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1CAN090204

September 9, 2002

U.S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, DC 20555

SUBJECT: Arkansas Nuclear One, Unit 1
Docket No. 50-313
Response to Request for Additional Information
One-Time Extension of the Integrated Leak Rate Test Interval

REFERENCE: Entergy Letter dated January 31, 2002, One-Time Extension of the Integrated Leak Rate Test Interval (1CAN010201)

Dear Sir or Madam:

The referenced correspondence was a request, pursuant to 10CFR50.90, by Entergy Operations, Inc. (Entergy) for an amendment for Arkansas Nuclear One, Unit 1 (ANO-1). The requested amendment was to change administrative Technical Specification 5.5.16 regarding Containment Integrated Leak Rate Testing (ILRT). The change clarifies the statement that the ILRT Program is in accordance with Regulatory Guide 1.163 by noting an exception based on NEI 94-01-1995. The effect of this change will be the allowance of an extended interval (15 years) for performance of the next ILRT.

The NRC Staff has reviewed the application and has provided two requests for additional information (RAI). Responses to these requests are attached. In Reference 1, the proposed change had been evaluated in accordance with 10CFR50.91(a)(1) using criteria in 10CFR50.92(c) and it has been determined that this change involves no significant hazards considerations. The supplemental information in the responses does not impact the conclusions of that determination.

There are no new commitments made in the responses to these RAIs. If you have any questions or comments concerning this request, please contact Jerry Burford at (601) 368-5755.

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I declare under penalty of perjury that the foregoing is true and correct. Executed on September 9, 2002.

Sincerely,

Sherrie R. Cotton

Sherrie R. Cotton
Director, Nuclear Safety Assurance

SRC/fjb

Attachments:
1. Response to Request for Additional Information
2. Supplemental Risk Evaluation

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Attachment 1

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Response to Request for Additional Information

Response to Request for Additional Information

ANO-1 has received a question from the Probabilistic Safety Assessment Branch (SPSB) Branch and from the Mechanical and Civil Engineering Branch (EMEB). Both of these questions and the Entergy response are presented below.

PSA Question:

The staff has reviewed ANO's submittal of their request for a one-time extension of the Type A test interval to 15 years. Our confirmatory calculations conclude that the increase in Large Early Release Frequency (LERF) in going from a 3 in 10 years test interval to a 1 in 15 years test interval is 1.5E-07. We can provide spreadsheets if it would help the discussion.

Regulatory Guide (RG) 1.174 states that when the calculated increase in LERF is in the range of 1E-07 to 1E-06 proposed changes will be considered if the total LERF is less than 1E-05 In order to process their request we would need the licensee to provide an estimate of total LERF. The total LERF estimate should include external as well as internal events. RG 1.174 references NUREG/CR-6595 to assist licensees in making such estimates in case they have not done so as part of their IPEEE. Seabrook and STP have taken this approach.

An alternative approach would be to argue that the proposed change is less than 1E-07 per reactor-year, which is the risk acceptance guideline for a very small change as defined in RG 1.174. There is some likelihood that the undetected flaw in the containment liner estimated as part of the class 3b frequency would be detected as part of the IWE visual examination process of the containment liner. For example, if 60% of the liner is inspected, then the class 3b frequency would be reduced by 60% and the increase in LERF would go from 1.5E-07 to 6.0E-08. Brunswick, Calvert Cliffs, and Salem took this approach

Finally, licensees' making similar requests have been requested by EMEB to address what effect potential degradation of the inaccessible side of the containment liner would have on the risk assessment. Calvert Cliffs recently provided information (ADAMS Accession No. ML02090100) in support of a similar tech spec amendment to address the issue ANO may want to consider Calvert Cliffs' response prior to submitting their response.

Response:

ANO-1 has considered the question above and notes the NRC calculation of the impact of the change on plant risk are in agreement with the ANO-1 results presented in the original submittal. These results did slightly exceed the acceptance guidelines of RG 1.174. These results, however, can be adjusted as pointed out above based on the likelihood that the undetected flaw estimated as part of the Class 3b frequency would be detected as part of the IWE visual examination process of the containment liner. ANO-1 has evaluated the effect of this adjustment on the ANO-1 results and a summary of that evaluation is presented in Attachment 2 (see page 5).

Note that Attachment 2 also presents a supplemental evaluation in the same format as that in the original submittal. This revision modifies the input to Table 3, Note 1 to reflect the use of data from EPRI TR-104285 rather than the plant-specific PSA model. This discussion is intended to provide a supplemental evaluation that is more consistent in the inputs and more comparable to the risk evaluation and conclusions of NUREG-1493.

Mechanical Question:

Previous inspections of some reinforced containments (e g., North Anna, Brunswick, D. C Cook, etc.) have indicated degradation from the uninspectable (embedded) side of the steel liner of primary containments. The major uninspectable areas of the reinforced containment include the embedded side of the steel liner and part of the steel liner embedded in the basemat. Please discuss whether there are uninspectable areas and what programs are used to monitor its condition. Also, address how potential leakage due to age related degradation from these uninspectable areas are factored into the risk assessment in support of the requested ILRT interval extension from 10 to 15 years.

Response:

Two events of corrosion that initiated from the non-visible (backside) portion of the containment liner have occurred in the industry. These events are summarized below:

- On September 22, 1999, during a coating inspection at North Anna Unit 2, a small paint blister was observed and noted for later inspection and repair. Preliminary analysis determined this to be a through-wall hole. On September 23, a local leak rate test was performed and was well below the allowable leakage. The corrosion appeared to have initiated from a 4"~4"x6' piece of lumber embedded in the concrete.

  An external inspection of the North Anna Containment Structures was performed in September 2001. This inspection (using the naked eye, binoculars, and a tripod-mounted telescope) found several additional pieces of wood in both Unit 1 and Unit 2 Containments. No liner degradation associated with this wood was discovered.

- On April 27, 1999, during a visual inspection of the Brunswick 2 drywell liner, two through-wall holes and a cluster of five small defects (pits) in the drywell shell were discovered. The through-wall holes were believed to have been started from the coated (visible side). The cluster of defects was caused by a worker's glove embedded in the concrete.

The Containment In-service Inspection (CII) program at ANO-1 is described in plant procedure CEP-CII-007. The program requirements include a general visual examination of the containment surfaces each inspection period. The general visual examinations are conducted in accordance with plant procedures. Any indications exceeding the screening criteria are provided to a qualified containment engineer who compares the indication to the design requirements of the containment vessel. Any indications that exceed the design requirements are documented in the Corrective Action Program and are dispositioned in accordance with the ASME code requirements. In addition, the program currently requires VT examinations of bolted connections and moisture barriers.

Scheduled in-service inspection (ISI) exams are performed in accordance with the requirements of the ASME Section XI, Subsection IWE, and 10CFR50.55a. Currently, the ANO-1 program is designed to the 1992 Edition, with 1992 Addenda of ASME XI. These documents require visual examination of essentially 100% of the containment liner accessible surface area once per ISI period (three in ten years). This exam is performed and documented by Certified NDE Examiners during the outage and/or before an ILRT.

This exam is performed both directly and remotely, depending upon the accessibility to the various areas. To date, there have been no recordable indications of liner plate degradation. As noted in the original submittal, there are currently no areas requiring Augmented Inspections.

There are inaccessible areas of the ANO-1 containment liner, including both the back-side (embedded) face as well as surfaces inside the Containment Building covered or blocked by concrete. The overall inner surface area of the Reactor Building is approximately 82,900 square feet. Of this area, approximately 12,500 square feet or about 15% is covered by concrete or is otherwise inaccessible. Approximately 9800 square feet (11% of the total surface area) of this inaccessible area is the base mat and containment floor area. There are no programs that monitor the condition of the inaccessible areas of the liner plate directly When there is an indication of potential degradation of inaccessible areas of the liner plate, this finding is evaluated and appropriate actions are taken to assure the adequacy and integrity of the liner. Note that no such indications have been detected to date for the ANO-1 liner.

A simplified analysis of the potential impact of liner corrosion resulting in a leak that would not be detected by the ILRT is provided in Attachment 2 (see page 6) to this submittal It demonstrates that liner corrosion is estimated to pose a negligible increase in the risk associated with this requested change.

ANO-1 would also like to correct a statement on page 5 of Attachment 1 in the original submittal (Reference 1). It had indicated that the extended test interval for Type B penetrations is a minimum of 120 months It should read: ".. a maximum of 120 months."

Attachment 2

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Supplemental Risk Evaluation

Supplemental Risk Evaluation

As described in the response to the SPSB RAI received on the ANO-1 amendment request for a one-time extension of the Integrated Leak Rate Test (ILRT) interval, a supplemental evaluation of the risk impact of the change is presented below This supplemental evaluation incorporates data from EPRI TR-104285, "Risk Impact Assessment of Revised Containment Leak Rate Testing Intervals" in lieu of the ANO-1 plant-specific model as noted in Note 1 associated with Table 3 of the original submittal. The format of this evaluation mimics that of the original submittal; the release values have been revised based on the NUREG-1493 and the effect of this change on the values in each of the tables in the original submittal is documented. Note that the summary level information (Tables 7 and 8) are not updated here and the Conditional Containment Failure Probability discussions were not affected

The original submittal had estimated that the cumulative increase in risk was 0 49 percent This was based on plant-specific release values that are much lower than those used in the evaluations performed for NUREG-1493. This resulted in the estimated cumulative risk impact for ANO-1 appearing to be greater than that in NUREG-1493 (i e., 0.49% compared to 0 14%) In NEI guidance (issued 11/13/01), it was noted that either plant-specific data or release data used in the EPRI report may be used. This change provides a more reasonable comparison of the ANO-1 results to the risk increases in NUREG-1493 In addition, ANO-1 provides a basis for reducing the estimated risk impact of this change by crediting the likelihood of an undetected flaw in the containment liner being detected by the ASME XI, IWE visual examinations

Evaluation of Baseline ILRT Interval

The risk results of this evaluation for the baseline case are presented in Table 3 The release frequencies for the Class 2, 6, 7, and 8 bins are taken from the ANO-1 IPE. As noted in Table 1, the risk associated with the Class 4 and 5 bins is not impacted by the ILRT interval and is not analyzed here. The release frequencies for the Class 3a and 3b bins are determined based on the previously approved methodology (see next paragraph). The release frequency for Class 1 is the value of core damage frequency (CDF) reduced by the frequencies of the Class 3a and 3b scenarios.

Table 3
ANO-1 Risk Evaluation
of Baseline ILRT Interval

Class	Frequency (per reactor-year)	Release (person-rem)	Risk (person-rem/year)
1	CDF intact - freq(3a)-freq(3b) = 3 54E-05	L_a = 1.10E+03	0 0390
2, 6	3.74E-08	4.07E+06	0 152
3a	0.064 x CDF = 3.13E-06	10 L_a = 1.10E+04	0.0344
3b	0.021 x CDF = 1.03E-06	35 L_a = 3.85E+04	0.0395
7	8 98E-06	2.16E+06	19.40
8	2 08E-07	1.24E+07	2.58
		Total Risk	22 24

Using the previously approved methodology, the risk contribution due to the ILRT Type A testing is considered to be due to the Class 3a and 3b scenarios. From Table 3, it can be seen that the risk contribution associated with the ILRT testing interval considering Classes 3a and 3b is:

$$\% \text{ Risk} = [(\text{Risk}_{\text{Class 3a}} + \text{Risk}_{\text{Class 3b}}) / \text{Total Risk}] \times 100$$

$$= [(0.0344 + 0.0395) / 22.24] \times 100$$

$$= 0.33\%$$

Risk Evaluation of the Current ILRT Interval (1 in 10 years)

This analysis of the current 'once in 10 years' interval is performed using the same approach taken above for the baseline case. The frequencies for all release classes, except Class 1, 3a, and 3b, are unaffected by the change in the interval and remain as in Table 3. And the releases for all of the classes are the same as those shown in Table 3 for the baseline case.

The increased probability of not detecting excessive leakage in a Type A test directly impacts the frequencies of the Class 3 events In the previously approved methodology, the Class 3a and 3b frequencies are determined by multiplying the baseline frequency by a factor of 1.1. This same factor is used in this analysis to be consistent with the previously approved methodology. With this change in the Class 3 frequencies, the Class 1 frequency is also adjusted to preserve the total CDF. The evaluation of the current interval is presented in Table 4.

Table 4
ANO-1 Risk Evaluation
of Current ILRT Interval

Class	Frequency (per reactor-year)	Release (person-rem)	Risk (person-rem/year)
1	CDF intact - freq(3a)-freq(3b) = 3.50E-05	L_a = 1.10E+03	0.0385
2, 6	3 74E-08	4.07E+06	0.152
3a	1 1 x 0.064 x CDF = 3.44E-06	10 L_a = 1.10E+04	0.0379
3b	1.1 x 0.021 x CDF = 1.13E-06	35 L_a = 3.85E+04	0.0435
7	8.98E-06	2.16E+06	19.40
8	2.08E-07	1.24E+07	2 58
		Total Risk	22.25

As was noted above for the baseline evaluation the risk contribution due to the Type A test interval is [(0.0379 + 0.0435) / 22.25] x 100, or 0 37%

Risk Evaluation of the Proposed ILRT Interval (1 in 15 years, one-time)

This analysis of the proposed 'once in 15 years' interval utilized the same approach as taken above for the baseline case The frequencies for all release classes, except Class 1, 3a, and 3b, are unaffected by the change in the interval and remain as in Table 3 The releases for all of the classes are the same as those shown in Table 3 for the baseline case.

The increased probability of not detecting excessive leakage in a Type A test directly impacts the frequencies of the Class 3 events Based on the previously approved methodology, the Class 3a and 3b frequencies are determined by simply multiplying the baseline frequency by a factor of 1.15 With this change in the Class 3 frequencies, the Class 1 frequency is also adjusted to preserve the total CDF The evaluation of the proposed interval is presented in Table 5.

Table 5
ANO-1 Risk Evaluation
of Proposed ILRT Interval

Class	Frequency (per reactor-year)	Release (person-rem)	Risk (person-rem/year)
1	CDF intact - freq(3a)-freq(3b) = 3.48E-05	L_a = 1 10E+03	0 0383
2, 6	3.74E-08	4 07E+06	0.152
3a	1.15 x 0.064 x CDF = 3.60E-06	10 L_a = 1.10E+04	0 0396
3b	1.15 x 0.021 x CDF = 1.18E-06	35 L_a = 3.85E+04	0 0455
7	8.98E-06	2.16E+06	19 40
8	2.08E-07	1 24E+07	2.58
		Total Risk	22 26

As was noted above for the baseline evaluation the risk contribution due to the Type A test interval is [(0 0396 + 0.0455) / 22 26] x 100, or 0.38%.

Summary for Supplemental Risk Evaluation

The original submittal included a summary statement (see page 3 of 17 of Attachment 1 of the original submittal) describing the risk increase of the change to a 15-year interval The increase had been found to be greater than the range of risk increase that had been estimated in NUREG-1493. This was based on plant-specific release values that are much lower than those used in the evaluations performed for NUREG-1493. This resulted in the estimated cumulative risk impact for ANO-1 appearing to be greater than that in the NUREG (i.e., 0 49% compared to 0.14%.) This statement can be revised based on the above supplemental evaluation to read·

1. The risk of extending the ILRT interval for Type A tests from its current interval of 10 years to 15 years was evaluated for potential public exposure impact (as measured in person-rem/year). The risk assessment predicts a slight increase in risk when compared to that estimated from current requirements For the change from a 10-year test interval to a 15-year test interval, the increase in the risk (person-rem/year within 50 miles) was found to be 0.04%. Note that the cumulative increase in risk, given the change from the original frequency of 3 tests in 10 years to a 15-year test interval, was found to be 0 09%. This is within the range of risk increases, 0 02 to 0.14%, estimated in NUREG-1493 when going from the 3 tests in 10 years test frequency to a 10-year test interval. NUREG-1493 concluded this represents an imperceptible increase in risk Therefore, the increase in the risk for the proposed change is considered small

Effect of Improved Visual Inspections of the Containment Liner

The increase in LERF resulting from a change in the Type A test interval from the original 3 in 10 years to 1 in 15 years is estimated to be 1.5E-07. This was based on a methodology consistent with that of EPRI TR-104285.

However, there is some likelihood that the undetected flaw in the containment liner could be detected by the visual inspections conducted in accordance with ASME XI, Section IWE. At ANO-1 the initial IWE examination of the liner was completed in 2001 An additional liner examination is scheduled to occur no later than 2004, with follow-on examinations occurring once every three or four years in accordance with ASME requirements

At ANO-1, the overall inner surface area of the Reactor Building is estimated to be 82,900 square feet. Of this area, approximately 12,500 square feet or about 15% is covered by concrete or is otherwise inaccessible Approximately 9800 square feet (11% of the total surface area) of this inaccessible area is the base mat and containment floor area Thus, approximately eighty-five percent of the containment liner is accessible for visual examination. For the risk evaluation purposes here, this value will be conservatively reduced to 80%

The effectiveness of the examination must also be considered in this risk impact evaluation Based on the qualification requirements for examiners, the examinations are considered to be highly effective in detecting visible flaws A 5% flaw detection failure rate would be expected based on engineering judgement. However, for conservatism, a total flaw detection failure likelihood of 10% will be assumed. A parametric evaluation is included to assess the sensitivity of the risk impact to various degrees of examination effectiveness.

The visual examinations and increased examination frequency reduce the delta-LERF values The calculation is essentially the old delta-LERF (column 3) times the term one minus the fraction accessible (column 1) times the effectiveness of the exam (column 2)

Table 6
Risk Reduction Due to Liner Examination Credit

Fraction of liner accessible (80%)	Examination effectiveness	Original delta-LERF (see table 6)	New delta-LERF
0.8	1.0	1.5E-07	3.0E-08
0.8	0.9	1.5E-07	4.2E-08
0.8	0.8	1.5E-07	5.4E-08

In summary, conservatively assuming that only 80% of the containment liner is accessible for examination and considering the examinations to be 90% effective results in a reduction in the delta-LERF value. The risk impact of the requested change in the ILRT interval in going from a test frequency of 3 in 10 years to 1 in 15 years would go from a delta-LERF of 1.5E-07/year to 4 2E-08/year.

Consideration of Liner Corrosion

The following approach was used to determine the change in likelihood, due to extending the ILRT, of detecting liner corrosion. This likelihood was then used to determine the resulting change in risk. The following issues are addressed:

- Differences between the containment basemat and the containment cylinder and dome;
- The historical liner flaw likelihood due to concealed corrosion;
- The impact of aging,
- The liner corrosion leakage dependency on containment pressure, and
- The likelihood that visual inspections will detect a flaw.

A simplified analysis of the potential impact of liner corrosion resulting in a leak that would not be detected by the ILRT was provided by Calvert Cliffs Nuclear Power Plant (CCNPP) in their March 27, 2002 supplemental submittal That analysis appears to be generic in nature and is conservative with respect to ANO-1 (based on the fact that the ANO-1 ILRT pressure is less than for CCNPP). One adjustment that will be made in the methodology is to account for the inaccessible portion of the containment shell area The result of the analysis, when applied to the adjusted increase in LERF developed above in the discussion of the liner examination provides a reasonable estimate of the impact for ANO-1. The inputs and assumptions used in the table below are derived from the CCNPP submittal except where noted

Table 7
Liner Corrosion Analysis

Step	Description	Shell/Dome Area – Accessible (85%)	Shell Area – Inaccessible (4%)	Basemat – Inaccessible (11%)
1	Historical Liner Flaw Likelihood	5.2E-03		1.3E-03
2	Age Adjusted Liner Flaw Likelihood (15-year average)	6 27E-03		1 57E-03
3	Increase in Flaw Likelihood between 3 and 15 years	8 7%		2.2%
4	Likelihood of Breach given Liner Flaw	1%	1%	0.1%
5	Visual Examination Detection Failure Likelihood	10%	100%	
6	Likelihood of Non-detected Containment Leakage (step 3 * 4 * 5 * %-accessible)	0 087*0.01*0 1* 0 85 = 0 0075%	0.087*0.01*1.0* 0 04 = 0.0035%	0.022*0.001*1 0 *0.11 = 0.0002%

So, based on Table 7 results, the total likelihood of a corrosion-induced, non-detected flaw resulting in containment leakage is the sum of the Step 6 results.

Likelihood of Non-detected Leakage = 0 0074% + 0 0035% + 0 0002% = 0 011%

The non-large early release frequency failures for ANO-1 are estimated at 3.9E-5 per year. The total CDF is 4.9E-5 If all of the non-detectable containment leakage events are considered to be LERF, then the increase in LERF associated with the liner corrosion issue is:

Increase in LERF (extension from 3 to 15 years) = 0.011% * 3.9E-05 = 4.3E-09

The total increase in LERF for the extension of the testing frequency, including the IWE visual inspections and the impact of the corrosion-induced leakage can be seen as follows:

4 2E-08 + 4.3E-09 = 4 6E-08

Therefore increasing the ILRT interval to 15 years is considered to be a very small change in LERF in accordance with the risk guidelines of RG 1 174.