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Status of Topic Area V: Nuclear Waste Management and Subsurface Science

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U.S. DEPARTMENT OF ENERGY | Nuclear Energy

NNSA National Nuclear Security Administration

NNSA IAEC Advance Meeting

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NNSA-IAEC Collaboration in Nuclear Waste Management and Subsurface Science

- Area V NNSA/IAEC collaborations were initiated in an October 2016 Workshop in Albuquerque, NM
- Research Projects
  - 3 have been approved, funded, and making significant progress
  - 2 are in the planning stage
  - 2 are in the discussion stage
- Area V Leadership (Gabi Bar-Nes (NRCN), Ofra Klein-Ben David (NRCN), Annie Kersting (LLNL), Paul Dixon (LLNL), Robert MacKinnon (SNL)) have regular telecoms to discuss status and plans for future activities
- Foreseen activities in 2017
  - Peer-to-peer exchanges and visits at labs and universities to conduct planned research
- Area V conducted a workshop in Israel at the Sde Boqer campus of the Ben Gurion University of the Negev on Dec 5-7, 2017

December 2017 Area V Workshop

December 2017 Area V Workshop*

- The objectives of the exchange were to:
  - Review progress of the active collaborative projects approved by the Joint Steering Committee in 2017;
  - Attain increased understanding of the geology of southern Israel as it pertains to concepts for geological disposal of nuclear waste;
  - Review presentations of new topics for consideration of mutual interest and elevation for review and approval to the Joint Steering Committee;
  - Convene project level working groups to discuss next steps of active projects and proposed new topics;
  - Strengthen relationships of the technical teams collaborating across all four laboratories, GSI, and Ben Gurion and Vanderbilt Universities.

* Gabi Bar-Nes, Technical Exchange Summary, NNSA IAEC NRCN GSI, S&T Topic Area V, December 5-7, 2017

Highlights of Active Projects*

- Damage Induced by Excavation and Heat Release of a Radioactive Waste Repository
  - Zenifim rock samples were shipped to Sandia for thermal, mechanical, and hydrologic characterization to develop constitutive models and support the GSI effort of modeling and numerical analyses.
  - NRCN has recruited to the team a computer scientist to accelerate the modeling codes on HPC class computers to simulate borehole integrity and migration performance.
  - Steve Bauer, SNL, attended a GSI hosted workshop in November in association with this project.

* Gabi Bar-Nes, Technical Exchange Summary, NNSA IAEC NRCN GSI, S&T Topic Area V, December 5-7, 2017

Highlights of Active Projects (cont.)

- Wasteform Interactions with Geological Strata
  - While not yet funded within the US labs, progress is being made on this project by NRCN and Vanderbilt University. Rock samples have been sent to Vanderbilt for analysis using EPA protocol to characterize mobility of contaminants through the samples. Cement formulation that will be cast around the samples has also been finalized.
  - A new NRCN post-doc has been hired for this work.
  - Transport data will be sent to Sandia for PFLOTRAN modeling, when funded. This is a reactive transport code. Results will be benchmarked with VU LSX-Orchestra modeling data. The SNL team will contribute in characterization of the samples using advanced methods.

Highlights of Active Projects (cont.)

- Deep Borehole Working Group
  - The working group began collaborating in August and has held five international teleconferences. Data needs for modeling and safety assessment based on US Deep Borehole research have been shared from Sandia to NRCN. An extensive bibliography was also provided.
  - NRCN and GSI are digitizing the well-logging analog data from boreholes drilled in the 1950s. Once finalized this will be provided to the US labs for 3D geologic framework development.
  - The working group identified waste form requirements and modified siting guidelines as additional steps necessary to the development of a deep borehole test design.

Highlights of Active Projects (cont.)

- Colloid-facilitated radionuclide transport in fractured carbonate rock
  - Emily Tran of BGU (PhD student) has a temporary assignment with LLNL to collaborate directly with Mavrick Zavarin and Annie Kersting to characterize specific fractured rock core samples regarding migration of colloids through the fractured zone using low-level radioactive tracer samples. This builds upon a year's worth of work at Ben Gurion using simulant tracers for the experiment.
- Mechanisms of subsurface flow and radionuclide transport
  - Ravid Rosenzweig (PI) has recruited an Israeli PhD student who has conducted a literature review. Prior to the workshop the Israeli together with the LANL team collected specific rock samples to be shipped to LANL to characterize geochemistry and hydrological properties.

Potential New Topics

- Several new topics were briefed by Israeli researchers to determine mutual interest. A few of these topics generated immediate interest and will be socialized further within the US labs
  - **Bio-cementation of Capping Layers in Near-Surface Radioactive Disposal Sites Using Microbial Induced Calcite Precipitation -** Hadas Raveh-Amit (NRCN) will be visiting SNL in March
  - **Mineralogical and geochemical characterization of the Zenifim Formation – potential nuclear waste repository,** Navot Morag, Geological Survey of Israel (GSI)