.40 wt% U-235
E7	3.40 wt% U-235 + 7.0 wt% Gd_2O_3	E16	4.70 wt% U-235
E8	3.40 wt% U-235 + 8.0 wt% Gd_2O_3	E17	4.70 wt% U-235 + 8.0 wt% Gd_2O_3
E9	3.80 wt% U-235	E18	4.95 wt% U-235
E10	4.00 wt% U-235		

Figure 4.14 ATRIUM-9B LSA-1 19B Assembly Design (continued)

SPCA9-396B-12GZC-100M



Lattice

SPCA9-0.72L-0.G0.0-100M

SPCA9-3.96L-8G5.0-100M

SPCA9-4.58L-8G6.0-100M

SPCA9-4.58L-8G6.0/4G3.0-100M

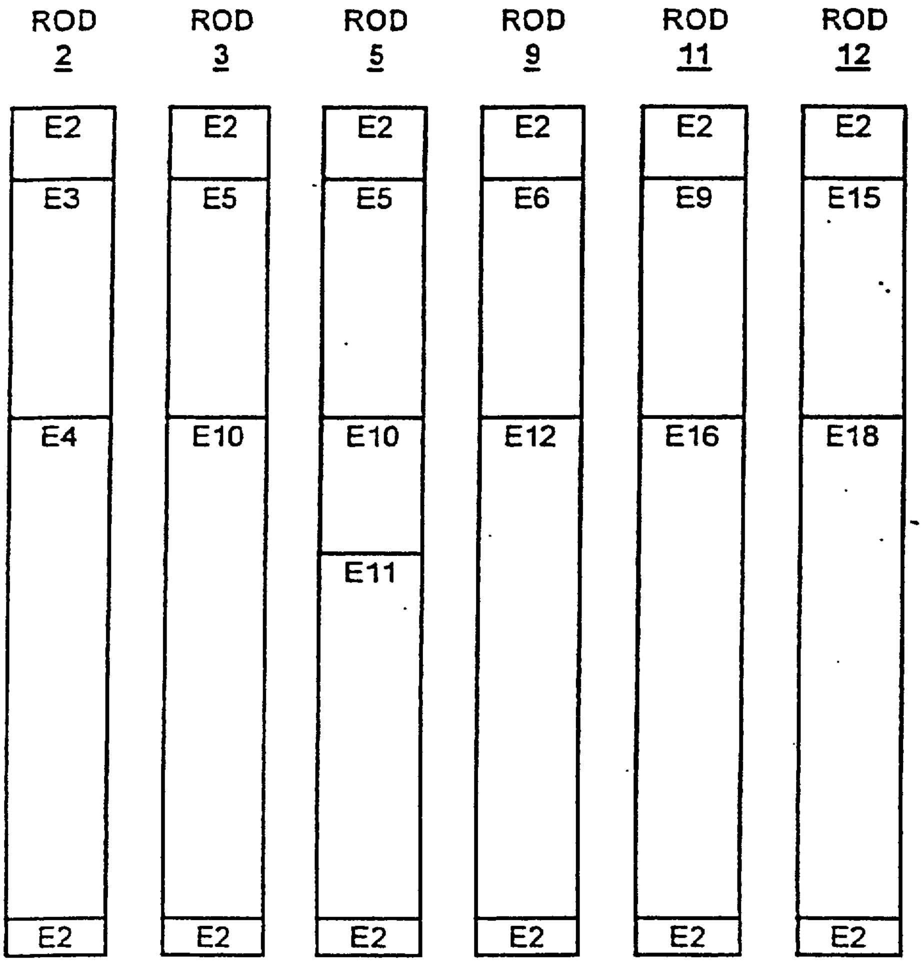
SPCA9-0.72L-0.G0.0-100M

2	3	11	12	12	12	11	3	2
3	5	12	9	12	9	12	5	3
11	12	12	12	12	12	12	12	11
12	9	12	W	W	W	12	9	12
12	12	12	W	W	W	12	12	12
12	9	12	W	W	W	12	9	12
11	12	12	12	12	12	12	12	11
3	5	12	9	12	9	12	5	3
2	3	11	12	12	12	11	3	2

Fuel Rod Type	No. Rods
2	4
3	8
5	4
9	8
11	8
12	40

Figure 4.15 ATRIUM-9B LSA-1 19C Assembly Design

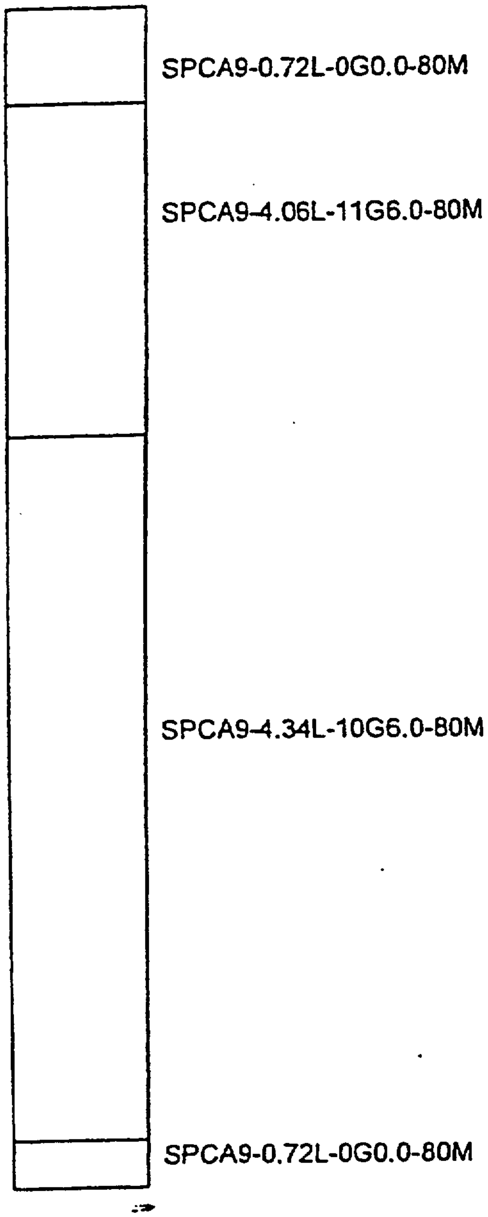
SPCA9-396B-12GZC-100M



Lattice Index	Enrichment + Gd	Lattice Index	Enrichment + Gd
E2	0.72 wt% U-235	E11	4.00 wt% U-235 + 3.0 wt% Gd_20_3
E3	2.60 wt% U-235	E12	4.20 wt% U-235 + 6.0 wt% Gd_20_3
E4	3.00 wt% U-235	E13	4.20 wt% U-235 + 7.0 wt% Gd_20_3
E5	3.40 wt% U-235	E14	4.20 wt% U-235 + 8.0 wt% Gd_20_3
E6	3.40 wt% U-235 + 5.0 wt% Gd_20_3	E15	4.40 wt% U-235
E7	3.40 wt% U-235 + 7.0 wt% Gd_20_3	E16	4.70 wt% U-235
E8	3.40 wt% U-235 + 8.0 wt% Gd_20_3	E17	4.70 wt% U-235 + 8.0 wt% Gd_20_3
E9	3.80 wt% U-235	E18	4.95 wt% U-235
E10	4.00 wt% U-235		

Figure 4.15 ATRIUM-9B LSA-1 19C Assembly Design (continued)

SPCA9-384B-11GZ-80M

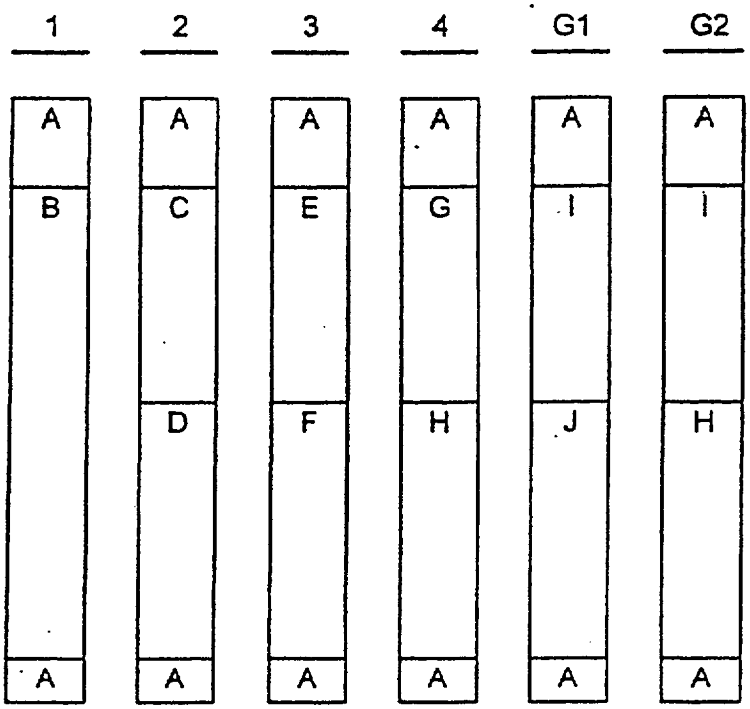


1	2	3	3	4	3	3	2	1
2	G1	4	4	G1	4	4	G1	2
3	4	4	4	4	4	4	4	3
3	4	4	W	W	W	G1	4	3
4	G1	4	W	W	W	4	G1	4
3	4	4	W	W	W	4	4	3
3	4	4	G1	4	4	G2	4	3
2	G1	4	4	G1	4	4	G1	2
1	2	3	3	4	3	3	2	1

Fuel Rod Type	No. Rods
1	4
2	8
3	16
4	33
G1	10
G2	1

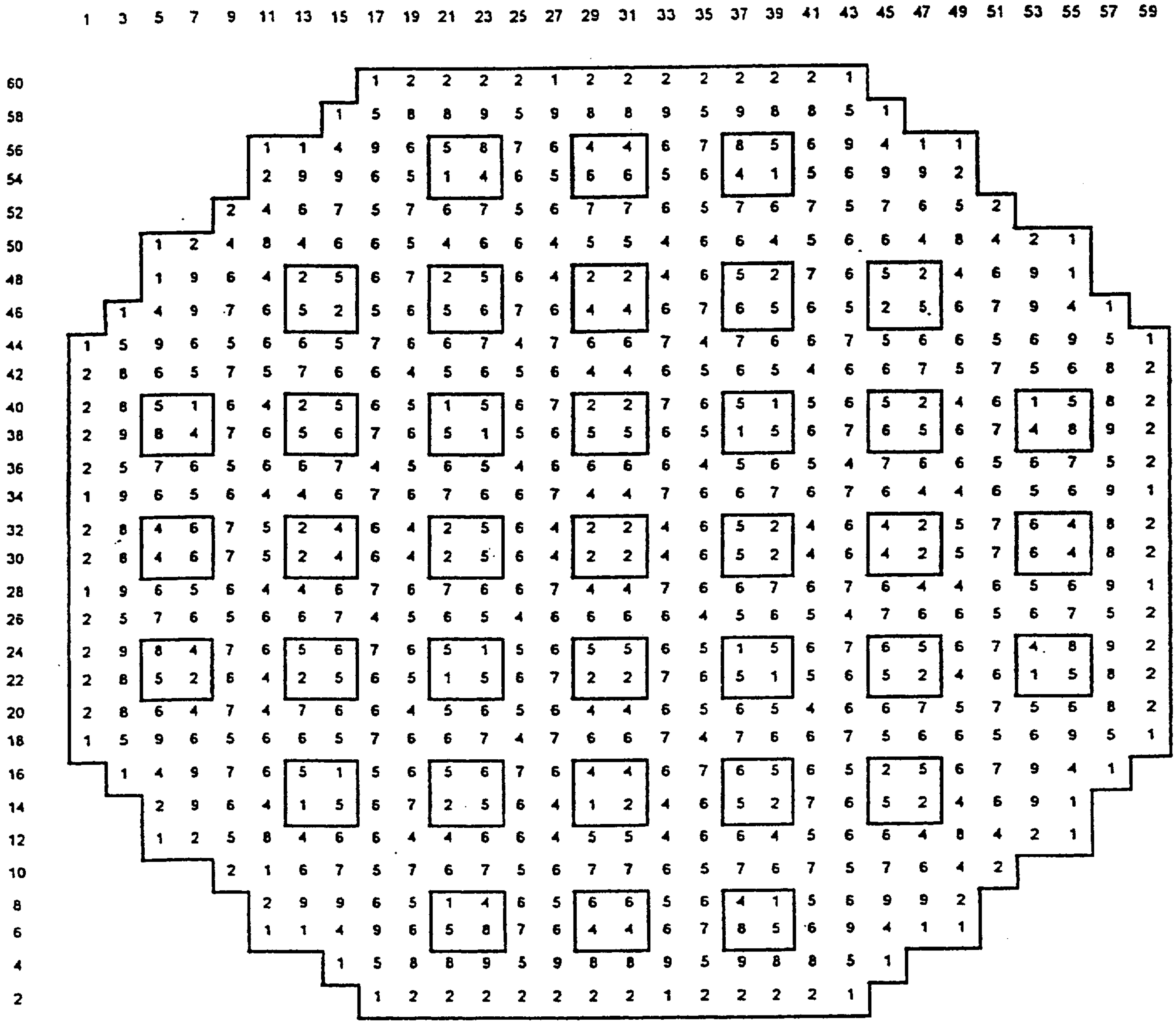
Figure 4.16 ATRIUM-9B SPCA9-384B-11GZ-80M Assembly Design

SPCA9-384B-11GZ-80M



A	0.72 wt% U-235
B	2.72 wt% U-235
C	3.53 wt% U-235
D	3.78 wt% U-235
E	3.94 wt% U-235
F	4.19 wt% U-235
G	4.53 wt% U-235
H	4.78 wt% U-235
I	3.69 wt% U-235 + 6.00 wt% Gd_2O_3
J	4.19 wt% U-235 + 6.00 wt% Gd_2O_3

Figure 4.16 ATRIUM-9B SPCA9-384B-11GZ-80M Assembly Design (continued)



	1	3	5	7	9	11	13	15	17	19	21	23	25	27	29	31	33	35	37	39	41	43	45	47	49	51	53	55	57	59
60									1	2	2	2	2	1	2	2	2	2	2	2	2	1								
58								1	5	8	8	9	5	9	8	8	9	5	9	8	8	5	1							
56						1	1	4	9	6	5	8	7	6	4	4	6	7	8	5	6	9	4	1	1					
54						2	9	9	6	5	1	4	6	5	6	6	5	6	4	1	5	6	9	9	2					
52					2	4	6	7	5	7	6	7	5	6	7	7	6	5	7	6	7	5	7	6	5	2				
50			1	2	4	8	4	6	6	5	4	6	6	4	5	5	4	6	6	4	5	6	6	4	8	4	2	1		
48			1	9	6	4	2	5	6	7	2	5	6	4	2	2	4	6	5	2	7	6	5	2	4	6	9	1		
46		1	4	9	7	6	5	2	5	6	5	6	7	6	4	4	6	7	6	5	6	5	2	5	6	7	9	4	1	
44	1	5	9	6	5	6	6	5	7	6	6	7	4	7	6	6	7	4	7	6	6	7	5	6	6	5	6	9	5	1
42	2	8	6	5	7	5	7	6	6	4	5	6	5	6	4	4	6	5	6	5	4	6	6	7	5	7	5	6	8	2
40	2	8	5	1	6	4	2	5	6	5	1	5	6	7	2	2	7	6	5	1	5	6	5	2	4	6	1	5	8	2
38	2	9	8	4	7	6	5	6	7	6	5	1	5	6	5	5	6	5	1	5	6	7	6	5	6	7	4	8	9	2
36	2	5	7	6	5	6	6	7	4	5	6	5	4	6	6	6	6	4	5	6	5	4	7	6	6	5	6	7	5	2
34	1	9	6	5	6	4	4	6	7	6	7	6	6	7	4	4	7	6	6	7	6	7	6	4	4	6	5	6	9	1
32	2	8	4	6	7	5	2	4	6	4	2	5	6	4	2	2	4	6	5	2	4	6	4	2	5	7	6	4	8	2
30	2	8	4	6	7	5	2	4	6	4	2	5	6	4	2	2	4	6	5	2	4	6	4	2	5	7	6	4	8	2
28	1	9	6	5	6	4	4	6	7	6	7	6	6	7	4	4	7	6	6	7	6	7	6	4	4	6	5	6	9	1
26	2	5	7	6	5	6	6	7	4	5	6	5	4	6	6	6	6	4	5	6	5	4	7	6	6	5	6	7	5	2
24	2	9	8	4	7	6	5	6	7	6	5	1	5	6	5	5	6	5	1	5	6	7	6	5	6	7	4	8	9	2
22	2	8	5	2	6	4	2	5	6	5	1	5	6	7	2	2	7	6	5	1	5	6	5	2	4	6	1	5	8	2
20	2	8	6	4	7	4	7	6	6	4	5	6	5	6	4	4	6	5	6	5	4	6	6	7	5	7	5	6	8	2
18	1	5	9	6	5	6	6	5	7	6	6	7	4	7	6	6	7	4	7	6	6	7	5	6	6	5	6	9	5	1
16		1	4	9	7	6	5	1	5	6	5	6	7	6	4	4	6	7	6	5	6	5	2	5	6	7	9	4	1	
14			2	9	6	4	1	5	6	7	2	5	6	4	1	2	4	6	5	2	7	6	5	2	4	6	9	1		
12			1	2	5	8	4	6	6	4	4	6	6	4	5	5	4	6	6	4	5	6	6	4	8	4	2	1		
10					2	1	6	7	5	7	6	7	5	6	7	7	6	5	7	6	7	5	7	6	4	2				
8						2	9	9	6	5	1	4	6	5	6	6	5	6	4	1	5	6	9	9	2					
6						1	1	4	9	6	5	8	7	6	4	4	6	7	8	5	6	9	4	1	1					
4								1	5	8	8	9	5	9	8	8	9	5	9	8	8	5	1							
2									1	2	2	2	2	2	2	2	1	2	2	2	2	1								

Fuel Type	Bundle Name	Number of Bundles	Load Cycle
1	GE9B-P8CWB322-11GZ-100M-150	56	7
2	GE9B-P8CWB320-9GZ-100M-150	89	7
4	GE9B-P8CWB343-12GZ-80M-150	104	8
5	GE9B-P8CWB342-10GZ-80M-150	143	8
6	SPCA9-393B-16GZ-100M	208	9
7	SPCA9-396B-12GZB-100M	88	9
8	SPCA9-384B-11GZ-80M	36	9
9	SPCA9-396B-12GZC-100M	40	9

Figure 4.17 LaSalle Unit 1 Cycle 9 Reference Loading Map

5.0 Anticipated Operational Occurrences

Applicable Disposition of Events — Reference 9.7

5.1 *Analysis of Plant Transients at Rated Conditions* — Reference 9.3

Limiting Transients:

Load Rejection No Bypass (LRNB)
Feedwater Controller Failure (FWCF)
Loss of Feedwater Heating (LFWH)

Transient	Scram Speed	Peak Neutron Flux (% Rated)	Peak Heat Flux (% Rated)	Peak Lower Plenum Pressure (psig)	ΔCPR ATRIUM-9B/GE9
LRNB[*]	TSSS	460.2	126.5	1206	0.34 / 0.38
FWCF[†]	TSSS	371.3	122.6	1167	0.30 / 0.33
LRNB[†]	NSS	401.1	121.3	1203	0.31 / 0.34
FWCF[†]	NSS	342.9	120.5	1164	0.28 / 0.31
LFWH[‡]		[‡]	[‡]	[‡]	[‡]

5.2 *Analysis for Reduced Flow Operation* — Reference 9.3

Limiting Transient: Slow Flow Excursion

MCPR$_f$ Manual Flow Control — ATRIUM-9B and GE9 Fuel	Figure 5.1
LHGRFAC$_f$ — ATRIUM-9B Fuel	Figure 5.2
MAPFAC$_f$ — GE9 Fuel	[‡]

MCPR$_f$ and LHGRFAC$_f$ results are applicable at all Cycle 9 exposures and in all EOD and EOOS scenarios presented in Table 1.1. MCPR$_f$ limits are provided for maximum core flows of 102.5% and 105% of rated. The LHGRFAC$_f$ multipliers provided in Figure 5.2 are applicable for maximum core flows of 102.5% and 105% of rated.

---

[*] Based on 100%P/81%F conditions.

[†] Based on 100%P/105%F conditions.

[‡] This data to be furnished by ComEd.

5.3 *Analysis for Reduced Power Operation*

	Reference 9.3
Limiting Transient: Load Rejection No Bypass (LRNB) Feedwater Controller Failure (FWCF)	
$MCPR_p$ Base Case Operation	Tables 5.1–5.4 Figures 5.3–5.6
$LHGRFAC_p$ Base Case Operation*	Tables 5.1–5.4
$MCPR_p$, EOOS Conditions	Tables 5.1–5.4
$LHGRFAC_p$, EOOS Conditions*	Tables 5.1–5.4
$MAPFAC_p$ — All Operating Conditions*	<To be furnished by ComEd.>

5.4 *ASME Overpressurization Analysis*

	Reference 9.3
Limiting Event	MSIV Closure
Worst Single Failure	Valve Position Scram
Maximum Vessel Pressure (Lower Plenum)	1320 psig
Maximum Steam Dome Pressure	1291 psig

5.5 *Control Rod Withdrawal Error*

Starting Control Pattern for Analysis	Figure 5.7

< This data is to be furnished by ComEd. >

5.6 *Fuel Loading Error*

< This data is to be furnished by ComEd. >

5.7 *Determination of Thermal Margins*

The results of the analyses presented in Sections 5.1–5.3 are used for the determination of the operating limit. Section 5.1 provides the results of analyses at rated conditions. Section 5.2 provides for the determination of the MCPR and LHGR limits at reduced flow ($MCPR_f$, Figure

---

* $LHGRFAC_p$ values presented are applicable to SPC fuel. GE $MAPFAC_p$ limits will continue to be applied to GE9 fuel at off-rated power.

5.1; LHGRFAC_f, Figure 5.2). Section 5.3 provides for the determination of the MCPR and LHGR limits at conditions of reduced power (Figures 5.3–5.6, Tables 5.1–5.4). Limits are presented for base case operation and the EOD and EOOS scenarios presented in Table 1.1. The results presented are based on the analyses performed by SPC. As indicated above, the final Cycle 9 MCPR operating limits need to be established in conjunction with the results from ComEd analyses.

Table 5.1 EOC Base Case and EOOS $MCPR_p$ Limits and $LHGRFAC_p$ Multipliers for TSSS Insertion Times for Prepower Uprate Conditions (3323 MWt Rated Power)*

		ATRIUM-9B Fuel		GE9 Fuel
EOOS Condition	Power (% Rated)	$MCPR_p$	$LHGRFAC_p$	$MCPR_p$
Base Case Operation	0	2.70	0.66	2.70
	25	2.22	0.66	2.22
	25	2.07	0.66	2.12
	63	1.56	0.94	1.57
	84	1.51	0.98	1.53
	100	1.46	0.99	1.50
Feedwater Heaters Out of Service (FHOOS)	0	2.85	0.64	2.85
	25	2.38	0.64	2.38
	25	2.38	0.64	2.38
	63	1.62	0.90	1.62
	100	1.47	0.99	1.51
Single-Loop Operation	0	2.71	0.66	2.71
	25	2.23	0.66	2.23
	25	2.08	0.66	2.13
	63	1.57	0.94	1.58
	84	1.52	0.98	1.54
	100	1.47	0.99	1.51
Turbine Bypass Valves Out of Service (TBVOOS)	0	2.70	0.66	2.70
	25	2.22	0.66	2.22
	25	2.17	0.66	2.17
	63	1.63	0.90	1.65
	100	1.49	0.94	1.53

---

* Limits support operation with any combination of one SRVOOS, up to 2 TIPOOS (or the equivalent number of TIP channels), up to a 20°F reduction in feedwater temperature (except for conditions with FHOOS), and up to 50% of the LPRMs out of service in the standard, ICF and MELLLA regions of the power/flow map.

Table 5.1 EOC Base Case and EOOS $MCPR_p$ Limits and $LHGRFAC_p$ Multipliers for TSSS Insertion Times for Prepower Uprate Conditions (3323 MWt Rated Power)*
(continued)

EOOS/EOD Condition	Power (% Rated)	ATRIUM-9B Fuel		GE9 Fuel
		$MCPR_p$	$LHGRFAC_p$	$MCPR_p$
Recirculation Pump Trip Out of Service (No RPT)	0	2.70	0.66	2.70
	25	2.22	0.66	2.22
	25	2.07	0.66	2.12
	63	1.60	0.86	1.63
	100	1.51	0.86	1.56
Turbine Control Valve (TCV) Slow Closure and/or No RPT	0	2.70	0.66	2.70
	25	2.22	0.66	2.22
	25	2.16	0.66	2.16
	84	1.65	0.86	1.69
	84	1.63	0.86	1.67
	100	1.56	0.86	1.60
TCV Slow Closure/ FHOOS and/or No RPT	0	2.85	0.63	2.85
	25	2.38	0.63	2.38
	25	2.38	0.63	2.38
	84	1.65	0.86	1.69
	84	1.63	0.86	1.67
	100	1.56	0.86	1.60
Idle Loop Startup	0	2.54	0.40	2.54
	25	2.54	0.40	2.54
	25	2.54	0.40	2.54
	63	2.54	0.40	2.54
	100	2.54	0.40	2.54

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* Limits support operation with any combination of one SRVOOS, up to 2 TIPOOS (or the equivalent number of TIP channels), up to a 20°F reduction in feedwater temperature (except for conditions with FHOOS), and up to 50% of the LPRMs out of service in the standard, ICF and MELLLA regions of the power/flow map.

Table 5.2 Base Case $MCPR_p$ Limits and $LHGRFAC_p$ Multipliers for NSS Insertion Times for Prepower Uprate (3323 MWt Rated Power)*

		ATRIUM-9B Fuel		GE9
EOOS Condition	Power (% Rated)	$MCPR_p$	$LHGRFAC_p$	$MCPR_p$
Base Case Operation	0	2.70	0.74	2.70
	25	2.22	0.74	2.22
	25	2.07	0.74	2.07
	63	1.54	0.95	1.56
	84	1.48	1.00	1.51
	100	1.43	1.00	1.46

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* Limits support operation with any combination of one SRVOOS, up to 2 TIPOOS (or the equivalent number of TIP channels), up to a 20°F reduction in feedwater temperature (except for conditions with FHOOS), and up to 50% of the LPRMs out of service in the standard, ICF and MELLLA regions for the power/flow map.

Table 5.3 EOC Base Case and EOOS $MCPR_p$ Limits and $LHGRFAC_p$ for Multipliers for TSSS Insertion Times for Power Uprate Conditions (3489 MWt Rated Power)*

		ATRIUM-9B Fuel		GE9 Fuel
EOOS/EOD Condition	Power (% Rated)	$MCPR_p$	$LHGRFAC_p$	$MCPR_p$
Base Case Operation	0	2.70	0.67	2.70
	25	2.20	0.67	2.20
	25	2.05	0.67	2.10
	60	1.56	0.94	1.57
	80	1.51	0.98	1.53
	100	1.45	1.00	1.49
Feedwater Heaters Out of Service (FHOOS)	0	2.85	0.65	2.85
	25	2.35	0.65	2.35
	25	2.35	0.65	2.35
	60	1.62	0.90	1.62
	100	1.45	1.00	1.49
Single-Loop Operation	0	2.71	0.67	2.71
	25	2.21	0.67	2.21
	25	2.06	0.67	2.11
	60	1.57	0.94	1.58
	80	1.52	0.98	1.54
	100	1.46	1.00	1.50
Turbine Bypass Valves Out of Service (TBVOOS)	0	2.70	0.67	2.70
	25	2.20	0.67	2.20
	25	2.15	0.67	2.15
	60	1.63	0.90	1.65
	100	1.47	0.94	1.51

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* Limits support operation with any combination of one SRVOOS, up to 2 TIPOOS (or the equivalent number of TIP channels), up to a 20°F reduction in feedwater temperature (except for conditions with FHOOS), and up to 50% of the LPRMs out of service in the standard, ICF and MELLLA regions of the power/flow map.

Table 5.3 EOC Base Case and EOOS MCPR$_p$ Limits and LHGRFAC$_p$ Multipliers for TSSS Insertion Times for Power Uprate Conditions (3489 MWt Rated Power)*
(continued)

		ATRIUM-9B Fuel		GE9 Fuel
EOOS/EOD Condition	Power (% Rated)	MCPR$_p$	LHGRFAC$_p$	MCPR$_p$
Recirculation Pump Trip Out of Service (No RPT)	0	2.70	0.67	2.70
	25	2.20	0.67	2.20
	25	2.05	0.67	2.10
	60	1.60	0.86	1.63
	100	1.50	0.86	1.55
Turbine Control Valve (TCV) Slow Closure and/or No RPT	0	2.70	0.67	2.70
	25	2.20	0.67	2.20
	25	2.15	0.67	2.15
	80	1.65	0.86	1.69
	80	1.63	0.86	1.67
	100	1.54	0.86	1.58
TCV Slow Closure/ FHOOS and/or No RPT	0	2.85	0.64	2.85
	25	2.35	0.64	2.35
	25	2.35	0.64	2.35
	80	1.65	0.86	1.69
	80	1.63	0.86	1.67
	100	1.54	0.86	1.58
Idle Loop Restart	0	2.54	0.40	2.54
	25	2.54	0.40	2.54
	25	2.54	0.40	2.54
	60	2.54	0.40	2.54
	100	2.54	0.40	2.54

---

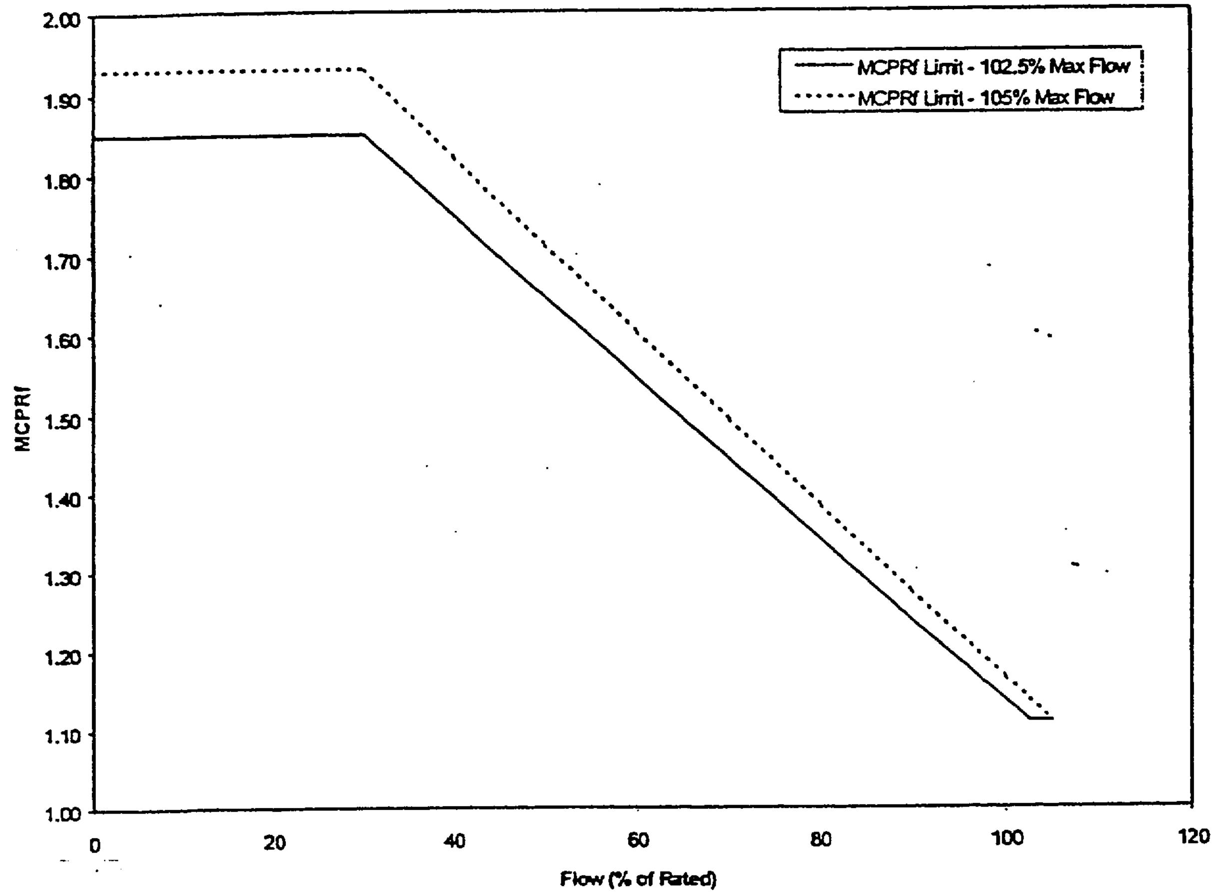
* Limits support operation with any combination of one SRVOOS, up to 2 TIPOOS (or the equivalent number of TIP channels), up to a 20°F reduction in feedwater temperature (except for conditions with FHOOS), and up to 50% of the LPRMs out of service in the standard, ICF and MELLLA regions of the power/flow map.

Table 5.4 EOC $MCPR_p$ Limits and $LHGRFAC_p$ Multipliers for NSS Insertion Times for Power Uprate Conditions (3489 MWt Rated Power)*

EOOS Condition	Power (% Rated)	ATRIUM-9B Fuel $MCPR_p$	ATRIUM-9B Fuel $LHGRFAC_p$	GE9 $MCPR_p$
Base Case Operation	0	2.70	0.75	2.70
	25	2.20	0.75	2.20
	25	2.05	0.75	2.05
	60	1.54	0.95	1.56
	80	1.48	1.00	1.51
	100	1.42	1.00	1.45

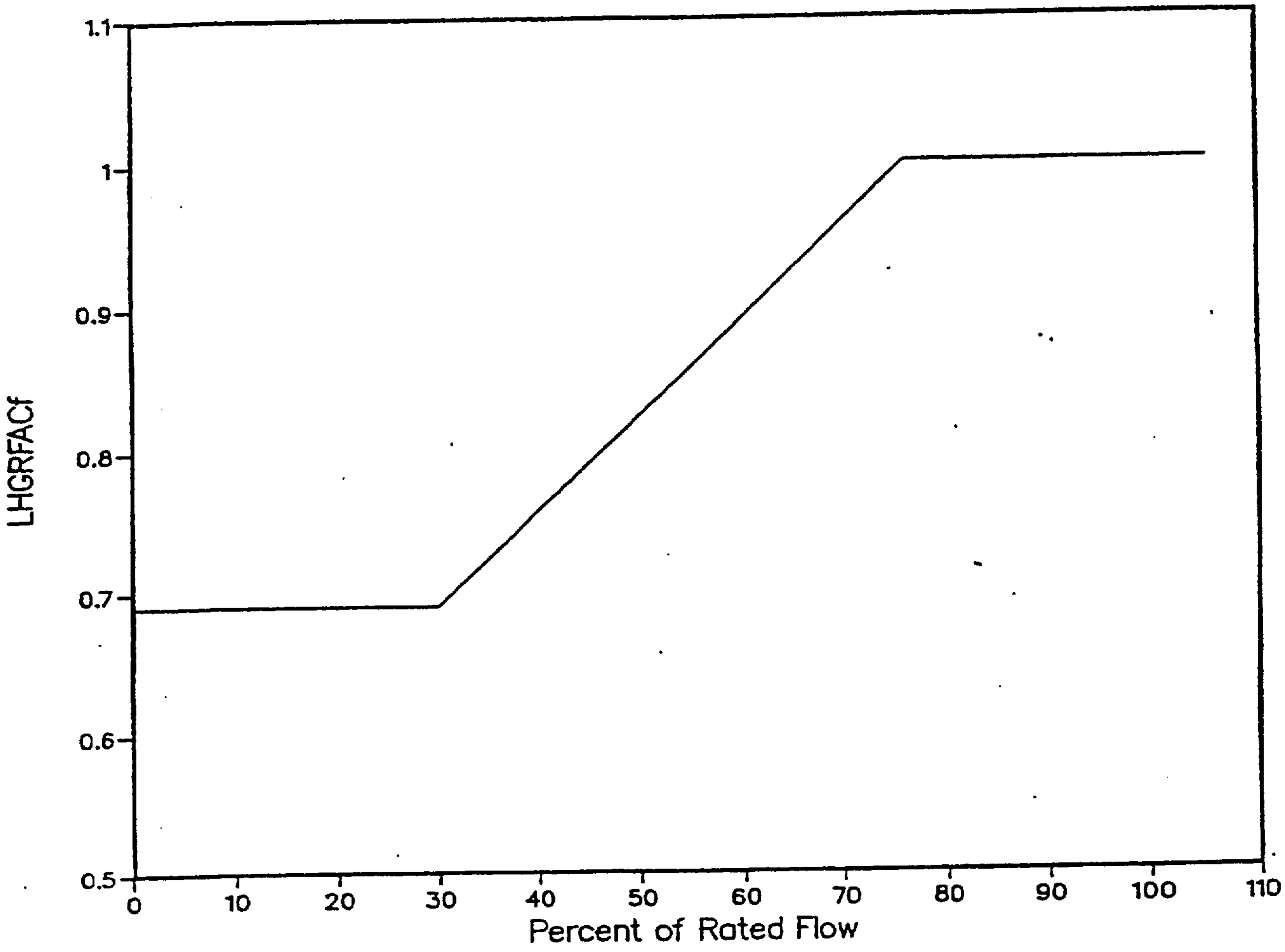
---

* Limits support operation with any combination of one SRVOOS, up to 2 TIPOOS (or the equivalent number of TIP channels), up to a 20°F reduction in feedwater temperature (except for conditions with FHOOS), and up to 50% of the LPRMs out of service in the standard, ICF and MELLLA regions of the power/flow map.



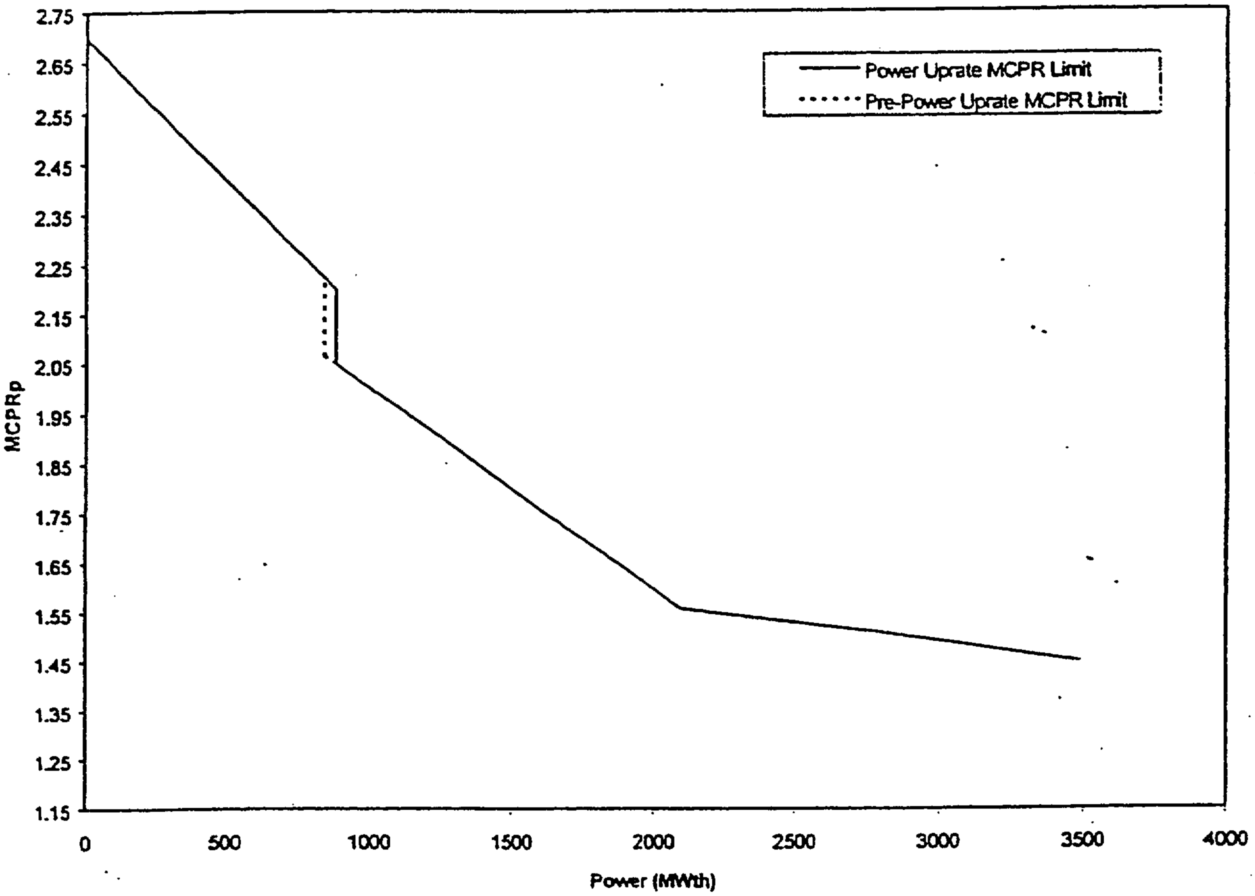
	102.5% Maximum Core Flow		105% Maximum Core Flow	
Flow (% rated)	MCPR$_f$ ATRIUM-9B	MCPR$_f$ GE9	MCPR$_f$ ATRIUM-9B	MCPR$_f$ GE9
0	1.85	1.85	1.93	1.93
30	1.85	1.85	1.93	1.93
102.5	1.11	1.11	1.14	1.14
105	1.11	1.11	1.11	1.11

Figure 5.1 Flow Dependent MCPR Limits for Manual Flow Control Mode



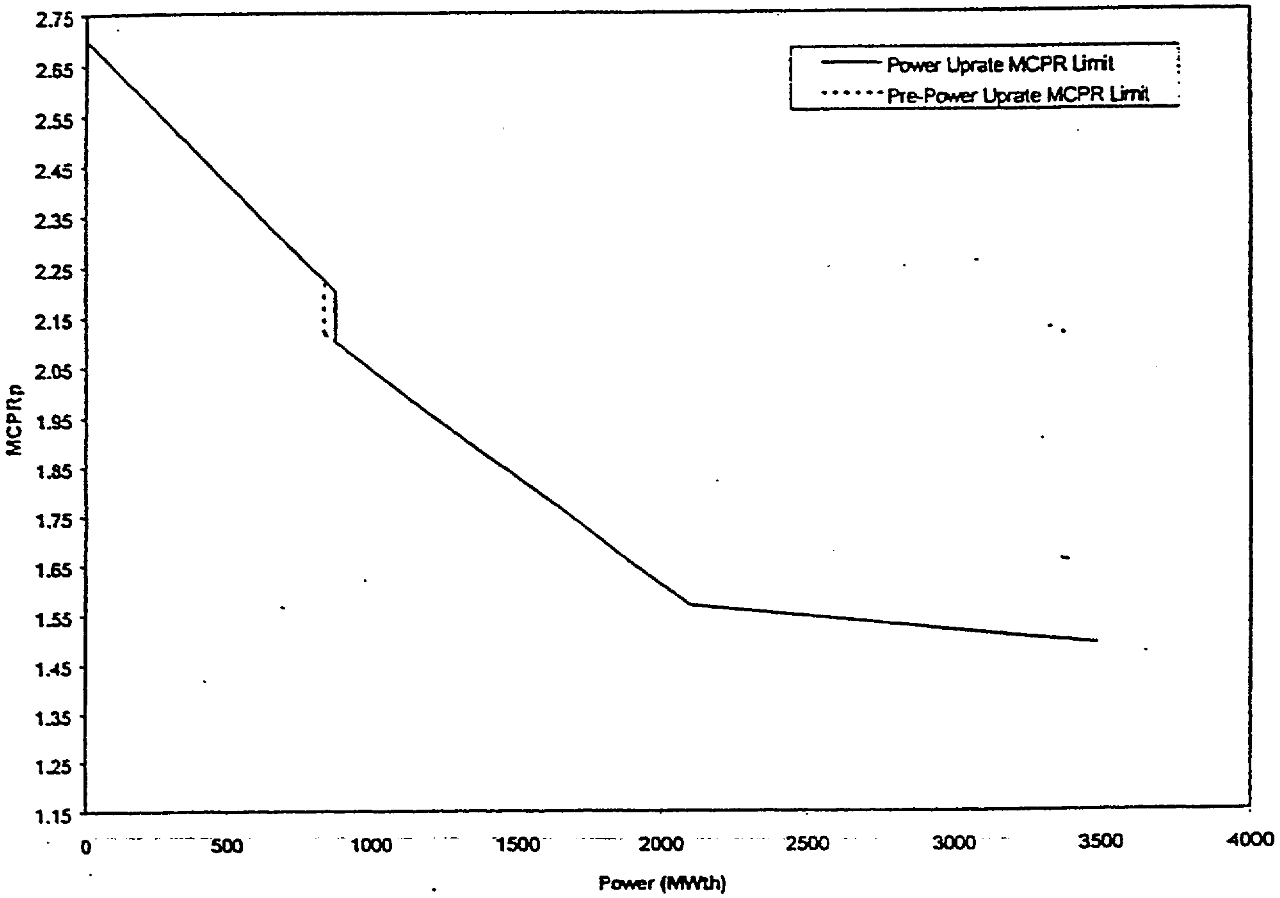
Flow (% rated)	$LHGRFAC_f$
0	0.69
30	0.69
⇒ 76	1.00
105	1.00

Figure 5.2 Flow Dependent LHGR Multipliers for ATRIUM-9B Fuel



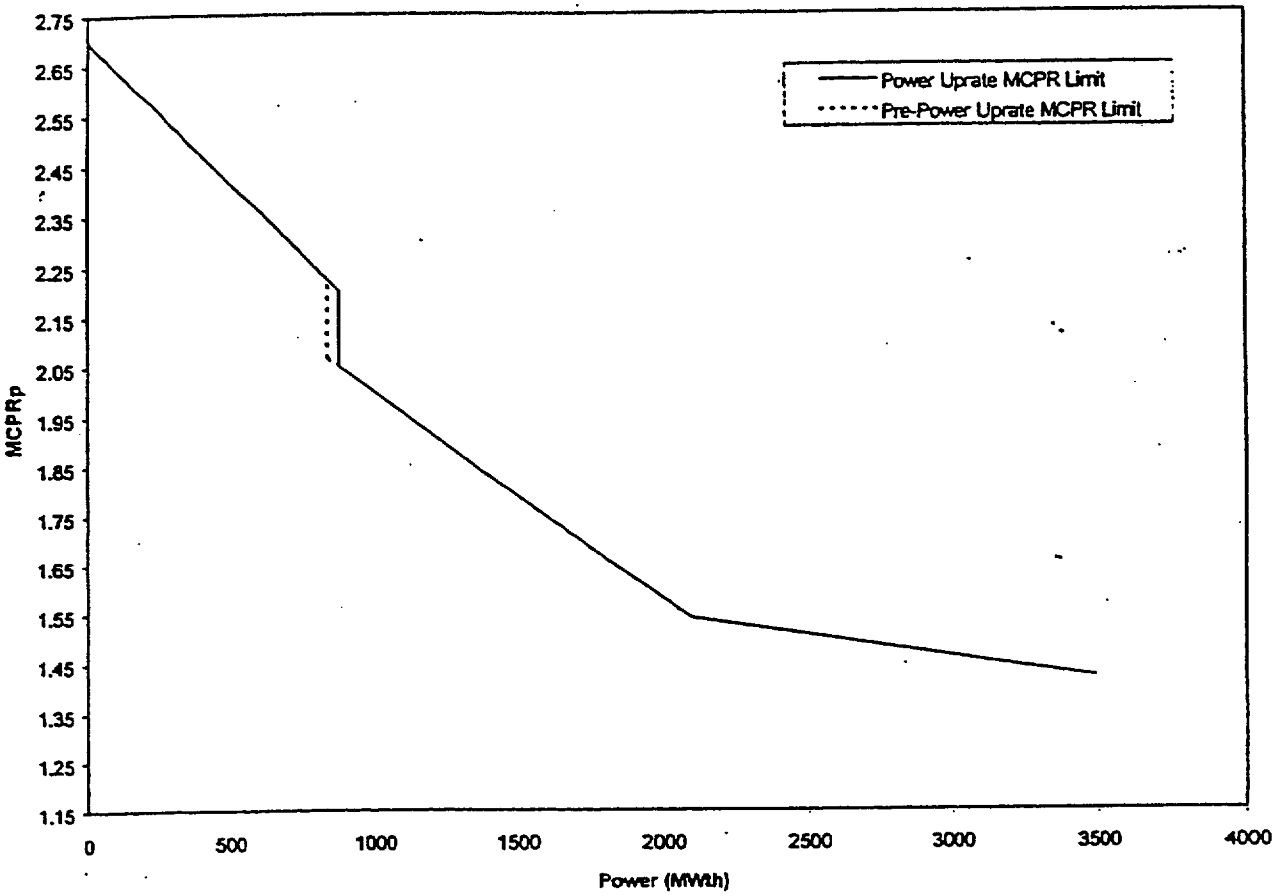
3323 MWt Rated Power		3489 MWt Rated Power	
Power (%)	MCPR$_p$ Limits	Power (%)	MCPR$_p$ Limits
100	1.46	100	1.45
84	1.51	80	1.51
63	1.56	60	1.56
25	2.07	25	2.05
25	2.22	25	2.20
0	2.70	0	2.70

Figure 5.3 Base Case Power Dependent MCPR Limits for ATRIUM-9B Fuel - TSSS Insertion Times



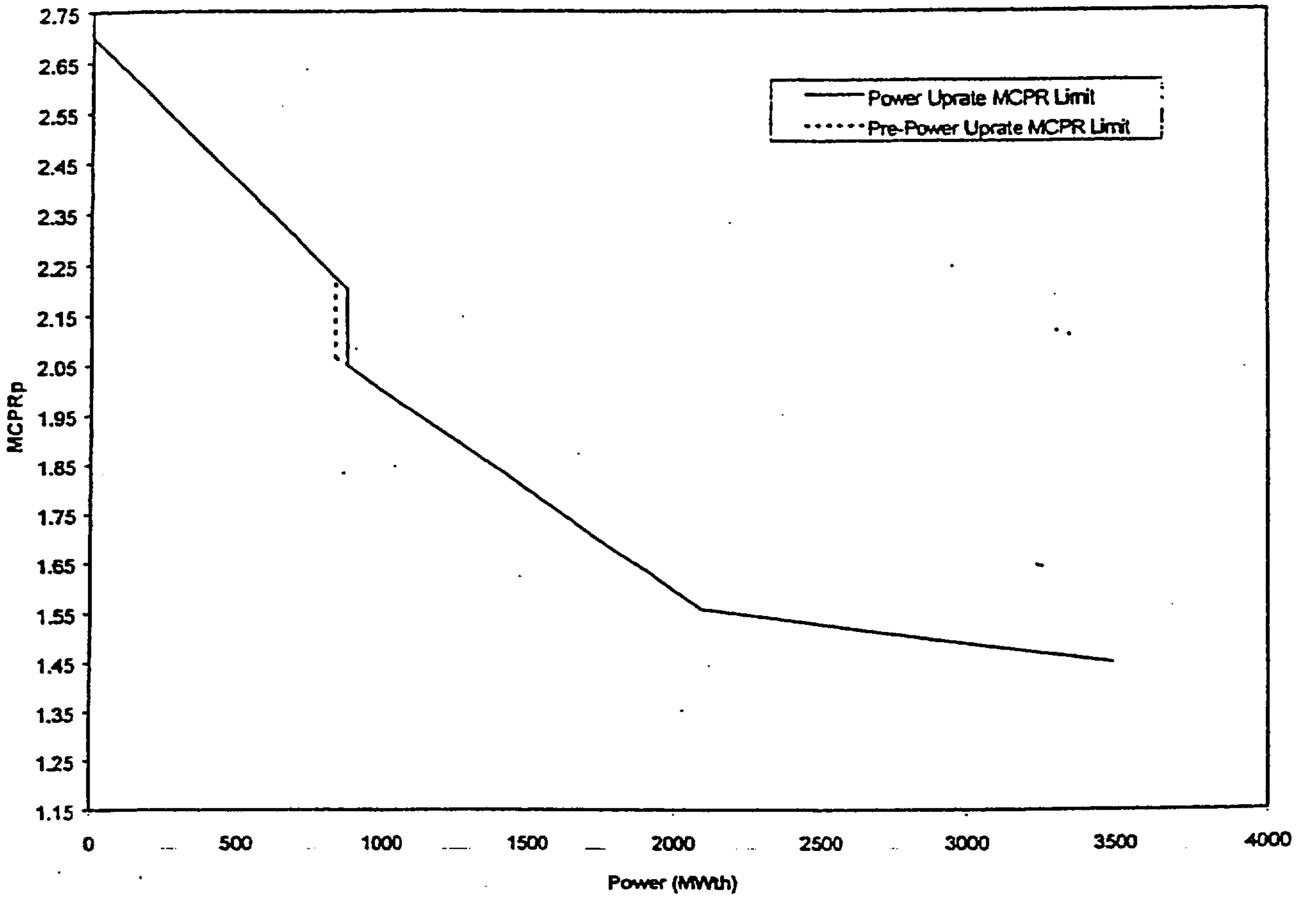
3323 MWt Rated Power		3489 MWt Rated Power	
Power (%)	MCPR_p Limits	Power (%)	MCPR_p Limits
100	1.50	100	1.49
84	1.53	80	1.53
63	1.57	60	1.57
25	2.12	25	2.10
25	2.22	25	2.20
0	2.70	0	2.70

Figure 5.4 Base Case Power Dependent MCPR Limits
for GE9 Fuel - TSSS Insertion Times



3323 MWt Rated Power		3489 MWt Rated Power	
Power (%)	MCPR$_p$ Limits	Power (%)	MCPR$_p$ Limits
100	1.43	100	1.42
84	1.48	80	1.48
63	1.54	60	1.54
25	2.07	25	2.05
25	2.22	25	2.20
0	2.70	0	2.70

Figure 5.5 Base Case Power Dependent MCPR Limits
for ATRIUM-9B Fuel - NSS Insertion Times



3323 MWt Rated Power		3489 MWt Rated Power	
Power (%)	MCPR_p Limits	Power (%)	MCPR_p Limits
100	1.46	100	1.45
84	1.51	80	1.51
63	1.56	60	1.56
25	2.07	25	2.05
25	2.22	25	2.20
0	2.70	0	2.70

Figure 5.6 Base Case Power Dependent MCPR Limits for GE9 Fuel - NSS Insertion Times

< This data is to be furnished by ComEd. >

⇒ Figure 5.7 Starting Control Rod Pattern for Control Rod Withdrawal Analysis

6.0 Postulated Accidents

6.1 *Loss-of-Coolant Accident*

6.1.1 Break Location Spectrum — Reference 9.8

6.1.2 Break Size Spectrum — Reference 9.8

6.1.3 MAPLHGR Analyses

The MAPLHGR limits presented in Reference 9.9 are valid for LaSalle Unit 1 ATRIUM-9B (LSA-1) fuel for Cycle 9 operation.

Limiting Break:	1.1 ft^2 Break Recirculation Pump Discharge Line High Pressure Core Spray Diesel Generator Single Failure

Peak clad temperature and peak local metal water reaction results for the Cycle 9 ATRIUM-9B reload fuel are 1795°F and 0.72% respectively. These results are bounded by the results presented in Reference 9.11, which support the Reference 9.9 MAPLHGR limits. The maximum core-wide metal-water reaction for Cycle 9 remains less than 0.16%. LOCA/heatup analysis results for LaSalle ATRIUM-9B are presented below (from Reference 9.11):

	Maximum PCT (°F)	Peak Local Metal-Water Reaction (%)
ATRIUM-9B Fuel	1825	0.79*

The maximum core wide metal-water reaction is < 0.16%.

6.2 *Control Rod Drop Accident*

< This data is to be furnished by ComEd. >

6.3 *Spent Fuel Cask Drop Accident*

The radiological consequences of a spent fuel cask drop accident have been evaluated for SPC ATRIUM fuel designs in conformance with the analysis described in the LSCS UFSAR Section

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* The peak local metal water reaction result is consistent with the limiting PCT analysis results reported in Reference 9.11.

15.7.5. The analysis is assumed to occur 360 days following shutdown of the reactor, and it is assumed that all 32 fuel assemblies in the cask completely fail as a result of the accident.

Because the accident is assumed not to occur sooner than 360 days following shutdown of the reactor, the source term for the accident will be very low due to fission product decay. Hence, the commensurate radiological whole-body and thyroid doses will be very low. The results of this analysis demonstrate that spent fuel cask drop accidents involving SPC ATRIUM fuel will not exceed the established radiological whole-body and thyroid dose limits which are a small fraction of the 10 CFR 100 limits for radiological exposures.

7.0 Technical Specifications

7.1 *Limiting Safety System Settings*

7.1.1 MCPR Fuel Cladding Integrity Safety Limit

MCPR Safety Limit (all fuel) — two-loop operation	1.11[*]
MCPR Safety Limit (all fuel) — single-loop operation	1.12[*]

7.1.2 Steam Dome Pressure Safety Limit

Pressure Safety Limit	1325 psig

7.2 *Limiting Conditions for Operation*

7.2.1 Average Planar Linear Heat Generation Rate

Reference 9.9

ATRIUM-9B Fuel MAPLHGR Limits		GE9 Fuel MAPLHGR Limits
Average Planar Exposure (GWd/MTU)	MAPLHGR (kW/ft)	< To be furnished by ComEd. >
0.0	13.5	
20.0	13.5	
61.1	9.39	

Single Loop Operation MAPLHGR Multiplier for SPC Fuel is 0.90	Reference 9.9

7.2.2 Minimum Critical Power Ratio

Rated Conditions MCPR Limit[†]

Flow Dependent MCPR Limits:

Manual Flow Control	Figure 5.1

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[*] Includes the effects of channel bow, up to 2 TIPOOS (or the equivalent number of TIP channels), a 2000 EFPH LPRM calibration interval and up to 50% of the LPRMs out of service.

[†] This data is to be furnished by ComEd.

Power Dependent MCPR Limits:

Base Case Operation - TSSS Insertion Times	Figures 5.3 & 5.4
Base Case Operation - NSS Insertion Times	Figures 5.5 & 5.6
EOD and EOOS Operation	Tables 5.1–5.4

7.2.3 Linear Heat Generation Rate

Reference 9.1

ATRIUM-9B Fuel
Steady-State LHGR Limits

Average Planar Exposure (GWd/MTU)	LHGR (kW/ft)
0.0	14.4
15.0	14.4
61.1	8.32

GE9 Fuel
Steady-State LHGR Limits

< To be furnished by ComEd. >

The protection against power transient (PAPT) linear heat generation rate curve for ATRIUM-9B fuel is identified in Reference 9.1 and is presented here as Figure 7.1 for convenience. $LHGRFAC_f$ and $LHGRFAC_p$ multipliers are applied directly to the steady-state LHGR limits at reduced power, reduced flow and/or EOD/EOOS conditions to ensure the PAPT LHGR limits are not violated during an AOO. Comparison of the Cycle 9 nodal power histories for the rated power pressurization transients with the approved bounding curves to show compliance with the 1% strain criteria for GE9 fuel is discussed in Reference 9.10.

LHGRFAC Multipliers for Off-Rated Conditions - ATRIUM-9B Fuel:

$LHGRFAC_f$	Figure 5.2
$LHGRFAC_p$	Tables 5.1–5.4

MAPFAC Multipliers for Off-Rated Conditions - GE9 Fuel:

$MAPFAC_f$	< To be furnished by ComEd. >
$MAPFAC_p$	< To be furnished by ComEd. >

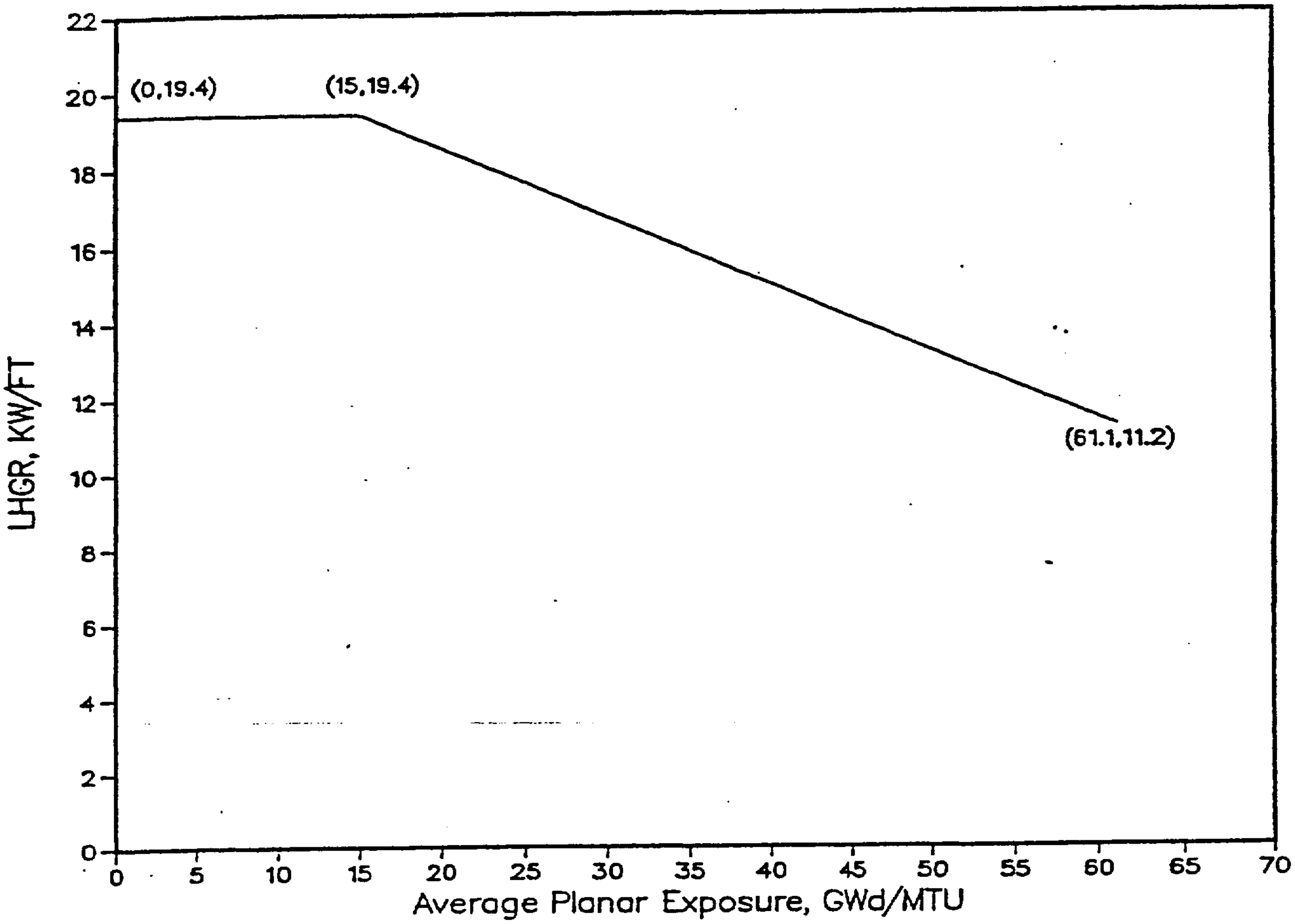


Figure 7.1 Protection Against Power Transient LHGR Limit for ATRIUM-9B Fuel

8.0 Methodology References

See XN-NF-80-19(P)(A) Volume 4 Revision 1 for a complete bibliography.

8.1 ANF-913(P)(A) Volume 1 Revision 1 and Volume 1 Supplements 2, 3 and 4, *COTRANSA2: A Computer Program for Boiling Water Reactor Transient Analyses*, Advanced Nuclear Fuels Corporation, August 1990.

8.2 ANF-524(P)(A) Revision 2 and Supplement 1 Revision 2, *ANF Critical Power Methodology for Boiling Water Reactors*, Advanced Nuclear Fuels Corporation, November 1990.

8.3 ANF-1125(P)(A) and ANF-1125(P)(A), Supplement 1, *ANFB Critical Power Correlation*, Advanced Nuclear Fuels Corporation, April 1990.

8.4 EMF-1125(P)(A), Supplement 1 Appendix C, *ANFB Critical Power Correlation Application for Co-Resident Fuel*, Siemens Power Corporation, August 1997.

8.5 ANF-1125(P)(A), Supplement 1 Appendix E Revision 0, *ANFB Critical Power Correlation Determination of ATRIUM-9B Additive Constant Uncertainties*, Siemens Power Corporation, September 1998.

8.6 XN-NF-80-19(P)(A) Volume 1 Supplement 3, Supplement 3 Appendix F, and Supplement 4, *Advanced Nuclear Fuels Methodology for Boiling Water Reactors: Benchmark Results for CASMO-3G/MICROBURN-B Calculation Methodology*, Advanced Nuclear Fuels Corporation, November 1990.

8.7 EMF-CC-074(P)(A) Volume 1, *STAIF - A Computer Program for BWR Stability Analysis in the Frequency Domain*, and Volume 2, *STAIF - A Computer Program for BWR Stability Analysis in the Frequency Domain - Code Qualification Report*, Siemens Power Corporation, July 1994.

9.0 Additional References

9.1 EMF-2249(P) Revision 1, *Fuel Design Report for LaSalle Unit 1 Cycle 9 ATRIUM™-9B Fuel Assemblies*, Siemens Power Corporation, September 1999.

9.2 ANF-89-014(P)(A) Revision 1 and Supplements 1 and 2, *Advanced Nuclear Fuels Corporation Generic Mechanical Design for Advanced Nuclear Fuels 9x9-IX and 9x9-9X BWR Reload Fuel*, Advanced Nuclear Fuels Corporation, October 1991.

9.3 EMF-2277 Revision 1, *LaSalle Unit 1 Cycle 9 Plant Transient Analysis*, Siemens Power Corporation, October 1999.

9.4 EMF-95-134(P), *Criticality Safety Analysis for ATRIUM™-9B Fuel, LaSalle Units 1 and 2 New Fuel Storage Vault*, Siemens Power Corporation, December 1995.

9.5 EMF-96-117(P), *Criticality Safety Analysis for ATRIUM™-9B Fuel, LaSalle Unit 1 Spent Fuel Storage Pool (BORAL Rack)*, Siemens Power Corporation, April 1996.

9.6 EMF-95-088(P), *Criticality Safety Analysis for ATRIUM™-9B Fuel, LaSalle Unit 2 Spent Fuel Storage Pool (Boraflex Rack)*, Siemens Power Corporation, February 1996.

9.7 EMF-95-205(P) Revision 2, *LaSalle Extended Operating Domain (EOD) and Equipment Out of Service (EOOS) Safety Analysis for ATRIUM™-9B Fuel*, Siemens Power Corporation, June 1996.

9.8 EMF-2174(P), *LOCA Break Spectrum Analysis for LaSalle Units 1 and 2*, Siemens Power Corporation, March 1999.

9.9 EMF-2175(P), *LaSalle LOCA-ECCS Analysis MAPLHGR Limits for ATRIUM™-9B Fuel*, Siemens Power Corporation, March 1999.

9.10 Letter, D. E. Garber (SPC) to R. J. Chin (ComEd), "LaSalle Unit 1 Cycle 9 Mechanical Limits for GE9 Fuel." DEG:99:213, August 4, 1999.

9.11 Letter, D. E. Garber (SPC) to R. J. Chin (ComEd), "10 CFR 50.46 Reporting for the LaSalle Units," DEG:99:129, May 6, 1999.

Attachment 3

LaSalle Unit 1 Cycle 9

Plant Transient Analysis (Excerpts)

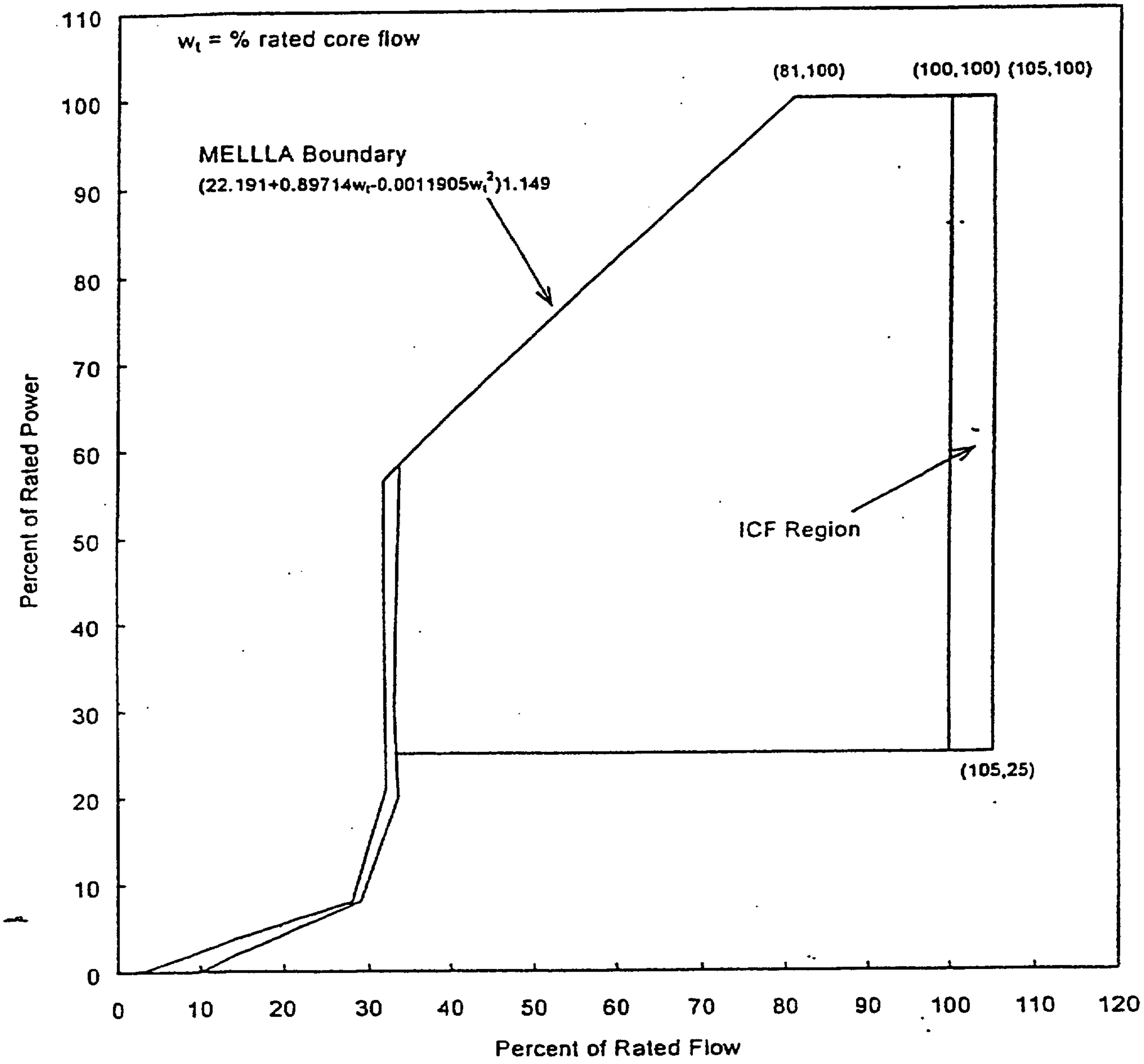
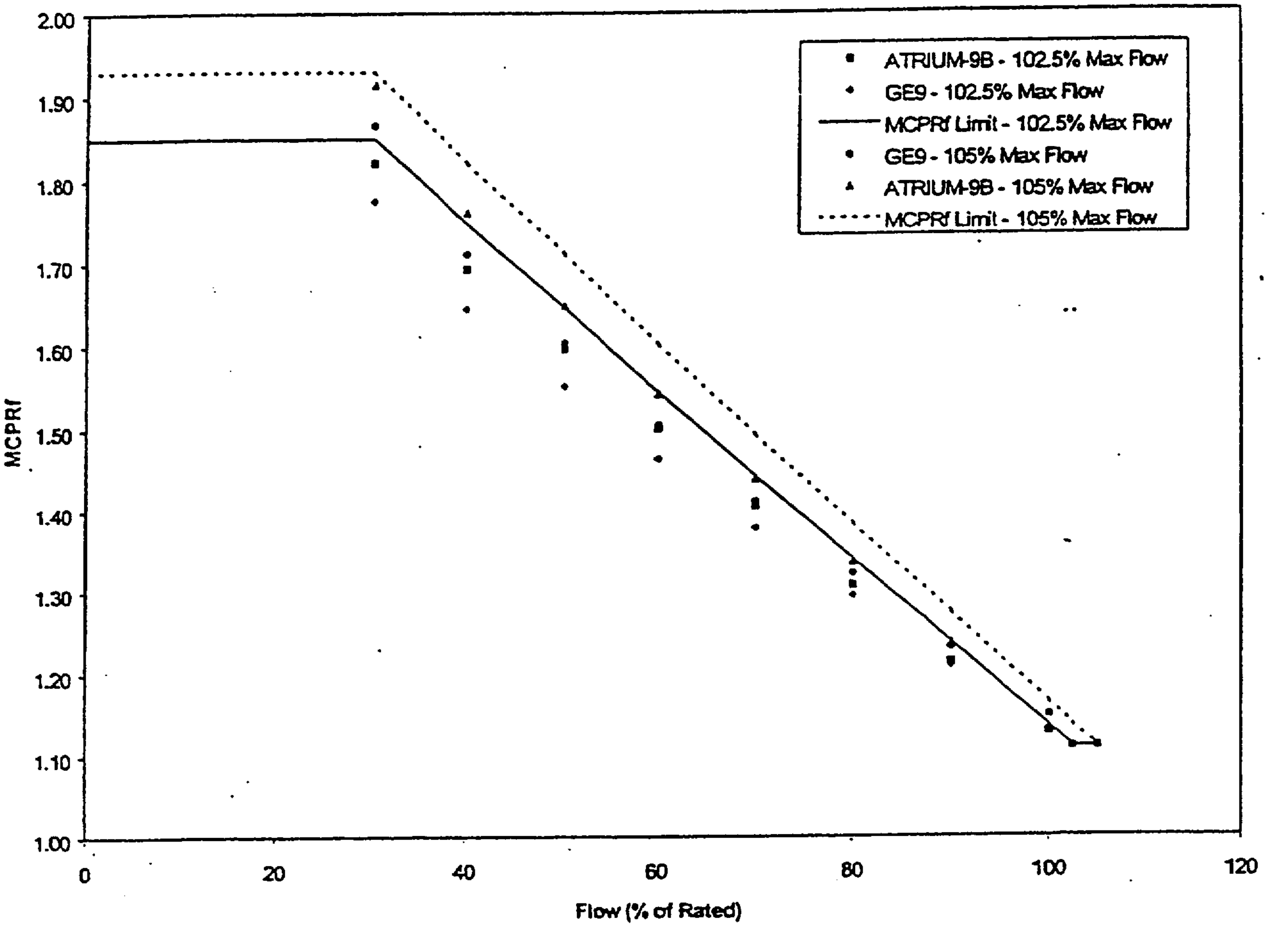
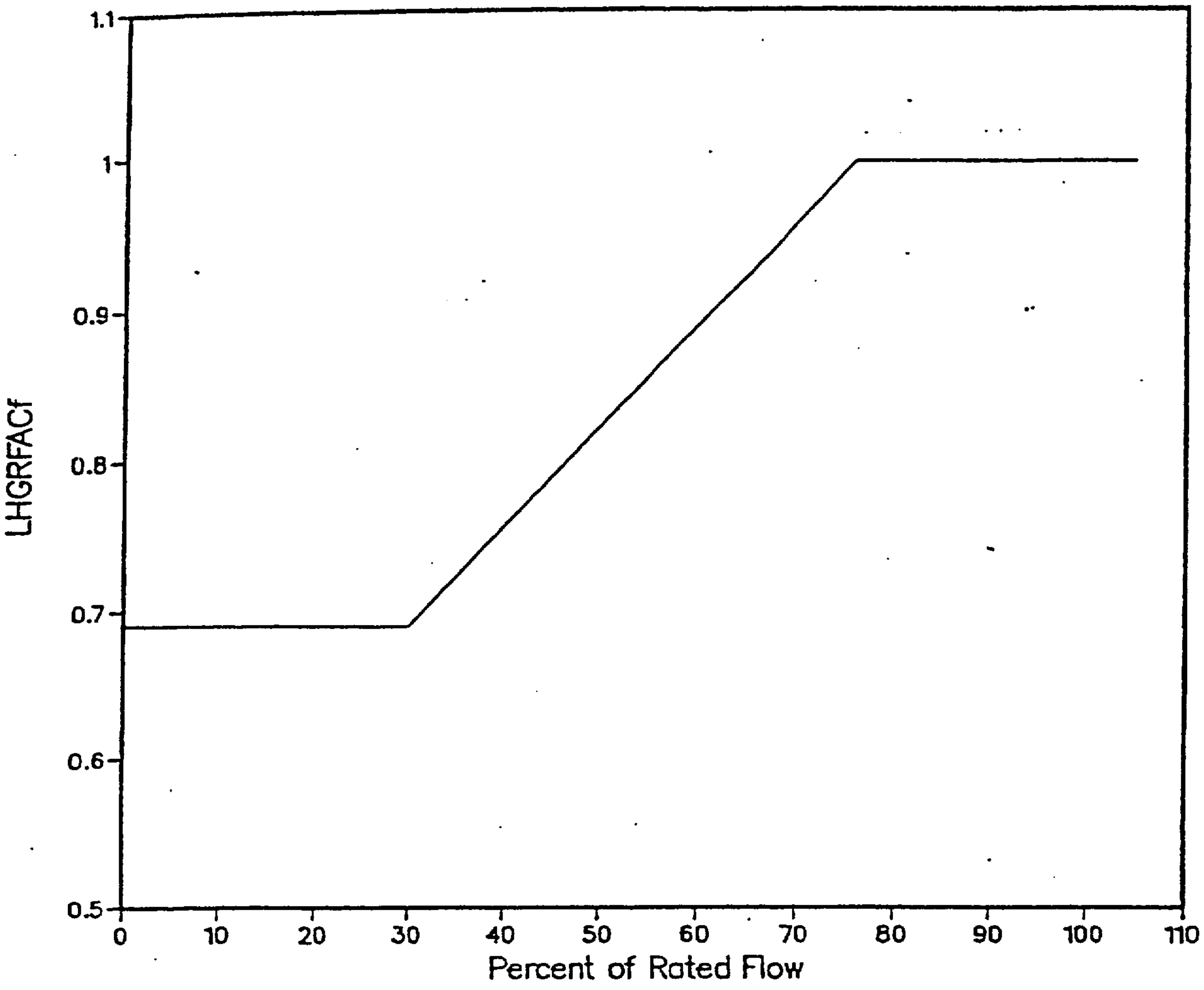


Figure 1.1 LaSalle County Nuclear Station Power / Flow Map



	102.5% Maximum Core Flow		105% Maximum Core Flow	
Flow (% rated)	MCPR$_f$ ATRIUM-9B	MCPR$_f$ GE9 (penalty included)	MCPR$_f$ ATRIUM-9B	MCPR$_f$ GE9 (penalty included)
0	1.85	1.85	1.93	1.93
30	1.85	1.85	1.93	1.93
102.5	1.11	1.11	1.14	1.14
105	1.11	1.11	1.11	1.11

Figure 2.1 Flow-Dependent MCPR Limits for Manual Flow Control Mode



Flow (% rated)	LHGRFAC$_f$
0	0.69
30	0.69
76	1.00
105	1.00

Figure 2.2 Flow-Dependent LHGRFAC
Multipliers for ATRIUM-9B Fuel

Table 3.1 LaSalle Unit 1 Plant Conditions at Rated Power and Flow

Reactor Thermal Power	3489 MWth
Total Core Flow	108.5 Mlbm/hr
Core Active Flow	93.8 Mlbm/hr
Core Bypass Flow*	14.7 Mlbm/hr
Core Inlet Enthalpy	523.9 Btu/lbm
Vessel Pressures	
Steam Dome	1001 psia
Core Exit (upper plenum)	1013 psia
Lower Plenum	1038 psia
TCV Inlet Pressure	948 psia
Feedwater/Steam Flow	15.145 Mlbm/hr
Feedwater Enthalpy	406.6 Btu/lbm
Recirculating Pump Flow (per pump)	15.83 Mlbm/hr
Core Average Gap Coefficient (EOC)	1173 Btu/hr-ft^2-°F

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* Includes water channel flow.

Table 3.2 Scram Speed Insertion Times

Control Rod Position (Notch)	TSSS Time (sec)	NSS Time (sec)
48 (full-out)	0.000	0.000
48*	0.200*	0.200*
45	0.430	0.380
39	0.860	0.680
25	1.930	1.680
5	3.490	2.680
0 (full-in)	3.880	2.804

---

* As indicated in Reference 8, the delay between scram signal and control rod motion is conservatively modeled. Sensitivity analyses indicate that using no delay provides conservative results.

Table 3.3 EOC Base Case LRNB Transient Results

Power*/ Flow	ATRIUM-9B ΔCPR	ATRIUM-9B $LHGRFAC_p$	GE9 ΔCPR	Peak Neutron Flux (% rated)	Peak Heat Flux (% rated)
TSSS Insertion Times					
100/105	0.325	1.000	0.362	438.8	123.7
100/81	0.337	1.000	0.377	460.2	126.5
80/105	0.332	1.000	0.368	367.6	98.2
80/57.2	0.377	1.000	0.410	323.7	99.3
60/105	0.319	1.033	0.349	253.1	72.3
60/35.1	0.301	1.098	0.289	135.0	67.1
40/105	0.260**	1.113	0.271	106.0**	45.6**
25/105	0.191**	1.202	0.177**	44.9**	27.0**
23.81/105	0.186**	1.211	0.171**	41.6**	25.6**
20/105 NDS	1.008	0.706	0.980	44.6	38.1
NSS Insertion Times					
100/105	0.304	1.000	0.338	401.1	121.3
100/81	0.288	1.000	0.323	409.5	122.0
80/105	0.317	1.009	0.351	347.5	96.9
80/57.2	0.278	1.014	0.306	256.1	94.2
60/105	0.309	1.038	0.338	245.9	71.6

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* Power presented relative to uprated power (3489 MWth).

** The analysis results presented are from an earlier cycle exposure. The ΔCPR and $LHGRFAC_p$ results are conservatively used to establish the thermal limits.

Table 3.4 EOC Base Case FWCF Transient Results

Power*/ Flow	ATRIUM-9B ΔCPR	ATRIUM-9B $LHGRFAC_P$	GE9 ΔCPR	Peak Neutron Flux (% rated)	Peak Heat Flux (% rated)
TSSS Insertion Times					
100/105	0.299	1.019	0.322	371.3	122.6
100/81	0.280	1.032	0.301	303.1	121.8
80/105	0.355	0.986	0.376	327.2	101.9
80/57.2	0.294	1.063	0.310	203.7	96.0
60/105	0.431**	0.955	0.440	218.3**	79.3**
60/35.1	0.251	1.143	0.252	104.7	67.0
40/105	0.582**	0.891**	0.546**	128.0**	58.8**
25/105	0.884**	0.767**	0.913**	62.5**	43.2**
23.81/105	0.936**	0.750**	0.964**	61.1**	42.2**
20/105 NDS	1.119	0.688	1.029	70.2	43.9
NSS Insertion Times					
100/105	0.280	1.033	0.301	342.9	120.5
80/105	0.341	1.000	0.360	312.3	100.8
60/105	0.417	0.959	0.430	229.7.	79.9
40/105	0.570**	0.895**	0.535**	124.6**	58.5**
25/105	0.861**	0.777**	0.871**	76.7**	44.0**
23.81/105	0.901**	0.760**	0.923**	73.8**	42.9**

---

* Power presented relative to uprated power (3489 MWth).

** The analysis results presented are from an earlier cycle exposure. The ΔCPR and $LHGRFAC_P$ results are conservatively used to establish the thermal limits.

Table 3.5 Input for MCPR Safety Limit Analysis

Fuel Related Uncertainties

Parameter	Source Document	Statistical Treatment
ANFB Correlation*		
ATRIUM-9B	Reference 17	Convoluted
GE9	Reference 12	Convoluted
Radial Power	Reference 16	Convoluted
Local Peaking Factor	Reference 5	Convoluted
Assembly Flow Rate (mixed core)	Reference 5	Convoluted
Channel Bow Local Peaking	Function of nominal and bowed local peaking and standard deviation of bow data (see Reference 18).	Convoluted

Nominal Values and Plant Measurement Uncertainties

Parameter	Value	Uncertainty (%) (Reference 8)	Statistical Treatment
Feedwater Flow Rate** (Mlbm/hr)	22.7	1.76	Convoluted
Feedwater Temperature (°F)	426.5	0.76	Convoluted
Core Pressure (psia)	1031.35	0.50	Convoluted
Total Core Flow (Mlbm/hr)	113.9	2.50	Convoluted
Core Power** (MWth)	5232.35	---	---

---

* Additive constant uncertainties values are used.

** Feedwater flow rate and core power were increased above design values to attain desired core MCPR for safety limit evaluation consistent with Reference 5 methodology.

Table 3.6 Flow-Dependent MCPR Results

Core Flow (% rated)	102.5% Maximum Core Flow		105% Maximum Core Flow	
	GE9	ATRIUM-9B	GE9	ATRIUM-9B
30	1.775	1.821	1.866	1.914
40	1.645	1.693	1.711	1.761
50	1.552	1.597	1.604	1.649
60	1.464	1.501	1.505	1.543
70	1.379	1.406	1.412	1.439
80	1.295	1.308	1.322	1.336
90	1.209	1.214	1.232	1.237
100	1.129	1.129	1.149	1.149
102.5	1.110	1.110	---	---
105	1.110	1.110	1.110	1.110

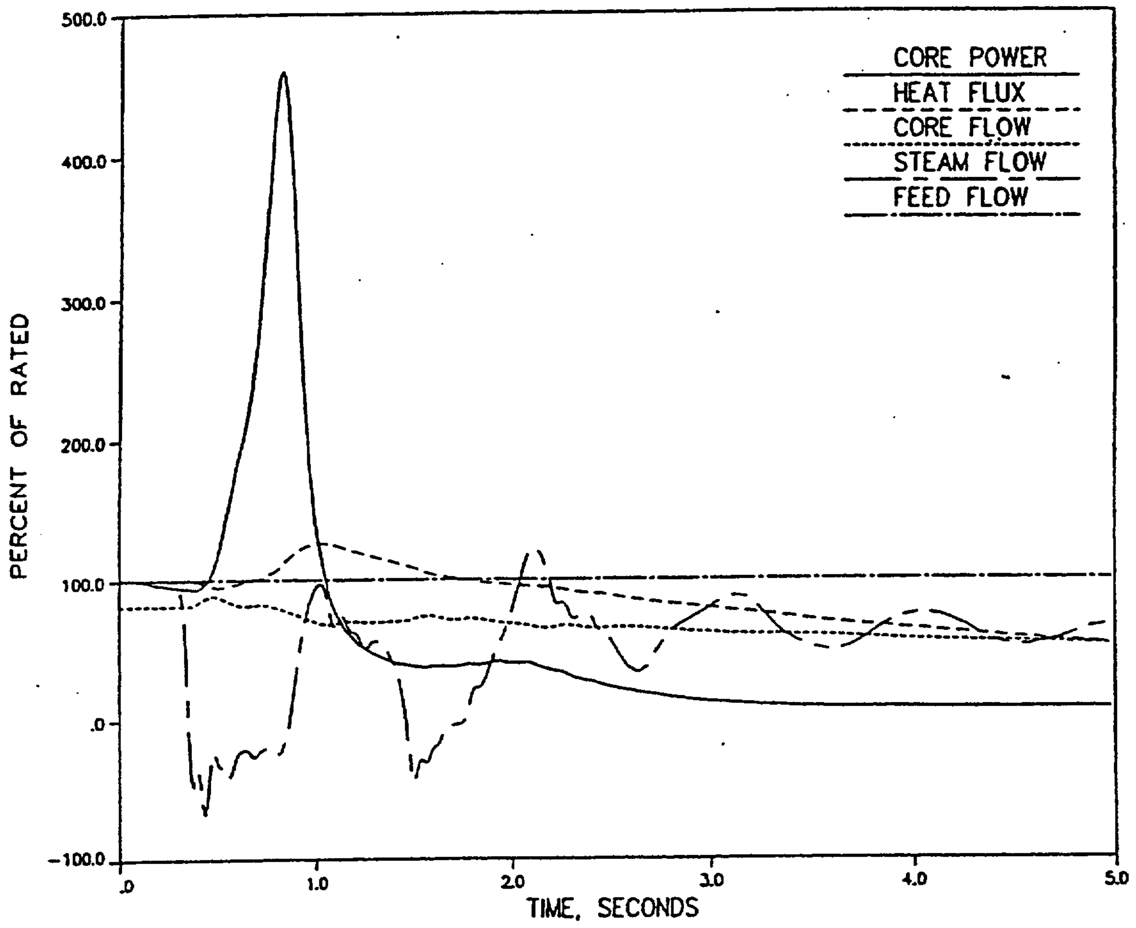


Figure 3.1 EOC Load Rejection No Bypass at 100/81 – TSSS Key Parameters

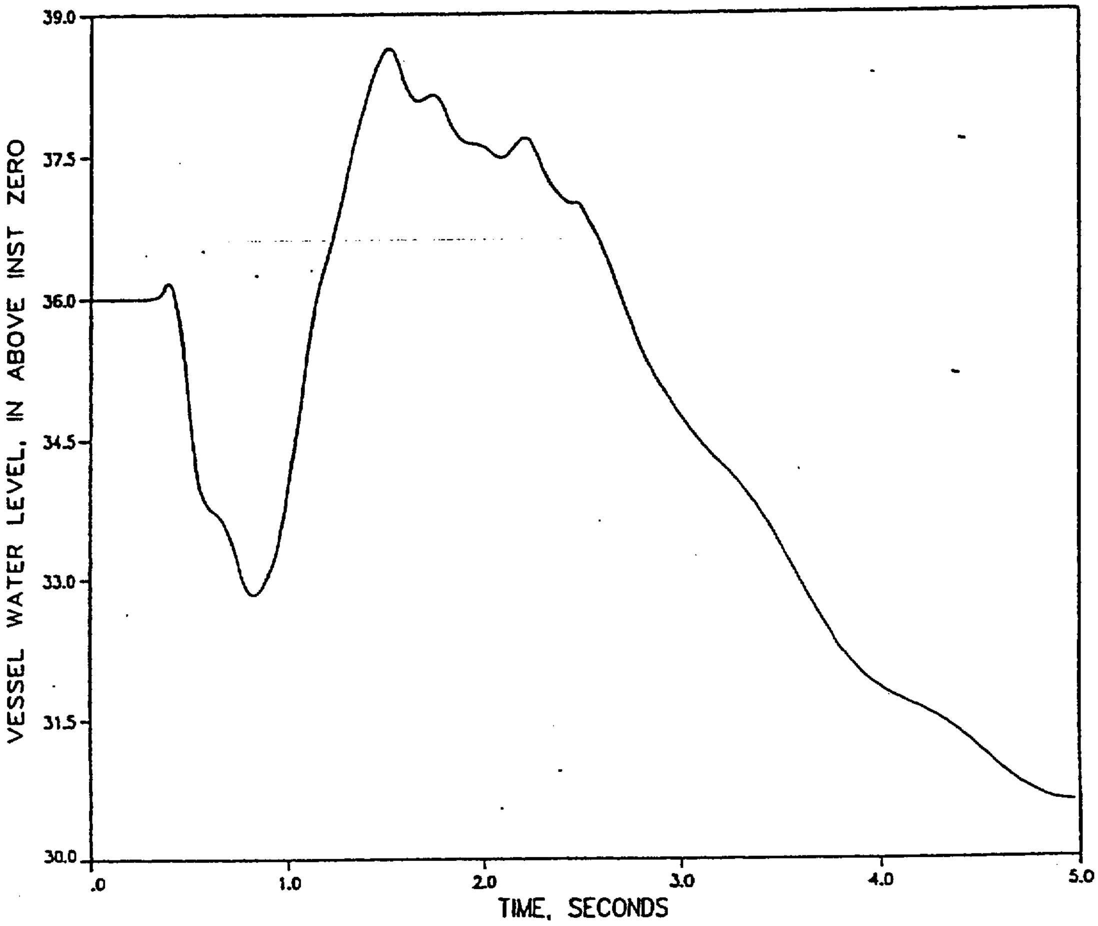


Figure 3.2 EOC Load Rejection No Bypass at 100/81 – TSSS Vessel Water Level

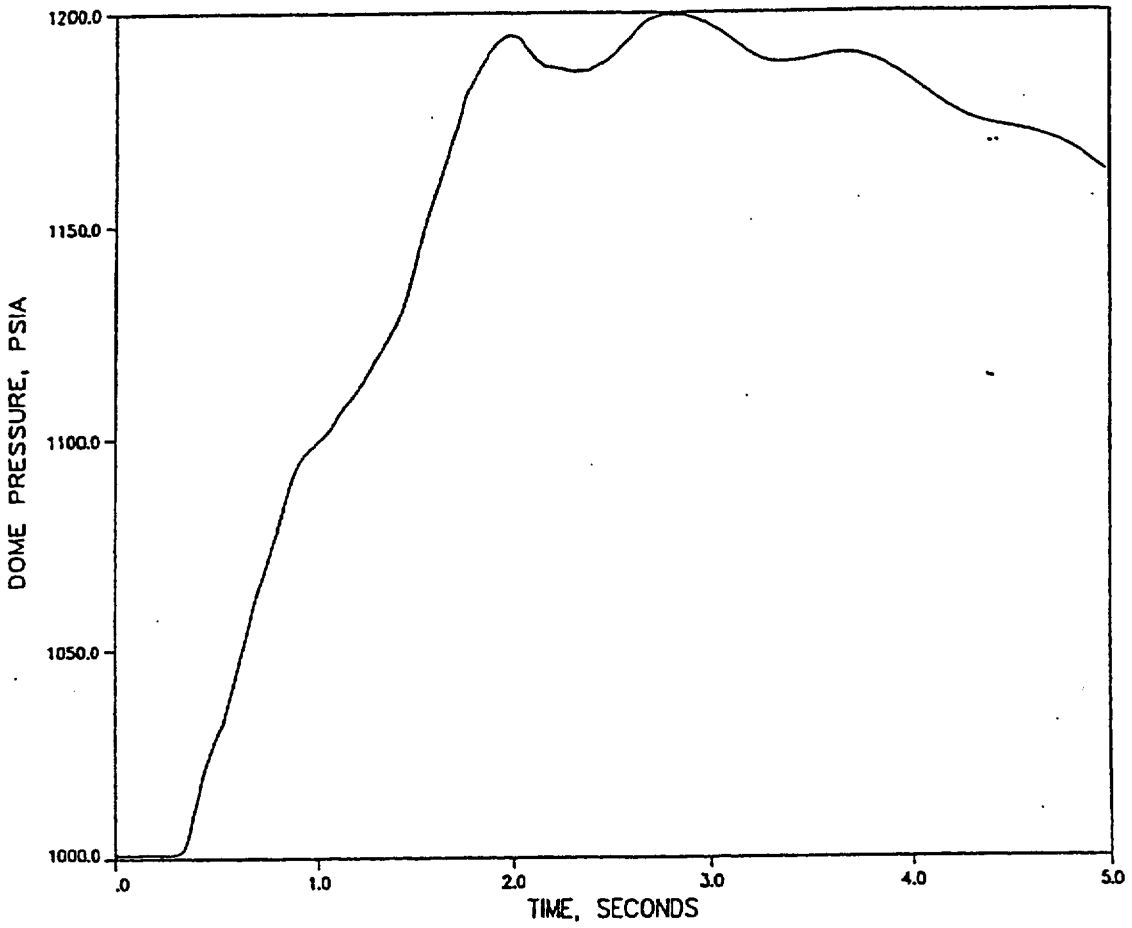


Figure 3.3 EOC Load Rejection No Bypass at 100/81 – TSSS Dome Pressure

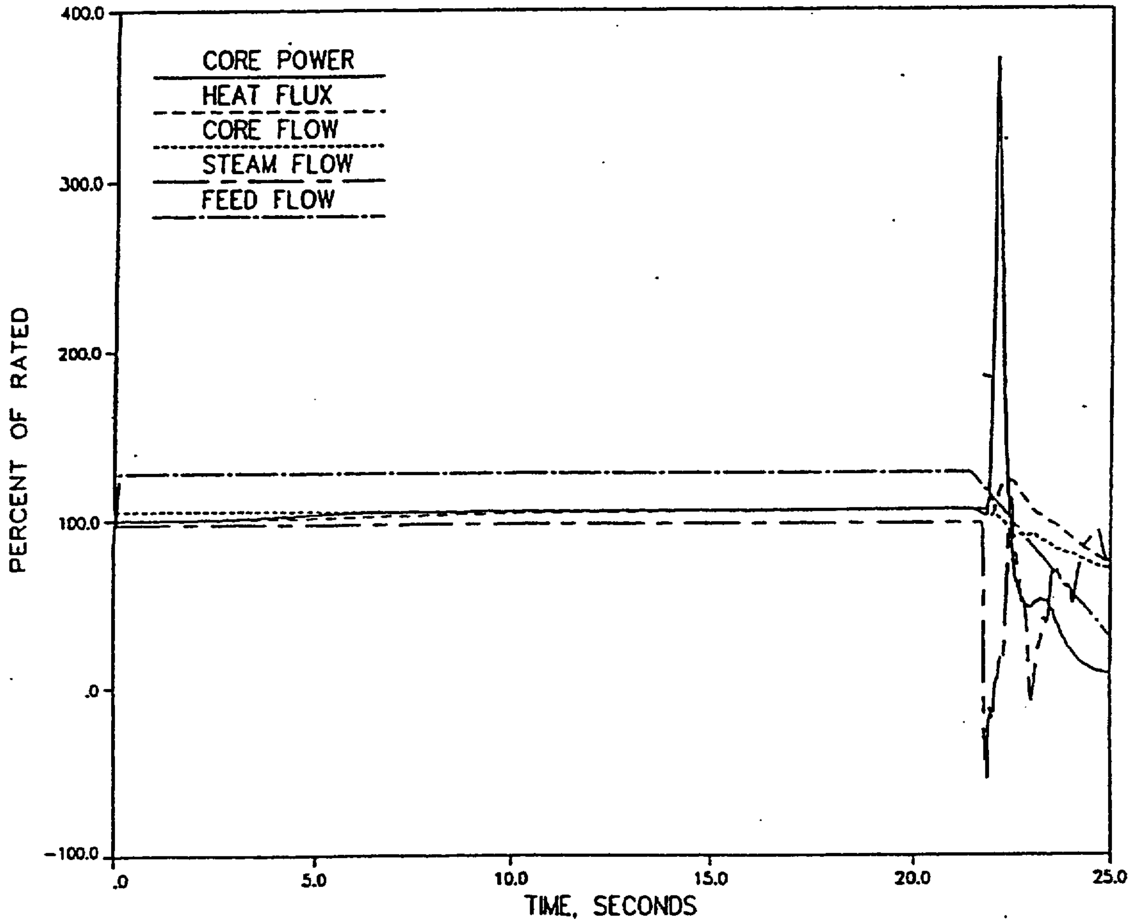


Figure 3.4 EOC Feedwater Controller Failure at 100/105 – TSSS Key Parameters

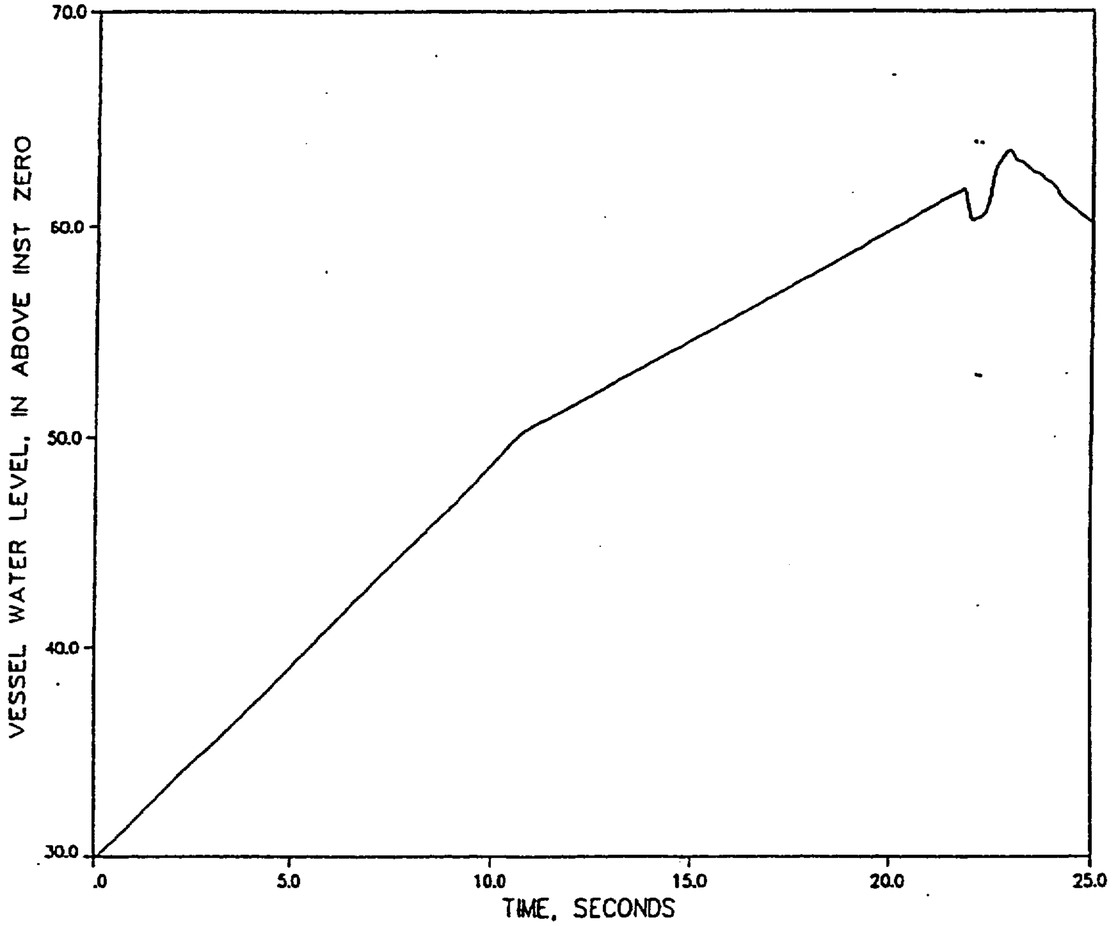


Figure 3.5 EOC Feedwater Controller Failure at 100/105 – TSSS Vessel Water Level

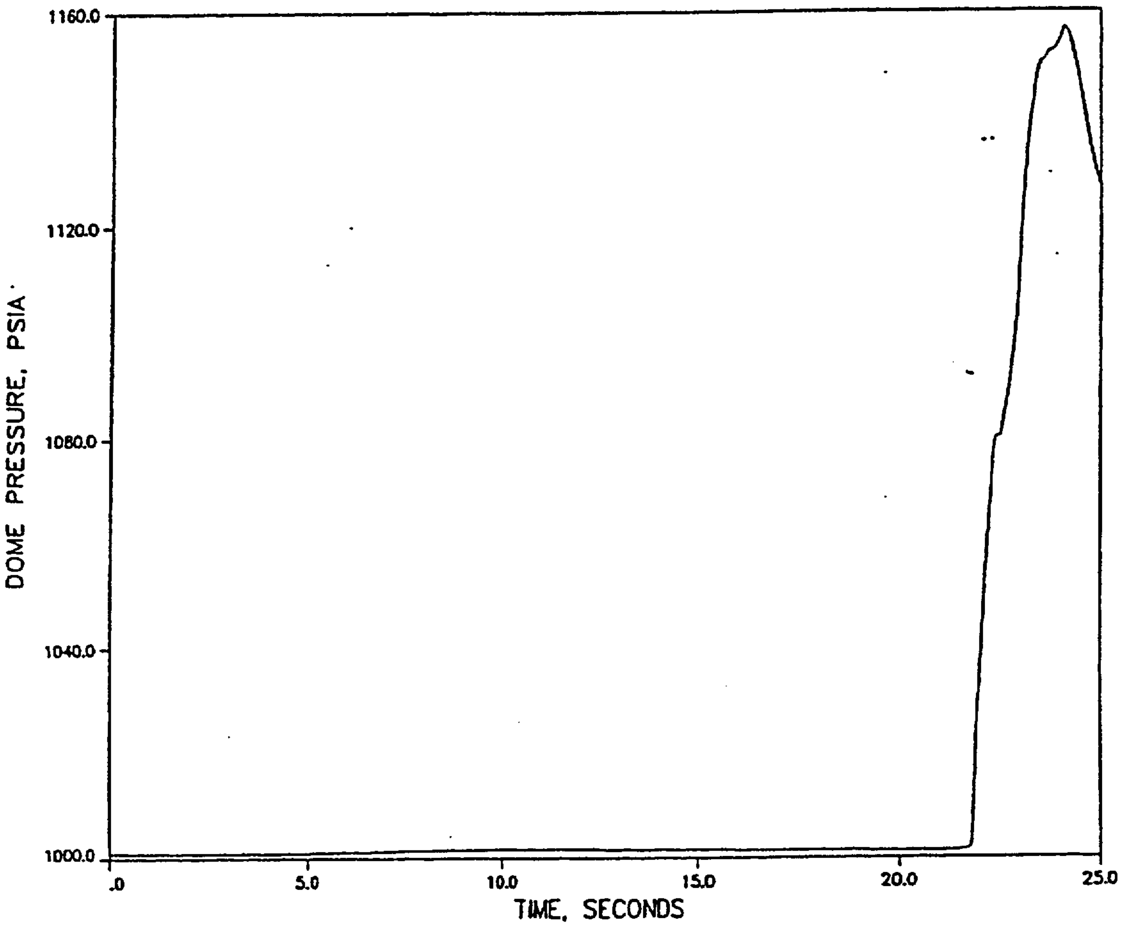


Figure 3.6 EOC Feedwater Controller Failure
at 100/105 – TSSS Dome Pressure

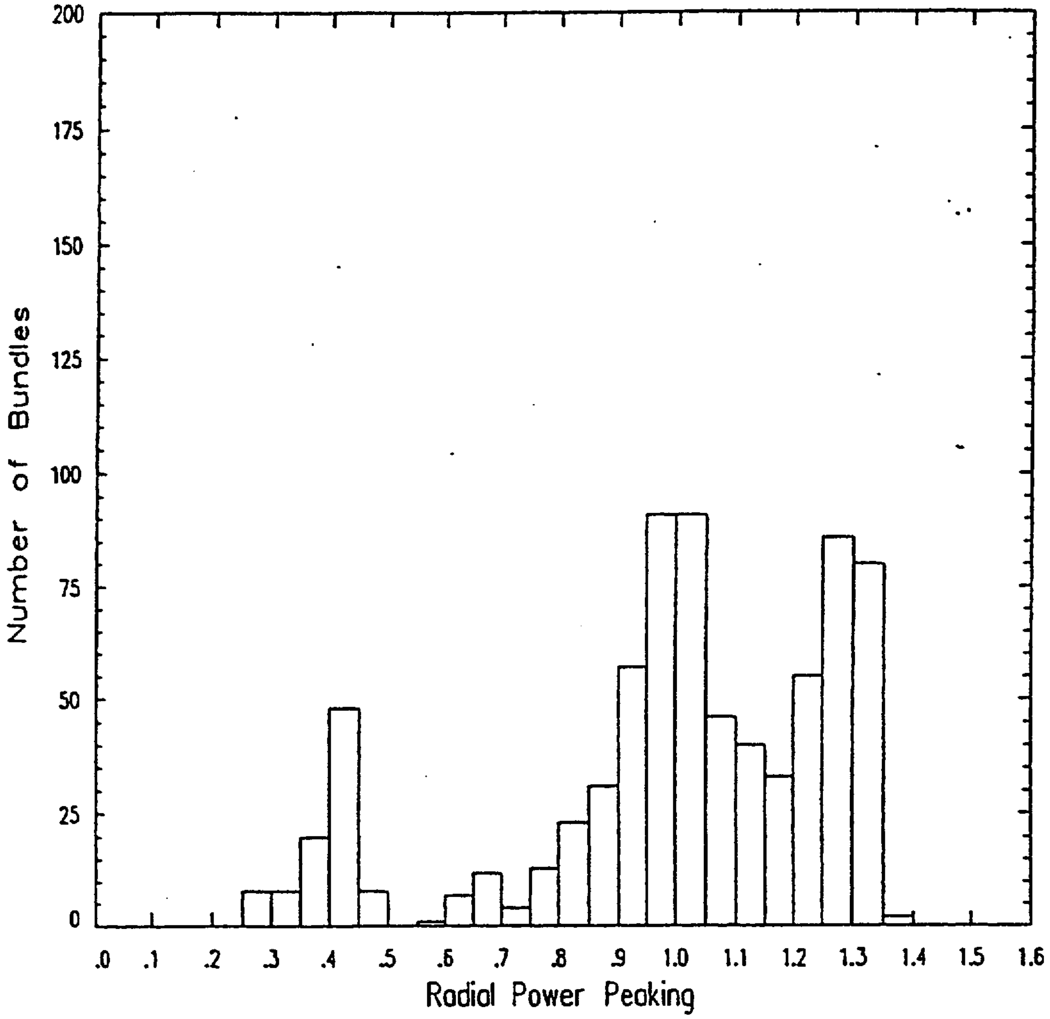


Figure 3.7 Radial Power Distribution for SLMCPR Determination

Control Rod Corner

Control Rod Corner

1.023	1.055	1.068	1.112	1.099	1.102	1.049	1.023	0.977
1.055	0.958	0.894	1.016	0.894	1.007	0.877	0.927	1.002
1.068	0.894	1.031	1.065	1.084	1.056	1.010	0.863	1.011
1.112	1.016	1.065	Internal Water Channel			1.044	0.980	1.051
1.099	0.894	1.084				1.063	0.863	1.038
1.102	1.007	1.056				1.035	0.971	1.041
1.049	0.877	1.010	1.044	1.063	1.035	0.990	0.846	0.992
1.023	0.927	0.863	0.980	0.863	0.971	0.846	0.895	0.970
0.977	1.002	1.011	1.051	1.038	1.041	0.992	0.970	0.931

Figure 3.8 LaSalle Unit 1 Cycle 9
Safety Limit Local Peaking Factors SPCA9-393B-16GZ-100M
With Channel Bow (Assembly Exposure of 22,500 MWd/MTU)

Control Rod Corner

Control Rod Corner

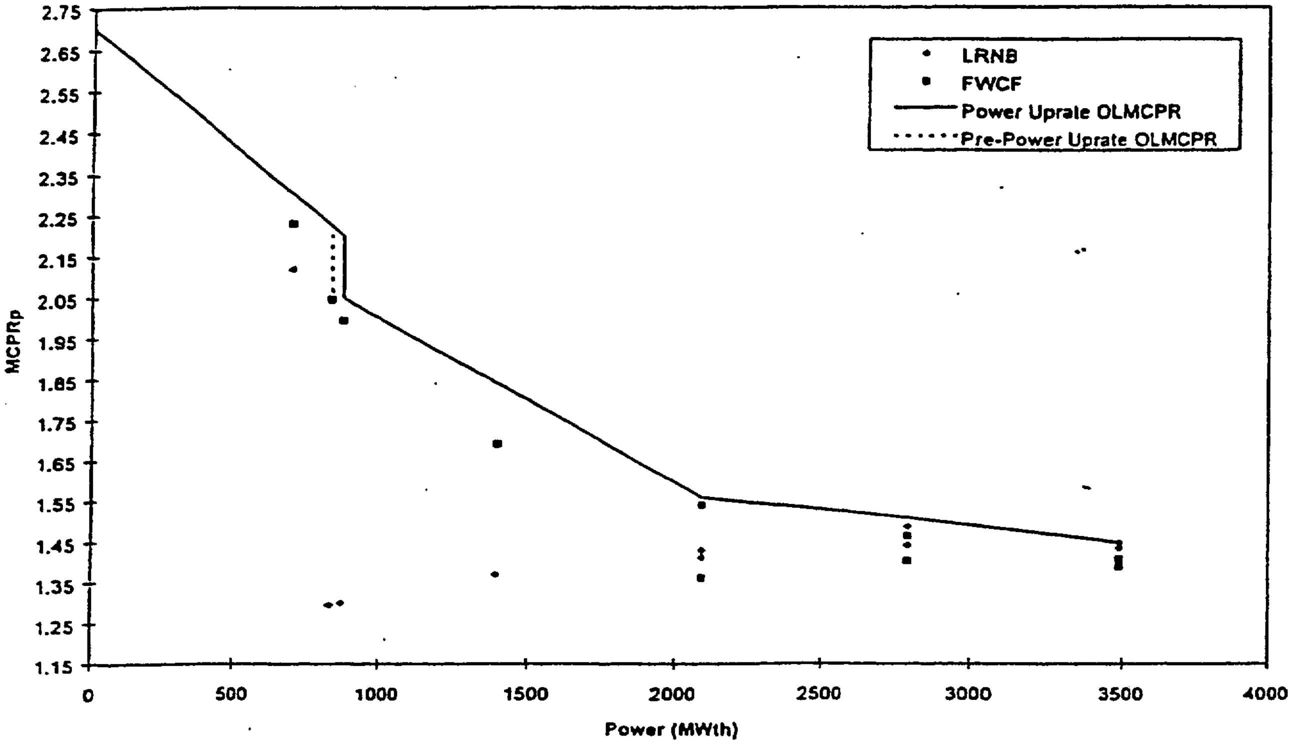
<table>
<tr><td>1.013</td><td>1.042</td><td>1.056</td><td>1.110</td><td>1.098</td><td>1.100</td><td>1.037</td><td>1.010</td><td>0.967</td></tr>
<tr><td>1.042</td><td>0.944</td><td>1.025</td><td>0.879</td><td>1.014</td><td>0.871</td><td>1.005</td><td>0.912</td><td>0.989</td></tr>
<tr><td>1.056</td><td>1.025</td><td>1.018</td><td>1.064</td><td>1.081</td><td>1.055</td><td>0.997</td><td>0.989</td><td>0.999</td></tr>
<tr><td>1.110</td><td>0.879</td><td>1.064</td><td rowspan="3" colspan="3">Internal
Water
Channel</td><td>1.043</td><td>0.848</td><td>1.047</td></tr>
<tr><td>1.098</td><td>1.014</td><td>1.081</td><td>1.059</td><td>0.978</td><td>1.035</td></tr>
<tr><td>1.100</td><td>0.871</td><td>1.055</td><td>1.034</td><td>0.840</td><td>1.037</td></tr>
<tr><td>1.037</td><td>1.005</td><td>0.997</td><td>1.043</td><td>1.059</td><td>1.034</td><td>0.977</td><td>0.968</td><td>0.979</td></tr>
<tr><td>1.010</td><td>0.912</td><td>0.989</td><td>0.848</td><td>0.978</td><td>0.840</td><td>0.968</td><td>0.881</td><td>0.956</td></tr>
<tr><td>0.967</td><td>0.989</td><td>0.999</td><td>1.047</td><td>1.035</td><td>1.037</td><td>0.979</td><td>0.956</td><td>0.921</td></tr>
</table>

⇒ Figure 3.9 LaSalle Unit 1 Cycle 9
Safety Limit Local Peaking Factors SPCA9-396B-12GZB-100M and SPCA9-396B-12GZC-100M
With Channel Bow (Assembly Exposure of 25,000 MWd/MTU)

Control Rod Corner

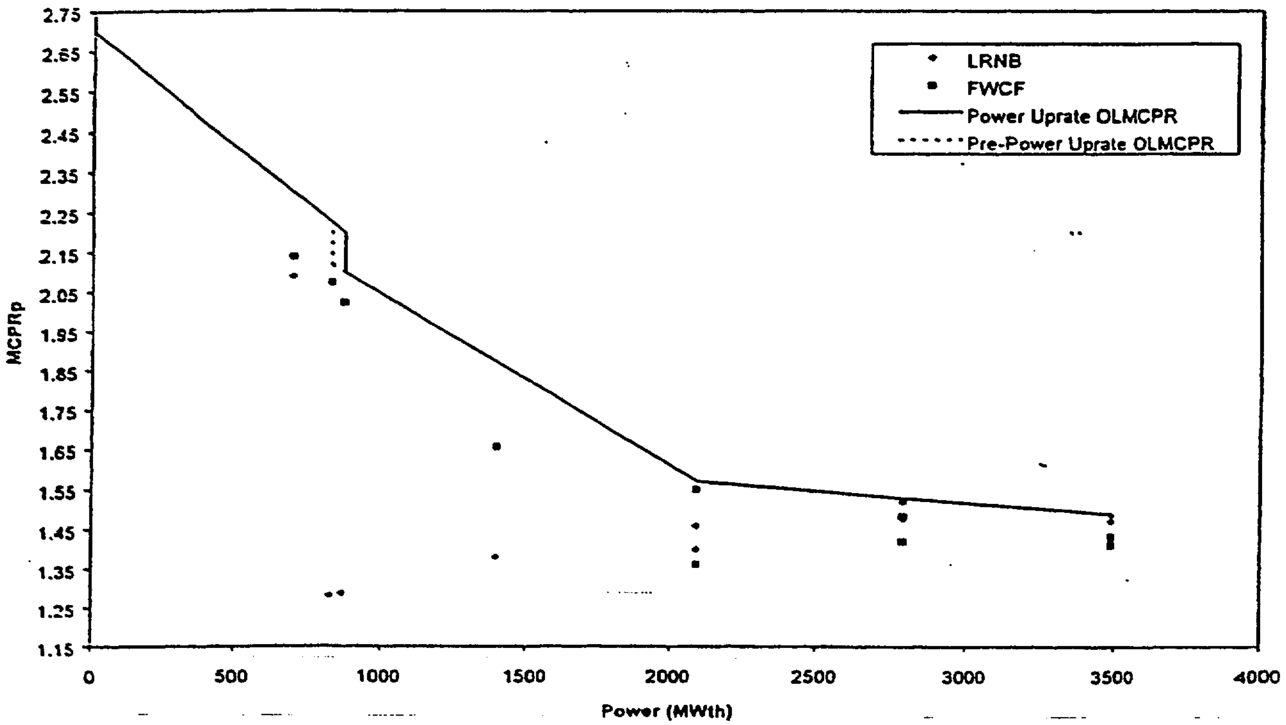
1.022	1.056	1.061	1.035	1.102	1.028	1.045	1.029	0.982
1.056	0.947	1.018	1.003	0.879	0.997	1.004	0.919	1.011
1.061	1.018	1.001	1.050	1.081	1.048	0.996	0.992	1.012
1.035	1.003	1.050	Internal Water Channel			0.926	0.983	0.987
1.102	0.879	1.081				1.077	0.853	1.049
1.028	0.997	1.048				1.040	0.970	0.979
1.045	1.004	0.996	0.926	1.077	1.040	0.859	0.980	0.996
1.029	0.919	0.992	0.983	0.853	0.970	0.980	0.891	0.983
0.982	1.011	1.012	0.987	1.049	0.979	0.996	0.983	0.941

Figure 3.10 LaSalle Unit 1 Cycle 9
Safety Limit Local Peaking Factors SPCA9-384B-11GZ6-80M
With Channel Bow (Assembly Exposure of 20,000 MWdMTU)



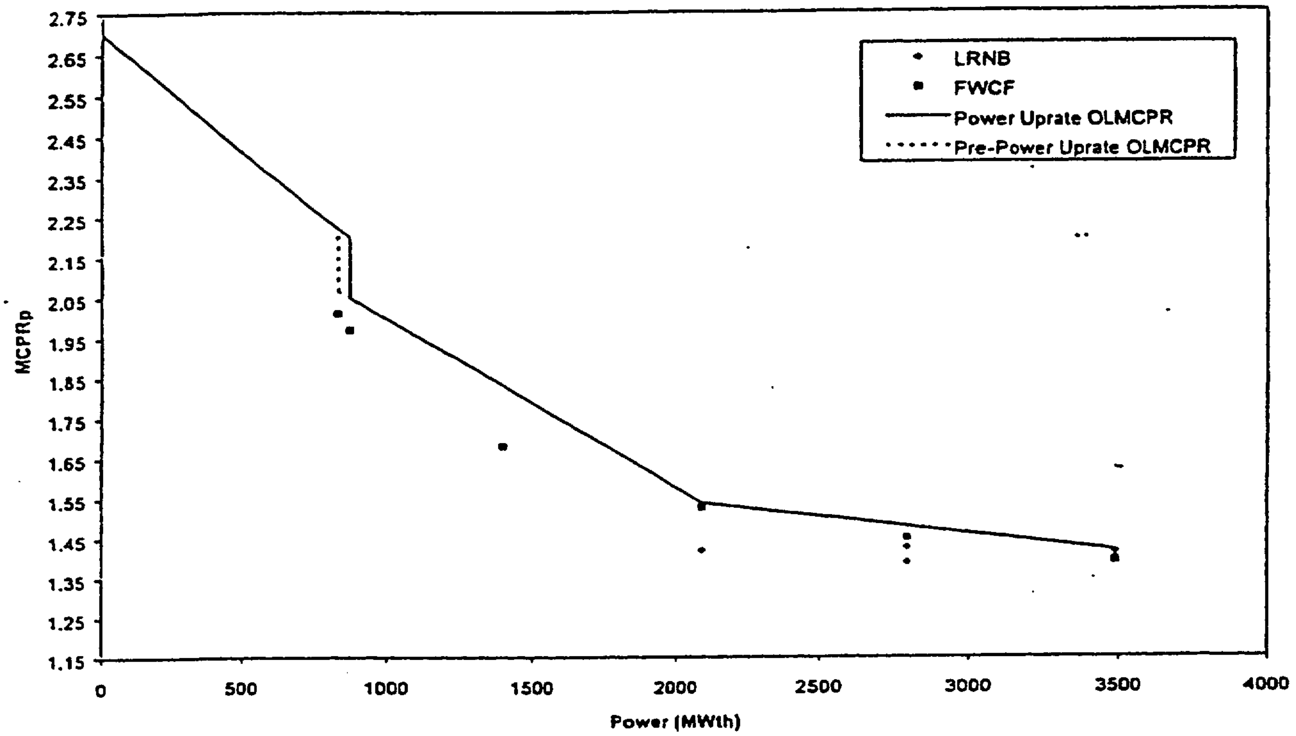
3323 MWth Rated Power		3489 MWth Rated Power	
Power (%)	$MCPR_p$ Limit	Power (%)	$MCPR_p$ Limit
100	1.46	100	1.45
84	1.51	80	1.51
63	1.56	60	1.56
25	2.07	25	2.05
25	2.22	25	2.20
0	2.70	0	2.70

Figure 3.11 EOC Base Case Power-Dependent MCPR Limits for ATRIUM-9B Fuel – TSSS Insertion Times



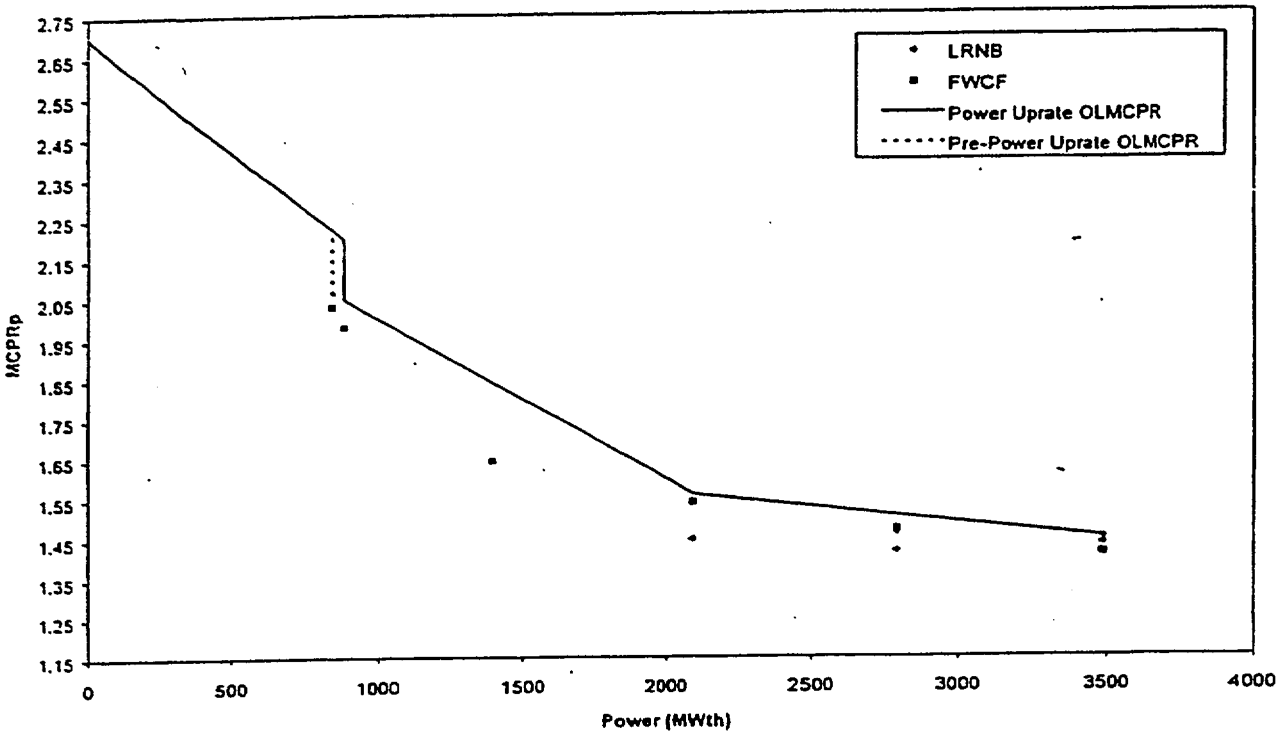
3323 MWth Rated Power		3489 MWth Rated Power	
Power (%)	$MCPR_p$ Limit	Power (%)	$MCPR_p$ Limit
100	1.50	100	1.49
84	1.53	80	1.53
63	1.57	60	1.57
25	2.12	25	2.10
25	2.22	25	2.20
0	2.70	0	2.70

Figure 3.12 EOC Base Case Power-Dependent MCPR Limits for GE9 Fuel – TSSS Insertion Times



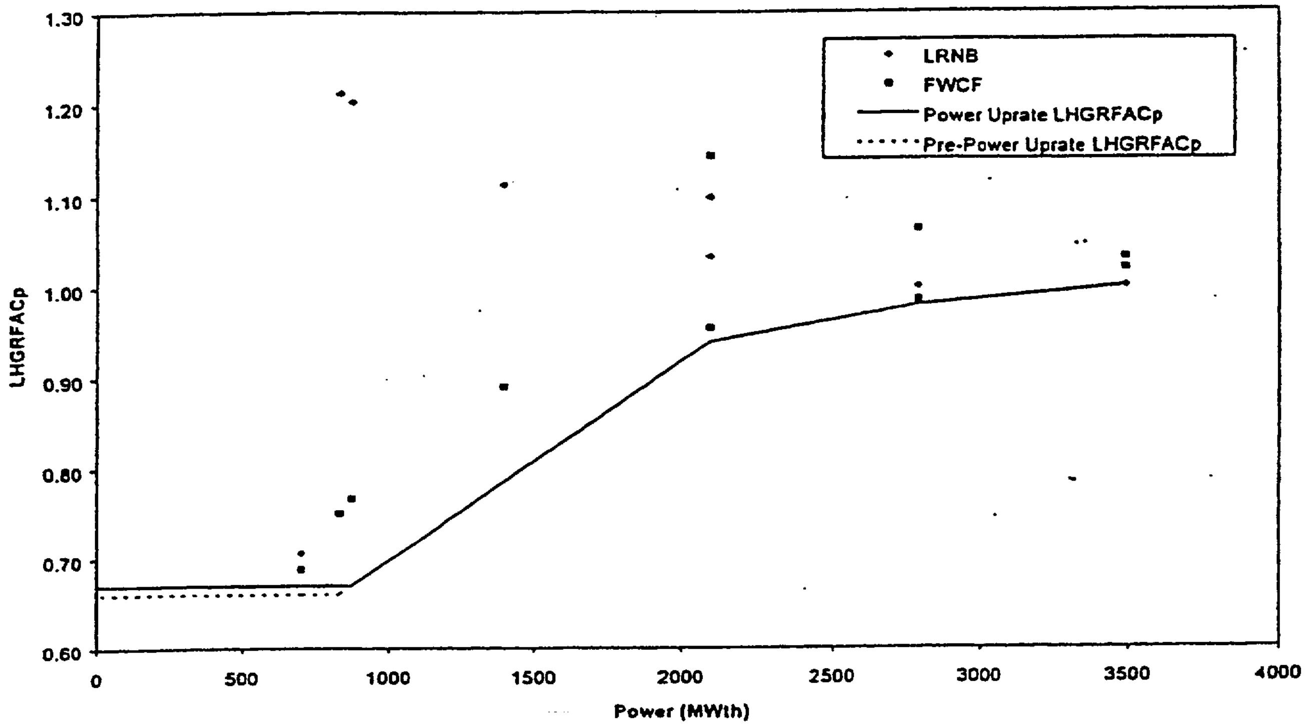
3323 MWth Rated Power		3489 MWth Rated Power	
Power (%)	$MCPR_P$ Limit	Power (%)	$MCPR_P$ Limit
100	1.43	100	1.42
84	1.48	80	1.48
63	1.54	60	1.54
25	2.07	25	2.05
25	2.22	25	2.20
0	2.70	0	2.70

Figure 3.13 EOC Base Case Power-Dependent MCPR Limits for ATRIUM-9B Fuel – NSS Insertion Times



3323 MWth Rated Power		3489 MWth Rated Power	
Power (%)	MCPR$_p$ Limit	Power (%)	MCPR$_p$ Limit
100	1.46	100	1.45
84	1.51	80	1.51
63	1.56	60	1.56
25	2.07	25	2.05
25	2.22	25	2.20
0	2.70	0	2.70

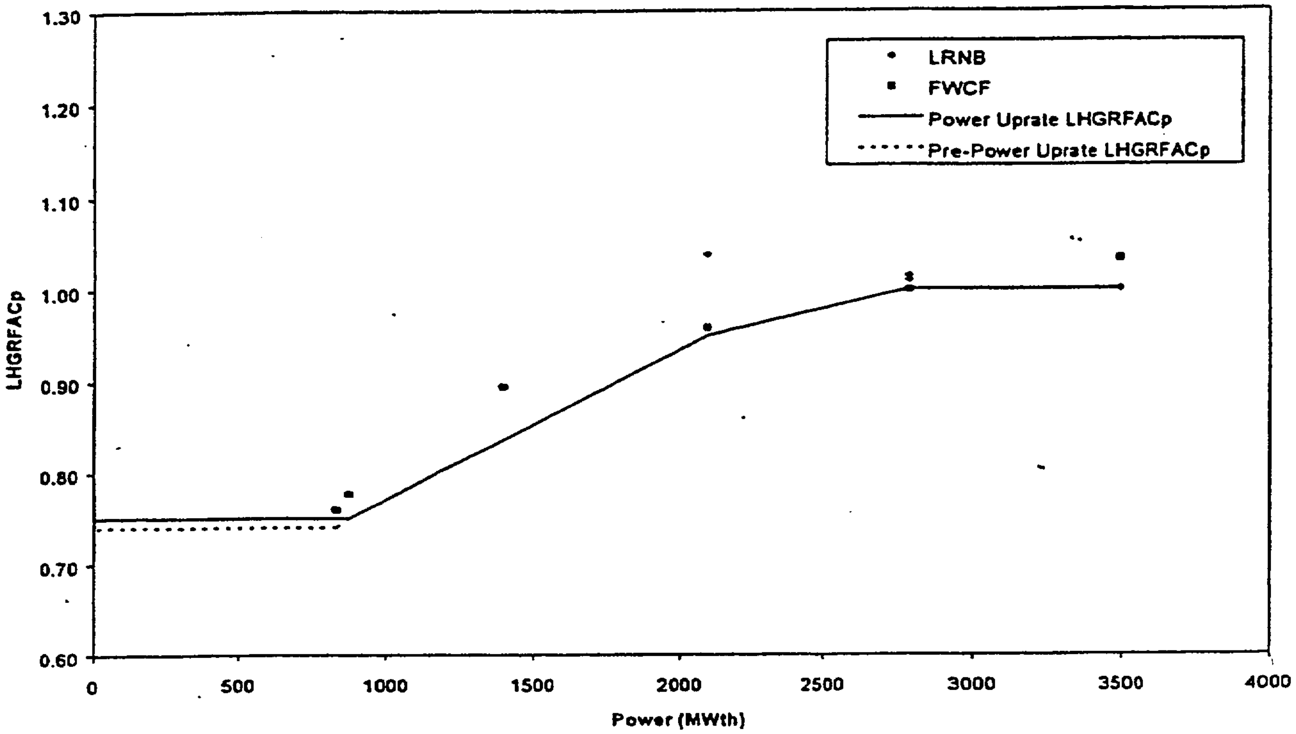
Figure 3.14 EOC Base Case Power-Dependent MCPR Limits for GE9 Fuel – NSS Insertion Times



3323 MWth Rated Power	
Power (%)	LHGRFAC$_P$
100	0.99
84	0.98
63	0.94
25	0.66
25	0.66
0	0.66

3489 MWth Rated Power	
Power (%)	LHGRFAC$_P$
100	1.00
80	0.98
60	0.94
25	0.67
25	0.67
0	0.67

Figure 3.15 EOC Base Case Power-Dependent LHGR Multipliers for ATRIUM-9B Fuel – TSSS Insertion Times



3323 MWth Rated Power		3489 MWth Rated Power	
Power (%)	LHGRFAC$_p$	Power (%)	LHGRFAC$_p$
100	1.00	100	1.00
84	1.00	80	1.00
63	0.95	60	0.95
25	0.74	25	0.75
25	0.74	25	0.75
0	0.74	0	0.75

Figure 3.16 EOC Base Case Power-Dependent LHGR Multipliers for ATRIUM-9B Fuel – NSS Insertion Times

Table 5.1 EOC Feedwater Heater Out-of-Service Analysis Results

		ATRIUM-9B		GE9
Event	Power*/Flow (%rated/%rated)	ΔCPR	$LHGRFAC_p$	ΔCPR
FWCF	100/105	0.311	1.000	0.329
FWCF	100/81	0.286	1.034	0.302
FWCF	80/105	0.376	0.968	0.390
FWCF	80/57.2	0.306	1.055	0.320
FWCF	60/105	0.482**	0.927**	0.472
FWCF	60/35.1	0.216	1.123	0.228
FWCF	40/105	0.698**	0.831**	0.677**
FWCF	25/105	1.142**	0.678**	1.156**
FWCF	23.81/105	1.209**	0.662**	1.216**

---

* Power presented relative to uprated power (3489 MWth).

** The analysis results presented are from an earlier cycle exposure. The ΔCPR and $LHGRFAC_p$ results are conservatively used to establish the thermal limits.

Table 5.2 Abnormal Recirculation Loop Startup Analysis Results

		ATRIUM-9B	
Power*/Flow (%rated/%rated)	FCV Position	ΔCPR**	$LHGRFAC_p$
33.33/47	27% open	1.40	0.425

---

* Power presented relative to uprated power (3489 MWth).

** ΔCPR results for ATRIUM-9B fuel are conservatively applicable for GE9 fuel.

Table 5.3 EOC Turbine Bypass Valves Out-of-Service Analysis Results

		ATRIUM-9B		GE9
Event	Power*/Flow (%rated/%rated)	ΔCPR	$LHGRFAC_p$	ΔCPR
FWCF	100/105	0.359	0.968	0.392
FWCF	100/81	0.359	0.947	0.394
FWCF	80/105	0.418	0.942	0.449
FWCF	80/57.2	0.417	0.957	0.447
FWCF	60/105	0.499**	0.917	0.514
FWCF	60/35.1	0.327	1.032	0.332
FWCF	40/105	0.658**	0.859**	0.619
FWCF	25/105	0.962**	0.750**	0.952**
FWCF	23.81/105	1.004**	0.736**	1.002**

---

* Power presented relative to uprated power (3489 MWth).

** The analysis results presented are from an earlier cycle exposure. The ΔCPR and $LHGRFAC_p$ results are conservatively used to establish the thermal limits.

Table 5.4 EOC Recirculation Pump Trip Out-of-Service Analysis Results

		ATRIUM-9B		GE9
Event	Power*/Flow (%rated/%rated)	ΔCPR	$LHGRFAC_p$	ΔCPR
LRNB	100/105	0.382	0.909	0.433
LRNB	100/81	0.371	0.868	0.430
LRNB	80/105	0.389	0.923	0.438
LRNB	80/57.2	0.391	0.899	0.439
FWCF	100/105	0.353	0.942	0.391
FWCF	100/81	0.308	0.948	0.349
FWCF	80/105	0.403	0.920	0.438
FWCF	80/57.2	0.295	1.003	0.327
FWCF	60/105	0.466	0.901	0.492
FWCF	60/35.1	0.190	1.120	0.193
FWCF	40/105	0.596**	0.857**	0.581
FWCF	25/105	0.858**	0.757**	0.861**
FWCF	23.81/105	0.896**	0.743**	0.910**

---

* Power presented relative to uprated power (3489 MWth)

** The analysis results presented are from an earlier cycle exposure. The ΔCPR and $LHGRFAC_p$ results are conservatively used to establish the thermal limits.

Table 5.5 EOC Turbine Control Valve Slow Closure Analysis Results

			ATRIUM-9B		GE9
Event	Slow Valve Characteristics	Power*/Flow (%rated/%rated)	ΔCPR	$LHGRFAC_p$	ΔCPR
LRNB	1 TCV closing at 2.0 sec	100/105**	0.420	0.902	0.461
LRNB	1 TCV closing at 2.7 sec	100/105**	0.419	0.899	0.461
LRNB	2 TCVs closing at 7.75 sec	100/105**	0.219	1.057	0.233
LRNB	1 TCV closing at 2.0 sec	100/81**	0.369	0.928	0.421
LRNB	2 TCVs closing at 7.75 sec	100/81**	0.199	1.107	0.223
LRNB	1 TCV closing at 2.0 sec	80/105**	0.432	0.911	0.466
LRNB	2 TCVs closing at 2.0 sec	80/105†	0.527	0.882	0.568
LRNB	2 TCVs closing at 7.75 sec	80/105**	0.293	1.014	0.314
LRNB	1 TCV closing at 2.0 sec	80/57.2**	0.504	0.911	0.548
LRNB	2 TCVs closing at 2.0 sec	80/57.2†	0.520	0.928	0.564
LRNB	2 TCVs closing at 7.75 sec, 2 TCVs closing at 2.7 sec	80/57.2**	0.277	1.115	0.305
LRNB	1 TCV closing at 2.0 sec	60/105**	0.432	0.932	0.461
LRNB	2 TCVs closing at 7.75 sec	60/105**	0.346	1.001	0.370
LRNB	1 TCV closing at 2.0 sec	60/35.1**	0.591	0.991	0.585
LRNB	1 TCV closing at 2.0 sec	40/105†	0.828‡	0.759‡	0.824
LRNB	1 TCV closing at 2.0 sec	25/105†	0.992‡	0.707‡	0.984‡
LRNB	1 TCV closing at 2.0 sec	23.81/105†	1.011‡	0.699‡	1.008‡
LRNB	2 TCVs closing at 7.75 sec	23.81/105†	0.977	0.721	0.954
LRNB w/ FHOOS	1 TCV closing at 2.0 sec	100/105**	0.363	0.944	0.396

---

* Power presented relative to uprated power (3489 MWth).

** Scram initiated by high neutron flux.

† Scram initiated by high dome pressure.

‡ The analysis results presented are from an earlier cycle exposure. The ΔCPR and $LHGRFAC_p$ results are conservatively used to establish the thermal limits.

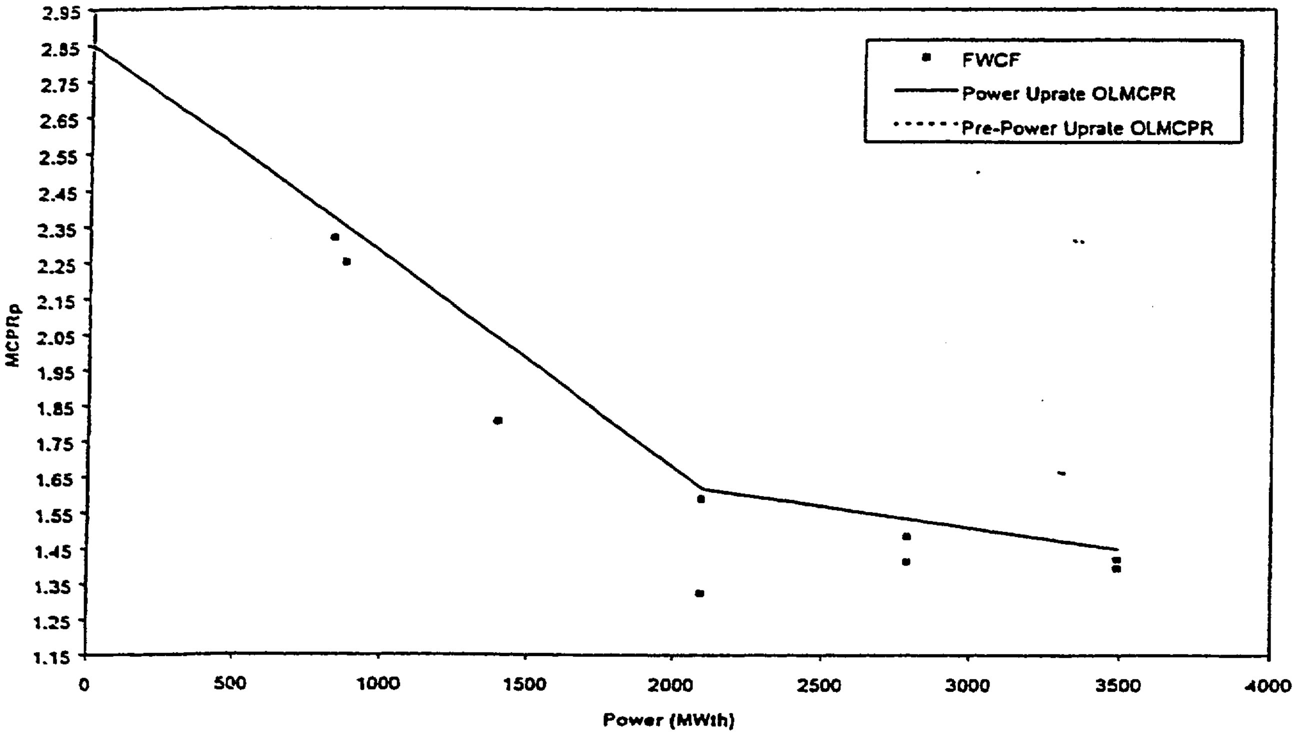
Table 5.6 EOC Recirculation Pump Trip and Feedwater Heater Out-of-Service Analysis Results

		ATRIUM-9B		GE9
Event	Power*/Flow (%rated/%rated)	ΔCPR	LHGRFAC$_p$	ΔCPR
LRNB	100/105	0.332	0.954	0.375
LRNB	100/81	0.305	0.948	0.354
FWCF	100/105	0.358	0.933	0.391
FWCF	100/81	0.307	0.968	0.342
FWCF	80/105	0.419	0.911	0.448
FWCF	80/57.2	0.300	1.007	0.329
FWCF	60/105	0.508**	0.882	0.523
FWCF	60/35.1	0.212	1.104	0.226
FWCF	40/105	0.705**	0.804**	0.664
FWCF	25/105	1.073**	0.673**	1.092**
FWCF	23.81/105	1.125**	0.658**	1.146**

---

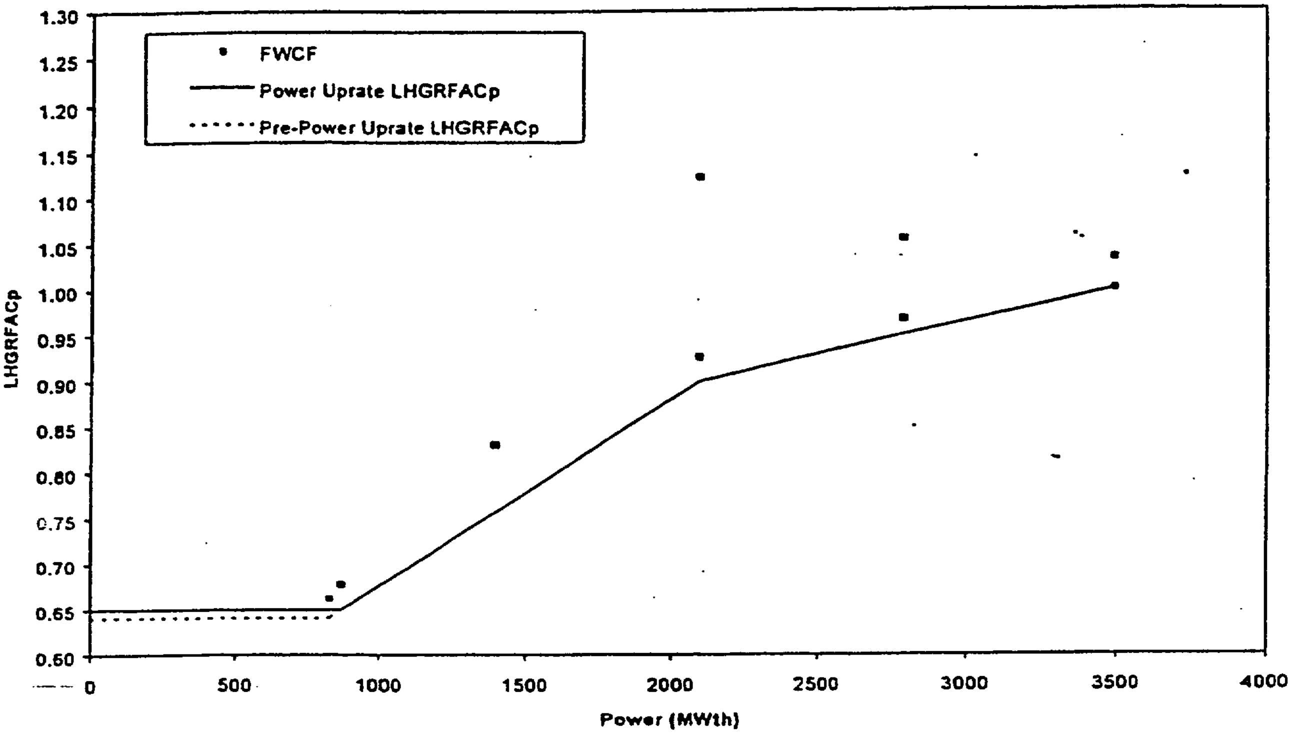
* Power presented relative to uprated power (3489 MWth).

** The analysis results presented are from an earlier cycle exposure. The ΔCPR and LHGRFAC$_p$ results are conservatively used to establish the thermal limits.



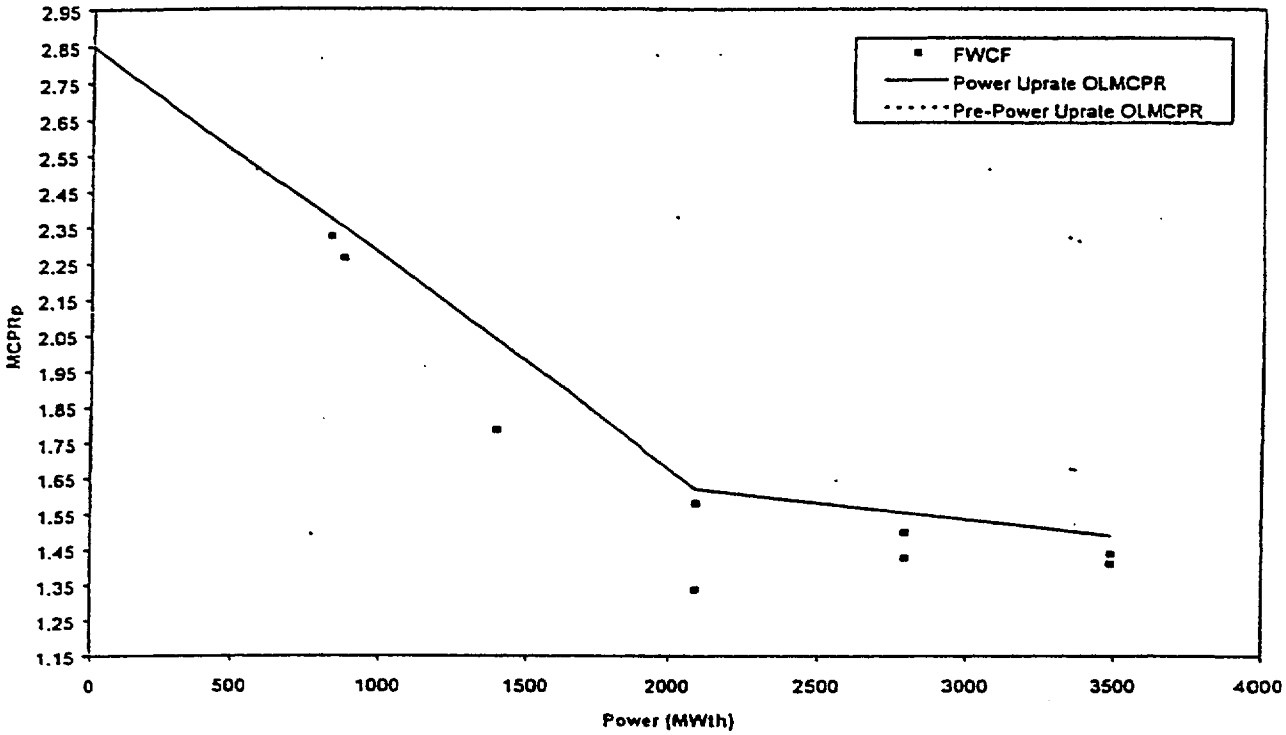
3323 MWth Rated Power		3489 MWth Rated Power	
Power (%)	MCPR$_P$ Limit	Power (%)	MCPR$_P$ Limit
100	1.47	100	1.45
63	1.62	60	1.62
25	2.38	25	2.35
25	2.38	25	2.35
0	2.85	0	2.85

Figure 5.1 EOC Feedwater Heaters Out-of-Service
Power-Dependent MCPR Limits for ATRIUM-9B Fuel



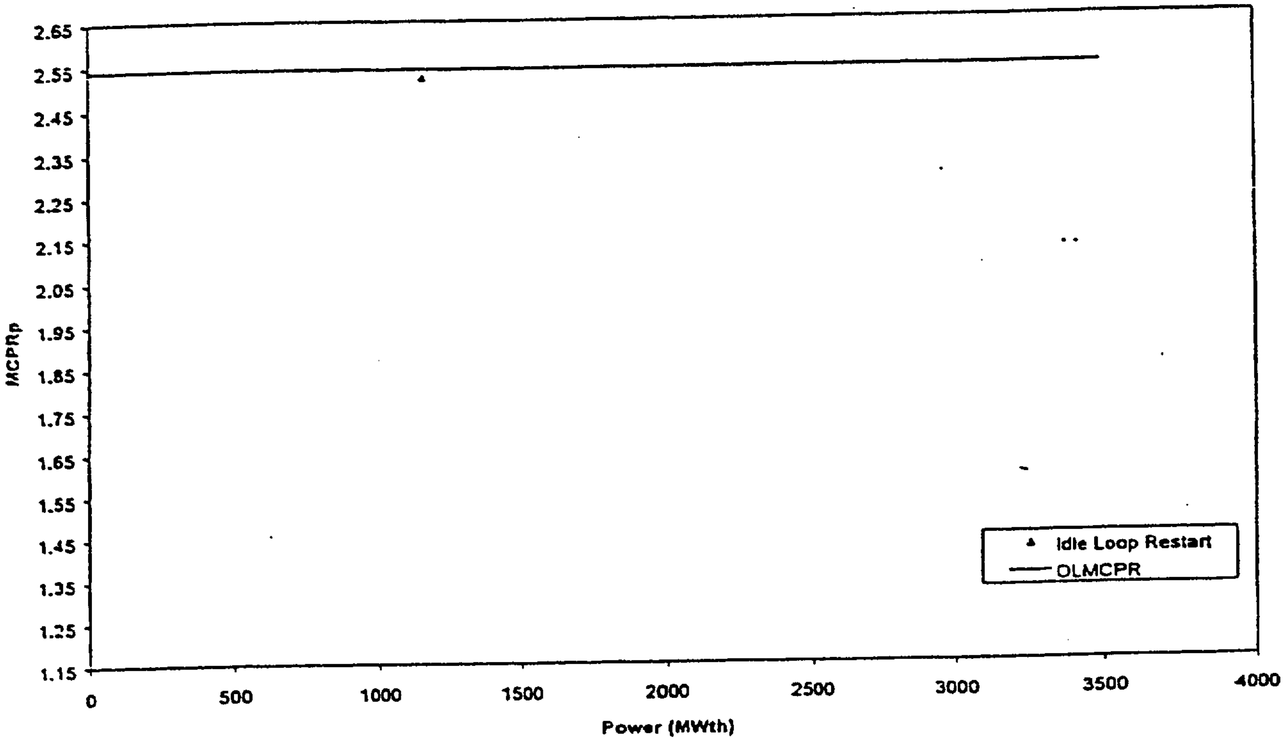
3323 MWth Rated Power		3489 MWth Rated Power	
Power (%)	LHGRFAC$_p$	Power (%)	LHGRFAC$_p$
100	0.99	100	1.00
63	0.90	60	0.90
25	0.64	25	0.65
25	0.64	25	0.65
0	0.64	0	0.65

Figure 5.2 EOC Feedwater Heaters Out-of-Service
Power-Dependent LHGR Multipliers for ATRIUM-9B Fuel



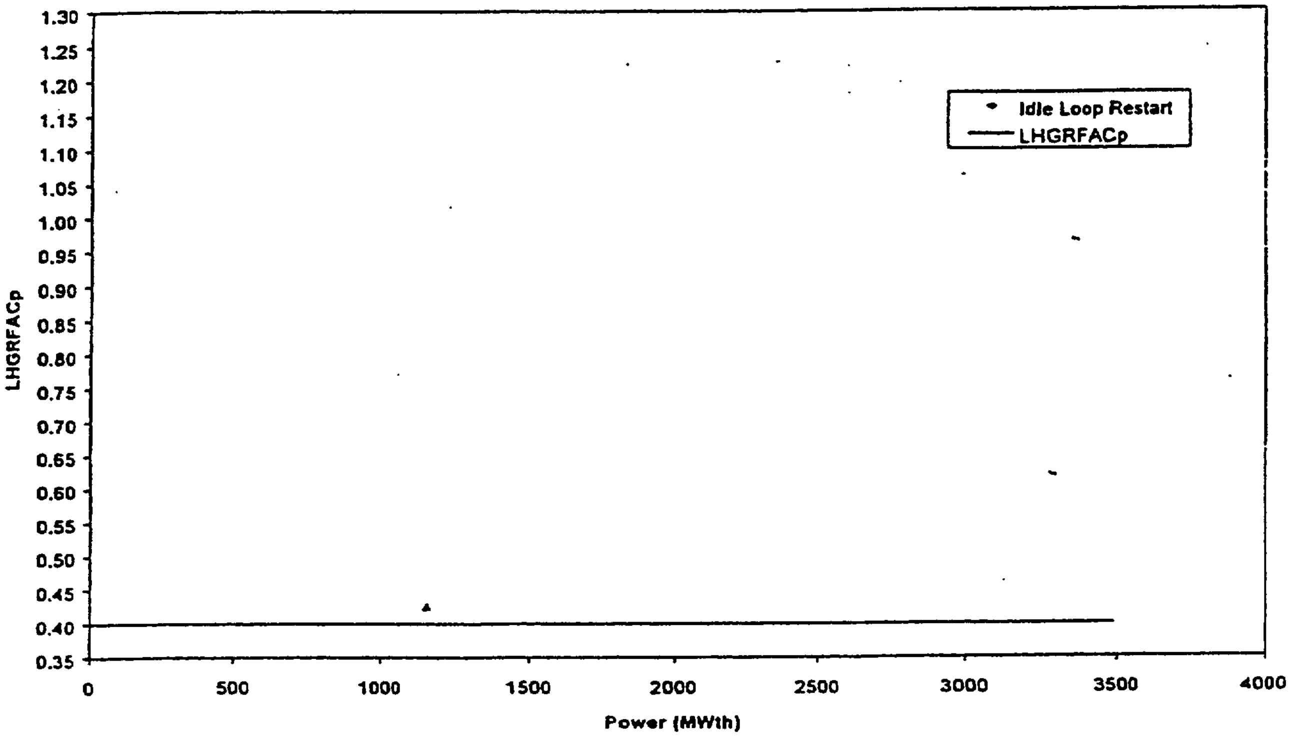
3323 MWth Rated Power		3489 MWth Rated Power	
Power (%)	$MCPR_p$ Limit	Power (%)	$MCPR_p$ Limit
100	1.51	100	1.49
63	1.62	60	1.62
25	2.38	25	2.35
25	2.38	25	2.35
0	2.85	0	2.85

Figure 5.3 EOC Feedwater Heaters Out-of-Service Power-Dependent MCPR Limits for GE9 Fuel



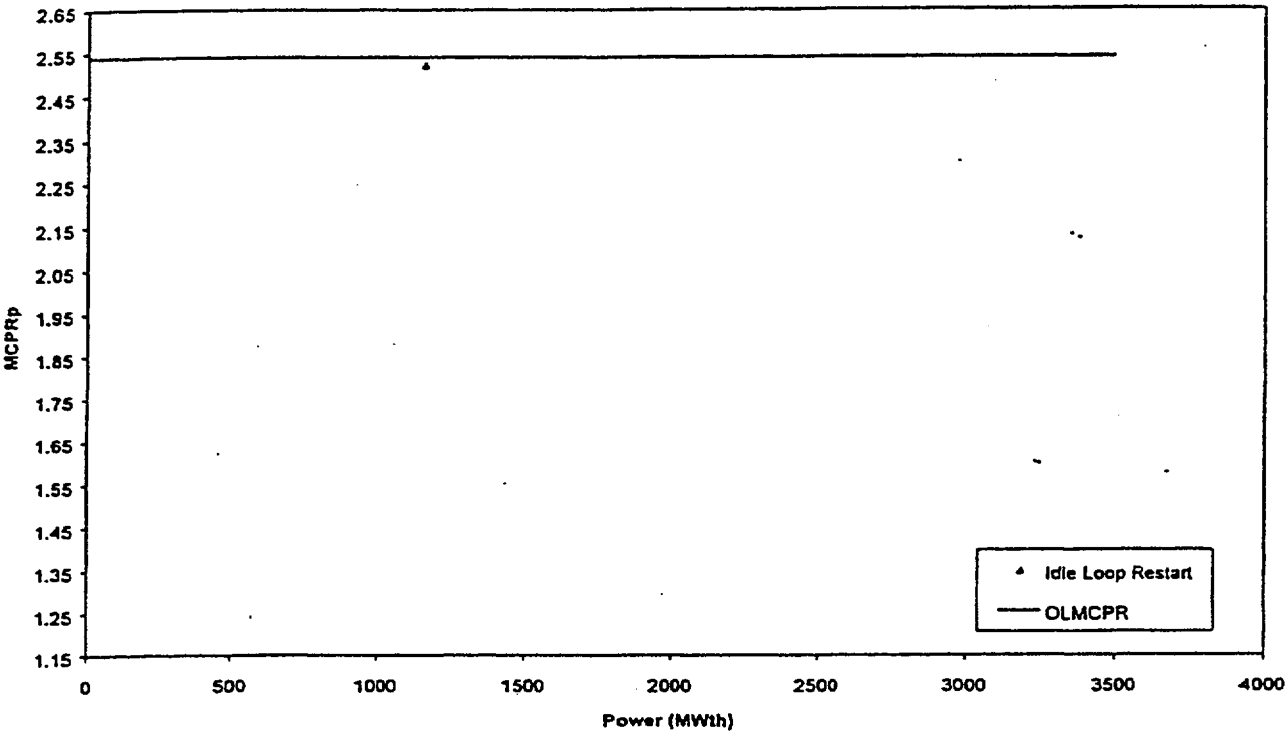
3323 MWth Rated Power		3489 MWth Rated Power	
Power (%)	MCPR$_p$ Limit	Power (%)	MCPR$_p$ Limit
100	2.54	100	2.54
63	2.54	60	2.54
25	2.54	25	2.54
25	2.54	25	2.54
0	2.54	0	2.54

Figure 5.4 Abnormal Idle Recirculation Loop Startup Power-Dependent MCPR Limits for ATRIUM-9B Fuel



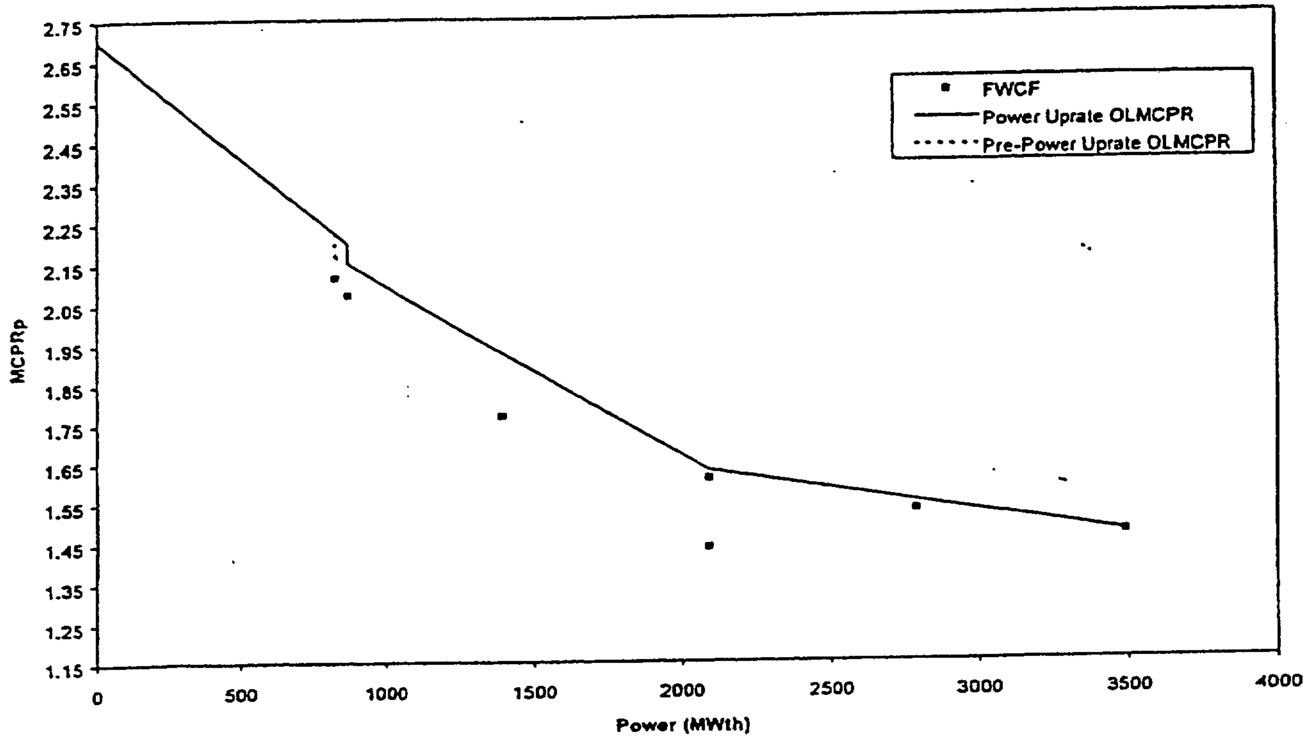
3323 MWth Rated Power		3489 MWth Rated Power	
Power (%)	LHGRFAC$_p$	Power (%)	LHGRFAC$_p$
100	0.40	100	0.40
63	0.40	60	0.40
25	0.40	25	0.40
25	0.40	25	0.40
0	0.40	0	0.40

Figure 5.5 Abnormal Idle Recirculation Loop Startup
Power-Dependent LHGR Multipliers for ATRIUM-9B Fuel



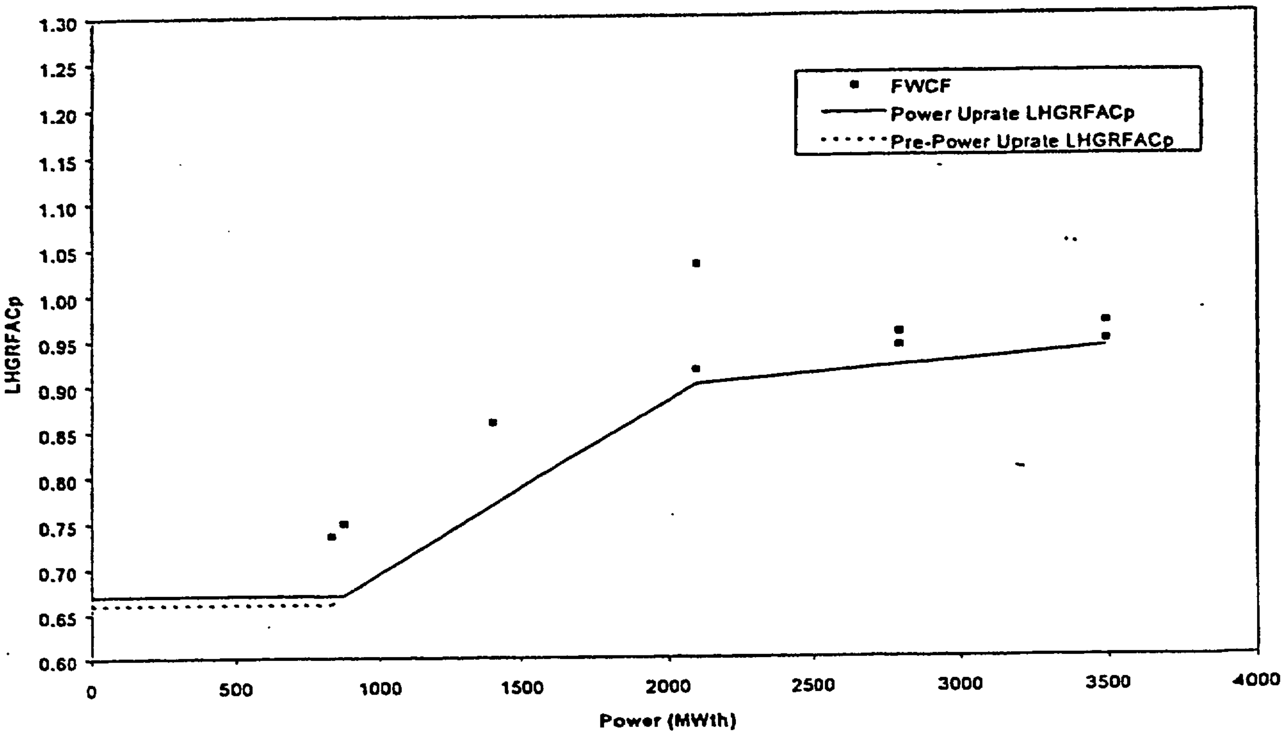
3323 MWth Rated Power		3489 MWth Rated Power	
Power (%)	MCPR_p Limit	Power (%)	MCPR_p Limit
100	2.54	100	2.54
63	2.54	60	2.54
25	2.54	25	2.54
25	2.54	25	2.54
0	2.54	0	2.54

Figure 5.6 Abnormal Idle Recirculation Loop Startup Power-Dependent MCPR Limits for GE9 Fuel



3323 MWth Rated Power		3489 MWth Rated Power	
Power (%)	MCPR$_p$ Limit	Power (%)	MCPR$_p$ Limit
100	1.49	100	1.47
63	1.63	60	1.63
25	2.17	25	2.15
25	2.22	25	2.20
0	2.70	0	2.70

Figure 5.7 EOC Turbine Bypass Valves Out-of-Service Power-Dependent MCPR Limits for ATRIUM-9B Fuel



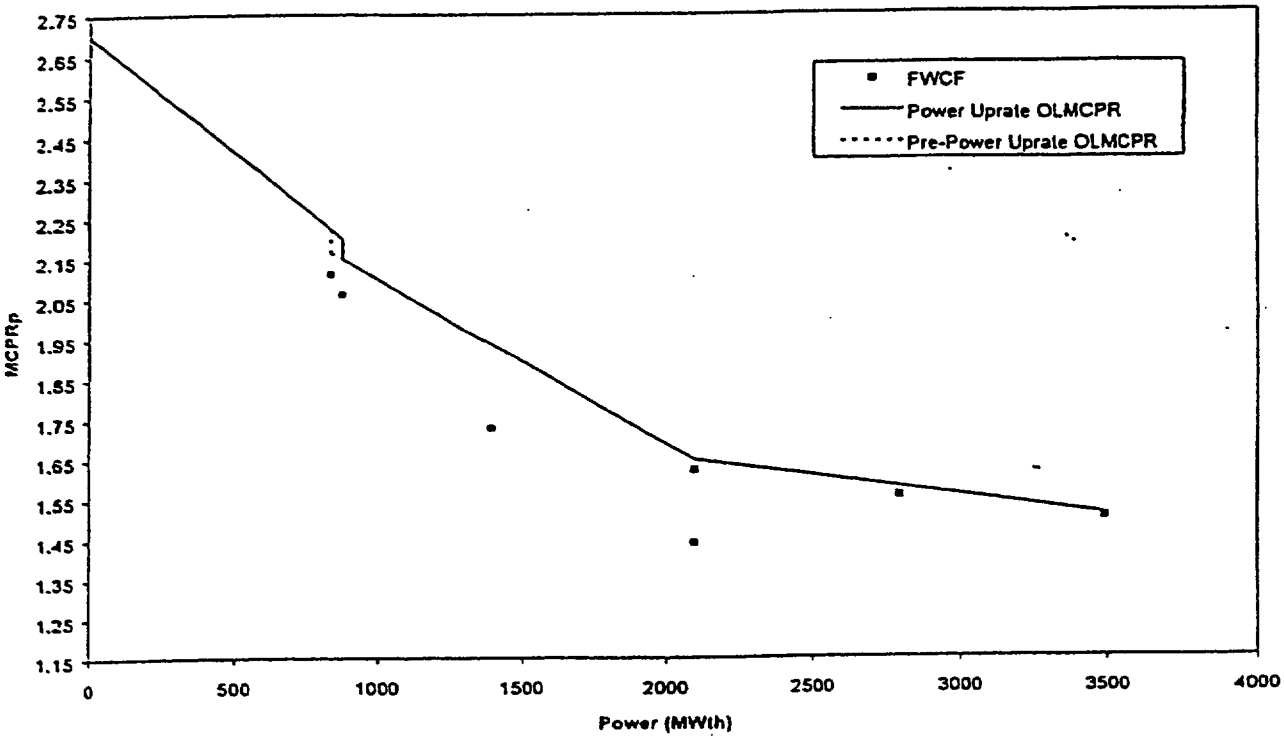
3323 MWth Rated Power

Power (%)	$LHGRFAC_p$
100	0.94
63	0.90
25	0.66
25	0.66
0	0.66

3489 MWth Rated Power

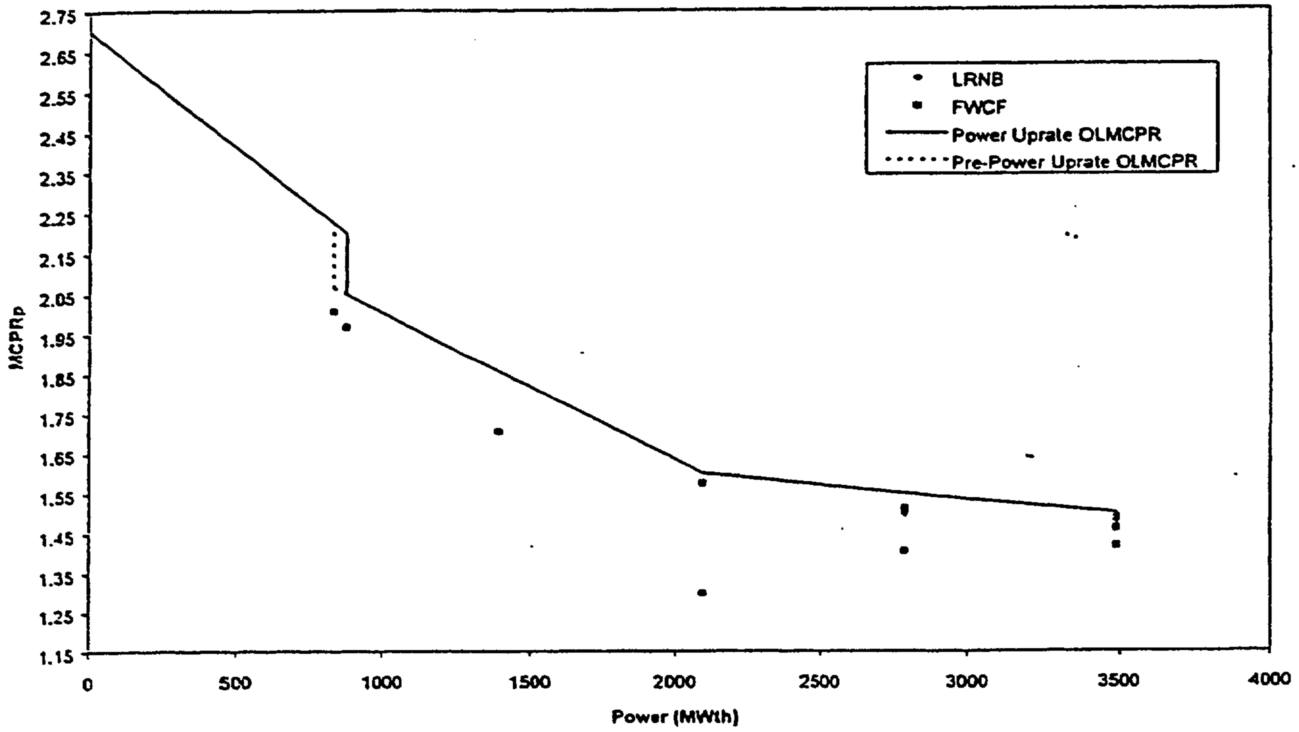
Power (%)	$LHGRFAC_p$
100	0.94
60	0.90
25	0.67
25	0.67
0	0.67

Figure 5.8 EOC Turbine Bypass Valves Out-of-Service Power-Dependent LHGR Multipliers for ATRIUM-9B Fuel



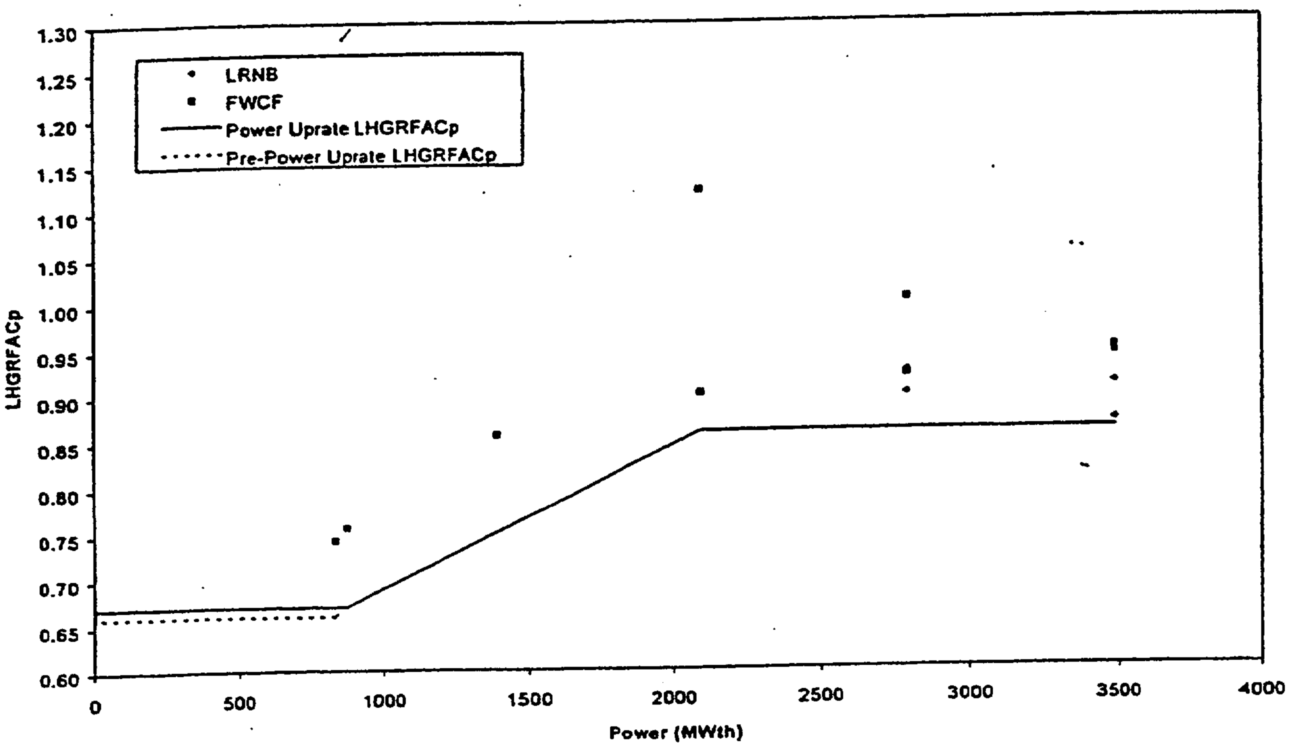
3323 MWth Rated Power		3489 MWth Rated Power	
Power (%)	$MCPR_P$ Limit	Power (%)	$MCPR_P$ Limit
100	1.53	100	1.51
63	1.65	60	1.65
25	2.17	25	2.15
25	2.22	25	2.20
0	2.70	0	2.70

Figure 5.9 EOC Turbine Bypass Valves Out-of-Service Power-Dependent MCPR Limits for GE9 Fuel



3323 MWth Rated Power		3489 MWth Rated Power	
Power (%)	MCPR$_p$ Limit	Power (%)	MCPR$_p$ Limit
100	1.51	100	1.50
63	1.60	60	1.60
25	2.07	25	2.05
25	2.22	25	2.20
0	2.70	0	2.70

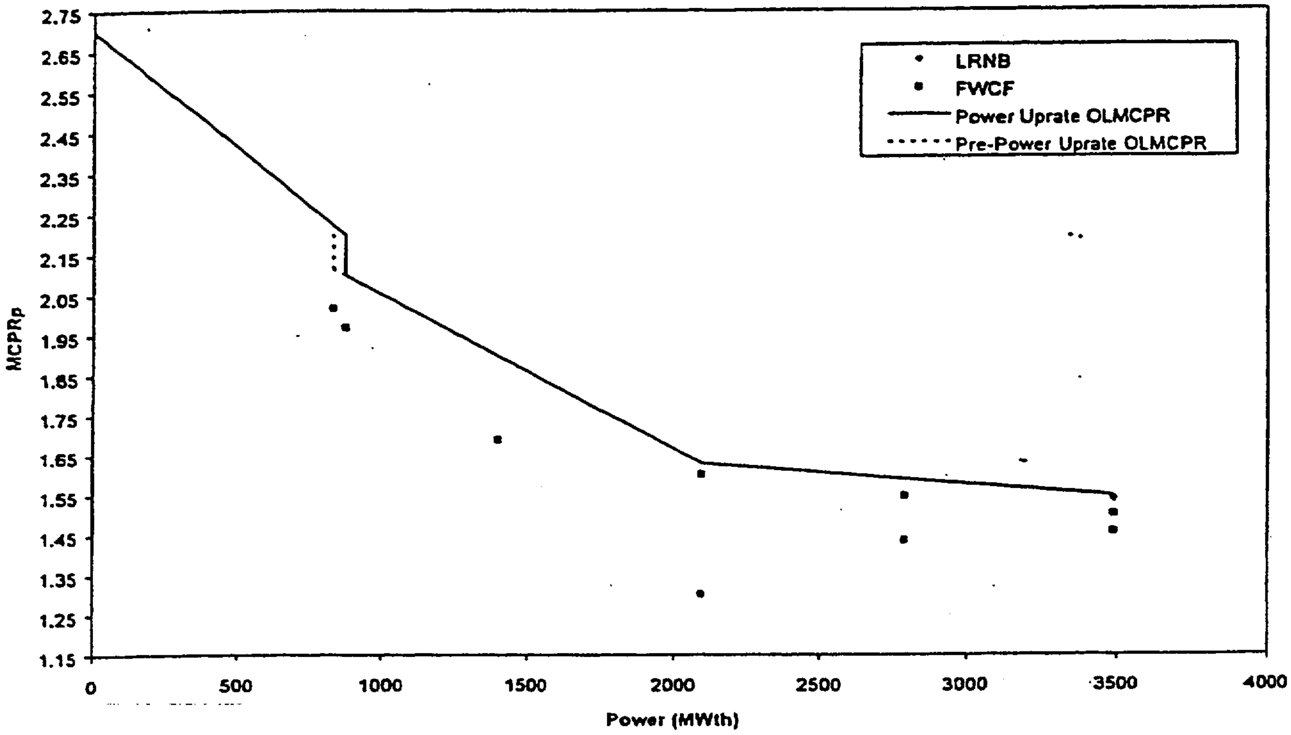
Figure 5.10 EOC Recirculation Pump Trip Out-of-Service
Power-Dependent MCPR Limits for ATRIUM-9B Fuel



3323 MWth Rated Power	
Power (%)	LHGRFAC$_p$
100	0.86
63	0.86
25	0.66
25	0.66
0	0.66

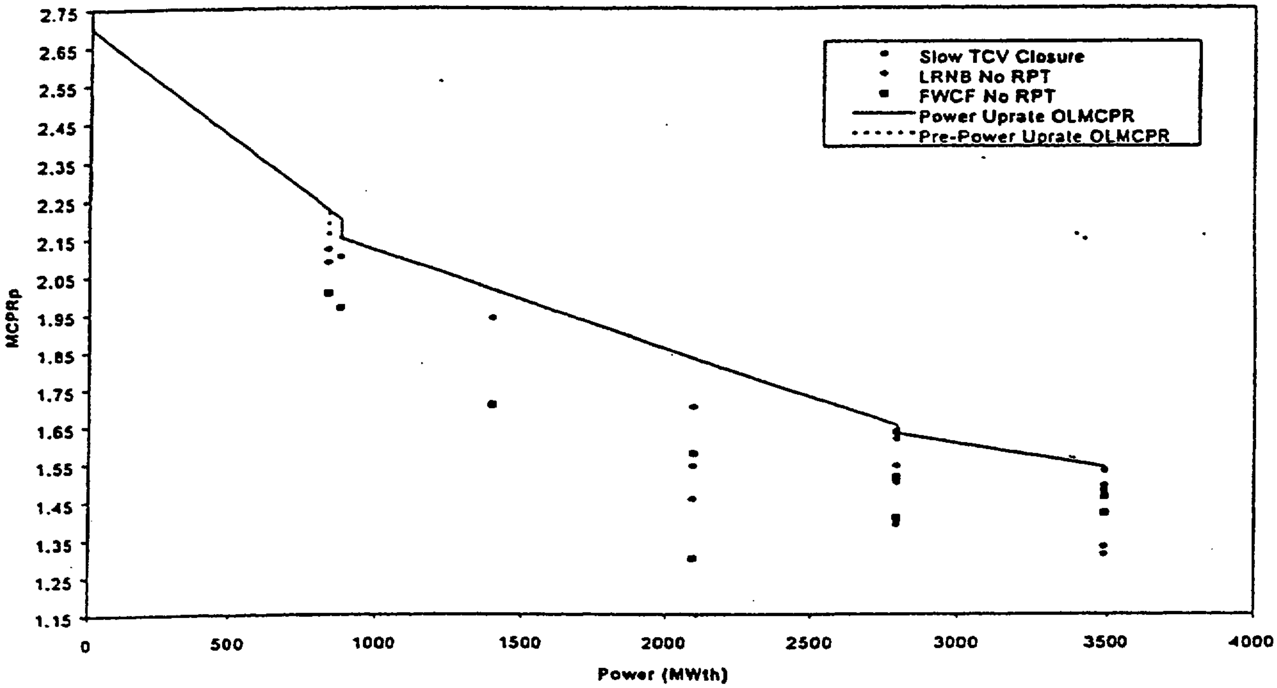
3489 MWth Rated Power	
Power (%)	LHGRFAC$_p$
100	0.86
60	0.86
25	0.67
25	0.67
0	0.67

Figure 5.11 EOC Recirculation Pump Trip Out-of-Service Power-Dependent LHGR Multipliers for ATRIUM-9B Fuel



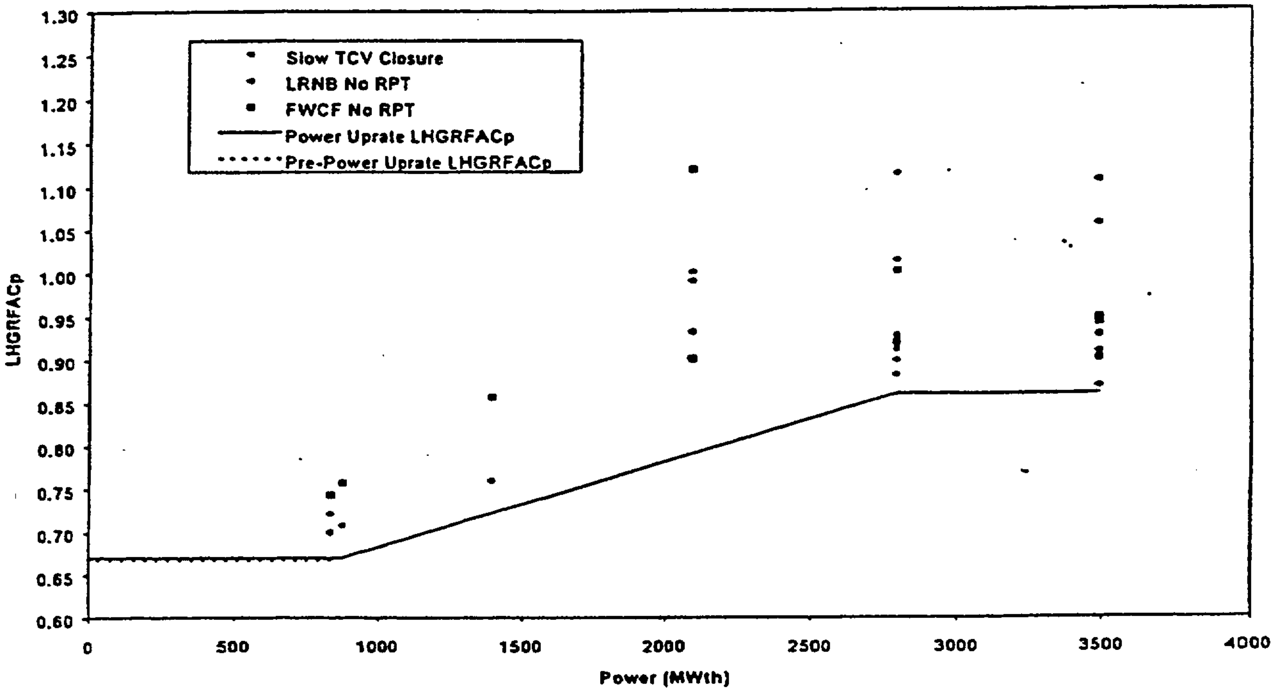
3323 MWth Rated Power		3489 MWth Rated Power	
Power (%)	$MCPR_p$ Limit	Power (%)	$MCPR_p$ Limit
100	1.56	100	1.55
63	1.63	60	1.63
25	2.12	25	2.10
25	2.22	25	2.20
0	2.70	0	2.70

Figure 5.12 EOC Recirculation Pump Trip Out-of-Service
Power-Dependent MCPR Limits for GE9 Fuel



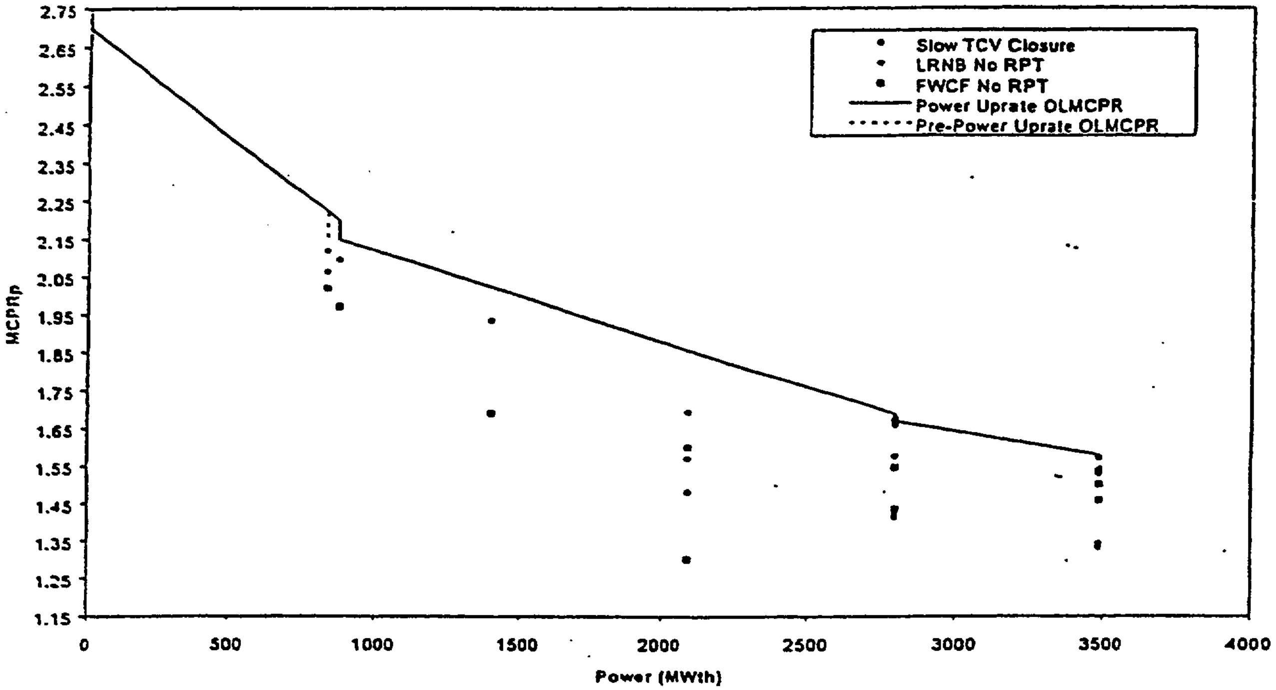
3323 MWth Rated Power		3489 MWth Rated Power	
Power (%)	$MCPR_p$ Limit	Power (%)	$MCPR_p$ Limit
100	1.56	100	1.54
84	1.63	80	1.63
84	1.65	80	1.65
25	2.16	25	2.15
25	2.22	25	2.20
0	2.70	0	2.70

Figure 5.13 EOC Turbine Control Valve Slow Closure and/or Recirculation Pump Trip Out-of-Service Power-Dependent MCPR Limits for ATRIUM-9B Fuel



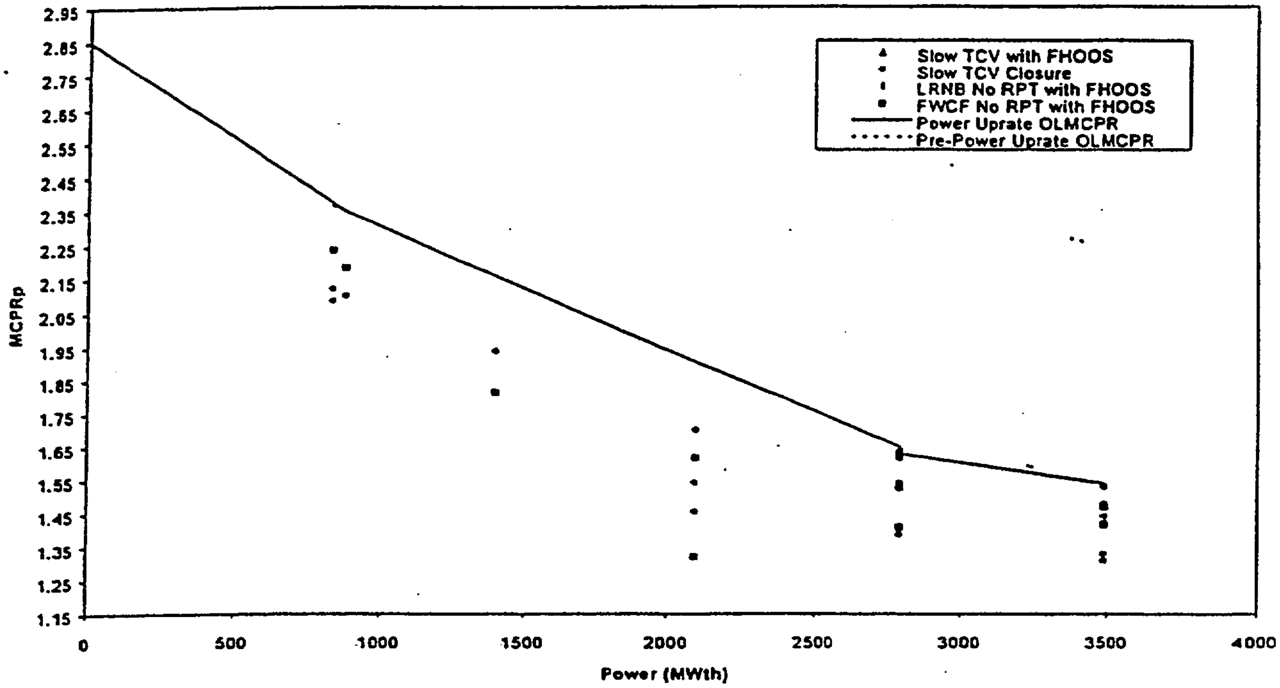
3323 MWth Rated Power		3489 MWth Rated Power	
Power (%)	LHGRFAC$_p$	Power (%)	LHGRFAC$_p$
100	0.86	100	0.86
84	0.86	80	0.86
84	0.86	80	0.86
25	0.66	25	0.67
25	0.66	25	0.67
0	0.66	0	0.67

Figure 5.14 EOC Turbine Control Valve Slow Closure and/or Recirculation Pump Trip Out-of-Service Power-Dependent LHGR Multipliers for ATRIUM-9B Fuel



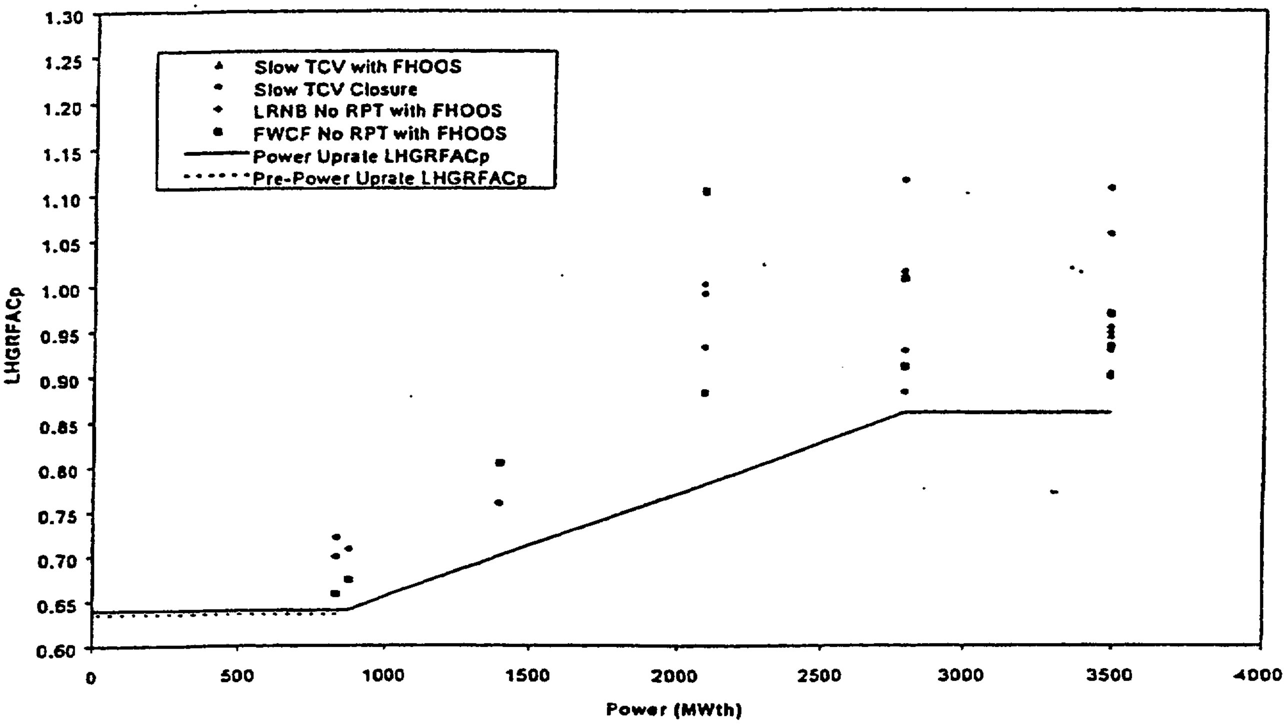
3323 MWth Rated Power		3489 MWth Rated Power	
Power (%)	MCPR$_p$ Limit	Power (%)	MCPR$_p$ Limit
100	1.60	100	1.58
84	1.67	80	1.67
84	1.69	80	1.69
25	2.16	25	2.15
25	2.22	25	2.20
0	2.70	0	2.70

Figure 5.15 EOC Turbine Control Valve Slow Closure and/or Recirculation Pump Trip Out-of-Service Power-Dependent MCPR Limits for GE9 Fuel



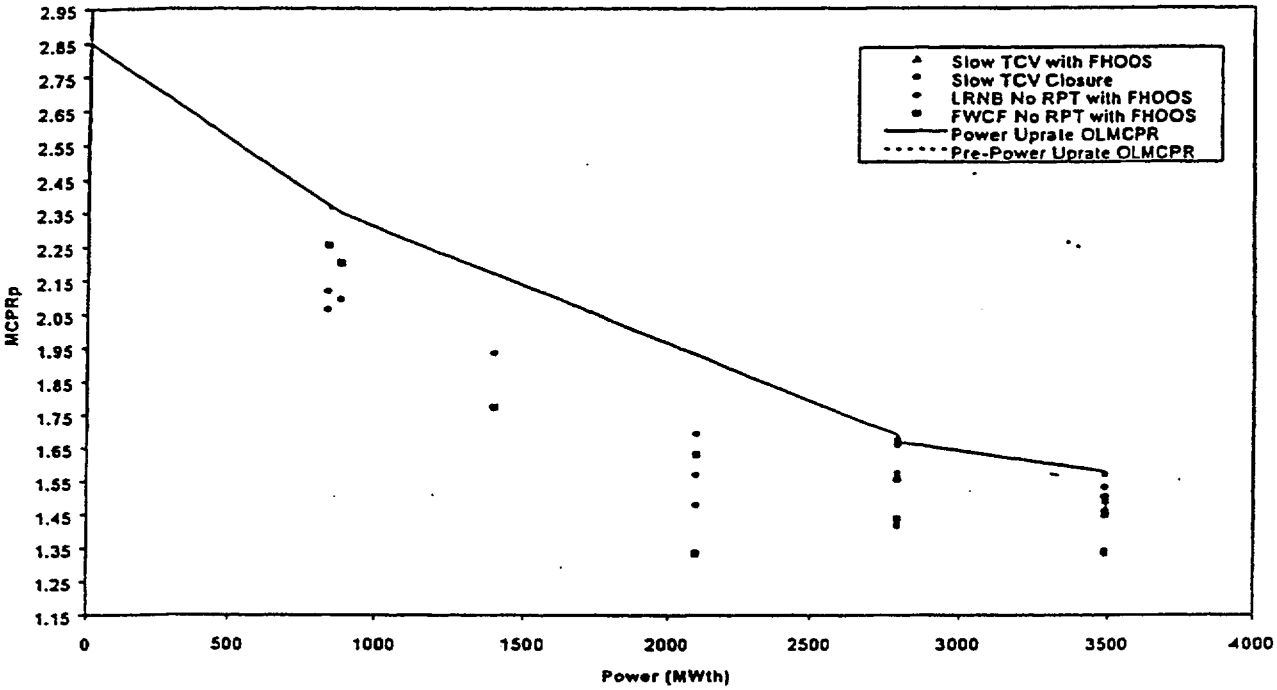
3323 MWth Rated Power		3489 MWth Rated Power	
Power (%)	MCPR$_p$ Limit	Power (%)	MCPR$_p$ Limit
100	1.56	100	1.54
84	1.63	80	1.63
84	1.65	80	1.65
25	2.38	25	2.35
25	2.38	25	2.35
0	2.85	0	2.85

Figure 5.16 EOC Turbine Control Valve Slow Closure and/or Recirculation Pump Trip and Feedwater Heaters Out-of-Service Power-Dependent MCPR Limits for ATRIUM-9B Fuel



3323 MWth Rated Power		3489 MWth Rated Power	
Power (%)	LHGRFAC$_P$	Power (%)	LHGRFAC$_P$
100	0.86	100	0.86
84	0.86	80	0.86
84	0.86	80	0.86
25	0.63	25	0.64
25	0.63	25	0.64
0	0.63	0	0.64

Figure 5.17 EOC Turbine Control Valve Slow Closure and/or Recirculation Pump Trip and Feedwater Heaters Out-of-Service Power-Dependent LHGR Multipliers for ATRIUM-9B Fuel



3323 MWth Rated Power		3489 MWth Rated Power	
Power (%)	MCPR$_p$ Limit	Power (%)	MCPR$_p$ Limit
100	1.60	100	1.58
84	1.67	80	1.67
84	1.69	80	1.69
25	2.38	25	2.35
25	2.38	25	2.35
0	2.85	0	2.85

Figure 5.18 EOC Turbine Control Valve Slow Closure and/or Recirculation Pump Trip and Feedwater Heaters Out-of-Service Power-Dependent MCPR Limits for GE9 Fuel

Table 7.1 ASME Overpressurization Analysis Results
102%P/105%F

Event	Peak Neutron Flux (%rated)	Peak Heat Flux (%rated)	Maximum Vessel Pressure Lower Plenum (psig)	Maximum Dome Pressure (psig)
MSIV	425.43	135.28	1320.26	1291.12
TCV	708.96	142.84	1318.41	1287.56
TSV	710.29	142.85	1318.41	1287.55

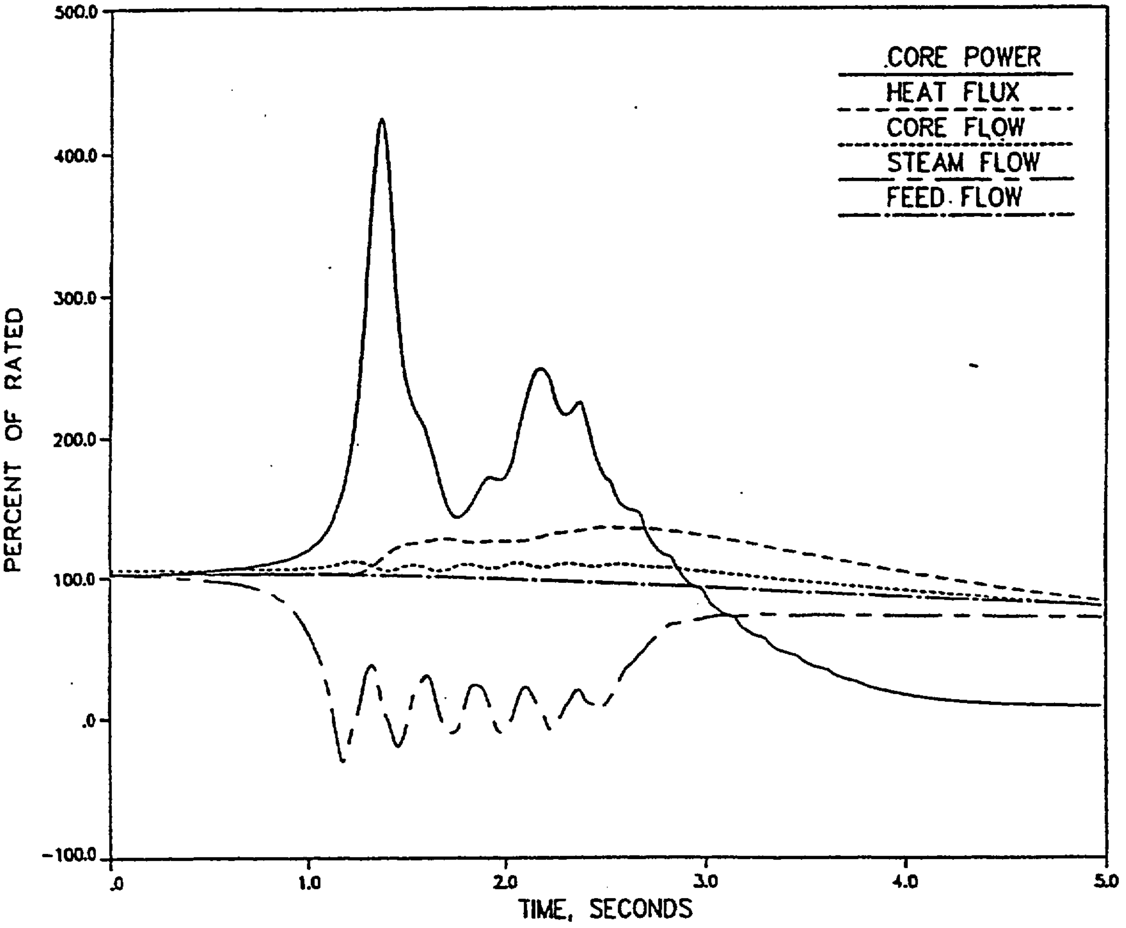


Figure 7.1 Overpressurization Event at 102/105 - MSIV Closure Key Parameters

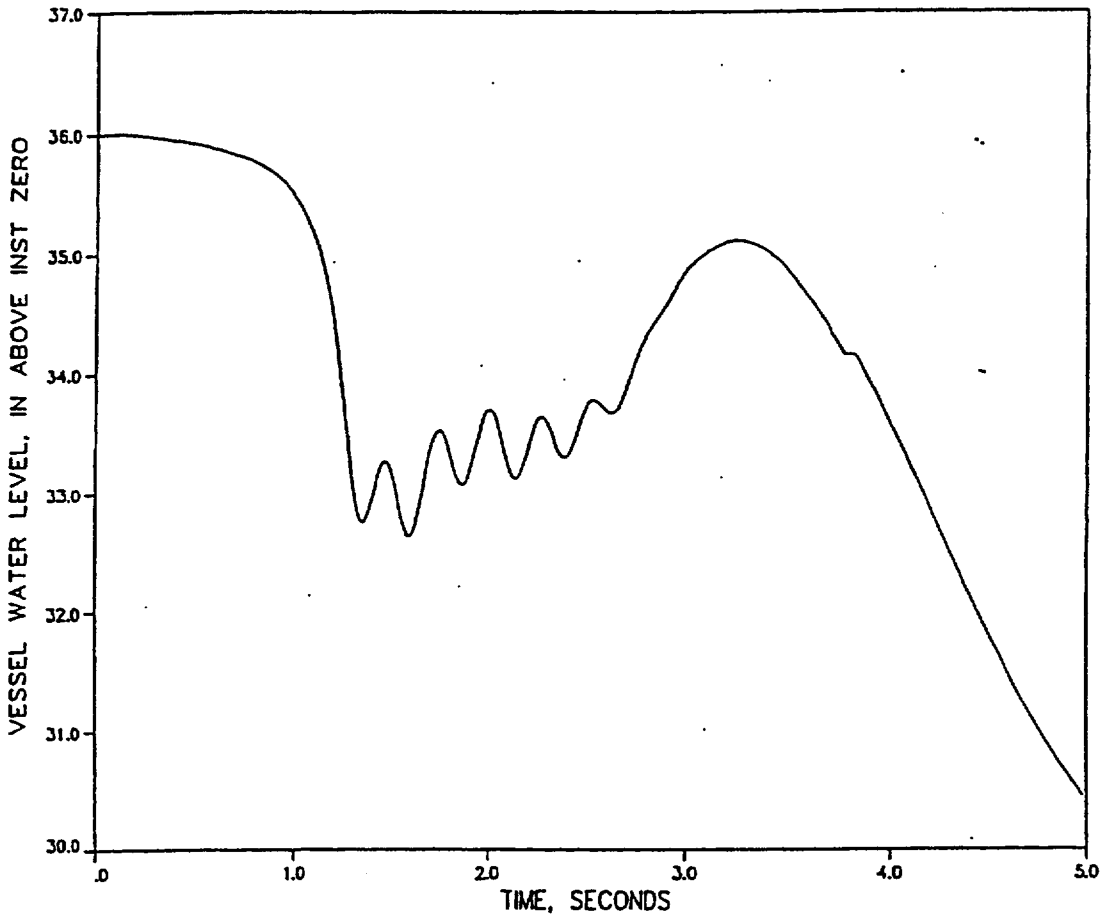
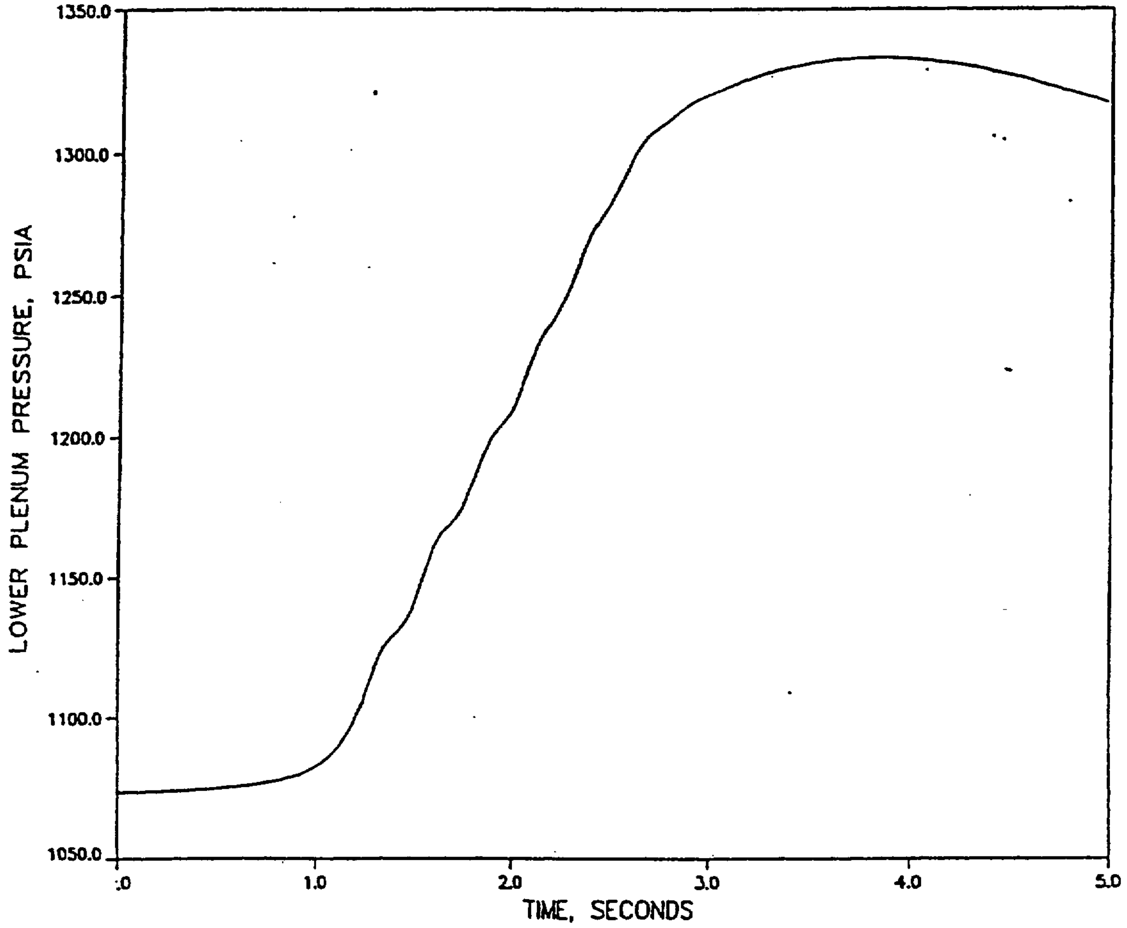


Figure 7.2 Overpressurization Event at 102/105 - MSIV Closure Vessel Water Level



⇒Figure 7.3 Overpressurization Event at 102/105 - MSIV Closure Lower Plenum Pressure

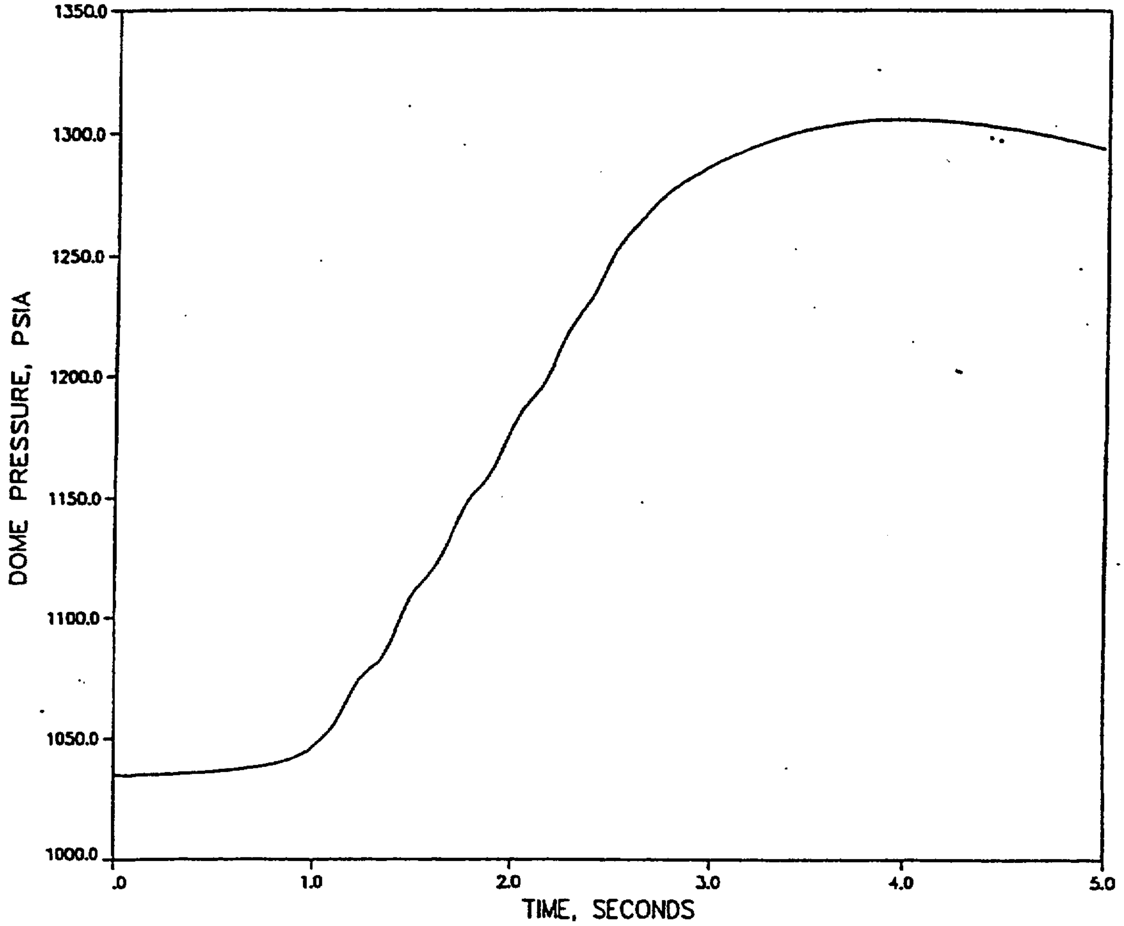


Figure 7.4 Overpressurization Event at 102/105 - MSIV Closure Dome Pressure

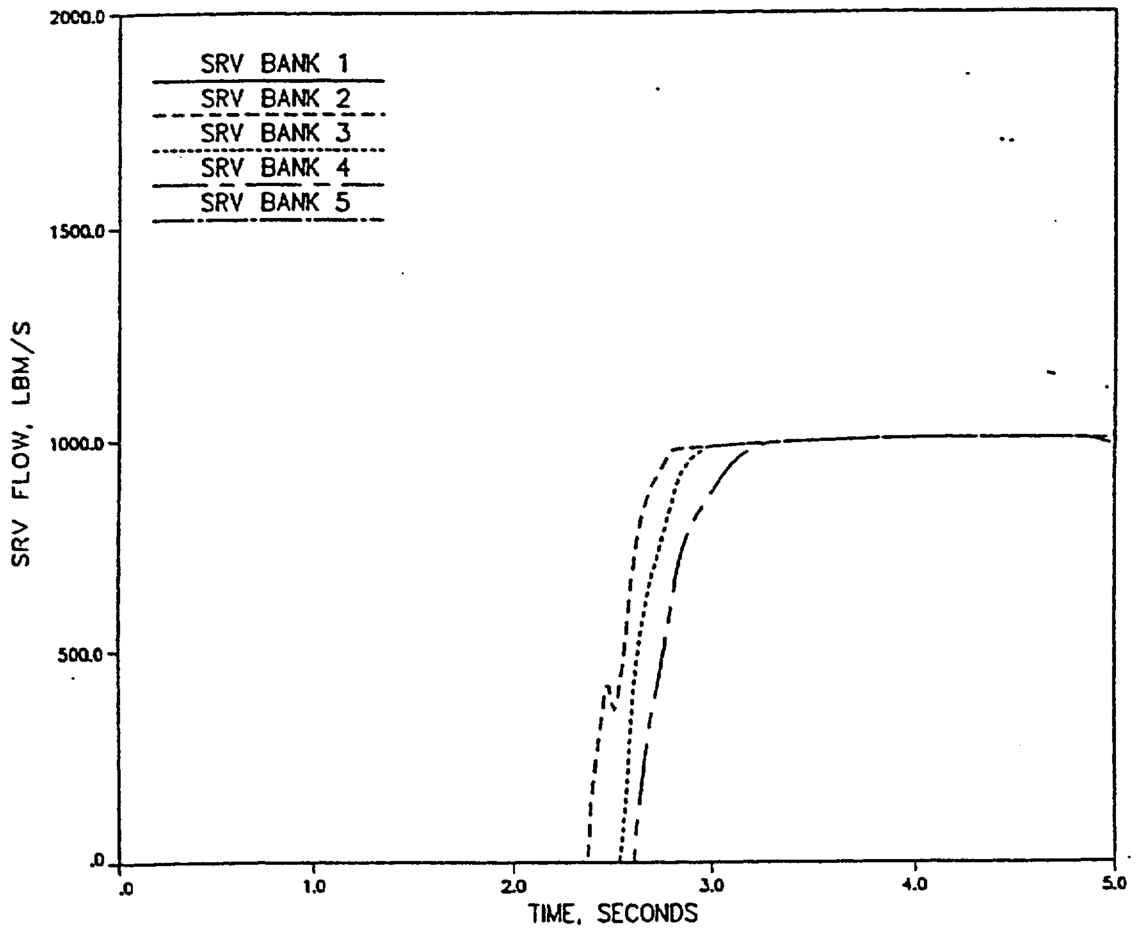


Figure 7.5 Overpressurization Event at 102/105 - MSIV Closure Safety/Relief Valve Flow Rates

Attachment 4

ARTS Improvement Program Analysis, Supplement 1 (Excerpts)

TOP/MOP and MAPFAC$_P$ Requirements

Limiting AOO	Power	Equipment Out of Service	TOP	MOP	Calculated MAPFAC$_P$	Generic MAPFAC$_P$
LRNBP	100	No EOOS	24.9	25.2	1.0	1.0
LRNBP	100	RPT OOS	30.3	30.6	1.0	1.0
FWCF	100	TBV OOS	28.7	30.0	1.0	1.0
FWCF	25	No EOOS	50.1	52.0	0.83	0.61
FWCF	25	RPT OOS	57.1	59.0	0.83	0.61
FWCF	25	TBV OOS	62.7	64.5	0.79	0.61

(a) Based on the GE9/10 LHGR Improvement Report, the MAPFACs are applied to LHGR (Reference 24)

Attachment 5

TCV Slow Closure Analysis (Excerpts)

Table 4. - TOP and MOP Values for the Off-rated Transient Events

	LRNBP, One TCV Slow Closure at 50%/s, 3 TCV Fast Closure	LRNBP, All TCV Slow Closure at 19%/s
Calculated TOP	26.17	49.27
Calculated MOP	26.17	55.30
Adjusted MOP		60.83
Required MOP		38.0
Required MAPFAC		0.62
Limiting MACFAC		0.60 (a)

Note : (a) Based on Figure 3.2-2 in COLR.

(b) Based on the GE9/10 LHGR Improvement Report, the MAPFACs are applied to LHGR (Reference 24)

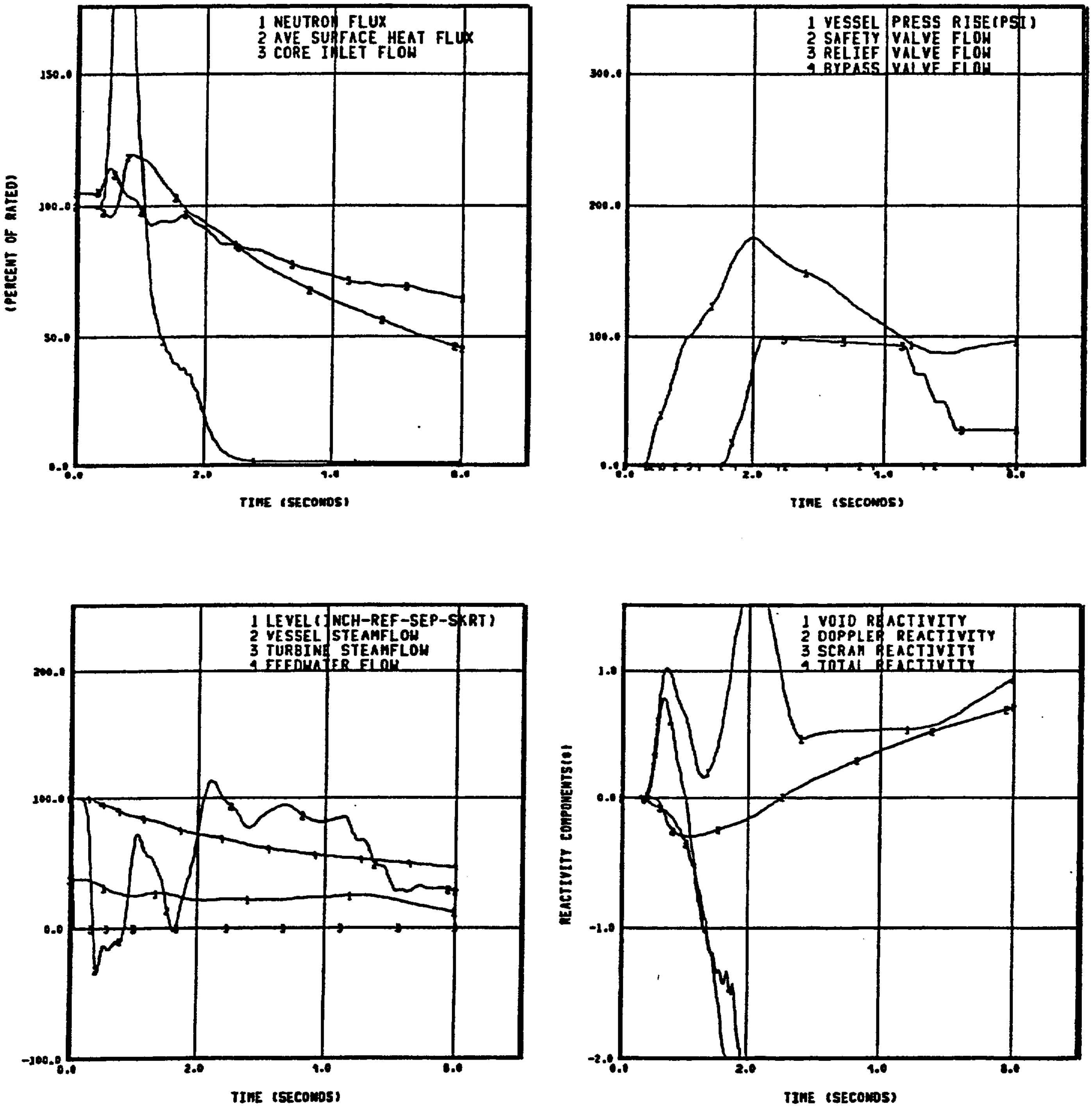


Figure 1. LRNBP from Rated Power, All TCV Fast Closure, Direct Scram, EOC-RPT

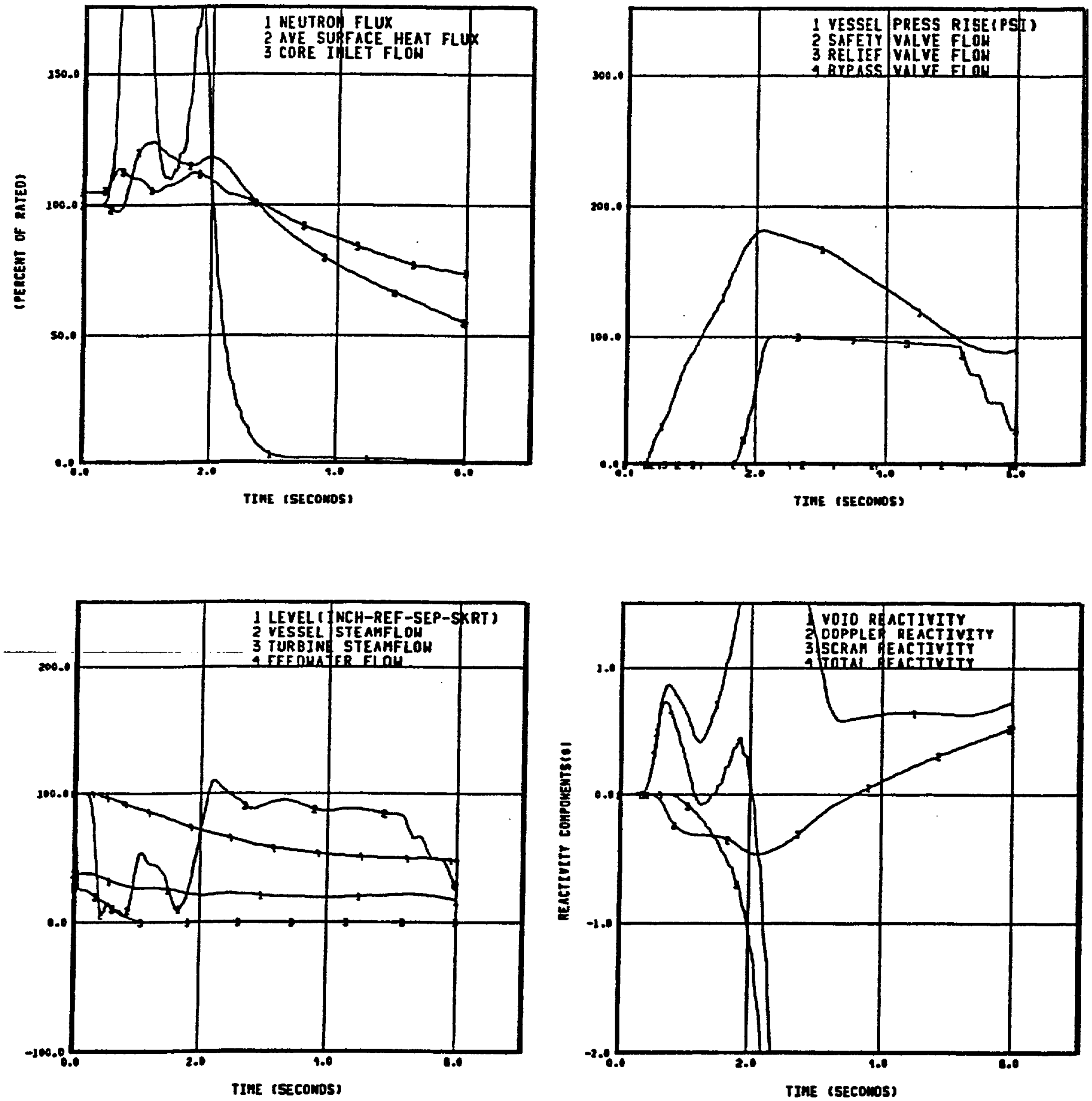


Figure 2. LRNBP from Rated Power, One TCV Slow Closure(50%/second)/Three TCV Fast Closure, Flu> Scram, EOC-RPT OOS

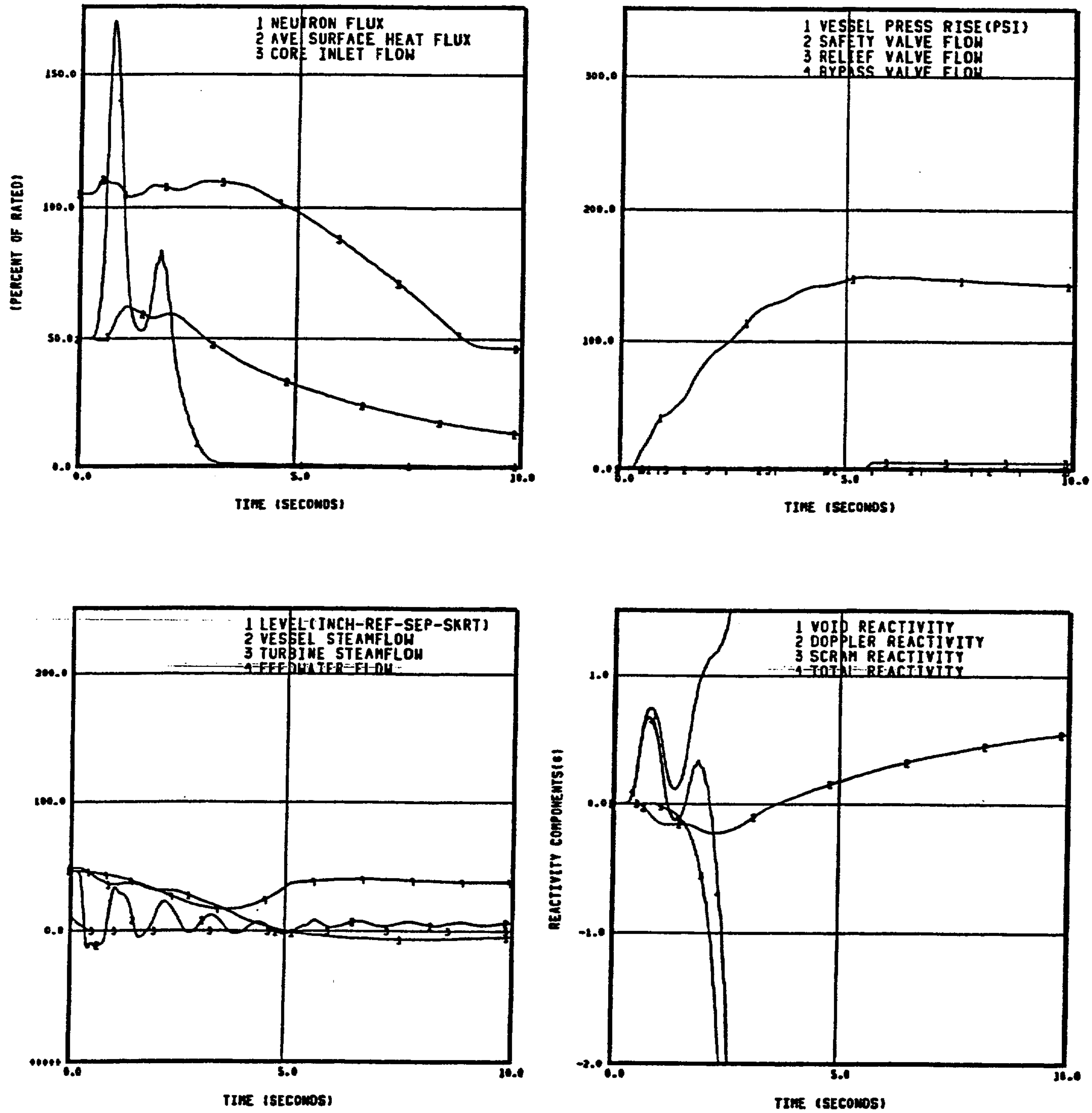


Figure 3. LRNBP from 50% Power, One TCV Slow Closure(50%/second)/Three TCV Fast Closure, Fl
Scram

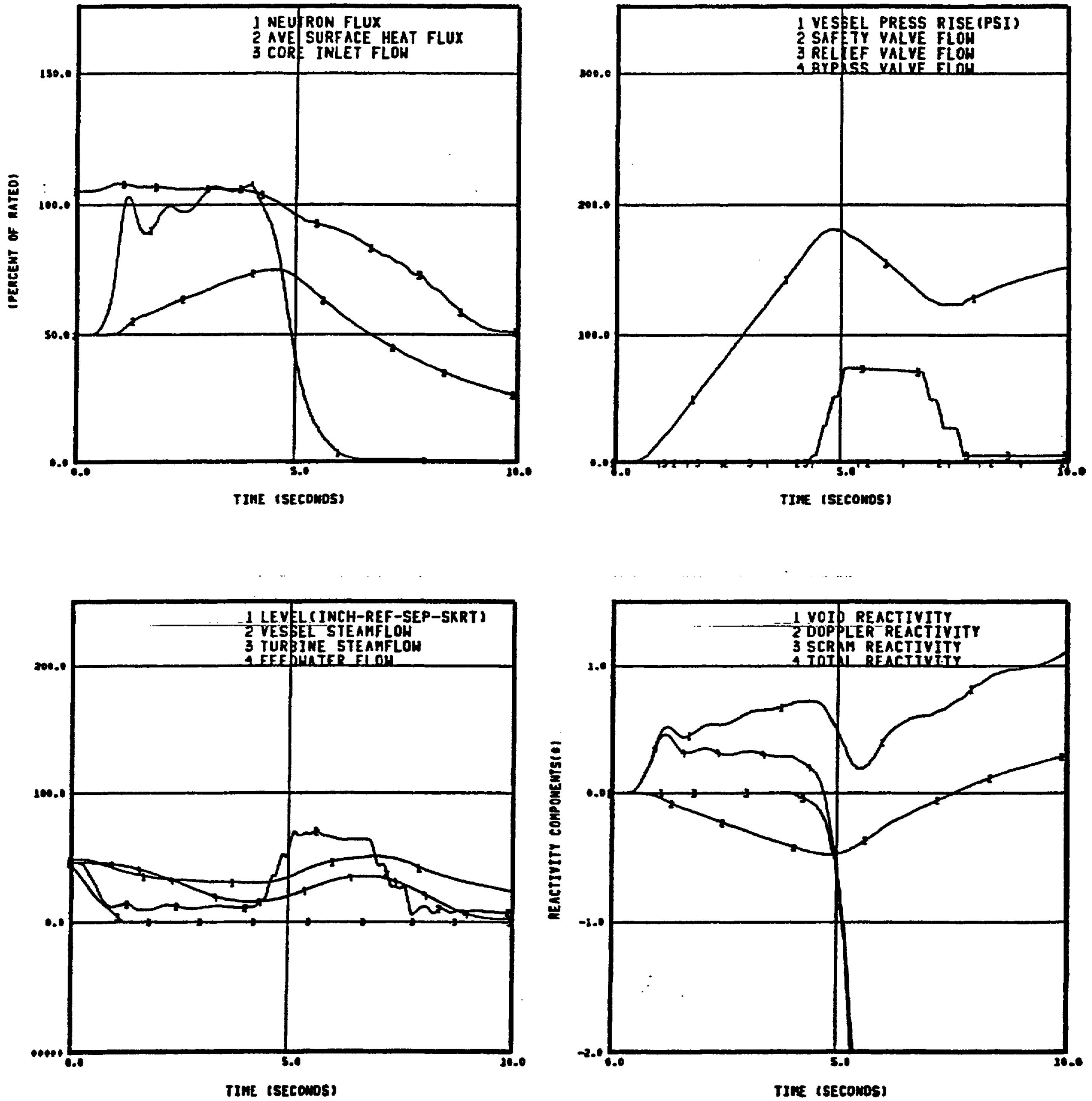


Figure 4. LRNBP from 50% Power, All TCV Closure at 19%/second, Pressure Scram

Attachment 6

LaSalle Unit 1 Cycle 9 Operating Limits For Proposed ITS Scram Times and Corrected Fuel Thermal Conductivity

FRAMATOME ANP

March 22, 2001
DEG:01:045

Dr. R. J. Chin
Nuclear Fuel Services (Suite 400)
Exelon Corporation
1400 Opus Place
Downers Grove, IL 60515-5701

Dear Dr. Chin:

LaSalle Unit 1 Cycle 9 Operating Limits for Proposed ITS Scram Times and Corrected Fuel Thermal Conductivity

Ref: 1: LaSalle County Nuclear Station Unit 1 Technical Specifications, as amended.

Ref: 2: EMF-2277 Revision 1, LaSalle Unit 1 Cycle 9 Plant Transient Analysis, Siemens Power Corporation, October 1999.

Ref: 3: EMF-2276 Revision 1, LaSalle Unit 1 Cycle 9 Reload Analysis, Siemens Power Corporation, October 1999.

Ref: 4: Letter~~, D. E. Garber~~ (FRA-ANP) to R. J. Chin (Exelon), "LaSalle ~~Unit 1~~ Cycle 9 Base Case Operating Limits for Proposed ITS Scram Times," DEG:01:013, January 18, 2001.

Ref: 5: Letter, D. E. Garber (FRA-ANP) to R. J. Chin (Exelon), "Transmittal of Condition Report 9191," DEG:01:038, February 27, 2001.

Exelon has proposed replacing the current Technical Specifications (Reference 1) with Improved Technical Specifications (ITS) during LaSalle Unit 1 Cycle 9 (L1C9) operation. The operating limits for L1C9 (References 2 and 3) were established consistent with the scram times presented in Reference 1 and are not consistent with the proposed ITS surveillance times. Exelon has requested that FRA-ANP perform analyses to address a mid-cycle transition to the ITS for base case operation and one equipment out-of-service (EOOS) scenario. Reference 4 describes the determination of analytical scram times consistent with the ITS and provided base case operating limits. Reference 5 identifies an error in the fuel thermal conductivity used in the transient analyses for LaSalle, including the analyses provided in Reference 4.

Framatome ANP Richland, Inc.

2101 Horn Rapids Road
Richland, WA 99352
Tel: (509) 375-8100
Fax: (509) 375-8402

The attachment provides the L1C9 base case and slow TCV closure/FHOOS and or no RPT transient analysis results and operating limits using the analytical scram times and the corrected fuel thermal conductivity. The base case operation limits provided in the attachment supercede those transmitted in Reference 4.

Very truly yours,

David Garber
Project Manager

slg

Enclosure

cc: P. Kong

LaSalle Unit 1 Cycle 9 Operating Limits for Proposed ITS Scram Times and Corrected Fuel Thermal Conductivity

Limiting Condition for Operation (LCO) 3.1.3.3 of the current LaSalle Unit 1 Technical Specifications (Reference 1) specifies the average scram insertion times of all operable control rods. The average control rod insertion times must not exceed the scram times for the requirements of LCO 3.1.3.3 to be met. Exelon is planning to implement Improved Technical Specifications (ITS) for LaSalle Unit 1 during Cycle 9. The scram surveillance times in the proposed ITS are slightly more restrictive than those presented in Reference 1. Additionally, the surveillance requirement for the ITS is that each rod must meet the scram times. The LaSalle Unit 1 Cycle 9 (L1C9) operating limits (References 2 and 3) are based on the average scram times presented in Reference 1. Therefore, the limiting base case and equipment out-of-service transient analyses used to set the operating limits provided in References 2 and 3 must be reanalyzed with revised scram times in order to support the mid-cycle implementation of the ITS.

FRA-ANP provided proposed ITS surveillance scram times to Exelon in Reference 4, Table 1. The Reference 4 analytical scram times are presented in Table 1 for completeness.

FRA-ANP informed Exelon of an error in the fuel thermal conductivity used in COTRANSA2 calculations (Reference 5). The analysis results presented in Tables 2 and 3 include the effect of the corrected fuel thermal conductivity.

Reference 9 provided a disposition of LOCA and UFSAR events for ITS scram times for LaSalle. The Reference 9 disposition remains applicable.

Base Case Operation

Reference 4 provided base case operating limits for the proposed ITS scram times. After Reference 4 was issued, FRA-ANP informed Exelon of an error in the fuel thermal conductivity used in COTRANSA2 calculations (Reference 5). The analyses provided in Reference 4 have been reanalyzed using the corrected fuel thermal conductivity. The results of these analyses are presented in Table 2.

Figures 1 and 2 present the revised base case $MCPR_p$ limits for the ATRIUM™-9B* and GE9 fuel, respectively. The sum of the L1C9 safety limit MCPR (1.11 per Reference 2) and the ΔCPR results from Table 2 are also presented in Figures 1 and 2.

The Reference 2 base case $LHGRFAC_p$ multipliers and the $LHGRFAC_p$ results from Table 2 are presented in Figure 3. Review of Figure 3 shows that all of the ATRIUM-9B $LHGRFAC_p$ results are above the $LHGRFAC_p$ multipliers, and therefore, the Reference 2 base case $LHGRFAC_p$ multipliers remain applicable for the proposed ITS scram times.

TCV Slow Closure/FHOOS and/or No RPT

Exelon requested that FRA-ANP provide operating limits for the most limiting equipment out-of-service (EOOS) scenario provided in Reference 2. Review of the Reference 2 limits shows that the most limiting two-loop operation EOOS scenario is TCV slow closure/FHOOS and/or no RPT.

The TCV slow closure/FHOOS and/or no RPT limits consider transient analysis results from the following scenarios: TCV slow closure (up to all four valves), EOC RPT OOS, FHOOS, and a combination of FHOOS and EOC RPT OOS. (Note: TCV slow closure analyses with FHOOS are bound by TCV slow closure analyses at nominal feedwater temperature, and therefore, no specific analyses are required for this scenario.) In order to reduce the workscope required to establish new limits, only a subset of the analyses reported in Reference 2 have been reanalyzed. Review of Figures 5.16, 5.17 and 5.18 in Reference 2 show that the TCV slow closure analyses are limiting for all power levels above 25% power (872.25 MWt); the FWCF no RPT with FHOOS is limiting at 25% power. Additionally, these figures show that there is considerable margin between the analysis results and the limits at power levels of 40% (1395.6 MWt) and 60% (2093.4 MWt).

Table 5.5 of Reference 2 was reviewed to determine which specific TCV slow closure analyses required reanalysis to establish the limits. Tables 5.1 (FHOOS) and 5.4 (EOC RPT OOS) of Reference 2 were also reviewed since the limits are applicable for EOC RPT OOS or FHOOS only. Table 3 presents the analysis results required to adequately establish the slow TCV closure/FHOOS and/or no RPT limits.

Figures 4 and 5 present the revised slow TCV closure/FHOOS and/or no RPT $MCPR_p$ limits for the ATRIUM-9B and GE9 fuel, respectively. The sum of the L1C9 safety limit MCPR (1.11 per Reference 2) and the ΔCPR results from Table 3 are also presented in Figures 4 and 5.

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* ATRIUM is a trademark of Framatome ANP.

The Reference 2 slow TCV closure/FHOOS and/or no RPT $LHGRFAC_p$ multipliers and the $LHGRFAC_p$ results from Table 3 are presented in Figure 6. Review of Figure 6 shows that all of the ATRIUM-9B $LHGRFAC_p$ results are above the $LHGRFAC_p$ multipliers, and therefore, the Reference 2 slow TCV closure/FHOOS and/or no RPT $LHGRFAC_p$ multipliers remain applicable.

The $MCPR_p$ limits and $LHGRFAC_p$ multipliers provided in Figures 4–6 protect operation with up to four TCVs closing slowly, EOC RPT OOS, FHOOS and any combination of up to four TCVs closing slowly, EOC RPT OOS and FHOOS. The only equipment out-of-service scenarios provided in Reference 2 not explicitly protected by the slow TCV closure/FHOOS and/or no RPT limits are single-loop operation (discussed below), turbine bypass valves OOS, and abnormal startup of an idle loop.

Comparison of turbine bypass valves OOS and the TCV slow closure/FHOOS and/or no RPT limits in Table 2.2 of Reference 3 shows the TCV slow closure/FHOOS and/or no RPT limits clearly bound the turbine bypass valves OOS limits. Consequently, applying the TCV slow closure/FHOOS and/or no RPT limits will protect operation with the turbine bypass OOS.

No analyses were performed to address the abnormal startup of an idle loop limits with ITS scram times and the corrected fuel thermal conductivity.

Single-Loop Operation

Figures 1–3 provide the two-loop operation (TLO) $MCPR_p$ limits and $LHGRFAC_p$ multipliers for base case operation. Reference 7 indicates that the consequences of base case pressurization transients in single-loop operation (SLO) are bound by the consequences of the same transient initiated from the same power/flow conditions in TLO and that the TLO base case ΔCPRs and the $LHGRFAC_p$ multipliers remain applicable for SLO. Reference 2 indicates the L1C9 TLO safety limit MCPR is 1.11 and the SLO safety limit MCPR is 1.12. Since the TLO ΔCPR results are applicable to SLO, the SLO ATRIUM-9B and GE9 $MCPR_p$ limits can be determined by adding 0.01 to the base case operation $MCPR_p$ limits provided in Figures 1 and 2 to account for the increase in safety limit MCPR. The base case operation $LHGRFAC_p$ multipliers presented in Figure 3 remain applicable for SLO.

The conclusion that TLO ΔCPR results generally bound SLO results has been demonstrated for both base case operation and some equipment out-of-service scenarios for other BWRs. Although specific L1C9 analyses for a combination of TCV slow closure/FHOOS and/or no RPT in SLO have not been performed, FRA-ANP expects the TLO operation ΔCPR results would remain applicable in

SLO for this scenario. Therefore, SLO $MCPR_p$ limits for TCV slow closure/FHOOS and/or no RPT can be determined by adding 0.01 to the TCV slow closure/FHOOS and/or no RPT $MCPR_p$ limits reported in Figures 4 and 5 to account for the increase in safety limit MCPR. The Figure 6 TCV slow closure/FHOOS and/or no RPT $LHGRFAC_p$ multipliers remain applicable for SLO.

GE9 Mechanical Limits

Reference 6 provides an evaluation of the GE mechanical limits for L1C9. An evaluation of the GE9 mechanical limits for the rated power analyses reported in Tables 2 and 3 was performed. It was demonstrated that the maximum nodal power ratio history curve for the analyses are bound by either the L1C9 or L2C8 curves. It is FRA-ANP's position that the GE mechanical limits criteria have been met for the implementation of ITS provided no GE9 LHGR set down was required for either L1C9 or L2C8; if an LHGR set down was required for the GE9 fuel for L1C9 or L2C8, further evaluation may be required.

References

1. *LaSalle County Nuclear Station Unit 1 Technical Specifications*, as amended.
2. EMF-2277 Revision 1, *LaSalle Unit 1 Cycle 9 Plant Transient Analysis*, Siemens Power Corporation, October 1999.
3. EMF-2276 Revision 1, *LaSalle Unit 1 Cycle 9 Reload Analysis*, Siemens Power Corporation, October 1999.
4. Letter, D. E. Garber (FRA-ANP) to R. J. Chin (Exelon), "LaSalle Unit 1 Cycle 9 Base Case Operating Limits for Proposed ITS Scram Times," DEG:01:013, January 18, 2001.
5. Letter, D. E. Garber (FRA-ANP) to R. J. Chin (Exelon), "Transmittal of Condition Report 9191," DEG:01:038, February 27, 2001.
6. Letter, D. E. Garber (SPC) to R. J. Chin (ComEd), "LaSalle Unit 1 Cycle 9 Mechanical Limits for GE9 Fuel," DEG:99:213, August 4, 1999.
7. EMF-95-205(P) Revision 2, *LaSalle Extended Operating Domain (EOD) and Equipment Out of Service (EOOS) Safety Analysis for ATRIUM™-9B Fuel*, Siemens Power Corporation, June 1996.
8. EMF-96-189 Revision 0, *LaSalle Unit 1 Cycle 9 Principal Transient Analysis Parameters*, Siemens Power Corporation, May 1999.
9. Letter D. E. Garber (SPC) to R. J. Chin (ComEd), "Evaluation of Improved Technical Specification Scram Times at Dresden, LaSalle and Quad Cities Station," DEG:99:195, July 26, 1999.

Table 1 Proposed ITS Scram Insertion Times

Position (notch)	TS Limit (sec)	Slow Rods (sec)	Analytical (sec)
48	0.00	0.00	0.00
48	0.20*	0.20*	0.20*
45	0.52	0.67	0.53
39	0.80	1.62	0.85
25	1.77	3.84	1.90
5	3.20	7.00	3.45
0	3.56	7.79	3.83

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* The 0.20-second delay is considered a nominal value that cannot be verified by the plant. Therefore, the transient analysis calculations are performed to bound a range of no delay (linear insertion from start signal to notch 45) to a delay value just before notch 45. This is consistent with the information provided in Reference 8.

Table 2 Base Case Transient Analysis Results With Proposed ITS Scram Times and Corrected Fuel Thermal Conductivity

Power / Flow	ATRIUM-9B ΔCPR	ATRIUM-9B LHGRFAC_p	GE9 ΔCPR	Peak Neutron Flux (% rated)	Peak Heat Flux (% rated)
			LRNB		
100 / 105	0.333	1.000	0.371	469.3	123.9
100 / 81	0.345	1.000	0.385	449.7	126.0
80 / 105	0.341	0.993	0.378	386.7	98.4
80 / 57.2	0.386	1.000	0.418	305.8	98.9
			FWCF		
100 / 105	0.308	1.012	0.332	398.9	123.0
80 / 105	0.365	1.000	0.387	342.4	102.2
60 / 105	0.442*	0.944*	0.448	226.0*	79.4*
40 / 105	0.594*	0.884*	0.557*	130.9*	58.8*
25 / 105	0.927*	0.752*	0.949*	66.9*	43.5*

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* The analysis results presented are from an exposure prior to EOC. The ΔCPR and LHGRFAC_p results are conservatively used to establish the thermal limits.

Table 3 EOOS Transient Analysis Results With Proposed ITS Scram Times and Corrected Fuel Thermal Conductivity

Power / Flow	Slow Valve Characteristics	ATRIUM-9B ΔCPR	ATRIUM-9B $LHGRFAC_p$	GE9 ΔCPR
Slow TCV Closure				
100 / 105[*]	1 TCV closing in 2.0 seconds	0.424	0.900	0.465
100 / 105[*]	1 TCV closing in 2.7 seconds	0.422	0.899	0.464
80 / 57.2[*]	1 TCV closing in 2.0 seconds	0.530	0.901	0.574
80 / 105[†]	2 TCV closing in 2.0 seconds	0.540	0.874	0.582
80 / 57.2[†]	2 TCV closing in 2.0 seconds	0.560	0.944	0.600
25 / 105[†]	1 TCV closing in 2.0 seconds	1.007[‡]	0.700[‡]	1.003[‡]
LRNB No RPT				
100 / 105	NA	0.393	0.902	0.445
100 / 81	NA	0.378	0.874	0.437
FWCF With FHOOS				
25 / 105	NA	1.194[‡]	0.664[‡]	1.202[‡]
FWCF No RPT With FHOOS				
25 / 105	NA	1.108[‡]	0.660[‡]	1.130[‡]

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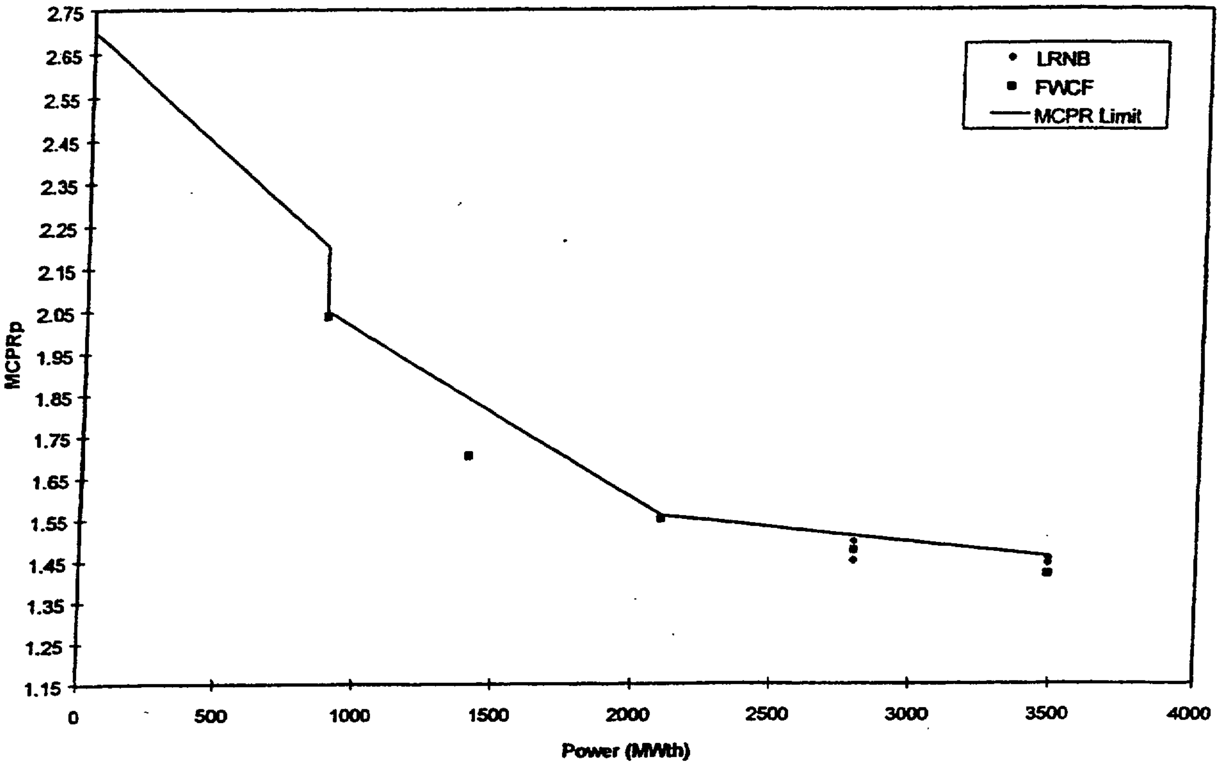
[*] Scram initiated by high neutron flux.

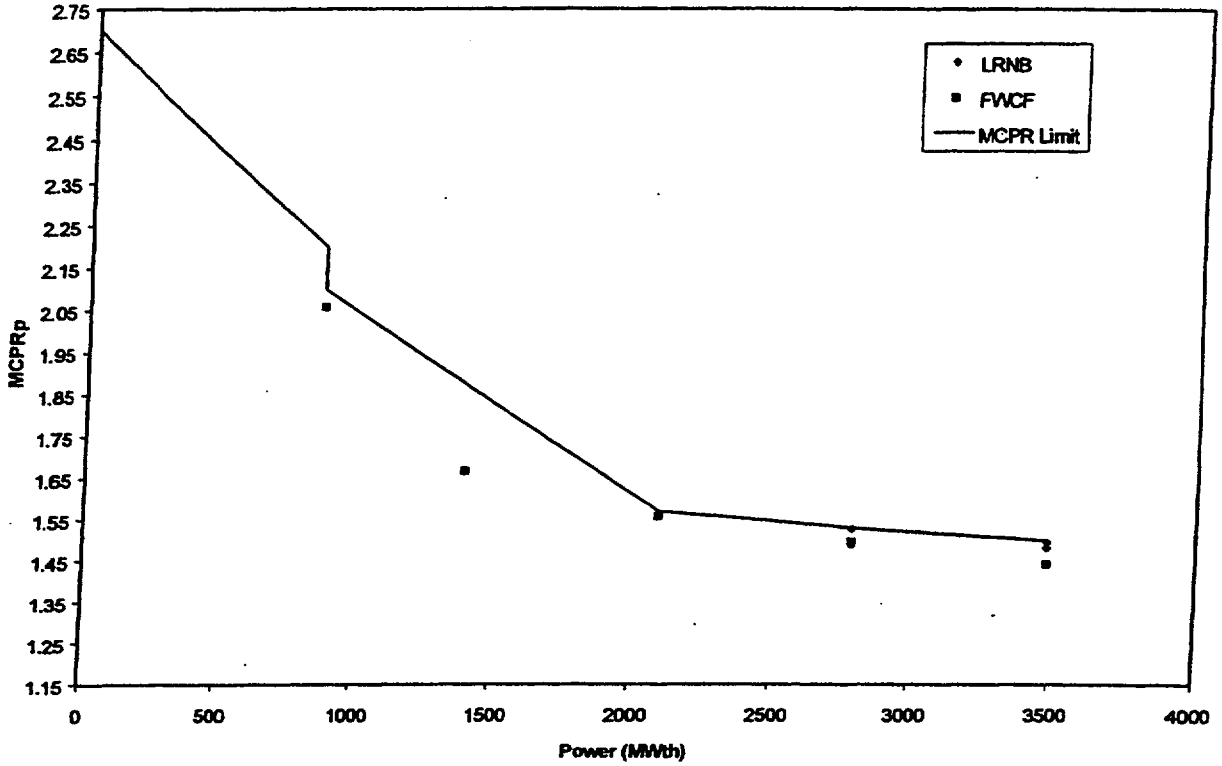
[†] Scram initiated by high dome pressure.

[‡] The analysis results presented are from an exposure prior to EOC. The ΔCPR and $LHGRFAC_p$ results are conservatively used to establish the thermal limits.



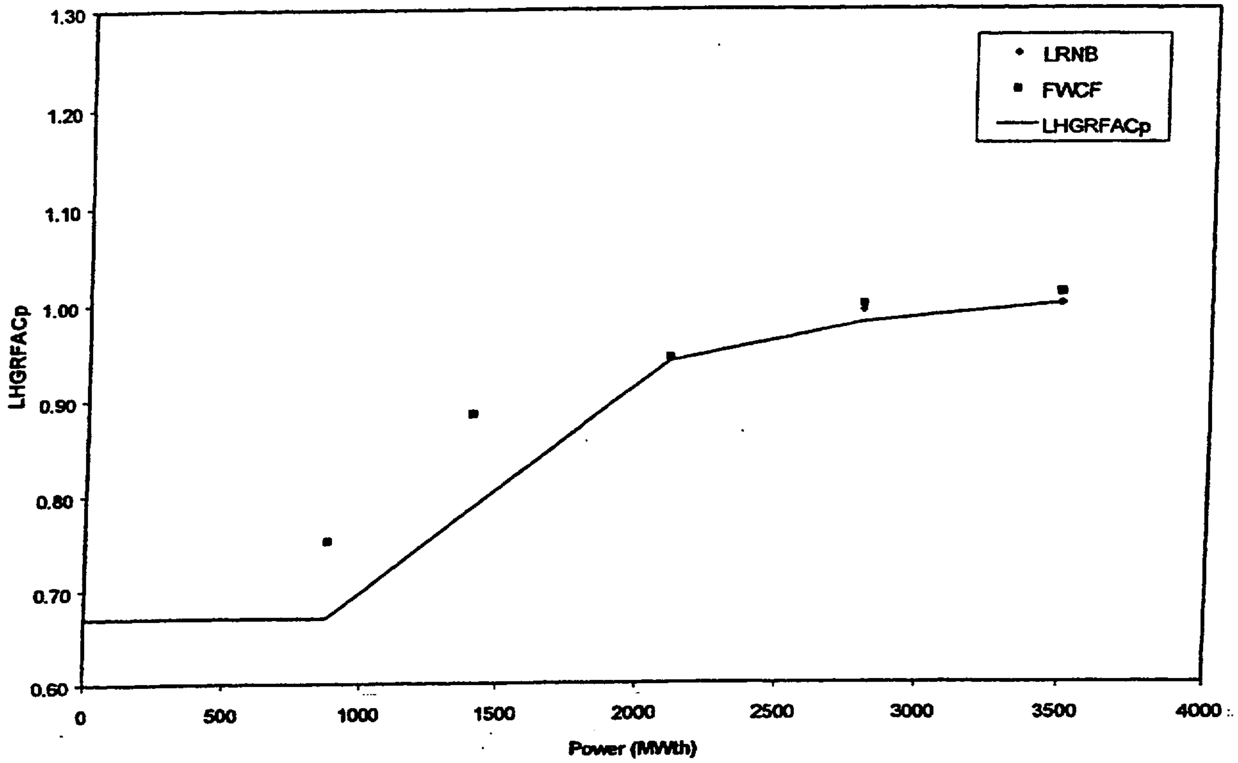
Power (%)	MCPR$_p$ Limit
100	1.46
80	1.51
60	1.56
25	2.05
25	2.20
0	2.70

Figure 1 EOC Base Case Power-Dependent MCPR Limits for ATRIUM-9B Fuel With Proposed ITS Scram Times and Corrected Fuel Thermal Conductivity



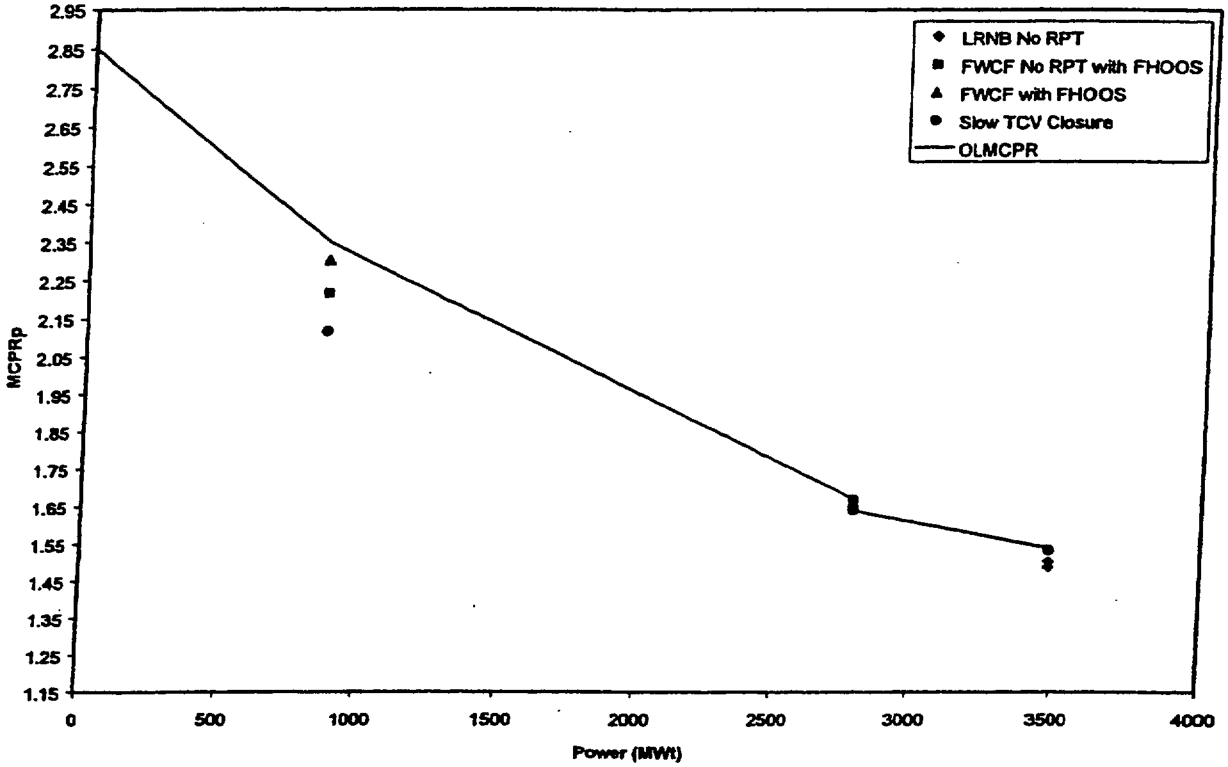
Power (%)	$MCPR_p$ Limit
100	1.50
80	1.53
60	1.57
25	2.10
25	2.20
0	2.70

Figure 2 EOC Base Case Power-Dependent MCPR Limits for GE9 Fuel With Proposed ITS Scram Times and Corrected Fuel Thermal Conductivity



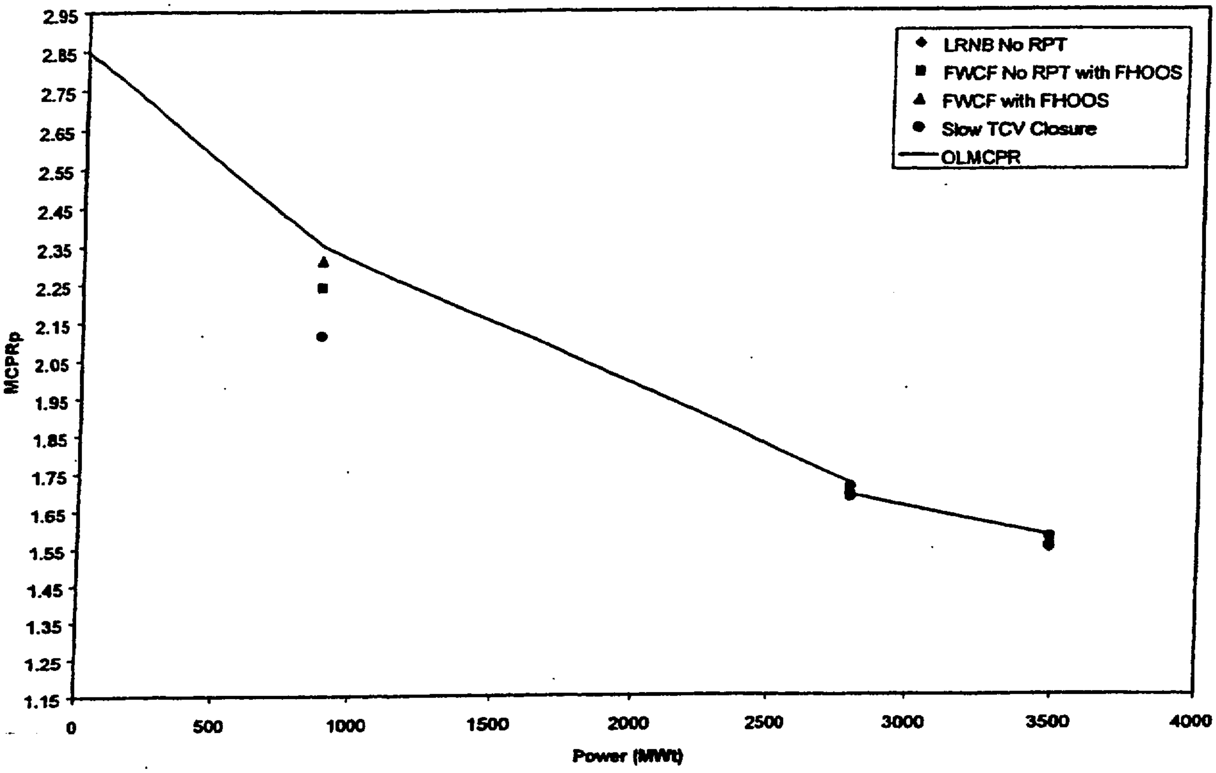
Power (%)	$LHGRFAC_p$ Multiplier
100	1.00
80	0.98
60	0.94
25	0.67
25	0.67
0	0.67

Figure 3 EOC Base Case Power-Dependent LHGR Multipliers for ATRIUM-9B Fuel With Proposed ITS Scram Times and Corrected Fuel Thermal Conductivity



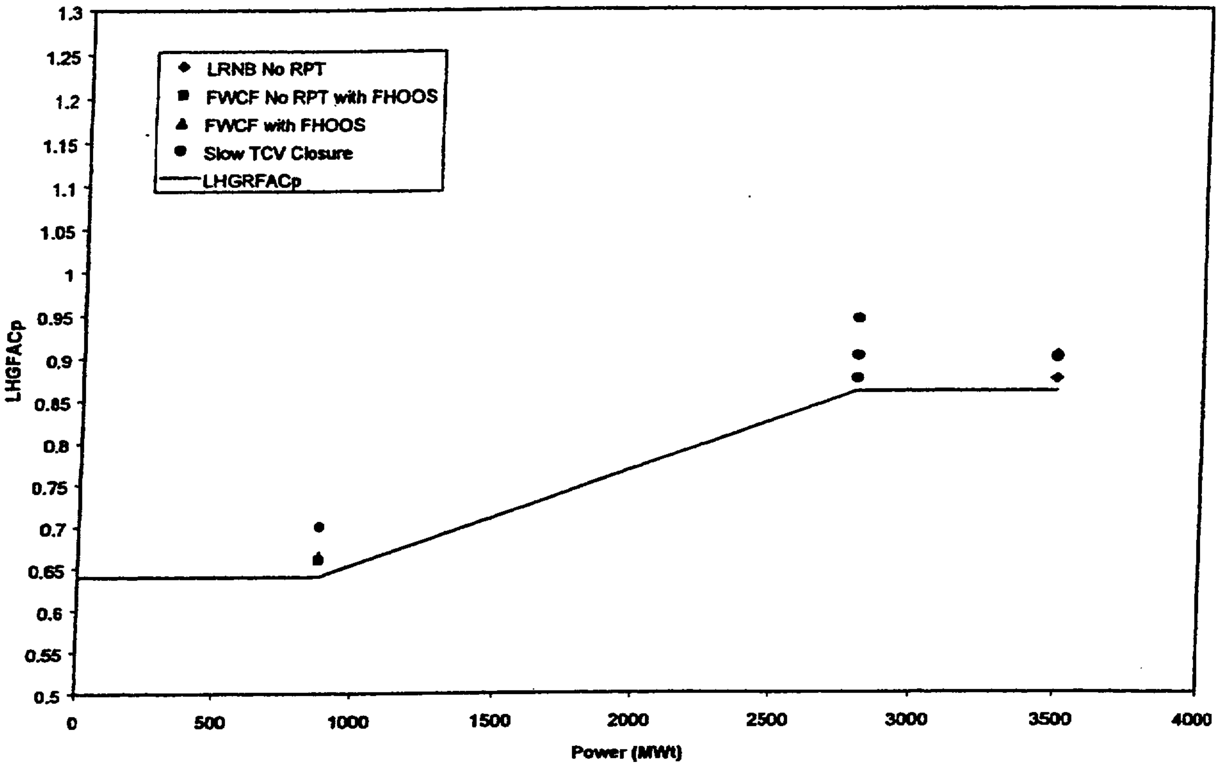
Power (%)	$MCPR_p$ Limit
100	1.54
80	1.64
80	1.67
25	2.35
25	2.35
0	2.85

Figure 4 EOC Slow TCV Closure/FHOOS and/or No RPT Power-Dependent MCPR Limits for ATRIUM-9B Fuel With Proposed ITS Scram Times and Corrected Fuel Thermal Conductivity



Power (%)	$MCPR_p$ Limit
100	1.58
80	1.69
80	1.71
25	2.35
25	2.35
0	2.85

Figure 5 EOC Slow TCV Closure/FHOOS and/or No RPT Power-Dependent MCPR Limits for GE9 Fuel With Proposed ITS Scram Times and Corrected Fuel Thermal Conductivity



Power (%)	LHGRFAC_p Multiplier
100	0.86
80	0.86
80	0.86
25	0.64
25	0.64
0	0.64

Figure 6 EOC Slow TCV Closure/FHOOS and/or No RPT Power-Dependent LHGR Multipliers for ATRIUM-9B Fuel With Proposed ITS Scram Times and Corrected Fuel Thermal Conductivity

Technical Requirements Manual - Appendix I
L1C9 Reload Transient Analysis Results

Attachment 7

LaSalle Unit 1 Cycle 9 Operating Limits For Proposed Cycle Extension

FRAMATOME ANP

September 21, 2001
DEG:01:148

Mr. F. W. Trikur
Exelon Nuclear
Nuclear Fuel Management
4300 Winfield Road
Warrenville, IL 60555

Dear Mr. Trikur:

LaSalle Unit 1 Cycle 9 Operating Limits for Proposed Cycle Extension

Ref: 1: Contract for Fuel Fabrication and Related Components and Services dated as of October 24, 2000 between Siemens Power Corporation and Commonwealth Edison Company for LaSalle Nuclear Plant.

Exelon has proposed operating LaSalle Unit 1 Cycle 9 beyond the currently licensed exposure of 18,477 MWd/MTU. The attachment provides the operating limits to support the planned cycle extension.

Very truly yours,

David Garber
Manager, Customer Projects

Enclosures

Framatome ANP, Inc.

2101 Horn Rapids Road
Richland, WA 99352

Tel: (509) 375-8100
Fax: (509) 375-8402

LaSalle Unit 1 Cycle 9
Operating Limits for Proposed Cycle Extension

Exelon has informed FRA-ANP of plans to extend LaSalle Unit 1 Cycle 9 (L1C9) beyond the current licensing core exposure of 29,439 MWd/MTU (page 4-2 of Reference 1, corresponding to a cycle exposure of 18,477 MWd/MTU) by implementing a combined FFTR/coastdown. Exelon has requested that FRA-ANP provide operating limits for base case Technical Specification scram speed (TSSS) and slow TCV closure and/or no RPT operation for the cycle extension. This letter report summarizes the transient analysis results and operating limits required to support the L1C9 cycle extension.

Cycle Extension

L1C9 was originally licensed to a cycle exposure of 18,477 MWd/MTU. The data provided in Reference 2 indicates the L1C9 full-power capability is projected to continue to a cycle exposure of 18,800 MWd/MTU with a final coastdown exposure of 19,600 MWd/MTU using a coastdown rate of 14.9% power/1000 MWd/MTU. Per discussions with Exelon, the L1C9 coastdown will include a final feedwater temperature reduction (FFTR) of 100°F.

The approach used to model the L1C9 cycle extension is consistent with the L2C9 FFTR/coastdown extension described in Item II.A of Reference 3. FRA-ANP began with the latest projection to the licensing EOC exposure of 18,477 MWd/MTU which includes core follow data to a cycle exposure of 11,564.3 MWd/MTU (References 4 and 5). The cycle was increased by 24 EFPD to account for the full-power capability extension due to the FFTR which corresponds to a cycle exposure of 19,100 MWd/MTU. Operation was then assumed to continue at a coastdown rate of 10% power/1,000 MWd/MTU. In order to protect a 10% power increase due to a Xenon transient, an additional 1,000 MWd/MTU of full power capability is included. Based on this approach, L1C9 is conservatively modeled to operate at rated power to a cycle exposure of 20,100 MWd/MTU.

Operating Limits

Reference 6 provided L1C9 EOC (18,477 MWd/MTU) operating limits for base case TSSS and slow TCV closure/FHOOS and/or no RPT scenarios to support the implementation of Improved Technical Specifications (ITS) and to correct an error in the fuel thermal conductivity. Tables 2 and 3 of Reference 6 list the transient analyses required to support the L1C9 EOC limits. A similar set of analyses is required to establish the L1C9 combined FFTR/coastdown limits. Analyses are only required at 105% of core flow to support the combined FFTR/coastdown, consistent with the L2C9 analysis approach presented in Table 4 of Reference 3. FFTR/coastdown analyses at 105% flow protect operation for all flows within the power/flow map provided in Figure 1.1 of Reference 7.

In general, performing analyses at higher exposures produces higher results. As a result, analyses performed at coastdown exposures tend to be more conservative than those performed at EOC. The L1C9 extension includes a 100°F temperature reduction to extend the full-power capability by 24 EFPD, and therefore, FFTR/coastdown exposures are higher than standard coastdown exposures. LRNB analyses tend to be more conservative for high feedwater temperatures (FWT) while low FWT produce higher results for FWCF analyses. It is obvious that FWCF analyses performed at the FFTR FWT and an FFTR/coastdown exposure bound all operation during the FFTR/coastdown. However, it is unclear if the combination of FFTR FWT and an FFTR/coastdown exposure would produce more conservative results than the upper bound FWT and a coastdown exposure for LRNB analyses. Therefore, in order to protect any operating scenario during FFTR/coastdown, the LRNB analyses were performed with the upper bound FWT at the FFTR/coastdown exposure.

All L1C9 FFTR/coastdown analyses were performed at a cycle exposure of 20,100 MWd/MTU. The transient analyses were performed with the ITS scram times shown in Table 1 of Reference 6 and include the correct fuel thermal conductivity.

Table 1 presents the base case TSSS analysis results for the combined FFTR/coastdown. Figures 1 and 2 present the base case TSSS $MCPR_p$ limits for the ATRIUM-9B and GE9 fuel, respectively. The sum of the L1C9 SLMCPR of 1.11 and the ΔCPR results from Table 1 are also presented in Figures 1 and 2. The FFTR/coastdown base case TSSS $LHGRFAC_p$ multipliers and the $LHGRFAC_p$ results from Table 2 are presented in Figure 3.

Table 2 presents the slow TCV closure and no RPT analysis results for the combined FFTR /coastdown. Figures 4 and 5 present the slow TCV closure and/or no RPT $MCPR_p$ limits for the ATRIUM-9B and GE9 fuel, respectively. The sum of the L1C9 SLMCPR of 1.11 and the ΔCPR results from Table 2 are also presented in Figures 4 and 5. The FFTR/coastdown slow TCV closure and/or no RPT $LHGRFAC_p$ multipliers and the $LHGRFAC_p$ results from Table 2 are presented in Figure 6.

Licensing Applicability

Reference 1 summarizes the L1C9 licensing analyses and limits for which FRA-ANP was responsible to a cycle exposure of 18,477 MWd/MTU. Licensing analyses performed by Exelon in support of L1C9 are presented elsewhere. In addition to the analyses listed in Tables 1 and 2, FRA-ANP has performed evaluations to determine the applicability of the Reference 1 analysis results and limits to the L1C9 cycle extension. The evaluations demonstrated that the Reference 1 licensing analysis results and limits remain applicable for the L1C9 cycle extension with the exception of the $MCPR_p$ limits and $LHGRFAC_p$ multipliers provided in Figures 1 through 6.

Reference 2 describes the planned L1C9 FFTR/coastdown as 14.9% power/1,000 MWd/MTU beginning at a cycle exposure of 18,800 MWd/MTU. The L1C9 operating limits provided in References 6 and 8 remain applicable to a cycle exposure of 18,477 MWd/MTU (core exposure of 29,439 MWd/MTU). The $MCPR_p$ limits and $LHGRFAC_p$ multipliers presented in Figures 1 through 6 must be used for operation beyond a cycle exposure of 18,477 MWd/MTU. In the event that the actual operation deviates significantly from the planned FFTR/coastdown, the following requirements must be met in order satisfy the coastdown analysis assumptions:

- Coastdown operation must begin prior to a cycle exposure of 19,100 MWd/MTU.
- Thermal power during FFTR/coastdown operation must be reduced at a rate faster than 10% power/1,000 MWd/MTU

The limits and multipliers presented in Figures 1 through 6 are applicable to a cycle exposure of 20,100 MWd/MTU. The $MCPR_p$ limits and $LHGRFAC_p$ multipliers are valid for any feedwater temperature within the bounds defined in Reference 7, Item 3.12.

Comparison of the Cycle 9 FFTR/coastdown nodal power histories for the rated power pressurization transients with the approved bounding curves to show compliance with the 1% clad strain and centerline melt criteria for GE9 fuel is discussed in Reference 9.

References

1. EMF-2276 Revision 1, *LaSalle Unit 1 Cycle 9 Reload Analysis*, Siemens Power Corporation, October 1999.

2. Exelon TODI NFM0100051, "LaSalle Unit 1 Cycle 10 Final Licensing Loading Plan (FLLP)," September 11, 2001.

3. Letter, D. E. Garber (SPC) to R. J. Chin (ComEd), "LaSalle Unit 2 Cycle 9 Post Analysis Calculation Plan," DEG:00:231, October 20, 2000.

4. Letter, J. K. Wheeler (Exelon) to D. E. Garber (SPC), "LaSalle Unit 1 Cycle 9 Core Follow Data through October 7, 2000," NFM0100004, January 5, 2001.

5. Letter, J. T. Fisher (Exelon) to D. E. Garber (FRA-ANP), "LaSalle Unit 1 Cycle 9 Core Follow Data October 8, 2000 through February," NFM0100037, March 27, 2001.

6. Letter, D. E. Garber (FRA-ANP) to R. J. Chin (Exelon), "LaSalle Unit 1 Cycle 9 Operating Limits for Proposed ITS Scram Times and Corrected Fuel Thermal Conductivity," DEG:01:045, March 22, 2001.

7. EMF-96-189 Revision 0, *LaSalle Unit 1 Cycle 9 Principal Transient Analysis Parameters*, Siemens Power Corporation, May 1999.

8. Letter, D. E. Garber (FRA-ANP) to R. J. Chin (Exelon), "LaSalle Unit 1 Cycle 9 NSS Base Case and TBVOOS or FHOOS Operating Limits for Proposed ITS Scram Times With Corrected Fuel Thermal Conductivity," DEG:01:074, May 15, 2001.

9. Letter, D. E. Garber (FRA-ANP) to F. W. Trikur (Exelon), "LaSalle Unit 1 Cycle 9 GE9 Mechanical Limits for Proposed Cycle Extension," DEG:01:143, September 18, 2001.

Table 1 Base Case TSSS FFTR/Coastdown Transient Analysis Results

Power (% rated)	ATRIUM-9B ΔCPR	ATRIUM-9B $LHGRFAC_p$	GE9 ΔCPR
		LRNB	
100	0.35	0.93	0.39*
80	0.39*	0.97	0.42*
		FWCF	
100	0.31	1.01*	0.34*
80	0.38	0.98	0.39*
60	0.50*	0.91*	0.49*
40	0.64	0.88*	0.60
25	1.20*	0.66*	1.21*

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* The analysis results presented are from an exposure prior to 20,100 MWd/MTU. The ΔCPR and $LHGRFAC_p$ results are conservatively used to establish the thermal limits.

Table 2 EOOS FFTR/Coastdown Transient Analysis Results

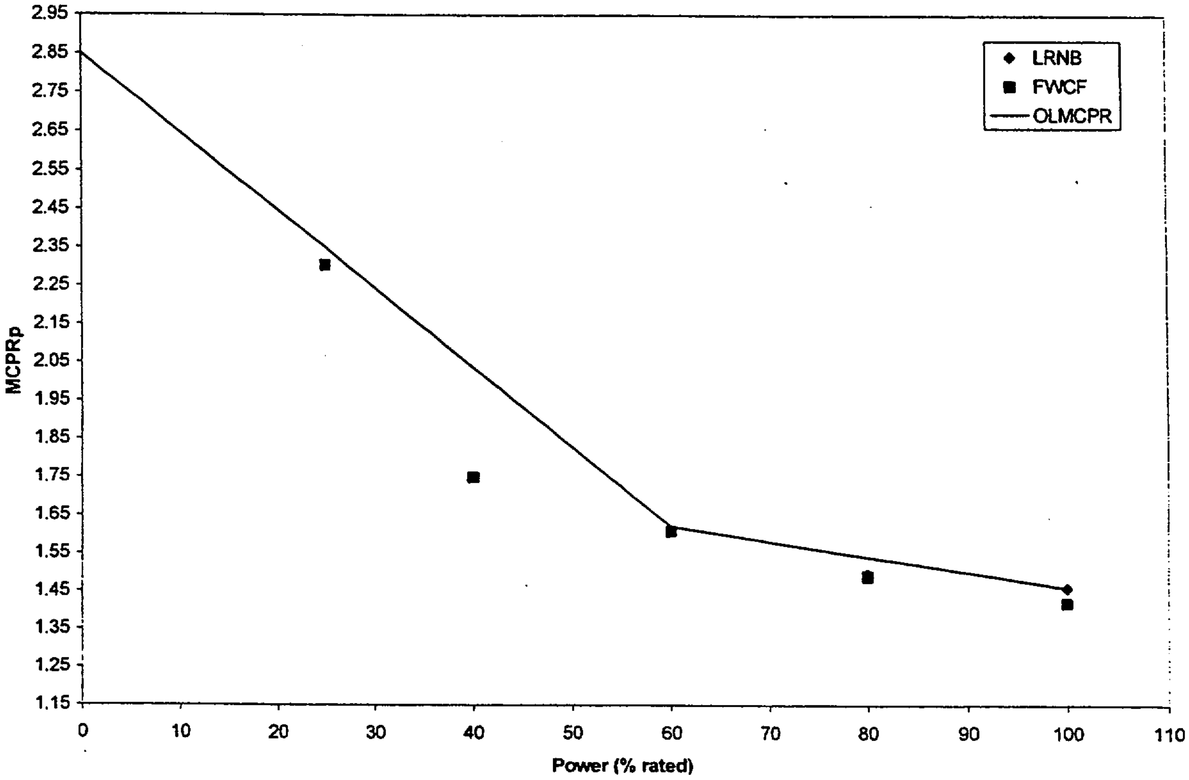
Power (% rated)	Slow Valve Characteristics	ATRIUM-9B ΔCPR	ATRIUM-9B LHGRFAC$_p$	GE9 ΔCPR
Slow TCV Closure				
100[*]	1 TCV closing in 2.0 seconds	0.46	0.83	0.50
100[*]	1 TCV closing in 2.7 seconds	0.46	0.83	0.50
80[*]	1 TCV closing in 2.0 seconds	0.53[†]	0.87	0.58[†]
80[‡]	1 TCV closing in 2.0 seconds	0.58	0.85	0.60[†]
25[‡]	1 TCV closing in 2.0 seconds	1.01[†]	0.70[†]	1.01[†]
LRNB No RPT				
100	---	0.42	0.83	0.46
FWCF No RPT With FHOOS				
25	---	1.11[†]	0.66[†]	1.13[†]

---

[*] Scram initiated by high neutron flux.

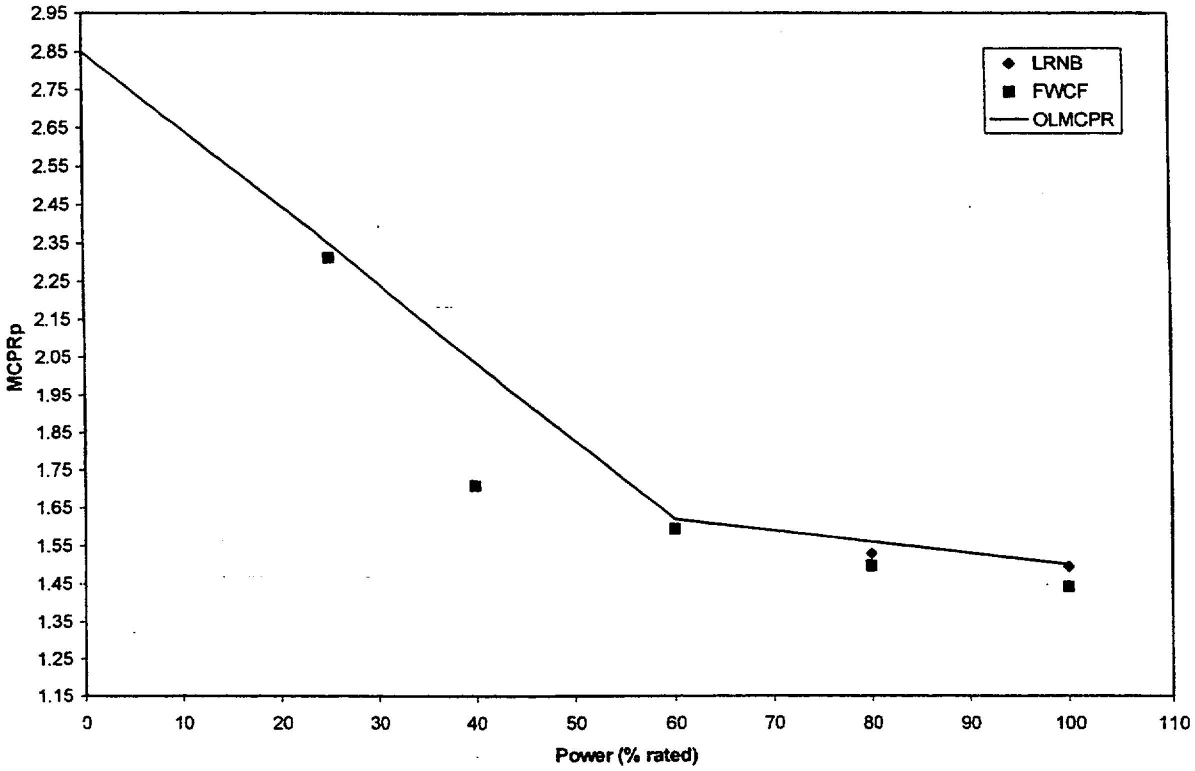
[†] The analysis results presented are from an exposure prior to 20,100 MWd/MTU. The ΔCPR and LHGRFAC$_p$ results are conservatively used to establish the thermal limits.

[‡] Scram initiated by high dome pressure.



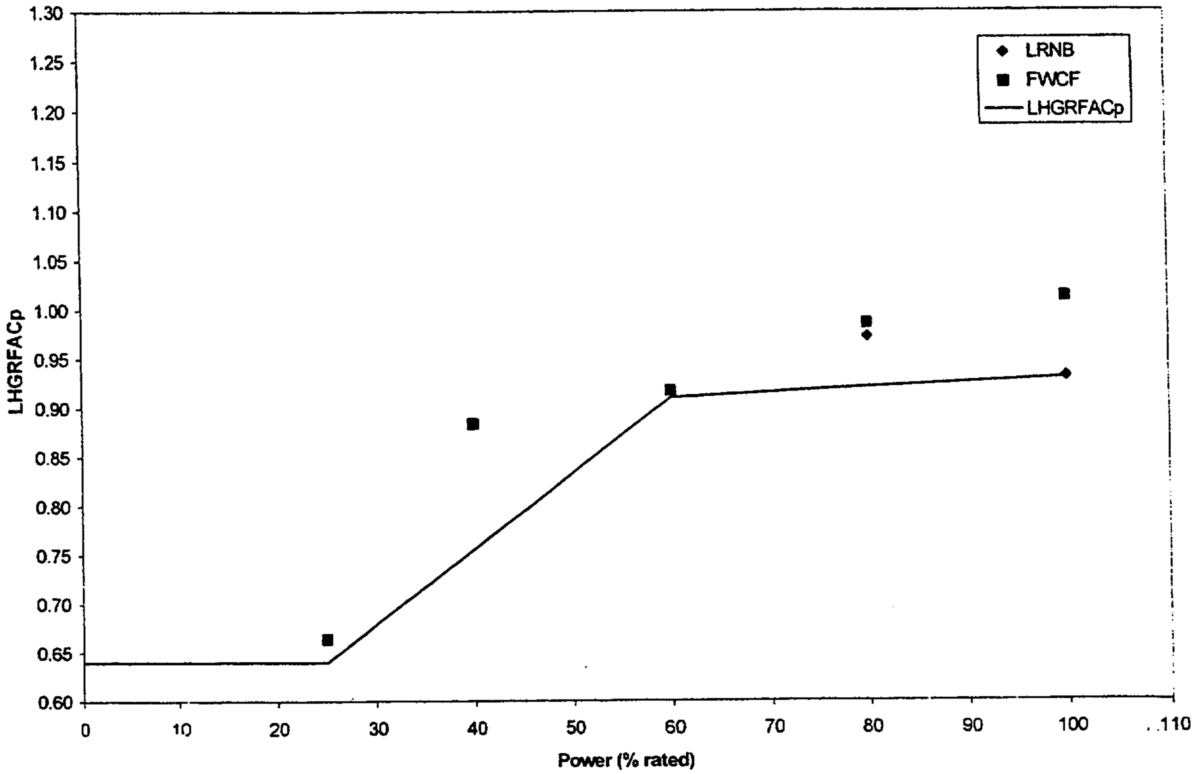
Power (%)	$MCPR_p$ Limit
100	1.46
60	1.62
25	2.35
25	2.35
0	2.85

Figure 1 FFTR/Coastdown Base Case Power-Dependent MCPR Limits for ATRIUM-9B Fuel



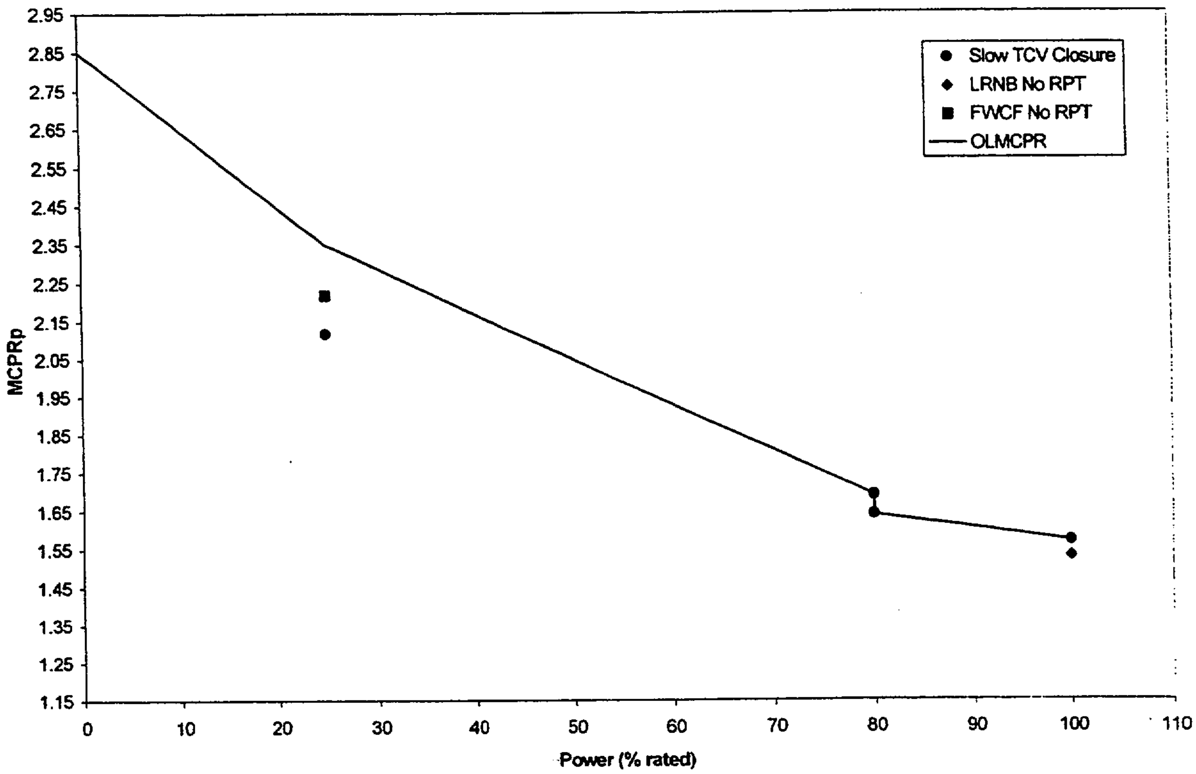
Power (%)	$MCPR_p$ Limit
100	1.50
60	1.62
25	2.35
25	2.35
0	2.85

Figure 2 FFTR/Coastdown Base Case Power-Dependent MCPR Limits for GE9 Fuel



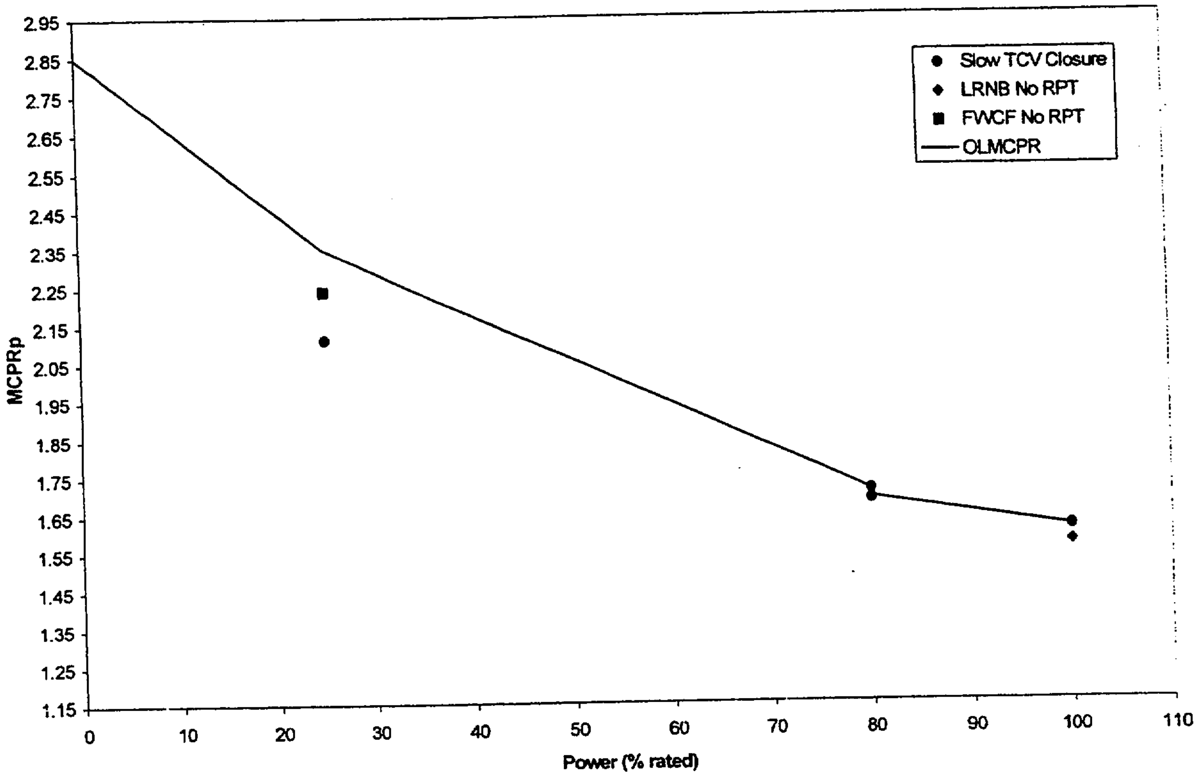
Power (%)	LHGRFAC$_p$ Multiplier
100	0.93
60	0.91
25	0.64
25	0.64
0	0.64

Figure 3 FFTR/Coastdown Base Case Power-Dependent LHGR Multipliers for ATRIUM-9B Fuel



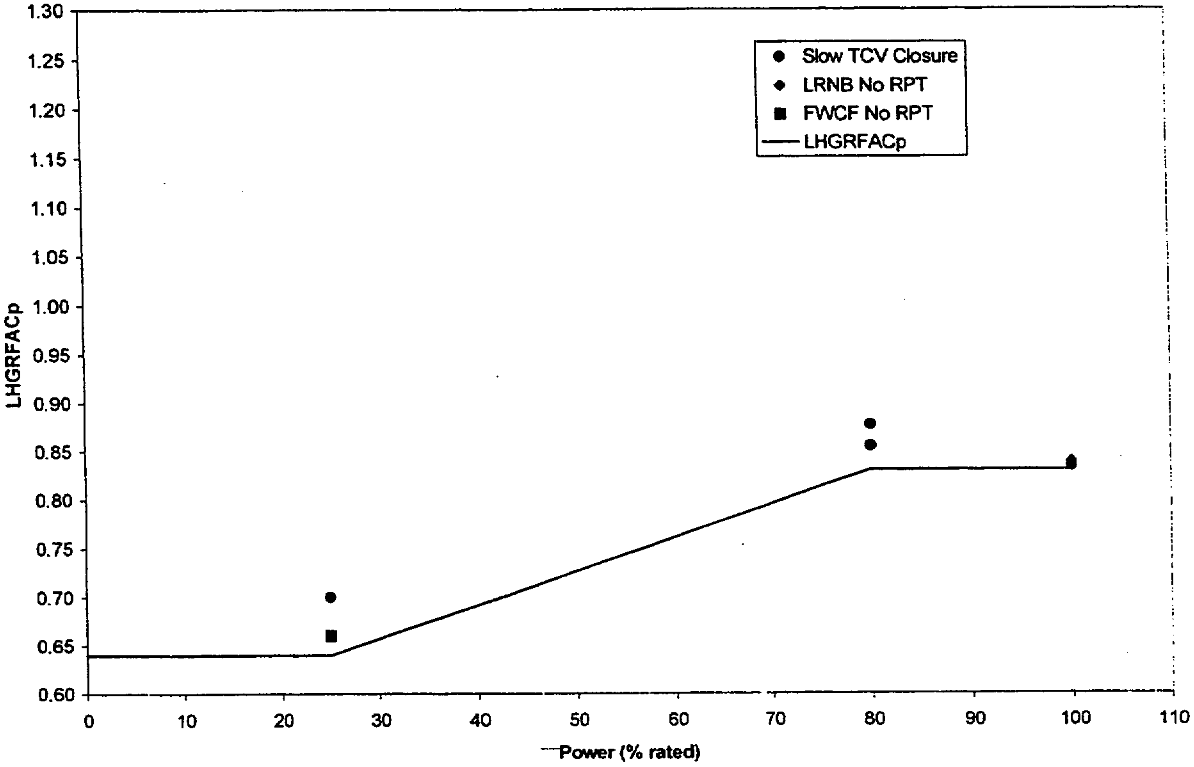
Power (%)	$MCPR_p$ Limit
100	1.57
80	1.64
80	1.69
25	2.35
25	2.35
0	2.85

Figure 4 FFTR/Coastdown Slow TCV Closure and/or No RPT Power-Dependent MCPR Limits for ATRIUM-9B Fuel



Power (%)	$MCPR_p$ Limit
100	1.61
80	1.69
80	1.71
25	2.35
25	2.35
0	2.85

Figure 5 FFTR/Coastdown Slow TCV Closure and/or No RPT Power-Dependent MCPR Limits for GE9 Fuel



Power (%)	LHGRFAC$_p$ Multiplier
100	0.83
80	0.83
80	0.83
25	0.64
25	0.64
0	0.64

Figure 6 FFTR/Coastdown Slow TCV Closure and/or No RPT Power-Dependent LHGR Multipliers for ATRIUM-9B Fuel