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# SALT UNDERGROUND RESEARCH FACILITY ACTIVITIES

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Research, Design, and Operation

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Sandia National Laboratories is a multi-program laboratory managed and operated by Sandia Corporation, a wholly owned subsidiary of Lockheed Martin Corporation, for the U.S. Department of Energy's National Nuclear Security Administration under contract DE-AC04-94AL85000.

*A consensus of Sandia salt scientists as to the most valuable tests and demonstrations that could be considered if a URL becomes available in salt, either in the USA (say at WIPP or elsewhere) or in Europe.*

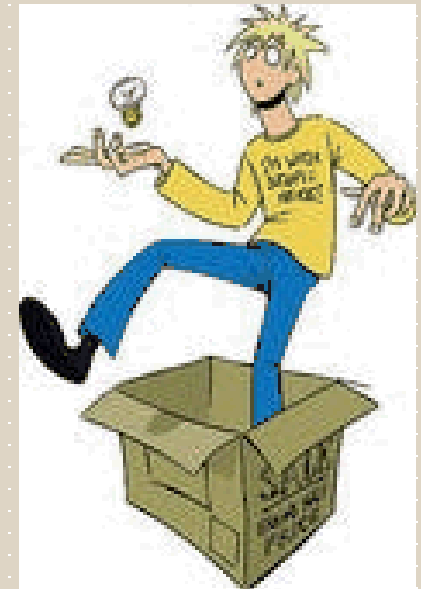
*We would like critical feedback on this list. We believe that the science basis for salt disposal is understood and the next testing can be prioritized regardless of the actual salt URL location. We would be open to collaboration on field tests.*

# Potentially Available Underground Research Space

- Äspö - Hard Rock Laboratory
- Asse Mine
- BfS
- Gorleben
- Grimsel Test Site
- HADES
- Horonobe Underground Research Center
- IRSN
- Konrad
- Korea Underground Research Tunnel (KURT)
- Mizunami Underground Research Laboratory
- Mont Terri Project
- Morsleben
- Olkiluoto Research Tunnel

**WIPP?**

**Commercial  
Mines?**



Underground research space is very expensive to create and maintain, and, as such, that space is precious and needs to be put to the best uses possible.

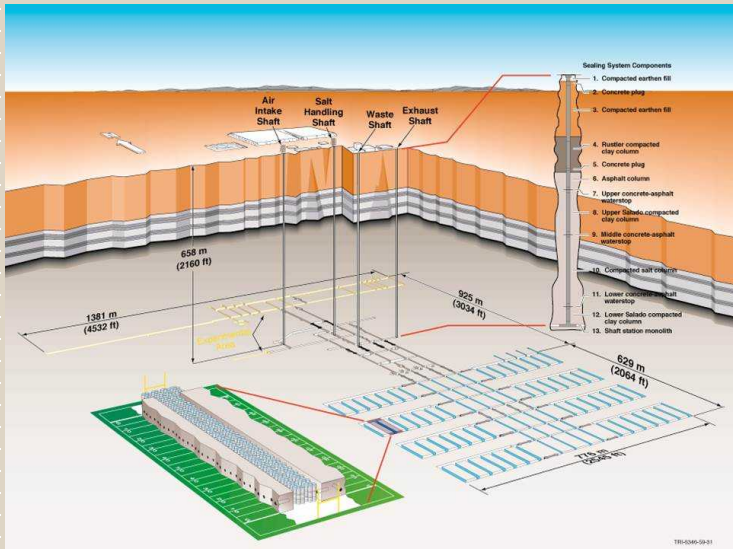
“BEST” work to be done in an underground research laboratory in salt would include at least the following guidelines:



- Engage in technical activities that will have the effect of reducing uncertainties to which assessments of long-term repository performance are sensitive.
- Propose activities that demonstrate the feasibility of operating a salt repository for heat-generating waste.
- Maintain consistency with identified international priorities

*A test or demonstration might address specific features, events or processes (FEPS) to confirm our understanding and ability to model performance of a deep geologic repository for heat generating radioactive waste in salt. An activity might be proposed to build confidence that the safety functions of a deep geologic repository in salt are understood and can be forecast over regulatory time periods. A URL activity might be identified by consensus of international collaborations. Many test concepts pertain to design and operational practice, which embody model prediction and confirmation at full-scale. These particular objectives align with similar lists put forward by IAEA and NEA*

# Safety Case Is Solid For Disposal Of Transuranic Waste In Salt



Site Selection

Site Characterization

Pre-Closure Safety Evaluation and Operations

Post-Closure Safety Evaluation

- Wastes and Engineered Barriers Features and Issues
- Natural Barriers Features and Issues
- Repository System Features and Issues
- Modeling Issues

Confidence Building

Materially Advance The Safety Case For Disposal Of Heat-generating Radioactive Waste In Salt.



anon5

## Slide 7

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**anon5** I do not know how to get these to reveal content.  
anon, 8/20/2015

# CHARACTERIZING EARLY EVOLUTION OF SALT EXCAVATIONS

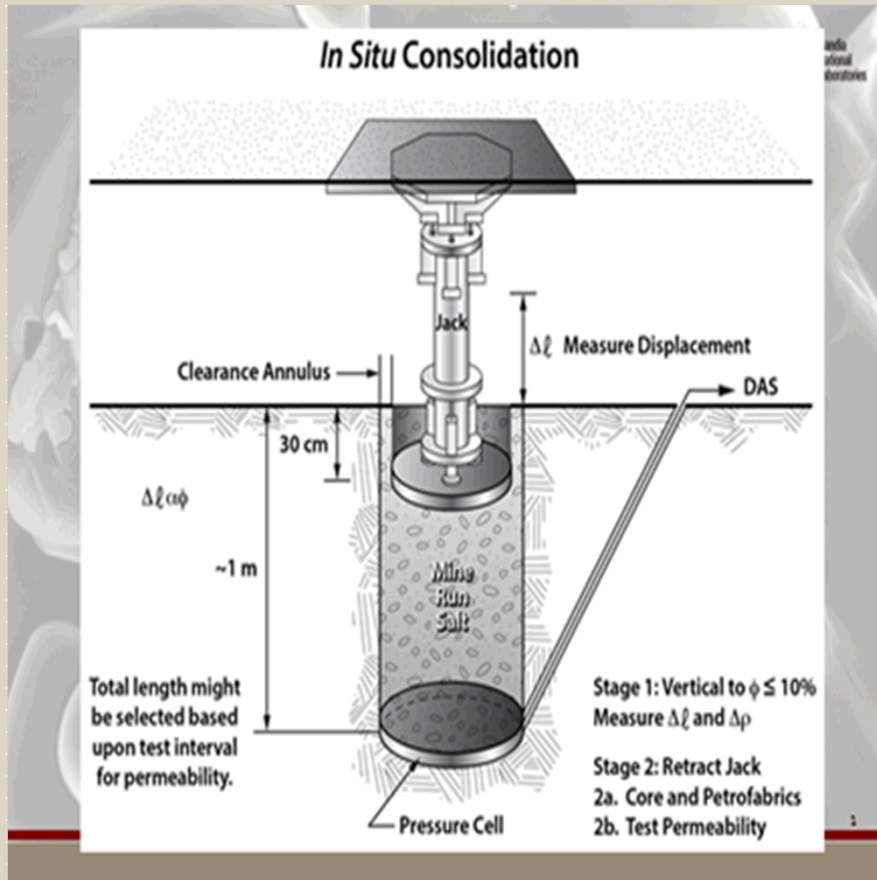
*Capturing early behavior of excavations in salt is a well identified information gap essential to geomechanical constitutive model development and evaluation.*



Interactive Session Summary

# LARGE-SCALE *IN SITU* CONSOLIDATION

*For most concepts of salt disposal, reconsolidation of granular salt to low porosity and low permeability at field-scale application is prerequisite to affecting sealing functions.*

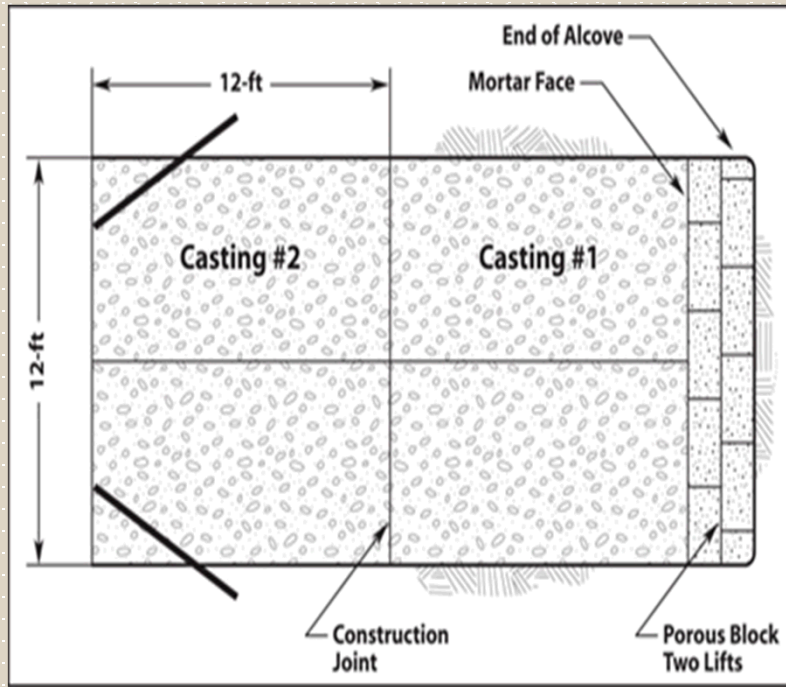


Interactive Session Summary

Figure 1. Field-scale reconsolidation of granular salt.

# DRIFT-SCALE SEAL DEMONSTRATION

*Geotechnical barriers are the second most vital consideration after the geologic formation itself for long-term isolation of nuclear waste.*

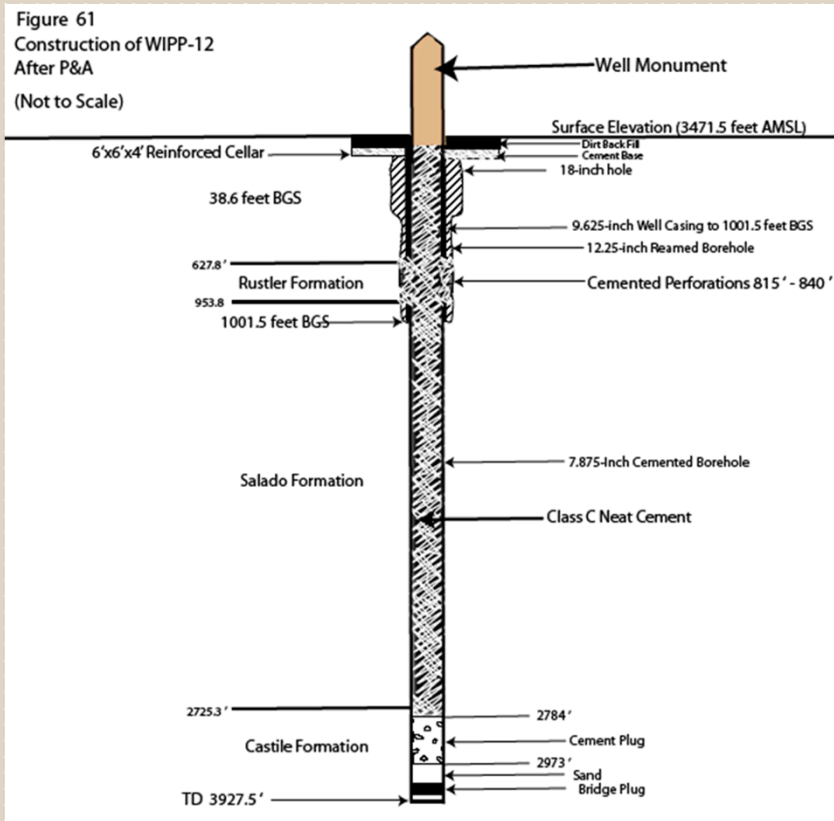


## Interactive Session Summary

Figure 2. Nominal schematic of drift-scale seal demonstration.

# BOREHOLE SEAL DEMONSTRATION

*A salt URL provides opportunity to place, test and forensically examine borehole plugs.*



Interactive Session Summary

Figure 3. Construction of WIPP-12 after plugging and abandonment (DOE 1996).

# SINGLE HEATER TEST

*A single heater test provides a flexible opportunity to predict and measure salt response and establish test protocol.*

## Interactive Session Summary

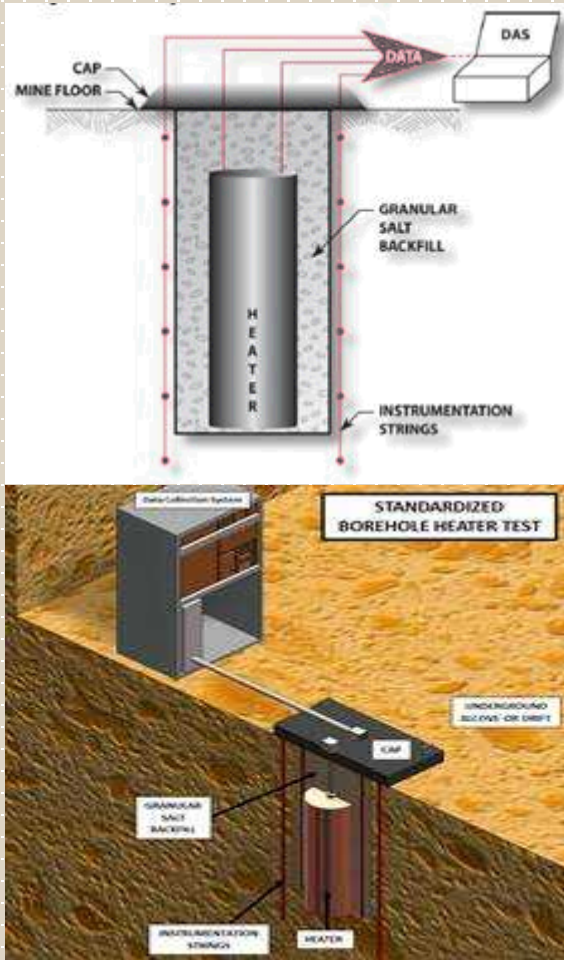
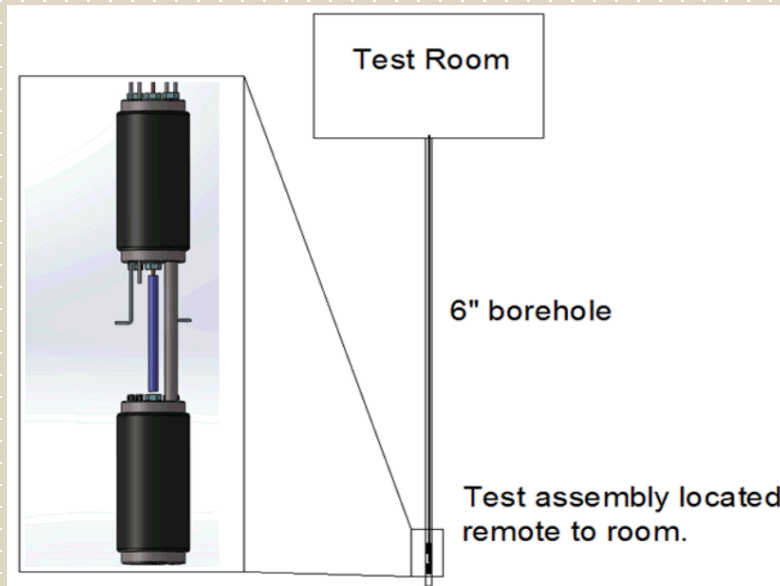


Figure 4. Schematic of single heater test.

# BRINE AVAILABILITY BOREHOLE HEATER TEST

*A small, standardized borehole heater test fielded in a range of vertical and horizontal boreholes will address generic open issues from previous tests and provide fundamental data for the local salt system.*

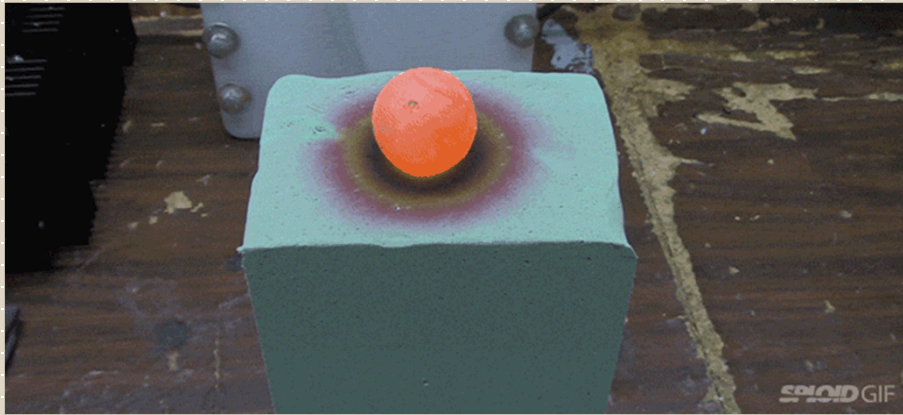


Interactive Session Summary

Figure 5. Standardized borehole brine availability test in salt

# SALT DECREPITATION TEST

*Salt subject to decrepitation has been observed to shatter or rupture, but the effects this process has on the porosity, permeability, and strength of the salt have not been quantified.*

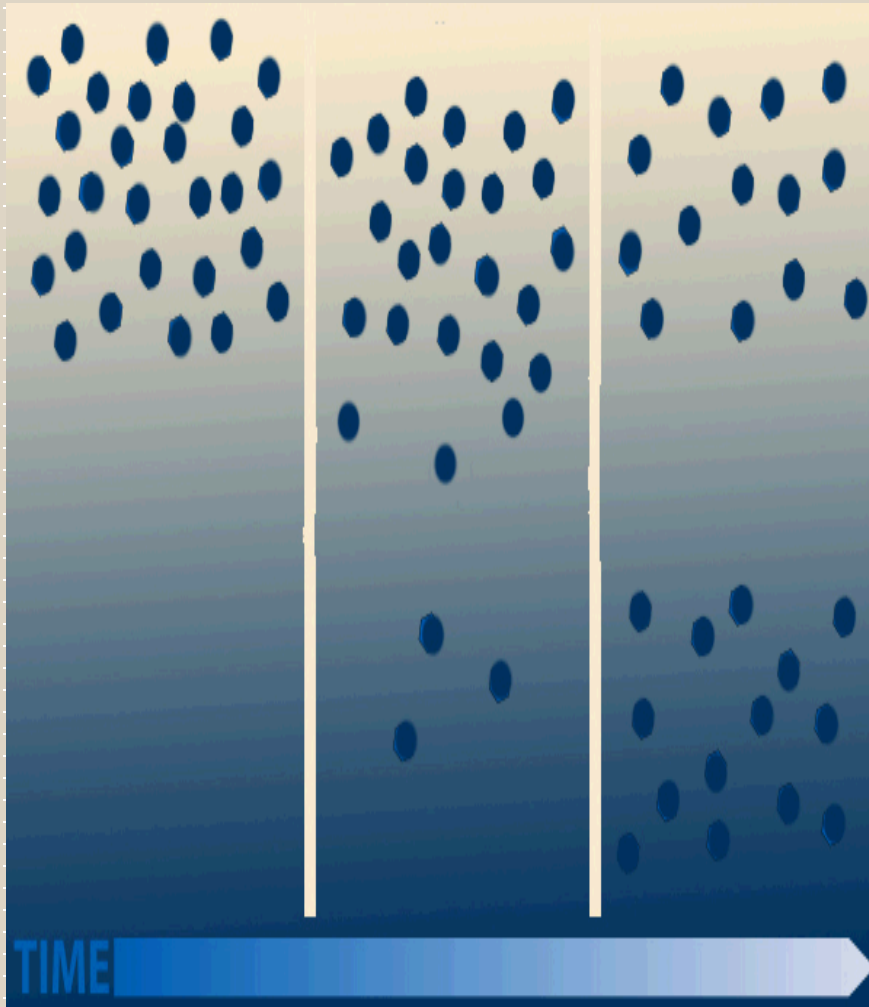


Interactive Session Summary



# DIFFUSION TEST

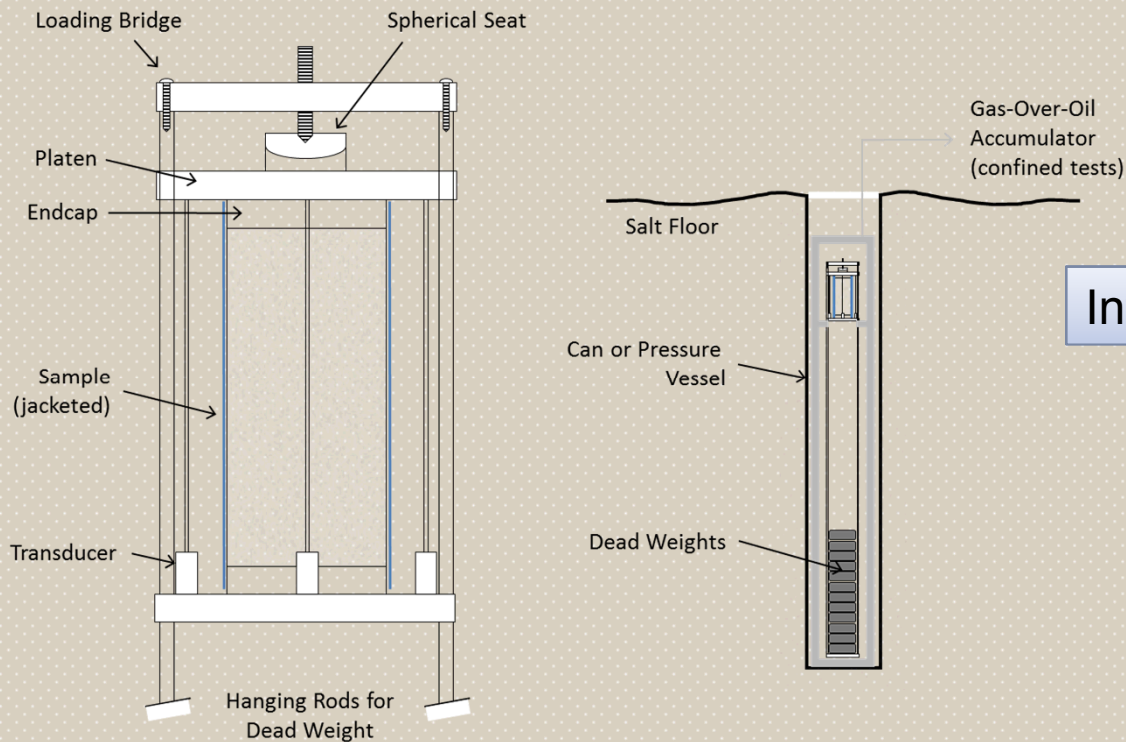
*Experimental measurements to characterize diffusion model parameters will be a key support for the safety case*



Interactive Session Summary

# UNDERGROUND SALT CREEP LABORATORY TO INVESTIGATE LOW-STRAIN-RATE WASTE PACKAGE BUOYANCY EFFECTS

*Understanding the potential for large, heavy waste packages to sink over time periods of  $10^4$  years or longer, is motivated by recently published low-strain-rate creep data, and requires advanced salt creep testing and modeling.*



Interactive Session Summary

**Figure 7. Concept drawing for low-stress (dead loaded) low strain-rate ambient temperature core testing apparatus, for confined and unconfined testing, to be deployed in a URL.**