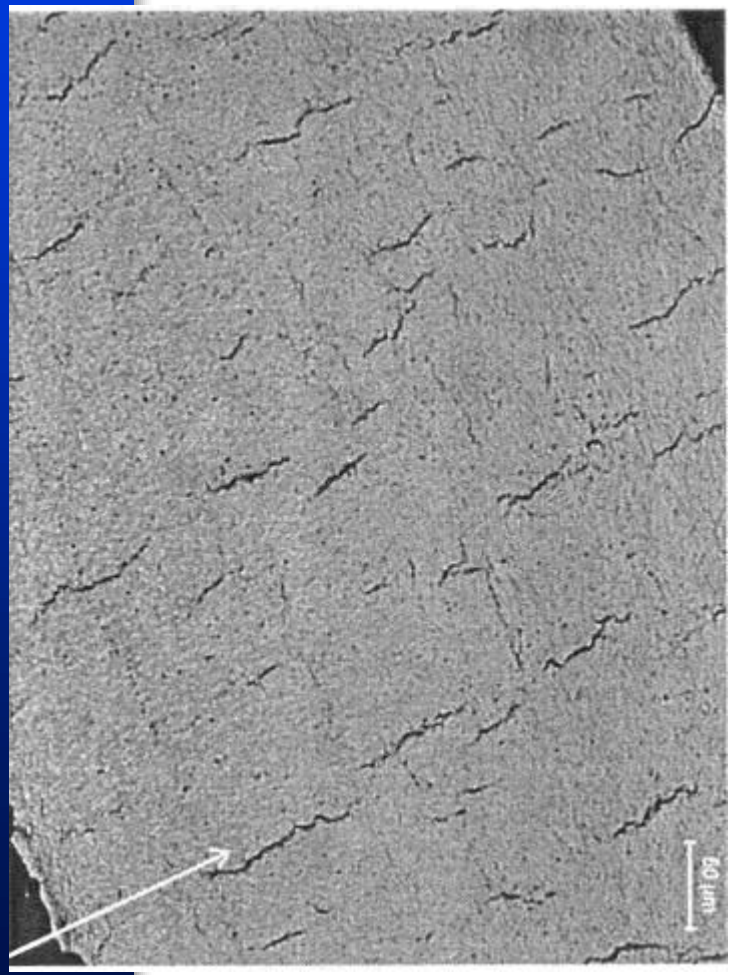
High Burnup Fuel Characteristics RAI Discussion



NRC-NEI Meeting

Washington, DC

July 10, 2002

Albert Machiels, EPRI

Joe Rashid, ANATECH

EPRI

Topics

- Objectives
- RAI Question Grouping
- Radial Hydrides
- Relevance to Hypothetical Accident Conditions
- Regulatory Requirements
- Discussion
- Action Items

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Objectives

Background

- NRC's Request for Additional Information (RAI), dated April 17, 2002, regarding high burnup fuel characteristics
- NRC's cover letter suggested
  - A conference call to discuss schedule for providing responses to the questions
  - Identifying potential dates for future meetings to discuss the technical issues, as necessary

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Objectives

- Given the following events and constraints:
  - May 2002 NEI Forum (Naples, Florida)
  - Pending revision of ISG-11/15
  - Urgency for bringing the overall issue of storage (and transportation) of high-burnup spent fuel to resolution
- By the end of this meeting, the objectives are to have a mutual understanding of
  - Which issues, or sub-issues, if any, remain to be addressed in the near term
  - Which issues, or sub-issues, if any, remain to be eventually addressed in the long term
  - Scope and schedule for providing responses to the RAI questions

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RAI Question Grouping

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Request for Additional Information

- RAI refers to two NEI submittals
  - Document submitted in August 2001 responding to a previous Request for Additional Information about EPRI Reports 1001207 (December 2001) and 1001281 (January 2001)
    - Questions A.1 through A.4
  - EPRI Report 1003135 *"Creep Modeling and Analysis Methodology for Spent Fuel in Dry Storage"* submitted in October 2001
    - Questions B.1 through B.6

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Request for Additional Information (cont.'d)

- In the RAI's cover letter:
  - "The staff understands … that the [EPRI] reports were not intended to address accident conditions …"
  - "… the Request for Additional Information … addresses the subjects of potential fuel reconfiguration during accident conditions and the overall risks of storing high burnup fuel."

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Request for Additional Information (cont.'d)

- In the RAI's preamble to the questions:
  - "… it is conceivable that if ***hydride reorientation*** were to occur over 20 years of storage (when the fuel is cooler, e.g., 150-200°C), the ***ductility and fracture*** properties of the high burnup cladding could become ***degraded***. Accordingly, the following questions are asked to address the effects that stresses generated during ***hypothetical accident conditions*** (such as a tip over accident), may have on the ability of the storage system to ***meet the regulatory requirements*** …"

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Request for Additional Information (cont.'d)

- Bottom line:
  - The RAI and questions focus on hypothetical accident conditions
    - With reference to regulatory requirements
    - With reference to overall risks
  - With special emphasis on the effect of cladding properties degradation due to potential hydride reorientation
  - Given the emphasis of the RAI, and the potential effort in responding to some of the questions, it may be appropriate to discuss the relative importance of the questions in terms of near-term issue resolution

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RAI Question Grouping

- Grouping #1: Questions B.1 through B.3
  - Questions requesting clarification of materials presented in EPRI Report 1003135 with the exception of a sub-question in B.1, which is a request for a compilation of mechanical properties for high burnup cladding; this compilation will be folded in the response to Question B.4, as it is used in the analysis of the loading conditions expected under accident conditions
  - Responses to be provided at this meeting (+ NEI letter transmitting the information by the end of July 2002)

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RAI Question Grouping (cont.'d)

- Grouping #2: Questions A.3 and A.4
  - Questions deriving from the burst test results reported in Garde's paper ["Effects of hydride precipitate localization and neutron fluence on the ductility of irradiated Zircaloy-4, Zirconium in the nuclear industry, 11th Int'l Symp., ASTM STP 1295, pp. 407-430 (1996)]
  - The correct interpretation of these results has been verbally discussed with the NRC Staff at NRC-Industry meetings held in April 2001 and March 2002
  - The response to these questions, which involve a re-analysis of Garde's data, will be provided, by the end of 2002, in the form of a paper intended for publication in a refereed Journal

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RAI Question Grouping (cont.'d)

- Grouping #3: Questions A.1 and A.2
  - These questions deal with the issue of potential hydride re-orientation during dry storage
  - The technical basis for evaluating the formation of radial hydrides for application to dry storage of spent-fuel will be reviewed
    - Suggestions for experimental work (for example, on H.B. Robinson rods presently at ANL) may be proposed as confirmatory
    - Prof. B. Cox, Dr. Einziger, Prof. Olander, and possibly others, will provide information and/or review
  - The response to these questions will be provided in the form of a report by the end of November 2002

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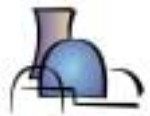

RAI Question Grouping (cont.'d)

- Grouping #4: Questions B.4 through B.6
  - Questions B.4 and B.6 request information on expected cladding failure percentage, margin to failure, and potential failure types for accident condition scenarios
    - In B.4, reference is made to Appendix III of the SAND-90-2406 report "A Method for Determining the Spent Fuel Contribution to Transport Cask Containment Requirements"
  - Question B.5 requests a risk quantification for various scenarios

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RAI Question Grouping (cont.'d)

- Grouping #4: Questions B.4 through B.6 (cont.'d)
  - Committing to responding to Question B.5 is considered premature
    - Lack of probabilistic risk framework (probabilistic safety assessments, specific design and operational considerations, generic site)
    - Situation may be remedied in the near future (NRC, EPRI)
  - Committing to responding to Questions B.4 and B.6 should be evaluated in terms of:
    - Existing regulatory requirements
    - Whether a response would result in any changes in regulatory practices

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