Moving Science into Practice:

Applying Science and Technology to Sustainably Manage Former Uranium Mill Tailings Sites in the United States

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Overview

- LM Sites Summary
- Applied Science and Technology Program
- Projects
- Network of National Laboratories for Environmental Management and Stewardship Organization

Rifle, CO Disposal Site

Overview of Uranium Ore Processing Sites – UMTRCA

- Most uranium mill sites are remediated under Uranium Mill Tailings Radiation Control Act (UMTRCA)
- 1980s -1990s: DOE remediated sites that were abandoned in 1978 (19 disposal cells contain 40 MCY)
- Private operators are remediating mill sites that were still operating after 1978
- The U.S. Nuclear Regulatory Commission (NRC) is the regulator
- LM and NRC conduct annual inspections and monitoring of these sites.

Applied Science and Technology Program: AS&T Portfolio

Vegetative cover at Monticello, Utah, Site

Plant Communities
Soil Conditions
Water Balance
Radon Barrier

Real-time Stormwater Monitoring:
Met Stations

Monitoring Approaches

Annual Inspections
License Requirement
10CFR40

Cell Performance:
High-Resolution Lidar Imaging

Chartiers Creek at Canonsburg, Pennsylvania, Site

Annual Inspection, Edgemont, South Dakota Site

Aerial Survey at Shiprock, New Mexico, Site

Applied Science and Technology Program

Developing solutions to long-term stewardship challenges

Foundational Knowledge

- Cover performance
- Water Balance
- Plant uptake
- Persistence

Integrated Studies

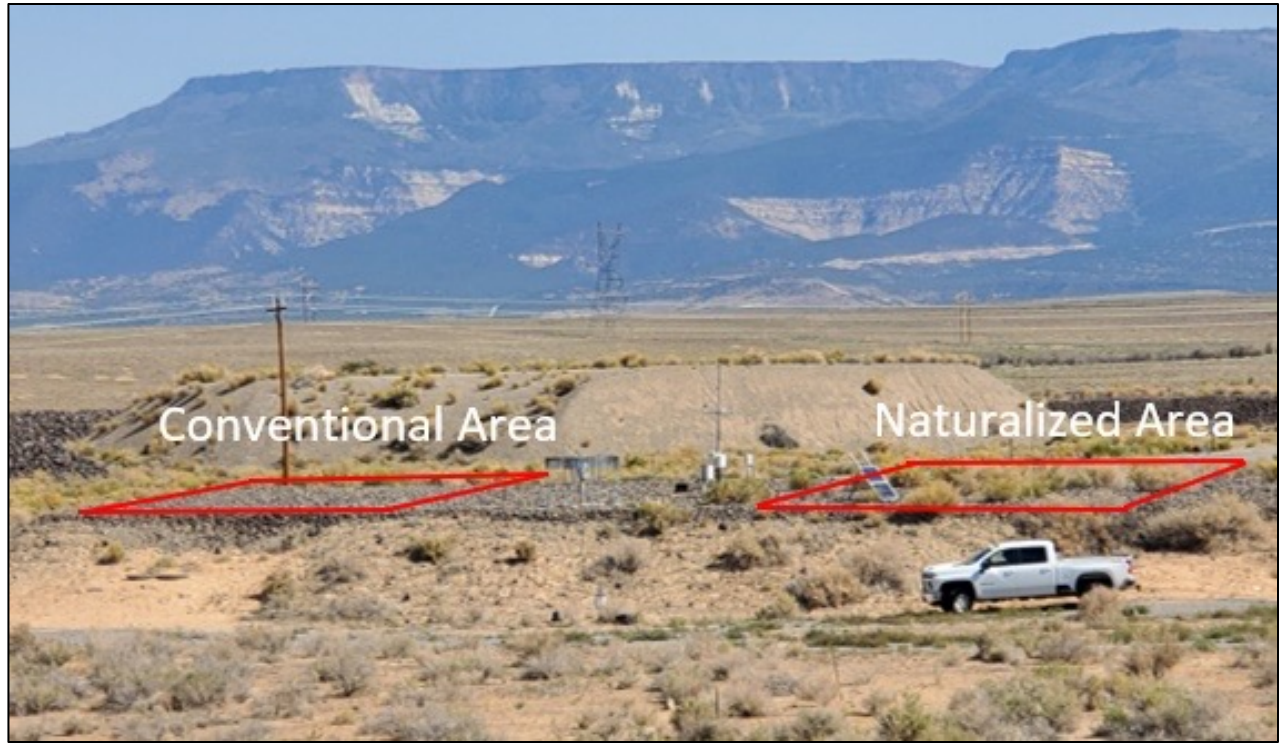
- Cover conversion
- Climate resilience
- Multispectral imaging
- Erosion risk

Sites

- Mexican Hat
- Bluewater
- L-Bar
- Crescent Junction
- Grand Junction

Enhanced Cover Assessment Project

- Compare and contrast
  - Vegetative vs. rock-riprap covers
  - Percolation and water balance
  - Soil physical properties
  - Radon diffusion
  - Plant contaminant uptake
- Alternative cover designs
- Developing regulatory guidance



Grand Junction, Colorado, Disposal Cell

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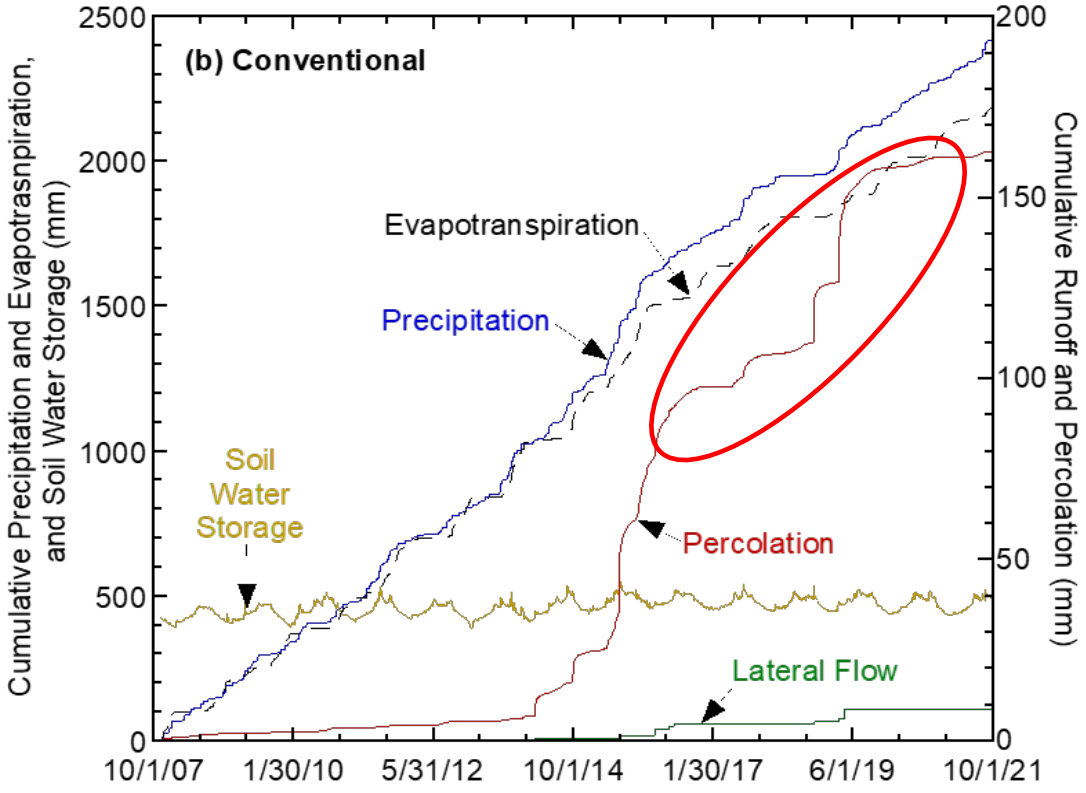
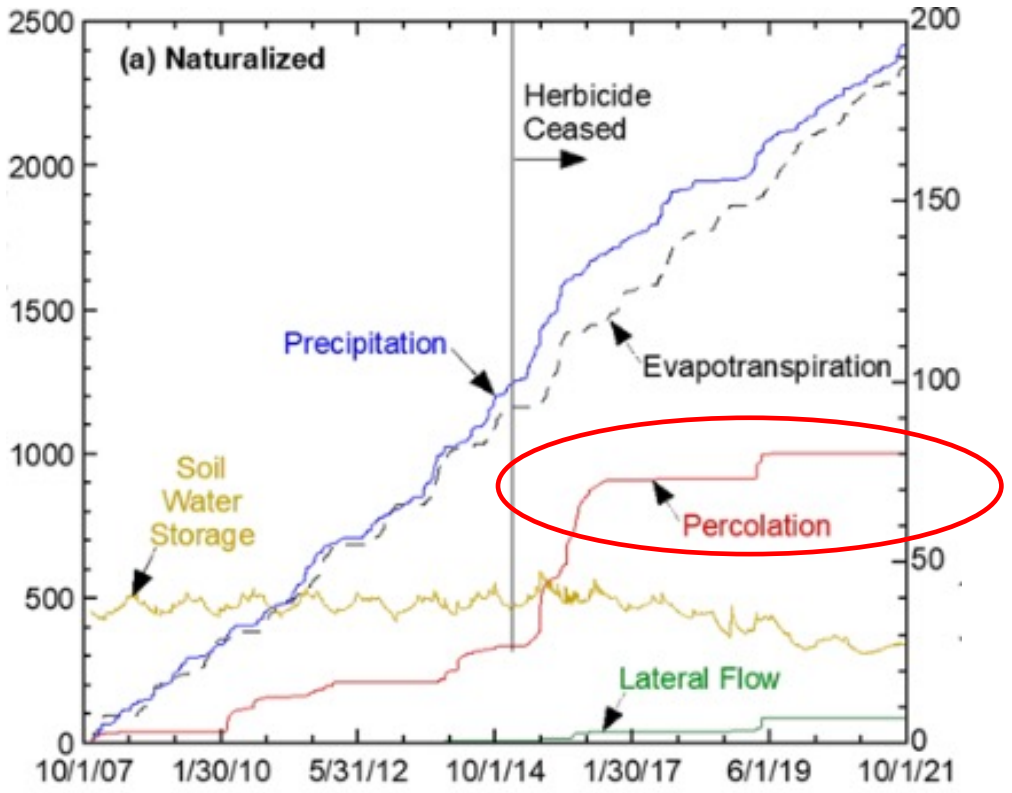
Commitment to Stewardship

Enhanced Cover Assessment Project

Lysimeter Water Balance Data



Conventional Area

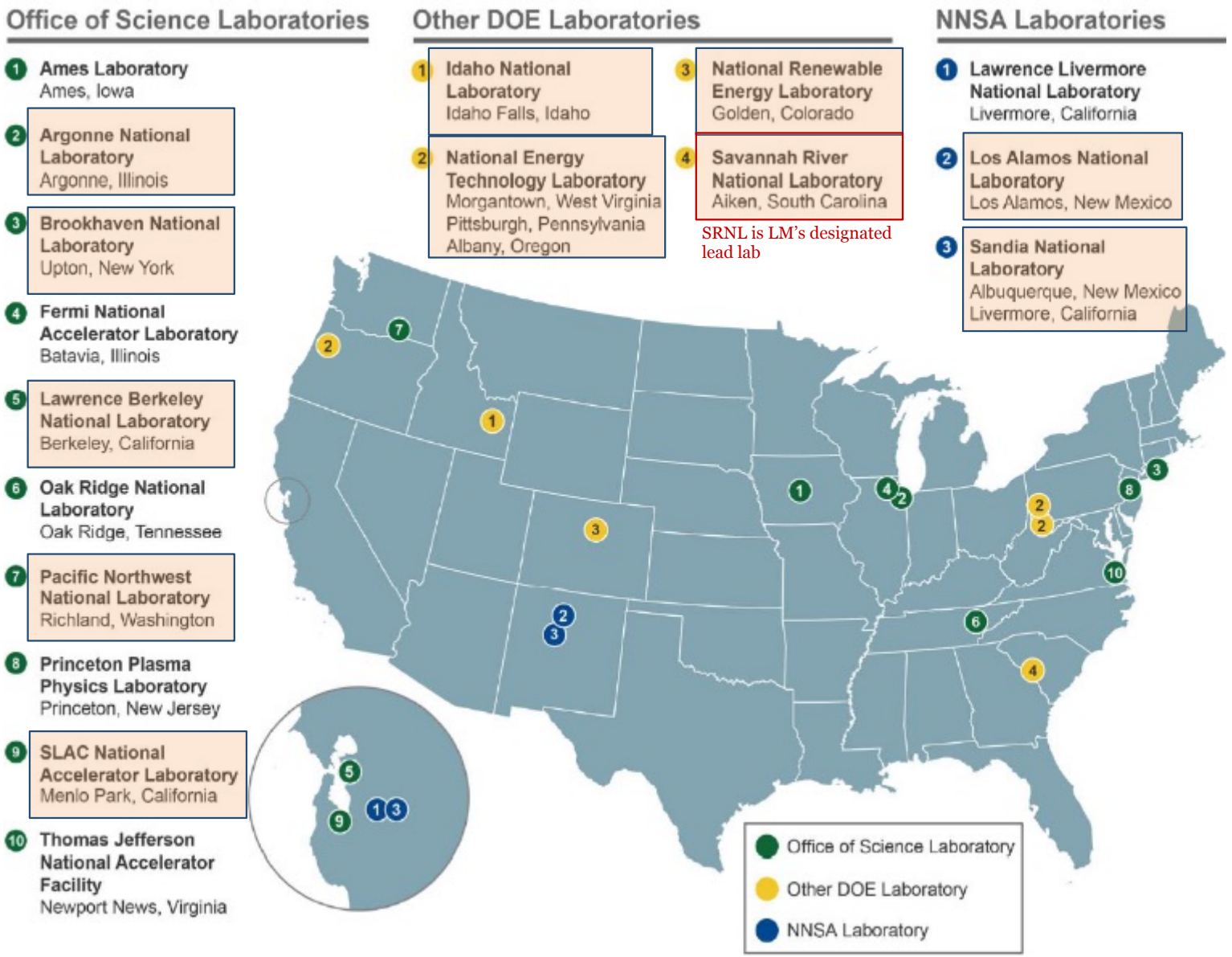


Natural Area

Legacy Management Risk Reduction Initiative

- LM ranked relative risks at sites across program
- Four ranking categories
  - Human health
  - Regulatory
  - Institutional control
  - Stakeholder
- Highest risk sites in the program:
  - Shiprock, New Mexico, Disposal Site
  - Tuba City, Arizona, Disposal Site
- We work toward impactful risk reduction at highest-risk sites

LM National Lab Network Participants



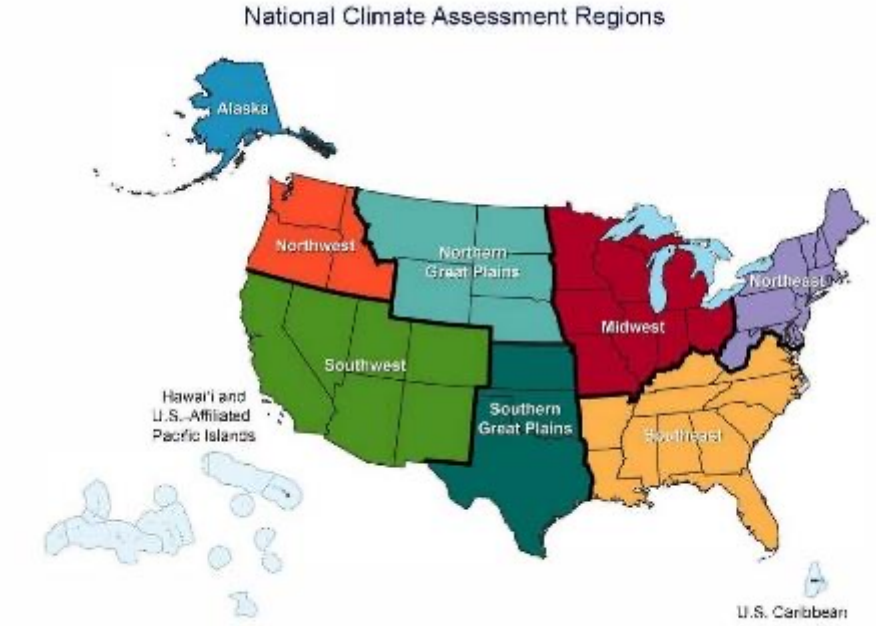
Network of National Laboratories for Environmental Management and Stewardship (NNLEMS)

Moab, UT processing site

Climate Resiliency and Adaptation

- Climate change is important because LM's mission is long term — we must ensure sites protect people and the environment far into the future
- May 2020 U.S. Government Accountability Office audit of LM Environmental Liabilities
  - Recommendation 3: Assess resiliency of LM sites to climate change and how it impacts their EL
  - Lawrence Berkeley National Laboratory started LM sites evaluations
- DOE Climate Action Plan
  - Requires all program offices to prepare vulnerability and resiliency plans for all sites
  - LM wants to integrate LBNL work with DOE CAP as much as possible to address climate and environmental remedies

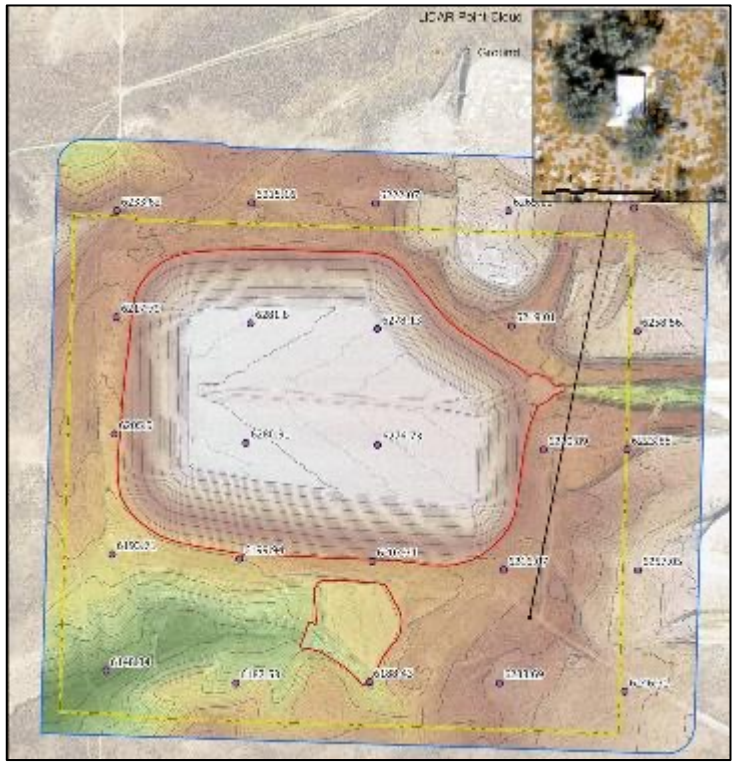
- LM manages sites in nine of the 10 regions used in the fourth National Climate Assessment (NCA-4)
- Conclusions about climate change impacts on environmental remedies from LBNL work could be used by other program offices



Regions Used for the Fourth National Climate Assessment (NCA-4; 2018

Long-Term Surveillance Using UAS

- LM began baseline aerial surveys in 2018
- Through March 2023, LM has completed baseline aerial surveys at 20 sites
  - Also completed 6 follow-up aerial surveys (post-baseline) at additional sites since October 2021, including performing change detection analysis versus the site's previous baseline aerial surveys



Lidar imagery of Maybell West, Colorado, Disposal Site

Partnerships and Collaboration

- Lectures and seminars
- Field tours
- Publications and media
- Graduate committees
- Mentorships

DOE and Nuclear Regulatory Commission staff inspect the temporary cover on the Moab tailings disposal site in Crescent Junction, Utah

AS&T scientist gives a field tour to Colorado Mesa University undergraduate students

Summary and Discussion

- Office of Legacy Management AS&T program
  - Developing solutions to long-term stewardship challenges
  - “Tempered by the past, poised for the future…”

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