December 6, 2001

Mr. H. B. Barron
Vice President, McGuire Site
Duke Energy Corporation
12700 Hagers Ferry Road
Huntersville, NC 28078-8985

SUBJECT: MCGUIRE NUCLEAR STATION, UNITS 1 AND 2 RE: REQUEST FOR ADDITIONAL INFORMATION - RISK INFORMED INSERVICE INSPECTION (TAC NOS. MB2375 AND MB2376)

Dear Mr. Barron:

The Nuclear Regulatory Commission is reviewing your Request for Relief 01-005, "Application of Risk-Informed Methods to Piping ISI" dated June 26, 2001, and has identified a need for additional information as identified in the enclosure. These issues were discussed with your staff on November 13, 2001. Please provide a response to this request within 30 days of receipt of this letter so that we may complete our review.

Sincerely,

***/RA/***

Robert E. Martin, Senior Project Manager, Section 1
Project Directorate
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Docket Nos. 50-369 and 50-370

Enclosure: Request for Additional Information

cc w/encl: See next page

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REQUEST FOR ADDITIONAL INFORMATION

RISK INFORMED INSERVICE INSPECTION

MCGUIRE NUCLEAR STATION, UNITS 1 AND 2

DUKE ENERGY CORPORATION

Reactor Systems

1. One major step in the Westinghouse Commercial Atomic Power (WCAP) process is the identification of degradation mechanisms and the development of corresponding pipe failure frequencies. The requested Table 1 summarizes the qualitative results of this step by identifying the different degradation mechanisms, combinations of mechanisms, and the prevalence of the different mechanism. The calculated ranges in Table 1 summarize the quantitative results of the analysis. This information will illustrate how the degradation mechanism identification and failure frequency development step in the WCAP methodology was implemented, and provide an overview of the results generated. Please expand the current Table 3.4-1 to include the following information.

| a) System | b) Degradation Mechanism/ Combination | c) Failure Probability range at 40 years with no ISI | | d)Comments |
|---|---|---|---|---|
| | | leak | disabling leak | |
| | | | | |

a) System: Each system included in the analysis.

b) Degradation Mechanism/Combination: Segment failure probabilities are characterized in the WCAP method by imposing all degradation mechanism in a segment (even if they occur at different welds) and the worst case operating conditions at the segment on a “representative” weld, and using the resulting failure probability for the segment. Please identify the dominant degradation mechanisms and combination of degradation mechanisms selected in each system. The reported mechanisms should cover all segments in the system. The table in the current submittal is not clear about which specific degradation mechanisms or combination of mechanisms are included in the leak estimates provided.

c) Failure Probability range at 40 years with no inservice inspection (ISI): For each dominant degradation mechanism and combination of degradation mechanisms, please provide the range of estimates developed for the leak and disabling leak sizes as applicable. If multiple loss-of-coolant accident (LOCA) sizes are estimated for larger pipes reflecting the possibility of different size leaks, the frequency range of for size should be given. The table in the current submittal provided the range of leak estimates only.

d) Comments: These should provide further explanations and clarifications on the particular characteristics of the system/segments leading to the selection of the degradation mechanism(s). Other information that should be included is the identification of which degradation mechanism(s) are applied to socket welds, if a break calculation was needed to evaluate pipe whip constraints, and if the degradation mechanism is addressed by an augmented program.

2. Another major step in the WCAP process is assignment of segments into safety significance categories based an integrated decision making process, and the selection of segments for inspection locations. The requested Table 3 summarizes the results of the safety significance categorization process as determined by the quantitative criteria, by the expert panel's deliberation on the medium safety significant segments, and by the expert panel's deliberations based on other considerations. The summarizing information requested in Table 3 will provide an overview of the distribution of the safety significance of the segments based on the quantitative results, and the final distribution based on the integrated decision making. Each segment has four risk reduction worth (RRWs) calculated, a core damage frequency (CDF) with and without operator action, and a large early release frequency (LERF) with and without operator action. Please provide the following Table.

| System | Number of segments with any RRW > 1.005 | Number of segments with any RRW between 1.005 and 1.001 | Number of segments with any RRW between 1.005 and 1.001 placed in HSS | Number of segments with all RRW < 1.001 | Number of segments with all RRW < 1.001 selected for inspection | Total number of segments selected for inspection |
|---|---|---|---|---|---|---|
| | | | | | | |

3. Another major step in the WCAP process is development of the consequences of segment ruptures. The WCAP methodology requires that a summary of the consequences be developed for each system and provided to the expert panel during their deliberations. Please provide this summary for each system. The summary will illustrate that the appropriate types of consequences (i.e., initiating events, mitigating system failure, and combinations) are included in the evaluation and will provide an overview of the results of the step.

4. Please add the statement that the sensitivity study to address uncertainty as described on page 125 was performed, and identify how many segments' RRW increased from below 1.001 to greater than or equal to 1.005. If the sensitivity study was not performed, provide a description and justification of any deviation.

5. Please state that the change in risk calculations were performed according to all the guidelines provided on page 213 of the WCAP or provide a description and justification of any deviation. Many submittals using the WCAP methodology are deviating from one

of the guidelines (third bullet from the top) insofar as they are taking credit for leak detection for systems other than the reactor coolant system (RCS). If you have also taken credit for leak detection in non-RCS piping, please describe the characteristic of the piping and the justification for taking leak detection credit.

6. The quantitative change in risk results are adequately summarized in the current template tables 3-5 and 3-10. Please state that all four criteria for accepting the final selection of inspection locations provided on page 214 and 215 in WCAP-14572 Rev. 1-NP-A were applied. If all four criteria were not used, please provide a description and justification of the deviation. If comparison with any of the criteria indicated that "reevaluation" of the selected locations was needed, please identify the criteria that required the reevaluation and summarize the results of the reevaluation. If the results of the reevaluation can be found in the footnotes of Table 5-1, please refer to the footnotes.

7. Briefly describe the qualifications, experience, and training of the users of the SRRA code on the capabilities and limitations of the code.

8. Section 2.2 of the submittal states that augmented programs remain unchanged, but augmented programs may have an impact on the results. Please provide the following information regarding the treatment of augmented programs during the risk informed (RI)-ISI program development.

   a) Treatment of augmented program inspections during categorization is described on page 80 (Section 3.5.5) of WCAP-14572, Rev. 1-NP-A. Please add the statement that the effects of ISI on existing augmented programs are included in your calculations used to categorize the segments or provide a description and justification of any deviation.

   b) When the structural reliability and risk assessment (SRRA) code is used for calculating failure probabilities for flow accelerated corrosion (FAC), please describe whether calculations were coordinated with the existing plant program since the code requires input that can be obtained from the knowledge gained from ongoing monitoring and evaluations of wall thinning rates.

9. Please confirm that SRRA code was only used to calculate failure probabilities for the failure modes, materials, degradation mechanisms, input variables and uncertainties it was programmed to consider, as discussed in the WCAP Supplement 1, page 15. For example, SRRA code should only be applied to standard piping geometry (circular piping geometry with uniform wall thickness). If the code was applied to any non-standard geometry, please describe how the SRRA inputs were developed.

10. Please describe any sensitivity studies performed to support the use of the SRRA code.

11. Please provide the total number of Class 1 butt welds and socket welds, the percentage of Class 1 butt welds selected for volumetric inspection, and the percentage of Class 1 socket welds selected for inspection in the RI-ISI program. If the total number of socket welds is not readily available, an estimate of the number is acceptable.

12. Page 83 of the Topical states that for a Westinghouse Owners Group (WOG) plant application, "(SRRA) tools were used to estimate the failure probabilities for the piping segment." Pages 6 and 7 of the related safety evaluation also state that the failure probability estimate, "is subsequently used to represent the failure probability of the weld." Section 3.4 of the submittal states that the team used, "the risk assessment (SRRA) software program (...) to aid in the process." Please confirm that, where the SRRA code was applicable, the appropriate failure frequencies estimated by the SRRA code (that is all the significant degradation mechanism and the worst operating characteristics within the segment applied at one location) were used in the subsequent risk ranking and change in risk calculations. If, instead, the failure frequencies used in the risk ranking or the change in risk calculations were selected from a range of values (or otherwise modified) by the expert panel or other analysts, please provide a description of this process and explain how your method comports with the approved Topical and the Safety Evaluation (SE).

13. Section 3.8 of the submittal discusses a number of segments where the Perdue model was not applied and refers to Section 3.7.3 in the WCAP. WCAP Section 3.7.3 *Selection of Actual Inspection Locations* starts once the number of locations for inspection has been determined. Application of the methodology for determining the number of locations to be inspected in 3.7.1 *Structural Element Selection Matrix* and 3.7.2 *Sample Size Selection* indicates that, if the single butt weld segments in Region 1 have a weld that is exposed to a degradation mechanism (Region 1A), the weld should be inspected. If the single butt weld is not exposed to a degradation mechanism, the default of one inspection for the segment or segment parts in Region 1B would indicate that the weld should be inspected. In the 12 segments that had only one butt weld in Unit 1 and the 18 segments that had only one butt weld in Unit 2, how many of these welds are to be inspected, if all welds are not being inspected?

    a) please describe how the number of inspections was determined and justify this deviation from the WCAP methodology, and

    b) how many of these segments' welds were being inspected in the Section XI program versus the RI-ISI program and how is the change in risk estimated for each segment?

14. The submittal states that the probabilistic risk assessment (PRA) dated December 1997 was used to evaluate the consequence of pipe ruptures. The submittal further states that "plant changes are reviewed to ensure that the PRA model and supporting documentation accurately reflect the current configuration and operational practices consistent with its intended application." Please confirm that this review was performed as part of the development of the RI-ISI submittal and that documentation of this review is retained as a program record.

15. The submittal states that a peer review was performed by the WOG Risk-Based Technology Working Group. Please identify the relationship between a review by this group and a WOG PRA peer review certification team. Please confirm that the results of the working group's review, were reviewed to ensure that none of the changes or issues raised are expected to influence the results used to support the RI-ISI submittal. Please confirm that the documentation of this review is retained as a program record.

16. Please provide the following with respect to the Staff Evaluation Report on the individual plant examination (IPE) submittal, dated June 30, 1994.

    a) The SER stated that PRA upon which the IPE was based included external events. The submittal states that the CDF and LERF results provided exclude the contribution from seismic initiators. How were external events included in the evaluation to support the RI-ISI submittal?

    b) The SER noted a weakness in the documentation of the Human Reliability Analysis (HRA) that could complicate the subsequent updates of the PRA. Please provide any comments or observations from the WOG Risk-Based Technology Working Group regarding the adequacy of the HRA documentation. If there are any negative comments, please provide an explanation regarding the potential influence of the difficulty of HRA updates on the results used to support the submittal.

17. Will the RI-ISI program be updated every 10 years and submitted to the NRC consistent with the current ASME XI requirements?

18. Under what conditions will the RI-ISI program be resubmitted to the NRC before the end of any 10-year interval?

19. Page 8 of your submittal “Additional Examinations” presents the criteria for additional examinations if unacceptable flaws or relevant conditions are found during examinations.

    a. Please clarify the term “initial number of elements required to be inspected.” Does this refer to inspections planned for the current outage or for the current interval?

    b. Please verify that the elements selected for additional examination based on the root cause or damage mechanism will include high risk significant as well as medium risk significant elements (if needed) to reach the required number of additional elements.

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