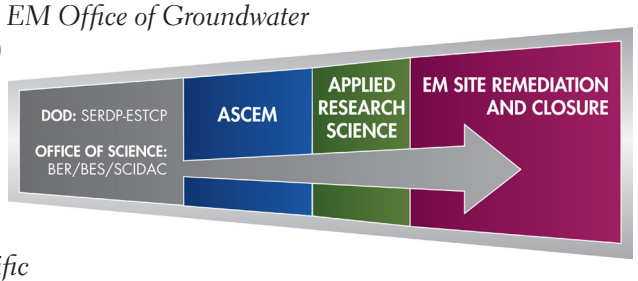
Scientific Opportunities to Reduce Risk in Groundwater and Soil Remediation

What Did the National Academy of Sciences Identify as the Key Technical Challenges in Groundwater and Soil Remediation?

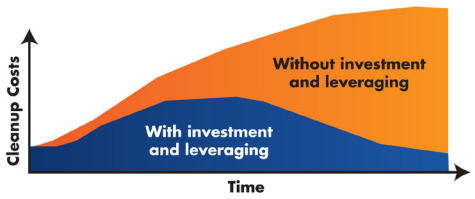
- *Contaminant subsurface behavior is poorly understood (high risk).*
- *Site and contaminant source characteristics may limit the usefulness of baseline (traditional) approaches.*
- *Long-term performance of trench caps, liners, and reactive barriers cannot be assessed with current knowledge.*
- *Long-term ability of cementitious materials to isolate wastes is not demonstrated*

How Does Transforming Office of Science (SC) Products Advance DOE Environmental Management's (EM) Commitment to the Public, and Environment and Impact Site Milestones?

- *The work conducted within the EM Office of Groundwater and Soil Remediation (EM-32) is the critical link between basic science understanding and the implementation of remediation technologies that match real-world site needs.*



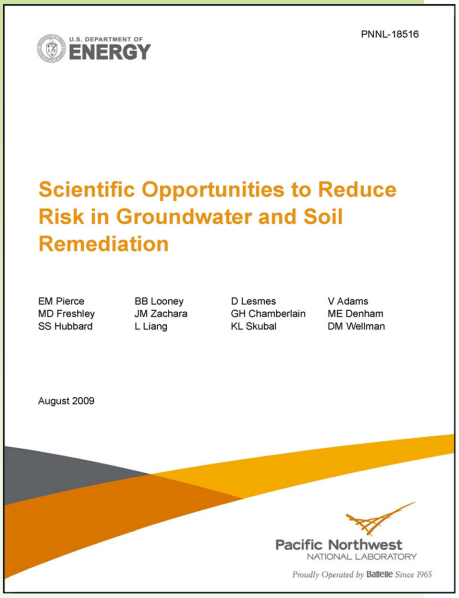
- *EM-32 transforms basic scientific and engineering knowledge to provide advanced remedial solutions to reduce the technical risk, cost and timeline necessary to address unique soil and groundwater challenges and bring sites to closure.*



- *Investment in the EM-32 program now will result in significant cost savings over the long term, particularly for sites that require stewardship over time frames of hundreds or thousands of years.*

Why Must the SC and EM Maintain a Multiscale, Interdisciplinary Approach for Remediation Risk Reduction?

- *The DOE complex represents, one of the largest, most complex, and formidable subsurface environmental restoration challenges in the world.*
- *A basic science approach cannot fully capture the emergent properties of complex systems that often dominate the overall system response.*
- *An applied research approach also cannot account for the inherent complexity of real earth systems, which leads to ineffective approaches to site characterization, modeling, and stewardship.*



U.S. DEPARTMENT OF ENERGY

EM Environmental Management

safety ❖ performance ❖ cleanup ❖ closure

For more information:
www.em.doe.gov/Pages/GroundwaterSoilCleanup.aspx

How Is EM Leveraging Basic Science to Develop Innovative Remedial Solutions?

- *SC and EM program managers regularly communicate program direction, significant research findings, and emerging issues.*
- *Informal technical exchanges and formal meetings, such as SC's Subsurface Biochemical Research Program annual Primary Investigator (PI) meeting and EM-32's annual program review, facilitate sharing of basic and applied research findings between SC and EM principal investigators.*

What Strategic Areas and Transformational Approaches Is EM Advancing to Address NAS Challenges and Site Milestones?

- ***Improved Sampling and Characterization Technologies and Strategies*** *– Basic science describing controls on contaminant behavior in complex subsurface environments is translated into novel methods for characterizing, accessing, stabilizing, and monitoring contaminants, e.g., in vadose zone environments.*
- ***Advanced Predictive Capabilities*** *– State-of-the-art scientific tools are being developed to understand and predict contaminant fate and transport in natural and engineered subsurface systems.*
- ***Enhanced Remediation Methods*** *– Novel, systems-based remedial solutions consider both vadose zone remediation and groundwater goals, reducing costs, increasing effectiveness, and reducing risks to human health and the environment.*
- ***Enhanced Long-Term Performance Evaluation and Monitoring*** *– A technical basis for transitioning from active to passive remediation is incorporated into long-term strategies for site remediation, monitoring, and verification.*

Interface Between Basic Science (SC) and Applied Research (EM) in Subsurface Science