



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

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

SUPPORTING AMENDMENT NO. 61 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

1.0 Introduction

By letter dated June 28, 1980, Iowa Electric Light and Power Company (the licensee) requested reinstatement of Amendment No. 60 to Facility Operating License No. DPR-49 for the Duane Arnold Energy Center (DAEC). The request would permit the DAEC to operate at up to 50% of rated power with one recirculation loop out of service from June 28, 1980 to July 2, 1980.

In April 1980, an equipment malfunction requiring extensive repairs caused one recirculation pump to be taken out of service. The Technical Specifications in effect at that time required a plant shutdown unless the pump was returned to service within 24 hours. The licensee submitted an amendment application to permit interim plant operation at reduced power until repairs could be effected. Amendment No. 60 (transmitted by NRC letter dated May 6, 1980, from T. Ippolito to Duane Arnold) modified the DAEC Technical Specifications to permit plant startup and operation with one recirculation loop out of service during the requested period necessary to effect repairs. The power level was limited to 50% of rated power. Amendment No. 60 was applicable only for the period required to effect the necessary repairs.

On June 27, 1980, an equipment malfunction, unrelated to the aforementioned, caused one recirculation pump to again be taken out of service. Repairs were necessary which could not be effected within 24 hours. The licensee requested the provisions of Amendment No. 60 to be reinstated until July 2, 1980.

2.0 Evaluation

2.1 Accidents (Other than LOCA) and Transients Affected by One Recirculation Loop out of Service

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2.1.1 One Pump Seizure Accident

The licensee has qualitatively compared the consequences of a pump seizure accident during single loop operation with the consequences of a LOCA during full power operation with both loops in service. Previous analyses have demonstrated that the pump seizure accident is not as severe as a LOCA for two pump operation. The same conclusion can be made for the one pump case by analyzing the two events. In both events, the recirculation driving loop flow is lost instantaneously, in the seizure because of pump stoppage, in the LOCA because of a line severance. In the seizure event, natural circulation flow continues, water level is maintained, and the core remains submerged; thus a continuous core cooling mechanism is provided. However, for a LOCA complete flow stoppage occurs and the water level decreases, resulting in core uncover and subsequent fuel rod cladding overheating. In addition, the reactor pressure does not decrease for a pump seizure event, whereas complete depressurization occurs for the LOCA. Since the potential effects of a pump seizure accident are bounded by the effects of a LOCA, the licensee has taken the position that specific pump seizure analyses for one loop operation are not necessary. Although this gives some assurance of acceptability of the pump seizure event, the staff notes that the acceptance criteria for pump seizure are more stringent than the criteria for a LOCA. Standard Review Plan 15.3.3 (Reactor Coolant Pump Rotor Seizure, and Reactor Coolant Pump Shaft Break) requires that for the pump seizure accident, the release of radioactivity should be a fraction of 10 CFR 100 guidelines. Only limited amounts of fuel failures are acceptable for pump seizures, whereas significantly more failures are acceptable for LOCA.

The licensee, however, will limit reactor power during single loop operation to 50% of rated power. As indicated on the DAEC power/flow operating map, the natural circulation line intersects the 100% flow control line at 53% power. Thus, with power limited to 50%, reactor power is at a value where no fuel damage will occur even if pump seizure should occur.

The staff finds the power limit of 50% to be acceptable on the basis that the power limit will assure no significant fuel damage will result should the pump seizure event occur during one loop operation at DAEC.

2.1.2 Abnormal Transients

2.1.2.1 Idle Loop Startup

The idle loop startup transient was analyzed, in the DAEC FSAR, with an initial power of 55%. The licensee has committed to operate at no greater than 50% power with one loop out of service. Additionally, the Technical Specifications are being modified to require that, during single loop operation, the suction valve in the idle loop be shut and electrically disconnected. These measures are being taken to preclude startup of an idle loop.

2.1.2.2 Flow Increase

The Minimum Critical Power Ratios (MCPRs) in the present Technical Specifications for operation at full power have previously been reviewed and found to be acceptable. A large inadvertent flow increase could cause the MCPR to decrease below the Safety Limit MCPR for a low initial MCPR at reduced flow conditions. Therefore, the required MCPR must be increased at reduced core flow by a flow factor, K_f . The K_f factors are derived assuming both recirculation loops increase speed to the maximum permitted by the scoop tube position set screws. This condition maximizes the power increase and hence the Δ MCPR for transients initiated from less than rated conditions. When operating on one loop the flow and power increase will be less than with two pumps increasing speed, therefore the K_f factors derived from the two-pump assumption are conservative for one loop operation.

2.1.2.3 Rod Withdrawal Error

The rod withdrawal error at rated power analysis indicated that the rod block monitor (RBM) will stop rod withdrawal at a critical power ratio (CPR) which is higher than the safety limit. The minimum critical power ratio (MCPR) requirement for one loop operation will be equal to that for two loop operation because the nuclear characteristics are independent of whether core flow is attained by one or two pump operation, if flow asymmetries are not incurred with one-loop operation. Tests at Quad Cities have shown that flow is uniform across the core for one pump operation with the equalizer valve closed. The results of these tests are considered applicable and acceptable for DAEC.

One-pump operation results in backflow through 8 of the 16 jet pumps while flow is being supplied to the lower plenum from the active jet pumps. Because of this backflow through the inactive jet pumps the present rod-block equation and APRM settings must be modified. The licensee has modified the two-pump rod block equation and APRM settings that exist in the Technical Specification, for one-pump operation and the staff has found them acceptable.

The staff finds that one loop transients and accidents other than LOCA, which is discussed below, are bounded by the two loop operation analysis and are therefore acceptable.

2.2 Loss of Coolant Accident (LOCA)

The licensee has contracted General Electric Co. (GE) to perform single loop operation analysis for DAEC LOCA. The licensee states that preliminary evaluation of these calculations (that are performed according to the procedure outlined in NEDO-20566-2, Rev. 1) indicates that a multiplier of 0.86 should be applied to the MAPLHGR limits for single loop operation of the DAEC. The licensee asserts further that GE has performed a large number of single loop analyses for similar plants; and, in no case has a multiplier of less than 0.70 been required. Additionally, because DAEC does not have the LPCI modification and because the limiting LOCA break is a suction line break, the single loop MAPLHGR multiplier is expected to be significantly larger than for most other BWRs. However, the licensee has proposed that, until the GE calculations can be verified, a multiplier of 0.65 be utilized.

The staff's evaluation finds that value of MAPLHGR reduction factor to be conservative and, therefore, acceptable.

3.0 Summary

For the reasons previously discussed, the staff finds acceptable the proposed single loop operation until July 2, 1980. Power is limited to no greater than 50% of rated power.

4.0 Environmental Considerations

We have determined that this amendment does not authorize a change in effluent types or total amounts nor an increase in power level and 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 Section 51.5(d)(4) that an environmental impact statement, negative declaration, or environmental impact appraisal need not be prepared in connection with the issuance of this amendment.

5.0 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: