

# **Nuclear Safety Considerations**

Nuclear Waste Technical Review Board  
International Technical Workshop on Deep  
Borehole Disposal of Radioactive Waste  
Panel 2: Emplacement Mode

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# Discussion Topics

- Applicable standards for safety
- Radiological safety during routine operations
- Nuclear safety and off-normal events
- Organizational cultures and nuclear safety
- Accounting for DOE's organizational culture

# Applicable Standards

- Project documentation is unclear as to what nuclear safety and quality assurance requirements and standards the project will have to comply with (e.g., NRC, DOE, EPA, or some combination)
- A clear understanding of requirements is essential to ensuring the fidelity of the field test activities
- There should be an early and collaborative decision between agencies on which one(s) would likely have jurisdiction of the activity, and what requirements will be applied

# Radiological safety in routine operations

- DOE has extensive experience handling materials with very high direct radiation exposure rates
- With properly designed equipment, shielding, workplace radiological monitoring, and procedures, handling and emplacement of packages is within the realm of DOE's current capabilities
- DOE should draw extensively on its previous experience with high exposure rate materials during the development and operation of both DBD field test and actual DBD

# Nuclear safety and off-normal events

- Critical elements for effective nuclear safety are
  1. High quality knowledge regarding nature of waste
  2. Confidence in the integrity of waste packaging
  3. Effective safety controls for minimizing potential risks
  4. Robust and reliable safety-related systems
- Process knowledge of legacy materials is inherently weak; be skeptical of all assumptions
- Integrity of existing containers cannot be assumed; waste packaging must be sufficiently robust
- Incorporating both safety and operational goals at all stages of design, construction, and operation improves effectiveness
- Safety-related systems should be highly reliable and designed for fail-safe or fault-tolerant operations

## Nuclear safety and off-normal events, cont.

- Risk profiles will shift during different phases of handling and emplacement; ensure that all phases, such as above- and below-grade handling of waste, are separately analyzed and controlled
- Radiological exposure pathways during and after accidents will vary with nature and chemical form of waste material; ensure that various forms of waste are separately analyzed and controlled
- Workplace monitoring needs will vary based on nature and chemical form of waste; ensure that workplace controls are specific to waste form being handled

# Organizational cultures and nuclear safety

- Organizational cultures are inculcated by shared practices, prior experiences, perceived priorities, and professional/craft education and training
- Drillers understand how to drill safely and effectively
- Nuclear operators understand how to handle radioactive material safely and effectively

*Would you expect a nuclear operator  
to operate a drill rig?*

- Functions, roles and responsibilities should be properly defined, and staff should be selected such that skills and responsibilities align

# Accounting for DOE's organizational culture

- DOE is an inherently dynamic organization; budget, leadership, policies, and goals change frequently
- Those dynamics create significant pressure on decision-making, driving a *faster, better, cheaper* paradigm emphasizing *faster* and *cheaper* over *better*
- Decisions influenced by this paradigm are at the root of most accidents and project failures
- Design and operating decisions should not be unduly influenced by non-safety considerations such as schedule or budget



**“Each decision, taken by itself, seemed correct, routine, and indeed, insignificant and unremarkable. Yet in retrospect, the cumulative effect was stunning.”**

(Space Shuttle *Columbia* Accident Investigation Board, 2003)

# Non-Project References

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