ARPA-EM
ADVANCED RESEARCH PROJECTS AGENCY
FOR ENVIRONMENTAL MANAGEMENT

Advanced Research Project Agency for Environmental Management

Reducing Project Risk, Accelerating Cleanup Mission

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Innovation Important to EM Success

Significant Return on Investment

- Billions of Dollars Saved
- Years Off Baseline Schedule
- Approximately 20:1 Return on Investment

Partnerships Move Science to Operations

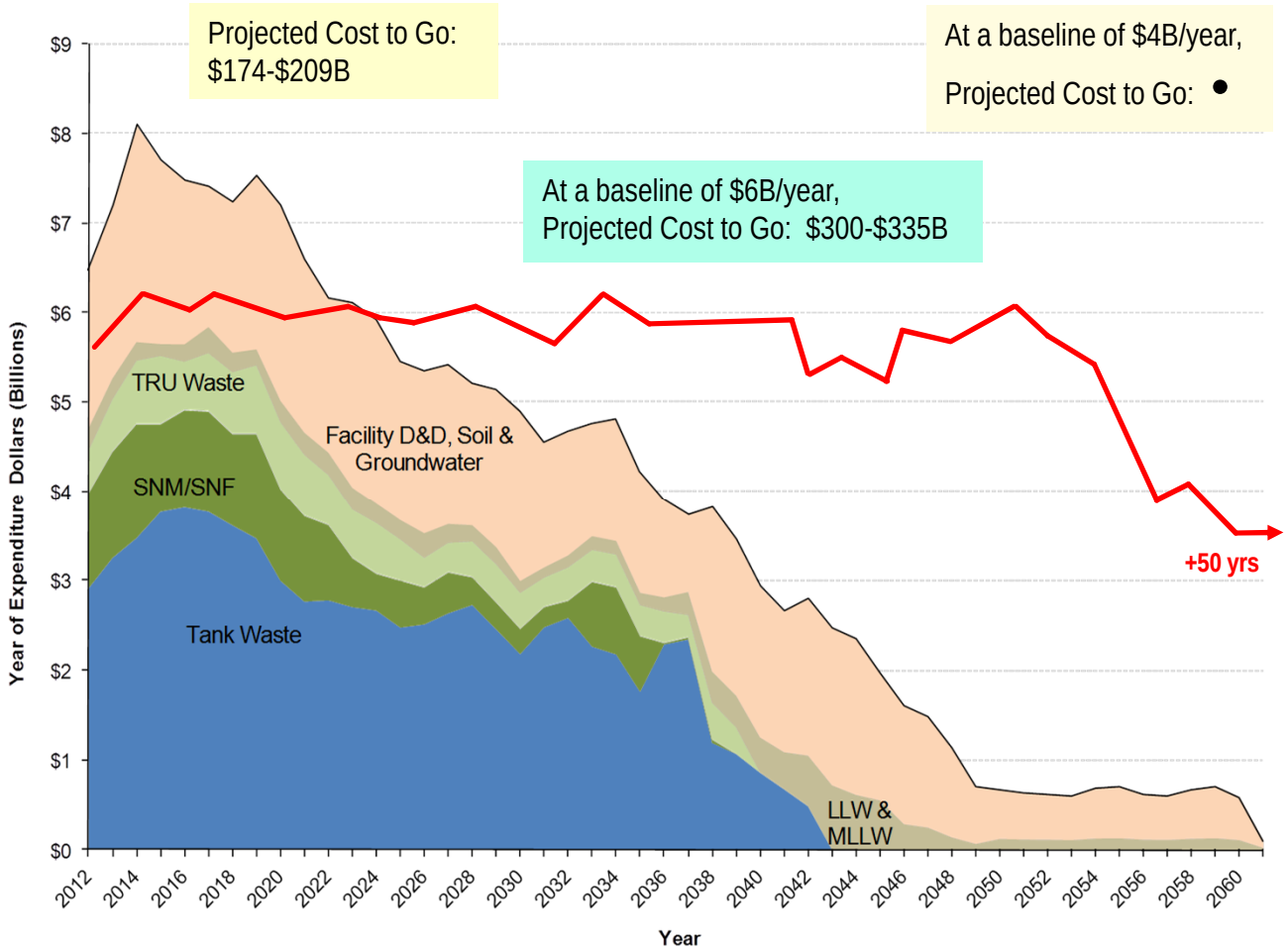
- National Laboratories, Universities, Contractors, Regulators

Consistent and Focused Investments

- Discover/Develop/Deploy

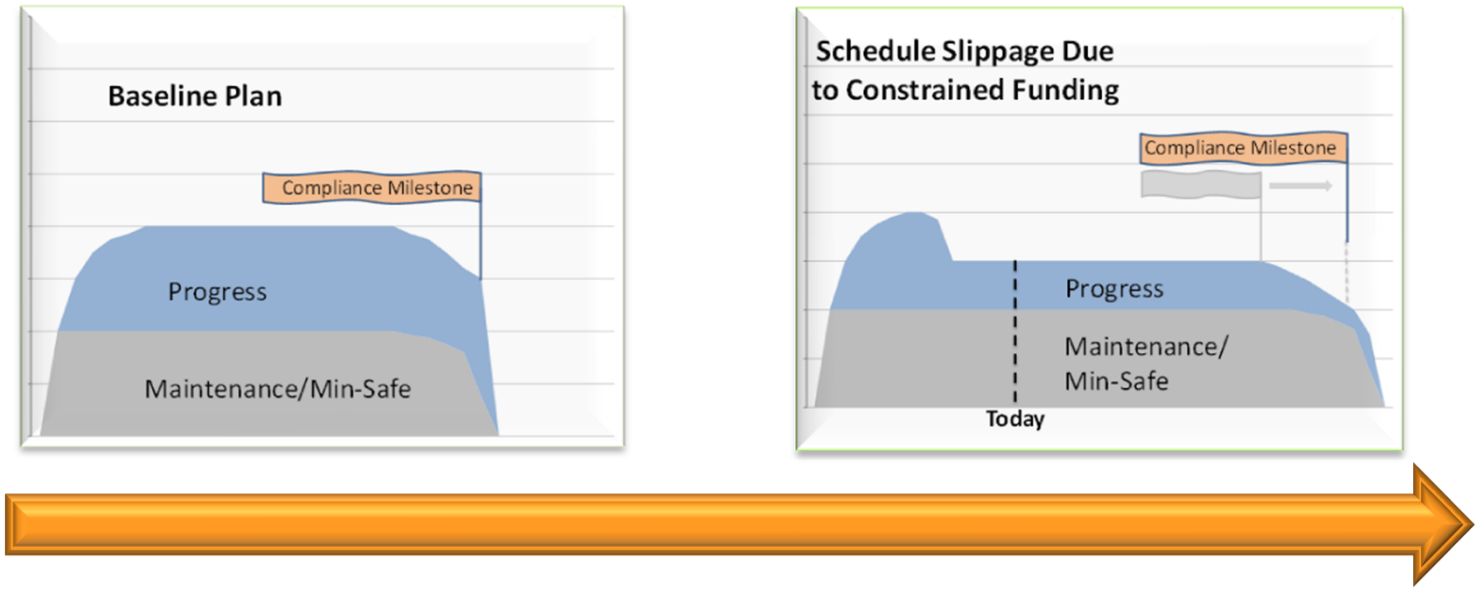
EM Lifecycle Cost is Function of Funding Level

- Meeting baseline regulatory agreements will require unrealistic funding.
- Optimistic funding levels push cleanup schedule past 2070.
- As cleanup schedule extends, maintenance and infrastructure consume increasing fraction of available funds.



Innovation is Needed Now More than Ever

Accelerate Progress / Reduce Capital and Operating Cost



ARPA-EM Program Areas of Opportunity:

- **Processing High-Level Liquid Waste and Legacy Materials**
  Over 80M gallons of liquid waste
- **Remediating Soil, Groundwater, and Contaminated Facilities**
  Over 90 soil/groundwater plumes
- **Assessing/Validating Long-Term Remedies**
  Long-term monitoring/assessment at "closed" EM sites estimated at $10B through 2070

High Level Waste and Legacy Materials

Challenges

- 80+ million gallons liquid radioactive waste stored in degrading underground tanks
- Large waste processing facilities take decades to design and build
- Many construction projects have multi-year delays and substantial cost overruns

Desired Outcomes

- Reduce capital and life-cycle costs
- Decrease plant footprint
- Reduce chemical and criticality risks
- Increase flexibility for process upgrades/changes

Opportunities for Innovation

- Chemical Process Intensification (CPI) to reduce scale, minimize hazards and improve efficiency
- Smart Manufacturing (SM) to automate and simplify operations, reducing complexity and cost
- Small, modular equipment adapted for processing flexibility

Green, Sustainable Remediation of Soil, Groundwater & Contaminated Facilities

Challenges

- Cleanup of ~100 groundwater plumes and over 1000 contaminated facilities
- Limits on disposal records, difficulties in analysis, inadequate models of contaminant distribution and migration

Desired Outcomes

- Reduce worker exposure
- Eliminate secondary waste streams
- Improve operating efficiencies and reduce lifecycle cost

Opportunities for Innovation

- Natural attenuation to replace energy-intensive active remediation systems
- Coupled hydrogeologic/analytical data models to predict contaminant behavior
- Virtual/gaming environment to train workers and plan decommissioning
- Remote and robotic systems to characterize and decontaminate facilities
- In-situ decommissioning approaches

Assessment of Long-term Effectiveness

Challenges

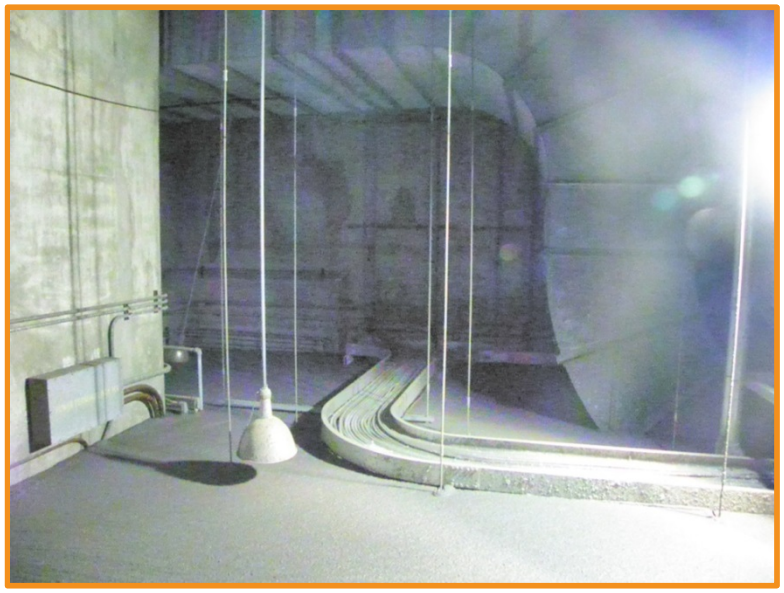
- Hundreds of individual remedies across complex
- Extensive characterization and monitoring required to assess remedy effectiveness
- Decades-long monitoring and assessment required
- Thousands of wells and hundreds of locations require assessment and monitoring

Desired Outcomes

- Reduce worker exposure
- Reduce need for sampling, sample transport, and assessment
- Improve remedy evaluation and decision process

Opportunities for Innovation

- Remote sensing and secure wireless technology for monitoring
- Transport models coupled with characterization data to provide improved assessment/decision process



Translating the DARPA Model to EM – Key Characteristics

Challenge-Based Approach

- Work with field offices, HQ, site contractors to identify and address highest priority challenges
- Focus on revolutionary technical options for step-change impacts

Strong Technical Program Managers

- Deep understanding of EM challenges
- Provide compelling end-state vision
- Assesses merit of new technology/operational requirements
- Accounts for outcomes and program success

Focus on Implementation

- Clear insertion targets
- Project plans span concept development to Technical Readiness Level Five

Getting ARPA-EM Started

FY14 – Program Initiation and Development

- Select Program Director, Program Managers
- Establish organizational framework, support structure
- Begin identification of technical program areas and key program challenges

FY15 – Ramp up to Full Operation

- Complete appointments of Program Managers, program structure
- Work closely with stakeholders to develop vision statements in initial program areas
- Communicate objectives, needs, process to broad technical community- especially seeking to engage non-traditional technical suppliers (i.e., not usually engaged in EM work)
- Develop and issue solicitations, make initial awards

FY16 – Fully Operational – Developing the Portfolio

- Develop and issue solicitations in additional program areas
- Make awards in program areas according to plans
- Conduct progress reviews on technical projects that are underway
- Increase visibility and engagement in technical community
- Conduct internal review to assess and analyze progress, adjust program accordingly

Potential Organization Structures

Stand-alone Organization

- Separate organization within DOE - operating as a program office
- Significant autonomy - control of program priorities and focus areas
- High level of visibility and priority

Under the Umbrella of Existing Program (e.g., ARPA-E)

- Interim step to jump start a stand-alone structure
- Takes advantage of existing support structure (contracting, financial systems, etc.)
- Provides shared cultural environment for new ARPA-EM program management

Within Office of Environmental Management

- Risk of having priorities and funding redirected for near-term needs
- Loss of autonomy to be disruptive
- Lack of Congress/OMB support

Completing Innovation Ecosystem

- Basic science providing new tools and understanding
- EM-TD to improve current technologies
- ARPA-EM challenging current approaches
- Program incentives to encourage change