



U.S. DEPARTMENT OF
ENERGY

Nuclear Energy

**Office of Nuclear Energy Activities Supporting
the Management of Used Nuclear Fuel and High-
Level Radioactive Waste in the
United States**

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Technologies
Office of Nuclear Energy**

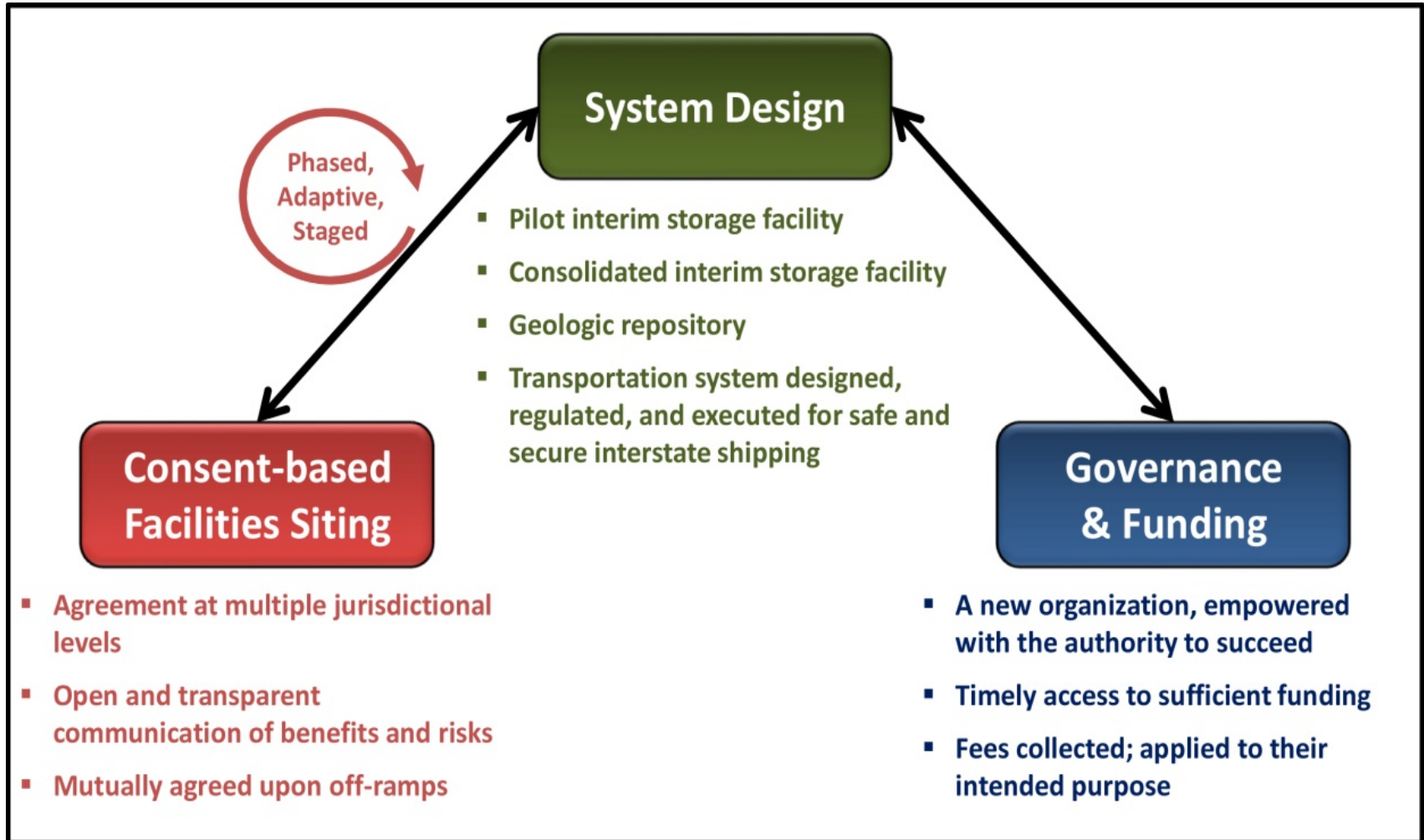
Waste Management '15

Phoenix, AZ

March 2015



Key Elements of Administration Strategy January 2013



Elements of the Administration Strategy

- **Facilities sited using consent-based process and licensed by the Nuclear Regulatory Commission**
- **Pilot-scale interim storage facility**
 - Operational in 2021
- **Consolidated interim storage facility**
 - Operational in 2025
- **Geologic Repository**
 - Sited using consent-based process by 2026
 - Designed and licensed by 2042
 - Operational in 2048

Used Nuclear Fuel Disposition Mission

- **Used Nuclear Fuel Disposition R&D Campaign** – *Identify alternatives and conduct scientific research and technology development to enable storage, transportation and disposal of used nuclear fuel and wastes generated by existing and future nuclear fuel cycles.*
- **Nuclear Fuels Storage and Transportation Planning Project** – *Lay the groundwork for implementing interim storage, including associated transportation, per the Administration’s Strategy for the Management and Disposal of Used Nuclear Fuel and High-Level Radioactive Waste, and develop a foundation for a new nuclear waste management organization.*

Used Nuclear Fuel Disposition: Interim Storage Planning

Begin laying the ground work for implementing interim consolidated storage:

- **Perform systems analysis and design studies for interim storage facilities**
- **Promote better integration of storage into waste management system**
- **Compile lessons-learned relative to siting process**
- **Evaluate system benefits of standardization**



Used Nuclear Fuel Disposition: Transportation Planning

Prepare for the eventual large-scale transport of used nuclear fuel and high-level waste:

- Collaborate with stakeholders on revised NWSA Section 180(c) Policy and National Transportation Plan
- Evaluate the inventory, transportation interface, and shipping status of used nuclear fuel, initial focus on shut-down reactor sites
- Assess and address transportation needs, (e.g., rail cars, casks, support and security).



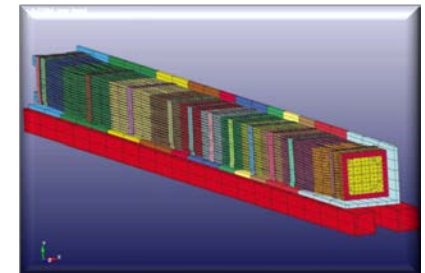
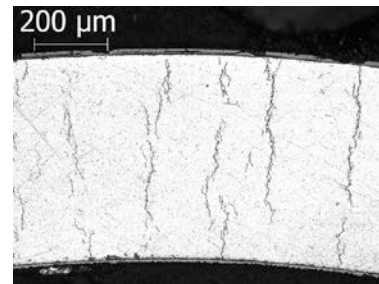
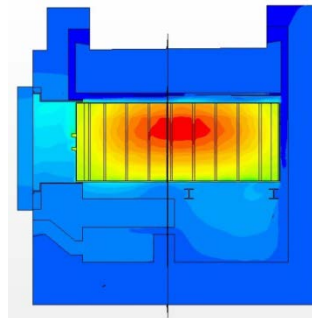
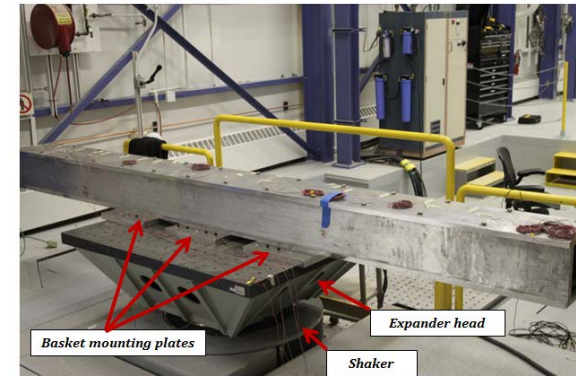
Facilities and railcars at Valognes Railway Terminal



Used Nuclear Fuel Disposition Extended Storage & Transportation R&D

Better understand degradation mechanisms relevant to long-term storage and subsequent transportation:

- Potential for corrosion of stainless steel canisters
- Thermal history of used fuel in storage
- Effects of hydride formation and reorientation on the material properties of high-burnup cladding
- Mechanical loads on fuel assemblies during normal conditions of transport





Used Nuclear Fuel Disposition Cask Storage Demonstration R&D

- The Cask Storage Demonstration contract was awarded to the EPRI Team to evaluate extended storage of high burnup used nuclear fuel:



EPRI

ELECTRIC POWER
RESEARCH INSTITUTE



Dominion

•North Anna Nuclear Power Plant

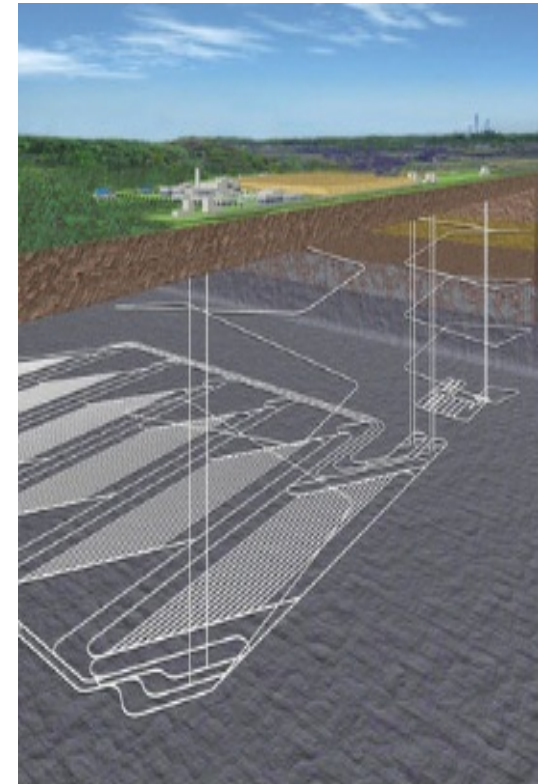


AREVA Federal Services
AREVA Transnuclear
AREVA Fuels



Used Nuclear Fuel Disposition Disposal R&D

- Provide a sound technical basis for the assertion that the U.S. has multiple viable disposal options
- Increase confidence in the robustness of generic disposal concepts
- Develop plan for field test of deep borehole disposal concept
- Evaluate the technical feasibility of the direct disposal of existing storage and transportation canisters

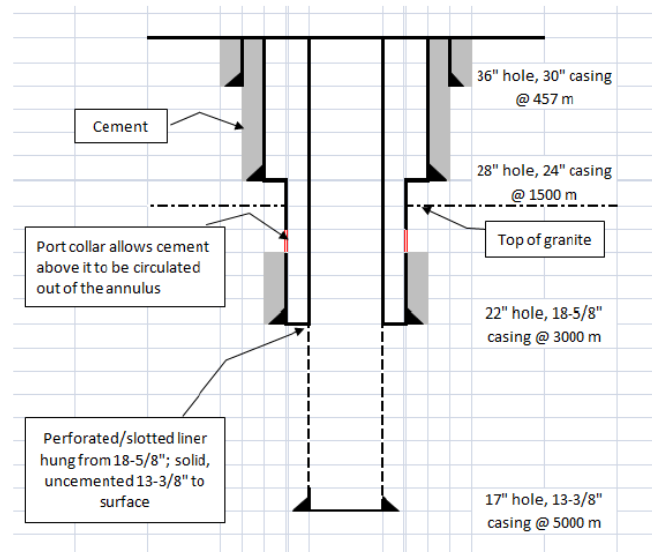
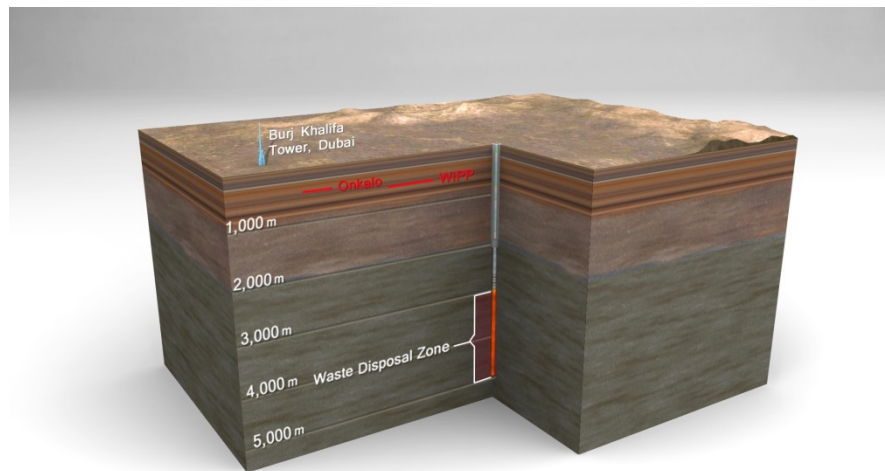




Deep Borehole Concept: Improving Scientific Understanding with a Field Experiment

■ Several factors suggest the disposal concept is viable and safe:

- Crystalline basement rocks are common in many stable continental regions
- Existing drilling technology permits dependable construction at acceptable cost
- Low permeability and long residence time of high-salinity groundwater in deep continental crystalline basement at many locations suggests very limited interaction with shallow fresh groundwater resources





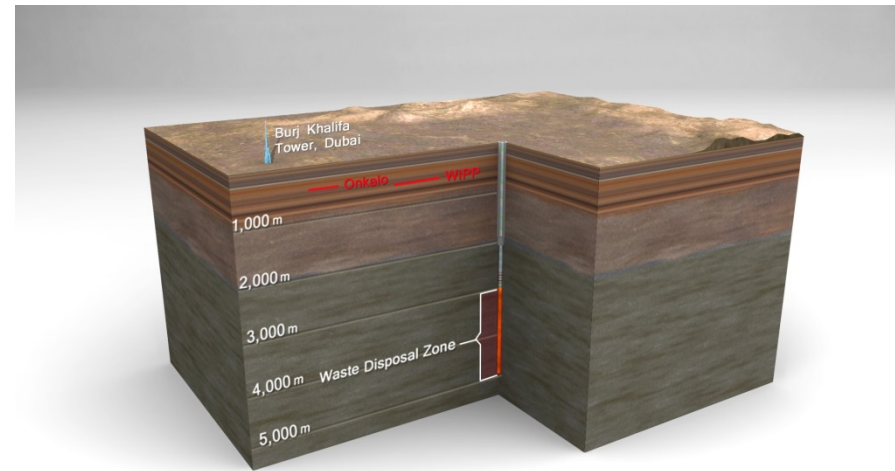
Deep Borehole Concept: Improving Scientific Understanding with a Field Experiment

- DOE's proposed Deep Borehole field test is the next logical step in evaluating the DBH concept and is part of the Department's cross cut in subsurface research.

- No radioactive waste will be used during the field test.

- **The DBH Field Test will:**

- Demonstrate the feasibility of characterizing and engineering deep boreholes
- Demonstrate safe processes and operations for safe waste emplacement downhole





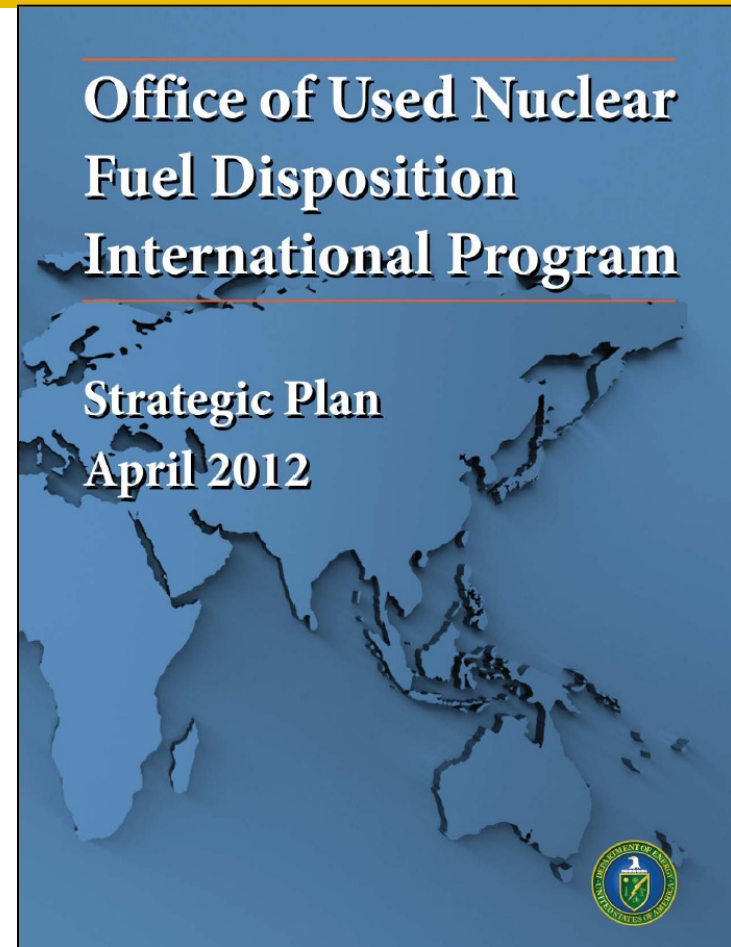
Background

Strategic Plan for International Program

The DOE Office of Nuclear Energy has four strategic goals for the UFD International Program

- Leverage global knowledge to meet domestic goals
- Increase global deployment of advanced technology
- Build a foundation for collaboration, trust, and joint action
- Accelerate global learning and innovation

<http://www.energy.gov/ne/downloads/office-unf-disposition-international-program-strategic-plan>





2014 International Collaboration Report

■ Content of Report:

- International Opportunities and Strategic Considerations
- Multinational Cooperative Initiatives
- Bilateral Collaboration Opportunities
- Selection of International Collaboration Activities
- Status of International Collaboration Activities with Focus on URL Experiments
- Brief Status of Other International Collaboration Activities

*International
Collaboration Activities
in Different Geologic
Disposal Environments*

Fuel Cycle Research & Development

Prepared for
U.S. Department of Energy
Used Fuel Disposition
Jens Birkholzer
Lawrence Berkeley National Laboratory
September, 2014

FCRD-UFD-2014-000065





Disposal

Current Collaboration in International Partnerships/Activities

Multinational Initiatives

- ❑ **Mont Terri Project**
 - *Participate in experiments at Mont Terri clay URL in Switzerland*
- ❑ **DECOVALEX Project**
 - *Participate in model comparison initiative for several URL related tasks in different host rocks*
- ❑ **Colloid Formation and Migration Project**
 - *Participate in colloid research at Grimsel granite URL in Switzerland*
- ❑ **SKB Task Forces (New)**
 - *Participate in crystalline rock research centered around Äspö HRL in Sweden*
- ❑ **FEBEX DP (New)**
 - *Participate in FEBEX dismantling project, which will analyze bentonite-rock behavior after 17 years of heating*
- ❑ **Nuclear Energy Agency (NEA)**
 - *Thermochemical Database Project*
 - *Salt Club*
 - *Clay Club*

Bilateral Agreements

- ❑ **US-China**
 - *Bilateral Civil Nuclear Energy Cooperative Action Plan (BCNECAP) with working group in Spent Fuel Storage and Repository Science*
- ❑ **US-Germany benchmarking study for salt**
 - *Participate in model comparison for TM behavior of domal and bedded salt*
- ❑ **US-Republic of Korea (ROK)**
 - *KAERI Underground Research Tunnel (KURT), experiments in crystalline rock*
 - *Joint Fuel Cycle Study (JFCS), information exchange in used fuel disposal*
- ❑ **Other Potential Opportunities**
 - *Explore use of existing Memorandum of Understanding (MoU) between DOE and Spain (ENRESA), France (ANDRA), Japan (JNEAP) and Belgium*

Conclusions

The Department of Energy is committed to moving forward with development of management strategies and technologies for the storage and disposal of used nuclear fuel and high-level radioactive waste.

■ **The Used Nuclear Fuel Disposition program is:**

- Laying the foundation for the development of storage, transportation and disposal options.
- Evaluating the behavior of used high burnup used nuclear fuels during storage and transportation.
- Evaluating disposal options in several geologic media, including borehole disposal and direct disposal of existing canisters.