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# Deep Borehole Storage of Nuclear Fuel and Overview of Session 3 (Day Two) Activities

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**Spent Fuel and Reduction of Radiological Risk after Fukushima and Deep Borehole and Spent Fuel in East Asia WORKING GROUP MEETING**

**May 28-30, 2013, Beijing, China**

# OUTLINE OF PRESENTATION

- Introduction to Deep Borehole Disposal of Nuclear Spent Fuel and Other Materials
- Significance of Deep Borehole Disposal in the Context of Current Project
- Introduction to Session 3

# Introduction to Deep Borehole Disposal and its Applications

- **Mined disposal or long-term storage of spent fuel and other nuclear wastes (including high-level wastes—HLW—from reprocessing has been investigated internationally for decades**
  - **Excavated or natural caverns or galleries, tens to hundreds of meters deep**
  - **Typically designed for retrievable storage**
  - **Considerable experience with design, engineering, initial construction in the US, Europe**
  - **Investigations and design work in East Asia**
  - **As yet, no large-scale mined repositories in operation**

# Introduction to Deep Borehole Disposal and its Applications

- Given the expense, difficulties of siting mined repositories for spent fuel and other wastes, other potential means of disposal have been considered
- With advances in deep drilling technologies, many (but not all) developed for the oil and gas industries, “deep borehole disposal” (DBD) of nuclear materials has been offered as an alternative disposal method in recent years

# Introduction to Deep Borehole Disposal and its Applications

- **DBD: borehole less than a meter in diameter is drilled into stable geologic strata using standard (or advanced) drilling techniques derived from petroleum and mining industries**
  - **Depth of 3 to 5 km below ground level**
  - **Radioactive materials, potentially including cooled spent fuel, HLW, and/or plutonium (pure or in mixtures) placed in suitable canisters, lowered into a "disposal zone" in bottom 1 to 2 km of borehole**
  - **Borehole filled with inert materials (rock and clay), sealed, sometimes at several depths and surface, with plugs of concrete**

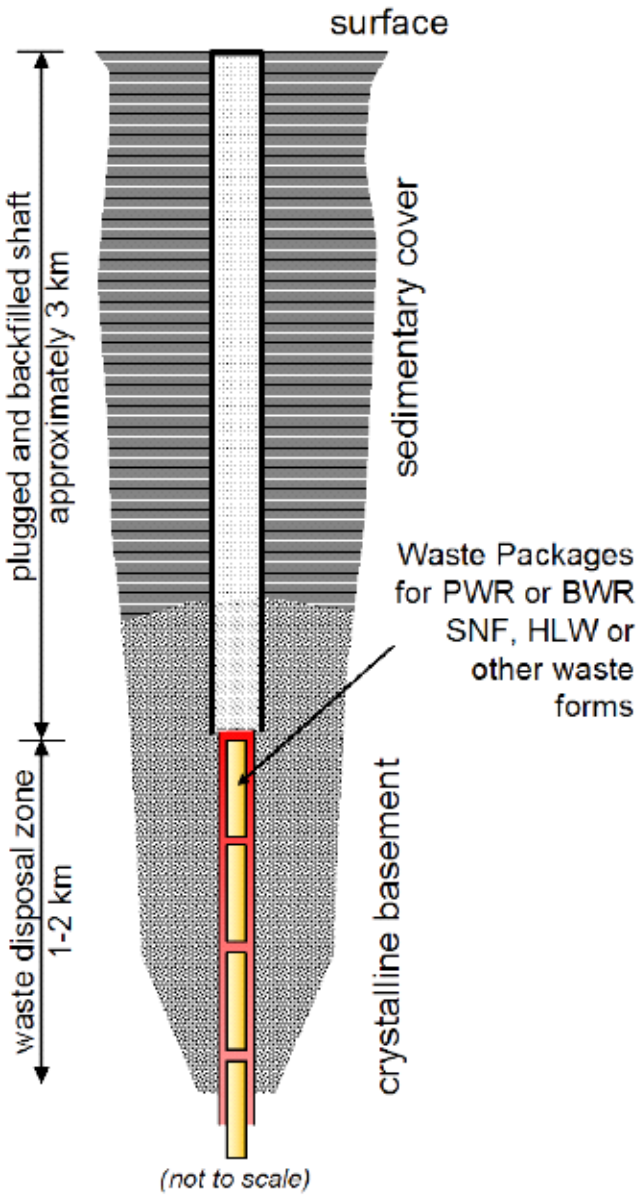
# Introduction to Deep Borehole Disposal and its Applications

- **Potential attributes/advantages of DBD**
  - **Placement of the materials to be disposed of in deep, "basement" rock that does not exchange water with near-surface aquifers essentially permanently isolates wastes from the biosphere**
  - **Deep aquifers highly saline, do not mix with near-surface waters**
  - **Retrieval (or clandestine removal) of radioactive materials from the borehole would be very difficult, with current technology, meaning that borehole disposal facilities might need no significant ongoing on-site monitoring**

# Introduction to Deep Borehole Disposal and its Applications

- **Potential Attributes/advantages of DBD for Spent Fuel Disposal**
  - **Would avoid many of the proliferation-prone steps involved with reprocessing and recycling fissile materials from spent fuel**
  - **Could prove to be more acceptable socially and politically**
  - **Likely more economic than mined repositories or fuel recycling in the short and long run**
  - **Likely less hazardous with respect to technological and ecological risks arising from the disposition of large amounts of radioactive material**

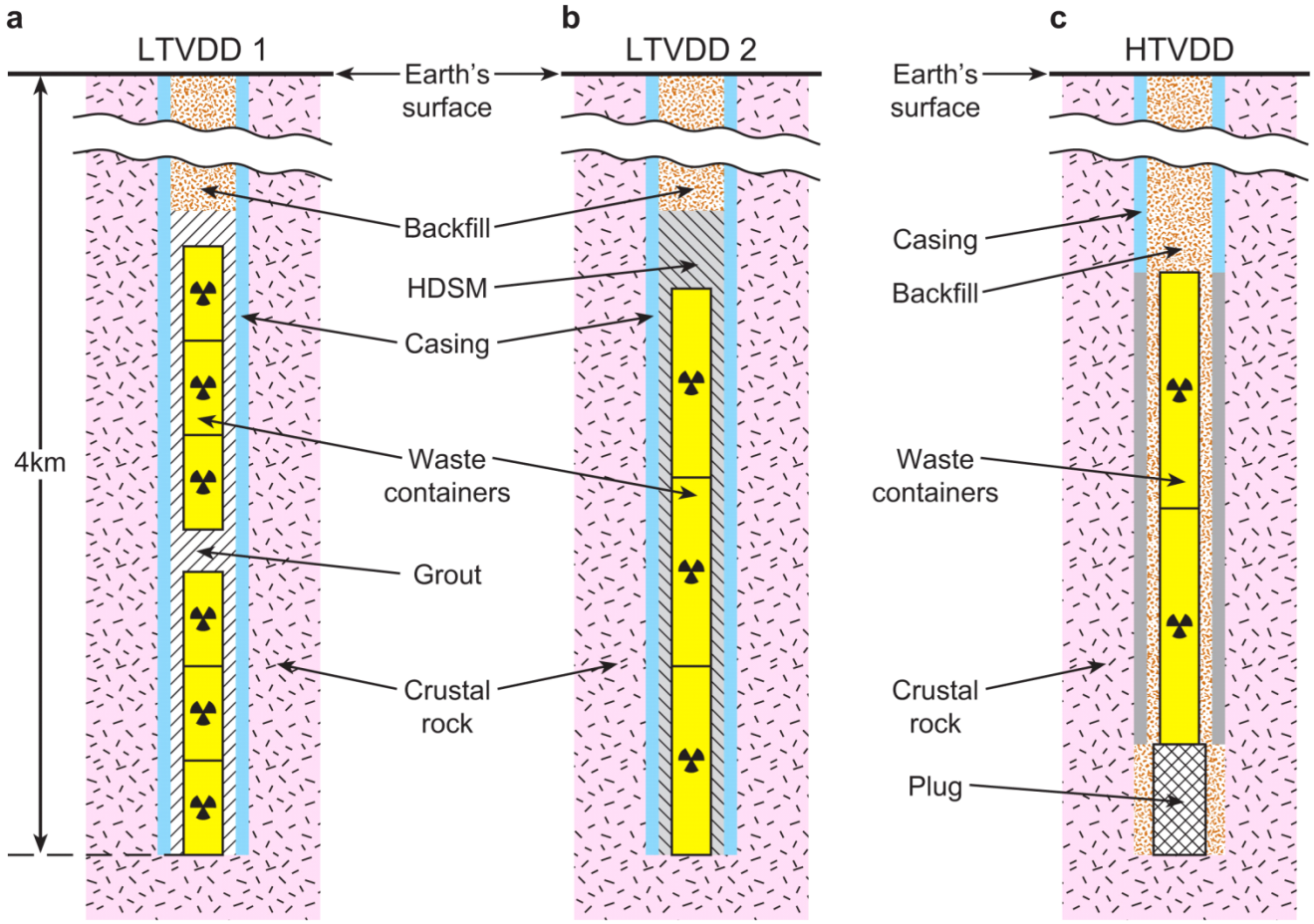
# Introduction to Deep Borehole Disposal and its Applications




- Schematic of Borehole Disposal Concept Showing Placement of Nuclear Materials within Borehole

# Introduction to Deep Borehole Disposal and its Applications

- Examples of Wastes Emplacement in Boreholes with Different Sealing Approaches (LTVDD = “Low Temperature Very Deep Disposal” and HTVDD = “High Temperature Very Deep Disposal”)



# Significance of Deep Borehole Disposal in Current Project Context

- One of several options for sequestering radiological hazards such that they are not vulnerable to accident or attack
- Presents opportunities for regional cooperation to explore the potential for DBD, compare with other regional cooperation schemes to manage spent fuel
- Potential to help avoid safeguards and security dilemmas associated with accumulating large amounts of separated fissile material from spent fuel

# Significance of Deep Borehole Disposal in Current Project Context

- **Potential to assist in medium-term where spent fuel storage is/will be in scarce supply**
- **Could play a role in eventual resolution of the North Korean nuclear weapons issue  if a regional nuclear weapon free zone or similar arangment is adopted that includes collaboration between national nuclear fuel cycles**

# Introduction to Session 3

- **Presentations providing updates on general geologic potential, research to date, policy issues associated with DBD and other geologic disposal options by country:**
  - **China: Dr. ZHOU Yun, Harvard University Managing the Atom Project (presented by teleconference)**
  - **ROK: Dr. KANG Jungmin, Korea Advanced Institute of Science and Technology**
  - **Japan: Professor Tomochika TOKUNAGA, University of Tokyo**

# Introduction to Session 3

- **Deep Borehole Disposal of Spent Fuel and Other Radioactive Wastes An International Overview: Neil CHAPMAN, Chapman and Co. Consulting**
- **Discussion on Prospects for, Challenges Facing Deep Borehole Disposal of Spent Fuel and other Nuclear Waste Materials in East Asia**
  - **Discussion of implications of the data presented, including consideration of how to integrate implications of DBD reports into overall energy sector and nuclear energy analysis**

# THANK YOU!

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