# Independent Assessment of Science and Technology for the Department of Energy's Defense Environmental Cleanup Program

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**Presentation to the *Committee on Supplemental Treatment of Low-Activity Waste at the Hanford Nuclear Reservation***

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# Study Request

**Section 3131** of the conference report for the National Defense Authorization Act of 2017 (P.L. 114-328) .

The study mandate was placed into the Act by the House Armed Services Committee because “The [Committee] believes that such a study will support progress [in the cleanup program] and provide an opportunity to increase focus on promising technology advances or alternative approaches” (H Rept. 114-537).

# Statement of Task

The study will provide

1. A **review of DOE-EM's technology development efforts**, including an assessment of the processes by which technologies are identified and selected for development.

2. A review and assessment of the **types of technologies** and/or alternative approaches for the DOE-EM cleanup program that could

   a. Reduce long-term costs,
   b. Accelerate schedules,
   c. Mitigate uncertainties, vulnerabilities, or risks, or
   d. Otherwise significantly **improve the cleanup program**.

# Academies Committee

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# The Committee's Position

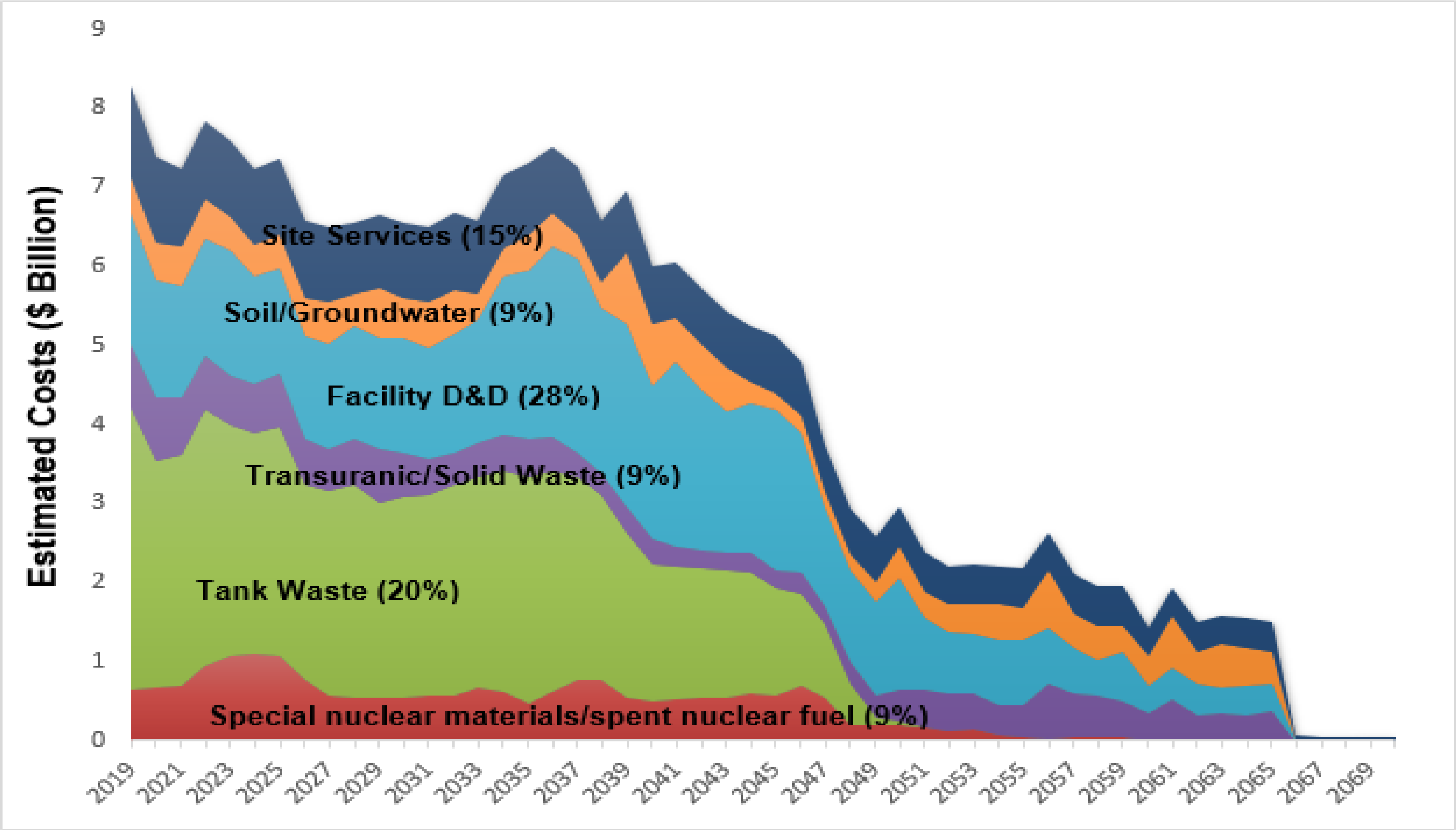
- Since 1989 DOE-EM has cleaned up 91 sites at a cost of about $170 billion.

- The cleanup program has not yet reached its halfway point from either a cost or a schedule standpoint.
    - Cleanup of the remaining 16 sites will continue for at least another 50 years at an estimated cost of $377 billion.*
    - Many of EM's most complex challenges (Hanford, Savannah River, Oak Ridge, and Idaho) remain.

- The cleanup program's 50+ year timeline provides ample time for new cleanup approaches and technologies to be developed and deployed in order to reduce cleanup costs and schedules and to mitigate cleanup risks and uncertainties.

* A recent update on Hanford's lifecycle costs and schedules suggests that DOE's current estimate could be low by hundreds of billions of dollars and several decades

# Lifecycle Cost Estimates

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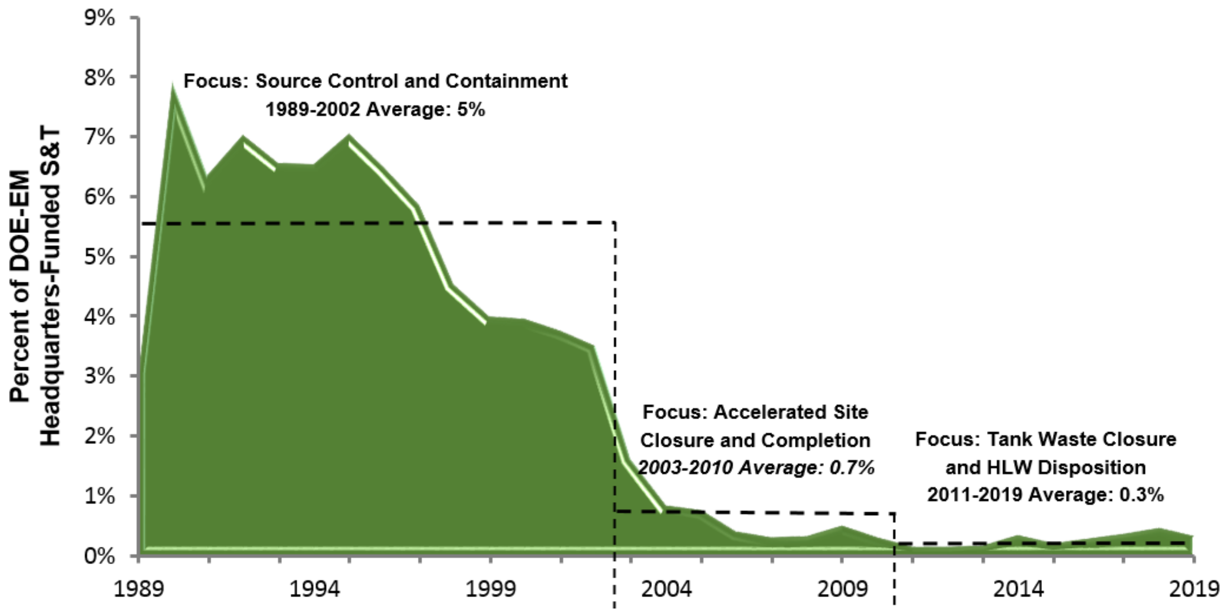
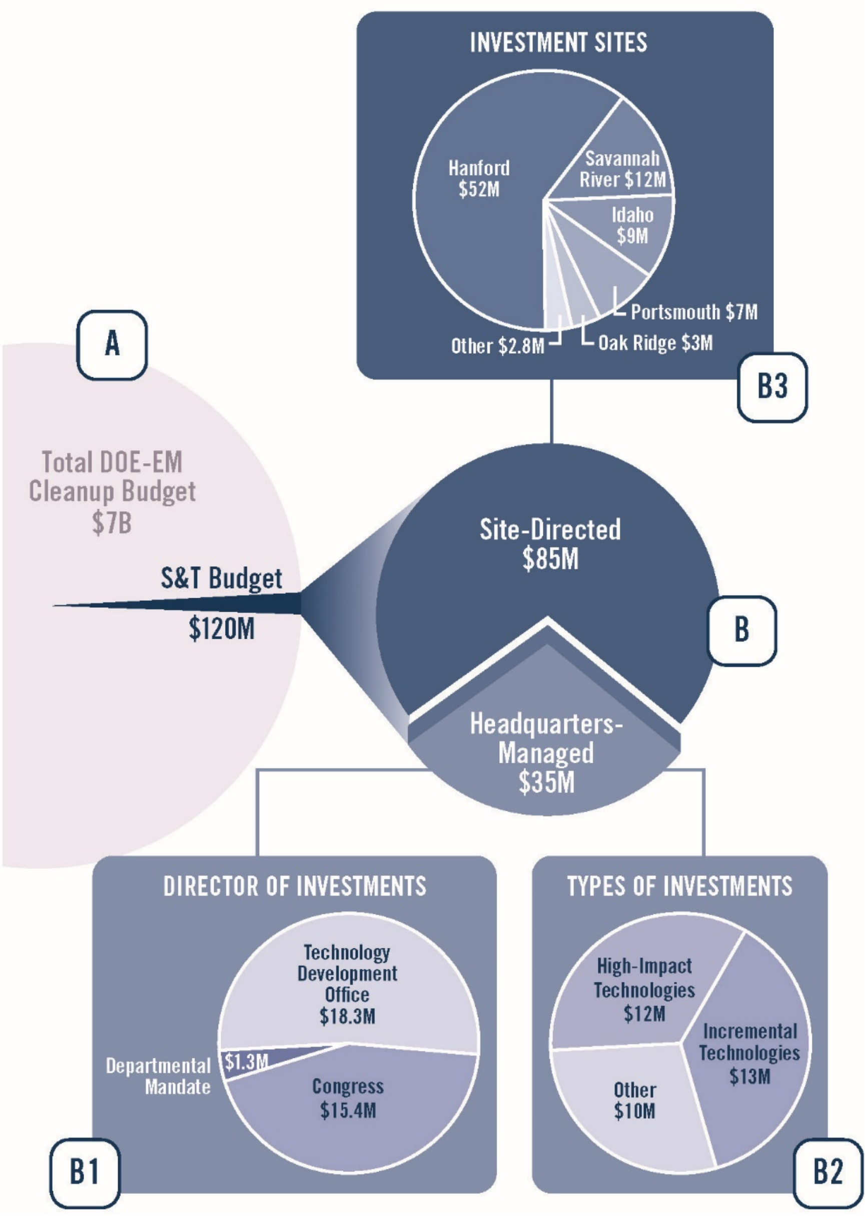
# S&T Investments over the Years



# S&T Investments in 2018



# Charge 1:

Review of DOE-EM's Technology Development Efforts

- **4 Findings**
- **3 Recommendations**

## Recommendation A

**independent assessment of the cleanup program's lifecycle costs and schedules**

## Recommendation B

**design and implementation of integrated S&T management process**

## Recommendation C

**focus portion of S&T on breakthrough technologies and solutions**

# Lifecycle Cost Estimates

**Recommendation A:** DOE-EM **should obtain an independent assessment of the cleanup program's lifecycle costs and schedules** from a government engineering organization—for example, the U.S. Army Corps of Engineers—that is specifically **focused on identifying key remaining technical risks and uncertainties**. DOE-EM should use this assessment to reevaluate the major cleanup challenges it faces, including the timeline and costs associated with addressing them using current S&T investments, and make any necessary adjustments to its S&T development program.

# S&T Management Process

- **Recommendation B: DOE-EM should design and implement an *S&T management process* for identifying, prioritizing, selecting, developing, and deploying the new knowledge and technologies needed to address its cleanup challenges, including the technical risks and uncertainties identified from the assessment in Recommendation A. Independent peer review should be used to evaluate (1) the S&T management process before it is implemented, (2) S&T projects before they are funded, and (3) the overall effectiveness and impact of DOE-EM's S&T efforts.**

# S&T ON Breakthrough Technologies and Solutions

**Recommendation C (truncated):** A portion of the technology development effort should **focus on breakthrough technologies and solutions** that can substantially reduce cleanup lifecycle costs, schedules, risks, and uncertainties. Such a program would require substantial new funding *separate* from the DOE-EM budget.

This technology development effort should be:

- Managed by **ARPA-E**.
- Informed by the independent assessment of the cleanup program's key remaining risks and uncertainties called for in Recommendation A and the S&T management process called for in Recommendation B.
- Be independently peer reviewed to evaluate its impact on the cleanup program.

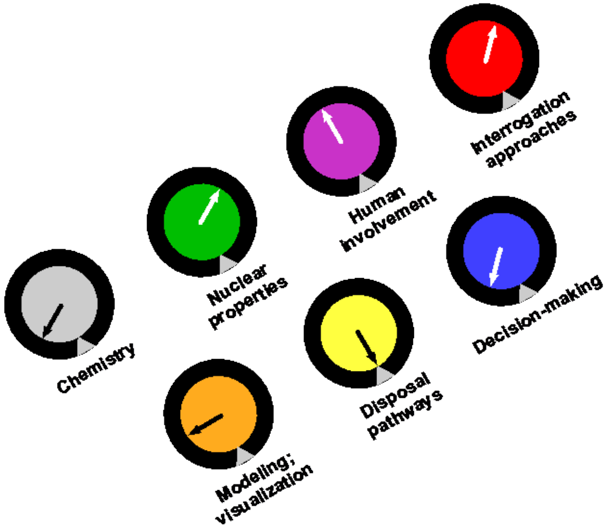
DOE-EM should work cooperatively with ARPA-E to identify and implement these breakthrough technologies and solutions into the cleanup program.

# Charge 2:

## Types of Technologies and Alternative Approaches

- **One Finding**

**7 example technologies and alternative approaches**

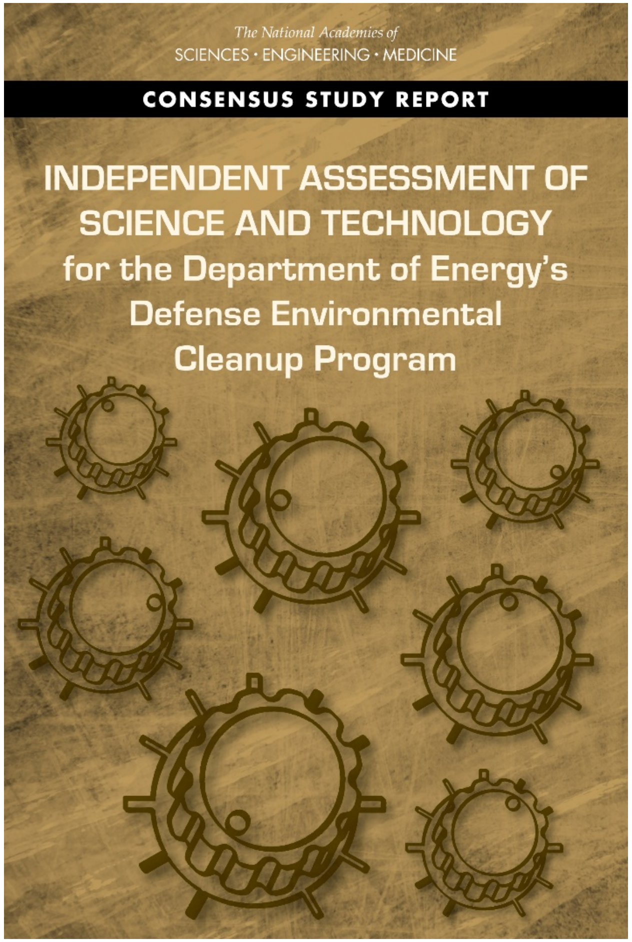



## Recommendation C

**focus portion of S&T on breakthrough technologies and solutions with an ARPA-E managed program**

| Cleanup Challenge | *Examples* of Applicable Change Knobs |
|---|---|
| Characterize and retrieve tank waste | • Chemistry at bulk and interfacial scales (1)<br>• Human involvement (3)<br>• Interrogation approaches (4) |
| Stabilize residual tank waste and tanks in place | • Chemistry at bulk and interfacial scales (1)<br>• Modeling and visualization approaches (5)<br>• Decision-making approaches (7) |
| In situ tank monitoring | • Human involvement (3)<br>• Interrogation approaches (4)<br>• Modeling and visualization approaches (5) |
| Analysis and modification of waste stream processing | • Chemistry at bulk and interfacial scales (1)<br>• Interrogation approaches (4)<br>• Modeling and visualization approaches (5) |
| Separate radioactive constituents from waste streams | • Nuclear properties (2)<br>• Chemistry at bulk and interfacial scales (1)<br>• Disposal pathways (6) |
| Characterize and remove radioactive contamination from equipment and buildings | • Human involvement (3)<br>• Interrogation approaches (4)<br>• Disposal Pathways (6) |
| Characterize, stabilize, and/or retrieve deep vadose zone contamination | • Chemistry at bulk and interfacial scales (1)<br>• Interrogation approaches (4)<br>• Modeling and visualization approaches (5) |
| Monitor waste disposal cells and barriers | • Interrogation approaches (4)<br>• Modeling and visualization approaches (5)<br>• Decision-making approaches (7) |
| Monitor locations and movements of subsurface plumes | • Human involvement (3)<br>• Interrogation approaches (4)<br>• Decision-making approaches (7) |

# ACADEMIES REPORT

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## Questions or Comments?

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