SAND2017-5212PE

National Nuclear Security Administration

Science and Technology Working Group Update

Topic Area V: Science of Waste Management

May 24 - 26, 2017
Tel Aviv, Israel

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Topic Area V: Science of Waste Management

Major activities in 2016

- LANL/LLNL/SNL/SNRC/NRCN Technical Workshop 28-29 Feb. 2016
  - Areas of joint interest identified
- Scientific discussions between Labs' POCs and PIs to identify specific topics of mutual interest and to draft research proposals
- NNSA-IAEC Workshop on Nuclear Waste Management and Subsurface Science, Oct 31 – Nov 2 in Albuquerque, NM, to reach consensus on scopes of research and finalize proposals

Bob Huelskamp Lab POC (SNL)
Lab Technical POCs:
Gabi Bar Nes (NRCN)
Bob MacKinnon (SNL)
Annie Kersting (LLNL)
Paul Dixon (LANL)

Topic Area V: Science of Waste Management

Final proposals developed for three research topics

1st Topic: Damage Induced by Excavation and Heat Release of a Radioactive Waste Repository (SNL, LLNL, GSI, NRCN)

2nd Topic: Colloid-facilitated radionuclide transport in fractured carbonate rock: An integrated laboratory, field & numerical modeling study (LLNL, LANL, BGU, NRCN)

3RD Topic: Mechanisms of subsurface flow and radionuclide transport (LANL, SNL, NRCN, GSI)

The JSC has recommended the 3 proposed projects be initiated in 2017

Topic Area V: Science of Waste Management

Topics of interest for future collaboration

- **Nuclear Wasteform Interactions with Geologic Strata of the Yamin Plateau Northern Negev, Israel**

  Draft proposal developed

  Israel: Gabi Bar-Nes (PI), Erez Boukobza, Ofra Klein-BenDavid, NRCN
  US: Ed Matteo (PI), Patrick Brady, Sandia National Laboratories
  David Kosson & Kevin Brown, Vanderbilt University/CRESP

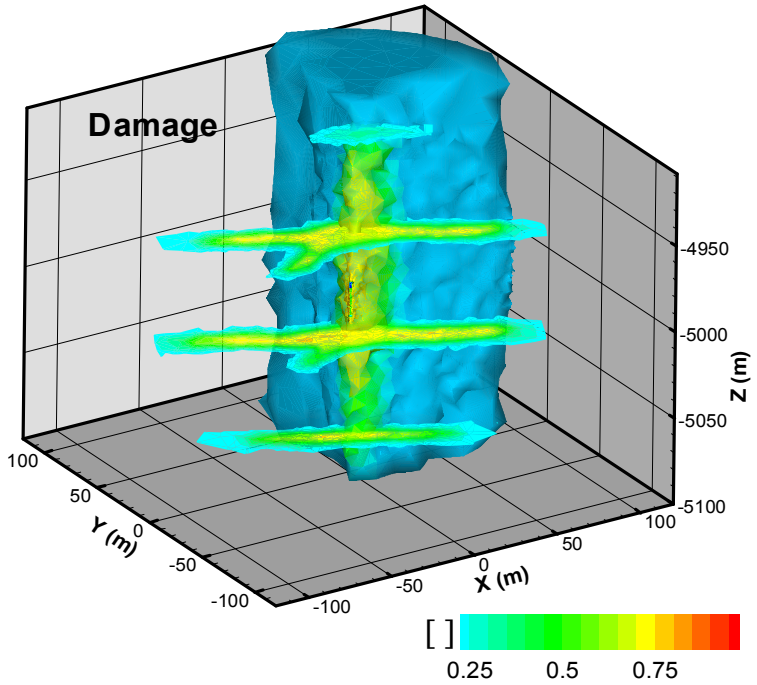
- **Deep Borehole Disposal Concept and Field Test**

Damage Induced by Excavation and Heat Release of a Radioactive Waste Repository

Eyal Shalev
Vladimir Lyakhovsky
GSI

Stephen Bauer
SNL

Tarabay Antoun
LLNL



Objectives

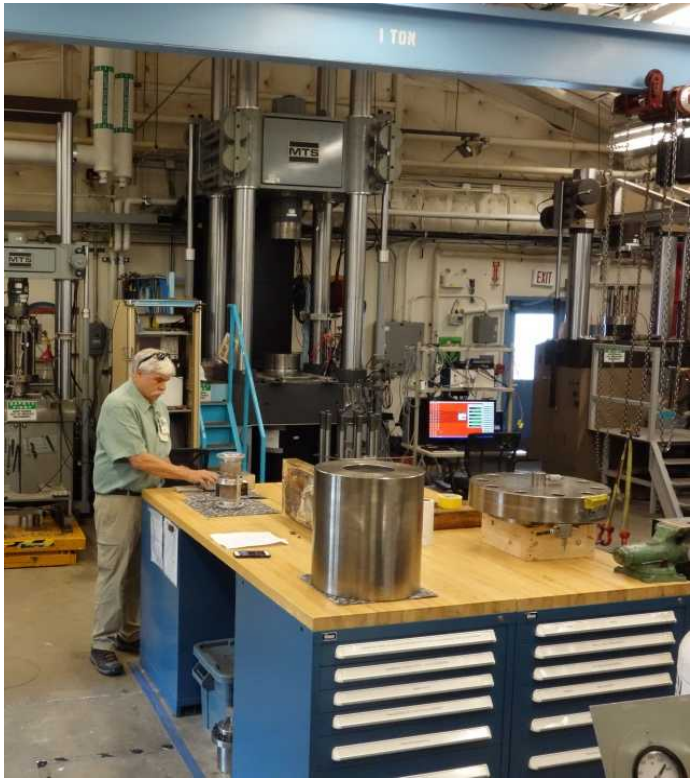
1. Develop and implement numerical methods to simulate excavation and thermal loading of deep borehole
2. Perform experiments to parameterize models and characterize host rock (arkose) for thermal, hydrologic and mechanical properties

Year 1 2017 Tasks

	Israel	SNL	LLNL
Task 1: Modeling Damage Created by Excavation	X		X
Task 2: Experimental study of the mechanical and transport properties for dry and saturated rock samples		X	
Task 3: Non-isothermal damage-porosity visco-elastic rheological model	X		X
Task 4: Code Modernization and Parallel Execution	X	X	X

Geomechanics Laboratory

Sandia National Laboratories



Colloid-facilitated radionuclide transport in fractured carbonate rock: an integrated laboratory, field & numerical modeling study

Noam Weisbrod[1], Ofra Klein-BenDavid[2], Emily Tran[1], Annie Kersting[3], Mavrik Zavarin[3] and Paul Reimus[4]

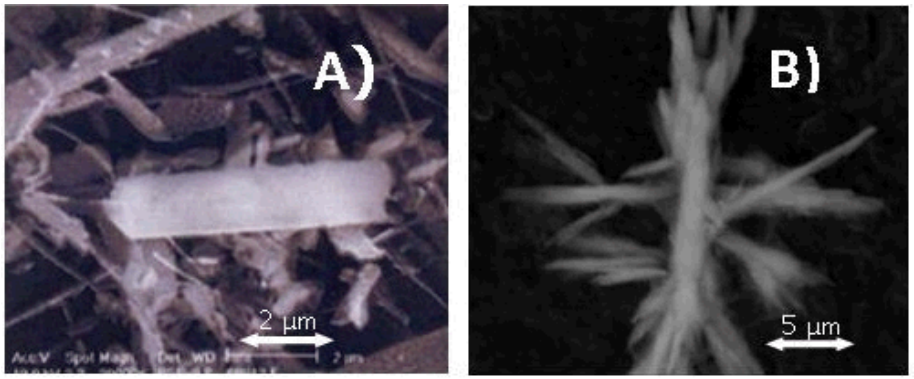
[1]Ben-Gurion University of the Negev Zuckerberg Institute for Water Research. [2]Nuclear Research Center of the Negev, [3]Lawrence Livermore National Laboratory, [4]Los Alamos National Laboratory

Objectives

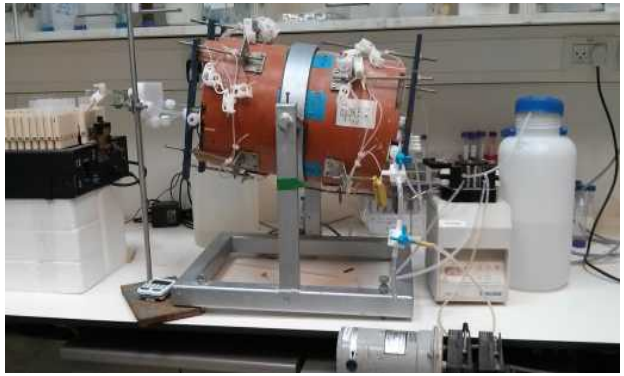
- To determine the importance of colloids in the migration of long-lived radionuclides from a spent nuclear waste repository in fractured carbonate rock
- Advance Israeli-US scientific capabilities in waste management
  - Collaborative science
  - Radiochemistry education
  - Student exchange
  - Numerical model application

Year 1 2017 tasks

	IAEC	LLNL	LANL
▪ Laboratory investigations of radionuclide transport parameters in support of follow-on transport experiments using naturally fractured carbonate rock core from Ne'ot Hovav, Israel	X	X	
▪ Modeling of previously collected geochemical and hydrologic field data from Ne'ot Hovav, Israel	X		X
▪ Israeli student exchange to both conduct research at LLNL and receive training in modeling and post-experiment advanced characterization techniques	X	X	
▪ Initiate fractured carbonate flow-through experiments	X	X	
▪ Convene an annual team planning workshop	X	X	X
▪ Write a joint summary report of work accomplished in FY17	X	X	X



Natural groundwater colloids

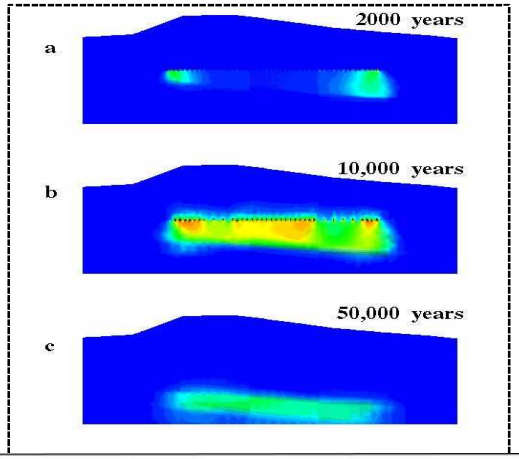


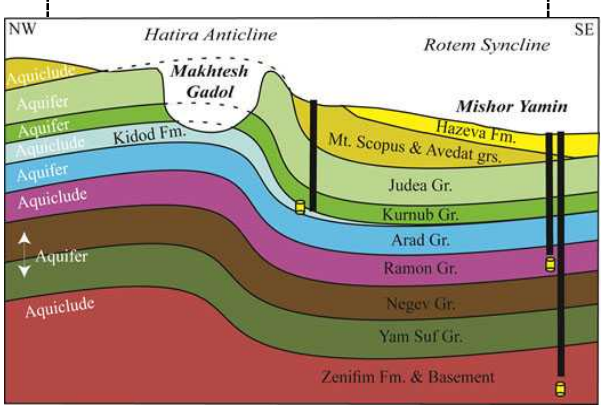
Flow-through rock core apparatus

Mechanisms of subsurface flow and radionuclide transport

Erez Boukobza[1], Gilles Bussod[2], Ofra Klein-BenDavid, Glenn Hammond[3],Paul Reimus[2], Ravid Rosensweig[4], Philip Stauffer[2], Hari Viswanathan[2]

[1]Nuclear Research Center of the Negev, [2]Los Alamos National Laboratory
[3]Sandia National Laboratory, [4]Geological Survey of Israel





Objectives

- To develop capabilities required to evaluate potential vadose zone sites for subsurface nuclear waste disposal in Israel.
- Demonstrate the applicability of advanced radionuclide transport modeling tools for generic application to geologic conditions in the Negev region.
- Carry out measurements using representative vadose zone samples from Israel that support parameterization of the NNSA and IAEC reactive subsurface flow and transport models.
- Initiate a joint collaboration and scientific exchange between US-NNSA and Israel-IAEC scientists

Year 1 2017 Tasks

	Israel	LANL	SNL
Year 1 Objective: Build preliminary "Conceptual Regional Subsurface Model" for Negev region.	X	X	X
Task 1: US Field Trip to GIS, Israel to: • Collect Negev rock specimens for analysis. • Design and initiate sample hydrologic measurements.	X X	X X	
Task 2: IAEC Scientist Visit to LANL to: • Design and Rad-Chemistry measurement protocols. • Initiate geochemistry/process modeling link.	X X	X X	X
Task 3: Initiate IAEC/LANL batch sorption and column desorption experiments.	X	X	X