April 12, 2000

Craig G. Anderson, Vice President
Entergy Operations, Inc.
Arkansas Nuclear One
1448 SR 333 GSB-3C
Russellville, Arkansas 72802

SUBJECT: REQUEST FOR ADDITIONAL INFORMATION (RAI) REGARDING SEVERE ACCIDENT MITIGATION ALTERNATIVES FOR ANO-1

Dear Mr. Anderson:

The staff has reviewed Entergy's analysis of severe accident mitigation alternatives (SAMAs) submitted in support of its application for license renewal for ANO-1, and has identified areas where additional information is needed to complete its review. Enclosed is the staff's request for additional information.

As discussed with your staff, we request that you provide your responses to these RAIs within 60 days of the date of this letter in order to support an accelerated review schedule. If you have any questions, please contact me at (301) 415-1120.

Sincerely,

/RA/

Thomas J. Kenyon, Environmental Project Manager
Generic Issues, Environmental, Financial, and
Rulemaking Branch
Division of Regulatory Improvement Programs
Office of Nuclear Reactor Regulation.

Enclosure: As stated

cc w/encl: See next page

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Request for Additional Information Regarding
Severe Accident Mitigation Alternatives for ANO-1

1. The Severe Accident Mitigation Alternative (SAMA) analysis is based on the ANO-1 Probabilistic Safety Assessment (PSA), which is an update of the Individual Plant Examination submitted to the NRC in 1993. The risk profile described by the PSA appears to be significantly different than that in the IPE. This has implications with respect to the identification and evaluation of plant-specific SAMAs. Provide the following information regarding the PSA to support the use of the PSA in the SAMA identification and evaluation process:

    a. A specific reference for the study, a description of the major differences between the Level 2 IPE and the Level 2 PSA in terms of both the methodology and assumptions and the insights/results of the studies, and a description of the internal and peer review of the PSA (Level 1 and 2).

    b. A listing of the dominant accident sequences (covering at least 95 percent of the core damage frequency), including the sequence logic in terms of event tree top events and descriptions of those top event headings. Note: the top 100 sequences would give additional insights beyond those offered from the previously submitted listing of cut sets, and could reveal if there is a pattern to the dominant sequences that could be addressed by a single SAMA.

    c. A breakdown of core damage frequency by leading contributors, for comparison with information in Figure 11.7 of NUREG-1560, "Individual Plant Examination Program: Perspectives on Reactor Safety and Plant Performance," December 1997, and a discussion of any unique features that may make the ANO-1 core damage frequency for key contributors significantly lower than at other Babcock & Wilcox (B&W) plants.

    d. The results of an importance analysis indicating those systems, structures, components, or human actions having the greatest potential worth for reducing risk at ANO-1.

    e. A discussion of the extent to which the PSA (in contrast to the IPE) was used to identify potential SAMAs.

2. Entergy submitted an Individual Plant Examination for External Events (IPEEE) in May 1996, but did not use that analysis to identify candidate SAMAs for external events or to estimate the added benefits that internal event SAMAs provide in external events. Instead, Entergy addressed only SAMAs for internal events and estimated the benefits of those SAMAs in external events by doubling the risk reduction estimates for internal events. This approach implicitly assumes that there are no cost beneficial SAMAs for external events, and that the contribution to risk and risk reduction from external events is equal in value and profile to that from internal events. Studies at other commercial nuclear power plants have shown that external events can be the dominant contributor

to core damage frequency and overall risk, and that numerous minor plant modifications can be warranted for external events. In this regard, provide the following:

a. Justification for omitting plant-specific SAMAs related to external events from the scope of the SAMA analysis and rationale as to why further enhancements for external events are not warranted at ANO-1, or alternatively, provide a revised SAMA analysis with consideration of plant-specific external event vulnerabilities.

b. Justification that the doubling assumption provides a reasonable upper bound estimate of the external event risk reduction for the SAMAs considered, or alternatively, provide an updated analysis that explicitly treats external event risk in the assessing the risk reduction for each SAMA.

3. The radionuclide release fractions in the SAMA analysis are identical to those in the IPE, but the frequency estimates differ. Please describe the reasons for these differences. Specifically discuss why:

a. Release mode BP-4 is included (and identified as a Large Early Release) in Table 4.7-4 of the IPE but omitted from Table G.1-2 of the ER.

b. There appears to be a large reduction (factor of 4 to 12) in the frequency of several plant damage states that are major contributors to estimated dose, specifically, E4-R, C6-R, C4-L, D4-L, and D4-R.

c. The individual frequencies for most plant damage states (PDSs) involving bypass with early release are higher in the SAMA analysis.

4. For important release modes, provide a comparison of the ANO-1 release fractions to corresponding release information for representative sequences in NUREG-1150, "Severe Accident Risks: An Assessment for Five US Nuclear Power Plants," June 1989, where applicable (e.g., Figures 3.7 and 3.8 in NUREG-1150).

5. As stated in the NRC's review of the IPE, the original Level 2 analysis submitted as part of the IPE used a simplified scoping analysis and lacked detailed plant-specific calculations. The conclusion of that review was that "the back-end analysis is likely to be of limited use for future applications beyond fulfilling the intent of Generic Letter 88-20." In view of this finding, please explain why no upgrades to the Level 2 IPE analysis were made for this application.

6. A Level 3 extension of the PSA was developed to support the SAMA study. This analysis has never been reviewed by the NRC. Although summary information regarding the MACCS calculations is provided in Attachment G.1, the following additional information is needed to assess the adequacy of the Level 3 analysis:

a. A description of the internal and peer review of the Level 3 analysis.

b. A breakdown of the population dose by leading contributors (e.g., functional sequences or release modes)

c. A discussion of why 1996 meteorological data was used, and justification why this can be considered a representative year.

d. An explanation of: (1) how the risk results would change if population projections out to 2034 were used (versus 2025), and (2) how the transient population growth was determined for the license renewal period.

e. Justification why evacuation times based on a 1981 evacuation study would remain valid for 2025 and 2034 given the projected increase in population relative to 1981.

f. A discussion of the factors (other than smaller release mode frequencies) that contribute to significantly lower offsite economic costs at ANO-1 relative to other plants, such as those presented in Table 5.6 of NUREG/BR-0184, "Regulatory Analysis Technical Evaluation Handbook," January 1997. Please provide: (1) a description of the major inputs/assumptions for modeling the economic impacts listed in Appendix G.1.2, and (2) a listing of the MACCS input file (excluding weather data).

7. To better understand the basis for the estimated reductions in core damage frequency and person-rem presented in Tables G.2-2 and G.2-3, please provide: (a) the analysis cases referred to in the “Basis for Conclusion” column of Table G.2-2, (b) a list or table summarizing the basic assumptions used in determining the delta CDF and delta person-rem estimates for each SAMA (see Table 7.5 in the Watts Bar analysis - NUREG-0498, "Final Environmental Statement Related to the Operation of Watts Bar Nuclear Plant, Units 1 and 2," Supplement 1, April 1995), and (c) a mapping of accident sequences to plant damage states and plant damage states to release modes.

8. Uncertainties in the PSA, risk reduction estimates, and cost estimates all contribute to uncertainties in the value-impact analyses for each SAMA. Factors of three to five are common for the Level 1 PSA alone. Uncertainties in these ranges could potentially make a number of SAMAs cost-beneficial. Please justify why uncertainties were not considered in the value-impact analysis, and explain the influence that uncertainties could have on the results of the SAMA analysis, including SAMA screening and dispositioning, if the impact of uncertainties was explicitly accounted for in the analysis.

9. The maximum attainable benefit of $145K is not consistent with NRC guidance for regulatory analysis in that it omits replacement power costs. These costs typically amount to about $100K per year. These costs should be included as a basic element of the averted onsite costs and should be considered before making adjustments for missing external events or uncertainty considerations as indicated above. Please reconsider the SAMA screening analysis and provide a revised version of Tables G.2-2 and G.2-3, considering replacement power costs within the baseline, and the potential impacts of uncertainties.

10. SAMA 129, “Emphasize timely recirculation swapover in operator training” was determined to be “marginally cost-beneficial” but was dismissed because it was not age-

related. Although not age-related, implementation of this SAMA may be justified to reduce risk under the current operating license. Please explain how this operator action was addressed in the training program considered at the time of the IPE, and how this training has changed since then. Are there any other changes that could be considered for further improvement?

11. In general, the candidate SAMAs focus on hardware changes that tend to be expensive to implement (of the 169 SAMAs, only 31 involved something other than hardware changes, and 13 of those had already been implemented at ANO-1). While hardware changes may often provide the greatest risk reduction, consideration should be given to other options that provide marginally smaller risk reductions but with much smaller implementation costs. For example, instead of adding another service water pump to improve services water (SW) reliability, consider determining the causes for failures in the existing SW pumps and adjusting the preventive maintenance program or procedures to address the dominant failure modes. Provide justification for why these type of options were not considered more often (e.g., as SAMAs to address the major risk contributors at ANO-1).

12. Section 4.13.4.3 (page 4-60) mentions the use of an expert panel in the costs and benefits estimation process. Please provide: (a) a description of the role of the expert panel in the SAMA study (e.g., level of involvement, specific tasks performed, etc.), and (b) a discussion of the value added by the panel with some examples of the impact of the panel on the study.

RGEB ROUTING SLIP

ORIGINATOR: Tom Kenyon

SUBJECT: RAI REAGARDING SEVERE ACCIDENT MITIGATION ALTERNATIVES FOR ANO-1

SECRETARY: Sue

NAME	DATE
T. Kenyon	______
B. Zalcman	______
C. Carpenter	______
C. Grimes	_______