ARKANSAS POWER & LIGHT COMPANY
FIRST COMMERCIAL BUILDING/P.O. BOX 551/LITTLE ROCK, ARKANSAS 72203/(501) 371-7901

January 28, 1985

T. GENE CAMPBELL
Vice President
Nuclear Operations

2CANØ185Ø5

Director of Nuclear Reactor Regulation
ATTN: Mr. James R. Miller, Chief
Operating Reactors Branch #3
Division of Licensing
U. S. Nuclear Regulatory Commission
Washington, DC 20555

SUBJECT: Arkansas Nuclear One - Unit 2
Docket No. 50-368
License No. NPF-6
Proposed Technical Specifications
Change Request - ANO-2 CPC Update

Gentlemen:

Attached are proposed changes to Arkansas Nuclear One - Unit 2 Technical Specifications 2.1.1.1, 2.2.1, Table 2.2-1, Table 2.2-2, 4.2.4.4, and their applicable bases where appropriate. These changes as proposed would:

1) Revise the Departure from Nucleate Boiling Ratio (DNBR) limit used by the Core Protection Calculators (CPC) to incorporate the findings of a recently completed Combustion Engineering (CE) study on rod bow penalty.

2) Remove the rod bow penalty factor surveillance requirement.

3) Modify the DNBR limit to incorporate penalties previously accounted for by one of the CPC addressable constants.

4) Revise the CPC addressable constants to incorporate proposed CPC software modifications.

5) Revise the CPC addressable constants allowable values to incorporate operational experience gained over the past five years.

The attached describes each of these changes in detail and provides bases for the changes. Revised Technical Specification pages are also attached.

Rec'd w/LTR & Check
For $150.00

PROP ENCL TO:
REG FILE(1)
R.S. Lee (PM)(4)

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In support of the DNBR limit revision we have attached CE study CEN-289(A) entitled "Revised Rod Bow Penalties for Arkansas Nuclear One Unit 2." CE has determined that certain portions of this document are proprietary per 10CFR2.790 and therefore requests that they be withheld from public disclosure. In support of this determination CE has provided the attached affidavit. To accommodate this determination, five proprietary copies (copies 2-6) and five nonproprietary copies of this report are attached.

In accordance with 10CFR50.92(c), we have determined the proposed amendment as having No Significant Hazards Considerations (NSHC), and to satisfy the Sholly provisions, we are including the basis of our NSHC determination as part of this amendment package. Also, a copy of this amendment package has been sent to Mr. E. Frank Wilson, Director, Division of Environmental Health Protection, State Department of Health.

The circumstances of this proposed amendment are not exigent or emergency; however, expeditious handling is requested, as these changes are necessary for Cycle 5 operation. The 2R4 refueling outage, during which we plan to implement these changes, is currently scheduled to begin the first week of March and end the middle of April, 1985.

Pursuant to 10CFR170.12(c) we are including a check for the amount of $150 as an application fee.

Very truly yours,

T. Gene Campbell

T. Gene Campbell

TGC:RBT:ds

Attachments

cc: Mr. E. Frank Wilson, Director
Division of Environmental Health Protection
State Department of Health
4815 West Markham Street
Little Rock, AR 72201

STATE OF ARKANSAS)
) SS
COUNTY OF PULASKI)

I, T. Gene Campbell, being duly sworn, subscribe to and say that I am Vice President, Nuclear Operations, for Arkansas Power & Light Company; that I have full authority to execute this oath; that I have read the document numbered 2CANØ185Ø5 and know the contents thereof; and that to the best of my knowledge, information and belief the statements in it are true.

T. Gene Campbell

SUBSCRIBED AND SWORN TO before me, a Notary Public in and for the County and State above named, this 29th day of January, 1984.

Notary Public

My Commission Expires:

4-1-85

PROPOSED AMENDMENT TO ANO UNIT 2 TECHNICAL SPECIFICATIONS
BASIS FOR CHANGES AND SAFETY EVALUATION

DNBR

This proposed change revises: 1) Technical Specifications 2.1.1.1 - Safety Limits Reactor Core DNBR, Table 2.2-1 - Limiting Safety System Settings Reactor Trip Setpoints, and the associated bases which support the Departure from Nucleate Boiling Ratio Limiting Safety System Settings (DNBR LSSS) and 2) the rod bow DNBR penalty factor surveillance requirement Specification 4.2.4.4 and the associated bases section 3/4.2.4 - DNBR Margin. The DNBR is a unitless value calculated for reactor core thermal-hydraulic conditions on a real-time basis from an NRC approved empirical correlation (Reference 1). It is a measure of thermal margin. Maintaining core conditions such that DNBR is above a prescribed value ensures that the fuel cladding will not overheat during normal and abnormal operation.

It is proposed that the ANO-2 DNBR limit be revised from 1.24 to 1.25. This is the result of incorporating into the DNBR limit a revised rod bow penalty and the current spacer grid penalty both of which are currently accounted for by adjusting the BERR1 addressable constant in the Core Protection Calculators (CPC).

The DNBR limit is being revised to reflect the reduction in the rod bow DNBR per[illegible] The present DNBR limit includes a 2% DNBR penalty to accommodate the effects of rod bowing (Reference 1). The revised rod bow DNBR penalty has been reduced to a value of 0.5%. In support of this reduction, Combustion Engineering has prepared CEN-289(A) (attached). In CEN-289(A) justification is provided, based on accumulated irradiated fuel data specific to ANO-2, to support the use of a channel closure model for ANO-2 based on an L^2/I extrapolation rather than L/I, as is currently used. The use of this extrapolation, along with reductions in the hot rod average heat flux and the reactor pressure values used in the DNBR calculations, allows the lowering of the DNBR limit.

The rod bow penalty value of 0.5% is derived from Figure 4 of CEN-289(A). The DNBR penalty factor of 0.5% corresponds to a fuel burnup of approximately 30,000 MWD/MTU. The 0.5% DNBR penalty is conservative for the ANO-2 fuel, as assemblies with $\geq$ 30,000 MWD/MTU burnup will not be subject to limiting DNBR conditions. The revised rod bow DNBR penalties have been reduced sufficiently to allow a bounding penalty to be included in the DNBR limit without adversely affecting operating margins. However, to assure ourselves that we do not violate the DNBR limits these limits will be verified by cycle design analyses.

The DNBR penalties listed in Section 4.2.4.4 were based on the L/I scaling method in absence of experimental data for the 16x16 fuel design. Based on new gap closure data supporting the L^2/I extrapolation it is proposed to remove this surveillance requirement and revise the associated bases.

In Reference 1 the NRC approved a DNBR limit of 1.26 as opposed to the original CPC design limit of 1.24. To accommodate this change, the NRC agreed that an appropriate adjustment for the 0.02 DNBR difference could be made via the BERR1 addressable constant using an NRC approved algorithm.

Using this algorithm the NRC specified a minimum BERR1 value which was incorporated as Footnote 6 of Table 2.2-1. Per this proposed Technical Specification change request, the BERR1 limit in Table 2.2-1 would be removed and the penalties previously accounted for by BERR1 would be incorporated into the new DNBR limit. A similar change has been approved by the NRC for the San Onofre Nuclear Generating Station Units 2 and 3 (SONGS 2 and 3) Technical Specifications via Amendments 29 and 15, respectively.

Standard zircaloy spacer grids have been replaced in ANO-2 with HID-1 grids beginning in Cycle 3. The use of both HID-1 and HID-2 grids has previously been approved by the NRC for the SONGS 2 and 3 cores (Reference 2). A DNBR penalty of 0.01 was imposed by the NRC on the DNBR limit to address NRC concerns about the effects of the HID-1 and HID-2 spacer grids and the larger grid spacing used for SONGS-2 and 3. This penalty for ANO-2 is conservative because, unlike SONGS-2 and 3, the ANO-2 grid spacing remains unchanged and no HID-2 grids have been used. Per this change request, the 0.01 penalty presently accounted for via BERR1 is proposed to be incorporated into the DNBR limit.

As a result of the adjustments discussed above, the DNBR limit is proposed to be revised from 1.24 to 1.25. This reflects 1) a 0.5% penalty for rod bow as opposed to the previous 2% penalty (1.231 X 1.005 = 1.237) and 2) the addition of the 0.01 DNBR unit increase due to the use of HID-1 grids which was previously accounted for in BERR1 (1.24 + 0.01 = 1.25) where 1.231 is the statistical combination of uncertainties equivalent value for DNBR and 1.237 is rounded to 1.24.

ADDRESSABLE CONSTANTS

Section 2.2.2 defines the functions and allowable values for the Core Protection Calculator (CPC) addressable constants. The CPC is an integral part of the reactor protection system. The addressable constants serve many CPC functions. Some addressable constants are provided to allow calibration of the CPC system for more accurate indications of power level, RCS flowrate and radial peaking. Other CPC addressable constants allow inclusion of allowances for measurement uncertainties or inoperable equipment.

The proposed changes revise the allowable value for three addressable constants, replace one addressable constant and add two new addressable constants to Table 2.2-2. These changes are in support of the CPC functional modifications discussed in CEN-288(A) which was transmitted to the NRC in our letter 2CAN118402 dated November 9, 1984 or are a result of operational experience gained. The descriptions of each change to Table 2.2-2 are discussed in the following section.

I. Azimuthal Tilt Allowance (TR); Point ID Number 63

Azimuthal power tilt is a measure of the core power asymmetry between azimuthally symmetric fuel assemblies. The azimuthal power tilt allowance is used by the CPC system to adjust the radial peaking for the core power asymmetry. The tilt allowance is entered into the CPC via the Type I addressable constant, TR. The CPC tilt allowance is verified, as per Section 3.2.3 of the Technical Specifications, by the Core Operating Limit Supervisory System (COLSS) and by CECOR. COLSS is an "on-line" system used, in part, for continuous tilt surveillance whereas CECOR is an "off-line" system used, in part, to verify the

COLSS tilt calculation. The proposed change would lower the minimum allowed value of the CPC tilt allowance from 1.02 to 1.00. Typically, the tilt actually present in the core is very small.

Previously, COLSS used an "arithmetic average" technique to compute a core average azimuthal tilt value which resulted in an overestimate of core tilt under normal operating conditions. This technique has been replaced with a "planar vector average" technique which is functionally the same as the CECOR tilt algorithm. When there is no appreciable azimuthal tilt in the core, the COLSS/CECOR planar vector average tilt calculation will yield an appropriately low tilt estimate.

In accordance with Section 2.2.2, the ANO-2 Plant Safety Committee (PSC) has in previous cycles reviewed the COLSS measured tilt and has permitted the lowering of the CPC tilt allowance (TR), a Type I addressable constant, below the current value (1.02). Therefore, the proposed change is only included in this Technical Specification change package to make the Technical Specifications consistent with the present range of the addressable constant.

II. Primary Delta T Calibration Constant (TPC); Point ID Number 64

The primary delta T calibration constant TPC is a Type I addressable constant used by the core protection calculators in the calculation of core thermal power (BDT). BDT is a function of RCS hot and cold leg temperature and primary coolant mass flow rate.

As specified in Technical Specification 4.3.1.1.1, TPC is adjusted to make BDT equal to the secondary calorimetric power, a more accurate calculation. A slight change in indicated RCS temperature may result in TPC set to a lower value than is presently allowed by Technical Specification Table 2.2-2. This effect is magnified at low powers when the core ΔT is small. Thus, to accommodate these changes, we propose to change the minimum allowable value of TPC specified in Technical Specification Table 2.2-2 from 0.90 to 0.80. Changes outside the allowable value range have been previously made after PSC review, in accordance with Section 2.2.2. This Technical Specification change will provide consistency between the value in the table and the value approved by the PSC.

III. Neutron Flux Power Calibration Constant (KCAL); Point ID Number 65

The neutron flux power calibration constant KCAL is a Type I addressable constant used by the core protection calculators in the calculation of calibrated neutron flux power (PHICAL). PHICAL is a function of excore neutron flux and varies as the core loading pattern changes.

As specified in Technical Specification 4.3.1.1.1, KCAL is adjusted to make PHICAL equal to the secondary calorimetric power, a more accurate calculation. Changes in the core radial flux distribution resulting from the placement of once and twice burned assemblies in the core interior and new fuel assemblies at the periphery resulted in an increase in neutron flux leakage relative to the initial cycle of

operation. As the neutron flux leakage increases, KCAL is reduced. Thus, to accommodate present and future core loading patterns, we propose to change the minimum allowable value of KCAL specified in Technical Specification Table 2.2-2 from 0.85 to 0.60.

IV. Temperature Shadowing Correction Factor Multiplier (CORR1); Point ID Number 98

The CPC system calculates the core neutron flux power based on neutron flux detectors located outside the reactor vessel (ex-core detectors). The neutron flux power can be decalibrated as a result of changes in the RCS coolant density passing between the reactor core and the ex-core detectors. This is referred to as "temperature shadowing". Currently, the CPC system corrects for this effect by using a temperature shadowing correction factor multiplier, a Type II addressable constant. The treatment of temperature shadowing in the CPC system is being modified as part of the CPC system changes discussed in Reference 5. To be consistent with this modified Temperature Shadowing Factor (TSF) treatment, the definition and function of the CPC addressable constant point ID number 98 must be changed from "Temperature Shadowing Correction Factor Multiplier" to "Reference Cold Leg Temperature".

The TSF algorithm was modified to include uncertainties directly in the calculations. This improvement provides a conservative correction of neutron flux power for moderator temperatures above or below the inlet moderator temperature at which the neutron flux power was last calibrated while providing a more accurate indication of power near the calibration temperature. To accomplish this correction, the coolant temperature at the time of the latest ex-core detector calibration must be input via on addressable constant. because of the calibration surveillance requirements, CPC addressable constant point ID Number 98 is also reclassified as a Type I addressable constant. The previous addressable constant associated with this point ID no longer needs to be addressable and is redefined as a fixed constant in the software. Therefore, it is proposed to be removed from Table 2.2-2.II.

V. Reactor Power Cutback Time Limit (RPCLIM); Point ID Number 103

Some C-E reactors include a Reactor Power Cutback System (RPCS) which is designed to eliminate the power imbalance without a trip after a loss of load. The ANO-2 plant does not contain the hardware necessary for a RPCS, thus, the proposed addition of point ID number 103 does not have any effect on CPC function. Even though ANO-2 does not have a RPCS, the RPCS algorithms were included in the ANO-2 CPC update in order to reduce the differences with other installed CPC systems. The effect of these algorithms on CPC have been nullified through setting the data base and addressable constants associated with the RPCS algorithm to zero. The approved CPC software change procedures (References 3 and 4) will be used to verify that the RPCS algorithms and value of the addressable constant have no effect on CPC performance and plant safety margins. This change was described in Reference 5.

VI. Secondary Calorimetric Power (PCALIB); Point ID Number 104

A power measurement uncertainty is applied to the calculations of thermal power and neutron flux power level in the CPC. Because of a change in these algorithms, as discussed in Reference 5, the addition of the Type I addressable constant point ID number 104 ensures the application of correct power measurement uncertainty.

Addressable constant point ID number 104 is added to the CPC core power bias algorithm. The power bias algorithm adjusts the thermal and neutron flux power levels in the CPCs for a power dependent power measurement uncertainty. Prior to its modification, the power bias algorithm applied a constant power measurement uncertainty for all power levels. However, since lower power conditions usually have a higher secondary calorimetric power measurement uncertainty than higher power conditions, a power dependent power measurement uncertainty is more appropriate. Addressable constant "PCALIB" is defined as the calorimetric power at the time of the latest CPC thermal and neutron flux power calibration. This value is used by the power bias algorithm to ensure a conservative application of the power measurement uncertainty.

As a result of the CPC software changes to be made, Bases 2.2.1, Reactor Trip Setpoints, is also proposed to be modified. The proposed modification would update the references contained in this specification so that the reader will be referred to the most current information describing the ANO-2 CPC software.

SIGNIFICANT HAZARDS CONSIDERATION

Based on the preceeding discussion, the proposed changes do not involve a significant hazards consideration in that:

(1) The proposed changes do not, in any way, affect the operation or the configuration of the facility. Hence, the proposed changes do not involve an increase in the probability or consequences of an accident previously evaluated.

(2) The proposed changes do not, in any way, cause a change in plant operating procedures. Hence, no new path is created which may lead to a new or different kind of accident.

(3) The proposed changes do not, in any way, reduce margins to safety. The transfer of the DNBR rod bow and spacer grid penalties from the BERR1 addressable constant represents an end to the use of a temporary adjustment procedure. Incorporation of these penalties into the DNBR limit is the preferred method. The rod bow penalty Surveillance Requirement was a temporary measure to assure conservatism which is being relieved based on the results of actual ANO-2 rod bow measurements. Broadening the allowable ranges of the TR, TPC and KCAL addressable constants is the result of improved monitoring techniques and additional operating experience. The proposed changes only make the Technical Specifications consistent with the range of values previously approved by the Plant Safety Committee. The temperature shadowing correction factor algorithm has been improved to provide actual cold leg temperature input via an addressable constant which will provide a more accurate indication of neutron flux power. The RPCLIM addressable constant has no effect in the ANO-2 CPC. Addition of the PCALIB addressable constant ensures the application of correct power measurement uncertainty to the CPC power level calculations.

The commission has provided guidance concerning the application of standards for determining whether a significant hazards consideration exists by providing certain examples (48 FR 14870) of amendments that are considered not likely to involve significant hazards considerations. The proposed changes described above are similar to example (iv) in that the proposed changes are refinements of the previously used calculational model as a result of improved monitoring and additional operational experience.

References

1. Robert A. Clark (NRC) to William Cavanaugh (AP&L), "Operation of ANO-2 During Cycle 2; Safety Evaluation Report for Amendment 26 to Facility Operating License No. NPF-6" Docket No. 50-368, July 21, 1981.

2. NUREG-0712, Supplement No. 4, "Safety Evaluation Report Related to the Operation of San Onofre Nuclear Generating Station, Units 2 and 3," Docket Nos. 50-361 and 50-362, January 1982.

3. CEN-39(A)-NP, Revision 02, "The CPC Protection Algorithm Software Change Procedure," December 21, 1978.

4. CEN-39(A)-NP, Supplement 1-NP, Revision 01, January 5, 1979.

5. CEN-288(A)-NP, "CPC Methodology Changes for Arkansas Nuclear One Unit 2 Cycle 5," October, 1984.