May 17, 1994

Docket No. 50-160

Dr. Ratib A. Karam, Director
Neely Nuclear Research Center
Georgia Institute of Technology
Atlanta, Georgia 30332

Dear Dr. Karam:

SUBJECT: REQUEST FOR ADDITIONAL INFORMATION

We are continuing our review of your proposal for your conversion from High-Enriched Uranium (HEU) to Low-Enriched Uranium (LEU) fuel which you submitted on January 21, 1993. During our review of your proposal, questions have arisen for which we require additional information and clarification. Please provide responses to the enclosed Request for Additional Information within 30 days of the date of this letter. Follcwing receipt of the additional information, we will continue our evaluation of your program. If you have any questions on this review, please contact me at (301) 504-1128.

This requirement affects nine or fewer respondents and, therefore, is not subject to Office of Management and Budget review under Public Law 96-511.

Sincerely,

Original signed by:

Marvin M. Mendonca, Senior Project Manager
Non-Power Reactors and Decommissioning
Project Directorate
Division of Operating Reactor Support
Office of Nuclear Reactor Regulation

Enclosure:
As stated

cc w/enclosure:
See next page

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UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

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Enclosure:
As stated

cc w/enclosure:
See next page

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ENCLOSURE

REQUEST FOR ADDITIONAL INFORMATION

GEORGIA INSTITUTE OF TECHNOLOGY

CONVERSION FROM HIGH-ENRICHED URANIUM (HEU) TO LOW-ENRICHED URANIUM (LEU) FUEL

DOCKET NO. 50-160

1. Specification 2.1.1, Safety Limits in the Forced Convection Mode

   a. Specification 2.1.1.a refers to Figure II-1, for which you have provided a revised version II-1 (new) to replace the existing II-1 (old).

      1. Because the line for HEU will no longer be applicable after the reactor is converted to LEU, the HEU line from Fig. II-1 (new) should be eliminated to avoid confusion.

      2. The remaining line for LEU (flow instability) should represent the acceptable safety limit envelope of the converted Georgia Tech Research Reactor, so it seems appropriate to ink that plot in solid, instead of dashed lines.

   Provide these changes or rationale as to why they are not needed.

   b. Specification 2.1.1, Basis, discusses departure from nucleate boiling (DNB) initially and then later discusses DNB and flow instability criteria. While mention of departure from nucleate boiling is acceptable, emphasis should be clearly placed on initiation of flow instability as the limiting criteria, since it is limiting. Provide changes that clarify this issue.

2. Specification 2.2.1, Limiting Safety System Settings in the Forced Convection Mode, Basis, uses the phrase "with no incipient boiling." For internal consistency in your T.S., the same phrases should be used wherever appropriate. If "incipient boiling" is inferred from either "departure from nucleate boiling" or "initiation of flow instability" calculations, use only the term that applies. If they are not interchangeable, please provide a reference as to your analyses that support this different usage or an explanation of the difference in the basis.

3. Specification 5.2, Fuel Elements; provide changes to this specification to accommodate the conversion to LEU fuel.

4. Provide a description of how the PARET code uses boundary conditions for inlet and outlet of the flow channels (e.g., pressure or flow, or can either be specified). Explain what boundary conditions are used for the transient analyses.

5. Describe the PARET heat transfer modeling from channel to channel (e.g., heat transfer from the hot to average channels).

6. Describe how the PARET subcooled boiling model has been benchmarked against any separate effects test, such as the Christensen, Marchaterre, or the Shoukri data. Describe the results of the benchmarking.

7. Describe how the PARET flow instability model has been benchmarked against any experiments. Were the comparisons for upflow and downflow? Describe the results of the benchmarking. Describe any nodalization studies that were performed to verify the effects of modeling on flow instability.

8. Describe how PARET models the "dynamic" pressure. Is it based on the average channel flow from a point where the boundary pressure is known using the momentum equation? Have any calculations been performed to assess this local pressure to a thermodynamic "state" pressure for two-phase flow?

9. Describe how PARET models void propagation applied to downflow conditions. Include discussion of the modeling of void propagation when boiling will most likely take place at the exit of the channel and can result in flow reversal.

10. Describe the rate of void production when using the Bergles-Rohsenow criteria for subcooled boiling in the PARET code. Is the void propagation model used in subcooled boiling?

11. Describe how the PARET code models the heated wall viscosity effects. Include discussion of the treatment of the viscosity decrease near the wall of a heated fuel plate. Describe how the decrease in friction is modeled. Include the description of the treatment for single phase friction or two-phase conditions.

12. Describe how PARET calculated the average channel flow. Is it equivalent to the imposition of an inlet pressure and an outlet pressure, and iteration for the friction loss and associated new time flow? Describe how the calculational approach precludes any local flow reversal within the channel if the average channel flow is calculated from the imposed pressures at the inlet and outlet.

13. For other recent LEU conversion analyses (e.g., Rhode Island) the modeling may have been different than used in that of Georgia Tech. The following questions are to better understand the potential modeling differences and effects.

    a. It is understood that the Whittle and Forgan flow instability model was recently instituted for use in the PARET code. When was that done? Is it an automatic option in the PARET code? For other recent LEU conversion calculations, was this model used? Discuss the accuracy of the model and comparison to other flow instability models that have been used or are available in PARET.

b. Describe the PARET modeling for heat transfer to side plates. Was this function modeled in other recent LEU conversion analyses? Provide a comparison of this modeling and assumptions for the different PARET applications.

c. Describe how the channel tolerances were modeled in the PARET code. Was this function modeled in other recent LEU conversion analyses? Provide a comparison of this modeling and assumptions for the different PARET applications.

d. Describe the modeling of the bypass flow in the PARET modeling and comparison to other recent LEU conversion analyses. What was the bypass percentage of total flow?

e. Provide a comparison of radial and axial peaking factors used in the PARET code with other recent LEU conversions.

14. Describe how the fuel plate heat transfer area is calculated. Is the area based on the width of the plate or the active fuel?