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U. S. Nuclear Regulatory Commission
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Subject: Arkansas Nuclear One - Unit 2
Docket No. 50-368
License No. NPF-6
Power Distribution Limits
Technical Specifications Change Request

Gentlemen:

Attached for your review and approval are proposed Technical Specifications (TS) changes revising 3.2.1 and 3.2.4 for ANO-2. This change increases the time limit that the Core Operating Limit Supervisory System (COLSS) may be out of service before the action requirements based on the more restrictive Core Protection Calculator (CPC) limits apply. Additionally the proposed change adds a distinction between the Action requirements for exceeding a COLSS calculated power operating limit and a CPC calculated operating limit (when COLSS is out of service). Finally, the proposed change modifies the minimum power required by action requirements to be consistent with the present TS applicability. This change has been approved for Waterford SES Unit 3, Docket No. 50-382.

The proposed change is intended to eliminate unnecessary power reductions and the rate at which the power reductions are accomplished. The proposed change will result in significant operational benefits while continuing to maintain a high degree of confidence that the core conditions remain well within the range of values assumed in the safety analysis.

The proposed change has been evaluated in accordance with 10CFR50.91(a)(1) using the criteria in 10CFR50.92(c) and it has determined that these changes involve no significant hazards considerations. The bases for these determinations are included in the enclosed submittal. Although the circumstances of this proposed amendment is not exigent or emergency, your prompt review and approval is requested.

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We request that the effective date for this change be 30 days after NRC issuance of the amendment to allow for distribution and procedural revision necessary to implement this change.

Very truly yours,

Neil S. Carns

NSC:sgw

cc: Mr. Robert Martin
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AFFIRMATION

I, N. S. Carns, being duly sworn, subscribe to and say that I am Vice President, Operations ANO for Entergy Operations, Inc.; that I have full authority to execute this affirmation; that I have read the document numbered 2CAN019107 know the contents thereof; and that to the best of my knowledge, information and belief the statements in it are true.

N. S. Carns

SUBSCRIBED AND SWORN TO before me, a Notary Public in and for the County and State above named, this 29th day of January, 1991.

Sandy Siebenmorgen
Notary Public

My Commission Expires:
May 11, 2002

ENCLOSURE

PROPOSED TECHNICAL SPECIFICATION

AND

RESPECTIVE SAFETY ANALYSES

IN THE MATTER OF AMENDING

LICENSE NO. 50-368

ENTERGY, INC.

ARKANSAS NUCLEAR ONE, UNIT 2

DOCKET NO. 50-368

Description of Proposed Change

This proposed change to the ANO-2 Technical Specifications (TS) would revise the Action statements associated with Limiting Condition for Operation (LCO) 3.2.1, Linear Heat Rate and LCO 3.2.4, DNBR Margin. LCOs 3.2.1 and 3.2.4 currently require core power to be maintained less than the linear heat rate (LHR) and DNBR power operating limits calculated by the Core Operating Limits Supervisory System (COLSS). If COLSS is out of service, the LHR and DNBR must be maintained within a more restrictive set of limits based on the Core Protection Calculators (CPCs). With these limits not being maintained, corrective action must be initiated within 15 minutes to restore the LHR and DNBR to within the applicable set of limits (depending on whether or not COLSS is operable) within 1 hour or the plant must be in at least Hot Standby within the next 6 hours.

The proposed change adds a distinction between the Action requirements for exceeding a COLSS calculated power operating limit (an actual plant condition warrenting rapid corrective action) and the Action requirements for exceeding a CPC calculated operating limit (when COLSS is out of service). When COLSS is in service, the present Action remains essentially unchanged except that the power level that must be maintained if the LHR or DNBR limits cannot be restored will be increased to be consistent with the present TS Applicability. However, with COLSS out of service, the proposed change will replace the current 15 minute time limit for initiating corrective action with a requirement to return COLSS to service within 2 hours. The time allowed for restoration of the DNBR and LHR limits would then increase from 1 hour to 2 hours. If the DNBR and LHR limits are not restored within the proposed 2 hours, the proposed change would require reactor power to be reduced to less than or equal to 20% of Rated Thermal Power within the next 6 hours.

Background

The COLSS is designed to assist the plant operators in implementing TS requirements for monitoring various LCOs. Specifically, COLSS uses inputs from various plant sensors (core inlet temperature, in-core detector signals, reactor coolant pump speeds and ΔPs, RCS pressure, etc.) to calculate a core power which corresponds to the LCO on DNBR. This power level is the DNBR Power Operating Limit (POL). Concurrently, COLSS performs a similar calculation (as a function of the incore power distribution) to determine the LHR POL. These two POLs in conjunction with the licensed core power level, represent the highest power level at which the core can safely, or legally, operate. Maintaining the actual core power below these COLSS calculated POLs ensures that no Anticipated Operational Occurrence (AOO) will result in a violation of Specified Acceptable Fuel Design Limits (SAFDLs) and no postulated accident will result in consequences more severe than those analyzed in Chapter 15 of the Safety Analysis Report.

Discussion

Since COLSS does not provide any trip functions (i.e., it does not initiate any direct safety-related function during AOOs or accidents) it is permissible to continue power operation when COLSS is out of service provided an alternate means of monitoring the approach to the specified

limits can be substituted. Under such circumstances, the TS allow the CPCs to be utilized to maintain the appropriate parameters within specified limits. However, because the CPCs cannot perform the required LHR and DNBR calculations as accurately as COLSS, the TS limits based on the CPC's monitoring capability are more restrictive than the TS limits based on the COLSS monitoring capabilities.

Due to the restrictive nature of the CPC limits, the current LCOs cannot be satisfied without a reduction in the core power level (i.e., full power operation is dependent on COLSS being operable). The actual degree of power reduction depends upon the cycle specific core design and the specific conditions that exist when COLSS indication is lost; however, a power reduction of approximately 15% will be necessary if COLSS operation is interrupted. The magnitude of the required power reduction increases near the end of the fuel cycle due to changes in the axial core power distribution.

Assuming that a 15% reduction from full power is necessary following a loss of COLSS, the rate of power change required to meet the current COLSS out of service limits equals 15% per hour. Similarly, since the end of cycle core power distribution may necessitate core power reductions of up to 25 to 30%, the current COLSS out of service limits may force power reductions at a rate approaching 30% per hour. Power reductions of this magnitude performed in 1 hour or less subject the plant to large transients and increase the probability that an avoidable challenge to the Reactor Protection System would occur. In addition, maneuvers such as this are difficult to perform during the last third of an operating cycle due to the reduced capability of rapidly deborating the Reactor Coolant System to offset the buildup of xenon. Together these considerations contribute to reduce plant reliability and the potential for increased reactor protection system actuations and subsequent challenges to safety systems.

Some, TS equipment out-of-service times are based not on a calculated interval intended to provide a maximum safe outage time, but rather are the minimal time periods necessary to restore equipment or perform some action. In determining these times, system configurations current at that time were considered. These configurations can lead to overly restrictive TS as systems and system parameters evolve through the years. The proposed change is a case in point. When the LHR/DNBR TS were first prepared, 15 minutes appeared to be an adequate COLSS recovery time and 1 hour to reduce power was considered acceptable because only small power reductions were anticipated to be necessary to meet the Action statement. These time periods were not calculated to be maximum safe intervals -- they were simply assumed to be achievable within the constraints of the NSSS design then existing. As noted above, the core design of ANO-2 to the point where the subject TS now require power reduction rates that could be difficult to control, particularly near the end of the fuel cycle. Accordingly, the proposed change increases the allowed out of service and power reduction times to bring them in line with current core design restraints without decreasing existing safety protections.

Increasing to two hours the time available to return COLSS to service would reduce the number and rate of power reductions, thereby decreasing the likelihood of challenges to the Reactor Protection System (RPS). While decreasing the probability of RPS actuations, the proposed change would not significantly increase the probability of exceeding the core power operating limits based on LHR and DNBR. During the relatively short time period the COLSS is out of service, detection of changes in LHR and DNBR is made easier by maintaining steady-state conditions and by increasing the monitoring frequency of the CPC calculated values of LHR and DNBR. If interruption of COLSS execution exceeds the proposed two hour time limit, then the ensuing power reduction can be performed in a slower, more controlled manner.

If the CPC LHR or DNBR limits cannot be restored within the proposed 2 hours, the proposed change will require a further power reduction to "less than or equal to 20% of Rated Thermal Power" within 6 hours. The LHR and DNBR LCOs currently require the reactor to be brought to at least Hot Standby conditions if the LHR or DNBR limits cannot be restored. This change is an administrative change to maintain consistency with the current TS Applicability statement which requires limits on LHR and DNBR only when the thermal power exceeds 20%. This is described in the following Determination of Significant Hazards below.

Determination Of Significant Hazards

An evaluation of the proposed change has been performed in accordance with 10 CFR 50.91 (a)(1) regarding no significant hazards consideration using the standards in 10 CFR 50.92(c). A discussion of those standards as they relate to this amendment request follows:

Criterion 1 - Does not involve a significant Increase in the Probability or Consequences of an Accident Previously Evaluated.

The proposed change does not modify the requirement to operate within the alternate LHR and DNBR limits nor does it modify the actual LHR or DNBR limits themselves. The proposed change simply makes a distinction between the Action requirements associated with exceeding a COLSS calculated power operating limit and the Action requirements associated with exceeding a CPC calculated operating limit following the loss of COLSS. In the first case (exceeding a COLSS calculated POL), Entergy Operations agrees that corrective action should be initiated promptly to bring the LHR and DNBR within their respective limits and, in this case, a 15 minute time limit is appropriate. However, in the latter case (exceeding a CPC calculated operating limit following the loss of COLSS), it is clear that simply because COLSS indication is lost does not mean that the plant is operating outside the range of conditions assumed in the Chapter 15 Safety Analysis and, in this case, a 15 minute time limit is not appropriate. An increase from 15 minutes to 2 hours to regain the monitoring capabilities of COLSS would not significantly increase the probability of exceeding the actual LHR or DNBR power operating limits since the increase in COLSS out-of-service time will be compensated for by increasing the monitoring frequency of the important CPC calculated parameters. Further, since the proposed change will result in maintaining steady-state conditions, it will be easier for the operators to detect any abnormal occurrence that has the potential to degrade either the LHR or the DNBR.

The primary consideration in extending the COLSS out of service time limit is the remote possibility of a slow, undetectable transient that degrades the LHR and/or DNBR slowly over the 2 hour period and is then followed by an AOO or an accident. The parameters normally monitored by COLSS which have the potential for degrading the LHR and DNBR if no corrective action is taken are: Reactor Coolant System (RCS) flow rate, axial and radial power distributions, core inlet temperature, core power, RCS pressure and azimuthal tilt. Of these parameters, core inlet temperature, core power, and RCS pressure are easily monitored by the plant operators using various safety-grade, redundant Control Room indications and, therefore changes in these parameters are readily apparent. Further, operating experience at ANO-2 and other CE nuclear steam supply systems using the same reactor coolant pumps (RCPs) as ANO-2 has shown that measurable changes in RCP ΔPs (which COLSS uses to calculate RCS flow) are very rare. When they do occur they involve abrupt step changes in flow which are readily apparent; hence, the probability of a slow degradation in the RCS flow rate is exceedingly small. Thus, the parameters that comparatively (although still remote) pose the highest potential for a degradation in the core thermal margin when COLSS is out of service relate to the axial and radial core power distributions and the azimuthal tilt. These parameters are discussed below.

Axial xenon oscillations are a normal consequence of the ANO-2 core design, particularly near the end of core life. As a result, ANO-2 operations personnel are instructed, per operating procedures to maintain strict control over the axial power shape in the core. Although the primary reason for axial shape control is to maintain an even fuel burnup throughout the core, it also results in maintaining the axial power shapes well within the limits assumed in the safety analysis. Typically, axial shape control practice at ANO-2 maintains the Axial Shape Index (ASI) within 0.05 ASI units of the Equilibrium Shape Index (ESI), which is normally very near 0.0.

Hypothetically, the most severe situation which could be postulated to occur, although again remote, would be if COLSS execution was lost just when the plant operators were ready to take manual action to return the ASI value to within the ESI $\pm$ 0.05 control band. Since a full xenon oscillation takes approximately 26 hours, there would be about 6 hours from the time that control action would normally be taken to the time that the ASI reached its peak value (i.e., it takes one quarter cycle for the ASI to travel from its ESI value to its peak value). Since operating procedures will be revised to require the CPC calculated LHR and DNBR to be monitored every 15 minutes (see below), any significant change in the ASI index will be apparent through a change in these CPC calculated values. Hence, due to the attention given the axial power distribution, both when COLSS is in service as well as when COLSS is out of service, it is very improbable that a change in ASI during two hours of steady-state operation with COLSS out of service could be either undetected or lead to a condition that place the reactor outside the range of initial conditions that were assumed in the safety analysis.

With regards to azimuthal tilt, there is very rarely any significant change in this parameter as long as all Control Element Assemblies (CEAs) are properly aligned. The only real contributor to a rapid increase in azimuthal tilt would be an inadvertent CEA drop; however, since the probability of a CEA drop is very low, the likelihood of this event

occurring within the two hour time limit is even lower. In the unlikely event that a CEA drop did occur, the Control Element Assembly Calculators (CEACs) provide a safety-grade, redundant means of alerting the operators that corrective action is necessary. Thus, the potential for a degradation in azimuthal tilt during two hours of steady-state operation following the loss of COLSS is both highly unlikely and relatively easy to detect using instrumentation already available in the Control Room. The ANO-2 Technical Specifications currently address actions for a dropped CEA.

As previously stated, upon approval of the proposed change, plant personnel will revise operating procedures to increase the monitoring frequency of the CPC calculated values of LHR and DNBR. Currently, procedures require that immediately following the loss of COLSS and every 2 hours thereafter, plant operators record (among other things) the CPC calculated values of LHR and DNBR. Procedures will be revised to require that the monitoring frequency for LHR and DNBR be increased from once every 2 hours to once every 15 minutes. Moreover, this procedure will be revised to define a maximum allowable change in the CPC calculated LHR or DNBR such that further degradation will require the operators to take immediate action to reduce reactor power and comply with the appropriate COLSS out of service TS limits. The monitoring frequency for DNBR and LHR of once every 15 minutes will be used until either COLSS is restored to service or DNBR and LHR have been restored to within their limits, at which time the monitoring frequency will become once per 2 hours as allowed by the existing surveillance requirements. Implementation of this procedure change provides additional assurance that potential reductions in core thermal margin will be quickly detected and, should it prove necessary, result in a decrease in reactor power and subsequent compliance with the existing COLSS out of service TS limits.

Extending the time to restore the CPC calculated LHR and DNBR to within the acceptable operating range from 1 hour to 2 hours is being proposed to assure that the maneuver can be accomplished in a gradual and controlled manner thus decreasing the probability of an avoidable challenge to the Reactor Protection System (RPS). When this Action statement was originally written it was anticipated that only a relatively small power reduction would be required to bring the reactor into conformance with the CPC operating limits. This relatively small power change could be accomplished in a fairly controlled manner over the one hour time limit currently in the TS; however, due to changes in CPC and COLSS software, it is possible that the required power reductions may exceed 25% near the end of the fuel cycle. These large power reduction rates result in a rapid increase in xenon concentration and a subsequent decrease in cold leg temperature (T-cold) that may be difficult to control. At the end of an operating cycle it is possible that such an event could lead to a violation of the minimum cold leg temperature Tech Spec (LCO 3.1.1.4) and/or a CPC generated reactor trip on T-cold out-of-range. Accordingly, given the potential for power reductions of this magnitude, it is appropriate to extend the time allowed to complete the maneuver so that it may be performed in a more gradual and controlled manner.

Changing the core power which must be maintained if the LHR and/or DNBR limits cannot be restored in the proposed 2 hours time limit from "Hot Standby" to "less than or equal to 20% of Rated Thermal Power" is consistent with the ANO-2 TS philosphy. That philosphy requires the reactor to be placed in an Operational Mode in which the LCO is no longer applicable if that LCO or its associated Action statements cannot be satisfied. Power levels of 20% and below, in combination with compliance with all other LCOs.

(e.g., CEA Insertion Limits), ensure that sufficient LHR and DNBR margin will be available and results in a core power high enough to allow the in-core and ex-core neutron detectors to provide meaningful data to the COLSS and CPCs, respectively. This higher power level will facilitate COLSS trouble-shooting and aid in the determination of COLSS operability once COLSS execution is restored.

The proposed changes will eliminate unnecessary power reductions along with the rate at which the power reductions are accomplished. The proposed change will result in significant operational benefits while continuing to maintain a high degree of confidence that the core conditions remain well within the range of values assumed in the safety analysis. Therefore, the proposed change will not result in a significant increase in the probability or consequences of any accident previously evaluated.

Criterion 2 - Does not create the Possibility of a New or Different Kind of Accident from any Previously Evaluated.

The proposed change does not alter the current power operating limits nor does it involve any changes to COLSS or CPC software. There has been no physical change to plant systems, structures or components nor will the proposed change affect the ability of any of the safety-related equipment required to mitigate AOOs or accidents. The only significant change associated with the proposed amendment involves changes to the operating procedures used when COLSS is out-of-service. All revisions to operating procedures will be reviewed and approved by appropriate plant personnel as required by the Administrative Controls (Section 6) in the ANO-2 Technical Specifications. Thus, operation of the facility in accordance with the proposed change will not create the possibility of a new or different kind of accident from any accident previously evaluated.

Criterion 3 - Does not Involve a Significant Reduction in the Margin of Safety.

The intent of LCOs 3.2.1 and 3.2.4 is to maintain the reactor within the range of initial conditions that was assumed in the Safety Analysis. Maintaining the LHR within the specified range ensures that in the event of a LOCA, the fuel cladding temperature will not exceed the 2200°F limit imposed by 10CFR46. Maintaining the DNBR within the specified range ensures that no AOO will result in a violation of the SAFDLs and that no postulated accident will result in consequences more severe than those described in Chapter 15 of the FSAR. Since there has been no change to the requirement to operate the reactor within the LHR and DNBR limits and no change to the actual LHR and DNBR limits themselves, the accident analyses described in Chapter 15 of the FSAR will not be affected and will therefore remain bounding.

The proposed change will eliminate unnecessary power reductions along with the rate at which the power reductions are accomplished. Maintaining steady-state conditions for up to two hours after the loss of COLSS while increasing the CPC LHR/DNBR monitoring frequency, provides plant personnel with a reasonable period of time to return COLSS to

service while continuing to maintain a high degree of confidence that the core conditions remain well within the range of values assumed in the safety analysis. Moreover, by reducing the number of plant transients there will be a reduction in probability of an AOO and subsequent RPS actuation. Hence, operation of the facility in accordance with the proposed change will not result in a significant reduction in the margin of safety.

The Commission has provided guidance concerning the application of the standards for determining whether a significant hazards consideration exists. The proposed amendment most closely matches examples:

(iv) "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."

(vi) "A change which either may result in some increase to the probability or consequences of a previously-analyzed accident or may reduce in some way a safety margin, but where the result of the change are clearly within all acceptable criteria with respect to the system or component specified in the Standard Review Plan, e.g., a change resulting from the application of a small refinement of a previously used calculational mode or design method."

This change has been approved for Waterford SES Unit 3, Docket No. 50-382.

Based on the above evaluation it is concluded that the proposed Technical Specification change does not constitute a significant hazards concern.