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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), the attached information is provided for additional clarification to questions posed by the NRC regarding Arkansas Nuclear One's – Unit 2 (ANO-2) submittal dated November 29, 1999 (2CAN119901), "Proposed Technical Specification Changes And Resolution of Unreviewed Safety Question Associated With Applicable Limits And Setpoints Supporting Steam Generator Replacement." Entergy Operations responded to questions from the Probabilistic Safety Assessment branch of the NRC by letter dated May 17, 2000 (2CAN050006). However, the NRC has requested additional discussion be provided to questions #2 and #5. Therefore, Entergy Operations, Inc. offers the following responses to the above questions.

<u>NRC Question #2</u>

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.

<u>ANO Response</u>

ANO letter 2CAN050006, dated May 17, 2000, provided an initial response to the above question. However, additional information has been requested to ensure the issue with respect to unfiltered control room in-leakage has been addressed for the Reactor Protective System setpoint changes associated with the replacement steam generators (RSG). To further

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address this question, new confirmatory control room dose calculations have been performed that reflect acceptable operator doses for inleakage up to 5000 cfm. The Feedwater Line Break (FWLB), Main Steam Line Break (MSLB) and seized rotor dose assessments were considered consistent with the assumptions provided in ANO letters 2CAN119901, dated November 29, 1999, and 2CAN050006, dated May 17, 2000, with the following exceptions:

1. Control room inleakage of 5000 cfm was assumed in this analysis versus the 10 cfm assumed in the prior analyses.

2. The control room inleakage resulted in an Iodine Protection Factor (IPF) of 1.38 versus 144 used in the prior analysis.

3. New χ/Q data was generated using ARCON96. The change in χ/Q data resulted from the use of 5 years of onsite meteorological data versus 3½ years used previously. In addition, a ground release was assumed instead of a vent release, and other parameters were adjusted to be consistent with the draft NRC guidance.

4. For the FWLB assessment, credit was taken for the break location being inside containment. A check valve inside containment prevents blowdown of the steam generators for breaks outside containment. The radiological releases for a feedwater line break outside containment are bounded by MSLB releases; hence, only inside containment feedwater line breaks are considered.

Additional information with respect to the atmospheric dispersion calculation is also being provided to allow for ease of review and performance of verification calculations. This information has been provided in the attachment to this submittal. Utilizing the new atmospheric dispersion factors and assuming 5000 cfm control room inleakage, control room doses were calculated to be within GDC 19 acceptable limits (30 Rem Thyroid, 5 Rem whole body, and 75 Rem skin).

The use of 5000 cfm control room inleakage is considered a bounding number based on the following considerations:

1. The total control room envelope is 40,000 cubic feet. The assumption of 5000 cfm inleakage is considered well in excess of actual possible inleakage. Per ASHRAE guidance, control room habitability envelopes are typically designed for one air change per hour or less, which corresponds to a maximum value of 667 cfm (1987 ASHRAE Handbook, Chapter 40). Because of ANO's pressurized design and relatively small envelope compared to the industry, the actual inleakage is expected to be well below this value. The 5000 cfm inleakage assumption implies that the control room volume is being exchanged once every 8 minutes.

2. The normal emergency mode recirculation flow is approximately 1667 cfm. The 5000 cfm inleakage assumption exceeds the emergency mode operation fan capacity.

3. The filtered intake flow is approximately 333 cfm

4. An IPF of only 1.38 is used for this analysis based on the assumption of 5000 cfm inleakage. Very little credit is being taken for the existence of the control room envelope. Less than a 40 % reduction in the control room thyroid dose has been credited in this analysis for the existence of the control room envelope.

5. The limiting MSLB and seized rotor consequence, based on an IPF of 1.38, was the thyroid dose for the MSLB Generated Iodine Spike case. A thyroid dose of 21.45 Rem was calculated for this case. Taking no credit for the control room envelope IPF (IPF of 1.0), increases this dose to 29.6 Rem, which remains within the acceptance criteria. The FWLB results exceed this limit only when an overly conservative assumption of a Decontamination Factor (DF) of 1 is assumed for the unaffected steam generator. The RSG FWLB analysis results do not reflect steam generator dryout for the unaffected steam generator; hence, a DF of 100 can be assumed. With this consideration, the FWLB analysis results will be bounded by the MSLB analysis results.

In response to the industry issue on control room inleakage, Entergy Operations, Inc. is actively participating in industry meetings and initiatives. ANO has initiated a condition report to track and resolve this generic issue. Actions are being taken to investigate the potential for unfiltered in-leakage and are being tracked under the condition report. A power uprate submittal for ANO-2 is also being developed and scheduled to be presented later this year. As part of this submittal, further consideration of control room inleakage will be addressed with respect to the Maximum Hypothetical Accident (MHA).

In addition to the condition report above, an active condition report written in 1998 addresses required actions to be taken to maintain a post accident control room envelope. Walkdowns and smoke testing of various control room penetrations have been performed by ANO Systems Engineering department to observe any potential concerns in the integrity of the control room. Deficiencies are corrected through the site's maintenance program and usually require the initiation of a condition report. Aged and/or obsolete components such as seals, dampers, and actuators are replaced or are evaluated for acceptability. A control room penetration log has been developed that identifies the location of the various penetrations and is used to identify items for additional action. Preventative maintenance programs have also been established for some control room integrity components. A sealed metal cover has been installed on the VSF-9 blower shaft to minimize the possibility of unfiltered inleakage from the shaft area. In addition, two of the four normal ventilation control room isolation dampers have been replaced/upgraded. Furthermore, an action from the 1998 condition report requires an inspection of all accessible control room penetrations, which is scheduled to be completed in the fall of 2000. In summary, Entergy Operations, Inc. has established a dedicated effort to ensure the integrity of the control room is maintained.

Based on the above information, Entergy Operations, Inc. believes that the aforementioned RPS setpoint changes as described in letter dated November 30, 1999 may be approved without imposing significant risk to the public or control room personnel. Furthermore, because the above analysis indicates acceptable margin to safety, the No Significant Hazards Considerations as stated within the November 30, 1999 letter remains valid.

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

ANO-2 station procedures describe the startup of the charging pumps. Although procedures do not prevent additional charging pumps from being started, normal operating procedures require additional charging pumps only to support plant maneuvers (startup and shutdown), which are very infrequent. Abnormal and emergency procedures may require the start of additional charging pumps. In the event of increasing reactor coolant iodine activity, however, procedures require reactor engineering and management to be notified. In turn, reactor engineering procedures provide steps for normalizing the iodine activity values to a standard flow rate, regardless of how many charging pumps are operating. In addition to the above, running more than one charging pump during steady-state power operations is not considered a desired practice since this would result in increased letdown flow, which in turn results in increased radiological concerns and increased heat loads on the component cooling water system (used to cool both letdown and reactor coolant pump seals). Historically, operation with more than one charging pump in service during steady-state operations is rare. Therefore, the statements found in the aforementioned submittals regarding charging pump operations remain valid.

Entergy Operations, Inc. requests the effective date for this change to be September 25, 2000. Should further information be desired, please do not hesitate to call.

Very truly yours,

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Director, Nuclear Safety Assurance

Attachment
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ATTACHMENT

TO

2CAN080004

ATMOSPHERIC DISPERSION

FACTOR CALCULATION

LICENSE NO. NPF-6

ENTERGY OPERATIONS, INC.

ARKANSAS NUCLEAR ONE, UNIT TWO

DOCKET NO. 50-368

ATMOSPHERIC DISPERSION FACTOR CALCULATION

The following information has been extracted from the χ/Q analysis.

1. The Arkansas Nuclear One - Unit 2 (ANO-2) control room emergency ventilation fan draws air from the surrounding area (Room 123) through a filtration unit (2VSF-9). Room 123 is open to a hallway that joins several rooms (Rooms 128 and 120 being the most significant). These rooms are supplied by multiple fan/cooling units, all of which intake air from VPH-2, located on the ANO - Unit 1 (ANO-1) auxiliary building roof. There are no other sources of forced air in this area.

   Although forced air flow from the subject fan/cooling units may stop on a Loss of Offsite Power (LOOP) concurrent with a design basis event, the proximity of Rooms 128 and 120 and the unrestricted flow area between these rooms to Rooms 123 suggest that most of the air to 2VSF-9 would either be from VPH-2 or from diffuse in-leakage through doors to the turbine and auxiliary buildings.

2. The ANO-1 control room emergency ventilation fan draws air from the surrounding computer room (Room 160) through a filtration unit (VSF-9). The room normally takes air from the ANO-1 control and computer room supply fans VSF-8A & B, which in turn intakes air from VPH-1. These fans are secured upon a high radiation signal received from either ANO-1 or -2, and the dampers automatically close. However, these dampers may allow a significant volume of air to leak into the room. No other source of forced air is supplied to this room.

   Another source of air to Room 160 is through leakage around the doors from the adjacent rooms. The most conservative door leakage source for VSF-9 is from the CRD Transformer Room 167, which is supplied by VSF-25. VSF-25 takes suction from VPH-1 on the auxiliary building roof. Door leakage from the spent fuel pool area and diffuse inleakage from the turbine building could also occur. The spent fuel pool area is supplied by VSF-4, which takes suction fromVPH-2.

3. The ANO-2 Atmospheric Dump Valves (ADV) release steam directly to the atmosphere via exhaust pipes that are situated on the auxiliary building roof near the containment building. The release from the two ADV stacks is also dependent on which secondary loop is damaged; therefore, the worst-case release point is assumed. The release is assumed to be from the ADV nearest to the Control Room intakes. This corresponds to a release from 2CV-1001, which is the ADV downstream of steam generator A (2E-24A) but upstream of the main steam isolation valve (2CV-1010-1).

4. During a MSLB accident, it is postulated that steam will be released with such force that the normal ventilation system will not be capable to control the release. It is therefore assumed that the walls and/or roof of the steam pipe area (Room 2155) will be dislodged from their fastened position, allowing direct release of all effluents to the environment. Since the path of the release is from the steam line to the room and then to the environment through the walls and/or roof, the source is conservatively modeled as a "ground release".

5. The stability index for meteorological data is calculated using the methods that are discussed in Regulatory Guide 1.23, "Onsite Meteorological Programs".

6. The Main Steam Safety Valves (MSSV) are postulated to release steam in several accident scenarios. Depending on the accident conditions, as few as two or as many as all ten MSSVs may release steam. To determine χ/Q values that would be conservative for use in all cases (instead of assuming a diffuse release from all ten valves), it is assumed that the release is from the valve with the lowest pressure setpoint that is closest to the control room intakes (2PSV-1002 for ANO-2).

7. Ground Level is assumed to be 354' 0". Furthermore, the height of the containment is taken as the elevation of the parapet, which is 533' 6".

8. In accordance with the draft NRC guidance, a "ground release" is appropriate for the majority of control room χ/Q assessments. Therefore, the "ground release" type was used for all cases. Vertical velocity, stack radius and stack flows are not required for ground level release evaluations.

9. Site-specific meteorological data are obtained from the meteorological tower, which is located approximately 0.51 mile due east of the ANO-1 containment building, at an elevation of 360 feet above sea level. The tower collects data at 10 and 57 meters above ground level. The meteorological data was obtained from January 1995 to December 1999 and included wind speed and direction for both the 10 and 57 meter elevations. Also included in the data is a stability index ranging from 1 to 7 that identifies the apparent atmospheric turbulence for each hour of the day over the stated period.

10. The building area, which may affect the turbulence of the release, is also input into ARCON96. The design basis Unit 2 building area is 2205 m^2.

11. For all cases considered, the receptor is assumed to be one of the control room intakes (VPH-1 and VPH-2 as described above). Both intake structures were analyzed.

12. The base of VPH-1 has an elevation of 447' 10 $^{15}/_{16}$" (28.62 m above grade). The base of VPH-2 has an elevation of 448' 0" (28.65 m above grade).

13. Release Data:

Release Source	Release Height Above Grade (m)	Horizontal Distance to Intake (m)		Direction from Intake to Release Source (North is 0°)	
		VPH-1	VPH-2	VPH-1	VPH-2
ADVs	30.56	79.77	92.22	346°	348°
MSSVs	30.66	69.23	81.73	347°	349°
MSLB	21.74	82.69	95.27	350°	351°

1. In accordance with the draft NRC guidance on the use of ARCON96, a surface roughness length of 0.2 meters is used.

2. In accordance with the draft NRC guidance on the use of ARCON96, a width constant of 4.3 is used.

3. Other ARCON96 default input values are unchanged.

The following results give the atmospheric dispersion values for releases to either VPH-1 or VPH-2. For all cases, the limiting χ/Q values are for releases to VPH-1.

Atmospheric Dispersion Factors for Unit 2 ADV Releases to VPH-1

Time Period	χ/Q Value
0 to 2 hrs	6.31×10^{-4} sec/m^3
2 to 8 hrs	3.65×10^{-4} sec/m^3

Atmospheric Dispersion Factors for Unit 2 ADV Releases to VPH-2

Time Period	χ/Q Value
0 to 2 hrs	4.78×10^{-4} sec/m^3
2 to 8 hrs	2.75×10^{-4} sec/m^3

Atmospheric Dispersion Factors for Unit 2 MSSV Releases to VPH-1

Time Period	χ/Q Value
0 to 2 hrs	8.05×10^{-4} sec/m^3
2 to 8 hrs	4.64×10^{-4} sec/m^3

Atmospheric Dispersion Factors for Unit 2 MSSV Releases to VPH-2

Time Period	χ/Q Value
0 to 2 hrs	5.91×10^{-4} sec/m^3
2 to 8 hrs	3.37×10^{-4} sec/m^3

Atmospheric Dispersion Factors for a Unit 2 Main Steam Pipe Release to VPH-1

Time Period	χ/Q Value
0 to 2 hrs	5.48×10^{-4} sec/m^3
2 to 8 hrs	3.23×10^{-4} sec/m^3

Atmospheric Dispersion Factors for a Unit 2 Main Steam Pipe Release to VPH-2

Time Period	χ/Q Value
0 to 2 hrs	4.22×10^{-4} sec/m^3
2 to 8 hrs	2.51×10^{-4} sec/m^3