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SERIAL: BSEP 02-0059

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BRUNSWICK STEAM ELECTRIC PLANT, UNIT NO. 1
DOCKET NO. 50-325/LICENSE NO. DPR-71
UNIT 1 CYCLE 14 CORE OPERATING LIMITS REPORT, SUPPLEMENTAL RELOAD LICENSING REPORT, LOSS-OF-COOLANT ACCIDENT ANALYSIS REPORT, AND PLANT-SPECIFIC EMERGENCY CORE COOLING SYSTEM (ECCS) EVALUATION

Ladies and Gentlemen:

The purpose of this letter is to submit the latest revision of the Core Operating Limits Report, Supplemental Reload Licensing Report, and Loss-of-Coolant Accident Analysis Report for Carolina Power & Light (CP&L) Company's Brunswick Steam Electric Plant (BSEP), Unit No. 1. This letter also provides notice that the Emergency Core Cooling System (ECCS) evaluation model for Unit 1 now includes GE14 fuel type information. These reports are applicable to operation at the maximum power level currently authorized by the facility operating license (i.e., 2558 megawatts thermal). Revisions to these reports will be submitted following NRC approval of CP&L's extended power uprate application, prior to operation above 2558 megawatts thermal.

Technical Specification 5.6.5.d requires that the Core Operating Limits Report be provided to the NRC, upon issuance, for each reload cycle. A copy of "Brunswick Unit 1, Cycle 14 Core Operating Limits Report March 2002," Revision 0, is provided in Enclosure 1. The NRC's Safety Evaluation for Amendment 19 to General Electric Licensing Topical Report NEDE-24011-P-A (i.e., GESTAR-II), "General Electric Standard Application For Reactor Fuel," states that the Technical Specifications will include, for each multiple lattice fuel bundle type, a plot of the limiting value of Average Planar Linear Heat Generation Rate (APLHGR) for the most limiting lattice as a function of exposure. Consistent with the guidance in NRC Generic Letter 88-16, "Removal of Cycle-Specific Parameter Limits From Technical Specifications," the limiting value of APLHGR for the most limiting lattice, as a function of exposure, has been relocated from the Technical Specifications to the Core Operating Limits Report. A plot of the limiting value of APLHGR, as a function of average planar exposure for each reload fuel type, is included in the enclosed Core Operating Limits Report.

The NRC's Safety Evaluation for Amendment 19 to GESTAR-II also states that each reload submittal should include a table of the most limiting and least limiting Maximum Planar

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Linear Heat Generation Rate (MAPLHGR) for each multiple lattice bundle type. A copy of "Supplemental Reload Licensing Report for Brunswick Steam Electric Plant Unit 1 Reload 13 Cycle 14," J11-03936SRLR, Revision 1, Class I, dated January 2002, is provided in Enclosure 2. The most limiting and least limiting MAPLHGR values for the new reload fuel types are provided in a table included in the Supplemental Reload Licensing Report for BSEP, Unit 1.

The NRC's Safety Evaluation for Amendment 19 to GESTAR-II states that each licensee should submit to the NRC, on a proprietary basis, information for each fuel bundle type on the axial location of each lattice in the bundle and composite MAPLHGR as a function of average exposure for each lattice in the bundle. A copy of "Loss-of-Coolant Accident Analysis Report for Brunswick Steam Electric Plant Unit 1 Reload 13 Cycle 14," NEDC-31624P, Supplement 1, Revision 6, Class III, dated November 2001, is provided in Enclosure 3. This report contains MAPLHGR, as a function of exposure, for each lattice of the fuel designs.

Global Nuclear Fuel considers portions of the Loss-of-Coolant Accident Analysis Report in Enclosure 3 to be proprietary information, as indicated by the bars drawn in the margin of the report. Therefore, the document should be withheld from public disclosure in accordance with 10 CFR 9.17 and 10 CFR 2.790. An affidavit supporting the request for withholding the document is provided in Enclosure 4.

By letter dated December 7, 2000 (Serial: BSEP 00-0165), CP&L submitted the results of a reanalysis of the limiting ECCS evaluation model for BSEP, Units 1 and 2. This letter stated that the GE7, GE8, GE9, and GE10 fuel types are no longer used in BSEP reactor cores; therefore, only results applicable to the GE13 fuel type would be considered the licensing basis for BSEP. Beginning with Cycle 14, the Unit 1 reactor core will include GE14 fuel. Therefore, the licensing basis ECCS evaluation model for BSEP, Unit 1 will now also include GE14 fuel type information. GE14-specific ECCS evaluation information applicable to both BSEP units is contained in a document entitled "Brunswick Steam Electric Plant Units 1 and 2 ECCS-LOCA Evaluation for GE14," GE-NE-J1103781-09-02P, DRF J11-03781-09, Class III, dated February 2001, a copy of which has been previously submitted as Enclosure 5 of CP&L's letter dated March 16, 2001 (i.e., NRC ADAMS Accession Number ML010790186).

There are no regulatory commitments being made in this submittal. Please refer any questions regarding this submittal to Mr. Leonard R. Beller, Supervisor - Licensing/Regulatory Programs, at (910) 457-2073.

Sincerely,

Leonard R. Beller for DCD

David C. DiCello
Manager - Regulatory Affairs
Brunswick Steam Electric Plant

WRM/wrm

Enclosures:

1. "Brunswick Unit 1, Cycle 14 Core Operating Limits Report March 2002," Revision 0
2. "Supplemental Reload Licensing Report for Brunswick Steam Electric Plant Unit 1 Reload 13 Cycle 14," J11-03936SRLR, Revision 1, Class I, dated January 2002
3. "Loss-of-Coolant Accident Analysis Report for Brunswick Steam Electric Plant Unit 1 Reload 13 Cycle 14," NEDC-31624P, Supplement 1, Revision 6, Class III, dated November 2001
4. Global Nuclear Fuels Affidavit Regarding Withholding From Public Disclosure In Accordance With 10 CFR 2.790

cc (with enclosures):

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ENCLOSURE 1

BRUNSWICK STEAM ELECTRIC PLANT, UNIT NO. 1
DOCKET NO. 50-325/LICENSE NO. DPR-71
UNIT 1 CYCLE 14 CORE OPERATING LIMITS REPORT,
SUPPLEMENTAL RELOAD LICENSING REPORT,
LOSS-OF-COOLANT ACCIDENT ANALYSIS REPORT,
AND PLANT-SPECIFIC EMERGENCY CORE
COOLING SYSTEM (ECCS) EVALUATION

"Brunswick Unit 1, Cycle 14
Core Operating Limits Report March 2002,"
Revision 0

BRUNSWICK UNIT 1, CYCLE 14

CORE OPERATING LIMITS REPORT

March 2002

Prepared By: Charles Stroupe / Thomas W. Dresser **Date:** 3-19-02

Charles Stroupe/ Tom Dresser

Approved By: Thomas W. Dresser for **Date:** 3-19-02

George E. Smith
Superintendent
BWR Fuel Engineering

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CAUTION

References to COLR Figures or Tables should be made using titles only; figure and table numbers may change from cycle to cycle.

LIST OF TABLES

LIST OF FIGURES

Introduction and Summary

CAUTION

References to COLR Figures or Tables should be made using titles only; figure and table numbers may change from cycle to cycle.

This report provides the values of the power distribution limits and control rod withdrawal block instrumentation setpoints for Brunswick Unit 1, Cycle 14 as required by TS 5.6.5.

OPERATING LIMIT	REQUIREMENT
Average Planar Linear Heat Generation Rate (APLHGR) limits (with associated core flow and core power adjustment factors)	TS 5.6.5.a.1
Minimum Critical Power Ratio (MCPR) limits (with associated core flow and core power adjustment factors)	TS 5.6.5.a.2
Period Based Detection Algorithm (PBDA) Setpoint for Function 2.f of TS 3.3.1.1, Oscillation Power Range Monitor (OPRM)	TS 5.6.5.a.3
Allowable Values and power range setpoints for Rod Block Monitor Upscale Functions of TS 3.3.2.1	TS 5.6.5.a.4
Scram values of the APRM Simulated Thermal Power-High Allowable Value ("Flow-Biased Scram")	TS 3.3.1.1
Control Rod Block values of the APRM - Upscale Allowable Value ("Flow-Biased Rod Block")	TRMS 3.3

Per TS 5.6.5.b and 5.6.5.c, these values have been determined using NRC approved methodology and are established such that all applicable limits of the plant safety analysis are met.

The limits specified in this report support single loop operation (SLO) as required by TS LCO 3.4.1 and inoperable Main Turbine Bypass System as required by TS 3.7.6.

In order to support the Stability Option III with an inoperable OPRM scram function, the following is also included in this report:

OPERATING LIMIT	REQUIREMENT
BWROG Interim Corrective Action Stability Regions	TS 3.3.1.1 LCO Condition I

This report conforms to Quality Assurance requirements as specified in Reference 1.

Single Loop Operation

Brunswick Unit 1, Cycle 14 may operate over the entire MEOD range with Single recirculation Loop Operation (SLO) as permitted by TS 3.4.1 with applicable limits specified in the COLR for TS LCO's 3.2.1, 3.2.2 and 3.3.1.1. The applicable limits are:

LCO 3.2.1, Average Planar Linear Heat Generation Rate (APLHGR) Limits: per Reference 1, the Figures 9 and10 described in the APLHGR Limits section below include a SLO limitation of 0.8 on the MAPLHGR(F) and MAPLHGR(P) multipliers.

LCO 3.2.2, Minimum Critical Power Ratio (MCPR) Limits: per Reference 1, Table 1 and Figures 11 and 12, the MCPR limits presented apply to SLO without modification.

LCO 3.3.1.1, Reactor Protection System Instrumentation Function 2.b (Average Power Range Monitors Simulated Thermal Power - High) Allowable Value: per footnote b, the -ΔW offset value is defined in Plant procedures. The current value of 5% developed for the initial installation of Stability Option III is used for the B1C14 COLR.

Inoperable Main Turbine Bypass System

Brunswick Unit 1, Cycle 14 may operate with an inoperable Main Turbine Bypass System in accordance with TS 3.7.6 with applicable limits specified in the COLR for TS LCO 3.2.1 and 3.2.2. Two or more bypass valves inoperable renders the System inoperable, although the Turbine Bypass Out-of-Service (TBPOOS) analysis supports operation with all bypass valves inoperable for the entire MEOD range and up to 110°F rated equivalent feedwater temperature reduction. The system response time assumed by the safety analyses from event initiation to start of bypass valve opening is 0.10 seconds, with 80% bypass flow achieved in 0.30 seconds. The applicable limits are as follows:

LCO 3.2.1, Average Planar Linear Heat Generation Rate (APLHGR) Limits: in accordance with Reference 1 as shown in Figure 10, TBPOOS does not require an additional reduction in the MAPLGHR(P) limits between 25% and 30% power, as the Turbine bypass Operable and Inoperable limits are identical.

LCO 3.2.2, Minimum Critical Power Ratio (MCPR) Limits: in accordance with Reference 1, TBPOOS does not require an additional increase in the MCPR(P) multiplier between 25% and 30% power, as shown in Figure 12, as the Turbine bypass Operable and Inoperable limits are identical. TBPOOS requires increased MCPR limits, included in Table 1.

APLHGR Limits

The limiting APLHGR value for the most limiting lattice (excluding natural uranium) of each fuel type as a function of planar average exposure is given in Figures 1 through 7. These values were determined with the SAFER/GESTR LOCA methodology described in GESTAR-II (Reference 2). Figures 1 through 7 are to be used only when hand calculations are required as specified in the bases for TS 3.2.1. Hand calculated results may not match a POWERPLEX calculation since normal monitoring of the APLHGR limits with POWERPLEX uses the complete set of lattices for each fuel type provided in Reference 3.

The core flow and core power adjustment factors for use in TS 3.2.1 are presented in Figures 9 and 10. For any given flow/power state, the minimum of MAPLHGR(F) determined from Figure 9 and MAPLHGR(P) determined from Figure 10 is used to determine the governing limit.

MCPR Limits

The ODYN OPTION A, ODYN OPTION B, and non-pressurization transient MCPR limits for use in TS 3.2.2 for each fuel type as a function of cycle average exposure are given in Table 1. These values were determined with the GEMINI methodology and GEXL-PLUS critical power correlation described in GESTAR-II (Reference 2), and are consistent with a Safety Limit MCPR of 1.12 specified by TS 2.1.1.2.

The core flow and core power adjustment factors for use in TS 3.2.2 are presented in Figures 11 and 12. For any given power/flow state, the maximum of MCPR(F) determined from Figure 11 and MCPR(P) determined from Figure 12 is used to determine the governing limit.

All MCPR limits presented in Table 1, Figure 11 and Figure 12 apply to two recirculation pump operation and SLO without modification.

RBM Rod Block Instrumentation Setpoints

The nominal trip setpoints and allowable values of the control rod withdrawal block instrumentation for use in TS 3.3.2.1 (Table 3.3.2.1-1) are presented in Table 2. These values were determined consistent with the bases of the ARTS program and the determination of MCPR limits with the GEMINI methodology and GEXL-PLUS critical power correlation described in GESTAR-II (Reference 2). Reference 8 revised certain of these setpoints to reflect changes associated with the installation of the new PRNM system.

Stability Option III

Brunswick Unit 1 has implemented BWROG Long Term Stability Solution Option III (Oscillation Power Range Monitor-OPRM) as described in Reference 4. Plant specific analysis incorporating the Option III hardware is described in Reference 5. Reload validation has been performed in accordance with Reference 6. The resulting stability based MCPR Operating Limit is provided for two conditions as a function of OPRM amplitude setpoint in Table 3. The reload validation calculation demonstrated that reactor stability does not produce the limiting OLMCPR for Cycle 14 as long as the selected OPRM setpoint produces values for OLMCPR(SS) and OLMCPR(2PT) which are less than the corresponding acceptance criteria. Because the acceptance criteria for OLMCPR(SS) is 1.50 and for OLMCPR(2PT) is 1.40, an OPRM setpoint (Amplitude Setpoint S_p) of 1.15 is supported for Cycle 14 without imposing any additional operational restrictions for stability protection. Therefore the OPRM PBDA setpoint limit referenced by function 2.f of Table 3.3.1.1-1 of Technical Specification 3.3.1.1 is 1.15 for Cycle 14. Per Table 3-2 of Reference 6, an S_p value of 1.15 supports selection of a Confirmation Count Setpoint N_p of 16 or less.

Four Power/Flow maps (Figures 13-16) were developed based on Reference 7 to facilitate operation under Stability Option III as implemented by function 2.f of Table 3.3.1.1-1 and LCO Condition I of Technical Specification 3.3.1.1. The corresponding Reference 7 maps are simply re-formatted (no change in data) to exhibit the appropriate headers for the COLR. All four maps illustrate the region of the power/flow map above 25% power and below 60% flow where the system is required to be enabled.

The maps supporting an operable OPRM function 2.f (Figures 13 and 15) show the same Scram Avoidance Region, which is not a licensing requirement but is an operator aid to illustrate where the OPRM system is reasonably likely to generate a scram to avoid an instability event. Figures 13 and 15 differ only in that the Figure 15 that supports SLO, indicates the maximum allowable core flow at 45 Mlbs/hr, and has the Simulated Thermal Power (STP) scram and rod block limits appropriately reduced for SLO. Note that the STP scram and rod block limits are defined in Technical Specifications, the Technical Requirements Manual, and Plant procedures, and are included in the COLR as an operator aid rather than a licensing requirement.

The maps (Figures 14 and 16) supporting an inoperable OPRM function 2.f show the BWROG-94078 Interim Corrective Actions stability regions required to support LCO Condition I. Both figures also include a 5% Buffer Region around the Immediate Exit Region as an operator aid. Figures 14 and 16 differ only in that the Figure 16 that supports SLO, indicates the maximum allowable core flow at 45 Mlbs/hr, and has the scram and rod block flow-biased limits appropriately reduced for SLO.

References

1) BNP Design Calculation 1B21-0604; "Preparation of the B1C14 Core Operating Limits Report," Revision 0, March 2002.

2) NEDE-24011-P-A; "General Electric Standard Application for Reactor Fuel," (latest approved version).

3) NEDC-31624P, "Loss-of-Coolant Accident Analysis Report for Brunswick Steam Electric Plant Unit 1 Reload 13 Cycle 14," Supplement 1, Revision 6, November 2001.

4) NEDO-31960-A, "BWR Owners Group Long-Term Stability Solutions Licensing Methodology," November 1995.

5) GE-NE-C51-00251-00-01, Revision 0, "Licensing Basis Hot Bundle Oscillation Magnitude for Brunswick 1 and 2," March 2001.

6) NEDO-32465-A, "Reactor Stability Detect and Suppress Solutions Licensing Basis Methodology for Reload Application," August 1996

7) Design Calculation 0B21-1015, Revision 1, "BNP Power/Flow Maps for Stability Option III," February 2002.

8) Design Calculation 1C51-0001 Revision 0, "BNP Power Range Neutron Monitoring System Setpoint Uncertainty and Scaling Calculation (1-C51-APRM 1 through 4 Loops and 1-C51-RBM-A and B Loops," July 2001.

Table 1

MCPR Limits

Steady State, Non-pressurization Transient MCPR Limits			
Fuel Type		Exposure Range: BOC - EOC	
GE13 and GE14		1.26	
Pressurization Transient MCPR Limits, OLMCPR (100%P): Turbine Bypass System Operable			
MCPR Option	**Fuel Type**	Normal and Reduced Feedwater Temperature Exposure Range: BOC to EOFPC-2026 MWd/MT	Normal and Reduced Feedwater Temperature Exposure Range: EOFPC-2026 MWd/MT to EOC
A	GE13	1.45	1.50
	GE14	1.57	1.69
B	GE13	1.40	1.42
	GE14	1.46	1.52
Pressurization Transient MCPR Limits, OLMCPR (100%P): Turbine Bypass System Inoperable			
MCPR Option	**Fuel Type**	Normal and Reduced Feedwater Temperature BOC to EOC	
A	GE13	1.54	
	GE14	1.72	
B	GE13	1.46	
	GE14	1.55	

This Table is referred to by Technical Specifications 3.2.2, 3.4.1 and 3.7.6.

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Table 2

RBM System Setpoints

Setpoint[a]	Trip Setpoint	Allowable Value
Lower Power Setpoint (LPSP[b])	27.7	≤ 29.0
Intermediate Power Setpoint (IPSP[b])	62.7	≤ 64.0
High Power Setpoint (HPSP[b])	82.7	≤ 84.0
Low Trip Setpoint (LTSP[c])	≤ 114.1	≤ 114.6
Intermediate Trip Setpoint (ITSP[c])	≤ 108.3	≤ 108.8
High Trip Setpoint (HTSP[c])	≤ 104.5	≤ 105.0
t_{d2}	≤ 2.0 seconds	≤ 2.0 seconds

[a] RBM Operability requirements are not applicable:
(1) if MCPR ≥ 1.70; or
(2) if MCPR ≥ 1.40 and thermal power ≥ 90% Rated Thermal Power.

[b] Setpoints in percent of Rated Thermal Power.

[c] Setpoints relative to a full scale reading of 125.
For example, ≤ 114.1 means ≤ 114.1/125.0 of full scale.

This Table is referred to by Technical Specification 3.3.2.1 (Table 3.3.2.1-1).

Table 3

PBDA Setpoints

OPRM Setpoint	OLMCPR(SS)	OLMCPR(2PT)
1.05	1.207	1.127
1.06	1.226	1.144
1.07	1.244	1.162
1.08	1.264	1.180
1.09	1.284	1.199
1.10	1.304	1.218
1.11	1.325	1.237
1.12	1.345	1.256
1.13	1.367	1.276
1.14	1.389	1.297
1.15	**1.412**	**1.319**
Acceptance Criteria	Off-rated OLMCPR @ 45% Flow	Rated Power OLMCPR

PDBA Setpoint	Setpoint Value
Amplitude S_p	**1.15**
Confirmation Count N_p	**16**

This Table is referred to by Technical Specification 3.3.1.1 (Table 3.3.1.1-1).

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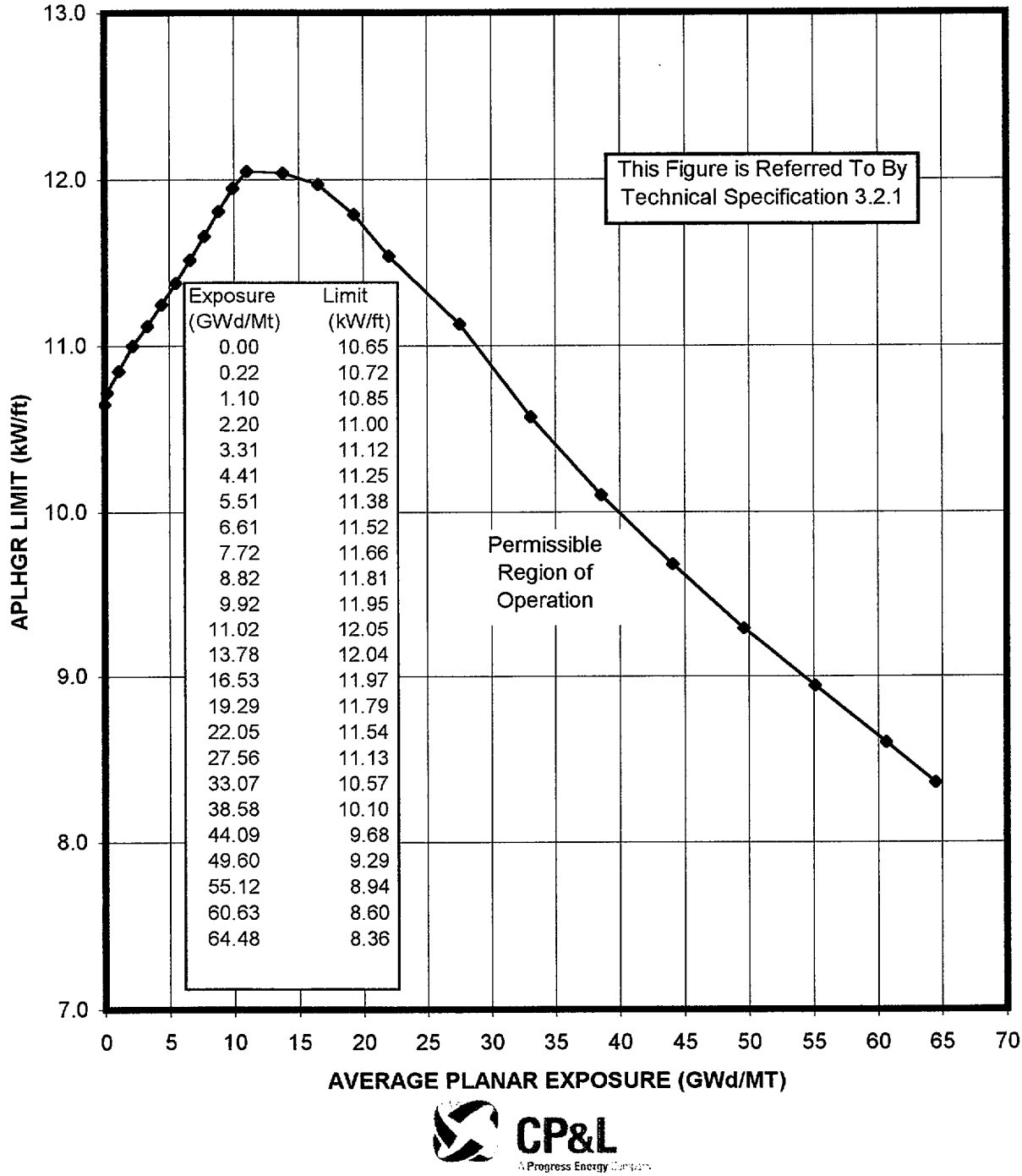
Figure 1

Fuel Type GE13-P9DTB403-5G6.0/7G5.0-100T-146-T (GE13)
Average Planar Linear Heat Generation Rate (APLHGR) Limit
Versus Average Planar Exposure



Exposure (GWd/Mt)	Limit (kW/ft)
0.00	10.65
0.22	10.72
1.10	10.85
2.20	11.00
3.31	11.12
4.41	11.25
5.51	11.38
6.61	11.52
7.72	11.66
8.82	11.81
9.92	11.95
11.02	12.05
13.78	12.04
16.53	11.97
19.29	11.79
22.05	11.54
27.56	11.13
33.07	10.57
38.58	10.10
44.09	9.68
49.60	9.29
55.12	8.94
60.63	8.60
64.48	8.36

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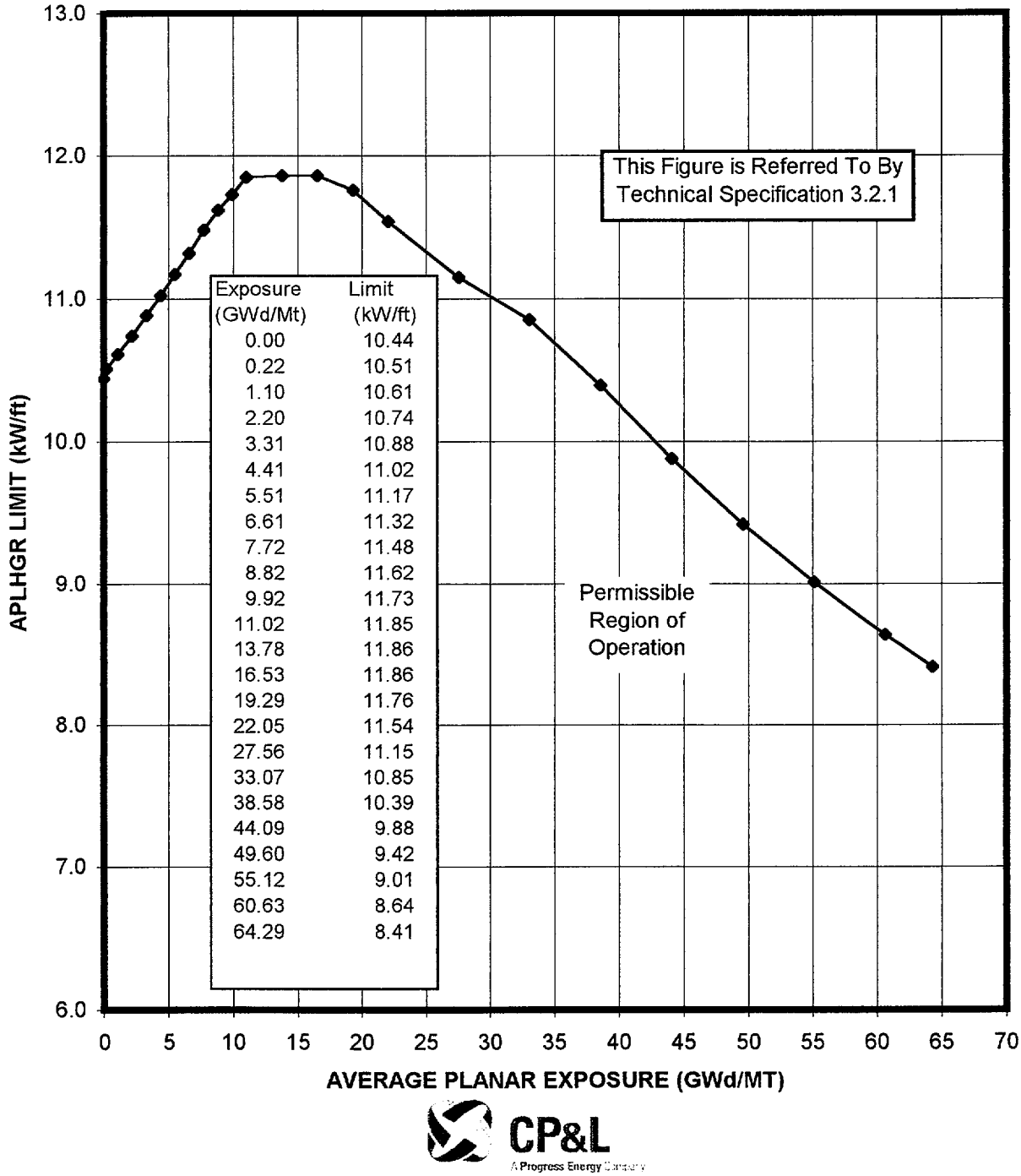
Figure 2

Fuel Type GE13-P9DTB403-7G6.0/7G5.0-100T-146-T (GE13)
Average Planar Linear Heat Generation Rate (APLHGR) Limit
Versus Average Planar Exposure



Exposure (GWd/Mt)	Limit (kW/ft)
0.00	10.44
0.22	10.51
1.10	10.61
2.20	10.74
3.31	10.88
4.41	11.02
5.51	11.17
6.61	11.32
7.72	11.48
8.82	11.62
9.92	11.73
11.02	11.85
13.78	11.86
16.53	11.86
19.29	11.76
22.05	11.54
27.56	11.15
33.07	10.85
38.58	10.39
44.09	9.88
49.60	9.42
55.12	9.01
60.63	8.64
64.29	8.41

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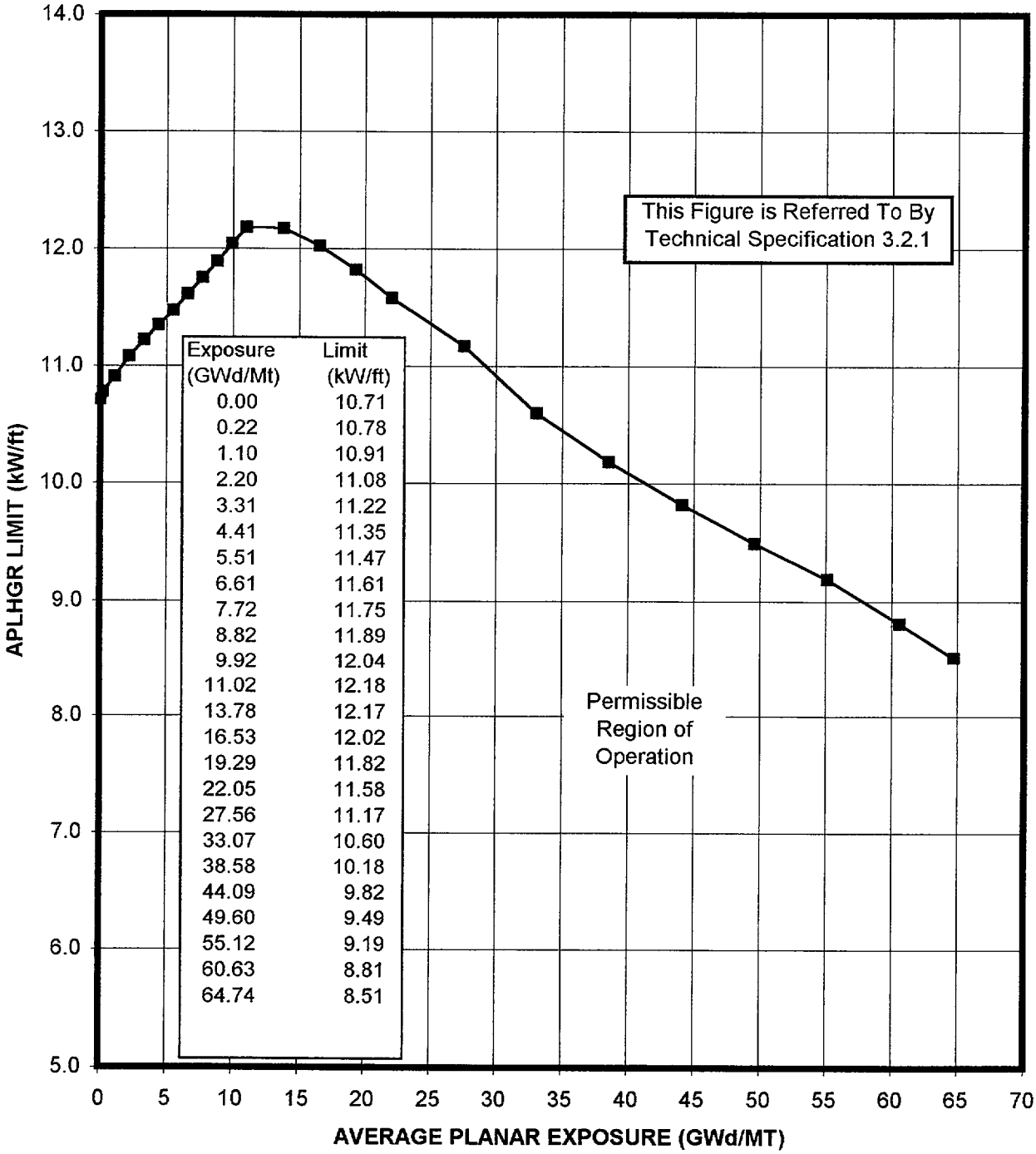
Figure 3

Fuel Type GE13-P9DTB405-5G6.0/7G5.0-100T-146-T (GE13)
Average Planar Linear Heat Generation Rate (APLHGR) Limit
Versus Average Planar Exposure



Exposure (GWd/Mt)	Limit (kW/ft)
0.00	10.71
0.22	10.78
1.10	10.91
2.20	11.08
3.31	11.22
4.41	11.35
5.51	11.47
6.61	11.61
7.72	11.75
8.82	11.89
9.92	12.04
11.02	12.18
13.78	12.17
16.53	12.02
19.29	11.82
22.05	11.58
27.56	11.17
33.07	10.60
38.58	10.18
44.09	9.82
49.60	9.49
55.12	9.19
60.63	8.81
64.74	8.51

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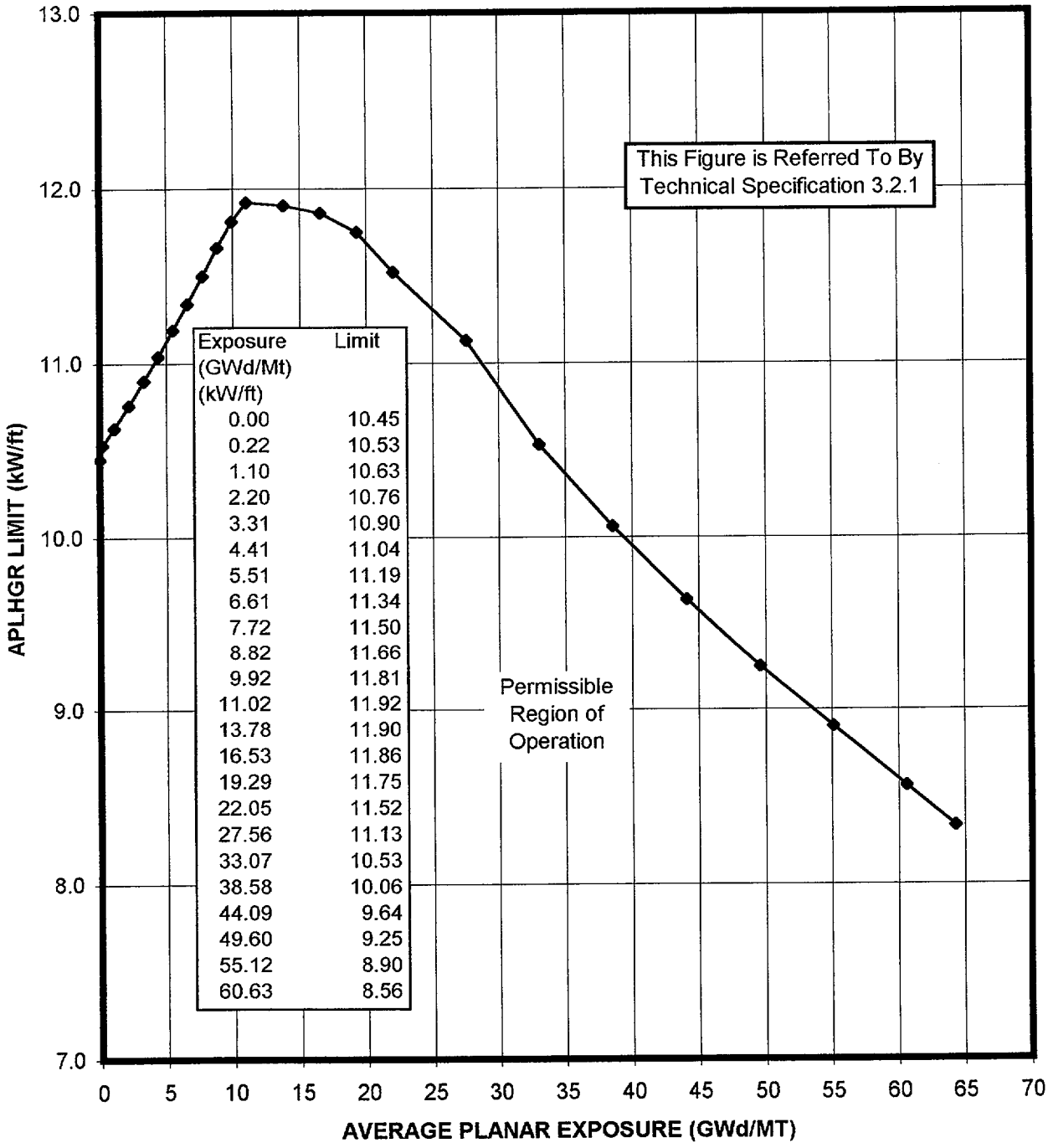
Figure 4

Fuel Type GE13-P9DTB402-13G6.0/1G2.0-100T-146-T (GE13)
Average Planar Linear Heat Generation Rate (APLHGR) Limit
Versus Average Planar Exposure



Exposure (GWd/Mt)	Limit (kW/ft)
0.00	10.45
0.22	10.53
1.10	10.63
2.20	10.76
3.31	10.90
4.41	11.04
5.51	11.19
6.61	11.34
7.72	11.50
8.82	11.66
9.92	11.81
11.02	11.92
13.78	11.90
16.53	11.86
19.29	11.75
22.05	11.52
27.56	11.13
33.07	10.53
38.58	10.06
44.09	9.64
49.60	9.25
55.12	8.90
60.63	8.56

Figure 5

Fuel Type GE14-P10DNAB416-17GZ-100T-150-T-2496 (GE14)
Average Planar Linear Heat Generation Rate (APLHGR) Limit
Versus Average Planar Exposure

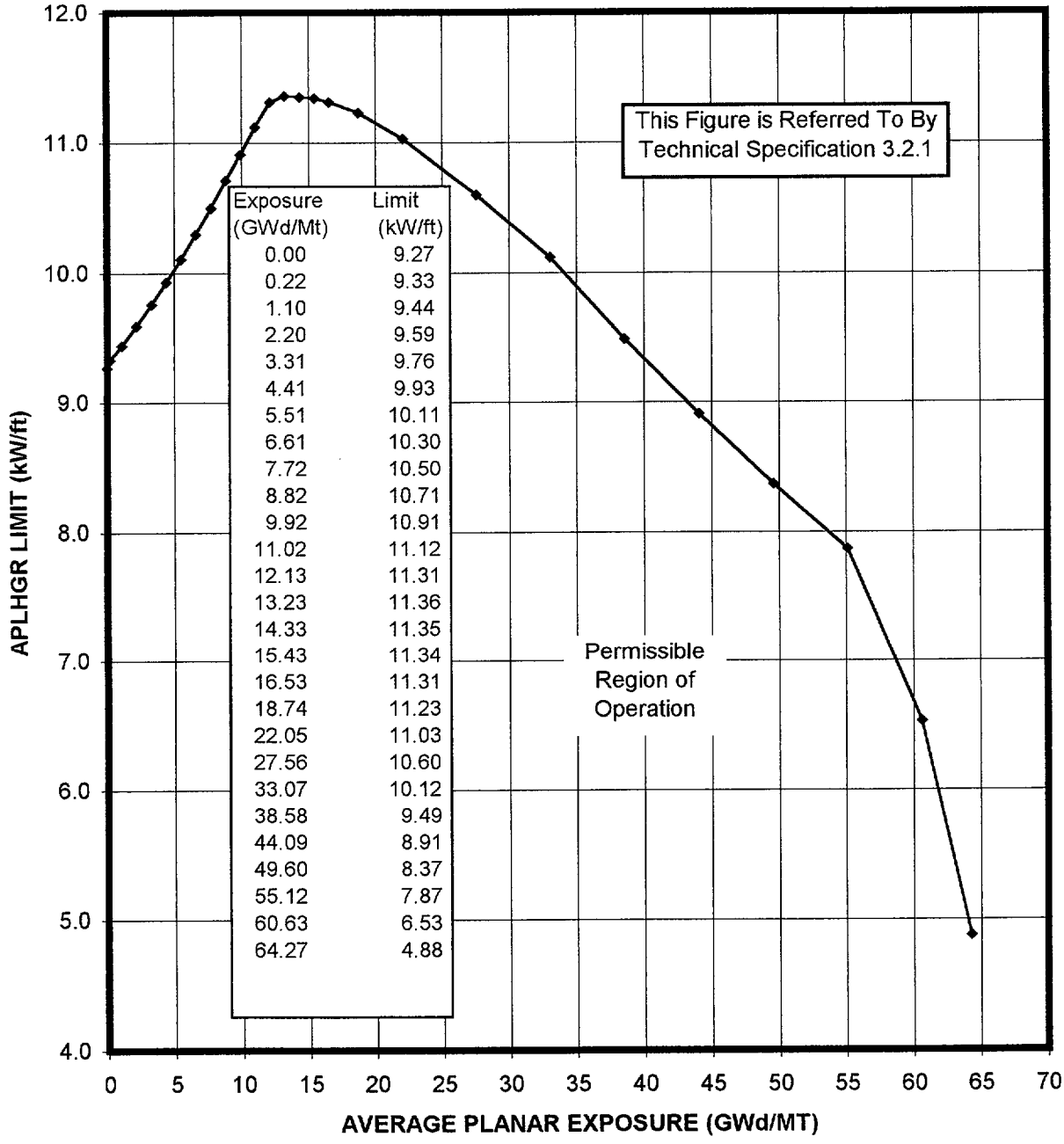


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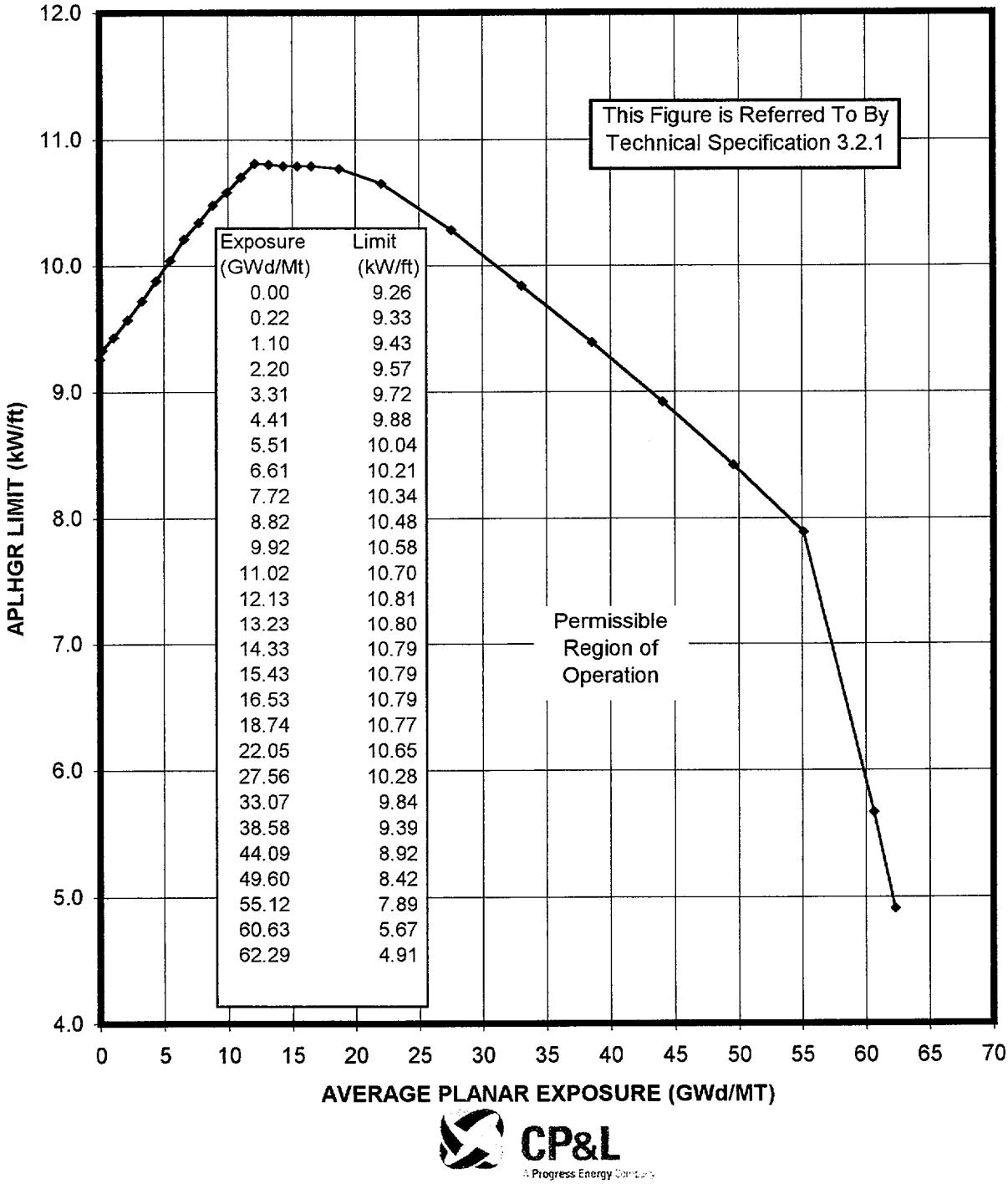
Figure 6

Fuel Type GE14-P10DNAB425-16GZ-100T-150-T-2497 (GE14) Average Planar Linear Heat Generation Rate (APLHGR) Limit Versus Average Planar Exposure



Exposure (GWd/Mt)	Limit (kW/ft)
0.00	9.26
0.22	9.33
1.10	9.43
2.20	9.57
3.31	9.72
4.41	9.88
5.51	10.04
6.61	10.21
7.72	10.34
8.82	10.48
9.92	10.58
11.02	10.70
12.13	10.81
13.23	10.80
14.33	10.79
15.43	10.79
16.53	10.79
18.74	10.77
22.05	10.65
27.56	10.28
33.07	9.84
38.58	9.39
44.09	8.92
49.60	8.42
55.12	7.89
60.63	5.67
62.29	4.91

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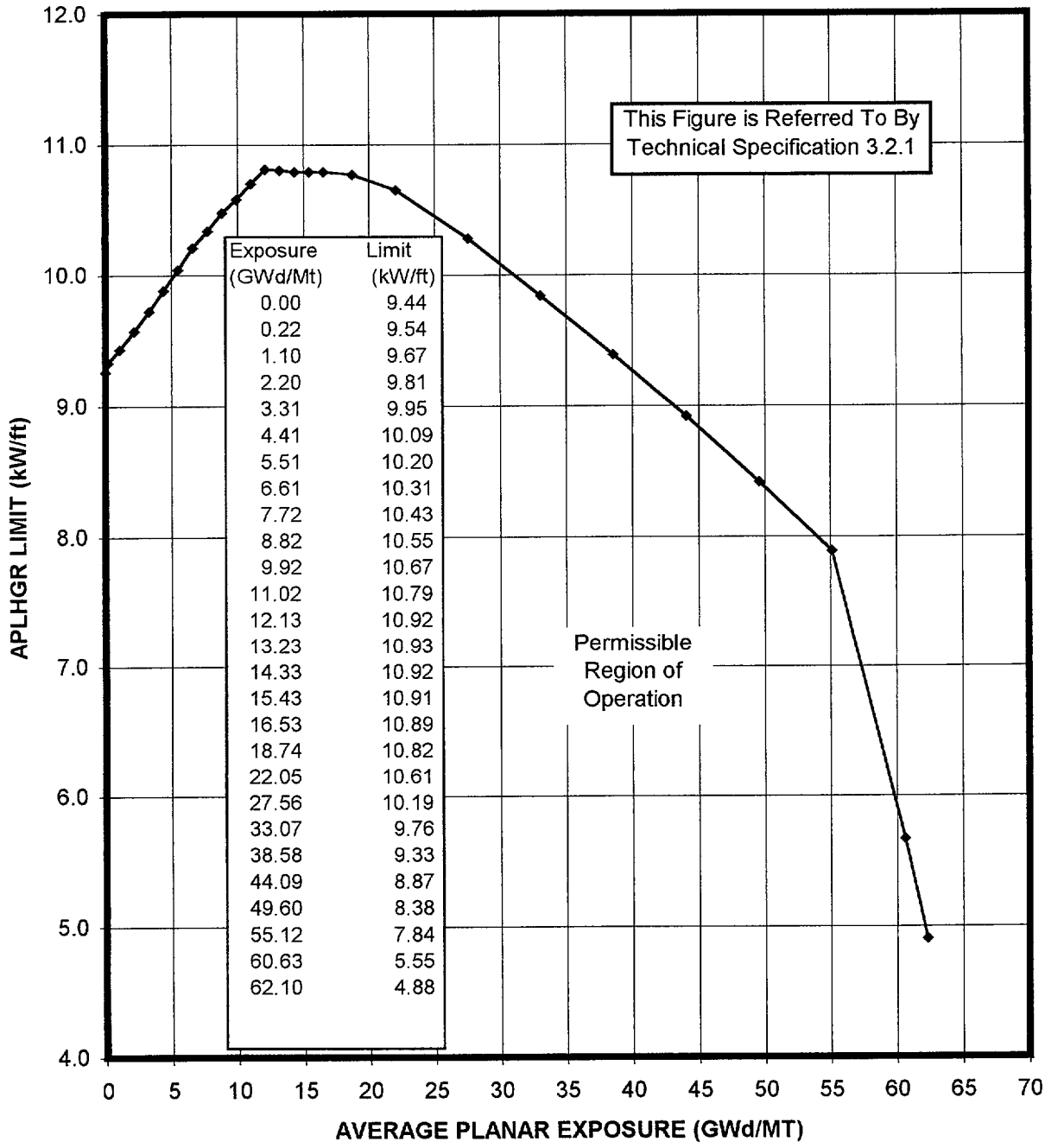
Figure 7

Fuel Type GE14-P10DNAB438-12G6.0-100T-150-T-2498 (GE14) Average Planar Linear Heat Generation Rate (APLHGR) Limit Versus Average Planar Exposure



Exposure (GWd/Mt)	Limit (kW/ft)
0.00	9.44
0.22	9.54
1.10	9.67
2.20	9.81
3.31	9.95
4.41	10.09
5.51	10.20
6.61	10.31
7.72	10.43
8.82	10.55
9.92	10.67
11.02	10.79
12.13	10.92
13.23	10.93
14.33	10.92
15.43	10.91
16.53	10.89
18.74	10.82
22.05	10.61
27.56	10.19
33.07	9.76
38.58	9.33
44.09	8.87
49.60	8.38
55.12	7.84
60.63	5.55
62.10	4.88

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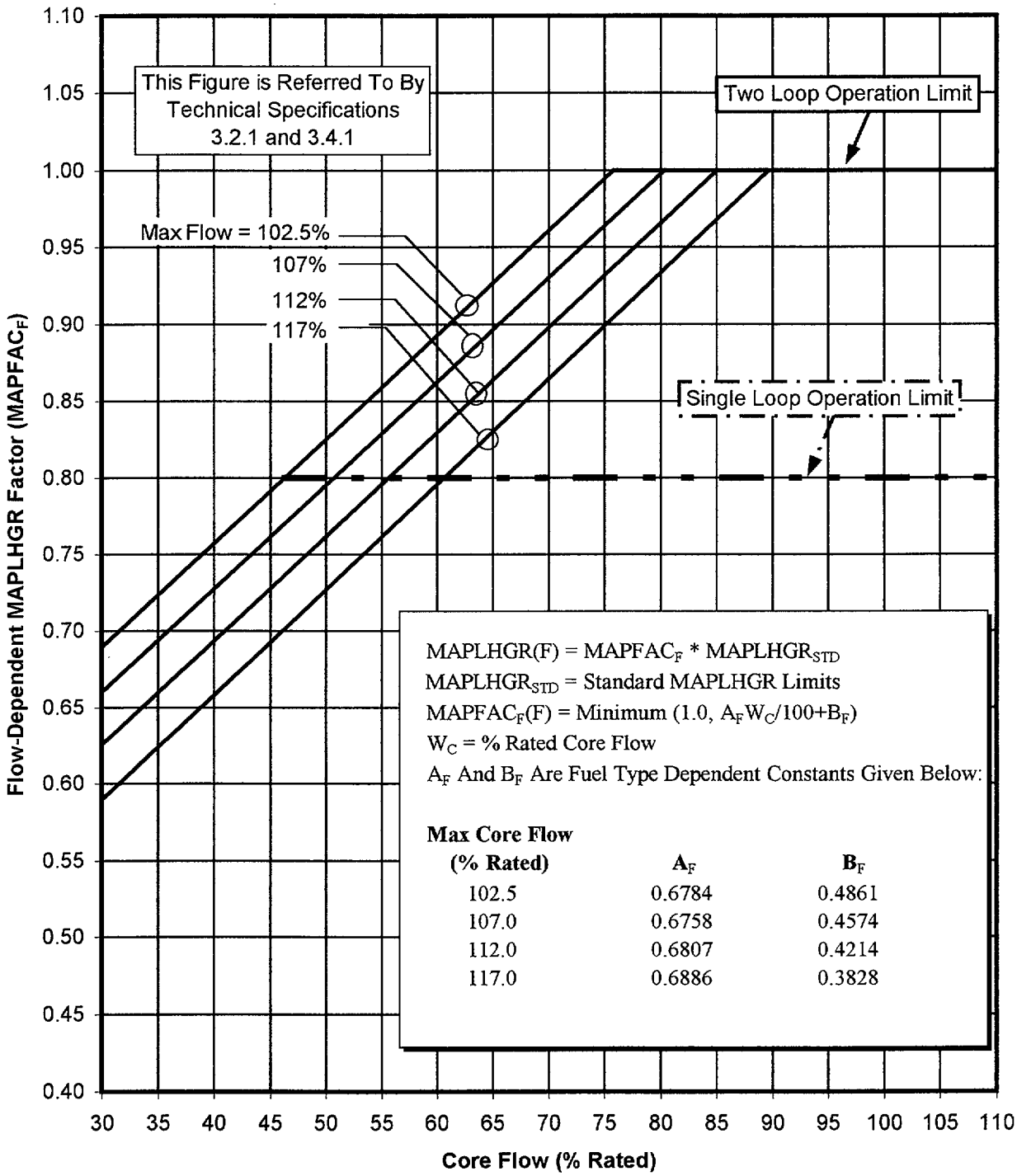
Figure 8 is **Not Used**

Figure 9

GE13 and GE14 Flow-Dependent MAPLHGR Limit, MAPLHGR(F)



Max Core Flow (% Rated)	A_F	B_F
102.5	0.6784	0.4861
107.0	0.6758	0.4574
112.0	0.6807	0.4214
117.0	0.6886	0.3828

Figure 10

GE13 and GE14 Power-Dependent MAPLHGR Limit, MAPLHGR (P)

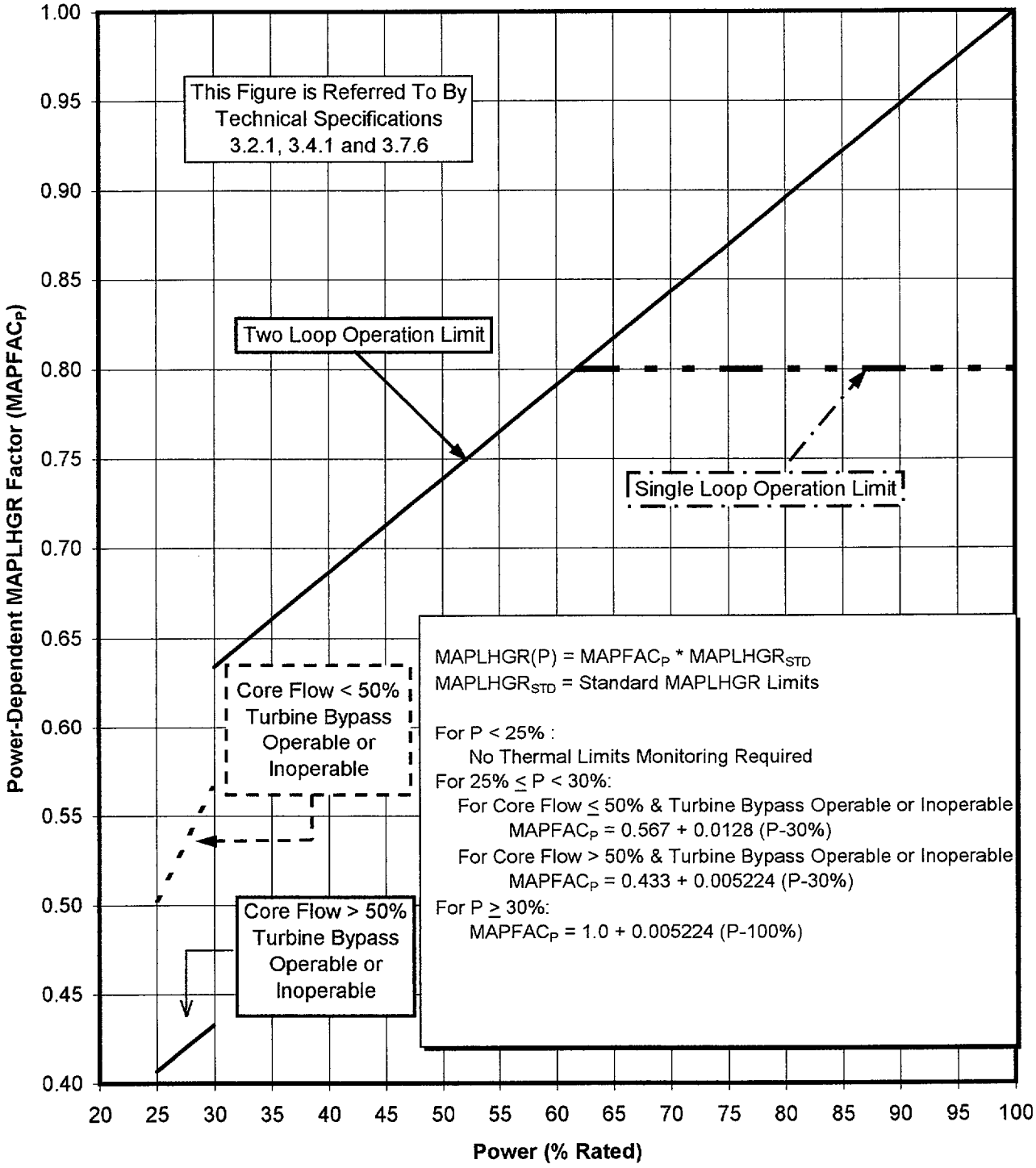


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Figure 11

GE13 and GE14 Flow-Dependent MCPR Limit, MCPR(F)

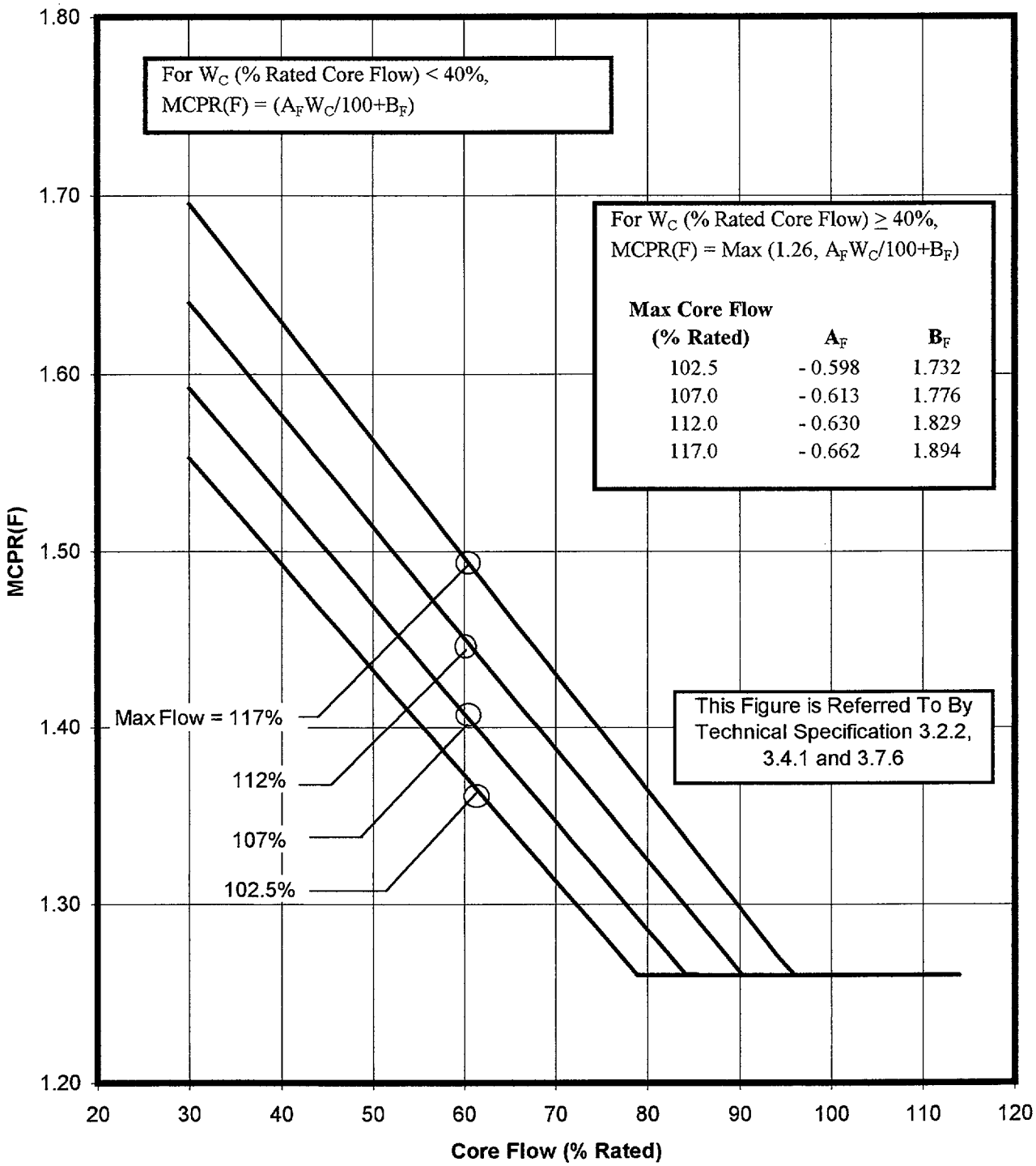

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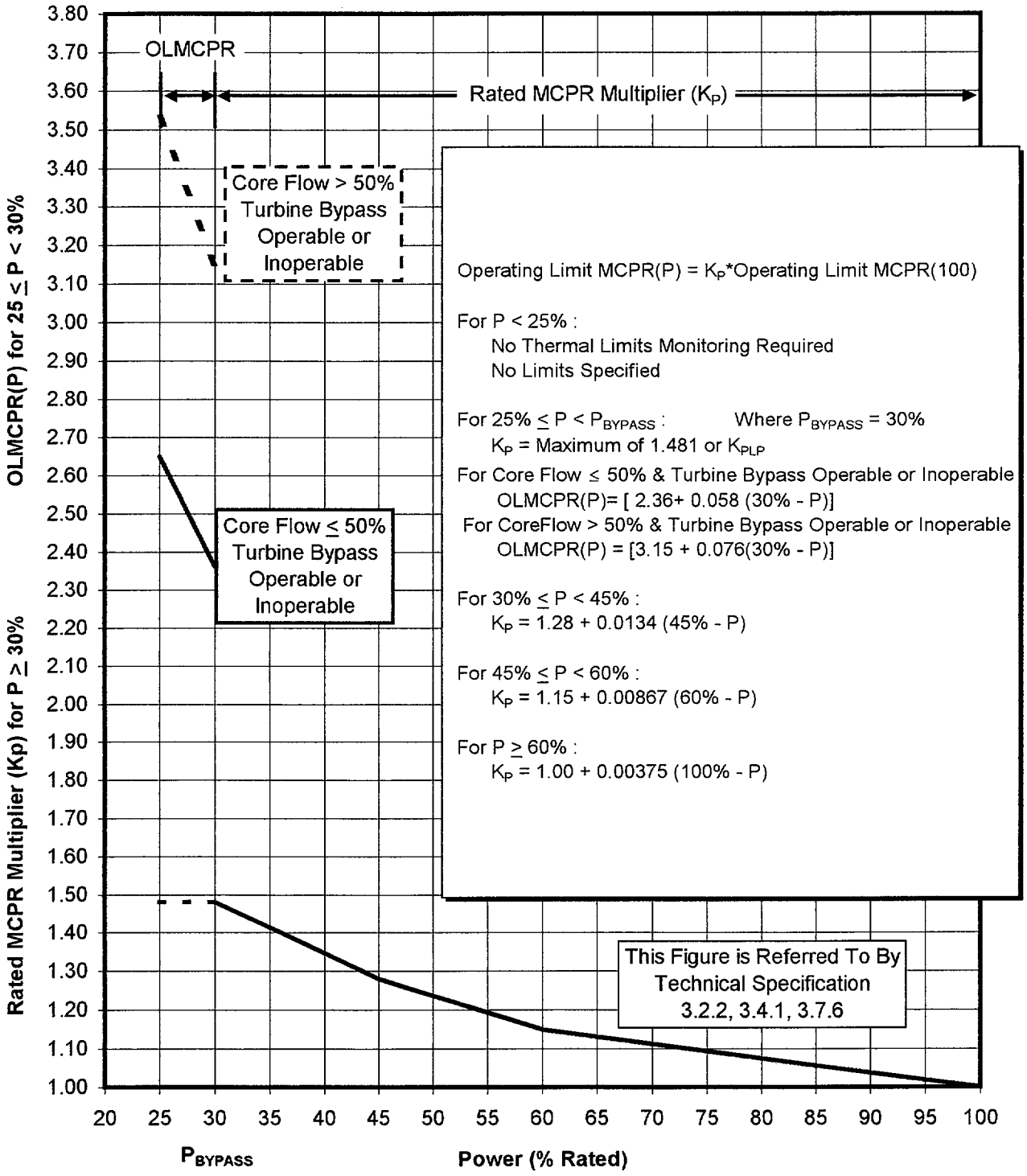
Figure 12

GE13 and GE14 Power - Dependent MCPR Limit, MCPR (P)



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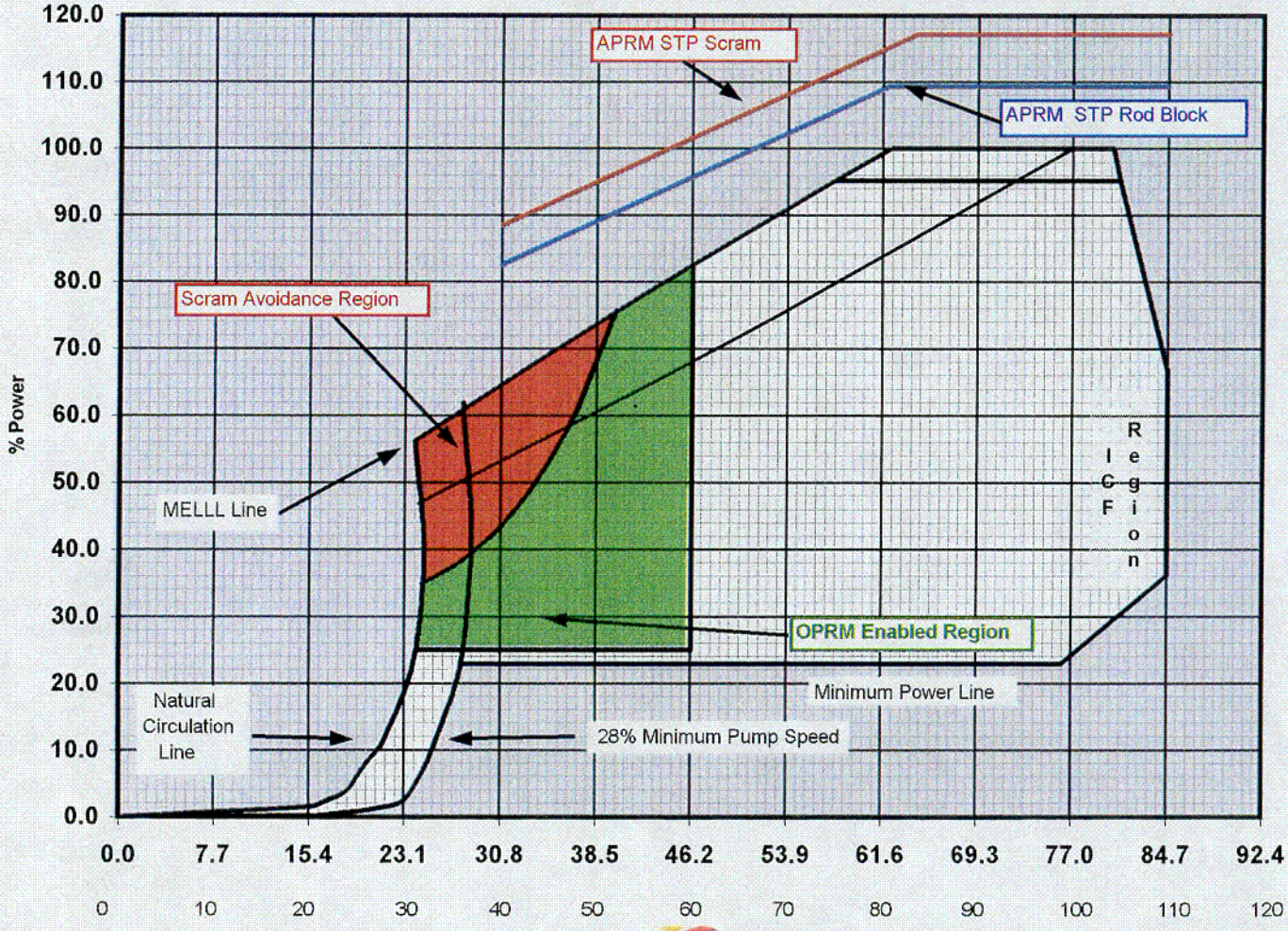
OPRM Operable, Two Loop Operation, 2558 MWt

This Figure supports Improved Technical Specification 3.3.1.1
and the Technical Requirements Manual Specification 3.3



Power %	Minimum (MELLL) Core Flow, Mlbs/hr	Maximum (ICF) Core Flow, Mlbs/hr
100	62.37	80.31
99	61.41	80.42
98	60.45	80.54
97	59.48	80.65
96	58.52	80.76
95	57.57	80.87
94	56.67	81.01
93	55.77	81.15
92	54.86	81.28
91	53.96	81.42
90	53.06	81.55
89	52.16	81.69
88	51.26	81.82
87	50.36	81.96
86	49.45	82.09
85	48.55	82.23
84	47.65	82.36
83	46.75	82.50
82	45.85	82.63
81	44.94	82.77
80	44.04	82.90
79	43.14	83.04
78	42.24	83.17
77	41.34	83.31
76	40.44	83.44
75	39.53	83.58
74	38.63	83.71
73	37.73	83.85
72	36.83	83.98
71	35.93	84.12
70	35.02	84.25
69	34.12	84.39
68	33.22	84.53
67	32.32	84.66
66	31.42	84.70

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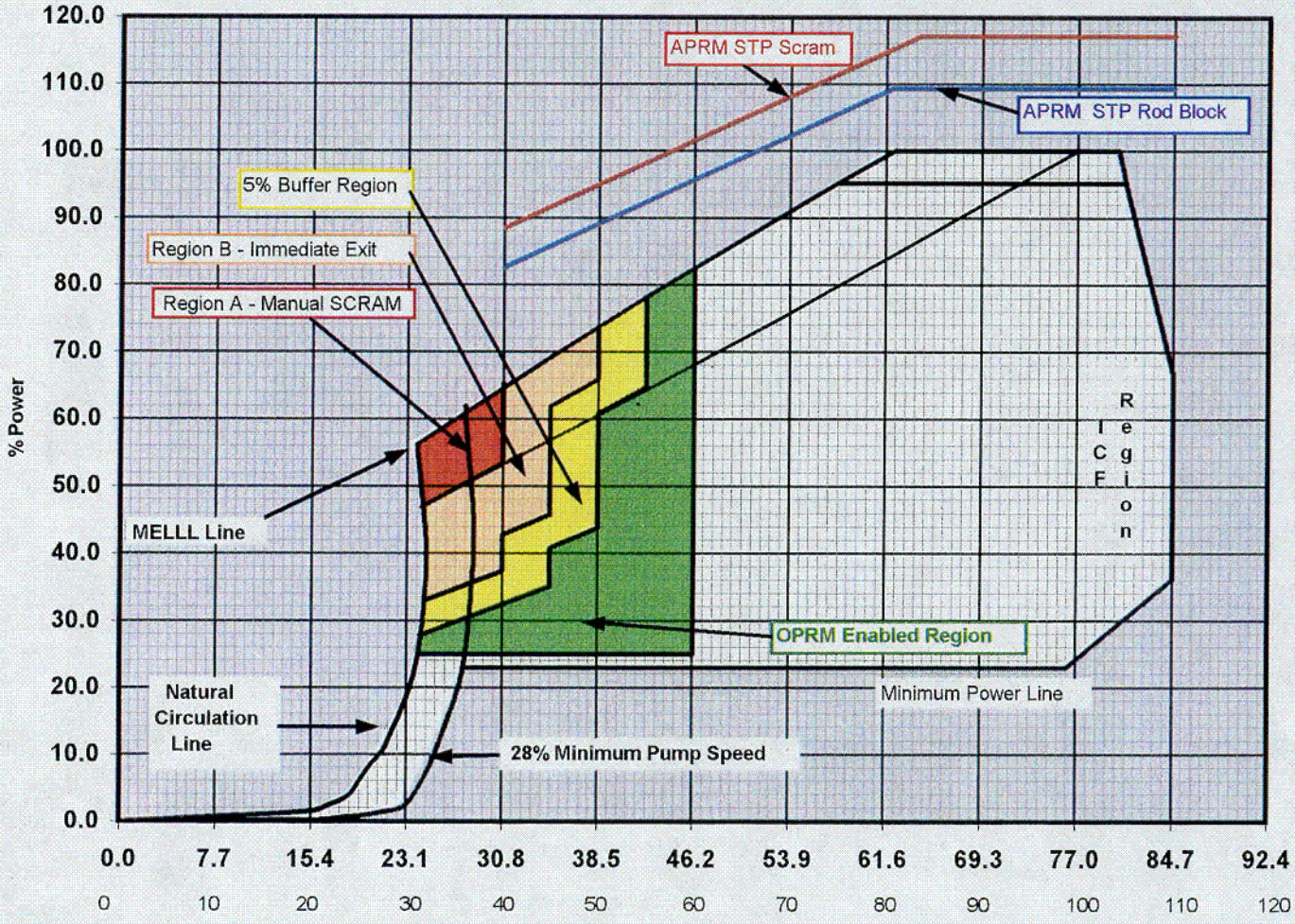
C02

OPRM Inoperable, Two Loop Operation, 2558 MWt

This Figure supports Improved Technical Specification 3.3.1.1 and the Technical Requirements Manual Specification 3.3



Power %	Minimum (MELLL) Core Flow, Mlbs/hr	Maximum (ICF) Core Flow, Mlbs/hr
100	62.37	80.31
99	61.41	80.42
98	60.45	80.54
97	59.48	80.65
96	58.52	80.76
95	57.57	80.87
94	56.67	81.01
93	55.77	81.15
92	54.86	81.28
91	53.96	81.42
90	53.06	81.55
89	52.16	81.69
88	51.26	81.82
87	50.36	81.96
86	49.45	82.09
85	48.55	82.23
84	47.65	82.36
83	46.75	82.50
82	45.85	82.63
81	44.94	82.77
80	44.04	82.90
79	43.14	83.04
78	42.24	83.17
77	41.34	83.31
76	40.44	83.44
75	39.53	83.58
74	38.63	83.71
73	37.73	83.85
72	36.83	83.98
71	35.93	84.12
70	35.02	84.25
69	34.12	84.39
68	33.22	84.53
67	32.32	84.66
66	31.42	84.70

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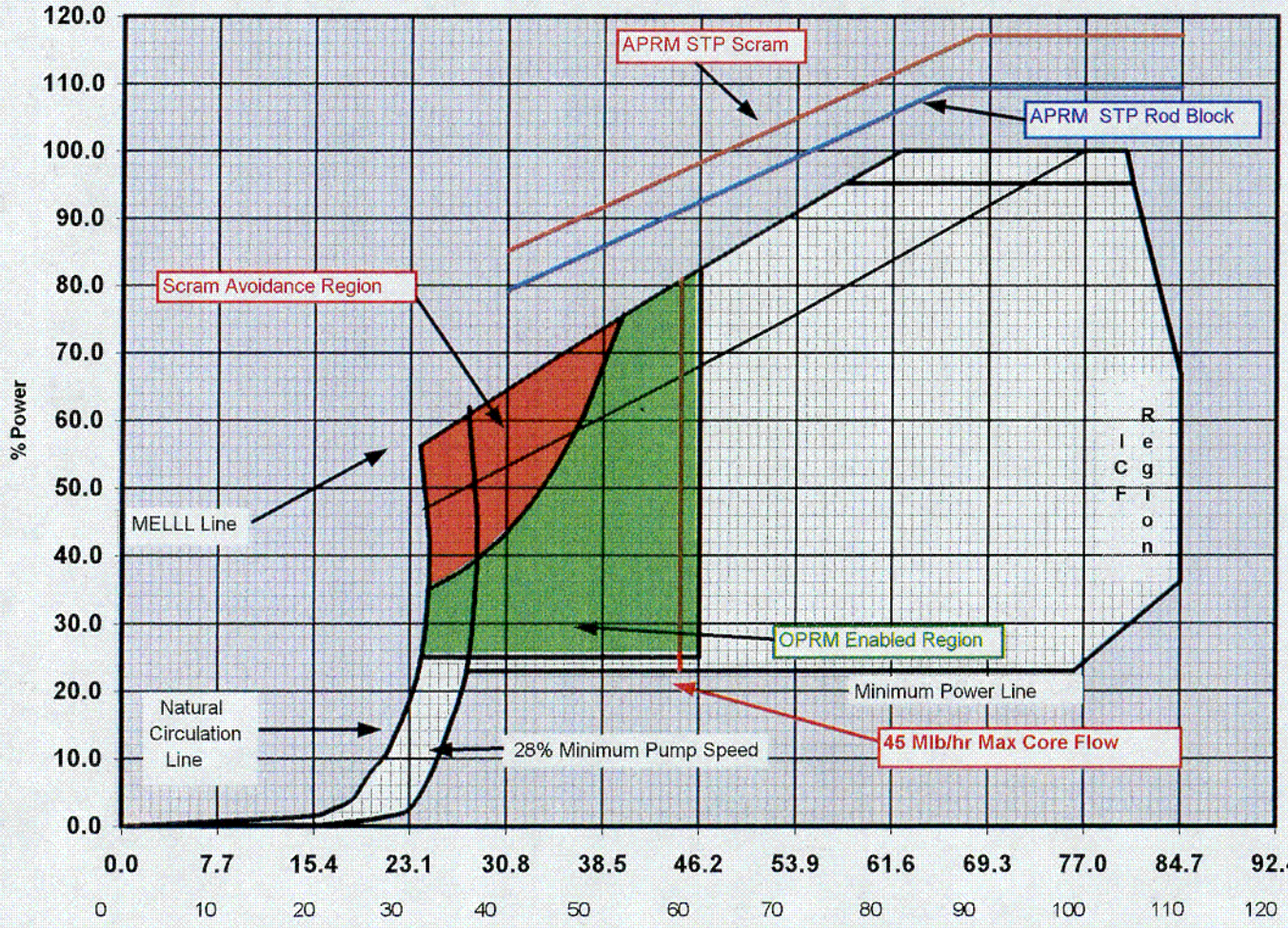
C03

OPRM Operable, Single Loop Operation, 2558 MWt

This Figure supports Improved Technical Specification 3.3.1.1 and the Technical Requirements Manual Specification 3.3



Power %	Minimum (MELLL) Core Flow, Mlbs/hr	Maximum (ICF) Core Flow, Mlbs/hr
100	62.37	80.31
99	61.41	80.42
98	60.45	80.54
97	59.48	80.65
96	58.52	80.76
95	57.57	80.87
94	56.67	81.01
93	55.77	81.15
92	54.86	81.28
91	53.96	81.42
90	53.06	81.55
89	52.16	81.69
88	51.26	81.82
87	50.36	81.96
86	49.45	82.09
85	48.55	82.23
84	47.65	82.36
83	46.75	82.50
82	45.85	82.63
81	44.94	82.77
80	44.04	82.90
79	43.14	83.04
78	42.24	83.17
77	41.34	83.31
76	40.44	83.44
75	39.53	83.58
74	38.63	83.71
73	37.73	83.85
72	36.83	83.98
71	35.93	84.12
70	35.02	84.25
69	34.12	84.39
68	33.22	84.53
67	32.32	84.66
66	31.42	84.70

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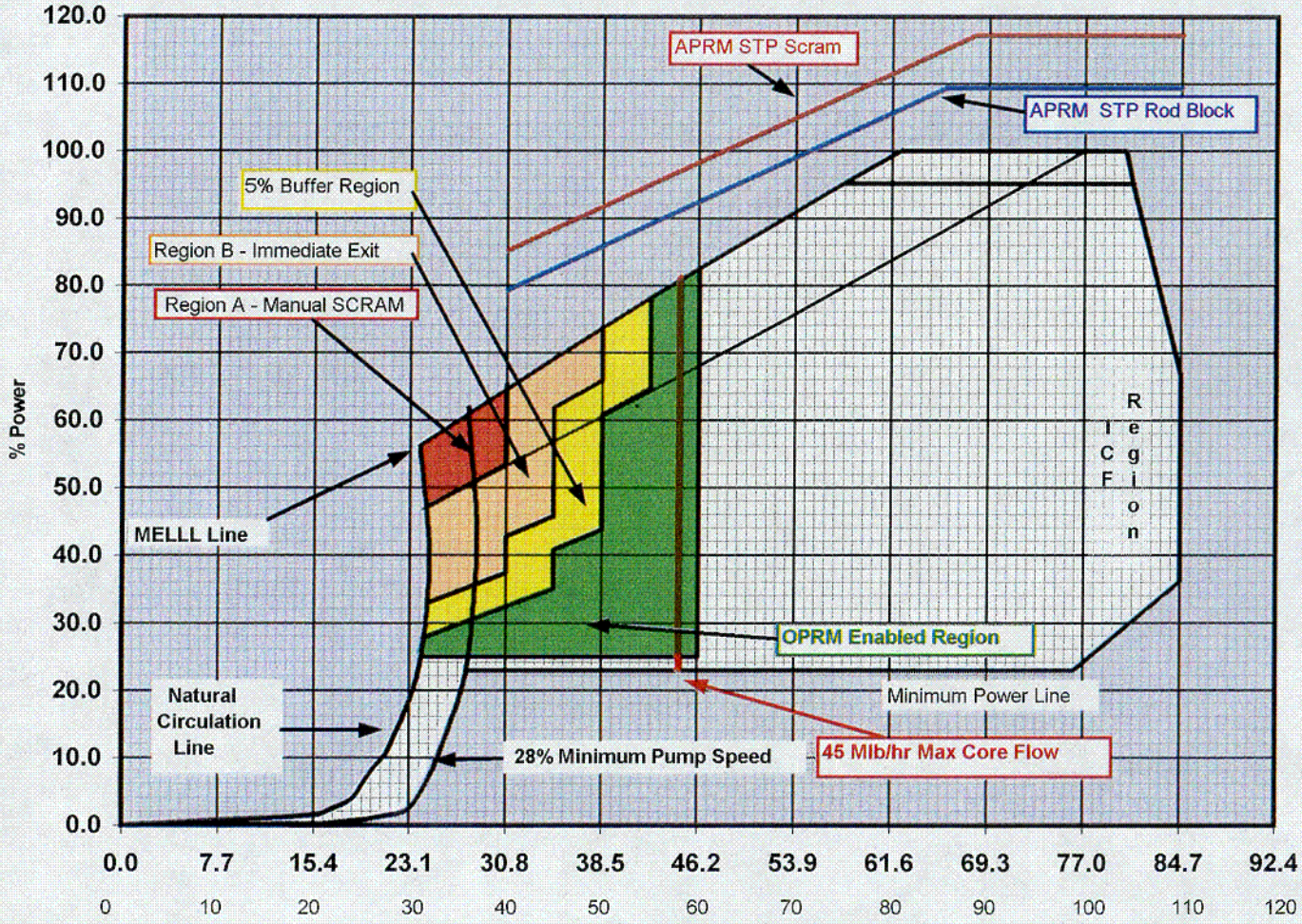
C04

OPRM Inoperable, Single Loop Operation, 2558 MWt

This Figure supports Improved Technical Specification 3.3.1.1 and the Technical Requirements Manual Specification 3.3



Power %	Minimum (MELLL) Core Flow, Mlbs/hr	Maximum (ICF) Core Flow, Mlbs/hr
100	62.37	80.31
99	61.41	80.42
98	60.45	80.54
97	59.48	80.65
96	58.52	80.76
95	57.57	80.87
94	56.67	81.01
93	55.77	81.15
92	54.86	81.28
91	53.96	81.42
90	53.06	81.55
89	52.16	81.69
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87	50.36	81.96
86	49.45	82.09
85	48.55	82.23
84	47.65	82.36
83	46.75	82.50
82	45.85	82.63
81	44.94	82.77
80	44.04	82.90
79	43.14	83.04
78	42.24	83.17
77	41.34	83.31
76	40.44	83.44
75	39.53	83.58
74	38.63	83.71
73	37.73	83.85
72	36.83	83.98
71	35.93	84.12
70	35.02	84.25
69	34.12	84.39
68	33.22	84.53
67	32.32	84.66
66	31.42	84.70

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ENCLOSURE 2

BRUNSWICK STEAM ELECTRIC PLANT, UNIT NO. 1
DOCKET NO. 50-325/LICENSE NO. DPR-71
UNIT 1 CYCLE 14 CORE OPERATING LIMITS REPORT,
SUPPLEMENTAL RELOAD LICENSING REPORT,
LOSS-OF-COOLANT ACCIDENT ANALYSIS REPORT,
AND PLANT-SPECIFIC EMERGENCY CORE
COOLING SYSTEM (ECCS) EVALUATION

"Supplemental Reload Licensing Report for
Brunswick Steam Electric Plant Unit 1 Reload 13 Cycle 14,"
J11-03936SRLR, Revision 1, Class I,
dated January 2002

Global Nuclear Fuel
A Joint Venture of GE, Toshiba, & Hitachi

J11-03936SRLR
Revision 1
Class I
January 2002

J11-03936SRLR, Rev. 1

Supplemental Reload Licensing Report

for

Brunswick Steam Electric Plant Unit 1

Reload 13 Cycle 14

Approved
G. A. Watford, Manager
Fuel Engineering Services

Approved R. E. Kingston for
C. J. Paone
Fuel Project Manager

Acknowledgement

The engineering and reload licensing analyses, which form the technical basis of this Supplemental Reload Licensing Report, were performed by "Fuel Engineering Services" and "Nuclear and Safety Analysis" personnel. The Supplemental Reload Licensing Report Revision 1 was prepared by G. M. Baka. This document has been verified by R. M. Butrovich.

The basis for this report is *General Electric Standard Application for Reactor Fuel*, NEDE-24011-P-A-14, June 2000; and the U.S. Supplement, NEDE-24011-P-A-14-US, June 2000.

1. Plant-unique Items

Appendix A: Analysis Conditions
Appendix B: Decrease in Core Coolant Temperature Events
Appendix C: Operating Flexibility Options
Appendix D: Implementation of GE14 Fuel
Appendix E: Improved GE13 Thermal/Mechanical Limits

2. Reload Fuel Bundles

Fuel Type	Cycle Loaded	Number
Irradiated:		
GE13-P9DTB403-5G6.0/7G5.0-100T-146-T (GE13)	12	28
GE13-P9DTB403-7G6.0/7G5.0-100T-146-T (GE13)	12	64
GE13-P9DTB405-5G6.0/7G5.0-100T-146-T (GE13)	13	52
GE13-P9DTB402-13G6.0/1G2.0-100T-146-T (GE13)	13	168
New:		
GE14-P10DNAB438-12G6.0-100T-150-T-2498 (GE14C)	14	48
GE14-P10DNAB425-16GZ-100T-150-T-2497 (GE14C)	14	88
GE14-P10DNAB416-17GZ-100T-150-T-2496 (GE14C)	14	112
Total		560

3. Reference Core Loading Pattern [1]

Nominal previous cycle core average exposure at end of cycle:	33576 MWd/MT (30460 MWd/ST)
Minimum previous cycle core average exposure at end of cycle from cold shutdown considerations:	33176 MWd/MT (30097 MWd/ST)
Assumed reload cycle core average exposure at beginning of cycle:	14350 MWd/MT (13018 MWd/ST)
Assumed reload cycle core average exposure at end of cycle (full power):	31690 MWd/MT (28748 MWd/ST)
Reference core loading pattern:	Figure 1

4. Calculated Core Effective Multiplication and Control System Worth - No Voids, 20°C

Beginning of Cycle, $k_{effective}$	
Uncontrolled	1.120
Fully controlled	0.956
Strongest control rod out	0.988
R, Maximum increase in cold core reactivity with exposure into cycle, Δk	0.000

5. Standby Liquid Control System Shutdown Capability

Boron (ppm) (at 20°C)	Shutdown Margin (Δk) (at 160°C, Xenon Free)
660	0.016

[1] The previous cycle core average exposure at beginning of cycle is 15095 MWd/MT (13694 MWd/ST).

6. Reload Unique GETAB Anticipated Operational Occurrences (AOO) Analysis Initial Condition Parameters

[2]Exposure: BOC14 to EOFPC14-2026 MWd/MT (1838 MWd/ST) with ICF							
	Peaking Factors						
Fuel Design	Local	Radial	Axial	R-Factor	Bundle Power (MWt)	Bundle Flow (1000 lb/hr)	Initial MCPR
GE14C	1.45	1.43	1.37	1.040	6.389	116.4	1.45
GE13	1.45	1.40	1.37	1.020	6.254	106.7	1.39

Exposure: EOFPC14-2026 MWd/MT (1838 MWd/ST) to EEOC14 with ICF							
	Peaking Factors						
Fuel Design	Local	Radial	Axial	R-Factor	Bundle Power (MWt)	Bundle Flow (1000 lb/hr)	Initial MCPR
GE14C	1.45	1.44	1.31	1.040	6.401	116.0	1.46
GE13	1.45	1.41	1.31	1.020	6.267	106.5	1.41

Exposure: BOC14 to EEOC14 with ICF and TBPOOS							
	Peaking Factors						
Fuel Design	Local	Radial	Axial	R-Factor	Bundle Power (MWt)	Bundle Flow (1000 lb/hr)	Initial MCPR
GE14C	1.45	1.42	1.31	1.040	6.317	116.6	1.49
GE13	1.45	1.39	1.31	1.020	6.170	107.2	1.43

[2] End of Full Power Capability (EOFPC) is defined as end-of-cycle all rods out, 100% power/104.5% flow, and normal feedwater temperature.

7. Selected Margin Improvement Options

Recirculation pump trip:	No
Rod withdrawal limiter:	No
Thermal power monitor:	Yes
Improved scram time:	Yes (ODYN Option B)
Measured scram time:	No
Exposure dependent limits:	Yes
Exposure points analyzed:	2 (EOFPC14-2026 MWd/MT and EEOC14)

8. Operating Flexibility Options

Single-loop operation:	Yes
Load line limit:	Yes
Extended load line limit:	Yes
Maximum extended load line limit:	Yes
Increased core flow throughout cycle:	Yes
Flow point analyzed:	104.5 %
Increased core flow at EOC:	Yes
Feedwater temperature reduction throughout cycle:	Yes
Temperature reduction:	110.3°F
Final feedwater temperature reduction:	Yes
ARTS Program:	Yes
Maximum extended operating domain:	Yes
Moisture separator reheater OOS:	No
Turbine bypass system OOS: (credit taken for 3 of 4 valves)	Yes
Safety/relief valves OOS: (credit taken for 9 of 11 valves)	Yes (Additional evaluations are required to support this option.)
ADS OOS:	Yes (2 valves OOS)

EOC RPT OOS: No

Main steam isolation valves OOS: Yes

9. Core-wide AOO Analysis Results

Methods used: GEMINI; GEXL-PLUS

Exposure range: BOC14 to EOFPC14-2026 MWd/MT (1838 MWd/ST) with ICF					
			Uncorrected ΔCPR		
Event	**Flux (%NBR)**	**Q/A (%NBR)**	**GE14C**	**GE13**	**Fig.**
Load Reject w/o Bypass	601	128	0.33	0.28	2

Exposure range: EOFPC14-2026 MWd/MT (1838 MWd/ST) to EEOC14 with ICF					
			Uncorrected ΔCPR		
Event	**Flux (%NBR)**	**Q/A (%NBR)**	**GE14C**	**GE13**	**Fig.**
Load Reject w/o Bypass	537	126	0.34	0.29	3

Exposure range: BOC14 to EEOC14 with ICF and TBPOOS					
			Uncorrected ΔCPR		
Event	**Flux (%NBR)**	**Q/A (%NBR)**	**GE14C**	**GE13**	**Fig.**
FW Controller Failure	579	131	0.37	0.32	4

10. Local Rod Withdrawal Error (With Limiting Instrument Failure) AOO Summary

The rod withdrawal error (RWE) event in the maximum extended operating domain was originally analyzed in the GE BWR Licensing Report, *Maximum Extended Operating Domain Analysis for Brunswick Steam Electric Plant*, NEDC-31654P, February 1989. The Cycle 14 analysis resulted in a RWE ΔCPR of 0.11 (which is bounded by the generic ARTS ΔCPR of 0.14) at a rod block monitor setpoint of 108%. The MCPR for rod withdrawal error is bounded by the safety limit adjusted operating limit MCPRs in Table 10-5(a) or 10-5(b) of NEDC-31654P. In addition, the RBM System setpoints shown in Table 10-5(c) of NEDC-31654P are supported for Brunswick Unit 1 Cycle 14. The RBM operability requirements specified in Section 10.5 of NEDC-31654P have been evaluated and shown to be sufficient to ensure that the Safety Limit MCPR and cladding 1% plastic strain criteria will not be exceeded in the event of an unblocked RWE event.

11. Cycle MCPR Values [3]

Safety limit: 1.12

Single loop operation safety limit: 1.14

Non-pressurization events:

Exposure range: BOC14 to EOC14		
	All Fuel Types	
Control Rod Withdrawal Error (RBM setpoint at 108%)	1.26	
Loss of Feedwater Heating [4]	1.26	
Fuel Loading Error (mislocated)	Not limiting [5]	
	GE14C	**GE13**
Fuel Loading Error (misoriented)	1.24	1.25

Pressurization events:

Exposure range: BOC14 to EOFPC14-2026 MWd/MT (1838 MWd/ST) with ICF [6] **Exposure point: EOFPC14-2026 MWd/MT (1838 MWd/ST)**				
	Option A		**Option B**	
	GE14C	**GE13**	**GE14C**	**GE13**
Load Reject w/o Bypass	1.57	1.45	1.46	1.40

Exposure range: EOFPC14-2026 MWd/MT (1838 MWd/ST) to EEOC14 with ICF [7] **Exposure point: EEOC14**				
	Option A		**Option B**	
	GE14C	**GE13**	**GE14C**	**GE13**
Load Reject w/o Bypass	1.69	1.50	1.52	1.42

[3] The Operating Limits MCPRs for two loop operation (TLO) bound the Operating Limit MCPRs for Single Loop Operation (SLO); therefore, the Operating Limits MCPRs need not be changed for SLO.
[4] See Appendix B.
[5] The mislocated bundle fuel loading error OLMCPR is bounded by the pressurization event OLMCPR.
[6] The ICF Operating Limits for the exposure range of BOC14 to EOFPC14-2026 MWd/MT (1838 MWd/ST) bound the Operating Limits for the following domains: MELLL, ICF and FWTR, MSIVOOS and ICF.
[7] The ICF Operating Limits for the exposure range of EOFPC14-2026 MWd/MT (1838 MWd /ST) to EEOC14 bound the Operating Limits for the following domains: MELLL, ICF and FWTR, MSIVOOS and ICF.

Exposure range: BOC14 to EEOC14 with ICF and TBPOOS [8] Exposure point: EEOC14				
	Option A		Option B	
	GE14C	GE13	GE14C	GE13
FW Controller Failure	1.72	1.54	1.55	1.46

12. Overpressurization Analysis Summary

Event	Psl (psig)	Pv (psig)	Plant Response
MSIV Closure (Flux Scram)	1282	1314	Figure 5

13. Loading Error Results

Variable water gap misoriented bundle analysis: Yes[9]

Misoriented Fuel Bundle	ΔCPR
GE13-P9DTB405-5G6.0/7G5.0-100T-146-T (GE13)	0.08
GE13-P9DTB402-13G6.0/1G2.0-100T-146-T (GE13)	0.13
GE14-P10DNAB416-17GZ-100T-150-T-2496 (GE14C)	0.06
GE14-P10DNAB425-16GZ-100T-150-T-2497 (GE14C)	0.12
GE14-P10DNAB438-12G6.0-100T-150-T-2498 (GE14C)	0.04

14. Control Rod Drop Analysis Results

This is a banked position withdrawal sequence plant, therefore, the control rod drop accident analysis is not required. NRC approval is documented in NEDE-24011-P-A-US.

15. Stability Analysis Results

Due to the recent Potential Reportable Condition (PRC 01-07) reported by GE on the DIVOM (Delta CPR Over Initial CPR Versus Oscillation Magnitude) slope, it is essential to confirm that the following Option III stability analysis results be applicable to Brunswick Unit 1 Cycle 14 or an interim OPRM system setpoint be used based on a validated new DIVOM slope.

[8] The TBPOOS ICF Operating Limits for the exposure range of BOC14 to EEOC14 bound the Operating Limits for all domains with TBPOOS.
[9] Includes a 0.02 penalty due to variable water gap R-factor uncertainty.

Should the Option III OPRM system be declared inoperable, the BWROG Interim Corrective Action will constitute the stability licensing basis for Brunswick Unit 1 Cycle 14.

Stability Option III

Brunswick Unit 1 has implemented BWROG Long Term Stability Solution Option III (Oscillation Power Range Monitor-OPRM) as described in NEDO-31960-A, "BWR Owners Group Long-Term Stability Solutions Licensing Methodology", November 1995. Plant specific analysis incorporating the Option III hardware is described in GE-NE-C51-00251-00-01, Revision 0, "Licensing Basis Hot Bundle Oscillation Magnitude for Brunswick 1 and 2", March 2001.

Reload validation has been performed in accordance with NEDO-32465-A, "Reactor Stability Detect and Suppress Solutions Licensing Basis Methodology for Reload Application", August 1996. The stability based MCPR Operating Limit is provided for two conditions as a function of OPRM amplitude setpoint in the following table. The two conditions evaluated are for a postulated oscillation at 45% core flow steady state operation (SS) and following a two recirculation pump trip (2PT) from the limiting full power operation state point. Current power and flow dependent limits provide adequate protection against violation of the Safety Limit MCPR for postulated reactor instability as long as the operating limit is greater than or equal to the specified value for the selected OPRM setpoint.

The stability-based OLMCPR was calculated for Cycle 14. The reload validation calculation demonstrated that reactor stability does not produce the limiting OLMCPR for Cycle 14 as long as the selected OPRM setpoint produces values for OLMCPR(SS) and OLMCPR(2PT) which are less than the corresponding acceptance criteria.

OPRM Setpoint	OLMCPR(SS)	OLMCPR(2PT)
1.05	**1.207**	**1.127**
1.06	**1.226**	**1.144**
1.07	**1.244**	**1.162**
1.08	**1.264**	**1.180**
1.09	**1.284**	**1.199**
1.10	**1.304**	**1.218**
1.11	**1.325**	**1.237**
1.12	**1.345**	**1.256**
1.13	**1.367**	**1.276**
1.14	**1.389**	**1.297**
1.15	**1.412**	**1.319**
Acceptance Criteria	**Off-rated OLMCPR @ 45% Flow**	**Rated Power OLMCPR as described in SRLR Section 11**

Interim Corrective Action Stability

GE SIL-380 recommendations and BWROG Interim Corrective Actions (BWROG-94079) have been included in the Brunswick Unit 1 operating procedures. Regions of restricted operation defined in Attachment 1 to NRC Bulletin No 88-07, Supplement 1, *Power Oscillations in Boiling Water Reactors (BWRs)* and expanded in BWROG-94079, are applicable to Brunswick Unit 1.

16. Loss-of-Coolant Accident Results

LOCA method used: SAFER/GESTR-LOCA

The SAFER/GESTR-LOCA analysis results are presented in NEDC-31624P, "Brunswick Units 1 and 2 SAFER/GESTR-LOCA Loss-of Coolant Accident Analysis Application to GE13 Fuel," Supplement 3, Revision 1, November 2000 and GE-NE-J1103781-09-02P, "Brunswick Steam Electric Plant Units 1 and 2 ECCS-LOCA Evaluation for GE14," February 2001. The Licensing Basis Peak Cladding Temperature (PCT) is <1710°F for GE13 fuel and <1580°F for GE14 fuel. The maximum local oxidation fraction is <1% and the core-wide metal-water reaction is <0.1% for both fuel types. The initial operating MCPRs are 1.20 for GE13 and 1.275 for GE14 fuels.

The ECCS MAPLHGR multiplier for single loop operation (SLO) is 0.80 for both GE13 and GE14 fuels.

The ECCS-LOCA analysis for GE13 fuel has been reviewed in light of the proposed improved LHGR limits for GE13 fuel. From this review it was determined that the limiting ECCS results were unaffected. Thus the referenced LOCA results are still applicable with the improved GE13 LHGR limits.

A review of the Brunswick Unit 1 ECCS-LOCA analyses identified errors that have not been accounted for in the reference analyses for GE13 and GE14 fuels. The impact of applicable errors for GE13 and GE14 fuels are as follows:

10CFR50.46 Applicable Errors to Brunswick Unit 1 SAFER/GESTR Reference Analysis

10CFR50.46 Error Notifications	10CFR50.46 Error Description	GE13	GE14
2001-02	Inconsistency in accounting for ECCS pressure rate in OPL-4 ECCS analysis	+10°F	N/A
2001-03	Dryout time and initial pressure errors	N/A	-20°F
Total Licensing Basis PCT Adder		+10°F	-20°F

The most limiting and the least limiting MAPLHGRs for the GE13 fuel based on the improved LHGR limits and for the GE14 fuel bundles to be added in this cycle are presented in the following tables.

16. Loss-of-Coolant Accident Results (cont.)

Bundle Type: GE13-P9DTB403-5G6.0/7G5.0-100T-146-T

Average Planar Exposure		MAPLHGR (kW/ft)	
(GWd/ST)	(GWd/MT)	Most Limiting	Least Limiting
0.00	0.00	10.65	10.73
0.20	0.22	10.72	10.79
1.00	1.10	10.85	10.88
2.00	2.20	11.00	11.03
3.00	3.31	11.12	11.21
4.00	4.41	11.25	11.35
5.00	5.51	11.38	11.50
6.00	6.61	11.52	11.66
7.00	7.72	11.66	11.82
8.00	8.82	11.81	11.99
9.00	9.92	11.95	12.12
10.00	11.02	12.05	12.26
12.50	13.78	12.04	12.36
15.00	16.53	11.97	12.29
17.50	19.29	11.79	12.07
20.00	22.05	11.54	11.79
25.00	27.56	11.13	11.23
30.00	33.07	10.57	10.83
35.00	38.58	10.10	10.33
40.00	44.09	9.68	9.87
45.00	49.60	9.29	9.44
50.00	55.12	8.94	9.05
55.00	60.63	8.60	8.68
58.49	64.48	8.36	8.50
59.19	65.25	--	8.31

16. Loss-of-Coolant Accident Results (cont.)

Bundle Type: GE13-P9DTB403-7G6.0/7G5.0-100T-146-T

Average Planar Exposure		MAPLHGR (kW/ft)	
(GWd/ST)	(GWd/MT)	Most Limiting	Least Limiting
0.00	0.00	10.44	10.44
0.20	0.22	10.51	10.51
1.00	1.10	10.61	10.63
2.00	2.20	10.74	10.77
3.00	3.31	10.88	10.93
4.00	4.41	11.02	11.09
5.00	5.51	11.17	11.26
6.00	6.61	11.32	11.43
7.00	7.72	11.48	11.59
8.00	8.82	11.62	11.74
9.00	9.92	11.73	11.89
10.00	11.02	11.85	12.04
12.50	13.78	11.86	12.16
15.00	16.53	11.86	12.21
17.50	19.29	11.76	12.06
20.00	22.05	11.54	11.80
25.00	27.56	11.15	11.36
30.00	33.07	10.85	10.92
35.00	38.58	10.39	10.42
40.00	44.09	9.88	9.99
45.00	49.60	9.42	9.58
50.00	55.12	9.01	9.18
55.00	60.63	8.64	8.78
58.33	64.29	8.41	8.51
59.06	65.11	--	8.36

16. Loss-of-Coolant Accident Results (cont.)

Bundle Type: GE13-P9DTB405-5G6.0/7G5.0-100T-146-T

Average Planar Exposure		MAPLHGR (kW/ft)	
(GWd/ST)	(GWd/MT)	Most Limiting	Least Limiting
0.00	0.00	10.71	10.85
0.20	0.22	10.78	10.90
1.00	1.10	10.91	10.99
2.00	2.20	11.08	11.10
3.00	3.31	11.22	11.27
4.00	4.41	11.35	11.46
5.00	5.51	11.47	11.61
6.00	6.61	11.61	11.76
7.00	7.72	11.75	11.92
8.00	8.82	11.89	12.08
9.00	9.92	12.04	12.22
10.00	11.02	12.18	12.36
12.50	13.78	12.17	12.45
15.00	16.53	12.02	12.34
17.50	19.29	11.82	12.12
20.00	22.05	11.58	11.85
25.00	27.56	11.17	11.22
30.00	33.07	10.60	10.90
35.00	38.58	10.18	10.44
40.00	44.09	9.82	10.03
45.00	49.60	9.49	9.62
50.00	55.12	9.19	9.22
55.00	60.63	8.81	8.88
58.73	64.74	8.51	8.64
59.47	65.55	--	8.59

16. Loss-of-Coolant Accident Results (cont.)

Bundle Type: GE13-P9DTB402-13G6.0/1G2.0-100T-146-T

Average Planar Exposure		MAPLHGR (kW/ft)	
(GWd/ST)	(GWd/MT)	Most Limiting	Least Limiting
0.00	0.00	10.45	10.46
0.20	0.22	10.53	10.53
1.00	1.10	10.63	10.64
2.00	2.20	10.76	10.79
3.00	3.31	10.90	10.95
4.00	4.41	11.04	11.11
5.00	5.51	11.19	11.28
6.00	6.61	11.34	11.45
7.00	7.72	11.50	11.63
8.00	8.82	11.66	11.80
9.00	9.92	11.81	11.95
10.00	11.02	11.92	12.10
12.50	13.78	11.90	12.19
15.00	16.53	11.86	12.21
17.50	19.29	11.75	12.05
20.00	22.05	11.52	11.78
25.00	27.56	11.13	11.14
30.00	33.07	10.53	10.79
35.00	38.58	10.06	10.29
40.00	44.09	9.64	9.83
45.00	49.60	9.25	9.40
50.00	55.12	8.90	9.01
55.00	60.63	8.56	8.64
58.34	64.31	8.33	8.40
59.04	65.08	--	8.28

16. Loss-of-Coolant Accident Results (cont.)

Bundle Type: GE14-P10DNAB416-17GZ-100T-150-T-2496

Average Planar Exposure		MAPLHGR (kW/ft)	
(GWd/ST)	(GWd/MT)	Most Limiting	Least Limiting
0.00	0.00	9.27	9.50
0.20	0.22	9.33	9.55
1.00	1.10	9.44	9.67
2.00	2.20	9.59	9.83
3.00	3.31	9.76	10.00
4.00	4.41	9.93	10.18
5.00	5.51	10.11	10.37
6.00	6.61	10.30	10.57
7.00	7.72	10.50	10.79
8.00	8.82	10.71	11.01
9.00	9.92	10.91	11.24
10.00	11.02	11.12	11.47
11.00	12.13	11.31	11.70
12.00	13.23	11.36	11.83
13.00	14.33	11.35	11.89
14.00	15.43	11.34	11.89
15.00	16.53	11.31	11.87
17.00	18.74	11.23	11.71
20.00	22.05	11.03	11.41
25.00	27.56	10.60	10.79
30.00	33.07	10.12	10.17
35.00	38.58	9.49	9.66
40.00	44.09	8.91	9.13
45.00	49.60	8.37	8.59
50.00	55.12	7.87	8.04
55.00	60.63	6.53	6.88
58.30	64.27	4.88	5.23
58.36	64.33	--	5.20
58.93	64.95	--	4.92
58.95	64.98	--	4.91

16. Loss-of-Coolant Accident Results (cont.)

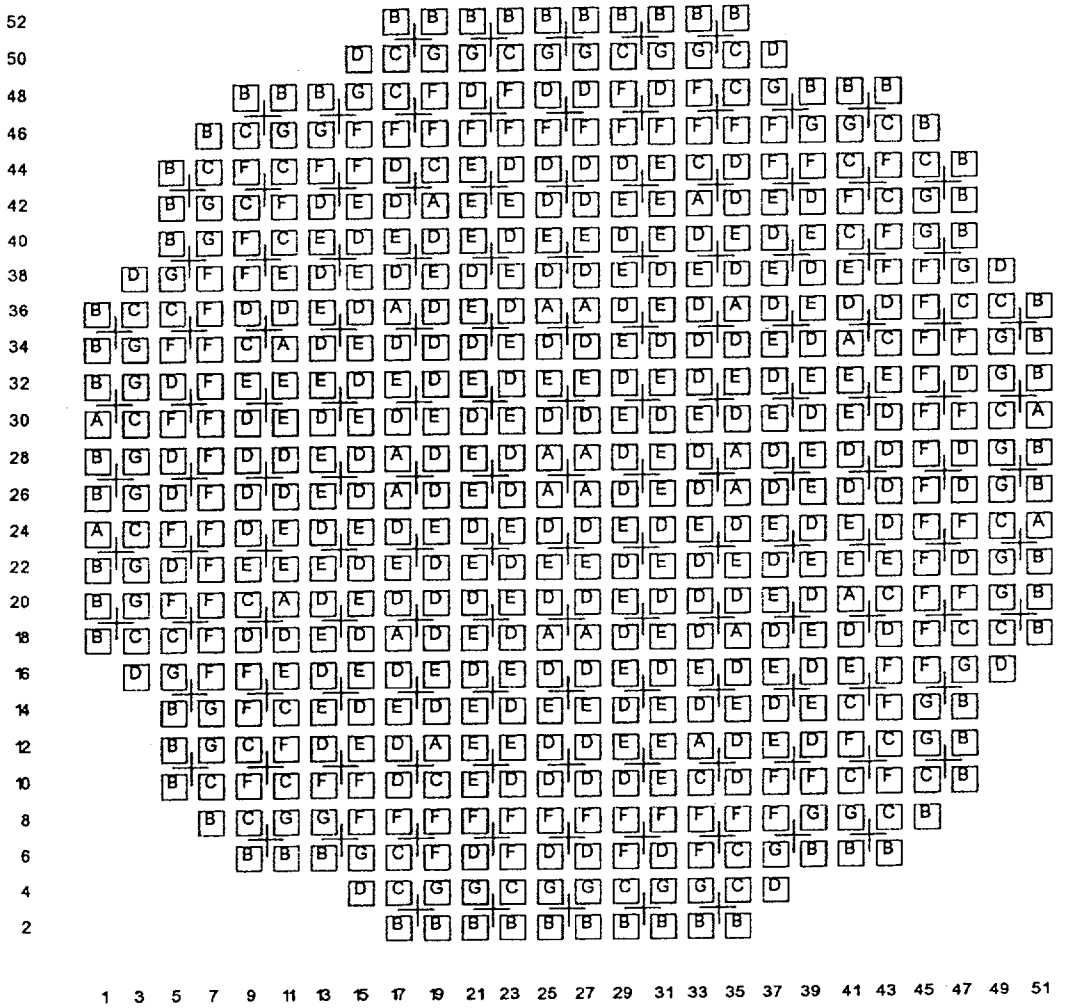
Bundle Type: GE14-P10DNAB425-16GZ-100T-150-T-2497

Average Planar Exposure		MAPLHGR (kW/ft)	
(GWd/ST)	(GWd/MT)	Most Limiting	Least Limiting
0.00	0.00	9.26	9.52
0.20	0.22	9.33	9.57
1.00	1.10	9.43	9.65
2.00	2.20	9.57	9.76
3.00	3.31	9.72	9.88
4.00	4.41	9.88	10.01
5.00	5.51	10.04	10.14
6.00	6.61	10.21	10.27
7.00	7.72	10.34	10.37
8.00	8.82	10.48	10.49
9.00	9.92	10.58	10.64
10.00	11.02	10.70	10.79
11.00	12.13	10.81	10.93
12.00	13.23	10.80	10.97
13.00	14.33	10.79	11.02
14.00	15.43	10.79	11.07
15.00	16.53	10.79	11.12
17.00	18.74	10.77	11.15
20.00	22.05	10.65	11.02
25.00	27.56	10.28	10.60
30.00	33.07	9.84	10.12
35.00	38.58	9.39	9.58
40.00	44.09	8.92	9.06
45.00	49.60	8.42	8.59
50.00	55.12	7.89	8.08
55.00	60.63	5.67	6.40
56.51	62.29	4.91	5.65
57.56	63.45	--	5.12
57.82	63.73	--	4.99

16. Loss-of-Coolant Accident Results (cont.)

Bundle Type: GE14-P10DNAB438-12G6.0-100T-150-T-2498

Average Planar Exposure		MAPLHGR (kW/ft)	
(GWd/ST)	(GWd/MT)	Most Limiting	Least Limiting
0.00	0.00	9.44	9.81
0.20	0.22	9.54	9.86
1.00	1.10	9.67	9.94
2.00	2.20	9.81	10.05
3.00	3.31	9.95	10.16
4.00	4.41	10.09	10.28
5.00	5.51	10.20	10.41
6.00	6.61	10.31	10.54
7.00	7.72	10.43	10.67
8.00	8.82	10.55	10.81
9.00	9.92	10.67	10.95
10.00	11.02	10.79	11.09
11.00	12.13	10.92	11.23
12.00	13.23	10.93	11.28
13.00	14.33	10.92	11.29
14.00	15.43	10.91	11.30
15.00	16.53	10.89	11.28
17.00	18.74	10.82	11.18
20.00	22.05	10.61	10.94
25.00	27.56	10.19	10.50
30.00	33.07	9.76	10.07
35.00	38.58	9.33	9.61
40.00	44.09	8.87	9.16
45.00	49.60	8.38	8.62
50.00	55.12	7.84	8.08
55.00	60.63	5.55	6.34
56.33	62.10	4.88	5.67
57.70	63.60	--	4.98
57.75	63.66	--	4.95



Fuel Type	
A=GE13-P9DTB403-5G6.0/7G5.0-100T-146-T (Cycle 12)	E=GE14-P10DNAB416-17GZ-100T-150-T-2496 (Cycle 14)
B=GE13-P9DTB403-7G6.0/7G5.0-100T-146-T (Cycle 12)	F=GE14-P10DNAB425-16GZ-100T-150-T-2497 (Cycle 14)
C=GE13-P9DTB405-5G6.0/7G5.0-100T-146-T (Cycle 13)	G=GE14-P10DNAB438-12G6.0-100T-150-T-2498 (Cycle 14)
D=GE13-P9DTB402-13G6.0/1G2.0-100T-146-T (Cycle 13)	

Figure 1 Reference Core Loading Pattern

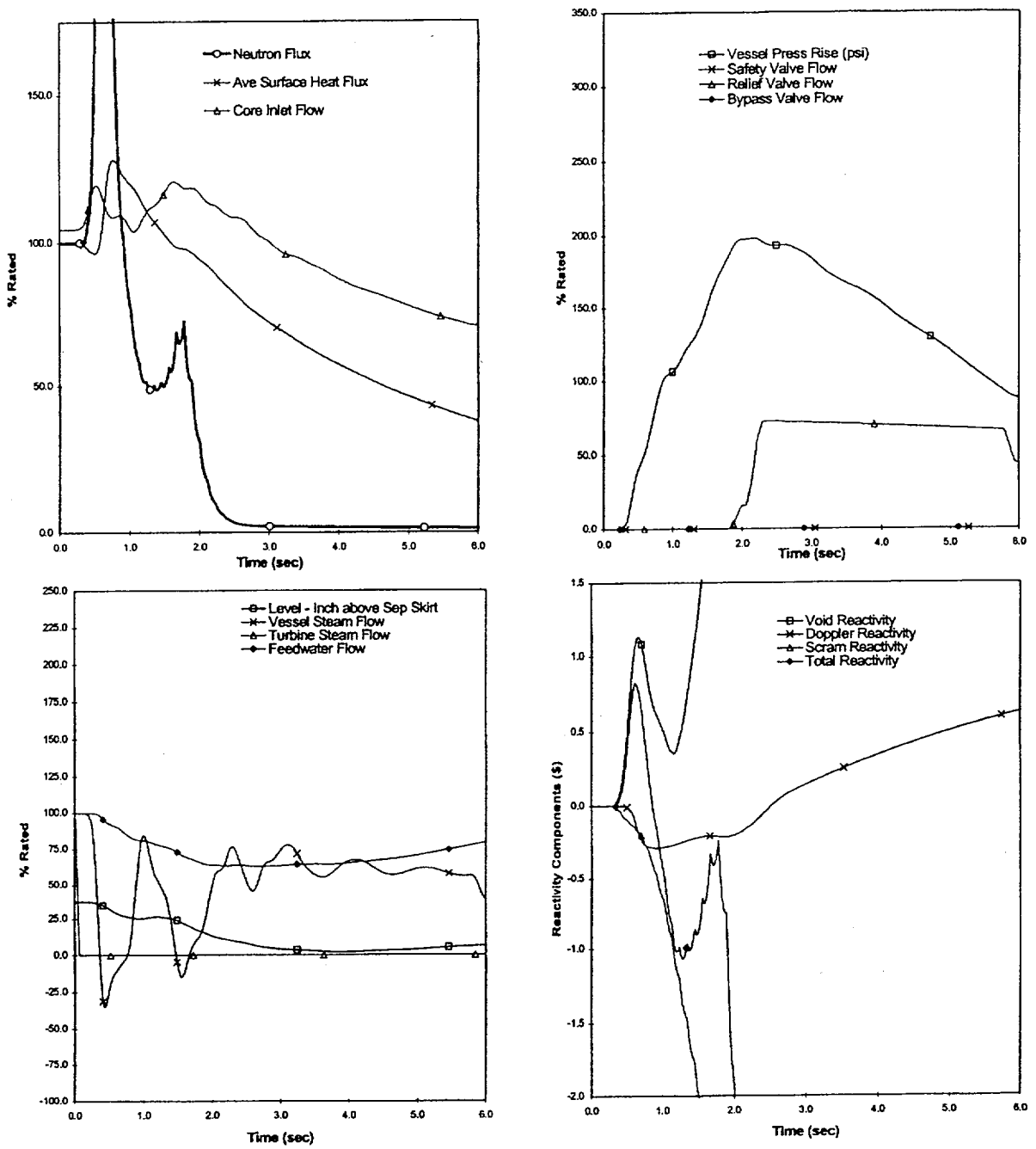


Figure 2 Plant Response to Load Reject w/o Bypass
BOC14 to EOFPC14-2026 MWd/MT (1838 MW/ST) with ICF

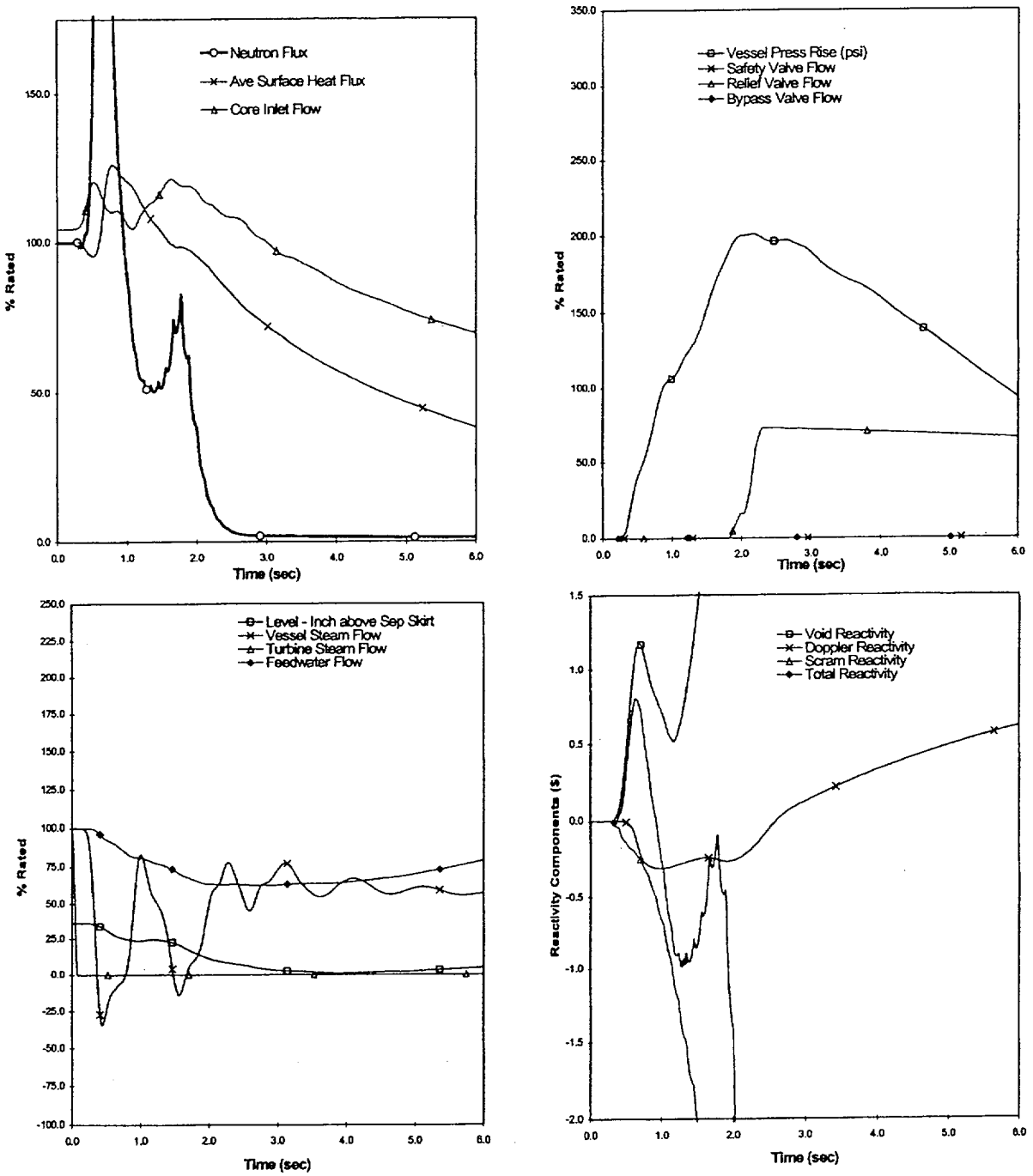


Figure 3 Plant Response to Load Reject w/o Bypass
EOFPC14-2026 MWd/ST (1838 MWd/ST) to EEOC14 with ICF

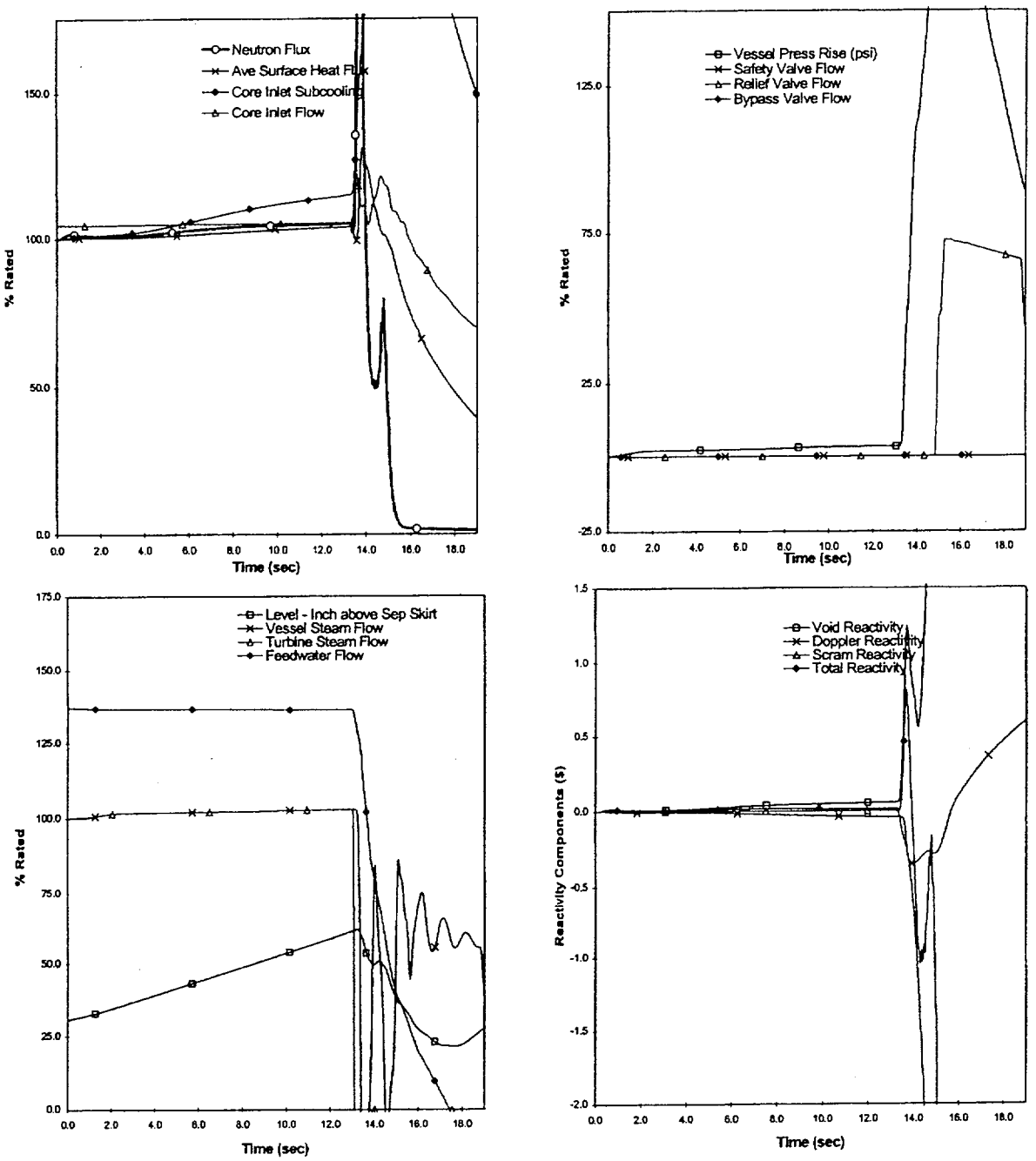


Figure 4 Plant Response to FW Controller Failure
BOC14 to EEOC14 with ICF and TBPOOS

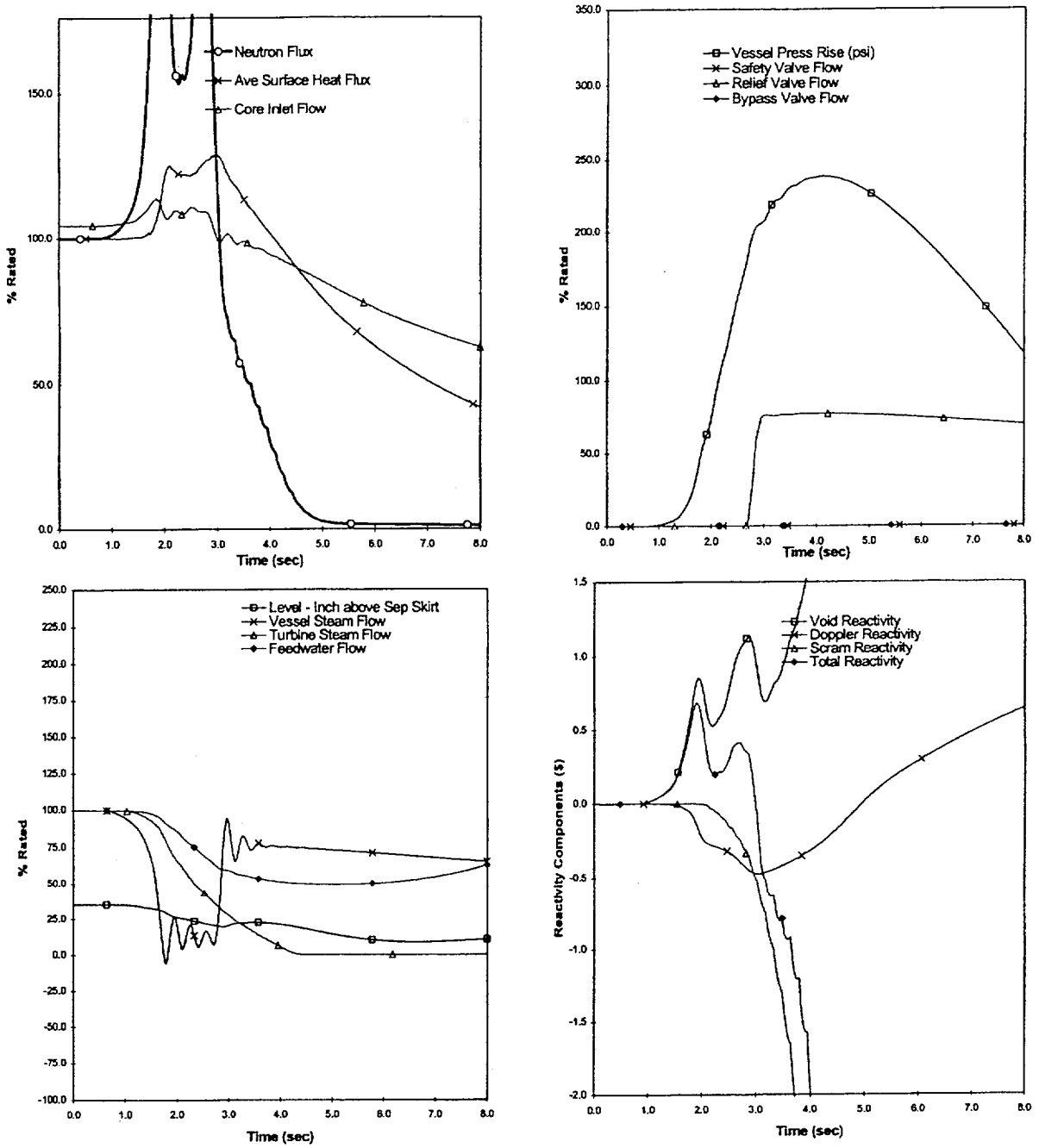


Figure 5 Plant Response to MSIV Closure
Flux Scram

Appendix A
Analysis Conditions

To reflect actual plant parameters accurately, the values shown in Table A-1 were used this cycle.

Table A-1

	Analysis Value		
Parameter	**ICF**	**FWTR**	**MELLL**
Thermal power, MWt	2557.6	2557.6	2557.6
Core flow, Mlb/hr	80.5	80.5	62.4
Reactor pressure, psia	1039.0	1021.0	1035.0
Inlet enthalpy, BTU/lb	527.6	514.8	521.3
Non-fuel power fraction	0.036	0.036	0.036
Steam flow, Mlb/hr	10.95	9.72	11.16
Dome pressure, psig	1009.5	992.5	1009.1
Turbine pressure, psig	964.5	956.5	962.2
No. of Safety/Relief Valves	9	9	9
Relief mode lowest setpoint, psig	1163.9	1163.9	1163.9
Recirculation pump power source	on-site [10]	on-site [10]	on-site [10]
Turbine control valve mode of operation	Partial arc	Partial arc	Partial arc

[10] Bounds operation with off-site power source for reload licensing events for Cycle 14.

Appendix B
Decrease in Core Coolant Temperature Events

The Loss of Feedwater Heating (LFWH) event and the Inadvertent HPCI start-up event are the only cold water injection AOOs checked on a cycle-by-cycle basis.

The LFWH event was analyzed for Brunswick Unit 1 Cycle 14 (the initial application of GE14 fuel) at Extended Power Uprate (EPU) using the BWR Simulator Code. The use of this code is permitted in GESTAR II. The transient plots, neutron flux and heat flux values normally reported in Section 9 are not an output of the BWR Simulator Code; therefore, those items are not included in this document. The OLMCPR result is shown in Section 11.

In addition, the Inadvertent HPCI start-up event was shown to be bounded by the LFWH event in Brunswick Unit 1 Cycle 14 in accordance with Reference B-1.

Reference

B-1. *Determination of Limiting Cold Water Event*, NEDC-32538P-A, February 1996.

Appendix C
Operating Flexibility Options

Reference C-1 provides a basis for operation of the Brunswick Steam Electric Plant (BSEP) with one Main Steamline Isolation Valve Out of Service (MSIVOOS) (three steamline operation) and all S/RVs in service. For MSIVOOS, the OLMCPRs presented in Section 11 and peak overpressure results in Section 12 are bounding.

Reference C-2 provides a basis for operation of the Brunswick Steam Electric Plant (BSEP) with Feedwater Temperature Reduction. The required OLMCPRs are provided in Section 11.

Reference C-3 provides a basis for operation of the Brunswick Steam Electric Plant (BSEP) with Maximum Extended Operating Domain (MEOD). The required OLMCPRs are provided in Section 11.

Reference C-4 provides a basis for operation of the Brunswick Steam Electric Plant (BSEP) with all Turbine Bypass Valves Out of Service (TBPOOS). The required OLMCPRs are provided in Section 11.

The impact of GE14 fuel on the operating flexibility options is addressed in Appendix D.

The ARTS power and flow dependent operating limits for all operating flexibility options are provided in References C-3 and C-5. Due to a safety limit change for Brunswick Unit 1 Cycle14 from the reference safety limits used in References C-3 and C-5 there will be a required adjustment to the MCPR(p) below P-bypass limits, MCPR(f) limits adjustment and an adjustment to the required minimum GE14 OLMCPR for the recirculation pump seizure event.

MCPR(p) below P-bypass is increased for a Safety Limit of 1.12 by the ratio of $\left(\frac{1.12}{1.09}\right)$.

The limits below P-bypass for current rated power for all fuel types in the core are as follows:

Power/Flow	**Reference C-5** MCPR(P)	**Brunswick Unit 1 Cycle 14** MCPR(P) Limit
30/105	3.07	3.15
25/105	3.44	3.53
30/50	2.30	2.36
25/50	2.58	2.65

The Reference C-3 MCPR(f) limits are increased for a Safety Limit of 1.12 by the ratio of $\left(\frac{1.12}{1.07}\right)$.

The following coefficients apply for all fuel types in the core:

Maximum Core Flow (% of Rated)	A(f)	B(f)	Flow Intercept	MCPR
102.5	-0.598	1.732	78.93	1.26
107.0	-0.613	1.776	84.18	1.26
112.0	-0.630	1.829	90.32	1.26
117.0	-0.662	1.894	95.77	1.26

Per Reference C-5, if the cycle-specific SLO SLMCPR is larger than 1.12, the cycle specific TLO full-power GE14 OLMCPR should be no lower than 1.32 x 1.14/1.12 prior to application to SLO operation such that the MCPR(p) curve bounds GE14 SLO, where 1.14 is the single loop operating limit. The GE14 OLMCPR for Brunswick Unit 1 Cycle 14 must be greater than 1.34 to protect the recirculation pump seizure event.

References

C-1. *Main Steamline Isolation Valve Out of Service for the Brunswick Steam Electric Plant*, EAS-117-0987, GE Nuclear Energy (Proprietary), April 1988.

C-2. *Feedwater Temperature Reduction with Maximum Extended Load Line Limit and Increased Core Flow for Brunswick Steam Electric Plants Units 1 and 2*, NEDC-32457P, Revision 1, GE Nuclear Energy (Proprietary), December 1995.

C-3. *Maximum Extended Operating Domain Analysis for Brunswick Steam Electric Plant*, NEDC-31654P, GE Nuclear Energy (Proprietary), February 1989.

C-4. *Turbine Bypass Out of Service Analysis for Carolina Power & Light Company's Brunswick Nuclear Plants Units 1 and 2*, NEDC-32813, Revision 3, GE Nuclear Energy (Proprietary), June 1998.

C-5. *GE14 Fuel Design Cycle-Independent Analyses for Brunswick Steam Electric Plants Units 1 and 2*, GE-NE-L12-00876-00-01P, GE Nuclear Energy (Proprietary), February 2001.

Appendix D
Implementation of GE14 Fuel

Reference D-1 provided the results of the cycle-independent analyses and evaluations supporting the implementation of GE14 fuel for the Brunswick Steam Electric Plant Units 1 and 2, including an update of the plant-specific ARTS power and flow dependent MCPR and MAPLHGR limits and a description of how to adjust them for different SLMCPR. Section 11 of this report presents the GE14 cycle-dependent MCPR limits.

Reference

D-1. *GE14 Fuel Design Cycle-Independent Analyses for Brunswick Steam Electric Plant Units 1 and 2,* GE-NE-L12-00876-00-01P, GE Nuclear Energy (Proprietary), February 2001.

Appendix E
Improved GE13 Thermal/Mechanical Limits

Reference E-1 documents the thermal-mechanical, thermal-hydraulic and LOCA assessments which have been performed to support the application of improved, i.e., "GE11/13-UPGRADE", LHGR limits for GE13 fuel in the Brunswick Steam Electric Plant (BSEP). Compliance with all licensing criteria have been confirmed. Additionally, reliability assessments have been performed and demonstrate that no significant change in fuel reliability performance is expected. On the basis of these assessments, it is concluded that the improved LHGR limits are acceptable for GE13 fuel in BSEP-1.

Reference

E-1. *Improved LHGR Limits (designated as 'GE11/13-UPGRADE') for GE13 Fuel in Brunswick 1 and 2*, GNF-J1103057-268, Global Nuclear Fuel – Americas (Proprietary), January 2002.

ENCLOSURE 4

BRUNSWICK STEAM ELECTRIC PLANT, UNIT NO. 1
DOCKET NO. 50-325/LICENSE NO. DPR-71
UNIT 1 CYCLE 14 CORE OPERATING LIMITS REPORT,
SUPPLEMENTAL RELOAD LICENSING REPORT,
LOSS-OF-COOLANT ACCIDENT ANALYSIS REPORT,
AND PLANT-SPECIFIC EMERGENCY CORE
COOLING SYSTEM (ECCS) EVALUATION

Global Nuclear Fuels Affidavit Regarding
Withholding From Public Disclosure
In Accordance With 10 CFR 2.790

Affidavit

I, Glen A. Watford, being duly sworn, depose and state as follows:

(1) I am Manager, Fuel Engineering Services, Global Nuclear Fuel – Americas, L.L.C. ("GNF-A") and have been delegated the function of reviewing the information described in paragraph (2) which is sought to be withheld, and have been authorized to apply for its withholding.

(2) The information sought to be withheld is contained in the document, NEDC-31624P, Supplement 1, Revision 6, "Loss-of-Coolant Accident Analysis Report for Brunswick Steam Electric Plant Unit 1 Reload 13 Cycle 14," November 2001.

(3) In making this application for withholding of proprietary information of which it is the owner or licensee, GNF-A relies upon the exemption from disclosure set forth in the Freedom of Information Act ("FOIA"), 5 USC Sec. 552(b)(4), and the Trade Secrets Act, 18 USC Sec. 1905, and NRC regulations 10 CFR 9.17(a)(4) and 2.790(a)(4) for "trade secrets and commercial or financial information obtained from a person and privileged or confidential" (Exemption 4). The material for which exemption from disclosure is here sought is all "confidential commercial information," and some portions also qualify under the narrower definition of "trade secret," within the meanings assigned to those terms for purposes of FOIA Exemption 4 in, respectively, Critical Mass Energy Project v. Nuclear Regulatory Commission, 975F2d871 (DC Cir. 1992), and Public Citizen Health Research Group v. FDA, 704F2d1280 (DC Cir. 1983).

(4) Some examples of categories of information which fit into the definition of proprietary information are:

a. Information that discloses a process, method, or apparatus, including supporting data and analyses, where prevention of its use by GNF-A's competitors without license from GNF-A constitutes a competitive economic advantage over other companies;

b. Information which, if used by a competitor, would reduce his expenditure of resources or improve his competitive position in the design, manufacture, shipment, installation, assurance of quality, or licensing of a similar product;

c. Information which reveals cost or price information, production capacities, budget levels, or commercial strategies of GNF-A, its customers, or its suppliers;

d. Information which reveals aspects of past, present, or future GNF-A customer–funded development plans and programs, of potential commercial value to GNF-A;

e. Information which discloses patentable subject matter for which it may be desirable to obtain patent protection.

The information sought to be withheld is considered to be proprietary for the reasons set forth in paragraphs (4)a. and (4)b., above.

(5) The information sought to be withheld is being submitted to NRC in confidence. The information is of a sort customarily held in confidence by GNF-A, and is in fact so held. Its initial designation as proprietary information, and the subsequent steps taken to prevent its unauthorized disclosure, are as set forth in (6) and (7) following. The information sought to be withheld has, to the best of

my knowledge and belief, consistently been held in confidence by GNF-A, no public disclosure has been made, and it is not available in public sources. All disclosures to third parties including any required transmittals to NRC, have been made, or must be made, pursuant to regulatory provisions or proprietary agreements which provide for maintenance of the information in confidence.

(6) Initial approval of proprietary treatment of a document is made by the manager of the originating component, the person most likely to be acquainted with the value and sensitivity of the information in relation to industry knowledge, or subject to the terms under which it was licensed to GNF-A. Access to such documents within GNF-A is limited on a "need to know" basis.

(7) The procedure for approval of external release of such a document typically requires review by the staff manager, project manager, principal scientist or other equivalent authority, by the manager of the cognizant marketing function (or his delegate), and by the Legal Operation, for technical content, competitive effect, and determination of the accuracy of the proprietary designation. Disclosures outside GNF-A are limited to regulatory bodies, customers, and potential customers, and their agents, suppliers, and licensees, and others with a legitimate need for the information, and then only in accordance with appropriate regulatory provisions or proprietary agreements.

(8) The information identified in paragraph (2) is classified as proprietary because it contains details of GNF-A's fuel design and licensing methodology.

The development of the methods used in these analyses, along with the testing, development and approval of the supporting methodology was achieved at a significant cost, on the order of several million dollars, to GNF-A or its licensor.

(9) Public disclosure of the information sought to be withheld is likely to cause substantial harm to GNF-A's competitive position and foreclose or reduce the availability of profit–making opportunities. The fuel design and licensing methodology is part of GNF-A's comprehensive BWR safety and technology base, and its commercial value extends beyond the original development cost. The value of the technology base goes beyond the extensive physical database and analytical methodology and includes development of the expertise to determine and apply the appropriate evaluation process. In addition, the technology base includes the value derived from providing analyses done with NRC–approved methods.

The research, development, engineering, analytical, and NRC review costs comprise a substantial investment of time and money by GNF-A or its licensor.

The precise value of the expertise to devise an evaluation process and apply the correct analytical methodology is difficult to quantify, but it clearly is substantial.

GNF-A's competitive advantage will be lost if its competitors are able to use the results of the GNF-A experience to normalize or verify their own process or if they are able to claim an equivalent understanding by demonstrating that they can arrive at the same or similar conclusions.

The value of this information to GNF-A would be lost if the information were disclosed to the public. Making such information available to competitors without their having been required to undertake a similar expenditure of resources would unfairly provide competitors with a windfall, and deprive GNF-A of the opportunity to exercise its competitive advantage to seek an adequate return on its large investment in developing and obtaining these very valuable analytical tools.

Affidavit

State of North Carolina)
County of New Hanover) SS:

Glen A. Watford, being duly sworn, deposes and says:

That he has read the foregoing affidavit and the matters stated therein are true and correct to the best of his knowledge, information, and belief.

Executed at Wilmington, North Carolina, this 5th day of February, 2002

Glen A. Watford
Global Nuclear Fuel – Americas, LLC

Subscribed and sworn before me this 5th day of February, 2002

Notary Public, State of North Carolina

My Commission Expires Feb. 6, 2006