Technology Development—Priorities

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June 14, 2013

Why is this this a priority?

Technology investment results in:

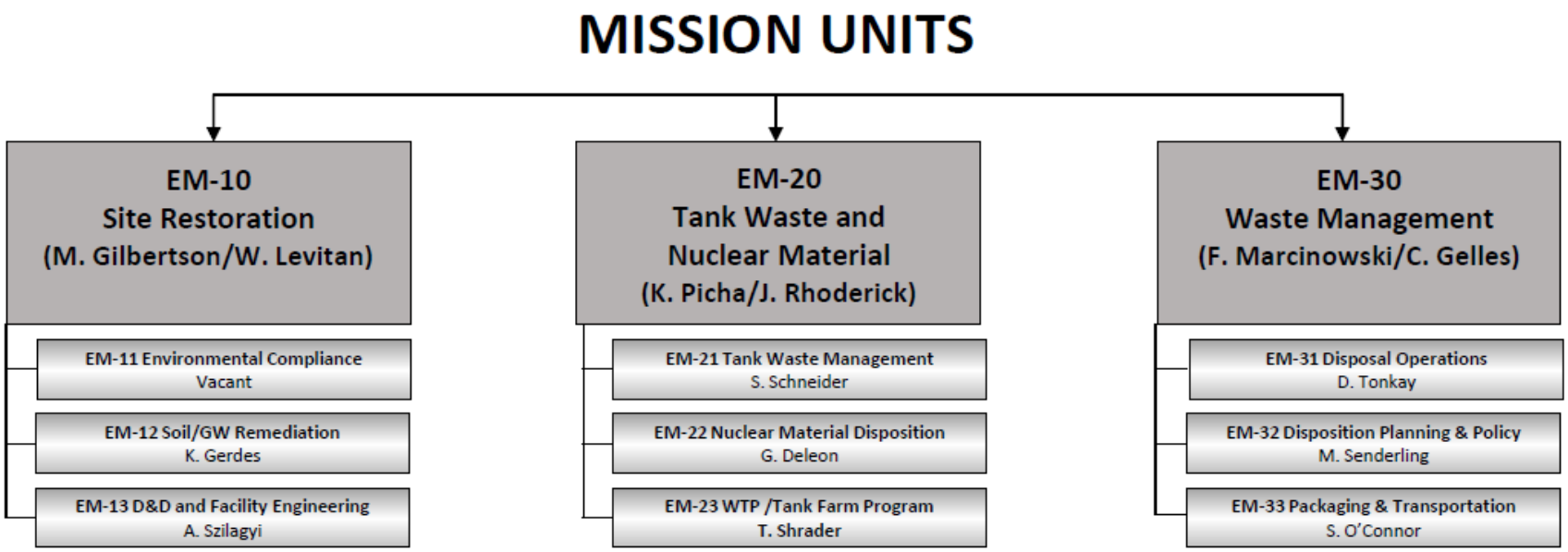
- Improved worker safety
- Reduced technical risk
- Facilitated accelerated cleanup
- Resolution of complex technical challenges
- Significant lifecycle savings

Initiatives

- EM's new National Laboratory role
  - SRNL and PNNL are jointly engaging the broader national laboratory community to bring the scientific and technological rigor needed to evaluate/prioritize alternatives, define/execute technology development opportunities, and inform decisions that will reduce technical and programmatic risks

- EM, NE, NNSA roadmap for coordinated, Department-wide approach to nuclear separations

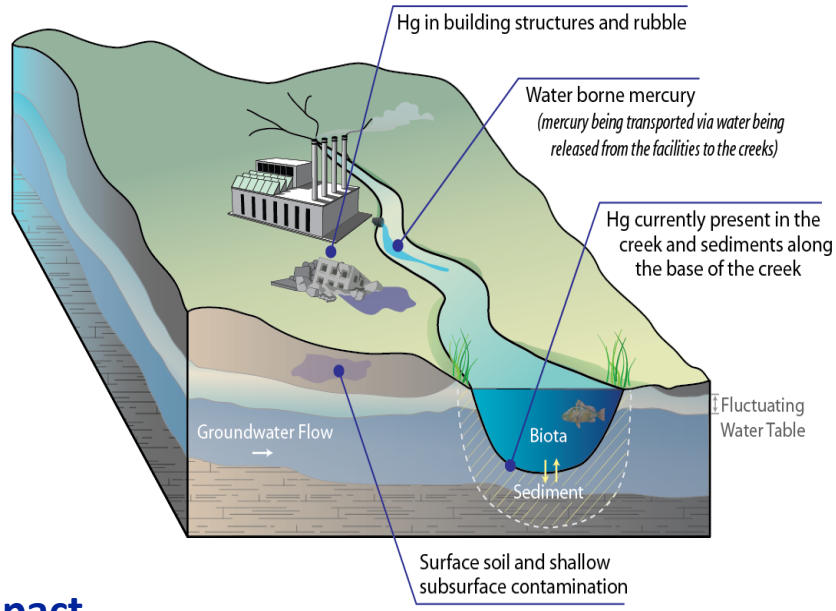
Organization Chart: Where Does Technology Development Fit?



Remediation of Mercury and Industrial Contaminants - Applied Field Research Initiative

Challenge

- Identify and quantify the release behavior of mercury and other contaminant sources
- Develop a scientifically-defensible approach to treat, stabilize, and dispose of mercury-contaminated waste (soil, sediment, and debris) in a cost-effective manner
- Develop remediation approaches that control contaminant flux to surface water, groundwater, and ecological receptors
- Provide the technical underpinning needed to support a scientifically-defensible and regulatory-acceptable end-state



Solution – *Transformational Applied Science*

- Mercury Sorption Technology – new and commercially available adsorption media to support an interim treatment action for controlling mercury flux at Y-12
- New Conceptual Model – improved, updated understanding of mercury sources, transport pathways, and flux at Y-12
- Soil Treatment Technology – remediation approaches for in situ mercury stabilization are in development
- Characterization tools – identification of subsurface mercury with less need for invasive sampling

Impact

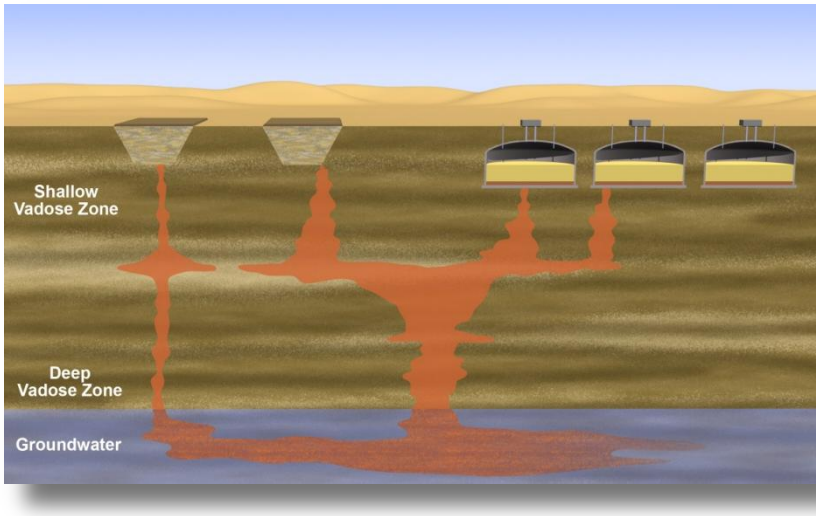
- A systems-based approach to control the flux of contaminants in soil and water to protect surface water, groundwater, and ecological receptors from decades old contamination at Oak Ridge and other DOE sites

Project Investment: $40 to $60M over 5 years
Potential Lifecycle Cost Savings: $0.5 – $1B
EM Soil & Groundwater Program
Program Investment: $150 to $200M over 5 years
Potential Lifecycle Cost Savings: $6 – $10B

Deep Vadose Zone - Applied Field Research Initiative

Challenge

- The properties of the DVZ and the paucity of suitable remediation, characterization, and monitoring capabilities complicate decision process for vadose zone remedial actions. Primary challenges hindering vadose zone remediation and closure are:
  1. Defining risk-informed contaminant fluxes from vadose zone to groundwater, and
  2. Developing, implementing and monitoring flux minimization technologies to reduce vadose zone contamination below levels requiring control



Solution – *Transformational Applied Science*

- Define scientifically and technically defensible risk-informed end points that constitute cleanup progress or completion which are protective of human health and the environment, and
- Provide the scientific and technical understanding for technology development and implementation of advanced systems-based approaches for subsurface characterization, monitoring, and remediation to achieve alternate end points and meet cleanup and closure goals of DOE sites

Impact

- Ensure long-term protection of water resources through development and application of effective solutions in characterization, prediction, remediation, and monitoring DOE's deep vadose zone challenges

Project Investment: $40 to $60M over 5 years
Potential Lifecycle Cost Savings: $0.5 – $1B
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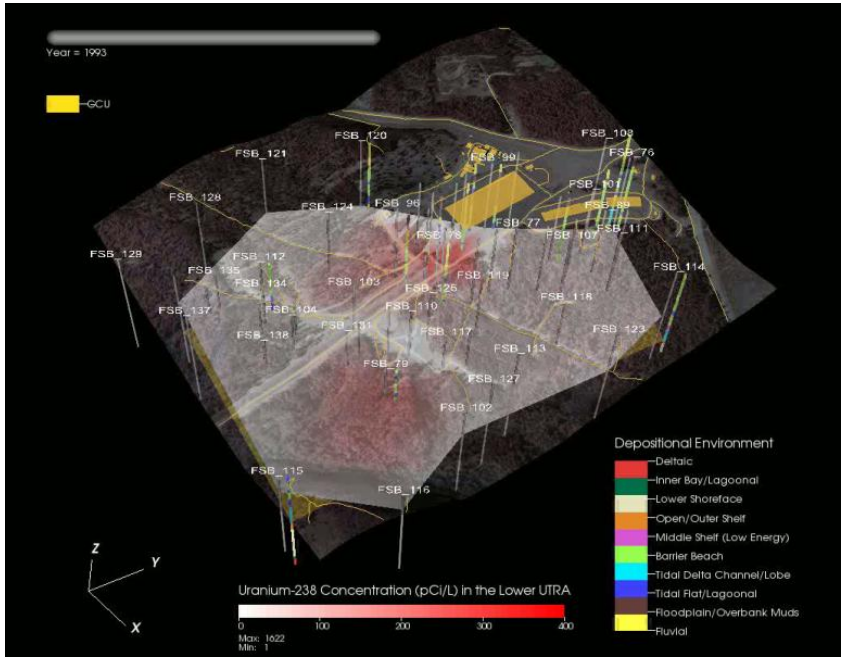
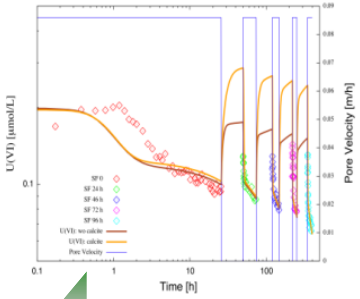
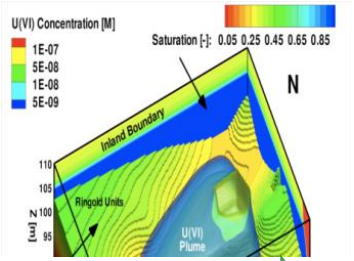
Advanced Simulation Capability for Environmental Management (ASCEM)

- A state-of-the-art tool for predicting contaminant fate and transport through natural and engineered systems
- The modular and open source design will facilitate a new approach for integrated modeling and site characterization
- Will enable robust and standardized future performance and risk assessments for EM cleanup and closure



Wide Range of Platforms





Wide Range of Complexity

Advanced Simulation Capability for Environmental Management (ASCEM)

Challenge

- Reduce time required and financial cost of remedial actions at sites within EM complex by providing scientifically defensible modeling and simulation tools that accurately address complex environmental management situations
- Develop an integrated, high-performance computer modeling capability to simulate multiphase, multi-component, multi-scale flow and contaminant transport, waste degradation and contaminant release, including
- Provide tools for decision making: parameter estimation, visualization, uncertainty quantification, data management, risk analysis, and decision support
- Leverage investments made by SC, NE, RW, and FE as well as other Federal agencies to capitalize on significant investments and reduce the lifecycle development time and costs

Impact

- Provides scientifically defensible and standardized risk and performance assessment
- Facilitates optimization of remediation and monitoring strategies

In-Situ Decommissioning (ISD)

Challenge

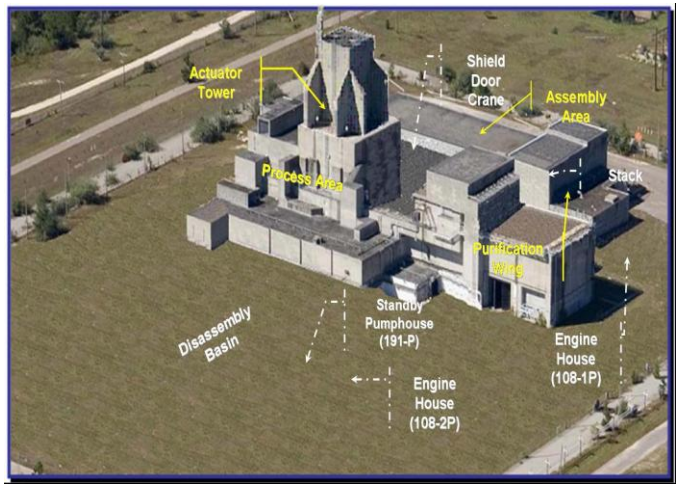
- DOE currently has thousands of contaminated excess buildings awaiting decommissioning
- Traditional demolition is costly, results in significant risks to workers, as well as risks and costs associated with transporting the materials requires significant energy input and results in greenhouse gas emissions.

Solution

- ISD is a viable alternative to demolition. ISD efforts focus on:
  - Material Science – Improved grout formulation, delivery systems and material degradation analysis
  - Sensors and network systems for long-term monitoring of contaminant release and movement

Results

- ISD of P and R reactors at SRS complete, U plant in process
- Effectively achieve end-state requirements; protect human health and the environment; reduce the need for additional landfill space; and reduce carbon emissions by decreasing trucking requirements



Investment: $3M to date, $9M needed

Potential Lifecycle Cost Savings: $4B

Historical Black Colleges and Universities

- Supporting 9 schools in South Carolina and Georgia
  - Allen University, Benedict College, Claflin University, Clinton Jr. College, Denmark Technical College, Morris College, Paine College, South Carolina State University, Voorhees College
- Approximately $8M in funding per year
- Focus on STEM (science, technology, engineering, math)
- Support includes:
  - Scholarships
  - Student internships at national laboratories
  - Vocational training
  - Faculty and post-doc salaries and hiring
  - K-12 education and teacher training
  - Laboratory renovations, equipment, supplies
  - Research projects in remediation, emergency response, transportation modeling, waste treatment

Interstate Technology & Regulatory Council (ITRC)

- ITRC works to break down barriers to the use of innovative environmental technologies by
  - Producing guidance documents and training that are used by environmental professionals across the country to increase regulatory consistency from state to state
  - Fostering integration of new technical developments within existing regulations
  - Creating networks of technical experts for use by states when making decisions on innovative environmental technologies/approaches
- ITRC consists of 50 states, the District of Columbia, multiple federal partners, industry participants, and other stakeholders
- ITRC FY 2013 teams are: Environmental Molecular Diagnostics, Biochemical Reactors, Contaminated Sediments – Remediation, Groundwater Statistics and Monitoring Compliance, DNAPL Site Characterization, Munitions Response, Petroleum Vapor Intrusion, and Risk Assessment

Working with the Office of Science

Identifying scientific research opportunities to resolve major legacy waste challenges

- **Waste Forms**: Reducing glass volume and alternatives to LAW
- **Tank Waste Chemistry**: Controlling the glass
- **Multi-phase flow and rheology**: Enabling safe and effective mixing and transfer
- **Predictive modeling and subsurface remediation**: Enabling site closure
- **Legacy mercury**: A watershed-scale scientific and technical cleanup conundrum.

Other Resources

Consortium for Risk Evaluation with Stakeholder Participation (CRESP)

- Cementitious Barrier Partnership
- Leaching Environmental Assessment Framework
- Optimization of Liquid Waste Processing at the Hanford Site under Uncertainty
- Ecological and Human Health Evaluation, Buffer zones, and Stakeholder involvement
- DOE Landfill Partnership
- Long term performance of near surface contamination isolations systems
- Long term performance of geosynthesis Used in Surface barriers for disposal facilities

Florida International University (FIU)

- Various small projects

Path Forward

- FY 2013 HQ Technology Development Budget Request: $20M
  - FY2013 Sequestration: $9.8M (based on FY2012 Enacted)
  - FY2013 Continuing Resolution: $20M
- FY 2014 HQ Technology Development Budget Request: $29M
- Beyond: EM recognizes additional technology investments are needed to achieve significant life cycle savings