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Distribution

Docket  
 ORB #3  
 NRC PDR  
 Local PDR  
 VStello  
 KRGoeller/TJCarter  
 CParrish  
 GLear  
 JShea  
 Attorney, OELD  
 OI&E (5)  
 BJones (4)  
 BScharf (10)  
 JMcGough  
 DEisenhut  
 ACRS (16)  
 OPA (Clare Miles)

DRoss  
 TBAbernathy  
 JRBuchanan

Docket No. 50-331

Iowa Electric Light & Power Company  
 ATTN: Mr. Duane Arnold, President  
 P. O. Box 351  
 Cedar Rapids, Iowa 52406

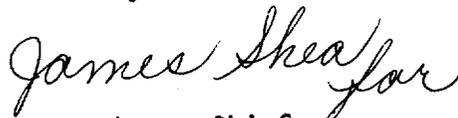
Gentlemen:

The Commission has issued the enclosed Amendment No. 25 to Facility License No. DPR-49 for the Duane Arnold Energy Center. This amendment consists of changes to the Technical Specifications and is in response to your application dated November 9, 1976.

This amendment will revise the Technical Specifications by reducing the Minimum Critical Power Ratios (MCPR) for the last 1000 MWD/T in their fuel cycle. The reduction is based on full scale test data which demonstrated that the fuel bundle bypass flow is greater than was assumed in previous analyses.

Copies of the related Safety Evaluation and the Federal Register Notice are also enclosed.

Sincerely,



George Lear, Chief  
 Operating Reactors Branch #3  
 Division of Operating Reactors

Enclosures:

1. Amendment No. 25
2. Safety Evaluation
3. Federal Register Notice

cc w/enclosures:  
 See next page



Cover 1  
 OR

OFFICE >	ORB #3	ORB #3	OELD	ORB #3		
SURNAME >	CParrish	JShea:mjf	Attorney	GLear		
DATE >	12/ /76	12/15/76	12/15/76	12/22/76		

Iowa Electric Light & Power Company - 2 -

cc:

Mr. Robert Lowenstein, Esquire  
Harold F. Reis, Esquire  
Lowenstein, Newman, Reis and Axelrad  
1025 Connecticut Avenue, N. W.  
Washington, D. C. 20036

Office for Planning and Programming  
523 East 12th Street  
Des Moines, Iowa 50319

Chairman, Linn County  
Board of Supervisors  
Cedar Rapids, Iowa 52406

Iowa Electric Light & Power Company  
ATTN: G. G. Hunt  
P. O. Box 351  
Cedar Rapids, Iowa 52406

Chief, Energy Systems Analysis Branch (AW-459)  
Office of Radiation Programs  
U. S. Environmental Protection Agency  
Room 645, East Tower  
401 M Street, S. W.  
Washington, D. C. 20460

U. S. Environmental Protection Agency  
Region VII  
ATTN: EIS COORDINATOR  
1735 Baltimore Avenue  
Kansas City, Missouri 64108

Cedar Rapids Public Library  
426 Third Avenue, S. E.  
Cedar Rapids, Iowa 52401



UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
WASHINGTON, D. C. 20555

IOWA ELECTRIC LIGHT AND POWER COMPANY  
CENTRAL IOWA POWER COOPERATIVE  
CORN BELT POWER COOPERATIVE

DOCKET NO. 50-331

DUANE ARNOLD ENERGY CENTER

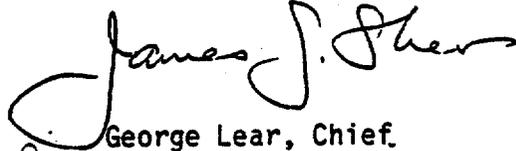
AMENDMENT TO FACILITY OPERATING LICENSE

Amendment No. 25  
License No. DPR-49

1. The Nuclear Regulatory Commission (the Commission) has found that:
  - A. The application for amendment by Iowa Electric Light and Power Company, Central Iowa Power Cooperative, and Corn Belt Power Cooperative (the licensees) dated November 9, 1976, complies with the standards and requirements of the Atomic Energy Act of 1954, as amended (the Act), and the Commission's rules and regulations set forth in 10 CFR Chapter I;
  - B. The facility will operate in conformity with the application, the provisions of the Act, and the rules and regulations of the Commission;
  - C. There is reasonable assurance (i) that the activities authorized by this amendment can be conducted without endangering the health and safety of the public, and (ii) that such activities will be conducted in compliance with the Commission's regulations;
  - D. The issuance of this amendment will not be inimical to the common defense and security or to the health and safety of the public; and
  - E. The issuance of this amendment is in accordance with 10 CFR Part 51 of the Commission's regulations and all applicable requirements have been satisfied.
2. Accordingly, the license is amended by a change to the Technical Specifications as indicated in the attachment to this license amendment.

3. This license amendment is effective as of the date of its issuance.

FOR THE NUCLEAR REGULATORY COMMISSION

A handwritten signature in cursive script, appearing to read "James J. Lear".

 George Lear, Chief.  
Operating Reactors Branch #3  
Division of Operating Reactors

Attachment:  
Changes to the Technical  
Specifications

Date of Issuance: December 22, 1976

ATTACHMENT TO LICENSE AMENDMENT NO. 25  
TO THE TECHNICAL SPECIFICATIONS  
FACILITY OPERATING LICENSE NO. DPR-49  
DOCKET NO. 50-331

Replace pages 3.12-9a and 3.12-11 with the attached revised pages.

TABLE 3.12-2

MCPR LIMITS

<u>Fuel Type</u>	<u>Exposure Remaining to End of Cycle</u>		
	<u>&gt; 2000 MWD/T</u>	<u>≤ 2000 MWD/T, &gt; 1000 MWD/T</u>	<u>≤ 1000 MWD/T to E.O.C.</u>
7 x 7	1.26	1.26	1.35
8 x 8	1.30	1.34	1.44

3.12-9a

## 3.12 REFERENCES

1. Duane Arnold Energy Center "Safety Analysis with Bypass Holes Plugged", June 9, 1975 and Supplement 1, June 16, 1975.
2. General Electric BWR Generic Reload Application for 8 x 8 Fuel, NEDO-20360, Revision 1, November 1975.
3. "Fuel Densification Effects on General Electric Boiling Water Reactor Fuel", Supplements 6, 7 and 8, NEDM-19735, August 1973.
4. Supplement 1 to Technical Reports on Densifications of General Electric Reactor Fuels, December 14, 1973 (AEC Regulatory Staff).
5. Communication: V. A. Moore to I. S. Mitchell, "Modified GE Model for Fuel Densification", Docket 50-321, March 27, 1974.
6. R. B. Linford, Analytical Methods of Plant Transient Evaluations for the GE BWR, February 1973 (NEDO-10802).
7. General Electric Company Analytical Model for Loss-of-Coolant Analysis in Accordance with 10 CFR Part 50, Appendix K, NEDE-20566 (Draft), August 1974.
8. Duane Arnold Energy Center Reload Number One Licensing Submittal, January 1976.
9. Duane Arnold Energy Center Reload Number One Licensing Submittal, NEDO-21082-01, October 1976.



UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
WASHINGTON, D. C. 20555

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

SUPPORTING AMENDMENT NO. 25 TO LICENSE NO. DPR-49

IOWA ELECTRIC LIGHT AND POWER COMPANY  
CENTRAL IOWA POWER COOPERATIVE  
CORN BELT POWER COOPERATIVE

DOCKET NO. 50-331

DUANE ARNOLD ENERGY CENTER

Introduction

By letter dated November 9, 1976, Iowa Electric Light and Power Company requested an Amendment to Facility Operating License No. DPR-49 for the Duane Arnold Energy Center (DAEC). The proposed amendment would revise the DAEC Technical Specifications by reducing the Minimum Critical Power Ratios (MCPR) for the last 1000 MWD/T in their fuel cycle. The reduction is based on full scale test data which demonstrate that the fuel bundle bypass flow is greater than was assumed in previous analysis.

On July 9, 1976, the NRC issued Amendment No. 21 for DAEC which authorized operating limit MCPR's of 1.40 for 7x7 fuel and 1.50 for 8x8 fuel for the last 1000 MWD/T for fuel Cycle 2. These limits were based on a thermal-hydraulic analysis (1) of the DAEC core using the General Electric Thermal Analysis Bases (GETAB) (2). The current request from Iowa Electric Light and Power Company would revise the 7x7 fuel and 8x8 fuel MCPR values to 1.35 and 1.44, respectively. The benefit to be realized from this revision applies only to End-of-Cycle (EOC) limits. In certain cases, power level is restricted due to operating conditions. This revision would permit a power level increase of approximately 5% (but not to exceed rated power) for the last 1000 MWD/T of fuel depletion.

Evaluation

The current analysis (3) was performed with an experimentally-verified fuel bundle bypass flow for the plugged lower core support plate configuration in full scale test facilities. This calculation with a higher bypass flow has been previously approved on other BWR plants, e.g., Hatch.

Fuel Bundle Bypass Flow

The full scale Tests (4) were conducted for the development of permanent plant modifications to eliminate significant in-core vibration and consequent

channel box wear in the GE-BWR-4 product line, DAEC is included in this category. These tests experimentally demonstrated that the total fuel bundle bypass flow for a plugged core configuration is greater than that previously predicted from analytical models. For the DAEC in the plugged configuration, the derived bypass flow rate is about 6.4% of the total core flow rate as compared to the 4.8% of total core flow rate for the analytically derived bypass flow rate. We have reviewed the new bypass flow information derived from the test programs and have concluded that its application to the DAEC thermal-hydraulic analysis is acceptable.

#### Operating Limit MCPR

The operating limit MCPR is established such that during normal operation or anticipated transients 99.9% of the fuel rods in the core will not experience boiling transition. The previously reviewed and approved safety limit MCPR was established as 1.07. To assure that this safety limit is not violated during operational transients, the most limiting transients are analyzed and the greatest decrease in the Critical Power Ratio (CPR) is added to the safety limit MCPR. The current DAEC analysis (1) provided an exposure-dependent operating limit MCPR. With the advent of the fuel bundle bypass flow data a new analysis for operating limit MCPR for EOC has been performed.

Application of the new bypass flow data shows that there is actually less void formation in the bypass regions of the core during plant operation than that which had been established from the previous thermal-hydraulic analysis. This reduction in the calculated bypass region void fraction results in a less negative value of void reactivity coefficient and an increased reactivity worth in the EOC scram curve. These resultant characteristics of the increased fuel bundle bypass flow results in a significant decrease in  $\Delta$ CPR for several of the abnormal transients analyzed.

DAEC has submitted the results of the analyses of those abnormal transients for EOC-2 conditions (3), Table 1. The initial parameters used for the analyses were conservative and included initial CPR values which were equal to or greater than the operating limit MCPR value. These analyses also utilized the less negative value for the void coefficient of reactivity for EOC-2 conditions and an EOC-2 scram reactivity insertion rate which conservatively bounds the actual exposure-dependent scram reactivity insertion rates. The analysis is applied for a core average exposure range from 1000 MWD/T before EOC-2 to EOC-2.

The increased bypass flow for the plugged DAEC core results in decreased value in  $\Delta$ CPR of 0.05 for 7x7 fuel and 0.06 for 8x8 fuel for the most restrictive operational transient, the turbine trip without bypass. The  $\Delta$ CPR for the loss of feedwater heater is less than the  $\Delta$ CPR of the turbine trip without bypass and the consequent change in  $\Delta$ CPR due to

increased bypass flow is not as great. The remaining transients, e.g., rod withdrawal, fuel loading error, and overpressurization, are relatively insensitive (or their consequences are minimized at EOC) to the increased bypass flow and there is no resultant change in these analyses.

Based on the discussion above, we conclude that the proposed changes to the operating limit MCPR values are acceptable.

#### Environmental Consideration

We have determined that this amendment does not authorize a change in effluent types or total amounts of effluents. The effect on operating flexibility may permit a small increase in overall power generation with this core loading. However, the total overall power remains within the rated power levels and energy output considered in the FES published in connection with the issuance of the operating license. Accordingly, this amendment will not result in any significant environmental impact. Having made this determination, we have further concluded that the amendment involves an action which is insignificant from the standpoint of environmental impact and pursuant to 10 CFR §51.5(d)(4) that an environmental impact statement, or negative declaration and environmental appraisal need not be prepared in connection with the issuance of this amendment.

#### Conclusion

We have concluded, based on the considerations discussed above, that: (1) because the amendment does not involve a significant increase in the probability or consequences of accidents previously considered and does not involve a significant decrease in a safety margin, the amendment does not involve a significant hazards consideration, (2) there is reasonable assurance that the health and safety of the public will not be endangered by operation in the proposed manner, and (3) such activities will be conducted in compliance with the Commission's regulations and the issuance of this amendment will not be inimical to the common defense and security or to the health and safety of the public.

Dated:

TABLE 1

ΔCPR LIMITS FOR BURNUP CONDITIONS  
FROM 1000 MWD/T BEFORE EOC TO EOC

	<u>W/O INCREASE</u> <u>FUEL BUNDLE</u> <u>BYPASS FLOW</u>		<u>WITH INCREASE</u> <u>FUEL BUNDLE</u> <u>BYPASS FLOW</u>	
	<u>7x7</u> <u>Fuel Type</u>	<u>8x8</u> <u>Fuel Type</u>	<u>7x7</u> <u>Fuel Type</u>	<u>8x8</u> <u>Fuel Type</u>
Turbine Trip W/O Bypass	0.33	0.43	0.28	0.37
Loss of Feedwater Heater	0.16	0.19	0.15	0.18

References

1. "General Electric Boiling Water Reactors Reload No. 1 Licensing Submittal for Duane Arnold Energy Center With Bypass Flow Holes Plugged," License No. DPR-49, Docket No. 50-331, NEDO 21082, Class 1, Supplement 1, June 1976.
2. "General Electric Thermal Analysis Basis (GETAB): Data Correlation and Design Application," General Electric Company, BWR Systems Department, NEDE-10958, Class III, November 1973.
3. "General Electric Boiling Water Reactor Reload No. 1 Licensing Submittal for Duane Arnold Energy Center" License No. DPR-49, Docket No. 50-331, NEDO-21082-01, Class 1, Supplement 2, October 1976.
4. "Supplemental Information for Plant Modification to Eliminate Significant In-Core Vibration," BWR Projects Department, General Electric Company, NEDE-21156, Class III, January 1976.

UNITED STATES NUCLEAR REGULATORY COMMISSION

DOCKET NO. 50-331

IOWA ELECTRIC LIGHT AND POWER COMPANY  
CENTRAL IOWA POWER COOPERATIVE  
CORN BELT POWER COOPERATIVE

NOTICE OF ISSUANCE OF AMENDMENT TO FACILITY  
OPERATING LICENSE

The U. S. Nuclear Regulatory Commission (the Commission) has issued Amendment No. 25 to Facility Operating License No. DPR-49 issued to Iowa Electric Light and Power Company, Central Iowa Power Cooperative, and Corn Belt Power Cooperative, which revised Technical Specifications for operation of the Duane Arnold Energy Center, located in Linn County, Iowa. The amendment is effective as of its date of issuance.

The amendment will revise the Technical Specifications by reducing the Minimum Critical Power Ratios (MCPR) for the last 1000 MWD/T in their fuel cycle. The reduction is based on full scale test data which demonstrated that the fuel bundle bypass flow is greater than was assumed in previous analysis.

The application for the amendment complies with the standards and requirements of the Atomic Energy Act of 1954, as amended (the Act), and the Commission's rules and regulations. The Commission has made appropriate findings as required by the Act and the Commission's rules and regulations in 10 CFR Chapter I, which are set forth in the license amendment. Prior public notice of this amendment was not required since the amendment does not involve a significant hazards consideration.

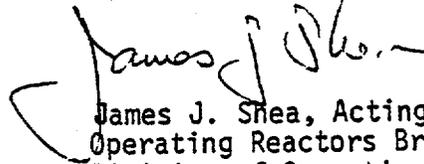
The Commission has determined that the issuance of this amendment will not result in any significant environmental impact and that pursuant to 10 CFR §51.5(d)(4) an environmental statement or negative declaration and environmental impact appraisal need not be prepared in connection with issuance of this amendment.

For further details with respect to this action, see (1) the application for amendment dated November 9, 1976, (2) Amendment No. 25 to License No. DPR-49, and (3) the Commission's related Safety Evaluation. All of these items are available for public inspection at the Commission's Public Document Room, 1717 H Street, N. W., Washington, D. C. and at the Cedar Rapids Public Library, 426 Third Avenue, S. E., Cedar Rapids, Iowa 52401.

A copy of items (2) and (3) may be obtained upon request addressed to the U. S. Nuclear Regulatory Commission, Washington, D. C. 20555, Attention: Director, Division of Operating Reactors.

Dated at Bethesda, Maryland, this 22nd day of December 1976.

FOR THE NUCLEAR REGULATORY COMMISSION



James J. Shea, Acting Chief  
Operating Reactors Branch #3  
Division of Operating Reactors