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Geologic Repository Programs of North America:
Crisis or Opportunity?

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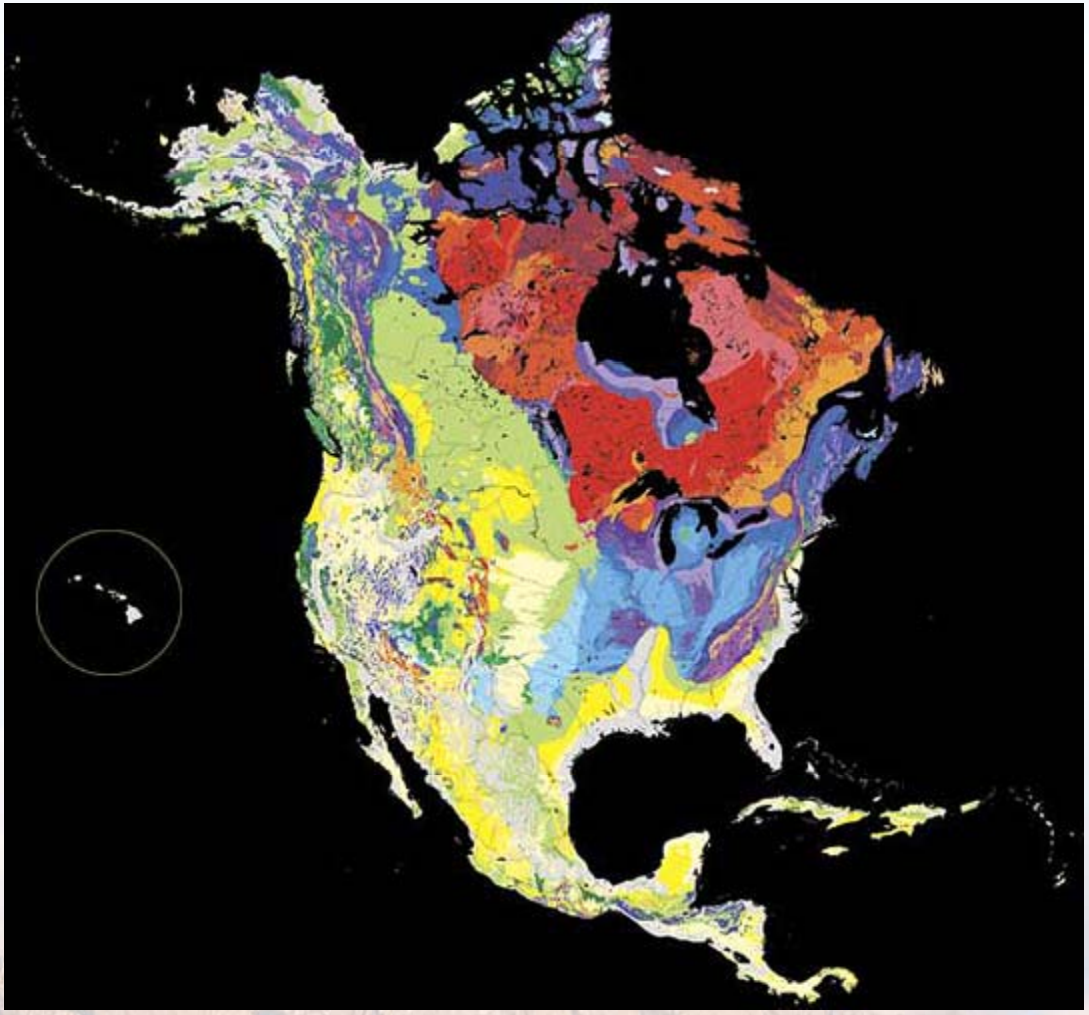
Discussion Outline

- Status of Repository Programs in North America
- A Vision for North American Repository Science
- The European Commission Framework 7 and the IGD-TP
- Deep Borehole Disposal



http://nationalatlas.gov/articles/geology/maps/geomap.html

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U.S. Geologic Repository Program

Yucca Mountain Status: Light at the End of the Tunnel?

- **February 2009: The Obama administration (sworn in January 2009) eliminated all funding in the fiscal year 2010 budget except that needed to answer inquiries from the Nuclear Regulatory Commission, "while the Administration devises a new strategy toward nuclear waste disposal."**
- **"The Administration has determined that developing a repository at Yucca Mountain, Nevada, is not a workable option and has decided to terminate the Office of Civilian Radioactive Waste Management. The Nation needs a different solution for nuclear waste disposal. As a result, in 2010, the Department will discontinue its application to the U.S. Nuclear Regulatory Commission for a license to construct a high-level waste geologic repository at Yucca Mountain and establish a Blue Ribbon Commission to inform the Administration as it develops a new strategy for nuclear waste management and disposal. All funding for development of the Yucca Mountain facility and the Office of Civilian Radioactive Waste Management will be eliminated by the end of FY10. The Administration remains committed to fulfilling its obligations under the Nuclear Waste Policy Act. Ongoing responsibilities under the Act, including administration of the Nuclear Waste Fund and the Standard Contract, will continue under the Office of Nuclear Energy, which will lead future waste management activities."**
  - From Dept. of Energy, FY-2011 Congressional Budget Request
- **March 2009: What's wrong with Yucca Mountain, Mr. Chu," McCain asked at an Energy and Natural Resources Committee hearing on support for scientific research.**
  - "I think we can do a better job," replied the Nobel Prize-wining physicist.

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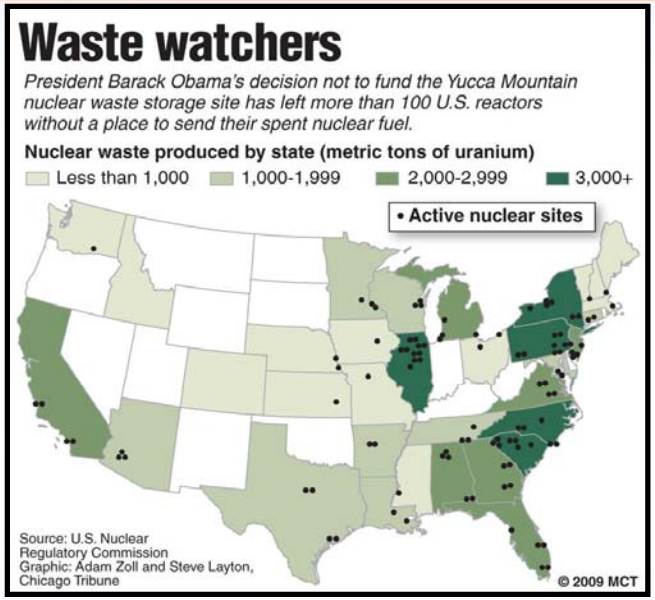
Geopolitical Reaction

- **March 2010: DOE files motion to withdraw license application with prejudice**
  - "The Secretary's judgment here is not that Yucca Mountain is unsafe or that there are flaws in the (license application), but rather that is not a workable option and that alternatives will better serve the public interest," said DOE in papers filed in federal court.
  - The motion to withdraw the license application sparks controversy…
    - Legal challenges by SC & WA
    - Opposing inquiries, resolutions and questions by Congress
    - Editorials and trade groups raise objections



- **June 2010: ASLB denies DOE request to withdraw the license**
  - "We do so because the Nuclear Waste Policy Act of 1982, as amended does not permit the Secretary to withdraw the Application that the NWPA mandates the Secretary file. Specifically, the NWPA does not give the Secretary the discretion to substitute his policy for the one established by Congress in the NWPA that, at this point, mandates progress toward a merits decision by the Nuclear Regulatory Commission on the construction permit."
- **October 2010: NRC Chairman directs termination of Yucca licensing effort**
  - The NRC "will proceed to an orderly closure of high level waste activities," as outlined in an budget memo directive. Volume 3 of the safety evaluation report that was scheduled to be released next month may not be released.

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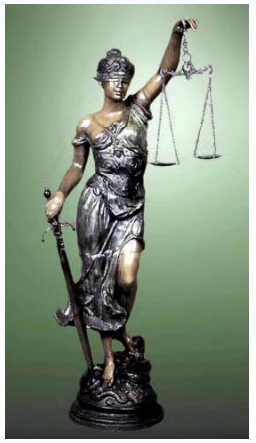
What's Next?

- **Court to allow the NRC to exhaust administrative remedies**
- **NRC Commission to rule on whether the DOE can withdraw the application**
  - NRC Commissioners either uphold or reverse ASLB's earlier denial of DOE motion to withdraw the LA
  - Regardless of the NRC ruling, one party will be unsatisfied and will likely petition the court to resume the case that is now stayed (pending NRC ruling)
- **November Election Effects?**
  - Democrat (& Senate Majority Leader) Harry Reid vs. Republican (& Tea Party favorite) Sharron Angle



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- **CHARTER: The Secretary of Energy, acting at the direction of the President, is establishing the Commission to conduct a comprehensive review of policies for managing the back end of the nuclear fuel cycle, including all alternatives for the storage, processing, and disposal of civilian and defense used nuclear fuel, high-level waste, and materials derived from nuclear activities. Specifically, the Commission will provide advice, evaluate alternatives, and make recommendations for a new plan to address these issues, including:**
  - Evaluation of existing fuel cycle technologies and R&D programs,
  - Options for safe storage of used nuclear fuel while final disposition pathways are selected and deployed,
  - Options for permanent disposal of used fuel and/or high-level nuclear waste, including deep geological disposal,
  - Options to make legal and commercial arrangements for the management of used nuclear fuel and nuclear waste,
  - Options for decision-making processes for management and disposal that are flexible, adaptive, and responsive,
  - Options to ensure that decisions on nuclear waste management are open, transparent, with broad participation,
  - The possible need for legislation or amendments to existing laws, including the Nuclear Waste Policy Act.

- ***Yucca Mountain as a repository is off the table for the BRC consideration of alternatives***
- ***Possible BRC Outcomes***
  - Volunteer approach to repository site selection
  - Revise the role of government
  - Changes to the NWPA
  - R&D for advanced fuel cycles
  - Centralized interim storage
  - Begin a repository development program

- **Congress has to take action to implement**
- **Court of Appeals decisions may have influence**

Canadian Nuclear Fuel Waste

TABLE 2: Summary of Projected Nuclear Fuel Waste from Existing Reactors

Location	Waste Owner	Total June 2009 (# bundles)	Typical Annual Production (# bundles)	Low Scenario (# bundles)	High Scenario (# bundles)
Bruce A	OPG	403,256	22,500 [1]	483,000	1,039,000 [4]
Bruce B	OPG	498,339	23,500 [1]	640,000	1,345,000
Darlington	OPG	356,504	23,000 [1]	645,000	1,335,000
Douglas Point	AECL	22,256	0 [2]	22,256	22,256
Gentilly 1	AECL	3,213	0 [2]	3,213	3,213
Gentilly 2	HQ	112,445	4,800	120,000	274,000
Pickering A	OPG	598,687	6,800 [3]	746,000	1,181,000
Pickering B	OPG		13,800 [1]		
Point Lepreau	NBPN	121,758	4,800	121,758	283,000 [5]
AECL Whiteshell	AECL	2,268	0 [2]	2,268	2,268
AECL Chalk River	AECL	4,886	0 [6]	4,886	4,886
TOTAL (bundles)[7]		**2,123,612**	**99,200**	**2,789,000**	**5,490,000**
(t-HM)		***42,000***	***1,990***	***56,000***	***110,000***

- **Low Scenario – No refurbishment of existing reactors**
- **High Scenario – Refurbishment of existing reactors, no new reactors**

Nuclear Fuel Waste Projections in Canada – 2009 Update (NWMO TR-2009-30)

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Canada Nuclear Fuel Waste Projections

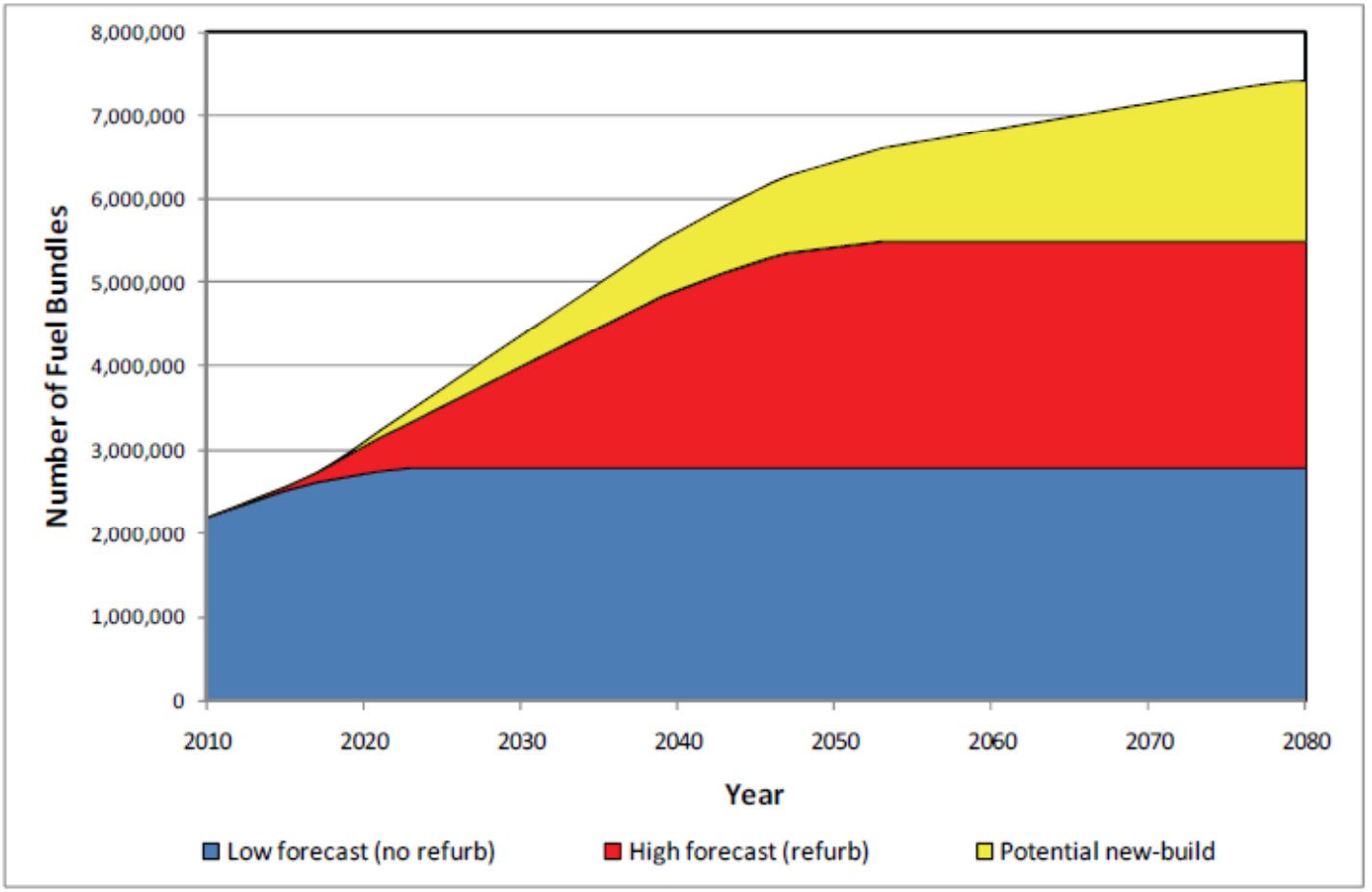

FIGURE 1: Summary of Projected Used Fuel Inventory

Nuclear Fuel Waste Projections in Canada – 2009 Update (NWMO TR-2009-30)

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Canadian Repository Program

- **The Government of Canada selected Canada's plan for the long-term management of used nuclear fuel in June 2007. The approach, called *Adaptive Phased Management*, involves the development of a large infrastructure project in an informed and willing host community. The Nuclear Waste Management Organization (NWMO) is federally mandated to implement this project and is beginning the multi-year process for selecting an informed and willing community to host this national facility.**
- **Over the past two years, the NWMO has worked collaboratively with interested organizations and individuals to design a fair and appropriate process for identifying an informed and willing community to host the deep geological repository for Canada's used nuclear fuel. NWMO is now beginning to implement this community-driven process.**

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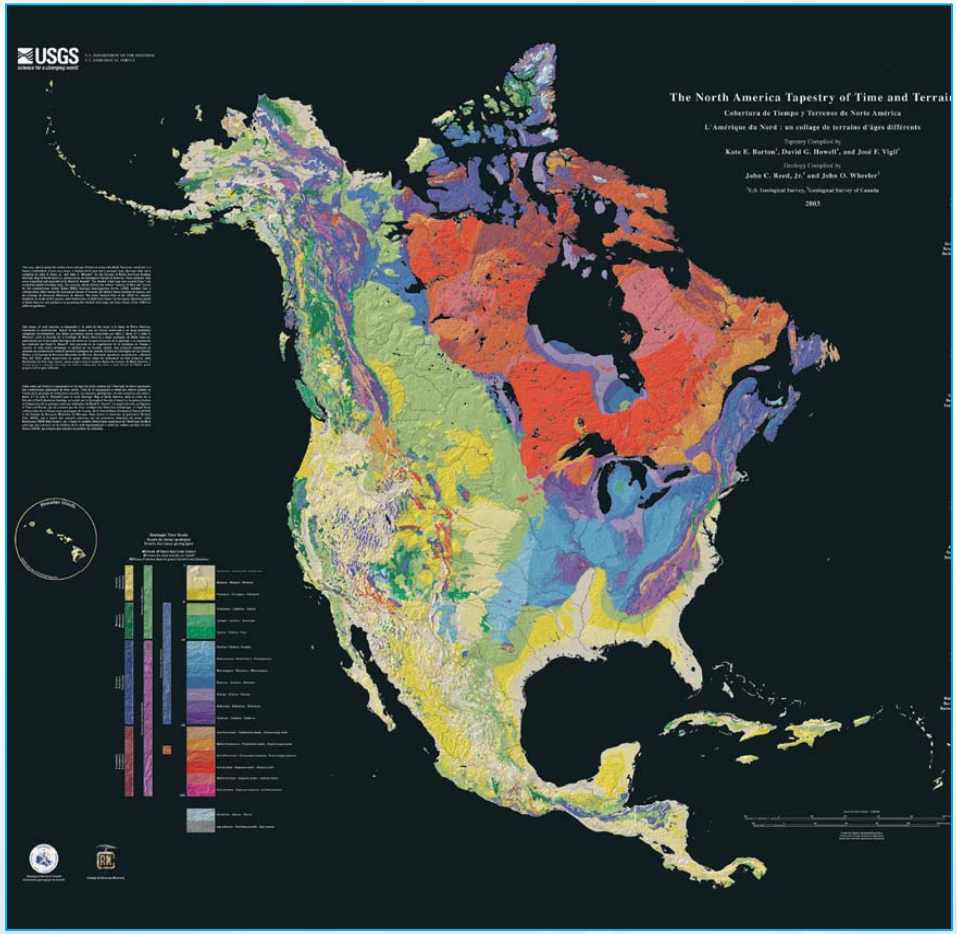
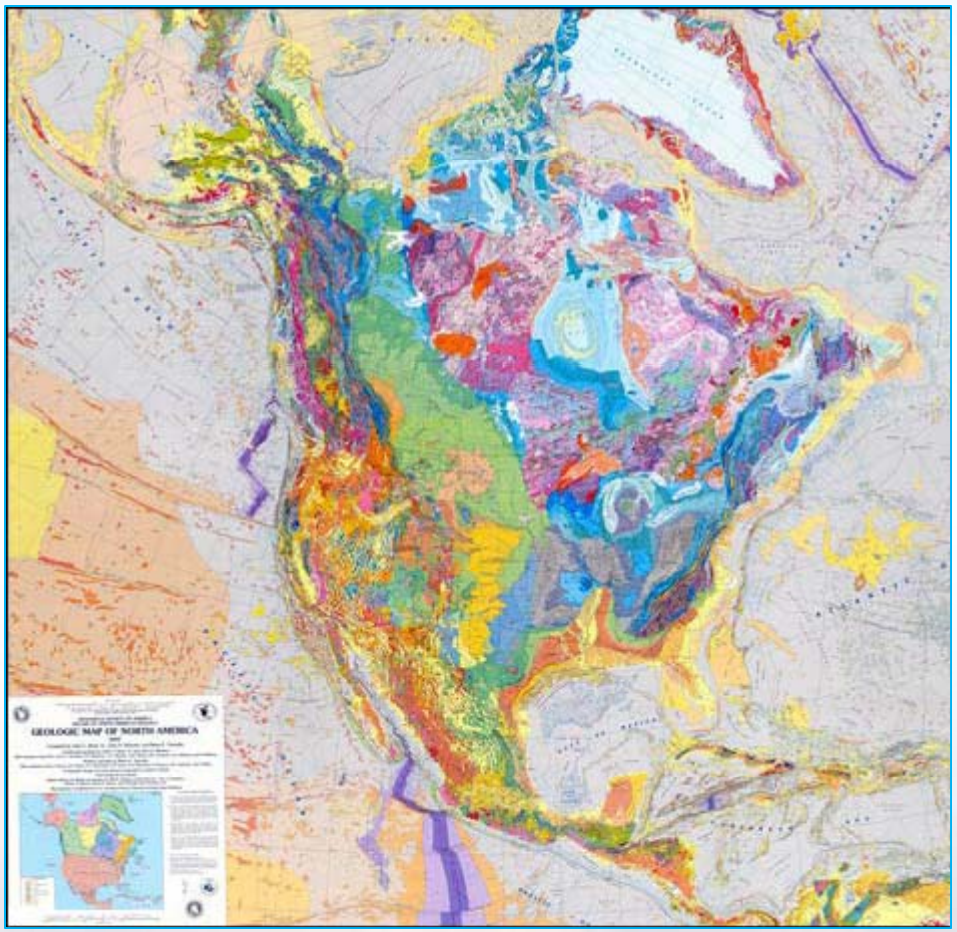
Mexico Spent Fuel Management

- **Used nuclear fuel from the Laguna Verde reactors is stored underwater at the site. The storage pools have been re-racked to provide enough space for the reactors' entire lives. About 1100 tonnes of used fuel exists at present. The same strategy of on-site storage is employed with used fuel from research reactors.**

Technical Challenges Exist Across Borders





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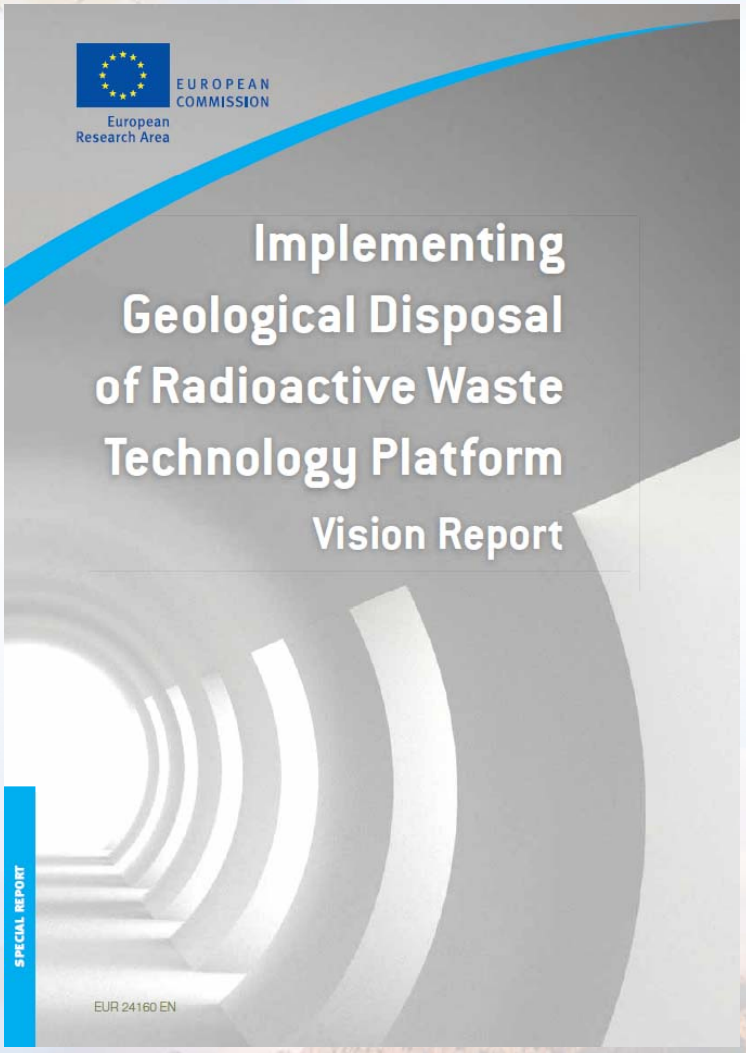
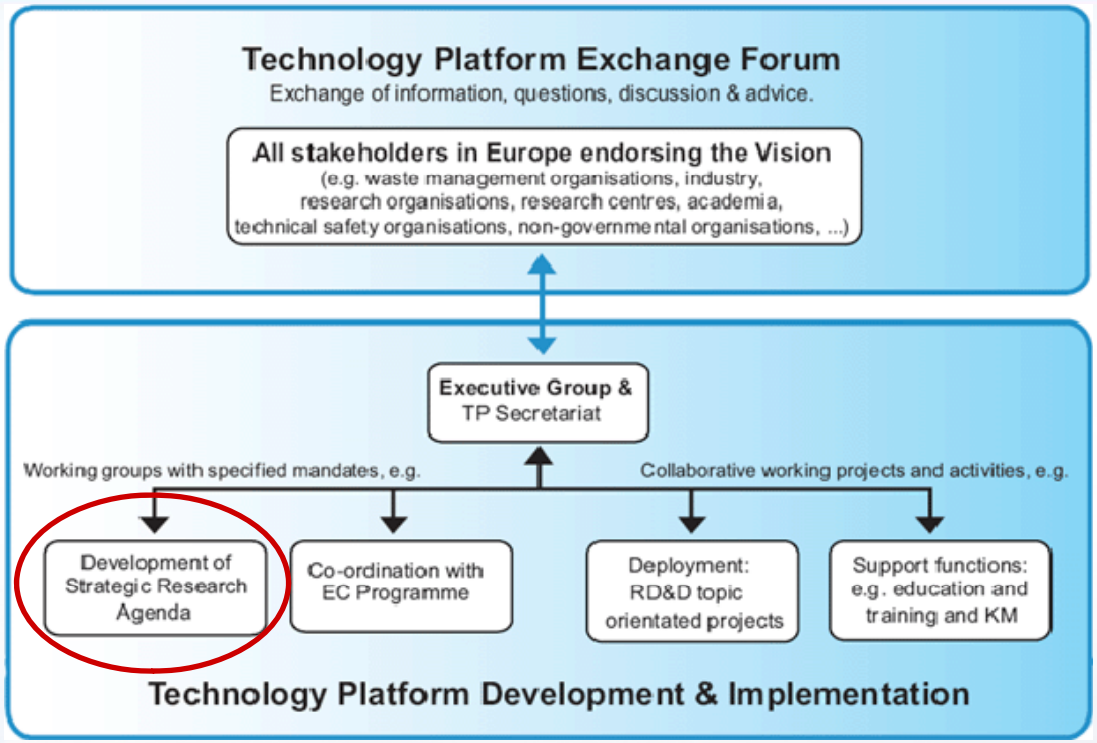
EU Frameworks, Programmes, Platforms and Implementation

Secretariat of the Implementing Geological Disposal Technology Platform





IGD-TP

http://www.igdtp.eu/

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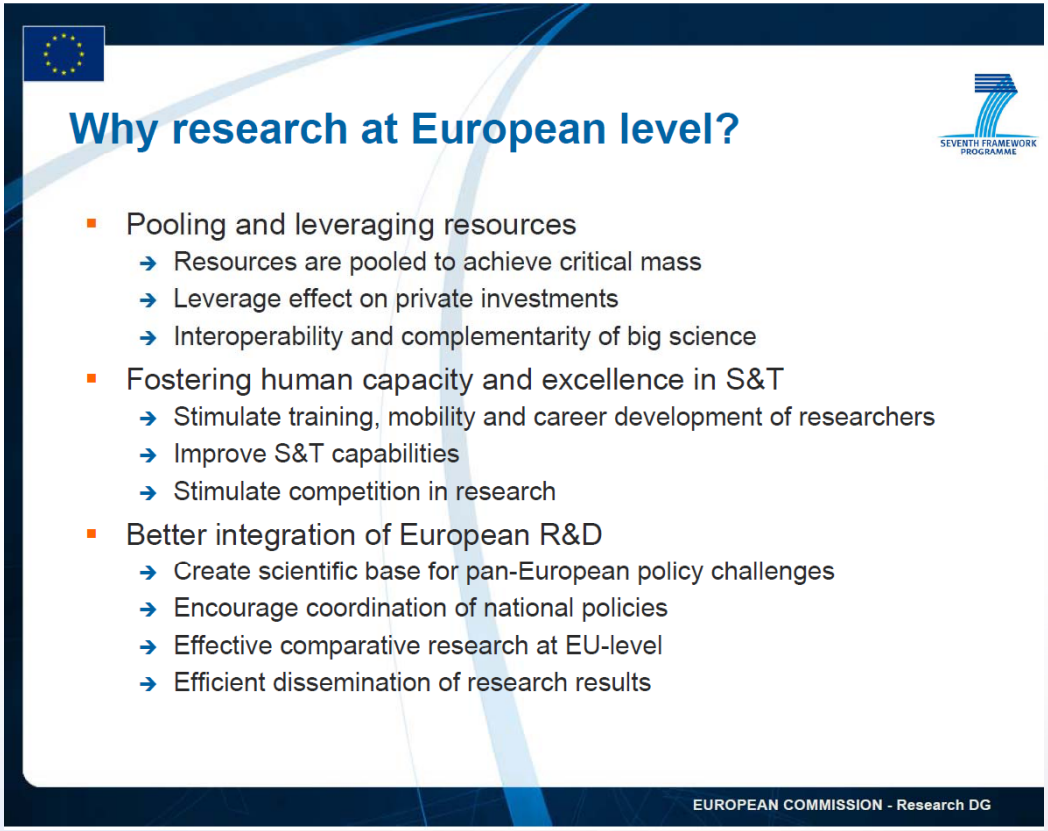
Benefits of EU Collaboration are Applicable to North America

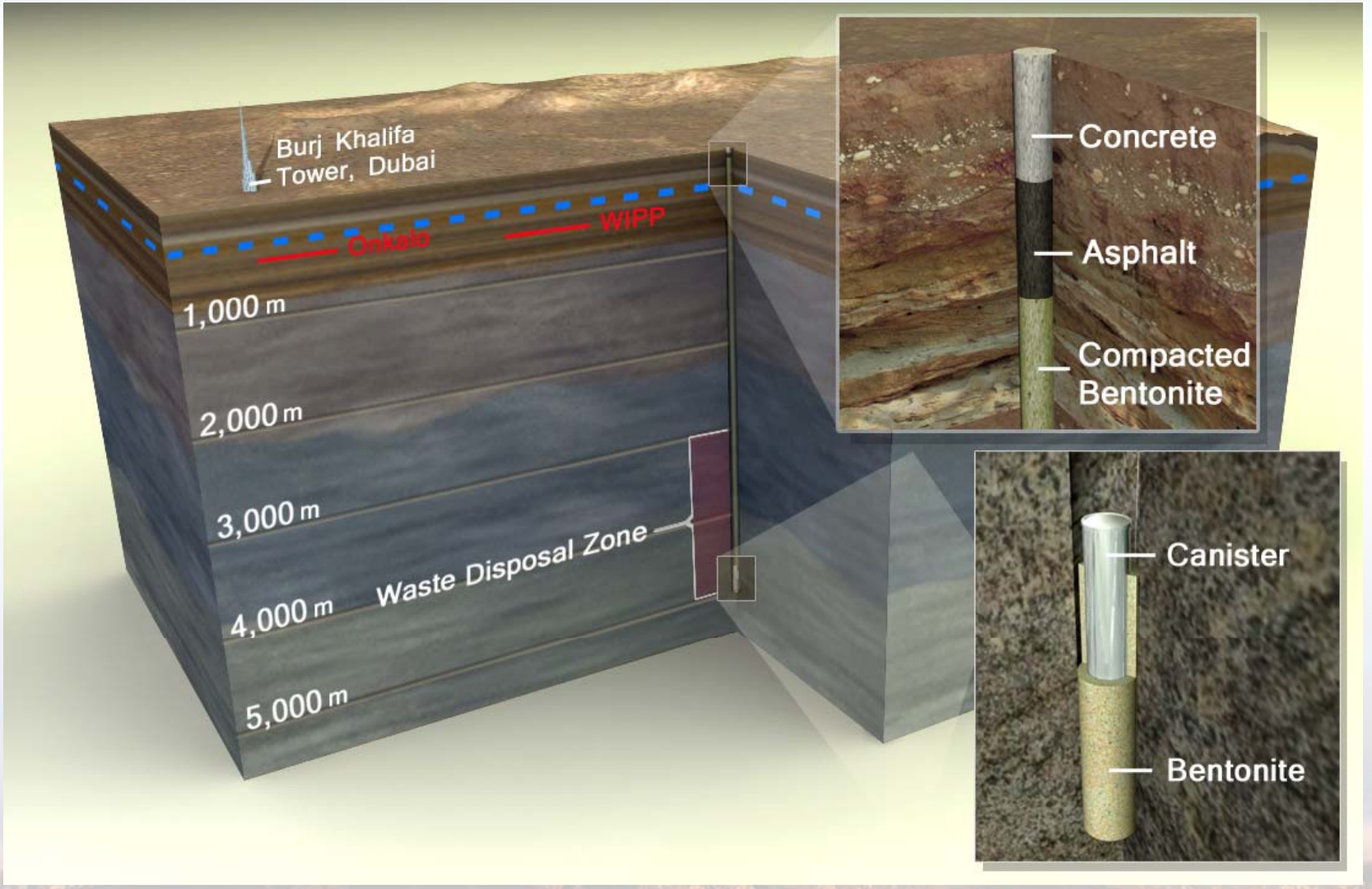


- **The commitment of the IGD technology platform members**
  - is to build confidence in the safety of geological disposal solutions among European citizens and decision-makers,
  - is to encourage the establishment of waste management programs that integrate geological disposal as the accepted option for the safe long-term management of nuclear waste,
  - is to facilitate access to expertise and technology and maintain competence in the field of geological disposal for the benefit of member states.

From: http://ec.europa.eu/research/fp7/pdf/fp7_press_launch.pdf

Deep Borehole Disposal Concepts

An Opportunity for Collaboration



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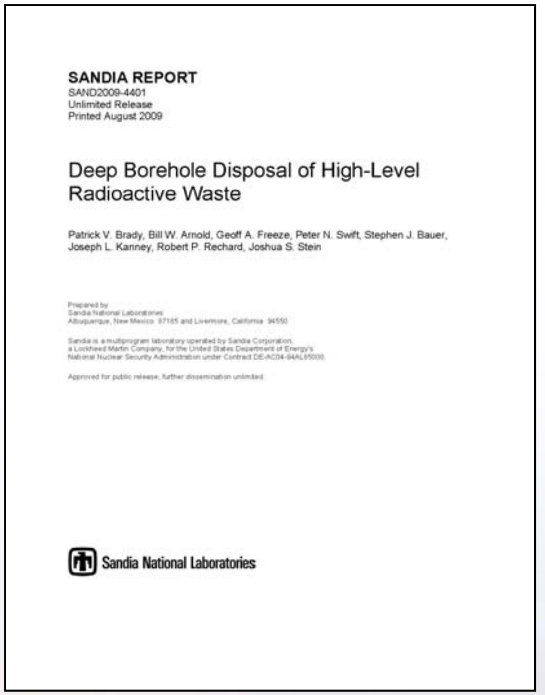
Disposal Concept Viability and Safety

- Crystalline basement rocks are relatively common at depths of 2 km to 5 km
- Existing drilling technology permits construction of boreholes at a cost of about $20 million each
- Low permeability and high salinity in the deep crystalline basement suggest extremely limited interaction with shallow groundwater resources
- Geochemically reducing conditions limit solubility and enhance the sorption of many radionuclides
- Disposal could occur at multiple locations, reducing waste transportation costs and risks
- The deep borehole disposal concept is modular, with construction and operational costs scaling approximately linearly with waste inventory
- Disposal capacity of ~950 boreholes would allow disposal of projected US spent nuclear fuel inventory



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Deep Borehole Disposal of High-Level Radioactive Waste

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