Core Operating Limits Report

Dresden Station Unit 2

Cycle 12

Revision 1

May 1990

Issuance of Changes Summary

Affected Section	Affected Pages	Summary of Changes	Date
All	All	Original Issue	12/89
5.0	5-1,5-2,5-4	Channel Bow MCPR Adjusment	5/90

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References

1. Commonwealth Edison Company Docket No. 50-249, Dresden Nuclear Power Station, Unit 2, Facility Operating License DPR-19.

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 Technical Specifications.

List of Figures

List of Tables

1.0 CONTROL ROD WITHDRAWAL BLOCK INSTRUMENTATION

1.1 Technical Specification Reference

Technical Specification 3.2.C - Control Rod Block Actuation

1.2 Description

The Rod Block Monitor Upscale Instrumentation Setpoints are determined from the relationships shown in Table 1.2-1.

Table 1.2-1

Control Rod Withdrawal Block Instrumentation Setpoints

Trip Function	Trip Level Setting
Rod Block Monitor Upscale (Flow Bias)	
Dual Loop Operation	Less than or equal to (0.65 Wd plus 45) (See Note)
Single Loop Operation	Less than or equal to (0.65 Wd plus 41) (See Note)

Note: Wd - percent of drive flow required to produce a rated core flow of 98 Mlb/hr.

2.0 AVERAGE PLANAR LINEAR HEAT GENERATION RATE

2.1 Technical Specification References

Section 2.2: Technical Specification 3.5.I - Average Planar LHGR

Section 2.3: See Table 2.3-1

2.2 Description

The Maximum Average Planar Linear Heat Generation Rate (MAPLHGR) versus Bundle Average Exposure for ANF 8x8 fuel is determined from Figure 2.2-1.

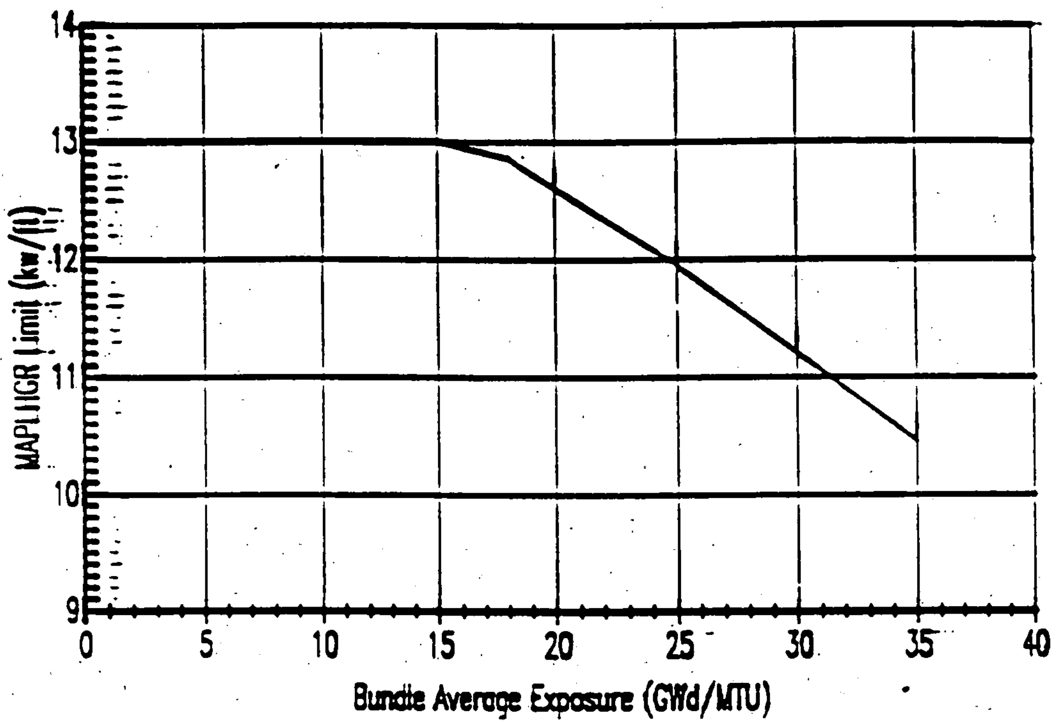
The Maximum Average Planar Linear Heat Generation Rate (MAPLHGR) versus Bundle Average Exposure for ANF 9x9 fuel is determined from Figure 2.2-2.

The Maximum Average Planar Linear Heat Generation Rate (MAPLHGR) versus Average Planar Exposure for the GE 8X8 LTAs is determined from Figure 2.2-3.

2.3 MAPLHGR Multipliers

The appropriate multiplicative factors to apply to the base MAPLHGR limits specified in Section 2.2 are shown in Table 2.3-1.

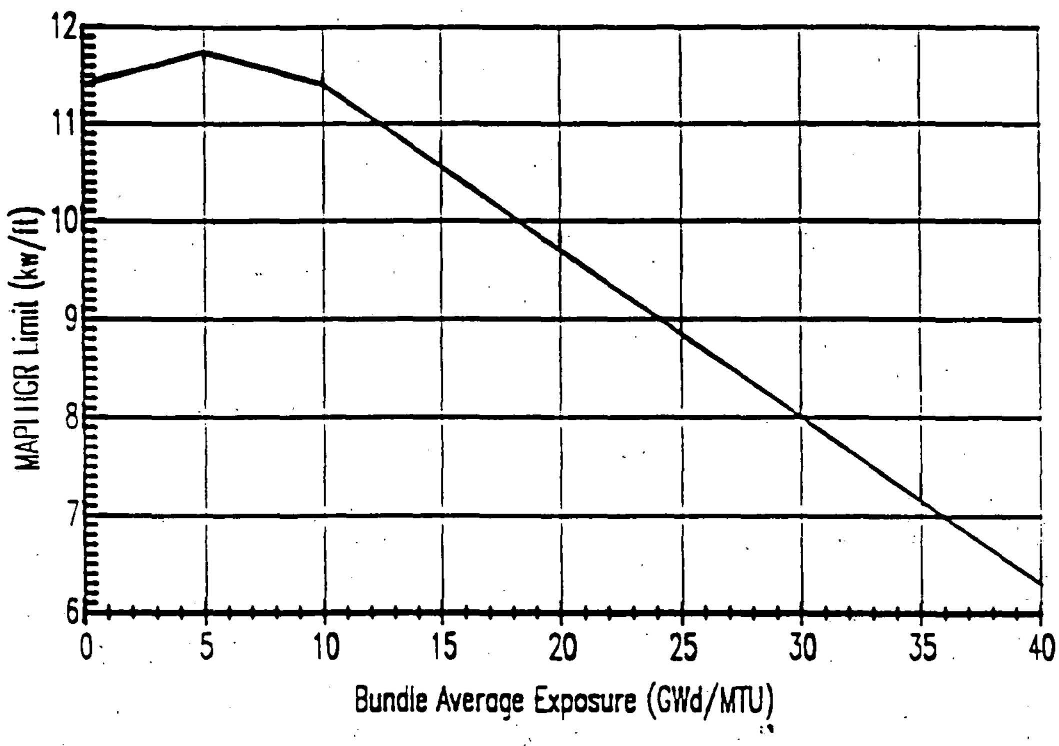
Figure 2.2-1
MAPLHGR Limit vs. Bundle Average Exposure
ANF 8x8 Fuel



The above graph is based on the following MAPLHGR summary for ANF 8x8 fuel design.

Bundle Average Exposure (GWd/MTU)	MAPLHGR Limit, Kw/ft
0	13.00
10	13.00
15	13.00
18	12.85
20	12.60
25	11.95
30	11.20
35	10.45

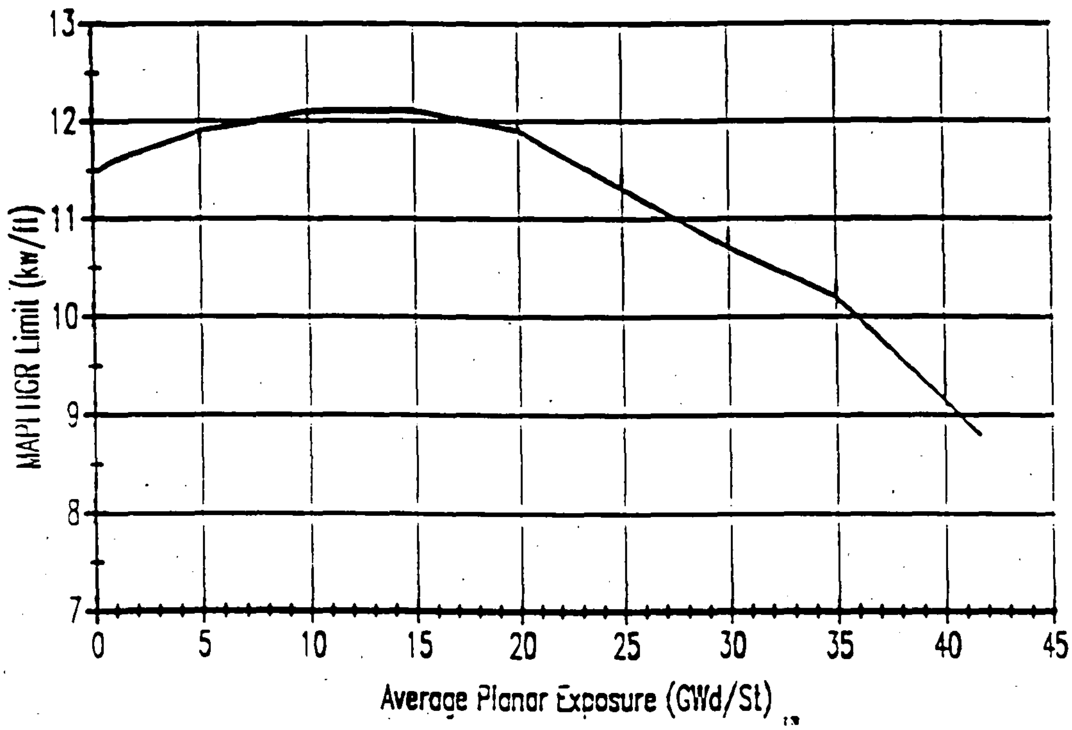
Figure 2.2-2
MAPLHGR Limit vs. Bundle Average Exposure
ANF 9x9 Fuel



The above graph is based on the following MAPLHGR summary for ANF 9x9 fuel design.

Bundle Average Exposure (GWD/MTU)	MAPLHGR Limit, Kw/ft
0	11.40
5	11.75
10	11.40
15	10.55
20	9.70
25	8.85
30	8.00
35	7.15
40	6.30

Figure 2.2-3
MAPLHGR Limit vs. Average Planar Exposure
GE 8X8 LTAs



The above graph is based on the following MAPLHGR summary for the GE LTA fuel design.

Average Planar Exposure (GWD/STU)	MAPLHGR Limit, Kw/ft
0.2	11.5
1.0	11.6
5.0	11.9
10.0	12.1
15.0	12.1
20.0	11.9
25.0	11.3
30.0	10.7
35.0	10.2
41.6	8.8

Table 2.3-1
MAPLHGR Multipliers

Specification	Title of TS	Scenario	Multiplicative Factors ANF 8x8	ANF 9x9
3.5.D.2	Automatic Pressure Relief Subsystems	One Relief Valve Out of Service.	0.89	0.76
3.5.I and 3.6.H.3.f	Average Planar LHGR Recirc Pump Flow Limitations	Single Loop Operation	0.91	0.91
3.5.I and 3.6.H.3.f	Average Planar LHGR Recirc Pump Flow Limitations	Single Loop Operation and One Relief Valve Out of Service.	0.89	0.76

3.0 LOCAL STEADY STATE LHGR

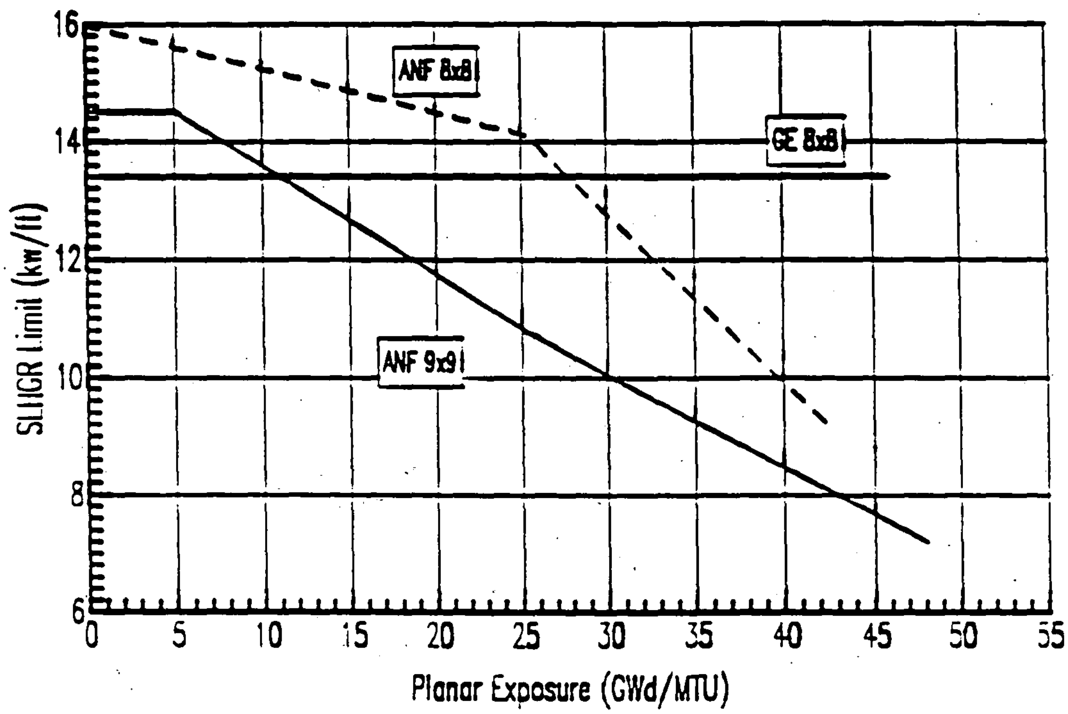
3.1 Technical Specification Reference

Technical Specification 3.5.J - Local Steady State LHGR

3.2 Description

The Local Steady State LHGR (SLHGR) limit versus Average Planar Exposure for all resident fuel is determined from Figure 3.2-1.

Figure 3.2-1
Steady State Linear Heat Generation Rate (SLHGR) Limit
vs. Planar Exposure



GE 8X8 Fuel

Exposure	LHGR
0.0	13.4
45.8	13.4

ANF 8x8 Fuel

Exposure	LHGR
0.0	16.0
25.4	14.1
42.0	9.3

ANF 9x9 Fuel

Exposure	LHGR
0.0	14.5
5.0	14.5
25.2	10.8
48.0	7.2

4.0 LOCAL TRANSIENT LHGR

4.1 Technical Specification Reference

Technical Specification 3.5.K - Local Transient LHGR

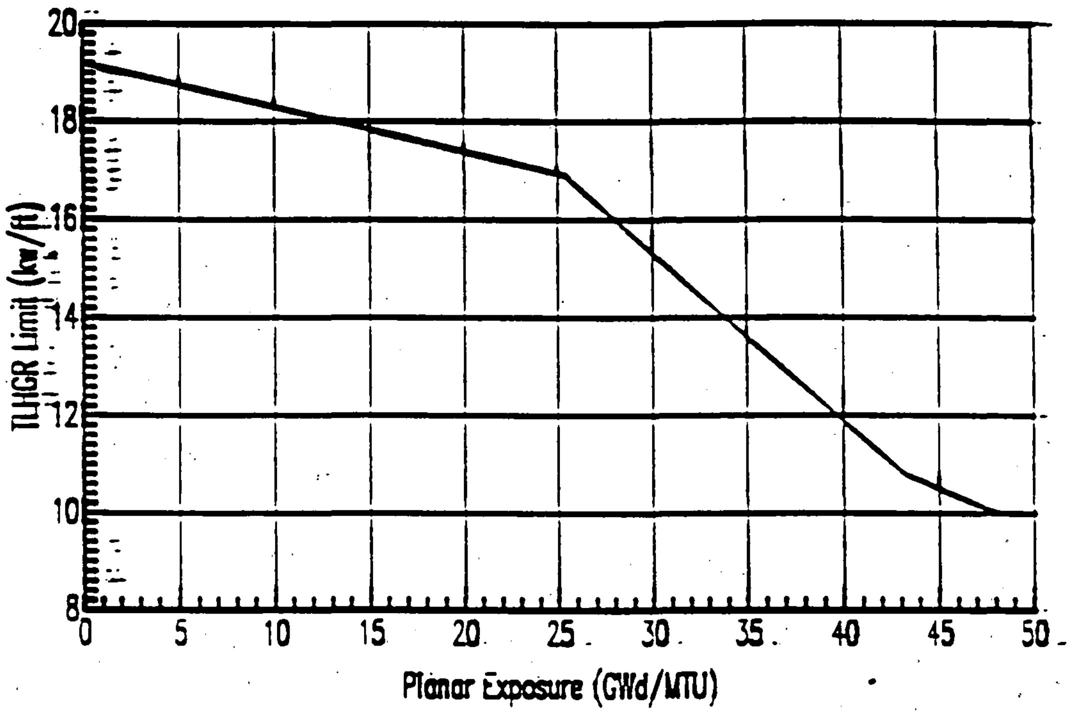
4.2 Description

The Local Transient LHGR (TLHGR) limit versus Average Planar Exposure for ANF 8x8 fuel is determined from Figure 4.2-1.

The TLHGR limit versus Average Planar Exposure for ANF 9x9 fuel is determined from Figure 4.2-2.

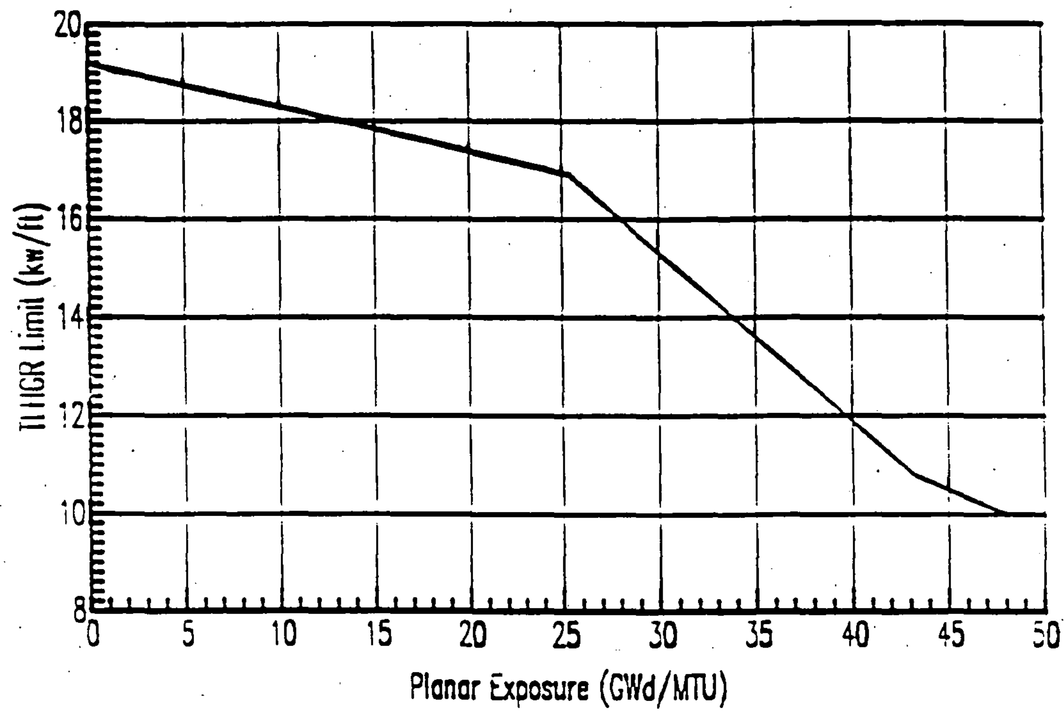
For core modeling purposes, the TLHGR limit versus Average Planar Exposure for the GE 8X8 LTAs is 1.2 * (SLHGR Limit). The SLHGR limit is determined from Figure 3.2-1

Figure 4.2-1
Transient Linear Heat Generation Rate (TLHGR) Limit
vs. Planar Exposure for ANF 8x8 Fuel



Exposure	LHGR
0.0	19.2
25.4	16.9
43.2	10.8
48.0	10.0

Figure 4.2-2
Transient Linear Heat Generation Rate (TLHGR) Limit
vs. Planar Exposure for ANF 9x9 Fuel



Exposure	LHGR
0.0	19.2
25.4	16.9
43.2	10.8
48.0	10.0

5.0 MINIMUM CRITICAL POWER RATIO OPERATING LIMIT

5.1 Technical Specification References

Technical Specification 3.5.L - Minimum Critical Power Ratio (MCPR)

5.2 Description

a. The MCPR Operating Limit at rated flow versus measured scram time is shown in Figure 5.2-1. The MCPR Operating Limit is 1.45 or greater whenever the measured 90% insertion time is 3.50 seconds or less.

b. During Manual Flow Control, the MCPR Operating Limit at reduced flow rates can be determined from:

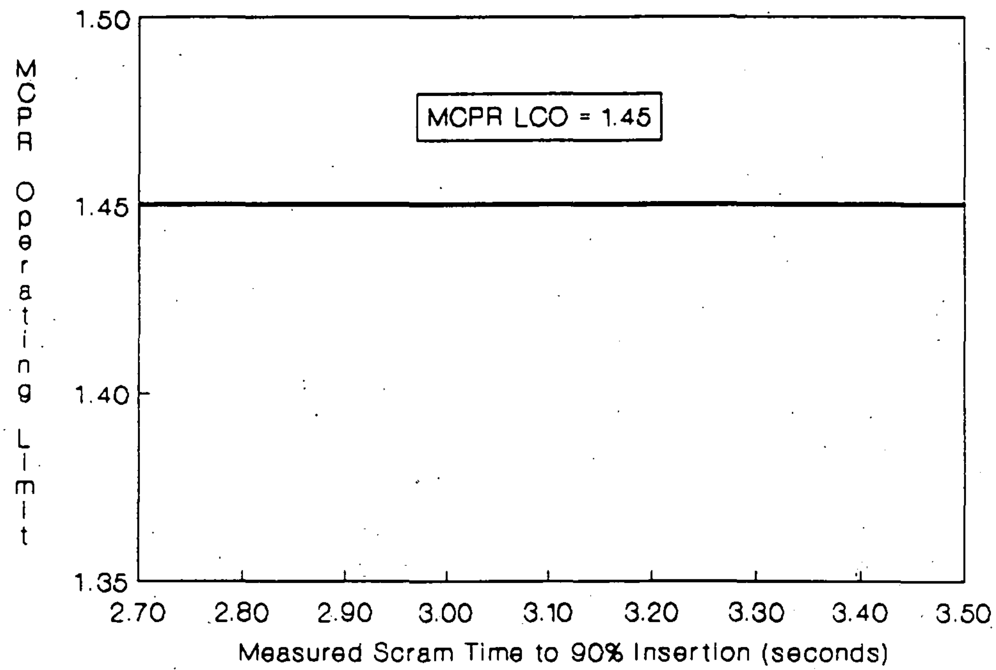
   i. Figure 5.2-2 using the appropriate flow rate, or

   ii. The rated flow MCPR Operating Limit determined via Figure 5.2-1,

   whichever is greater.

c. During Automatic Flow Control, the MCPR Operating Limit at reduced flow rates can be determined from Figure 5.2-3 using the appropriate flow rate and rated flow MCPR Operating Limit, which is obtained from Figure 5.2-1. Linear interpolation between the curves on Figure 5.2-3 is permissible.

Figure 5.2-1
MCPR Limit vs. Measured Scram Time to 90% Insertion
Rated Flow Conditions

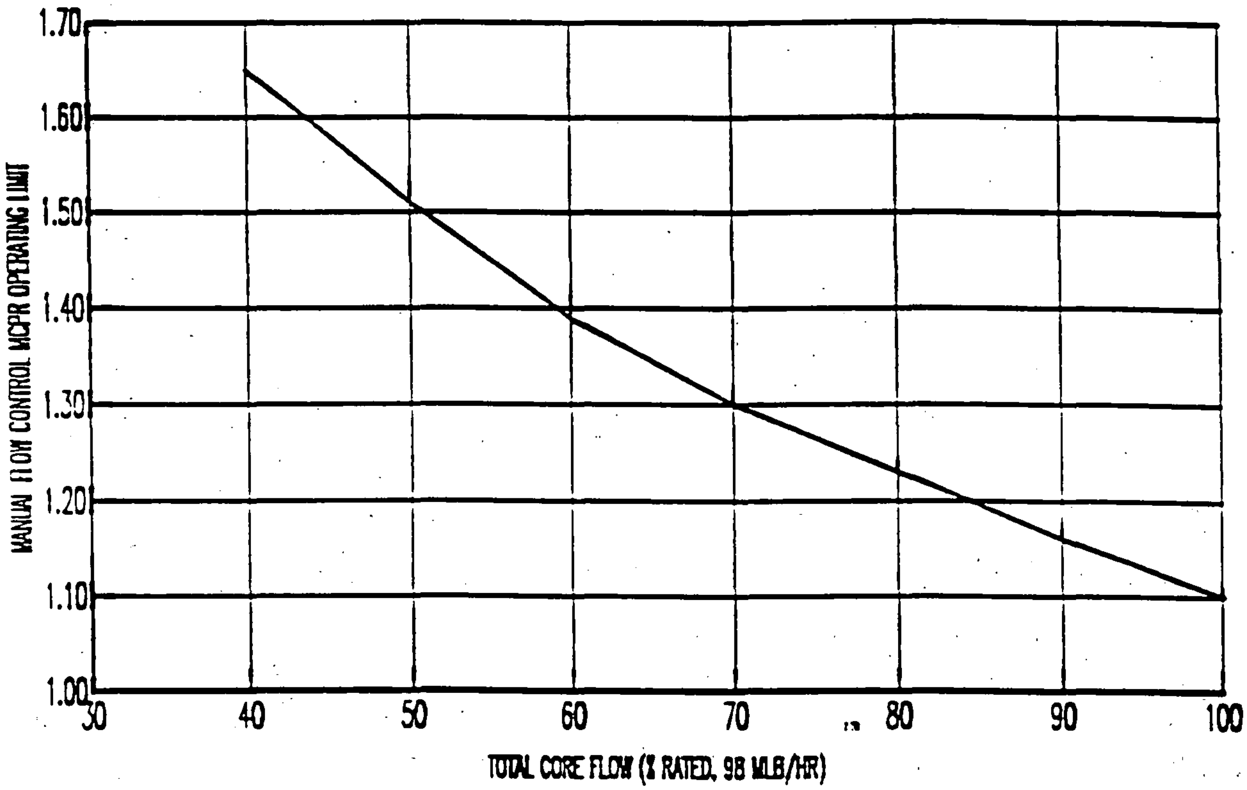


The above graph demonstrates the following dependence of the MCPR Operating Limit versus measured scram time to 90% insertion for all resident fuel types:

MCPR LCO = 1.45

Note that the MCPR Operating Limit is not a function of scram time assuming the Technical Specification scram time limit of 3.50 seconds to 90% insertion (3.3.C) is met.

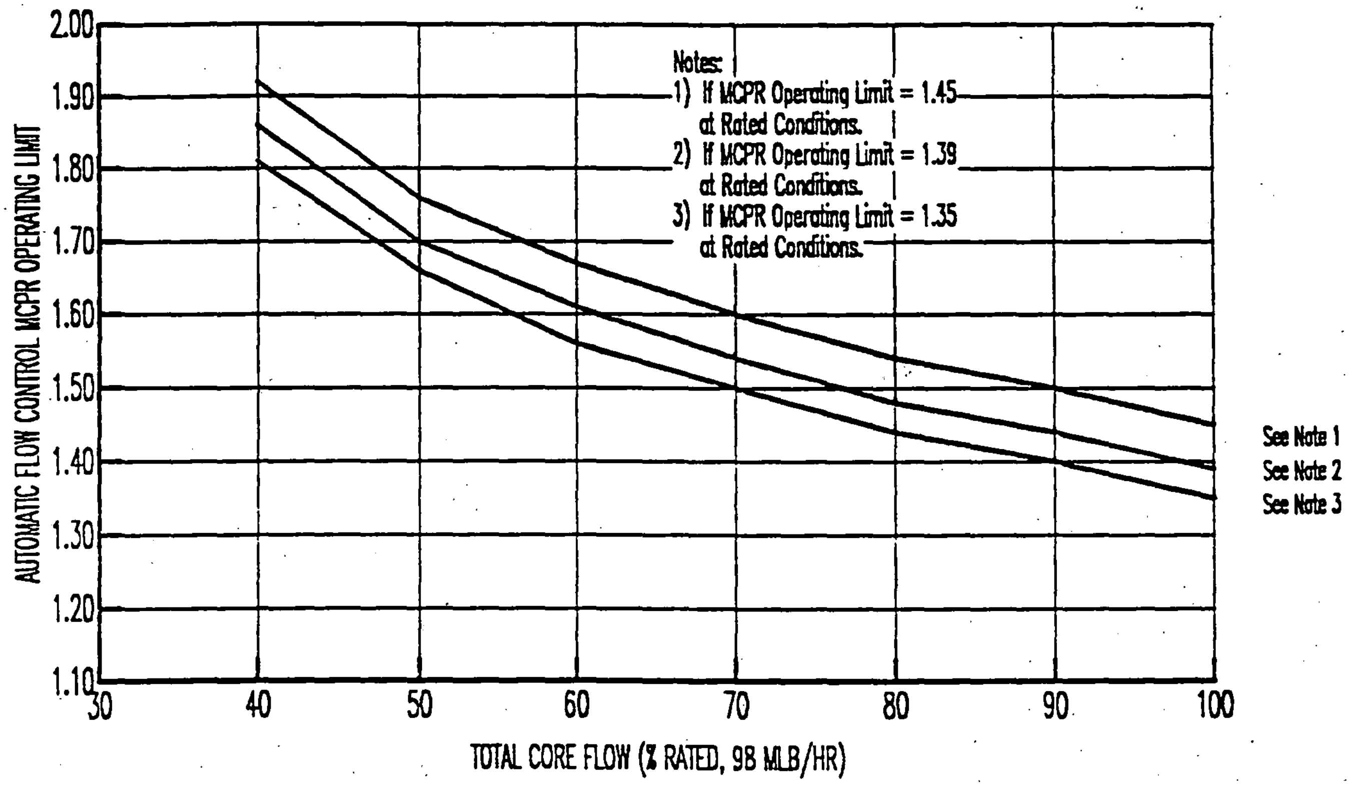
Figure 5.2-2
MCPR Operating Limit for Manual Flow Control



The above curve is based on the following MCPR operating limit summary for Manual Flow Control and all fuel types:

Total Core Flow (% Rated)	MCPR Operating Limit
100	1.10
90	1.16
80	1.23
70	1.30
60	1.39
50	1.51
40	1.65

Figure 5.2-3
MCPR Operating Limit for Automatic Flow Control



The above curve is based on the following MCPR operating limit summary for Automatic Flow Control and all fuel types:

Total Core Flow (% Rated)	MCPR Operating Limit* 1.35	1.39	1.45
100	1.35	1.39	1.45
90	1.40	1.44	1.50
80	1.44	1.48	1.54
70	1.50	1.54	1.60
60	1.56	1.61	1.67
50	1.66	1.70	1.76
40	1.81	1.86	1.92

* Column Headers are MCPR operating limits at rated flow.

DRESDEN UNIT 2 CYCLE 12

MCPR ADJUSTMENT

SAFETY EVALUATION

Background

Commonwealth Edison (CECo) recently completed its review of NRC Bulletin 90-02 (Reference 1). The bulletin requested that all BWR licensees address the effect of channel bow on thermal margin in Boiling Water Reactors (BWRs), particularly the bow of channels that are being reused for a second bundle lifetime. Such reuse may result in high channel exposures, leading to excessive channel bow and an increase in the assembly wide-wide water gap. This additional thermalization increases the peaking of the fuel pins near the control blade, thereby potentially decreasing thermal margin.

The CECo evaluation determined that the full flow operating MCPR limit for Dresden Unit 2 may not be sufficient to bound the effects of channel bow in the current operating cycle (Cycle 12). An appropriate adjustment to the MCPR operating limit was administratively implemented at that time based on an analysis by the fuel vendor (Reference 2). Edison committed to incorporate this MCPR limit adjustment in the Dresden 2 Core Operating Limits Report (COLR) by May 31, 1990 (see Reference 1). The following discussion provides the bases for the MCPR limit adjustment and an evaluation of its safety implications.

Dresden 2 Cycle 12 has a significant number of reused channels as a result of CECo's channel management strategy in the early to mid 1980s. During the Cycle 9 and Cycle 10 refueling outages, fresh reload fuel assemblies received channels with one or two prior cycles of irradiation. A total of 303 reused channels remain in Dresden 2 Cycle 12. The remaining 421 assemblies do not have reused channels.

Channel exposures were compiled and projected to the end of Cycle 12. Of the 303 reused channels, 194 will exceed 40 GWd/MTU exposure and 28 will surpass 50 GWd/MTU prior to shutdown for refueling which is currently scheduled for September 1990. Essentially all of the reused channels, 297 out of 303, were manufactured by Carpenter Technology. These channels exhibit less irradiation induced growth than GE channels of the same vintage.

MCPR Limit Adjustment For Dresden 2 Cycle 12

In light of the high channel exposures, Advanced Nuclear Fuels (ANF) has completed a cycle specific analysis for Dresden Unit 2 Cycle 12 to assess the impact of channel bow on thermal margin for the current operating cycle (Reference 2). Using the end of Cycle 12 channel exposure projections, the CASMO-3G lattice physics code, and the ANFB critical power correlation, ANF has determined the impact of CPR using a procedure similar to that outlined in Reference 3. ANF's generic channel bow methodology, currently under NRC review, statistically accounts for the effects of channel bow by an adjustment to the MCPR Safety Limit; however, an equivalent adjustment to the MCPR operating limit provides the same level of thermal margin protection.

ANF has evaluated the CPR degradation based on the actual Dresden 2 Cycle 12 loading pattern and projected end of cycle exposure conditions. The calculated CPR adjustment for channel bow is partially offset by the inherent conservatism of the XN-3 CPR correlation (the current thermal margin licensing basis for Dresden) relative to the ANFB correlation. ANF has discussed this inherent XN-3 conservatism with the NRC and transmitted the supporting documentation via Reference 4. The results of the Dresden Unit 2 channel bow analysis are summarized below:

(MCPR OL) +	(CPR Bow Penalty) -	(XN-3 Conservatism) =	(New MCPR OL)
1.39	0.15	0.09	1.45

Revision 1 to the Dresden Unit 2 Cycle 12 COLR (Attachment 1) reflects this change in the full flow MCPR operating limit as well as the corresponding change to the reduced flow MCPR limits for Automatic Flow Control operation (COLR Figure 5.2-3).

Safety Evaluation

CECo has performed a safety evaluation of this adjustment to the MCPR limit and has concluded that no unreviewed safety questions exist for reasons described below.

(a) The primary concern with excessive channel bow is loss of thermal margin. Because of the large number of highly exposed channels in Dresden 2, an appropriate MCPR Operating Limit adjustment has been implemented and included in the attached Core Operating Limits Report to ensure protection of the safety limit for fuel integrity. Future reload analyses will explicitly account for channel bow effects. It is anticipated that the effect will decrease because Commonwealth Edison's current channel management strategy prohibits the reuse of channels on new fuel assemblies. Additionally, stringent as-built channel bow criteria have been established to maintain bow levels to a minimum. For these reasons, the probability of occurrence or the consequences of an accident or malfunction of equipment important to safety previously evaluated in the FSAR is not increased.

(b) By accounting for the effects of the channel bow, the safety limit for fuel cladding integrity remains protected and no new accident scenarios are created. CECo has also determined that channel bow will not significantly affect the performance of any safety related system. Since the characteristic deformation at high channel exposures is oriented such that the channel bows away from the control rod, CRD system capabilities (scram times, normal insert and withdraw functions, etc.) are not adversely impacted. While there may be some effect on in-core neutron monitor indications, Traversing In-core Probe (TIP) asymmetries measured at BOC and periodically during Cycle 12 have been verified to be within the assumptions of licensing analyses. For these reasons, the possibility for an accident or malfunction of a different type than previously evaluated in the FSAR is not created.

(c) CECo has ensured the margin to the MPCR Safety Limit is maintained at a level sufficient to withstand any limiting operational occurrences; therefore, margin of safety as defined in the bases for any Technical Specification is not reduced.

In summary, CECo has evaluated the effects of channel bow and has determined that no unreviewed safety question exists for D2C12 operation with a full flow MCPR operating limit of 1.45 or greater (as described in Reference 1). However, until NRC review of the vendor's generic channel bow methodology is complete, Staff concurrence with this interim limit adjustment for D2C12 (and a similar adjustment for D2C13, if needed) should be obtained.

References

1. Letter, M.H. Richter to USNRC, "Dresden Station Units 2 and 3, Quad Cities Station Units 1 and 2, LaSalle County Station Units 1 and 2 Response to NRC Bulletin 90-02, NRC Docket Nos. 50-237/249, 50-254/265 and 50-373/374", dated April 26, 1990.

2. ANF proprietary document "CECo Channel Bow Analysis Results" (Attachment B to Reference 1), April, 1990.

3. ANF-524(P), Revision 2, Supplement 1, "Advanced Nuclear Fuels Corporation Critical Power Methodology for Boiling Water Reactors - Methodology for Analysis of Assembly Channel Bowing Effects", November 1989.

4. Letter, R.A. Copeland (ANF) to R.C. Jones (USNRC), "Loss of Thermal Margin Caused by Channel Box Bow", dated April 9, 1990.