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OFFICE OF SECRETARY
RULEMAKINGS AND
ADJUDICATIONS STAFF

Docket No. 50-413/414-OLA Official Exh. No. 42
In the matter of Duke Catawba
Staff ✓ IDENTIFIED 7/14/04
Applicant RECEIVED 7/14/04
Intervenor REJECTED
Counsel Off.
Contractor DATE
Other WITNESS
Reporter Ellen Miller

February 23, 2004

MEMORANDUM TO: Suzanne C. Black, Director
Division of Systems Safety and Analysis
Office of Nuclear Reactor Regulation

FROM: Farouk Eltawila, Director *RA/*
Division of Systems Analysis and Regulatory Effectiveness
Office of Nuclear Regulatory Research

SUBJECT: RESPONSE TO USER NEED FOR DEVELOPMENT OF RADIOLOGICAL SOURCE TERMS FOR REVIEW OF MIXED OXIDE FUEL LEAD TEST ASSEMBLIES

By memorandum dated November 27, 2003, your office requested[1] research support of NRR reviews of license amendments for the use of mixed-oxide (MOX) fuel. That memorandum supplemented previous requests from your office on the same issue[2,3].

We are aware that Duke Energy Corporation has submitted a license amendment[4] to allow the use of four lead test assemblies at Catawba, and that the licensee has requested a decision on its application by August 2004. We are also aware of NRR's intent to issue a safety evaluation of the lead test assembly amendment in March 2004. Consistent with these requirements, our schedule for responding to your request was provided by memorandum dated January 7, 2004[5]. This memorandum transmits the short-term items you requested to facilitate the lead test assembly review process. These are:

(1) For non-LOCA design basis accidents, affirm that the current regulatory positions on gap fractions in Regulatory Guide 1.183[6], Section 3.2 and Table 3, are conservative for use with weapons-grade MOX fuel such as that proposed by Duke.

(2) For fuel handling accidents, affirm that current regulatory assumptions on iodine decontamination in Regulatory Guide 1.183 are conservative for weapons-grade MOX Lead Test Assemblies. The objective of this assessment is to affirm that the currently allowable spent fuel pool rod pressure of 1300 psig is conservative for use with weapons-grade MOX fuel.

Results of our analyses, which have been discussed with your staff, are provided in Attachment A of this memorandum. The analytical models, used to account for the effects of plutonium, are described in Attachment B. The mixed-oxide model information, along with the experimental data upon which the models are based, were previously provided to your office.

Our analyses support the contention that, for nominal conditions, the requirements of Regulatory Guide 1.183 on gap inventory and rod pressure are met. Compliance under more severe conditions, which account for uncertainties, are described in Attachment A.

NRC Staff Exhibit 5

Template = SECY-027

SECY-02

Our analyses are based on calculations performed under an Office of Nuclear Regulatory Research contract with Pacific Northwest National Laboratory (PNNL). For the MOX LTA review activity, this arrangement has been particularly useful for several reasons:

- PNNL provided technical support directly to NRR during the original formulation of Regulatory Guide 1.183.

- Calculating the gap inventory of radionuclides identified in Regulatory Guide 1.183 requires a departure from a more routine calculation of stable noble gases in the gap. To satisfy this requirement, PNNL proposed an analyses using two fission gas release models: Massih and ANS-5.4. This dual approach is described in Appendix A and code changes necessary to accomplish this are documented in Attachment C.

- Through a long-standing program sponsored by Office of Nuclear Regulatory Research, PNNL has been an active participant in the ANS-5.4 Working Group activities on radioactive fission gas release. Consequently, the results provided in this memorandum are particularly well-qualified.

The schedule requested by your office for delivery of these analyses has been very aggressive. However, the cooperation and technical support provided by your staff have enabled the work to be accomplished in a timely manner. We appreciate your efforts.

Should you require additional information regarding this transmittal, please contact John Voglewede of my staff on 415-7415.

Attachments: As stated

REFERENCES

1. Memorandum from James Dyer (NRR) to Ashok Thadani (RES) on *User Need Request for Development of Radiological Source Terms for Design Basis Accident Analyses in Support of Reviewing Amendments Associated with Mixed-Oxide Fuel and High Burnup Low Enrichment Uranium Fuel* dated November 27, 2003

2. Memorandum from Sam Collins (NRR) to Ashok Thadani (RES) on *Research User Need for Development of Multiple Issues to Prepare for Reviewing Amendments Associated with Mixed-Oxide Fuel* dated November 5, 1999

3. Memorandum from Sam Collins (NRR) to Ashok Thadani (RES) on *Update of Active NRR Requests for Assistance* (pp. 16-17) dated January 31, 2002

4. Letter from Duke Energy to USNRC on *Proposed Amendments to the Facility Operating License and Technical Specifications to Allow Insertion of Mixed Oxide (MOX) Fuel Lead Assemblies and Request for Exemption from Certain Regulations in 10 CFR Part 50* dated February 27, 2003

5. Memorandum from Ashok Thadani (RES) to James Dyer (NRR) on *Response to User Need Request for Development of Radiological Source Terms for Design Basis Accident Analyses in Support of Reviewing Amendments Associated with Mixed Oxide Fuel and High Burnup Low Enrichment Uranium Fuel* dated January 7, 2004.

6. *Alternative Radiological Source Terms for Evaluating Design Basis Accidents at Nuclear Power Reactors*, U.S. Nuclear Regulatory Commission Regulatory Guide 1.183, July 2000.

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Table 2. Helium Results from Halden Test High-Burnup PWR MOX "Mother Rods"

Reactor/Full Length Rod (Rod Diameter in mm)	Base Irradiation Cycles	Burnup, GWd/MTM	BOL/EOL Helium inventory, STPcc
Gravelines-4/N12 (9.35)	4	50	449/454
Gravelines-4/P16 (9.35)	4	47	417/422
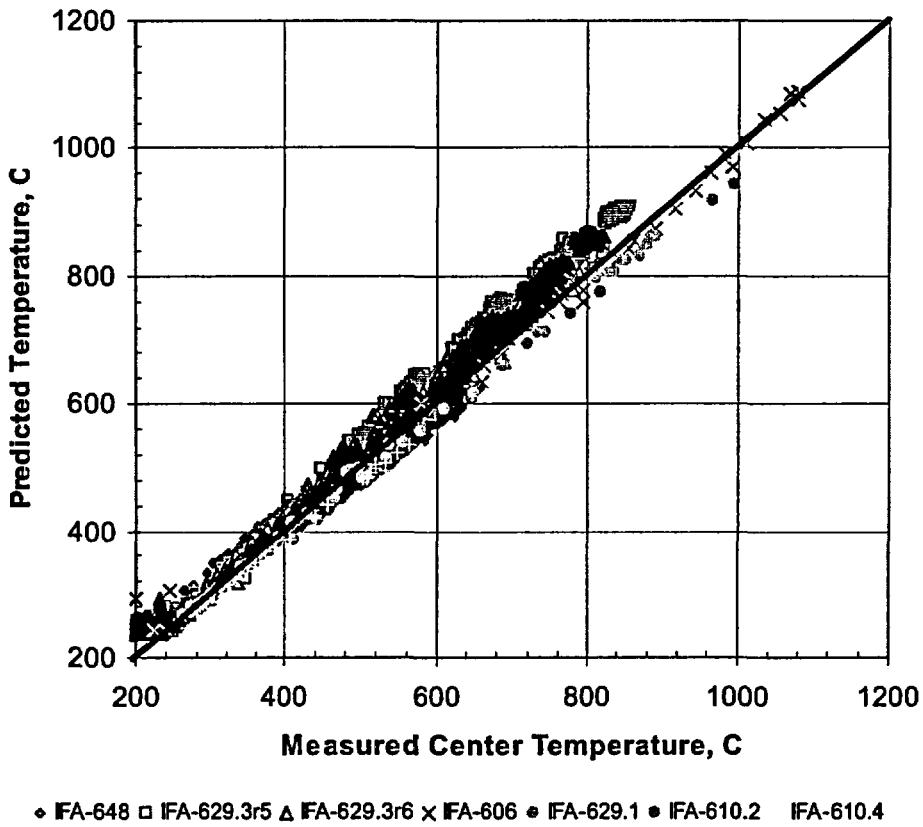
Figure 1. Predicted vs. Measured Fuel Center Temperatures for Halden MOX Tests