March 8, 2004

Mr. G. R. Peterson, Vice President
McGuire Nuclear Station
Duke Energy Corporation
12700 Hagers Ferry Road
Huntersville, NC 28078

SUBJECT: MCGUIRE NUCLEAR STATION, UNITS 1 AND 2 - REQUEST FOR ADDITIONAL INFORMATION FOR THE PROPOSED AMENDMENTS CONCERNING SPENT FUEL ASSEMBLY STORAGE (TAC NOS. MC0945 AND MC0946)

Dear Mr. Peterson:

By letter dated September 29, 2003, you submitted a request for amendments to the Technical Specifications for McGuire Nuclear Station, Units 1 and 2, concerning spent fuel assembly storage. Enclosed is a request for additional information (RAI) that we need to continue our review. We discussed this RAI with your staff during a conference call held on February 18, 2004. The enclosed RAI contains changes to the version that we discussed with you. These changes, indicated by a strike through and change bar in the margin, were made as a result of comments from my supervisor. Mr. Norman Simms of your staff has indicated that the response to this RAI will be provided within 45 days of the date of this letter.

If you have any further questions on this matter, please call me at (301) 415-1419.

Sincerely,

/RA/

Leonard N. Olshan, Project Manager, Section 1
Project Directorate II
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Enclosure: As stated

Docket Nos. 50-369 and 50-370

March 8, 2004

Mr. G. R. Peterson, Vice President
McGuire Nuclear Station
Duke Energy Corporation
12700 Hagers Ferry Road
Huntersville, NC 28078

SUBJECT: MCGUIRE NUCLEAR STATION, UNITS 1 AND 2 - REQUEST FOR ADDITIONAL INFORMATION FOR THE PROPOSED AMENDMENTS CONCERNING SPENT FUEL ASSEMBLY STORAGE (TAC NOS. MC0945 AND MC0946)

Dear Mr. Peterson:

By letter dated September 29, 2003, you submitted a request for amendments to the Technical Specifications for McGuire Nuclear Station, Units 1 and 2, concerning spent fuel assembly storage. Enclosed is a request for additional information (RAI) that we need to continue our review. We discussed this RAI with your staff during a conference call held on February 18, 2004. The enclosed RAI contains changes to the version that we discussed with you. These changes, indicated by a strike through and change bar in the margin, were made as a result of comments from my supervisor. Mr. Norman Simms of your staff has indicated that the response to this RAI will be provided within 45 days of the date of this letter.

If you have any further questions on this matter, please call me at (301) 415-1419.

Sincerely,

/RA/

Leonard N. Olshan, Project Manager, Section 1
Project Directorate II
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Enclosure: As stated

Docket Nos. 50-369 and 50-370

Distribution:
PUBLIC
PDII-1 R/F
RidsNrrDlpmLpdii-1 (JNakoski)
RidsNrrLACHawes (Hard Copy)
RidsNrrPMLOlshan
RidsRgn2MailCenter (LPlisco)
RidsNrrDlpmDpr
RidsNrrPMRMartin
RidsOgcRp
RidsAcrsAcnwMailCenter

ADAMS Accession No.: ML040610781 NRR-088

OFFICE	PDII-1/PM	PDII-1/LA	PDII-1/SC
NAME	LOlshan	CHawes	JNakoski
DATE	3/8/04	3/8/04	3/8/04

OFFICIAL RECORD COPY

REQUEST FOR ADDITIONAL INFORMATION RELATED TO

SPENT FUEL ASSEMBLY STORAGE - SEPTEMBER 29, 2003, AMENDMENT REQUEST

MCGUIRE NUCLEAR STATION, UNITS 1 AND 2

1. In the note at the bottom of the proposed Technical Specification (TS) Tables 3.7.15-1 through 3.7.15-4, Duke Energy Corporation (Duke, the licensee) states the following: "Fuel which differs from those designs used to determine the requirements of Table 3.7.15-[*] may be qualified for use as a Region 2 [**] Assembly by means of an analysis using NRC approved methodology to assure that the k_{eff} [effective multiplication factor] is less than 1.0 with no boron and less than or equal to 0.95 with credit for soluble boron." Where * indicates the applicable table number and ** indicates the appropriate fuel assembly classification; Unrestricted, Restricted, Filler, or Empty Checkerboard. Please provide additional information to identify and describe the Nuclear Regulatory Commission (NRC) approved methodology that will be employed to qualify assemblies for storage as one of the aforementioned fuel assembly classifications.

2. After reviewing the licensee's proposed TS changes, the NRC staff has determined that the use of Boral poison panel inserts should be described in Section 4.0, "Design Features," of the McGuire Nuclear Station TSs. The NRC staff has determined that a reference to the Boral inserts satisfies Title10 of the *Code of Federal Regulations* (10 CFR), Section 50.36, "Technical Specifications." Specifically, 10 CFR 50.36(c)(4), *Design Features*, states that, "Design features to be included [in the TSs] are those features of the facility such as materials of construction and geometric arrangements, which, if altered or modified, would have a significant effect on safety..." ~~Since Boral is a material of construction, which if altered or modified would have a significant effect on safety, the NRC staff requests that the licensee add a new TS 4.3.1.1g stating the following:~~

   ~~"*Neutron absorber (Boral) installed between fuel assemblies in the Region 1 racks*."~~

   Since Boral is a material of construction, which if altered or modified would have a significant effect on safety, please provide a revised technical specification requirement that accounts for the use of Boral in this application.

3. In Attachment 6, Section 3, "Fuel Assembly Designs Considered," the licensee stated that the Burnable Poison Rod Assembly (BPRA) designs used in the MkBI and MkBW fuel can have variable Boron-10 content. Additionally, the licensee stated that it assumed boron carbide (B_4C) loadings of 1.4 weight percent for MkBI assemblies and 4.0 weight percent for MkBW assemblies and that these loadings are at, or "very near" to, the highest boron concentrations used in the BPRAs for these fuel types. Please describe the analysis or evaluation that was performed to determine the maximum B_4C loading used in these assembly types. Additionally, if the licensee could not ascertain the maximum bounding B_4C loading used, the NRC staff requests that the licensee justify why it did not include an appropriate bias or uncertainty in the spent fuel pool (SFP) criticality analyses.

4. In Attachment 6, Section 3, the licensee stated that the "WABA" and "Pyrex" BPRAs contained a standard Boron-10 content. However, in Table 4, "Design Data for Burnable Poison Rod Assemblies (BPRAs) Considered in the McGuire SFP Region 2 Criticality Analysis," the licensee did not provide the uncertainty in any of the key design parameters, such as poison pellet density, poison pellet inside and outside radii, or Boron-10 concentration. Please describe how the tolerances in these and the other parameters in Table 4 were accounted for in the Region 2 SFP criticality analysis.

5. In Attachment 6, Section 6, "Computation of the Maximum 95/95 k_{eff}," the licensee described the Fixed Poison Self-Shielding Bias it included in the criticality analysis for Region 1. Please provide additional information to describe the analysis that was performed to determine the value of the bias and how it was determined that the bias was appropriately conservative.

6. In Table 5, "Pertinent 95/95 Biases and Uncertainties to be Considered in the McGuire New Fuel Vault (NFV) and SFP Criticality Analysis," the licensee shows that the Monte Carlo Computational Uncertainty is not included in the SFP Region 2 analyses. However, the licensee stated in Section 4 that KENO V.a was used in the verification of the Checkerboard/Empty configurations used in the Region 2 analyses. Also the licensee stated that the SFP Region 2 calculations used 600 neutron generations for KENO V.a. Please identify whether the Monte Carlo Computational Uncertainty was included in any Region 2 analysis. For example, the NRC staff requests that the licensee state whether the Monte Carlo Computational Uncertainty was included in the verification analyses for the Checkerboard/Empty configurations.

7. In Attachment 6, Section 4, "Criticality Computer Code Validation," the licensee describes the mechanical tolerances considered in calculating the Mechanical Uncertainty term. To better aid the NRC staff in evaluating the acceptability of the Mechanical Uncertainty values used in the licensee's criticality analyses, please provide a table, similar to Table 5, listing the following: 1) a detailed list of all tolerances included in the criticality analysis, 2) a summary of which tolerances were considered in each criticality analysis, 3) the value of the tolerance, and 4) the reactivity effect (delta-k) for each tolerance.

8. In Attachment 6, Section 4, the licensee described the Burnup Computational Uncertainty used in the McGuire spent fuel pool criticality analyses. The licensee stated that it had determined the bounding uncertainty as a function of burnup and provided the equation it will use to calculate this uncertainty. However, the licensee did not provide detailed information to demonstrate that it had determined the appropriate burnup dependent uncertainty or that its equation was indeed bounding. Therefore, please provide additional information describing the methodology employed to determine the burnup dependent uncertainty as well as the means used to demonstrate that this equation was truly bounding.

9. Table 6 of Attachment 6 provides the bounding criticality analysis for storage of fuel in the NFV. The licensee stated that fuel assemblies are stored in the NFV without any location restrictions. Please identify whether the NFV criticality analysis assumed a uniform loading of the highest reactivity assembly type or a co-location of various

assembly types in adjacent cells within the NFV. Please describe how the bounding storage configuration for the NFV was determined.

10. The licensee stated that "Extensive historic and projected 3D burnup, temperature, boron, and burnable poison data are employed to appropriately quantify the isotopic content of the fuel designs considered." Please describe the analysis that was performed and assumptions that were used to demonstrate that appropriately conservative values of the aforementioned parameters were used and that the reactivity of the spent fuel assemblies was maximized.

11. In Section 8.2, "SFP Region 2 Criticality Analysis," of Attachment 6, the licensee described how it homogenized the Region 2 rack model for analysis using CASMO-3. To accomplish this, the licensee stated that the cell wall location was adjusted in the model to be located at the midpoint between the stored assemblies; thereby, making neighboring cells identical to each other. This change affects the amount of moderator directly adjacent to each assembly. Please describe in greater detail how the dimensions of the model differ from those of the actual racks. In Table 8, the licensee provided a limited set of comparison calculations which show significant variability between KENO V.a heterogeneous and homogenous models and a CASMO-3 homogenous model. The most bounding rack analysis varies based on model used, fuel type, and enrichment. This table fails to demonstrate that the licensee's CASMO-3 homogenous model conservatively bounds either the KENO V.a homogenous or heterogeneous models for varying fuel types and enrichments. Therefore, please evaluate the reactivity difference between an actual rack loaded with fuel of the highest permissible reactivity and the homogenous model rack loaded with fuel of the highest permissible reactivity. Also, please provide sufficient information to demonstrate that the model conservatively bounds the actual rack design for all fuel types and enrichments.

12. In Section 8.2, the licensee described the interpolation procedure to be used when cooling times and burnup limits fall between the values provided in TS Tables 3.15.1-4. The licensee stated that it quantified the maximum error associated with its proposed interpolation methodology. Please provide additional information describing how the maximum error was identified and how it was verified that this error is bounding.

13. In its criticality analyses, the licensee assumed the temperature extremes permitted in the design basis of the McGuire spent fuel pools. For example, the licensee performed the criticality analyses at both 150 and 32 degrees Fahrenheit (°F) to ensure that it had bounded the criticality analyses based on the spent fuel pool moderator temperature coefficient (MTC). However, the maximum density of water occurs at 39.2 °F. Therefore, the licensee's analyses performed at 32 °F may not calculate the maximum reactivity in the SFP if the MTC is negative. Please review the criticality analyses to determine for each analysis whether the MTC is negative and add an appropriately conservative temperature bias to account for the difference in the density of the water at 39.2 °F as apposed to 32 °F.

14. In its proposed TS Figure 3.7.15-2, the licensee determined that it can store fuel assemblies meeting the burnup and cooling time requirements of TS Table 3.7.15-4 in a 3-of-4 checkerboard configuration. The remaining cell must remain empty in this

configuration. Please provide additional information on the physical or administrative controls which will be used to ensure these cells remain empty.

15. The licensee has placed considerable emphasis on credit for burnup of the spent fuel for storage in the Region 2 racks. Please provide detailed information describing the methods that will be in place, either administratively or experimentally, to independently confirm the fuel burnup before an assembly is placed in the storage racks.

16. In Attachment 3, the licensee stated that, "[t]he placement of an assembly between the rack and the pool wall would result in a lower k_{eff} relative to the criticality analysis due to the increased neutron leakage at the spent fuel pool wall because the criticality analysis assumes an infinite array of fuel assemblies." Sometimes, this inherent leakage was assumed in the original design of the spent fuel storage racks resulting in no poison inserts and smaller flux traps on the periphery of the racks. Please evaluate the center-to-center spacing that would exist between assemblies during this accident and verify that the spacing is greater than or equal that assumed in the criticality analyses.

17. In Attachment 6, Section 8.2, the licensee stated that when predicted and measured burnup data was compared, the maximum individual assembly error observed was about 4.0 percent. The licensee then stated that "[w]hen an array of fuel assemblies large enough to affect system reactivity is evaluated for the McGuire SFP Region 2, and the distribution of predicted-to-measured burnup differences is accounted for, the maximum system reactivity increase observed is [approximately] 0.00125 delta-k." Please provide the following:

    a. An explanation of whether the determination of the maximum system reactivity increase is based on the maximum individual assembly error observed (about 4.0 percent) or on a distribution of observed predicted-to-measured burnup differences.

    b. If the maximum individual assembly error observed was used, provide a detailed explanation justifying why this error will remain bounding for future spent assemblies.

    c. If a distribution of observed predicted-to-measured burnup differences was used, provide a detailed description of how the distribution used to arrive at the 0.00125 delta-k value was selected and an explanation of why this distribution is bounding for all potential spent fuel loading configurations.

18. In Attachment 6, Section 8.2, the licensee stated that axial profile k_{eff} errors compare rather well with a normal distribution. Additionally, the licensee identified that the largest individual assembly axial profile error calculated is +0.030 delta-k. However, the licensee determined the bounding axial profile uncertainty by considered a group of fuel assemblies large enough to affect system reactivity and taking into account the distributions of axial profile k_{eff} errors within that group. The licensee determined that the bounding axial profile uncertainty is ±0.00305 delta-k. Please provide detailed information on the methodology that was used to select the distribution used to calculate the axial profile uncertainty and why this distribution is bounding for all potential spent fuel loading configurations.

19. In accordance with the guidance provided in the August 19, 1998, Kopp letter, "Guidance on the Regulatory Requirements for Criticality Analysis of Fuel Storage at Light-Water Reactor Power Plants," please verify the results of the primary method of analysis (CASMO-3) for the Region 2 spent fuel racks. The licensee should perform a second, independent analysis of the Region 2 racks loaded with the bounding reactivity configuration presented in Table 22 of its amendment request. Furthermore, the licensee's second analysis should use the KENO V.a code to independently confirm that the bounding storage configuration in Region 2 racks will remain below 1.0 when flooded with unborated water.

20. In its analysis of accident conditions in the McGuire SFPs, the licensee discussed abnormal temperatures up to 212 °F. However, the licensee did not provide sufficient information to demonstrate accident conditions such as voiding (boiling) in the SFPs would not cause an increase in reactivity. Please provide additional information demonstrating that either sufficient soluble boron is present in the spent fuel pool to offset any reactivity increase caused by voiding or that voiding in the McGuire SFPs will insert negative reactivity. Also, provide additional information describing the design basis temperatures for the spent fuel pool including any differences in these design temperatures between the regions.

21. As stated in 10 CFR 50.68(b)(8), licensees are required to update their Final Safety Analysis Report (FSAR) to indicate compliance with 10 CFR 50.68. The licensee's amendment request does not contain a description of the proposed changes to Section 9.1, "Fuel Storage and Handling," of the FSAR. Since the licensee's proposed TSs (4.3.1.1a, 4.3.1.1b, 4.3.1.2b and 4.3.1.2c) reference Section 9.1 of the FSAR as containing a description of the allowance for uncertainties in its analysis, please provide a copy of the revised portions of FSAR, Section 9.1. However, if the licensee's response to Question 7 is thorough in providing the requested information, the licensee may reference that response and state that the information provided therein will be incorporated into the revision for Section 9.1.

22. The licensee's proposed TS Limiting Condition of Operation 3.7.15b states "New or irradiated fuel which has decayed at least 16 days may be stored in Region 2 of the spent fuel pool in accordance with these limits:". For background information that would expedite the NRC staff's review, please describe the basis for the 16-day limit prior to storing irradiated assemblies in the Region 2 racks. Specifically, since a description of the basis for the 16-day limits is not provided in the corresponding TS bases, state whether this limit is developed from its criticality analysis or this limit is based on dose considerations. Additionally, describe how it was confirmed that the 16-day limit is still conservative in light of the proposed changes to the spent fuel storage requirements such as fuel enrichment, burnup, and cooling times.

McGuire Nuclear Station

cc:

Ms. Lisa F. Vaughn
Duke Energy Corporation
Mail Code - PB06E
422 South Church Street
P.O. Box 1244
Charlotte, North Carolina 28201-1244

County Manager of
Mecklenburg County
720 East Fourth Street
Charlotte, North Carolina 28202

Mr. C. Jeffrey Thomas
Regulatory Compliance Manager
Duke Energy Corporation
McGuire Nuclear Site
12700 Hagers Ferry Road
Huntersville, North Carolina 28078

Anne Cottingham, Esquire
Winston and Strawn
1400 L Street, NW.
Washington, DC 20005

Senior Resident Inspector
c/o U.S. Nuclear Regulatory Commission
12700 Hagers Ferry Road
Huntersville, North Carolina 28078

Dr. John M. Barry
Mecklenburg County
Department of Environmental
Protection
700 N. Tryon Street
Charlotte, North Carolina 28202

Mr. Peter R. Harden, IV
VP-Customer Relations and Sales
Westinghouse Electric Company
6000 Fairview Road
12th Floor
Charlotte, North Carolina 28210

Ms. Karen E. Long
Assistant Attorney General
North Carolina Department of
Justice
P. O. Box 629
Raleigh, North Carolina 27602

Mr. R. L. Gill, Jr.
Manager - Nuclear Regulatory
Issues and Industry Affairs
Duke Energy Corporation
526 South Church Street
Mail Stop EC05P
Charlotte, North Carolina 28202

NCEM REP Program Manager
4713 Mail Service Center
Raleigh, North Carolina 27699-4713

Mr. Richard M. Fry, Director
Division of Radiation Protection
North Carolina Department of
Environment, Health and Natural
Resources
3825 Barrett Drive
Raleigh, North Carolina 27609-7721

Mr. T. Richard Puryear
Owners Group (NCEMC)
Duke Energy Corporation
4800 Concord Road
York, South Carolina 29745