

EG&G ENERGY MEASUREMENTS GROUP

San Ramon Operations

2801 OLD CROW CANYON ROAD, SAN RAMON, CA • TEL (415)837-5381 • MAIL: BOX 204, SAN RAMON, CA 94583

In reply please refer to:

Dick Clark

Mr. Jack Donohew
U.S. NUCLEAR REGULATORY COMMISSION
Office of Nuclear Reactor Regulation
Division of Licensing
Operating Reactors Assessment Branch
7920 Norfolk Avenue
Bethesda, MD 20014

3 February 1982
ESD #7591

Dear Jack:

Attached is a list of questions on the (N-1) Cooling Loop Protection System for Cooper Nuclear Station. If the questions meet with your approval, a quick response would be obtained if the questions were telecopied to the licensee by the PM. A conference call may then be made to obtain the answers. A letter of verification could then be sent by the licensee to confirm and document the telephone conversation.

~~Also attached is a copy of the draft TEB for Zion 1 and 2 which has been revised per the conference call with you and J. T. Beard. We can discuss your comments on the phone after you and J.T. have reviewed it.~~

Sincerely,

Bill Kountanis

BILL KOUNTANIS
ENGINEERING SPECIALIST

BK/lf

Attachment

- cc: J. Cooper
- B. Mayn
- B. Nishimura
- R. White, NLV

8406070208 840319
PDR FGIA
BELL84-105 PDR

QUESTIONS REGARDING COOPER NUCLEAR CENTER

TECHNICAL SPECIFICATION CHANGE FOR SINGLE LOOP OPERATION

1. Describe how the change from normal two recirculation cooling loop operation to one loop operations would be accomplished, with what physical and administrative controls, and while complying with branch technical position EICSB 12 regarding multiple setpoints and their control, and with IEEE STD. 279-4.15.
2. 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 operations.
3. 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-24258 Page 1-1/1-2 and how is this requirement ensured in the technical specification change?
4. Where set point adjustments for single loop operation are required, is sufficient range available on the adjustment mechanisms to keep the new settings within the stable operating portion of the adjusting device?

NO SIGNIFICANT HAZARDS CONSIDERATION DETERMINATION
AND NOTICING ACTION

Jocket No. 50-298 Facility: Cooper Nuclear Station
 Licensee: Nebraska Public Power District Date of application: 08/05/80 as modified
05/06/82 & 08/05/82
 Request for:

(See attached.)

Initial Determination:

- () Proposed determination - amendment request involves no significant hazards considerations (NSHC).
 (XX) Final determination - amendment request involves significant hazards considerations (SHC).

Basis for Determination

- () Licensee's NSHC discussion has been reviewed and is accepted. See attached amendment request.
 (XX) Basis for this determination is presented in the attached.)
 () Other (state):

(Attach additional sheets as needed.)

Initial Noticing Action: (Attach appropriate notice or input for monthly FRN)

1. () Monthly FRN. Notice of opportunity for hearing (30 days) and request for comments on proposed NSHC determination - monthly FRN input is attached (Attachment 8).
2. () Individual FRN (30 days). Same notice matter as above. Time does not allow waiting for next monthly FRN (Attachments 9a and 9b).

(THIS FORM SHOULD BE TYPED EXCEPT FOR UNUSUAL, URGENT CIRCUMSTANCES.)

request for:

Technical Specification changes and a license change to permit reactor operation at power levels of 50% of rated power with one recirculation loop out of service. Presently, the Cooper Nuclear Station operating license requires plant shutdown if an idle recirculation loop cannot be returned to service within 24 hours. The change proposed by the licensee would delete this license condition and modify the Technical Specifications (TSs) to provide for: appropriate Average Power Range Monitor (APRM) flux scram trip and rod block settings; an increase in the safety limit Minimum Critical Power Ratio (MCPR) value; revisions to the allowable Average Planar Linear Heat Generation Rate (APLHR) values suitable for use with an idle recirculation loop; and the inclusion of APRM flux and core plate pressure drop limits during single loop operation.

asis:

The Commission has provided guidance for the application of the standards for determining whether a significant hazards consideration exists by providing examples of amendments that are considered not likely to involve significant hazards considerations (48 FR 14870). One such amendment involves a relief granted upon demonstration of acceptable operation from an operating restriction that was imposed because acceptable operation was not yet demonstrated. This assumes that the operating restriction and the criteria to be applied to a request for relief have been established in a prior review and that it is justified in a satisfactory way that the criteria have been met.

The Cooper Nuclear Station (CNS) license presently requires plant shutdown if an idle recirculation loop cannot be returned to service within 24 hours. This restriction was imposed because insufficient information existed to enable the staff to establish criteria for operation with an idle recirculation loop. Although such criteria have since been established, and analyses have indicated that it should be safe to operate BWRs on a single loop in the range of 85% power, operating experience with an idle recirculation loop at Browns Ferry 1 (BF-1) in late 1979 raised concerns about authorizing single loop operation for BWRs. When the Tennessee Valley Authority (TVA) tried to increase power at BF-1 above about 59% of rated power while operating on a single loop, variations in jet pump flow, neutron flux, and related parameters were noted. Neither the causes nor the potential effects of these variations have been determined or reviewed by the staff for operation with a single recirculation loop. Thus, it has not been justified in a satisfactory way that the criteria for operation with a single loop have been met.

Since CNS has not operated at 50% with an idle recirculation loop for even 24 hours as permitted by the current technical specifications, the application for amendment involves changes which do not satisfy the criteria of the applicable example of an amendment which would likely be found not to involve significant hazards considerations. Therefore, the staff has made a determination that the application for amendment may involve a significant hazards consideration.



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

2-14

revised

DRAFT

Docket No. 50-298

Mr. J. M. Pilant, Director
Licensing and Quality Assurance
Nebraska Public Power District
Post Office Box 499
Columbus, Nebraska 68601

Dear Mr. Pilant:

The Commission has issued the enclosed Amendment No. to Facility Operating License No. DPR-46 for the Cooper Nuclear Station. This amendment consists of changes to the Technical Specifications in response to your submittal dated August 5, 1980, as supplemented by your May 6, 1982 and July 28, 1982 submittals which provided additional information.

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.

Sincerely,

Byron L. Siegel, Project Manager
Operating Reactors Branch #2
Division of Licensing

Enclosures:

1. Amendment No. to License No. DPR-46
2. Safety Evaluation
3. Notice of Issuance

cc w/enclosures:
See next page



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

NEBRASKA PUBLIC POWER DISTRICT
DOCKET NO. 50-298
COOPER NUCLEAR STATION
AMENDMENT TO FACILITY OPERATING LICENSE

Amendment No.
License No. DPR-46

1. The Nuclear Regulatory Commission (the Commission) has found that:
 - A. The application for amendment by Nebraska Public Power District dated August 5, 1980, as supplemented, May 6, 1982, and July 28, 1982, 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 licensee 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-46 is hereby amended to read as follows:

(2) Technical Specification

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

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

FOR THE NUCLEAR REGULATORY COMMISSION

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

Attachment:
Changes to the Technical
Specifications

Date of Issuance:



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-46

COOPER NUCLEAR STATION

DOCKET NO. 50-298

1.0 Introduction

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.

By letter dated August 5, 1980, Nebraska Public Power District (licensee) requested changes to the Technical Specifications for CNS that would permit CNS to operate at up to 72% 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 72% rated power, the experience (reference letter from L. M. 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 59% 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 50% 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 50% 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, 1982 and July 28, 1982; which incorporated a request for approval for single loop operation at power levels up to 50% of rated thermal power. The August 5, 1980 submittal also contained the CNS plant specific safety analysis titled: "Cooper Nuclear Station Single Loop Operation," General Electric Report NEDO-24258, dated May 1980, to support the changes requested.

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 = 56% 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 (MCPR) 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 CNS.

The idle loop startup transient was analyzed, in the CNS FSAR, with an initial power of 60%. 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_f . The K_f 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_f 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 50% 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-24258 for single-loop operation at CNS.
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_f factors that are in the CNS Technical Specifications. This will preclude an inadvertent flow increase from causing the MCPR to stop below the safety limit MCPR.
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 CNS. 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 CNS. The licensee stated that evaluation of these calculations performed according to the procedure outlined in GE Report NEDO-20566-2, Rev. 1. Using this procedure a full spectrum of break sizes for both the suction and discharge side breaks were analyzed. Because the reflood

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 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-24858, May 1980 for all the fuel types used in the core (7x7, 8x8, 8x8R and P8x8R). 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 ("GE 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 TIP 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 analyses 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-24258) 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 50%, those previously determined at 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 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 full power on the limited experience observed during single-loop operation; 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 May 6, 1982 and July 28, 1982 submittals provided the staff and its contractor, EG&G Energy Measurement Group, 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 flow bias average power range monitor (APRM) scram, rod block, and rod block monitor (RBM) trip settings would then be adjusted downward in order to accommodate an error in flow measurement due to backflow through the idle recirculation loop jet pumps.

The licensee has also 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. EG&G provided a Technical Evaluation Report (TER) (SRO-324, dated May 1983) of the electrical instrumentation and control design aspects of single loop operation of CNS. We have determined based on our review of EG&G's TER and the licensee's submittals that the licensee's proposed method for single loop operation and associated setpoint changes are acceptable.

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. 50-298NOTICE 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 revised 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 50% 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 I, which are set forth in the license amendment.

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 15, 1983, 48FR41537. 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 - 15th 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 B. Vassallo, Chief
Operating Reactors Branch #2
Division of Licensing