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Spent Fuel and Waste Science and Technology

Used Fuel Disposition Disposal R&D Roadmap - Synopsis

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Presentation Overview

- **Used Fuel Disposition Disposal R&D Roadmap Development**
  - Background
  - Identify and prioritize research and development activities for generic disposal system concepts in the context of each generic *Safety Case*
- **Safety Case – Key Elements**
- **Approach**
  - Identification
  - Prioritization
- **Safety Case Summary and R&D Linkages of Activities**

Roadmap Background

- **UFD recognized the need for a disposal research and development roadmap since its inception in June 2009**
  - FY10 planning included completing a final disposal R&D roadmap
- **FY10 activities focused on gaining an understanding of other disposal concepts**
  - What is the state of the art?
  - What are the key technical gaps?
- **Held the 1st Disposal R&D Roadmap workshop in June 2010**
  - Obtained a list of potential R&D opportunities – no priorities
  - FY10 activities subsequent to the workshop identified additional R&D opportunities
- **Issued Disposal R&D Roadmap status report in September 2010 and deferred final Disposal R&D Roadmap to FY11**
  - Need to further identify R&D opportunities
  - Need to obtain information to support prioritization by UFD management
- **FY11 activities**
  - Established process for prioritizing R&D issues
  - Held 2nd Disposal R&D Roadmap in December 2010
  - Developed information prioritization matrix and draft documents – circulated for review
  - Completed Roadmap on March 30, 2011
- **Revised (Rev01) September 2012**

Key Objectives of the Safety Case

- **Demonstrate sound understanding of the repository system – surface processes, engineered and geologic barriers, and biosphere**
  - Show how this understanding is the basis for the evaluation of long-term performance and safety
  - Provide multiple lines of evidence that support the results of a safety assessment and understanding of the system
  - Quantify and substantiate with requisite confidence the safety of the repository
- **Provide a framework to help plan and prioritize technical work as the repository program moves through the various phases of repository development**
- **Provide a vehicle to communicate the understanding of safety to a broad audience of stakeholders**

Systematic Approach to R&D: Identification

- **Objectives**
  - Cannot establish high-level requirements for a “new” repository without a clear definition of the regulatory framework
  - Can identify objectives based on international (IAEA) safety documents
    - *Containment*
    - *Limited Release: Natural and Engineered Systems*
    - *Dilution (secondary function)*
- **Utilize Features, Events, and Process structure to identify R&D “Issues”**
- **Features: Map features of generic disposal system to objectives**
- **Identification of R&D “Issues”**
  - Using an “Issue Resolution” type approach: similar to previous site characterization plans
  - Processes used to define “Issues”
- **UFD FEPs list (FY10) was used to identify the features and the processes**

Systematic Approach to R&D: Prioritization

- **Generic Applicability: Can an issue be addressed through generic R&D?**
  - No: issue is entirely site specific, design specific or both – no need to conduct generic R&D
  - Partially: Some aspect of the issue can be addressed through generic R&D
    - *Specific data/parameters relevant to an issue may be site specific.*
    - *Generic R&D could be conducted to develop improved field/laboratory/analytic methods to obtain the data.*
    - *Generic R&D could be conducted to develop improved modeling methods*
  - Yes: Generic R&D could be conducted to develop methods and gather data
- **Importance to the Safety Case: UFD is using the NEA definition of the safety case to support prioritization of R&D opportunities**
  - Safety Assessment: importance of an issue to the safety assessment
    - *Media and design specific*
  - Design/Construction/Operation: What is the importance of an issue with respect to… For example
    - *Is the behavior of an engineered material, such as concrete, known well enough to include in a facility design?*
    - *Are special construction, fabrication, and operational techniques required? Have they been demonstrated?*
  - Broad confidence in the safety case
    - *Issue may not be important to either safety assessment or design/construction/operation*
    - *Addressing an issue may be of important to building confidence in the overall safety case*

High Medium Low

Media / Design Specific

Safety Case Summary and R&D Linkages

- **International experience should lessen the technical challenges with building a Safety Case and License Application**
  - URL collaboration for
    - *Field-based natural system testing (e.g., Mont Terri)*
    - *Engineered barrier evolution/field-scale behavior (e.g., Febex)*
  - Laboratory data and models
    - *Waste form and materials behavior (e.g., FMDM)*
- **Two Key Objectives of the Safety Case**
  - Demonstrate sound understanding of the repository system – surface processes, engineered and geologic barriers, and biosphere
  - Show how this understanding is the basis for the evaluation of long-term performance and safety
- **Development of the Safety Case is an iterative process**
  - PA is the framework around which integration among repository design, site characterization, and PA groups can be organized
  - Reference Case for each generic disposal concept
- **Conceptual repository system models provide a framework to develop and document the assessment basis**
  - Integrated GDSA approach for mined repository concepts
    - *Site model for each generic disposal concept*
    - *EBS model for argillite*
    - *Process models (integration table)*
    - *Experimental/testing results (e.g., colloids, backfill buffer materials)*
  - DBFT
- **Prioritization of R&D and site characterization activities can be formalized using sensitivity analysis and decision analysis – important to document basis for all decisions**
- **Structure of the Safety Case should be developed early in the licensing process**