Used Fuel Disposition Campaign

Deep Borehole Field Test (DBFT) FY15 Site Evaluation Overview

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Presentation Outline

- **Deep Borehole Field Test (DBFT) Project Overview**
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  - Scope
  - Background
- **Site Evaluation Update**
  - Status
  - Process
- **DBFT Technical Site Guidelines**

DBFT Objectives

- **Recently initiated DBFT will assess viability of the DBH disposal concept**
  - Drill and construct deep borehole(s)
    - *Characterization hole*
    - *Field Test hole*
  - Verify deep hydrogeochemical conditions via characterization and testing
  - Evaluate canister designs
  - Develop engineering methods for downhole canister emplacement/retrieval, and seals deployment
  - Identify concept variations for different waste types
- **The DBFT will be used to validate proof of concept, but will NOT involve the disposal of actual waste**

UFDC DBFT Participants & Laboratories

- **DOE**
  - NE-53 (NV): Tim Gunter, Lam Xuan
  - DOE-ID Procurement: Gordon McClellen, Bradley Heath
- **SNL – DBFT Project Technical Lead**
  - Bob MacKinnon, Geoff Freeze, Dave Sassani, Kris Kuhlman, Ernie Hardin, (Bill Arnold), Pat Brady, Jack Tillman, Mark Rigali
- **LANL – Geoscience, GIS**
  - Frank Perry, Rich Kelley
- **LBNL – Geoscience, characterization**
  - Jim Houseworth, Pat Dobson, Jens Birkholzer
- **PNNL**
  - Brady Hanson
- **INL – GIS Support to LANL siting database**
  - Dan Jensen
- **ORNL – GIS surface siting characteristics (OR-SAGE)**
  - Randy Belles, Rob Howard

DBFT FY15 Scope (WBS 1.02.08.17)

- **5 Primary Activities**
  - Site Evaluation (Sassani)
  - Site Characterization (Kuhlman)
  - Field Test Design (Hardin)
  - Project Management and Regulatory (Freeze)
  - Procurement (DOE-ID)
- **3 SNL FY15 Level 2 Milestones**
  - ***06/04/15: - Site Selection Evaluation for Deep Borehole Field Test***
    - ***plan/approach to evaluation of technical information***
  - 09/15/15: Report – Deep Borehole Field Test Specifications
  - 09/29/15: Report – Conceptual Design and Requirements for Characterization and Field Test Boreholes

DBFT Background Information

- 2009-2014 numerous reports: SNL LDRD + UFD projects
  - Brady et al. (2009) SAND2009-4401 *Deep Borehole Disposal of High-Level Radioactive Waste*
  - Arnold et al., (2011) SAND2011−6749 *Reference Design and Operations for Deep Borehole Disposal of High-Level Radioactive Waste*
  - Arnold et al., (2013) SAND 2013-9490P *Deep Borehole Disposal Research: Demonstration Site Selection Guidelines, Borehole Seals Design, and RD&D Needs*
- April 15, 2014: UFD Report on Evaluation of Disposal Options
  - "Evaluation of Options for Permanent Geologic Disposal of Spent NuclearFuel and High-Level Radioactive Waste"
    - *Study conclusions include: 1) deep borehole disposal option is a good option for small waste forms and provides flexibility for disposal*
- Oct 22: DOE issued Disposal Options report:
  - "Assessment of Disposal Options for DOE-Managed High-Level Radioactive Waste and Spent Nuclear Fuel"
    - *Pursue alternative disposal methods for some YM-bound waste*
    - *Develop a research and development plan for DBD*

DBFT FY15 Site Evaluation Status

- Oct 24, 2014: DOE issued Deep Borehole RFI:
  - "Request for Information (RFI) - Deep Borehole Field Test"
    - *Solicitation Number: DE-SOL-0007705*
    - *Consistent with its Fiscal Year 2015 Budget Request, the Department of Energy is proposing to conduct a demonstration of the Deep Borehole (DBH) disposal concept*
  - Responses received Dec 8, 2014
- Jan 7, 2015: Site Evaluation/Selection Workshop:
  - Reviewed and updated Technical Site Guidelines
  - Decision to utilize Request for Proposal (RFP) process to procure site and site management/operations team
- Draft RFP released April 7, 2015 requesting feedback
  - "Deep Borehole Field Test: Site and Characterization Borehole Investigations"
    - *Solicitation Number: DE-SOL-0008071*
  - Feedback received May 5, 2015
  - Revisions to finalize RFP in process

Site Evaluation Process – Draft RFP Criteria

- **Three Technical Criteria:**
  - Criterion 1. Availability and Geologic Conditions of Proposed DBFT
    - *Site Technical site guidelines*
  - Criterion 2. Organization and Qualifications
    - *Site management team experience, expertise, knowledge, and capabilities*
  - Criterion 3. Proposed Approach
    - *Methodology for successful accomplishment*
- **Three Additional Criteria**
  - Nontechnical criteria for DOE procurement

DBFT Technical Site Guidelines

- **The site area should be sufficient to accommodate:**
  - two drilling operations with boreholes nominally separated by at least 200 m;
  - surface facilities
    - to support the drilling operations;
    - for sample management and on-site data collection;
    - for evaluation of handling operations for surrogate (mock-up) waste containers; and
    - for site operation needs
  - Sites with ample open area surrounding the drilling site would be preferred.
  - The site area should be outside of wetlands areas and should be outside of 100-year flood zones, with ample access for heavy equipment needs.
- **Depth to crystalline basement –**
  - Less than 2 km (1.2 miles) depth to crystalline basement

DBFT Technical Site Guidelines (Continued)

- **Lack of conditions associated with fresh ground water flow at depth –**
  - Geologic information and bases should include conditions/features (and the technical bases for those identified) that provide evidence of the absence of recharge at depth. This could include (but is not limited to) for example
    - Lack of significant topographic relief that would drive deep recharge,
    - Evidence of ancient groundwater at depth, and/or
    - Data suggesting high-salinity groundwater at depth
- **Geothermal heat flux –**
  - Geologic information and bases should include evidence of the geothermal gradient and/or geothermal heat flux at the proposed site
    - A heat flux of less than 75 mW/m^2 is preferred

DBFT Technical Site Guidelines (Continued)

- **Low seismic/tectonic activity –**
  - Less than 2% probability within 50 years of peak ground acceleration greater than 0.16 g (generally indicative of area of tectonic stability)
  - Distance to Quaternary age volcanism or faulting greater than 10 km
  - Geologic information and bases should provide evidence of the aspects listed above, as well as any evidence that is available on
    - Existence, and orientation, of any foliation in the crystalline basement rocks
    - The horizontal stress state at depth in the crystalline basement rocks
      - Lack of steeply dipping foliation or layering is preferred
      - Low differential horizontal stress is preferred
- **Crystalline basement structural simplicity –**
  - Lack of known major regional structures, major crystalline basement shear zones, or major tectonic features
  - Geologic information and bases should include identification of major regional structures, basement shear zones, or other tectonic features within 50 km of the proposed site

DBFT Technical Site Guidelines (Continued)

- **Low potential for interference with testing from other surface and subsurface usage –**
  - Information and bases provided for the proposed site should identify any *previous or current* uses of the surface and/or subsurface that could interfere with the test investigations. Such activities include but are not limited to
    - Wastewater disposal by deep well injection,
    - CO_2 injection,
    - Oil and gas production,
    - Mining,
    - Underground drinking water extraction, and
    - Strategic petroleum reserve sites
  - Absence of potential resources in the crystalline basement and sedimentary overburden is preferable
  - The information and bases provided for the proposed site should identify existing drinking water aquifers and any previous or current uses of the surface and/or subsurface (such as listed above) within 30 km of the proposed site as far back as available records indicate

DBFT Technical Site Guidelines (Continued)

- **Lack of *existing/previous* surface or subsurface anthropogenic radioactive or chemical contamination –**
  - Information and bases provided for the proposed site should identify any *previous or current* anthropogenic radioactive or chemical contamination within 10 km of the proposed site