Long-Term Performance Monitoring of Metals and Radionuclides in the Subsurface; Strategies, Tools and Case Studies

DOE Vadose Zone and Long-Term Stewardship S&T Roadmaps Discussion

Facilitators: Stephen J. Kowall
                Daniel B. Stephens
End States - Vadose Zone and LTS
Cleanup, Closure and Research Drivers
Purpose of an S&T Roadmap

• Create a shared vision of R&D needs based on closure and enduring site activities and associated capabilities needed now/future

• Communicate capability-based technical needs among cleanup and closure sites and the R&D community

• Develop schedule and priorities for R&D

“We need these capabilities...”  “We can supply...”
S&T Roadmap Approach

• Identify needed S&T capabilities and compare with current capabilities and practices

• *Identify science and technology that will provide needed capability improvements*

• *Identify tasks to complete R&D, and put capability improvements into practice.*
The VZ S&T Roadmap Team

The Executive Committee

**Chair:** Dan Stephens, DB Stephens & Assoc.

**Vice-chair:** Steve Kowall, INEEL

Frank Parker, Vanderbilt University
Lorne Everett, IT Group
Ed Weeks, USGS
Mike Graham, BHI
Carl Enfield, EPA
Cathy Vogel, DoD
John Wilson, New Mexico Tech
Darwin Ellis, Schlumberger Corp.
Dave Borns, Sandia National Lab
Rien Van Genuchten, USDA
The LTS S&T Roadmap
Executive Committee

**Board of Directors**

- Chair: E. Larry Davis, BWXT SRS
  - George Apostolakis, MIT
  - J. Lane Butler, Kaiser-Hill
  - Shah Chourhury, DOD BRAC
  - Lorne G. Everett, The IT Group
  - Howard Roitman, Colorado DPHE - ECOS LTS
  - James Woolford, EPA HQ
  - Clay Nichols, DOE-ID
  - Bruce, Hallbert, INEEL, Ex Officio

**Steering Committee**

- Dave Borns, Sandia National Lab - Monitoring and Sensors
- James H. Clarke, Vanderbilt - Contamination Containment and Control
- W. R. Freudenburg, UC SB - Decisionmaking and Institutional Performance
- James V. Mohatt, JVM & Assoc. - Safety Systems and Institutional Controls
  - Steve Kowall, INEEL, Integration
Roadmap Participant Composition
Roadmap Executive Committee and Work Groups - (38 people)

**Affiliation**
- Private: 24%
- University: 24%
- Govmt: 16%
- DOE Contractors: 36%

**Perspective**
- Site Operations: 37%
- R&D: 42%
- Legal: 8%
- Oversight: 13%
Monitoring and Stewardship of Legacy Nuclear and Hazardous Waste Sites Workshop, Erice, Sicily

- Stephen Kowall, INEEL
- Lorne Everett, UC Santa Barbara and Lakehead University
- G. Balamurugan, Institute Engineers, Malaysia
- James H. Clarke, Vanderbilt
- Allan Duncan, NIREX/Euratom
- Liz Hocking, ANL
- Tomio Kawata, Japan Nuclear Cycle Development Institute
- Andrei Rybalchenko, All-Russian Design and Research Inst.
- David Smith, LLNL
- Igor Zektser, Russian Academy of Sciences
Integration Thrusts From the VZ S&T Roadmap

Combining The Basics To Understand, Measure, Monitor and Model Vadose Zone Systems

• Coupling basic properties and processes
• Combining processes and data at different scales in integrated models
• Estimation and Reduction of Uncertainty
• Improving Site-Monitoring Systems
  – Progressive Steps for a Monitoring System at a Contaminated Vadose Zone Site
  – Fate and Transport Monitoring and Conceptual Model Cataloguing
  – Source Identification and Monitoring
• Model Integration and Validation at the System Level
Capability Enhancements Necessary for LTS System 
from the Pre-Decisional Draft LTS S&T Roadmap 

**Monitoring and Sensors**

- **Monitor the Site and the LTS System – Sensors and Sensor Systems**
  - Identify contaminant monitoring needs for all media of potential transport or exposure and fill sensor technology gaps...
  - Establish site-specific parameters for environmental exposure routes for both occupational...and non-occupational...routes
  - Improve...systems for... active and passive safety systems
- **Manage the LTS System – Performance Verification and Monitoring**
  - Provide (tools) to demonstrate, verify and monitor (LTP)...of containment and control systems
  - ...improve (tools for) subsystems
  - Improve tools for collecting, analyzing, evaluating, and disseminating performance data
Erice Recommendation Areas

• Stakeholder Involvement in Stewardship
• Containment of Legacy Wastes During Stewardship
• Near-Surface Containment of Legacy Wastes Requiring Long-Term Stewardship
• Monitoring of Legacy Wastes and Burial Sites

  • “EU has proscribed designs with no monitoring.”

• For Erice paper contact KOWASJ@INEL.GOV
Sources for Roadmaps

- http://www.inel.gov/vadosezone/
- http://lts.inel.gov/st-roadmap/

- A National Roadmap for Vadose Zone Science & Technology, Understanding, Monitoring, and Predicting Contaminant Fate and Transport in the Unsaturated Zone, DOE/ID-10871, August 2002
- Long-Term Stewardship Science and Technology Roadmap, DOE/ID-10926, September 2003, Pre-Decisional Draft
Take Away Message

• Roadmaps represent a federal multi-agency, state, national laboratory, university, and, industry consensus product
• Recommendations are in line with those of many workshops & stakeholder meetings
• Roadmaps have near-term value
• Roadmaps can be developed into long-term implementation plans given a federal Champion, but require a “plus up”