EMRTAI
Environmental Monitoring and Remediation Technology Assessment Initiative

Advancing Technological Innovation and Supporting Informed Decision-making in Critical Minerals Recovery from Mine Waste

A New Initiative Supported by the Environmental Protection Agency Office of Mountains, Deserts, and Plains

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Battelle Memorial Institute, EMRTAI Project Manager
June 18, 2024

EMRTAI – Competitively Awarded Cooperative Agreement

- In 2024, the Office of Mountains, Deserts, and Plains issued a Request for Applications (RFA) for the Environmental Monitoring and Remediation Technology Assessment Initiative (EMRTAI)
- RFA was issued as a cooperative agreement (CA)
- CAs are like grants, but provide the Federal government with **substantial involvement** in carrying out activities
- Allows Federal experts and cooperator (i.e., CA awardee) to conduct research together
- Awarded to Battelle Memorial Institute in March 2024

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Cooperative Agreement Responsibilities

- EPA can facilitate interactions with Remedial Project Managers and Site Managers to obtain samples or conduct field demonstrations
- EPA reviews documents to ensure defensible and unbiased data are produced
- Battelle has the scope to do three main tasks:
  1. Create SOP, QAPP, or other documents to assess technologies
  2. Conduct engineering and technology assessments (laboratory and/or field) and develop reports that capture results
  3. Conduct stakeholder engagement and community outreach to support the Initiative

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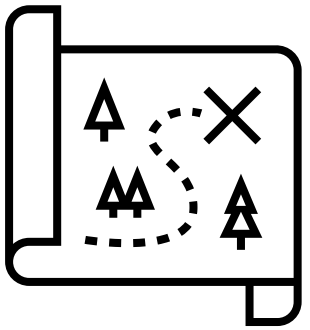
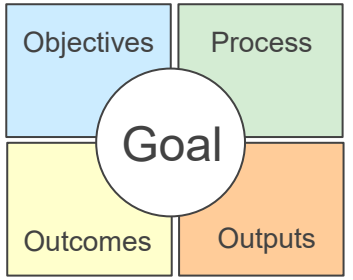
Presentation Roadmap





- EMRTAI's Goal
- Mining and Mineral Processing Site Remediation
- Critical Minerals Recovery – Federal Initiatives and Cross-agency Efforts
- Stakeholder-supported initiative
- Technology Assessments to facilitate innovation and decision-making
- Getting Involved
- Questions/Learning More

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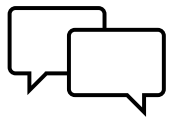
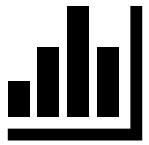
EMRTAI's Goal



EMRTAI is the **E**nvironmental **M**onitoring and **R**emediation **T**echnology **A**ssessment **I**nitiative



<u>Goal:</u> To drive and advance **innovation** and facilitate **dialogue** through **technology assessments** that produce data for **informed decisions** surrounding the **identification and recovery of critical minerals** from **mine waste** at legacy mining and mineral processing sites during site **remediation**.

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EMRTAI's Objectives

(1) To conduct technology assessments that will produce credible performance data to accelerate technology implementation for the benefit of diverse stakeholders

(2) To advance the Initiative through stakeholder engagement

(3) To host community outreach to foster dialogue within the communities where technology assessments may occur

(4) To create a community of practitioners focused on resource recovery while reducing risk to human health and the environment

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Mining and Mineral Processing (MMP) Site Remediation

- 100+ MMP sites on EPA Superfund National Priority List (NPL) undergoing remediation
- Mining produces large amounts of waste material
- Mine waste can serve as feedstock for minerals (unconventional source)
- Recovery of minerals can be incorporated into remedial action plans to promote sustainable materials management (SMM) and potentially offset costs

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MMP Remediation: Challenges and Opportunities

1. Identification and monitoring/measurement of critical minerals
2. Advancing recovery technologies to commercial scale
3. Data to inform decision-making

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MMP Remediation

- 500,000+ legacy and abandoned mine sites scattered throughout the U.S.
- Cleanup costs are substantial, environmental impacts are substantial
  - Metals-contaminated soils and sediment
  - Mine impacted water (MIW)
  - Waste rock, tailings, chat, heap leach piles, etc.
- Remediation – protection of human health and the environment and productive re-use of sites
- Green remediation and beneficial reuse of waste, using principles of SMM, has been a part of remediation for more than a decade

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SMM and The Life Cycle of Materials

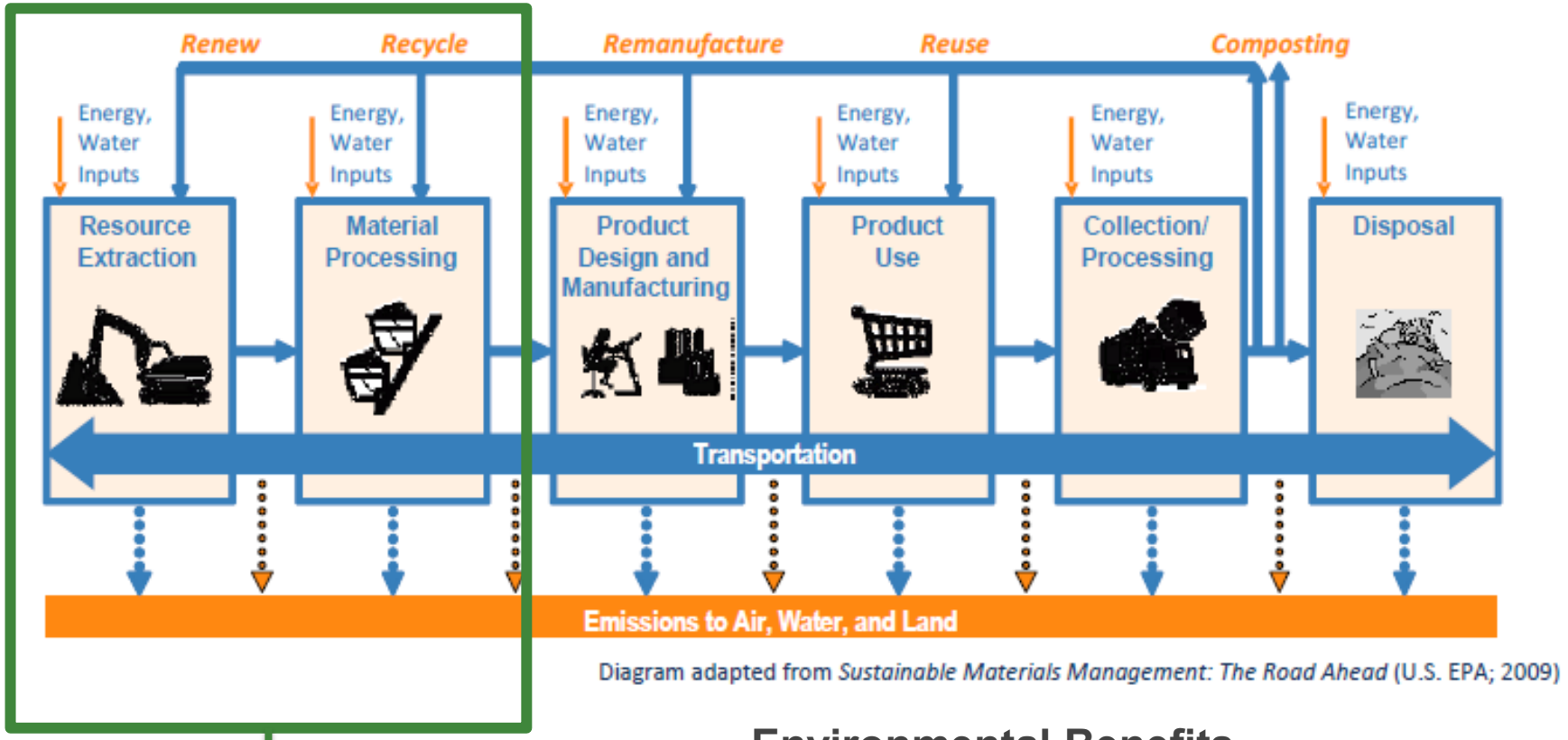

Diagram adapted from *Sustainable Materials Management: The Road Ahead* (U.S. EPA; 2009)

Waste rock
MIW
Contaminated soil/sediment

Core Elements of Greener Cleanups

From: *Sustainable Materials Management in Site Cleanup* (EPA, 2013) and Green *Remediation Best Practices* (EPA, 2012)

Environmental Benefits

- Conserves natural resources
- Reduces energy consumption
- Conserves landfill space
- Decreases the demand for virgin products
- Reduces risk through remediation

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Critical Minerals

Definition

- "… essential to the economic or national security of the U.S., have a supply chain of which is vulnerable to disruption, and serve an essential function in the manufacturing of a product (including energy technology-, defense-, currency-, agriculture-, consumer electronics-, and healthcare-related applications), the absence of which would have significant consequences for the economy or national security" (Energy Act of 2020)

Potential for critical minerals recovery from unconventional sources

- Building a U.S. supply chain to meet current and projected needs for critical minerals is a federal priority (Executive Order 14017).

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Federal Actions: Critical Minerals Recovery from Mine Waste

- **Dec 2017** — E.O. 13817: *A Federal Strategy to Ensure Secure and Reliable Supplies of Critical Minerals*
- **Feb 2021** — E.O. 14017: *America's Supply Chains*
- **Jun 2021** — *Building Resilient Supply Chains, Revitalizing American Manufacturing, and Fostering Broad-based Growth: 100-Day Reviews under E.O. 14017*
- **Nov 2021** — Infrastructure Investment and Jobs Act directed the USGS to assess potential critical mineral resources in mine wastes.
- **Feb 2022** — *The Biden-Harris Administration Fundamental Principles for Domestic Mining Reform*
- **Feb 2022** — USGS updated the U.S. list of critical minerals following a multi-agency assessment process

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Critical Minerals

- Aluminum
- Antimony
- Arsenic
- Barite
- Beryllium
- Bismuth
- Cerium (REE)
- Cesium
- Chromium
- Cobalt
- Dysprosium (REE)
- Erbium (REE)
- Europium (REE)
- Fluorspar
- Gadolinium (REE)
- Gallium
- Germanium
- Graphite
- Hafnium
- Holmium (REE)
- Indium
- Iridium
- Lanthanum (REE)
- Lithium
- Lutetium (REE)
- Magnesium
- Manganese
- Neodymium (REE)
- Nickel
- Niobium
- Palladium
- Platinum
- Praseodymium (REE)
- Rhodium
- Rubidium
- Ruthenium
- Samarium (REE)
- Scandium (REE)
- Tantalum
- Tellurium
- Terbium (REE)
- Thulium (REE)
- Tin
- Titanium
- Tungsten
- Vanadium
- Ytterbium (REE)
- Yttrium (REE)
- Zinc
- Zirconium

Site characterization is focused on minerals that pose risk to humans and/or the environment, so concentrations of many critical minerals at sites remain unknown and are likely to be variable.

Critical mineral with an EPA Maximum Contaminant Level (MCL) or a Regional Screening Level (RSL)

REE = rare earth element

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EMRTAI

- Promoting technological advancement
- Two types of technologies
  - In-situ measurement/monitoring
  - Mineral recovery (one or several minerals)
- Technology assessments to produce credible, quality assured performance data
  - Advance technologies to commercialization
  - Support implementation

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Superfund and AML Sites as Test Beds

- 90% of Superfund MMP sites have contaminated soil/sediment
- 50% of Superfund MMP sites have MIW
- 50% of Superfund MMP sites have solid waste present
- Technology assessments can be conducted onsite to demonstrate performance under real environmental conditions

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Building the Community to Support the Initiative

Steering Committee	• Provide oversight to the EMRTAI Program • Manage annual scope, goal setting, and stakeholder process • Meet twice annually via teleconferences to review EMRTAI progress; discuss industry and agency developments; and review technology assessment priorities program budget
Stakeholder Group	• Provide insight on stakeholder and user group needs • Support identification of priority technology categories • Meet quarterly to focus on technology assessments
Technical Panels	• Provide technical leadership and oversight for technology assessment categories • Support identification of priority technology categories • Meet as needed to focus on technology assessment protocols, conducting assessments, and developing assessment reports

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Key Roles to Promote EMRTAI Goals

EPA Program Officer	EMRTAI Project Manager

Technology Assessment Lead

- Technical leadership and Technology Assessment Oversight
- Recruitment/interaction with vendors and collaborators
- Assessment Reports and Statements

Stakeholder Engagement Lead

- Stakeholder coordination and teleconferences
- Co-organization of technical panels
- Outreach materials

Community Outreach Lead

- Outcomes-based metrics
- Place-based community engagement plan development
- Community meeting facilitator

Quality Assurance Manager

- QA oversight and Quality System
- Quality Management Plan
- QA auditing

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Technology Assessment Process

- First call in late summer 2024
- Subsequent calls over the initial 3-year program duration

- Generic, media-specific protocols
- Key performance parameters
- Environmental parameters

- Parameters
- Performance metrics
- Methods
- DQOs
- Statistical Design
- QA Activities
- Data Analysis
- Sustainability metrics

- Anticipate one or more concurrent assessments focused on a particular media
- Onsite, with prior lab testing

- Publicly available summary reports
- Verification statements may be issued for commercial technologies

- Stakeholder outreach, presentations, reports, etc.

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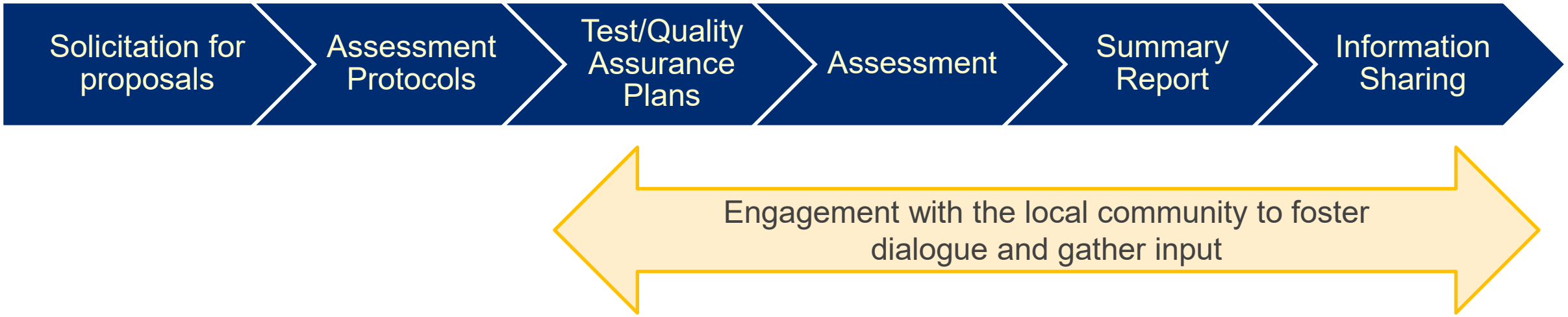
Community Engagement and Outreach



- EMRTAI is committed to listening to and communicating transparently with the people who live and work around the Superfund NPL sites, or any locations, that host its technological assessments
- Dialogue is the goal – a technology assessment at a site does not suggest that the technology will be implemented
  - Information sharing
  - Listening

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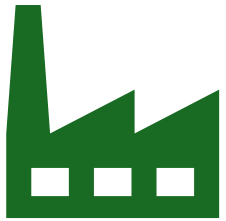
Technology Advancement

Type		Media	Technology Identification Approach
Monitoring	Recovery	Soil/Sediment	•CMs that are also COCs •CMs co-recovered with COCs using existing technologies •CMs with recovery technologies from mineral resources that may be applied to waste materials or impacted media
		Mining Influenced Water	
		Tailings	

Advancing technological innovation



Supporting decision-making and commercial-scale implementation

Benefits to Technology Developers and Vendors

- Access to independent third-party evaluation
- Recognition resulting from verification
- Data to support technological advancement

Benefits to Users

- Confidence in technology selection
- Credibility of test data
- Openness of testing process

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Driving Positive Remediation Outcomes

Outcomes	
Pollutant/Emissions Reductions	• Risk reduction • Broad applicability • Achievement of standards or clean up goals
Greater Regulatory Compliance	• Assessment data informing or being incorporated into regulations, guidance, etc.
Resource Conservation	• SMM – mass/year of critical minerals recovered/used and prevented from landfilling • Reduced material consumption
Increase in Financial or Economic Competitiveness	• Cost reduction in site characterization • Datasets to support techno-economic analyses • Vendor sales/inquiries; developer funding support • Reduced permitting, regulatory costs • Economic benefits from human and/or environmental health improvements
Increased Technology Acceptance and Use	• Number of sites where technology is applied • Number of communities and community members engaged
Scientific Advancement	• Number of technologies verified • Filling a high priority gap or promoting technology improvement • Training and outreach to broaden use/impact

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Timeline and Engagement

Upcoming Opportunities to Get Involved:

- June 2024 – Introduction to EMRTAI Webinar
- July 2024 – Stakeholder Group Kick-off Meeting
- August 2024 – Stakeholder Subgroup Meetings
  - Formation of Expert Panels
- September 2024 – First solicitation of applications for technology assessment (anticipate 4-6 technology assessments)

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Questions?

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For more information on EMRTAI:

Email: emrtai@epa.gov

Website: https://cluin.org/issues/default2.focus/sec/Characterization,_Cleanup,_and_Revitalization_of_Mining_Sites/cat/Cleanup_Technologies/ [cluin.org]

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