Quad Cities Unit 1 Cycle 14

Core Operating Limits Report

ISSUANCE OF CHANGES SUMMARY

Affected Section	Affected Pages	Summary of Changes	Date
All	All	Original Issue (Cycle 11)	06/89
All	All	Original Issue (Cycle 12)	10/90
All	All	Original Issue (Cycle 13)	11/92
2	iv, 2 2-1 - 2-8	Converted Figures 2-1 through 2-8 to actual tables from References 4 and 5	01/93
All 2,4,5	All 2,4,5	Original Issue (Cycle 14), Added Section 2.3 on SLO, Revised Section 4.2 requiring OLMCPR penalty during coastdown operation, Added Section 5.0 on Analytical Methods	3/94

TABLE OF CONTENTS

REFERENCES iii

LIST OF TABLES iv

LIST OF FIGURES v

1.0 CONTROL ROD WITHDRAWAL BLOCK INSTRUMENTATION 1

1.1. TECHNICAL SPECIFICATION REFERENCE: 1

1.2. DESCRIPTION: 1

2.0 AVERAGE PLANAR LINEAR HEAT GENERATION RATE (APLHGR) 2

2.1 TECHNICAL SPECIFICATION REFERENCE: 2

2.2 DESCRIPTION: 2

3.0 LINEAR HEAT GENERATION RATE (LHGR) 3

3.1 TECHNICAL SPECIFICATION REFERENCE: 3

3.2 DESCRIPTION: 3

4.0 MINIMUM CRITICAL POWER RATIO (MCPR) 4

4.1 TECHNICAL SPECIFICATION REFERENCE: 4

4.2 DESCRIPTION: 4

5.0 ANALYTICAL METHODS: 5

REFERENCES

1. Commonwealth Edison Company and Iowa-Illinois Gas and Electric Company Docket No. 50-254, Quad Cities Station, Unit 1 Facility Operating License, License No. DPR-29.

2. Letter from D. M. Crutchfield to All Power Reactor Licenses and Applicants, Generic Letter 88-16; Concerning the Removal of Cycle-Specific Parameter Limits from Technical Specifications.

3. Supplemental Reload Licensing Report for Quad Cities Nuclear Power Station, Unit 1 Reload 13 Cycle 14, 23A7229, Revision 1, Class I, March 1994.

4. Quad Cities Nuclear Power Station, Units 1 and 2, SAFER/GESTR - LOCA Loss-of-Coolant Accident Analysis, NEDC-31345P, Revision 2, Class III, July 1989 (as amended).

5. Extended Operating Domain and Equipment Out-Of-Service for Quad Cities Nuclear Power Station Units 1 and 2, NEDC-31449, Revision 1, Class II, April 1992.

6. GE document GENE-637-03[illegible]193, Class II, "Analysis of End of Full Power Capability Coastdown with Load Following for Quad Cities 1 and 2, dated November, 1993.

LIST OF TABLES

Table	Title	Page
2-1	Maximum Average Planar Linear Heat Generation Rate (MAPLHGR) vs. Average Planar Exposure for GE8B-P8DQB300-7G4.0-80M-4WR-145-T.	2-1
2-2	Maximum Average Planar Linear Heat Generation Rate (MAPLHGR) vs. Average Planar Exposure for GE8B-P8DQB300-9G4.0-80M-4WR-145-T.	2-2
2-3	Maximum Average Planar Linear Heat Generation Rate (MAPLHGR) vs. Average Planar Exposure for GE8B-P8DQB301-9GZ-80M-4WR-145-T.	2-3
2-4	Maximum Average Planar Linear Heat Generation Rate (MAPLHGR) vs. Average Planar Exposure for GE9B-P8DWB258-4G4.0/3G3.0-80M-145-T.	2-4
2-5	Maximum Average Planar Linear Heat Generation Rate (MAPLHGR) vs. Average Planar Exposure for GE9B-P8DWB258-9GZ-80M-145-T.	2-5
2-6	Maximum Average Planar Linear Heat Generation Rate (MAPLHGR) vs. Average Planar Exposure for GE9B-P8DWB305-7GZ-80M-145-T.	2-6
2-7	Maximum Average Planar Linear Heat Generation Rate (MAPLHGR) vs. Average Planar Exposure for GE10-P8HXB311-8GZ-100M-145-T	2-7
2-8	Maximum Average Planar Linear Heat Generation Rate (MAPLHGR) vs. Average Planar Exposure for GE10-P8HXB312-7GZ-100M-145-T	2-8

LIST OF FIGURES

Figure	Title	Page
4-1	Kf Factor vs. % Core Flow.	4-1

1.0 CONTROL ROD WITHDRAWAL BLOCK INSTRUMENTATION (3.2/4.2)

1.1. TECHNICAL SPECIFICATION REFERENCE:

Technical Specification Table 3.2-3 and 3.6.H

1.2. DESCRIPTION:

The Rod Withdrawal Block Monitor Upscale Instrumentation Trip Setpoint for two recirculation loop operation is determined from the following relationship:

$$\leq (0.65)Wd + 43\% \text{ **}$$

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

Wd is the percent of drive flow required to produce a rated core flow of 98 million lb/hr. Trip level setting is in percent of rated power (2511 MWth).

2.0 AVERAGE PLANAR LINEAR HEAT GENERATION RATE (APLHGR) (3.5/4.5)

2.1 TECHNICAL SPECIFICATION REFERENCE:

Technical Specification 3.5.1

2.2 DESCRIPTION:

The Maximum Average Planar Linear Heat Generation Rates (MAPLHGR) versus Average Planar Exposure for GE8B-P8DQB300-7G4.0-80M-4WR-145-T is determined from Table 2-1.

The Maximum Average Planar Linear Heat Generation Rates (MAPLHGR) versus Average Planar Exposure for GE8B-P8DQB300-9G4.0-80M-4WR-145-T is determined from Table 2-2.

The Maximum Average Planar Linear Heat Generation Rates (MAPLHGR) versus Average Planar Exposure for GE8B-P8DQB301-9GZ-80M-4WR-145-T is determined from Table 2-3.

The Maximum Average Planar Linear Heat Generation Rates (MAPLHGR) versus Average Planar Exposure for GE9B-P8DWB258-4G4.0/3G3.0-80M-145-T is determined from Table 2-4.

The Maximum Average Planar Linear Heat Generation Rates (MAPLHGR) versus Average Planar Exposure for GE9B-P8DWB258-9GZ-80M-145-T is determined from Table 2-5.

The Maximum Average Planar Linear Heat Generation Rates (MAPLHGR) versus Average Planar Exposure for GE9B-P8DWB305-7GZ-80M-145-T is determined from Table 2-6.

The Maximum Average Planar Linear Heat Generation Rates (MAPLHGR) versus Average Planar Exposure for GE10-P8HXB311-8GZ-100M-145-T is determined from Table 2-7.

The Maximum Average Planar Linear Heat Generation Rates (MAPLHGR) versus Average Planar Exposure for GE10-P8HXB312-7GZ-100M-145-T is determined from Table 2-8.

2.3 SINGLE LOOP OPERATION MULTIPLIER

The tabulated values are multiplied by 0.85 whenever Quad Cities enters Single Loop Operation.

TABLE 2-1

MAPLHGR vs. AVERAGE PLANAR EXPOSURE
FOR BUNDLE TYPE GE8B-P8DQB300-7G4.0-80M-4WR-145-T

LATTICE 565 : P8DQL071-NOG-80M-4WR-T
LATTICE 584 : P8DQL319-7G4.0-80M-4WR-T
LATTICE 649 : P8DQL071-7GE1-80M-4WR-T

AVERAGE PLANAR EXPOSURE (GWd/ST)	MAPLHGR LIMITS (KW/FT)		
	565	584	649
0.2	11.34	11.58	11.34
2.0	11.26	11.78	11.26
4.0	11.40	12.34	11.40
6.0	11.55	12.87	11.55
8.0	11.66	13.14	11.66
10.0	11.72	13.37	11.72
12.5	11.48	13.33	11.48
15.0	11.15	13.00	11.15
20.0	10.46	12.36	10.46
39.8	6.14	-	6.14
46.3	-	7.12	-

TABLE 2-2

MAPLHGR vs. AVERAGE PLANAR EXPOSURE
FOR BUNDLE TYPE GE8B-P8DQB300-9G4.0-80M-4WR-145-T

LATTICE 565 : P8DQL071-NOG-80M-4WR-T
LATTICE 644 : P8DQL320-9G4.0-80M-4WR-T
LATTICE 686 : P8DQL071-9GE2-80M-4WR-T

AVERAGE PLANAR EXPOSURE (GWd/ST)	MAPLHGR LIMITS (KW/FT)		
	565	644	686
0.2	11.34	11.24	11.34
2.0	11.26	11.48	11.26
4.0	11.40	12.12	11.40
6.0	11.55	12.75	11.55
8.0	11.66	13.11	11.66
10.0	11.72	13.32	11.72
12.5	11.48	13.36	11.48
15.0	11.15	13.01	11.15
20.0	10.46	12.33	10.46
39.8	6.14	-	6.14
46.1	-	7.16	-

TABLE 2-3

MAPLHGR vs. AVERAGE PLANAR EXPOSURE FOR BUNDLE TYPE GE8B-P8DQB301-9GZ-80M-4WR-145-T

LATTICE 565 : P8DQL071-NOG-80M-T
LATTICE 854 : P8DQL320-6G2.0-80M-T
LATTICE 855 : P8DQL320-3G3.0/6G2.0-80M-T
LATTICE 856 : P8DQL071-9GE-80M-T

AVERAGE PLANAR EXPOSURE (GWd/ST)	MAPLHGR LIMITS (KW/FT)			
	565	854	855	856
0.0	11.57	12.18	11.41	11.57
0.2	11.50	12.23	11.49	11.50
1.0	11.30	12.34	11.63	11.30
2.0	11.28	12.60	11.94	11.28
3.0	11.33	12.89	12.34	11.33
4.0	11.40	13.01	12.61	11.40
5.0	11.48	13.14	12.82	11.48
6.0	11.55	13.24	13.02	11.55
7.0	11.61	13.31	13.18	11.61
8.0	11.66	13.34	13.28	11.66
9.0	11.69	13.35	13.34	11.69
10.0	11.72	13.35	13.37	11.72
12.5	11.44	13.33	13.31	11.44
15.0	11.07	12.95	12.94	11.07
20.0	10.29	12.23	12.21	10.29
25.0	9.50	11.50	11.48	9.50
35.0	7.93	10.13	10.11	7.93
45.0	-	8.52	8.48	-
50.0	-	6.27	6.21	-

TABLE 2-4

MAPLHGR vs. AVERAGE PLANAR EXPOSURE
FOR BUNDLE TYPE GE9B-P8DWB258-4G4.0/3G3.0-80M-145-T

LATTICE 731 : P8DWL071-NOG-80M-T
LATTICE 1002 : P8DWL278-4G4.0/3G3.0-80M-T
LATTICE 1003 : P8DWL290-4G4.0/3G3.0-80M-T
LATTICE 1004 : P8DWL071-7GE-80M-T

AVERAGE PLANAR EXPOSURE (GWd/ST)	MAPLHGR LIMITS (KW/FT)			
	731	1002	1003	1004
0.0	11.64	12.02	11.23	11.64
0.2	11.57	12.09	11.30	11.57
1.0	11.38	12.25	11.47	11.38
2.0	11.36	12.46	11.69	11.36
3.0	11.41	12.66	11.98	11.41
4.0	11.49	12.86	12.20	11.49
5.0	11.56	13.07	12.40	11.56
6.0	11.63	13.20	12.54	11.63
7.0	11.69	13.30	12.69	11.69
8.0	11.74	13.40	12.84	11.74
9.0	11.78	13.46	12.97	11.78
10.0	11.81	13.50	13.06	11.81
12.5	11.54	13.44	13.04	11.54
15.0	11.16	13.07	12.79	11.16
20.0	10.37	12.34	12.29	10.37
25.0	9.58	11.66	11.75	9.58
35.0	8.01	10.34	10.24	8.01
43.7	4.71	-	-	4.71
45.0	-	8.33	8.15	-
50.9	-	-	5.10	-
52.4	-	4.90	-	-

TABLE 2-5

MAPLHGR vs. AVERAGE PLANAR EXPOSURE FOR BUNDLE TYPE GE9B-P8DWB258-9GZ-80M-145-T

LATTICE 731 : P8DWL071-NOG-80M-T
LATTICE 1005 : P8DWL277-7G3.0-80M-T
LATTICE 1006 : P8DWL288-7G3.0-80M-T
LATTICE 1007 : P8DWL288-2G4.0/7G3.0-80M-T
LATTICE 1008 : P8DWL071-9GE-80M-T

AVERAGE PLANAR EXPOSURE (GWd/ST)	MAPLHGR LIMITS (KW/FT)				
	731	1005	1006	1007	1008
0.0	11.64	12.07	11.27	10.75	11.64
0.2	11.57	12.14	11.35	10.85	11.57
1.0	11.38	12.33	11.55	11.04	11.38
2.0	11.36	12.56	11.80	11.33	11.36
3.0	11.41	12.79	12.10	11.70	11.41
4.0	11.49	13.03	12.31	11.99	11.49
5.0	11.56	13.23	12.53	12.25	11.56
6.0	11.63	13.33	12.71	12.47	11.63
7.0	11.69	13.41	12.84	12.67	11.69
8.0	11.74	13.45	12.94	12.86	11.74
9.0	11.78	13.47	13.00	12.99	11.78
10.0	11.81	13.47	13.05	13.08	11.81
12.5	11.54	13.41	13.02	13.03	11.54
15.0	11.16	13.04	12.77	12.78	11.16
20.0	10.37	12.32	12.27	12.28	10.37
25.0	9.58	11.64	11.73	11.73	9.58
35.0	8.01	10.32	10.23	10.20	8.01
43.7	4.71	-	-	-	4.71
45.0	-	8.33	8.15	8.12	-
50.7	-	-	-	5.12	-
50.9	-	-	5.09	-	-
52.4	-	4.89	-	-	-

TABLE 2-6

MAPLHGR vs. AVERAGE PLANAR EXPOSURE FOR BUNDLE TYPE GE9B-P8DWB305-7GZ-80M-145-T

LATTICE 731 : P8DWL071-NOG-80M-T
LATTICE 1516 : P8DWL339-3G4.0/4G3.0-80M-T
LATTICE 1517 : P8DWL339-7G3.0-80M-T
LATTICE 1518 : P8DWL324-7G3.0-80M-T
LATTICE 1061 : P8DWL071-7GF1-80M-T

AVERAGE PLANAR EXPOSURE (GWD/ST)	MAPLHGR LIMITS (KW/FT)				
	731	1516	1517	1518	1061
0.0	11.64	12.00	12.00	11.97	11.64
0.2	11.57	12.10	12.11	12.04	11.57
1.0	11.38	12.26	12.27	12.11	11.38
2.0	11.36	12.42	12.44	12.31	11.36
3.0	11.41	12.59	12.60	12.59	11.41
4.0	11.49	12.74	12.75	12.91	11.49
5.0	11.56	12.88	12.89	13.09	11.56
6.0	11.63	13.01	13.01	13.23	11.63
7.0	11.69	13.10	13.06	13.36	11.69
8.0	11.74	13.13	13.09	13.48	11.74
9.0	11.78	13.15	13.12	13.54	11.78
10.0	11.81	13.16	13.15	13.56	11.81
12.5	11.54	13.07	13.08	13.52	11.54
15.0	11.16	12.72	12.73	13.12	11.16
20.0	10.37	12.04	12.05	12.35	10.37
25.0	9.58	11.39	11.40	11.60	9.58
35.0	8.01	10.15	10.15	10.19	8.01
43.7	4.71	-	-	-	4.71
45.0	-	8.69	8.69	8.68	-
50.7	-	-	5.90	-	-
50.7	-	5.89	-	-	-
51.2	-	-	-	5.78	-

TABLE 2-7

MAPLHGR vs. AVERAGE PLANAR EXPOSURE FOR BUNDLE TYPE GE10-P8HXB311-8GZ-100M-145-T

LATTICE 1807 : P8HXL071-8GE-100M-CECO
LATTICE 1806 : P8HXL335-8G3.0-100M-CECO
LATTICE 1805 : P8HXL353-2G4.0/6G3.0-100M-CECO
LATTICE 1804 : P8HXL335-4G4.0/4G3.0-100M-CECO
LATTICE 1054 : P8HXL071-1[illegible]oG-100M-CECO

AVERAGE PLANAR EXPOSURE (GWD/ST)	MAPLHGR LIMITS (KW/FT)				
	1054	1806	1805	1804	1807
0.0	11.85	12.06	11.10	12.02	11.85
0.2	11.78	12.12	11.14	12.08	11.78
1.0	11.59	12.28	11.27	12.22	11.59
2.0	11.57	12.48	11.51	12.40	11.57
3.0	11.61	12.68	11.81	12.57	11.61
4.0	11.68	12.89	12.14	12.76	11.68
5.0	11.75	13.11	12.50	12.94	11.75
6.0	11.81	13.29	12.88	13.12	11.81
7.0	11.86	13.41	13.19	13.28	11.86
8.0	11.91	13.47	13.28	13.40	11.91
9.0	11.94	13.48	13.34	13.46	11.94
10.0	11.97	13.46	13.39	13.49	11.97
12.5	11.75	13.34	13.44	13.33	11.75
15.0	11.38	12.96	13.09	12.95	11.38
20.0	10.59	12.22	12.40	12.22	10.59
25.0	9.81	11.51	11.73	11.50	9.81
35.0	8.26	10.13	10.39	10.13	8.26
44.9	4.93	-	-	-	4.93
45.0	-	8.55	9.00	8.55	-
50.4	-	5.85	-	-	-
50.5	-	-	-	5.85	-
51.5	-	-	5.86	-	-

TABLE 2-8

MAPLHGR vs. AVERAGE PLANAR EXPOSURE
FOR BUNDLE TYPE GE10-P8HXB312-7GZ-100M-145-T

LATTICE 1811 : P8HXL071-7GE-100M-CECO
LATTICE 1810 : P8HXL336-7G3.0-100M-CECO
LATTICE 1809 : P8HXL354-1G4.0/6G3.0-100M-CECO
LATTICE 1808 : P8HXL336-3G4.0/4G3.0-100M-CECO
LATTICE 1054 : P8HXL071-NoG-100M-CECO

AVERAGE PLANAR EXPOSURE (GWD/ST)	MAPLHGR LIMITS (KW/FT)				
	1054	1810	1809	1808	1811
0.0	11.85	12.04	11.27	12.01	11.85
0.2	11.78	12.11	11.31	12.08	11.78
1.0	11.59	12.27	11.42	12.23	11.59
2.0	11.57	12.49	11.65	12.43	11.57
3.0	11.61	12.72	11.93	12.65	11.61
4.0	11.68	12.96	12.24	12.88	11.68
5.0	11.75	13.15	12.58	13.09	11.75
6.0	11.81	13.30	12.94	13.22	11.81
7.0	11.86	13.41	13.15	13.32	11.86
8.0	11.91	13.46	13.32	13.40	11.91
9.0	11.94	13.47	13.43	13.45	11.94
10.0	11.97	13.45	13.50	13.47	11.97
12.5	11.75	13.35	13.45	13.35	11.75
15.0	11.38	12.97	13.10	12.97	11.38
20.0	10.59	12.24	12.41	12.23	10.59
25.0	9.81	11.52	11.74	11.51	9.81
35.0	8.26	10.15	10.41	10.14	8.26
44.9	4.93	-	-	-	4.93
45.0	-	8.60	9.01	8.61	-
50.5	-	5.85	-	-	-
50.6	-	-	-	5.85	-
51.6	-	-	5.86	-	-

3.0 LINEAR HEAT GENERATION RATE (LHGR) (3.5/4.5)

3.1 TECHNICAL SPECIFICATION REFERENCE:

Technical Specification 3.5.J

3.2 DESCRIPTION:

A. The LHGR limit is 14.4 Kw/ft for all fuel types in the Q1C14 core:

1. GE8B-P8DQB300-7G4.0-80M-4WR-145-T
2. GE8B-P8DQB300-9G4.0-80M-4WR-145-T
3. GE8B-P8DQB301-9GZ-80M-4WR-145-T
4. GE9B-P8DWB258-4G4.0/3G3.0-80M-145-T
5. GE9B-P8DWB258-9GZ-80M-145-T
6. GE9B-P8DWB305-7GZ-80M-145-T
7. GE10-P8HXB311-8GZ-100M-145-T
8. GE10-P8HXB312-7GZ-100M-145-T

4.0 MINIMUM CRITICAL POWER RATIO (MCPR) (3.5/4.5)

4.1 TECHNICAL SPECIFICATION REFERENCE:

Technical Specifications 3.5.K and 3.6.H

4.2 DESCRIPTION:

During steady-state operation at rated core flow, the Operating Limit MCPR (OLMCPR) shall be greater than or equal:

1.29 for $t_{ave} \leq 0.68$ seconds

1.39 for $t_{ave} \geq 0.86$ seconds

$(0.557)t_{ave} + 0.911$ for $0.68 < t_{ave} < 0.86$ seconds

where t_{ave} = mean 20% scram insertion time for all surveillance data from Technical Specification 4.3.C which has been generated in the current cycle.

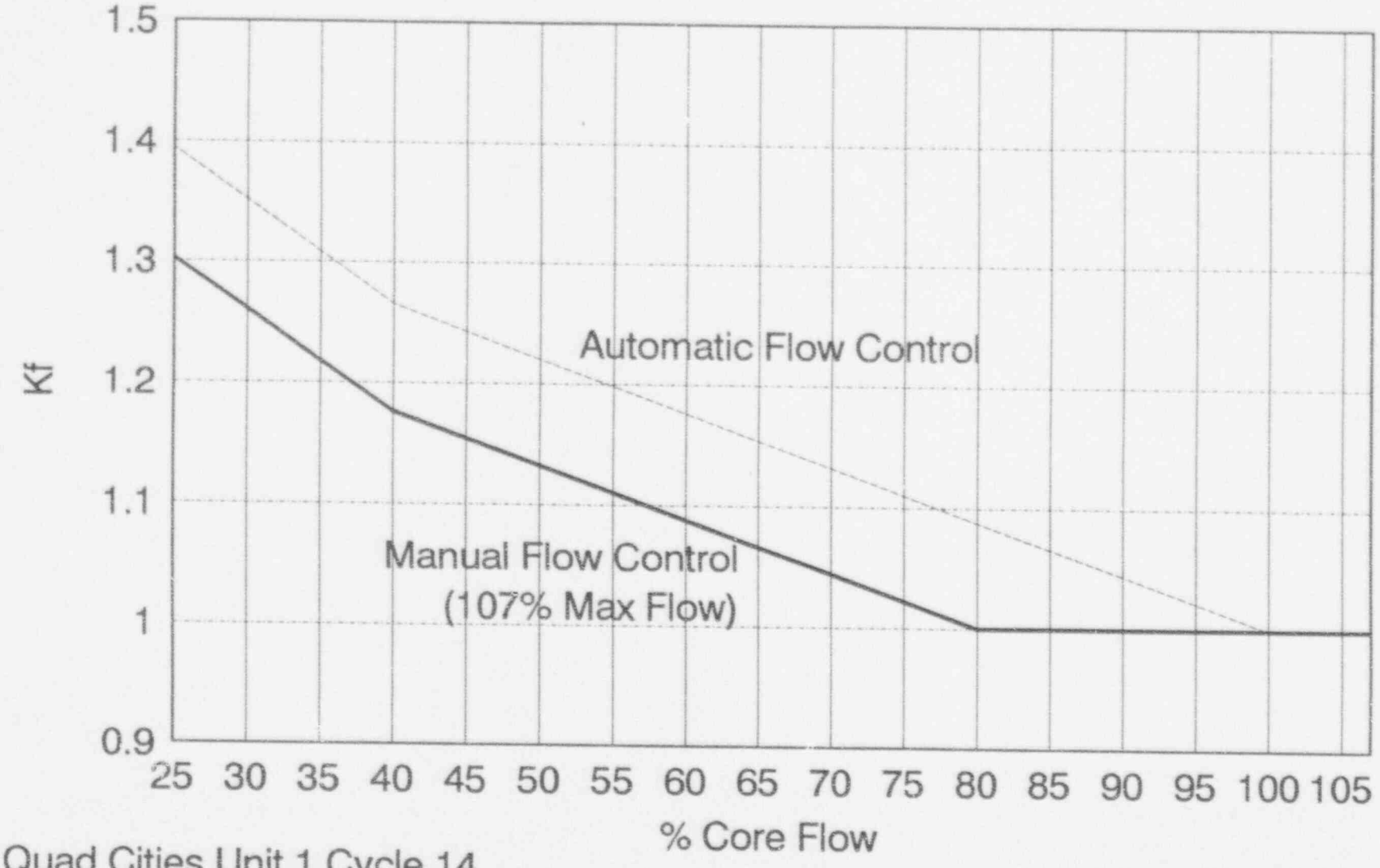
For core flows other than rated, these nominal values of OLMCPR shall be increased by a factor of Kf where Kf is as shown in Figure 4-1.

A cycle independent OLMCPR of 1.32 (Option B) was calculated (Reference 5) for operation with a Feedwater Heater Out-of-Service (FWHOOS). Therefore, the OLMCPR, calculated using the above information, shall be increased by 0.03 whenever operating with a FWHOOS. This event, which conservatively bounds the requirements detailed within the EOD/EOOS document (Reference 5), goes beyond all normal operating conditions in the SRLR (Reference 3).

Q1C14 has been approved for operating up to 15% (Reference 6) above equilibrium coastdown power level with multiple control rods inserted. At End of Full Power Capability (EFPC) a generic MCPR operating limit MCPR penalty of 0.06 must be added to the operating limit MCPR in order to exceed equilibrium coastdown power.

FIGURE 4-1

Kf FACTOR



5.0 Analytical Methods

The analytical methods used to determine the core operating limits shall be those previously reviewed and approved by the NRC in the latest approved revision or supplement of the topical reports describing the methodology. For Quad Cities Unit 1, the topical reports are:

(1) NEDE-24011-P-A "General Electric Standard Application for Reactor Fuel," (latest approved revision).

(2) Commonwealth Edison Topical Report NFSR-0085, "Benchmark of BWR Nuclear Design Methods," (latest approved revision).

(3) Commonwealth Edison Topical Report NFSR-0085, Supplement 1, Quad Cities Gamma Scan Comparisons," (latest approved revision).

(4) Commonwealth Edison Topical Report NFSR-0085, Supplement 2, Design Methods - Neutronic Licensing Analyses," (latest approved revision).