December 10, 2001

Mr. M. S. Tuckman, Executive
Vice President - Nuclear Generation
Duke Energy Corporation
526 South Church St. EC07H
Charlotte, NC 28201

SUBJECT: REQUEST FOR ADDITIONAL INFORMATION RELATED TO THE STAFF'S REVIEW OF THE SEVERE ACCIDENT MITIGATION ALTERNATIVES ANALYSIS FOR LICENSE RENEWAL AT CATAWBA NUCLEAR STATION, UNITS 1 AND 2 (TAC NOS. MB2031 AND MB2032)

Dear Mr. Tuckman:

The NRC staff has reviewed Duke Energy Corporation's severe accident mitigation alternatives (SAMA) analysis, submitted as part of the application for license renewal for Catawba Nuclear Station, Units 1 and 2 (Catawba). The staff finds that additional information is needed before it can complete its review. Please respond to the enclosed request for additional information (RAI) regarding your SAMA analysis for Catawba within 60 days of the date of this letter, as discussed with your staff.

If you have any questions about this RAI, please contact me at (301) 415-1108.

Sincerely,
Original Signed By: JHWilson
James H. Wilson, Senior Project Manager
Risk Informed Initiatives, Environmental,
Decommissioning, and Rulemaking Branch
Division of Regulatory Improvement Programs
Office of Nuclear Reactor Regulation

Docket Nos. 50-413 and 50-414

Enclosure: As stated

cc: See next page

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*See previous concurrence

DOCUMENT NAME: G:\RGEB\Catawba\RAIs\SAMA RAI transmittal to Duke.wpd

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DATE	12/06/01	12/06/01	12/06/01	12/06/01	12/10/01

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ENCLOSURE 1

OFFICE OF NUCLEAR REACTOR REGULATION
REQUEST FOR ADDITIONAL INFORMATION
REGARDING SEVERE ACCIDENT MITIGATION ALTERNATIVES
RELATED TO LICENSE RENEWAL FOR CATAWBA NUCLEAR STATION,
UNITS 1 AND 2 (TAC NOS. MB2031 AND MB2032)

OFFICE OF NUCLEAR REACTOR REGULATION
REQUEST FOR ADDITIONAL INFORMATION
REGARDING SEVERE ACCIDENT MITIGATION ALTERNATIVES
RELATED TO LICENSE RENEWAL FOR CATAWBA NUCLEAR STATION,
UNITS 1 AND 2 (TAC NOS. MB2031 AND MB2032)

1. Please provide the following information related to the 2000 update to the Catawba probabilistic risk assessment (PRA) that forms the basis for the severe accident mitigation alternatives (SAMA) analysis:

    a. a description of the major changes made to the level 1 and 2 PRA/IPE previously reviewed by the staff, and their respective impacts on core damage frequency (CDF) and release frequency;

    b. a description of the internal and external peer review process used for the updated PRA/IPE; and

    c. justification for the estimated steam generator tube rupture (SGTR) -induced core damage frequency of $3.6x10^{-8}$ per reactor year, which is very low compared to the results of other studies for similar plants (e.g., NUREG-1150 study for Sequoyah shows a value of $7x10^{-6}$ per year).

2. Please provide an estimate of the uncertainties associated with the calculated core damage frequency and risk for internal and external events for Catawba, and the rationale for not explicitly considering these uncertainties in the SAMA analyses. This is of particular interest in light of the fact that, for some risk contributors, alternative/additional SAMAs could be postulated that offer much of the benefit of the evaluated SAMAs at a substantially lower cost (see Question 6 below).

3. Attachment H (Page 19) of the submittal states that, “For the Catawba containment the conditional probability of having an early release of fission products to the public from early containment failures, isolation failures, and containment bypass following a severe accident is estimated to be approximately 10 percent”. Using the results from the updated Catawba PRA, and considering both internally- and externally-initiated events, please provide:

    a. the core damage frequency from events involving station blackout (SBO), including a breakdown into slow SBO and fast SBO;

    b. the conditional containment failure probabilities (both “early” and “late”) in core damage events involving station blackout; and

    c. a comparison of the conditional early containment failure probability for Catawba to the conditional early containment failure probabilities reported in a recent NRC-sponsored study by Sandia National Laboratory -- “Assessment of the DCH Issue for Plants with Ice Condenser Containments”, NUREG/CR-6427, and discussion of the models and assumptions in the Catawba PRA that account for the major differences.

4. In light of the issues raised in NUREG/CR-6427 concerning the likelihood of early containment failure in SBO events, please provide a reevaluation of the benefits associated with the hydrogen control measures in Table 5-1 (install back-up power to igniters, install containment inerting) assuming a containment response consistent with the findings in NUREG/CR-6427 (i.e., using the containment failure probabilities for direct containment heating [DCH] and non-DCH events provided in Tables 4.21 and 4.24 of NUREG/CR-6427, respectively).

5. Based on the Catawba PRA used for the SAMA evaluation, please provide the frequency and population exposure (person-rem within 50 miles) for each containment failure mode (radiological release mode), and a breakdown of the population dose (person-rem per year) by containment end-state (similar to Table 5-4 in NUREG-1437, Supplement 2). Identify which of these release modes most closely represents each of the following scenarios:

   - Early containment failure (i.e., at or around the time of vessel breach) due to hydrogen combustion resulting from a SBO with containment sprays unavailable, and a dry reactor cavity

   - Late containment failure (i.e., within a few hours after vessel breach) due to hydrogen combustion resulting from a SBO with containment sprays unavailable, and a dry reactor cavity

   - Late containment failure (i.e., at or about 24 hours after the start of core damage) due to gradual containment overpressurization in a SBO with containment sprays unavailable, and a dry reactor cavity

   - No containment failure, containment sprays unavailable, and a dry reactor cavity.

6. Attachment H (Page 23) states that "The cost to implement any of the containment performance improvement alternatives listed in Table 5-1 for Catawba will range anywhere from a few million dollars to tens of millions of dollars...." It is not clear why lower cost improvements that can achieve much of the benefit have not been considered in the evaluation of alternatives. For example, for containment hydrogen control, a severe accident management strategy to power a subset of igniters from a portable generator, or the use of passive autocatalytic recombiners (PARs) would cost less than one million dollars and provide a risk reduction similar to the SAMAs evaluated in the Environmental Report (e.g., install backup power to igniters, install containment inerting system.) Similarly, the installation of a watertight wall around the 6900/4160V transformers (mentioned on Page 15 of the submittal) could be less expensive than the option of manning the standby shutdown system 24 hours a day, which was considered as a SAMA for reducing core damage frequency. Please provide a discussion of any lower cost improvements that were also considered. If none were considered, please provide an explanation for not doing so, particularly for hydrogen control and the turbine building flooding scenario.

7. SAMAs for reducing core damage frequency (CDF) appear to have been identified through an examination of the top 200 internal and external cut sets from the Catawba PRA, i.e. those that make up at least 0.08 percent of CDF individually (Section 4.2 of Attachment H), and through the use of basic event importance rankings (Section 4.3 of Attachment H).

   a. What is the total percentage contribution of these 200 cutsets to CDF?

   b. Since some potential SAMAs could impact or eliminate a large number of cutsets, please explain why the method described is viewed as sufficient to identify all potentially cost-beneficial SAMAs aimed at reducing CDF.

   c. Please explain why the list of potential SAMAs obtained in the manner described above is viewed as sufficient given that some SAMAs involving the addition of new systems to the plant would not necessarily be identifiable this way.

8. The SAMA analysis assessed benefits in terms of averted offsite person-rem (public dose) but did not include other averted costs that should be included in accordance with the Regulatory Analysis Guidelines (NUREG/BR-0184). The SAMA analysis should be modified to include all potential averted costs associated with each potential improvement, in particular, replacement power costs, and for potential containment-related SAMAs, the averted offsite property damage costs. In addition, a sensitivity study should be performed to assess the value of SAMAs over the remainder of the current operating license and the license renewal period.

9. Page 23 of Attachment K states that "...almost all of the large early release frequency (LERF) is attributable to the interfacing systems loss-of-coolant-accident (ISLOCA) initiator." However, Table 5-1 (page 27) states that the conditional "Early Containment Failures" probability is 7 percent and that the ISLOCA and SGTR combined is <1 percent. Please define what is meant by "early" in LERF, how it is different from the "early" in Table 5-1, and whether/how this impacts the SAMA analysis.

10. Provide a discussion of the meteorological data and emergency planning assumptions used in performing the SAMA analysis. Provide an assessment of the impact of the license renewal period on emergency planning assumptions (i.e., effects of increased population).

11. Figure 6.1 of NUREG/CR-6427 displays fragility curves for Catawba. Is this curve similar to the curves used in the current Catawba PRA? If not, please explain the differences.