

EG&G

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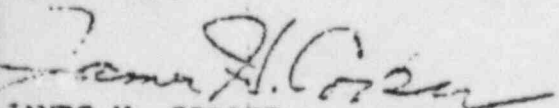
Mr. Paul Shemanski
US NUCLEAR REGULATORY COMMISSION
Office of Nuclear Reactor Regulation
Division of Licensing
Operating Reactors Assessment Branch
7920 Norfolk Avenue/MS-416
Bethesda, MD 20014

24 March 1981
ESD# 7160

Dear Paul:

Attached are proposed questions with an attachment, for the Duane Arnold Energy Center regarding their license amendment and technical specification change for single recirculation loop operation. Their answers will be needed to complete the technical evaluation and to write the report. If there are any concerns, give me a call, or if it is acceptable, please forward the questions to the plant project manager to send to the licensee. Thanks for the information that you sent previously from the technical specification and FSAR and the nuclear supplier's report.

Sincerely,


JAMES H. COOPER
ENGINEER SPECIALIST I

JC/ss

Attachments

cc: B. Mayn
M. Nishimura

3406070202 840319
PDR FOIA
BELL84-105 PDR

BRANCH TECHNICAL POSITION IC3B 12
PROTECTION SYSTEM TRIP POINT CHANGES FOR OPERATION WITH REACTOR COOLANT
PUMPS OUT OF SERVICE

A. BACKGROUND

For the past several years, including a time prior to the development of IEEE Std 279, the staff has required automatic adjustment to more restrictive settings of trips affecting reactor safety by means of circuits satisfying the single failure criterion. The basis for this requirement is that the function can be accomplished more reliably by automatic circuitry than by a human operator. This design practice, which has also been adopted independently by the national laboratories and by much of industry, served as the basis for paragraph 4.13, "Multiple Set Points," of IEEE Std 279.

More recently, all applicants have stated that their protection systems were designed to meet IEEE Std 279. Paragraph 4.13 of IEEE Std 279 specified that where a mode of reactor operation requires a more restrictive set point, the means for ensuring use of the more restrictive set point shall be positive and must meet the other requirements of IEEE Std 279. A number of designs have been proposed and accepted which reliably and simply satisfy this requirement. During the review of some applications, however, certain design deficiencies have been found. The purpose of this position is to provide additional guidance on the application of Section 4.13 of IEEE Std 279.

B. BRANCH TECHNICAL POSITION

1. If more restrictive safety trip points are required for operation with a reactor coolant pump out of service, and if operation with a reactor coolant pump out of service is of sufficient likelihood to be a planned mode of operation, the change to the more restrictive trip points should be accomplished automatically.
2. Plants with designs not in accordance with the above should have included in the plant technical specifications a requirement that the reactor be shut down prior to changing the set points manually.

C. REFERENCES

1. Millstone-3 Safety Evaluation Report, September 24, 1973.
2. Beaver Valley-2 Safety Evaluation Report, October 10, 1973.
3. IEEE Std 279, "Criteria for Protection Systems for Nuclear Power Generating Stations."

QUESTIONS REGARDING DUANE ARNOLD ENERGY CENTER

TECHNICAL SPECIFICATION CHANGE PRO SINGLE LOOP OPERATION

Describe how the change from normal two recirculation cooling loop operation to one loop operation would be accomplished, with what physical and administrative controls, and while complying with branch technical position EICSB 12 (attached) regarding multiple setpoints and their control, and with IEEE STD. 279-4.15.

What provisions would be made in the technical specification for decreased flow stability in single loop operation?

Describe changes made to the flow computer to automatically account for magnitude and sense change for reverse flow in the idle loop jet pumps during single loop operation.

Is there a requirement for the recirculation flow equalizer valves to be closed and tagged prior to commencing single recirculation loop operation as stated in NEDO-24272 Page 1-1 and how is this requirement ensured in the technical specification change?

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Pl to the Lessee.

Paul Sheemanski
27474

~~3/25/81~~
3/25/81

TO: PAUL SIEMANSKI
USNRC
Office of Nuclear Reactor Regulation
Division of Licensing
Operating Reactors Assessment Branch
7920 Norfolk Avenue/MS-416
Bethesda, MD 20014

FROM: James Cooper
EC&C, Inc.
San Ramon Operations

(3 Pages)

W. 1000

(3)

Docket No. 50-331

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

Dear Mr. Arnold:

The Commission has issued the amended
Amendment No. to Facility Operating
License No. DPR-49 for the Duane Arnold
Energy Center. This amendment consists
of changes to the Technical Specifications in
partial response to your application dated
October 17, 1980 as supplemented September
1981.

Your application of October 17, 1980, requested approval
to operate at power levels up to a maximum
of 85% of rated power with one recirculation
+ pump out of service. Your September 1981
application referred to the guidelines contained in the October
1980 submission and requested approval for operation
at power levels up to 85% of rated power with
one recirculation pump out of service pending
completion of the shaft repair of the
contract.

2 - This amendment changes the Technical Specifications to permit operation at power levels not to exceed 50% of rated power with one recirculation loop out of service.

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

Sincerely,
TTC, Chief
ORB #2
DL

Enclosures:

1. Amendment No.
2. Safety Evaluation
3. Notice

cc. w/ enclosure
See next page

undated

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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:

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Duane Arnold Energy Center (DAEC)

January 12, 1983

The Commission has issued the enclosed Amendment No. _____ to Facility Operating License No. DPR-~~44~~ for the ~~Coecker Nuclear Station~~. This amendment consists of changes to the Technical Specifications in response to your submittal dated ~~April 27, 1982~~, as supplemented by your ~~May 4, 1982 and July 28, 1982~~ submittals which provided ~~additional~~ information. *connected pages of DAEC Technical Specifications.*

The amendment modifies the Technical Specifications to permit operation up to 50% of rated power with one recirculation loop out of service.

Copies of the Safety Evaluation and Notice of Issuance are also enclosed.

~~October 17, 1980,~~

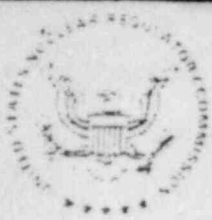
Sincerely,

~~December 18, 1981,~~ ~~June 2nd, 1983~~

Mohan C. Trandani
Mohan C. Trandani, Project Manager
Operating Reactors Branch #2
Division of Licensing

Enclosure:
Notice of Consideration

cc w/enclosure:
See next page



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

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

SUPPORTING AMENDMENT NO. TO FACILITY

OPERATING LICENSE NO. DPR-49

IOWA ELECTRIC LIGHT AND POWER COMPANY
COOPER NUCLEAR STATION

DUANE ARNDT ENERGY CENTER

DOCKET NO. 50-376 831

1.0 Introduction

Duane Arndt Energy Center (DAEC)

The current ~~Cooper Nuclear Station (CNS)~~ Technical Specifications do not permit plant operation beyond 24 hours if an idle reactor coolant recirculation loop cannot be returned to service. The ability to operate at reduced power with a single loop is highly desirable from an availability/outage planning standpoint in the event maintenance or component unavailability renders one recirculation loop inoperable. Such events have nearly occurred several times.

October 17, 1980

January 17, 1981, Iowa Electric Light and Power Company

By letter dated ~~August 6, 1980, Browns Ferry Nuclear Station (licensee)~~ DAEC requested changes to the Technical Specifications for ~~the~~ that would permit DAEC to operate at up to ~~75%~~ 80% of rated power with one recirculation loop out of service for unlimited time. Although analyses indicate that it may be safe to operate BWRs with a single recirculation loop in the range of 80% rated power, the experience (reference letter from L. W. Mills, TVA, dated March 17, 1980 to H. Denton, NRC) at Browns Ferry Unit 1 has caused concern about flow and power oscillations that were observed during single recirculation loop operation at a power level of about 89% of the rated power level.

Therefore, we informed the licensee that until there was an acceptable resolution to the problem, we would consider limiting authorization of single recirculation loop operation to no greater than 80% of the licensed rated power level. This consideration is based on the results of acceptable flow and power characteristics experienced with single loop operation at up to 80% of rated power at Browns Ferry Unit 1 and several other operating BWRs. Accordingly, the licensee amended its application by letter submittals dated ~~May 6, 1980~~ December 1, 1980 and ~~July 23, 1982~~ December 1, 1980; which incorporated a request for approval for single loop operation at power levels up to 80% of rated thermal power. ~~The request by~~ the licensee ~~incorporated the CNS plant specific safety analysis~~ incorporated the CNS plant specific safety analysis ~~and the~~ and the ~~licensee requested~~ licensee requested ~~approval for~~ approval for ~~single loop operation at~~ single loop operation at ~~power levels up to 80% of rated power.~~ power levels up to 80% of rated power.

DAEC requested limited single loop rated power operation to 80% maximum power of 80% of the rated power for one loop operation. The Iowa Electric Light and Power Company submitted changes to Technical Specifications to be consistent with the licensee amendment for cycle 7 (Amendment 27, issued April 20, 1981). The major changes deal with increased MCRB operating limits and new maximum power limits for one loop operation.

Cycle 7. The design was designed to allow for a recirculation loop to be out-of-service but by electrically isolating the recirculation loop instead of closing the suction valve as ~~previously~~ previously proposed by the licensee.

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2.0 Evaluation

To fully determine the acceptability of operation with a single recirculation loop this evaluation addresses the following aspects: transients and accidents affected by single loop operation; thermal hydraulic consideration; stability analysis results; and electrical, instrumentation and control system changes.

2.1 Accidents (Other Than a LOCA) and Transients Affected by One Recirculation Loop Out of Service

The licensee stated that the postulated one pump seizure accident is a relatively mild event during operation with two recirculation pumps. Similar analyses were performed to determine the impact this postulated accident would have on one recirculation pump operation. These analyses were performed using the NRC reviewed and approved General Electric Generic Reload Fuel Application Report NEDE-24011-P-A-1 for a large core BWR/4 plant. The analyses were conducted from steady-state operation at the following initial conditions, with the added condition of one inactive recirculation loop. Two sets of initial conditions were assumed:

- a. Thermal Power = 75% of rated
Core Flow = 58% of rated
- b. Thermal Power = 82% of rated
Core Flow = 55% of rated

These conditions were chosen because they represent reasonable upper limits of single loop operation within existing maximum average planar linear heat generation rate (MAPLHGR) and minimum critical power ratio (M CPR) limits at the same maximum pump speed. Pump seizure was simulated in the analyses by setting the single operating pump speed to zero instantaneously.

The anticipated sequence of events following a postulated occurrence of recirculation pump seizure during plant operation with the alternate recirculation loop out of service is as follows:

- a. The recirculation loop flow in the loop in which the pump seizure occurs drops instantaneously to zero.
- b. Core voids increase which result in a negative reactivity insertion and a sharp decrease in neutron flux.
- c. Heat flux drops more slowly because of the fuel time constant.
- d. Neutron flux, heat flux, reactor water level, steam flow, and feedwater flow all exhibit transient behaviors. However, it is not anticipated that the increase in water level will cause a turbine trip and result in a reactor scram.

It is expected that the accident will terminate at a condition of natural circulation and reactor operation will continue. There will also be a small decrease in system pressure.

The licensee concluded that the MCPR for the pump seizure accident for the large core BWR/4 plant was determined to be greater than the fuel cladding integrity safety limit; therefore, no fuel failures were postulated to occur as a result of this analyzed event. The results of these analyses, which were performed using methodology provided in the NRC reviewed and approved GE topical report, NEDE-24011-P-A-1 are applicable to ~~the~~ DAEC.

The idle loop startup transient was analyzed, in the ^{DAEC}~~FSAR~~ FSAR, with an initial power of ~~50%~~ 50%. This analysis showed that no damage occurs to the fuel cladding and no significant changes in nuclear system pressure results from the transient. Since the licensee would be restricted to operate at power levels not to exceed 50% with a single recirculation loop out of service, operation is bounded by the FSAR analysis. In addition, there are electrical interlocks that prevent startup of the recirculation pump in the idle loop unless the discharge valve is closed.

For single loop operation, the rated condition steady-state MCPR limit is increased by 0.01 to account for increased uncertainties in the core total flow and traversing incore probe (TIP) readings. The MCPR will vary depending on flow conditions. This leads to the possibility of a large inadvertent flow increase which could cause the MCPR to decrease below the Technical Specification safety limit 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_2 . The K_2 factors are derived assuming both recirculation loop pumps increase speed to the maximum permitted by the scoop tube position set screws. This condition maximizes the power increase and hence, the MCPR for transients initiated from less than rated conditions. When operating with one recirculation pump the potential flow and power increase will be less than that associated with two recirculation pumps operating; therefore, the K_2 factors derived from the two-pump assumption are conservative for single loop operation.

The rod withdrawal error at rated power is given in the FSAR for the initial core and in cycle dependent reload supplemental submittals. These analyses are performed to demonstrate that, even if a reactor operator ignores all instrument indications and the alarm which could occur during the course of the transients, the rod block system will stop rod withdrawal at a minimum critical power ratio which is higher than the fuel cladding integrity safety limit. Correction of the rod block equation and lower initial power for single-loop operation assures that the MCPR safety limit is not violated.

One pump operation results in backflow through 10 of the 20 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. We have reviewed the modifications made to the rod block equation and APRM settings and determined they have been conservatively modified for one-pump operation and are therefore acceptable.

We find that since the analyses of transients and accidents with single loop operation other than LOCA which is discussed below, are bounded by the two-loop operation analyses, single loop operation at 80% of rated power is acceptable.

The licensee has proposed the following Technical Specification changes to assure safe single-loop operation during the most limiting transient and accident conditions.

1. Increasing the MCPR safety limit by 0.01 to account for uncertainties in core flow and traversing incore probe readings. The basis for this increase in MCPR safety limit was addressed in the plant specific NEDO-24272 ~~Sign~~ for single-loop operation at ~~the~~ DAEC.

2. Increasing the MCPR operating limit by 0.01, similar to other operating conditions when the core flow is less than rated, and multiplying the MCPR operating limit by the appropriate two-loop K_x factors that are in the ~~the~~ Technical Specifications. This will preclude an inadvertent flow increase from causing the MCPR to stop below the safety limit MCPR.
DAEC

3. Modifying the two-loop APRM scram, rod block and rod block monitor (RBM) setpoints to account for backflow through half the jet pumps based in plant specific analyses by GE.

We have determined that these Technical Specification changes proposed by the licensee are consistent with the results of the analyses discussed above and provide adequate protection for safe single-loop operation. Similar changes have been previously approved for Peach Bottom Units 2 and 3 which are similar to ~~the~~ ^{the} ~~the~~ Based on these facts, we find the proposed Technical Specification changes acceptable.

2.2 Loss-of-Coolant-Accident (LOCA)

The licensee contracted GE to perform a LOCA analysis for single-loop operation for the ~~the~~ ^{the} ~~the~~ The licensee stated that evaluation of these calculations performed according to the procedure outlined in GE Report NEDO-20566 ~~the~~ ^{the} ~~the~~ Using this procedure a full spectrum of break sizes for both the suction and discharge side breaks were analyzed. Because the reflood
Start

minus uncover time for the single-loop analysis is similar to the two-loop analysis, the maximum average planar linear heat generation rate (MAPLHGR) curves currently applied to ~~the~~ ^{CNS} were modified by derived reduction factors for use during one recirculation pump operation.

We find that since single-loop LOCA analyses performed by the licensee do not result in the acceptance criteria in 10 CFR 50.46 being exceeded, single loop operation at 50% of rated power is acceptable.

The licensee has proposed Technical Specification changes to the multipliers that should be applied to the MAPLHGR limits for single-loop operation at CNS that were calculated in accordance with GE Report NEDE-~~2488~~, ~~Vol. 1, 1977~~ ²⁴²⁷⁸ for all the fuel types used in the core (7x7, 8x8, ~~9x9~~ ^{9x9} and ~~10x10~~ ^{10x10}). The staff has approved operation of Peach Bottom Units 2 and 3 with MAPLHGR values reduced by similar multipliers for an unlimited period of time for the first three types of fuel identified. Based on these facts, we find the proposed Technical Specification changes acceptable.

It should be noted that the APRM scram, rod block setpoints and RBM setpoints Technical Specification changes proposed by the licensee to account for the postulated accidents and transients discussed in Section 2.1 of this Safety Evaluation are also applicable for the LOCA.

2.3 Thermal Hydraulic

The licensee has confirmed that the thermal hydraulic analysis uncertainties are independent of whether flow is provided by two loops or a single loop ("NCR BWR Thermal Analysis Bases: Data, Correlation, and Design Application," GE Report NEDO-10958-A, January 1977). The only exceptions to this are increased uncertainties in the core total flow and T/P readings. To account for these uncertainties, the MCPR limit has been increased by 0.01. The steady state operating MCPR with single loop operation will be conservatively established by multiplying the K_f factor to the rated flow MCPR limit.

We have reviewed these changes and determined that they will conservatively account for the thermal hydraulic analysis uncertainties. The corresponding Technical Specification changes specified in Section 2.1 of this Safety Evaluation are also applicable and therefore, are acceptable.

2.4 Stability Analyses

The licensee has stated in its submittal (GE Report NEDO-24268) that operation along the minimum forced recirculation line with one pump running at minimum speed is more stable than operating with natural circulation flow only, but is less stable than operating with both pumps operating at minimum speed. To accommodate any flow control oscillations which may occur in the recirculation flow control system under single-loop operation the licensee has stated that the plant will be operated in the manual control mode.

The staff has accepted previous stability analyses results, contained in CNS reload submittal reports, as evidence that the core can be operated safely while our generic evaluation of BWR stability characteristics and analysis methods continues. These previous stability analyses include natural circulation conditions and thus bound the single-loop operation. Therefore, we conclude that single-loop operation is safe provided the recirculation flow control system is operated in the manual control mode, as proposed by the licensee, to eliminate the need for control system analyses and to reduce the effects of potential core instabilities.

To assure core stability during single-loop operation, the licensee following discussions with the staff, revised their submittal in a May 6, 1982 letter to incorporate monitoring provisions into their proposed Technical Specification changes. The licensee has proposed to monitor the APRM flux noise once per shift and reduce the average peak to peak fluctuations if these fluctuations exceed, by more than 80%, those previously determined at $\leq 40\%$ power. The licensee has also proposed to monitor core plate delta pressure noise fluctuations once per shift and reduce the recirculation pump speed if the average peak to peak fluctuations exceed by more than 50% those previously determined at $\leq 40\%$ power.

Based on the licensee's submittals and subsequent discussions, we have concluded that: single-loop operation is acceptable, since no oscillatory problems have been observed at CNS based on the limited experience observed during single-loop operation permitted by the existing Technical Specifications (less than 24 hours); and the Technical Specifications proposed by the licensee to monitor the APRM flux noise and core plate delta pressure noise are adequate to detect and prevent core instabilities during sustained single-loop operation.

2.5 Electrical, Instrumentation, and Control

The licensee in a May 6, 1982 submittal provided the staff additional plant specific information related to single-loop operation at CNS. The information was requested to provide assurance that any electrical, instrumentation, and control system changes required for single-loop operation would be made in an acceptable manner and addressed in plant operating procedures.

The licensee, in these submittals, stated that entry into single recirculation pump operation would be accomplished either through the automatic tripping of one recirculation pump or manual removal from service by reducing the speed of one pump to minimum and opening the motor feeder circuit breaker. One setpoint adjustment would be required when it is determined that single recirculation pump operation is required for longer than 24 hours. The CNS plant average power range monitor (APRM) alarm, red block, and red block monitor (RBM) set settings would then be adjusted downward in order to accommodate an error in flow measurement due to backflow through the late recirculation loop jet pumps.

... of the proposed amendment and control system design of single loop operation. We have determined that the licensee has stated that changes in setpoints would be accomplished in accordance with Station Procedure 10.1, "APRM Calibration" which has been utilized extensively at CNS since plant startup in 1974. Since no new unfamiliar procedures will be utilized to change from two-loop to single-loop operation, we conclude that the existing administrative controls ensure that the APRM setpoint adjustments necessary for single-loop operation will be performed properly.

3.0 Environmental Considerations

We have determined that the 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 51.5(d)(4), that an environmental impact statement, or negative declaration and environmental impact appraisal need not be prepared in connection with the issuance of the amendment.

4.0 Conclusions

We have 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.

Principal Contributors: G. Thomas
B. Siegel

Dated:

UNITED STATES NUCLEAR REGULATORY COMMISSIONDOCKET NO. 80-298NOTICE OF ISSUANCE OF AMENDMENT TO FACILITYOPERATING LICENSE

The U. S. Nuclear Regulatory Commission (the Commission) has issued Amendment No. to Facility Operating License No. DPR-46 issued to Nebraska Public Power District (the licensee) which revises the Technical Specifications for operation of the Cooper Nuclear Station located in Nemaha County, Nebraska. The amendment is effective as of its date of issuance.

The amendment modifies the Technical Specifications to permit operation up to 80% of rated power with one recirculation loop out of service.

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 1, 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.

Notice of Consideration of Issuance of Amendment and Opportunity for Prior Hearing in connection with this action was published in the FEDERAL REGISTER on September 18, 1983, 48FR41607. No request for a hearing or petition for leave to intervene was filed following this notice.

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 impact statement or negative declaration and environmental impact appraisal need not be prepared in connection with the issuance of this amendment.

For further details with respect to this action, see (1) the application for amendment dated August 5, 1980, as supplemented May 6, and July 28, 1982, (2) Amendment No. to License No. DPR-46 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 Auburn Public Library, 188 - 18th Street, Auburn, Nebraska 68304. 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 Licensing.

Dated at Bethesda, Maryland, this day of

FOR THE NUCLEAR REGULATORY COMMISSION

Domenic S. Vassallo, Chief
Operating Reactors Branch #2
Division of Licensing

Document Name:
AMENDMENT 80-298

Requestor's ID:
AMY

Author's Name:
~~B. Stee~~

Document Comments:
App 8/8/80, 8/6/82 & 7/23/82 Re: Oper w/1 Rectro Loop T t