ANO-2 Control Room Inleakage

<u>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.

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. To further address this question new confirmatory control room dose calculations have been performed which reflect acceptable operator doses for inleakage up to 5000 cfm. The FWLB, 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, a ground release was assumed versus a vent release, and other parameters were adjusted to be consistent with the draft NRC guidance provided at the NEI meetings.
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 below.

Utilizing the new atmospheric dispersion factors and assuming 5000 cfm control room inleakage, control room doses were calculated within GDC 19 acceptable limits (30 Rem Thyroid, 5 Rem whole body, and 75 Rem skin).

ATTACHMENT

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 our 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 Iodine Protection Factor 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 is being 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 (GIS) case. A Thyroid dose of 21.45 Rem was calculated for this case. Taking no credit for the control room envelope IPF increases this dose to 29.6 Rem, which is still within the acceptance criteria. The FWLB results exceed this limit only when an overly conservative assumption of a 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 CR inleakage, Entergy Operations 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 for later this year. As part of this submittal further consideration of control room inleakage will be addressed with respect to the 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 periodically performed by ANO Systems Engineering 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 and types 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 eliminate 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 has established a dedicated effort to ensure the integrity of the control is maintained.

ATMOSPHERIC DISPERSION FACTOR CALCULATION

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

1. The Unit 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 have intake from VPH-2 (on the Unit 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 suggests 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 Unit 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 Unit 1 control and computer room supply fans VSF-8A & B which in turn intakes air from VPH-1. These fans are secured on a high radiation signal from either Units 1 or 2 and the dampers are closed. 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 which 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 Unit 2 ADV's release steam directly to the atmosphere via exhaust pipes that are situated on the Auxiliary Building near the containment building. The release from these two stacks is also dependent on which secondary loop is damaged, so the worst-case release point is used. The release is assumed to be from the ADV's nearest to the Control Room intakes. This corresponds to a release from 2CV-1001, which is the ADV downstream of steam generator A (2E-24) 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, which will allow 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 MSSV's are postulated to release steam in several accident scenarios. Depending on the accident conditions, as few as two or as many as all sixteen MSSV's may release steam. To determine χ/Q values that would be conservative for use in all cases, instead of a diffuse release from sixteen 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 Unit 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 Unit 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 were obtained from January 1995 to December 1999 and include wind speed and direction for both the 10- and 57-meter heights. Also included in these 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. The receptor for all cases considered is one of the control room intakes, which are VPH-1 and VPH-2 per discussion 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
ADV's	30.56	79.77	92.22	346°	348°
MSSV's	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 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