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Subject: Arkansas Nuclear One - Unit 2
Docket No. 50-368
License No. NPF-6
Supplemental Information on Reactor Protective System Setpoint Changes – Probabilistic Safety Assessment Branch

Gentlemen:

By request of the Nuclear Regulatory Commission (NRC) during conference calls held on April 3, 2000 and April 20, 2000 between the NRC and Arkansas Nuclear One – Unit 2 (ANO-2), the attached information is provided as a supplement to ANO's submittal dated November 29, 1999 (2CAN119901), regarding various Reactor Protective System (RPS) setpoint changes required to support the replacement steam generator (RSG) outage scheduled for the fall of 2000. The information provided responds to six NRC questions regarding dose concerns for RPS setpoint changes. Should further information be desired, please do not hesitate to call.

Very truly yours,

Jimmy D. Vandergrift
Director, Nuclear Safety Assurance

JDV/dbb
Attachment

A001

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NRC Questions And ANO Responses To Questions Regarding Dose Concerns For RPS Setpoint Changes

NRC Question #1:

Your submittal does not address the impact of the proposed changes on the ability of the ANO-2 control room to meet the habitability requirements of General Design Criterion (GDC)–19 (or the ANO-2 commitments to NUREG-0737, Item III.D.3.4). In a phone call with the staff, you stated that the maximum hypothetical accident (i.e., loss of coolant accident (LOCA)) was the limiting accident for control room habitability at ANO-2. Please provide a statement describing your evaluation of the impact on the habitability of the ANO-2 control room that justifies your conclusion that the LOCA is still the limiting accident. Your statement should address differences in control room isolation actuation for the different accidents and differences in χ/Q values for the different release points involved.

ANO Response:

Confirmatory control room dose calculations for the MSLB, FWLB and Seized Rotor analyses were performed. The results of these confirmatory analyses indicate that the MHA control room consequences are still bounding. In these analyses, conservative χ/Q values were calculated using ARCON96.

χ/Q Values				
Time Period	From ADVs	From MSSVs	From MSLB Pipe	From Aux Bldg Vent
0-2 hr	4.96×10^{-2}	3.92×10^{-2}	5.42×10^{-4}	4.54×10^{-3}
2-8 hr	2.13×10^{-2}	2.00×10^{-2}	3.21×10^{-4}	2.94×10^{-3}

In some cases, the ARCON96 values were less than the χ/Q value used in the MHA control room dose analysis (5.6×10^{-3} sec/m^3); however, the confirmatory calculations did not credit χ/Q values less than that assumed in the MHA analysis.

The ANO-1 and ANO-2 control rooms are located adjacent to each other within a common control room envelope. The ANO-1 control room radiation monitoring system consists of an area radiation detector, which monitors the control room, and a radiation detector in the ANO-1 normal air supply duct. Either of these two detectors provides isolation and annunciation signals on the detection of high radiation. The ANO-2 control room radiation monitoring system consists of a radiation detector installed in the ANO-2 control room supply air duct. The ANO-2 radiation detector located in the normal air supply duct has an associated display device which monitors the control room supply air and provides isolation and annunciation signals on the detection of high radiation. If any of these radiation monitors reach their associated isolation setpoint, the control room isolation dampers will be actuated closed and the associated train of Control Room Emergency Ventilation System (CREVS) will be started. This condition of control room isolation and filtration is called emergency recirculation. The setpoint for the duct monitors is ≤ 2 times background. Additional information with respect to the control room duct monitors can be found in ANO letter (2CAN029807) dated February 27, 1998.

NRC Question #2:

The ANO-2 SAR indicates that the control room unfiltered in-leakage is limited to 10 cfm. The staff considers in-leakage to be subject to the design control measures of 10 CFR 50, Appendix B, Criterion 3. Several power reactors (representing about 20% of the U. S. plants) have performed testing of their control room in-leakage. In all but one case, the test results showed in-leakage in excess of the facility's design basis. Please provide an explanation supporting your conclusions that the unfiltered in-leakage at ANO is limited to only 10 cfm.

ANO Response:

The confirmatory control room dose analyses performed for the MSLB, FWLB and Seized Rotor analyses described in response to Question 1 have been shown to be bounded by the current MHA analysis. The assumptions made in the confirmatory control room dose calculations are consistent with the assumptions used in the MHA analysis. The concern with respect to unfiltered control room in-leakage is, therefore, more applicable to the bounding MHA control room habitability calculation. Entergy is actively participating in industry meetings and initiatives established to resolve this issue. As this is an issue relating to the current MHA bounding control room dose calculation and considered a generic industry issue, resolution of this issue will be pursued through industry initiatives.

NRC Question #3:

Section 15.1.0.5.5.K of the marked-up SAR indicates that a pre-existing and an event generated iodine spike were assumed for non-fuel failure postulated accidents. Table 15.1.14-40 presents the dose results for the Cycle 15 feedwater line break event, but does not provide the doses for the spiking cases. The analysis description in the SAR mark-up and that on page 40 of 172 of your submittal does not indicate that fuel damage is postulated. Please provide the doses for the spiking cases.

ANO Response:

The proposed SAR Section 15.1.0.5.5.K should read:

"K. For iodine spiking considerations in the MSLB event, a pre-existing spike of 60 times the normal, and an event generated spike with a spiking factor of 500 assuming normal operation with one charging pump running;"

As indicated, the results from the FWLB analysis do not reflect any fuel failure. An iodine spiking case was not presented for the FWLB analysis. This is consistent with the ANO-2 licensing basis since the original SAR analyses did not consider iodine spiking. As such, only the MSLB analysis results will reflect an iodine spiking case, consistent with the original Safety Evaluation Report (SER) considerations.

NRC Question #4:

Page 25 of 172 of your submittal states "For this evaluation, the reported fuel failure for the radiological doses are back-calculated from the 10 CFR dose criteria." Please explain how the fuel damage estimate arrived in this manner reflects the fuel damage projected by the thermo-dynamic analysis of the transient.

ANO Response:

At the time this submittal was developed, the Cycle 15 thermo-dynamic results had not been completed. To ensure that the dose consequences would bound Cycle 15 and future cycle fuel failure predictions by the thermo-dynamic calculations, a larger fuel failure fraction (14%) than anticipated was chosen for consideration in the dose assessment. This fuel failure fraction value was chosen such that it would bound future cycle fuel failure considerations yet stay within the acceptance criteria. The current Cycle 15 thermo-dynamic results are not finalized at this point; however, preliminary calculations reflect actual fuel failures just under 3%.

NRC Question #5:

Your re-analyses incorporates iodine spiking. In early 1999 Beaver Valley submitted an LER regarding non-conservatisms of the accident-generated iodine spike appearance rate. In summary, Beaver Valley determined that its contractor had used minimum values for purification flow rate and demineralizer efficiency which resulted in an iodine appearance rate which was not bounding for all plant operating conditions. The staff notes that the Cycle 12 main steam line break analysis submitted to the staff on December 12, 1997 assumes the purification flow to be 40 gpm. However, your system design allows for flow up to 128 gpm. Please confirm that your recent analyses used the appropriate flow rate.

ANO Response:

The iodine spiking analyses was performed based on the normal operating mode of having only one charging pump running. A single charging pump with a flow rate of 46 gpm and a maximum heat exchanger efficiency of 100% was assumed in the analyses. Plant operation with more than one charging pump in operation is a very infrequent mode of operation. In addition to the infrequency at which more than one charging pump may be operating at power, procedural guidance also ensures Reactor Engineering and management involvement should iodine concentrations approach the TS limits or should a second charging pump be required to improve iodine clean-up.

NRC Question #6:

The staff has performed independent calculations of the seized rotor event, feedwater line break, and main steam line break using the parameters and values documented in your submittal. Our results are reasonably consistent with the results presented in the submittal, with the exception of the seized rotor event.

Please provide the following additional information:

a) **Please briefly explain how the Ci/pin data in Table 15.1.0-3C (per 15.1.0.5.5.D) are converted to reactor coolant system (RCS) activity or RCS concentration in you analysis.**

b) **What is the RCS mass and steam generator liquid mass assumed in your seized rotor event?**

c) **Please include any other description that you believe would help the staff resolve the differences between our analyses.**

ANO Response:

The Ci/pin data in the proposed ANO-2 SAR Table 15.1.0-3C is considered average total pin activities. Of these activities 10% of the Noble gas pin concentration is assumed to be released upon clad failure due to exceeding a DNBR limit of 1.25, except for Kr-85 in which 30% is assumed to escape and 12% of Iodine. These release fractions are used in combination with the maximum number of fuel pins of 41,772 and a peaking factor of 1.65.

An RCS liquid mass of 418,748 lbm is assumed. Two separate steam generator masses are considered. A per steam generator minimum mass of 138,200 lbm is

used when determining the steaming rate fraction and a maximum mass of 280,700 lbm for the determination of the initial activity. The range in steam generator masses is used to bound both hot full power and hot zero power conditions.

In addition to the above information, ANO uses an Iodine Protection Factor for the control room operators of 144. This factor is based on a calculation from Murphy-Campe.