



# Presentation to NCSL: Safe and Permanent Isolation of Spent Nuclear Fuel

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# A Market in Need of Solutions



## Waste Accumulates, No Disposal

- 80,000 metric tons of spent nuclear fuel currently in the US
- 2,000 metric tons generated annually
- Currently in temporary storage at reactor sites
- One in three Americans live within 50 miles of a temporary storage site

## Increasing Costs with Time

- **\$1-2 billion** spent per year for storage
- Projected to cost **\$25 billion** over the next 10 years
- **\$15 billion** spent on the Yucca Mountain project to-date and an additional **\$96 billion** expected to complete



# Founded by a Unique Duo

A Father-Daughter team that co-founded Berkeley Earth and has been working together for the past decade.

Uniting technical savvy with strategic vision.

## CEO Elizabeth Muller

Co-Founder and Executive Director  
of Berkeley Earth

## CTO Richard Muller

MacArthur “genius” and founder of two projects that led to Nobel prizes for his postdoctoral fellows (Cosmic Microwave Uniformity, Discovery of Dark Energy).



Liz is the classic Chief Executive  
~ Will Glaser, Founding CTO of Pandora





# OUR SOLUTION



Temporary  
emplacement rig, 160-feet high

Aquifer casing  
Aquifer

Plugged vertical  
access drill hole  
(with steel casing  
and concrete)

Actual pipe diameter:  
14-inches

Dead end trap

Spent nuclear fuel  
canister storage

Plumbers trap

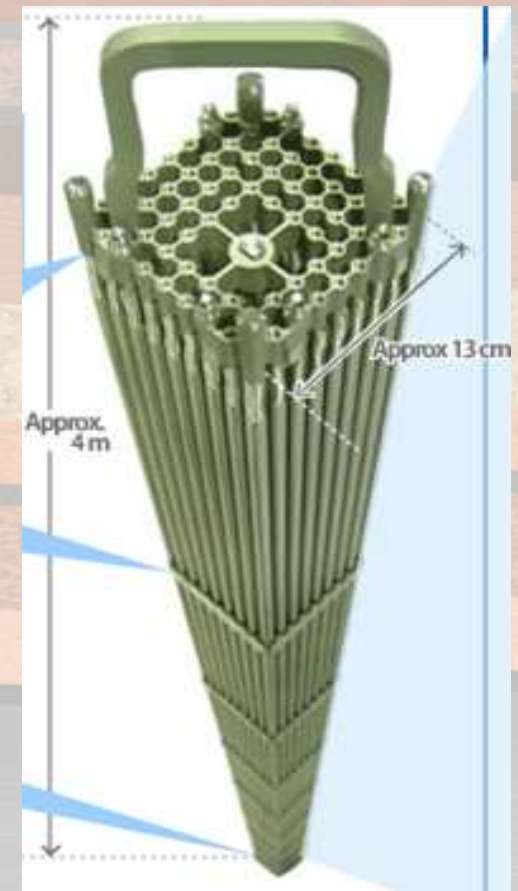
# OUR SOLUTION:

Secured thousands of feet deep under-  
ground in sedimentary rock, a natural  
protective barrier.

(not to scale)

# A Unique Technology

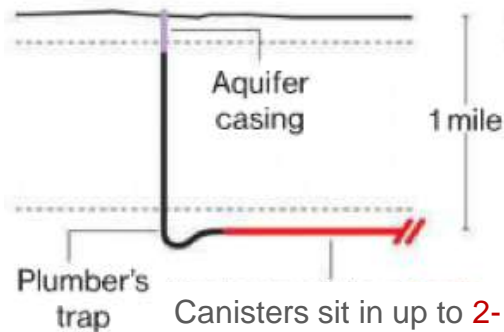
- Shale has held volatile gas (methane) for millions of years, making a prima facie case for isolation
- No need for humans at depth
- Minimize transportation by locating near existing nuclear reactors
- First patent issued for disposal in or under shale layer; 4 more pending, others in development
- Spent fuel is compact; one drill hole can store 200 to 400 tons
- 3-4 drill holes per nuclear reactor



# Comparison of Methods

## Deep Isolation

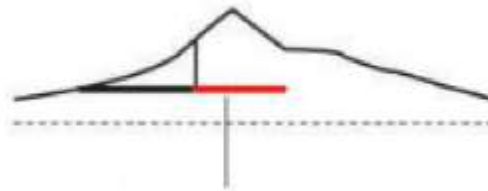
Directional drilling techniques secure sealed containers thousands of feet beneath sedimentary rock.



Canisters sit in up to **2-mile-long drill holes 14 inches in diameter**, and can be retrieved, if desired.

## Yucca Mountain

America's spent nuclear fuel is supposed to be stored in a single massive repository.



**Parallel storage tunnels, 18-feet** in diameter just 1000 feet underground are arranged in a 5-mile region.

## DOE deep borehole military waste repositories

The waste containers are on top of one another, increasing the risk of rupture.



Canisters are placed in the **bottom mile of a 3-mile deep shaft**, which is topped with layers of bentonite, rock, and concrete.

# Broad Interest in Our Solution

## The Public



- **82% agree:** It would be better to **dispose** of nuclear waste at its current location **in their state** than transport it across (and out of) their state.\*

## Nuclear Sites



- **6 out of 7** nuclear reactor host communities visited want to learn more about Deep Isolation disposal in their locale.

## Environmental and Anti-Nuclear Groups



- Have been **mostly open** to talking to us.
- They **are intrigued** by our solution and approach.



“ Deep Isolation is adapting recently developed drilling technologies to make disposal of nuclear fuel less expensive and even safer than other approaches. This is a technology that could prove important, not only in the US, but around the world. ”



~ Steve Chu

*Former Secretary of Energy, Nobel Laureate*

**Deep Isolation Advisors Include:**

- ✓ 2 Nobel Laureates
- ✓ Former Secretary of Energy
- ✓ Advisor to Director for Yucca Mountain
- ✓ Member of Blue Ribbon Commission
- ✓ Member of Nuclear Waste Technical Review Board

# Historic Problems

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## Barriers to Solutions

- **Not currently possible** for private companies to apply for license to dispose of commercial spent nuclear fuel
- Licensing **costs are high**, NRC requirements are stringent
- Many examples of **stakeholder engagement failure**
- **Opposition** from environmental groups



# Deep Isolation's Solution

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## Uniquely Suited for the Disposal of Spent Nuclear Fuel

- **Private innovation** is driving down cost and increasing efficiency allowing for new problem-solving approaches in partnership with the government
- Licensing **costs lower** for our solution
- **Stakeholder engagement** is a core competency
- Forging **partnerships with environmental groups**; they are showing genuine interest

# Features of DI's Solution

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- Safe and backed by sound science
  - Superior retentive properties of shale rock
  - Completely below aquifer
- Vastly more economical
  - Mature technology, 3-4 drill holes per unit
  - Saves tens of billions USD
- Potential to solve problem faster
  - Gets waste out of biosphere
  - Ends utilities ongoing obligation to manage

# **Path Forward: Three-pronged Approach to Commercial SNF Disposal**

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- **Legislative & Regulatory**
  - Congressional Allowance for DOE to Pursue a Second Repository
  - NRC License
  - DOE Remains Obligated to Pay (Nuclear Waste Fund)
- **Community & Utility Engagement**
  - Revenue Sharing Model
  - Identifying Receptive Communities
- **Scientific & Technological Development**



# DEEP ISOLATION

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