April 28, 1989

Docket No. 50-331

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Mr. Lee Liu
Chairman of the Board and
Chief Executive Officer
Iowa Electric Light and Power Company
Post Office Box 351
Cedar Rapids, Iowa 52406

Dear Mr. Liu:

SUBJECT: AMENDMENT NO. 158 TO FACILITY OPERATING LICENSE NO. DPR-49
(TAC NO. 63066)

The Commission has issued the enclosed Amendment No. 158 to Facility Operating License No. DPR-49 for the Duane Arnold Energy Center. This amendment consists of changes to the Technical Specifications in response to your application dated September 15, 1986.

The amendment revises the DAEC Technical Specification requirements related to jet pump operability to implement the improved monitoring guidelines contained in General Electric Service Information Letter No. 330, "Jet Pump Beam Cracks," June 9, 1980. These guidelines were approved by the NRC staff in NUREG/CR-3052, "Closeout of IE Bulletin 80-07: BWR Jet Pump Assembly Failure," issued November 1984.

A copy of the related Safety Evaluation is also enclosed. Notice of issuance will be included in the Commission's next biweekly Federal Register notice.

Sincerely,

/s/

James R. Hall, Project Manager
Project Directorate III-3
Division of Reactor Projects - III,
IV, V & Special Projects
Office of Nuclear Reactor Regulation

Enclosures:
1. Amendment No. 158 to License No. DPR-49
2. Safety Evaluation

DFO1
1/1

cc w/enclosures:
See next page

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Date:	4/13/89	4/14/89	4/17/89	4/17/89	4/17/89

4/28/89

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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. 158
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, et al., dated September 15, 1986 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.

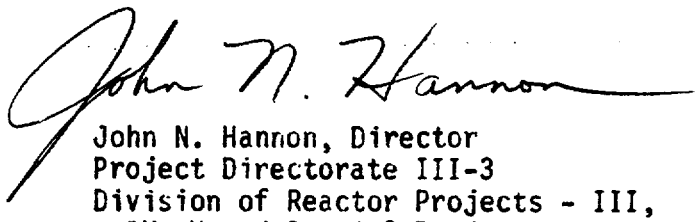
2. Accordingly, the license is amended by changes to the Technical Specifications as indicated in the attachment to this license amendment and paragraph 2.C.(2) of Facility Operating License No. DPR-49 is hereby amended to read as follows:

(2) Technical Specifications

The Technical Specifications contained in Appendix A, as revised through Amendment No. 158, are hereby incorporated in the license. The licensee shall operate the facility in accordance with the Technical Specifications.

3. The license amendment is effective as of the date of issuance and shall be implemented within 30 days of the date of issuance.

FOR THE NUCLEAR REGULATORY COMMISSION



John N. Hannon, Director
Project Directorate III-3
Division of Reactor Projects - III, IV, V and Special Projects
Office of Nuclear Reactor Regulation

Attachment:
Changes to the Technical Specifications

Date of Issuance: April 28, 1989

ATTACHMENT TO LICENSE AMENDMENT NO. 158

FACILITY OPERATING LICENSE NO. DPR-49

DOCKET NO. 50-331

Replace the following pages of the Appendix A Technical Specifications with the enclosed pages. The revised areas are indicated by marginal lines.

Pages

3.6-6
3.6-7
3.6-30
3.6-31
3.6-32

LIMITING CONDITION FOR OPERATION	SURVEILLANCE REQUIREMENT
2.a. From and after the date that the safety valve function of one relief valve is made or found to be inoperable, continued reactor operation is permissible only during the succeeding thirty days unless such valve function is sooner made OPERABLE.	2. At least one of the relief valves shall be disassembled and inspected once per operating cycle.
b. From and after the date that the safety valve function of two relief valves is made or found to be inoperable, continued reactor operation is permissible only during the succeeding seven days unless such valve function is sooner made OPERABLE.	
3. If Specification 3.6.D.1 is not met, an orderly shutdown shall be initiated and the reactor coolant pressure shall be reduced to atmospheric within 24 hours.	3. With the reactor pressure $\geq$ 100 psig and turbine bypass flow to the main condenser, each relief valve shall be manually opened and verified open by turbine bypass valve position decrease and pressure switches and thermocouple readings downstream of the relief valve to indicate steam flow from the valve once per operating cycle.*
E. Jet Pumps	E. Jet Pumps
1. Whenever the reactor is in the RUN mode, all jet pumps shall be OPERABLE. If the requirements of 4.6.E.1.a or .b are not met, perform the surveillance requirements of 4.6.E.2 within 24 hours. If one or more jet pumps do not meet the requirements of 4.6.E.2 and	1. Jet pump operability shall be verified daily, following startup of a recirc pump and after any unexplained changes in either core flow, jet pump loop flow, recirculation loop flow, or core plate differential pressure (ΔP), by recording the jet pump diffuser to lower plenum ΔP's, recirculation pump flows, recirculation pump speeds, and jet pump loop flows and verifying that:
a. the recirculation pump speed is less than 60% of rated, continue to monitor the jet pump(s) performance per 4.6.E.2 daily until the evaluation can be performed at pump speed greater than 60%.	a. The recirculation pump flow to pump speed ratio does not vary from the normal expected operating range by more than 5%, and
	*Intent Change Only (definition of operating cycle).

LIMITING CONDITIONS FOR OPERATION	SURVEILLANCE REQUIREMENT
b. the recirculation pump speed is greater than or equal to 60% of rated, evaluate the reason for the deviation and if the evaluation verifies the jet pump(s) to be INOPERABLE, the reactor shall be placed in COLD SHUTDOWN within 24 hours.	b. The jet pump loop flow to recirculation pump speed ratio does not vary from the normal expected operating range by more than 5%. 2. Record the individual jet pump ΔP's and verify that the individual jet pump ΔP percent deviation from the average loop ΔP does not vary from its normal expected operating range by more than 20%. 3. The surveillance requirements of 4.6.E.1 and .2 do not apply to the idle recirculation loop and associated jet pumps when in SLO. 4. Following each REFUEL OUTAGE, as soon as practical after reaching 60% of rated pump speed, update the baseline data used to perform the above evaluations. Baseline data for SLO shall be updated as soon as practical after entering SLO.
F. Jet Pump Flow Mismatch	F. Jet Pump Flow Mismatch
1. When both recirculation pumps are in steady state operation, the speed of the faster pump may not exceed 122% of the speed of the slower pump when core power is 80% or more of rated power or 135% of the speed of the slower pump when core power is below 80% of rated power. 2. If Specification 3.6.F.1 cannot be met, one recirculation pump shall be tripped. The reactor may be started and operated, or operation may continue in SLO provided that:	1. Recirculation pump speeds shall be checked and logged at least once per day. 2. a. Prior to SLO and core thermal power greater than the limit specified in Figure 3.3-1, establish baseline APRM and LPRM* neutron flux noise levels, provided that baseline values have not *Detector levels A and C of one LPRM string per core octant plus detector levels A and C of one LPRM string in the center of the core shall be monitored.

3.6.E & 4.6.E BASES:

Jet Pumps

Failure of a jet pump nozzle assembly hold down mechanism, nozzle assembly and/or riser increases the cross sectional flow area for blowdown following the postulated design basis double-ended recirculation line break, i.e., the design basis LOCA. Therefore, if such a failure occurs, repairs must be made to assure the DAEC LOCA evaluations remain valid, and the plant does not operate outside its analyzed envelope.

The following factors form the basis for the surveillance requirements:

a. Recirculation Pump Flow/Speed Ratio: the pump operating characteristic is determined by the flow resistance from the loop suction through the jet pump nozzle. Since this resistance is essentially independent of core power, the flow is linearly proportional to pump speed, making their ratio a constant (flow/RPM is constant). A decrease in the ratio indicates a plug, flow restriction, or loss in pump hydraulic performance. An increase indicates a leak or new flow path between the recirculation pump discharge and jet pump nozzle.

b. Jet Pump Loop Flow/Recirculation Pump Speed Ratio: this relationship is an indication of overall system performance.

c. Jet Pump Differential Pressure Relationships: if a potential problem is indicated, the individual jet pump differential pressures are used to determine if a problem exists since this is the most sensitive indicator of significant jet pump performance degradation.

However, these tests are not very accurate below 60% of rated recirculation pump speed due to the instrument accuracy and the significant influence of natural circulation at core flows less than 50% of rated. Therefore, anomalous readings should be evaluated at higher pump speeds before declaring a jet pump inoperable.

After CORE ALTERATIONS, particularly when new fuel designs are loaded into the core, the established relationships for monitoring recirculation system performance may be affected. Hence the requirement to reevaluate the data base after each refuel outage to determine if the baseline data for normal expected operation range remain valid. As stated above, the data is not very reliable below 60% of rated pump speed; thus, the reevaluation of the data base should be performed after reaching 60% pump speed.

Agreement of indicated core flow with established power-core flow relationships provides the most assurance that recirculation flow is not bypassing the core through inactive jet pumps. This bypass flow is reverse with respect to normal jet pump flow. The indicated total core flow is a summation of the flow indications for the sixteen individual jet pumps. The total core flow measuring instrumentation sums reverse jet pump flow as though it were forward flow in the case of a failed jet pump. Thus the indicated flow is higher than actual core flow by

at least twice the normal flow through any backflowing jet pump.* Reactivity inventory is known to a high degree of confidence so that even if a jet pump failure occurred during a shutdown period, subsequent power ascension would promptly demonstrate abnormal control rod withdrawal for any power-flow operating map point.

A nozzle-riser system failure could also generate the coincident failure of a jet pump body; however, the converse is not true.

The lack of any substantial stress in the jet pump body makes failure impossible without an initial nozzle riser system failure.

*Note: In the case of SLO, when the recirculation pump is tripped, the flow through the inactive jet pumps is subtracted from the total jet pump flow, yielding the correct value for the total core flow.

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

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO AMENDMENT NO. 158 TO FACILITY OPERATING LICENSE NO. DPR-49

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

DUANE ARNOLD ENERGY CENTER

DOCKET NO. 50-331

1.0 INTRODUCTION

By letter dated September 15, 1986 (Reference 1), the Iowa Electric Light and Power Company (IELP) proposed revised Technical Specifications (TS) for the Duane Arnold Energy Center (DAEC). The proposed changes would revise TS's 3.6.E. and 4.6.E. and their associated bases to improve monitoring of jet pump performance to detect any impending failures of jet pumps or their holddown beams. The proposed changes incorporate the guidance provided in NRC IE Bulletin 80-07, "BWR Jet Pump Assembly Failure," dated April 4, 1980 (Reference 2), and General Electric Service Information Letter (SIL) No. 330, "Jet Pump Beam Cracks," dated June 9, 1980 (Reference 3).

2.0 EVALUATION

During 1980 and 1981, hold-down beam bars for jet pumps at six BWR/3 plants and one BWR/4 plant were found to have stress corrosion cracking. At two BWR/3 plants, the cracking was severe enough to cause failure of a beam bar with a resultant displacement of the jet pump mixer section. The mixer displacement causes degradation of jet pump performance during normal operation. Of greater concern is the effect of the mixer displacement on core conditions following a postulated LOCA. The elevation of the jet pump inlets corresponds approximately to the two-thirds height of the active fuel region and helps assure maintenance of a relatively high water level in the core region following a postulated break in a recirculation line. However, displacement of the mixer section opens a lower level leakage path for injected water and might reduce the margin of safety during postulated accidents.

In response to this concern, the NRC staff issued Reference 2, which specified a surveillance program to be followed until either the plant TS were changed or the cause of beam failure was identified and corrected. The DAEC implemented the improved jet pump surveillances specified in Reference 2 and has continued to perform them pending revision of the applicable TS's. In Reference 3, General Electric issued recommendations for modifications to the TS to improve

jet pump performance monitoring and detection of impending failure of hold down beams. The proposed TS for the DAEC incorporate these recommendations. In addition, General Electric has developed improved hold-down beam bars which are subjected to a new heat treatment. Although no cracking of beam bars was observed at the DAEC, all 16 beam bars were replaced during the 1988 refueling outage with those of improved design.

The specific changes proposed consist of the following:

(1) Revise the Limiting Condition for Operation for jet pump operability (Section 3.6.E) to specify the actions to be taken if the surveillance requirements cannot be met. Different actions are indicated depending upon the value of recirculation pump speed. For speeds less than 60% of rated, additional daily surveillances are required until the specified evaluations are performed at higher pump speeds. If the speed is greater than or equal to 60% of rated and the requirements are not met, i.e., the jet pumps are verified to be inoperable, the reactor must be in a cold shutdown condition within 24 hours.

(2) Revise the Surveillance Requirements for jet pump operability (Section 4.6.E) to incorporate the improvements in monitoring performance of jet pumps, outlined in GE SIL No. 330, as follows:

   (a) Delete the "simultaneous" requirement of the present Technical Specifications, as it is no longer needed to ensure that anomalous readings are discounted.

   (b) Replace the present performance parameters (flow imbalance and independent core flow measurements) with better indicators of jet pump performance, i.e., ratios of recirculation pump flow to speed and jet pump loop flow to recirculation pump speed.

   (c) Revise the acceptance requirement for deviation of individual jet pump differential pressure (ΔP) from average loop ΔP from the present 10% to 20%.

   (d) Clarify the present requirements to specify that, during single loop operation (SLO), the surveillance requirements of 4.6.E.1 and .2 apply only to the active loop.

   (e) Add a requirement to update the baseline data base after each refueling to ensure that any changes due to the new core loading are incorporated into the data base.

(3) Update the Bases Section for 3.6.E/4.6.E to reflect the above changes.

These proposed changes require monitoring various parameters, including core flow, core plate differential pressure, recirculation pump flow and speed, and jet pump loop flow and differential pressure. Monitoring these parameters will result in a more accurate evaluation of jet pump performance. The proposed Limiting Conditions for Operation (LCO) contain the minimum acceptable standards for jet pump operability, requiring shut down within 24 hours if a jet pump is determined to be inoperable. For recirculation pump speeds below 60% of rated, jet pump flow and differential pressure signals are inherently noisy and thus do not provide reliable indication of jet pump performance. Therefore, when the parameters of proposed Surveillance Requirement 4.6.E.1 are exceeded, proposed LCO 3.6.E.1.a and Surveillance Requirement 4.6.E.2 require daily evaluations of individual jet pump deviations from average loop differential pressure, until an accurate evaluation of jet pump operability can be performed at recirculation pump speeds above 60%. These specifications will preclude unnecessary plant shutdowns due to anomalous data while providing for enhanced monitoring of suspect jet pumps during operation at low recirculation pump speeds. This additional surveillance provides added assurance that any jet pump degradation will be detected prior to jet pump failure.

The staff has reviewed the proposed changes and concludes that revised TS 3.6.E and 4.6.E and the associated bases incorporate the recommended procedures of Reference 3 for improved monitoring of jet pump performance. These procedures were approved by the staff in NUREG/CR-3052, "Closeout of IE Bulletin 80-07: BWR Jet Pump Assembly Failure," Appendix D, November 1984 (Reference 4). In addition, the replacement of the original jet pump hold down beams with improved beams during the 1988 refueling outage provides added assurance that jet pump failures will not occur. Therefore, the staff finds the proposed changes acceptable.

3.0 ENVIRONMENTAL CONSIDERATIONS

This amendment changes a requirement with respect to installation or use of a facility component located within the restricted area as defined in 10 CFR Part 20 or changes a surveillance requirement. The staff has determined that the amendment involves no significant increase in the amounts, and no significant change in the types, of any effluents that may be released offsite, and that there is no significant increase in individual or cumulative occupational radiation exposure. The Commission has previously issued a proposed finding that the amendment involves no significant hazards consideration and there has been no public comment on such finding. Accordingly, the amendment meets the eligibility criteria for categorical exclusion set forth in 10 CFR 51.22(c)(9). Pursuant to 10 CFR 51.22(b), no environmental impact statement or environmental assessment need be prepared in connection with the issuance of the amendment.

4.0 CONCLUSION

The staff has concluded, based on the considerations discussed above, that: (1) there is reasonable assurance that the health and safety of the public will not be endangered by operation in the proposed manner, and (2) such activities will be conducted in compliance with the Commission's regulations, and the issuance of the amendment will not be inimical to the common defense and security or to the health and safety of the public.

5.0 REFERENCES

1. Letter from R. McGaughy, IELP, to H. Denton, NRC, "Technical Specification Change (RTS-206) Jet Pump Operability," September 15, 1986, NG-86-3011.

2. USNRC IE Bulletin No. 80-07, "BWR Jet Pump Assembly Failure," April 4, 1980.

3. General Electric Company Service Information Letter (SIL) 330, "Jet Pump Beam Cracks," June 9, 1980.

4. USNRC NUREG/CR-3052, "Closeout of IE Bulletin 80-07: BWR Jet Pumps Assembly Failure," November, 1984.

Principal Contributor: J. R. Hall

Dated: April 28, 1989