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U.S. NUCLEAR REGULATORY COMMISSION

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TO: MR. BENARD C. RUSCHE

FROM: IOWA ELECTRIC LIGHT & POWER CO. CEDAR RAPID, IOWA LEE LIU

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LTR. (NOTORIZED) 5/14/76 WITH ATTACHED.......
APPLICATION FOR AMENDMENT TO INCORPOTATE :
PROPOSED CHANGES TO TECH SPEC (APPENDIX A TO LICENSE).

PLANT NAME:

DUANE ARNOLD

ENCLOSURE

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IOWA ELECTRIC LIGHT AND POWER COMPANY

General Office

CEDAR RAPIDS, IOWA

LEE LIU
VICE PRESIDENT – ENGINEERING

May 14, 1976
IE-76-759

RECEIVED MAY 18 1976 U.S. NUCLEAR REGULATORY COMMISSION Mail Section

50-331

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

Dear Mr. Rusche:

Transmitted herewith in accordance with the requirements of 10CFR50.59 and 50.90, is an application for amendment of DPR-49 to incorporate proposed changes to the Technical Specifications (Appendix A to License) for the Duane Arnold Energy Center.

Operating limit MCPR's presently contained in the DAEC Technical Specifications are 1.40 for 7 x 7 fuel and 1.50 for 8 x 8 fuel calculated using End of Cycle parameters, which results in a power capability of about 92%. General Electric is presently calculating operating limit MCPR's for 2000 MWD/T and 1000 MWD/T prior to end of cycle, which will be completed in early June. These calculations are being conducted in the same manner as the presently specified operating limit MCPR's were calculated in the DAEC reload license submittal using appropriate parameters for that time in the cycle. Iowa Electric expects this analysis to show that a significant reduction in the operating limit MCPR's is possible while still maintaining the safety limit MCPR of 1.07. This reduction in limits while maintaining safety margins is possible primarily due to improved scram reactivity curves earlier in the cycle. Iowa Electric expects that these new operating limit MCPR's will correspond to an approximate increased capability of 5-8% power compared to the present limits. The MCPR's for 2000 MWD/T prior to end of cycle are expected to be in the range of 1.25 to 1.30, for both 7 x 7 and 8 x 8 fuel. Included with this application are the appropriate pages from the Technical Specifications indicating anticipated changes.

This change does not result in any change to the presently licensed safety limit MCPR of 1.07.

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This application has been reviewed and approved by the DAEC Operations Committee and the DAEC Safety Committee. This application does not involve a significant hazards consideration.

The primary purpose of this submittal is to allow the DAEC to produce increased power during the peak summer demand. Iowa Electric's peak demand tends to occur during late June and July, and the ability to produce this 25-45 MWe at the DAEC will reduce the cost of electricity to the consumer and result in increased reliability of the electrical supply in this area. For this reason, we request that you give full consideration for a rapid approval of this application.

This application will be amended by June 7, 1976 with the detailed proposed Technical Specifications and the supportive submittal.

Three signed and notarized originals and 37 additional copies of this application are transmitted herewith. This application, consisting of the foregoing letter and enclosure hereto, is true and accurate to the best of my knowledge and belief.

Iowa Electric Light and Power Company

By: Larry D. Root
Lee Liu for
Vice President, Engineering

LL/KAM/ms
Enc.
cc: D. Arnold
J. Newman
J. Keppler (NRC)
J. Shea (NRC)
L. Root
File A-117
File J-40b

Subscribed and Sworn to before me on this 14th day of May, 1976.

Wendy A. Rodenhizer
Notary Public in and for the State of Iowa.

Wendy Rodenhizer
NOTARY PUBLIC
STATE OF IOWA
Commission Expires
September 30, 1976

SAFETY LIMIT

16 C. Power Transient

To ensure that the Safety Limits established in Specification 1.1.A and 1.1.B are not exceeded, each required scram shall be initiated by its primary source signal. A Safety Limit shall be assumed to be exceeded when scram is accomplished by a means other than the Primary Source Signal.

D. With irradiated fuel in the reactor vessel, the water level shall not be less than 12 in. above the top of the normal active fuel zone.

LIMITING SAFETY SYSTEM SETTING

Where: S = Setting in percent of rated power (1,593 MWt).

W = Recirculation loop flow in percent of rated flow. Rated recirculation loop flow is that recirculation loop flow which corresponds to 49×10^6 lb/hr core flow.

MTPF = Actual Maximum Total peaking factor.

For a peaking factor greater than 2.61 (7 x 7 array) or 2.43 (8 x 8 array), the APRM scram setpoint shall be:

$$S \leq (0.66\,W + 54)\,\frac{(\ *\ )}{MTPF}$$

NOTE: These settings assume operation within the basic thermal design criteria. These criteria are LHGR ≤ 18.5 KW/ft (7 x 7 array) or 13.4 KW/ft (8 x 8 array) and MCPR ≥ values as indicated in Table 3.12-2 times K_f, where K_f is defined by Figure 3.12-1. Therefore, at full power, operation is not allowed with total peaking factor greater than * even if the scram setting is reduced. If it is determined that either of these design criteria is being violated during operation, action must be taken immediately to return to operation within these criteria.

2. APRM High Flux Scram

When in the REFUEL or STARTUP and HOT STANDBY MODE. The APRM scram shall be set at less than or equal to 15 percent of rated power.

* 2.61 (7 x 7 array) or 2.43 (8 x 8 array)

insertion rate acceptable by Technical Specifications. The effect of scram worth, scram delay time and rod insertion rate, all conservatively applied, are of greatest significance in the early portion of the negative reactivity insertion. The rapid insertion of negative reactivity is assured by the time requirements for 25.6% and 46.4% insertion. By the time the rods are 67.2% inserted, approximately four dollars of negative reactivity have been inserted which strongly turns the transient, and accomplishes the desired effect. The times for 4.7% and 88.1% insertion are given to assure proper completion of the expected performance in the earlier portion of the transient, and to establish the ultimate fully shutdown steady-state condition.

For analyses of the thermal consequences of the transients a MCPR of values as indicated in Table 3.12-2.

This choice of using conservative values of controlling parameters and initiating transients at the design power level produces more conservative results than would be obtained by using expected values of control parameters and analyzing at higher power levels.

Steady-state operation without forced recirculation will not be permitted, except during special testing. The analysis to support operation at various power and flow relationships has considered operation with either one or two recirculation pumps.

In summary:

i. The abnormal operational transients have been analyzed to a power level of 1658 MWt.

ii. The licensed maximum power level is 1658 MWt.

iii. Analyses of transients employ adequately conservative values of the controlling reactor parameters.

during operation. Reducing this operating margin would increase the frequency of spurious scrams which have an adverse effect on reactor safety because of the resulting thermal stresses. Thus, the APRM scram trip setting was selected because it provides adequate margin for the fuel cladding integrity Safety Limit yet allows operating margin that reduces the possibility of unnecessary scrams.

The scram trip setting must be adjusted to ensure that the LHGR transient peak is not increased for any combination of MTPF and reactor core thermal power. The scram setting is adjusted in accordance with the formula in Specification 2.1.A.1, when the maximum total peaking factor is greater than 2.61 (7 x 7 array) or 2.43 (8 x 8 array).

Analyses of the limiting transients show that no scram adjustment is required to assure MCPR $\geq$ 1.07 when the transient is initiated from MCPR $\geq$ values as indicated in Table 3.12.2.

2. APRM High Flux Scram (Refuel or Startup & Hot Standby Mode).

For operation in these modes the APRM scram setting of 15 percent of rated power and the IRM High Flux Scram provide adequate thermal margin between the setpoint and the safety limit, 25 percent of rated. The margin is adequate to accommodate anticipated maneuvers associated with power plant startup. Effects of increasing pressure at zero or low void content are minor, cold water from sources available during startup is not much colder than that already in the system, temperature coefficients are small, and control rod patterns are constrained to be uniform by operating procedures backed up by the rod

LIMITING CONDITIONS FOR OPERATION

C. Minimum Critical Power Ratio (MCPR)

During reactor power operations, MCPR shall be ≥ values as indicated in Table 3.12-2 at rated power and flow. If at any time during reactor power operation it is determined by normal surveillance that the limiting value for MCPR is being exceeded, action shall then be initiated within 15 minutes to restore operation to within the prescribed limits. If the operating MCPR is not returned to within the prescribed limits within two hours, the reactor shall be brought to the cold shutdown condition within 36 hours. Surveillance and corresponding action shall continue until the prescribed limits are again being met.

For core flows other than rated the MCPR shall be ≥ values as indicated in Table 3.12-2 times K_f, where K_f is as shown in Figure 3.12-1.

D. Reporting Requirements

If any of the limiting values identified in Specifications 3.12.A, B or C are exceeded, a Reportable Occurrence report shall be submitted. If the corrective action is taken, as described, a thirty-day written report will meet the requirements of this specification.

SURVEILLANCE REQUIREMENTS

C. Minimum Critical Power Ratio (MCPR)

MCPR shall be determined daily during reactor power operation at ≥ 25% rated thermal power and following any change in power level or distribution that would cause operation with a limiting control rod pattern as described in the bases for Specification 3.3.2.

2. MCPR Limits for Core Flows Other than Rated Flow

The purpose of the K_f factor is to define operating limits at other than rated flow conditions. At less than 100% flow the required MCPR is the product of the operating limit MCPR and the K_f factor. Specifically, the K_f factor provides the required thermal margin to protect against a flow increase transient. The most limiting transient initiated from less than rated flow conditions is the recirculation pump speed up caused by a motor-generator speed control failure.

For operation in the automatic flow control mode, the K_f factors assure that the operating limit MCPR of values as indicated in Table 3.12-2 will not be violated should the most limiting transient occur at less than rated flow. In the manual flow control mode, the K_f factors assure that the Safety Limit MCPR will not be violated for the same postulated transient event.

The K_f factor curves shown in Figure 3.12-1 were developed generically and are applicable to all BWR/2, BWR/3 and BWR/4 reactors. The K_f factors were derived using the flow control line corresponding to rated thermal power at rated core flow.

For the manual flow control mode, the K_f factors were calculated such that at the maximum flow state (as limited by the pump scoop tube set point) and the corresponding core power (along the rated flow control line), the limiting bundle's relative power was adjusted until the MCPR was slightly above the Safety Limit. Using this relative bundle power, the MCPR's were calculated at different points along the rated flow control line corresponding to different core flows. The ratio of the MCPR calculated at a given point of core flow, divided by the operating limit MCPR determines the value of K_f.

For operation in the automatic flow control mode, the same procedure was employed except the initial power distribution was established such that the MCPR was equal to the operating limit MCPR at rated power and flow.

The K_f factors shown in Figure 3.12-1 are conservative for Duane Arnold operation because the operating limit MCPR of values as indicated in Table 3.12-2 is greater than the original 1.20 operating limit MCPR used for the generic derivation of K_f.

D. Reporting Requirements

The Limiting Conditions for Operation associated with monitoring the fuel rod operating conditions are required to be met at all times, i.e., there is no allowable time in which the plant can knowingly exceed the limiting values of MAPLHGR, LHGR and MCPR. It is a requirement, as stated in Specifications 3.12.A, B and C that if at any time during reactor power operation, it is determined that the limiting values for MAPLHGR, LHGR or MCPR are exceeded, action is then initiated to restore operation to within the prescribed limits. This action is initiated as soon as normal surveillance indicates that an operating limit has been reached. Each event involving operation beyond a specified limit shall be reported as a Reportable Occurrence. If the specified corrective action described in the LCO's was taken, a thirty-day written report is acceptable.

TABLE 3.12-2

MCPR LIMITS

Fuel Type	Exposure Prior to End of Cycle		
	> 2000 MWD/T	≤ 2000 MWD/T, > 1000 MWD/T	≤ 1000 MWD/T to E.O.C.
7 x 7	1.xx	1.xx	1.40
8 x 8	1.xx	1.xx	1.50