July 16, 2002

Mr. Ross T. Ridenoure
Division Manager - Nuclear Operations
Omaha Public Power District
Fort Calhoun Station FC-2-4 Adm.
P.O. Box 550
Fort Calhoun, NE 68023-0550

SUBJECT: REQUEST FOR ADDITIONAL INFORMATION (RAI) REGARDING SEVERE ACCIDENT MITIGATION ALTERNATIVES FOR THE FORT CALHOUN STATION, UNIT 1

Dear Mr. Ridenoure:

The staff has reviewed Omaha Public Power District's analysis of severe accident mitigation alternatives (SAMAs) submitted in support of its application for license renewal for the Fort Calhoun Station, Unit 1, and has identified areas where additional information is needed to complete its review. Enclosed is the staff's request for additional information.

We request that you provide your responses to these RAIs by September 27, 2002, in order to support the license renewal review schedule. If you have any questions, please contact me at (301) 415-1120.

Sincerely,
Original Signed By: TJKenyon
Thomas J. Kenyon, Project Manager
Environmental Section
License Renewal and Environmental Impacts
Division of Regulatory Improvement Programs
Office of Nuclear Reactor Regulation

Docket No. 50-285

Enclosure: As stated

cc w/encl: See next page

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**REQUEST FOR ADDITIONAL INFORMATION ON
SEVERE ACCIDENT MITIGATION ALTERNATIVES
FOR THE FORT CALHOUN STATION**

1. The severe accident mitigation alternative (SAMA) analysis appears to be based on the current version of the "living" probabilistic risk assessment (PRA) model for internal events, which is a modification to the original Individual Plant Examination (IPE) reviewed by the U. S. Nuclear Regulatory Commission (NRC) and the version of the PRA that was peer-reviewed in 1999. Please provide the following:

    a. the date and/or version of the PRA used for the SAMA analysis (which appears to be Revision 3 of the PRA), and a description of the internal and external peer review of the Level 1, 2, and 3 portions of this PRA,

    b. a description of the major changes (plant and/or modeling changes) made to both the Level 1 and 2 PRA/IPE previously reviewed by the staff, and the version of the PRA peer-reviewed in 1999, and the respective impacts of these changes on core damage frequency (CDF) and release frequency,

    c. a breakdown of the CDF by initiating event (specifically, Loss of Offsite Power (LOOP), General Transients, Station Blackout, anticipated transients without scram (ATWS), Loss-of-Coolant Accidents (LOCAs), Interfacing System LOCA (ISLOCA), and Steam Generator Tube Rupture (SGTR), and other initiators), and the contribution to CDF from external flooding and seismic initiators that are represented in the PRA model,

    d. A short description defining all the Plant Damage States (PDSs), and the accident sequences that dominate the PDSs,

    e. an assessment of the uncertainties associated with the calculated CDF and risk (e.g., the mean and median CDF estimates and the 5th and 95th percentile values of the uncertainty distribution), and the impact on SAMA identification and screening results if risk reduction estimates were based on the upper end of the distribution rather than the mean value (Section 5.5 only provides a portion of this information), and

    f. a breakdown of the population dose (person-rem per year) by containment release mode in the following form:

Containment Release Mode	Fraction of Population Dose
SGTR (Late and Early)	
Interfacing Systems LOCAs	
Early containment failure	
No vessel breach, no containment failure	
Late containment failure	
No containment failure (vessel breach)	

ENCLOSURE

In addition, please provide, separately, the contribution of hydrogen and CO combustion to early and late containment failure probability, and the fraction of population dose attributable to external flooding and seismic initiators.

2. The discussions on page 5-5 of the application state that the CDF for fire events based on the Fire Induced Vulnerability Evaluation (FIVE) methodology is 2.78×10^{-5} per year, and the 95th percentile CDF value for internal events (plus some dominant external event contributors) is about 4.68×10^{-5} per year. The last paragraph on page 5-5 states that, based on the ratio of the sum of these frequencies to the baseline CDF, the estimated uncertainty factor for application to SAMA assessment should be approximately 3 (i.e., $7.46 \times 10^{-5} / 2.45 \times 10^{-5} \sim 3$). On the other hand, on page 4-38, it is stated, "In general, if the expected cost exceeded twice the calculated benefit, the SAMA was considered not to be cost beneficial." The information provided on page 5-5 does not appear to support the decision to use a factor of two multiplier to account for various uncertainties, including external events. Please justify the use of a factor of two multiplier in the SAMA evaluation process, in view of the uncertainty assessment that indicates a factor of three may be more appropriate. Would any of your conclusions for individual SAMAs change if a factor of three were considered, compared to a factor of two?

3. On page 4-36, it is stated, "...the top 100 cutsets of the Level 1 PRA update were examined to identify the important contributors to plant risk...." Please provide the following:

   a. more specifics on how CDF importance measures were used in support of the SAMA identification and screening process. (OPPD states, on page 4-37, that risk measures were used for "preliminary screening," but it is not clear if and how they were used in the rest of the SAMA identification process.)

   b. a list of key equipment failures and human actions that dominate CDF and the large early and late release frequencies, which have the greatest potential for reducing the risk of severe accidents at FCS, along with the results of any supporting importance analyses (e.g., Fussel-Vesely and/or risk reduction importance measures).

   c. the percentage contribution to the CDF of the top 100 cut sets.

4. In Section 5.2.1.2, Source Terms, OPPD states that the source terms were obtained from the latest Level 2 FCS PRA model analysis. Please provide more detailed information (e.g., a tabular list) on the release categories, including the definition, fractional releases, frequency, containment matrix (relationship between PDSs and release categories), and the associated conditional consequences, used in the SAMA analyses.

5. Provide the following information concerning the application of meteorological data to the MACCS2 code:

   a. Describe the meteorological sampling approach and specifications used in the MACCS2 calculations for FCS, as described in Sections 5.13 through 5.17 of the code manual for MACCS2 (NUREG/CR-6613, Volume 1).

   b. In Section 5.2.1.1 of the application, it states that 131 radionuclides are used to represent the core inventory. However, in Section 5.2.1.7, it states that the dose conversion factors (DCFs) for early fatalities and injuries were taken from DOE/EH-0070, and are limited to the original MACCS set of 60 radionuclides. Clarify the number of radionuclide groups used in the MACCS2 calculations. If 60 groups were used, explain how the additional 71 groups were accounted for in the analysis. Also, please describe and justify the assumed deposition velocity in the MACCS2 analysis (indicated to be 0.03 meters per second in Section 5.2.1.11), and discuss the sensitivity of consequence results to changes in this parameter.

   c. Describe the differences, if any, in the meteorological sampling used with the 1988 data and the data for the 1994-1998 period.

   d. Confirm that the release was limited to particles of a single size, and non-depositing gases. If some or all gases were assumed to deposit, describe and justify the choice of deposition parameters for various classes of gases.

   e. Confirm that precipitation was included in the meteorological data set. If it was included, was wet deposition modeled? If wet deposition was modeled, describe and justify the wet deposition model parameters used (Section 5.5 of NUREG/CR-6613, Vol. 1). If not, explain why it was not modeled.

6. Discuss the implications of any extended power uprate under consideration on the SAMA study, in particular, on the SAMA selection process and benefit (averted risk) determination.

7. OPPD notes, "... SAMAs that affect structures, systems, and components that may enhance mitigation functions during both at-power and <u>*shutdown*</u> conditions are addressed." (Page 4-36) Please identify and discuss any SAMAs that might significantly enhance mitigation functions during shutdown. Are any in the group evaluated in Section 5.4?

8. Based on a review of the SAMAs considered by OPPD, the staff requests the following additional information regarding specific SAMAs. Also, the source references provided in Table 5.3-1 for the various SAMAs do not appear to be consistently indexed with the references in Section 5.5. Please provide corrected source references for Table 5.3-1.

   a. SAMA 60 - Please provide a brief description of the four basic events that were set to zero (Page 5-52).

b. SAMA 70 - It is not clear why this SAMA was considered to not apply since 2-out-of-4 logic is used at both FCS and the plant for which this SAMA was originally identified. Please provide a discussion of the significance of spurious safety system actuation events at FCS, and why this SAMA would not be effective for FCS.

c. SAMA 84 - Provide a description of which penetrations constitute the dominant contributors to ISLOCA risk, and whether some subset of these lines can be tested at an increased frequency without the need for significant hardware modifications, thereby deriving some benefit without the large cost of adding or modifying test lines and instrumentation.

d. SAMAs 182, 183, and 184 - All three of these SAMAs call for a portable generator to be used for various applications. What would be the power ratings of these portable sources for the various SAMA applications? Are such generators already available on the FCS site, and would these generators be dedicated for the purpose of the SAMA or installed on an ad hoc basis, if needed?

e. SAMA 4 - In Table 4.16-2, page 4-42, OPPD indicates that the cost of SAMA 4 is >$30K. The staff assumes that this is a typo and that it should read "<$30K, as stated on page 5-45. Please confirm the proper value.

f. SAMA 181 - In Table 4.16-2, page 4-44, OPPD indicates that the cost of the modification would "exceed" the estimated benefits. It appears that this should state that the cost (<$30K) is less than the benefit ($78K). Please clarify.

9. In Table 4.16-2, page 4-42, OPPD lists the estimated benefit of each SAMA candidate. It is not clear whether the values presented in the table have been multiplied by two to account for external events (note comment on page 4-38 on the factor of two.) The following SAMAs appear to have a positive or neutral net value if the benefit values in Table 4.16-2 are doubled: SAMAs 54, 56, and 185. Clarify what the values represent.

   In addition, SAMA 188 has a benefit (including the factor of two) of $32,000 while the cost is indicated as >2xbenefit. From the "description" on page 5-63, it is not clear whether this SAMA includes hardware changes. If procedural changes alone are sufficient for enhancing plant response to external flooding, then a procedural change (costing about $30,000) may be justified. Discuss the cost estimate and role of hardware modifications, if necessary.

10. It is indicated on page 4-34 that the net present value of cleanup and decontamination over the life of the plant (U_{cd}) is $1.61E+10. The correct value appears to be $1.16E+10 based on the equation presented on page 4-33 of the application. Please confirm the correct value.