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NRC FORM 195 (2-76) B0761

U.S. NUCLEAR REGULATORY COMMISSION

NRC DISTRIBUTION FOR PART 50 DOCKET MATERIAL

DOCKET NUMBER	50-331
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TO: Mr. B.C. Rusche	FROM: Iowa Elec. Light & Power Co. Cedar Rapids, Iowa Lee Liu	DATE OF DOCUMENT	3-10-77
		DATE RECEIVED	3-15-77
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DESCRIPTION: Ltr notarized 3-14-77....trans the following:

ENCLOSURE: Drilling Priorities....(1P)

Fully Drilled Analysis-Suppl Info for Reload Number 2 Lic. Submittal....(16P)

ACKNOWLEDGED

DO NOT REMOVE

PLANT NAME: Duane Arnold Plant

DHL

FOR ACTION/INFORMATION

SAFETY		ENVIRO
ASSIGNED AD:		ASSIGNED AD:
BRANCH CHIEF:	Lear (5)	BRANCH CHIEF:
PROJECT MANAGER:	Shea	PROJECT MANAGER:
LIC. ASST.:	Parrish	LIC. ASST.:

INTERNAL DISTRIBUTION

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NRC PDR	HEINEMAN	TEDESCO	ENVIRO ANALYSIS
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OELD		LAINAS	
GOSSICK & STAFF	ENGINEERING	IPPOLITO	ENVIRO TECH.
MIPC	MACARRY	KIRKWOOD	ERNST
CASE	BOSNAK		BALLARD
HANAUER	SIHWEIL	OPERATING REACTORS	YOUNGBLOOD
HARLESS	PAWLICKI	STELLO	
			SITE TECH.
PROJECT MANAGEMENT	REACTOR SAFETY	OPERATING TECH.	GAMMILL
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P. COLLINS	NOVAK	SHAO	HULMAN
HOUSTON	ROSZTOCZY	BAER	
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NRC FORM 195 (2-76)

IOWA ELECTRIC LIGHT AND POWER COMPANY

General Office

CEDAR RAPIDS, IOWA

March 10, 1977
IE-77-515

LEE LIU
VICE PRESIDENT - ENGINEERING

Mr. Benard C. Rusche, Director
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Washington, D.C. 20545

Dear Mr. Rusche:

In accordance with 10CFR50.59 and 50.90, we transmitted our application dated January 31, 1977, for amendment to DPR-49 and the Technical Specifications (Appendix A to license) for the Duane Arnold Energy Center (DAEC) for Cycle 3 operational limits and safety limits.

Since submitting that application to you, we have had further discussions with your staff and with the General Electric Company concerning our plans for drilling the tie plates of irradiated fuel which will remain in the reactor during Cycle 3. Your staff has advised that it would be desirable for us to obtain NRC approval with respect to (1) applicability of procedures for drilling and (2) operation of the plant with drilled irradiated fuel.

Accordingly, in addition to the amendment of DPR-49 and the Technical Specifications requested in our application of January 31, 1977, we request your approval of procedures for drilling tie-plates at DAEC of irradiated fuel in accordance with the General Electric letters of April 1 and April 23, 1976. The drilling sequence would proceed as described in Attachment 1 to this letter.

We are also requesting you approve our operation of the plant with more than 100 drilled bundles, the precise number to depend upon the time available for drilling of irradiated fuel during the plant outage which, as you know, is scheduled to commence March 12 for refueling. For this purpose, we are submitting herewith Supplement 1 to NEDO-21082-02 (Attachment 2) which justifies the applicability of the safety analyses provided in our January 31, 1977 submittal for a core configuration with more than 100 drilled bundles.

In order for us to drill irradiated fuel tie plates during the forthcoming refueling outage, it would be necessary for us to receive your approval for drilling by March 18, 1977. If you have any questions concerning the application made in this letter with regard to drilling, please do not hesitate to telephone me.

We trust that questions concerning the applications made herein will not be permitted to delay processing and approval of our separate application dated January 31, 1977.

Three signed and 40 additional copies of this application are transmitted herewith. This application consisting of the foregoing letter and enclosures hereto is true and accurate to the best of my knowledge and belief.

Iowa Electric Light and Power Company

By: _____
Lee Liu
Vice President, Engineering

Subscribed and Sworn to before me on this 14th day of March, 1977.

_____
Notary Public in and for the State of Iowa.

Jean R. Smith
NOTARY PUBLIC
STATE OF IOWA
Commission Expires
September 30, 1978

LL/KAM/ms

cc: K. Meyer
D. Arnold
R. Lowenstein
J. Shea (NRC)
L. Root

ATTACHMENT 1

DRILLING PRIORITIES

1. Drill all Reload 1 bundles
2. Maintain octant core symmetry and radial uniformity
3. Provide each of the instrument channels with as many adjacent drilled bundles as possible in order to minimize bypass region boiling effects on instrument readings.

A listing of bundles for drilling which follows the above priorities has been developed by General Electric. Drilling will follow that listing. Bundles will be drilled in groups as time permits.

The groupings follow the pattern as follows:

Reload 1 fuel 16-16-16-4-16-16-16

Initial fuel 8-16-16. . . .16-16-8

NEDO-21082-02
Class I
Supplement 1
February 1977

FULLY DRILLED ANALYSIS --
SUPPLEMENTAL INFORMATION FOR
RELOAD NUMBER 2 LICENSING SUBMITTAL

DUANE ARNOLD ENERGY CENTER

IMPORTANT NOTICE REGARDING

CONTENTS OF THIS REPORT

Please Read Carefully

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1. INTRODUCTION

The initial Duane Arnold Reload No. 2 License Submittal was prepared on the basis that only the reload-2 bundles would contain the alternate bypass flow path (see Reference 1). Since publication of that document, reviews have concluded that it may be desirable to machine alternate bypass flow holes in most if not all irradiated bundles. The purpose of this document is to justify the applicability of the safety analyses presented in the previous licensing submittal (References 1) to the new configuration.

Machining of the irradiated bundles will be performed by electro-discharge machining (EDM) which was developed as an alternative to mechanical drilling. Both methods are summarized in Reference 2. The modification of plugging the 1-inch bypass holes and drilling two holes in the fuel bundle lower tie plate was reviewed by the NRC staff and its acceptability as a solution to eliminate significant in-core vibration has been documented in Reference 3. During drilling of irradiated bundles in a BWR several of the drills were broken and stuck in place. General Electric then developed a contingency plan relying on the EDM method to remove the broken drill bits. In the subsequent review of EDM by the staff, an evaluation was made that EDM is acceptable as a primary method for providing alternate bypass flow holes (ABFH). This evaluation is documented in Reference 4.

In the following sections the safety of the proposed configuration is justified on the basis that the safety analysis input data are within the envelopes presented in Reference 1 which was evaluated for the partially drilled core. The only exception is the rod withdrawl error and bundle loading error events. These events were reanalyzed and the results are presented in subsection 6.

2. SUMMARY

The design reference core configuration for this license consists of bundles defined in Table 2-1. The relative location of each fuel bundle type is shown in Figure 2-1.

Table 2-1

FUEL TYPE AND NUMBER

Fuel Type	Number
Initial Core	
Type 2 7D212	152
Type 3 7D212	28
Interim Reload 7D230	4
Reload 1	
8D274H	52
8D274L	32
Reload 2	
8D274H	68
8D274L	32
TOTAL	368

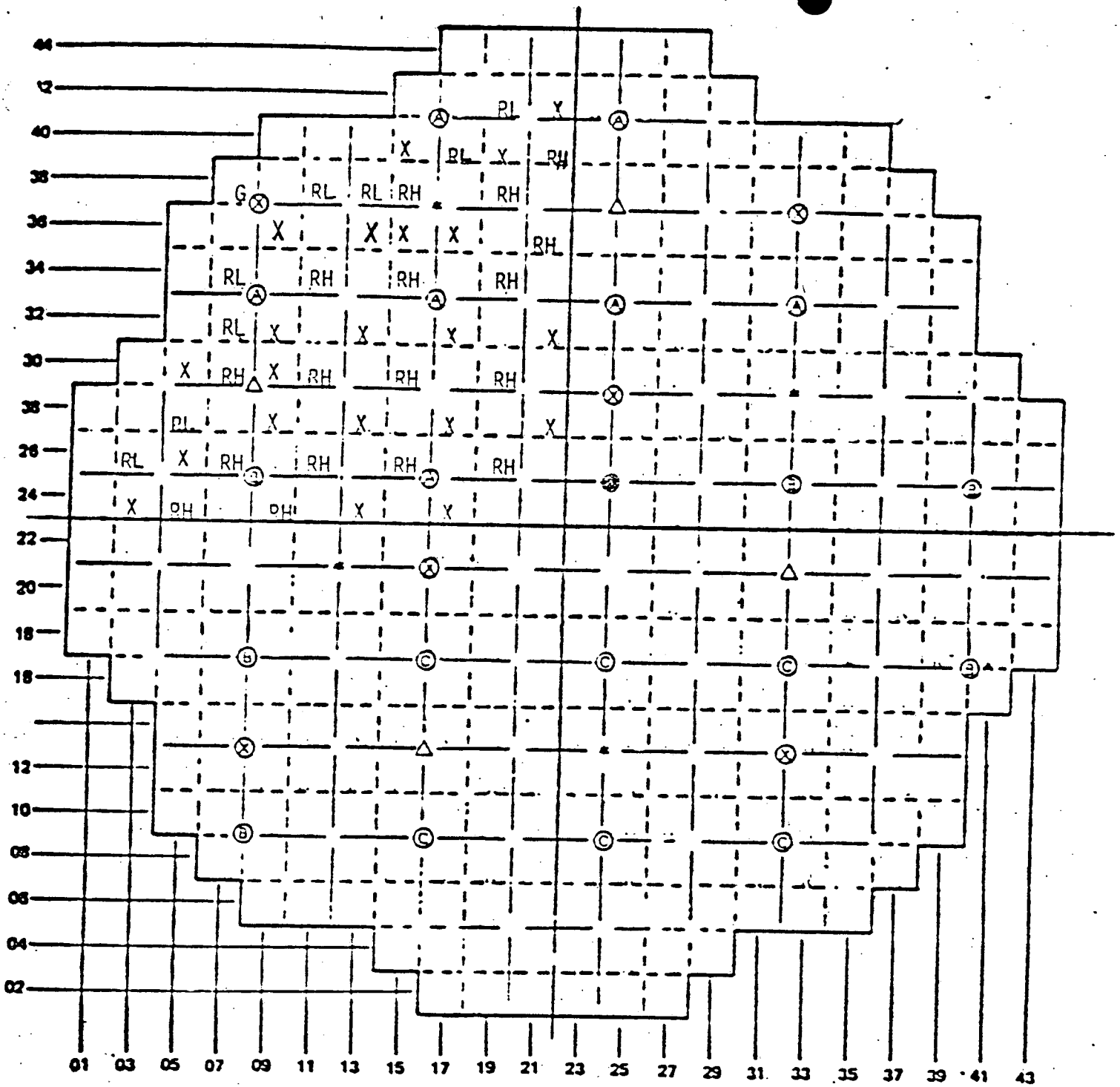

Figure 2-1. DAEC R-2 Design Reference Core Loading - Quarter Core Mirror Symmetry Upper Left Quadrant Only Shown

3. MECHANICAL DESIGN

The mechanical design of the Reload 2 fuel is described in Section 3 of Reference 1.

The core configuration described in this supplement differs from Reference 1 in that initial core bundles remaining in the core will have two bypass flow holes provided in the lower tie plate.

4. THERMAL-HYDRAULIC ANALYSES

Thermal-hydraulic performance of the alternate bypass flow path is evaluated in Section 4 of Reference 2. The safety limit MCPR's presented in Reference 1 are conservative for the configuration of Figure 2-1 since the lower void contents in the bypass region of the latter result in a lower TIP uncertainty.

5. NUCLEAR CHARACTERISTICS

The effect of full lower tie plate drilling on reactor shutdown margins and other nuclear characteristics of the core will not be significant except for the void coefficient which will be somewhat less negative. As stated elsewhere, this results in more conservative thermal limits.

6. SAFETY ANALYSIS

6.1 INTRODUCTION

The effect of drilling the irradiated bundles is to increase bypass flow, thus lowering the void content in the bypass region. This results in a less negative void coefficient and more negative reactivity insertion during scram.

6.2 MODEL APPLICABILITY TO 8X8 FUEL

No change.

6.3 RESULT OF SAFETY ANALYSIS

6.3.1 Core Safety Analyses

The operating limits and fuel damage limits will not change as a result of the increased bypass flow. Operating margins, however, will be increased.

6.3.2 Accident Analyses

6.3.2.1 Main Steam Line Break Accident

The consequences of the main steam line break analysis will not be increased as a result of the increased bypass flow.

6.3.2.2 Refueling Accident

No change.

6.3.2.3 Control Rod Drop Accident

Values of Doppler reactivity coefficient, accident reactivity shape function, and scram reactivity function are evaluated at cold and hot standby conditions; therefore, these values are not affected by the increase in bypass flow.

6.3.2.4 Loss-of-Coolant Accident

In subsection 4.4 of Reference 2, the following conclusions are presented:

a. The post loss-of-coolant accident (LOCA) reflooding time is unchanged or improved by the complete plant modification with two 9/32-inch holes drilled in all fuel assembly lower tie plates and the bypass flow holes in the core support plate plugged. The ECCS limits which existed prior to plugging* of the bypass flow holes are applicable.

b. The "plug only"** ECCS limits conservatively bound the partial drill case.

Thus, the ECCS limits are conservatively bounded by the MAPLHGR's with the bypass flow holes plugged presented in Reference 1.

6.3.2.5 Loading Error Accident

Calculations performed for BWR/4-type plants have shown that the change in in-channel flow from a partial to a fully machined core is negligible. For the worst case error, there is no change in MCPR from that quoted in Reference 1.

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*These ECCS limits are those which were calculated for the original core configuration. In these calculations, ECCS flow was assumed to pass from the bypass region to the lower plenum through the bypass flow holes. No alternate flow path was assumed in these calculations.

**The "plug only" ECCS limits are calculated using the same assumptions as existed for the original core configuration except no flow is assumed to pass through the bypass flow holes.

6.3.3 Abnormal Operating Transients

6.3.3.1 Transients and Core Dynamics

The increase in bypass flow decreases the amount of voiding in the bypass region. This results in a less negative void coefficient and a more negative reactivity insertion during scram. This combination results in a less severe plant response to limiting transients. Thus, the transient analysis presented in subsection 6.3.3 of Reference 1 is conservative for the configuration of Figure 2-1.

6.3.3.2 Rod Withdrawal Error

The rod withdrawal error reanalyzed with alternate bypass flow holes machined in all bundles (worst case) shows that for a 105% rod block monitor (RBM) setpoint, the rod block occurs at 4 feet withdrawn. The ΔCPR at this state is 0.15 for 7x7 fuel and 0.16 for 8x8 fuel. These are identical to the maximum ΔCPR values presented in Reference 1; therefore, the GETAB operating limit MCPR for rated operations during Cycle 2 does not change. Figures 6-1 through 6-3 show the results of the reanalysis.

6.3.4 ASME Pressure Vessel Code Compliance

By the argument presented in subsection 6.3.3.1, the main steam line isolation valve closure, flux scram analysis presented in Reference 1 is conservative for the configuration of Reference 1. Therefore, the margin to the vessel code limit of 1375 psig will be greater than that quoted in Reference 1.

6.3.5 Thermal-Hydraulic Stability Analysis

Results of stability analyses demonstrate that a more negative void coefficient results in a less stable reactor. The increase in bypass flow results in a less negative void coefficient; therefore, the decay ratio presented in subsection 6.3.5 of Reference 1 are conservative for the configuration of Figure 2-1.

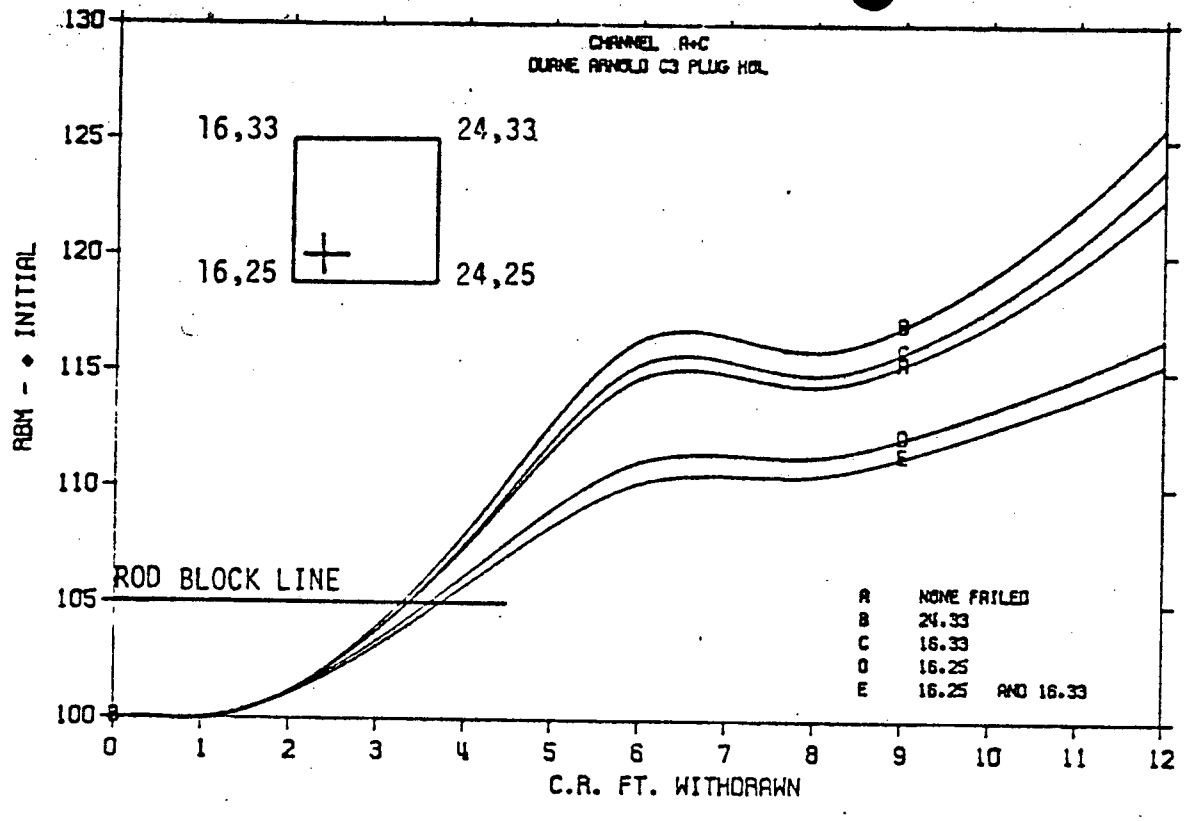

Figure 6-1 RBM Response to Control Rod Motion for Rod Withdrawal Error Channel A+C

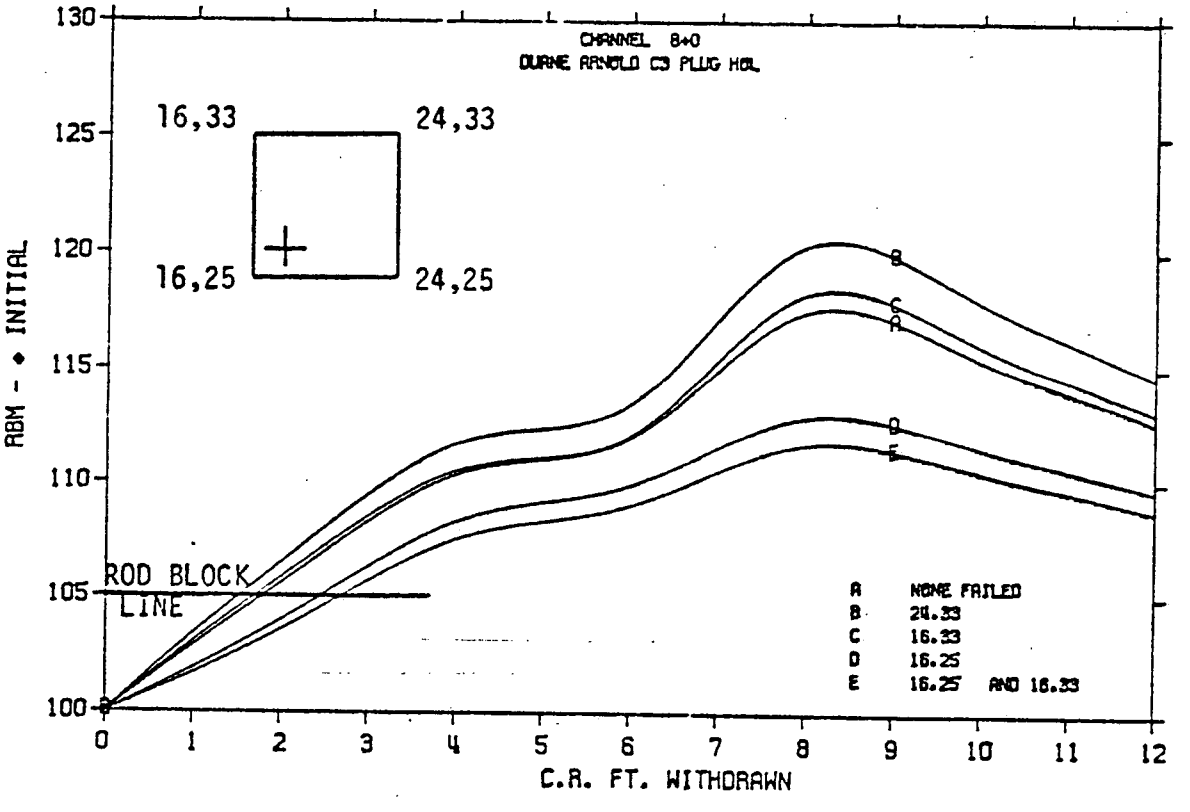

Figure 6-1 . RBM Response to Control Rod Motion for Rod Withdrawal Error-- Limiting Case, Channel B+D

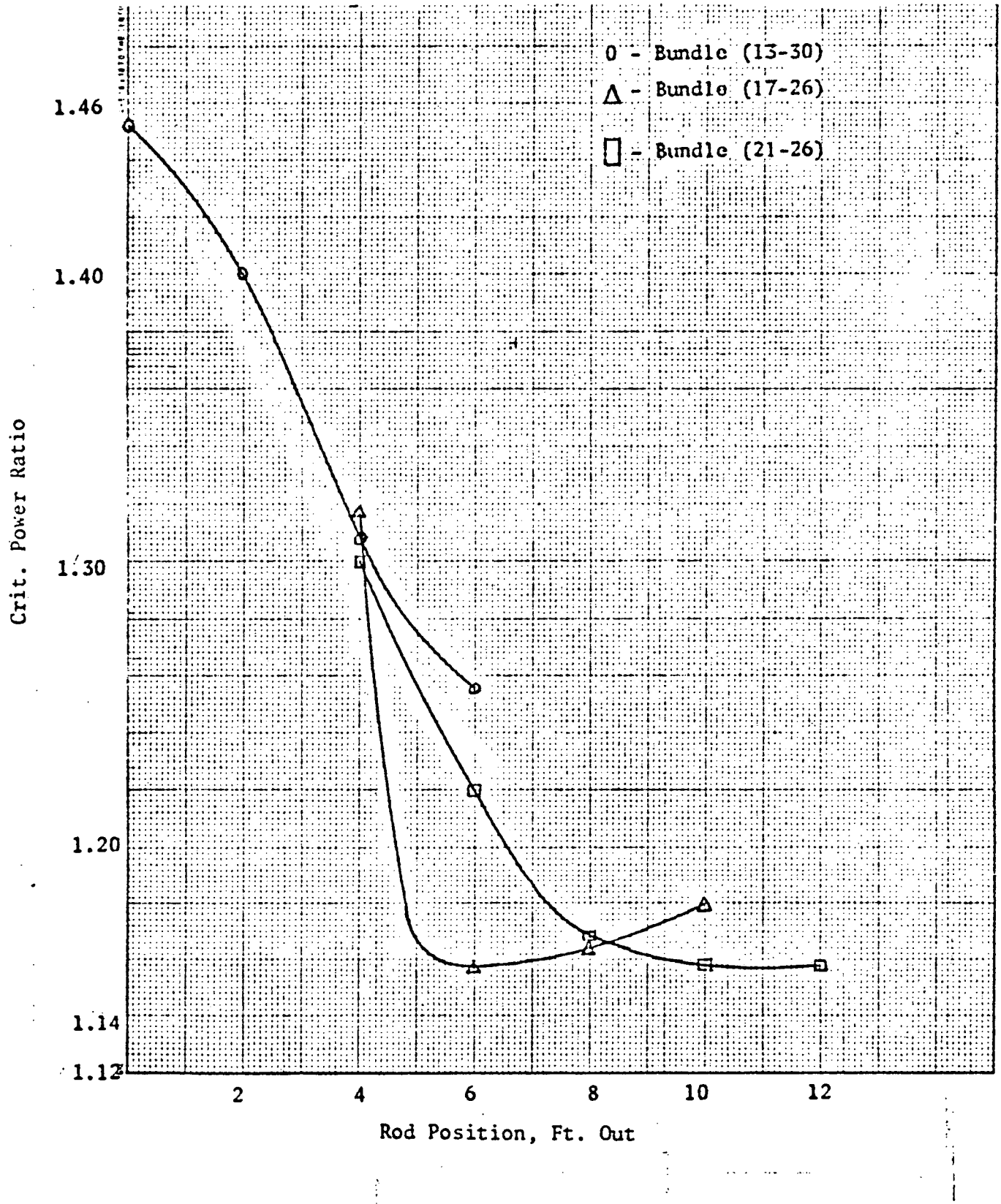

Figure 6-2.CPR Response (7X7)

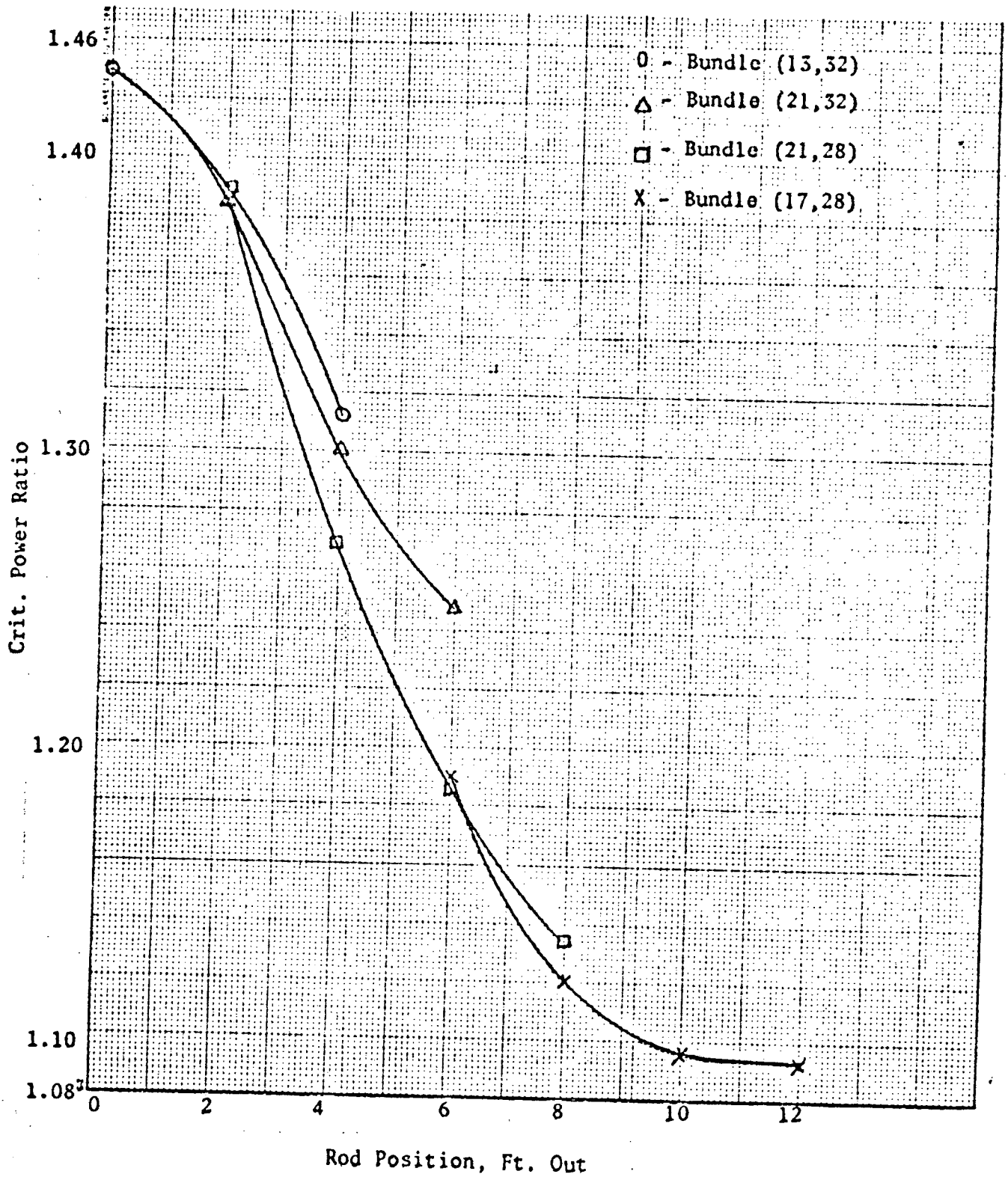

Figure 3. CPR Response (8X8)

7. References

1. "Reload-2 License Submittal for Duane Arnold Energy Center", General Electric Company, January 1977 (NEDO 21082-02).

2. "Supplemental Information for Plant Modification to Eliminate Significant In-Core Vibration," General Electric Company, January 1976, Class III (NEDE-21156).

3. "Safety Evaluation Report on the Reactor Modification to Eliminate Significant In-Core Vibration in Operating Reactors with 1-Inch Bypass Holes in the Core Support Plate," USNRC, February 1976.

4. "Safety Evaluation Report on Electrical-Discharge Machining of Lower Tie Plates of Irradiated BWR Fuel Assemblies," USNRC, May 1976.