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Date: 2/10/04 5:19PM
Subject: Responses to Steve LaVie RAIs on ANO-1 OTSG ISI Report

Tom,

Attached is the draft response to Steve LaVie's RAI; questions 1-4. In
addition, what we provided to Emmett is contained as question 5.

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<u>**Expansion of Question #5 from the Previous RAI**</u>
<u>**Steam Generator Inspection Report**</u>
<u>**Arkansas Nuclear One, Unit 1**</u>

1.   [Lavie] What is the acceptance criterion that is being used?

<u>Response</u>: The acceptance criteria established for the "best estimate" LB LOCA from the ANO-1 once through steam generators is 9.0 gpm and 3.0 gpm for the remaining 30 days. This is the bounding assumption used in the offsite and CR dose calculations.

2.   [Lavie] What is the basis / derivation of the acceptance criterion?

<u>Response</u>: The most significant parameter for tube leakage under LBLOCA conditions is the tube tensile load created by the tube to tubesheet temperature differences when the tubesheet dilation occurs. The large axial tube loads pose a concern to tubes found to have circumferential cracks. Therefore, the predominant LB LOCA contributor to LB LOCA leakage was from circumferential cracks. A small amount of leakage was also assigned to repair products from 1R17. The bounding leakage was conservatively assumed to be 9 gpm for two minutes (duration of maximum tubesheet bore dilation) and 3 gpm for the remainder of the 30 day event.

The actual ANO-1 "best estimate" LB LOCA leakage values determined for 1R17 were:

	2 min.	30 day
1R17	1.87 gpm [1]	1.46 gpm

[1] - Only the 2 minute leakage value was reported in the January 17, 2003 OTSG ISI report for 1R17.

3.   [Lavie] If the acceptance criterion is expressed in terms of post-accident dose or if the acceptance criteria was back-calculated from dose, please explain the significant assumptions and inputs that are used to calculate the dose from the measured leakage and vice versa.

<u>Response</u>: See response below

4.   [Lavie] Are the methodology, assumptions and inputs of these analyses consistent with regulatory guidance for design basis accidents?

<u>Response</u>: The calculated doses were performed to support the best-estimate assessment for tube leakage. The LB LOCA dose assumptions use the same basis as that established in the ANO-1 SAR 14.2.2.5.6 for estimating (LB LOCA) doses with the total release of the fuel gap inventory, which differs from the TID source term assumed for the MHA. ICRP30 dose conversion factors were used to develop the nuclide library. To model offsite doses from primary to secondary leakage which might occur due to SG tube loads induced by the LOCA transient, it is conservatively assumed that 10% of whatever leaks into the secondary from the RCS is released to the environment. Consistent with the evaluation of the dose from ECCS leakage, it is assumed that only iodine is in solution in the RCS inventory. The noble gases in the RB have already been accounted for in the LB LOCA dose. Therefore, only the thyroid dose was assumed for the purposes of this analysis. The same X/Qs and breathing rates were used for the

offsite dose consequences dose calculation. Control room doses were similarly developed using licensing basis assumptions.

The results of the analysis for 9 gpm leakage (2 minute) and 3 gpm leakage (30 days) results in the following doses:

	EAB	LPZ	CR Thyroid
SAR RB Leakage Dose (rem)	7.01	2.66	1.21
Primary to Secondary Leakage (rem)	22.22	19.34	13.61
Total (rem)	29.23	22.00	14.82

- The resulting EAB and LPZ doses from this leakage when added to the doses reported in Table 14-49 of the ANO-1 SAR are far less than the 10CFR100 thyroid limit of 300 Rem, and were bounded by the EAB and LPZ doses reported for the Maximum Hypothetical Accident (MHA) in Table 14-52 (148.68 and 52.38 rem, respectively) of the Unit 1 SAR.

- Using the same Control Room model as used for the MHA, the thyroid dose to the control room operator from the above scenario is well below the GDC-19 guideline of 30 Rem and less than the MHA Control Room thyroid dose reported in section 14.2.2.6.7 of the Unit 1 SAR (18.93 rem).

5. [Murphy] Provide summary description of how the 1.87 gpm leak rate estimate was determined for LBLOCA. This should include the following information:

a. Does this estimate consider leakage from flaws other than circumferential cracks?

Response: A small amount of leakage was assigned to repair products for 1R17. That is the only other leakage assigned besides circumferential flaws. The leakage values assigned to flaws are in accordance with the ANO-1 Safety Evaluation Report dated March 28, 2001 which states:
    Determination of the best-estimate total leakage that would result from an analysis of the limiting LBLOCA based on circumferential cracking in the original tube-to-tubesheet rolls, tube-to-tubesheet reroll repairs, and heat affected zones of seal welds as found during each inspection.

b. Brief description of method used to calculate leakage for circumferential cracks in the original roll or heat affected zone adjacent to the tube-to-tubesheet seal weld if no reroll is present.

Response: The reported leakage associated with the rolled joint or the heat affected zone is the calculated leakage through the rolled joint as determined by loading and predicted dilations for LBLOCA for that specific radial location (ratio added for LBLOCA loads). The leakage for a specific flaw is determined by the calculating the stress on the flaw, determining the percent degraded area (PDA) of the flaw and assigning leakage.

c. Brief description of method used to calculate leakage for circumferential cracks at or below lower transition of original roll if no reroll is present.

Response: The leakage is determined by sizing the flaw and determining which section of the flaw could leak without taking any credit for rolled area. The leakage is determined by taking the lesser of the leakage associated with the actual flaw and the leakage through the annulus.

d. Brief description of method used to calculate leakage for circumferential cracks at reroll repair.

Response: A reroll length as short 0.86" has been leak tested by Framatome under operational and accident conditions. This leakage is applied if the flaw has moved into the heel transition (outboard or non-pressure boundary). Again, depending upon the radial distance of tube with the flaw, a leak rate is assigned through the reroll joint or the leak associated with the actual flaw whichever is less. No circumferential cracks were found in rerolls during 1R17.

e. Brief description of method used to calculate leakage for circumferential cracks inboard of reroll repair.

Response: The leakage is determined by sizing the flaw and determining which section of the flaw could leak without taking any credit for rolled area. Again, annulus leakage was assigned as discussed in item "c" above.

f. Brief description of method used to calculate leakage for circumferential cracks outboard of reroll repair. Are the portions of tubing outboard of reroll repairs subject to inspection?

Response: Yes the outboard reroll is inspected for Circ cracking. As discussed above, the leakage assigned is the leakage through the reroll joint or the leakage through the flaw, whichever is less.